



# 3. International World Energy Conference **ABSTRACTS BOOK**

## **EDITORS**

Mustafa Serdar GENÇ

Gamze GENÇ

Şükrü Taner AZGIN

Saltuk Buğra SELÇUKLU



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# INTERNATIONAL WORLD ENERGY CONFERENCE-III

December 4-5, 2023 / Kayseri, Türkiye



## ABSTRACTS BOOK

### EDITORS

Prof. Dr. Mustafa Serdar GENÇ  
Prof. Dr. Gamze GENÇ  
Assoc Prof. Şükrü Taner AZGIN  
Assist. Prof. Saltuk Buğra SELÇUKLU

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# CONFERENCE ID

## CONFERENCE TITLE

3. International World Energy Conference

## DATE and PLACE

December 4-5, 2023 / Kayseri, Türkiye

## ORGANIZATION

IKSAD-Institute of Economic Development and Social Research, Türkiye

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## COORDINATORS

**Atabek MOVLYANOV**

Erciyes University, Faculty of Engineering Energy Systems Eng. department, Türkiye

**NUMBER of ACCEPTED PAPERS-190**

**NUMBER of REJECTED PAPERS-15**

## PARTICIPANTS COUNTRY

Algeria(14), Brazil(1), France(1), Germany(1), Hungary(1), India(17), Indonesia(1), Iran(1), Iraq(1), Italy(2), Kazakhstan(1), Kosovo(4), Morocco(28), Nigeria(14), Pakistan(5), Poland(2), Romania(1), South Africa(1), Tunisia(1), Türkiye(93)

## PRESENTATION

Oral presentation

## EVALUATION PROCESS

All applications have undergone a double-blind peer review process

\*\*\*

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**Dr. Anna Maria Vasile** - National Institute for Economic Research "Costin C. Kirişescu" (NIER), Romanian Academy, Romania

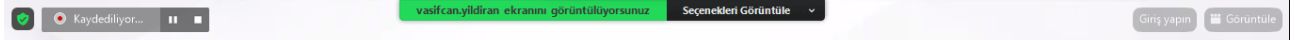


# PHOTO GALLERY



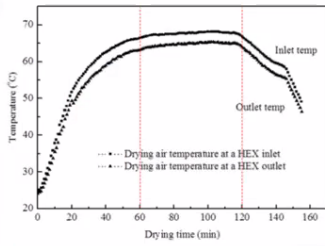




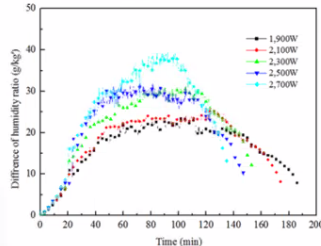


## THE LITERATURE REVIEW OF THE EXPERIMENTAL STUDY CONDUCTED FOR A CONDENSING HEAT EXCHANGER (HEX) DURING THE DRYING PROCESS

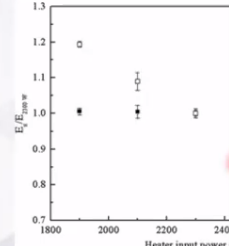
### Effect of Heater Power



Variation of air temperature at the inlet and the outlet of the condensing heat exchanger (HEX) during the drying process

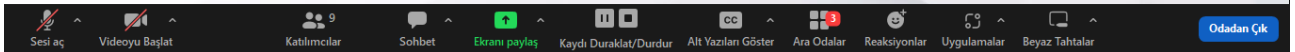


Differences of humidity ratio between the inlet and the outlet of heat exchanger.



Effect of heater power on the total energy consumption and the drying time normalized by the heater power of 2,300 W at the drying rate of 0.5 m<sup>3</sup>/h, and the cooling air flow rate of 1.5 m<sup>3</sup>/h.

- The total energy consumption rate has almost no relationship to the heater power. In addition, the larger the heater power, the shorter the drying time. Total energy consumption is due to the fan and the heater power. This result means that the increase in the rate of energy use by the heater is compensated by the decrease of the fan power due to the shorter drying time.





Kaydediliyor... Giriş yapın Görüntüle

**OBSERVER H-2...**

Hall-2, Hakan SONMEZ-Dokuz Eylül University

OBSERVER H-2 Ülke EKSİN

muraterdem

Hall-2, Kifayet E...

Dr. İbrahim Öza...

Sinan Güneş

Hall-2, Kifayet ERDEM ARSLAN

Dr. İbrahim Özyurtk

Sinan Güneş

Sesi aç Videoyu Başlat Katılımcılar Sohbet Ekranı paylaş Kaydı Duraklat/Durdur Alt Yazıları Göster Ara Odalar Reaksiyonlar Uygulamalar Beyaz Tahtalar Odadan Çık

Zoom Toplantı - Hall-3 / Online Session-1

Kaydediliyor... Giriş yapın Görüntüle

**Observer Hall-3**

Hall-3, Sevde ERTURK CETINKA...

Observer Hall-3

Hall 3-Semih Yurttaş

MeliH MANIR

imran

Hall 3 - Prof. Dr. Gamze GENÇ

Hall-3, İlyas deveci

Hall-3, Mustafa ASRSLAN

Saliha

HALL-3 Mukad...

HALL-3 Mukaddes EZİCİ

**Hall-3-Zafer İPE...**

Hall-3-Zafer İPEKLİ

Prof. Dr. Mustafa Serdar GENÇ

**EMİNE İŞİN**

EMİNE İŞİN

**Büşra Ayyıldız**

1 atanmamış katılımcı

Sesi aç Videoyu Başlat Katılımcılar (14) Sohbet Ekranı paylaş Reaksiyonlar Uygulamalar Beyaz Tahtalar Daha fazla Odadan Çık

TR 10:40 04.12.2023

Kaydediliyor... Giriş yapın

**Observer Hall-5**

Hall-5, Evrim Özrahat

GÖKHAN ÇAYLI

Hall-5, Mücahit...

Hall 5- Mehmet...

Sürüntüle

Observer Hall-5

Hall-5, Evrim Özrahat

GÖKHAN ÇAYLI

Hall-5, Mücahit Kaan ...

Hall 5- Mehmet Erdin...

YUNUS EMRE GÜNDÜZ SUNUM - PowerPoint (Orun Etkinleştirilmedi)

YUNUS EMRE GÜNDÜZ SUNUM - PowerPoint (Orun Etkinleştirilmedi)

Ne yapmamak istediğimizi söyleyin...

Metin Yeni - Metin Hizala - SmartArt'a Dönüştür - Yazı Tipi - Paragraf - Çizim - Yutma - Şekli Değiştir - Bul - Şekli Anahattı - Şekli Etkiletiler - Döndürme

1 2 3 4 5 6

**International World Energy Conference-III**

YENİLİKÇİ BİR YALITIM MALZEMESİNİN YANGIN PERFORMANSININ GELENEKSEL YALITIM MALZEMELERİ İLE KIYASLANMASI

Yunus Emre GÜNDÜZ  
Dr. Öğr. Üyesi Evrim ÖZRAHAT

Kayseri Üniversitesi  
Sivil Savunma ve İtfaiyecilik Programı

Sesi aç Videoyu Başlat Katılımcılar (11) Sohbet Ekranı paylaş Reaksiyonlar Uygulamalar Beyaz Tahtalar Daha fazla Odadan Çık

Tümünü Sessize Al

Katılımcılar (11)

Q Katılımcı bul

- OH O... (Ortak oturum sahibi, ben)
- HE Hall-5, Evrim Özrahat
- AY Ahmet Yagmur
- AB Altuğ BOZKURT
- EE EOY ersanomeryuzer@haktari.e...
- GÇ GÖKHAN ÇAYLI
- M Haal-5 Yunus Emre Gündüz
- H5 Hall 5- Mehmet Erdinç Arda
- HM Hall-5, Mücahit Kaan Yiğit
- HA Havanur Akça
- MIG mustafa gencyay

TUR 10:25 4.12.2023



Zoom Konferansiyası - Hall-6 / Online Session-1

Вы просматриваете экран SOUFIANE-ELHADFI

Observer Hall-6 | Hall-6, Bianca Ş... | SOUFIANE-ELHADFI | Andréa Azevedo, Sess... | Salman Ali | Abubakar Abdu... | Вид

Слайд презентации:

**LEMZA** | **UN** | **IWEC**

**International World Energy Conference-III (IWEG)**  
DECEMBER 4-5, 2023, KAYSERLI TÜRKIYE

**Conception of new organic solar cells based on carbon nanotubes: A DFT study**

Authors :  
Soufiane Elhadfi, Jamal Chenouf, Brahim Fakrach, Abdelhal Rahmani, Hassane Chadli and Abdelali Rahmani

Advanced Material and Applications Laboratory (LEMZA), Moulay Elmouloud University FSM-ESTM, BP 11201, Zitouna, M'oknes, 50000, Morocco.

Участники (6): Observer ... (Сопреорганизатор и), SOUFIANE-ELHADFI, Andréa Azevedo, Session-4, Hall-6, Bianca Şulan, Salman Ali, Abubakar Abdullahi

Zoom Toplantı - Hall-5

Zakaria Alii ekranını görüntüleyorsunuz

HALL 5- OBSER... | Moderator: Tari... | S. Bahhar | Siham ELMAZO... | Görüntüle

Слайд презентации:

**International World energy conference**  
**Mohamed Khider University of Biskra Algeria**  
**LMSE laboratory**

**Title of the work**  
**The optimal design for Grid Connected PV systems**

Presented by :  
Alili zakaria

Катилмчилар (6): H... (Ortak oturum sahibi, ben), Zakaria Alii, Moderator: Tarik Touiss, Joseph Chisom Okoye, S. Bahhar, Siham ELMAZOUZI

Zoom Toplantı - Hall-5

MRAJJI ekranını görüntüleyorsunuz

HALL 5- OBSER... | MRAJJI | Osamah Ihsan Ali | taha | Görüntüle

Слайд презентации:

**esith** | **International World Energy Conference-III** | **WORLD ENERGY CONFERENCE**

**Numerical investigation of eco-friendly materials for building envelope**

Dr. MRAJJI OUAHIBA  
Email : [ouahiba.mrajji@gmail.com](mailto:ouahiba.mrajji@gmail.com)

Laboratory of Physical Chemistry, Materials and Catalyst, Faculty of Sciences Ben M'Sick -HASSAN II University of Casablanca, Casablanca, Mo...  
Laboratory textile materials research (REMTEX), Higher School of Textile and clothing Industries, Casablanca Morocco

Катилмчилар (4): HALL ... (Ortak oturum sahibi, ben), MRAJJI, Osamah Ihsan Ali, taha

Hall 6- Observer

Müziyenler için Orjinal Ses: Kapalı

Kaydediliyor...

100  
100th Anniversary of the Republic of Turkey

**International World Energy Conference-III**

DECEMBER 4-5, 2023  
KAYSERİ, TÜRKİYE

UİP

Katılımcılar (3)

- H6 H... (Ortak oturum sahibi, ben)
- ZM Zineb MOUJOU
- BB Balarabe Bala

## Natural Fiber-based Geopolymer Composites with Low Thermal Conductivity for Energy Efficient Buildings

Presented by: MOUJOU ZINEB

1 atanmamış katılımcı

Sesi aç Videoyu Başlat Katılımcılar Sohbet Ekranı paylaş Reaksiyonlar Uygulamalar Beyaz Tahtalar Daha fazla Odadan Çık

Hall 6- Observer

Müziyenler için Orjinal Ses: Kapalı

Kaydediliyor...

Giriş yapın

Kalan: 09:37:16

Tam araçlar Düzenle Donatılar İnce

Metin veya ses bul

Katılımcılar (8)

Q Katılımcı bul

- H6 H... (Ortak oturum sahibi, ben)
- HK H6\_Fikret Kaya
- EY Esmâ YILDIRIM
- H6\_Onur Akar
- HS Hall\_6 Sinem Keskin
- Hall-6, Yasemin Selçuk
- S Hall-6-Seda Nur BOZKURT
- Y yousef

**IWEC International World Energy Conference-III**

<https://www.worldenergyconference.org/>

**Paper Title**

**Developments In Off-grid On-Board Portable Electric Vehicle Charging Station**

**Fikret KAYA (MSc)**  
**Assist. Prof. Dr. Onur AKAR**  
**Marmara University**

Sesi aç Videoyu Başlat Katılımcılar Sohbet Ekranı paylaş Reaksiyonlar Uygulamalar Beyaz Tahtalar Daha fazla Odadan Çık

Müziyenler için Orjinal Ses: Kapalı

Kaydediliyor...

Giriş yapın

Kalan: 09:24:05

Görüntüle

Esmâ YILDIRIM

Hall 6- Observer

H6\_Onur Akar

H6\_Fikret Kaya

ADonuk

H6\_Onur Akar

ADonuk

S

youssef

Hall\_6 Sinem Ke...

Hall-6-Seda Nur BOZKURT

youssef

Hall\_6 Sinem Keskin

Ulku

Dr. HMD

Sese bağlanıyor

1 atanmamış katılımcı

Katılımcılar (11)

Q Katılımcı bul

- H6 H... (Ortak oturum sahibi, ben)
- EY Esmâ YILDIRIM
- HK H6\_Fikret Kaya
- A ADonuk
- Dr. HMD
- H6\_Onur Akar
- HS Hall\_6 Sinem Keskin
- Hall-6, Yasemin Selçuk
- S Hall-6-Seda Nur BOZKURT
- Y yousef
- U Ulku

Tümünü Sessize Al



**Hall 6- Observer** **Esmâ YILDIRIM** **Hall-6-Seda Nur BOZKURT** Görüntüle

Müziyenler için Orjinal Ses: Kapatılı Kaydediliyor... Giriş yapın Kalan: 09:04:57

**DATA-BASED MODELS FOR REMAINING USEFUL LIFE ESTIMATION OF TURBOFAN ENGINES -A REVIEW**

Seda Nur BOZKURT, SELDA KAPAN ULUSOY

**Katılımcılar (12)**

Q Katılımcı bul

- H6 H... (Ortak oturma sahibi, ben)
- S Hall-6-Seda Nur BOZKURT
- Prof. Dr. Mustafa Serdar GENÇ
- A ADonuk
- Dr. HMD
- EY Esmâ YILDIRIM
- HK H6\_Fikret Kaya
- H6\_Onur Akar
- HS Hall\_6 Sinem Keskin
- Hall-6, Yasemin Selçuk
- U Ulku
- Y youssef

Sesi aç Videoyu Başlat Katılımcılar 12 Sohbet Ekranı paylaş Reaksiyonlar Uygulamalar Beyaz Tahtalar Daha fazla Odadan Çık

Kaydediliyor... Giriş yapın Kalan: 09:34:19 Görüntüle

**Observer H-1**

Hall - 1, Uğur Cem Türker Observer H-1 Hall-1 Selime Beyza Korumaz

Hall-1 Hasan Can Berber Hall-1 Doç. Dr. Levent Yiğittepe Emine Erden Kaya

Hall 1 - Halil Çeçen Ali Kemal Büyüboğulu

Sesi aç Videoyu Başlat Katılımcılar 8 Sohbet Ekranı paylaş Kaydı Duraklat/Durdur Alt Yazıları Göster Ara Odalar Reaksiyonlar Uygulamalar Beyaz Tahtalar Odadan Çık



Zoom meeting interface showing a presentation slide titled "INTRODUCTION" about Biodiesel. The slide content is as follows:

## INTRODUCTION

**Biodiesel is proved to be an alternative to fossil fuels**

- Renewable
- Available
- Carbon neutrality
- Biodegradable
- Non-toxic

The slide features a central circular diagram with four arrows forming a cycle, labeled "Biodiesel" in the center. The arrows are colored blue, yellow, green, and red, pointing clockwise.

The meeting interface includes a grid of participants, a control bar at the bottom with options like "Sesi aç", "Videoyu Başlat", "Katılımcılar", "Sohbet", "Ekranı paylaş", "Kaydet", "Alt Yazıları Göster", "Ara Odalar", "Reaksiyonlar", "Uygulamalar", "Beyaz Tahtalar", and "Odadan Çık". The top right shows "Giriş yapın", "Kalan: 09:55:54", and "Görüntüle".



Zoom Toplantısı

Hall 4 - Obse... kahouadji ch... Michael Smar... Moderator: H... Hall 4\_ Aniek... >

Kaydediliyor... Kalan: 08:52:56

**WEAR** **MSG**

**EXPLORING APPROACHES IN HIGHER EDUCATION TO INTEGRATE ENERGY SUSTAINABILITY (A REVIEW)**

**.A paper presented at the International World Energy Conference – III  
4 – 5. December, 2023**

**Author:**  
**Aderinsola E. Kayode**  
Faculty of Management Sciences, Durban University of Technology, South Africa

**ORCID NO: 0000-0002-5674-299X**

**Presenter: Kayode Aderinsola Eunice(PhD)**  
Postdoctoral Fellow, Faculty of Management Sciences, Durban University of Technology, South Africa

**DUT DURBAN TECHNOLOGICAL UNIVERSITY** **FACULTY OF MANAGEMENT SCIENCES**

Katılımcılar (7)

Q Ara

- H4 (Ortak oturum sahibi...
- SH Session-4 Hall-4 ka...
- MH Moderator: Hall-4, Chahi...
- E EMINE İŞİN
- H4 Hall 4\_ Aniek Essienub...
- KC kahouadji chaima
- MS Michael Smart Hall 4 Ses...

Tümünü Sessize Al Daha fazla

Zoom Toplantısı

Hall 4 - Obse... Rukhsar khan >

Kaydediliyor... Kalan: 09:16:51

**ENERGY SUPPLY FOR TÜRKİYE :  
OIL AND GAS IN UKRAINE UNDER  
THE BLACK SEA**

**TÜRKİYE İÇİN ENERJİ KAYNAĞI: UKRAYNA  
PETROL VE GAZ KARADENİZ ALTINDA**

**INTERNATIONAL WO ENERGY CONFERENCE December  
4-5, 2023 / Kayseri, Türkiye**

**UNIVERSITY of DEBRECEN**

**WEAR** **MSG** **100\*** **INSTITUTE OF ECONOMIC RESEARCH**

**SÁNDOR FÖLDVÁRI**  
ORCID: 0000-0002-7825-0531  
Research Scholar, Budapest, Hungary;  
& Debrecen Üniversitesi,  
Beşeri Bilimler Fakültesi, Macaristan  
& Univ. Of Illinois, Chicago, USA: SRL awarded  
alexfoldvari@gmail.com  
www.unideb.academia.edu/SandorFoldvari  
Kyiv, "Interdisciplinary Readings" Editorial Board member,  
ASEEES; NIC; Asociația Română pentru Studii Baltice și Nordice

Katılımcılar (7)

Q Ara

- H4 Hall 4... (Ortak oturum sahibi, ben)
- Hall-4 Moderator Sándor Földvári
- H4 : Prof. Deepak Bansal
- H4 : Prof. PADMA KANTA MISHRA -
- hA hall-4, Andréa Azevedo
- Rk Rukhsar khan
- R Hall4 : Padma Kanta Mishra Presentation

Tümünü Sessize Al Daha fazla



Zoom Toplantısı

Kalan: 08:44:02

Katılımcılar (9)

H4 Hall 4... (Ortak oturma sahibi, ben)

Hall-4 Moderator Sándor Földvári

SM Stefania Mele

H HALL - 4 - Rosario Marropodi

Hall 4 : Prof. Deepak Bansal

hA hall-4, Andréa Azevedo

m mrajji

RK Rukhsar khan

H4 Hall 4 : Padma Kanta Mishra

Tümünü Sessize Al Daha fazla

Hall 4 - Observer

Rukhsar khan

mrajji

Zoom Toplantısı - Hall-2

Kalan: 08:48:03

Katılımcılar (13)

O... (Ortak oturma sahibi, ben)

Fatih ÖNDER

YK Yakup Karakoyun

A Ahmet

berdan ulaş

BERKAY AYTIÖRK

EMINE İŞİN

Hatice Aydın

Mehmet ŞEN

Murat Gençğa

Seyda

Sinan Güneş

Fatih ÖNDER

Mehmet ŞEN

Hatice Aydın

Sinan Güneş

EMINE İŞİN

Sesi aç Videoyu Başlat Katılımcılar 13 Sohbet Ekranı paylaş Reaksiyonlar Uygulamalar Beyaz Tahtalar Daha fazla Odamdan Çık

Ara

XU100 endeksi yobsc...

TUR 11:04 5.12.2023

Zoom Konferans - Hall-3

Вы просматриваете экран Hall-3, Eren Anil Sezer

Настройка просмотра

Observer Hall-3

Hall-3 houđa la... Hall-3 Mete Öz... Burak Genckan

Observer Hall-3 Hall-3, Strzelecki Stanislaw Hall-3, Eren Anil Sezer Hall-3 houđa lahyani Hall-3 Mete Özbaltan Burak Genckan

Uçak

WEAR

Effect of Airfoil Thickness on Flow over the Symmetric Airfoils: Part II-Numerical Analysis

<sup>1,2,a</sup> Eren Anil SEZER, <sup>1,2,b</sup> Rumeysa Şahin, <sup>1,2,c</sup> Mehmet SİNCAR, <sup>1,2,d</sup> Mustafa Özde, <sup>1,2,e</sup> Halil Hakan ACIKEL, <sup>1,2,3,f</sup> Mustafa Serdar GENÇ

<sup>1</sup> Energy Systems Engineering", Erciyes University, 38039, Kayseri, Turkey

<sup>2</sup>Wind Engineering & Aerodynamic Research Group", Erciyes University, 38039, Kayseri, Turkey,

<sup>3</sup> MSG Technology Co. Ltd., Erciyes Technopark, Techno-1 Building No:61/20, 38039, Kayseri, Turkey,

Wind Engineering and Aerodynamics Research Group

2 назначенных участников

14

Участники (7)

OH Observer ... (Координатор, я)

HS Hall-3, Strzelecki Stanislaw

BG Burak Genckan

HH Hall-3 houđa lahyani

HM Hall-3 Mete Özbaltan

PA Phil-Jacques Alphonse

Включить звук Начать видео Участники 7 Чат Демонстрация экрана Реакции Приложения Доска сообщений Дополнительно Выйти из зала Выключить звук для всех

Поиск

Record High KAZ 13:08 05.12.2023

Zoom Конференция - Hall-3

Вы просматриваете экран Hall-3, Saliha Ozarlan

Настройка просмотра

Observer Hall-3

Observer Hall-3

Hall-3- Saliha Ozarlan

Sultan Faal

metehan kanyilmaz

Erhan ONAT

Burak Genckan

Вход

Запись...

3. International World Energy Congress  
4-5 December 2023, Kayseri

**Modelling Combustion of Biomass Tea Waste in a Vertical Furnace Under Different Excess Air Ratios: A CFD Analysis**

Saliba ÖZARSLAN<sup>1</sup>, Melih YILDIZ<sup>2\*</sup>

<sup>1</sup>Amasya University, Technical Sciences Vocational School, Automotive Program, Amasya, Türkiye

<sup>2</sup>Iğdır University, Faculty of Engineering, Department of Mechanical Engineering, Iğdır, Türkiye

Выход

Участники (8)

OH Observer ... (Соорганизатор, и)

HS Hall-3, Saliba Ozarlan

S Sultan Faal

BG Burak Genckan

EO Erhan ONAT

HS Hall-3 Sess-3 Savelkin Nikita, Ass...

MK metehan kanyilmaz

AG Ayetül Gelen (Hall-3)

Выключить звук для всех

Выключить звук

Начать видео

Участники

Чат

Демонстрация экрана

Реакции

Приложения

Доски сообщений

Дополнительно

Выйти из зала

Поиск

-4°C Sunny

14:33

05.12.2023

Zoom Конференция - Hall-3

Вы просматриваете экран Hall-3 Sess-3 Savelkin Nikita...

Настройка просмотра

Observer Hall-3

Observer Hall-3

Sultan Faal

metehan kanyilmaz

Hall-3 Sess-3 Savelkin Nikita...

Burak Genckan

Erhan ONAT

Erhan ONAT

Вход

Осталось: 08:45:56

Producing green hydrogen by hydrogen by low-temperature temperature electrolysis

Introduction: Hydrogen is the most common element on earth, but it is chemically bound in water, hydrocarbons, carbohydrates and other substances. To separate hydrogen, you need to invest energy.

YESSENOV UNIVERSITY

Kassayeva Asykanym. Zh. - professor  
Savelkin Nikita Kirillovich - assistant

Выход

Участники (9)

OH Observer ... (Соорганизатор, и)

HS Hall-3 Sess-3 Savelkin Nikita, ...

BS Betül ŞAHİN

BG Burak Genckan

EO Erhan ONAT

HJ Hall-3 /Hamza BENAALI

HB Hall3-Fella BOUCETTA

MK metehan kanyilmaz

S Sultan Faal

Выключить звук для всех

Выключить звук

Начать видео

Участники

Чат

Демонстрация экрана

Реакции

Приложения

Доски сообщений

Дополнительно

Выйти из зала

Поиск

-4°C Sunny

15:38

05.12.2023

Zoom Конференция - Hall-3

Вход

Осталось: 09:52:37

Вид

Observer Hall-3

Observer Hall-3

Hall-3 Ben Obakpo Johnson

Observer Hall-3

AYKUT FATİH GÜVEN

HALL 3-EMINE İŞİN

Hall3-Fella BOUCETTA

Hall3-Emm

Hall3-Gökhan KEVEN

3 неназначенных участников

Выход

Участники (7)

OH Observer Hall... (Соорганизатор, и)

AYKUT FATİH GÜVEN

E HALL 3-EMINE İŞİN

HB Hall-3 Ben Obakpo Johnson

Hall3-Emm

HB Hall3-Fella BOUCETTA

HK Hall3-Gökhan KEVEN

Выключить звук для всех

Выключить звук

Начать видео

Участники

Чат

Демонстрация экрана

Запись

Реакции

Приложения

Доски сообщений

Дополнительно

Выйти из зала

Поиск

-6°C Sunny

17:02

05.12.2023

Zoom Конференция - Hall-3

Вы просматриваете экран Gökhan KEVEN

Настройки просмотра

Observer Hall-3

AYKUT FATİH GÜVEN HALL 3-EMİNE İŞİN Hall3-Fella BOUCETTA Gökhan KEVEN Mustafa Kaplan

Участники (7)

- OH Observer ... (Соорганизатор, и)
- GK Gökhan KEVEN
- AG AYKUT FATİH GÜVEN
- MK Mustafa Kaplan
- E HALL 3-EMİNE İŞİN
- HB Hall-3 Ben Obakpo Johnson
- HB Hall3-Fella BOUCETTA

INTERNATIONAL WORLD ENERGY CONFERENCE-III  
December 4-5, 2023 / Kayseri, Türkiye

100

REDUCED HARMONICS IN A SEVEN LEVEL ASYMMETRIC MULTILEVEL INVERTER WITH APERIODIC DC SOURCES

DR. GÖKHAN KEVEN

Выйти из зала

Выключить звук для всех

Zoom Конференция - Hall-3

Вы просматриваете экран Hall3-Fella BOUCETTA

Настройки просмотра

Observer Hall-3

AYKUT FATİH GÜVEN HALL 3-EMİNE İŞİN Hall3-Fella BOUCETTA Gökhan KEVEN Mustafa Kaplan

Участники (6)

- OH Observer ... (Соорганизатор, и)
- HB Hall3-Fella BOUCETTA
- AG AYKUT FATİH GÜVEN
- GK Gökhan KEVEN
- E HALL 3-EMİNE İŞİN
- MK Mustafa Kaplan

International World Energy Conference-III  
December 5th, 2023, Kayseri, Turkey  
Hall-3 / Online Session-4 / TSI Time - 15h-17h

CONTROL OF INDUCTION MOTOR USING FUZZY LOGIC APPROACH SIMULATION AND EXPERIMENTAL RESULTS

Presented by : Fella BOUCETTA  
Ph.D student in Electrical Engineering  
At University Mohamed Khider Biskra, Algeria.

Выйти из зала

Выключить звук для всех



# INTERNATIONAL WORLD ENERGY CONFERENCE-III

December 4-5, 2023 / Kayseri, Türkiye



## Conference Program

Zoom ID: 833 1287 1999

Passcode: 100100

### Important, Please Read Carefully

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- All congress participants can connect live and listen to all sessions.
- Moderator is responsible for the presentation and scientific discussion (question-answer) section of the session.

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- Make sure your computer has a microphone and is working.
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**exp. Atabek Movlyanov**



# -OPENING CEREMONY-

DATE: 04.12.2023 / TSI TIME-09<sup>00</sup>:10<sup>00</sup>

Zoom ID: 833 1287 1999 / Passcode: 100100

## **Prof. Dr. Mustafa Serdar GENÇ**

Erciyes University, Director of the Energy Conversions Research and Application Center

HEAD OF CONFERENCE

## **Prof. Dr. İ. Engin TÜRE**

Chairman of the Board at Clean Energy Foundation

INVITED SPEAKER

"Solar Cooling"

## **Ord. Prof. Dr. Beycan İBRAHİMOĞLU**

Ankara Science University

INVITED SPEAKER

"Maddelerin Faz Diyagramı"

04.12.2023 / In-person Session-1 / TSI Time-13<sup>30</sup>:15<sup>30</sup>



VENUE: Erciyes University, Faculty of Engineering, Conference Hall (-1 floor, Next to the Canteen)



HEAD OF SESSION: Prof. Dr. Gamze GENÇ

Authors	Affiliation	Presentation title
<b>Res. Assist. Selen AVCI AZKESKİN</b> <b>Res. Assist. Ezgi GÜLER</b> <b>Zerrin ALADAĞ</b>	Kocaeli University, Türkiye Bilecik Şeyh Edebali University, Türkiye	ANALYSIS OF TÜRKİYE'S PROVINCES BASED ON ENERGY NEEDS USING MACHINE LEARNING METHODS
<b>Res. Assist. Selen AVCI AZKESKİN</b> <b>Res. Assist. Ezgi GÜLER</b> <b>Zerrin ALADAĞ</b>	Kocaeli University, Türkiye Bilecik Şeyh Edebali University, Türkiye	FUZZY CLUSTERING OF TÜRKİYE'S PROVINCES ACCORDING TO RENEWABLE ENERGY POTENTIALS
<b>Kübra Turgut</b> <b>Sinem Altinisik</b> <b>Gizem Yanalak</b> <b>Sermet Koyuncu</b> <b>İmren Hatay Patır</b>	Selcuk University, Türkiye Canakkale Onsekiz Mart University, Türkiye	EVALUATION OF PHOTOCATALYTIC HYDROGEN PRODUCTION ACTIVITY AND PHOTOELECTROCHEMICAL MEASUREMENTS OF TPCBP-B_TiO <sub>2</sub> PHOTOCATALYST
<b>Kübra Turgut</b> <b>Gizem Yanalak</b> <b>Adem Sarılmaz</b> <b>Faruk Özel</b> <b>İmren Hatay Patır</b>	Selcuk University, Türkiye Karamanoglu Mehmetbey University, Türkiye	EXAMINATION OF CESIUM BROMIDE PHOTOCATALYST FOR PHOTOCATALYTIC HYDROGEN PRODUCTION
<b>Özgenur DİNÇER ŞAHAN</b> <b>Ahmet KARADAĞ</b> <b>Attia HAMİD</b>	Yozgat Bozok University, Türkiye	ONE OF THE SECOND GENERATION ENERGY SOURCES FOR AGRICULTURAL ENERGY: INDUSTRIAL HEMP
<b>Esra ÇELİK</b> <b>Assist. Prof. Dr. Saltuk Buğra</b> <b>SELÇUKLU</b>	Republic of Türkiye Ministry of Energy and Natural Resources, Türkiye Erciyes University, Türkiye	ANALYSIS OF TÜRKİYE'S NUCLEAR ENERGY POLICIES WITHIN THE SCOPE OF COMBATING CLIMATE CHANGE AND EMISSION TARGETS
<b>Salman Ali</b> <b>Romolo Di Bernardo</b> <b>Fabrizio Marignetti</b> <b>Giovanni Busatto</b>	University of Cassino and Southern Lazio, Italy	ENHANCING PERFORMANCE OF PRINTED CIRCUIT BOARD AXIAL FLUX PERMANENT MAGNET MACHINES (PCB- AFPMM) THROUGH HEAT SINK INTEGRATION



04.12.2023 / In-person Session-2 / TSI Time-15<sup>30</sup>:17<sup>30</sup>



VENUE: Erciyes University, Faculty of Engineering, Conference Hall (-1 floor, Next to the Canteen)



HEAD OF SESSION: Prof. Dr. Mustafa Serdar GENÇ

Authors	Affiliation	Presentation title
<b>Ayberk Salim MAYIL</b> <b>Burcu KARA ER</b> <b>Can UĞURELLİ</b> <b>Nurhan VATANSEVER</b>	Haier Europe Research and Development Center, Türkiye	ENERGY EFFICIENCY CALCULATIONS ON RADIANT HOBS AND INDUCTION HOBS
<b>Bahadır ÖZELER</b> <b>Assoc. Prof. Dr. Merve KALEM</b>	Konya Teknik University, Türkiye	EVALUATION OF THE SOLID PRODUCT OBTAINED FROM PLASTIC WASTE PYROLYSIS IN ALTERNATIVE FUEL PRODUCTION
<b>Ayberk Salim MAYIL</b> <b>Vasif Can YILDIRAN</b>	Haier Europe Research and Development Center, Türkiye	EVALUATION OF DOMESTIC BUILT-IN OVEN COOLING SYSTEMS USING CFD ANALYSIS
<b>Büşra AYYILDIZ</b> <b>Dr. Kanber SEDEF</b> <b>Prof. Dr. Mustafa Serdar GENÇ</b>	Erciyes University, Türkiye Dener Machinery Inc., Türkiye	NEW REGENERATIVE BRAKING APPROACH; ROAD TOPOLOGY MODELING
<b>Yernat Zhuamdil</b> <b>Halil ÖZTÜRK</b> <b>Berkay KABAL</b> <b>Ünal UYSAL</b> <b>Ali ÇORUH</b>	Sakarya University, Türkiye	HYBRID VERTICAL WIND TURBINE DESIGN
<b>Prof. Dr. Volkan KALEM</b> <b>Assoc. Prof. Dr. İlyas ŞAVKLIYILDIZ</b> <b>Assist. Prof. Dr. Emrah ÇETİN</b> <b>Zeynep TÜFEK</b>	Konya Technical University, Türkiye Bozok University, Türkiye	DIELECTRIC AND PIEZOELECTRIC PROPERTIES OF BNT-BKT CERAMICS PREPARED BY SOLUTION COATING METHOD COMPARISON OF STORAGE TECHNOLOGIES IN POWER SYSTEMS INCLUDING RENEWABLE ENERGY PLANTS

04.12.2023 / Hall-1 / Online Session-1 / TSI Time - 10<sup>00</sup>:12<sup>00</sup>



ZOOM ID: 833 1287 1999 / PASSCODE: 100100



HEAD OF SESSION: Prof. Dr. Demet YILMAZ

Authors	Affiliation	Presentation title
<b>Assist. Prof. Dr. Selma AKÇAY</b>	Çankırı Karatekin University, Türkiye	HEAT TRANSFER ANALYSIS IN A STRAIGHT CHANNEL CONTAINING AN EXPANDING CHAMBER WITH WINGLETS
<b>Prof. Dr. Sennur ALAY AKSOY</b> <b>Prof. Dr. Demet YILMAZ</b>	Süleyman Demirel University, Türkiye	PRODUCTION OF POLYESTER RING SPUN YARNS WITH THERMOREGULATING FUNCTION CONTAINING MICROENCAPSULATED PHASE CHANGE MATERIALS (PCM) FOR PERSONAL THERMAL MANAGEMENT (PTM) APPLICATIONS
<b>Engin ŞİMŞEK</b> <b>Korhan ÖKTEN</b>	Amasya University, Türkiye	COMPARISON OF HYBRID AND ACTIVE PV COOLING SYSTEMS WITH A 1-D MATHEMATICAL MODEL BASED ON CONCENTRATION RATIO
<b>Vasif Can YILDIRAN</b> <b>Prof. Dr. Hasan GÜNEŞ</b>	Istanbul Technical University, Türkiye	EXPERIMENTAL INVESTIGATION OF DRYING AND ENERGY PERFORMANCE IN A CONDENSER TUMBLE DRYER
<b>Onur ATA</b> <b>Prof. Dr. Özlem ONAY</b> <b>Assist. Prof. Dr. Emre TÜFEKÇİOĞLU</b>	Eskişehir Technical University, Türkiye	MODELING THE ENERGY OBTAINED BY PIEZOELECTRIC ENERGY HARVESTING FROM THE VIBRATION OF AN ELECTRIC MOTOR
<b>Assist. Prof. Dr. Sercan DOĞAN</b> <b>Assist. Prof. Dr. Sercan YAGMUR</b> <b>Assoc. Prof. Dr. Aziz Hakan ALTUN</b>	Konya Technical University, Türkiye Selcuk University, Türkiye	FIRE SIMULATION FOR CLOSED CAR PARK IN THE SHOPPING CENTER
<b>Onur KARAASLAN</b> <b>Prof. Dr. Hasan GÜNEŞ</b>	Istanbul Technical University, Türkiye	HEAT SHIELD DESIGN AND ANALYSIS FOR THE COMBUSTION CHAMBER SYSTEM IN TURBOJET ENGINES
<b>Res. Assist. Mehmet ORUÇ</b> <b>Prof. Dr. Sedat YAYLA</b>	Van Yuzuncu Yil University, Türkiye	EXPERIMENTAL INVESTIGATION OF OIL-WATER SEPARATION EFFICIENCY

04.12.2023 / Hall-2 / Online Session-1 / TSI Time - 10<sup>00</sup>:12<sup>00</sup>



ZOOM ID: 833 1287 1999 / PASSCODE: 100100



HEAD OF SESSION: Dr. Hakan SÖNMEZ

Authors	Affiliation	Presentation title
<b>Dr. İbrahim ÖZAYTÜRK</b>	Nigde Omer Halisdemir University, Türkiye	THE IMPACT OF SHALE GAS USAGE OF US TO TURKISH FOREIGN TRADE DEFICIT
<b>Assoc. Prof. Dr. İlkey Noyan YALMAN</b> <b>Lect. Dr. Kifayet ERDEM ARSLAN</b>	Cumhuriyet University, Türkiye	RENEWABLE ENERGY POTENTIAL AND INVESTMENTS IN THE TR72 REGION
<b>Lect. Dr. Murat ERDEM</b> <b>Assist. Prof. Dr. Mert GÜRTÜRK</b>	Fırat University, Türkiye	AN ANALYSIS ON TURKEY'S PREVIOUS RENEWABLE ENERGY SUPPORT MECHANISM
<b>Dr. Hakan SÖNMEZ</b>	Dokuz Eylul University, Türkiye	EFFECT OF ENERGY CONSUMPTION AND GREENHOUSE GAS EMISSIONS ON ECONOMIC GROWTH IN TURKEY: EMPIRICAL EVIDENCE FROM THE AGRICULTURAL SECTOR
<b>Dr. Ahmet DEMİRALP</b> <b>Res. Assist. İbrahim Sezer BELLİLER</b>	Harran University, Türkiye	THE RELATIONSHIP BETWEEN CARBON DIOXIDE EMISSIONS AND OIL CONSUMPTION IN SELECTED EUROPEAN COUNTRIES: EVIDENCE FROM NONLINEAR ARDL MODELS
<b>Res. Assist. İbrahim Sezer BELLİLER</b> <b>Dr. Ahmet DEMİRALP</b>	Harran University, Türkiye	ARE CARBON DIOXIDE EMISSIONS CONVERGING IN SELECTED EUROPEAN COUNTRIES? EVIDENCE FROM NON-LINEAR UNIT ROOT TESTS
<b>Res. Assist. Ayşegül ÖZKAN</b>	Uşak University, Türkiye	THE RELATIONSHIP BETWEEN RENEWABLE ENERGY CONSUMPTION AND EMPLOYMENT: THE CASE OF TURKEY



04.12.2023 / Hall-3 / Online Session-1 / TSI Time - 10<sup>00</sup>:12<sup>00</sup>



ZOOM ID: 833 1287 1999 / PASSCODE: 100100



HEAD OF SESSION: Prof. Dr. Gamze GENÇ

Authors	Affiliation	Presentation title
<b>Mukaddes EZİCi</b> <b>Yunus Emre ÖZDEMİR</b> <b>Metin YAVUZ</b>	Ondokuz Mayıs University, Türkiye Republic Of Türkiye Ministry Of Agriculture And Forestry Black Sea Agricultural Research Institute, Türkiye	A COMPREHENSIVE ANALYSIS OF SOLAR CELL PATENTS
<b>Res. Assist. Dr. Semih YURTDAS</b>	Karamanoğlu Mehmetbey University, Türkiye	EFFECT OF Na DOPED ZnO BUFFER LAYER ON EFFICIENCY IN ORGANIC SOLAR CELLS
<b>Melih MANIR</b> <b>Prof. Dr. Gamze GENÇ</b> <b>Prof. Dr. Murat TOMAKİN</b> <b>Prof. Dr. Vagif NEVRUZOĞLU</b>	Recep Tayyip Erdogan University, Türkiye Erciyes University, Türkiye	INVESTIGATION OF PHOTOVOLTAIC PROPERTIES OF n- CdS/p-Cu <sub>2</sub> S SOLAR CELLS PRODUCED BY THREE DIFFERENT METHODS
<b>Imran KANMAZ</b> <b>Prof. Dr. Murat TOMAKİN</b> <b>Göksel AYTEMİZ</b> <b>Melih MANIR</b> <b>Prof. Dr. Vagif NEVRUZOĞLU</b>	Recep Tayyip Erdogan University, Türkiye	THE EFFECT OF THERMAL TREATMENT CONDITIONS ON THE BAND-GAP PROPERTIES OF TiO <sub>2</sub> THIN FILMS DEPOSITED ON QUARTZ GLASS
<b>Lect. Dr. Mustafa ARSLAN</b> <b>Lect. Cemile ARSLAN</b> <b>Lect. Gökhan YALÇIN</b>	Konya Technical University, Türkiye	EXPERIMENTAL SETUP FOR INVESTIGATING THE PERFORMANCE OF PHOTOVOLTAIC PANELS UNDER DIFFERENT CLIMATE CONDITIONS
<b>Lect. Dr. Mustafa ARSLAN</b> <b>Assist. Prof. Dr. İlyas DEVECİ</b> <b>Res. Assist. Emre ÜNVER</b>	Konya Technical University, Türkiye	THE EFFECT OF SOIL SAMPLES COLLECTED FROM SOLAR POWER PLANTS IN KONYA PROVINCE ON PHOTOVOLTAIC PANEL EFFICIENCY
<b>Sevde ERTÜRK ÇETİNKAYA</b> <b>Prof. Dr. Gamze GENÇ</b> <b>Assist. Prof. Dr. Muhammet ÇELİK</b>	Erciyes University, Türkiye	NUMERICAL ANALYSIS OF THE BEHAVIOR OF DIFFERENT ANODE MATERIALS IN LITHIUM-ION BATTERIES

04.12.2023 / Hall-4 / Online Session-1 / TSI Time - 10<sup>00</sup>:12<sup>00</sup>



ZOOM ID: 833 1287 1999 / PASSCODE: 100100



HEAD OF SESSION: Prof. Dr. Dilek ERDİRENÇELEBİ

Authors	Affiliation	Presentation title
<b>Prof. Dr. Dilek ERDİRENÇELEBİ</b>	Konya Technical University, Türkiye	BENEFITS OF TEMPERATURE AND MIXING MODE VARIATIONS IN THE MONO- AND CO-DIGESTION ON THE SLUDGE LINE OF MUNICIPAL WWTPS
<b>Lect. Dr. Fatma ŞENER FİDAN</b>	Abdullah Gül University, Türkiye	A COMPARATIVE ANALYSIS OF WASTE DISPOSAL METHODS AND METHODOLOGIES ABOUT GREENHOUSE GAS EMISSIONS FOR ACHIEVING A SUSTAINABLE FUTURE
<b>Prof. Dr. Dilek ERDİRENÇELEBİ</b>	Konya Technical University, Türkiye	ANAEROBIC DIGESTION CHARACTERISTICS OF PRIMARY AND SECONDARY SEWAGE SLUDGES AT LOW ORGANIC LOADING RATES AT THE UPPER MESOPHILIC LEVEL
<b>Assoc. Prof. Dr. Skender Demaku Donika Sylejmani Arbnorë Aliu Ermond Frangu Lumturie Shkodra Leonita Dugolli</b>	University of Pristina, Kosovo	CHEMICAL, PHYSICAL AND BIOLOGICAL ANALYSIS OF RIVER WATER AND SEDIMENT; SITNICA, IBRI, TREPÇA AND DRENICA - CORRELATION WITH EU STANDARDS – FOR SURFACE WATERS
<b>Assoc. Prof. Dr. Skender Demaku Donika Sylejmani Arbnorë Aliu Bahrije Dobra Islam Zuzaku Muhamet Kiqina Alma Ejupi Aurita Muji</b>	University of Pristina, Kosovo	HEAVY METALS AS WATER AND SEDIMENT POLLUTANTS OF THE LLAP RIVER, DISTRICT; PODUJEV-LLUZHAN-BARILEV
<b>Usman Aliyu Taliyawa Yahaya Ado Gashua</b>	Federal University Dutsin-Ma, Nigeria	ECONOMIC VIABILITY OF CARBON CAPTURE AND STORAGE (CCS) TECHNOLOGIES: ASSESSING COSTS, INVESTMENT REQUIREMENTS, AND POLICY IMPLICATIONS
<b>Sayanti Das Assist. Prof. Dr. Monalisa Halder Dr. Jinia Datta Dibakar Das</b>	Abacus Institute of Engineering and Management, India	ADVERSE EFFECT OF CLIMATE CHANGE ON INDIAN ECONOMY
<b>Fatima Ait Nouh Hassan Khajmi Abdelhafid El Alaoui El Fels Chaymae Lachguer Saida Bahsine</b>	Cadi Ayyad University of Marrakech, Morocco Higher Institute of Nursing Professions and Health Technics, Morocco University Sultan Moulay Sliman, Morocco	ASSESSMENT OF THE DOSE IN DRINKING WATER RECEIVED BY INDIVIDUALS IN THE INDUSTRIAL REGION OF SAFI IN MOROCCO BY USING THE DSTN METHOD AND THE ICP-MS TECHNIQUE

04.12.2023 / Hall-5 / Online Session-1 / TSI Time - 10<sup>00</sup>:12<sup>00</sup>



ZOOM ID: 833 1287 1999 / PASSCODE: 100100



HEAD OF SESSION: Assoc. Prof. Dr. Gökhan ÇAYLI

Authors	Affiliation	Presentation title
<b>Yunus Emre GÜNDÜZ</b> Assist. Prof. Dr. Evrim ÖZRAHAT	Kayseri University, Türkiye	COMPARISON OF THE FIRE PERFORMANCE OF AN INNOVATIVE INSULATION MATERIAL WITH CONVENTIONAL INSULATION MATERIALS
<b>Mücahit Kaan Yiğit</b> Res. Assist. Alperen EVCİMEN Assoc. Prof. Burak MARKAL	Recep Tayyip Erdoğan University, Türkiye Karadeniz Technical University, Türkiye	EFFECTIVENESS ANALYSIS OF MINI-CHANNEL SHELL-AND-TUBE HEAT EXCHANGER
<b>Assoc. Prof. Dr. Gökhan ÇAYLI</b>	Istanbul University-Cerrahpaşa, Türkiye	PRODUCTION OF ENERGY EFFICIENT BUILDING ELEMENTS FROM RENEWABLE RESOURCES
<b>Assoc. Prof. Dr. Gökhan ÇAYLI</b>	Istanbul University-Cerrahpaşa, Türkiye	SYNTHESIS OF MONOGLYCERIDES VIA A NEW ENERGY-EFFICIENT METHOD
<b>Mustafa GENÇAY</b> Assist. Prof. Dr. Altug BOZKURT Lect. Dr. Ersan Omer YUZER	Yıldız Teknik University, Türkiye Hakkari University, Türkiye	ENERGY EFFICIENCY AND GREEN TRANSFORMATION: AN EXAMPLE OF AN INDUSTRIAL FACILITY
<b>Assoc. Prof. Dr. Abdul Vahap KORKMAZ</b>	Afyon Kocatepe University, Türkiye	EFFECT OF MAGNESIUM SLAG PRODUCED BY THERMOCHEMICAL REDUCTION ON GRINDING BEHAVIOR AND ENERGY EFFICIENCY
<b>Assoc. Prof. Dr. Abdul Vahap KORKMAZ</b>	Afyon Kocatepe University, Türkiye	GREEN TRANSFORMATION IN THE CEMENT INDUSTRY: THE ROLE OF ENERGY AND INNOVATION
<b>Mehmet Erdiñç ARDA</b> Dr. Berkan ZÖHRA	Amasya University, Türkiye	ENERGY OPTIMIZATION IN MICROGRIDS WITH MICROGRID ADVISOR SOFTWARE



04.12.2023 / Hall-6 / Online Session-1 / TSI Time - 10<sup>00</sup>:12<sup>00</sup>



ZOOM ID: 833 1287 1999 / PASSCODE: 100100



HEAD OF SESSION: Alina Amanzhol

Authors	Affiliation	Presentation title
<b>Zahra Nait Abdellah Mourad Keddam</b>	Université Mouloud Mammeri, Algeria	PLASMA PASTE-BORIDING OF AISI 316 STEEL: CHARACTERIZATION OF BORIDE LAYERS AND BORON ACTIVATION ENERGY CALCULATION
<b>Soufiane Elhadfi Jamal Chenouf Hassane Chadli Brahim Fakrach Abdelhai Rahmani Abdelali Rahmani</b>	Moulay Ismail University, Morocco	CONCEPTION OF NEW ORGANIC SOLAR CELLS BASED ON CARBON NANOTUBES: A DFT STUDY
<b>Bianca Ţuian Sonia Amariei</b>	Ştefan cel Mare University, Romania	RESEARCH ON NEW BIODEGRADABLE PACKAGING FOR FOOD INDUSTRY
<b>Issam Jilal Omar Azougagh Soufian El Barkany</b>	Sidi Mohamed Ben Abdellah University, Morocco	DISSOLUTION MECHANISM OF CELLULOSE IN A BENZYLTRIEHYLAMMONIUM/UREA DEEP EUTECTIC SOLVENT (DES): DFT-QUANTUM MODELING, MOLECULAR DYNAMICS AND EXPERIMENTAL INVESTIGATION
<b>Mohammed, Nadamau Shehu Kabiru I. Musa Shehu I. Galoji</b>	Abubakar Tafawa Balewa University, Nigeria Bauchi State University Gadau, Nigeria	BIOMETRIC IDENTIFICATION USING EEG SIGNALS: A DEEP LEARNING APPROACH FOR FEATURE EXTRACTION AND CLASSIFICATION
<b>Abdullahi Abubakar James Tolulope O. Uzaomaka A. Ezafulukwe Ibitokun, T. V Ogundeji A.A Babayemi, W.A</b>	Kebbi State University of Science and Technology, Nigeria University of Nigeria Nsukka, Nigeria	MONTE CARLO SIMULATION TECHNIQUES ON EVALUATING THE EFFECT OF SAMPLE SIZE ON SIMPLE LINEAR REGRESSION
<b>Fatima Shehu Tofa Usman Mahmud</b>	Bayero University, Nigeria Al-Qalam University, Nigeria	FUNDUS IMAGE-BASED DETECTION FOR GLAUCOMA WITH U-NET AND VISION TRANSFORMER
<b>Dr. Jyothi B Nair Lekshmi C. Nair Dr. Manu M Joseph</b>	Christ University, India	TRACKING THE FOOTPRINTS OF BIO-MOLECULES: EXPLORING THE SERS TRAJECTORY

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HEAD OF SESSION: Dr. Halil ÇEÇEN

Authors	Affiliation	Presentation title
<b>Uğur Cem TÜRKER</b> <b>Kerem AYDIN</b>	Ankara Hacı Bayram Veli University, Türkiye Sakarya University, Türkiye	RENEWABLE ENERGY CHOICE AND THE PUBLIC INTEREST: BENEFIT OF FUTURE GENERATIONS
<b>Assist. Prof. Dr. Emine ERDEN KAYA</b>	Amasya University, Türkiye	ENERGY CRISES AND THEIR EFFECTS ON GLOBAL POLITICS
<b>Assist. Prof. Dr. Ali Kemal EYÜBOĞLU</b> <b>Prof. Dr. Muharrem Kemal ÖZFIRAT</b>	Maltepe University, Türkiye Dokuz Eylül University, Türkiye	COMPARATIVE ANALYSIS OF OCCUPATIONAL SAFETY IN OFFSHORE WIND ENERGY AND OFFSHORE OIL AND GAS ENERGY FACILITIES
<b>Hasan Can BERBER</b>	Ondokuz Mayıs University, Türkiye	THE ROLE OF SUSTAINABLE TRANSPORTATION POLICIES IN COMBATING CLIMATE CHANGE
<b>Selime Beyza KORUMAZ</b> <b>Assoc. Prof. Dr. Levent YİĞİTTEPE</b>	Karamanoğlu Mehmetbey University, Türkiye	RUSSIA'S NUCLEAR ENERGY TARGETS IN THE CHANGING ENERGY SECURITY ENVIRONMENT: ROSATOM'S MIDDLE EAST APPLICATIONS
<b>Dr. Halil ÇEÇEN</b>	Nuh Naci Yazgan University, Türkiye	ASSESSMENT OF THE RENEWABLE ENERGY MIXES IN THE EUROPEAN UNION AND TÜRKİYE IN ACCORDANCE WITH THE STATISTICS OF THE INTERNATIONAL RENEWABLE ENERGY AGENCY (IRENA)
<b>Dr. Halil ÇEÇEN</b>	Nuh Naci Yazgan University, Türkiye	REVIEW OF THE NEW RENEWABLE ENERGY SOURCES SUPPORT SCHEME ACCORDING TO THE TURKISH PRESIDENTIAL DECISION DATED ON 30 APRIL 2023 AND NUMBERED 7189 WITHIN THE FRAMEWORK OF ACQUIS COMMUNAUTAIRE

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HEAD OF SESSION: Assist. Prof. Dr. Yakup KARAKOYUN

Authors	Affiliation	Presentation title
<b>Hatice AYDIN</b> <b>Prof. Dr. Muciz ÖZCAN</b>	Necmettin Erbakan University, Türkiye	FLEXIBLE CONNECTION OF DISTRIBUTED ENERGY RESOURCES TO THE GRID
<b>Mustafa Sadeddin ERDENİZ</b> <b>Yusuf HIZAL</b> <b>Murat GENÇAĞA</b> <b>Assoc. Prof. Dr. Ahmet FEYZİOĞLU</b>	EMELEC, Türkiye Marmara University, Türkiye	DEVELOPMENT OF PD SENSOR FOR MEDIUM VOLTAGE CABLES
<b>Berkay AYTÜRK</b> <b>Res. Assist. Seyda ÖZBEKTAŞ</b> <b>Assoc. Prof. Dr. Bilal SUNGUR</b>	Samsun University, Türkiye Ondokuz Mayıs University, Türkiye	EXPERIMENTAL INVESTIGATION OF THE POTENTIAL OF THERMOELECTRIC GENERATORS WITH DIFFERENT POWERS
<b>Res. Assist. Seyda ÖZBEKTAŞ</b> <b>Assoc. Prof. Dr. Bilal SUNGUR</b> <b>Assoc. Prof. Dr. Alirza KALELİ</b>	Ondokuz Mayıs University, Türkiye Samsun University, Türkiye	NUMERICAL INVESTIGATION OF THE THERMAL AND ELECTRICAL BEHAVIOR OF A CYLINDRICAL LITHIUM-ION BATTERY AT DIFFERENT DISCHARGE RATES
<b>Fatih ÖNDER</b> <b>Prof. Dr. Ünal KURT</b>	Amasya University, Türkiye	EVALUATION OF THE EFFECTS OF DISTRIBUTED GENERATION FACILITIES ON DISTRIBUTION NETWORKS
<b>Assist. Prof. Dr. Yakup KARAKOYUN</b>	Van Yuzuncu Yil University, Türkiye	A COMPARATIVE ANALYSIS ON THE EFFECT OF PRECIPITATION ON THE ENERGY PRODUCTION OF HYDROPOWER PLANTS
<b>Assist. Prof. Dr. Berdan ULAŞ</b>	Van Yuzuncu Yil University, Türkiye	SYNTHESIS AND CHARACTERIZATION OF Pd <sub>x</sub> Nb <sub>(100-x)</sub> /CNT ANODE CATALYSTS FOR ETHYLENE GLYCOL ELECTROOXIDATION



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HEAD OF SESSION: Dr. Stanislaw Strzelecki

Authors	Affiliation	Presentation title
<b>Assist. Prof. Dr. Mete ÖZBALTAN</b> <b>Lect. Mehmet KURUCAN</b>	Erzurum Technical University, Türkiye Ardahan University, Türkiye	POWER-AWARE RECONFIGURATION MANAGER FOR SMARTPHONES
<b>Koray ALIN</b> <b>Assist. Prof. Dr. İsmail TEMİZ</b>	Marmara University, Türkiye	PREDICTIVE MAINTENANCE APPLICATION ON PIPELINES USING ARTIFICIAL INTELLIGENCE MODEL
<b>Ahlem CHEBEL</b> <b>Abdelouahab BENRETEM</b> <b>Ivan DOBREV</b>	Badji-Mokhtar-Annaba University, Algeria Arts et Métiers-Paris Tech, France	INTEGRATION OF FUZZY LOGIC CONTROL IN THE MODELING OF A WIND ENERGY CONVERSION SYSTEM
<b>Dr. Stanislaw Strzelecki</b>	Lodz University of Technology, Poland	FRICITION LOSS GENERATED IN MULTILOBE AND TILTING – PAD JOURNAL BEARINGS
<b>Dr. Lahyani Houda</b> <b>Dr. Akourri Omar</b>	Abdelmalek Essaâdi University, Morocco	THE FLEXIBILITY EVALUATION IN THE ASSEMBLY WORKSHOP OF A TERMINAL AUTOMOTIVE FACTORY
<b>Eren Anil SEZER</b> <b>Rumeysa ŞAHİN</b> <b>Mehmet SİNCAR</b> <b>Dr. Mustafa ÖZDEN</b> <b>Asst. Prof. Halil Hakan AÇIKEL</b> <b>Prof. Dr. Mustafa Serdar GENÇ</b>	Erciyes University, Türkiye	EFFECT OF AIRFOIL THICKNESS ON FLOW OVER THE SYMMETRIC AIRFOILS: PART II-NUMERICAL ANALYSIS

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HEAD OF SESSION: Dr. Zakaria LAFDAILI

Authors	Affiliation	Presentation title
<b>Dr. Zakaria LAFDAILI</b> <b>Hamid MOUNIR</b> <b>Khalid EL ATIFE</b> <b>Sakina El-Hamdani</b>	Mohammed V University, Morocco Ibn Zohr University, Morocco	USE OF A REFINED MESH WITH TWO NON-CONFORMING BLOCKS TO NUMERICALLY STUDY THE EFFECT OF THE GROOVES OF A VERTICAL WALL IN A DIFFERENTIALLY HEATED SQUARE CAVITY ON THE NATURAL CONVECTION OF A NANO-FLUID
<b>Khalid Elatife</b> <b>Abdellatif El Marjani</b> <b>Zakaria Lafdaili</b>	Mohammed V University in Rabat, Morocco	EVALUATION OF THE EFFECT OF BLADE PROFILES ON THE PERFORMANCE OF RADIAL IMPULSE TURBINES FOR WAVE ENERGY CONVERSION
<b>Dr. Hammoufi Marwane</b> <b>El Haim Mohamed</b>	Abdelmalek Essaâdi University, Morocco	FORECASTING LAND SHIFT RISKS WITH MAPPING IN MOROCCO'S MIDDLE RIF.
<b>Dr. Swarupa Rani gurram</b> <b>Dr. Mohammed Afzal Azam</b>	Vikas College of Pharmaceutical Sciences, India	EVOLUTION OF ENERGY SYSTEMS: PATTERNS AND MECHANISMS
<b>Shehu Ahmadu Nadamau</b> <b>Ibrahim Mustapha</b>	Ahmadu Bello University, Nigeria College of Health Science and Technology, Nigeria	CURRENT ADVANCES IN BIOENERGY PRODUCTION HARNESSING THE POWER OF NATURE FOR SUSTAINABLE ENERGY
<b>Bijender Singh</b> <b>Anu</b> <b>Davender Singh</b>	Central University of Haryana, India Maharshi Dayanand University, India RPS Degree College, India	ALKALINE PRETREATMENT AND ENZYMATIC SACCHARIFICATION OF RICE STRAW FOR THE PRODUCTION OF BIOETHANOL
<b>Hooman Fatoorehchi</b> <b>Seyed Amirreza Babaei</b> <b>Niloofar Arabi</b>	University of Tehran, Iran	STABILITY ANALYSIS OF A HYDRO POWER PLANT BASED ON BERKOWITZ ALGORITHM AND ROUTH-HURWITZ CRITERION
<b>Krimech, A.</b> <b>Cherifi, O.</b> <b>Hejjaj, A.</b> <b>Mugani, R.</b> <b>Ouazzani, N.</b> <b>Kerner, M.</b> <b>Oudra, B.</b> <b>Mandi, L.</b>	Cadi Ayyad University, Morocco SSC Strategic Science Consult GmbH, Germany	BIOMASS PRODUCTION OF <i>Chlorella sorokiniana</i> UCAM 001 IN FLAT-PLATE PHOTOBIOREACTORS UNDER THE ARID CLIMATE OF MOROCCO

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HEAD OF SESSION: Dr. Ashok Kumar Atri

Authors	Affiliation	Presentation title
<b>Zanaira Batool Shanza Abbas</b>	Comsats University Islamabad, Pakistan	ENERGY JUSTICE: BRIDGING GAPS IN ACCESS, DISTRIBUTION, AND ENVIRONMENTAL IMPACTS
<b>Dr. Ashok Kumar Atri</b>	RKSD College, India	RISING ENERGY DEMAND IMPELS INDIA TO LOOK FOR SUPPLY ALTERNATE
<b>Ayushi Singh Sparsh Yadav Nalinesh Singh Neha Yash Prarup</b>	Galgotias University, India	DISPUTE RESOLUTION MECHANISMS IN CROSS-BORDER ENERGY AGREEMENTS
<b>Ganya, Adamu Hauni Dauda, Hauwa Ango, Monica Asabe Ibrahim</b>	Usmanu Danfodiyo University, Nigeria Shehu Shagari University of Education Sokoto, Nigeria Federal University of Agriculture, Nigeria	ENERGY-SAVING MECHANISMS FOR EVALUATING EFFICIENCY IMPROVEMENT AND LOSSES REDUCTION SCENARIOS IN THE THERMAL POWER PLANTS SECTOR OF NIGERIA
<b>Alya Nisrina Huwaida Ismahatul Hanifah Hendri Hermawan ADINUGRAHA</b>	UIN K.H. Abdurrahman Wahid Pekalongan, Indonesia	ELECTRIC ENERGY CONSUMPTION BEHAVIOR VIEWED FROM AN ISLAMIC ECONOMIC PERSPECTIVE
<b>Chakib EL FISSI</b>	Hassan II University of Casablanca, Morocco	ENERGY EFFICIENCY AND ENERGY STRATEGIES
<b>Thomas, Ekaobong Akan</b>	Akwa Ibom State Polytechnic, Nigeria	AN APPRAISAL OF THE LEGAL AND REGULATORY FRAMEWORK FOR RENEWABLE ENERGY IN NIGERIA
<b>Joseph Chisom Okoye Chidi U. Arubalueze</b>	University of Nigeria, Nigeria	ENERGY TRANSITION IN AGRICULTURE: ASSESSING THE IMPACT OF RENEWABLE TECHNOLOGIES ON FARMING PRACTICES WORLDWIDE
<b>Ayushi Singh Sparsh Yadav Nalinesh Singh</b>	Galgotias University, India	NAVIGATING LEGAL COMPLEXITIES: CHALLENGES IN CORPORATE ENERGY PROCUREMENT

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HEAD OF SESSION: Samira Ontunch

Authors	Affiliation	Presentation title
<b>Dr. BENCHEKROUN Marwa</b> <b>Dr. BABA SLIMANE Nour El Houda</b>	University Saad Dahleb of Blida-1, Algeria High School of Architecture and Urban Planning, Algeria	ADVANCING SUSTAINABLE DEVELOPMENT: BUILDING CERTIFICATION INITIATIVES IN ALGERIA
<b>Dr. BABA SLIMANE Nour El Houda</b> <b>Dr. BENCHEKROUN Marwa</b>	High School of Architecture and Urban Planning (EPAU), Algeria University Saad Dahleb of Blida-1-, Algeria	ENHANCING ENERGY EFFICIENCY THROUGH BIOPHILIC ARCHITECTURE
<b>Salim Mesbahi</b> <b>Samih Djemai</b>	Ferhat Abbas University, Algeria	GREEN SOLUTIONS FOR COOLING: TOWARDS SUSTAINABLE AND ENERGY- EFFICIENT COOLING SYSTEMS
<b>Samih Djemai</b> <b>Salim Mesbahi</b>	Ferhat Abbas University, Algeria	HARNESSING SOLAR ENERGY FOR COOLING IN BUILDINGS: PRINCIPLES, POTENTIAL BENEFITS, AND INTEGRATION STRATEGIES
<b>Zineb MOUJOURD</b> <b>Abdeslam EL BOUARI</b> <b>Omar TANANE</b>	Hassan II University of Casablanca, Morocco	NATURAL FIBER-BASED GEOPOLYMER COMPOSITES WITH LOW THERMAL CONDUCTIVITY FOR ENERGYEFFICIENT BUILDINGS
<b>Bala Balarabe</b> <b>Andy Anderson Bery</b> <b>Umar Mahmood</b>	Ahmadu Bello University, Nigeria	APPLICATION OF ELECTRICAL RESISTIVITY METHOD FOR PRE- CONSTRUCTION ASSESSMENT



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HEAD OF SESSION: Prof. Dr. Cemil ALKAN

