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# PREFACE

The risky limits of fossil fuel reserves are rapidly increasing the importance of energy in sustainable development. Global energy consumption is expected to increase by 28% by 2040. High economic growth rates of developing countries increase their energy consumption. The changing geographical and economic balances in energy reveal the necessity of long-term solutions to energy markets. Energy policies, green energy and new technologies are emerging as priority issues in the energy market. In the case of predictions, renewable energy will stand out as the fastest growing energy source in the world. Renewable energy sources accounted for nearly 20% of global energy consumption at the beginning of the 21st century, largely from traditional uses of biomass such as wood for heating. Despite this increase in renewable energy sources, coal, oil and natural gas are expected to maintain their position as main energy sources by 2040 and 77% of global energy consumption will still be provided from fossil fuels in 2040. It is expected that natural gas will be the fastest growing energy type among fossil fuels. In 2018, over 33% of global energy consumption comes from petroleum and liquid fuels, and by 2040, this ratio is expected to fall slightly to 30%. It is foreseen that nuclear energy consumption worldwide will increase by 1.5 times between 2018-2040.

Computational Science and Engineering is an interdisciplinary field in which large-scale simulations and high-performance computations are used to solve complex real-life problems in scientific research and engineering. Computational science researchers use advanced computing capabilities to address scientific and engineering challenges in fields ranging from condensed matter physics and nonlinear dynamics to computational fluid Dynamics in order to gain new insights and drive innovations in energy efficiency and renewable energy technologies. They use advanced high-performance computing to propel technology innovation to find new ways to tackle energy challenges that cannot be addressed through traditional experimentation alone. Researchers' state-of-the-art computational modeling and predictive simulation capabilities reduce the risks and uncertainty that are often barriers to industry adopting new and innovative technologies, thereby accelerating the transformation of energy system. Advanced high-performance computing

enables high-impact research on renewable energy. Some recent examples include computational modelling and design of residential buildings, supercapacitors, batteries, and fuel cells, photovoltaics, wind power plants, etc.

We hope that the "International Conference on Sustainable Energy & Energy Calculations (ICSEEC)" will prove to be informative and useful for researchers interested in computational science for energy research.

Further to the success of this event, we would like to express our sincere thanks and gratitudes to Prof. Dr. Halil Akkanat, the rector of Turkish-German University, to Mr. Erdinc Dolu, the district governor of Koycegiz, to the office of the mayor of Koycegiz and to the all organizations, especially Turkish-German University who organized "International Conference on Sustainable Energy & Energy Calculations (ICSEEC)"and all the participants. Furthermore, we, as all participants to this event, acknowledge the EU Project titled "Green Energy Skills for Youth (Green4U)".

April 2019

Prof. Dr. Idris Adnan Gumus
Maltepe University, Istanbul, Turkey
Honoured Speaker of the Conference.

# Contents

# Utilizing Quantum Capacitance in Energy Storage

Afif Siddiki[1]

[1] afifsiddiki@gmail.com, ETCSA & Harvard University

Capacitors are the basic ingredients of electromagnetic energy storage devices. The most simple approach imposes that the capacitance is directly proportional to the insulation properties of the dielectric material used between conducting materials, together with the geometry of the device. It is well known that, the dielectric constant of the material is strongly dependent on the available states at both insulating and conducting materials. The available electronic states are described by the Density of States (DOS) in quantum mechanics and obtained by solving the relevant Schrödinger equation. Interestingly, DOS does not only depend on the geometry or the material properties of the system, but also depends on the quantizing magnetic field. In this presentation, I will provide a brief introduction to quantum mechanical description of insulating states and low-dimensional materials. In the next step, I will be discussing the quantization lead by an external magnetic field on interacting 2D systems and talk about quantum capacitance. Finally, proposed quantum capacitors based on hexagonal symmetric systems will be presented. Our experimental and theoretical findings will be concluding the talk.