Authors	Affiliation	Presentation title
<b>Assist. Prof. Dr. Alper UĞUR</b> <b>Assoc. Prof. Dr. İlker AVAN</b>	Eskişehir Technical University, Türkiye	TRIBOFILM FORMATION OF ZNS NANOPARTICLES MODIFIED WITH LIPOPHILIC ORGANIC MOLECULE
<b>Zehra EROL</b> <b>Prof. Dr. Meryem EVECEN</b>	Amasya University, Türkiye	EFFECTS OF MONO-FLOR(CHLORINE)-SUBSTITUTION ON THE STRUCTURAL AND NON-LINEAR OPTICAL PROPERTIES OF POLY(3-HEXYLTHIOPHENE-2,5- DIYL) FOR SOLAR CELL APPLICATIONS
<b>Prof. Dr. Nuray TOKGÖZ</b> <b>Dr. Emre AVUNDUK</b>	Istanbul University Cerrahpaşa, Türkiye Istanbul Technical University, Türkiye	ENERGY AVAILABILITY ANALYSIS OF TRAKYA REGION COALS WITH NEW GENERATION TECHNOLOGIES
<b>Usman Ahmed Kehinde</b> <b>Bello Yusuf Ayoola</b> <b>Hassan Yusuf Adigun</b> <b>Aliyu Yahaya</b>	Ahmadu Bello University, Nigeria The Air Force Institute of Technology (AFIT), Nigeria	EVALUATION OF GEOTHERMAL ENERGY RESOURCE POTENTIAL IN NORTH - EASTERN NIGERIA USING SPECTRAL ANALYSIS OF AEROMAGNETIC DATA
<b>Zeba Ali Mumtaz</b> <b>Abdul Rahman Khan</b> <b>Saimah Khan</b>	Integral University, India	ECO-FRIENDLY WASTEWATER TREATMENT TECHNIQUES IN CONSTRUCTED WETLANDS THAT PROMOTE ENERGY CONSERVATION
<b>Lect. Dr. Nazan GÖKŞEN TOSUN</b> <b>Prof. Dr. Cemil ALKAN</b>	Tokat Gaziosmanpaşa University, Türkiye	SYNTHESIS and CHARACTERIZATION OF A P(VCL-co-AA) COPOLYMER AS THERMOTROPIC POLYMER
<b>Lect. Dr. Nazan GÖKŞEN TOSUN</b> <b>Prof. Dr. Cemil ALKAN</b>	Tokat Gaziosmanpaşa University, Türkiye	1,4-PHENYLENE DISTEARYLAMIDE AS A NOVEL PHASE CHANGE MATERIAL FOR THERMAL ENERGY STORAGE

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HEAD OF SESSION: Res. Assist. Gökhan YÜKSEK

Authors	Affiliation	Presentation title
<b>Assoc. Prof. Dr. Mehmet Uğraş CUMA Assoc. Prof. Dr. Murat Mustafa SAVRUN</b>	Çukurova University, Türkiye Adana Alparslan Türkeş Science and Technology University, Türkiye	EXAMINING THE MULTIPLE ELECTRIC VEHICLE PERFORMANCE OF BATTERY BUFFERED DC FAST CHARGER
<b>Res. Assist. Gökhan YÜKSEK Assoc. Prof. Dr. Alkan ALKAYA</b>	Mersin University, Türkiye	A NOVEL APPROACH TO EXTEND THE BATTERY LIFE BY STATE OF HEALTH MANAGEMENT CONSIDERING THE CELL TEMPERATURE
<b>Res. Assist. Gökhan YÜKSEK Assoc. Prof. Dr. Alkan ALKAYA</b>	Mersin University, Türkiye	COMPARATIVE ANALYSIS OF DC-DC CONVERTER TOPOLOGIES IN BATTERY-SUPERCAPACITOR HYBRID ENERGY SYSTEMS: A SIMULATION STUDY
<b>Doughri Doha Mehdaoui Boubker El Bouari Abdeslam</b>	University Hassan II of Casablanca, Morocco	EXPLORING Li <sub>4</sub> MSbO <sub>6</sub> AS A POTENTIAL CANDIDATE FOR NEXT-GENERATION Li-Ion BATTERIES: STRUCTURAL AND ELECTRICAL CHARACTERISTICS
<b>Kaoutar Moulakhnif Hanane Ait Ousaleh Said Sair Youness Bouhaj Mohssine Ghazoui Abdessamad Faik Abdeslam El Bouari</b>	Hassan II University of Casablanca, Morocco Mohammed VI Polytechnic University, Morocco Sultan Moulay Slimane University, Morocco	ADSORBENT MATERIALS BASED-SALT HYDRATE FOR THERMOCHEMICAL ENERGY STORAGE
<b>Madhavan Madheswaran Shobana Babu Pandiaraja Duraisamy Prakash Periakaruppan</b>	Madurai Kamaraj University, India	THE COMPARISON OF THE LIFETIME ESTIMATION OF ELECTROCHEMICAL ENERGY STORAGE DEVICES USING STOCHASTIC DIFFERENTIAL EQUATIONS

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Authors	Affiliation	Presentation title
<b>Lect. Dr. Betül ŞAHİN</b>	Trabzon University, Türkiye	PLANT BIOMASS POTENTIAL OF ELAZIĞ PROVINCE
<b>Assist. Prof. Dr. Saliha ÖZARSLAN</b> <b>Assist. Prof. Dr. Melih YILDIZ</b>	Amasya University, Türkiye İğdir University, Türkiye	MODELING COMBUSTION OF BIOMASS TEA WASTE IN A VERTICAL FURNACE UNDER DIFFERENT EXCESS AIR RATIOS: A CFD ANALYSIS
<b>Metehan KANYILMAZ</b> <b>Prof. Dr. Sema YURDAKUL</b> <b>Assoc. Prof. Dr. Barış GUREL</b>	Süleyman Demirel University, Türkiye	INVESTIGATION OF TOREFICATION PARAMETERS OF ROSE PULP AND CHICKEN MANURE
<b>Sultan FAAL</b> <b>Assoc. Prof. Dr. Mehmet Sait İZGİ</b> <b>Assist. Prof. Dr. Erhan ONAT</b>	Siirt University, Türkiye Bitlis Eren University, Türkiye	SYNTHESIS OF CARBON QUANTUM DOTS BY SOLVOTHERMAL METHOD AND HYDROGEN PRODUCTION FROM THE HYDROLYSIS OF DIMETHYLAMINE BORANE
<b>Assist. Prof. Dr. Erhan ONAT</b> <b>Sultan FAAL</b> <b>Assoc. Prof. Dr. Mehmet Sait İZGİ</b>	Bitlis Eren University, Türkiye Siirt University, Türkiye	HYDROLYSIS AND KINETIC MECHANISM OF DIMETHYLAMINE BORANE USING NI NANOCATALYST OBTAINED VIA GREEN SYNTHESIS
<b>Burhan Burak GENÇKAN</b> <b>Assist. Prof. Dr. Ayetül GELEN</b>	Bursa Technical University, Türkiye	DESIGN and FABRICATION of a TEST STATION for VARIOUS FUEL CELLS
<b>H. Benaali</b> <b>A. Tahiri</b> <b>M. Naji</b> <b>S. bahhar</b>	Sidi Mohamed Ben Abdellah University, Morocco Chouaïb Doukkali University, Morocco	DFT-BASED FIRST-PRINCIPLES CALCULATIONS OF NEW KXH <sub>3</sub> (X = Mn, Fe) HYDRIDE COMPOUNDS FOR HYDROGEN STORAGE APPLICATIONS
<b>Assoc. Prof. Dr. Kassayeva</b> <b>Assylkanym Zhulamanovna</b> <b>Savelkin Nikita Kirillovich</b>	Yessenov University, Kazakhstan	PRODUCTION OF GREEN HYDROGEN BY LOW-TEMPERATURE ELECTROLYSIS

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HEAD OF SESSION: Prof. Dr. C. Slimani

Authors	Affiliation	Presentation title
<b>Aniekan Essienubong Ikpe Mfonobong Rivenus Asuquo Michael Okon Bassey</b>	Akwa Ibom State Polytechnic, Nigeria	POTENTIAL BENEFITS AND DRAWBACKS OF WASTE-TO-ENERGY CONVERSION: A REFLECTION ON THE ENVIRONMENTAL IMPACT, ECONOMIC VIABILITY AND SOCIAL IMPLICATIONS
<b>Mohamed Farhaoui Prof. Dr. C. Slimani</b>	Sidi Mohamed Ben Abdellah University, Morocco	EFFECTS OF GREEN BUILDING AND ENERGY SAVING ON HOUSING MARKET VALUATION
<b>Oussama Hartal Salah Souabi Abdelaziz Madinzi</b>	University Hassan II, Morocco	OPTIMIZATION OF THE COAGULATION-FLOCCULATION PROCESS FOR THE TREATMENT OF WASTEWATER FROM VEGETABLE OIL REFINERIES
<b>Chaima Kahouadji Tayeb Hocine Brahim Bouras Kamel Ismet Benabadji Oussama Bouras Amal Hocine</b>	University of Tlemcen, Algeria	APPLICATION OF A COPOLYMER TO WATER TREATMENT
<b>Smart M. O. Okumodi B. O. Bamigboye T. O. Ibironke O. H. Roberts A. E.</b>	Federal College of Forestry, Nigeria Forestry Research Institute of Nigeria, Nigeria University of Ibadan, Nigeria	ECOLOGICAL RISK ASSESSMENTS OF POTENTIALLY TOXIC ELEMENTS IN SOILS AROUND LAPITE DUMP SITE, AKINYELE LOCAL GOVERNMENT
<b>Khadija Zidan Laila Mandi Abdessamed Hejjaj Naaila Ouazzani Ali Assabbane</b>	Cadi Ayyad University, Morocco University Ibn Zohr, Morocco	SEASONAL EFFECTS ON THE EFFICIENCY OF A NEW HYBRID MULTI-SOIL-LAYERING ECO-FRIENDLY TECHNOLOGY FOR REMOVING POLLUTANTS FROM DOMESTIC WASTEWATER UNDER AN ARID CLIMATE



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HEAD OF SESSION: Assoc. Prof. Dr. Tarik Touiss

Authors	Affiliation	Presentation title
<b>Assoc. Prof. Dr. Tarik Touiss</b> <b>Prof. Dr. Driss BRIA</b>	Mohamed Frist University, Morocco	DEFECTIVE PHOTONIC COMB-LIKE WAVEGUIDES STRUCTURE USING TRANSFER MATRIX METHOD
<b>Assoc. Prof. Dr. Tarik Touiss</b> <b>Prof. Dr. Driss BRIA</b>	Mohamed Frist University, Morocco	ANALYSIS OF PERIODIC CYLINDRICAL WAVEGUIDES FOR PHOTONIC FILTERING APPLICATIONS USING THE TRANSFER MATRIX METHOD
<b>S. Bahhar</b> <b>A. Jabar</b> <b>L. Bahmad</b> <b>S. Benyoussef</b> <b>A. Tahiri</b>	Chouaïb Doukkali University, Morocco Hassan II University of Casablanca, Morocco Mohammed V University, Morocco	COMPUTATIONAL STUDY OF STRUCTURAL, MAGNETIC, ELECTRONIC, OPTICAL, AND THERMOELECTRIC PROPERTIES OF QUATERNARY FULL-HEUSLER ALLOY FeCuMnSi
<b>Bilal Merouane Turki</b> <b>Haroun Righi</b> <b>Massaoud Caid</b> <b>Djamel Rached</b> <b>Youcef Rached</b> <b>Ahmed Arab Ait belkacem</b>	University of Sidi-Bel- Abbes, Algeria Universit´e Ahmed Ben Yahia El- Wancharisi Tissemsilt, Algeria	HETEROSTRUCTURES OF SEMI CONDUCTRICES
<b>Abdelmoumen Ghilani</b> <b>Amel Terki</b> <b>Ahmed Marouane Ghodbane</b> <b>Zakaria alili</b>	University of Biskra, Algeria	THE OPTIMAL DESIGN FOR GRID-CONNECTED PV SYSTEMS
<b>S. Elmazouzi</b> <b>H. Mabrak</b> <b>A. Salim</b> <b>I. Zerdani</b> <b>Y. Naimi</b>	Hassan II University of Casablanca, Morocco	OPTIMIZING ELECTRO-ACTIVE BIOFILM FORMATION FOR ENHANCED MICROBIAL FUEL CELL PERFORMANCE
<b>Astitva Kumar Rao</b>	Dr. B. R. Ambedkar National Law University, India	INTEGRATION OF RENEWABLE ENERGY SOURCES IN THE POWER GRID: CHALLENGES AND SOLUTIONS
<b>Assist. Prof. Dr. Jogendra Kumar</b>	G.B.Pant Institute of Engineering and Technology, India	SIMULATION PERFORMANCE ANALYSIS OF ROUTING PROTOCOLS USING ENERGY MODEL

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Authors	Affiliation	Presentation title
<b>Noor Nabi Shah</b>	University of Engineering and Technology, Pakistan	A LEAST SQUARE-LAPLACE TRANSFORM METHOD FOR SOLVING VOLTERRA INTEGRAL EQUATION WITH HIGHLY OSCILLATORY BESSEL KERNELS
<b>LAGRINI Ismail TBATOU Taoufik BENCHEIKH Mohamed</b>	Hassan II University of Casablanca, Morocco	DOSIMETRIC OPTIMIZATION IN HIGH-DOSE RADIOTHERAPY: TECHNIQUES AND CHALLENGES
<b>Mostafa RACHIK Issam KHALOUFI Youssef BENFATAH Hamza BOUTAYEB Hassan LAARABI</b>	Hassan II University of Casablanca, Morocco	ON THE CONTROL OF THE FINAL SPEED FOR A CLASS OF FINITE-DIMENSIONAL LINEAR SYSTEMS: CONTROLLABILITY AND REGULATION
<b>Dr. BRAKNI Oumaima Dr. Amrouche Fethia Dr. Abdallah Mohammedi Prof. KERBOUA ZIARI Yasmina</b>	University of Science and Technology Houari Boumediene (USTHB), Algeria Centre de Développement des Énergies Renouvelables, Algeria University of Batna 2, Algeria	UNVEILING EFFICIENCY: CFD STUDY ON PEMFC PERFORMANCE VIA FLOW FIELD CHANNEL DESIGN WITH GAMBIT AND FLUENT FOR SUSTAINABLE ENERGY
<b>Blerina Bylykbashi</b>	University of Prishtina, Kosova	INCREASING PERFORMANCE OF PHOTOVOLTAIC SYSTEMS: A CASE STUDY KOSOVA

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HEAD OF SESSION: Dr. Bukurije Hoxha

Authors	Affiliation	Presentation title
<b>Jisike Oluchukwu Faith Eje Ozoemena Emmanuel</b>	University of Nigeria, Nigeria	BIOMASS FOR BIOFUEL PRODUCTION AND ENERGY EFFICIENCY: CHALLENGES AND FUTURE PROSPECT
<b>Vidya Padmakumar Murugan Shanthakumar</b>	Bangalore University, India	AN EVALUATION OF THE ECOLOGICAL IMPACTS OF TIDAL POWER PLANTS ON MARINE BIODIVERSITY AND ECOSYSTEM SERVICES
<b>Basma BENBOUYA Hocine CHEGHIB Oussama TOUABA Meriem BEHIM</b>	Annaba University, Algeria Unit of research and development of renewable energy, Algeria	PARTIALLY SELF-CHARGING SOLAR VEHICLE
<b>Bekir Bytyqi Bukurije Hoxha</b>	University of Debrecen, Hungary University of Prishtina Hasan Prishtina, Kosovo	THE POSSIBILITY OF USING BIOMASS AS A SOURCE OF ENERGY, CASE OF KOSOVO
<b>Kosovare Latifaj Bukurije Hoxha</b>	University of Prishtina Hasan Prishtina, Kosovo	THE CONTRIBUTION OF WIND ENERGY TO ENERGY STABILITY IN KOSOVO
<b>Prof. Vijay Kumar Dr. Sunil Kumar</b>	Indira Gandhi University, India	STRUCTURAL MORPHOLOGY DEPENDENCE ON PERFORMANCE OF NATURAL DYE-SENSITIZED ZnO SOLAR CELLS
<b>Oumaima Chajji Younes Chemchame Abdeslam El Bouari</b>	Hassan II University of Casablanca, Morocco	APPLICATION OF A NATURAL DYE IN DYE-SENSITIZED SOLAR CELLS AND THEIR CHARACTERISTICS
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<b>Badis Bakri Hani Benguesmia Zied Driss</b>	University of M'sila, Algeria University of Sfax, Tunisia	STUDY OF A SOLAR AIR HEATER TEST BENCH PERFORMANCE

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Authors	Affiliation	Presentation title
<b>Res. Assist. Rana UZUN</b> <b>Assoc. Prof. Dr. Seher GÜZELÇOBAN MAYUK</b> <b>Assist. Prof. Dr. Elif ÖZER YÜKSEL</b>	Gebze Technical University, Türkiye	CURRENT PRACTICES IN ENERGY-EFFICIENT FACADE DESIGN: DOUBLE SKIN FACADE SYSTEMS AND PHASE CHANGE MATERIALS
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<b>Sushrut Patankar</b> <b>Raju Kumar Swami</b> <b>Sameer Nanivadekar</b>	Pacific Academy of Higher Education and Research University, India A P Shah Institute of Technology, India	EMERGING TRENDS IN SMART BUILDING ENERGY MANAGEMENT: A COMPREHENSIVE REVIEW OF AI, IoT, AND SUSTAINABILITY ADVANCES
<b>Sinan GÜNEŞ</b> <b>Prof. Dr. Mustafa TOMBUL</b>	Ankara University, Türkiye	GREY BOX APPROACH FOR ENERGY CONSUMPTION FORECASTING IN UNIVERSITY CAMPUS BUILDINGS



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<b>Res. Assist. Emine İŞİN Assoc. Prof. Dr. Nurettin ÇETİNKAYA</b>	Konya Technical University, Türkiye	DETERMINATION OF OPTIMUM DC/AC RATIO FOR PV POWER PLANTS USING ARTIFICIAL INTELLIGENCE
<b>Assist. Prof. Dr. Gökhan KEVEN</b>	Nevşehir Hacı Bektaş Veli University, Türkiye	REDUCED HARMONICS IN A SEVEN LEVEL ASYMMETRIC MULTILEVEL INVERTER WITH APERIODIC DC SOURCES
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<b>Assoc. Prof. Dr. R. Boussetta Dr. O. Mommadi Prof. A. EL-Moussaouy Prof. A. EL-Miad Kerkour</b>	University Mohamed I, Morocco	THE IMPACT OF GEOMETRICAL CONFINEMENT AND EXTERNALLY APPLIED ELECTRIC AND MAGNETIC FIELDS ON THE ELECTRONIC ENERGY LEVELS IN A GAAS QUARTER TORUS QUANTUM DOT

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<b>Maciej Śniegowski</b>	University of Szczecin, Poland	THE CHALLENGES OF THE HEAT PRODUCTION IN THE FRAME OF SUSTAINABLE EU DEVELOPMENT STRATEGY
<b>Andréa Silva AZEVEDO Luciano Sergio HOCEVAR Carine Tondo ALVES Jadiel dos Santos PEREIRA Gabrielly de Moura BEZERRA Maria Cândida Arrais de Miranda MOUSINHO Silvio Alexandre Beisl VIEIRA DE MELO</b>	Federal University of Bahia, Brazil Federal Institute of Bahia, Brazil Federal University of Recôncavo da Bahia, Brazil	ENERGY POVERTY IN THE ERA OF GLOBALIZATION: BRAZIL, CHINA AND INDIA
<b>Hamid FARRICHA</b>	Hassan II University of Casablanca, Morocco	ENERGY CHALLENGES IN WEST AFRICA
<b>Syeda Nada Qadri Rukhsar Khan</b>	Aligarh Muslim University, India	POWER STRUGGLES: ANALYZING THE GEOPOLITICS OF RENEWABLE ENERGY TRANSITION
<b>Rukhsar Khan Syeda Nada Qadri</b>	Aligarh Muslim University, India	FROM OIL DISCOVERY TO ENERGY HUB: TRACING THE HISTORICAL EVOLUTION OF GULF STATES' FUEL ECONOMIES
<b>Rosario Marrapodi Stefania Mele Caterina Galdiero Cecilia Maltempo</b>	Univerity of Campania Luigi Vanvitelli, Italy University of Salerno, Italy	EXPLORING SMART WORK'S IMPACT ON SUSTAINABILITY: A BIBLIOMETRIC ANALYSIS
<b>Sri Padma Kanta Mishra Assist. Prof. Deepak Bansal</b>	Indian Institute of Finance, India	ETHICAL ISSUES IN GLOBAL OIL PRICING AND ITS IMPACT ON EXCHANGE RATES AND STOCK MARKETS UNDER UNCERTAINTY
<b>Dr. Aderinsola E. Kayode</b>	Durban University of Technology, South Africa	EXPLORING APPROACHES IN HIGHER EDUCATION TO INTEGRATE ENERGY SUSTAINABILITY (A REVIEW)
<b>Dr. Sándor Földvári</b>	Debrecen University, Hungary	ENERGY SUPPLY FOR TÜRKIYE: OIL AND GAS IN UKRAINE UNDER THE BLACK SEA

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Authors	Affiliation	Presentation title
<b>Talha Mashhood Dr. Muhammad Ibrahim Dr. Akbar Ali</b>	Government College University Faisalabad, Pakistan	SYNTHESIS AND BIOLOGICAL SCREENING OF HYDRAZONES USING ISOLATED CHOLIC ACID
<b>Y.Didi M.Belhajji A.Rjeb A.Tahiri M.Naji S.Bahhar</b>	Sidi Mohamed Ben Abdellah University, Morocco Chouaib Doukkali University, Morocco	BASED ON THE CALCULATION OF THE STRUCTURAL, MECHANICAL, OPTICAL, AND ELECTRONIC PROPERTIES OF THE OXIDE PEROVSKITE $XBkO_3$ ( $X = Pb, Ra, Sr$ ): A DFT STUDY
<b>Prof. Dr. Abbas Khan Ubaid Ur Rahman Asad Ullah Rashid Nawaz</b>	Abdul Wali Khan University Mardan, Pakistan	SYNTHESIS AND CHARACTERIZATION OF Zn DECORATED GRAPHENE OXIDE FOR ENHANCE PHOTOCATALYTIC APPLICATION
<b>Wali Muhammad Prof. Dr. Abbas Khan Dr. Sajjad Hussain</b>	Abdul Wali Khan University Mardan, Pakistan Ghulam Ishaq Khan Institute of Engineering Sciences and Technology, Pakistan	IMPROVING PHOTOCATALYTIC EFFICIENCY OF GRAPHATIC CARBON NITRIDE NANOCOMPOSITES BASED ON DOUBLE Z-SCHEME HETEROJUNCTIONS
<b>Ouahiba Mrajji Abdeslam EL Bouari Omar Cherkaoui</b>	Hassan II University of Casablanca, Morocco Higher School of Textile and clothing Industries, Morocco	NUMERICAL INVESTIGATION OF ECO-FRIENDLY MATERIALS FOR BUILDING ENVELOPE
<b>Roguai Sabrina Djelloul Abdelkader</b>	Abbes Laghrour University, Algeria	STRUCTURAL, OPTICAL, AND ELECTRICAL PROPERTIES OF 4%Co-SnO <sub>2</sub> FILMS BY USP METHOD
<b>Derrar Oum hani Djelloul Abdelkader</b>	Larbi Tbessi University, Algeria HD CRTSE, Algeria	STUDY OF THE MORPHOLOGICAL, STRUCTURAL AND OPTICAL PROPERTIES OF THIN LAYERS CZTS FOR PHOTOVOLTAIC APPLICATIONS
<b>Osamah Ihsan Ali Taha Hussein Mohammed</b>	University of Pannonia, Hungary University of Babylon, Iraq	MECHANICAL CHARACTERIZATION OF ADVANCED CHEMICAL VAPOR DEPOSITION COATINGS FOR CUTTING TOOL APPLICATIONS

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<b>Ülkü KÖSE</b>	Izmir Bakırçay University, Türkiye	STUDIES IN THE FIELD OF CARBON TRADE AND ENERGY LAW
<b>Yasemin SELÇUK</b> <b>Prof. Dr. Ebru Vesile ÖCALIR</b>	Gazi University, Türkiye	BICYCLE TRANSPORTATION, URBAN PLANNING AND ENERGY EFFICIENCY, BIBLIOMETRIC ANALYSIS STUDY
<b>Fikret KAYA</b> <b>Assist. Prof. Onur AKAR</b>	Marmara University, Türkiye	DEVELOPMENTS IN OFF-GRID ON-BOARD PORTABLE ELECTRIC VEHICLE CHARGING STATION
<b>Seda Nur BOZKURT</b> <b>Assoc. Prof. Dr. Selda KAPLAN ULUSOY</b>	Erciyes University, Türkiye	DATA-BASED MODELS FOR REMAINING USEFUL LIFE ESTIMATION OF TURBOFAN ENGINES -A REVIEW
<b>Esmâ YILDIRIM</b> <b>Assoc. Prof. Dr. Atilla DÖNÜK</b>	Aydın Adnan Menderes University, Türkiye	ENERGY EFFICIENCY PRACTICES IN PUBLIC HOSPITALS
<b>Ali BEYKONT</b> <b>Res. Assist. Sinem KESKIN</b> <b>Prof. Dr. Mustafa Serdar GENÇ</b>	Erciyes University, Türkiye	ANALYSIS OF THE WIND LOAD ON THE BUILDING IN TURBULENT FLOW IN OPENFOAM



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## TÜRKİYE İLLERİNİN ENERJİ İHTİYAÇLARINA GÖRE MAKİNE ÖĞRENMESİ YÖNTEMLERİYLE ANALİZİ

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### ÖZET

Günlük hayatın sekteye uğramadan devam edebilmesi için enerji zorunlu bir ihtiyaçtır. Ülkelerin üretim yapabilmeleri ve dolayısıyla ekonomik olarak kalkınabilmeleri için temel bir kaynak olan enerji, ülkelerin dışa bağımlılıklarını ve refah düzeylerini de doğrudan belirler. Küreselleşme, hızla gelişen teknoloji, artan nüfus vb. durumlar diğer tükenebilir kaynaklar gibi enerji kaynaklarını da etkilemiştir. Tüm dünya ülkeleri gibi ülkemiz için de enerji kaynaklarının ne kadar önemli bir konu olduğu bilinen bir gerçektir. Türkiye gibi büyük ve çeşitlilik gösteren bir ülkede enerji ihtiyacı için genel bir analiz yerine bölgelerin sosyoekonomik özelliklerine dayalı analizler, daha etkili ve hedefe yönelik politika oluşturma süreçlerine katkıda bulunabilir. Bu çalışmada, Türkiye'nin illerinin enerji ihtiyacına göre sosyoekonomik özellikler çerçevesinde kümelenmesi konusuna odaklanılmıştır. Kümeleme ve sınıflandırma yöntemleri kullanılarak farklı bölgeler arasındaki benzerlikler ve farklılıklar ortaya konmuş, bölgesel kalkınma planlamasında ve kaynakların etkin kullanımında yol gösterici olmak amaçlanmıştır. Çalışmada öncelikle enerji ihtiyacını etkilediği düşünülen yirmi iki sosyoekonomik değişken belirlenerek veri ön işleme adımları gerçekleştirilmiştir. Ön işleme adımlarında iki kriter elenmiş ve veriler normalize edilmiştir. Sonrasında, Öklid, Manhattan, Canberra ve Minkowski olmak üzere dört farklı uzaklık metriği kullanılarak küme sayısı 4, 5, 6, 7, 8 ve 9 olmak üzere K-ortalamlar yöntemiyle iller kümelenmiştir. Ardından, makine öğrenmesi yöntemlerinden K en yakın komşu, Rassal Orman (RF) ve Destek Vektör Makineleri (SVM) kullanılarak sınıflama hatası hesaplanmış ve böylece kümeleme başarısı analiz edilmiştir. Tüm yöntemler uygulanırken çapraz doğrulamalar yapılarak parametre optimizasyonu gerçekleştirilmiştir. Ayrıca, RF yöntemiyle değişkenlerin önem derecesi hesaplanmış ve buna göre veri seti ağırlıklandırılarak algoritma adımları yinelenmiştir. Farklı uzaklık metriği, küme sayısı, kriter ağırlıklıkları ve parametrelere göre tüm sınıflandırmalar için ortalama hatalar hesaplanarak en başarılı üç set kümeleme elde edilmiştir. Tüm setlerde kümelerin net bir şekilde ayrıldığı tespit edilmiştir.

**Anahtar Kelimeler:** Enerji ihtiyacı, makine öğrenmesi, K-ortalamlar, K en yakın komşu, Rassal Orman (RF), Destek Vektör Makineleri (SVM).

### ANALYSIS OF TÜRKİYE'S PROVINCES BASED ON ENERGY NEEDS USING MACHINE LEARNING METHODS

#### ABSTRACT

In order for daily life to continue without disruption, energy is a necessary requirement. Energy, which is a fundamental resource for countries to be able to produce and consequently develop economically, also directly affects the dependency of countries on external sources and their levels of prosperity. Globalization, rapidly advancing technology, increasing population, and other factors have also impacted energy resources, just like other depletable resources. It is a well-known fact that energy resources are of great importance for our country,

as well as for all countries around the world. In a large and diverse country like Türkiye, analyses based on the socio-economic characteristics of regions, rather than a general analysis of energy needs, can contribute to more effective and targeted policy-making processes. This study focuses on clustering the provinces of Türkiye based on their socio-economic characteristics in relation to energy needs. By using clustering and classification methods, similarities and differences between different regions are identified, aiming to provide guidance in regional development planning and efficient resource utilization. In this study, twenty-two socio-economic variables thought to influence energy needs were first identified, and data preprocessing steps were carried out. In the preprocessing steps, two criteria were eliminated and the data was normalized. Subsequently, using four different distance metrics - Euclidean, Manhattan, Canberra, and Minkowski - provinces were clustered using the K-means method with cluster numbers of 4, 5, 6, 7, 8, and 9. Then, classification errors were calculated using machine learning methods such as K-Nearest Neighbors (KNN), Random Forest (RF), and Support Vector Machines (SVM), and thus the clustering success was analyzed. Cross-validations were performed during the application of all methods for parameter optimization. In addition, the importance of variables was calculated using the RF method, and accordingly, the algorithm steps were repeated by weighting the dataset. Average errors were calculated for all classifications based on different distance metrics, cluster numbers, criterion weights, and parameters, and the three most successful clustering sets were obtained. It was observed that clusters were clearly separated in all sets.

**Keywords:** Energy requirement, machine learning, K-means, K-Nearest Neighbors, Random Forest (RF), Support Vector Machines (SVM).



## TÜRKİYE İLLERİNİN YENİLENEBİLİR ENERJİ POTANSİYELLERİNE GÖRE BULANIK KÜMELENMESİ

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### ÖZET

Ülkelerin ekonomik ve sosyal kalkınmaları için gerekli en önemli kaynaklardan biri enerjidir. Artan dünya nüfusu, her gün gelişen teknoloji ve hızlı sanayileşme enerji ihtiyacını da büyük oranda arttırmıştır. Günlük hayat için de vazgeçilmez bir unsur olan enerji diğer tükenbilir kaynaklar gibi hızla azaldığından yenilenebilir enerji kaynaklarına (YEK) olan ihtiyaç da artmaktadır. Türkiye gibi coğrafi özellikleri ve iklim koşulları bölgeden bölgeye değişen bir ülke için tek bir YEK önermek doğru olmayabilir. Bunun yerine bölge özelinde YEK potansiyeli ve sosyoekonomik özelliklere dayalı analizler daha etkili olabilir. Bu çalışmada, Türkiye'nin illeri sosyoekonomik özellikleri ve konumları da dikkate alınarak YEK potansiyellerine göre kümelendirilmiştir. Bunun için; yüzölçüm, nüfus, kişi başına gayri safi milli hasıla (GSYİH), alınan göç, verilen göç, istihdam ve sanayi hacmi gibi yirmi bir sosyoekonomik kriter belirlenmiştir. YEK potansiyeli için ise ortalama sıcaklık, ortalama rüzgar hızı, toplam yağış miktarı, toplam ortalama debi, sulama alanı, orman serveti, tarımsal alanlar gibi yirmi beş kriter ele alınmıştır. Son olarak illerin konumları probleme enlem, boylam, kuzeydoğu sınırı enlem ve boylam, güneybatı sınırı enlem ve boylam olarak dâhil edilmiştir. Ardından tüm kriterler bir arada değerlendirilerek iller bulanık C-ortalamlar (Fuzzy C-means - FCM) algoritmasıyla küme sayısı 4, 5, 6, 7, 8, 9 ve 10 olmak üzere kümelendirilmiştir. İkinci olarak, veri setindeki kriterler “sosyoekonomik”, “konum” ve “YEK potansiyeli” olarak üçe ayrılmıştır. Her veri seti için C-ortalamlar algoritması ayrı ayrı uygulanmıştır. Bulanık kümeleme sonucu her kümeye üyelik dereceleri elde edildikten sonra tüm üyelik dereceleri birleştirilerek yeni bir veri seti elde edilmiş ve son olarak bu veri seti yeniden kümelendirilmiştir. Böylelikle iki adımlı hiyerarşik bulanık kümeleme elde edilmiştir. Son olarak kümeleme başarısının tespit edilmesi için sınıflama algoritmalarından Rassal Orman (Random Forest - RF) kullanılmış ve her küme için doğruluk değerleri bulunmuştur.

**Anahtar Kelimeler:** Yenilenebilir enerji kaynağı (YEK), bulanık kümeleme, bulanık C-ortalamlar (FCM), rassal orman (RF).

## FUZZY CLUSTERING OF TÜRKİYE'S PROVINCES ACCORDING TO RENEWABLE ENERGY POTENTIALS

### ABSTRACT

One of the most crucial resources for the economic and social development of countries is energy. The increasing global population, evolving technology on a daily basis, and rapid industrialization have significantly escalated the demand for energy. Energy, an indispensable element for daily life, is diminishing rapidly, similar to other finite resources, necessitating an increased reliance on renewable energy sources (RES). Proposing a single type of RES for a country with diverse geographical and climatic conditions like Turkey may not be accurate. Instead, region-specific analyses based on RES potential and socioeconomic

characteristics might prove more effective. In this study, Turkish provinces were clustered based on their RES potentials, considering both their socioeconomic features and locations. To achieve this, twenty-one socioeconomic criteria such as land area, population, per capita gross national income (GNI), immigration, emigration, employment, and industrial capacity were determined. Additionally, twenty-five criteria, including average temperature, average wind speed, total precipitation, total average flow rate, irrigated area, forest wealth, and agricultural areas, were considered for RES potential. Finally, the geographical locations of provinces were incorporated into the problem, including latitude, longitude, northeast boundary latitude and longitude, and southwest boundary latitude and longitude. Subsequently, all criteria were collectively evaluated, and the provinces were clustered using the Fuzzy C-means (FCM) algorithm with cluster numbers of 4, 5, 6, 7, 8, 9, and 10. Secondly, the criteria in the dataset were divided into three categories: "socioeconomic," "location," and "RES potential." The C-means algorithm was separately applied to each dataset. After obtaining membership degrees for each fuzzy cluster, all membership degrees were combined to create a new dataset, which was then clustered again. Thus, a two-step hierarchical fuzzy clustering was obtained. Finally, to assess the clustering success, the Random Forest (RF) classification algorithm was employed, and accuracy values were determined for each cluster.

**Keywords:** Renewable energy sources (RES), fuzzy clustering, fuzzy C-means (FCM), random forest (RF).





## EVALUATION OF PHOTOCATALYTIC HYDROGEN PRODUCTION ACTIVITY AND PHOTOELECTROCHEMICAL MEASUREMENTS OF TPCBP-B\_TiO<sub>2</sub> PHOTOCATALYST

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### ABSTRACT

Nowadays, environmental pollution and climate change, among other adverse consequences, have been driving an increased interest in environmentally friendly, green, and sustainable energy sources. Efforts are being made to investigate renewable energy sources in order to minimize dependence on fossil fuels, which are responsible for the emergence of these adverse effects. Photocatalytic hydrogen production is considered a promising method for renewable energy generation, aiming to produce hydrogen gas through the decomposition of water under the influence of sunlight. This approach represents a method where solar energy is harnessed to convert water into hydrogen, a clean energy source. Researchers are interested in the synthesis, characterization, and performance optimization of highly efficient photocatalysts for photocatalytic (PC) and photoelectrocatalytic (PEC) hydrogen production. For this reason, in this study, the TPCBP-B\_TiO<sub>2</sub> photocatalyst was synthesized from star-shaped viologen derivatives for PC hydrogen. Transmission electron microscopy (TEM) and scanning electron microscopy (SEM) measurements were conducted to investigate the morphology of TiO<sub>2</sub> nanoparticles coated with TPCBP-B. In the TPCBP-B\_TiO<sub>2</sub> photocatalyst, viologen, as an electron donor moiety, exhibits electron-accepting properties through its incorporation into the carbazole-viologen scaffold. The modified viologen derivative, when combined with TiO<sub>2</sub> nanoparticles, was found to demonstrate high performance in PC hydrogen production, attributed to its light absorption capability, unique structure, and electron-accepting characteristics. Hydrogen production from the photocatalyst was investigated using gas chromatography (GC), with measurements taken at 8 h intervals. The average photocatalytic hydrogen production potential of the TPCBP-B\_TiO<sub>2</sub> photocatalyst has been calculated to be 2.335 mmol g<sup>-1</sup> for 8h visible light illumination. Additionally, the photoelectrochemical properties of the TPCBP-B\_TiO<sub>2</sub> working electrode were investigated using chronoamperometry (CA) and linear sweep voltammetry (LSV).

**Keywords:** photocatalysis, viologen, hydrogen evolution



## EXAMINATION OF CESIUM BROMIDE PHOTOCATALYST FOR PHOTOCATALYTIC HYDROGEN PRODUCTION

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### ABSTRACT

One of the greatest needs of our era is uninterrupted energy. The increasing population, advancing technology, ascending standards, growing expectations and, competition are leading to a rapid increase in energy demand. Sustainable methods are being investigated for the increasing demands. Photocatalytic hydrogen production through water splitting has been considered a promising renewable energy source. Low-cost, highly efficient and easily produced catalysts are preferred for the photocatalytic hydrogen production reaction. As a result, researchers are conducting various studies to synthesize high-efficiency catalysts for photocatalytic hydrogen production, characterize them and optimize their performance. Cesium bromide (CsBr) photocatalyst was synthesized using the solvothermal method. The synthesized photocatalyst was characterized using Scanning Electron Microscopy (SEM) and X-ray Powder Diffraction (XRD). The photocatalytic hydrogen production activity of CsBr catalyst was investigated for 8 hours under visible light illumination in the presence of triethanolamine (TEOA) and EY as electron donor and dye sensitizer, respectively. The amount of produced hydrogen gas was measured using a gas chromatography device and calculated to be approximately 0.807 mmol g<sup>-1</sup>. Additionally, in order to enhance the hydrogen production, platinum (Pt) co-catalyst was investigated for the proposed HER system under the same experimental conditions which produced by photodeposition method. The photocatalytic HER activity of Pt co-catalyst onto the CsBr was reached 15.684 mmol g<sup>-1</sup> and production efficiency increased 19 fold when compare with bare CsBr.

**Keywords:** Photocatalytic hydrogen, photocatalyst, co-catalyst



## TARIMSAL ENERJİYE YÖNELİK İKİNCİ NESİL ENERJİ KAYNAKLARINDAN BİRİ: ENDÜSTRİYEL KENEVİR

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### ÖZET

Enerji; günlük hayatın sürdürülebilmesi, tüm yaşamsal, biyokimyasal faaliyetlerin gerçekleştirilmesi için gerekli ve yegâne bir kaynaktır. Özellikle fosil enerji kaynaklarının çevre üzerindeki olumsuz etkilerinden dolayı yenilenebilir enerji kaynaklarına talep ve rağbet her geçen gün artmaya devam etmektedir.

Dünyada çok çeşitli yenilenebilir enerji kaynaklarının üretim ve kullanımı artık bir disiplin haline gelmişken, enerji gereksinimlerindeki artışların süreklilik göstermesi insanoğlunu yeni ve alternatif sürdürülebilir enerji kaynaklarına sevk etmiş, etmeye de devam etmektedir. Gezegenimizdeki güneş, rüzgar ve su gibi doğal enerji kaynakları yanında özellikle bitki ve gıda artıkları başta olmak üzere hemen hemen her çeşit bitki biyokütle esaslı alternatif yenilenebilir biyoyakıt (tarımsal enerji) kaynaklarının üretim ve kullanımları yapılmakta, verim ve çeşitliliklerine yönelik araştırmalar da önemle devam etmektedir.

Gıda olarak tüketimlerinin önemli olduğu, dolayısıyla da enerji üretimlerinde tercih edilirliliğinin dezavantaj oluşturduğu birinci nesil bitkiler yerine ikinci ve hatta hammadde olarak algaeların (yosun) kullanıldığı üçüncü nesil tarımsal enerji üretim ve kullanımları dünyada her geçen gün artarak devam etmektedir.

Tarımsal enerji kaynağı açısından avantaj oluşturan ikinci nesil biyoyakıt kaynakları çeşitlilik gösterse de, bu çeşitliliği hem artırmak hem de bu kaynaklardan daha yüksek enerji üretmek için yeni üretim süreçleri geliştirerek Ülkemizin “**Enerji Arz Güvenliği**”ne pekala katkı sunulabilir.

Ülkemizde şu anda 20 ilde üretimine izin verilen ve bütün biyokütlenin katma değeri yüksek ürünlere dönüştürme potansiyelinin oldukça yüksek olduğu, tarımı ile birlikte tarım ekim alanlarına ve bulunduğu bölgeye birçok faydalarının olduğu ve de yetiştirilmesinde ilaç kullanımına gereksinim duyulmadığı su izi düşük bir bitki olan Endüstriyel Kenevir; tarımsal enerji üretiminde ikinci nesil hammadde olma potansiyeline sahip bir biyokütledir.

Bölgesel kalkınmaya odak “Endüstriyel Kenevir” alanında İhtisas Üniversitesi olan Yozgat Bozok Üniversitesi (YOBÜ) bünyesinde kenevir biyokütlesinin enerji üretiminde de kullanılmasına yönelik her düzeyde yapılacak çalışmaların daha anlamlı, gerekli ve önemli olduğu düşünülmektedir. Kenevir tohumu esaslı biyodizel üretimi, selülozik biyoetanol üretimi hatta kenevirden aktif karbon üretimi ile “Süper Kapasitör” (Yeni Nesil Batarya) üretimi mümkündür.

Bu bildiride, bu zamana kadar yenilenebilir enerji kaynakları üzerine, özellikle de tarımsal enerji kaynakları üzerine yapılan çalışmaların ve “Endüstriyel Kenevir” özelinde; oldukça önemli olan ikinci nesil biyoyakıt çeşitliliğinin artırılması ve bunlardan daha verimli olarak enerji hammaddelerinin üretimine yönelik araştırmaların derlenmesi ve alternatif önerilerin ortaya konması amaçlanmıştır.

**Anahtar Kelimeler:** Biyoyakıt, Tarımsal Enerji, Endüstriyel Kenevir, Yenilenebilir Enerji, Sürdürülebilir Enerji

## ONE OF THE SECOND GENERATION ENERGY SOURCES FOR AGRICULTURAL ENERGY: INDUSTRIAL HEMP

### ABSTRACT

Energy; It is a necessary and unique resource for sustaining daily life and performing all vital, biochemical activities. The demand for renewable energy sources continues to increase day by day, especially due to the negative effects of fossil energy resources on the environment.

While the production and use of a wide variety of renewable energy sources in the world has now become a discipline, the constant increase in energy needs has led humanity to new and alternative renewable energy sources and continues to do so. On our planet, in addition to the natural energy resources such as sun, wind and water, almost all kinds of plant biomass-based alternative renewable biofuel (agricultural energy) resources, especially plant and food residues, are produced and used, and research is carried out on their efficiency and diversity continues.

Instead of first generation plants, which are important for their consumption as food and therefore disadvantageous in their preferability in energy production, second and even third generation agricultural energy production and use, in which algae (seaweed) are used as raw materials, continues to increase day by day in the world.

Although second generation biofuel sources, which are advantageous in terms of agricultural energy sources, vary, we can contribute to our country's "**Energy Supply Security**" by developing new production processes that will both increase this diversity and produce higher energy from these sources.

Industrial Hemp is a plant with a low water mark, which is currently allowed to be produced in 20 provinces in our country, has a very high potential to transform all biomass into high value-added products, has many benefits for the agricultural cultivation areas and the region where it is located, and does not require the use of pesticides in its cultivation; It is a biomass that has the potential to become a second generation raw material in agricultural energy production.

It is thought that there is more studies at all levels on the use of hemp biomass in energy production within Yozgat Bozok University (YOBÜ), a university specialized in the field of "Industrial Hemp" focusing on regional development, are more meaningful, necessary and important. It is possible to produce "Super Capacitor" (New Generation Battery) with hemp seed-based biodiesel production, cellulosic bioethanol production and even activated carbon production from hemp.

In this paper, the studies carried out so far on renewable energy resources, especially agricultural energy resources, and in the case of "Industrial Hemp"; It is aimed to increase the diversity of second generation biofuels, which is very important, and to compile research on the production of more efficient energy raw materials and to put forward alternative suggestions.

**Keywords:** Biofuel, Agricultural Energy, Industrial Hemp, Renewable Energy, Sustainable Energy



## İKLİM DEĞİŞİKLİĞİ İLE MÜCADELE VE EMİSYON HEDEFLERİ KAPSAMINDA TÜRKİYE’NİN NÜKLEER ENERJİ POLİTİKALARI ANALİZİ

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### ÖZET

Küresel iklim değişikliğiyle mücadelede temiz enerjiye geçiş için fosil yakıt tüketimi dünya genelinde azaltılmakta ve fosil yakıtlar yerini temiz enerji kaynaklarına bırakmaktadır. Ancak, rüzgâr ve güneş gibi yenilenebilir kaynakların kesintili olması önemli kısıtlayıcı bir faktördür. Bu sebeple nükleer enerji, enerji güvenliğini sağlarken aynı zamanda iklim değişikliğiyle mücadele etmek amacıyla temiz enerji geçişinin temel bir taşıyıcısı olarak ortaya çıkmaktadır. Elektrik üretimi sırasında karbon salımı olmaması ve yaşam döngüsü emisyonlarının fosil yakıtlara ve bazı yenilenebilir kaynaklara göre daha düşük olması nedeniyle nükleer enerji, enerji dönüşümü politikaları için önemli bir seçenektir. Bu çalışmada, dünyada ve Türkiye’de enerji politikalarında nükleer enerjinin yeri iklim değişikliğiyle mücadele kapsamında incelenmiş ve bu incelemeler ışığında Türkiye’nin net sıfır emisyon hedefine ulaşmasında nükleer enerjinin rolünü belirlemek amacıyla bir analiz yapılmıştır. Analizler, sera gazı emisyonlarının minimizasyonuna dayalı üç senaryo içeren bir optimizasyon modeli üzerinden gerçekleştirilmiştir. Nükleer enerjinin Türkiye’nin enerji politikasında yer almadığı, mevcut durumdaki nükleer politikanın geçerli olduğu ve nükleer enerjiye ilişkin bir sınırlamanın yapılmadığı üç senaryo için elde edilen sonuçlar doğrultusunda politika çıkarımlarında bulunulmuştur.

**Anahtar Kelimeler:** Nükleer enerji, enerji politikaları, iklim değişikliği, karbon emisyonları, net sıfır emisyon

## ANALYSIS OF TÜRKİYE’S NUCLEAR ENERGY POLICIES WITHIN THE SCOPE OF COMBATING CLIMATE CHANGE AND EMISSION TARGETS

### ABSTRACT

In order to transition to clean energy in the fight against global climate change, fossil fuel consumption is being reduced worldwide and fossil fuels are being replaced by clean energy sources. However, the intermittency of renewable resources such as wind and solar is an important limiting factor. For this reason, nuclear energy emerges as a key carrier of the clean energy transition to combat climate change while ensuring energy security. Nuclear energy is an important option for energy transition policies because it has no carbon emissions during electricity production and its life cycle emissions are lower than fossil fuels and some renewable resources. In this study, the place of nuclear energy in energy policies in the world and Türkiye was examined within the scope of combating climate change, and in light of these examinations, an analysis was made to determine the role of nuclear energy in reaching Türkiye’s net zero emission target. The analyses were carried out through an optimization model that included three scenarios based on the minimization of greenhouse gas emissions. Policy inferences were made in line with the results obtained for three scenarios in which i) nuclear energy is not included in Türkiye’s energy policy, ii) the current nuclear policy is valid and ii)) there is no limitation on nuclear energy.

**Keywords:** Nuclear energy, energy policies, climate change, carbon emissions, net zero emissions.





## ENHANCING PERFORMANCE OF PRINTED CIRCUIT BOARD AXIAL FLUX PERMANENT MAGNET MACHINES (PCB-AFPMM) THROUGH HEAT SINK INTEGRATION

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### ABSTRACT

Printed Board Circuit (PCB) Axial Flux Permanent Magnet Machines are increasingly popular due to their reliability, robustness and easy manufacturing. PCB stator allows to bypass time taking and complex winding manufacturing process and simplifies the manufacturing process of AFPM machines as well as it helps to increase the durability and reduce the weight of machine although the heat generated from the losses of motor is critical for PCB AFPM machines. The research aims to design, simulate and prototype PCB AFPM and heat-sink for PCB AFPM machine for thermal management of PCB AFPM machine. Considering the motor losses, it was possible to size a heat sink so that it could be applied on the stator and to dispose of a total of 10 W of thermal power. The geometry used for the design of the fins is circular arc and allows both to maximize the exchange surface and to increase the stiffness of the fins. Finally, the heat sink was numerically simulated with Ansys Students verifying that it satisfies the criteria for which it was designed.

**Keywords:** PCB, AFPM, Thermal management.

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## ENERGY EFFICIENCY CALCULATIONS ON RADIANT HOBS AND INDUCTION HOBS

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### ABSTRACT

As concerns over energy conservation and environmental sustainability continue to grow, the importance of energy efficiency in domestic cookers cannot be overstated. Domestic cookers, encompassing various types such as gas, electric, radiant, and induction hobs, are central to modern culinary practices. However, they are also significant contributors to residential energy consumption. The quest for energy efficiency in these appliances is driven by the recognition that inefficient cookers not only waste energy but also produce greenhouse gas emissions, further exacerbating environmental concerns. Radiant hobs and induction hobs are two popular cooking technologies in the realm of electric cooktops. Understanding their respective efficiencies is crucial for optimizing energy consumption and heat transfer in cooking processes. Radiant hobs rely on electrical resistance heating elements placed beneath a glass-ceramic surface. They emit infrared radiation, which directly heats the cookware placed on the surface. Radiant hobs are known for their relatively slower response time and energy dispersion, which may lead to inefficiencies, especially for large or mismatched cookware. On the other hand, induction hobs utilize electromagnetic induction to generate heat within the cookware itself. They are celebrated for their rapid heating response, precise temperature control, and energy efficiency. Induction hobs minimize energy wastage by directly transferring heat to the cookware, resulting in faster cooking times and less overall energy consumption. This paper presents the results of a series of experiments conducted to quantify the energy efficiency of both radiant and induction hobs. The experiments include measuring the time required to boil water, heat retention, and energy consumption. During the experimental studies, 4 zones radiant cooker and 3 zones induction cooker have been used and for each zone, energy efficiency has been calculated. Based on the results, critical points for the efficiency have been evaluated.

**Keywords:** Radiant Hob, Induction Hob, Energy Efficiency



## PLASTİK ATIK PİROLİZİNDEN ELDE EDİLEN KATI ÜRÜNÜN ALTERNATİF YAKIT OLARAK KULLANILABİLİRLİĞİ

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### ÖZET

Piroliz atık bertarafında kullanılabilen ve proses sonunda katı, sıvı ve gaz formda değerli ürünlerin elde edildiği önemli bir termokimyasal süreçtir.

Bu çalışma kapsamında piroliz yan ürünlerinden biri olan katı ürünün, piroliz gazının arıtımında adsorban olarak kullanılması hedeflenmiştir. Buna ilave olarak, piroliz gazı arıtımından sonra meydana gelen ve yeni bir atık olan piroliz katısının alternatif katı yakıt olarak kullanılabilirliği araştırılmıştır. Bu doğrultuda yapılan deneysel çalışmalar ile PP türü plastik atıkların sırasıyla 500°C, 600°C ve 700°C'de hedef sıcaklıklarında piroliz işlemleri gerçekleştirilmiştir. Bu piroliz işlemlerinden elde edilen katı ürün (kok), aktivasyon işlemine uğratarak, uygulamada en önemli adsorban olan aktif karbon (AC) ile kıyaslanmıştır. Daha sonrasında elde edilen bu adsorbanın, yine ilgili plastik türünün pirolizinden elde edilen gaz ürünün adsorpsiyon verimi analitik metodlarla incelenmiştir.

Çalışma sonucunda atık PP piroliz gaz ürününün adsorpsiyonunda; yine atık PP piroliz katısından elde edilen adsorban ile, %40-80 oranında adsorpsiyon verimleri elde edilmiştir. Piroliz koklarından oluşturulan adsorpsiyon kolonlarında, yine piroliz gazlarının tutunmasında PP türü aktivasyonlu kokların en yüksek verimle adsorbe ettiği bileşenler 500°C, 600°C ve 700°C'de sırasıyla toluen, stiren ve stiren olmuştur. BET analizi sonuçlarıyla bir değerlendirme yapıldığında aktivasyon metoduyla birlikte kok türlerinde yüzey alanı noktasında aktivasyonsuz hallerine göre adsorpsiyon veriminde yaklaşık 20 kat artış görülmüştür. Adsorpsiyon işlemi sonucunda elde edilen ve ikincil bir atık olan PP kokları geri kazanılarak, C, S ve N içerikleri ve kalorifik değerleri araştırılmıştır. Bunun sonucunda adsorpsiyon işleminde kullanılmış adsorbanlar içinde 700°C de elde edilen aktivasyonlu kokun, ısıl değer ve yanma sonucu yaratacağı emisyonlar açısından en uygun alternatif yakıt olmuştur.

Bu çalışma ile birlikte plastik atıkların piroliz yöntemiyle bertarafı sonrası ortaya çıkan yan ürünlerden kokun kullanımına yönelik alternatif bir yol sunulurken, bir diğer piroliz ürünü olan ve toksik özellikleri bilinen pirolitik gazın, piroliz katısı ile arıtımı sağlanmıştır. Arıtım çalışması sonunda da meydana gelen katı ürünün geri kazanılarak alternatif bir yakıt olarak kullanılabilirliği ortaya koyulmuştur.

**Anahtar Kelimeler:** Adsorpsiyon, alternatif yakıt, katı ürün, piroliz, plastik atık.

## EVALUATION OF THE SOLID PRODUCT OBTAINED FROM PLASTIC WASTE PYROLYSIS IN ALTERNATIVE FUEL PRODUCTION

### ABSTRACT

Pyrolysis is an important thermochemical process that can be used in waste disposal and produces valuable products in solid, liquid and gaseous form at the end of the process.

Within the scope of this study, it is aimed to use the solid product, which is one of the pyrolysis by-products, as an adsorbent in the purification of pyrolysis gas. In addition, the usability of pyrolysis solid, which is a new waste produced after pyrolysis gas purification, as an alternative solid fuel, was investigated. With experimental studies carried out in this direction, pyrolysis processes of PP type plastic waste were carried out

at target temperatures of 500°C, 600°C and 700°C, respectively. The solid product (coke) obtained from these pyrolysis processes was activated and compared with activated carbon (AC), which is the most important adsorbent in practice. Afterwards, the adsorption efficiency of this adsorbent and the gaseous product obtained from the pyrolysis of the relevant plastic type was examined with analytical methods.

As a result of the study, in the adsorption of waste PP pyrolysis gas product; Again, adsorption efficiencies of 40-80% were obtained with the adsorbent obtained from waste PP pyrolysis solid. In the adsorption columns created from pyrolysis coke, the components that PP type activated coke adsorbed with the highest efficiency in adsorption of pyrolysis gases were toluene, styrene and styrene, respectively, at 500°C, 600°C and 700°C. When an evaluation was made with the BET analysis results, an approximately 20-fold increase in the adsorption efficiency was observed in the surface area of coke species with the activation method, compared to their non-activated state. PP coke, which is a secondary waste obtained as a result of the adsorption process, was recovered and its C, S and N contents and calorific values were investigated. As a result, among the adsorbents used in the adsorption process, activated coke obtained at 700°C has become the most suitable alternative fuel in terms of calorific value and emissions as a result of combustion.

With this study, an alternative way is presented for the use of coke, one of the by-products resulting from the disposal of plastic waste by pyrolysis method, while pyrolytic gas, which is another pyrolysis product and known to have toxic properties, is treated with pyrolysis solid. At the end of the treatment study, the solid product formed was recovered and its usability as an alternative fuel was demonstrated.

**Keywords:** Adsorption, alternative fuel, plastic waste, pyrolysis, solid product.



## EVALUATION OF DOMESTIC BUILT-IN OVEN COOLING SYSTEMS BY USING CFD ANALYSIS

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### ABSTRACT

Domestic built-in ovens are one of the essential household appliances in the market status. With the increasing carbon emissions in last decades, regulations are getting more restrictive on energy consumption of ovens. For ensuring efficient energy consumption strategy in ovens, well management heat source strategy is inevitable. During this process different cooking functions are used, and, on this period, high temperature occurs on oven outer surfaces. In order to assure comfort conditions for the users, oven cooling systems have the critical roles. Cooling system is the result of a ventilation system and oven door working together. Ventilation system comprises of fan and air channel. Oven door have the glasses, metal parts for door assembly on oven cavity and air flow channel apparatus. For better evaluation of oven cooling system by monitoring air flow between glasses using CFD method has the advantage. In this study, an oven cooling system has been investigated by using experimental method and CFD methods. Experimental method is used for the validation of CFD analysis. For better examination, different CFD software packages which ANSYS Fluent and FloEFD are used in this paper for evaluating simulation results in different solution perspectives. In both simulations, system is analysed with the same simplified model by using k- $\epsilon$  turbulence model with the similar mesh numbers so that two software packages are compared. All results are used for detected air flow details inside door glasses and ventilation channel. All experimental and numerical studies are applied in Haier Europe Research and Development Center.

**Keywords:** Built-In oven, Cooling system, CFD, Ventilation system



## NEW REGENERATIVE BRAKING APPROACH; ROAD TOPOLOGY MODELING

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### ABSTRACT

A regenerative braking system is a mechanism that recovers energy by storing the existing kinetic energy of a moving vehicle, which can be used immediately or until needed, and converting it into the same or a different type of energy. Thanks to the regenerative braking system, in addition to reducing the vehicle's fuel consumption, it will use the brake system less, significantly extend its life, and provide a systemic efficiency that can prevent rapid wear of the vehicle's mechanical parts. Today, different regenerative braking methods are used in both internal combustion engine vehicles and electric vehicles. In the work to be carried out, an intersection system will be developed and an inclined road will be constructed to this intersection system. In this way, it was aimed to both slowdown traffic at intersections and reduce unnecessary brake use. In the study, a sample numerical modelling was developed by considering kinetic energy, potential energy and energy conversion formulas. In sample studies, it was observed that the amount of lost braking energy increased as the speed and weight of the vehicles increased.

**Keywords:** Braking Energy, Regenerative Brake, Regenerative Braking System, Energy Storage





## HYBRID VERTICAL WIND TURBINE DESIGN

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### ABSTRACT

The importance of the energy needed in the modern world is an undeniable fact. It is necessary to have safe, high quality and continuous access to this needed energy. Unlike fossil fuels, wind energy is a more environmentally friendly type of energy. Wind energy, which is among the renewable energy sources, has gained importance and developed in recent years. Until now, wind energy has been active in the field of generating electrical energy in steppe areas, pumping water. Today, it has taken it in the sector as an active energy source. The purpose of wind turbines is to be a system that converts the kinetic energy of the wind into mechanical energy with their blades and then into electrical energy. In this design study, Darrieus and Savonius vertical hybrid wind turbine design was made. The meaning of wind energy, its historical development and the classification of turbines are explained. Darrieus and Savonius designed wind turbines in a hybrid way and tried to achieve the highest efficiency.

**Key words:** hybrid wind turbine, Darrieus turbine, Savonius türbine and efficiency of hybrid turbine



## DIELECTRIC AND PIEZOELECTRIC PROPERTIES OF BNT-BKT CERAMICS PREPARED BY SOLUTION COATING METHOD

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### ABSTRACT

In this study, production and electrical characterization of BNT-BKT ( $\text{Bi}_{0.5}\text{Na}_{0.5}\text{TiO}_3\text{-Bi}_{0.5}\text{K}_{0.5}\text{TiO}_3$ ) piezoelectric ceramics were carried out. These compositions can be utilized in energy-storage and energy-harvesting applications. Ceramic powders with a composition of 90BNT-10BKT were synthesized by a method called "solution coating". In this method, sodium- and potassium-precursor solutions were coated onto  $\text{TiO}_2$  particles. Single-phase perovskite BNT-BKT powders with an average particle size of less than 100 nm were obtained after a one-step calcination process at 700 °C. Ceramic samples prepared using these powders were sintered by conventional sintering at 1150 °C for 2 hours. Composition, phase content, and microstructure analyses of powder batches and sintered samples were carried out using X-ray diffraction (XRD) and scanning electron microscopy (SEM). Dielectric and piezoelectric properties were examined using an LCR-meter. It was determined that the dielectric constant ( $\epsilon_r$ ), which is an important parameter in terms of storing electric charge, is around 975. The planar electromechanical coupling factor ( $k_p$ ), which reveals the efficiency of the conversion between electrical energy and mechanical energy of the material for energy-harvesting applications, has a value of 0.28. Experimental results proved that the conventional calcination (850 °C) and sintering (>1200 °C) temperatures of BNT-BKT piezoelectric ceramics can be reduced using the solution coating method.

**Keywords:** Piezoelectric, Dielectric, BNT-BKT, Energy Harvesting, Energy Storage.



## COMPARISON OF STORAGE TECHNOLOGIES IN POWER SYSTEMS INCLUDING RENEWABLE ENERGY PLANTS

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### ABSTRACT

Renewable energy sources cannot provide continuous energy due to their nature. Although power plants such as solar and wind do not have resource costs, operating costs and system stability are affected because the energy is not continuous. Excess energy produced from alternative sources is stored by transferring it to different types of energy storage units, and the stored energy meets the load demand when the primary resources are insufficient (Kozak & Kozak, 2012). The whole world, especially the countries located in the "Sun Belt" (36-42 north and south latitudes), should benefit from the inexhaustible energy source in the most beneficial way (Hakan et al., 2010). The amount of energy used on Earth is 10th thousands of the amount of sunlight reaching the Earth. If humans use only 0.01 of the sunlight coming into the world efficiently, they can meet all their energy needs. Energy storage is the collection and storage of energy in periods when there is excess energy and its use in periods when energy is unavailable. Thanks to energy storage, it minimizes energy outages and increases the security of electrical networks (Aslan et al., 2014). Therefore, better and more efficient storage of renewable energy resources is essential to balance the fluctuations in energy demand, make power resources continuously available, and increase the sustainability of the energy system. To benefit from renewable energy resources more efficiently, many studies have been carried out to store energy on Earth (Emeksiz & Kara, 2022). Energy storage has been attempted for years with different methods and purposes. Within the scope of this study, energy storage methods will be examined, and the best energy storage method will be determined through Matlab/Simulink.

**Keywords:** Energy storage- super capacitor-batteries.



## HEAT TRANSFER ANALYSIS IN A STRAIGHT CHANNEL CONTAINING AN EXPANDING CHAMBER WITH WINGLETS

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### ABSTRACT

Heat transfer improvement methods remain up-to-date among important research topics as they contribute significantly to energy efficiency and savings. Passive heat transfer improvement methods are widely used in many engineering applications because they do not require additional energy. Therefore, this study aimed to increase heat transfer efficiency by using more than one passive method together. In the presented study, flow and heat transfer characteristics in a straight channel containing an expanding chamber with winglets are numerically analyzed. Analyzes are carried out with ANSYS Fluent software, which provides solutions with the finite volume method. The pressure-velocity connection is handled with the SIMPLE algorithm. There are adiabatic straight sections at the entrance and exit of the channel. The channel structure contains an expanding chamber near the entrance of the channel, and triangular winglets are installed within the chamber. The surfaces of the channel before and after the expanding chamber are flat. The expanding chamber and subsequent channel surfaces are kept at a constant temperature of  $T_s=340K$ . Nusselt number (Nu), friction factor (f) and performance factor (PF) are calculated for different Reynolds numbers. The findings of the study are presented as a function of dimensionless numbers. The numerical study is compared with previous study results. To observe the effects of the expanding chamber and winglets on the flow and temperature fields, flow and temperature images in the channel are obtained at different parameters, and the results are discussed. In addition, the study results are compared to the channel without winglets and the straight channel. Numerical results show that the winglets in the expanded chamber increased the heat transfer by improving the flow mixing. However, the presence of winglets causes a slight increase in pressure drop.

**Keywords:** Expanding chamber, Winglet, Straight channel, Heat transfer improvement, Friction factor.



## PRODUCTION OF POLYESTER RING SPUN YARNS WITH THERMOREGULATING FUNCTION CONTAINING MICROENCAPSULATED PHASE CHANGE MATERIALS (PCM) FOR PERSONAL THERMAL MANAGEMENT (PTM) APPLICATIONS

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### ABSTRACT

Thermoregulation is defined as the ability of textile material to keep the temperature constant under dynamic external environment. Thermoregulation affects thermal comfort of human body and hence energy consumption due to the requirement of building heating, ventilation, and air conditioning (HVAC). Phase change material (PCM) incorporated textiles offer buffering effect under sudden temperature changes by maintaining the body temperature constant and thus providing prolonged thermal comfort. PCM integrated textiles provide personal thermal management (PTM) by keeping the body temperature constant instead of cooling/heating the entire building space. In this work, it was aimed to produce PCM nanocapsule integrated polyester spun yarns that can be used for thermal regulation and personal thermal management (PTM) textile applications. PCM nanocapsules with gelatine-gum Arabic walled and n-octadecane core were synthesized by complex coacervation method and applied to polyester staple fibers via a specially designed application method during ring spun yarn production. Prior to the application, at first, nanocapsule dispersions were prepared at 6% PCM nanocapsule concentration. And then, PCM nanocapsule dispersion was applied to the polyester fiber bundle during the drafting process of the ring spinning by using two different feeding rates varying between 62.5 mL/h and 80 mL/h, and Ne 30/1 polyester ring spun yarns with knitted twist ( $\alpha_e=3.4$ ) were produced. Morphological properties of the produced polyester ring spun yarns were analysed by Scanning Electron Microscope (SEM) images. Thermal properties of the PCM nanocapsule incorporated yarns were measured by the Thermal-History (T-History) test method and the changes in surface temperatures of yarn samples were analysed. SEM images showed that PCM nanocapsules could be integrated into the yarn structure and hence PCM nanocapsule incorporated polyester ring spun yarns provided lower surface temperatures compared with virgin yarn during all the measurement process. It was determined that PCM incorporated yarns exhibited thermoregulation function more than 2 °C compared to unloaded virgin yarns. With respect to the analysis results, obtained novel heat storage polyester yarn is a promising material for thermal energy storage and desirable thermal comfort applications to the internal structure of the yarn.

**Keywords:** Personal thermal management (PTM), energy saving, thermoregulating textiles, phase change materials (PCMs), functional yarn, polyester fiber.



## HİBRİT VE AKTİF PV SOĞUTMA SİSTEMLERİNİN KONSANTRASYON ORANINA BAĞLI 1-D MATEMATİKSEL MODEL İLE KARŞILAŞTIRILMASI

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### ÖZET

**GİRİŞ-AMAÇ:** PV (fotovoltaik) panellerde sıcaklık artışı, elektrik üretimini olumsuz yönde etkileyen faktörlerin başında gelmektedir. Dolayısıyla ile bu çalışmada aktif ve pasif soğutma sistemlerini birlikte kullanarak PV panelin verimliliği artırmak için panel tabanına su kanalı üstte olmak üzere, su kanalı ve PCM (faz değiştiren madde) yerleştirildiği hibrit durum incelenmiştir. Pv panelin su ile soğutulduğu sistem Model 1, hibrit sistem ile soğutulan sistem ise Model 2 olarak isimlendirilmiştir. **GEREÇ-YÖNTEM:** Çalışma kapsamında önerilen Model 2'nin avantaj ve dezavantajlarının belirlenmesi için PV sıcaklığı, elektrik üretimi, PV ve termal verim ifadeleri, Model 1 ile konsantrasyon oranına bağlı olarak kıyaslanmıştır. Bu kıyaslama her iki modelinde 1-D matematiksel olarak elde edilmiş ve literatür çalışmalarıyla doğrulanmış bir model aracılığı ile gerçekleştirilmiştir. Bu modelden sayısal sonuçların elde edilmesi için EES (Engineering Equation Solver) yazılımı kullanılmıştır. **BULGULAR:** Konsantrasyon oranının artması Model 1'e kıyasla Model 2'de daha düşük PV sıcaklıkları elde edilmesine yol açmış bu durum elektrik üretimini ve PV verimini artırmıştır. Ayrıca termal verimdede bir miktar iyileşme gözlemlenmiştir. Ancak konsantrasyonun aşırı artışı her iki durumdada PV panel sıcaklığını aşırı artırdığından her iki durumdada elektrik üretimi önemli miktarda düşüş göstermiştir. **SONUÇ:** Model 2 kullanımının konsantrasyonlu panellerde PCM katmanının erimesine bağlı olarak kanal içerisindeki hareketli suyun ortalama sıcaklığını düşürdüğü ve PV panel sıcaklığının düşürülmesinde etkin rol oynadığı belirlenmiştir. Ancak PCM katmanının konsantrasyon parametre değerinin 1 seçilmesi durumunda erime olmadığı belirlenmiş bundan dolayı Model 2'nin su çıkış sıcaklığının daha yüksek olmasına neden olmuştur. Dolayısıyla PCM katmanının eridiği durumlarda Model 2'nin Model 1'e kıyasla elektrik üretiminin farkı en çok 5.815 kW olduğu, PV veriminin %0,41-3,95 aralığında artırıldığı tespit edilmiştir.

**Anahtar Kelimeler:** Konsantre PV, PV soğutma, Hibrid soğutma, Faz Değiştiren Malzeme, Verimlilik

## COMPARISON OF HYBRID AND ACTIVE PV COOLING SYSTEMS WITH A 1-D MATHEMATICAL MODEL BASED ON CONCENTRATION RATIO

### ABSTRACT

**INTRODUCTION-PURPOSE:** Temperature increase in PV (photovoltaic) panels is one of the factors that negatively affects electricity production. Therefore, in this study, a hybrid situation in which water channel and PCM (phase change material) are placed on the panel base, with the water channel on top, to increase the efficiency of the PV panel by using active and passive cooling systems together, was examined. The system in which the PV panel is cooled by water is called Model 1, and the system cooled by the hybrid system is called Model 2. **MATERIALS-METHODS:** In order to determine the advantages and disadvantages of Model 2 proposed within the scope of the study, PV temperature, electricity production, PV and thermal efficiency expressions were compared with Model 1 depending on the concentration ratio. This comparison was carried out in both models through a model that was obtained 1-D mathematically and verified by literature studies. EES (Engineering Equation Solver) software was used to obtain numerical results from this model. **RESULTS:** The increase in the concentration rate led to lower PV temperatures in Model 2 compared to Model 1, which increased electricity production and PV efficiency. Additionally, some improvement in



thermal efficiency was observed. However, since the excessive increase in concentration increased the PV panel temperature excessively in both cases, electricity production decreased significantly in both cases. **RESULT:** It has been determined that the use of Model 2 reduces the average temperature of the moving water in the channel due to the melting of the PCM layer in concentrated panels and plays an active role in reducing the PV panel temperature. However, if the concentration parameter value of the PCM layer was selected as 1, it was determined that there was no melting, thus causing the water outlet temperature of Model 2 to be higher. Therefore, it has been determined that in cases where the PCM layer melts, the difference in electricity production of Model 2 compared to Model 1 is at most 5.815 kW, and the PV efficiency is increased within the range of 0.41-3.95%.

**Keywords:** Concentrated PV, PV cooling, Hybrid cooling, Phase Change Material, Efficiency



## EXPERIMENTAL INVESTIGATION OF DRYING AND ENERGY PERFORMANCE IN A CONDENSER TUMBLE DRYER

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### ABSTRACT

With the advancement of technology, machines ubiquitous in almost every aspect of our lives make our daily routines more comfortable. These routines can sometimes give rise to needs. However, the increasing number of machines in response to growing demands also leads to a rise in energy consumption. Appliances, nearly present in every household and significantly contributing to energy consumption, are the focus of numerous studies. Consequently, energy classes are becoming increasingly stringent, urging engineers to develop more efficient machines. Energy savings are achievable to the extent that the system performance of machines can be enhanced.

In this study, the focus has been on the tumble dryer within the white goods product group. Electric tumble dryers generally come in three different types: vented, condenser, and heat pump dryers. In the scope of this study, the drying and energy performance of a condenser tumble dryer has been examined through experimental methods. Experimental studies include energy performance tests of the existing machine, temperature data obtained with thermocouples, and flow measurements of air cycles. The results obtained for the existing machine are compared with the results of experimental studies with different configurations. At the end of the experimental studies, the drying performance has been improved from around 3.3 % to 1.1 %, and the energy consumption has also been improved by approximately 4.5 %.

**Keywords:** Tumble Dryer, Condenser Tumble Dryer, Energy Efficiency, Drying Performance.



## BİR ELEKTRİK MOTORUNUN TİTREŞİMİNDEN PİEZOELEKTRİK ENERJİ HASADI İLE ELDE EDİLEN ENERJİNİN MODELLENMESİ\*

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### ÖZET

Enerjinin dünyada oldukça kritik seviyelerde ihtiyaç duyulduğu bu dönemde ortamda atıl olan titreşimin enerjiye dönüştürülme ve verim elde etme çalışması küresel bir önem arz etmektedir. Piezoelektrik enerji hasadının ortamdaki titreşimden elektrik enerji üretmesi; enerji kaybını azaltmaktadır. Bu çalışmada piezoelektrik enerji hasat ünitesi ile bir elektrik motoru üzerindeki titreşim piezoelektrik enerji hasadı ve hasatta enerji üretimini yükseltmek amacıyla çeşitli senaryolar üzerinden bir değerlendirme yapılmıştır. Elde edilen elektrik enerjisinin hangi durumlarda daha üst seviyelere çıkabileceği ve elektrik üretiminde kullanılacak olan piezo dönüştürücünün farklı ağırlıklar altında nasıl bir tepki göstereceği ve ne tür sonuçlar vereceğine dair senaryoları ortaya konulmuştur. Ağırlıklı ve ağırlıksız piezo dönüştürücü senaryoları Ansys Workbench paket programında çeşitli modlarda simule edilmiştir. Ansys Workbench paket programı aracılığıyla doğal frekansı bulmak için sonlu elemanlar ve modal analiz yöntemi uygulanmıştır. İlk olarak Piezo dönüştürücü ağırlıksız bir şekilde program içeriğinde bulunan modal analiz ve sonlu elemanlar metodu kullanılarak doğal çalışma frekansını deney ortamında kullanılan 50 Hz çalışma frekansına sahip olan motorun frekansına olabildiğince yakınlaştırmak için çalışmalar yapılmıştır. Sonrasında ise piezo dönüştürücü üzerine 0.17 gr ağırlıklı 4 mm çapa sahip olan 7000 kg/m<sup>3</sup> yoğunluğa 0.24 poisson oranına sahip magnetler farklı adet ve yerleşim düzenleri ile yerleştirilmiştir. Program çözümünde her bir senaryonun en yüksek elektrik enerji çıktısı elde edeceği doğal frekans değerleri bulunarak bu frekans değerleri içinde üretilen elektrik değerleri ortaya konulmuştur ve irdelenmiştir. Bu durumun yanısıra piezoelektrik dönüştürücülerin hangi işlevlerde ve nasıl fayda sağlayacakları irdelenmiştir.

**Anahtar Kelimeler:** Modal analiz, Piezoelektrik enerji hasadı, Sonlu elemanlar analizi

\*Bu bildiri özeti Prof. Dr. Özlem Onay ve Dr. Öğretim Üyesi Emre Tüfekçioğlu'nun danışmanlığında Onur Ata tarafından yapılan "Endüstriyel Tesislerde Enerji Sağlama Alternatiflerinin İrdelenmesi: Piezoelektrik Enerji Hasadı İle Bir Elektrik Motorunun Ürettiği Titreşimin Modellenmesi" başlıklı yüksek lisans tez çalışmasından üretilmiştir.

## MODELING THE ENERGY OBTAINED BY PIEZOELECTRIC ENERGY HARVESTING FROM THE VIBRATION OF AN ELECTRIC MOTOR\*

### ABSTRACT

In this period when energy is needed at very critical levels in the world, the study of converting the inert vibration in the environment into energy and obtaining efficiency is of global importance. Piezoelectric energy harvesting generates electrical energy from the vibration in the environment; reduces energy loss. In this study, piezoelectric energy harvesting unit and vibration on an electric motor were evaluated over various scenarios in order to increase the energy production in piezoelectric energy harvesting and harvesting. Scenarios have been put forward in which cases the electrical energy obtained can be increased to higher levels and how the

piezo transducer to be used in electricity generation will react under different weights and what kind of results it will give. Weighted and unweighted piezo transducer scenarios were simulated in various modes in Ansys Workbench package program. Finite element and modal analysis method was applied to find the natural frequency through Ansys Workbench package program. Firstly, the piezo transducer was weightlessly simulated using the modal analysis and finite element method in the program to get the natural operating frequency as close as possible to the frequency of the motor with an operating frequency of 50 Hz used in the experimental environment. Afterwards, magnets with a weight of 0.17 g and a diameter of 4 mm with a density of 7000 kg / m<sup>3</sup> and a Poisson's ratio of 0.24 were placed on the piezo transducer with different numbers and layouts. In the program solution, the natural frequency values at which each scenario will obtain the highest electrical energy output are found and the electrical values produced within these frequency values are revealed and examined. In addition to this situation, the functions and benefits of piezoelectric converters have been analyzed.

**Keywords:** Modal analysis, Piezoelectric energy harvesting, Finite element analysis

\* This abstract is derived from Onur Ata's Master's thesis entitled "Examining Energy Supply Alternatives in Industrial Plants: Modeling the Vibration Produced by an Electric Motor with Piezoelectric Energy Harvesting" conducted by Onur Ata under the supervision of Prof. Dr. Özlem Onay and Assist.Prof.Dr.Emre Tüfekçioğlu.



## ALIŞVERİŞ MERKEZİ KAPALI OTOPARKI İÇİN YANGIN SİMÜLASYONU

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### ÖZET

Özellikle kapalı ortamlarda yangın çıkması durumunda fanların havayı hızlı tahliye etmesi ve uygun yer seçimi gibi parametreler önemlidir. Ayrıca, ortamdaki O<sub>2</sub> ve CO<sub>2</sub> gazlarının kütle oranı hayati önem taşımaktadır. İnsanların yoğun olarak bir arada olduğu kapalı ortamlarda, alışveriş merkezlerinde ve büyük hacimli iş yerlerine ait otoparklarda yangın çıkması halinde duman tahliye edilmesi jet fanlar yardımıyla yapılmaktadır. Bu durum göz önüne alınarak; çalışmada kapalı bir alışveriş merkezi otoparkına ait tip proje üzerinden jet fanların dahil edildiği bir yangın simülasyonu ANSYS-Fluent programı yardımıyla yapılmıştır. Kapalı otoparkın belirli bir bölgesinde yangın çıkması durumunda 7 adet jet fanın çalışmasını simüle eden akış analizi sonuçları elde edilmiştir. Çalışmada tek bir senaryo üzerinden yapılan simülasyon sonucunda; ortamdaki sıcaklık, hız, CO<sub>2</sub> ve O<sub>2</sub> değerlerinin değişimleri elde edilmiştir. Kritik bölge için hazırlanan yangın senaryosuna rağmen fanların yeterli kapasitede olduğu görülmüştür. Ayrıca, taze hava giriş kısmına yerleştirilen fanın yangın sonrası oluşan dumanı çıkışa yönlendirmede etkili olduğu tespit edilmiştir.

**Anahtar Kelimeler:** Yangın, Kapalı otopark, Akış analizi, Simülasyon.

## FIRE SIMULATION FOR CLOSED CAR PARK IN THE SHOPPING CENTER

### ABSTRACT

Especially in case of a fire in closed environments, parameters such as fast evacuation of air by fans and appropriate location selection are important. In addition, the mass ratio of O<sub>2</sub> and CO<sub>2</sub> gases in the environment is of vital importance. In case of a fire in closed environments, shopping centers and large workplaces where people are crowded together, smoke evacuation is done with the help of jet fans. Considering these situations, a fire simulation including jet fans carried out by ANSYS-Fluent program, based on a typical project of shopping center underground parking. Flow analysis results simulating the operation of 7 jet fans in the event of a fire in a certain area of the underground parking were obtained. As a result of the simulation conducted on a single scenario in the study; changes in temperature, velocity, CO<sub>2</sub> and O<sub>2</sub> values in the environment were obtained. Despite the fire scenario prepared for the critical area, the fans were found to have sufficient capacity. Additionally, it has been determined that the fan placed at the fresh air inlet is effective in directing the smoke formed after the fire to the exit.

**Keywords:** Fire, Closed Car Park, Flow Analysis, Simulation.



## TURBOJET MOTORLARDA YANMA ODASI SİSTEMİ İÇİN ISI KALKANI TASARIM VE ANALİZİ

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### ÖZET

Günümüzde savunma sanayisinde havacılık sektörü, beraberinde kritik teknolojileri barındıran, ülkemizde ve dünyada önemli bir yere sahip bir sektördür. Hava araçları için gerekli olan itkiyi üreten sistemlerden biri olan turbojet motorların itkiyi üretirken harcadığı yakıt enerjisi ile yüksek sıcaklıklar açığa çıkmaktadır. Bir arada uyum içinde çalışması gereken sistemlerin maruz kaldığı sıcaklıkların belirlenmesi ve önlem alınması için termal analiz yöntemlerinin gözden geçirilmesi ve gerekli bölgelerde termal yalıtım uygulamalarının yapılması sistemin güvenliği ve ömrü açısından kritiktir. Turbojet motorlarda yaygın olarak kullanılan termal yalıtım uygulamalarından biri de ısı kalkanı uygulamasıdır.

Bu bildiriye, savunma sanayisindeki önemli yeri olan turbojet motorlarda ısı kalkanı tasarımının gereksinimlerinin belirlenmesi ve bu gereksinimlere uygun bir tasarım çalışmasından bahsedilecektir. Çalışma kapsamında yanma odası gövdesinde kullanılacak ısı kalkanının tasarım adımları belirlenmiş, tasarlanan ısı kalkanının analizleri gerçekleştirilmiştir.

Tasarım çalışmasının ilk aşaması turbojet motorda ısı kalkanının maruz kalacağı termal yükler için kullanılacak teorinin incelenmesi ile denklemlerin türetilmesidir. İlgili denklemler, turbojet motor çalışma prensibi gereği kullandığı yüksek sıcaklıktaki hava-yakıt karışımı ile iletim, taşınım ve ışınım gibi ısı transfer mekanizmalarının bir arada kullanılması ile termal direnç ve enerji dengesi denklemleri türetilmiştir sistem üzerindeki etkisi incelenmiştir.

Çalışmanın ikinci aşamasında ısı kalkanı üretimi için kullanılacak yalıtım malzeme seçimi yapılmıştır. Yalıtım malzemesi seçilirken sektörde kullanılan uygulamalar incelenmiş olup seçilen 2 ürünün yalıtım performansı karşılaştırması için test faaliyeti yürütülmüştür. Kullanılacak yalıtım malzemesi belirlendikten sonra yalıtımı örten malzeme seçimi yapılmıştır.

Tasarım çalışmasının sonraki aşamasında dikkat edilmesi gereken hususlardan bahsedilmiştir. Tasarım geometrisi belirlendikten sonra CAD model oluşturulmuştur. Analiz programı kullanılarak örnek olarak girilen sıcaklık, akışkan hızı, ısı kalkanı çapı gibi sınır koşulları ile 2-Boyutlu ısı transferi uygulanmıştır. Farklı kalınlıklardaki yalıtım uygulamalarıyla elde edilecek sıcaklıklar ortaya çıkarılmıştır.

Son olarak elde edilen bulguların değerlendirilmesi, ısı kalkanı tasarım, analiz doğrulamasına yönelik uygulanması gereken yöntemler ile çalışmanın ileriye dönük planlarından bahsedilerek tamamlanmıştır.

**Anahtar Kelimeler:** Turbojet motor, ısı transferi, ısı kalkanı

## HEAT SHIELD DESIGN AND ANALYSIS FOR THE COMBUSTION CHAMBER SYSTEM IN TURBOJET ENGINES

### ABSTRACT

In today's defense industry, the aviation sector is a significant field that encompasses critical technologies, holding a prominent position both in our country and worldwide. Turbojet engines, which are one of the systems responsible for generating the thrust required for aircraft, release high temperatures as a result of the



fuel energy expended during thrust production. Determining the temperatures to which systems that must work in harmony are exposed and taking measures to prevent them is crucial for the safety and lifespan of the system. One commonly used thermal insulation application in turbojet engines is the implementation of a heat shield.

This paper discusses the determination of the requirements for heat shield design in turbojet engines, emphasizing its crucial role in the defense industry, and describes a design study that meets these requirements. The design steps for a heat shield that can be used in the combustion chamber of the engine are identified, and analyses of the designed heat shield are carried out.

The first stage of the design study involves examining the theory to be used for the thermal loads that the heat shield in the turbojet engine will be subjected to and deriving equations. The relevant equations are derived based on the principles of the turbojet engine, which involves the simultaneous use of heat transfer mechanisms such as conduction, convection, and radiation with the high-temperature air-fuel mixture used by the engine. The thermal resistance and energy balance equations are derived, and their impact on the system is examined.

In the second stage of the study, the selection of insulation material for heat shield production is discussed. The insulation material is chosen by examining applications used in the industry, and a test activity is conducted to compare the insulation performance of the selected materials. Once the insulation material is determined, the material covering the insulation is also chosen.

The next stage of study discusses important considerations after determining the design geometry. After defining the design geometry, a CAD model is created. Using an analysis program, two-dimensional heat transfer is applied with boundary conditions. Temperatures resulting from insulation applications of different thicknesses are revealed.

Finally, the paper concludes by evaluating the findings, discussing methods for the heat shield design and analysis verification, and outlining future plans for the study.

**Keywords:** Turbojet Engine, heat transfer, heat shield



## EXPERIMENTAL INVESTIGATION OF OIL-WATER SEPARATION EFFICIENCY

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### ABSTRACT

The need for energy in the world is increasing day by day, and accordingly the search for new energy sources continues. Although the interest and investment in renewable energy has increased recently, the use of non-renewable (fossil-based) energy resources still maintains its top position. Among fossil energy sources, it is inevitable that the importance of petroleum, which is the most preferred and consumed, will increase. In this case, it is important to benefit as much as possible from the petroleum that is already extracted to the surface at high costs. Petroleum extracted to the earth; Since it consists of a mixture containing water, mud and some gas, it is first crash at high speed against the plates placed horizontally in the tank and kept in the relevant tank for a certain period of time. By this method, separation of most of the gas and sludge in the mixture is achieved. This process is called the first process, and as a result of this process, crude petroleum, separated water (wastewater), sludge, and gas are obtained. The obtained separated water may contain 20%-5% petroleum. Some processes are applied within the scope of the second process to separate this petroleum in the waste water. In this study, within the scope of the second process, corrugated plates were used based on the gravitational separation method, which is widely preferred because it does not require any energy source in the separation of petroleum in waste water and provides separation to a large extent. In order to consider the effect of corrugated plates on the separation efficiency, 3 (three) different hole diameters (15, 35, 55 mm) and 3 (three) different plate lengths (600, 800, 1000 mm) parameters were considered. Also the individual and compound effects of each parameter on the separation efficiency were examined. In all experiments, the same petroleum-water mixture samples (88% water, 12% petroleum) were used and the temperature of the relevant samples was kept at 23 °C. The change in the separation efficiency of the petroleum-water mixture pumped into the separation system at a constant flow rate of 20 liters/minute was examined according to the parameters. The petroleum/water ratio of the mixture pumped into the system and the petroleum/water ratio of the water separated from the system were measured, and the difference between the two measurements was considered as the separation efficiency. As a result of the measurements, it was seen that each parameter considered affected the separation efficiency both individually and relatively. It was observed that the highest separation efficiency of 98.75% was obtained when the plate hole diameter was 55 mm and the plate length was 800 mm.

**Keywords:** Oil-water separation, gravitational separation, separation efficiency, corrugated plates.



## AMERİKA'DA KAYA GAZI KULLANIMININ TÜRKİYE'NİN DIŞ TİCARET AÇIĞINA ETKİSİ

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### ÖZET

1999 yılında Amerika Birleşik Devletleri'nin (ABD) Teksas eyaletinden bir işadammının kaya gazı üretim maliyetlerini düşürmesiyle kullanım alanı bulmaya başlayan kaya gazı, 2000'li yıllardan itibaren çok sayıda yatırımcının sektöre girmesiyle gelişme göstermiştir. Kaya gazı bu yıllardan itibaren hem sektörde kullanım alanı genişlemiş hem de yapılan araştırmalara konu olmaya başlamıştır. Çıkarım teknolojilerinin gelişmesiyle birlikte 2040'lı yıllara gelindiğinde üretilen doğal gaz miktarının 1.7 trilyon  $m^3$  olması beklenmektedir. Bu veriler çevresinde kaya gazının ABD'nin enerji ithalatına, dolayısıyla dünya petrol fiyatlarına etkisi araştırmacılar için ilgi çekici bir konu olmuştur. Bu çalışmada, kullandığı enerjinin %60'nı petrolden elde eden ABD'nin kaya gazına geçmesiyle birlikte ithal ettiği petrolün ve dolayısıyla petrol fiyatlarının düşebileceği öngörülmektedir. Bu düşüş paralelinde kullandığı enerjinin %74'ünü dışarıdan ithal eden Türkiye'nin enerji maliyetlerinin ve dış ticaret açığının düşebileceği düşünülmektedir. ABD'nin kaya gazı kullanımının dünya petrol fiyatlarına etkisi bulmak ve dolayısıyla Türkiye'nin dış ticaret açığına etkisini araştırmak çalışmanın amacını oluşturmaktadır. 2000:Q1-2023:Q8 aylık verilerinin kullanıldığı çalışmada, VAR analizi tercih edilmiştir. ADF (Genişletilmiş Dickey-Fuller) ve PP (Phillip-Peron) birim kök testleri ile durağanlığı ölçülmeye çalışılmıştır. Sonrasında Eşbütünleşme testi yapılan çalışmada Granger Nedensellik Testi ile seriler arasındaki nedensellik ilişki test edilmeye çalışılmıştır. Elde edilen sonuçlarda, 2000'li yılların başından itibaren kaya gazı üretiminde maliyet avantajını yakalayan ABD'nin, kaya gazı kullanım alanlarını genişlettiği anlaşılmıştır. İlerleyen zamanlarda kaya gazının kullanım alanlarının genişlemesiyle enerji ihtiyacının büyük kısmını karşıladığı petrole bağımlılığı azalmaya başlamış ve petrol ithalatında 2000'li yılların başından itibaren bir düşüş olduğu anlaşılmıştır. Yüksek oranda petrol ithalatçısı olan ABD'nin ithalat oranlarındaki düşüş petrol fiyatlarının göreceli düşmesine neden olmuştur. Bu düşüşle birlikte Türkiye'nin dış ticaret açığının da azaldığı yapılan testlerden elde edilmiştir.

**Anahtar Kelimeler:** Uluslararası ticaret, ithalat, kaya gazı, dış ticaret açığı

### THE IMPACT OF SHALE GAS USAGE OF US TO TURKISH FOREIGN TRADE DEFICIT

#### Abstract

Shale gas that started to use in 1999 when an investor from Texas, United States (US) reduced shale gas production costs has developed with the entry of many investors into the sector since the 2000s. The area of use of shale gas in the sector has expanded with these years. With the development of extraction technologies, the amount of natural gas produced by the 2040s is expected to be 1.7 trillion  $m^3$ . Based on these expectation, the impact of shale gas on the US's energy imports and therefore on world oil prices has been an interesting subject for people. In this study, it is predicted that switches to shale gas for the US that obtains 60% of the energy it uses from oil, and therefore oil prices in the world may decrease by usage amount. In parallel with this decrease, it is thought that the energy costs and foreign trade deficit of Türkiye, which imports 74% of the energy it uses, may decrease as well. The aim of the study is to find out the effect of the US's shale gas usage on world oil prices and therefore to investigate its effect on Türkiye's foreign trade deficit. The 2000:Q1-2023:Q8 monthly data selected and analyzed method is selected VAR analysis. Unit roots measured with ADF (Augmented Dickey-Fuller) and PP (Phillip-Peron) tests for this research. The cointegration test and the causality relationship between the series was tried to be tested with the Granger Causality Test. The results obtained show that the US that has achieved a cost advantage in shale gas production since the early 2000s has expanded its shale gas usage areas. Over time, as the areas of use of shale gas expanded, its dependence on oil

that met most of its energy needs began to decrease. It was also understood that there was a decrease in oil imports since the early 2000s. The decrease in import rates of the US that is a high oil importer has caused a relative decrease in oil prices. It was obtained from the tests that Türkiye's foreign trade deficit decreased with this lower price of petroleum price.

**Keywords:** International trade, import, shale gas, foreign trade deficit



## TR 72 BÖLGESİNDE YENİLENEBİLİR ENERJİ POTANSİYELİ VE YATIRIMLAR

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### ÖZET

Dünya nüfusunun artması ile birlikte enerjiye olan ihtiyaç ve talep hızla artmaktadır. Ülkemizde enerji ihtiyacının %80'nin den fazlası fosil yakıtlardan (kömür, doğalgaz, petrol) karşılanmaktadır. Fosil yakıt en yaygın bilinen enerji kaynaklarından. Son yıllarda gerek ülkemizde gerekse dünyada ki gelişmeler göz önünde bulundurulduğunda fosil yakıtlardan kaynaklanan başta karbondioksit ve diğer sera gazlarının salınımının artması, atmosfere zarar vermekte, küresel ısınma ya da iklim değişikliği ile birlikte çevre sorunlarını artırmaktadır. Dolayısıyla bu kaynakların sınırlılığı da alternatif enerji kaynak arayışını kaçınılmaz kılmaktadır. Özellikle ulusal enerji kaynaklarının dışa bağımlılığının azaltılması, yenilenebilir enerji kaynaklarının sürdürülebilirliğinin sağlanması adına temiz enerji kaynaklarına olan ihtiyaç, başta sanayi olmak üzere, tarım, gıda, sağlık, çevre gibi pek çok sektörde bugün ve gelecekte giderek önem kazanmaktadır.

Son yıllarda özellikle artan nüfus, teknolojik gelişmeler ve üretim kapasitesine paralel olarak artan enerji kullanımının yanısıra, enerjide arz güvenliğini güçlendirmek ve enerji de alternatif kaynak arayışını hızlandırmak, Türkiye'nin öncelikli hedefleri arasında yer almaktadır. Bu bağlamda 2017 yılında kabul edilen Milli Enerji Politikası ile hem yerli hem de yenilenebilir enerji kaynaklarının kullanımına yer verilmektedir. Bu hedefler doğrultusunda Türkiye, yenilenebilir enerjide kurulu güç bakımından Avrupa'da 5. ve dünyada 12. sıraya yükselmiştir. Türkiye'de 2022 yılın da yenilenebilir enerji kaynak kullanımını %54 e çıkararak hedeflerini gerçekleştirmektedir.

Çalışmada Türkiye genelinde ve TR 72 bölgesi özelinde yenilenebilir enerji kaynaklarına değinilecektir. TR 72 bölgesinde bulunan Sivas, Yozgat ve Kayseri illerindeki mevcut yenilenebilir enerji kaynakları ve potansiyelleri araştırıldığında bölgenin, güneş enerjisi, rüzgar enerjisi, hidroelektrik, biyokütle ve jeotermal enerji kaynakları açısından zenginliği dikkat çekmektedir.

**Anahtar Kelimeler:** Enerji, Yenilenebilir Enerji, TR 72 Bölgesi

## RENEWABLE ENERGY POTENTIAL AND INVESTMENTS IN THE TR 72 REGION

### ABSTRACT

With the increase in the world population, the need and demand for energy is increasing rapidly. In our country, more than 80% of the energy need is met from fossil fuels (coal, natural gas, oil). Fossil fuel is one of the most widely known energy sources. Considering the developments both in our country and in the world in recent years, the increase in the emission of carbon dioxide and other greenhouse gases from fossil fuels damages the atmosphere and increases environmental problems with global warming or climate change. Therefore, the limitation of these resources makes the search for alternative energy sources inevitable. The need for clean energy resources, especially in order to reduce the external dependence of national energy resources and to ensure the sustainability of renewable energy resources, is becoming increasingly important today and in the future in many sectors such as industry, agriculture, food, health, environment.

In recent years, in addition to increasing energy use in parallel with the growing population, technological developments and production capacity, strengthening the security of energy supply and accelerating the search for alternative sources of energy are among Turkey's prioritized goals. In this context, the National Energy Policy adopted in 2017 includes the use of both domestic and renewable energy resources. In line with these

targets, Turkey ranked 5th in Europe and 12th in the world in terms of installed capacity in renewable energy. Turkey is realizing its targets by increasing the use of renewable energy sources to 54% in 2022.

In the study, renewable energy resources in Turkey in general and TR 72 region in particular will be mentioned. When the existing renewable energy resources and potentials in Sivas, Yozgat and Kayseri provinces in TR 72 region are investigated, the richness of the region in terms of solar energy, wind energy, hydroelectricity, biomass and geothermal energy resources draws attention.

**Keywords:** Energy, Renewable Energy, TR 72 Region





## AN ANALYSIS ON TURKEY'S PREVIOUS RENEWABLE ENERGY SUPPORT MECHANISM

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### ABSTRACT

This study is related to the Renewable Energy Resources Support Mechanism (YEKDEM) announced in 2021. YEKDEM aims to encourage investors to invest more in this field. Giving these incentives in this way is of course beneficial, but it is debatable whether they are sufficient. For this, an analysis covering the years July 2021 and July 2023 has been carried out for solar energy. In the analysis, the incentive amounts have been found as TL-kurus per kWh and the incentive amounts given to the investor have been calculated by converting them into cents US\$/kWh. Incentive amounts are highest in July and lowest in January. In this 24-month period, a total incentive amount of 545.57 is found in TL-kurus/kWh and the equivalent of this value is 33.70 cents US\$/kWh.

**Key words:** Solar energy, Solar power plant, YEKDEM



## EFFECT OF ENERGY CONSUMPTION AND GREENHOUSE GAS EMISSIONS ON ECONOMIC GROWTH IN TURKEY: EMPIRICAL EVIDENCE FROM THE AGRICULTURAL SECTOR

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### ABSTRACT

The agricultural sector involves intensive energy usage in various stages, including soil cultivation, irrigation, harvesting, and product storage. Thus, planning the energy use in agriculture efficiently is crucial for reducing costs, minimizing environmental impacts, and ensuring the sustainability of agricultural productivity. The aim of this study is to determine the impact of energy consumption and greenhouse gas emissions on growth in Turkey within the agricultural sector between 1998 and 2020. The agricultural gross domestic product data has been used to represent the variable of economic growth in the agricultural sector. Data that represent total energy consumption in the agricultural sector, measured in tera joules for energy consumption, and data indicating total greenhouse gas emissions in the agricultural sector, measured in million tons of CO<sub>2</sub> equivalent for carbon emissions, have been utilized. The results of the unit root tests have indicated that the variables used in the model have been stationary at different levels which is I(0) and I(1). Thus, the Autoregressive Distributed Lag Bound Test approach, which has been employed and provides consistent and unbiased results in small samples for series with different levels of stationarity, has been used to examine short and long-term relationships between variables. Moreover, the long term coefficient results indicate that a 1% increase in energy consumption in the agricultural sector corresponds to a 0.24% increase in the agricultural gross domestic product value. Furthermore, the vector error correction model coefficient, which has been calculated as 0.62, indicates that short-term imbalances have been corrected within 1.67 periods. Also, greenhouse gas emissions from the agricultural sector have had a positive and significant impact on agricultural gross domestic product. It has been considered that to reduction of fossil fuel use and increase in renewable energy sources, increase in incentives for the use of high-energy efficiency smart agricultural technologies.

**Keywords:** Agricultural sector, energy consumption, greenhouse gas emissions, economic growth, ARDL bounds testing approach,



## SEÇİLMİŞ AVRUPA ÜLKELERİ'NDE KARBONDİOKSİT GAZI EMİSYONU VE PETROL TÜKETİMLERİ ARASINDAKİ İLİŞKİ: DOĞRUSAL OLMAYAN ARDL MODELLERİNDEN KANITLAR

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### ÖZET

Küresel iklim krizinin derinleşmesiyle birlikte birçok gelişmiş ve gelişmekte olan ülke iklim kriziyle mücadelede önemli adımlar atmaya başlamıştır. Özellikle gelişmiş ülkelerin çoğu küresel iklim kriziyle başa çıkmak için çeşitli anlaşmalar imzalamış çeşitli tedbirler almaya başlamışlardır. Çalışmamız fosil enerji kaynaklarından olan ve Dünya'da en çok ticareti yapılan emtialarından olan petrol ve karbondioksit gazı emisyonu arasındaki ilişkiyi incelemek üzerine kurulmuştur. Analizimizde karbondioksit gazı emisyon değeri en yüksek olan 13 Avrupa ülkesi ve bu ülkelerin petrol tüketimleri ele alınmıştır. Analize konu olan Avrupa ülkeleri; Almanya, Belçika, Çek Cumhuriyeti, Danimarka, Fransa, Hollanda, İngiltere, İspanya, İsveç, İtalya, Macaristan, Polonya ve Romanya'dır. Veri seti olarak 1965-2022 yılları arasındaki en güncel ve en uzun zaman aralığı incelemeye alınmıştır. Karbondioksit emisyon verileri milyon ton olarak, petrol tüketim verileri de milyon ton olarak ele alınmıştır. Analize dahil edilen Avrupa ülkelerinin karbondioksit gazı emisyonu ile petrol tüketimleri arasındaki ilişki doğrusal olmayan eşbütünleşme testlerinden olan Shin, Yu ve Greenwood-Nimmo'nun (2014) literatüre kazandırdığı doğrusal olmayan gecikmesi dağıtılmış model NARDL ile incelenmiştir. Analize konu alınan ülkeler için bazılarının petrol tüketimi ile karbondioksit gazı arasında uzun dönemli ilişki tespit edilememişken bazılarında ise uzun dönemli bir ilişki tespit edilmiştir. Doğrusal olmayan gecikmesi dağıtılmış model NARDL sayesinde modellerin uzun dönem pozitif ve negatif katsayılar hesaplanmış olup bu katsayıların istatistiksel olarak anlamlılıkları da tespit edilmiştir. Ayrıca kısa dönemli asimetric katsayılar da hesaplanıp analiz zenginleştirilmiştir. Avrupa ülkeleri için Almanya, Belçika, Danimarka ve Fransa gibi sanayileşmesi yüksek olan bazı ülkelerin karbondioksit emisyonları ve petrol tüketimleri arasında uzun dönemli bir eşbütünleşme ilişkisi tespit edilmiştir. Sanayileşme ve ekonomik gelişmişlik düzeyi olarak lider ülkelerin gerisinde kalmış bazı ülkeler için de karbondioksit emisyonları ve petrol tüketimleri arasında uzun dönemli bir ilişki tespit edilememiştir.

**Anahtar Kelimeler:** Karbondioksit emisyonu, NARDL, Eşbütünleşme, Yakınsama

### THE RELATIONSHIP BETWEEN CARBON DIOXIDE EMISSIONS AND OIL CONSUMPTION IN SELECTED EUROPEAN COUNTRIES: EVIDENCE FROM NONLINEAR ARDL MODELS

### ABSTRACT

With the deepening of the global climate crisis, many developed and developing countries have started to take important steps to combat the climate crisis. Most of the developed countries have signed various agreements and started to take various measures to cope with the global climate crisis. Our study is based on analyzing the relationship between oil, which is one of the fossil energy sources and one of the most traded commodities in the world, and carbon dioxide gas emissions. In our analysis, 13 European countries with the highest carbon dioxide gas emission value and the oil consumption of these countries are considered. The European countries subject to the analysis are; Germany, Belgium, Czech Republic, Denmark, France, France, Netherlands, UK, Spain, Sweden, Italy, Hungary, Poland, Poland, and Romania. The most recent and longest period between 1965 and 2022 is analyzed as a data set. Carbon dioxide emission data are considered in a million tonnes and oil consumption data in a million tonnes. The relationship between carbon dioxide gas emissions and oil consumption of the European countries included in the analysis is analyzed with the non-linear lagged

distributed model NARDL, which is one of the non-linear cointegration tests introduced to the literature by Shin, Yu, and Greenwood-Nimmo (2014). For the countries analyzed, no long-run relationship was found between oil consumption and carbon dioxide gas in some countries, while a long-run relationship was found in others. Long-run positive and negative coefficients of the models have been calculated and statistical significance of these coefficients has been determined by the nonlinear lag distributed model NARDL. Short-run asymmetric coefficients are also calculated to enrich the analysis. For European countries, a long-run cointegration relationship was found between carbon dioxide emissions and oil consumption of some industrial leaders such as Germany, France, Denmark and France. For some countries that lag behind the leading countries in terms of industrialization and economic development, no long-run relationship was found between carbon dioxide emissions and oil consumption.

**Keywords:** Carbon dioxide emission, NARDL, Cointegration, Convergence



## SEÇİLİ AVRUPA ÜLKELERİ'NDE KARBONDİOKSİT EMİSYONLARI YAKINSIYOR MU? DOĞRUSAL OLMAYAN BİRİM KÖK TESTLERİNDEN KANITLAR

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### ÖZET

Küresel iklim değişikliğinin etkilerini arttırmasıyla birlikte ülkeler son yıllarda karbondioksit gibi sera etkisi yapan gazların salınımını azaltmada ciddi tedbirler almaya başlamıştır. Küresel iklim değişikliğinin etkilerinin ilk konuşulmaya başlandığı Avrupa kıtasında bulunan ülkeler özellikle zehirli gazların atmosfere salınımıyla ilgili sıkı yönetmelikleri devreye sokmaya başlamışlardır. Çalışmamızda da küresel iklim değişikliğinin en yüksek sesle konuşulmaya başlandığı Avrupa ülkeleri incelenmektedir. Enerji üretiminde çevreye salınan karbondioksit gazı emisyon değerlerinin en fazla olduğu 13 Avrupa ülkesi analize dahil edilmiştir. Analize konu olan Avrupa ülkeleri; Almanya, Belçika, Çek Cumhuriyeti, Danimarka, Fransa, Hollanda, İngiltere, İspanya, İsveç, İtalya, Macaristan, Polonya ve Romanya'dır. Veri seti için bulunabilen en geniş zaman aralığı alınarak 1965-2022 yılları arasındaki karbondioksit emisyon değerleri incelenmiştir. İncelenen 13 Avrupa ülkesi için alınan tedbirlerin faydalı olup olmadığını sorgulama amacıyla yakınsama analizi kullanılmıştır. Yakınsama analizi için 13 Avrupa ülkesinin karbondioksit emisyon değerlerinin grup ortalamasına yakınsama durumu birim kök testleriyle incelenmiştir. Analiz için öncelikle kesirli Fourier birim kök testleri kullanılmıştır. Test sonuçları doğrultusunda incelenen Avrupa Ülkeleri'nden hiçbirinin Fourier terimleri anlamlı bulunamamıştır. Fourier terimlerinin istatistiksel olarak anlamsız bulunmasıyla birlikte Fourier tipi olmayan farklı birim kök testleri kullanılmıştır. Yakınsama analizi için ani kırılmaları dikkate alan RALS tipi birim kök testleri kullanılmıştır. RALS tipi birim kök testleri normal dağılmama durumunu dikkate aldığı için daha etkin parametre tahminleri sunması açısından tercih konusu olmuştur. Hem trendde hem de sabit terimde iki kırılmayı yakalayabilen RALS-LM birim kök testinin kullanılması da yakınsamanın tespit edilebilmesi açısından önem arz etmektedir. Yumuşak geçişleri ifade eden Fourier fonksiyonlarının anlamsız çıkması analize dahil edilen ülkeler için yapısal değişimin olmadığı olarak yorumlanmamalıdır. Bu nedenle ani kırılmaları dikkate alan birim kök testleri yumuşak geçişler bulunmasa dahi tercih edilmiştir. RALS birim kök testi sonucunda Fransa, İsveç, Polonya haricinde ele alınan 10 Avrupa ülkesinin karbondioksit salınımlarının yakınsama davranışı gösterdiği tespit edilmiştir.

**Anahtar kelimeler:** Karbondioksit emisyonu, Yakınsama, RALS-tipi birim kök testi

## ARE CARBON DIOXIDE EMISSIONS CONVERGING IN SELECTED EUROPEAN COUNTRIES? EVIDENCE FROM NON-LINEAR UNIT ROOT TESTS

### ABSTRACT

With the increasing effects of global climate change, countries have started to take serious measures to reduce the emission of greenhouse gases such as carbon dioxide in recent years. Countries in the European continent, where the effects of global climate change first started to be discussed, have started to put into effect strict regulations, especially regarding the release of toxic gases into the atmosphere. In our study, European countries, where global climate change has started to be discussed most loudly, are analyzed. The 13 European countries with the highest carbon dioxide gas emission values released to the environment in energy production are included in the analysis. Carbon dioxide emission values between 1965-2022 are analyzed by taking the widest time interval available for the data set. Convergence analysis is used to question whether the measures taken for the 13 European countries are beneficial or not. For the convergence analysis, the convergence of carbon dioxide emission values of 13 European countries to the group average was analyzed by unit root tests.

Firstly, fractional Fourier unit root tests were used for the analysis. According to the test results, the Fourier terms of none of the European countries analyzed were found to be significant. As the Fourier terms were found to be statistically insignificant, different non-Fourier type unit root tests were used. For convergence analysis, RALS-type unit root tests that take into account sudden breaks were used. Since RALS-type unit root tests take into account the non-normal distribution, they are preferred in terms of providing more efficient parameter estimates. The use of the RALS-LM unit root test, which can capture two breaks in both the trend and the constant term, is also important in terms of detecting convergence. The fact that the Fourier functions expressing smooth transitions are insignificant should not be interpreted as the absence of structural change for the countries included in the analysis. For this reason, unit root tests that take into account sudden breaks are preferred even if there are no smooth transitions. As a result of the RALS unit root test, it was found that the carbon dioxide emissions of the 10 European countries except France, Sweden, and Poland showed convergence behavior.

**Keywords:** Carbon dioxide emission, Convergence, RALS-type unit root test





## THE RELATIONSHIP BETWEEN RENEWABLE ENERGY AND EMPLOYMENT: THE CASE OF TURKEY

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### ABSTRACT

Energy, which penetrates almost all of our lives, is one of the indispensable basic factors determining the level of economic development of countries; our need for energy has increased in parallel with population growth, urbanisation, technological development, globalisation and industrialisation. Today, the fact that 80-90% of the world's energy supply is met from fossil fuels has led to the need to meet the increasing energy demand in harmony with low cost and sustainable environmental purposes. At this point, renewable energy sources come to mind as a solution. The fact that renewable energy resources can renew themselves with a continuous movement, are distributed more fairly, are easy to obtain, support sustainable development and create new employment areas, and have very little damage to the ecosystem compared to fossil fuels makes these resources attractive. In the age we live in, many countries have started to produce and consume renewable energy resources in order to ensure energy supply security by reducing external dependence on energy and to access cleaner energy resources. In addition, the transition to renewable energy sources creates a series of job opportunities for individuals with different qualifications and qualifications. In this context, in this study, the relationship between employment and renewable energy is analysed using the ARDL Border Test Method with the help of the data set for the period 2000-2021 for Turkey. As a result of the analysis, it is found that there is a cointegration relationship between renewable energy and employment in the long run, that is, the series move together in the long run. In this framework, it is thought that with the increase in investments and demand for renewable energy resources in Turkey in the coming years, this situation will be more effective on employment.

**Keywords:** Renewable Energy, Employment, ARDL Bound Test Approach.

## YENİLENEBİLİR ENERJİ VE İSTİHDAM İLİŞKİSİ: TÜRKİYE ÖRNEĞİ

### ÖZET

Hayatımızın neredeyse tamamına nüfus eden enerji ülkelerin ekonomik kalkınmışlık düzeyini belirleyen vazgeçilmez temel faktörlerden biri olup; enerjiye olan ihtiyacımız nüfus artışı, kentleşme, teknolojik gelişme, küreselleşme ve sanayileşmeye paralel olarak artmıştır. Günümüzde dünya enerji arzının %80-90'nının fosil yakıtlardan karşılanması artan enerji talebinin düşük maliyetli ve sürdürülebilir çevre amacıyla uyum içerisinde karşılanma ihtiyacını doğurmuştur. Bu noktada çözüm olarak akla yenilenebilir enerji kaynakları gelmektedir. Yenilenebilir enerji kaynaklarının kendini sürekli bir devinimle tazeleyebilmeleri, daha adil bir şekilde dağılması, elde edilebilirliğinin kolay olması, sürdürülebilir kalkınmayı desteklemesi ve yeni istihdam alanları yaratması ve ekosisteme verdiği zararın fosil yakıtlarla kıyaslandığında çok az olması bu kaynakları cazip hale getirmektedir. Yaşadığımız çağda birçok ülke enerjide dışa bağımlılığı azaltarak enerji arz güvenliğini sağlamak hem de daha temiz enerji kaynaklarına erişmek üzere yenilenebilir enerji kaynaklarını üretmeye ve tüketmeye başlamıştır. Ayrıca yenilenebilir enerji kaynaklarına geçiş farklı vasıfta ve nitelikte bireyler için bir dizi iş imkanı ortaya çıkarmaktadır. Bu kapsamda çalışmada istihdam ve yenilenebilir enerji arasındaki ilişki Türkiye için 2000-2021 dönemi veri seti yardımıyla ARDL Sınır Testi Yöntemi kullanılarak analiz edilmektedir. Analiz sonucunda uzun dönemde yenilenebilir enerji ile istihdam arasında eşbütünleşme ilişkisi olduğu yani serilerin uzun dönemde birlikte hareket ettiğine ulaşılmıştır. Bu çerçevede, Türkiye'de gelecek yıllarda yenilenebilir enerji kaynaklarına olan yatırımların ve talebin artması ile birlikte bu durumun istihdam üzerinde daha etkili olacağı düşünülmektedir.

**Anahtar Kelimeler:** Yenilenebilir Enerji, İstihdam, ARDL Sınır Testi Yaklaşımı.



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## ÖZET

Patent verilerinin analizi, bir teknoloji veya endüstrinin mevcut durumu ve potansiyel trendlerinin tespit edilmesi ve pazar fırsatlarını anlamak için önemli bir yöntemdir. Bu çalışmada, Questel Orbit yazılımı kullanılmıştır. Questel Orbit, patent araştırması yapmak için kapsamlı veritabanına sahip bilgi sağlayıcısıdır. Patent aramasında "Solar Cell" (ya da photovoltaic solar cell) anahtar kelimeler kullanılarak patent verileri elde edilmiştir.

Bu çalışma, 1998 ile 2020 yılları arasındaki Güneş hücre teknolojisi ile ilgili küresel patent başvurularının bir analizini sunmaktadır. Bu zaman aralığı, 1998 yılından önce bu teknolojiler için kayda değer sayıda patent bulunmaması nedeniyle belirlenmiştir. Bu teknolojinin, toplam 448798 buluş sayısı ile küresel düzeyde yoğun bir patent aktivitesine sahip olduğu görülmektedir. Bu analizde incelenecek başlıklar, kronolojik patent aktiviteleri, coğrafi dağılım, anahtar oyuncular ve teknik alanlar olarak sıralanmaktadır. Patent aktivitesi her yıl artmakta olmasına karşın 2017 ile 2020 yılları arasında %5.1'lik bir azalma ile gerileme göstermektedir. Patentlerin coğrafi dağılımları incelendiğinde, Çin ve Japonya'nın lider konumda olması bu ülkelerin bu konudaki teknolojik ilerlemeye yönelik önemli çabalar sarf edildiğini göstermektedir. Bu teknolojinin, ilk beş oyuncusu Sharp, State Grid Corporation China, Mitsubishi Electric, Panasonic, Canon Inc. gibi Çin ve Japon menşeli şirketlerdir. Güneş hücreleri ile ilgili teknolojilerdeki patentler, elektriksel makinalar, aparatlar, enerji alanı ve güneş radyasyonunu elektrik enerjisine dönüştürmek için yarı iletken alanı öne çıkmaktadır. Modern toplumda enerji tüketiminin artmasıyla birlikte çevreye duyarlı kirlilik içermeyen yenilenebilir enerji kaynaklarının araştırma ve geliştirme faaliyetleri de her geçen gün üzerine yenisini koymaktadır. Güneş hücresi teknolojisindeki patent verileri, araştırmacılar ve bu endüstrideki uzmanlara önemli bilgiler sağlamaktadır. Bu bilgiler, sürdürülebilir bir geleceği şekillendirmede rehberlik edecektir.

**Anahtar Kelimeler:** Patent analiz, Güneş hücresi, Fikri mülkiyet,

## A COMPREHENSIVE ANALYSIS OF SOLAR CELL PATENTS

### ABSTRACT

The analysis of patent data is a crucial method for identifying the current state and potential trends of a technology or industry and for understanding market opportunities. This study employs the Questel Orbit software, which is an information provider with an extensive database for conducting patent research. Patent data was collected using "Solar Cell" (or photovoltaic solar cell) as keywords in the search.

This work presents an analysis of global patent applications related to Solar Cell technology from 1998 to 2020. This time frame was selected due to the negligible number of patents for these technologies prior to 1998. It is evident that this technology has experienced intensive patent activity globally, with a total of 448,798 inventions. The subjects to be examined in this analysis include chronological patent activities,

geographical distribution, key players, and technical fields. Although patent activity has been increasing annually, there has been a decline of 5.1% between 2017 and 2020. When examining the geographic distribution of patents, the leading positions of China and Japan indicate significant efforts by these countries in technological advancement in this field. The top players in this technology are companies originating from China and Japan, such as Sharp, State Grid Corporation of China, Mitsubishi Electric, Panasonic, and Canon Inc. In the field of technologies related to Solar Cells, patents are prominent in electrical machines, apparatuses, the energy field, and the semiconductor field for converting solar radiation into electrical energy.

With the increase in energy consumption in modern society, research and development activities for renewable energy sources, which are environmentally friendly and pollution-free, are continually being added upon. Patent data in solar cell technology provides critical information to researchers and experts in this industry. This information will guide the shaping of a sustainable future.

**Keywords:** Patent analysis, Solar Cells, Intellectual property,



## Na KATKILI ZnO TAMPON TABAKASININ ORGANİK GÜNEŞ HÜCRELERİNDE VERİME ETKİSİ

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### ÖZET

Dünya nüfusunun giderek artması ile her geçen gün enerji talebi de artış göstermektedir. Bununla beraber fosil yakıtların azalması ve yakıldıklarında çevreye vermiş oldukları zarar da yadsınamaz bir gerçektir. Dolayısıyla yenilenebilir enerji kaynakları gittikçe önem kazanmaktadır. Yenilenebilir enerji kaynakları arasında güneş enerjisi, geleneksel fosil yakıtların yerine geçen, modern çağın ihtiyaçlarını karşılayan, tükenmez, çevre dostu ve sürdürülebilir bir enerji kaynağı olarak karşımıza çıkmaktadır.

Fotovoltaik etkinin keşfi 1800'lü yıllarda gerçekleşmiş olsa da ilk güneş hücresi 1954 yılında silisyum kristali üzerine yapılmış ve bu tarihten günümüze kadar gerçekleştirilen güneş hücreleri üç nesilde sınıflandırılmıştır. Birinci nesil güneş hücreleri kristal silisyum tabanlı güneş hücrelerinden oluşmaktadır. İkinci nesil güneş hücreleri ince film tabanlı güneş hücreleridir. Üçüncü nesil güneş hücreleri ise organik güneş hücreleri başta olmak üzere boya duyarlı güneş hücreleri ve perovskit güneş hücrelerinden oluşmaktadır. Bu gruptaki hücrelerin ticarileşmeleri noktasında daha yüksek verim değerlerine ulaşılması gerekmektedir.

Yapılan bu çalışmada Na katkılı ve katkısız ZnO sol-jel yöntemi ile sentezlenmiş olup evrik yapıdaki organik güneş hücrelerinde elektron taşıyıcı tabaka olarak kullanılmıştır. Üretilen aygıtın yapısı ITO / (Na)- ZnO / P3HT:PCBM / MoO<sub>3</sub> / Ag şeklindedir. ZnO içerisine Na, molce %1, %2 ve %3 oranlarında katkılanarak deneysel çalışmalar gerçekleştirilmiştir.

Na katkılı ve katkısız ZnO ince filmleri XRD, UV-Vis Spektrofotometre ve temas açısı ölçümleri ile karakterize edilmiştir. Ayrıca üretilen aygıtların verimleri 100 mw/cm<sup>2</sup> güneş ışınması altında Keithley 2400 kaynak ölçer yardımı ile belirlenmiştir.

Sonuçlara göre %0-1-2-3 Na/ZnO içeren aygıtlar için sırasıyla elde edilen verim değerleri %2,90, 3,01, 3,15 ve 2,92'dir. Tüm hücrelerden elde edilen açık devre gerilimi (V<sub>oc</sub>) 590 mV'tur. Dolum faktörü (FF) %64,8 ile %69,5 değerleri arasında bulunmuştur. Akım yoğunlukları (J<sub>sc</sub>) ise yine %0-1-2-3 Na/ZnO içeren aygıtlar için sırasıyla 7,54, 7,54, 7,70 ve 7,64 mA/cm<sup>2</sup> olarak bulunmuştur. En yüksek verime %3,15 değeri ile %2 Na/ZnO içeren aygıt ile ulaşılarak Na içermeyen aygıtta göre yaklaşık olarak %10'luk bir verim artışı sağlanmıştır.

**Anahtar Kelimeler:** Na, ZnO, Organik Güneş Hücreleri

## EFFECT OF Na DOPED ZnO BUFFER LAYER ON EFFICIENCY IN ORGANIC SOLAR CELLS

### ABSTRACT

With the increasing population of the world, energy demand is increasing day by day. However, the decrease in fossil fuels and the damage they cause to the environment when burned is an undeniable fact. Therefore, renewable energy sources are becoming more and more important. Among renewable energy sources, solar energy emerges as an inexhaustible, environmentally friendly, and sustainable energy source that replaces traditional fossil fuels and meets the needs of the modern age.

Although the discovery of the photovoltaic effect took place in the 1800s, the first solar cell was made on silicon crystal in 1954, and the solar cells made since then have been classified into three generations. First generation solar cells consist of crystalline silicon-based solar cells. Second generation solar cells are thin film based solar cells. Third generation solar cells consist of primarily organic solar cells, dye-sensitive solar cells,

and perovskite solar cells. Higher efficiency values must be achieved for the commercialization of cells in this group.

In this study, Na-doped and undoped ZnO was synthesized by the sol-gel method and used as the electron transport layer in inverted organic solar cells. The structure of the produced device is ITO / (Na)- ZnO / P3HT:PCBM / MoO<sub>3</sub> / Ag. Experimental studies were carried out by adding Na to ZnO at 1%, 2% and 3% mole ratio.

Na-doped and undoped ZnO thin films were characterized by XRD, UV-Vis Spectrophotometry and contact angle measurements. In addition, the efficiency of the produced devices was determined with the help of a Keithley 2400 source meter under 100 mW/cm<sup>2</sup> solar radiation.

According to the results, the efficiency values obtained for devices containing 0-1-2-3% Na/ZnO are 2.90, 3.01, 3.15 and 2.92%, respectively. The open circuit voltage (V<sub>oc</sub>) obtained from all cells is 590 mV. Filling factor (FF) was found between 64.8% and 69.5%. Current densities (J<sub>sc</sub>) were found to be 7.54, 7.54, 7.70 and 7.64 mA/cm<sup>2</sup>, respectively, for devices containing 0-1-2-3% Na/ZnO. The highest efficiency, with a value of 3.15%, was achieved with the device containing 2% Na/ZnO, providing an efficiency increase of approximately 10% compared to the device containing Na/ZnO.

**Keywords:** Na, ZnO, Organic Solar Cells



## ÜÇ FARKLI YÖNTEMLE ÜRETİLEN n-CdS/p-Cu<sub>2</sub>S GÜNEŞ PİLLERİNİN FOTOVOLTAİK ÖZELLİKLERİNİN İNCELENMESİ

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### ÖZET

Bu çalışmada tek kristal CdS üzerine Cu ince filmi, kriyojenik etki yöntemi ile 200 K altlık sıcaklığında, klasik vakum buharlaştırma yöntemi ile 300 K altlık sıcaklığında ve kimyasal daldırma yöntemi kullanılarak elde edildi. CdS/Cu ikili yapısında heteroeklem oluşumu için örnekler 180°C'de 10 dakika süre ile ısıtılma tabii tutularak n-CdS/p-Cu<sub>2</sub>S güneş pilleri elde edildi. Alan emisyonlu taramalı elektron mikroskobu (FESEM) görüntüleri, 200 K altlık sıcaklığında elde edilen Cu katmanının soliton büyüme mekanizmasına uygun olarak 10-15 nm çaplı nanoparçacıklardan oluştuğunu gösterdi. n-CdS/p-Cu<sub>2</sub>S güneş pili örneklerinde çalışma alanının tespiti için dalga boyuna göre duyarlılık spektrumu ölçüldü. Elde edilen sonuçlar 200 K altlık sıcaklığında üretilen n-CdS/p-Cu<sub>2</sub>S güneş pilinin daha geniş dalga boyu aralığında fotovoltaik değerler ürettiğini gösterdi. n-CdS/p-Cu<sub>2</sub>S güneş pilinin 12 hafta boyunca karanlık ve aydınlık ortamda (93 mW/cm<sup>2</sup>) I-V ve C-V ölçümleri yapıldı. I-V ölçümlerinden açık devre gerilimi (Voc), kısa devre akımı (Isc), maksimum güç (Pmax), doldurma faktörü ve verimlilik değerleri hesaplandı. Hazırlanan güneş pilleri için en yüksek verim değeri 200 K altlık sıcaklığında 7. Haftada, 300 K altlık sıcaklığında ise 5. haftada elde edildi. C-V ölçümlerinden donör yoğunluğu (Nd) ve bariyer potansiyeli (Vbi) hesaplandı. 200 K altlık sıcaklığında üretilen güneş pili daha yüksek donör yoğunluğuna (1. hafta 2,99 x 10<sup>16</sup> cm<sup>-3</sup> ve bariyer potansiyeli değerlerine (12. hafta 0,411 V) sahip olduğu görüldü. 200 K altlık sıcaklığında üretilen güneş pilinde daha yüksek fotovoltaik parametre değerlerinin Cu katmanında meydana gelen yüzey plazmon rezonans olayından kaynaklandığı düşünüldü. 12 haftalık süre sonunda 200 K ve 300 K altlık sıcaklıklarında oluşturulan güneş pillerinin bozulma oranı sırasıyla %51 ve %94 oldu.

**Anahtar Kelimeler:** CdS, Kriyojenik Etki, Solar Cell.

### INVESTIGATION OF PHOTOVOLTAIC PROPERTIES OF n-CdS/p-Cu<sub>2</sub>S SOLAR CELLS PRODUCED BY THREE DIFFERENT METHODS

#### ABSTRACT

In this study, Cu thin film on single crystal CdS was obtained using the cryogenic effect method at 200 K substrate temperature, the classical vacuum evaporation method at 300 K substrate temperature and the chemical immersion method. For the formation of heterojunction in the CdS/Cu binary structure, the samples were subjected to heat treatment at 180°C for 10 minutes to obtain n-CdS/p-Cu<sub>2</sub>S solar cells. Field emission scanning electron microscope (FESEM) images showed that the Cu layer obtained at 200 K substrate temperature consisted of nanoparticles with a diameter of 10-15 nm in accordance with the soliton growth



mechanism. To determine the working area in n-CdS/p-Cu<sub>2</sub>S solar cell samples, the sensitivity spectrum was measured according to wavelength. The results showed that the n-CdS/p-Cu<sub>2</sub>S solar cell produced at 200 K substrate temperature produced photovoltaic values in a wider wavelength range. I-V and C-V measurements of the n-CdS/p-Cu<sub>2</sub>S solar cell were made in dark and bright conditions (93 mW/cm<sup>2</sup>) for 12 weeks. Open circuit voltage (V<sub>oc</sub>), short circuit current (I<sub>sc</sub>), maximum power (P<sub>max</sub>), filling factor and efficiency values were calculated from I-V measurements. The highest efficiency value for the prepared solar cells was obtained in the 7th week at 200 K substrate temperature and in the 5th week at 300 K substrate temperature. Donor density (N<sub>d</sub>) and barrier potential (V<sub>bi</sub>) were calculated from C-V measurements. The solar cell produced at 200 K substrate temperature has higher donor density (1st week  $2.99 \times 10^{16} \text{ cm}^{-3}$ ) and barrier potential values (12th week 0.411 V). At the end of the 12-week period, the degradation rate of solar cells created at 200 K and 300 K substrate temperatures was 51% and 94%, respectively.

**Keywords:** CdS, Cryogenic Effect, Solar Cell.



## THE EFFECT OF THERMAL TREATMENT CONDITIONS ON THE BAND-GAP PROPERTIES OF TiO<sub>2</sub> THIN FILMS DEPOSITED ON QUARTZ GLASS

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### ÖZET

Bu çalışmada, 0,5M konsantrasyonlu çözelti kullanılarak Kuvars cam üzerinde TiO<sub>2</sub> ince filmleri üretmek için döndürerek kaplama yöntemi kullanılmıştır. Kaplama işleminin ardından numuneler 100°C ortam havasında ısıtılarak kurutuldu. Hazırlanan numunelerin 60 dakika boyunca tavlama için 300°C, 500°C, 700°C ve 900°C olmak üzere dört farklı sıcaklık uygulanmıştır. Daha sonra üretilen numuneler üzerinde Taramalı Elektron Mikroskobu (SEM), Enerji Dağılım Spektroskopisi (EDS), X-ışını Kırınımı (XRD) ve optik analizler yapıldı. Elde edilen veriler numunelerin yapısal ve optik özelliklerinin belirlenmesinde kullanıldı. Özellikle farklı tavlama sıcaklıklarına maruz kalan numunelerin optik ölçümlerine dayanan Tauc yöntemi kullanılarak bant aralığı hesaplamaları yapıldı. Sonuçlara göre 300°C, 500°C, 700°C ve 900°C'de tavlama numuneler sırasıyla 3.42eV, 3.34eV, 3.32eV ve 3.29eV bant aralığı değerleri sergiledi.

**Anahtar Kelimeler:** TiO<sub>2</sub> İnce film, sol-jel, bant aralığı, termal tavlama

## THE EFFECT OF THERMAL TREATMENT CONDITIONS ON THE BAND-GAP PROPERTIES OF TiO<sub>2</sub> THIN FILMS DEPOSITED ON QUARTZ GLASS

### ABSTRACT

In this study, a spin coating method was employed to produce TiO<sub>2</sub> thin films on Quartz glass using a 0.5M concentration solution. Following the coating process, the samples were dried through heat treatment in ambient air at 100°C. Four different temperatures, namely 300°C, 500°C, 700°C, and 900°C, were applied for annealing the prepared samples for 60 minutes. Subsequently, Scanning Electron Microscope (SEM), Energy Dispersion Spectroscopy (EDS) X-ray Diffraction (XRD), and optical analyses were conducted on the produced samples. The obtained data were utilized to determine the structural and optical properties of the samples. Particularly, band-gap calculations were performed using the Tauc method based on optical measurements of samples exposed to different annealing temperatures. According to the results, samples annealed at 300°C, 500°C, 700°C, and 900°C exhibited band-gap values of 3.42eV, 3.34eV, 3.32eV, and 3.29eV, respectively.