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# Hybrid Si Nanowires for Green Energy

Muhammad Y. Bashouti[1]

[1] Bashouti@bgu.ac.il, Department of Environmental Physical and Solar Energy, Ben-Gurion University of the Negev, Israel

Si Nanowires (Si NWs) are a promising candidate for the realization of Green Energy. The lecture will be divided into three parts: (i) Realizing Si NWs, in particular, we will show bottom-up vapor–liquid solid growth as well as a top-down approach by wet and dry etching, (ii) Chemical surface functionalization and optoelectronic characterization, and (iii) NWs integration into device prototypes. Remarkably, as the dimensions are scaled down, the surface and interface area of NWs become more critical – to the level that they might control the whole NW opto-electronic properties. It is therefore essential to understand the surface properties and charge exchange between the NW surfaces and their bulk on a microscopic level. In particular, we show molecular approach to modify the NW surfaces through covalent bonds related electronics. The main analytical tool adopted in our research towards this goal is photoelectron spectroscopy and kelvin probe. Band diagrams will be extracted from based on this analysis and correlated with electrical and material properties of the NWs. Along this route, we have developed a new surface doping technique in contrast to the conventional doping approach (doping via Boron or Phosphorus to obtain p and n type respectively). Our technique based on a combination of work function engineering and phys/chem adsorption of appropriate dopant molecules (organometallic complexes) at the surface. The perspectives of our results for NW based devices, specifically with respect to efficiency enhancement of field effect transistors, hybrid solar-cells and water splitting will be discussed.

# Latent Transmogrification of Our Lives and Existence Using BCI Technologies

Md. Haidar Sharif[1]

[1] md.sharif@uoh.edu.sa, University of Hail, Kingdom of Saudi Arabia

Brain Computer Interface (BCI) technologies open up a world of possibilities. BCI technologies use signals recorded from the brain (e.g., EEG: Electroencephalography) to apply miscellaneous controls and communications including but not limited to: (i) Brain to device control, (ii) Device to brain control, (iii) Brain to Internet communications with an infinite amount of information storage and retrieval, (iv) Mind to mind communication, (v) Memories and feelings transformation, and (vi) Brain to brain control. BCI technologies are still in its primitive stages. When the maturity of these technologies will be attended, we will get all sensory information. Consequently, we can do whatever we would think. In essence, we will have all lives from all other people. We will know all people's feelings each other. Most importantly, we will be living in the Heaven on this Earth. But our minds would be controlled by various brain hackers. The brain hackers would insert or delete our memories without our prior knowledge and then we will have the feelings of the Hell on this Earth. It would be needed to optimize between these two issues. In concise and succinct, we are on the cusp of the forthcoming BCI technologies which are extremely powerful and have very high potential to drastically transmute our lives and existence.

# Energy and Exergy Analysis of Anode-Supported and Electrolyte-Supported Solid Oxide Fuel Cells Gas Turbine Power System

Abdulrazzak Akroot[1], Lutfu Namli[2]

[1] abdulrazzakakroot@karabuk.edu.tr, Karabuk University, Turkey
[2] Ondokuz Mayis University, Turkey

Solid oxide fuel cells (SOFCs) are one of the most promising technologies since they can produce electricity directly from a fuel and generate a lot of waste heat that is generally used in the gas turbines to promote the general performance of the thermal power plant.

In this study, the energy and exergy analyses of a solid oxide fuel cell/gas turbine hybrid system was proceed in MATLAB to examine the performance characteristics of the hybrid system in two different configurations: anode-supported model and electrolyte-supported model. The obtained results indicate that if the fuel utilization factor reduces from 0.85 to 0.65, the overall efficiency decreases from 64.61 to 59.27% for the anode-supported model whereas it reduces from 58.3 to 56.4% for the electrolyte-supported model. Besides, the overall exergy reduces from 53.86 to 44.06% for the anode-supported model whereas it reduces from 39.96 to 33.94% for the electrolyte-supported model. Furthermore, increasing the air utilization factor has a negative impact on the electrical power output and the efficiencies of the overall system due to the reduction in the $O_2$ concentration at the cathode-electrolyte interface.

**Keywords:** Solid oxide fuel cells (SOFCs), anode-supported model, electrolyte-supported model, exergy

# Thermodynamic Analysis of Combined Power Plant of Gas Turbine and Stirling Engine

Abdulrazzak Akroot[1], Eiad Saif[2]

[1] abdulrazzakakroot@karabuk.edu.tr, Department of Mechanical Engineering, Karabuk University, Turkey

[2] Department of Electrical and Electronic Engineering, Ondokuz Mayıs University, Turkey

An integrated gas turbine and Stirling engine for combined heat and power (CHP) application is investigated. In this study, the waste heat of the gas turbine is reused in the Stirling engine to boost the electrical efficiency, power output of the combined power plant, and reduce the exergy loss of the gas turbine cycle released in the environment, freely.

The influence on the system performance are inspected of differ five key system parameters: compression pressure ratio, turbine after pressure, fuel flow rate, exhaust temperature, and air fuel ratio. The influence of these parameters on the power output and thermal efficiency are obtained by the energy balance utilizing MATLAB software.

According to the obtained results, the electrical efficiency of the combined power plant is diminished with the increase of the compressor pressure ratio, exhaust temperature, and the air fuel ratio rate whereas the overall power output of the combined system decreases dramatically with the increase of the system pressure. Furthermore, increasing the compressor pressure ratio and the air fuel ratio decrease the Stirling engine cycle power output but the increasing in the fuel flow rate has a positive impact on the performance of the Stirling engine.

**Keywords:** Gas Turbine (GT), Stirling Engine (SE), Efficiency, Power Plant

# Biomass to Energy Supply Chain: A Review of Methodologies and Challenges

Ahmet Alp Senocak[1], Hacer Guner Goren[2]

[1] asenocak@pau.edu.tr, Pamukkale University, Turkey
[2] Pamukkale University, Turkey

Energy demand has been increased tremendously in consequence of growing population, industrialization and comfort level all around the world since the Industrial Revolution. Today, non-renewable energy sources such as oil, natural gas and coal has been utilized as the primary sources to compensate energy requirement. But having negative impact on environmental pollution and rapid decrease in fossil fuel reserves have made it necessary to consider alternative energy resources. One of the renewable energy resources, biomass, is regarded as a strategic source of energy for being renewable, its ability to grow everywhere, providing socio-economic development, its contribution to the protection of the environment and the generation of electricity. The main biomass sources for bioenergy production can be classified as wood, agriculture and forestry residues, various energy crops (sunflower, canola, sugar beet, wheat, corn, beet, flax, hemp, sorghum, etc.), human and animal wastes, city and industrial waste. Although, many researchers have focused on biomass conversion technologies, designing a reliable, sustainable biomass supply chain network is as important as the efficiency of these conversion methods to deliver affordable products to the end users. Therefore, in order to analyze and review the current literature on biomass to energy supply chain network design and management, this paper provides a systematic literature review on published researches. The major goals of this paper are to determine the most widely used methodologies to address the solution of the problem and present an analysis of the existing gaps and the potential future directions in bioenergy supply chain modelling and management.

**Keywords:** Sustainability, Biomass, Energy, Supply chain, Literature review

# Feasibility Analysis of Domestic Electricity Production from Rooftop Photovoltaic Systems in Three Provinces of Turkey

Anil C. Duman[1], Kaan Deveci[2], Omer Gonul[3], Onder Guler[4]

[1] dumanan@itu.edu.tr, Istanbul Technical University & Turkish-German University, Turkey
[2,3] Istanbul Technical University & Turkish-German University, Turkey
[4] Istanbul Technical University, Turkey

This study presents economic analysis of grid-connected residential rooftop photovoltaic systems in Turkey under current incentives. Provinces of Bursa, Ankara and Mersin were selected to represent northern, central and southern regions of Turkey, respectively. As an autonomous electrical load, an average four-person Turkish household with daily electricity consumption of 11.45 kWh was determined and rooftop photovoltaic systems with PV capacity of 5 kW and inverter capacity of 4 kW were simulated using HOMER Grid software. Results were evaluated through two economic determinants: Discounted Payback Period (DPBP) and Profitability Index (PI). While favorable residential PV systems are expected to have DPBP of 7-8 years today, DPBP of the systems were found to be above 11 years in the central and northern provinces, and around 8 years in the southern part of Turkey. Since current incentives were found to be insufficient to promote rooftop PV systems in the central and northern regions, sensitivity analysis was conducted to analyze future scenarios. Over the results of the sensitivity analysis, the ways of promoting rooftop photovoltaic systems also in the northern parts of the country were discussed.