**Keywords:** TiO<sub>2</sub> Thin film, sol-gel, band-gap, thermal annealing



## EXPERIMENTAL SETUP FOR INVESTIGATING THE PERFORMANCE OF PHOTOVOLTAIC PANELS UNDER DIFFERENT CLIMATE CONDITIONS

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### ABSTRACT

The increasing demand for energy has increased the interest of investors in the use of renewable energy sources. In this context, the importance of power plants that produce electrical energy from the sun has increased. Environmental factors affecting panel efficiency play an important role in power plants where photovoltaic panels are used. It is known that the electrical energy production of photovoltaic panels varies depending on parameters such as heat, light, humidity, wind speed, and dust. Testing photovoltaic panels in real-time under all climatic conditions and different conditions is a long-term and costly application. Instead, it is much easier and more cost-effective to measure the output energy of photovoltaic panels by performing experiments under conditions where heat, light, humidity, wind speed and dust amount can be controlled. For this purpose, a laboratory-scale experimental setup was prepared using fiber material with dimensions of 1mx1mx1m. With the prepared mechanism, it is possible to perform experiments at ambient temperatures between 25°C and 45°C and at different percentages of humidity. Ambient temperature was provided by a Quartz heater placed inside the cabin by a PID-controlled electronic circuit. A 1000W halogen bulb was used as the light source. It is also possible to perform wind tests at different speeds between 3km/h and 27km/h by means of a DC motor with PID speed control circuit. It is also possible to conduct dusting experiments in the cabin using dust samples taken from places with different geographical characteristics. Current, voltage and panel temperature data obtained from the sample photovoltaic panel placed in the experimental setup prepared for different climatic conditions can be measured and recorded at 5-second intervals. For this purpose, a software that can provide fast results has been developed in accordance with the mechanism. In the laboratory environment, by changing the temperature, humidity, amount of dust in the air and wind speed parameters under controllable conditions, the effect of the amount of dust accumulated on the sample panels on the electrical energy produced can be observed. With this developed mechanism, the effect of dust samples of the location of solar power plants established or to be established in regions with different geographical characteristics on the electric current produced by the panel can be observed. It is thought that this established mechanism will be of great benefit in estimating panel efficiency in photovoltaic studies to be carried out in the laboratory environment.

**Keywords:** Photovoltaic panel, Photovoltaic panel efficiency, The experimental setup



## THE EFFECT OF SOIL SAMPLES COLLECTED FROM SOLAR POWER PLANTS IN KONYA PROVINCE ON PHOTOVOLTAIC PANEL EFFICIENCY

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### ABSTRACT

One of the important factors affecting the power losses of photovoltaic panels is stated in the literature as dusting. Dusting can be expressed as the accumulation of dust particles in the air on the surface of the object. The most important factor affecting the amount of dust accumulation on the surface of the photovoltaic panel is the size and chemical content of the dust in the area where the panel is located. Three different mechanisms are proposed for dust deposition on the surface. These are gravitational sedimentation, inertial or turbulent deposition and Brownian motion, respectively. Dust deposition at the surface is generally dependent on particle size and wind speed. Very small dust particles (~1 µm in diameter and smaller) are randomly distributed in the environment and tend to be entrained by air movements. Very large particles (dust particles ~100 µm and larger) are governed by gravity and settle rapidly out of the air, independent of airflow. Medium-sized particles (on average ~10 µm in diameter) are influenced by their own mass and airflow. In this context, the size distribution and chemical structure of the dust particles in the panel environment affect the amount of dusting. In this study, we tried to increase the consistency of the experiments by collecting real dust samples from solar power plants (SPPs) in Konya and its region. For this purpose, dust samples were collected from 4 different SPPs in and around Konya province. The chemical and physical properties and size distributions of the collected samples were determined by XRD, SEM, FTIR and EDX analysis. It is important that the samples are collected in the real environment for the consistency of the experimental data. The effect of the collected powder samples on the panel yields was investigated in the experimental setup built in our laboratory. In the experimental setup, the amount of dust accumulation and efficiency losses on the sample panel, as well as the % transmittance changes of the sample lamellas were examined at conditions had controllable temperature, humidity, dust amount in the air and wind speed parameters in the laboratory environment. The results show that beyond the amount of dust deposition, the size of the dust has significant effects on efficiency losses and light transmittance.

**Keywords:** Photovoltaic panel, Photovoltaic panel efficiency, Dust Type, Dust Size.



## NUMERICAL ANALYSIS OF THE BEHAVIOR OF DIFFERENT ANODE MATERIALS IN LITHIUM-ION BATTERIES

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### ABSTRACT

Nowadays, with the development of a clean environment understanding, being sensitive to the environment has become a sought-after feature in batteries. The sustainability and performance of lithium-ion batteries is also an important issue that is open to improvement. The most important issue affecting the performance of the battery is the components in the internal structure of the battery and the electrochemical working principle. The anode material called the negative electrode, which is one of the internal components of the battery, is very important in terms of battery performance. In this study, a numerical investigation of the behavioral properties of different negative electrode materials in lithium-ion batteries has been aimed. In line with this aim, four different anode materials which are Graphite1, Carbon, Carbon-based, and Graphite 2 are considered. Numerical analyses were performed by using the COMSOL application. The results bring out that the change of the anode material affects the performance of Li-ion batteries, and the best result of the simulated anode materials belongs to Graphite 2 material.

**Keywords:** Lithium-ion battery, Anode material, COMSOL.



## KENTSEL AAT'LERDE ÇAMUR HATTI TEKLİ VE ÇOKLU ÇAMUR ÇÜRÜTMELERİNDE SICAKLIK VE KARIŞIM DERESESİ AYARLAMALARININ ENERJİ GERİ KAZANIMINA ETKİLERİ

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### ÖZET

Kentsel atıksu arıtma tesislerinde (AAT) üretilen arıtma çamurları yıllık milyonlarca tona ulaşmakta ve stabilizasyon ve uygun bertaraf yöntemleri tesis işletim masraflarının %50-60'ını oluşturmaktadır. Arıtma çamurlarının anaerobik çürütmesi metan ve CO<sub>2</sub> içeren biyogazla enerji geri kazanımı sağlayarak sayıca ve büyüklükçe artış gösteren kentsel AAT için önemli bir tasarruf sağlamaktadır. Birincil çökeltme ve biyolojik arıtım üniteleri içeren AAT'lerde oluşan birincil ve ikincil arıtma çamurları karıştırılarak anaerobik çürütücü içeren AAT'lerde birlikte stabilize edilmektedir. İki çamur fraksiyonu farklı özelliklere haiz olmaları nedeniyle klasik sisteme göre çamur hattı işletiminde ayrı/teklî çürütme ile farklı işletim şartlarında daha yüksek enerji eldesi ve stabilizasyon derecesi sağlanabilir.

Bu çalışmada, 35 and 38°C iki farklı çürütme sıcaklığı ve aralıklı ve sürekli karıştırma ve düşük organik yükleme hızı (OYH) (birincil, ikincil ve karışık çamur için sırasıyla 0,48-0,8, 0,28-0,33 ve 0,39-0,58 kg UKM/m<sup>3</sup>.gün) şartlarında teklî ve çoklu anaerobik çürütme modelleri uygulanmıştır. Elde edilen sonuçlara göre karışım modunu artırmak birincil çamurdan metan dönüşümünü %93 ile artırmada daha etkili olurken sıcaklık artışının etkisi %11'de kalmıştır. Zıt bir sonuç olarak ikincil çamur çürütmesinde aralıklı karışım metan dönüşümünde %26 ve sıcaklık artışı %4 artış sağlamıştır. Karışık çamur çürütmesinde aralıklı karışım ve sıcaklık artışı ile %12 seviyesinde sınırlı bir iyileşme elde edilmiştir. Düşük OYH'de birincil ve ikincil ayrı çamur çürütmesinde optimum işletim koşulları sırasıyla sürekli karışım+35°C ve aralıklı karışım+35°C olarak elde edilirken aralıklı karışım+38°C'de çoklu çürütmeye kıyasla OYH'de %38 ve günlük metan üretiminde %97'lik artış gerçekleşmiştir. Tekil paralel çürütmenin çoklu çürütmeye göre kazanımları önemli seviyede elde edilerek mevcut sistemlerin uygulanabilir dönüşümle kentsel AAT'lerde enerji kazanımı ve tasarrufların artırılması yönünde önemli bir potansiyel sunduğu gösterilmiştir.

**Anahtar Kelimeler:** Arıtma çamuru, anaerobik çürütme, enerji, geri kazanım, işletim.

### BENEFITS OF TEMPERATURE AND MIXING MODE VARIATIONS IN THE MONO- AND CO-DIGESTION ON THE SLUDGE LINE OF MUNICIPAL WWTPS

#### ABSTRACT

The sewage sludge produced in municipal wastewater treatment plants (WWTPs) has reached millions of tons per year and requires high costs for its stabilization and proper disposal methods making 50-60% of the plant's operational costs. Anaerobic digestion of the sewage sludge is the best option for the stabilization and energy recovery in the form of methane and CO<sub>2</sub> making up a major income for municipal WWTPs which are expected to expand in number and size worldwide. Primary sludge (PS) and secondary sludge (SS) (waste activated sludge), two sewage sludge fractions produced in municipal WWTPs having both primary sedimentation and biological treatment units, are mixed and co-digested conventionally but would inherit benefits in the separate mono-digestion system under different operational conditions as they possess different characteristics that could optimize the sludge line in terms of energy gain and stabilization degree.

In the present study, mono- and co-digestion models were implemented at two digestion temperature (DT) levels as 35 and 38°C and mixing modes as intermediate and continuous at organic loading rates (OLR) of 0.48-0.8, 0.28-0.33 and 0.39-0.58 kg VS/m<sup>3</sup>.d for PS, SS and mixed sludge (MS), respectively. Increasing degree of mixing mode was more influential on the methane yield as specific methane production (SMP) at



93% increase than DT rise which provided an increase at 11% in PS digestion. Contrarily, low level of mixing degree gave 26% more SMP in SS digestion with only 4% increase with DT rise. A 12% increase in low degree mixing and DT rise was effective in co-digestion (MS). Optimum operational conditions for PS and SS were CM+35°C and IM+35°C, respectively, at low OLRs resulting 38% and 97% higher OLR and daily methane production, respectively, compared to co-digestion at IM+38°C as the optimum operational condition which required a higher degree of energy input for the stabilization process. The study showed a high potential of parallel mono-digestion system in terms of energy recovery and savings in municipal WWTPs towards efficiency improvement on the conventional system with a feasible modification.

**Keywords:** Sewage sludge, anaerobic digestion, energy, recovery, operation.



## A COMPARATIVE ANALYSIS OF WASTE DISPOSAL METHODS AND METHODOLOGIES ABOUT GREENHOUSE GAS EMISSIONS FOR ACHIEVING A SUSTAINABLE FUTURE

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### ABSTRACT

The quantification of greenhouse gas emissions is crucial in addressing global climate change, forming the basis for efforts to attain a sustainable future. The significance of greenhouse gas emissions generated by solid waste cannot be disregarded. The measurement of emissions associated with waste materials depends on elements such as the properties of the waste, the method of disposal, and the calculating methodology employed. Effectively managing waste is crucial for minimizing environmental impacts and promoting the shift towards a circular economy by encouraging sustainable use of resources. This study utilized the Waste Reduction technique developed by the United States Environmental Protection Agency to examine greenhouse gas emissions resulting from solid waste based on the chosen waste management approach. This methodology is an invaluable instrument for quantifying the environmental advantages linked to waste reduction and recycling endeavors from a life cycle standpoint. Based on the acquired results, it was recommended to prioritize the recycling method due to its low greenhouse gas emissions. The efficacy of combusting techniques varied based on the attributes of the solid waste and did not ensure a decrease in greenhouse gas emissions in every instance. The utilization of combusting, composting, and anaerobic digesting techniques for treating organic waste has resulted in a decrease in emissions as compared to the landfill method. Consequently, it has been discovered that the selection of waste disposal methods plays a crucial role in addressing climate change and emphasizes the significance of carefully choosing waste disposal techniques to minimize greenhouse gas emissions.

**Keywords:** Solid waste, disposal methods, EPA WARM, GHG Emissions, Climate Change



## BİRİNCİL VE İKİNCİL ARITMA ÇAMURLARININ ÜST MEZOFİLİK SICAKLIKTA VE DÜŞÜK ORGANİK YÜKLEME HIZLARINDA ANAEROBİK ÇÜRÜME ÖZELLİKLERİ

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### ÖZET

Yıllık milyonlarca tona ulaşan arıtma çamurlarının stabilizasyon ve bertarafında kentsel atıksu arıtma tesislerinde (AAT) üretilen birincil ve ikincil arıtma çamurlarının farklı özelliklere haiz olmaları nedeniyle anaerobik çürütme ile stabilizasyon özelliklerinin farklı işletim şartlarında incelenmesi gerekmektedir. Arıtma çamurlarının anaerobik çürütmesi metan ve CO<sub>2</sub> içeren biyogazla enerji geri kazanımı sağlayarak sayıca ve büyüklükçe artış gösteren kentsel AAT için önemli bir tasarruf sağlamaktadır. Birincil çökeltme ve biyolojik arıtım üniteleri içeren AAT'lerde oluşan birincil ve ikincil arıtma çamurları karıştırılmasıyla oluşan karışık çamurun anaerobik çürütmesi en sık uygulanan stabilizasyon şeklidir. Bu çalışmada, mevcut tesislerde uygulanan 35°C ile üst mezofilik sınır olan 40°C olarak iki farklı çürütme sıcaklığı ve aralıklı ve sürekli karıştırma ve düşük organik yükleme hızı (OYH) (birincil, ikincil ve karışık çamur için sırasıyla 0.8, 0.33 and 0.58 kg UKM/m<sup>3</sup>.gün) şartlarında tekli ve çoklu anaerobik çürütme modelleri uygulanmıştır

Üst mezofilik sıcaklık ayrık çürütme sisteminde metan dönüşümünde azalmaya neden olurken birleşik sistemde etkisiz kalmıştır. Aralıklı karışım sırasıyla BÇ, İÇ ve KÇ çürütmelerinde negatif, sıfır ve kısmi pozitif etki gerçekleştirmiştir. Karışımdan bağımsız olarak üst mezofilik sıcaklıkta İÇ ve KÇ için artan UKM giderimi fakat azalan metanojenik verim elde edilmesi, artan sıcaklık ile hidroliz reaksiyonunun arttığını fakat oluşan ara ürünlerin metan üretiminde negatif etkisinin oluştuğunu göstermiştir. pH seviyeleri karşılaştırıldığında BÇ çürütmesinde ağırlıklı olarak karbonhidrat ve yağ-gres maddelerinin ve İÇ çürütmesinde proteinli maddelerin ayrıştığı gözlenmiştir. İÇ'un EPS ve protein yapısının ağırlıklı olduğunun literatürde gösterilmesi bu ayrışma özelliğini desteklemiştir. BÇ için SMÜ'nin 40°C'de azalması (aynı OYH değerinde) ve UKM'nin aynı dönemde artması kesikli karışım şartında daha yüksek olmak üzere biyokütle sentezinde artışı göstermiştir. Benzer düşüşün zeta potansiyelinde de gerçekleşmesi 40°C'de işletimde koloidal yapıların da azalma gösterdiğini desteklemiştir. En düşük pH seviyesinin bu dönemde gerçekleşmesi de sistemde asidojenlerin arttığını ve metanojenik aktivitenin azaldığını göstermiştir. İÇ'da karışımın etkisi görülmezken 40°C'de en düşük iletkenlik, SMÜ ve UKM gerçekleşmesi, düşük sıcaklıklara göre daha kompleks bir oluşumun (metanojenler üzerinde negatif etki ve diğer bakteri gruplarında özellikle hidrolitik bakteriler üzerinde pozitif etki) gerçekleştiğini göstermiştir.

**Anahtar Kelimeler:** Arıtma çamuru, anaerobik çürütme, enerji, geri kazanım, üst mezofilik sıcaklık.

## ANAEROBIC DIGESTION CHARACTERISTICS OF PRIMARY AND SECONDARY SEWAGE SLUDGES AT LOW ORGANIC LOADING RATES AT THE UPPER MESOPHILIC LEVEL

### ABSTRACT

The sewage sludge produced in municipal wastewater treatment plants (WWTPs) is a significant pollutant and needs improving in stabilization and disposal methods to reduce its share at 50-60% of the plant's operational costs. Anaerobic digestion of the sewage sludge is widely implemented as the best option for the stabilization and energy recovery in the form of methane making up a major income for municipal WWTPs which are expected to increase in number and size worldwide. Primary sludge (PS) and secondary sludge (SS) (waste activated sludge), two sewage sludge fractions produced in municipal WWTPs having both primary sedimentation and biological treatment units, have different characteristics that need to be investigated under different operational conditions.

In the present study, mono- and co-digestion models were implemented at two digestion temperature (DT) levels as 35 and 40°C, upper mesophilic level, and mixing modes as intermediate and continuous at organic loading rates (OLR) of 0.8 and 0.33 kg VS/m<sup>3</sup>.d for PS and SS, respectively. Upper mesophilic temperature reduced methane yield in comparison to 35°C. Intermediate mixing caused negatif, none and limited pozitiv effect on PS, SS and MS, respectively. Volatile solid (VS) reduction increased while methanogenic activity dropped independently of the mixing mode pointing out to fastened hydrolysis reaction and the negative effect of the intermediate products on them. As pH dropped in PS digestion, it showed that carbohydrates and lipids were degraded mostly while proteinaceous matter was degraded in SS digestion. The EPS and protein content reported at a high level in SS supported this finding. Reduced methane yield at the same OLR while VS increased pointed out to increased biosynthesis in the IM mode. Drop in zero potential supported increased biosynthesis. The lowest pH level indicated increase in acidogens and decrease in methanogenic activity. A similar pattern was also observed in SS digestion with promoted hydrolytic bacteria and inhibited methanogens with no effect of mixing mode with the lowest electrical conductivity, methane yield and stable VS concentration.

**Keywords:** Sewage sludge, anaerobic digestion, energy, recovery, upper mesophilic temperature.



## CHEMICAL, PHYSICAL AND BIOLOGICAL ANALYSIS OF RIVER WATER AND SEDIMENT; SITNICA, IBRI, TREPÇA AND DRENICA - CORRELATION WITH EU STANDARDS - FOR SURFACE WATERS

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### ABSTRACT

Hazardous waste in water and sediment is a big problem facing developing countries, including our country. The research has highlighted the concentration of heavy metals in the water and sediment of the rivers; Sitnica, Trepça, Ibri and Drenica. Chemical analyzes of water and sediment are essential to determine the level of trace elements in these ecosystems. The water and sediment concentration level were used to determine the Health Risk Index (HRI) for the exposed population. Trace elements were determined in water and sediment using the ICP-OES method. The samples were collected in September/ 2023, at eight different sampling points. Concentration (maximum value) for: Cr (0.079 mg/l), Zn (0.084 mg/l), Mn (0.097 mg/l) Fe (0.305 mg/l) Ni (0.107 mg/l) Pb (0.101 mg /l) and Cu (0.052 mg/l) in all sampling points, such as: (M1-M2, Sitnica river), (M3-M4, Trepça river), (M5-M6, Ibri river) and (M7- M8, Drenica river) and it turned out that most of the heavy metals were below the recommended US-EPA and WHO standards. But the concentration (maximum value) for: Fe>Ni and Pb, at all sample points were found to be above the recommended norms of US-EPA and WHO. All these chemical elements, (their concentration in water and sediment) originate from urban and industrial sources, around the researched areas. From the statistical analysis, a very significant positive relationship of Fe and Ni with Pb was found, originating mainly from the minerals and manufacturing industries around these rivers.

**Keywords:** Rivers, pollution, heavy metals, urban and industrial discharges.



## HEAVY METALS AS WATER AND SEDIMENT POLLUTANTS OF THE LLAP RIVER, DISTRICT; PODUJEV-LLUZHAN-BARILEV

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### ABSTRACT

**Aim of the study:** Most of the rivers in Kosovo are highly polluted by the anthropogenic factor. Different types of pollution in river waters are further transmitted through the water cycle, which means that river pollution has a negative impact on people and the environment. Some of the research conducted in this field have shown that the concentration of heavy metals in water and sediment is constantly increasing, compared to previous scientific research. Our scientific research aimed to evaluate the quality of water and mud of the Llap River, where through scientific research, we will analyze heavy metals, such as: Cu> Zn> Cd> Pb> Ni> Cr> Mn and Fe, found in the analyzed environments, and we will identify the factors that affect the quality of this River. The results for this study will be extracted using the analytical method: Atomic Absorption Spectrometry (SAA). It is estimated that the mass concentration, for: Fe (0.594 mg/l), Ni (0.458 mg/l), Pb (0.360 mg/l) and Mn (0.336 mg/l) in some sampling sites, exceeds the criteria allowed according to; US-EPA and WHO for water and sediment quality. Ultimately, this research will serve as one of the scientific facts, for local and central authorities, to create a national strategy for monitoring toxic wastes and managing these wastes, in protected and well-preserved deposits, from the impact of them in water-environmental ecosystems.





## ECONOMIC VIABILITY OF CARBON CAPTURE AND STORAGE (CCS) TECHNOLOGIES: ASSESSING COSTS, INVESTMENT REQUIREMENTS, AND POLICY IMPLICATIONS

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### ABSTRACT

Carbon capture and storage (CCS) is a critical technique for lowering carbon dioxide (CO<sub>2</sub>) emissions from big industrial sources such as power generation, steel manufacture, and cement production. It entails trapping CO<sub>2</sub>, transporting it, and storing it deep underground to prevent it from entering the atmosphere and contributing to global warming. This article looks at the costs, investment needs, and regulatory consequences of CCS technologies to evaluate their economic feasibility. CCS technologies are classified into three categories: post-combustion capture, pre-combustion capture, and oxy-fuel combustion. Economic issues explored in assessing the viability of CCS technology include cost-benefit analysis, levelized cost of capture and storage, and investment needs. These elements are essential for evaluating the competitiveness and economic viability of CCS projects. The costs connected with CCS technology are broken down into capital costs, operating costs, and maintenance charges. The cost-effectiveness of CCS is determined by some factors, including the size of the operation, technical improvements, and the regulatory environment. The aforementioned parameters are crucial in ascertaining the economic feasibility of carbon capture and storage technology and warrant careful evaluation by policymakers, industry stakeholders, and investors. Numerous studies and initiatives have examined the economic viability of implementing CCS in certain industries, such as steel, cement, and power generation. CCS adoption across several industries is hampered by many obstacles to its widespread deployment. These difficulties include exorbitant prices, a dearth of financial incentives, unclear regulations, resistance from the general public, and uncertainty over storage capacity. Various elements impact the success of carbon capture and storage projects, including engineering economics, financial credibility, local and larger political qualities, regulatory frameworks, and commercial strategies.

**Key Words:** Carbon capture, Cost-benefit analysis, Economic feasibility, Regulatory environment, Investment needs.



## ADVERSE EFFECT OF CLIMATE CHANGE ON INDIAN ECONOMY

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## ABSTRACT

**INTRODUCTION:** One of the biggest environmental issues facing the world now is climate change. India is also dealing with numerous issues. Agriculture, water resources, forests and biodiversity, health, coastal management, and temperature rise are all negatively impacted by climate change. The primary effect of climate change on India is a decline in agricultural productivity. The majority of people are either directly or indirectly dependent on agriculture. The ecological and social systems, which are already under a great deal of pressure from increasing industrialization, urbanization, and economic development, will be further stressed by climate change. This paper examines the effects of climate change and all of its facets in relation to India.

**IMPACT OF CLIMATE CHANGE IN INDIAN ECONOMY: Agriculture:** Weather patterns may become less predictable due to climate change. Farmers' decisions regarding what crops to plant and when to grow them are impacted by uncertainty about monsoonal fluctuations, which lowers productivity.

**Labour-market:** Health hazards could lead to a loss in productivity and can also cause migration from areas that are more prone to climate risks: Physical risk (like Extreme weather conditions, temperature swings etc.) and transition risk (like the risk for risks for banks and other financial institutions may include credit, market, liquidity etc.)

**Infrastructure:** Climate change's increased extremes of natural disaster have had a significant impact on the infrastructure. For instance, in the past ten years, floods in India have cost the country \$3 billion in economic losses, or 10% of the total.

**Drainage system:** Himalayan glaciers are melting more fast and more frequently due to rising temperatures and increased seasonal unpredictability. If the rate rises, glacial lakes may overflow their boundaries and river basins supplied by these glaciers may flood. Subsequently, the flows would decrease, leading to a shortage of water.

**Aggravation of Inequality:** India's adaptive capacity varies by state, location, and socioeconomic standing. Low-income families are especially susceptible to financial losses brought on by climate change since they are directly touched by rising cereal costs and falling agricultural wages. Therefore, for the welfare of individuals with less resources, coping with climate change may lead to budget constraints and slow economic progress.

**CONCLUSION:** We have seen how the Indian economy's pillars—agriculture, cattle, etc.—are being impacted by climate change, as well as why adopting strict climate laws is frequently met with resistance (energy economy). Even if India is the only G20 country with emissions that are compatible with limiting global warming to 2 °C, it wouldn't hurt for it to take even stricter measures to combat climate change. It will be able to climate-proof its upcoming developmental attempts by adopting more resilient and carbon-efficient policies. Government and the people will need to work together on this.



## ASSESSMENT OF THE DOSE IN DRINKING WATER RECEIVED BY INDIVIDUALS IN THE INDUSTRIAL REGION OF SAFI IN MOROCCO BY USING THE DSTN METHOD AND THE ICP-MS TECHNIQUE

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### ABSTRACT

Rapid population growth is putting pressure on the environment by generating large quantities of radioactive materials and pollutants. These substances are discharged into natural ecosystems without pre-treatment, resulting in harmful pollution of water, soil, sediments, fauna and flora. The health risks become particularly serious when levels of radioactive nuclides and heavy metals in surface and groundwater exceed the safety standards set for drinking water.

This study aims to assess the contamination of drinking water from wells of the Safi industrial zone by radionuclides from phosphate waste by combining Solid State Nuclear Track Detectors SSNTD and ICP-MS technique. The study examined the annual effective doses (ACED) resulting from the ingestion of  $^{238}\text{U}$  and  $^{232}\text{Th}$  through well water for individuals falling into the following age groups: under 1 year, 1-2 years, 2-7 years, 7-12 years, 12-17 years, and over 17 years. According to the mean of  $244.9 \text{ mBq.l}^{-1}$ , the levels of  $^{238}\text{U}$  and  $^{232}\text{Th}$  ranged from  $168.2 \text{ mBq.l}^{-1}$  to  $325.4 \text{ mBq.l}^{-1}$  and from  $17.7 \text{ mBq.l}^{-1}$  to  $96.9 \text{ mBq.l}^{-1}$  with a mean of  $58.6 \text{ mBq.l}^{-1}$ , respectively. It has been determined how pH, conductivity, and activity concentration of  $^{238}\text{U}$  and  $^{232}\text{Th}$  relate to one another. For all age groups, the total ACED resulting from the presence of the aforementioned radionuclides in the water under study ranges from  $9.4 \text{ mSv.y}^{-1}$  to  $135.2 \text{ mSv.y}^{-1}$ . The estimated doses were significantly higher in areas near the industrial zone of Safi, posing significant health risks for populations especially for children.

**Keywords:** U-238; Th-232; SSNTD ; Drinking water; Wells; Effective dose; ACED



## YENİLİKÇİ BİR YALITIM MALZEMESİNİN YANGIN PERFORMANSININ GELENEKSEL YALITIM MALZEMELERİ İLE KIYASLANMASI

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### ÖZET

Temel olarak barınmak ve daha birçok amaç için kullandığımız yapılar hayatımızın önemli bir parçasıdır. İçinde yaşadığımız veya çalıştığımız bu yapıların yangına karşı dayanıklı olması; en azından belirli bir süre mukavemetini koruması beklenir. Bu da ancak uygun malzemelerin kullanımı ile mümkündür. Her alanda gelişen teknoloji ile birlikte yapı malzemesi sektörü de gelişmektedir. Her geçen gün yeni ve yenilikçi malzemeler sektöre katılmaktadır. Binalarda kullanılan yalıtım malzemesi de gelişmekte ve değişmektedir. Bu çalışmada Faz Değişim Malzemesi (FDM) katılmış iç sıva katmanının yangın performansı diğer yalıtım malzemeleri ile karşılaştırmalı olarak araştırılmıştır. Deneysel uygulamalar EN ISO 11925-2 standardında tanımlanmış yöntem ile gerçekleştirilmiştir. İlk olarak standart ile belirlenmiş boyutlarda numuneler hazırlanmıştır. Geleneksel olarak XPS, EPS, Cam yünü ve Taş yünü inşaat sektöründe kullanılan yalıtım malzemeleridir. Hazırlanan tüm numunelere Tek Alev Kaynağı Testi (EN ISO 11925-2) uygulanmıştır. Ayrıca farklı karışım oranlarının (alçı ve FDM) yeni yalıtım malzemesinin yangın performansına etkisi de ayrıntılı olarak incelenmiştir. Termal performans ve yangın performansı açısından en uygun karışım oranı belirlenmiştir. Elde edilen sonuçlar oldukça umut vericidir. Özellikle enerji tasarrufu açısından yapıya fayda sağlayan yeni bir malzemenin pek de araştırılmamış olan yangın dayanımı hakkında fikir sahibi olunmuştur.

**Anahtar Kelimeler:** Yapı malzemesi, Yangın dayanımı, FDM.

## COMPARISON OF THE FIRE PERFORMANCE OF AN INNOVATIVE INSULATION MATERIAL WITH CONVENTIONAL INSULATION MATERIALS

### ABSTRACT

Buildings that we basically use for shelter and many other purposes are an important part of our lives. The fire resistance of these structures in which we live or work; It is expected to maintain its strength for at least a certain period of time. This is only possible with the use of appropriate materials. With the developing technology in every field, the building material sector is also developing. New and innovative materials are joining the industry every day. Insulation materials used in buildings are also developing and changing. In this study, the fire performance of the internal plaster layer containing Phase Change Material (PCM) was investigated in comparison with other insulation materials. Experimental applications were first carried out with the method defined in the EN ISO 11925-2 standard. Samples were prepared in sizes determined by the standard. Traditionally, XPS, EPS, Glass wool and Rock wool are insulation materials used in the construction industry. Single Flame Source Test (EN ISO 11925-2) was applied to all prepared samples. In addition, the effect of different mixture ratios (gypsum and PCM) on the fire performance of the new insulation material was examined in detail. The most appropriate mixture ratio was determined in terms of thermal performance and fire performance. The results obtained are quite promising. An idea was gained about the fire resistance of a new material, which is beneficial to the structure especially in terms of energy saving, which has not been researched much.

**Keywords:** Building material, Fire resistance, FDM.



## MİNİ KANALLI GÖVDE BORULU ISI DEĞİŞTİRİCİSİNİN ETKENLİK ANALİZİ

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## ÖZET

Bu çalışmada, mini kanallı gövde borulu bir ısı değiştiricisinin deneysel ve sayısal analizi gerçekleştirilmiştir. Deneysel çalışma için mini kanal çapı 2.2 mm olan bir gövde borulu ısı değiştiricisi imal edilmiştir. Isı değiştiricisinde dokuz adet mini kanal bulunmaktadır. Her bir mini kanal paslanmaz çelik borudan ve uzunluğu 110 mm olacak şekilde imal edilmiştir. Soğuk ve sıcak akışkanlar, paralel akışlı ısı değiştiricisine aynı kütleli debide ( $0.00379 \text{ kg s}^{-1}$ ) girmektedir. Deneysel çalışmada, iş akışkanı olarak deiyonize su kullanılmıştır. Soğuk akışkan ve sıcak akışkan giriş sıcaklıkları, sırasıyla,  $20 \text{ }^\circ\text{C}$  ve  $60 \text{ }^\circ\text{C}$  ( $\pm 0.5 \text{ }^\circ\text{C}$ ) değerindedir. Deneysel çalışma sonucunda, sıcak ve soğuk akışkan çıkış sıcaklıkları, sırasıyla,  $51.5 \text{ }^\circ\text{C}$  ve  $28.8 \text{ }^\circ\text{C}$  olarak ölçülmüştür. Elde edilen deneysel sonuçlar sayısal analiz için doğrulama verileri olarak kullanılmış ve debi oranının 1 değeri ( $C_{FR} = 1$ ) için sayısal analiz doğrulanmıştır. Sayısal analizden elde edilen sonuçlar, deneysel çalışma sonuçları ile karşılaştırıldığında sıcak akışkan çıkış sıcaklığı için %1.1 ve soğuk akışkan çıkış sıcaklığı için ise %2.4 düzeyinde bir fark olduğu görülmüştür. Sayısal kısımda Ansys Fluent paket programı kullanılmış olup,  $C_{FR} = 1 - 20$  aralığında çalışılmıştır. Isı değiştiricisinin etkenliğinin incelenmesi için  $\epsilon$ -NTU (Effectiveness Number of Transfer Units) yöntemi kullanılmıştır. Elde edilen sonuçlarda,  $C_{FR}$  değeri arttıkça etkenliğin arttığı görülmüştür. Örnek olarak,  $C_{FR} = 10$  değerinde, etkenlik 0.85 olarak hesaplanmış ve soğuk akışkan çıkış sıcaklık değeri  $54 \text{ }^\circ\text{C}$  olarak bulunmuştur. İlgili  $C_{FR}$  değerinde, soğuk akışkanın çıkış sıcaklığı  $C_{FR} = 1$  koşulları ile karşılaştırıldığında %82.9 düzeyinde artış olduğu belirlenmiştir.

**Anahtar Kelimeler:** mini kanal, ısı değiştiricisi, sayısal analiz,  $\epsilon$ -NTU

## EFFECTIVENESS ANALYSIS OF MINI-CHANNELED SHELL-AND-TUBE HEAT EXCHANGER

### ABSTRACT

Experimental and numerical analysis of a mini-channeled shell-and-tube heat exchanger was carried out in the present study. For the experimental part, a shell-and-tube heat exchanger with a mini-channel diameter of 2.2 mm was manufactured. There are nine mini-channels in the heat exchanger. Each of the mini-channels is made of stainless steel and has a length of 110 mm. Cold and hot fluids entered parallel flow heat exchanger at the same mass flow rate ( $0.00379 \text{ kg s}^{-1}$ ). In the experiments, the working fluid used was the deionized water. Inlet temperatures of the cold and hot fluids are  $20^\circ\text{C}$  and  $60^\circ\text{C}$ , respectively, with an accuracy of  $\pm 0.5 \text{ }^\circ\text{C}$ . The results of the experimental investigation showed that outlet temperatures of the hot and cold fluids were  $51.5^\circ\text{C}$  and  $28.8^\circ\text{C}$ , respectively. The obtained experimental results were used as validation data for numerical analysis, and the numerical analysis was validated for the flowrate ratio of both fluids of 1 ( $C_{FR} = 1$ ). The results of the numerical analysis showed that there is a difference of approximately 1.1% for the hot fluid outlet temperature and 2.4% for the cold fluid outlet temperature in comparison with the experimental results. The commercial Ansys Fluent software was used for the numerical part, and analyses were performed for  $C_{FR} = 1 - 20$  range. The  $\epsilon$ -NTU (Effectiveness Number of Transfer Units) procedure was applied to examine the

effectiveness of the heat exchanger. Results indicated an increase in effectiveness with an increase in the  $C_{FR}$  value. For example, at  $C_{FR} = 10$ , the effectiveness was calculated as 0.85, and the cold fluid outlet temperature was found to be 54 °C. It was found that at this  $C_{FR}$  value, there was an increase of 82.9% in the cold fluid outlet temperature compared to the conditions of  $C_{FR} = 1$ .

**Keywords:** minichannel, heat exchanger, numerical analysis,  $\epsilon$ -NTU





## YENİLENEBİLİR KAYNAKLARDAN ENERJİ VERİMLİ YAPI ELEMANLARININ ÜRETİMİ

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### ÖZET

Sürdürülebilir kalkınma sosyal, ekonomik ve çevre ayakları olan ve bu üçayağın faydasını gözeten bir kalkınma modelidir. Gerek fosil kaynakların tükenmesi gerekse konvansiyonel üretim ve tüketim modelleri yüzünden çevresel sorunların daha da ağırlaşması sebebiyle özellikle de çevreye saygılı üretim metotları giderek daha tercih edilmektedir. Bu çalışmada çevreyle daha uyumlu olan biyo malzemelerden yapılmış poliüretan içeren perlit kompozitlerinden yapı elemanlarının üretimi ve bu yapı elemanlarının termal özellikleri araştırılmıştır. Çalışma sonucunda 400 kg/m<sup>3</sup> yoğunluklu, 2 Mpa basınç dayanımına sahip ve 0,05 W/mK termal iletim katsayısına sahip perlit-biyopoliüretan kompozitleri üretilmiştir.

**Anahtar Kelimeler:** Hint yağı, poliüretan, biyomalzemeler, perlit, kompozit malzemeler, termal iletim katsayısı.

## PRODUCTION OF ENERGY EFFICIENT BUILDING ELEMENTS FROM RENEWABLE RESOURCES

### ABSTRACT

Sustainable development is a development model that consider social, economic and environmental aspects and benefits. Due to the depletion of fossil resources and the aggravation of environmental problems due to conventional production and consumption models. Thus, environmentally friendly production methods are getting more preferred techniques. In this study, the production of building elements from perlite composites containing polyurethane, made of biomaterials were studied. Additionally, the thermal properties of these environmentally friendly building elements were investigated. As a result of the work, perlite-biopolyurethane composites with a density of 400 kg/m<sup>3</sup>, a compressive strength of 2 Mpa and a thermal conductivity coefficient of 0.05 W/mK were produced.

**Keywords:** Castor oil, polyurethane, biomaterials, perlite, composite materials, thermal conductivity coefficient.



## ENERJİ VERİMLİ YENİ BİR METOTLA MONOGLİSERİT SENTEZİ

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### ÖZET

Monoglisericidler yağ asitlerinin gliserin monoesterlerdir. Yüzey aktif maddelerdir ve bu sebeple gıda, kosmetik, polimer ve tıp endüstrisinde oldukça fazla kullanıma sahiptir. Konvansiyonel metotlarla yapılan üretimlerde triglisericitler (yağ asidi gliserin triesteri) fazla miktardaki gliserinle bazik veya asidik bir katalizör varlığında reaksiyona sokulur. Reaksiyon 200 °C lar civarında gerleşmekte olup reaksiyon süresi ortalama 24 saat civarındadır. Bu metodun dışında lipaz enzimlerinin katalizör olarak kullanıldığı üretimler varsa da bunların stabilite ve bu üretim için gerekli koşullar rekabetçi değildir. Bu çalışmada ortaya konulan metotta ise yüksek verimli mono gliserit sentezi borik asit asidolizi denilen bir reaksiyonla gerçekleştirilmektedir. Reaksiyon 170 °C ta ve 2 saat içinde tamamlanmaktadır. Reaksiyon verimi %90 ların üzerindedir.

**Anahtar Kelimeler:** Triglisericit, monoglisericit, gliserit, borik asit, borik asit esteri.

## SYNTHESIS OF MONOGLYCERIDES VIA A NEW ENERGY-EFFICIENT METHOD

### ABSTRACT

Monoglycerides are glycerin monoesters of fatty acids. They are surfactants and therefore have many uses in the food, cosmetics, polymer and medical industries. In production using conventional methods, triglycerides (fatty acid glycerin triester) are reacted with excess amounts of glycerin in the presence of a basic or an acidic catalyst. The reaction takes place at around 200 °C and the reaction time is approximately 24 hours on average. Apart from this method, although there are productions in which lipase enzymes are used as catalysts, their stability and the conditions required for this production are not competitive. In the method presented in this study, high-efficiency monoglyceride synthesis is carried out by a reaction called boric acid acidolysis. The reaction is completed at 170 °C and within 2 hours. The reaction efficiency is over 90%.

**Keywords:** Triglyceride, monoglyceride, glyceride, boric acid, boric acid ester.



## ENERGY EFFICIENCY AND GREEN TRANSFORMATION: AN EXAMPLE OF AN INDUSTRIAL FACILITY

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### ABSTRACT

Energy efficiency, which came to the agenda of the EU energy policy in the 1970s, has become the basis of energy and climate change issues worldwide over time. This importance has increased even more with the publication of the European Green Deal and the European Recovery Fund in 2019. According to the recommendations of the European Commission and the European Parliament, greenhouse gas reduction targets have been revised and a new energy system has been modelled. It has been shown that achieving these targets will require significant amounts of renewable energy and energy savings. In parallel with global trends, Turkey has also taken important steps in energy efficiency. In this context, it has established many renewable energy sources and encouraged energy saving. In this study, the energy-saving potential, carbon emission effect, and payback period of investment were analyzed through an industrial facility operating in the Organized Industrial Zone. An energy efficiency change is planned for the lighting system, which accounts for approximately 15% of the facility's overall energy consumption. This change has been made with motion sensors and more efficient LED luminaires instead of the existing fluorescent luminaires. According to the results of the analysis, 227 kWh of electrical energy was saved per month and 108 kg of carbon emissions were reduced as environmental impact. In addition, the new system was found to be approximately 3.23 times more efficient than the existing system. The results of the study show that energy efficiency and green transformation not only provide environmental benefits but also offer economic advantages. The proposed scenarios are applicable by industrial organizations taking into account criteria such as initial investment cost, energy savings, and payback period. By adopting such measures quickly, industrial enterprises in Turkey can maintain their competitive advantage with European Union countries and be better prepared for future challenges such as the carbon tax.

**Keywords:** Lighting, LED, Energy Efficiency, Green Transformation, Cost Analysis



## EFFECT OF MAGNESIUM SLAG PRODUCED BY THERMOCHEMICAL REDUCTION ON GRINDING BEHAVIOR AND ENERGY EFFICIENCY

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### ABSTRACT

Since 2016, Turkey has started to produce domestic magnesium metal from dolomite mines in its facility in an integrated manner for the first time, including in Europe. In the facility, A mixture of dolomite, ferrosilicate and fluorite raw materials is ground and magnesium metal is obtained due to thermochemical reduction in reduction furnaces, and 60,000 tons of slag annually are stored in the facility area without any further processing. As a result of research, it has been revealed that the chemical and mineralogical structure of magnesium production slag is similar to Portland cement clinker. Although the effect of the mineral structure of Portland cement clinker cooling conditions on the grinding efficiency is known, the impact of the mineral structure of magnesium production slag on the grinding efficiency has not yet been explained. This study investigated the effect of the mineral structure of magnesium production slag on micron and nanoscale grinding efficiency. Quantitative phase analysis was performed using X-ray diffraction (XRD) of magnesium production slag samples obtained by allowing them to self-cool under different temperature conditions. The crumbling behaviour of magnesium production slag samples was analyzed using the top-down approach. Micron and nanoscale productions were carried out using magnesium production slag samples with the top-down approach. Grinding efficiency was evaluated based on product size and energy consumption.

**Keywords:** Magnesium Slag, Cement, Grinding, Energy



## GREEN TRANSFORMATION IN THE CEMENT INDUSTRY: THE ROLE OF ENERGY AND INNOVATION

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### ABSTRACT

In the cement sector, energy is consumed intensively and is generally based on fossil fuels. With green energy, the cement industry aims to reduce carbon emissions, optimize energy consumption and minimize concentration effects. The cement industry is undergoing a significant transformation towards industrial sustainability. This transformation includes various innovations to optimize energy consumption and reduce carbon footprint, making cement factories' energy use more efficient and environmentally friendly. Innovations such as using alternative raw materials and carbon capture and storage technologies shape the cement industry and create a sustainable road map. This paper highlights how the green transformation process of cement takes place. Green transformation is critical in developing the cement industry and contributing to global sustainability efforts. The cement industry has significantly changed within the sustainability and environmental awareness framework. This study examines the green transformation of the cement industry, focusing primarily on the role of energy use and innovation. It looks at how green energy conversion (solar, wind, hydroelectric) can be used in cement production and how energy methods can be developed. It discusses the green transformation process of the cement industry and explains the role of energy use and innovation in this process. Additionally, the assessment of cement production sustainability is designed to highlight innovations in the sector and exploit both the challenges and opportunities of green performance. Thus, by providing information on the sustainability of the cement industry, producers in the sector will be informed in the light of discussions and solution suggestions.

**Keywords:** Cement, Green transformation, Energy, Innovation.



## MICROGRID ADVISOR YAZILIMI İLE MİKRO ŞEBEKELERDE ENERJİ OPTİMİZASYONU

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### ÖZET

Son yıllarda yaşanan enerji krizlerini de göz önüne aldığımızda ülkelerin kendi enerji ihtiyacının hiç de azımsanmayacak bir kısmını ana şebekeden bağımsız, kesintisiz ve yenilenebilir kaynaklardan karşılamayı planladıkları bir gerçektir. Bu konudaki ana motivasyonları daha ucuz enerji maliyetleri, kesintisiz enerji ve sürdürülebilirliktir. Bununla beraber tüm enerji ihtiyacımızı yenilenebilir kaynaklarından karşılayamasak da 'grid-tied' (şebeke ile entegre) veya 'Island-able' (ada modeli) mikro şebeke yapıları ile geleneksel enerji kaynaklarımızı çeşitlendirip optimize etmek mümkündür. Daha ucuz, sürdürülebilir ve dirençli elektrik altyapısına sahip yazılım destekli mikro şebekeler ile konutların, kurumların ve hatta devletlerin enerji ihtiyaçlarının karşılanması mümkündür. Mikro şebekeler, tüm saha işlemlerinde birbiri ile iletişim kuran ve internete açılarak bulut katmanına çıkabilen bağlanabilir niteliklere sahip cihazların kullanılması ile oluşturulur. Oluşturulan şebeke dağıtılmış enerji kaynaklarının tamamından uluslararası protokoller vasıtasıyla nokta bazlı veriler toplanır. Alınan tüm veriler PLC'ler gibi saha cihazlarında toplanır. Toplanan veriler buluta çıkabilen bir kontrol cihazı üzerinden bu alana özel olarak geliştirilmiş, makine öğrenmesi gibi yetkin karar algoritmalarını destekleyen 'Akıllı Mikro Şebeke Yazılım'ına aktarılır. Buradan dağıtılmış enerji kaynakları arasında sisteme entegre SCADA desteği ile operasyonel olarak yönlendirmeler, otopilot modunda çalışma modeli veya gelişmiş izleme ve tahmin yöntemi ile çıktılar takip edilir. Yazılım, üretilen ve tüketilen enerjinin herhangi bir 't' anında en verimli şekilde kullanılması için binlerce senaryo arasından en doğruyu seçer ve buna göre yönlendirme yapar. Bunu yaparken tüketilen enerjinin mümkün olduğunca yenilenebilir kaynaklardan sağlanması, ucuz olarak tüketilmesi ve enerjinin sürekliliği esas alınır. Bu bağlamda kaynakların yönlendirilmesinde elektrik tarife ücretinin durumu da göz önünde bulundurulur. Ayrıca karar sürecinde veri tabanında tutulan istatistiksel veriler ve hava tahmini gibi çevresel koşullara ait veriler kullanılarak geleceğe yönelik %98'in üzerinde doğruluk payı ile tahminler yapılabilir. Yazılım destekli kararlı mikro şebeke modeli ile enerji taleplerinin yüksek kaliteli, kesintisiz ve verimli bir şekilde karşılanması olanaklı hale gelmektedir. Yapılan bu çalışma modeli ile mikro-şebeke mimarileri, bileşenleri ve Schneider Electric tarafından geliştirilerek piyasa sunulan Microgrid Advisor yazılımının kullanım olanaklarının incelemesi yapılmıştır. Çalışma kapsamında bir Demo uygulama ile şebeke yönetimi yazılımının sunduğu saha çözümleri uygulamalı olarak gözlemlenmiştir.

**Anahtar Kelimeler:** Mikrogrid, Şebeke Optimizasyonu, SCADA, Microgrid Advisor

### ENERGY OPTIMIZATION IN MICROGRIDS WITH MICROGRID ADVISOR SOFTWARE

#### ABSTRACT

Considering the energy crises experienced in recent years, it is a fact that countries plan to meet a significant part of their energy needs from uninterrupted and renewable sources independent of the main grid. Their main motivations in this regard are cheaper energy costs, uninterrupted energy and sustainability. However, even if we cannot meet all our energy needs from renewable sources, it is possible to diversify and optimize our traditional energy sources with 'grid-tied' (integrated with the grid) or 'Island-able' (island model) microgrid structures. It is possible to meet the energy needs of residences, institutions and even governments with software-supported microgrids with cheaper, sustainable and resilient electrical infrastructure. Microgrids are



created by using connectable devices that communicate with each other in all field operations and can be accessed to the cloud layer by opening to the internet. The created network collects point-based data from all distributed energy resources through international protocols. All received data is collected in field devices such as PLCs. The collected data is transferred to the 'Smart Micro Grid Software', which has been developed specifically for this field and supports competent decision algorithms such as machine learning, through a control device that can go to the cloud. From here, the outputs are monitored through operational guidance, operating model in autopilot mode or advanced monitoring and forecasting method among distributed energy sources with SCADA support integrated into the system. The software selects the most correct scenario among thousands of scenarios to ensure that the energy produced and consumed is used in the most efficient way at any time 't' and directs accordingly. In doing so, the basis is to ensure that the energy consumed is sourced from renewable sources as much as possible, that it is consumed cheaply, and that the continuity of the energy is ensured. In this context, the status of the electricity tariff fee is also taken into consideration when directing resources. In addition, predictions for the future can be made with an accuracy of over 98% by using statistical data kept in the database and data on environmental conditions such as weather forecasts during the decision-making process. With the software-supported stable microgrid model, it becomes possible to meet energy demands in a high-quality, uninterrupted and efficient manner.

In this study, microgrid architectures, components and usage possibilities of Microgrid Advisor software developed and marketed by Schneider Electric were examined. Within the scope of the study, field solutions offered by the network management software were observed in practice with a demo application.

**Keywords:** Microgrid, Grid Optimization, SCADA, Microgrid Advisor



## PLASMA PASTE-BORIDING OF AISI 316 STEEL: CHARACTERIZATION OF BORIDE LAYERS AND BORON ACTIVATION ENERGY CALCULATION

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### ABSTRACT

The AISI 316 steel was plasma paste-boronized by using a gas mixture of 70% H<sub>2</sub>–30% Ar with a boron source of 100% B<sub>2</sub>O<sub>3</sub> in the range of 700 to 800 °C between 3 and 7 h. The cross-sections of boronized layers on AISI 316 steel were examined by scanning electron microscope (SEM). The XRD analysis was carried out to identify the iron and metallic borides present inside the boronized layer. In addition, the value of boron activation energy for the AISI 316 steel was estimated as 118.12 kJ mol<sup>-1</sup> and compared with the literature results.

**Keywords:** Boriding, Metallic borides, Kinetic, Activation energy.



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## CONCEPTION OF NEW ORGANIC SOLAR CELLS BASED ON CARBON NANOTUBES: A DFT STUDY

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## **ABSTRACT**

Organic solar cells are gaining prominence as a viable alternative to conventional photovoltaic cells, primarily due to their intrinsic flexibility and potential for efficient production. These advancements hinge on a groundbreaking technique involving the encapsulation of carbon chains within carbon nanotubes. This innovative method holds the promise of significantly improving the performance of organic solar cells, with a specific emphasis on enhancing energy efficiency. In this study, we delved into the structural, electronic, and optical properties of numerous carbon chains with varying lengths. The optimal diameter for the carbon nanotube encapsulating the linear chains was determined using the Lenard-Jones (LJ) potential. Subsequently, we calculated the optoelectronic properties of the resulting heterostructures within the framework of density functional theory (DFT) using Quantum Espresso software. The calculations were conducted employing the generalized gradient approximation (GGA) with the Perdew-Burke-Ernzerhof (PBE) functional to accurately capture the exchange-correlation function.

Our calculations yield crucial theoretical insights, establishing a benchmark that underscores the promising potential of linear chains/carbon nanotubes heterostructures as a stable and exceptional new component for organic solar cell devices.

**Keywords:** Carbon nanotubes Linear Chains, Heterostructure, Optoelectronic, Organic Photovoltaic, DFT.



## RESEARCH ON NEW BIODEGRADABLE PACKAGING FOR FOOD INDUSTRY

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### ABSTRACT

Like others fields, the packaging industry is in continuous development. The use of plastic has grown in recent decades, being a practical form of packaging, providing comfort in handling during transportation and optimal storage conditions for food preservation. Despite the great series of major advantages, the price paid for health is a high one because generates a big problem: microplastic migration in environment, food products, and human body. An alarm signal is raised, especially due to the fact that this effect can be cumulative because the microplastic remains in the body. In this context, modern packaging tends to include a wide spectrum of uses, traditional packaging remaining an outdated aspect. The main research directions aim at the integration of biopolymers in the production of new types of packaging. The goal is, on the one hand, to reduce the amount of polyethylene, and on the other hand, to integrate natural biopolymers in the production of packaging, together with natural pigments or by-products. In this way active or smart packaging can be obtained, which are environmentally friendly, without endangering human health.

The present paper presents such researches with innovative packaging that, through their composition, bring more nutritional value to food, extending the shelf life. Different sustainability aspects of the bio-based materials are also discussed.

**Keywords:** biodegradable, active, smart, packaging



## DISSOLUTION MECHANISM OF CELLULOSE IN A BENZYLTRIETHYLAMMONIUM/UREA DEEP EUTECTIC SOLVENT (DES): DFT-QUANTUM MODELING, MOLECULAR DYNAMICS AND EXPERIMENTAL INVESTIGATION

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### ABSTRACT

A benzyltriethylammonium/urea DES was investigated as a new green and eco-friendly medium for the progress of organic chemical reactions, particularly the dissolution and the functionalization of cellulose. In this regard, the viscosity–average molecular weight of cellulose ( % Mw) during the dissolution/regeneration process was investigated, showing no significant degradation of the polymer chains. Furthermore, density functional theory (DFT) was used to evaluate the topological characteristics of the polymeric system such as potential energy density (PED), laplacian electron density (LED), energy density, and kinetic energy density (KED) at bond critical points (BCPs) between the cellulose and the DES.



## BIOMETRIC IDENTIFICATION USING EEG SIGNALS: A DEEP LEARNING APPROACH FOR FEATURE EXTRACTION AND CLASSIFICATION

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### ABSTRACT

Biometric identification is the process of verifying the identity of a person based on their unique physiological or behavioral traits. Among the various biometric modalities, electroencephalography (EEG) signals, which capture the brain's electrical activity, have attracted considerable interest due to their high individuality and non-invasiveness. However, EEG signals are complex, noisy, and high-dimensional, posing challenges for feature extraction and classification. In this research, a deep learning approach is we propose for EEG-based biometric identification, which leverages the power of convolutional neural networks (CNNs) and Transformer models to automatically learn discriminative features from raw EEG data and perform accurate classification. The research evaluates the approach on a publicly available EEG dataset and demonstrates its superiority over existing methods in terms of identification accuracy and efficiency. The approach provides a novel and effective solution for EEG-based biometric identification, with potential applications in security, health care, and entertainment.

**Keywords:** EEG signal, Convolutional Neural Network, Classification, Feature extraction





## MONTE CARLO SIMULATION TECHNIQUES ON EVALUATING THE EFFECT OF SAMPLE SIZE ON SIMPLE LINEAR REGRESSION

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### ABSTRACT

The determination of getting an appropriate sample size in statistics is still challenging despite its dependency on different factors. Therefore, this study evaluate the effect of sample size on simple linear regression using Monte Carlo simulation techniques. Sample sizes greater than 30 were used. The Monte Carlo simulation procedure employed an ordinary least squares (OLS) to estimate regression coefficients ( $\beta_0$  and  $\beta_1$ ) their performance based on criteria such as mean, standard deviation, bias, and mean squared error (MSE) were evaluated. Simulations were conducted for sample sizes of 100, 200, 300, 400, and 500, with 1,000 iterations for each dataset. The results yielded important insights into the relationship between sample size and the accuracy of regression parameter estimates. The analysis revealed that as sample size increases, the precision of regression parameter estimates improves. Notably, for sample sizes of 400 and 500, the estimated coefficients ( $\beta_0 = 0.3005$  and  $\beta_1 = 0.5001$ ) closely match the true population parameters ( $\beta_0 = 0.3$  and  $\beta_1 = 0.5$ ), indicating that larger sample sizes yield more accurate results.

**Keywords:** Sample sizes, monte carlo, simulation, ordinary least squares (OLS)



## FUNDUS IMAGE-BASED DETECTION FOR GLAUCOMA WITH U-NET AND VISION TRANSFORMER

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### ABSTRACT

Glaucoma is an irreversible eye disease that leads to total blindness. It is mostly caused by elevation of intraocular pressure IOP which can lead to total damage to the optic nerves and cause vision loss if left untreated. However, many deep learning techniques have been developed for the diagnosis of glaucoma which involves examining the optic nerves through fundus image. This paper proposes the U-Net architecture along with the vision transformer model for early detection of glaucoma in a fundus image. The U-Net architecture is used for the optic cup segmentation while the Vit model is used for the classification of the fundus image whether it detects glaucomatous or non-glaucomatous features. Vision transformers employ multi-head attention mechanisms to capture global characteristics of the fundus image which makes it a better choice in computer vision tasks. In this proposed model different public datasets consisting of cropped and full fundus images are merged for the evaluation of glaucoma. The performance of our model is compared to that of the most recent DCNNs and other deep learning models, such as DenseNet169, ResNet 152v2, and Inception ResNet. The proposed model obtained results better than the CNN and the state-of-the-art.

**Keywords:** Glaucoma, Fundus Image, U-Net, Convolutional Neural Network(CNN), Vision Transformers(ViT), intraocular pressure (IOP), Segmentation, Classification.



## TRACKING THE FOOTPRINTS OF BIO-MOLECULES: EXPLORING THE SERS TRAJECTORY

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### ABSTRACT

The application of Raman and surface-enhanced Raman spectroscopy (SERS) in disease detection has garnered tremendous attention in recent decades. SERS, known for its high sensitivity and non-destructive capabilities, enables the provision of unique fingerprint vibrational spectra of surface species, reaching down to the single-cell and single-molecular level. This exceptional platform holds the potential for visualizing internalization processes and monitoring therapeutic effects, particularly the challenging task of deciphering mechanistic events. In one of our study, we showcase the synthesis of a theranostic probe based on spherical and hollow gold nanoparticles, illustrating its utilization in unraveling biomolecular events. The spherical gold nanoprobe, prepared for the purpose, is employed to track internalization and microtubule disruption events associated with the non-fluorescent drug paclitaxel (PTX). For Employing SERS fingerprinting and imaging, we conducted another study to visualize the effects of a targeted theranostic platform utilizing novel hollow gold nanoparticles, thereby monitoring the molecular-level therapeutic progression of combination therapy in cells and spheroidal models. The promising findings and analytical validation presented in this work signify the necessary steps towards clinical validation, emphasizing the potential of SERS in biological applications.



## YENİLEBİLİR ENERJİ TERCİHİ VE KAMU YARARI: GELECEK NESİLLERİN YARARI

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### ÖZET

Küresel ısınma, fosil yakıtların sınırlı kaynaklar olması ve çevreye verdiği zararlar son yıllarda enerji kaynaklarında dönüşüm konusunu gündeme getirmiştir. Bu değişim özellikle tüm dünyanın sorunu olan iklim ve enerji krizinin çözümünü amaçlamaktadır. Dünyanın geleceği için en büyük sorunlardan olan iklim krizine enerji arz yöntemlerinin sebebiyet verdiği ifade edilmektedir. Enerji arzı için geleneksel yöntem olarak değerlendirilen fosil yakıt kaynaklı tesisler yenilenebilir enerji kaynaklı enerji tesislere göre kurulum maliyetleri açısından daha uygun seçeneklerdir. Fakat gelecekteki faydaları düşünülerek yenilenebilir enerji teşvik edilmiş, kurulumlarına rağbet gösterilmiştir. Ülkemizde özellikle 2005 yılında yürürlüğe giren 5346 sayılı Yenilenebilir Enerji Kaynaklarının Elektrik Enerjisi Üretimi Amaçlı Kullanımına İlişkin Kanun ile enerji piyasası için değişim politikaları uygulanmaya başlamıştır. Yasama faaliyeti ile başlayan bu eğilim kamu tarafından destekler ile devam etmiştir. Bu eğilimi idare hukuku açısından değerlendirdiğimizde talep garantisi, vergi, kredi gibi maddi destekler verilmesi kamu yararı açısından irdelenecektir. Sağlanan destekler çeşitli piyasalar oluşması ve sanayi ile yakından ilişki desteklerin yanında enerji verimliliği gibi yeni kavramların doğmasına bu alanlar için yeni normatif düzenlemelerin oluşmasına neden olmuştur. Fakat dünya üzerinde iklim krizi merkezli kamuoyu oluşması ve bu kapsamda oluşan yeşil ekonomi eleştirilmiştir. Yine bu tedbirlerin ancak tüm dünya ile ortak hareket edilmesiyle fayda sağlayacağı ifade edilmiştir. Bu kapsamda ilgili çatışmalar literatür, mevzuat araştırması yapılarak kamu yararı özelinde değerlendirilecektir.

**Anahtar Kelimeler:** Ekonomik kamu yararı, hukuk ve ekonomi, yenilenebilir enerji, kamu yararı

## RENEWABLE ENERGY CHOICE AND THE PUBLIC INTEREST: BENEFIT OF FUTURE GENERATIONS

### ABSTRACT

Global warming, the fact that fossil fuels are limited resources and the damage they cause to the environment have brought the issue of transformation in energy resources to the agenda in recent years. This transformation aims to solve the climate and energy crisis, which is the problem of the whole world. It is stated that the climate crisis, which is one of the biggest problems for the future of the world, is caused by energy supply methods. Fossil fuel-based facilities, which are considered as the conventional method for energy supply, are more suitable options in terms of installation costs than renewable energy-based energy facilities. However, considering the future benefits, renewable energy has been encouraged and their installations have been in demand. In our country, especially with the Law No. 5346 on the Utilisation of Renewable Energy Resources for the Purpose of Electricity Generation, which entered into force in 2005, change policies have started to be implemented for the energy market. This trend, which started with legislative activity, continued with public support. When we evaluate this trend in terms of administrative law, financial support such as demand guarantee, tax and loan will be analysed in terms of public interest. The supports provided have led to the formation of various markets and the emergence of new concepts such as energy efficiency in addition to the supports closely related to the industry and the formation of new normative regulations for these areas. However, the formation of public opinion centred on the climate crisis in the world and the green economy formed within this scope have been criticised. Again, it has been stated that these measures will only be

beneficial by acting jointly with the whole world. In this context, the relevant conflicts will be evaluated in terms of public interest by conducting literature and legislation research.

**Keywords:** Economic Public Interest; Law and Economics; Renewable Energy; Public Incentives



## ENERJİ KRİZLERİ VE KÜRESEL SİYASETE ETKİLERİ

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### ÖZET

Dünya nüfusunun sürekli artışı, sanayileşmenin ve şehirleşmenin hız kazanması, enerjiye olan gereksinimi de paralel ölçüde etkilemekte ve enerji tüketimini sürekli arttırmaktadır. Bu durum enerji kaynaklarını ve bu kaynakları yönetmeyi küresel güç dengelerinde ulus-devletlerin öncelikli hedeflerinden biri haline getirmektedir. Bu gelişmeler ise özellikle yakın tarihte oldukça fazla sayıda uluslararası enerji krizlerinin yaşanmasına neden olmuştur. Küreselleşen dünya, 24 Şubat 2022 başlayan Rusya-Ukrayna savaşıyla, Soğuk Savaş sonrası belki de bir post-Soğuk Savaş dönemi olarak da adlandırılabilir yeni bir krizle daha karşı karşıya kalmıştır. Bu krizlerin en önemli etkileri ve getirileri ise enerji kaynaklarına bağımlılıkları, ülkeler tekelden çıkarma çabaları veya alternatif enerji kaynaklarına yönelme modelleri ile şekillenmektedir. Son dönemde örneğini gördüğümüz bu yeni enerji krizi ise aslında tarihsel arka planında özellikle 20. yüzyılda fosil yakıtların kullanımıyla süreçteki güç dengeleri savaşlarının ve krizlerinin de devamı niteliğindedir. Enerji alanında bu tür krizler, hem var olan sorunların ülkeler arası krizleri çözme ve hem de iklim değişimine olan negatif etkilerini sınırlama üzerine yapılan politikaların sayısını da her geçen gün arttırmaktadır. Anlaşıldığı üzere enerji krizleri, enerji politikalarıyla birlikte iç ve dış politikalarda da belirleyici, yönlendirici bir etkiye sahiptir. Aynı zamanda enerji krizleri, uzun yıllar süren sosyo-ekonomik açıdan olumsuz etkilere sahip olsalar da krizlerin, mevcut enerji kaynaklarına karşı alternatif kaynak arayışı veya kullanımı gibi olumlu etkileri de bulunmaktadır. Yakın tarihte yaşanan enerji krizlerinden çıkış yollarından biri olarak yenilenebilir enerji yatırımlarına ağırlık verilmesi bu durumun bir göstergesidir. Güvenilirliği, çeşitliliği ve maliyetleri, ve iklim krizini azaltıcı etkileri nedeniyle yenilenebilir enerji kaynaklarının enerji krizlerinin çözümünde önemli alternatif oldukları bilinmektedir. Bu süreçlerin yönetimi ise özellikle politika yapım süreçlerini doğru yönlendirme ile yakından ilişkilidir. Bu çalışmanın konusu, tarihsel perspektifle ve karşılaştırmalı analiz yöntemiyle, özellikle 20. ve 21. yüzyıllarda yaşanan enerji krizleri ve küresel siyasete etkileridir. Çalışma kapsamında, ilk olarak yakın tarihte enerji çeşitleri ve bunların küreselleşme sürecinde önemini nasıl yükseldiği, enerji çeşitlerinin tedariki ve nasıl paylaşıldığı incelenecek, sonrasında hangi nedenlerle küresel enerji krizlerinin yaşandığı ve bu krizlerin hangi politikalarla çözülmeye çalışıldığı analiz edilmeye çalışılacaktır.