# Occupational Health and Safety Study in Coal Thermal Power Plant

Akide Cerci Ogmen[1], Ismail Ekmekci[2]

[1] akidecerci@gmail.com, Istanbul Commerce University, Turkey
[2] Istanbul Commerce University, Turkey

The advancement of technology, the increase in population, the idea of dominating the world and the development of industry increase the speed of energy demand. Energy is an indispensable part of industrialization and daily life. The economic and social development of a country is the basic indicator of the need for energy. Energy is one of the main inputs for economic and social development. Energy consumption inevitably grows in parallel with increasing population, urbanization, industrialization, technology expansion and welfare. In energy production in the world, non-renewable energy sources such as coal, natural gas and oil take the first place.

This study focuses on the distribution of 4 years of occupational accidents occurring in the coal power plant. Thermal power plants are the largest industry in electricity production. In thermal power plants, accidents are caused by boiler, turbine, generator, material handling and operation and maintenance hazards. These data were collected by personal interviews such as boiler section, turbine and generator section, coal and ash processing plant of workers working in different parts of thermal power plant. Analyses were made on the basis of different variables. The distribution of accidents by age, educational status, according to the hours of the shift, days of the week, months and according to the wounded regions of the body are shown. The results are shown in tables and graphs.

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# Human Awareness and Ecological Footprint

Boris Abersek[1], Metka Kordigel Abersek[2], Andrej Flogie[3], Jasmina Heric[4], Dejan Zemljak[5]

[1] boris.abersek@um.si, Faculty of Natural Science and Mathematics, University of Maribor, Slovenia
[2] Faculty of Education, University of Maribor, Slovenia
[3] Faculty of Natural Science and Mathematics, University of Maribor, Slovenia
[4,5] University of Maribor, Slovenia

In the process of education when we mostly point out importance of getting knowledge, to developing cognitive competences, the question arises of what happens with the students' social skills and their social competences, and whether we can increase social competences gradually, step by step? Human beings are definitely social beings. From our own research, as well as from the research conducted by many other researchers it is obvious that with intensive individualization and differentiation of the teaching/learning process (one-on-one tutoring), a drastic decrease in social skills and social awareness, which is crucial in the area of ecology.

What can / must we do? As we have already mentioned, the recurrent theme of this research will be the "ecological footprint". We must develop awareness in every individual; we must "change" or establish the specific way of thinking (creative, critical, and conscious thinking); and it is very important to begin this process with students of the youngest possible age. In the case of the ecological footprint problem, competences must be developed step by step, which enable us to deal with the day-to-day needs of others, and which help raise the awareness that we have only one earth — a complex puzzle, for which everyone is responsible, and to which everyone can contribute their small (but important) piece.

The analysis of the results of project GREEN4U clearly points to the effectiveness of the proposed research- and problem-based strategies of learning (supported by collaborative teaching/learning) for developing social competences. Nonetheless, a more detailed research with a larger sample of students would have to be conducted in order to receive even more relevant results. The development of historical memory in humans is a gradual process happening over a long period of time. Little by little, lesson by lesson, it is going to alter our own awareness by constructing and adding new elements on the level of intuitive thinking. Such research work will be crucial for developing a complete, integrated, well-rounded personality of a student; for creating positive interpersonal relationships; and for constructing a tolerant society of the future.

# Fabrication and Electronic Properties of a Diode Based On Organic Material

Bayram Gunduz[1]

[1] bgunduz83@hotmail.com, Department of Science Education, Faculty of Education, Mus Alparslan University, Turkey

The anticipated advantages of organic materials rely on the possibility to fabricate organic opto-electronic devices such as organic photovoltaics (OPVs), organic photovoltaic cells (OPVCs), organic field-effect transistors (OFETs), organic phototransistors, organic light emitting diodes (OLEDs), organic photodetectors and organic resonant tunneling diodes [1-4].

In here, we fabricated a diode based on organic material. We have taken the current-voltage (I-V) measurements under dark with a Keithley 2400 sourcemeter. We obtained its electronic parameters such as rectification ratio (r), reverse saturation current ($I_o$), ideality factor (n) and barrier height ($\phi_B$).

**Acknowledgements:** This study was supported by The Management Unit of Scientific Research Projects of Mus Alparslan University (MUSBAP) under Project BAP-17-EMF-4901-09.

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# Optoelectronic Device Based On Gold Nanoparticle

Bayram Gunduz[1]

[1] bgunduz83@hotmail.com, Department of Science Education, Faculty of Education, Mus Alparslan University, Turkey

Gold nanoparticles (GNPs) are versatile materials for a wide applications and have been used for centuries because of the vibrant colors produced by their interaction with visible light, easy modified surface chemistry and well-developed synthetic procedures [1-3]. In recent years, these unique optoelectronic properties have been investigated. The GNPs have been used in many high electronic, photonic and optoelectronic applications including electronic conductors, therapeutic agents, drug delivery in biological and medical applications, organic photovoltaics, catalysis and sensory probes [4,5].

In this study, we used a gold nanoparticle, which was purchased from Sigma-Aldrich Company and we investigated electronic, photonic and optoelectronic characteristics of optoelectronic device based on GNP. We obtained many interesting and useful results.

**Acknowledgements:** This study was supported by The Management Unit of Scientific Research Projects of Mus Alparslan University (MUSBAP) under Project BAP-17-EMF-4901-09.

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# Investigating Household Electricity Consumption of Engineering Students

Burak Isik[1], Alper Ozpinar[2]

[1] burakisik@ticaret.edu.tr, Istanbul Commerce University, Turkey
[2] Istanbul Commerce University, Turkey

Sustainable development is becoming a much bigger issue as depletion of major fossil fuels, global warming and air pollution while renewable energy plants can't satisfy current electricity consumption amounts. For a sustainable development not only ratio of renewable energy sources have to expand in total electricity production, but also human behavior has to be modified to provide a resilient grid structure.

A portion of the electric power capacity goes active only during peak consumption hours to cope with demand and they are generally idle during base load and mean load sections during day. An extravagant approach to match demand is to build new plants according to overall energy strategy. A better approach would modify demand to find a solution which has optimal usage of system resources.

With increasing variety and utility in consumer electric goods, household electricity consumption is becoming much more dominant in total electricity consumption. Various techniques and strategies are implemented in developed countries to prevent consumers from having increased electricity consumption during peak hours. Household consumers are one of the hardest consumer type to predict load patterns as it is heavily dependant on physical conditions (climate, building age, building insulation etc.), variations in appliance characteristics (quantity, energy efficiency) and human behavior. Seasonal variations and distinct differences between workdays and holidays were observed in previous studies. In this study, engineering students from various departments are asked to fill home energy survey. Dominant parameters such as building characteristics, household energy usage frequencies for major consuming machinery and portion of household energy activity is investigated. Household consumption statistics of developing countries are compared to find relations.

# The Effect of Annealing on Nanostructured CdO Thin Film Sensor for ($H_2$) Gas Detection

Bunyamin Sahin[1], Eyyup Donmez[2]

[1] bsahin@mku.edu.tr, Department of Physics, Faculty of Arts and Sciences, Mustafa Kemal University, Turkey

[2] Department of Physics, Graduate School of Natural and Applied Sciences, Mustafa Kemal University, Turkey

With the increasing consumption of fossil fuels, the accumulation of greenhouse gases in the atmosphere is increasing and needs to be inspection. Gas sensors play an important role in order to achieve this goal and have been comprehensively developed during the past decades.

In this study, cadmium oxide (CdO) films have been deposited on soda lime glass substrates by using an easy and low-cost SILAR technique. The effects of various annealing temperature on the morphology, crystallographic structure, optical band gap and hydrogen ($H_2$) sensing properties of the films were studied. The produced CdO films were characterized via Scanning Electron Microscopy (SEM), X-Ray diffraction (XRD) analyses, and UV–Vis Spectroscopy. The results exhibited that the annealing temperature highly affected the main physical properties of CdO nanomaterials. Optical band gap energy and transmission characteristics can be tuned accordingly by annealing treatment. This impact can potentially be used in solar cell applications of CdO films where band gap engineering is a prominent agent. The $H_2$ sensing percentages of the CdO films were determined for three different temperature conditions and the results showed that $H_2$ sensing percentage increases with increasing temperature.

**Keywords:** SILAR, CdO, Annealing Effects, $H_2$ Sensing

**Acknowledgements:** This work is financially supported by Scientific Research Projects Commission of the Mustafa Kemal University (Project No: 11362).