**Anahtar Kelimeler:** Enerji Krizleri, Küreselleşme, Uluslararası Siyaset

## ENERGY CRISES AND THEIR EFFECTS ON GLOBAL POLITICS

### ABSTRACT

The continuous increase in the world population and the acceleration of industrialization and urbanization affect the need for energy in parallel and constantly increase energy consumption. This makes energy resources and managing these resources one of the primary goals of nation-states in the global balance of power. These developments have caused many international energy crises, especially in recent history. With the Russia-Ukraine war that started on February 24, 2022, the globalizing world has faced a new crisis after the Cold War, which can perhaps be called a post-Cold War period. The most important effects and benefits of these crises are shaped by models of removing dependence on energy resources from monopolies or turning to alternative energy sources. This new energy crisis, which we have seen recently, is a continuation of the balance of power wars and crises in the historical background, especially with the use of fossil fuels in the 20th century. Such crises in the field of energy increase the number of policies made both to solve existing problems and international crises and to limit the negative effects of climate change. As it is understood, energy crises have a determining and guiding effect on domestic and foreign policies as well as energy policies. At the same time,

although energy crises have negative socio-economic effects that last for many years, crises also have positive effects such as the search for or use of alternative sources to existing energy sources. The emphasis on renewable energy investments as one of the ways out of the recent energy crises is an indication of this situation. It is known that renewable energy sources are important alternatives in solving energy crises due to their reliability, diversity and costs, and their effects on mitigating the climate crisis. The management of these processes is closely related to the correct direction of policy-making processes. The subject of this study is the energy crises and their effects on global politics, especially in the 20th and 21st centuries, with a historical perspective and comparative analysis method. Within the scope of the study, firstly the types of energy in recent history and how their importance increased in the globalization process, the supply of energy types and how they are shared will be examined. Then the reasons for which global energy crises occurred and with which policies these crises were tried to be solved will be analyzed.

**Keywords:** Energy Crises, Globalization, International Politics





## AÇIK DENİZ RÜZGAR ENERJİSİ İLE AÇIK DENİZ PETROL VE DOĞALGAZ ENERJİSİ TESİSLERİNİN İŞ GÜVENLİĞİ AÇISINDAN KARŞILAŞTIRILMASI

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### ÖZET

Bu çalışmada, açık deniz rüzgar enerjisi ile açık deniz petrol ve doğalgaz enerjisi tesislerinin iş güvenliği açısından karşılaştırmalı bir analizi yapılmıştır. Araştırmanın odak noktası, her iki enerji üretim yönteminin iş güvenliği riskleri ve yönetim stratejilerini incelemek ve bu alandaki bilgi eksikliğini gidermektir. Bu amaçla, rüzgar enerjisi ve petrol/doğalgaz tesislerinin iş güvenliği standartları, riskleri ve uygulamaları ayrıntılı olarak incelenmiştir. Çalışma, her iki sektördeki teknolojik gelişmeleri, iş sağlığı ve güvenliği yönetimi yaklaşımlarını ele almakta, benzerlik ve farklılıkları ortaya koymaktadır. Gerçek vaka çalışmaları ve kazalar üzerinden elde edilen veriler, her iki alandaki iş güvenliği uygulamalarının etkinliği ve zorlukları hakkında değerli bilgiler sunmaktadır. Ayrıca, sektörlerdeki yenilikçi teknolojilerin iş güvenliği üzerindeki potansiyel etkileri tartışılmakta ve gelecekteki trendlere dair öngörüler sunulmaktadır. Çalışma, iş güvenliği konusunda somut öneriler sunarak enerji sektöründe güvenlik uygulamalarının geliştirilmesine yönelik değerli bir kaynak oluşturmayı amaçlamaktadır.

**Anahtar Kelimeler:** Açık Deniz Rüzgar Enerjisi, Açık Deniz Petrol ve Doğalgaz, İş Güvenliği

## COMPARATIVE ANALYSIS OF OCCUPATIONAL SAFETY IN OFFSHORE WIND ENERGY AND OFFSHORE OIL AND GAS ENERGY FACILITIES

### ABSTRACT

This study presents a comparative analysis of occupational safety in offshore wind energy and offshore oil and gas energy facilities. The focus of the research is to examine the occupational safety risks and management strategies of both energy production methods and to address the lack of information in this area. To this end, the occupational safety standards, risks, and practices of wind energy and oil/gas facilities have been examined in detail. The study addresses technological developments and occupational health and safety management approaches in both sectors, highlighting similarities and differences. Data obtained from real case studies and accidents provide valuable insights into the effectiveness and challenges of occupational safety practices in both fields. Additionally, the potential impacts of innovative technologies in these sectors on occupational safety are discussed, and projections for future trends are presented. The study aims to provide concrete recommendations for enhancing safety practices in the energy sector, making it a valuable resource for improving occupational safety.

**Keywords:** Offshore Wind Energy, Offshore Oil and Gas, Occupational Safety



## SÜRDÜRÜLEBİLİR ULAŞIM POLİTİKALARININ İKLİM DEĞİŞİKLİĞİ İLE MÜCADELEDEKİ ROLÜ

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### ÖZET

İklim değişikliğinin etkileri her geçen gün şiddetini artırarak daha belirgin hale gelmektedir. Tüketim istahındaki sürekli artış, üretim faaliyetlerinin kapsamını genişletmekte ve bu durum daha çok karbon salınımını beraberinde getirmektedir. Sorunların daha yakından hissedilir bir hal alması iklim değişikliği ile mücadeleye yönelik ulusal ve uluslararası gayretleri de artırmıştır. 20.yy'ın sonları ve 21.yy'ın başlarında popülerlik kazanan yönetişim, sürdürülebilir kalkınma gibi yeni kavramlar ve yaklaşımlar iklim değişikliği ile mücadele politikalarına da sirayet etmiştir. Birçok paydaşın bir araya gelmesiyle katılımcı bir anlayışı benimseyen yönetişim, iklim değişikliği ile mücadelede aktörlerin önemini pekiştirmiştir. Öte yandan sürdürülebilir kalkınma ise Birleşmiş Milletlerin on yedi temel hedef üzerinden inşa ettiği, bugünün ihtiyaçlarını karşılarken gelecek nesilleri de düşünmenin gerekliliğini vurgulayan bütüncül bir yaklaşımdır. Kaynakların sınırlı olması, iklim değişikliğinin de etkileriyle birleştiğinde gelecek için tablo karamsar bir hal almakta ve durum zamanla daha kötüye gitmektedir. İnsan faaliyetleri iklim değişikliğinin olumsuz etkilerinin artışına neden olurken, iklim değişikliği de insan faaliyetlerini olumsuz yönde etkilemektedir. Sürdürülebilir kalkınma ilkeleri doğrultusunda yaşam standartlarında küresel iyileştirmeler hedeflenirken iklim değişikliğinin de hemen her aşamada göz önünde bulundurulması gerekmektedir. Bu çalışmada sürdürülebilirlik ve iklim değişikliği ilişkisi ulaşım politikaları üzerinden kurulmuştur. Ulaşım faaliyetleri, endüstriyel üretimle birlikte karbon salınımının en büyük sebepleri arasında gelmektedir. Nüfusun artması dünya genelinde hareketliliği artırmakta, daha çok ulaşım faaliyeti daha çok karbon salınımı anlamını taşımaktadır. Bu nedenle ulaşımında etkin ve uygulanabilir politikaların benimsenmesi hem enerji kaynaklarının verimli kullanımına hem de iklim değişikliği ile mücadeleye doğrudan katkı sağlayacaktır. Bu çalışmadaki amaç yenilikçi, iklim dostu, sürdürülebilir ulaşım politikalarını ve uygulamalarını çeşitli örneklerle ele alarak iklim değişikliği ile mücadeledeki rolün ortaya konmasıdır. Bu doğrultuda sürdürülebilir ulaşım ulusal ve uluslararası politika belgeleri ışığında; çekme-itme politikaları, enerji alternatifleri, akıllı ulaşım sistemleri şeklinde üç temel başlıkta ele alınmıştır. Sayısal verilerle ulaşım ve iklim değişikliği ilişkisi desteklenmiş, başarılı uygulama örnekleriyle de konunun pekiştirilmesi hedeflenmiştir.

**Anahtar Kelimeler:** Sürdürülebilir ulaşım, iklim değişikliği, karbon salınımı

### THE ROLE OF SUSTAINABLE TRANSPORTATION POLICIES IN COMBATING CLIMATE CHANGE

#### ABSTRACT

The effects of climate change are becoming increasingly pronounced day by day, intensifying and becoming more evident. The continuous increase in consumption appetite expands the scope of production activities, leading to a higher level of carbon emissions. The heightened awareness of these issues has increased national and international efforts to combat climate change. Governance, a concept that gained popularity in the late 20th century and early 21st century, along with new concepts and approaches such as sustainable development, has also influenced policies addressing climate change. Governance, embracing a participatory understanding through the collaboration of various stakeholders, has reinforced the importance of actors in the fight against climate change. On the other hand, sustainable development is a holistic approach emphasized by the United Nations, built upon seventeen fundamental goals, highlighting the necessity of considering the needs of future generations while meeting the current ones. The limited availability of resources, combined with the effects of climate change, paints a pessimistic picture for the future, worsening over time. Human activities contribute

to the increase in the negative impacts of climate change, while climate change also adversely affects human activities. In pursuit of improvements in global living standards in line with sustainable development principles, it is crucial to consider climate change at every stage. In this study, the relationship between sustainability and climate change is established through transportation policies. Transportation activities, along with industrial production, rank among the major causes of carbon emissions. The increase in population worldwide leads to increased mobility, and more transportation activities imply more carbon emissions. Therefore, adopting effective and implementable transportation policies contributes directly to efficient energy use and the fight against climate change. The aim of this study is to highlight the role of innovative, climate-friendly, sustainable transportation policies and practices in combating climate change through various examples. In this context, sustainable transportation is addressed under three main headings based on national and international policy documents: pull-push policies, energy alternatives, and smart transportation systems. The relationship between transportation and climate change is supported by numerical data, and successful application examples aim to reinforce the subject.

**Keywords:** Sustainable transportation, climate change, carbon emissions



## DEĞİŞEN ENERJİ GÜVENLİĞİ ÇERÇEVESİNDE RUSYA’NIN NÜKLEER ENERJİ HEDEFLERİ: ROSATOM’UN ORTA DOĞU UYGULAMALARI

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### ÖZET

Uluslararası sistemde gelişen teknolojiyle birlikte insanlığa karşı tehditlerinde değişime uğradığı görülmüştür. Bu durum uluslararası güvenliğin sağlanmasında önem arz eden enerji güvenliğini de daha görünür hale getirmiştir. Bu çerçevede uluslararası sistemde devletler nükleer enerjiye yönelmişlerdir. Nükleer enerji, küreselleşmenin etkisi ile yaygın hale gelmiş ve devletler açısından önemli bir enerji kaynağı olarak görülmeye başlanmıştır. Nükleer enerjinin, diğer enerji kaynaklarına alternatif olarak görülmesi ve nükleer silah üretimi nedeniyle devletler için önemi giderek artmıştır. Nükleer enerji, sadece atom bombası üretiminde değil özellikle İkinci Dünya Savaşı sonrasında artan petrol fiyatları sonucunda elektrik üretiminde de kullanılmıştır. SSCB’nin yıkılmasının ardından kurulan Rusya’nın SSCB’nin geleneklerini devam ettirdiği görülmüştür. Bu kapsamda, Rusya, teknolojik egemenlik ve düşük karbon enerjisi temelinde çalışmalar gerçekleştirmiştir. Bu çalışmalardan biri de Rosatom adı altında Moskova merkezli devlet şirketinin kurulmasıdır. Rosatom, Rusya’nın tüm nükleer faaliyetlerini yürüten bir kuruluştur. Rosatom, nükleer enerji ile çalışan buz kıran donanmasına sahip tek kuruluş olarak karşımıza çıkmıştır. Rosatom’un nükleer enerji faaliyetleri Rusya’nın küreselleşmenin etkisi ile değişen uluslararası sistemde enerji konusunda süper güç olma yolunda politikalar izlediğini göstermiştir. Rosatom, nükleer enerjinin diğer enerji kaynaklarına dönüştürülmesi ile enerji kaynaklarına daha düşük maliyet ile sahip olunmasını amaçlamıştır. Rosatom, Orta Doğu ülkeleri nükleer enerji alımı ve yatırımları hakkında çok yoğun bir uluslararası nükleer diplomasi girişimi yürütmektedir. Buna örnek olarak, Mısır’ın ilk nükleer güç santral yapımı için Rusya–Mısır arasında nükleer enerji yatırımı mutabakatı imzalanmıştır. Rosatom’un yürüttüğü diğer önemli proje MENA bölgesinde bulunan, Türkiye’deki Akkuyu NGS projesidir. Orta Doğu’da başlatılan nükleer enerji temelli projeler kapsamında petrol tüketiminin azaltılması amaçlanmıştır. Bu durum ile çevre kirliliği azaltılmış ve düşük maliyette enerji üretimi sağlanmıştır. Bu çalışmada, nükleer enerjinin uluslararası arenadaki önemi açıklanırken Rusya’nın nükleer enerji konusunda yapmış olduğu çalışmalara odaklanılmış ve Rosatom’un Orta Doğu uygulamalarının üzerinden bir analiz yapılırken Orta Doğu uygulamalarının amaçları sunulmuştur. Çalışmada, Rosatom’un son dönemdeki yapmış olduğu nükleer enerji faaliyetlerinin verilerinden faydalanılmıştır.

**Anahtar Kelimeler:** Enerji, Nükleer Enerji, Orta Doğu, Rosatom, Rusya.

## RUSSIA'S NUCLEAR ENERGY TARGETS IN THE CHANGING ENERGY SECURITY ENVIRONMENT: ROSATOM'S MIDDLE EAST APPLICATIONS

### ABSTRACT

It has been observed that threats against humanity have changed with the developing technology in the international system. In the face of this situation, energy security, which has an important place in ensuring international security and in the global system, has gained more importance as a result of these changing threats. In this context, nuclear energy has gained importance for states in the international system. Nuclear energy has become widespread with the influence of globalization and has begun to be seen as an important energy source for states. Nuclear energy has been considered important by states in terms of being seen as an alternative to energy sources and the production of nuclear weapons. Nuclear energy is of great importance as

a result of the changing understanding of security with the changing threats in the international system. Nuclear energy was used not only in the production of atomic bombs but also in the production of electricity, especially as a result of the increasing oil prices after the Second World War. In this context, nuclear energy has been seen as an alternative to traditional energy sources. It has been observed that there has been a race between the Soviet Union (USSR) and the United States of America (USA) in the historical process within the scope of nuclear energy. It has been seen that Russia, which was established after the collapse of the USSR, continued the traditions of the USSR. In this context, Russia has focused on nuclear deterrence in the international arena by improving itself in systematic nuclear weapons. At the same time, Russia has carried out studies on the basis of technological sovereignty and low carbon energy. One of these efforts is the establishment of a Moscow-based state company under the name Rosatom. Rosatom is an organization that carries out all nuclear activities of Russia. Rosatom emerged as the only organization with a nuclear-powered icebreaker navy. Rosatom's nuclear energy activities have shown that Russia is pursuing policies to become a superpower in energy in the international system changing with the impact of globalization. Rosatom aims to obtain energy resources at lower costs by converting nuclear energy into other energy sources. Rosatom carries out a very intense international nuclear diplomacy initiative regarding nuclear energy purchases and investments in Middle Eastern countries. As an example, a nuclear energy investment agreement was signed between Russia and Egypt for the construction of Egypt's first nuclear power plant. Another important project carried out by Rosatom is the Akkuyu NPP project in Turkey, located in the MENA region. It is aimed to reduce oil consumption within the scope of nuclear energy-based projects initiated in the Middle East. With this situation, environmental pollution has been reduced and low-cost energy production has been achieved. In this study, while explaining the importance of nuclear energy in the international arena, Russia's studies on nuclear energy are focused on, and while an analysis is made on Rosatom's Middle East applications, the aims of the Middle East applications are presented. In the study, data from Rosatom's recent nuclear energy activities were used.

**Keywords:** Energy, Nuclear Energy, Middle East, Rosatom, Russia.



## ASSESSMENT OF THE RENEWABLE ENERGY MIXES IN THE EUROPEAN UNION AND TÜRKİYE IN ACCORDANCE WITH THE STATISTICS OF THE INTERNATIONAL RENEWABLE ENERGY AGENCY (IRENA)

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### ABSTRACT

**Background:** The content of renewable energy sources are decided in the regulations of the European Union and Türkiye. The International Renewable Energy Agency (IRENA), which is an intergovernmental organization in the field of renewable energy and has 169 members, together with 168 states and the EU, also determines the renewable energy sources and published the decennary statistics on the basis of renewable energy types of its Members and the EU in 2023.

**Purpose:** Based on the above-mentioned information, this research aims to review how renewable energy mixes are formed in the EU and Türkiye by using the current data of IRENA. In this context, to review whether there is a connection between statistical data for Türkiye and the renewable energy sources which were decided to benefit from the RES support mechanism is also another research question.

**Methodology:** In the research, the statistical data of IRENA, the regulations existing in the *acquis communautaire* and Turkish law were discussed. A literature review regarding the subject of the research was also made.

**Results:** The renewable energy capacity in the EU, which was 337 583 MW in 2013, approximately doubled to 566 063 MW in 2022. Among the EU Member States, Germany had the highest renewable energy installed capacity in 2022. The other EU Member States which have high renewable energy capacity following Germany are Spain, France and Italy.

In accordance with the statistics of IRENA, the renewable energy capacity in Türkiye, which was 25 551 MW in 2013, increased to 55 943 MW in 2022. If Türkiye were an EU Member State, it would have been the fifth state after Italy with the current renewable energy capacity.

Another result of the research is related to the changes in renewable energy mixes in the EU and Türkiye in the last decade. According to the statistics of IRENA, on the basis of each renewable energy sources, there is a decrease in marine energy and a slight increase in hydropower (from 146 307 MW in 2013 to 152 601 MW in 2022) in the EU. The sectors that showed a significant increase in the EU in the last decade were solar energy (from 80 051 MW in 2013 to 197 629 MW in 2022) and onshore wind energy (from 102 684 MW in 2013 to 187 438 MW in 2022). Proportionally, the capacity in offshore wind energy had a significant increase (from 2 985 MW in 2013 to 16 101 MW in 2022). Another renewable energy source, which the capacity increased, was geothermal energy in the EU (from 809 MW in 2013 to 892 MW in 2022).

In Türkiye, there is a significant increase in the field of hydropower (from 22 289 MW in 2013 to 31 571 MW in 2022) in the last decade. But there has been no progress in installations in marine energy and offshore wind energy. The capacity in onshore wind energy has been significantly on the rise with approximately quadruple increase. Türkiye has achieved significant success in solar energy, by increasing its installed capacity from only 19 MW in 2013 to 9 426 MW in 2022. Türkiye has also made a significant breakthrough in bioenergy (from 172 MW in 2013 to 1 858 MW in 2022) and in geothermal energy (from 311 MW in 2013 to 1 691 MW in 2022).

Among the renewable energy sources that were decided to benefit from the support scheme in the Presidential Decision dated 30 April 2023 and numbered 7189, the support scheme application prices given to geothermal energy, pumped storage hydroelectric production facility, biomethanization and offshore wind energy are higher than the application prices given to the other renewable energy sources. This regulation may enable the continuation of the increase in geothermal, pumped storage hydroelectricity and biomethanization investments,

as well as it may enable a start in offshore wind energy installations, which has not been established in Türkiye yet.

**Conclusion:** Evaluating the statistical data of IRENA, it appears that there has been a significant increase in renewable energy installations in the EU and Turkey in the last decade. Although the EU has achieved a significant proportional increase in offshore wind energy, the fact that offshore wind energy installation has not been established in Turkey yet, necessitates Turkish governmental authorities to determine a strategy for offshore wind energy. Thanks to its geothermal resources, the geothermal energy capacity installed in Türkiye is approximately twice the total capacity of all EU Member States. Promoting investments by regulating the support scheme application price in geothermal energy higher in Turkish law, is a proof of the strategic importance Türkiye attaches to geothermal energy.

**Keywords:** RES Support Scheme, renewable energy, European Union, IRENA, renewable energy statistics, geothermal energy.





## REVIEW OF THE NEW RENEWABLE ENERGY SOURCES SUPPORT SCHEME ACCORDING TO THE TURKISH PRESIDENTIAL DECISION DATED ON 30 APRIL 2023 AND NUMBERED 7189 WITHIN THE FRAMEWORK OF ACQUIS COMMUNAUTAIRE

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### ABSTRACT

**Background:** Due to the higher costs of renewable energy investments compared to conventional energy investments, support schemes are regulated in the *acquis communautaire* and Turkish law to attract investors. In this context, the EU Directives (2001/77/EC, 2009/28/EC, 2018/2001) allows the Member States to promote renewable energy investments in order to carry out the commitments given to reduce greenhouse gas emissions within the framework of the Kyoto Protocol and the Paris Agreement by using support schemes such as feed-in tariffs, feed-in premiums, tax incentives or exemptions, green certificates, etc.

Based on this ground, each EU Member State adopts regulations to promote renewable energy investments in its national law with different types of support schemes. The support schemes also take place in Turkish law and the Renewable Energy Sources Support Schemes Application Price and the Local Content Application Price are decided by Presidential Decisions.

**Purpose:** Based on the above-mentioned explanations, this research reviews the new Renewable Energy Sources Support Scheme regulated by the Presidential Decision dated 30 April 2023 and numbered 7189 within the framework of the *acquis communautaire*. Thus in the light of Turkish renewable energy policy, the compliance of the new support scheme with the *acquis communautaire* and international law is discussed in the research.

**Methodology:** As methodology, the regulations in Turkish law, *acquis communautaire* documents and international law instruments were reviewed. Additionally, studies in the literature were also discussed.

**Results:** In accordance with the Presidential Decision dated 30 April 2023 and numbered 7189, the application price of the renewable energy sources support scheme varies depending on each type of renewable energy sources. In particular, it seems that the new application prices in the support scheme for offshore wind energy, geothermal energy, biomethanization and pumped storage hydroelectric production facilities, which are of strategic importance for Turkish renewable energy policies, are higher than the application prices regulated for the other types of renewable energy sources.

As stated by the European Commission, Türkiye is largely in line with the *acquis communautaire* in the field of renewable energy. However, the European Commission warns Türkiye at the same time about the incompatibility of the local content requirements in Turkish renewable energy regulations with the World Trade Organization and the EU-Türkiye Customs Union rules. In this regard, as a result of the complaints before the World Trade Organization Panel regarding the local content requirements of various countries, it was ruled by the Panel that the local content requirement practices contradicted with the World Trade Organization Agreements.

**Conclusion:** The Presidential Decision dated 30 April 2023 and numbered 7189 seems as a strategical regulation to promote the renewable energy sources which have sectoral importance in terms of Turkish renewable energy policy by supporting these sources with higher support scheme application prices. However, despite the European Commission's warnings regarding the local content requirements in Turkish administrative regulations related to renewable energy sector, there is a risk that the foreign investors may complain the ongoing local content requirements and the local content application prices in the new support scheme by claiming that these regulations contradict with the World Trade Organisation and EU-Türkiye Customs Union rules.

**Keywords:** Turkish RES Support Scheme, renewable energy, Turkish Presidential decree, local content requirements, *acquis communautaire*.



## FLEXIBLE CONNECTION OF DISTRIBUTED ENERGY RESOURCES TO THE GRID

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### ABSTRACT

In many electricity distribution systems around the world, the penetration of Distributed Energy Resources at distribution levels is increasing due to the negative impact of traditional fossil fuel energy sources on the climate. This penetration is causing the traditional electricity distribution system to change rapidly. With this change, the way new smart technologies interact with the energy system is also changing. However, while a higher percentage of generation from traditional Distributed Energy Resources (DERs) is promising in terms of decarbonization, it will create problems for distribution system operators and asset owners (producers and consumers) in the long run. In this paper, we propose a new connection type, flexible connection concept, for electricity distribution grids where the number of distributed energy resources and power electronic devices is increasing. The flexible connection method aims to increase the hosting capacity of distributed generation resources, improve the power quality parameters of the grid, ensure energy supply-demand balance, ensure system reliability, and prevent negative market pricing and instability. Firstly, the definitions of the concept of flexibility in the electricity distribution system, flexible connection in the literature, why this concept is needed, and flexible generation, storage and consumption resources, which are flexible energy resource types, are examined. In the next section, the increasing need for flexible resources in electricity distribution systems, different flexibility mechanisms, flexible connection applications in the world are researched and sample applications are included. In addition, flexible connection and flexible curtailment methods, which are widely preferred and currently being implemented in the UK, are examined. In the last section, the benefits of integrating distributed energy resources into the system with flexible connection and the issues that need to be improved in practice are analysed. As a result of the study, it is concluded that flexibility will provide a significant increase in the integration of distributed generation resources, provide alternative connection options for generation plants that want to connect, contribute positively to the sustainability of the system when integrated both on the electricity distribution system side and on the user (producer or consumer) side, increase system resilience especially at times of peak energy consumption, and reduce operating and investment costs. Energy storage facilities appear to be an important factor in resilience. However, there are many issues that need to be developed and researched, such as flexible assets, flexibility parameters, the effects on the transmission side and the energy market etc.

**Keywords:** Distributed energy resources, Electric power systems, Flexible connection, Flexible concept, Flexible resources, Hosting capacity.



## ORTA GERİLİM KABLolarI İÇİN PD SENSÖRÜ GELİŞTİRİLMESİ

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### ÖZET

Orta gerilim şebekeleri Türkiye’de 10,15 kV-34,5 kV volt değerleri arasındaki dağıtım sistemlerini kapsar. Orta gerilim şebekeleri, 154 kV veya 380 kV iletim hatlarını trafo merkezleri tarafından 10,15 veya 34.5 kV seviyelerine indirerek, dağıtım şebekelerine bağlantı yapar. Küçük şehirler ve sanayi bölgelerine elektrik enerjisinin dağıtılmasında kullanılır.

Orta gerilim güç sistemlerinin sağlıklı çalışması, elektrik enerjisinin son kullanıcıya güvenli ve sürekli temini için önemlidir. Bu bileşenlerde meydana gelen arızalar kısa veya uzun süreli enerji kesintilerine ve yüksek maliyetli kayıplara yol açmaktadır. Orta gerilim sisteminde yer alan güç sistemi bileşenlerinde, arıza oluşumuna yol açabilecek olumsuzlukların erken aşamada tespit edilmesi büyük önem taşımaktadır.

IEC 60270 standardına göre kısmi deşarj, “yalnızca iletkenler arasındaki yalıtıma kısmen köprü oluşturan ve bir iletkenin bitişiğinde veya başka bir belli yerde meydana gelen elektriksel boşalma” olarak tanımlanmaktadır. Kısmi deşarjın sürekliliği, izolasyon malzemeleri üzerinde zayıflıklar meydana getirmekte ve arızalara sebep olmaktadır. Bu sebeple kısmi deşarjın tespit edilmesi meydana gelebilecek arızaların önlenmesi adına önemlidir.

Kısmi deşarjların (PD) tespit edilmesinde yüksek frekanslı akım transformatörleri (HFCT) yaygın şekilde kullanılmaktadır. Bu bileşenlerde oluşan kısmi deşarjlar bileşenin toprak bağlantısı üzerinden toprağa akan yüksek frekanslı sinyaller oluşturmaktadır. HFCT sensörleri izlenecek bileşenin topraklama iletkeni (ekranı) üzerine yerleştirilerek bu sinyallerin tespit edilmesini sağlar. HFCT’lerin kullanıldığı alanlardan en yaygın olanı kablo uygulamalarıdır.

HFCT; ABS gövdesi, nüveyi çevreleyen dolgu malzemesi ve içerisinde metal parça bulundurmaması sayesinde mekaniksel ve elektriksel dayanımlara (AC, DC, Yıldırım Darbe Dayanımı) karşı uzun ömürlüdür. Ekran bağlantı kutusu içerisinde bulunan HFCT, ferrit nüve ve sekonder sarımları ile 0.2-30Mhz aralığında kısmi deşarj sinyallerinin tespit edilebilmesi için özel olarak tasarlanmış bir sensördür.

Bu çalışmada orta gerilim güç sistemlerindeki arızaların kök nedeni olan kısmi deşarj olaylarının tespit edilerek sistem bileşenlerinde süreklilik sağlamak, arızayı önceden tespit ederek, düzeltici ve önleyici faaliyetlerinin artırılmasını, işletme maliyetlerinin azaltılması ve müşterilere sağlanan kaliteli hizmetin sürdürülebilmesi adına HFCT’nin önemi vurgulanmıştır.

**Anahtar Kelimeler:** Orta Gerilim Şebekesi, Yüksek Frekanslı Akım Transformatörü

**DEVELOPMENT OF PD SENSOR FOR MEDIUM VOLTAGE CABLES****ABSTRACT**

Medium voltage grids in Turkey include distribution systems between 10, 15 kV and 34.5 kV. Medium voltage grids connect 154 kV or 380 kV transmission lines to distribution network by reducing them to 10,15 or 34.5 kV levels by substations. It is used to distribute electrical energy to small cities and industrial areas.

The healthy operation of medium voltage power systems is important for the safe and continuous supply of electrical energy to the end user. Faults occurring in these components lead to short or long-term power outages and costly losses. It is of great importance to detect at an early stage any problems that may cause malfunctions in the power system components in the medium voltage system.

According to the IEC 60270 standard, partial discharge is defined as “an electrical discharge that only partially bridges the insulation between conductors and occurs adjacent to a conductor or at another specific location.” Continuity of partial discharge creates weaknesses in the insulation materials and causes malfunctions. For this reason, detecting partial discharge is important to prevent possible malfunctions.

High-frequency current transformers (HFCT) are widely used to detect partial discharges (PD). Partial discharges occurring in these components create high-frequency signals that flow to the ground through the ground connection of the component. HFCT sensors are placed on the grounding conductor (screen) of the component to be monitored, allowing these signals to be detected. The most common area where HFCTs are used is cable applications.

HFCT; It has a long life against mechanical and electrical resistance (AC, DC, Lightning Impact Resistance) thanks to its ABS body, the filling material surrounding the core and the absence of metal parts. HFCT, located in the link box, is a sensor specially designed to detect partial discharge signals in the range of 0.2-30Mhz with its ferrite core and secondary windings.

In this study, the importance of HFCT is emphasized in order to ensure continuity in system components by detecting partial discharge events, which are the root cause of failures in medium voltage power systems, to detect the failure in advance, to increase corrective and preventive activities, to reduce operating costs and to maintain the quality service provided to customers.

**Keywords:** Medium Voltage Grid, High Frequency Current Transformer



## FARKLI GÜÇTEKİ TERMOELEKTRİK JENERATÖRLERİN POTANSİYELİNİN DENEYSEL ARAŞTIRILMASI

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### ÖZET

Günümüzde enerji ihtiyacını azaltma ve sıfır atık ısı yolunda birçok çalışma yapılmaktadır. Bu bağlamda çevreye yayılan atık ısıyla tekrardan enerji elde etmek oldukça popüler bir çalışma alanıdır. Özellikle son yıllarda malzeme teknolojisindeki gelişmelerle birlikte termoelektrik jeneratörlere (TEJ) olan ilgi giderek artmaktadır. Termoelektrik jeneratörler ısıyı elektrik enerjisine çeviren cihazlardır. Ancak enerji dönüşümü sırasında bu cihazların verimlilikleri oldukça düşük kalmaktadır. Bu çalışma kapsamında farklı model termoelektrik jeneratörlerin hangi koşullarda daha verimli çalışabileceği deneysel olarak araştırılmıştır. Bu amaç doğrultusunda farklı güçlere sahip termoelektrik jeneratörlerin farklı sıcaklıklarda sergiledikleri termal ve elektriksel performansları karşılaştırılmıştır. Çalışma sonucunda sıcak yüzey sıcaklığının artmasıyla tüm TEJ'lerin yüzeyleri arasındaki sıcaklık farkları ve dolayısıyla elektriksel çıktıları artmıştır. En yüksek güç çıktısı 150 °C sıcak yüzey sıcaklığında TEC12706 modelinde 1.80 W olarak elde edilirken en düşük güç çıktısı 50 °C sıcak yüzey sıcaklığında TEG12610-4.3 modelinde 0.04 W olarak elde edilmiştir. Verim açısından bakıldığında artan sıcaklıkla tüm modellerde verim artmıştır. Bu bağlamda en yüksek verim 150 °C sıcak yüzey sıcaklığında %4.33 ile TEC12706 modelinde elde edilmiştir. Bu çalışmayla farklı uygulama alanlarında atık ısıdan elektrik üretiminde doğru TEJ modelinin seçiminde bir fikir vermesi açısından literatüre katkı sağlanmıştır.

**Anahtar Kelimeler:** Termoelektrik jeneratörler, atık ısı, yenilenebilir enerji, optimizasyon

### EXPERIMENTAL INVESTIGATION OF THE POTENTIAL OF THERMOELECTRIC GENERATORS WITH DIFFERENT POWERS

#### ABSTRACT

Today, many efforts are being made to reduce energy needs and achieve zero waste heat. In this context, obtaining energy again from waste heat released into the environment is a very popular field of study. Especially in recent years, interest in thermoelectric generators (TEGs) has been increasing with the developments in material technology. TEGs are devices that convert heat into electrical energy. However, the efficiency of these devices during energy conversion is quite low. Within the scope of this study, the performances of different models of TEGs under different operating conditions were experimentally investigated. For this purpose, the thermal and electrical performances of TEGs with different powers at different temperatures were compared. As a result of the study, as the hot surface temperature increased, the temperature differences between the surfaces of all TEGs and therefore their electrical outputs increased. The highest power output was obtained as 1.80 W in the TEC12706 model at a hot surface temperature of 150 °C, while the lowest power output was obtained as 0.04 W in the TEG12610-4.3 model at a hot surface temperature of 50 °C. In terms of efficiency, efficiency increased in all models with increasing temperature. In this context,

the highest efficiency was obtained in the TEC12706 model with 4.33% at a hot surface temperature of 150 °C. This study contributed to the literature in terms of giving an idea on the selection of the appropriate TEG model in electricity production from waste heat in different application areas.

**Keywords:** Thermoelectric generators, waste heat, renewable energy, optimization.



## SİLİNDİRİK BİR LİYUM-İYON PİLİNİN FARKLI DEŞARJ ORANLARINDAKİ TERMAL VE ELEKTRİKSEL DAVRANIŞIN NÜMERİK İNCELENMESİ

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### ÖZET

Ulaşım amaçlı ve hayatımızın vazgeçilmez bir parçası olan motorlu taşıtların sayısı dünya nüfusuyla orantılı olarak artmaktadır. Bu araçların yaydığı zehirli gazlar hem çevreyi kirletmekte hem de insan sağlığını tehdit etmektedir. Bu durum bilim insanlarının çevre dostu ve temiz enerji kaynaklı araçlar üzerine çalışmalarını arttırmıştır. Gelişen teknolojiyle ve yenilenebilir enerjiye daha fazla önem verilmesiyle birlikte bu sorunu hafifletmek ve yayılan zehirli gaz miktarını kontrol altına almak için içten yanmalı motorların yerini hibrit elektrikli motorlar ve elektrikli motorlar almaya başlamıştır. Bu motorların ihtiyaç duydukları güç, çok sayıda pil hücresinden oluşan batarya modülleri tarafından karşılanmaktadır. Batarya modülünden çekilen güç miktarının artmasıyla pillerin ve dolayısıyla batarya modülünün sıcaklıkları da artmaktadır. Bu durum pil hücresinde kapasite ve performans kaybına sebep olmaktadır. Bu bağlamda etkili ve uygun batarya soğutma sistemlerinin geliştirilmesinde pillerin farklı deşarj hızlarında sergiledikleri termal ve elektriksel davranışların bilinmesi gerekmektedir. Bu çalışmayla silindirik bir lityum-iyon pil hücresinin farklı deşarj hızlarında sergilediği termal ve elektriksel davranış nümerik olarak incelenmiştir. Nümerik modelleme fluent paket programı içerisinde yer alan çift potansiyelli Çok Ölçekli Çok Boyutlu (MSMD) pil modeli kullanılarak gerçekleştirilmiştir. Tüm deşarj hızlarında zamanla pil hücresinin sıcaklığı artarken sahip olduğu nominal voltaj değeri azalmıştır. Ayrıca deşarj hızının artmasıyla pil hücresinde meydana gelen pik sıcaklık ve nominal voltaj düşüş hızı artmıştır. Bu çalışma batarya soğutma sistemi tasarımına bir ön hazırlık olarak literatüre katkı sağlamıştır.

**Anahtar Kelimeler:** Lityum-iyon pil, deşarj oranı, pil modelleme

### NUMERICAL INVESTIGATION OF THE THERMAL AND ELECTRICAL BEHAVIOR OF A CYLINDRICAL LITHIUM-ION BATTERY AT DIFFERENT DISCHARGE RATES

### ABSTRACT

The number of motor vehicles, which are for transportation purposes and an indispensable part of our lives, is increasing in proportion to the world population. Toxic gases emitted by these vehicles both pollute the environment and threaten human health. This situation has increased work of scientists on environmentally friendly and clean energy-based vehicles. With developing technology and greater emphasis on renewable energy, internal combustion engines have begun to be replaced by hybrid electric motors and electric motors in order to alleviate this problem and control the amount of toxic gases emitted. The power required by these engines is met by battery modules consisting of many battery cells. As the amount of power drawn from the battery module increases, the temperatures of the battery cells and therefore the battery module also increase. This situation causes loss of capacity and performance in the battery cell. In this context, when developing effective and proper battery cooling systems, it is necessary to know the thermal and electrical behaviors of



battery cells at different discharge rates. In this study, the thermal and electrical behavior of a cylindrical lithium-ion battery cell at different discharge rates was investigated numerically. Numerical modeling was carried out using the dual potential Multi-scale Multi-dimensional (MSMD) battery model included in the fluent package program. While the temperature of the battery cell increased over time at all discharge rates, the nominal voltage value decreased. In addition, as the discharge rate increased, the peak temperature and nominal voltage drop rate in the battery cell increased. This study contributed to the literature as a preliminary preparation for battery cooling system design.

**Keywords:** Lithium-ion battery, discharge rate, battery modeling.



## DAĞITIK ÜRETİM TESİSLERİNİN DAĞITIM ŞEBEKELERİNE ETKİLERİNİN DEĞERLENDİRİLMESİ

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### ÖZET

Dağıtık üretim tesisleri, T.C. Enerji ve Tabii Kaynaklar Bakanlığı'nın Türkiye Elektrik Dağıtım A.Ş. 'ne ait elektrik dağıtım şebekelerine bağlanması üzere bağlantı görüşü verilmiş ve belirli mevzuatlar gereğince dağıtım şebekelerine lisanslı/lisanssız kapsamda bağlanmış olan tesislerdir. Bu üretim tesisleri genellikle güneş, rüzgâr ve hidrolik vs. gibi yenilenebilir enerji kaynaklarından enerji üretimi yapar. Söz konusu tesislerin bazıları, tesis sahiplerinin tüketim noktalarında kurulmuş ve tüketim noktalarındaki sayaçlarıyla doğrudan irtibatlandırılmış olup, tüketim yerinde üretimin anlık olarak harcanması üzere planlanmıştır. Diğer üretim tesisleri de kaynakların coğrafi açıdan bulunduğu yerlerde değerlendirilmiş ve dağıtım şebekeleri üzerinden üretimin enterkonnekte şebekeye kazandırılması amacıyla planlanmıştır. Üretilen enerjinin dağıtım şebekelerine ait enerji nakil hatlarıyla bu şebekede tüketime harcanması veya enterkonnekte şebekede, yine dağıtım şebekelerine ait enerji nakil hatları üzerinden ihtiyaç duyulan noktalara iletilerek tüketilmesi üzere planlama çalışır durumdayken, nominal şebeke koşulları ve arıza durumları için etkilerinin incelenmesi ve teknik kalite değerlerinin hangi açıdan etkilendiğinin değerlendirilmesi ele alınmaktadır. Elektrik Dağıtım Sisteminin Teknik Kalitesi, kullanıcıların elektrik enerjisi talebinin; gerilimin frekansı, genliği, dalga şekli ve üç faz simetrisi açısından ulusal ve uluslararası standartlar ile ilgili mevzuatta belirlenen değişim sınırları içerisinde kesintisiz karşılanabilme kapasitesidir. Günümüz şartlarında sayıları ve kurulu güçleri sürekli artan dağıtık üretim tesislerinin, dağıtım şebekelerindeki bağlantı süreçleri ve sonrasında işletme koşulları incelendiğinde enerjideki teknik kalite hem dağıtım şebekesi sistemlerini hem de kullanıcıları birçok yönden etkilemektedir. Dağıtım şebekelerinin, birinci derecede kaynağı olan Türkiye Elektrik İletim AŞ'nin güç trafolarından sonra, dağıtım şebekelerine doğrudan bağlı üretim tesisleri de ikinci sırada olup en önemli kaynak unsurlarıdır. Bu kaynaklardaki güç kalitesi verimi, özellikle gerilim, frekans ve hat kayıpları konusunda önemli bir yere sahiptir. Bu noktada dağıtım şebekelerindeki dağıtık üretim bölgeleri, TEİAŞ kaynaklarının uzağında bulunan bölgeler için teknik kalitede düzenleyici bir görev üstlenmiş durumdadır. Dağıtık Üretim Tesislerinin bağlantı noktalarındaki hat uzunlukları, bağlantı güçleri ve bağlandıkları enerji nakil hatlarındaki kesitlerin üretim ve tüketim yönünden teknik açıdan analizlerinin çok hassas bir şekilde hesaplanmalıdır. Analizi verimli olmayan bağlantı hesapları, gerilim yükselmesi, kesit uyumsuzluğu ve kısa devre akım-gerilim-güç değerlerini olumsuz yönde etkilemektedir.

Bu bağlamda dağıtık üretim tesislerinin, dağıtım şebekelerine bağlanmasında hem dağıtım sistemi hem de ihtiyaç duyulan üretim sistemi açısından dağıtım şebekesinin durumu ve üretim tesisinin teknik kaliteyi etkileyecek tüm parametreleri ile analiz etmek gerekmektedir.

**Anahtar Kelimeler:** Dağıtık üretim tesisleri, dağıtım şebekesi, teknik kalite.

## EVALUATION OF THE EFFECTS OF DISTRIBUTED GENERATION FACILITIES ON DISTRIBUTION NETWORKS

### ABSTRACT

Distributed generation facilities, T.R. Ministry of Energy and Natural Resources, Türkiye Electricity Distribution Inc. These are the facilities that have been given a connection opinion to be connected to the

electricity distribution networks of , and have been connected to the distribution networks on a licensed/unlicensed basis in accordance with certain legislation. These production facilities are generally solar, wind and hydraulic, etc. It produces energy from renewable energy sources such as. Some of the facilities in question were established at the consumption points of the facility owners and are directly connected to the meters at the consumption points, and are planned to instantly consume the production at the consumption point. Other production facilities were also evaluated in locations where resources were geographically located and planned to bring production to the interconnected network via distribution networks. While planning is in operation to consume the produced energy in this network through the energy transmission lines of the distribution networks or to consume it in the interconnected network by transmitting it to the required points through the energy transmission lines of the distribution networks, examining the effects of nominal network conditions and fault situations and determining in what way the technical quality values are affected. evaluation is considered. Technical Quality of the Electricity Distribution System, users' electrical energy demand; It is the capacity to meet voltage frequency, amplitude, wave shape and three-phase symmetry without interruption, within the change limits specified in national and international standards and relevant legislation. When the connection processes in the distribution networks and the subsequent operating conditions of distributed generation facilities, whose number and installed power are constantly increasing in today's conditions, are examined, the technical quality in energy affects both distribution network systems and users in many ways. After the power transformers of Turkey Electricity Transmission Inc., which are the primary source of distribution networks, generation facilities directly connected to distribution networks are in second place and are the most important resource elements. Power quality efficiency in these sources has an important place, especially in terms of voltage, frequency and line losses. At this point, dispersed production regions in distribution networks have assumed a regulatory role in technical quality for regions located far from TEIAS resources. Line lengths at the connection points of Distributed Generation Facilities, connection powers and technical analysis of the sections on the energy transmission lines they are connected to in terms of production and consumption must be calculated very precisely. Connection calculations whose analysis is not efficient, voltage rise, section mismatch and short circuit negatively affect current-voltage-power values.

In this context, when connecting distributed generation facilities to distribution networks, it is necessary to analyze the status of the distribution network in terms of both the distribution system and the required production system and all parameters that will affect the technical quality of the production facility.

**Keywords:** Distributed generation facilities, distribution network, technical quality.



## A COMPARATIVE ANALYSIS ON THE EFFECT OF PRECIPITATION ON THE ENERGY PRODUCTION OF HYDROPOWER PLANTS

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### **ABSTRACT**

The waning accessibility of fossil fuels, along with an increasing recognition of the phenomenon of global warming, has compelled several states to accord precedence to the utilization of renewable energy sources. Hydropower emerges as the prevailing renewable energy source, comprising a substantial share of the overall renewable energy. The production of energy from hydropower plants is influenced by several factors and conditions. Precipitation is one of the effective parameter that has influence on energy production from hydropower plants. In this study, a comparative work has been conducted on determination of effect of precipitation on energy production. Selected two hydropower plants, in Turkey, have been investigated based on the obtained precipitation and energy production data for two years. Study reveals that there is an obvious correlation between energy output and precipitation when considering monthly average data. However, there is no obvious relationship between the amount of precipitation on a certain day and the amount of energy produced on that particular day.

**Keywords:** Hydropower plants, Energy production, Precipitation



## SYNTHESIS AND CHARACTERIZATION OF Pd<sub>x</sub>Nb<sub>(100-x)</sub>/CNT ANODE CATALYSTS FOR ETHYLENE GLYCOL ELECTROOXIDATION

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### ABSTRACT

With increasing energy demand and the rapid depletion of traditional fossil fuels, the development of clean and efficient power sources has attracted the attention of researchers in recent years. Direct liquid-fed fuel cells are considered the ideal power conversion system for this purpose. Among various fuel cells, direct ethylene glycol fuel cells (DEGFCs) stand out with lower toxicity, less volatility and high electrical power conversion efficiency. At the anode side of DEGFCs, ethylene glycol (EG) electrooxidation reaction takes place. Therefore, designing anode catalysts with high activity and stability for EG electrooxidation is crucial for the performance of DEGFCs. In addition, reducing the noble metal ratio of fuel cell anode catalysts is an important strategy to reduce the total cost. Accordingly, carbon nanotube (CNT) supported Pd<sub>90</sub>Nb<sub>10</sub>, Pd<sub>80</sub>Nb<sub>20</sub>, Pd<sub>70</sub>Nb<sub>30</sub>, Pd<sub>60</sub>Nb<sub>40</sub> and Pd<sub>50</sub>Nb<sub>50</sub> anode catalysts were prepared by NaBH<sub>4</sub> reduction method. PdNb/CNTs prepared at varying atomic molar ratios were characterized by X-ray diffraction (XRD), transmission electron microscopy (TEM) and inductively coupled plasma-mass spectrometry (ICP-MS). The Pd<sub>50</sub>Nb<sub>50</sub>/CNT catalyst outperformed the other ratios with a specific activity of 9.02 mA cm<sup>-2</sup> for EG electrooxidation. In addition, Pd<sub>50</sub>Nb<sub>50</sub>/CNT catalyst was found to be both more stable and lower charge transfer resistance than other catalysts.

**Keywords:** Fuel cell, ethylene glycol, electrooxidation, palladium, niobium.



## POWER-AWARE RECONFIGURATION MANAGER FOR SMARTPHONES

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### ABSTRACT

We systematically present the development of a power-aware reconfiguration manager tailored for smartphones. In this study, we focus on the reconfigurable regions within the System on Chip (SoC) of smartphones, specifically within the individual tiles, where we select the most suitable alternative tasks in order to create an energy-efficient manager. We accomplish this through symbolic discrete control synthesis. By selecting the most appropriate tasks within the reconfigurable tiles, our manager minimizes energy consumption, contributing to the overall power efficiency of smartphones. The combination of symbolic discrete control synthesis, safety considerations, and optimization strategies provides a robust framework for achieving the dual goals of system reliability and energy optimization. Our empirical findings and results, showcased in an application, underscore the effectiveness of our approach in real-world smartphone scenarios. We validate our approach through a practical application, demonstrating its significant efficiency.

**Keywords:** Discrete Event Systems, Symbolic Discrete Controller Synthesis, Safety Algorithm, Optimization Algorithm, Smartphones



## BORU HATLARINDA YAPAY ZEKÂ MODELİ KULLANARAK KESTİRİMCİ BAKIM UYGULAMASI

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### ÖZET

Son yıllarda boru hatlarında meydana gelen kayıp ve kaçaklar hem ekonomik hem de çevresel açıdan problemler oluşturuyor. Bu problemlerin çözümü için boru hatlarındaki arızaların önceden teşhis edilip tespit edilmesi önemlidir. Bu çalışmada, boru hatlarında oluşan arıza durumları için SVM yöntemiyle kestirimci bakım uygulanmaktadır. Literatür incelendiğinde, boru hatlarında arızaların tespiti için halihazırda MFL (Manyetik Akı Sızıntısı) yönteminin kullanıldığı görülüyor. MFL tekniği, aynı zamanda bir tahribatsız muayene yöntemi olarak, boru çeperlerindeki hataların tespitinde yaygın olarak kullanılıyor. Tespit edilen arıza durumları görüntü analizleriyle inceleniyor. Bu çalışmada, deneysel yöntemler kullanılarak veri toplandı. Veriler, basınç sensörleri aracılığıyla elde edildi. Toplanan verilerle veri setleri oluşturuldu ve oluşturulan veri setlerine SVM (Destek Vektör Makineleri) yapay zekâ modeli uygulandı. SVM, genellikle sınıflandırma problemlerinde kullanılan gözetimli öğrenme yöntemlerinden biridir. Bir düzlem üzerine yerleştirilmiş noktaları ayırmak için bir doğru çizer. Bu doğrunun, iki sınıfın noktaları için de maksimum uzaklıkta olmasını amaçlar. Bu yöntemle kestirimci bakım felsefesiyle arızalar henüz oluşmadan tespit edilebilir. SVM modeli ile boru hatlarındaki arıza durumlarında kestirimci bakım uygulanabilir olması, bu çalışmanın hipotezidir. Boru hatlarındaki arızaların önlenmesi; boru hatları ile taşınan su, doğal gaz, petrol gibi sıvı ve gaz kaynaklarının tükenmesini önleme yolunda önemli bir adım olup çevreyi koruyacaktır.

**Anahtar Kelimeler:** Boru Hatları, Yapay zekâ, Kestirimci Bakım.

## PREDICTIVE MAINTENANCE APPLICATION ON PIPELINES USING ARTIFICIAL INTELLIGENCE MODEL

### Abstract

Recent losses and leaks in pipelines have presented significant economic and environmental challenges. Addressing these issues necessitates early detection and diagnosis of faults within the pipelines. This study employs predictive maintenance utilizing the Support Vector Machine (SVM) method to address potential fault scenarios. Currently, the Magnetic Flux Leakage (MFL) method is prevalent in detecting pipeline faults. MFL is also widely utilized as a non-destructive testing technique for identifying defects in pipe walls. Identified fault conditions are analysed through image processing. In this study, experimental techniques were employed to collect data, utilizing pressure sensors. Data sets were generated from the collected data, and an SVM artificial intelligence model was applied to these sets. SVM, a commonly used supervised learning method for classification tasks, establishes an optimal separation line for points on a plane. The goal is to maximize the distance of this line from points of both classes. This approach enables the detection of faults before they manifest, aligning with the philosophy of predictive maintenance. The hypothesis of this study posits that the SVM model can effectively implement predictive maintenance in the event of pipeline failures. Preventing malfunctions in pipelines represents a critical step in conserving liquid and gas resources, including water, natural gas, and oil transported through pipelines, ultimately safeguarding the environment.

**Keywords:** Pipelines, Artificial Intelligence, Predictive Maintenance.





## INTEGRATION OF FUZZY LOGIC CONTROL IN THE MODELING OF A WIND ENERGY CONVERSION SYSTEM

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### ABSTRACT

This study focuses on the integration of fuzzy logic control into the modeling of a wind energy conversion system. Wind energy is an essential source of renewable power, and effective control strategies are crucial to harness its potential efficiently. In this research, a detailed model of a wind turbine is developed, and fuzzy logic control is implemented to enhance the system's performance. The use of fuzzy logic allows for adaptive and robust control, addressing the inherent variability of wind energy. This paper explores the benefits of incorporating fuzzy logic in wind turbine modeling, highlighting its potential to improve the system's power output and grid integration. The results of the study demonstrate the efficacy of fuzzy logic in enhancing the performance and reliability of wind energy conversion systems, contributing to the advancement of renewable energy technology.

**Keyword:** Wind Turbine, Fuzzy Logic, fuzzification.



## FRICITION LOSS GENERATED IN MULTILOBE AND TILTING –PAD

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### ABSTRACT

The multilobe or tilting-pad journal bearings show good cooling conditions, good damping of vibrations and the stability during operation and they are mostly used in high-speed rotating machines. These bearings are applied, e.g. in the spindle systems of grinding machines that apply the 3-, 4-, 6- and 8- lobe fixed lobes or in the steam and gas turbines, turbo-compressors and turbine gearboxes. As compared to the cylindrical journal bearings, the multilobe bearings with fixed segments or tilting-pads show higher friction loss. One of the advantages of the tilting-pad journal bearings consists in a progressive increase of assembly stiffness with geometric preload. However, some disadvantages of these types of bearings include a higher friction and lower load capacity than the multilobe ones.

This paper considers the friction loss in multilobe and tilting-pad journal bearings applied in different branches of industry, e.g. in the bearing system of grinding machine and large overall dimensions bearings of water turbines. The friction loss expressed by the friction force was obtained from numerical solution of Reynolds, energy, geometry and viscosity equations. Incompressible lubricant, laminar and adiabatic flow of oil in the bearing gap of finite length bearing were assumed. Aligned orientation of bearing and journal axis without deflections of bearing and journal or tilting-pads was assumed. Calculations were performed on the conditions of the static equilibrium position of journal.

**Keywords:** multilobe, tilting-pad journal bearings, friction force.



## THE FLEXIBILITY EVALUATION IN THE ASSEMBLY WORKSHOP OF A TERMINAL AUTOMOTIVE FACTORY " MIXED-MODEL ASSEMBLY LINES "

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### ABSTRACT

The automotive industry, renowned for its dynamism, faces increasing pressure to adapt to ever-evolving market dynamics. In this comprehensive literature review, we delve deep into the industry, with a specific focus on the critical theme of flexibility within mixed-model assembly lines. This theme is encapsulated in our title, "The Flexibility Evaluation in the Assembly Workshop of a Terminal Automotive Factory - Mixed-Model Assembly Lines."

Our exploration commences with a meticulous examination of the theoretical foundations of flexibility, a concept that lies at the very core of automotive manufacturing. We embark on a journey through various facets, ranging from the intricacies of production system configurations to the nuances of assembly line operations, all while critically assessing the very essence of flexibility itself.

This literature review, more than just an academic exercise, serves as the foundational cornerstone for our forthcoming research endeavours. Our ultimate aspiration is to seamlessly integrate the multifaceted insights garnered here into a cohesive framework. This framework will not only contribute to a more profound comprehension of flexibility within the context of the automotive industry but will also pave the way for innovative, real-world solutions to the continually evolving challenges that confront automotive manufacturers.

Our overarching objective transcends the realms of academia; it is intrinsically tied to the betterment of the industry itself. We seek to empower companies navigating the dynamic landscape of the automotive sector by enhancing their competitiveness and operational efficiency. As the industry grapples with unprecedented changes, we believe that the strategic deployment of flexibility can be a transformative force.

In the coming months, we invite you to stay engaged with our ongoing research initiatives. One of our primary areas of focus will be the exploration of the transformative potential of Industry 4.0 on flexibility within the automotive sector. This topic, while briefly introduced here, will be the centrepiece of our subsequent research efforts, wherein we plan to dive deeper into the practical implications of this technological revolution. We look forward to sharing our findings and insights as we continue to bridge the gap between theory and the ever-evolving realities of the automotive industry.

**Keywords:** Automotive manufacturers, Mixed-model assembly lines, Flexibility, Theoretical foundations.



## EFFECT OF AIRFOIL THICKNESS ON FLOW OVER THE SYMMETRIC AIRFOILS: PART II- NUMERICAL ANALYSIS

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### ABSTRACT

This study investigated numerically and experimentally NACA 0012, NACA 0015, and NACA 0018 airfoils at  $AoA=8^\circ$  and Reynolds number of  $1.5 \times 10^5$ . Oil-flow visualization experiments were used to compare laminar separation bubble, separation, and reattachment results on the airfoil's upper surface with skin friction coefficient contours obtained from numerical analyses. The k-w SST transition model was run in the numerical analyses, where two different boundary conditions were tested: symmetry and wall conditions. Comparisons indicated that the transition model provided accurate results and the wall condition was in good agreement with the experimental data. The examination of aerodynamic force coefficients for symmetrical airfoils revealed that the  $C_L$  value for NACA0012 was 0.6, which increased to 0.64 for the thicker NACA0015 airfoil. However, the lift force coefficient of the NACA0018 airfoil decreased to 0.52 with a further increase in thickness. Furthermore, it was observed that the drag force coefficients increased as the thickness increased.

**Keywords:** Aerodynamic, CFD, Airfoil



## USE OF A REFINED MESH WITH TWO NON-CONFORMING BLOCKS TO NUMERICALLY STUDY THE EFFECT OF THE GROOVES OF A VERTICAL WALL IN A DIFFERENTIALLY HEATED SQUARE CAVITY ON THE NATURAL CONVECTION OF A NANO-FLUID

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### ABSTRACT

In this research, we conducted numerical investigations on the natural convection of a carbon-based nanofluid (a mixture of water and C60) inside a square cavity with differential heating. One of the vertical walls of the cavity has grooves and is maintained at a high temperature. The main objective of this study was to compare the impact of the macrostructural characteristics of the grooves and the addition of fullerene nanoparticles (C60) to pure water on the heat exchange through natural convection in this specific geometry.

To accurately quantify the convective heat exchange near the grooves, we employed a refined grid with two non-conforming blocks at the hot wall. The governing equations were discretized using the finite volume method, utilizing a power law scheme known for its stability in such flows. A dedicated numerical code was developed to perform numerical simulations as an investigative tool.

The results are presented in the form of streamlines and isothermal fields. The variation in the mean Nusselt number on the cold wall to the right of the cavity was calculated as a function of the volume fractions of the nanoparticles (ranging from 0 to 0.06) for different groove numbers, sizes, and Rayleigh numbers (ranging from  $10^3$  to  $10^6$ ).

**Keywords:** Numerical, convection, double refined grid, nanofluid.



## EVALUATION OF THE EFFECT OF BLADE PROFILES ON THE PERFORMANCE OF RADIAL IMPULSE TURBINES FOR WAVE ENERGY CONVERSION

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### ABSTRACT

The main objective of this study is to evaluate how different blade profiles affect the performance of bidirectional radial impulse turbines when used in oscillating water column (OWC) systems for wave energy conversion. Numerical flow simulations were performed using ANSYS Fluent software, considering two turbine geometries with circular and elliptical blade profiles. The flow is assumed to be viscous, uniform, incompressible, turbulent and three-dimensional. In this study, we used periodic constraints and sliding mesh techniques. The performance of the turbine during inspiratory and expiratory states was analyzed for different flow rate coefficients. Performance analysis of each turbine assembly includes evaluation and comparison of total pressure drop, local aerodynamic losses, flow angle variation and efficiency. The obtained results show a significant sensitivity of the turbine performance to the blade profile. Significant differences in turbine efficiency were observed, especially in inhalation mode. The use of a circular profile has been shown to result in a significant improvement, with a total efficiency improvement of up to 11% in the inhalation mode. Furthermore, a detailed analysis of the local flow in the channel between the rotor blades revealed regions where the flow divergence is large for elliptical blades, especially at the trailing edge. To further improve the efficiency of the turbine, an intelligent system was proposed that controls the geometric angle of the blades with the flow angle.

**Keywords:** Wave Energy Conversion; radial impulse turbine; blade effect; performance analysis.



## FORECASTING LAND SHIFT RISKS WITH MAPPING IN MOROCCO'S MIDDLE RIF

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### ABSTRACT

To investigate the history of landslides in Morocco, particularly in the Central Rif region between Al Jebha and Al Hoceïma, it's crucial to understand the significant incidents that have occurred. The area has experienced serious events like temporary road closures due to landslides, notably during the Al-Hoceïma earthquake of 2003 and extreme rainfall periods. For instance, the Regional Road N° 610 near Kassita and areas near National Route N° 16, close to El Jebha, have been affected.

Given the high risk of ground movement, the Moroccan government's development plans for the Al Hoceïma and El Jebha region, including new ports, roads, railway, and urban infrastructure, must consider landslide risks. Selecting locations shielded from landslide risks during the preliminary technical study phase is crucial. This approach is aimed at reducing the maintenance costs of these infrastructures over their operational lifespan.

To support this objective, the creation of landslide risk maps for the study area was undertaken. This involved conducting an inventory of predominant surface soils and rocks and their spatial representation in geotechnical maps, which were previously unavailable. These geotechnical maps were then combined with topographic contour lines to identify areas where soils with weak geotechnical characteristics intersect with steep topographic gradients. The ultimate goal of this work is to delineate areas at high risk of landslides, enhancing safety and infrastructure sustainability in the region.

**Keywords:** Slope instability, risk map, geotechnical design, Middle Rif Morocco





## EVOLUTION OF ENERGY SYSTEMS: PATTERNS AND MECHANISMS

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### ABSTRACT

Clarifying the evolution mechanisms of energy systems is related to our understanding of the essence of energy systems, which belongs to the category of epistemology. We use the principle of ecological complexity to expound on the synergies between energy systems and ecosystems and energy systems and complex systems, respectively, summarize the evolution pattern of energy systems, and propose the evolution mechanisms of energy systems from the micro to macro level. We argue that energy systems are driven by both momentum force and random walk force at the micro level, which makes the evolution of energy systems full of uncertainty in the definite trend. At the meso level, energy systems meet four conditions to form a self-organization structure: enough openness, far from equilibrium, small fluctuation, and nonlinear interaction. Therefore, the evolution at this level follows the law of self-organization evolution. At the macro level, the three agents of energy systems, households, firms, and governments, under the constraints of the ecosystem and technology, pursue the continuous improvement of efficiency as the common goal or compete or cooperate to enable mutual benefits and coexistence, and jointly promote the evolution of energy systems.



## CURRENT ADVANCES IN BIOENERGY PRODUCTION HARNESSING THE POWER OF NATURE FOR SUSTAINABLE ENERGY

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### **ABSTRACT**

This Research explores the current advances in bioenergy production, focusing on the significant progress made in harnessing the power of nature to address the world's increasing energy demands. Bioenergy offers a sustainable and renewable alternative to traditional energy sources, and this research highlights recent innovations and breakthroughs in the field. Through an examination of related works and methodologies, the research concludes with a vision for a future powered by bioenergy.

**Keyword:** Bioenergy, recent innovations and future powered by bioenergy.



## ALKALINE PRETREATMENT AND ENZYMATIC SACCHARIFICATION OF RICE STRAW FOR THE PRODUCTION OF BIOETHANOL

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### ABSTRACT

Rice straw is an important lignocellulosic biomass generated in huge quantity in India during crop harvesting. This lignocellulosic biomass is mainly composed of cellulose, hemicellulose and lignin. Rice straw management involving burning in open fields creates environmental pollution and health hazards. Therefore, utilization of rice straw for the production of second generation bioethanol is an important strategy for its proper utilization and management. Alkaline pretreatment does not produce toxic inhibitors like acidic pretreatment. Alkaline pretreatment efficiently removes lignin from the lignocellulosic biomass. Rice straw was pretreated with sodium carbonate, sodium bicarbonate and ammonia. Ammonia resulted in maximum delignification of 40 % as compared to others. Pretreated biomass was characterized using X-ray diffraction and Fourier transform infrared spectroscopy. Pretreated rice straw was hydrolyzed using cellulolytic enzymes of *Myceliophthora thermophila*. Maximum release of reducing sugars (220mg/g) was attained at 60°C, pH 5.0 after 6h using enzyme dose of 20U/g. However, the amount of reducing sugars increased with increase in incubation time with maximum yield (369mg/g) after 24 h. The reducing sugars were analyzed by thin layer chromatography showing high yield of glucose in the hydrolysate. Enzymatic hydrolysate was used in the medium for the cultivation of yeast, *Saccharomyces cerevisiae*. High ethanol yield of 18g/L was obtained at 30°C after 72 h using 20% hydrolysate. Therefore, alkaline pretreatment supported high saccharification of rice straw for bioethanol production, which will help in reduction of energy crisis due to excess consumption and depletion of fossil fuels. The important findings of this study will be discussed.



## STABILITY ANALYSIS OF A HYDRO POWER PLANT BASED ON BERKOWITZ ALGORITHM AND ROUTH-HURWITZ CRITERION

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### ABSTRACT

In this paper, we delve into the dynamics of a hydro power plant, specifically examining the stability of a single machine connected to an infinite bus (SMIB) system using a state-space dynamical model. Our approach involves leveraging the Berkowitz theorem to compute the characteristic polynomial linked to the system's state matrix, a technique that allows for insightful analysis. We then apply the Routh-Hurwitz criterion to evaluate the stability of the power plant's operational state. An intriguing aspect of our methodology lies in utilizing the Berkowitz algorithm, which is parallelizable and holds potential for extending its application to study the stability of more complex models. Our findings not only shed light on the stability considerations of this specific power plant configuration but also present a scalable method that could prove beneficial for analyzing higher-order models in similar contexts.

**Keywords:** Hydro power plant, linear stability, Berkowitz algorithm, Routh-Hurwitz criterion.



## BIOMASS PRODUCTION OF *Chlorella sorokiniana* UCAM 001 IN FLAT-PLATE PHOTOBIOREACTORS UNDER THE ARID CLIMATE OF MOROCCO

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## **ABSTRACT**

The present study aims to investigate the effects of temperature and light intensity on the growth and physiology of the species *Chlorella sorokiniana* UCAM 001 strain utilizing annual optimization monitoring and a groundwater as a culture media. In order to evaluate the phycoremediation process and biomass production, the strain was subsequently grown in domestic wastewater during the best season. *C. sorokiniana* was cultivated in 2 outdoor flat-plate photobioreactors (PBRs) with a capacity of 30 L each, scaled up for the first time at the Faculty of Sciences Semlalia (Marrakech, Morocco). The first culture medium with no limiting nutrient concentrations was groundwater (10 and 100 mg.L<sup>-1</sup> of additional phosphorus and nitrate, respectively). Daily checks were made on the temperature, light level, algal growth, and biomass productivity. Every 4 days, proline, glycine-betaine, and catalase levels were examined concurrently to gauge the level of algal stress. According to the findings, springtime saw an increase in biomass productivity, reaching 30 mg L<sup>-1</sup> day<sup>-1</sup> with a specific growth rate of 0.73 day<sup>-1</sup>. However, during the summer, when the PBR reached temperatures above 45°C and the high light intensity around 1700 mol m<sup>-2</sup> s<sup>-1</sup>, no growth was observed. The physiological indicators demonstrated how the environment had an impact on algae growth. However, compared to the groundwater media, the biomass output was significantly higher when we used household wastewater as a culture medium during the spring (71.66 mg L<sup>-1</sup> day<sup>-1</sup>). Algal growth also efficiently purified wastewater contamination, removing 97% of TP, 99% of TN, and 78% of COD.