# An Assessment of Turkey's Energy Dependency: Energy Resources and Policies

Burcu Yavuz Tiftikcigil[1], Arif Karabuga[2], Zafer Utlu[3]

[1] burcu.tiftikcigil@gedik.edu.tr, Istanbul Gedik University, Turkey
[2,3] Istanbul Gedik University, Turkey

There are many studies that examine both theoretical and empirical framework of the relationship between energy consumption and economic growth in Turkey. Although the direction of the causality relationship observed in the studies differs, it has also been observed that Turkey's energy consumption has increased significantly in connection with its economic growth since the 2000's. However, energy supply cannot meet energy demand in Turkey. For this reason, there is dependency on other countries in energy. This dependency was 72% in 2018. This situation is extremely problematic in terms of ensuring energy supply security. In this context, one of the main objectives of the energy policies implemented in Turkey is to go for resource diversification.

Currently, there are three resources for power generation, namely fossil fuels, renewable energy and nuclear energy. A comparison of these three energy resources from both an economic and a political perspective determines the direction of the country's investments. In this context, it is important to carry out an analysis of Turkey's energy dependency, examine the energy policies in place and demonstrate in a realistic way the advantages and disadvantages of using fossil fuel, renewable and nuclear energy resources so as to reduce Turkey's energy dependency and thus ensure sustainable economic growth.

In the first part of the study, Turkey's energy outlook and energy dependency is going to be examined. In the second part of the study, the energy policies designed to eliminate Turkey's energy dependency are going to be examined. In the last part of the study, a comparison of the energetic, exergetic, economic and environmental dimensions of fossil fuel, renewable and nuclear energy resources is going to be made.

**Keywords:** Renewable energy, Energy policy, Energy economy, Energy dependency

# Mechanical and Microstructure Behaviors of PDMS/zeolite Composite Membranes

Cenk Denktas[1]

[1] cdenktas@yildiz.edu.tr, Department of Physics, Yildiz Technical University, Turkey

Membranes are a very important both a science and technology for the social and economic growth of the world. Polydimethylsiloxane (PDMS) has been widely used in membrane systems but little attention has been paid to the mechanical properties of PDMS/zeolite composite in the past. In this study, polydimethylsiloxane (PDMS) and Na-Y zeolite added composite membranes were prepared for films containing from 0 to 20% by weight of Na-Y zeolite. All the membranes were characterized by ATR-FTIR, and mechanical properties methods. The FTIR spectra results showed that there is physical interaction exists between the PDMS matrix and Na-Y zeolite. Mechanical properties of the membranes were also investigated. The Na-Y zeolite added films led to the significant improvement in the mechanical properties that both the tensile strength and Young's modulus increased by 3 times. These results suggest that zeolite particles in the polymer matrix may act as physical cross-links where they bind hydrogen with different moieties on the same chain or interact with different polymer chains with different polymer chains.

# Superhydrophobic Hybrid Paper Sheets

Cagla Kosak Soz[1], Simon Trosien[2], Markus Biesalski[3]

[1] soz@tau.edu.tr, Materials Science and Technologies, Turkish-German University, Turkey

[2,3] Macromolecular Chemistry and Paper Chemistry, Darmstadt Technical University, Germany

Janus-type hybrid paper sheets with single-sided superhydrophobicity were prepared. The modified side of the paper sheet exhibits superhydrophobic properties, whereas the nontreated side remains hydrophilic and therefore can take up aqueous solutions by capillary wicking. A thin coating composed of cross-linked poly(dimethyl siloxane) (PDMS) and inorganic particles of various sizes ranging from nanometers to several tens of micrometers was applied both onto the Whatman No. 1 filter paper and lab-engineered cotton linters based paper substrates to prepare hybrid paper sheets. High chemical durability, mechanical stability, and flexibility were achieved due to the covalent attachment of the particles to paper fibers and the inherent elasticity of PDMS chains. In spite of the superhydrophobicity of the coating, the untreated side of the paper substrates preserved its hydrophilicity, resulting in Janus-type wetting properties. Moreover, the hybrid sheets remained porous and permeable to gases. All of these properties make our hybrid paper materials potential candidates for packagings, intelligent membranes, and wound dressings with a liquid directing and confinement ability.