**Keywords:** *Chlorella sorokiniana*; flat plate photobioreactor; light; temperature; groundwater, wastewater.



## ENERGY JUSTICE: BRIDGING GAPS IN ACCESS, DISTRIBUTION, AND ENVIRONMENTAL IMPACTS

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### ABSTRACT

The equitable distribution of advantages and disadvantages related to energy production, consumption, and environmental effects is the focus of the complex idea of energy justice. An overview of the main components of energy justice is given in this abstract, with a focus on the need to address inequalities in distribution, access, and the effects that energy systems have on society and the environment. One of the main components of energy justice is having access to energy resources. Millions of people worldwide lack steady access to reasonably priced, clean energy sources, which impedes their ability to grow economically and generally improve their quality of life. The difficulties marginalized communities face are examined in this presentation, along with the significance of inclusive energy policies that put universal access first. The equitable division of the costs and benefits of energy systems is the main goal of distributional justice. When it comes to the location of energy infrastructure, disparities frequently occur, and the environmental and health costs fall disproportionately on marginalized communities. Case studies demonstrating these discrepancies are covered in the abstract, along with tactics to encourage equitable distribution of both positive and negative effects. In order to address the disproportionate effects of energy production on vulnerable populations, environmental justice is a crucial component of energy justice. The abstract explores how marginalized communities are affected by pollution, climate change, and the extraction of fossil fuels. It looks at how a fair switch to renewable energy can lessen injustices against the environment and promote a more just and sustainable future. The presentation also emphasizes how advocacy and legislation can advance energy justice. Finally, the abstract highlights how critical it is to give energy justice top priority in conversations about energy policy by highlighting how social, economic, and environmental factors are intertwined. Society can get closer to a future in which the benefits of energy are distributed fairly and the burdens are lessened for the most vulnerable communities by adopting a comprehensive approach to energy justice.

**Keywords:** Energy Justice, Access to energy, Distributional Justice, Environmental Justice, Extraction, Emphasis, Intertwined, Disproportionate, Tactics.



## RISING ENERGY DEMAND IMPELS INDIA TO LOOK FOR SUPPLY ALTERNATE

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### ABSTRACT

India is on the brink of fastest economic growth and striving hard to achieve the goal of \$5 billion economy. Simultaneously, energy demand is rising rapidly day by day with growing economy at an average annual rate of 7 to 8%. This emerging economic alignment impels India to look for reliable long-term source of energy to boost up its economy. Russia, Central Asia, West Asia and Middle East have the potentials to meet out India's energy demand, but how to get easy access there will be more important. India is not having direct physical link with these countries. That's why India is trying hard to make arrangements for direct access in these areas with likeminded countries. The efforts of revival of ancient trade routes i.e. Silk Route, Spice route, North-South corridor, renovation of Chabahar port in Iran and connect it to Zarang and Delram in Afghanistan and further to Uzbekistan, and latest envisaged India-Middle East Europe corridor (IMEEC) on the sideline of Group-20 summit could be seen in this direction. The laying of TAPI gas pipeline initiative could also be seen in the same direction. If all these initiatives could have been materialized fully, it will present great opportunities for India to get fulfill its rising energy demand. All These routes are not only originated between Europe and Asia, but the location of all these have also positioned at the crossroad of South Asia, Middle East, and to Europe. These energy routes bridge the natural enriched region with emerging consumer market and developing industrial hub. This combination has made these routes much more dynamic for trade activities.

Adding to this, trade routes have always been remained the areas of interest for India due to historical and cultural reasons. The latter sees these routes not only just the roads for carrying merchandise and precious commodities through transportation but also understand these routes as the means to brought about much more in term of transmission of knowledge, ideas, culture and beliefs, which had a profound impact on the history and civilization of surrounding areas. India has supported every effort of revival civilization bonding that strengthens interaction among human being but it should meet the principles of inclusive, sustainable and transparent in nature and respect the sovereignty and territorial integrity of nations. That's why all the major stakeholders or likeminded countries in adjoining areas are collaborating on the bases of technology, design, finance and regulatory standards to make these inter-linkages initiatives as a reality. Hence, these initiatives have been found initial success and almost get ready for functional level.

The dynamics of this positivity were not without problems and challenges for India. Emerging scenario in West Asia and Middle East, instability and fragile political set up in Afghanistan, unfriendly relations with Pakistan and its nefarious designs towards India and further most China's activism and monopolistic & dubious activities on the name of 'Belt and Road Initiative particularly its sub-branch China Pakistan Economic Corridor (CPEC) have emerged as the major challenges for Indian policy makers' while addressing the issue to gain direct access towards energy enriched areas.

All these issues have demanded a constructive and analytical outlook and deliberation for further study and reach out to any conclusion. This will help the research scholars, academicians and policy makers associated with this dynamic issue of energy study.

**Keywords:** Energy Demand, Trade Routes, Silk Route, IMEEC, Access, Culture, Beliefs, CPEC





## DISPUTE RESOLUTION MECHANISMS IN CROSS-BORDER ENERGY AGREEMENTS:

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### ABSTRACT

Cross-border energy agreements, with their inherent complexities stemming from diverse legal systems and geopolitical considerations, necessitate robust dispute resolution mechanisms. These mechanisms serve as the backbone of these agreements, ensuring a structured and fair resolution process when disputes arise. The choice of dispute resolution methods plays a pivotal role in shaping the effectiveness and efficiency of the resolution process.

Arbitration emerges as a prevalent and favored method in cross-border energy disputes. Its appeal lies in its flexibility, neutrality, and the potential for appointing arbitrators with specialized knowledge in the energy sector. Moreover, arbitration proceedings are often confidential, fostering a discreet resolution process. Mediation, another alternative, emphasizes cooperation and conciliation, encouraging parties to reach mutually agreeable solutions through facilitated negotiations. While less adversarial, mediation may require robust enforcement mechanisms to guarantee compliance with any resulting agreement.

Litigation in national or international courts is a more formalized approach to dispute resolution. However, it presents challenges such as jurisdictional issues, enforceability, and the potential for protracted legal proceedings. Some cross-border energy agreements adopt a tiered approach to dispute resolution, incorporating negotiation, mediation, and arbitration. This tiered structure allows parties to escalate the dispute resolution process progressively, tailoring the approach to the evolving nature of the disagreement.

The effectiveness of these mechanisms depends on the specific nature of the dispute, the preferences of the involved parties, and the legal landscape within which the agreements operate. Striking a delicate balance between enforceability, efficiency, and fairness is paramount in crafting dispute resolution provisions that inspire confidence and ensure the sustainability of cross-border energy agreements.

**KEYWORDS:** Arbitration, Mediation, Litigation, Tiered Approach



## ENERGY-SAVING MECHANISMS FOR EVALUATING EFFICIENCY IMPROVEMENT AND LOSSES REDUCTION SCENARIOS IN THE THERMAL POWER PLANTS SECTOR OF NIGERIA

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### ABSTRACT

Increasing electricity costs, scarcity of fuel, ever-increasing production costs, and concerns about global warming have prompted the implementation of incentives and punishments to reduce distribution system losses. As a fundamental industry, the electric power industry and its continuation are necessary for economic viability, industrial development, and social welfare. Energy resources, such as fossil fuels have brought about numerous benefits for humanity, leading to issues like climate change, greenhouse effects of global warming, acid rains, and carcinogens. The primary consumers of fossil fuels are industries and factories, domestic and commercial heating systems, motor vehicles, and power plants, which account for the most significant portion of consumed fossil fuels. Reduced losses in distribution networks are implemented because of the increasing prices of electricity delivery, fuel shortages with ever-increasing costs of energy generation, and concerns about global warming. Power loss in distribution systems is classified into technical and non-technical, and local power loss in the technical category depends on material properties and electrical resistance emitted in the form of heat. A familiar example is the loss of power due to electrical resistance in distribution lines and transformers. Simulating and calculating the technical losses is also an option. Non-technical losses, on the other hand, are caused by unauthorized connections, electricity theft, meter manipulation, disparate billings, and other abnormalities in the process of bill collection. Most technical and non-technical losses can cause low customer service quality, high costs produced by futile or too early investment, and low revenues due to capital issues with all its economic repercussions. As environmental concerns grow, humans have begun attempting to limit the impact of conventional power plants. Today, the most crucial objective in designing and equipping a power plant is reducing energy use and pollutants while enhancing efficiency and output power with minimum costs. With respect to energy-carbon relations, these article analyses focused primarily on the potential for future reductions and low-carbon transitions

**KEYWORDS:** Energy-Saving, Evaluating Efficiency, Improvement and Losses Reduction, and Thermal Power Plants.



## **ELECTRIC ENERGY CONSUMPTION BEHAVIOR VIEWED FROM AN ISLAMIC ECONOMIC PERSPECTIVE**

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### **ABSTRACT**

This research explores electrical energy consumption behavior through the lens of Islamic economics. In this perspective, energy consumption is considered a trust (amanat) that must be managed wisely and fairly. The concept of trust encourages individuals and companies to consider the environmental and social impacts of their electrical energy consumption. The Islamic economic approach emphasizes distributive justice, where resources, including energy, are supposed to be distributed fairly for the common good. This study discusses Islamic economic principles, such as hisbah (social supervision) and israf (extravagance), as a foundation for managing energy consumption. In addition, the potential of Islamic financial instruments, such as green sukuk, to support sustainable energy projects is examined. The integration of Islamic economic values in electrical energy consumption decision-making can bring long-term benefits, including economic stability, social justice, and environmental sustainability. This research creates awareness of the urgency of a values-based approach in managing energy resources, creating a path towards a more sustainable and just society.

**Keywords:** Islamic Economics, Energy Consumption Behavior, and Green Sukuk.



## ENERGY EFFICIENCY AND ENERGY STRATEGIES

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### **ABSTRACT**

The current energy context is characterized by a growing demand for energy, a dependence on hydrocarbons, and environmental constraints. In the face of these challenges, energy efficiency is considered one of the most promising solutions. However, for this approach to be effective, it is essential to adopt best practices in this field to enable consumers to meet their energy needs with reduced resource consumption. These practices and measures will only be optimal if states, regions, businesses, and citizens implement them appropriately. They rely on the establishment of a dedicated public institutional framework, specific legislation and regulations, and appropriate financial incentives.

Furthermore, recent technological advances offer promising prospects for energy efficiency. Thanks to digitization, it is now possible to achieve optimal energy management and the development of new tools, even leading to unprecedented technological breakthroughs. To support this dynamic, it is imperative to establish innovative financial instruments that encourage investment in these technologies.

**Keywords:** Energy efficiency, energy strategy, financial incentives, technology, prospects, digitization, operational energy.



## AN APPRAISAL OF THE LEGAL AND REGULATORY FRAMEWORK FOR RENEWABLE ENERGY IN NIGERIA

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### ABSTRACT

Energy is a catalyst for any nation's drive for industrialisation. For a nation like Nigeria where Micro, Small and Medium Enterprises (MSMEs) constitute a large percentage of its economic activities, the energy sector must be well positioned to attain economic prosperity and sustainability. Regrettably, Nigeria's persistent electricity shortage hold dire consequences for households and businesses who have resorted to purchasing generator sets to power their properties and businesses inspite of its present volatility and high cost. In a recent online survey by Business Day, it is revealed that 79 percent of Nigerian household and businesses get less than 10 hours of electricity supply daily whilst 43% do not have access to electricity. Similarly, it is reported that some 1.1 billion inhabitants (constituting about 17% of the world population) do not have access to electricity and about 2.7 billion people (38% of the world population) use conventional biomass for cooking, heating and lighting in their homes all of which poses grievous risk to their health. As an alternative, renewable energy which are sources of clean, inexhaustible, affordable energy constitutes a panacea (from providing low-cost energy, offering long term viability to avoiding adverse environmental consequences) from the woes of fossil-fuel and should be harnessed to enable the nation achieve its sustainable development goals. Thus, this paper which will be principally library-based appraises the existing Legal and Regulatory Framework for the development and sustainability of renewable energy in Nigeria. It also looks into the challenges bedevilling the harnessing/development of renewable energy projects in Nigeria. The paper recommends the prioritization of the development and utilization of renewable energy by granting electricity generation licenses to meet renewable energy generation obligations as may be prescribed by the Nigerian Electricity Regulatory Commission.

**Keywords;** Energy, Renewable Energy, Sustainable Development Goals



## ENERGY TRANSITION IN AGRICULTURE: ASSESSING THE IMPACT OF RENEWABLE TECHNOLOGIES ON FARMING PRACTICES WORLDWIDE

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### ABSTRACT

This research delves into the dynamic landscape of agriculture amidst a transformative energy shift, focusing on the global integration of renewable technologies. The study meticulously examines how the adoption of renewable energy sources, including solar, wind, and bioenergy, influences diverse farming practices worldwide. Through a systematic analysis, the research assesses the implications of this energy transition on agricultural productivity, environmental sustainability, and the broader socio-economic fabric of farming communities.

By synthesizing data from various agricultural systems across the globe, the research aims to provide a nuanced understanding of the multifaceted impacts of renewable technologies. It scrutinizes the efficacy of these technologies in enhancing crop yields, resource management, and the overall resilience of agricultural operations in the face of evolving climatic patterns.

Beyond technical considerations, the study investigates the social and economic dimensions of the energy transition in agriculture. It explores how the widespread adoption of renewable technologies shapes rural livelihoods, influences employment structures, and contributes to the accessibility of sustainable farming practices. Potential challenges and opportunities associated with this transition are examined to offer insights for informed decision-making by policymakers, researchers, and practitioners.

This research contributes a comprehensive perspective on the intricate interplay between energy choices and agricultural sustainability on a global scale. By identifying key patterns, success stories, and potential pitfalls, the findings seek to guide efforts towards a more sustainable and resilient future for agriculture worldwide.



## NAVIGATING LEGAL COMPLEXITIES: CHALLENGES IN CORPORATE ENERGY PROCUREMENT

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### **Abstract**

Corporate energy procurement involves the acquisition of energy resources, often from renewable sources, to meet the energy needs of businesses. While the shift towards sustainable and renewable energy sources is increasingly prevalent, corporations face a range of legal challenges in navigating this complex landscape.

One primary challenge is regulatory compliance. Companies must adhere to a myriad of local, national, and international regulations governing energy procurement, emissions standards, and environmental impact assessments. Meeting these legal requirements is crucial for avoiding penalties and maintaining a positive corporate image.

Contractual issues also pose significant legal challenges. Negotiating power purchase agreements (PPAs) or other energy contracts requires a deep understanding of complex legal frameworks. Ensuring that contracts align with regulatory standards, reflect the specific needs of the corporation, and provide flexibility for changing market conditions is essential.

Furthermore, the evolving nature of energy markets introduces uncertainties, making it challenging for corporations to predict long-term energy costs accurately. This unpredictability can complicate financial planning and risk management. Intellectual property concerns arise, particularly in emerging energy technologies. Securing intellectual property rights for innovations in renewable energy is crucial for maintaining a competitive edge, but it also involves navigating a complex legal landscape of patents, trademarks, and licensing agreements.

**Keywords:** Corporate Energy Procurement, Legal Challenges, Sustainability





## ADVANCING SUSTAINABLE DEVELOPMENT: BUILDING CERTIFICATION INITIATIVES IN ALGERIA

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### ABSTRACT

Certification for sustainable buildings in Algeria is gaining prominence as the country recognizes the importance of environmentally friendly construction practices. In recent years, there has been a growing emphasis on integrating sustainability principles into the built environment, aligning with global efforts to address climate change and resource conservation.

Algeria's approach to sustainable building certification involves adapting international standards to suit local conditions and priorities. While various certification systems exist globally, the country may tailor these frameworks to align with its unique environmental challenges, cultural context, and climate considerations. Leadership in Energy and Environmental Design (LEED) and Building Research Establishment Environmental Assessment Method (BREEAM) are examples of widely recognized international standards that can be adapted to Algerian contexts.

Certification processes in Algeria typically involve evaluating aspects such as energy efficiency, water management, material sourcing, and indoor environmental quality. Given Algeria's arid climate, there is often a heightened focus on water conservation and efficient use of resources in sustainable building projects. Additionally, attention is paid to the incorporation of renewable energy sources to reduce reliance on traditional energy grids.

Professionals in the Algerian construction industry, including architects, engineers, and builders, play a crucial role in achieving sustainable certifications. They must navigate the challenges posed by local regulations, availability of eco-friendly materials, and awareness among stakeholders. The government, recognizing the significance of sustainable development, may incentivize or mandate adherence to certification standards through policies and regulations.

Certified sustainable buildings in Algeria contribute to mitigating environmental impacts, improving energy efficiency, and enhancing overall urban resilience. Beyond environmental benefits, these structures often offer economic advantages, such as reduced operational costs through energy savings and increased market value due to their eco-friendly credentials.

As Algeria strives to balance economic development with environmental stewardship, sustainable building certification serves as a guiding framework. The integration of international best practices adapted to local conditions ensures that Algeria's built environment aligns with global sustainability goals while addressing the specific challenges and opportunities of the region.

**Keywords:** Sustainable Construction, Energy Efficiency, Water Conservation, Renewable Energy, Architectural Sustainability



## ENHANCING ENERGY EFFICIENCY THROUGH BIOPHILIC ARCHITECTURE

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### ABSTRACT

Within the global imperative to confront energy challenges, this study strategically positions biophilic architecture as an innovative and transformative solution within the built environment. Biophilic architecture seamlessly integrates natural elements and processes into the architectural landscape, with a dual aim of fostering spaces that not only enhance occupant well-being but also curtail energy consumption. This presentation meticulously explores the myriad ways in which biophilic architecture serves as a catalyst for optimizing energy efficiency. From passive heating and cooling strategies to the implementation of green roofs and the strategic incorporation of natural lighting, a comprehensive analysis is undertaken to illustrate the versatility and impact of biophilic design. Biophilic architecture, by its very nature, goes beyond mere functionality. It seeks to create environments that resonate with the inherent connection between humans and nature. This intrinsic relationship forms the cornerstone of strategies to reduce energy consumption. By examining and implementing these strategies, not only can we create physical spaces that are energy-efficient, but we can also contribute substantively to the broader goals of sustainability and harmony. The presentation navigates through case studies and practical applications, showcasing successful instances where biophilic principles have been seamlessly integrated, yielding both ecological and human-centric benefits. In essence, this exploration underscores the pivotal role of biophilic architecture in redefining the paradigm of energy efficiency within the built environment. It invites a profound rethinking of how we design and inhabit spaces, advocating for a deeper connection to nature as an integral component of sustainable design. Through this lens, the presentation contends that biophilic architecture is not just a design choice but a transformative force, propelling us toward a future where our built environment harmonizes seamlessly with the natural world.

**Keywords:** Biophilic architecture, Energy efficiency, Sustainable design, Natural elements, Occupant well-being.



## GREEN SOLUTIONS FOR COOLING: TOWARDS SUSTAINABLE AND ENERGY-EFFICIENT COOLING SYSTEMS

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### ABSTRACT

This paper provides an overview of the key aspects of green solutions for cooling. By implementing energy-efficient practices, integrating renewable energy sources, leveraging advanced technologies, and promoting policy support, we can transition towards a sustainable and environmentally friendly cooling paradigm, mitigating climate change impacts while ensuring human comfort and well-being.

**Keywords:** solar cooling, solar energy, solar heating.



## HARNESSING SOLAR ENERGY FOR COOLING IN BUILDINGS: PRINCIPLES, POTENTIAL BENEFITS, AND INTEGRATION STRATEGIES

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### ABSTRACT

The primary objective of this study is to introduce the core principles of utilizing solar energy for cooling purposes in buildings and highlight the potential benefits that contemporary solar energy technologies can provide for applications in the building sector. This research showcases the notion that a modern building is more than just a physical structure; it is a comprehensive and intricate energy system that is interconnected with various components.

**Keywords:** solar cooling, solar energy, solar heating.



## NATURAL FIBER-BASED GEOPOLYMER COMPOSITES WITH LOW THERMAL CONDUCTIVITY FOR ENERGY EFFICIENT BUILDINGS

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### ABSTRACT

Thermal insulation materials find extensive applications in building construction; they protect the structure from heat loss to save energy and money. Nowadays, many attempts have been made to use natural fibers as reinforcement additives in building materials to develop an eco- friendly composite material with better thermal insulation properties. Natural fibers have gained importance due to their abundant local availability, low cost, recyclability, and low density. The main objective of this work is to investigate the physical, mechanical, morphological, and thermal characteristics of new natural fiber reinforced geopolymer composites. The density, porosity, compressive strength, scanning electron microscopy, and thermal conductivity of geopolymer composites were determined. The results showed that the density of geopolymer composites decreased with increasing fiber content. The increase of fiber content decreased the compressive strength of geopolymer composites. In addition, the porosity also increased with the increase in fiber content, while the thermal conductivity was reduced. Therefore, as a green and ecological building material, the use of natural-fiber-based composite geopolymers for has the advantage of saving energy, reducing costs, and protecting the environment.

**Keywords:** Natural fibers; Alkali treatment; Geopolymer composites; Thermal insulation.



## APPLICATION OF ELECTRICAL RESISTIVITY METHOD FOR PRE-CONSTRUCTION ASSESSMENT

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### ABSTRACT

It is crucial to provide a proper picture of the nature of the subsurface for construction purposes. Electrical Resistivity Method (ERM) was employed to determine the subsurface competence of USM main campus using three survey profiles. Werner-Schlumberger array was selected for the subterranean zones, layers, and depth values for the purpose of the construction on the study area. The results suggest that the studied subsurface consists of two major regions: loose sand and clay associated boulders as the unsaturated region and weathered/fracture region typically of granitic rocks, with resistivity values of 5 – 700 ohm.m, depth of 1.0 – 4.0 m; relative to deep saturated region. While the second region with resistivity values of 700 – 1300 ohm.m was interpreted to be weathered or unsaturated zones. The result of ERM determine the responses of the subsurface materials and properties by resistivity and depth values which provide insights for the stability of foundation at the construction site.

**Key words:** ERM, Clay, Foundation, Stability, Depth.



## TRIBOFILM FORMATION OF ZNS NANOPARTICLES MODIFIED WITH LIPOPHILIC ORGANIC MOLECULE

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### ABSTRACT

Tribological properties play an important role in determining the usage performance of machine parts, especially for pairs of materials that interact with each other. It is stated that 23% of the total energy consumption worldwide is due to tribological contacts. Lubrication appears as a major solution to decrease these energy losses. Nano-sized oil additives improve the tribological and thermophysical properties of the base oil by reducing friction and wear through their unique structural properties. In this study, ZnS nanoparticles (NPs) modified with lipophilic organic molecules were prepared at less than 250 nm and used as a nanometal-based oil additive. The specially designed wear test device had a rotating pin on the cylinder geometry. The viscosity of nanolubricant was min. 5% increased when modified ZnS NP was added to the base oil. The Zn and S were detected on the worn surfaces with the least content (wt.%) of 0.25 and 0.77, respectively. FTIR analysis confirmed the EDX results with the appearance of peaks of Zn-S bonds. Compared to the 10W base oil, the mass loss of the test pins and the size of the wear scar were reduced by at least 12.2% and 11.4% respectively, for the best nanoadditive concentration (0.0125 wt.%). A sulfuration layer is detected on the surfaces of the wear scars, which could prevent hard contact and improve the availability to form a tribofilm with interacting surfaces.

**Keywords:** ZnS; Lubricant additives, Lipophilicity, Tribofilm, Sulfuration Layer.

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## EFFECTS OF MONO-FLOR(CHLORINE)-SUBSTITUTION ON THE STRUCTURAL AND NON-LINEAR OPTICAL PROPERTIES OF POLY(3-HEXYLTHIOPHENE-2,5-DIYL) FOR SOLAR CELL APPLICATIONS

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### ABSTRACT

Poly(3-hexylthiophene-2,5-diyl) (P3HT) and its derivatives are good organic semiconductors and have various applications in many fields such as photovoltaic systems, organic light-emitting diodes. In this study, the structural and nonlinear optical properties of P3HT were examined theoretically by dopping Chlorine and Fluorine to its structure. Gaussian 09 programs were used for calculations and GaussView programs were used for visuals. It was found that the bond lengths and bond angles of the isolated molecule were greater than the substituted P3HT. The band gap was calculated for fluorine-doped P3HT and chlorine-doped P3HT. Doped molecules were found to be more reactive than their isolated forms because they had lower chemical hardness values. Results on nonlinear optical (NLO) properties show that doped P3HT has good first-order hyperpolarizability. The open circuit voltage was also calculated. According to the results, the doped molecules have potential applications for photovoltaic devices due to good electron transfer.

**Keywords:** Photovoltaic, organic, P3HT, DFT.



## TRAKYA BÖLGESİ KÖMÜRLERİNİN YENİ NESİL TEKLOJİLERLE ENERJİDE KULLANILABİLİRLİK ANALİZİ

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### ÖZET

Son yıllarda, enerji kaynaklarında küresel ve bölgesel bazda yaşanan ve enerjide arz güvenliği tehdit eden savaşlar, Paris iklim anlaşması ve beraberindeki yükümlülükleri de adeta unutturup, hiçe sayarak, ülkeleri zorunlu olarak yerli kömür kaynaklarına yöneltmiştir. Kömür dünyada, %35,72 payla enerji kaynakları içinde liderliğini, 2022 yılında da sürdürmeye devam etmektedir.

Türkiye'nin Trakya Bölgesi kömürleri ise, bölgenin merkezi enerji geçiş koridoru (enerjide hub) kimliğine bağlı jeopolitik ve jeostratejik açıdan öneminin artması ile Trakya'nın kısa vadede tek yerli ve stratejik enerji kaynağı olarak dikkat çekmektedir.

Bu düşüncelerden hareketle, 20,4 milyar ton olan Türkiye toplam kömür rezervinden, 4,43 milyar ton ile %16-20'lik pay alan Trakya Bölgesi kömürleri, kömür üretiminden temiz enerji üretimine kadar geçen süreçte ve bütüncül bir yaklaşımla, bu araştırma kapsamında sayısal olarak analiz edilip, değerlendirilmiştir.

Tüm bu sayısal analiz ve değerlendirmelerden; kömürün, Trakya'nın enerjisinde vazgeçilemez yerli bir enerji kaynağı olduğu, Trakya toplamında 4,43 milyar ton toplam rezervi ile 2000 MW gücünde termik potansiyelinin bulunduğu saptanmıştır. Bu bölgenin kömürlerinin yeraltı üretiminde mekanizasyon geçiş süreci 2019 yılında ilk ve öncü olarak Edine-Uzunköprü-Harmanlı'da başlamış olup, sıfır gaz emisyonlu yeni nesil bir termik santrale beslenecek kömür üretim hızlarına ( $\dot{U} > 1,5-2$  milyon ton/yıl) ulaşılmıştır. Böylelikle Trakya bölgesi, bu üretim ölçeği ve beraberindeki istihdam ile kömür sektörü sanayi üretim indeksinin büyümesine önemli katkı sağlamıştır. Ayrıca, Edirne-Uzunköprü Harmanlı Bölgesi, Oligosen alt bitümlü kömürlerinin, toplam kükürt içeriği, alt ısı değer, kül ve nem gibi yakıt kalite karakteristikleri ile dışalım (ithâl) bitümlü kömürlerle kolaylıkla rekâbet edebileceği, ancak bunun için mutlaka bu bölge kömürlerinin özellikle iç ve dış pazar payı bulabilmesi için "tescillenmesi" gerektiği sonucuna da yine araştırmada ulaşılmıştır.

**Anahtar Kelimeler:** Trakya Bölgesi Edirne-Harmanlı, Alt Bitümlü Oligosen Kömür, Termik Santral ve Gazlaştırma, Enerji ve Çevre.

## ENERGY AVAILABILITY ANALYSIS OF TRAKYA REGION COALS WITH NEW GENERATION TECHNOLOGIES

### ABSTRACT

In recent years, global and regional wars over energy resources, which threaten the security of energy supply, have forced countries to turn to domestic coal resources, almost forgetting and disregarding the Paris Climate Agreement and its commitments. Coal remains the world's leading energy resource with a 35.72% share in 2022.

In contrast, Turkey-Trakya region coal resources stands out as the only domestic and strategic energy source for Trakya in the short term due to the region's growing geopolitical and geostrategic importance as a central energy transit corridor (energy hub).

Based on these considerations, the coal resources of Trakya, which have a share of 16-20% with 4.43 billion tons out of the total coal reserves of 20.4 billion tons in Turkey, have been analyzed and evaluated numerically within the scope of this research with a holistic approach in the process from coal production to clean energy production.

From all these numerical analyses and evaluations; it has been determined that coal is an indispensable domestic energy source for Trakya, with a total reserve of 4.43 billion tons in Trakya and a thermal potential of 2000 MW. In Trakya underground mechanized coal production has started in Edirne-Uzunköprü-Harmanlı as the first and pioneer in 2019, and coal production rates (PR>1.5-2 million tons/year) have been reached to feed a new generation thermal power plant with zero gas emission. Thus, with this scale of coal production has made a significant contribution to the growth of the industrial production index of Trakya region. The study also concluded that the Oligocene sub-bituminous coals of the Edirne-Uzunköprü Harmanlı region can easily compete with imported bituminous coals with coal quality characteristics such as total sulfur content, lower calorific value, ash and moisture, but for this purpose the coals of this region need to be "registered" in order to find domestic and foreign market share.

**Keywords:** Trakya Region Edirne-Harmanlı, Sub Bituminous Coal, Thermal Power Plant and Gasification, Energy and Environment.



## EVALUATION OF GEOTHERMAL ENERGY RESOURCE POTENTIAL IN NORTH - EASTERN NIGERIA USING SPECTRAL ANALYSIS OF AEROMAGNETIC DATA

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### ABSTRACT

Nigeria is a country with insufficient generation of electricity for the consumption of the populace at large despite continue increase in population. The need for renewable and alternative sources of energy necessitates the need for this research work. The spectral analysis of aeromagnetic data was carried out with the purpose of evaluating of geothermal energy resource potential in Northeastern Nigeria. The study area is bounded by latitudes  $9^{\circ}30'00''$  N –  $14^{\circ}0'00''$  N and longitudes  $9^{\circ}0'00''$  E –  $14^{\circ}30'00''$  E. Separation of Regional/residual was carried out on the total magnetic field intensity (TMI) using fitting method of order one. For the spectral analysis, radially power spectrum was applied to the residual data divided into eighty-five (85) square blocks and each block analyzed by plotting log of power spectrum against wavenumber to obtain depths to the top ( $Z_t$ ) and centroid ( $Z_o$ ) of magnetic anomalous body (source). These depths were used to evaluate the Curie-point depth (CPD), geothermal gradient (GTG) and near-surface heat flow (HF) in the study area. The results revealed that the values of curie point depth ( $Z_b$ ) range from 10.2816 km to 50.6147 km with a mean of 34.015 km, geothermal gradient values range from  $11.4591^{\circ}\text{Ckm}^{-1}$  to  $56.4115^{\circ}\text{Ckm}^{-1}$  with a mean of  $18.1426^{\circ}\text{Ckm}^{-1}$  and heat flow values range from  $28.6478\text{ mWm}^{-2}$  to  $141.0286\text{ mWm}^{-2}$  with a mean value of  $45.3564\text{ mWm}^{-2}$ . The heat flow has the maximum values around the southwestern portion of the study area. This portion and the entire study area with high values of heat flow might probably be good geothermal sources and thereby further recommended for detailed geothermal exploration.



## ECO-FRIENDLY WASTEWATER TREATMENT TECHNIQUES IN CONSTRUCTED WETLANDS THAT PROMOTE ENERGY CONSERVATION

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### ABSTRACT

Wastewater treatment plays a vital role in safeguarding both the environment and public health. However, traditional wastewater treatment methods typically demand substantial energy resources, contributing to environmental challenges and escalating costs. In response to this, constructed wetlands have emerged as an innovative and sustainable alternative for wastewater treatment. Unlike conventional methods, constructed wetlands operate as eco-friendly, energy-efficient systems that offer promising solutions to the challenges posed by energy-intensive treatment processes.

Constructed wetlands utilize natural processes and various plant and microbial interactions to treat wastewater effectively. The plants in these wetlands assist in absorbing nutrients and filtering pollutants, while the microorganisms break down organic matter. By harnessing these natural mechanisms, constructed wetlands significantly reduce the need for energy-intensive treatments, making them environmentally friendly and cost-effective.

This report delves into the application of energy-efficient technologies within constructed wetlands, exploring their intricate processes and mechanisms. These technologies leverage the power of biological and ecological interactions to efficiently treat wastewater. By optimizing the synergistic relationships between plants, microorganisms, and aquatic life, constructed wetlands can achieve high levels of treatment without the excessive energy consumption associated with traditional methods.

Furthermore, this report examines the future prospects of energy-efficient technologies in constructed wetlands. As advancements in ecological engineering and wastewater treatment continue to evolve, there is a growing potential for enhancing the efficiency and scalability of constructed wetland systems. Research and innovation in this field are paving the way for the development of novel technologies and approaches, ensuring that constructed wetlands remain at the forefront of sustainable wastewater treatment solutions.

**Keywords:** Wastewater, Constructed wetland, Eco-friendly technique.



## P(VCL-co-AA) KOPOLİMERİN TERMOTROPİK POLİMER OLARAK SENTEZİ ve KARAKTERİZASYONU

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### ÖZET

Poli (vinil kaprolaktam), termotropik özellikleri nedeniyle iyi bilinen bir malzemedir. Faz geçiş sıcaklığının hidrofilik monomerlerle birleştirilmesiyle daha yüksek sıcaklık derecelerine ayarlanmasının mümkün olduğu da bilinmektedir. Akrilik asit (AA) bu amaçla kullanılmayan monomerlerden biridir. Bu çalışmada faz dönüşüm karakteristikleri ve termotropik özellikleri üretilmiş ve test edilmiştir. Karakterizasyon için H-NMR, GPC, DSC, TGA ve FTIR Spektroskopi analizi kullanıldı. Sentezlenen malzeme ile öncü arasındaki yüzey morfolojisi farkını göstermek için POM da çalıştırıldı.

**Anahtar Kelimeler:** termotropik malzeme, termal enerji depolama malzemesi, vinil kaprolaktam.

## SYNTHESIS and CHARACTERIZATION OF A P(VCL-co-AA) COPOLYMER AS THERMOTROPIC POLYMER

### ABSTRACT

Poly (vinyl caprolactam) is a well-known material for its thermotropic properties. It is also known that it is possible to adjust phase transition temperature to higher degrees of temperature by incorporating it with hydrophilic monomers. Acrylic acid (AA) is one of the monomers that has not been used for this purpose. Here in this work, it has been produced and tested for the phase transformation characteristics and thermotropic properties. H-NMR, GPC, DSC, TGA, and FTIR Spectroscopy analysis were used for characterization. POM was also operated to show the surface morphology difference between the synthesized material and precursor.

**Keywords:** thermotropic material, thermal energy storage material, vinyl caprolactam.



## TERMAL ENERJİ DEPOLAMA İÇİN YENİ BİR FAZ DEĞİŞİM MALZEMESİ OLARAK 1,4-FENİLEN DİSTEARİLAMİT

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### ÖZET

Termal enerji depolama uygulamalarına yönelik yeni nesil faz değişim malzemeleri, mevcut malzemelerin uygulama potansiyelinin düşük olması ve daha fazla işlevselliğin sağladığı faydalar nedeniyle sıcak bir konudur. Bu malzemelerdeki amin grupları, türevlerine enerji toplama özellikleri kazandıran metalik yapıları nedeniyle özellikle önemlidir. Bu nedenle 1,4-fenilen distearilamid, yaklaşık faz geçiş sıcaklıklarında yararlanılabilecek potansiyel bir malzeme olarak hazırlanmıştır. Bu çalışmada 1,4-fenilen distearilamidin termal enerji depolama özellikleri tespit edilmiştir. Karakterizasyon için DSC, TGA ve FTIR Spektroskopi analizi kullanıldı. Sentezlenen malzeme ile öncü arasındaki yüzey morfolojisi farkını göstermek için POM da çalıştırıldı.

**Anahtar Kelimeler:** faz değişim malzemesi, termal enerji depolama malzemesi, yağlı amid.

## 1,4-PHENYLENE DISTEARYLAMİDE AS A NOVEL PHASE CHANGE MATERIAL FOR THERMAL ENERGY STORAGE

### ABSTRACT

New generation phase change materials for thermal energy storage applications is a hot topic due to the low application potential of the present materials and the benefits produced by further functionality. Amine groups in these materials are especially important due to their donated metallic structure to impart energy-harvesting properties to their derivatives. For this reason, 1,4-phenylene distearylamide has been prepared as a potential material to exploit at around its phase transition temperatures. In this study, 1,4-phenylene distearylamide has been identified with its thermal energy storage properties. DSC, TGA, and FTIR Spectroscopy analysis were used for characterization. POM was also operated to show the surface morphology difference between the synthesized material and precursor.

**Keywords:** phase change material, thermal energy storage material, fatty amide.





## BATARYA TAMPONLU DC HIZLI ŞARJ İSTASYONUNUN ÇOKLU ELEKTRİKLİ ARAÇ PERFORMANSININ İNCELENMESİ

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### ÖZET

Günümüzde, elektrikli araçların (EA) yaygınlaşmasına paralel olarak şarj istasyonu çözümleri üzerine çalışmalar da hız kazanmıştır. Bu çözümlerden doğru akım (DA) hızlı şarj istasyonları kısa şarj süresi avantajı ile kullanıcıların EA'ları daha hızlı benimsemesine ve menzil/şarj kaygısı olmadan seyahat etmelerine olanak tanımaktadır. Ancak, DA hızlı şarj istasyonlarının yüksek kurulu güçleri ve anlık yüksek güç talepleri nedeniyle, yerel şebekeyi olumsuz etkilemesi muhtemeldir. İlgili şarj istasyonları, yerel şebeke altyapısının eski ve zayıf olduğu bölgelerde şebekenin hızla kurulu güç sınırlarına ulaşmasına ve dolayısıyla güç kalitesi sorunlarına ve diğer yüklerin çalışmasını olumsuz etkileyebilecek şebeke dalgalanmalarına yol açabilmektedir. Bu tür sorunlar enerji depolama sistemleri gibi yerel olarak elektriği depolayabilen sistemler ile bertaraf edilmektedir. Bu sorunları önlemek ve şebeke güvenilirliğini artırmak amacıyla, batarya depolama üniteleri ile donatılmış DA hızlı şarj istasyonu üzerine ticari ve akademik çalışmalar gerçekleştirilmektedir. İlgili ürünler şebekeye gerilim/frekans desteği sağlamakla birlikte şebekeden alınan gücü de sınırlandırmaktadır. EA'ların ihtiyacı olan yüksek şarj gücünün geriye kalan kısmını ise (diğer bir deyişle büyük bir yüzdesini) tampon bataryalar ile sağlamaktadır. Bu avantajlara ek olarak, ortak DA bara sayesinde yenilenebilir enerji kaynaklarının bu sisteme entegre edilmesi de mümkün olmaktadır. Bu çalışmada ise batarya tamponlu DA hızlı şarj istasyonunun iki elektrikli araç ile performans incelemesi gerçekleştirilmiştir. Bu kapsamda, 30 kW çift yönlü çalışabilen şebeke dönüştürücüsü, 150 kW tek yönlü DA-DA dönüştürücü ve tampon bataryası içeren şarj istasyonu MATLAB/Simulink ortamında modellenmiştir. Şarj cihazı performansı iki EA'yı senkron ve asenkron şarj etme, şebekeye gerilim/frekans desteği sağlama, tampon bataryayı şebekeden şarj etme koşulları altında incelenmiştir. Olası tüm güç akış senaryoları altında test edilen batarya tamponlu DA hızlı şarj istasyonu sonuçları sistem etkinliğini ve uygulanabilirliğini doğrulamaktadır.

**Anahtar Kelimeler:** DA hızlı şarj cihazı, batarya, tampon, elektrikli araç

## EXAMINING THE MULTIPLE ELECTRIC VEHICLE PERFORMANCE OF BATTERY BUFFERED DC FAST CHARGER

### ABSTRACT

Nowadays, along with the widespread adoption of electric vehicles (EVs), there has been an acceleration in research on charging station solutions. Among these solutions, direct current (DC) fast-charging stations, with the advantage of short charging times, enable users to embrace EVs more rapidly and allow them to travel without concerns about range or charging. However, due to the high installed power and instantaneous high-power demands of DC fast charging stations, they may negatively impact the local power grid. These charging stations can lead to the rapid reaching of power limits in regions where the local grid infrastructure is old and weak, thereby causing power quality issues and grid fluctuations that could negatively impact the operation of other loads. To address such issues, studies and developments are being conducted on commercial and academic levels for DC fast charging stations equipped with battery storage units. These products offer voltage/frequency support to the grid while limiting the power drawn from the grid. They provide a significant portion of the high charging power required by EVs, primarily through buffer batteries. In addition to

aforementioned advantages, the related system allows to integrate the renewable energy sources into this system with the common DC bus. In this study, a performance analysis of a battery-buffered DC fast charging station with two electric vehicles has been conducted. For this purpose, a charging station has been modeled in MATLAB/Simulink, incorporating a 30 kW bidirectional grid rectifier, a 150 kW unidirectional DC-DC converter, and a buffer battery. The performance of the charging system has been examined under conditions of synchronously and asynchronously charging two EVs, providing voltage/frequency support to the grid, and buffering the battery from the grid. The results of the battery-buffered DC fast charging station, tested under all possible power flow scenarios, confirm the system's efficiency and feasibility.

**Keywords:** DC fast charger, battery, buffer, electric vehicle.



## HÜCRE SICAKLIĞINI TEMEL ALAN SAĞLIK DURUMU YÖNETİMİ İLE BATARYA ÖMRÜNÜ UZATMAK İÇİN YENİ BİR YAKLAŞIM

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### ÖZET

Elektrikli araçlardan akıllı telefonlara kadar geniş bir kullanım alanına sahip olan ve günlük hayatımızın vazgeçilmez bir parçası haline gelen bataryalar, aşırı sıcaklık koşullarından olumsuz etkilenmekte, yaşlanmaları ve kapasite kayıpları önemli ölçüde hızlanmaktadır. Yüksek sıcaklıklarda bataryaların kimyası stres altında daha çabuk bozulurken, düşük sıcaklıklarda verimlilik ve kapasite kaybı yaşanmaktadır. Sıcaklığın batarya üzerindeki etkisini en aza indirmek ve bataryayı verimli kullanmak için gelişmiş bir batarya yönetim sistemi (BMS) tasarımı gerekmektedir. Tasarlanacak BMS, termal aşırılıklardan korunmak için ortam ve hücre sıcaklığını sürekli izlemeli, sorun oluşmadan önlem almalı veya bu parametreleri göz önünde bulundurarak sistem kontrolü gerçekleştirmelidir. Bu nedenle, sıcaklığa duyarlı bir yönetim sistemi, yüksek performans ve dayanıklılık gerektiren uygulamalarda güvenliği artırır ve pil ömrünü ve güvenilirliğini artırır. Önerilen çalışma, sıcaklığın bir kontrol girişi olarak kullanıldığı ve şarj oranının buna göre değiştirilerek batarya ömrünün uzatıldığı ve güvenliğin artırıldığı bir BMS tasarımı sunmaktadır. Önerilen yaklaşım, sıcaklık değişimlerinin ve şarj oranlarının hücre yaşlanmasını ve kapasite bozulmasını nasıl etkilediğini analiz etmeye ve batarya kimyası üzerindeki termal etkileri anlamaya dayanmaktadır. Benzetim çalışması sonuçları, önerilen BMS'nin batarya ömrünü önemli ölçüde uzatırken yüksek verimlilik altında operasyonel güvenlik sağlayabileceğini göstermektedir. Batarya üzerinde kimyasal stres yaratan iki durumu göz önünde bulunduran BMS, sıcaklığın artması durumunda C-Rate değerini düşürerek stresi en aza indirmeyi hedeflemektedir. Bu sayede bataryadan elde edilen toplam enerji miktarının önemli ölçüde arttığı gösterilmiştir.

**Anahtar Kelimeler:** Lityum bataryalar, Batarya yönetim sistemleri, Yenilenebilir enerji kaynakları, Enerji depolama, Bataryalar.

### A NOVEL APPROACH TO EXTEND THE BATTERY LIFE BY STATE OF HEALTH MANAGEMENT CONSIDERING THE CELL TEMPERATURE

#### ABSTRACT

Batteries, which have a wide range of uses from electric vehicles to smartphones and have become an indispensable part of our daily lives, are adversely affected by extreme temperature conditions, and their aging and capacity loss accelerate significantly. While the chemistry of the batteries deteriorates more quickly under stress at high temperatures, efficiency, and capacity loss are experienced at low temperatures. An improved battery management system (BMS) design is required to minimize the effect of temperature on the battery and to use the battery efficiently. The BMS to be designed must continuously monitor the ambient and cell temperature to protect against thermal extremes, take precautions before the problem occurs, or perform system control by considering these parameters. Therefore, a temperature-conscious management system improves safety and increases battery life and reliability in applications requiring high performance and endurance. The proposed study presents a BMS design in which temperature is used as a control input, and the charging rate is varied accordingly to extend battery life and improve safety. Proposed approach is based on analyzing how temperature changes and charging rates affect cell aging and capacity degradation and understanding the thermal effects on battery chemistry. The simulation study results show that the proposed BMS can provide

operational safety under high efficiency while significantly extending the battery life. Considering two situations that create chemical stress on the battery, the BMS aims to minimize the stress by reducing the C-Rate value in case of an increase in temperature. In this way, it has been shown that the total amount of energy obtained from the battery is significantly increased.

**Keywords:** Lithium batteries, Battery management systems, Renewable energy sources, Energy storage, Batteries.



## BATARYA-SÜPERKAPASİTÖR HİBRİT ENERJİ DEPOLAMA SİSTEMLERİNDE DC-DC DÖNÜŞTÜRÜCÜ TOPOLOJİLERİNİN KARŞILAŞTIRMALI ANALİZİ ÜZERİNE BİR BENZETİM ÇALIŞMASI

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### ÖZET

Bataryaları ve süper kapasitörleri birleştiren hibrit enerji depolama sistemlerinde DC-DC dönüştürücü topolojisi etkili enerji yönetimi için gerekli bir faktördür ve genel olarak pasif, yarı aktif ve aktif olarak sınıflandırılmaktadır. Pasif topolojiler basit ve güvenilir olmalarının yanı sıra, tipik olarak aktif kontrol bileşenleri olmadan doğrudan bağlantılar içermektedir ve sağlamlığın ve düşük karmaşıklığın kritik olduğu uygulamalar için kullanılmaktadır. Yarı aktif topoloji, tam aktif topoloji karmaşıklığı olmadan gelişmiş performans ve verimlilik için sınırlı kontroller içeren bir denge sağlamaktadır. Öte yandan aktif topolojiler, enerji akışını hassas bir şekilde yönetmek, değişen yük taleplerine uyum sağlamak ve hem bataryaların hem de süper kapasitörlerin performansını optimize etmek için gelişmiş elektronik kontrol sistemleri kullanarak en yüksek düzeyde kontrol ve verimlilik sunmaktadır, ancak daha karmaşıktır ve uygulanması genellikle daha yüksek maliyetli olmaktadır. Gerçekleştirilmiştir kapsamlı benzetim çalışması, bu topolojilerin değişen çalışma koşulları altında farklı şekillerde performans gösterdiğini ortaya koymaktadır. Yarı aktif ve aktif topolojilerin sistemin ihtiyaç duyduğu maksimum tepe akımını sağlamada etkili olduğu gösterilirken, pasif topoloji, büyük ölçüde süper kapasitörün doğal fiziksel sınırlamaları nedeniyle düşük performans göstermektedir. Aktif HEDS topolojisinde, iki farklı dönüştürücünün varlığı süperkapasitörden çekilen akımın daha uzun bir süre boyunca daha eşit bir şekilde dağıtılmasını sağlar. Bu dağılım, batarya üzerindeki baskıyı etkili bir şekilde azaltarak batarya ömrünü ve verimliliğini potansiyel olarak artırmaktadır. Ayrıca deşarj süresi bu sistemlerde kilit bir parametredir ve bataryanın aktivasyonu üzerinde doğrudan bir etkiye sahiptir. Benzetim sonuçlarında aktif topoloji 8,6 saniye ile en uzun deşarj süresini sağlamasına rağmen, yarı aktif topoloji 5,01 amper ile sisteme verilen maksimum akım açısından en başarılı topoloji olmuştur. Sonuçlar, her bir topoloji türünün kendine özgü avantajları ve ödünlere olduğunu ve bu sayede farklı koşullar altında çalışan hibrit enerji depolama uygulamaları için uygun olduğunu göstermektedir.

**Anahtar Kelimeler:** Lityum bataryalar, Batarya yönetim sistemleri, Yenilenebilir enerji kaynakları, Enerji depolama, Bataryalar.

### COMPARATIVE ANALYSIS OF DC-DC CONVERTER TOPOLOGIES IN BATTERY-SUPERCAPACITOR HYBRID ENERGY STORAGE SYSTEMS: A SIMULATION STUDY

#### ABSTRACT

The DC-DC converter topology is essential for effective energy management in hybrid energy storage systems that combine batteries and supercapacitors. It is broadly classified into passive, semi-active, and active. Passive topologies are simple and reliable, typically involving direct connections with no active control components, and are ideal for applications where robustness and low complexity are critical. Semi-active topology provides a trade-off, incorporating limited controls for improved performance and efficiency without the complexity of fully active. On the other hand, active topologies offer the highest level of control and efficiency, using sophisticated electronic control systems to precisely manage energy flow, adapt to varying load demands, and optimize the performance of both batteries and supercapacitors, but are more complex and typically more

expensive to implement. An extensive simulated study has been carried out, showing that these topologies perform in different ways. While the semi-active and active topologies are shown to be effective in providing the maximum peak current required by the system, the passive topology underperforms, mainly due to the inherent physical limitations of the supercapacitor. In the active HEDS topology, two different converters allow the current drawn from the supercapacitor to be distributed more evenly over a more extended period. This distribution effectively reduces the stress on the battery, potentially increasing battery life and efficiency. A key parameter in these systems is the discharge time, which is of vital importance as it directly impacts the activation of the battery. According to the simulation results, the semi-active topology was the most successful regarding the maximum current delivered to the system at 5.01 amps. However, the active topology provided the longest discharge time at 8.6 seconds. Results show that each type of topology has its advantages and compromises, making it suitable for hybrid energy storage applications operating under different conditions.

**Keywords:** Lithium batteries, Battery management systems, Renewable energy sources, Energy storage, Batteries.



## EXPLORING $\text{Li}_4\text{MSbO}_6$ AS A POTENTIAL CANDIDATE FOR NEXT-GENERATION Li-Ion BATTERIES: STRUCTURAL AND ELECTRICAL CHARACTERISTICS

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### ABSTRACT

Li rich material has garnered significant attention as a promising candidate for the next generation of high-capacity lithium-ion batteries due to its large storage capacity. In this study, we present a comprehensive investigation into the structural and electrical properties of  $\text{Li}_4\text{MSbO}_6$  oxide. The synthesis of  $\text{Li}_4\text{MSbO}_6$  was accomplished via a straightforward solid-phase method, followed by detailed characterization employing X-ray diffraction and dielectric measurements.

The X-ray diffraction analysis revealed the formation of a pure phase of  $\text{Li}_4\text{MSbO}_6$  with a monoclinic crystal structure, belonging to the space group  $C2/m$ . The lattice parameters were determined to be  $a=5.1706(5)$  Å,  $b=8.9382(5)$  Å, and  $c=5.1635(2)$  Å. To gain insights into its electrical behavior, we conducted temperature-dependent conductivity studies and analyzed the data using complex formalisms of dielectric permittivity and complex electrical modulus.

Our findings shed light on the evolution of permittivity, impedance, and complex modulus as functions of both frequency and temperature. Additionally, several key parameters, including activation energy, were extracted from our analysis. These results contribute to a deeper understanding of  $\text{Li}_4\text{MSbO}_6$ 's potential as an electrode material for advanced lithium-ion batteries, opening up new avenues for enhancing energy storage technologies.

**Keywords:** Structure, X-ray diffraction, Dielectric,  $\text{Li}_4\text{MSbO}_6$ .





## ADSORBENT MATERIALS BASED-SALT HYDRATE FOR THERMOCHEMICAL ENERGY STORAGE

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### ABSTRACT

In recent years, the building sector has been considered as the biggest consumer of energy. The increasing use of fossil fuels in this sector is leading to greenhouse gas emissions and worldwide climate change. It is therefore necessary to find alternative energy sources that are both economically viable and low lifecycle emissions. Solar energy has emerged as a more appealing technology, and has great potential for a range of applications. However, there is a significant gap between sustainable energy supply and energy demand which presents problems for its widespread adoption [1,2]. Hence, thermal energy storage (TES) is needed to bridge the gap between supply and demand. Among the three types of TES, thermochemical energy storage presents a promising approach. For thermochemical materials, salt hydrates have been extensively studied in recent years, and a series of important advances have been made, that it exhibits many advantageous such a high density, low cost, safety which make it a great potential for thermochemical energy storage, however some drawbacks such as corrosion can limit its performance. Hence, composite thermochemical materials (CTCMs) can resolve this issue [3]. Herein, this work focuses on adsorbent materials based-salt hydrate for thermochemical energy storage.

**Keywords:** TES, Adsorbent materials, Salt hydrates, TCM, CTCMs

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## THE COMPARISON OF THE LIFETIME ESTIMATION OF ELECTROCHEMICAL ENERGY STORAGE DEVICES USING STOCHASTIC DIFFERENTIAL EQUATIONS

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### ABSTRACT

In the present work, we estimated and compared the lifetimes of two energy storage devices called supercapacitors. A supercapacitor is a type of electrochemical energy storage device that has a high power density and specific capacitance. The reliability parameters of the supercapacitor, such as capacitance and equivalent series resistance, are considered for its lifetime estimation. Initially, the equivalent series resistance was observed, and based on the observation, we fitted and stimulated a stochastic differential equation model. The time to failure was calculated as the time for the resistance value to reach the optimal percentage of the initial value. The time to failure helps determine how long a device will operate before it fails. The paper describes the method of reliability estimation, stochastic model simulation procedure, and estimation of lifetime estimation.

**Keywords:** Supercapacitor, equivalent series resistance, stochastic differential equations, reliability, capacitance



## ELAZIĞ İLİNİN BİTKİSEL BİYOKÜTLE POTANSİYELİ

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### ÖZET

Dünya nüfusunun artışına paralel olarak enerji arzı da artmaktadır. Üstelik gelişen teknolojilerle birlikte kişisel enerji arzında da artış yaşanmaktadır. Mevcut enerji kaynakları bu arzı karşılayamadığı gibi bugün hala en birincil enerji kaynağımız olan fosil yakıtların birkaç yüzyıl içerisinde tükeneceği tahmin edilmektedir. Daha da önemlisi fosil yakıtların verdiği zararlarla dünya geri dönüşü olmayan bir iklim krizine girmiştir. Fosil yakıtlar hızla tükenirken verdiği zararlarda göz önüne alınca alternatif enerji kaynaklarının önemi daha net görülmektedir.

Alternatif enerji kaynakları içinde doğaya zarar vermemesi, ulaşılabilirliği, yenilenebilirliği, sürdürülebilirliği ile yenilenebilir enerji kaynakları ön plan çıkmaktadır. Günümüz enerji sistemlerinin büyük çoğunluğu hala fosil yakıtlar kullanılmaktadır. Var olan sistemlerin dönüşümü, dönüşemiyorsa yeniden kurulumunun belirli bir zaman gerektireceği ve elbette ki yeterli teşviklerle mümkün olabileceği açıktır. Bu sistemsel geçişe öncülük edebilecek, kaynak veri oluşturabilecek çalışmaların varlığı bu sebeplerle çok önemlidir.

Yenilenebilir enerji kaynaklarından biri olan biyokütle enerjisi, canlı ya da ölü bütün organik canlılardan elde edilmektedir. Bereketli toprakları, güneşli gün sayısının fazlalığı ve zengin su kaynakları ile Türkiye bir tarım ülkesidir. Biyokütle enerjisi bakımından da oldukça zengindir. Bu çalışmada Türkiye'nin Doğu Anadolu bölgesinde yer alan Elazığ ilinin bitkisel biyokütle potansiyeli incelenmiştir. Çalışmada Elazığ da hasat edilmiş baklagiller, yumru bitkiler, yağlı tohumlar, endüstriyel bitkiler ve yem bitkileri kullanılmıştır. Veriler 2021 yılına ait olup TÜİK' den elde edilmiştir. Bahsi geçen ürünlerin hasadı toplamda 1360160 dekarlık bir alanda yapılmıştır. Alınan veriler işlenerek enerji değerleri hesaplanmıştır. 85195,2 TEP değeri ile tahıllar, ilin en yüksek bitkisel biyokütle potansiyeline sahiptir. Daha sonra sırasıyla endüstriyel bitkiler, yumru bitkiler, baklagiller, yem bitkileri ve yağlı tohumlar gelmektedir. Elazığ ilinin toplamda bitkisel biyokütle potansiyeli ise  $0,2 \cdot 10^7$  MWh'dir.

**Anahtar kelimeler:** Yenilenebilir enerji kaynakları, Biyokütle enerjisi, Bitkisel biyokütle potansiyeli, Türkiye-Elazığ

## PLANT BIOMASS POTENTIAL OF ELAZIĞ PROVINCE

### ABSTRACT

In parallel with the increase in the world population, energy supply is also increasing. Moreover, there is an increase in personal energy supply with developing technologies. Existing energy resources cannot meet this supply and fossil fuels, which are still our primary source of energy today, are estimated to run out within a few centuries. More importantly, the damage caused by fossil fuels has caused an irreversible climate crisis. The importance of alternative energy sources can be seen more clearly when the damages caused by the rapid depletion of fossil fuels are taken into account.

Among alternative energy sources, renewable energy sources come to the forefront with their accessibility, renewability and sustainability. The vast majority of today's energy systems still use fossil fuels. It is clear that the transformation of existing systems, or if not, their re-installation, will require a certain amount of time and can only be possible with adequate incentives. The existence of studies that can pioneer this systemic transition and create source data is very important for these reasons.

Biomass energy, one of the renewable energy sources, is obtained from all organic organisms, living or dead. Turkey is an agricultural country with its fertile soils, high number of sunny days and rich water resources. It

is also rich in biomass energy. In this study, the plant biomass potential of Elazığ province located in the Eastern Anatolia region of Turkey was investigated. Legumes, tuber crops, oilseeds, industrial plants and forage crops harvested in Elazığ were used in the study. The data belongs to 2021 and was obtained from TUIK. These crops were harvested in a total area of 1360160 decares. Energy values were calculated by processing the received data. With 85195.2 TOE, cereals have the highest plant biomass potential in the province. Industrial crops, tuber crops, legumes, fodder crops and oilseeds follow respectively. The total plant biomass potential of Elazığ province is  $0.2 \cdot 10^7$  MWh.

**Keywords;** Renewable energy, biomass energy, plant biomass potential, Türkiye-Elazığ



## MODELING COMBUSTION OF BIOMASS TEA WASTE IN A VERTICAL FURNACE UNDER DIFFERENT EXCESS AIR RATIOS: A CFD ANALYSIS

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### ABSTRACT

This study presents the numerical analysis of biomass tea waste (BTW) combustion in a vertical furnace under various excess air ratios, using Computational Fluid Dynamics (CFD). The biomass tea waste fuel was injected at the bottom of the furnace. The primary and secondary air inlets in different cross-section areas were also located at the bottom of the furnace in which the coaxial of the injected fuel. The fuel was defined by employing the proximate and ultimate analyses. The numerical studies were carried out for four excess air ratios (1.2 to 2.1 with 0.3 increment) to determine its effect on the combustion temperature and NO<sub>x</sub> formation. The combustion simulation is based on the Species Transport model with Eddy-Dissipation turbulence-chemistry interaction model approach. The RNG  $k-\epsilon$  model and discrete phase model (DPM) to predict the follow motion, P1 radiation model for flame radiation, and NO<sub>x</sub> models were employed in the current study. Results show that the increase in excess air ratio leads to an increase in the peak temperature value in the flame zones while it decreases the furnace outlet temperature due to its cooling effect inside the furnace. The NO<sub>x</sub> formation rises with the increasing excess air ratio, and its concentration reaches 250 ppm at the furnace outlet.

**Keywords:** Biomass, tea waste, combustion, CFD, NO<sub>x</sub> emission



## GÜL POSASI VE TAVUK GÜBRESİNİN TOREFİKASYON PARAMETRELERİNİN ARAŞTIRILMASI

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### ÖZET

Nüfus arttıkça enerji ihtiyacı da artmaktadır. 2040 yılında dünyanın enerji talebinin bugüne kıyasla %56 oranında artacağı tahmin edilmektedir. Geçmişten günümüze enerji ihtiyacının karşılanmasında en yaygın araç olan fosil yakıtlar hayatımızın ayrılmaz bir parçası haline gelmiştir. Ancak fosil yakıtların sera gazı yayması, canlılara ve genel çevreye zararlı olması, ayrıca yenilenemez olması nedeniyle alternatif enerji kaynakları olan yenilenebilir enerji kaynaklarına yönelim artmaya başlamıştır. Biyokütle, dünyadaki önemli yenilenebilir enerji kaynaklarından biridir ve çeşitli işlemlerden geçirilerek yakıtla dönüştürülebilmektedir. Hayvansal atıklar ve bitki posaları yakıt üretmek için en yaygın kullanılan biyokütlelerdir. Ancak, biyokütlenin düşük enerji yoğunluğu ve ham halindeki yüksek hacimli yapısı nedeniyle fiziksel veya kimyasal olarak dönüştürülmesi gerekir. Torefikasyon, biyokütlenin oksijensiz ortamda belirli sürelerde 200 ila 300 °C arasında ısıtılarak kimyasal özelliklerini değiştiren termokimyasal işlemlerden biridir. Bu çalışmada, Isparta ili ve çevresinde çok miktarda bulunması nedeniyle tavuk gübresi ve gül posası biyokütle olarak seçilmiştir. Çalışmada, tavuk gübresi ve gül posası örneklerinin torefikasyon performansı üzerinde torefikasyon parametrelerinin etkisi araştırılmıştır. Bu amaçla, üç sıcaklık (250, 275 ve 300 °C) ve üç bekletme süresi (30, 60 ve 90 dakika) araştırılmıştır. Sıcaklık ve bekletme süresinin seçilen biyokütlelerin torefikasyon seviyesi üzerinde etkili olduğu bulunmuştur. Gül posası ve tavuk gübresinin sabit karbon içeriği ham hallerine kıyasla sırasıyla %61 ve %100 oranında artmıştır.

**Anahtar Kelimeler:** Bıyoçar, Biyokütle, Gül posası, Tavuk gübresi, Torefikasyon

## INVESTIGATION OF TOREFICATION PARAMETERS OF ROSE PULP AND CHICKEN MANURE

### ABSTRACT

As the population increases, the need for energy also increases. In 2040, it is estimated that the world's energy demand will increase by 56% compared to today. From the past to the present, fossil fuels, the most common means of meeting energy needs, have become an integral part of our lives. However, since fossil fuels emit greenhouse gases and are harmful to living things and the general environment, and also because they are non-renewable, the tendency towards renewable energy sources, which are alternative energy sources, has started to increase. Biomass is one of the important renewable energy sources in the world and can be converted through various processes into fuel. Animal wastes and plant pulps are the most commonly used biomasses to produce fuel. However, biomass needs to be physically or chemically converted due to its low energy density and bulky nature in its raw form. Torrefaction is one of the thermochemical processes that change the chemical properties of biomass in an oxygen-free environment by mildly heating it between 200 and 300°C for certain periods of time. In this study, chicken manure and rose pulp were selected as the biomass due to their



occurrence in large quantities in and around Isparta Province. In the study, the effect of the torrefaction parameters on the torrefaction performance of the chicken manure and rose pulp samples was investigated. For this purpose, three temperatures (250, 275, and 300°C) and three holding times (30, 60, and 90 min) were investigated. The temperature and the holding time were found to be effective on the torrefaction degree of the selected biomasses. The fixed carbon content of the rose pulp and chicken manure was increased by 61% and 100% as compared to their raw form, respectively.

**Keywords:** Biochar, Biomass, Chicken manure, Rose pulp, Torrefaction



## SOLVOTERMAL YÖNTEMLE KARBON KUANTUM NOKTALARININ SENTEZİ VE DİMETİLAMİN BORANDAKİ HİDROLİZİNDEN HİDROJEN ÜRETİMİ

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### ÖZET

Bu çalışmada solvotermal sentez yöntemi kullanılarak şekil ve boyut kontrollü Ni bazlı katalizör sentezlenmiştir. Bilindiği üzere solvotermal sentez yönteminde su yerine farklı organik çözücüler kullanılarak malzemenin sentezi yapılmaktadır. Burada öncelikle üreden solvotermal yöntemle karbon kuantum noktaları (KKN) elde edildi. Daha sonra, Ni metali elde edilen (KKN) üzerine farklı yükleme koşulları ile en etkili yükleme metodu belirlendi. Çalışmanın bir sonraki aşamasında ise, hidrojen üretiminde stabiliteyi sağlamak amacıyla optimum sodyum hidroksit konsantrasyonu belirlendi. Burada farklı sodyum hidroksit konsantrasyonunun dimetilamin boranın hidrolizi (DMAB) ile hidrojen üretimi üzerinde ne kadar etkin ve önemli olduğu belirlenmiştir.

**Anahtar Kelimeler:** Karbon Kuantum Noktaları, Ni katalizör, Hidrojen, Dimetil aminboran

## SYNTHESIS OF CARBON QUANTUM DOTS BY SOLVOTHERMAL METHOD AND HYDROGEN PRODUCTION FROM THE HYDROLYSIS OF DIMETHYLAMINE BORANE

### ABSTRACT

In this study, shape and size-controlled Ni-based catalysts were synthesized using the solvothermal synthesis method. As known, in the solvothermal synthesis method, different organic solvents are used instead of water to synthesize the material. Here, carbon quantum dots (CQDs) were first obtained through the solvothermal method using urea. Subsequently, the most effective loading method with different loading conditions onto the obtained Ni metal (CQDs) was determined. In the next stage of the study, the optimum sodium hydroxide concentration was determined to ensure stability in hydrogen production. It was investigated how different concentrations of sodium hydroxide affect the hydrogen production through the hydrolysis of dimethylamine borane (DMAB) and how effective and crucial they are in this process.

**Keywords:** Carbon Quantum Dots, Ni Catalyst, Hydrogen, Dimethylamineborane



## YEŞİL SENTEZ YOLUYLA ELDE EDİLEN Nİ NANOKATALİZÖRÜN DİMETİLAMİN BORANDAKİ HİDROLİZİ ve KİNETİK MEKANİZMASI

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### ÖZET

Bu çalışmada yeşil sentez yöntemi kullanılarak çevre dostu, kullanışlı ekonomik ve etkili Ni katalizörü sentezlendi. Elde edilen Ni katalizörü dimetilamin borandaki (DMAB) hidrolizi üzerine etkisi incelendi. DMAB çük yüksek hidrojen depolama kapasitesine sahip olup (% 16.9) hidrojen depolama için çok iyi bir aday olduğu görülmüştür. Bu çalışmada üreden solvotermal yöntemle elde edilen karbon kuantum noktalarına Ni metali doplanıp Ni(0) nanokatalizörü elde edilerek DMAB hidrolizine etkisi incelendi. Ni(0) nanokatalizörünü kinetik mekanizmasını belirlemek için farklı sıcaklıklarda DMAB hidrolizi yapılarak aktivasyon enerjisi, reaksiyon derecesi ve entalpisi belirlendi. reaksiyon derecesinin sıfırcı (0) dereceden ilerlediği aktivasyon enerjisinin 50.8 kJ/mol, entalpisinde 48.2 kJ/mol olduğu belirlendi.

**Anahtar Kelimeler:** Yeşil sentez, Ni nanokatalizör, Hidrojen, Dimetil aminboran, Solvotermal

## HYDROLYSIS AND KINETIC MECHANISM OF DIMETHYLAMINE BORANE USING NI NANOCATALYST OBTAINED VIA GREEN SYNTHESIS

### ABSTRACT

In this study, an environmentally friendly, practical, economical, and effective Ni catalyst was synthesized using a green synthesis method. The obtained Ni catalyst's impact on the hydrolysis of dimethylamine borane (DMAB) was investigated. DMAB was found to have a relatively high hydrogen storage capacity (16.9%), making it a promising candidate for hydrogen storage. In this research, carbon quantum dots obtained from urea using the solvothermal method were doped with Ni metal to obtain Ni(0) nano catalyst, and its effect on DMAB hydrolysis was examined. To determine the kinetic mechanism of Ni(0) nanocatalyst, DMAB hydrolysis was carried out at different temperatures, and the activation energy, reaction order, and enthalpy were determined. It was found that the reaction follows zeroth-order kinetics, with an activation energy of 50.8 kJ/mol and an enthalpy of 48.2 kJ/mol.

**Keywords:** Green Synthesis, Ni Nano catalyst, Hydrogen, Dimethylamine borane, Solvothermal



## ÇEŞİTLİ YAKIT HÜCRELERİ için TEST İSTASYONU TASARIMI ve İMALATI

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### ÖZET

Dünyanın enerji ihtiyacının büyük kısmının fosil kaynaklı yakıtlardan karşılanması ve bu kaynakların rezervlerinin yetersiz olması insanlığı sürdürülebilir, alternatif ve daha temiz enerji kaynaklarını araştırmaya yöneltmiştir. Alternatif elektrik enerjisi üretim teknolojilerinden bir tanesi de hidrojeni ana yakıt olarak kullanan yakıt pilleridir. Yakıt pilleri; yakıtın kimyasal enerjisini doğrudan elektrik enerjisine dönüştüren, yüksek verimlilik ve düşük olumsuz çevresel etki gibi özellikleri olan elektrik enerjisi üretim teknolojilerinden biridir.

Bu bildiriye; katı oksit yakıt pili (SOFC) geliştirme ve araştırmalarında kullanmak için tasarlanmış bir test istasyonunun, birden fazla yakıt pili çeşidini test edebilecek şekilde geliştirilmesi üzerine bir çalışma sunulmuştur. Farklı yakıt pili çeşitlerinin farklı çalışma sıcaklıklarında, nem değerlerinde, gaz basıncı ve fiziksel baskı kuvvetlerinde çalışmaları nedeniyle bu parametrelerin değiştirilebilir ve aynı zamanda ölçülebilir olması önemlidir. Bu bakış açısı doğrultusunda ve özellikle araştırmacı ve kullanıcıların bu husustaki ihtiyaçları dikkate alınarak gerekli teknik ihtiyaçlar ve özellikler belirlenmiştir. Ayrıca mevcutta bulunan ürünler de incelenmiş ve bu çalışma kapsamında geliştirilen prototipin üstünlükleri ve farkları ortaya konmuştur. Bir test istasyonu için temel özelliklerin dışında gerekli olan özellikler olarak farklı sıcaklıklarda çalışma, hassas sıcaklık kontrolü ve soğutma özelliği olan kabin, yük basınç sabitlemesi, ısı geri kazanım özelliği, sızdırmazlık testi için hassas basınç sensörlerinin entegrasyonu vb. sayılabilir. Belirlenen teknik ihtiyaçlara göre test istasyonunda gerekli değişim ve geliştirmeler yapılarak maksimum 100 W gücündeki yakıt pili tek hücre veya yığınlarını ölçebilecek şekilde bir prototip elde edilmiştir. Bu prototipte hava pompası, debimetre, sensörler, ısı değiştiricisi, yüksek sıcaklık fırını, yalıtım malzemeleri, elektronik panosu, fırın sıcaklık kontrolörü, DC elektronik yük birimi, dokunmatik kontrol paneli gibi birimler bulunmaktadır.

Ayrıca bu test istasyonunda, FC 50 model bir proton değişim membran (PEM) tipi yakıt pili kullanılarak test gerçekleştirilmiş ve DC elektronik yük birimi aracılığı ile yakıt pilinin akım, gerilim gibi elektriksel parametreleri başarılı bir şekilde ölçülmüştür. Böylece hassas ve tekrarlanabilir testlerin yapılmasına imkan sağlayan bir hidrojen yakıt pili test istasyonu ortaya çıkmıştır.

**Anahtar Kelimeler:** Yakıt pilleri, SOFC, PEMFC, test sistemi tasarımı, alternatif enerji.

### DESIGN and FABRICATION of a TEST STATION for VARIOUS FUEL CELLS

#### ABSTRACT

The fact that most of the world's energy needs are met by fossil fuels and the reserves of these resources are insufficient have led humanity to search for sustainable, alternative, and cleaner energy sources. One of the alternative electrical energy generation technologies is fuel cells that use hydrogen as the main fuel. Fuel cells are one of the electrical energy generation technologies that directly convert the chemical energy of the fuel into electrical energy and have features such as high efficiency and low negative environmental impact.

In this paper, a study is presented on the development of a test station designed for use in solid oxide fuel cell (SOFC) development and research that can test more than one fuel cell type. Since different types of fuel cells operate at different operating temperatures, humidity values, gas pressure, and physical pressure forces, it is

important that these parameters can be changed and measured at the same time. In line with this perspective and especially taking into account the needs of researchers and users in this regard, the necessary technical needs and features were determined. In addition, existing products were examined, and the advantages and differences of the prototype developed within the scope of this study were revealed. Apart from the basic features for a test station, the features required for a test station include working at different temperatures, a cabin with precise temperature control and cooling features, load pressure stabilization, heat recovery features, the integration of sensitive pressure sensors for leakage testing, etc. By making the necessary changes and improvements in the test station according to the determined technical needs, a prototype was obtained that can measure fuel cell single cells or stacks with a maximum power of 100 W. This prototype includes units such as an air pump, flowmeter, sensors, heat exchanger, high-temperature furnace, insulation materials, electronic panel, furnace temperature controller, a DC electronic load unit, and a touch control panel.

In addition, at this test station, the test was carried out using an FC 50 model proton exchange membrane (PEM) type fuel cell, and the electrical parameters of the fuel cell, such as current and voltage, were successfully measured via the DC electronic load unit. Thus, a hydrogen fuel cell test station that allows sensitive and repeatable tests has emerged.

**Keywords:** Fuel cells, SOFC, PEMFC, test system design, alternative energy.



## DFT-BASED FIRST-PRINCIPLES CALCULATIONS OF NEW $KXH_3$ ( $X = Mn, Fe$ ) HYDRIDE COMPOUNDS FOR HYDROGEN STORAGE APPLICATIONS

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### ABSTRACT

Hydrogen energy is currently gaining significant attention as a key player in the global low-carbon transition. Unfortunately, hydrogen storage remains a critical barrier to its widespread adoption as a mainstream energy carrier. Thus, material discovery and modeling for solid-state hydrogen storage are needed for shaping a sustainable and greener world. Here, density functional theory (DFT) was employed to perform an ab-initio study of novel  $KXH_3$  ( $X = Mn, Fe$ ) solid-state storage compounds using the Generalized Gradient Approximation (GGA) with CASTEP package. The structural, electronic, elastic, optical and hydrogen storage properties of  $KMnH_3$  and  $KFeH_3$  chemical phases were calculated within the cubic-perovskite structure. Formation energies ( $\Delta H_f$ ) predict the thermodynamiques stability of investigated hydrides. Elastic constants of both compounds meet Born's stability criteria, reflecting their mechanical stability. In addition, both compounds were found elastically anisotropic and brittle. The electronic band structures for  $KXH_3$  single perovskites turn out metallic behavior. The gravimetric hydrogen storage capacity for  $KMnH_3$  and  $KFeH_3$  are found  $\approx 3.021$  and  $2.994$  wt%, respectively. Overall,  $KXH_3$  ( $X = Mn, Fe$ ) perovskite hydrides hold great potential as new hydrogen storage materials.

**Keywords:** DFT, Perovskite hydrides, Hydrogen storage, Elastic constants, Optical properties



## PRODUCTION OF GREEN HYDROGEN BY LOW-TEMPERATURE ELECTROLYSIS

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### ABSTRACT

Hydrogen is the most common element on earth, but it is chemically bound in water, hydrocarbons, carbohydrates and other substances. To separate hydrogen, you need to invest energy. There are several methods for producing hydrogen, such as steam conversion of natural gas, production from biomass, high-temperature decomposition of water and electrolysis.

The production of green hydrogen by low-temperature electrolysis makes it possible to obtain hydrogen up to 80% of energy consumption. During its decomposition, the resulting products, in addition to hydrogen, are oxygen and water vapor. The received energy will be generated at the expense of a power plant, the principle of operation of which is based on the use of alternative energy sources (water, wind, sun). It is recommended to install a hydrogen production plant on the shore of the Caspian Sea to reduce transportation costs and to increase production efficiency.

Electrolyzer installations are commercially available. The limit of the net efficiency of low-temperature electrolysis systems producing hydrogen at pipeline pressures is ~ 99%. With this method of hydrogen production, the cost will be three times lower than when using conventional methods of hydrogen production.

**Keywords:** Alternative energy, green hydrogen, electrolyzer, technological complex, sea, station, efficiency, economy, consumption.





## POTENTIAL BENEFITS AND DRAWBACKS OF WASTE-TO-ENERGY CONVERSION: A REFLECTION ON THE ENVIRONMENTAL IMPACT, ECONOMIC VIABILITY AND SOCIAL IMPLICATIONS

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### ABSTRACT

The world is facing numerous environmental challenges, including the increasing amount of waste generated. Waste management has become a critical issue, and finding sustainable solutions is imperative. One promising approach is the conversion of waste into energy, which has not only addressed the issues of waste management but also contribute to the production of clean, renewable and sustainable energy. This paper provides a detailed survey on the potential benefits and drawbacks of waste-to-energy conversion, focusing on its environmental impact, economic viability, and social implications. While improper waste disposal can result in land pollution, water, and air, causing severe harm to ecosystems and human health, it has been observed that waste conversion into energy offers a renewable and sustainable energy source. Traditional energy sources such as fossil fuels, are finite and contribute to greenhouse gas emissions, whereas, waste-to-energy technologies have the potential to generate electricity and heat. This energy can be utilized for various purposes, including powering homes, industries, and transportation systems. Waste conversion into energy can also contribute to economic growth and societal development. Therefore, it can reduce the reliance on non-renewable resources and decrease carbon emissions, thus combating climate change. In other words, findings from this survey also revealed that the conversion of waste into energy can significantly reduce the amount of waste sent to landfills and incinerators, thereby mitigating environmental pollution. Tapping into the energy potential of waste can diversify the energy mix and minimize dependence on fossil fuels. Although development and implementation of waste-to-energy projects require investments in infrastructure, technology, and skilled labour, it can stimulate economic activities and create employment opportunities in the renewable energy sector. However, one key concern is the proper management of emissions and by-products. While waste-to-energy technologies have significantly improved in recent years, there is need for stringent regulations and monitoring to ensure that emissions are within acceptable limits and any by-products are safely handled. Hence, careful planning, regulation, and monitoring are necessary to ensure the safe and efficient implementation of these technologies.

**Keywords:** Waste-To-Energy, Environment, Pollution, Economic viability, Waste management.



## EFFECTS OF GREEN BUILDING AND ENERGY SAVING ON HOUSING MARKET VALORIZATION

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### ABSTRACT

Real estate valuation is an issue of particular concern. It depends on many factors such as economic social and physical factors. The energy is one of the important factor, which affects the real estate value. In property appraisal, the energy can be considered as a price-setting factor in market price of real estate. Then, it is so difficult for real estate appraiser to determine why property price differ and how much this difference can be attributed to particular distinguishing features such as energy saving and energy consumption.

Many studies have examined the effects of green building and houses energy certification on real estate values in scientific way. However, a systemic approach is not applied taking into account technical, legal and environmental aspects of energy saving as factor of real estate value despite it great role in housing value determination. This paper seeks to fill that void by examining the effects of green building and energy saving on property values: design, construction and monitoring .... It presents many aspects related to interior environmental quality as value factor of real estate, it can be used to assess the market price and determine the influence of green building factor may have on the property final market value.

**Key words:** Energy, Green building, interior environmental quality, real estate valuation, value's factors, appraiser, property price.



## OPTIMIZATION OF THE COAGULATION-FLOCCULATION PROCESS FOR THE TREATMENT OF WASTEWATER FROM VEGETABLE OIL REFINERIES

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### ABSTRACT

Industrial wastewater has a considerable environmental impact on the environment. Wastewater from vegetable oil refineries poses significant challenges to treatment techniques due to its characteristic fluctuations. The present work aims to treat vegetable oil refinery wastewater by coagulation flocculation treatment using ferric chloride as coagulant and a cationic polymer as flocculant. Furthermore, the optimal conditions leading to efficient coagulation flocculation were obtained by varying the dosage of coagulant, flocculant and pH of the aqueous solution and by using jar test experiments. Under optimal conditions using 0.8 g L<sup>-1</sup> FeCl<sub>3</sub> and 1 mL L<sup>-1</sup> cationic polymer at pH = 6, the removal efficiencies of turbidity, COD and polyphenol are 97%, 81% and 86%, respectively. Therefore, it can be concluded that the method of treatment by coagulation flocculation is simple, very affordable and effective and can be used in small and medium enterprises to reduce the impact of pollution at the source.

**Keywords:** refinery wastewater, coagulation flocculation, removal of pollution.



## APPLICATION OF A COPOLYMER TO WATER TREATMENT

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### ABSTRACT

Water is an essential resource for every creature on earth [1]. For this reason, we thought about treating turbid water using the coagulation/flocculation as a treatment process [2]. In this study we synthesized a poly (AM-co-4VP-co-BISAM) copolymer based on acrylamide (AM), 4-vinylpyridine (4VP) and bis-acrylamide (BISAM). Adiabatic polymerization was carried out in an adiabatic reactor called Dewar in the aim to obtain a copolymer with a high macromolecular mass [3]. This low-cost copolymer is water-soluble, so it can be used as a good flocculant in the coagulation/flocculation. It is characterized by various techniques: FTIR spectrometry to identify the functional groups present in our product, UV visible spectrophotometry to determine the monomers ratio in the prepared copolymers using the Beer-Lambert law [4]. Characterization of the clay material (bentonite) is carried out by X-ray diffraction (XRD) to determine the bentonite interfoliar distance using Bragg's law before and after flocculation, and X-ray fluorescence (XRF) to quantify the elemental composition of the bentonite. Finally, we tested our flocculant in jar-test with the coagulation/flocculation technique. Parameters were optimized and different flocculant concentrations were tested at different settling times. A good flocculant behavior could be clearly observed by the reaching up to 86% removal of bentonite turbidity.

**Key words:** Copolymer; flocculant; bentonite; turbidity; coagulation/flocculation.

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## ECOLOGICAL RISK ASSESSMENTS OF POTENTIALLY TOXIC ELEMENTS IN SOILS AROUND LAPITE DUMP SITE, AKINYELE LOCAL GOVERNMENT AREA, IBADAN

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### ABSTRACT

The contamination and ecological risk posed by Potentially Toxic Elements (PTEs) on soils around Lapite dumpsite and its environs were assessed using different analytical techniques. Soil samples analyzed by Buck Scientific Atomic Absorption Spectrometer showed that the mean concentration of chromium (Cr), cadmium (Cd), and lead (Pb) (153.2mg/kg, 13.83mg/kg, 137.2mg/kg and respectively) have higher concentrations than their crustal abundance (CA). The enrichment factor analysis revealed that most of the soils collected have been enriched with Pb showing the most enrichment at the upper and middle slopes while Cd is the most enriched at the downslope. The contamination showed that Cr, Pb and Cd are also the elements showing significant contamination with Cr and Pb moderately contaminating soil (1.54 and 1.62 respectively) and Cd showing very high contamination in the soil (17.3). The ecological risk indices revealed that only Cd have high risk of polluting the soils (519) of the study area while the whole area is considered to be at a high risk of various degrees of pollution (534). Considering the health implications of these concerned elements (Cr, Pb and especially Cd) to the body, the habitants of the study area are advised to move away from these dumpsite and also relocate their farmlands to more environmental friendly sites.

**Keywords:** Potentially toxic elements, enrichment, contamination, pollution



## SEASONAL EFFECTS ON THE EFFICIENCY OF A NEW HYBRID MULTI-SOIL-LAYERING ECO-FRIENDLY TECHNOLOGY FOR REMOVING POLLUTANTS FROM DOMESTIC WASTEWATER UNDER AN ARID CLIMATE

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### ABSTRACT

The goal of this research is to assess and track the efficacy of hybrid multi-soil-layering (MSL) plant in treating domestic wastewater. The investigated wastewater treatment plant is composed of a solar septic tank followed by a vertical flow (VF-MSL) unit in series with a subsurface horizontal flow (HF-MSL) unit. The two-stage MSL units made up of permeable layers (PL) and soil-based layers (SBL). The PLs mostly consisted of gravel or zeolite, and the SBL composition contained soil, sawdust, charcoal, and iron metal which are arranged in brick-like patterns, although they are operated under an HLR of 250 L/m<sup>2</sup>day<sup>-1</sup>. The MSL system has the capacity to disinfect domestic wastewater due to the implication of different mechanisms, including filtration, precipitation, and biodegradation. The process effects are related to several factors, including climate variations. The novelty of the current study is to examine the effectiveness of a full-scale new hybrid multi-soil-layering (MSL) that, for the first time, combines a (VF-MSL) and a (HSSF-MSL) to treat domestic wastewater in urban areas with an arid climate. It is distinguished by being a low-cost and environmentally friendly technology that requires only a small area and has no energy requirements, as well as the ability to withstand the negative effects of odor and insects. Additionally, this hybrid MSL system is easier to manage and maintain compared with other treatment systems. The VF-MSL combined with the HSSF-MSL system resulted in significant removal of pollution significant reduction ( $p < 0.05$ ). Principal Component analysis (PCA) was done on the positive correlation between COD, NH<sub>4</sub><sup>+</sup>, TP removal, and summer seasons. Nonetheless, the winter season significantly influenced TN removal in the MSL system.

**Keywords:** Hybrid MSL, Efficiency, Domestic wastewater, Seasonal effects, arid climate





## DEFECTIVE PHOTONIC COMB-LIKE WAVEGUIDES STRUCTURE USING TRANSFER MATRIX METHOD

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### ABSTRACT

In this paper, using the transfer matrix method (TMM), we study theoretically and numerically the propagation of electromagnetic waves in one-dimensional photonic comb-like waveguides (CWGs) structure, composed by the periodicity of a segment and grafted in each site by one resonator. Numerical results show that this perfect structure presents passbands separated by large photonic bandgaps (the propagation of electromagnetic waves is forbidden) in the transmission spectrum and the band structure. We study the insertion of defects in the segment and resonator at the center of the perfect structure, these defects create localized states (defects modes) in the band gaps, these states are very sensitive to the length and permittivity of defects. The localized defects modes appear as very narrow peaks (high-quality factors) in the transmission spectrum of finite comb-like waveguides. This defective structure could be used for electromagnetic filtering.

**Keywords:** Defects modes, Comb-like Waveguides, Transfer Matrix.



## ANALYSIS OF PERIODIC CYLINDRICAL WAVEGUIDES FOR PHOTONIC FILTERING APPLICATIONS USING THE TRANSFER MATRIX METHOD

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### ABSTRACT

This paper presents a theoretical study of guided electromagnetic wave propagation in a perfect system consisting of two cylindrical waveguides periodically filled with dielectric materials. The goal of the system is to manipulate and control the propagation of electromagnetic waves, where the frequency of the modes must exceed the cutoff frequency of the transverse electric or magnetic modes for efficient propagation in the cylindrical waveguides. The dispersion relation and transmission rate of the perfect system are calculated using the transfer matrix method (TMM). The perfect system allows for the appearance of pass bands and band gaps for the TE<sub>z</sub> and TM<sub>z</sub> propagation modes in the transmission rate and band structure. The results of this research show that the pass bands and band gaps shift to lower frequencies as the radius of the cylindrical waveguides increases. The research also shows that the results are sensitive to various geometric and physical parameters of the system. The proposed system could be used as a filter to modulate electromagnetic modes at different frequencies, especially in microwave circuits and telecommunication systems. Furthermore, these results could be applied in the design of new devices for wireless communication and sensor networks, improving the selectivity and signal processing capability in antennas and filter circuits. Finally, this study can serve as a basis for further research to explore the effects of more complex structures on electromagnetic wave propagation, which could have important implications for understanding electromagnetic wave propagation in periodic cylindrical structures in general.

**Keywords:** Cylindrical Waveguides, Periodic Structure, Electromagnetic Band Gaps, Microwave Engineering, Transfer Matrix Method.



## COMPUTATIONAL STUDY OF STRUCTURAL, MAGNETIC, ELECTRONIC, OPTICAL, AND THERMOELECTRIC PROPERTIES OF QUATERNARY FULL-HEUSLER ALLOY FeCuMnSi

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### ABSTRACT

In the present study, we explore the structural, magnetic, electronic, optical, and thermoelectric properties of Quaternary FeCuMnSi Full-Heusler alloy through the implementation of density functional theory (DFT) within Wien2k software. The exchange-correlation potential was carried out using both GGA-PBE approach and the modified Becke-Johnson (mBJ) semi-local exchange potential. The band structure calculations indicate that this compound exhibits half-metallic behavior. The energy loss of electrons, absorption coefficient, real and imaginary dielectric tensors, real and imaginary optical conductivity have been calculated and analyzed. Furthermore, the electrical conductivity, Seebeck coefficient, electronic and lattice thermal conductivity were also conducted to evaluate thermoelectric properties of FeMnCuSi.



## HETEROSTRUCTURES OF SEMI CONDUCTRICES

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## **ABSTRACT**

Herein, the structural, electronic, and optical properties of  $(\text{BeSe})_m/(\text{ZnSe})_n$  ( $m$ - $n$ : 1-1, 2-2 and 3-1) superlattices (SLs) are explored by density functional theory (DFT) based on the full potential linearized augmented plane wave method (FP-LAPW) as implemented in the Wien2K package. We have adopted the generalized gradient approximation (GGA) in the scheme of Perdew-Burke-Ernzerhof (PBE), and the Tran and Blaha's modified Beckee Johnson (TB-mBJ). The stability of  $(\text{BeSe})_m/(\text{ZnSe})_n$  SLs were verified by the formation and cohesive energies. The band structure and density of states analysis predicted the semiconductor nature of the mentioned SLs. Moreover, the potential optical properties such as real and imaginary parts of the dielectric function, reflectivity, extinction coefficient, and optical conductivity were calculated up to 13eV, and for refractive index, and absorption coefficient were calculated in the range 100–1000 nm of photon wavelength. The optical parameters exhibit that the  $(\text{BeSe})_m/(\text{ZnSe})_n$  SLs are active in ultraviolet region. The obtained results suggest the  $(\text{BeSe})_m/(\text{ZnSe})_n$  SLs as a promising candidate for optoelectronic devices.

**Key Words:** Superlattices, DFT calculations, FP-LAPW method, Electronic structures, Optical properties.



## THE OPTIMAL DESIGN FOR GRID-CONNECTED PV SYSTEMS

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### ABSTRACT

Abstract. As the world's energy needs expand, grid-connected PV systems are gaining acceptance as a viable and attractive alternative energy source. Grid-connected photovoltaic systems use one of two unique topologies. The first is two-stage (DC-DC-AC), in which the voltage of the solar panels is first increased by a DC-DC converter and then converted to AC current by an inverter. This system was effective, but it had several flaws, such as its huge size, exorbitant cost, and inefficient multi-stage design. To improve system efficiency, in a second topology known as single stage conversion (DC-AC), the solar panels are connected directly to the inverter, and the DC-DC converter is eliminated. This paper aids engineers and researchers in choosing the optimal design for PV grid-connected systems by giving a comparative study of power loss, system efficiency, and MPPT algorithm performance for these two topologies for a 150 kW solar PV power plant under variable irradiance. And the simulation findings validated the analysis's perspective.



## OPTIMIZING ELECTRO-ACTIVE BIOFILM FORMATION FOR ENHANCED MICROBIAL FUEL CELL PERFORMANCE

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### ABSTRACT

A microbial fuel cell (MFC) is a type of biological fuel cell that uses microorganisms such as bacteria to produce electricity from organic matter. MFCs are often used to treat wastewater, agricultural waste, and food waste by generating electrical energy. The objective of this study is to develop a bio-anode by optimizing the conditions for the formation of an electro-active biofilm using a graphite electrode and various culture media. Initially, the electro-active biofilm was developed through chronoamperometry in suitable compost.

The results obtained in chronoamperometry demonstrate electro-active activity from the first days of potential application, which increases over time, corresponding to the development of the biofilm, eventually reaching a maximum current of 3.1 mA after 15 days of polarization. The electro-active biofilm was also developed using a nutrient broth inoculated with bacteria (*E. coli*). The results from chronoamperometry reveal a maximum current of 9 mA after 35 days of polarization. Scanning electron microscopy characterizations were conducted. Control experiments with sterilized media showed zero current even after applying a potential for several days.

**Keywords:** Microbial fuel cell; electro-active biofilm; chronoamperometry; microorganism.

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## INTEGRATION OF RENEWABLE ENERGY SOURCES IN THE POWER GRID: CHALLENGES AND SOLUTIONS

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### ABSTRACT

The global transition towards a sustainable energy future has led to an increased focus on the integration of renewable energy sources (RES) into existing power grids. While the adoption of renewable technologies promises numerous environmental and economic benefits, the integration process is not without its challenges. This abstract provides a concise overview of the key challenges faced during the integration of renewable energy sources into power grids and explores potential solutions to address these issues.

The first challenge revolves around the intermittent and variable nature of renewable energy generation, notably from sources like solar and wind. This creates a mismatch between energy supply and demand, requiring innovative energy storage solutions and advanced grid management techniques. It delves into the latest developments in energy storage technologies, such as advanced batteries and grid-scale storage, as well as smart grid technologies that enable real-time monitoring and control.

The second challenge centers on the need for grid infrastructure upgrades to accommodate the decentralized and distributed nature of renewable energy sources. The abstract discusses the importance of investing in smart grids, microgrids, and flexible transmission systems to enhance grid reliability and resilience. It also highlights the role of digital technologies, such as blockchain and artificial intelligence, in optimizing grid operations and facilitating seamless integration.

Another significant challenge is the impact of renewable energy integration on grid stability and power quality. The abstract explores the development of advanced control systems and grid management strategies to mitigate issues related to voltage fluctuations, frequency deviations, and grid congestion. It emphasizes the importance of international collaboration and standardized protocols to ensure interoperability among diverse renewable energy systems.

Furthermore, it addresses the socio-economic challenges associated with the integration of renewable energy. This includes considerations related to job displacement in traditional energy sectors, community engagement in renewable projects, and the need for supportive policy frameworks.

In conclusion, the integration of renewable energy sources into the power grid presents both opportunities and challenges. This abstract provides a comprehensive overview of the key challenges and offers insights into the innovative solutions and strategies needed to create a reliable, resilient, and sustainable power grid for the future. The successful integration of renewable energy will not only contribute to environmental goals but also drive economic development and enhance energy security on a global scale. The abstract outlines policy recommendations and regulatory measures to foster a just and inclusive transition to renewable energy.

**Keywords:** Energy, Renewable, Power, Technology, Environment





## SIMULATION PERFORMANCE ANALYSIS OF ROUTING PROTOCOLS USING ENERGY MODEL

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### ABSTRACT

This paper focuses on the simulation-based performance analysis of two widely adopted MANET routing protocols: Ad Hoc On-Demand Distance Vector (AODV) and Dynamic Source Routing (DSR). The evaluation is centered on a detailed examination of energy consumption, specifically in transmit mode, receive mode and idle mode and investigates the percentage distribution of energy consumption in each of these operational modes. Results from the simulation analysis reveal insights into the energy efficiency of AODV and DSR in various operational modes. This paper presents a detailed breakdown of the percentage distribution of energy consumption, shedding light on how each protocol allocates energy resources during different network states. These findings contribute to a comprehensive understanding of the trade-offs associated with AODV and DSR, assisting network designers and researchers in selecting routing protocols tailored to specific application requirements. This research exploration of energy consumption in transmit, receive, and idle modes paves the way for the development of more resilient and energy-efficient communication solutions, addressing the dynamic and resource-constrained nature of mobile and ad hoc environments.

**Keywords:** Wireless Network, AODV, DSR, Energy Model, Performance matrices Qualnet Tool



## A LEAST SQUARE- LAPLACE TRANSFORM METHOD FOR SOLVING VOLTERRA INTEGRAL EQUATION WITH HIGHLY OSCILLATORY BESSEL KERNELS

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### ABSTRACT

The propose new numerical tools for computation of integrals equation having oscillatory special functions like Bessel function and also any types of function on right hand side which may be oscillatory or non-oscillatory. We consider The Volterra integral equation of Oscillatory type. The Laplace transform of the right hand side is difficult to compute. We approximate the proposed model by the combination of the Least Square Series method and the Laplace transform. The right-hand side of the proposed integral equations will be converted in a special series, which enable us to compute the Laplace transform in simple manner. The Laplace transform will be applied to convert the model into some simple form, and will solve it for transformed solution. The solution will then be recovered with numerical inverse Laplace transform by incorporating some suitable contour in the complex plane. In doing this we aim to convert the oscillatory problem into very smooth non oscillatory problems and the to find the solution with great accuracy.

**Keywords:** Volterra integral equation, Bessel function, Least Square Series, Laplace transform.



## **DOSIMETRIC OPTIMIZATION IN HIGH-DOSE RADIOTHERAPY: TECHNIQUES AND CHALLENGES**

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### **ABSTRACT**

Precise monitoring of radiation doses in high-dose-rate (HDR) radiotherapy treatments is essential to precisely target cancer cells and minimize damage to healthy tissue. This ensures effective, safe and high-quality radiotherapy. Considerable progress has been made in physics and technology, resulting in improved medical devices that control the delivered dose and improve the accuracy and precision of radiation doses. The aim of this study is to explore the various methods and techniques used to control and optimize dosimetry in high-dose-rate therapies, including the role of treatment planning systems (TPS), dosimetry and imaging techniques in assessing dose delivery. In addition, challenges associated with dose control, such as motion management and tissue heterogeneity, are discussed. Emphasis is placed on the importance of implementing reliable dose control approaches in HDR radiotherapy to improve treatment outcomes.

**Key Words:** Dosimetric optimization, radiation dose monitoring, high-dose-rate (HDR), radiotherapy, cancer cells, healthy tissue, dose control, treatment planning systems (TPS).



## ON THE CONTROL OF THE FINAL SPEED FOR A CLASS OF FINITE-DIMENSIONAL LINEAR SYSTEMS: CONTROLLABILITY AND REGULATION

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### ABSTRACT

In this article, we extended the concept of controllability, traditionally used to control the final state of a system, to the exact control of its final speed. Inspired by Kalman's theory, we have established some conditions to characterize the control that allows the system to reach a desired final speed exactly. When the assumptions ensuring speed-controllability are not met, we adopt a regulation strategy that involves determining the control law to make the system's final speed approach as closely as possible to the predefined final speed, and this at a lower cost. The theoretical results obtained are illustrated through three examples.

**Keywords:** speed-controllability, controllability, continuous systems, regulation, Kalman's condition.



## UNVEILING EFFICIENCY: CFD STUDY ON PEMFC PERFORMANCE VIA FLOW FIELD CHANNEL DESIGN WITH GAMBIT AND FLUENT FOR SUSTAINABLE ENERGY

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### ABSTRACT

Fuel cell technology, particularly Proton Exchange Membrane Fuel Cells (PEMFCs), plays a pivotal role in the quest for clean and efficient energy solutions. The intricate interplay of fluid dynamics within the flow field channels significantly influences the overall performance of PEMFCs. This study employs Computational Fluid Dynamics (CFD) with Gambit and Fluent to meticulously examine the impact of flow field channel design variations, specifically focusing on constriction and enlargement configurations. Through a systematic analysis, we explore the nuanced effects of these geometric alterations on key performance metrics, including mass transport, water management, and overall cell efficiency. The study employs a multi-dimensional approach, considering diverse operational conditions and electrode configurations. The findings not only shed light on the underlying mechanisms governing PEMFC behavior but also provide valuable insights for optimizing flow field designs to enhance overall cell performance. This research contributes to the ongoing efforts to advance the understanding and efficiency of PEMFCs for a sustainable energy future.

**Keywords:** PEMFC - Fluent - Fluid dynamics - Fuel cell designs.



## INCREASING PERFORMANCE OF PHOTOVOLTAIC SYSTEMS: A CASE STUDY KOSOVA

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### ABSTRACT

The energy crisis and global warming has directed the focus from renewable energy sources and the emergency of using them to the greatest extent possible. Solar energy represents the main source of energy which is renewable and can be used anywhere. Solar systems represent the main systems that are used to convert this energy into electricity, but some existing photovoltaic systems that are years from their design are not always giving the right performance. In this paper, a real case will be analyzed and the ways of how the performance of the system can be improved in order to generate as much energy as possible from that system. This model can be used for other systems located in other locations and with different climatic conditions than the case studied in this paper.



## BIOMASS FOR BIOFUEL PRODUCTION AND ENERGY EFFICIENCY: CHALLENGES AND FUTURE PROSPECT

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### ABSTRACT

The global energy demand and the alarming fossil deposit depletion due to increased industrialization have left fear in the minds of the populace. Apart from the extinction of fossil deposits, the use of this conventional energy source causes global warming due to greenhouse gas emissions. Hence the quest for sustainable and eco-friendly energy sources such as organic biomass has become a promising candidate for biofuel production due to its renewability as opposed to conventional fossil fuels. To mitigate the adverse effects of climate change by reducing carbon emissions and fostering energy independence, organic biomass from plants, agricultural wastes, animal residues, and forestry by-products, presents a unique opportunity since physicochemical and fermentation strategies could be employed in achieving this fit. However, despite its potential, the adoption of biomass-based biofuels is facing some limitations, including the complex processes of converting biomass into efficient and economically viable biofuels. Striking a balance between energy inputs and outputs is crucial to ensure green energy production inputs do not outweigh the benefits. Despite these challenges, the prospects of biomass for biofuel production are promising, and advanced research and technology are adopted to address efficiency concerns with the potential to unravel new pathways for sustainable bioenergy solutions. Therefore, this review paper explores the current challenges in biomass-based biofuel production, highlighting the need for innovation across, industrial and scientific domains to circumvent the limitations and pave the way for a more sustainable and energy-efficient future.

**Keywords:** Energy, Biofuel, Renewability, Biomass, Global-warming, Fossil-fuel





## AN EVALUATION OF THE ECOLOGICAL IMPACTS OF TIDAL POWER PLANTS ON MARINE BIODIVERSITY AND ECOSYSTEM SERVICES

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### ABSTRACT

Tidal power plants have emerged as a promising renewable energy source due to their ability to harness the predictable and constant energy generated by tidal currents. However, their deployment and operation in coastal areas raise concerns about potential ecological impacts on marine biodiversity and ecosystem services. This abstract presents a comprehensive evaluation of the ecological effects associated with tidal power plants, shedding light on their implications for marine ecosystems. The study employs a multidisciplinary approach that combines existing literature, empirical data, and case studies to assess the ecological impacts of tidal power plants. It begins by examining the direct effects of tidal turbines, such as underwater noise, electromagnetic fields, and collision risks on marine organisms. Furthermore, it investigates the indirect effects, including habitat alteration, changes in hydrodynamics, and alterations in sediment transport patterns. The evaluation also addresses the potential consequences of these impacts on marine biodiversity. It explores the response of key species, including fish, marine mammals, and seabirds, to the presence of tidal power plants. The study considers the potential for habitat displacement, changes in species distributions, and alterations in ecological processes, such as migration and reproduction. Additionally, the assessment incorporates an examination of the effects of tidal power plants on ecosystem services. It explores the potential disruption of key ecological processes, such as nutrient cycling and primary production, which are essential for the provision of ecosystem services such as fishery productivity and coastal protection. The study also considers the potential trade-offs between tidal power generation and other ecosystem services. Overall, this evaluation provides a comprehensive understanding of the ecological impacts of tidal power plants on marine biodiversity and ecosystem services. The findings highlight the need for careful planning, site selection, and mitigation measures to minimize the potential negative effects. By considering these factors, policymakers, developers, and environmental stakeholders can make informed decisions to promote sustainable and responsible tidal energy development while safeguarding marine ecosystems and their associated services.

**Keywords:** Tidal Power; Ecological Impacts; Marine Biodiversity; Ecosystem Services; Turbines



## **PARTIALLY SELF-CHARGING SOLAR VEHICLE**

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### **ABSTRACT**

The solar vehicle with partial self-recharge represents a strategic point of interest between solar energy and electro-mobility that is the improvement of the competitiveness of storage, using solar panels as a secondary energy source that give a second life to the batteries so that they provide an intelligent supply of the drive train of the electric vehicle. The present work consists essentially of a global study on the powertrain of solar vehicles, whose body will be partially photovoltaic, allowing the use of energy stored in electric vehicles from these panels to support the battery during peak consumption periods.

**Keywords:** Solar vehicle, self-charging, traction chain, solar energy, photovoltaic panels.



## THE POSSIBILITY OF USING BIOMASS AS A SOURCE OF ENERGY, CASE OF KOSOVO

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### ABSTRACT

Kosovo, like many different countries in the world, has problems with electricity supply. In the part of renewable sources in Kosovo, from the beginning, renewable energy sources in the form of biomass were used, where clean wood was used. Biomass production has been mainly for the needs of thermal energy, i.e. for heating, but the analysis of the energy value of biomass and urban waste shows that it can also be used successfully for large plants and electricity generation. In this regard, there have been many cases when the use of these resources has been negatively exceeded because the permissible cuts have been exceeded. This paper will show the possibilities of processing pure biomass such as wood, then also other derivatives that come from other forms of biomass applicable in the country. In the total balance of determining the potential of biomass, urban wastes, which have high energy potential, were also taken into account. The paper highlights the contribution of biomass in meeting energy needs.

**Keywords:** Biomass, solid municipality waste, wood, biological composition, heat value.



## THE CONTRIBUTION OF WIND ENERGY TO ENERGY STABILITY IN KOSOVO

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### **ABSTRACT**

The main problems of energy generation in Kosovo are based on significant reserves of coal, but which have high environmental costs and not much studied sources of renewable energy. In recent years, the study of renewable sources in the country has also begun in order to study options for the diversification of energy sources. Thus, the current study presents a presentation of potential wind energy sites in the context of the maximum possibility of their exploitation. The analysis for the maximum utilization of wind energy is based on the average capacity factor of wind farms that are currently operating in Kosovo. The study also shows the possibility of integrating combined PV-Wind technologies in countries with wind energy potential, thus contributing to even greater growth in terms of energy diversification of resources.

**Key words:** wind energy, energy efficiency, diversification, PV-Wind.



## STRUCTURAL MORPHOLOGY DEPENDENCE ON PERFORMANCE OF NATURAL DYE-SENSITIZED ZnO SOLAR CELLS

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### ABSTRACT

Solvothermal (STT), solution combustion (SCT), and template synthesis (TS) techniques were used to synthesize ZnO nanostructures, showing the formation of rod-like, dot-like, and wire-like morphology. Pure-phase wurtzite structure was observed in case of samples synthesized by STT and SCT whereas mixed-phase wurtzite structure was observed for the samples synthesized by TS. UV-visible results shows the strong excitonic peaks in case of STT and TS samples, whereas the excitonic peak tend to shift for the SCT sample. Based on three type of morphologies, ZnO nanostructures based dye-sensitized solar cell devices were fabricated using natural anthocyanin dye as a sensitizer and their I–V characteristics was studied. The device based on sample with nano-wire morphology showed the maximum open-circuit voltage ( $V_{oc}$ ) and short-circuit current density ( $I_{sc}$ ) in comparison with the devices made by using samples with rod-like and flake-like morphologies. The photo-conversion efficiency (PCE) was found to be 3.2%, 4.4%, and 5.4% for the rod, dot-, and wire-like morphology, respectively. The increased charge collection at the interface of the ZnO photoanode and electrolyte layer can be the deciding factor for the enhancement of the PCE.

**Keywords:** ZnO, Solvothermal, Solution Combustion, Template Synthesis



## APPLICATION OF A NATURAL DYE IN DYE-SENSITIZED SOLAR CELLS AND THEIR CHARACTERISTICS

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### ABSTRACT

The world's growing demand for energy presents a global challenge in the search for alternative energy sources, which must be based on natural, renewable resources [1]. In this context, the focus has been on exploring natural pigments to replace the currently rare and expensive dyes used in the production of dye-sensitized solar cells [2]. This study examined the application of three common extraction methods to two different plant species, *Rubia tinctorum L.* and *Reseda luteola L.*, as natural sources of dyes. Ultrasonic-assisted extraction (UAE) and microwave-assisted extraction (MAE) methods were examined and compared with conventional thermal reflux extraction (HRE). The impact of various operational parameters, such as extraction time and solvent composition, on MAE and UAE techniques was studied [3], [4]. Under optimal conditions, the MAE and UAE methods showed significantly higher recoveries than the conventional extraction method. In addition, the use of the MAE method considerably reduced extraction time [5]. Extracted dyes were characterized by high-performance liquid chromatography, photodiode array detection and Fourier transform infrared spectroscopy.

**Keywords:** Energy, Solar Cell, Natural Dyes.

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## HAP MODIFIED BY SPINEL $ZnAl_2O_4$ USED AS HETEROGENEOUS CATALYST FOR BIODIESEL SYNTHESIS

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### ABSTRACT

The world is facing an energy crisis due to growing energy demand, resource depletion and global warming. It is therefore essential to develop sustainable alternative fuels with characteristics similar to those of conventional fuels. Biodiesel is widely studied as a sustainable fuel and has proven to be efficient, sustainable, economical and environmentally friendly. With this in mind, a novel catalyst was prepared by impregnating different amounts of zinc aluminate ( $ZnAl_2O_4$ ) in an equal mixture of eggshells and sardine scales to synthesize biodiesel from waste frying oil (WFO) by transesterification reaction. The catalysts were characterized by DRX and IR and the catalytic activity of catalysts impregnated with different amounts of  $ZnAl_2O_4$  was evaluated. The results confirmed that the main components of prepared catalysts were spinel ( $ZnAl_2O_4$ ), calcium oxide (CaO),  $\beta$  Tricalcium Phosphate ( $\beta$ TCP) and hydroxyapatite (HAP). Moreover, the best biodiesel yield and the strongest catalytic activity were obtained with a catalyst containing 20 wt%  $ZnAl_2O_4$  and then calcined at 900 °C for 3h. The optimal experimental conditions of the transesterification reaction allowing a maximum yield of 92% were obtained under the following conditions: methanol to oil molar ratio of 12:1, 2.5 wt.% catalyst concentration at 90 °C during 5h. The physicochemical properties of the produced biodiesel were investigated and compared with the EN14214 and ASTM D-6751 standards for biodiesel specifications. Consequently, the natural wastes such as eggshells and fish scales, used as heterogeneous catalysts, proved their effectiveness, sustainability and their contribution to reduce the abundant wastes.

**Keywords:** Biodiesel, Transesterification, Heterogeneous catalyst, CaO, HAP,  $\beta$ TCP,  $ZnAl_2O_4$





## STUDY OF A SOLAR AIR HEATER TEST BENCH PERFORMANCE

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### ABSTRACT

This paper is intended to check the thermal convection flow during a new solar air heater (SAH) test bench, which is conducted in the LASEM laboratory. In fact, the applied system includes a two-passage heater solar air separated by an absorber. On the other hand, a glass piece is connected to the box prototype via a pipe. The study was conducted using the Navier-Stokes equations associated with the  $k-\omega$  turbulence model through the use of Ansys 17.0 software. Based on our experimental results generated in a two-passage solar air heater connected to the box prototype, the computational approach and the simulation results were validated.

**Keywords:** Solar air heaters SAH, test bench, two air passages, box prototype, aerodynamic structure.



- |                                   |          |
|-----------------------------------|----------|
| 1. Digital thermometer type UT325 | 2. Duct  |
| 3. Anemometer type AM 4204        | 4. Glass |
| 5. Insulation                     | 6. Box   |

### Graphical abstract



## CURRENT PRACTICES IN ENERGY-EFFICIENT FACADE DESIGN: DOUBLE SKIN FACADE SYSTEMS AND PHASE CHANGE MATERIALS

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### ABSTRACT

The growing concerns surrounding energy consumption, driven by factors such as the industrial revolution, rapid population growth, and the extensive exploitation of natural resources, have prompted global efforts to minimize reliance on non-renewable energy sources. Collaboration between nations has fostered the development of renewable alternatives. The construction industry, a significant player in energy consumption, faces the challenge of adapting to these changes, given its 35% contribution to overall energy usage. As a response, contemporary building design prioritizes energy efficiency, climate adaptability, and user comfort. The building "facade," serving as a crucial interface between the interior and the external environment, plays a pivotal role in optimizing energy use. Technological advancements and innovative construction systems now enable the design of energy-efficient buildings, employing strategies such as multi-layered facades and novel materials. Double skin facade systems have emerged as a popular choice, effectively controlling heat and light to enhance energy efficiency. Another noteworthy approach involves integrating Phase Change Materials (PCM) into building facades. PCM can absorb and release significant latent heat energy during phase transitions, contributing to energy storage and management. Both double skin facade systems and PCM applications prove versatile, applicable to new constructions as well as retrofits of existing buildings, offering improvements in overall energy consumption. This study delves into these energy-efficient systems through a comprehensive literature review. It elucidates the principles behind double skin facade systems and PCM, examining buildings where these systems are implemented individually or in combination, along with their resulting energy efficiencies. The ultimate goal is to enlighten stakeholders, fostering awareness about energy efficiency and contributing valuable insights to global energy development plans.

**Keywords:** Energy-efficient facade design, double-skin facade systems, phase change materials.

## ENERJİ ETKİN CEPHE TASARIMINDA GÜNCEL UYGULAMALAR: ÇİFT KABUK CEPHE SİSTEMLERİ VE FAZ DEĞİŞTİREN MALZEMELER

### ÖZET

Sanayi devrimi, hızlı nüfus artışı ve doğal kaynakların kontrolsüz kullanımının getirdiği enerji tüketimine dair endişeler; ülkelerin ortak iş birliği sonucunda yenilenemeyen enerji kaynakları kullanımını en aza indirme ve yenilenebilir enerji kaynaklarına yönelme yaklaşımlarını ortaya çıkarmıştır. Küresel düzeyde konunun önemli bir paydaşı olan inşaat sektörü de enerji tüketimine katkısı bakımından bu durumdan etkilenmektedir. Bina inşaatı faaliyetleri, enerji tüketiminde %35 gibi önemli bir paya sahip olduğundan günümüzde yapı tasarım yaklaşımı; enerji tüketimini azaltacak, değişen iklim koşullarına uyum gösterecek ve kullanıcıya uygun konforu sağlayabilecek şekilde yeniden yorumlanmaya başlanmıştır. Bu bağlamda yapıyı dış ortamdan ayıran kabuğu 'cephe', enerjinin etkin kullanılması konusunda önemli yapı bileşenlerinden biri haline gelmiştir.

Gelişen teknoloji ve yapım sistemleri ile cephe katmanlarının sayısının artırılması ve cephenin bu katmanlarda yenilikçi malzemeler kullanılarak üretilmesi gibi uygulamalarla yeni yapıların enerji etkin tasarlanması mümkün hale gelmiştir. Çift kabuk cephe sistemleri de bu bağlamda günümüzde sıklıkla kullanılan sistemlerdendir. Dış ortam ile yapı içi arasında bir arayüz görevi üstlenen bu tür cephe sistemleri, ısı ve ışığın kontrol edilmesi ile enerji etkinliği sağlamaktadır. Bu sistemlere ek olarak yapı cephesinde kullanılan, erime ve katılma sırasında büyük miktarda gizli ısı enerjisi emebilen veya gerektiğinde ısı enerjisini depolayabilen Faz Değiştiren Malzemeler (FDM)'in kullanılması da yapının ısıtma-soğutma yüklerinin azaltılabilmesini sağlayan, enerji etkin bir başka sistemdir. Bu iki sistem, yeni yapılarda kullanılabildiği gibi mevcut yapı stoğuna da uygulanarak yapıların enerji tüketiminde iyileşme sağlayabilmektedir. Enerji etkin cephe tasarımında güncel uygulamaların araştırıldığı bu çalışma kapsamında, çift kabuk cephe sistemleri ve faz değiştiren malzemelerin kullanıldığı sistemler literatür taraması ile incelenmiştir. Çalışmada, sistemlerin tekil ve bir arada yer aldığı yapılar ve enerji etkinliklerinin değerlendirildiği araştırmalar incelenmiştir. Çalışma ile paydaşların konu hakkında bilgilendirilmesi ve enerji etkinliğine dair farkındalığın artırılması ile küresel ölçekte hedeflenen enerji kalkınma planına katkı sağlanması amaçlanmıştır.

**Anahtar Kelimeler:** Enerji etkin cephe tasarımı, çift kabuk cephe sistemleri, faz değiştiren malzemeler.



## BİNA KABUĞUNDA HAVA SIZDIRMAZLIĞI PARAMETRESİNE YÖNELİK LİTERATÜR İNCELEMESİ

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### ÖZET

Günümüzde hızla artan nüfus enerji talebini arttırmakta ve beraberinde doğal kaynakların hızla tükenmesine neden olmaktadır. Son yıllarda enerjinin verimli kullanımı ve kaynak kullanımının olabildiğince azaltılması konusundaki farkındalık artmaktadır. Enerji tüketimini birçok sektör etkilemekte olup yapı sektörü enerji tüketimini en çok etkileyen sektörlerden biridir. Yapıların yapım aşamasından yıkım aşamasına dek yaşam döngüsünün her anında enerji yoğun olarak kullanılmaktadır. Yapının kullanım sürecinde enerji iç mekan konfor koşullarını sağlamak için tüketilmekte olup yapının iç mekanı ile dış ortam arasında sınır görevi gören bina kabuğu enerji tüketimini ve iç mekan konfor koşullarını doğrudan etkilemektedir. Bina kabuğu iç mekan görsel, ısı ve akustik konforu ve bu konfor koşullarının optimum düzeyde tutulabilmesi için gerekli enerji miktarını etkilemektedir. Bina kabuğundaki pencere/duvar oranı gün ışığının iç ortama alınmasında etkilidir. İç mekana yeterli miktarda gün ışığının alınmaması iç mekan görsel performansını etkilediği gibi doğal aydınlatmaya ek olarak yapay aydınlatma kullanılması sonucu enerji tüketimini de arttırmaktadır. Bina kabuğunun yapının bulunduğu iklime uygun olarak tasarlanmaması sonucu iç mekan ısı konforunda olumsuzluklar oluşturacaktır. Örnek vermek gerekirse güneşlenmenin fazla olduğu bir bölgede pencere/duvar oranının fazla olduğu bir yapı tasarımı yapıldığında soğutma döneminde gün ışığı daha fazla alınacağından iç mekan sıcaklığı artacak ve soğutma için gerekli enerji miktarı artacaktır. Bina kabuğunun enerji tüketimi üzerinde birçok etkisi bulunmaktadır. Bina kabuğunda meydana gelen sorunlar da enerji ihtiyacı ve kullanıcı sağlığını etkilemektedir. Bu sorunlar nem sorunları, ısı köprüleri ve hava sızıntılarıdır. Bina kabuğundaki çatlaklardan, hasarlardan istemsiz bir şekilde iç ve dış ortam arasında hava geçişi olarak tanımlanan hava sızıntısı iç-dış ortam sıcaklık farkının yarattığı basınç farkına dayanmaktadır. Bina kabuğundaki sızıntılar enerji verimliliğini etkilediği gibi kullanıcı sağlığını da olumsuz yönde etkilemektedir. Özellikle dış ortamdaki gürültü ve insan sağlığına zararlı partiküllerin iç ortama girmesinde hava sızıntısı belirleyici rol oynar. Bu çalışmada bina kabuğu hava sızdırmazlığı üzerine yapılan çalışmalar kapsamlı bir şekilde incelenmiştir. Literatürde 20 yıllık süreçte bina kabuğu sızdırmazlığı üzerine yapılan çalışmalarda bu konunun nasıl ele alındığı ve sonuçlarına ilişkin karşılaştırmalı değerlendirmeler yapılmıştır. Çalışmanın temel amacı bina kabuğu sızdırmazlığı üzerine kapsamlı bir literatür taraması hazırlamak ve bu konu üzerine dikkat çekmektir. Ayrıca enerji tüketimi ve kullanıcı sağlığı üzerinde önemli etkisi olan bina kabuğu sızdırmazlığı üzerine yapılan çalışmaların hangi bölgelerde yapıldığı ve çalışmaların frekansı istatistiksel olarak belirtilmiştir.

**Anahtar Kelimeler:** Hava sızdırmazlık, BlowerDoor Test, Bina kabuğu, Enerji verimliliği, Konfor koşulları.

### LITERATURE REVIEW ON AIR TIGHTNESS PARAMETER IN BUILDING ENVELOPE

### ABSTRACT

Nowadays, the rapidly increasing population increases the demand for energy and causes the rapid depletion of natural resources. In recent years, awareness on the efficient use of energy and reducing the use of resources as much as possible has been increasing. Many sectors affect energy consumption and the construction sector is one of the sectors that affect energy consumption the most. Energy is used intensively at every moment of

the life cycle of buildings from the construction phase to the demolition phase. During the utilisation process of the building, energy is consumed to provide indoor comfort conditions, and the building envelope, which acts as a boundary between the interior of the building and the outdoor environment, directly affects energy consumption and indoor comfort conditions. The building envelope affects the indoor visual, thermal and acoustic comfort and the amount of energy required to maintain these comfort conditions at the optimum level. The window/wall ratio in the building envelope is effective in allowing daylight into the indoor environment. Insufficient amount of daylight into the interior space affects the visual performance of the interior space and increases energy consumption as a result of using artificial lighting in addition to natural lighting. If the building envelope is not designed in accordance with the climate in which the building is located, it will create negativities in indoor thermal comfort. For example, when a building design with a high window/wall ratio is made in a region with high insolation, the indoor temperature will increase and the amount of energy required for cooling will increase as more daylight will be received during the cooling period. The building envelope has many effects on energy consumption. Problems occurring in the building envelope also affect energy demand and user health. These problems are humidity problems, thermal bridges and air leaks. Air infiltration, which is defined as the involuntary passage of air between the indoor and outdoor environment through cracks and damages in the building envelope, is based on the pressure difference created by the indoor-outdoor temperature difference. Leaks in the building envelope not only affect energy efficiency but also negatively affect user health. Air infiltration plays a decisive role especially in the entry of noise and particles harmful to human health from the outdoor environment into the indoor environment. In this study, the studies on building envelope air tightness are comprehensively analysed. Comparative evaluations were made on how this issue was handled and the results of the studies on building envelope airtightness in the literature over a period of 20 years. The main purpose of the study is to prepare a comprehensive literature review on building envelope tightness and to draw attention to this issue. In addition, the regions in which the studies on building envelope sealing, which has a significant impact on energy consumption and user health, were carried out and the frequency of the studies were statistically indicated.

**Keywords:** Airtightness, BlowerDoor Test, Building envelope, Energy efficiency, Comfort conditions.



## DECARBONIZATION OF TRANSPORTATION AND BUILDING SECTORS IN TURKEY

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### ABSTRACT

In Turkey, the building and transportation sectors account for 56% of total final energy consumption. These sectors consume an extensive amount of fossil fuels. Natural gas accounts for 45% of the final energy consumption in the building sector, whereas petroleum products account for 98% of the final energy consumption in the transportation sector. By the year 2053, Turkey is committed to achieving net zero emissions. This ambitious goal entails a strategic focus on curtailing energy consumption and minimizing the reliance on fossil fuels within the transportation and building sectors, thereby mitigating greenhouse gas emissions. Transition of the energy system and increased electrification with renewable energy sources (RESs) will reduce external dependence on energy and Turkey's current account deficit. In this study, energy consumption in the transportation and building sectors in Turkey is analyzed and solutions for decarbonization of these sectors are presented. This review provides a perspective on the current status of the main technologies that can be used to decarbonize the transportation and building sectors and the opportunities that these technologies will offer in the future. This perspective is expected to contribute to the researchers who will carry out scientific studies in the related sectors in determining the study topics. In order to reduce transportation and sector emissions in Turkey, the electrification of these sectors should be increased and the electricity needed should be supplied from RESs. The number of electric vehicles (EVs) in road transportation, whose share in final energy consumption of the transport sector is approximately 94%, should be increased. RESs ought to be used for the generation of electricity required to power EV charging stations. A significant portion of the energy consumed in buildings in Turkey is provided by fossil resources, and about 46% of building energy consumption is met by natural gas. In order to reduce building sector emissions in Turkey, the use of RESs in buildings should be increased. To facilitate the electrification of buildings, it is advisable to employ heat pumps, given their increasing cost competitiveness and the escalating global trend towards their widespread adoption. The energy performance of buildings with poor energy efficiency should be enhanced, and new constructions should be ensured to be at least nearly zero-energy buildings. The increase in electrification facilitated by the use of RESs will contribute to the attainment of Sustainable Development Goals.

**Keywords:** Transportation, buildings, heat pumps, nearly zero energy buildings, electric vehicles, renewable energy sources, sustainable development goals.



## PASİF İKLİMLENDİRME YÖNTEMLERİNİN ENERJİ ETKİNLİĞİ AÇISINDAN İRDELENMESİ

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### ÖZET

Modern konfor anlayışının teknolojiyle bütünleşik olması enerji tüketimindeki artışı kaçınılmaz kılmıştır. Bu durum küresel ölçekte enerji talebini artırdığından, ülkelere getirdiği ithalat zorunluluğunun yanı sıra, fosil kaynaklara bağımlılık sebebiyle çevresel sürdürülebilirliği de zorlaştırmaktadır. Dolayısıyla, enerji tüketimini sınırlandırmak için ulusal ve uluslararası düzenlemeler zorunlu hale gelmiştir. Bu düzenlemelerin başında ise dünyadaki toplam enerji tüketiminin yaklaşık %40'ından ve CO<sub>2</sub> salımının büyük bir kısmından sorumlu endüstriyel ve barınma amaçlı yapılardaki enerji etkin uygulamaların artması gelmektedir. Dünyada bu amaçla aktif ve pasif iklimlendirme yöntemlerinin kullanılması söz konusudur. Pasif iklimlendirme yöntemleri, modern tüketim anlayışının aksine sorunu oluşturduktan sonra çözmeye değil sorunu en aza indirmeyi amaç edinen yardımcı enerji verimliliği yöntemleridir. Bu yöntemler, yapı formunu iklim verilerini dikkate alarak belirlemek ve sistem detaylarını çözümlenerek suretiyle hava hareketlerinden faydalanılarak ısı konforu sağlama ve hava kalitesini iyileştirmeyi amaçlar. Antik çağlardan beri etkin biçimde kullanılmalarına rağmen, günümüzde enerji kaynaklarının kolay ulaşılabilir olması ve teknolojinin etkisiyle iklimsel tasarım verilerinin gözardı edilerek tasarlanan yapıların yaygınlaştığı ve ısı konforunun enerji tüketimi ile sağlandığı görülmektedir. Her ne kadar bu yapıların iklimlendirilmesi sırasında harcanan enerji tüketiminden tasarruf sağlanabilir olsa da, fosil yakıtla yahut elektrikliğe bağlı olan mekanik elemanlarla desteklenen bu tür sistemler aktif sistemlerdir. Ancak pasif sistemler, enerji kullanımını gerektirmeyen, tasarım kararları ve kullanılan malzemelerde farklılık sağlanarak güneş ışınlarının yapı yüzeyleri tarafından depolanmasının ve iletim (kondüksiyon), taşınım (konveksiyon), ışınım (radyasyon) yollarından bir veya birkaçı kullanılarak iç mekânlara dağıtılmasını sağlamaktadır. Böylece pasif iklimlendirme sistemleri binalardaki enerji korunumu artırarak, aktif iklimlendirme sistemlerinin yükünü azaltabilmektedir. Bu durumda pasif iklimlendirme sistemlerinin uygulanması sayesinde fosil kaynaklara bağlılığın ve karbon ayak izini azaltılacağı öngörülerek çevreye duyarlı, enerji etkin yapıların oluşması kolaylaşabilecektir.

Bu bağlamda çalışmada literatür araştırmasıyla modern yapılara uygulanmış olan pasif iklimlendirme yöntemlerinin araştırılması ve enerji etkinliği açısından irdelenmesi amaçlanmıştır. Çalışmada, pasif sistemlerin, olumlu ve olumsuz yönleri belirlenmeye çalışılmıştır. Bunun sonucunda, pasif iklimlendirme yöntemlerinin yapılarda kullanılmasının enerji tüketimini azalttığı görülmüştür. Ayrıca, bu tür yöntemlerin Türkiye'de yoğun kullanılmama nedenlerinden birinin mevzuatta buna dair bir zorunluluğun yer almaması olarak belirlenmiştir.

**Anahtar Kelimeler:** Çevresel Sürdürülebilirlik, Enerji Etkin Yapılar, Pasif İklimlendirme Yöntemleri.

### EXAMINATION OF PASSIVE AIR CONDITIONING METHODS IN TERMS OF ENERGY EFFECTIVENESS

#### ABSTRACT

The integration of technology with the modern sense of comfort has inevitably led to an explosion in global energy demand due to increased energy consumption, which forces countries and states to overload energy imports. Moreover, it imperils environmental sustainability due to dependence on fossil resources. Consequently, national and international regulations have become mandatory to restrict over-energy



consumption, especially for directing energy-efficient applications in industrial and residential buildings, which are responsible for approximately 40% of the world's total energy consumption and a large part of CO<sub>2</sub> emissions. Air conditioning methods, both active and passive, have been used to reduce energy consumption and CO<sub>2</sub> emissions. In contrast to modern consumption manners, which seek solutions for emerging pollution, passive air conditioning approaches aim to reduce energy consumption before pollution arises. Such passive methods provide thermal comfort and high-quality air by considering the building form, direction of airflow and climate data and analyzing system details. Although they have been used effectively since ancient civilizations, nowadays, due to the easy accessibility of energy resources and the influence of technology, modern buildings designed by ignoring climatic data have become widespread, and thermal comfort has been provided by active energy consumption. Although it is possible to reduce energy consumption somewhat by adding mechanical elements to these active systems, such structures still depend on fossil fuels or electricity. However, passive systems do not require energy supply. They have consisted of the usage of alternative materials, which are suitable for the storage of solar rays by building surfaces and smart design decisions, which provide airflow inside the structure using one or more of the methods of conduction, convection and radiation. Therefore, it is anticipated that passive air conditioning systems can reduce the load of active air conditioning systems by increasing energy conservation in buildings and reducing dependence on fossil resources and carbon footprint, resulting in environmentally friendly, energy-efficient urbanization.

In this context, the study aims to investigate passive air conditioning applications in modern buildings through literature research and examine them in terms of energy efficiency. The positive and negative aspects of passive systems have been tried to be determined in the study. As a result of this, it was seen that using passive air conditioning methods in buildings reduces energy consumption. Nevertheless, these methods are not used extensively in Turkey due to a lack of obligation in legislation.

**Keywords:** Environmental Sustainability, Energy Efficient Buildings, Passive Air Conditioning Methods.



## YENİLENEBİLİR ENERJİ VE BELEDİYELER ARASI İŞBİRLİĞİ: ENERJİ KENTLERİ BİRLİĞİ ÖRNEĞİ

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### ÖZET

Tüm dünyada olduğu gibi ülkemizde de iklim değişikliğinin olumsuz etkileri görülmekte hem toplum hem de çevre için yıkıcı etkileri hissedilmektedir. İklim değişikliğinin en büyük sebebi sera gazları salımı olup bu salımın en büyük nedeni enerji üretimi ve tüketiminde fosil kaynakların kullanılmasıdır. Enerji üretim ve tüketimi toplam sera gazı salımının %74.5 ünü oluşturmaktadır. Enerji arz güvenliği ve iklim değişikliği ile mücadelede enerji üretimi için yenilenebilir kaynaklara yönelme ve enerji tüketiminde enerji verimliliği çabalarını ön plana çıkarmıştır. Bu çerçevede yerel yönetimlerin ve özelde belediyelerin güneş, jeotermal, hidrolik, rüzgar, biyokütle vb. enerji kaynaklarına yönelmesi yanında enerji verimliliği çabaları enerjide bağımsızlığı sağladığı gibi belediye gelirlerini artırması yanında giderlerinin de azaltılmasını amaçlamaktadır. Ayrıca iklim değişikliği ile mücadelede karbon ayak izinin azaltılması da bir başka önemli konu olarak karşımıza çıkmaktadır.

En az iki mahalli idarenin bir araya gelerek yürütmekle görevli oldukları hizmetlerden bazılarını birlikte görmek üzere kendi aralarında kurdukları kamu tüzel kişiliğine haiz kamu idareleri olarak tanımlanan mahalli idare birlikleri diğer bir ifadeyle yerel yönetim birlikleri, 2005 tarihli 5355 sayılı Mahalli İdare Birlikleri Kanununu ile kamu tüzel kişiliğine kavuşmuştur. Yerel Yönetimler Genel Müdürlüğünün verilerine göre toplam 964 adet birlik bulunmaktadır.

Bunlardan biri olan ve 1997 yılında faaliyete başlayan Enerji Kentleri Birliği üye belediyelerinin dinamiklerini bir araya getirerek; enerji kaynaklarının birlikte en verimli ve çevreye duyarlı şekilde belediyelerin katkısı ile yerel kalkınmaya, ülke refahına, ekonomisine ve istihdama en yüksek katma değeri sağlayacak hale getirmeyi hedeflemektedir.

Bu çalışmada ülkemizin yenilenebilir enerji görünümü, belediyelerin bu noktadaki yatırımları, iyi uygulama örnekleri, Enerji Kentleri Birliği'nin faaliyet raporları izlenerek belediyelerle yaptığı çalışmalar ve etkinliği ele alınacaktır.

**Anahtar Kelimeler:** Mahalli İdare Birlikleri, Belediye, Enerji, Yenilenebilir Enerji, Enerji Verimliliği, İklim Değişikliği

## RENEWABLE ENERGY AND COOPERATION BETWEEN MUNICIPALITIES: THE CASE OF THE UNION OF ENERGY CITIES

### ABSTRACT

As in the whole world, the negative effects of climate change are seen in our country and its destructive effects are felt for both society and the environment. The biggest cause of climate change is the emission of greenhouse gases and the biggest cause of this emission is the use of fossil resources in energy production and consumption. Energy production and consumption account for 74.5% of total greenhouse gas emissions. In the fight against energy supply security and climate change, turning to renewable resources for energy

production and energy efficiency efforts in energy consumption have come to the forefront. In this framework, local governments and municipalities in particular turn to energy resources such as solar, geothermal, hydraulic, wind, biomass, etc., as well as energy efficiency efforts provide energy independence and aim to increase municipal revenues as well as reduce expenses. In addition, reducing carbon footprint is another important issue in the fight against climate change.

Local administration unions, in other words, local government unions, which are defined as public administrations with public legal personality that at least two local administrations come together and establish among themselves in order to provide some of the services they are responsible for carrying out together, gained public legal personality with the Law No. 5355 on Local Administration Unions dated 2005. According to the data of the General Directorate of Local Authorities, there are 964 unions in total.

One of them, the Energy Cities Association, which started its activities in 1997, aims to bring together the dynamics of its member municipalities and to ensure that energy resources provide the highest added value to local development, national welfare, economy and employment with the contribution of municipalities in the most efficient and environmentally sensitive way.

In this study, the renewable energy outlook of our country, the investments of municipalities at this point, examples of good practices, the activities and effectiveness of the Energy Cities Union with municipalities by following the activity reports will be discussed.

**Keywords:** Local Administration Unions, Municipality, Energy, Renewable Energy, Energy Efficiency, Climate Change



## EMERGING TRENDS IN SMART BUILDING ENERGY MANAGEMENT: A COMPREHENSIVE REVIEW OF AI, IOT, AND SUSTAINABILITY ADVANCES

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### ABSTRACT

This study examines the latest developments in Energy Management Systems (EMS) for smart buildings, which represent a significant step towards improving sustainability and efficiency in the constructed environment. The technique employed in this study entailed a rigorous examination of existing scholarly works, with particular emphasis placed on publications within the past five years to guarantee both pertinence and originality. The study uncovers noteworthy technical developments in the field of Emergency Medical Services (EMS), encompassing the incorporation of advanced sensors, Internet of Things (IoT) gadgets, as well as progressions in artificial intelligence and data analytics. These advancements have enabled the smooth integration of renewable energy sources, enhanced operational effectiveness, and improved user engagement and involvement. Significantly, the integration of artificial intelligence (AI) and big data analytics within the field of energy management systems (EMS) has brought about a transformative impact on energy optimization tactics, resulting in considerable reductions in energy consumption and environmental impact. The article additionally examines the difficulties encountered within this field, including technical intricacies, financial limitations, and regulatory concerns. The review examines prospective avenues for future research and development in order to anticipate forthcoming trends. It emphasizes the dynamic characteristics of smart building technologies and their significant impact on the formation of sustainable urban environments. The primary objective of this study is to provide valuable insights to researchers, practitioners, and policymakers regarding the current advancements in EMS for smart buildings. This emphasizes the significance of ongoing innovation and interdisciplinary collaboration within this domain.

**Keywords:** IoT; Energy Management Systems; optimization tactics; artificial intelligence



## ÜNİVERSİTE KAMPÜS BİNALARINDA ENERJİ TÜKETİMİ TAHMİNİ İÇİN GRİ KUTU YAKLAŞIMI

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### ÖZET

Bina enerji tüketimi tahmininde yapılan çalışmalar, enerji maliyetlerini düşürme, çevresel etkileri azaltma, konforu artırma ve bina performansını optimize etme hedeflerine katkı sağlamaktadır. Bu bağlamda, üniversite kampüs binalarında enerji tüketimi tahminini iyileştirmeyi amaçlayan bu çalışma, zaman serisi ve fizik/mühendislik tabanlı veri setlerini entegre ederek bir tahmin modeli geliştirmeyi hedeflemektedir.

Metodoloji: Araştırma, mevcut binalardan elde edilen zaman serisi enerji tüketimi verileri ile birlikte bina fiziği/mühendislik verilerini kullanarak makine öğrenimi tekniklerini entegre etmiştir. Isıtma/soğutma ve aydınlatma için zaman serisi verileri, dış hava sıcaklığı, bağıl nem, bina taban alanı, kat yüksekliği ve malzeme türü gibi bina özelinde dış ortam verileri için kullanılan fizik/mühendislik verileri ile birleştirilmiştir.

Bulgular: Çalışma, zaman serisi ve hibrit modellerin kıyaslamalı analizi sonucunda enerji tüketimi tahminindeki başarısını tartışmaktadır. Mevcut literatürde genellikle tercih edilen zaman serisi veya fiziksel bilgileri içeren modellerin aksine bu çalışmada, her iki veri türünün bir araya getirilmesi ile tahmin doğruluğunun ilişkisi incelenmiştir.

Sonuç: Bu çalışma, enerji tüketimi tahmini alanında önemli bir ilerleme sunmaktadır. Elde edilen bulgular, enerji yöneticilerine ve bina sahiplerine, enerji verimliliğini artırmak ve sürdürülebilirlik hedeflerine ulaşmak için daha etkili stratejiler geliştirmeleri konusunda değerli bir yol gösterici niteliktedir. Bu yöntem, özellikle üniversite kampüsleri gibi karmaşık yapıların enerji yönetiminde daha geniş bir uygulama potansiyeline sahiptir.

**Anahtar Kelimeler:** enerji tüketim tahmini, gri kutu yaklaşımı, derin öğrenme

## GREY BOX APPROACH FOR ENERGY CONSUMPTION FORECASTING IN UNIVERSITY CAMPUS BUILDINGS

### ABSTRACT

Research conducted on building energy consumption forecasting contributes significantly to reducing energy costs, minimizing environmental impact, enhancing occupant comfort, and optimizing building performance. In this context, this study aims to enhance energy consumption forecasting in university campus buildings by integrating time series and physics/engineering-based datasets to develop a predictive model.

Methodology: The research integrates machine learning techniques by utilizing time series energy consumption data obtained from existing buildings alongside building physics/engineering data. Time series data for heating/cooling and lighting are combined with physics/engineering data, such as external environmental factors specific to the building, including outside air temperature, relative humidity, building floor area, floor height, and material type.

Results: The study discusses the success of energy consumption forecasting through a comparative analysis of time series and hybrid models. In contrast to models typically preferred in existing literature that focus on

either time series or physical information, this research explores the relationship between the accuracy of predictions and the amalgamation of both data types.

**Conclusions:** This study represents a significant advancement in the field of energy consumption forecasting. The findings offer valuable guidance to energy managers and building owners in developing more effective strategies to increase energy efficiency and achieve sustainability goals. This methodology holds broader applicability, particularly in the context of complex structures like university campuses, within the realm of energy management.

**Keywords:** energy consumption prediction, grey-box approach, deep learning



## PERFORMANCE IMPROVEMENT OF PEMFC BASED ON REDUCING SIZE OF THE SQUARE FLOW CHANNEL: A 3D CFD APPROACH

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### ABSTRACT

Proton exchange membrane fuel cells (PEMFCs) have significant potential to generate clean, renewable, and sustainable energy and reduce emissions to mitigate climate change. PEMFCs comprise distinct components, namely, membrane, anode and cathode gas diffusion layers, catalyst layers, flow channel and bipolar plates. The shape of gas flow channels affects the flow velocities, mass transfer and fuel cell performance. In this work, a three-dimensional model single phase model is improved via the PEMFC module of ANSYS FLUENT software. The square channel configurations with depths and widths ranging from 0.2 to 0.8 mm are generated by modifying the reference channel having 1 mm depth and width. The results showed that reducing dimensions of the square channel augmented the current density due to increasing flow velocity in the anode and cathode channels with the disadvantage of an elevated pressure drop. The configuration having a 0.2 x 0.2 mm square channel enhances the current density to 2.95 A/cm<sup>2</sup> with a rise of 57.6% compared to the reference case with a current density of 1.25 A/cm<sup>2</sup> at 0.4 V.

**Keywords:** PEMFC, square channel cross-section, CFD, Current density, Pressure drop.





## DETERMINATION OF OPTIMUM DC/AC RATIO FOR PV POWER PLANTS USING ARTIFICIAL INTELLIGENCE

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### ABSTRACT

The trend towards renewable energy sources is increasing day by day due to increasing energy costs and environmental awareness. Solar energy, one of the leading and widely used renewable energy sources has become one of the indispensable sources of electricity production. To keep electricity production at the maximum level in solar PV power plants, it is important that the feasibility studies are carried out correctly. Necessary evaluations should be made by considering the DC-installed power, the installation of the power plants, and their economic life. In this study, the importance of DC/AC ratio in solar power plants, performance problems in inverters which are of great importance for solar power plants (SPP), and the effects of losses in inverters on the power plant are explained. The configuration of the photovoltaic system, the dimensions of the inverters, the capacity of the PV array, and the clipped operating mode were examined, and the AC and DC plant conditions were commented on in the operation of the PV system. The output powers of the inverter and panels to be used are estimated using ANN. With this study, which tries to determine the DC/AC ratio more accurately, it is aimed to make investments more accurately. In this study, the importance of the DC/AC ratio in solar power plants, performance problems in inverters, which are of great importance for solar power plants (SPP), and the effects of losses occurring in inverters on the power plant are explained. Situations such as the configuration of the photovoltaic system, the dimensions of the inverters, the capacity of the PV array, and the cropped mode of operation were examined, and the AC and DC plant conditions were commented on the operation of the PV system. The output power of the inverter and panels to be used has been estimated using YSA. With this study, which tries to determine the DC/AC ratio more accurately, it is aimed to make investments more accurately. In addition, the performance of the PV power plant was evaluated with the results obtained.

**Keywords:** DC/AC ratio, photovoltaic panel, SPP, inverter clipping, inverter losses, ANN



## PERİYODİK OLMAYAN DC KAYNAKLAR KULLANAN YEDİ SEVİYELİ ASİMETRİK ÇOK SEVİYELİ EVİRİCİDE HARMONİK AZALTILMA

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### ÖZET

Günümüzde, çok seviyeli eviriciler genellikle endüstriyel uygulamalarda kullanılmaktadır. Kaskatlı H-Köprü yapısı, DC'yi AC'ye çevirmek için kullanılan çok seviyeli evirici topolojilerinden biridir. Bu işlemi gerçekleştirirken eğer farklı oranlarda DC kaynakları kullanılıyorsa, buna Asimetrik Çok Seviyeli Evirici denir. Eviricinin işlemi sırasında birçok farklı hata türü ortaya çıkabilir. Bu hatalardan biri, DC kaynağının azalması nedeniyle ortaya çıkar. Bu hata meydana geldiğinde, eviricinin çıkış dalga formu harmoniklerden dolayı sinüs formundan sapar. Bu durumu düzeltmek için eviricinin anahtarlama sinyallerini üretmek için kullanılan çok taşıyıcı PWM modülasyonunda değişiklik yapmak gereklidir. Bu çalışmada, yedi seviyeli Asimetrik Çok Seviyeli Eviricide bir veya her iki DC kaynağının azalması durumunda, çok taşıyıcı PWM modülasyonunu kullanarak çıkış dalga formundaki toplam harmonik bozulmayı azaltma amaçlanmıştır.

**Anahtar Kelimeler:** Harmonik, THD, Çok Seviyeli Evirici, Sinüsoidal PWM

## REDUCED HARMONICS IN A SEVEN LEVEL ASYMMETRIC MULTILEVEL INVERTER WITH APERIODIC DC SOURCES

### ABSTRACT

Nowadays, multilevel inverters are mostly used in industrial applications. Cascade H-Bridge structure is one of the multilevel inverter topology for converting DC to AC. While achieving this operation, if DC sources used with different ratios, it is called Asymmetric Multilevel inverter. Lots of different fault types can be accrued in the operation of inverter. One of this fault is caused by decreasing of the DC source. When this fault occurs, the output wave of the inverter will deviate from the sinus form due to harmonics. To correct this situation, it is necessary to make changes to the multi-carrier PWM modulation used to generate the switching signals of inverter. In this study, it is aimed to reduce the total harmonic distortion in the output wave by using multi-carrier PWM modulation in case of decrease in one or both of the DC sources in the seven-level Asymmetric multi-level inverter

**Keywords:** Harmonic, THD, Multilevel Inverter, Sinusoidal PWM.



## ZAMAN GECİKMELİ ÖRNEK BİR SİSTEMİN PID, 2DOFPID VE KDPID DENETLEYİCİ İLE KONTROLÜ VE KARŞILAŞTIRMASI

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### ÖZET

Zaman gecikmeli sistemler endüstride pek çok süreçte karşımıza çıkan yaygın fiziksel sistemlerdir. Özellikle kimyasal ve akışkan sistemlerde, fabrikalarda, iletişim sistemlerinde ve savunma sanayii ürünlerine yönelik süreçlerde karşımıza çıkmaktadırlar. Bu çalışmada örnek bir zaman gecikmeli sistemi kontrol etmek için PID, Kesir Dereceli PID (KDPID) ve 2DOFPID türü denetleyiciler kullanılmış ve denetleyicilerin performansları kıyaslanmış ve farkları ortaya konulmaya çalışılmıştır. Ayrıca, birim basamak tepkisinin analiziyle beraber, sistemin bozucu elemanlara karşı dayanıklılığını test etme işlemleri yapılmış ve bu test sonuçları değerlendirilmiştir. Ayrıca kontrolörler hata performans endeksleri olan Hata Karenin İntegrali (Integral Square Error (ISE)), Hatanın Mutlak Değerinin İntegrali (Integral of Absolute Value of Error (IAE)), Zaman Mutlak Hatanın İntegrali (Integral of Time-Absolute Error (ITAE)) ve Zaman Kare Hatanın İntegrali (Integral of Time-Square Error (ITSE)) kullanılarak hataya karşı elde ettikleri sonuçlar kıyaslanmıştır. Benzetimi yapılan sistemin tamamı Matlab/Simulink ortamında gerçekleştirilmiş ve sonuçlar elde edilmiştir.

**Anahtar Kelimeler:** zaman gecikmeli sistem, kesir dereceli PID denetleyici, hatanın mutlak değerinin integrali, kontrol sistemleri.

### CONTROL and COMPARISON of A TIME-DELAYED SYSTEM USING PID, 2DOFPID, and KDPID CONTROLLER

### ABSTRACT

Time-delayed systems are prevalent in industrial processes, commonly encountered in chemical and fluid systems, manufacturing plants, communication networks, and defense industry operations. This study employs PID, Fractional Order PID (FOPID), and Two Degrees of Freedom PID (2DOFPID) controllers to manage an example of a time-delayed system. In addition to analyzing the responses to unit step input, the system's resilience to introduced disturbances was also tested and the results were examined. Additionally, the controllers' efficacy against errors was evaluated using performance indices such as Integral Square Error (ISE), Integral of Absolute Value of Error (IAE), Integral of Time-weighted Absolute Error (ITAE), and Integral of Time-weighted Square Error (ITSE). The simulation of the system was fully conducted in the Matlab/Simulink environment, with results obtained for further discussion.

**Keywords:** time delay system, fractional order PID controller, integral of time absolute error, control systems.



## **Title: CONTROL OF INDUCTION MOTOR USING FUZZY LOGIC APPROACH SIMULATION AND EXPERIMENTAL RESULTS**

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### **ABSTRACT**

This work presents the theory, design and simulation of a fuzzy logic based controller used for an indirect vector controlled three-phase induction motor and its experimental implementation in laboratory. The objective is to replace the classic PI control technique with the robust fuzzy logic tuning technique to improve the performance of classic vector control. The design and simulation of the fuzzy logic controller for drive system are carried out based on the fuzzy set theory. The FLC algorithm has been simulated on Matlab simulink then implemented in dSPACE1104 with a real IM of 3kw in laboratory. The performance of the proposed Fuzzy logic controller has been analysing and compared to the results obtained from the conventional PI controller based drive at different operating conditions such as sudden change in load. Given the simulation and experimental results demonstrate that the performance of the fuzzy logic controller is better than that for the conventional PI controller.

**Keywords:** Fuzzy logic, Field oriented control (FOC), Induction machine (IM), Dspace1104.



## PREDICTION OF THE ELECTRONIC TRANSITIONS OF BENZENE USING THE CHARACTER TABLE AND THE CONJUGACY CLASSES OF THE DIRECT PRODUCT OF PAIR OF DIHEDRAL GROUPS

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### ABSTRACT

The electronic transitions of benzene have been studied using group theory concepts. The  $D_{6h}$  point group of benzene was determined, and its symmetry elements and operations were identified. The character table of the  $D_{6h}$  point group was constructed, and the symmetry of the relevant  $\pi$ -electron molecular orbitals of benzene was determined using the character table. The electronic spectrum of benzene was analyzed using group theory, and the allowed and forbidden electronic transitions were predicted based on symmetry arguments. The results of this study demonstrate the usefulness of group theory in predicting the electronic properties of molecules and provide insights into the electronic transitions of benzene.

**KEYWORDS:** Electronic Transmission, Benzene, Molecules, Group Theory, Point Group Symmetry, Dihedral Groups, Character Table, Conjugacy Classes, Symmetry Operations



## THE EFFECT FIELD ELECTRIC ON DIAMAGNETIC SUSCEPTIBILITY IN A GAAS TOROIDALE QUANTUM DOT

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### ABSTRACT

This study examines the behavior of an electron confined in a GaAs toroidal quantum dot in the presence of a shallow donor impurity. The Schrödinger equation is solved using the finite difference method, considering an infinite confinement potential and applying the effective mass approximation. The analysis focuses on the diamagnetic susceptibility for various angles of the electric field. The results indicate that the diamagnetic susceptibility is influenced by the direction of the electric field. Moreover, the diamagnetic susceptibility displays a symmetrical behavior with respect to the angle of the electric field.

**Keywords:** Quantum dot, FDM, Field electric



## THE IMPACT OF GEOMETRICAL CONFINEMENT AND EXTERNALLY APPLIED ELECTRIC AND MAGNETIC FIELDS ON THE ELECTRONIC ENERGY LEVELS IN A GAAS QUARTER TORUS QUANTUM DOT

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### ABSTRACT

This study investigates the behavior of an electron confined in a GaAs Quarter torus quantum dot in the presence of an externally applied electric and magnetic fields. The Schrödinger equation is solved using the finite difference method, considering an infinite confinement potential and utilizing the effective mass approximation. The electronic energy are analyzed for various geometric sizes of the quarter torus. The findings reveal that the electronic energy exhibits a important behavior in presence of externally applied electric and magnetic fields . These variations shed light on the effects of quantum dot size and externally applied electric and magnetic fields, thus enhancing the sensitivity of opto-electronic devices.

**Keywords:** Quantum dot, FDM, Field electric and magnetic, Quarter torus





## THE CHALLENGES OF THE HEAT PRODUCTION IN THE FRAME OF SUSTAINABLE EU DEVELOPMENT STRATEGY

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### ABSTRACT

Transformation of the energy sector, including heating, is one of the most important and currently the most widely discussed issues related to national and European climate and energy policy. The Polish heating industry is under enormous pressure, and changes are taking place very dynamically. This is due to the accumulation of many factors, the most important of which are reflected in the current situation related to energy security and in the set of EU regulations entitled “European Green Deal”.

The aim of the presentation is to present the necessary transformations which must undergo the processes of production and distribution of heat energy in the context of the necessity to implement the principles of sustainable development.

Managing and making decisions in the era of energy transformation within three areas of sustainable development: social, environmental, as well as economic and technical requires including many contradictory criteria that must take into account a long-term perspective. Decisions made in all of these areas need to reflect the long-term trade-off between maintaining environmental integrity, social justice and economic efficiency while engaging and meeting the expectations of stakeholders. As a result of the conducted research, the main areas of transformation of producers and suppliers of heat energy will be indicated.

**Keywords:** heat energy production and distribution, energy transition, sustainable development.



## ENERGY POVERTY IN THE ERA OF GLOBALIZATION: BRAZIL, CHINA AND INDIA

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## **ABSTRACT**

In the contemporary era, marked by increasing globalization and technological innovation, the issue of energy poverty persists as a topic of debate in various parts of the world. In contrast to developed nations, developing countries face considerable challenges in meeting the growing demand for energy. With the aim of analyzing the role of financial inclusion and its impact on energy poverty in three representative emerging economies—Brazil, China, and India—this article investigates disparities in electricity accessibility in these nations, examining them from the perspective of access as a human right. This article is dedicated to the analysis of the contribution of financial inclusion as a mitigating tool for energy poverty. The importance of energy in human subsistence is undeniable. Ensuring universal access to energy is not only a requirement to promote social well-being but also an imperative to drive the economic development of a nation. Within this context, the concept of energy poverty and its connection to renewable energy are addressed, taking into account both the human dimension and equity. To shape this research, a review of technical literature was conducted. This review emphasized the persistent inequality stemming from the distribution of income and energy as an urgent concern. However, there are indications that this disparity can be reduced through adjustments in energy tariff policies, grounded in research on socio-economic relations. In light of this purpose, this article aims to critically analyze the complex nuances of energy poverty. The research strives not only to mitigate the adverse effects of energy poverty but also to contribute significantly and comprehensively to the construction of a more inclusive future, where energy equity and sustainability are fundamental pillars. This proactive approach seeks to go beyond the mere identification of problems, actively aiming to be a driving force in promoting effective and lasting changes.

**Keywords:** Energy Poverty; Financial Inclusion; Renewable Energies; Brazil; China; India.



## ENERGY CHALLENGES IN WEST AFRICA

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### ABSTRACT

Africa's proven energy potential is abundant and diverse, ranging from fossil and renewable sources to biomass. However, despite this enormous potential, 600 million people still do not have access to energy on the continent. Over the years, humanity has emitted a lot of carbon in nature and contributed to the pollution of the environment due to the use and the frantic race for fossil fuels. This has led to the establishment of a global preventive policy consisting in promoting the transition to less or non-polluting renewable energies in order to preserve the global ecosystem. This policy, which comes in a context where Africa is trying to get out of poverty, is difficult to apply as resources are limited.

In West Africa, the member countries of the Economic Community of West African States (ECOWAS) have agreed to take a set of measures aimed at promoting universal access to energy for their citizens, and minimize increased use of biomass and other greenhouse gas emitting energy sources. Thus, a legal framework governing the West African energy sector has been set, and a policy as well as technical and operational bodies have been created. In accordance with the regional energy policy, at the national level, although the consumption of biomass remains dominant, the members strive to promote the energy transition by offering renewable energy solutions. They also participate in the development of a regional energy market in which energy exchanges are coordinated and gradually oriented towards renewables.

West Africa has abundant and diversified energy resources unevenly distributed across countries. To overcome this deficit, it practices a prudent energy policy to gradually reduce dependence on fossil fuels, the production costs of which remain too high, and on biomass, which contributes to the destruction of regional flora and the emission of GHGs. Despite the structural and infrastructural efforts of ECOWAS aimed at achieving independence and promoting energy transition, as well as allowing universal access to energy for populations and businesses, it remains highly dependent on imported energy resources such as gas, petroleum products, and biomass for cooking and heating. And energy consumption remains inefficient and concentrated in cities to the detriment of suburbs and rural areas.

**KEYWORDS:** Challenges, resources, energy policies, energy challenges, greenhouse gas, African energy sectors.



## POWER STRUGGLES: ANALYZING THE GEOPOLITICS OF RENEWABLE ENERGY TRANSITION

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### ABSTRACT

As the global community grapples with the imperative to transition towards sustainable energy sources, this research paper delves into the intricate geopolitics surrounding the shift to renewable energy. Focusing on the dynamics of power struggles inherent in this transition, the study employs a multidimensional analysis to explore the political, economic, and strategic dimensions shaping the global landscape.

The research investigates the geopolitical implications of renewable energy deployment, considering the interests and interactions of key state and non-state actors. By examining case studies from diverse regions, it aims to elucidate the varying degrees of political will, cooperation, and competition influencing the adoption of renewable technologies. The paper also scrutinizes the role of international institutions and agreements in mediating geopolitical tensions and facilitating a harmonious energy transition.

Furthermore, the research assesses the impact of renewable energy geopolitics on global power structures, resource distribution, and the potential for both collaboration and conflict. It seeks to uncover how nations leverage their renewable energy capabilities as tools of influence and soft power in the international arena.

In conclusion, this paper contributes to the evolving discourse on renewable energy transition by providing a nuanced understanding of the geopolitics involved. By shedding light on the complexities of power struggles, the research aims to inform policymakers, scholars, and stakeholders about the challenges and opportunities inherent in navigating the geopolitical landscape of a sustainable energy future.

**Keywords:** Renewable Energy Politics, Energy Transition, Power Struggle, Energy Geopolitics.



## FROM OIL DISCOVERY TO ENERGY HUB: TRACING THE HISTORICAL EVOLUTION OF GULF STATES' FUEL ECONOMIES

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### ABSTRACT

This research paper offers a comprehensive historical analysis of the transformation of Gulf States' economies from their initial oil discoveries to their current status as emerging energy hubs. Focused on the Gulf Cooperation Council (GCC) countries, namely Saudi Arabia, the United Arab Emirates, Kuwait, Qatar, Oman, and Bahrain, the study traces the intricate journey of these nations from their reliance on oil revenues to the diversification and integration of various energy sources.

Beginning with the early days of oil exploration and production in the mid-20th century, the paper investigates the pivotal role of oil in shaping the economic, social, and political landscapes of Gulf States. It explores the economic boom and subsequent challenges associated with oil dependency, leading to the formulation of strategic policies for economic diversification.

The research employs a historical lens to analyze the deliberate efforts of Gulf States to transition from mono-economies centered around oil to multifaceted energy hubs. By examining key policy decisions, investments, and technological advancements, the study aims to provide insights into the factors that facilitated or hindered successful economic diversification.

Furthermore, the paper assesses the implications of this economic evolution on regional and global energy dynamics. It delves into the diplomatic and geopolitical consequences of Gulf States' energy strategies, emphasizing their roles as influential players in the international energy market.

In conclusion, this research contributes to the understanding of the historical evolution of Gulf States' fuel economies, shedding light on the complexities of their transition from oil dependence to becoming dynamic energy hubs. By offering a nuanced perspective, the study aims to inform future policy decisions, economic strategies, and international collaborations in the realm of energy development and sustainability.

**Keywords:** Gulf States Economic diversification, Oil dependence, Historical analysis ,Gulf Cooperation Council (GCC)



## EXPLORING SMART WORK'S IMPACT ON SUSTAINABILITY: A BIBLIOMETRIC ANALYSIS

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### **ABSTRACT**

The main purpose of this study is to provide a comprehensive overview of the impact of smart working on sustainability. By highlighting the challenges and opportunities associated with optimizing the use of energy resources and promoting sustainable behaviors within organizational contexts, this research aims to shed light on the multifaceted impacts that smart working practices can have on environmental sustainability. A goal-oriented work organization, with flexible schedules and locations, indeed brings benefits not only to organizations but also to the environment. This study attempts to outline practical recommendations aimed at promoting the implementation of remote work practices that significantly contribute to a more sustainable future. These inquiries seek to unveil the current breadth and depth of research in the field of smart working and sustainability, identify influential figures and seminal works that shape this discourse, and track the evolution of keywords and thematic elements in relation to the outlined topics. Therefore, the authors have formulated specific research inquiries guiding the bibliometric study: What is the current scope and depth of research concerning the correlation between smart working and sustainability? Who are the influential authors and pivotal articles in this field? How have the keywords and thematic elements evolved concerning our outlined topics? Some responses stem from our scrutiny of existing literature on sustainability, while others derive from broader academic works or practical discourse. Our analysis confirms the escalating interest in this subject and marks an initial exploratory phase in the literature study, thereby charting the course for future research endeavors.

**Keywords:** smart working, organizations, sustainability.



## ETHICAL ISSUES IN GLOBAL OIL PRICING AND ITS IMPACT ON EXCHANGE RATES AND STOCK MARKETS UNDER UNCERTAINTY

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### ABSTRACT

Oil is a finite resource which have impact on global economy. Countries with abundant reserves of oil play an important role in economic wellbeing of various nations. Though relationship of oil prices with economic indicators like exchange rates and stock markets is highly complex there exist dynamic relationship between oil prices, exchange rates and stock markets. Apart from economic relationship that, oil price, has with exchange rates and stock markets under uncertainty it has far reaching consequences on ethical issues. Ethical considerations demand switching over to sustainable energy resources and to leave dependence on oil. One of the most significant ethical dilemma in the economics of oil price is the environmental impact of oil production and consumption. The burning of fossil fuels including oil contributes to problem like greenhouse emission, climate change and environmental degradation.

Oil being concentrated in countries with political instability, leads to geopolitical tension. The pursuit of oil resources lead to unethical issues like military intervention, human right abuses and support for authoritarian regime leading to universal conflict. As far as economic equity is concerned, fluctuation in oil prices hampers growth and development of nations. Higher oil prices give rise to inflation for oil importing countries. On the other hand, when oil prices drop, oil exporting countries loose revenue and face problem of providing social service. Ethical consideration demands that economist and policy makers prioritize sustainable energy resources and transition away from oil dependence.

Oil price change can affect the value of national currencies and stock market. Traders speculate on prices which lead to market volatility. Ethical issues in this area need to outweigh market manipulation, insider trading and other unethical practices.

The present paper shall highlight on the ethical issues emerging from global oil pricing and its impact on exchange rates and stock markets under uncertainty. Entire research work shall be presented in following section.

Section I shall comprise of brief introduction on need of ethical practices on global oil pricing.

Section II shall deal with impact of oil prices on Exchange Rates.

Section III shall elaborate on relationship of oil prices with stock markets

Section IV shall spell out the linkage of oil prices with Exchange Rates and Stock Markets under uncertainty

Section V shall conclude with ethical dimension of oil pricing.

**Key words**-Ethics, Oil Price, Exchange Rates, Stock Markets, Uncertainty





## EXPLORING APPROACHES IN HIGHER EDUCATION TO INTEGRATE ENERGY SUSTAINABILITY (A REVIEW)

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### ABSTRACT

This study delves into the exploration of approaches within higher education in Nigeria towards integration energy sustainability. The review recognizes the unique challenges and strategies employed by academic institution to incorporate sustainable energy practices in education. With a focus on dynamic landscape of sustainable practices in academic institutions, the review explores a myriad of strategies employed to integrate energy sustainability. The analysis examines a diverse dimensions, including technological innovations, institutional policies, and educational initiatives. The findings aim to provide valuable insights for regional stakeholders, policymakers, and educational institutions, facilitating the development of context-specific strategies to propel energy sustainability initiatives in Nigeria higher education. The study aligns with Sustainable Development Goal 4 and 7 targeting entrepreneurial and economic development among the youth within the higher education landscape

**Keywords:** Energy Integration, Sustainable Development Goals, Youth Entrepreneurship.



## ENERGY SUPPLY FOR TÜRKIYE: OIL AND GAS IN UKRAINE UNDER THE BLACK SEA

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### ABSTRACT

Türkiye can ensure its gas needs only in 2/3 measure, even after discovering the huge gas field under the Black Sea, in 2020, under the Turkish waters. But is yet not enough, still 1/3 is missing. Albeit the Black Sea much more than Turkish waters, and there are still more gas and oil field, too, around the Crimean Peninsula. There are three rich oil and gas fields in Ukraine, but none are yet exploited, which is why Ukraine needs imports. One is located next to the Crimea, under the sea. Another is in the Don Basin. There the English company Royal Shell has already started exploration, in 2013, albeit Russia urged a separatist war there in 2014, and the Shell Company stopped its activity due to that “hybrid war”. Russia began that hybrid war just after the leading company, Shell, began to exploit the shale gas in East Ukraine, in the Don Basin. The third oil- and gas field is located under Transcarpathia, extends into Romania, and the other half towards Lviv and Ternopil. This large oil field contains a shale gas field in its center, the Chevron Shale Gas Block. Thus, Russian military operations attacked the very areas where oil and gas are available: the Crimea and the Donbas. The shale gas under the continental shelf around Crimea may be of interest to Türkiye, too. First, it is located next to the maritime territorial waters of Türkiye. The security of the Black Sea is of great significance for Türkiye. Then, Türkiye is a strong, powerful country but has less oil and gas oil and gas deposits. In 2021, the largest gas field of Sakarya was discovered by Türkiye on the Black Sea, albeit it may cover only a third part of Türkiye’s need for gas. In 2020, Türkiye began to search for oil deposits under the eastern maritime territorial waters of the Mediterranean Sea, which belong to Türkiye, and the huge oil exploration vessel, the Oruc Reis. Therefore, Türkiye has modern technologies and the capability to exploit those oil- and shale gas fields, which are located under Crimea. President Erdoğan declared in a video message on the second summit of the Crimean Platform in August of 2022, that Türkiye does not recognize the Russian annexation of Crimea and urges Russia to give back Crimea to Ukraine. Still, he said, “The security and well-being of Crimea's indigenous Crimean Tatar people are important to Türkiye. Türkiye continues to stand by the Ukrainian government and the Crimean Tatars” – declared President Erdoğan. (Source: Anadolu Agency) Hence, when the war ends, the natural resources will be exploited by international cooperation and Western capital. It may be possible, that Türkiye would be interested in some investment in Ukraine, too. Moreover, the poor Crimean Tatars must be provided by providing jobs at new enterprises, such as Turkish companies, too. Even more, Crimean Tatars can be good manpower for Turkish enterprises in Ukraine, thus for them courses should be organized for them in Turkey so that they can learn trades and have a skilled worker qualification, and later they will be the best workers at Turkish enterprises if Türkiye makes investments in Ukraine. The lately happened international events proved the wisdom and good political insight of Türkiye, when the grain export corridor was provided for Ukraine, thanks to the diplomatic mediation of President Erdoğan between Russia and Ukraine. Thus, for the future, Türkiye’s role can be very promising when the rebuilding of Ukraine begins, and that country is a good soil for profitable Turkish investments. However, nobody has yet spoken about oil and gas. In this paper, Ukrainian oil and gas are regarded in this aspect: what benefits it can bring to Türkiye, and what possibilities and opportunities may be for profitable investments in this field. – The author had presented similar topics at the Bilsel and LUKAS conferences, but the full text was not sent. Now the author gives the synthesis of his research, and the full test will be given here

**Keywords:** Oil, gas, Crimea, Ukraine, investment, Tatars, Turkish\_interests



## SYNTHESIS AND BIOLOGICAL SCREENING OF HYDRAZONES USING ISOLATED CHOLIC ACID

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### ABSTRACT

Hydrazones possess an azomethine (-NHN=CH) group and are considered derivatives of aldehydes and ketones in which the oxygen atom has been replaced by the (R-NHN=C) functional group. They are archetypally generated by the reaction of hydrazide of cholic acid and carbonyl compounds which water molecules eliminate. These are widely studied molecules owing to their ease of preparation and diverse medicine, agriculture and pharmacology potential. This has led researchers to synthesize different heterocyclic compounds bearing hydrazones. Medical chemists worldwide have done immense work on hydrazones and developed agents with better activity and low toxicity profiles. Hydrazones have biological activities including anti-bacterial, anti-fungal and anti-cancer. The compound was isolated by preparative thin-layer chromatography, column chromatography and characterized by single crystal analysis, Ultra-Violet Visible Spectroscopy, infrared, Mass Spectrometry and Nuclear Magnetic Resonance Spectroscopy.

**Keywords** – azomethine, carbonyl compounds, biological activities, anticancer, bile acid

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## BASED ON THE CALCULATION OF THE STRUCTURAL, MECHANICAL, OPTICAL, AND ELECTRONIC PROPERTIES OF THE OXIDE PEROVSKITE $\text{XBkO}_3$ ( $X = \text{Pb}, \text{Ra}, \text{Sr}$ ): A DFT STUDY

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### ABSTRACT

In this study, we report the computational discovery of three new perovskite-type oxides  $\text{XBkO}_3$  ( $X = \text{Pb}, \text{Ra}, \text{Sr}$ ), using density functional theory (DFT) implemented in the CASTEP code. This exploration provided valuable insights into the structural, electronic, mechanical, and optical properties of these materials. Band structure and density of states (DOS) plots highlight the semiconducting properties of the  $\text{XBkO}_3$  oxides. The anisotropy mechanical stability of these perovskites was demonstrated by the compliance of their elastic constants to the Born stability criteria. The bulk modulus, shear modulus, Poisson's ratio, and Cauchy pressure were also derived from the elastic constants. The B/G ratio and Cauchy pressure reveal a ductile behavior in  $\text{PbBkO}_3$  and  $\text{SrBkO}_3$ , while  $\text{RaBkO}_3$  exhibits a brittle behavior. In addition, these  $\text{XBkO}_3$  compounds ( $X = \text{Pb}, \text{Ra}, \text{Sr}$ ) have demonstrated significant potential for optoelectronic devices capable of capturing ultraviolet light. These materials could find applications in high-performance electronic devices.

**Keywords:** DFT, CASTEP, Perovskite oxides, Density of States (DOS), bulk modulus, shear modulus, Poisson's ratio, Cauchy pressure, ultraviolet light



## SYNTHESIS AND CHARACTERIZATION OF ZN DECORATED GRAPHENE OXIDE FOR ENHANCE PHOTOCATALYTIC APPLICATION

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### ABSTRACT

The leakage of synthetic dyes into water is a major environmental problem that demands the development of long-term treatment methods. The study focused on the development of zinc-decorate graphene oxide (Zn@GO) as a novel photocatalyst/adsorbent for removing acid yellow dye from aqueous solution. Zn@GO was prepared using a simple and environmentally safe and low cost process that included zinc salt into the graphene oxide by in-situ method. The Successful synthesis of nanoparticle confirm through different analytical techniques like, X-ray diffraction (XRD), Fourier-transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM), and energy-dispersive X-ray spectroscopy (EDS) and was used to characterized the synthesis of Zn@GO material. The results showed that zinc was effectively decorated on graphene oxide surface that enhance the catalytic properties of graphene oxide. The photocatalytic efficiency of Zn@GO for the degradation of acid yellow dye was studied under a variety of experimental parameter such as initial dye concentration, contact time, catalyst dose, pH, and temperature. The equilibrium and dynamic components of the adsorption/photocatalytic process was studied using the adsorption isotherm and kinetic models. According to the findings, the photocatalytic degradation followed a pseudo-second-order kinetic model. The effect of pH on photocatalytic performance was investigated and the optimal pH range for absorptive removal of acid yellow dye by Zn@GO was exposed. The Zn@GO's adsorption capacity was found to be competitive with that of other reported adsorbents/catalyst, demonstrating its potential for practical applications in wastewater treatment. Moreover, the reusability and regeneration of Zn@GO was evaluated and indicating its promising stability and recyclability over many adsorption-desorption cycles.

**Key Words:** water pollution, Zinc decorated Grephene oxide, photocatalytic degradation



## IMPROVING PHOTOCATALYTIC EFFICIENCY OF GRAPHITIC CARBON NITRIDE NANOCOMPOSITES BASED ON DOUBLE Z-SCHEME HETEROJUNCTIONS

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### ABSTRACT

The global energy crises and environmental degradation are the two main hurdles in achieving the energy shortage; and to achieve this end photocatalysis can be used. For this purpose, the use of graphitic carbon nitride (g-C<sub>3</sub>N<sub>4</sub>) is a better option but their photocatalytic activities need to be improved and this can be done by making its nanocomposite with other semiconductors. Likewise, using solar energy to decompose H<sub>2</sub>O on photocatalysts is a huge challenge for researchers to produce zero-emission fuels. H<sub>2</sub> has been regarded as a promising chemical fuel substitute for fossil fuels. Similarly, a pollutants free environment is also a huge challenge for the survival of living organisms. In order to achieve these objectives, boron doped g-C<sub>3</sub>N<sub>4</sub> and metal oxides such as Fe<sub>2</sub>O<sub>3</sub>, TiO<sub>2</sub> and ZnO were synthesized and characterized in first phase. In the next phase, some binary/ternary nanocomposites of g-C<sub>3</sub>N<sub>4</sub> nanoparticles with other semiconductors/metallic oxides such as Fe<sub>2</sub>O<sub>3</sub>, TiO<sub>2</sub> and ZnO etc., were prepared and characterized. In the third phase, their potential catalytic/photocatalytic and environmental applications were explored and the effect of chemical composition/additives on the structural, physicochemical, and photoactive properties of these binary and ternary nanocomposites were investigated in detail. Similarly, the nanocomposites, so obtained, were characterized for their structural and chemical and physicochemical properties while using UV-Visible and FTIR spectroscopies, SEM, TEM, XRD, EDS, TGA and some other accessible techniques. After detailed physicochemical studies, the double Z-scheme heterojunction nanocomposite materials that exhibited the best performance were reported under different sets of parameter for potential energy production and environmental applications.

**Keywords:** photocatalysts, ternary nanocomposites and energy resources



## NUMERICAL INVESTIGATION OF ECO-FRIENDLY MATERIALS FOR BUILDING ENVELOPE

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### ABSTRACT

This work aims to evaluate the impact of new materials on thermal performance and energy savings. Indeed, this study shows the importance of the use of natural and recycled waste-based feather materials. For this purpose, a full-scale cell located in Casablanca was considered as a case study to build a simulation model performed on TRNSYS. This model is then used for the impact of the techniques studied on energy performance, GHG emissions, and hours of discomfort inside another cell in Casablanca. This study showed that the developed nonwovens exhibit excellent insulation performance with thermal conductivity in the range of 0.031–0.044 [W/m. K]. Moreover, the minimum energy performance is observed for developed wool insulation with a performance of 30 (KWh/year.m<sup>2</sup>). The comparison of these values with the Moroccan thermal regulation which sets a threshold of 40 (kWh/year.m<sup>2</sup>) for the annual thermal load of residential buildings in the climatic zone of Casablanca, shows that the feather waste insulation integrated into the building is mainly sufficient to meet the requirements of Moroccan regulations. Annual GHG emissions are mitigated by 44.61 for FC1, 46.54 for FC2, 47.95 for FC3, 46.59 for FW1, 46.99 for FW2 and 48.58 for FW3(%).

**KEYWORDS:** Nonwovens, Energy performance, Climatic zone, Buildings, Feather waste, TRNSYS, Thermal Insulation, Eco-friendly materials.





## STRUCTURAL, OPTICAL, AND ELECTRICAL PROPERTIES OF 4%Co-SnO<sub>2</sub> FILMS BY USP METHOD

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### ABSTRACT

The effect of Co-doping on the structural, optical, and electrical properties of SnO<sub>2</sub> thin films prepared by spray pyrolysis technique at 450°C method was utilized. Thin films of Co (4%) doped SnO<sub>2</sub> were deposited on glass substrates and characterized by X-ray diffraction (XRD), UV-Vis absorption. The tetragonal rutile-type structure was confirmed by X-ray diffraction with an average crystallite size of 20 nm. For the optical properties, the bandgap energy was determined by the Wemple-DiDomenico model. with a square resistance value of 100 Ohms Co-doped (4%). SnO<sub>2</sub> thin films.

**Keywords** –SnO<sub>2</sub>:Co, X ray diffraction, Optical properties

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## STUDY OF THE MORPHOLOGICAL, STRUCTURAL AND OPTICAL PROPERTIES OF THIN LAYERS CZTS FOR PHOTOVOLTAIC APPLICATIONS

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### ABSTRACT

Thin-film solar cells, such as those used in solar panels, convert light energy into electrical energy. Copper-zinc-tin sulfide (CZTS) films are a semiconducting quaternary compound that has attracted increasing interest in recent times for solar cell applications.

CZTS ( $\text{Cu}_2\text{ZnSnS}_4$ ) is a quaternary semiconductor described from models structures of two natural minerals: stannite (space group I-42m) and kesterite(space group I-4) both structure are tetragonal and thin film solar cells with  $\text{Cu}_2\text{ZnSnS}_4$  absorption layer ( $\text{Cu}_2\text{ZnSnS}_4$  solar cells) are an alternative to current well-developed CIGS solar cells. These films have suitable properties to make it into an absorption layer as they contain less toxic materials and also a suitable band gap in addition to a relatively high absorption coefficient  $10^4\text{cm}^{-1}$  and direct band gap of 1.4 to 1.5 eV, with p-type conductivity, which proved that the theoretical power conversion efficiency of the CZTS solar cell could reach up to 32.2% while the recently approximately obtained 12,8%

In our research paper, will deposition CZTS thin films by spin coating method, where prepared a sol-gel solution from the precursor. Cells will later be deposited on soda lime glass substrates and then we will perform an annealing process at different temperatures. The structural, electrical characterization, compositional of the thin film will be analyzed by energy Dispersive X-ray, scanning Electron Microscopy, SEM, X-ray diffraction XRD, the conductivity measurement UV- Visible spectrometer...

**Keywords:** CZTS, solar cells, thin film, spin coating



## MECHANICAL CHARACTERIZATION OF ADVANCED CHEMICAL VAPOR DEPOSITION COATINGS FOR CUTTING TOOL APPLICATIONS

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### ABSTRACT

In the field of materials engineering, the enhancement of tool performance is crucial for optimizing cutting technology and thermoforming processes. Various coating technologies have been developed to augment mechanical properties such as hardness, abrasion resistance, thermal stability, toughness, and chemical stability in tools. Chemical Vapor Deposition (CVD) technology stands out as a prevalent method for achieving these improvements. This paper provides a thorough examination of the characterization and properties of hard CVD coatings, with a specific focus on the essential methods and techniques employed for testing these thin films.

The review encompasses a detailed discussion of various testing methodologies used to characterize hard CVD coatings. Key aspects include the examination of coating structure through techniques like X-ray diffraction (XRD), scanning electron microscopy (SEM), Energy dispersive X-ray spectroscopy (EDS), transmission electron microscopy (TEM), and atomic force microscopy (AFM). Mechanical properties, such as hardness and nano-indentation, fatigue resistance under constant amplitude, adhesion, and wear resistance, are explored in depth. The paper also delves into the measurement methodologies for coating thickness and examines the oxidation and corrosion resistance of these coatings. The comprehensive overview concludes by offering insights into the practical implementation of different testing techniques for hard CVD coatings. By outlining the procedures for assessing various properties, the paper aims to facilitate a deeper understanding of the suitability of these coatings for diverse engineering applications. This review serves as a valuable resource for researchers, engineers, and practitioners seeking to enhance their knowledge of the advancements in testing methodologies for extraordinarily hard CVD coatings.

**Keywords:** Chemical vapor deposition, hard multilayered coatings, CVD, mechanical characterization, X-ray diffraction (XRD), scanning electron microscopy (SEM), atomic force microscopy (AFM).



## STUDIES IN THE FIELD OF CARBON TRADE AND ENERGY LAW

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### SUMMARY

Climate change is one of the biggest problems of the last century, and as a solution, efforts have been initiated to reduce and control greenhouse gas emissions in the first place. The Kyoto Protocol formed the basis of carbon trading by reducing greenhouse gas emissions through the development of technology and sustainable projects and by assigning responsibilities to countries in this regard, and the functioning of this market was named carbon trading. In this study, the current situation was evaluated with studies conducted in our country and around the world using the descriptive research method. Evaluations were made by making correlation analysis with Turkish and world statistical data and information obtained from publications. As a result, developments in the field of carbon market and law are revealed and information about the awareness and initiatives of energy and related companies in this regard is presented.

**Key words:** Carbon Trading, Energy Law, Green Deal, Data Analysis, Climate Change, Carbon Footprint.

### KARBON TİCARETİ ve ENERJİ HUKUKU ALANINDAKİ ÇALIŞMALAR

### ÖZET

İklim değişikliği, son yüzyılın en büyük sorunlarından biri olup çözüm olarak ilk etapta sera gazı emisyonlarını azaltmak ve kontrol altına almak için çalışmalar başlatılmıştır. Kyoto Protokolü, teknolojinin gelişmesi ve sürdürülebilir projeler aracılığıyla sera gazı emisyonlarını azaltmayı ve bu konuda ülkelere sorumluluklar yükleyerek karbon ticaretinin temelini oluşturmuş ve bu piyasanın işleyişi karbon ticareti olarak isimlendirilmiştir. Bu çalışmada, betimsel araştırma yöntemi ile ülkemiz ve dünyada yapılan çalışmalar ile güncel durum değerlendirilmiştir. Türkiye ve dünya istatistikler verileri, yayınlardan elde edilen bilgilerle korelasyon analizi yapılarak değerlendirilmeler yapılmıştır. Sonuç olarak karbon piyasası ve hukuku alanında ki gelişmeler ortaya konularak bu konuda enerji ve ilgili firmaların farkındalık ve girişimleri hakkında bilgiler sunulmuştur.

**Anahtar kelimeler:** Karbon Ticareti, Enerji Hukuku, Yeşil Mutabakat, Veri Analiz, İklim Değişikliği, Karbon Ayakizi.



## BİSİKLET ULAŞIMI, KENT PLANLAMA VE ENERJİ VERİMLİLİĞİ, BIBLİYOMETRİK ANALİZ ÇALIŞMASI

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### ÖZET

Ulaşım insanlığın başlangıcından günümüze insan aktiviteleri ve mekanların şekillenmesinde rol oynamış en önemli unsurlardan biridir. Teknolojinin ve medeniyetin gelişmesiyle birlikte ulaşımın sunduğu hem avantajlar hem de yarattığı sorunlar gelişmiştir. Özellikle sanayi devrimi sonrası kentler hızla büyümüş, kent içerisindeki işlev alanları arasındaki mesafeler artmıştır. İşlev alanları arasında artan bu mesafeler insanlığı motorlu taşıt kullanımına bağımlı kılmıştır. Motorlu taşıt kullanımının artması ise beraberinde başlıca karbondioksit gibi çevreye ve ozon tabakasına zararlı atıkları getirmiştir. Çağımızın en büyük sorunlarından birisi küresel ısınma olarak kabul edilmektedir. Küresel iklim değişikliğinin ise en önemli sebeplerinden birisi, enerji kaynağı olarak fosil yakıtların ağırlıklı kullanımınıdır. Araştırmalara göre fosil yakıt kullanımının %20'si ulaşım kaynaklıdır, bunun büyük bir kısmını ise karayollarındaki motorlu taşıtlar oluşturmaktadır. Küresel ısınmanın etkilerini fazlaca hissettiğimiz bu yıllarda dünya çapında sürdürülebilir ulaşım ve yeşil ulaşım modları çalışmaları hız kazanmaktadır. Bisiklet çevre dostu bir ulaşım aracı olarak sürdürülebilir ulaşım çalışmalarında ele alınan bir araçtır. Ancak motorlu taşıt merkezli gelişmiş kentlerde bisikleti aktif bir ulaşım modu kılabilmek ciddi ölçüde bir mücadele gerektirmektedir. Çünkü günümüze gelen süreçte bisiklet ve yayalar, ulaşım planlamalarında ikinci plana atılmış, kentler dev kavşaklar ve hızlı motorlu taşıtları merkez alan şekilde büyümüştür. Bu yüzden günümüzde bisiklet ulaşımı bir çok farklı disiplinin araştırma konularından biridir. Çalışmamız bisiklet ulaşımının kent planlamasındaki yerini ele alacaktır. Bunun için ilk olarak literatürün bir özeti sunulacaktır. İkinci olarak aşamalı şekilde; bisiklet ulaşımı-kent planlaması, bisiklet ulaşımı- enerji verimliliği ve bisiklet ulaşımı- kent planlaması ve enerji verimliliği kavramlarının VOSviewer programı üzerinden bibliyometrik analizi gerçekleştirilecektir. Analizler sonucunda bisiklet ulaşımının kent planlaması disiplini içerisindeki güncel yaklaşımları ve kavramlar arasındaki ilişkiler değerlendirilecektir. Çalışma bibliyometrik analizler üzerinden literatürde bisiklet ulaşımı, kentleşme ve enerji kavramları ilişkisini, kent planlama alanındaki yerini tespit ederek, literatüre öneriler sunmayı hedeflemektedir.

**Anahtar Kelimeler:** Bisikletli Ulaşım, Kent Planlama, Enerji verimliliği, Bibliyometrik Analiz, .

## BICYCLE TRANSPORTATION, URBAN PLANNING AND ENERGY EFFICIENCY, BIBLIOMETRIC ANALYSIS STUDY

### ABSTRACT

Transportation is one of the most important factors that has played a role in shaping human activities and spaces from the beginning of humanity to the present day. With the development of technology and civilization, both the advantages of transportation and the problems it creates have developed. Especially after the industrial revolution, cities grew rapidly and the distances between functional areas within the city increased. These increasing distances between functional areas have made humanity dependent on the use of motor vehicles. The increase in the use of motor vehicles has brought with it wastes that are harmful to the environment and the ozone layer, such as carbon dioxide. One of the biggest problems of our age is considered global warming. One of the most important reasons for global climate change is the heavy use of fossil fuels as an energy source. According to research, 20% of fossil fuel use comes from transportation, most of which

is motor vehicles on the highways. In these years when we feel the effects of global warming more and more, studies on sustainable transportation and green transportation modes are gaining momentum around the world. As an environmentally friendly means of transportation, the bicycle is a tool that is considered in sustainable transportation studies. However, making the bicycle an active transportation mode in motor vehicle-centered developed cities requires a serious struggle. Because in the period up to the present day, bicycles and pedestrians have been relegated to the background in transportation planning, and cities have grown with giant intersections and fast motor vehicles as the center. That's why today, bicycle transportation is one of the research topics of many different disciplines. Our study will discuss the place of bicycle transportation in urban planning. For this purpose, first a summary of the literature will be presented. Secondly, in a gradual manner; Bibliometric analysis of the concepts of bicycle transportation-urban planning, bicycle transportation-energy efficiency and bicycle transportation-urban planning and energy efficiency will be carried out through the VOSviewer program. As a result of the analyses, current approaches to bicycle transportation within the urban planning discipline and the relationships between concepts will be evaluated. The study aims to provide suggestions to the literature by determining the relationship between bicycle transportation, urbanization and energy concepts and their place in the field of urban planning through bibliometric analysis.

**Keywords:** Bicycle Transportation, Urban Planning, Energy Efficiency, Bibliometric Analysis,



## ŞEBEKEDEN BAĞIMSIZ ARAÇ İÇİ TAŞINABİLİR ELEKTRİKLİ ARAÇ ŞARJ İSTASYONUNDAKİ GELİŞMELER

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### ÖZET

Elektrikli Araç (EA)'ların kullanımı hızlı bir şekilde artarken, bu talebi karşılamak için çok sayıda şarj istasyonu kurulmasına ihtiyaç vardır. Sabit şarj istasyonlarını, geleneksel benzin istasyonları gibi birçok yerde kurulumu hem maliyet hem de teknik altyapı açısından oldukça zordur. Mevcut sabit şarj istasyonlarının eksikliği, menzil endişesi ve genel şarj süresinin çok uzun olmaması gibi nedenlerde EA'ların geniş çapta benimsenmesinin önündeki büyük engeller olarak görülmektedir. Şarj istasyonlarının tüm lokasyonlarda talep edilen şarj ihtiyacını karşılamada, altyapı eksikleri ve var olan elektrik dağıtım sistemlerinde oluşturacağı çeşitli elektriksel problemlerden dolayı zorluk yaşayacaktır. Böylece EA'ların pazardaki gelişim hızı yavaşlayacaktır. Bu noktada belirtilen zorlukları telafi etmede ve EA'ların otomobil sektörü içindeki talep edilebilirliğini arttırmada Mobil Şarj İstasyonları (MŞİ) bir çözüm olarak değerlendirilebilir. EA kullanıcılarının acil ihtiyaç durumlarında şarj ihtiyacını karşılama fikri MŞİ'lerin temel işlevini oluşturmaktadır. Bu yayında MŞİ'nin bağlı olduğu sistemlerdeki faydaları, bağlantı zorlukları, kullanılma şekilleri hakkında teknik bilgiler verirken, aynı zamanda sabit şarj istasyonlarına destek sağlamada esnek zamanlı ve lokasyonlu bir şarj imkânı oluşturduğunu ifade etmektedir. MŞİ hizmetlerinden faydalanırken kullanıcıların ödeyeceği maliyetler ve teknik olarak bilmeleri gereken bilgiler ile bu şarj sisteminin mevcut dağıtım şebekesine olan etkileri incelenmiş ve öneriler sunulmuştur.

**Anahtar Kelimeler:** Şarj Altyapısı, Elektrikli Araç, Mobil Şarj İstasyonu, Şebekeden Bağımsız Şarj

## DEVELOPMENTS IN OFF-GRID ON-BOARD PORTABLE ELECTRIC VEHICLE CHARGING STATION

### ABSTRACT

While the use of Electric Vehicles (EVs) is increasing rapidly, there is a need to establish many charging stations to meet this demand. Fixed charging stations, like traditional gas stations, are very difficult to install in many places in terms of both cost and technical infrastructure. The lack of available fixed charging stations, range anxiety and the general charging time not being too long are seen as major obstacles to the widespread adoption of EVs. Charging stations will have difficulty in meeting the charging needs demanded in all locations due to infrastructure deficiencies and various electrical problems that will occur in existing electricity distribution systems. Thus, the pace of development of EVs in the market will slow down. At this point, Mobile Charging Stations (MCS) can be considered as a solution to compensate for the difficulties mentioned and to increase the demand of EVs in the automobile industry. The idea of meeting the charging needs of EV users in emergency situations constitutes the basic function of MCSs. In this publication, it provides technical information about the benefits of MCS in the systems it is connected to, connection difficulties, and ways of using it, while also stating that it creates a flexible time and location charging opportunity to support fixed charging stations. The costs that users will pay when benefiting from MCS services and the technical information they need to know, as well as the effects of this charging system on the existing distribution network, have been examined and suggestions have been presented.

**Keywords:** Charging Infrastructure, Electric Vehicle, Mobile Charging Station, Off-grid Charging





## DATA-BASED MODELS FOR REMAINING USEFUL LIFE ESTIMATION OF TURBOFAN ENGINES -A REVIEW

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### ABSTRACT

The most important component of effective maintenance planning for turbofan engines is the estimation of the remaining useful life (RUL) of the engine. Physics-based models for RUL prediction requires expertise in domain knowledge and even with expertise it is very difficult to construct the equations that represent the degradation process of the engine. With the advancements in the sensor technology, various parts of the engine's health could be monitored providing a lot of data. Therefore, data-based models for RUL prediction gain importance. Within the data-based models especially deep learning-based models have attracted a lot of attention. In this study, we reviewed the literature on deep learning-based models for RUL prediction of turbofan engines.

**Keywords:** Turbofan Engine, Remaining Useful Life, deep learning



## KAMU HASTANELERİNDE ENERJİ VERİMLİLİĞİ UYGULAMALARI

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### ÖZET

Nüfus artışı, ekonomik büyüme, endüstriyel üretim, iklim koşulları ve teknolojik gelişmeler gibi faktörler her geçen gün enerji tüketiminin artmasına sebep olmaktadır. Fosil yakıtların tükenebilir olması, enerji kaynaklarının sürdürülebilirliği açısından önemli bir sorundur. Bu nedenle, fosil yakıtların tükenmesi, dünya genelinde enerji politikalarının yeniden gözden geçirilmesine neden olmuştur. Ülkemizde birincil enerji kaynaklarının önemli bir miktarı ithalat yoluyla elde edilmektedir. Enerjide gerek dışa bağımlılığı azaltmak gerekse de iç kaynakları etkin kullanmak amacıyla ülkeler enerji verimliliği politikaları geliştirmekte ve uygulamaktadır. Ülkemizde enerji verimliliği politikaları ve önlemleri 2 Mayıs 2007 tarihinde yürürlüğe giren 5627 sayılı Enerji Verimliliği Kanunu'na dayanmaktadır. Bu kanunun amacı, enerjinin etkin kullanılması, israfının önlenmesi, enerji maliyetlerinin ekonomi üzerindeki yükünün hafifletilmesi ve çevrenin korunması için enerji kaynaklarının ve enerjinin kullanımında verimliliğin sağlanmasıdır.

Enerji tüketiminde önemli bir paya sahip olan kamu binalarıyla ilgili enerji verimliliği uygulamaları literatürde geniş bir şekilde yer almaktadır. Bu çalışma kapsamında, 7/24 hizmet verme esasına dayanan kamu hastanelerinde enerji verimliliği potansiyelinin yüksek olacağı öngörülerek, uygulama binası olarak bir kamu hastanesi binası seçilmiştir. İlgili hastane binasında yapılan uygulamalar sonucunda elde edilen veriler enerji verimliliği uygulamalarıyla ilgili önemli ipuçları vermektedir. Uygulama alanı olarak seçilen hastane binasında çeşitli enerji verimliliği çalışmaları gerçekleştirilmiştir. Bu çalışmalar; yaz mevsiminde hasta odalarında pencereler açıldığında klimaların devre dışı bırakılması, bina genelinde daha önce montajı yapılan 4x18 W gücündeki floresan lambaların 36 W gücündeki led armatürlerle değiştirilmesi, eski ve ekonomik ömrünü doldurmuş olan üç adet buhar kazanının daha verimli yeni kazanlarla değiştirilmesi, kapasitif-reaktif cezaları önlemek amacıyla sayaçlara uzaktan okuma sisteminin kurulması, aydınlatma armatürlerine hareket sensörleri uygulanması gibi çeşitli enerji verimliliği uygulamalarını içermektedir. Gerçekleştirilen enerji verimliliği uygulamaları sonucunda elde edilen verilere göre; bir önceki yıla kıyasla % 51,181 daha az doğalgaz tüketimi gözlenmiştir. Ayrıca, enerji verimliliği uygulamaları yapıldıktan sonra birinci yılda bir önceki yıla göre %10,42, ikinci yılda bir önceki yıla göre %4,76, üçüncü yılda ise bir önceki yıla göre %16,96 elektrik enerjisi tüketimi verimliliği sağlanmıştır. Nihai enerji tüketiminde binalar, Türkiye'de yaklaşık %34, dünyada ise %40 ile en büyük paya sahiptir. Bu durum, binalara yönelik enerji verimliliği çalışmalarının önemini ortaya koymaktadır.

**Anahtar Kelimeler:** Enerji tüketimi, enerji verimliliği, kamu hastanesi.

## ENERGY EFFICIENCY PRACTICES IN PUBLIC HOSPITALS

### ABSTRACT

Factors such as population growth, economic growth, industrial production, climatic conditions and technological developments cause energy consumption to increase day by day. The exhaustibility of fossil fuels is an important problem for the sustainability of energy resources. Therefore, the depletion of fossil fuels has led to a reconsideration of energy policies around the world. A significant amount of primary energy resources used in our country are imported. Countries develop and implement energy efficiency policies in order to both reduce foreign dependence on energy and use domestic resources effectively. Energy efficiency

policies and measures in Türkiye are based on the Energy Efficiency Law No. 5627, which came into force on May 2, 2007. The purpose of this law is to ensure the efficient use of energy, to prevent its waste, to alleviate the burden of energy costs on the economy, and to ensure the use of energy resources and energy to protect the environment.

Energy efficiency practices related to public buildings, which have a significant share in energy consumption, are widely covered in the literature. Within the scope of this study, a public hospital building was chosen as the application building, anticipating that the energy efficiency potential would be high in public hospitals based on the principle of providing 24/7 service. The data obtained as a result of the applications carried out in the relevant hospital building gives important clues about energy efficiency applications. Various energy efficiency practices were carried out in the hospital building chosen as the application area. These practices includes some applications such as; disabling air conditioners when windows are opened in patient rooms during the summer, replacing previously installed 4x18 W fluorescent lamps throughout the building with 36 W LED fixtures, replacing three old and outdated steam boilers with new and more efficient boilers, preventing capacitive-reactive power penalties, installing a remote reading system on meters and applying motion sensors to lighting fixtures. According to the data obtained as a result of energy efficiency practices; 51,181% less natural gas consumption was observed compared to the previous year. In addition, after energy efficiency practices were implemented, 10.42% electrical energy consumption efficiency was achieved in the first year compared to the previous year, 4.76% in the second year compared to the previous year, and 16.96% in the third year compared to the previous year. Buildings have the largest share in final energy consumption, approximately 34% in Turkey and 40% in the world. This situation reveals the importance of energy efficiency for buildings.

**Key Words:** Energy consumption, energy efficiency, public hospital.



## ANALYSIS OF THE WIND LOAD ON THE BUILDING IN TURBULENT FLOW IN OPENFOAM

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### ABSTRACT

Nowadays, as the world's population grows, the number of high-rise buildings being built has significantly increased. This development causes concern about how wind may affect these buildings even more critically. Wind can interact with flexible structures, considerably enhancing wind forces and building sway. Extreme winds are often erratic and can cause structural deformation. Such irregular wind flows are called turbulent flow. This study aims to model turbulent wind flow around a building using OpenFOAM solver with Large Eddy Simulation (LES) and the pisoFoam solver with a logarithmic inlet profile.

**Keywords:** Wind, Turbulence, OpenFoam, LES, pisoFoam.