# Simulation of Pullout Test on Crystallite Segment of Antiparallel $\beta$-Sheets of Bombyx Mori Silk Fibroin

Cem Uguz[1,2], Unsal Akdere[3], Seckin D. Gunay[3], Cetin Tasseven[3]

[1] cemuguzfzk@gmail.com, Department of Physics, Yildiz Technical University, Faculty of Science, Turkey
[2] Maltepe University, Turkey
[3] Department of Physics, Yildiz Technical University, Faculty of Science, Turkey

Silk fibroin fiber has attracted the attention of wide range of scientists from tissue and biomedical engineering to military and industrial applications because of its exceptional physicochemical properties such as the ultra-high strength, low density, biocompatibility, and biodegradability. Hence, it is important to study mechanical local pulling test on the crystalline region in order to make contribution to the production of composite materials. Pulling test to different chains and sheets have been applied using the technique called Steered Molecular Dynamics simulation. The results suggest that antipolar model of crystallite forms a higher ultimate tensile force (UTF) compared to that of polar model.

# Synthesis and Characterization of Un-doped and Al-doped CuO Thin Films for Solar Cell Applications

Didem Tosun[1], Bunyamin Sahin[2]

[1] tosun.didem@gmail.com, Department of Physics, Graduate School of Natural and Applied Sciences, Mustafa Kemal University, Turkey
[2] Department of Physics, Faculty of Arts and Sciences, Mustafa Kemal University, Turkey

Cupric oxide (CuO) is an important semiconductor with a band gap of 1.2 eV used for the development of various technologies of solid state devices such as gas sensors and solar energy transformations. In this research, un-doped and Al-doped nanostructured CuO thin films were produced on soda-lime silica glass substrates by SILAR technique. The influence of Al-doping concentration and annealing process on the morphological, structural and optical properties of nanostructured CuO films were studied by scanning electron microscopy (SEM), X-ray diffraction (XRD) and UV-vis spectrophotometry measurements. From the SEM photos, it was observed that the particle sizes of CuO thin films increased with the increasing Al percentage in the growth solution. From the XRD analysis, it was obtained that Al addition tends to increase grain size. UV–vis. measurements showed that the optical properties of CuO films changed as a consequence of Al-doping percentage and annealing temperature. Therefore, Al-doped CuO film is a promising material for sustainable energy materials such as solar cells.

**Keywords:** Al-doping, SILAR, CuO, Annealing Effects, Optical properties

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# Comparison of Angström-Prescott Based Hourly Solar Radiation Models and Development of a New Model for Mardin, Turkey

Elvan Burcu Kosma[1]

[1] kosma@tau.edu.tr, Turkish-German University & Yildiz Technical University, Turkey

Solar radiation modelling began with the development of the Angström-Prescott model owing to the joint contributions of Angström and Prescott [1,2]. With years new models those are based on Angström-Prescott were continuously presented into the literature. Even if Angström-Prescott based models were found quite successful in modeling monthly average and daily solar radiation, it is considered that Angström-Prescott based models had a low prediction capability on hourly solar radiation modelling. This study uses a monthly separation approach for improving the solar radiation model results with using 16 different Angström-Prescott model formulas and a new developed model for Mardin, Turkey. Hourly solar radiation and daylight hours data were obtained from Turkish State Meteorological Service for the years between 2011-2016. Assessment and comparison of the model results were conducted using R2, Root Mean Square Error (RMSE), Mean Bias Error (MBE) statistical methods.

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# Numerical Analysis of The Distribution of Air Pollution And Its Impact on Patients in the Hospitals Operating Rooms

Eiad Saif[1], Abdulrazzak Akroot[2]

[1] eiad.saif2016@gmail.com, Department of Electrical and Electronic Engineering, Ondokuz Mayis University , Turkey
[2] Department of Mechanical Engineering, Karabuk University, Turkey

In hospitals, especially the operating rooms, air quality is more significance. The spreading of bacteria is the main issue in the hospital operating room infections. The effective computer technique tool for high accuracy predictions of indoor air flows is Computational Fluid Dynamics (CFD). The physical simulation processes that occur in operating rooms took place depending on CFD software. This paper provides a mathematical simulation for several forms to be placed in the air inlets and outlets of the operating room in order to get optimal model of air distribution inside the operating room. The results obtained were matched well with experimental data from approved literature and standards. These results found that airflow and air velocity significantly affect the patient's thermal comfort in the operating room. This velocity is also very important in pulling air contamination particles out of the room through the air exhausts. Therefore, air entering the operating room is very important and affects room temperature. In addition, it was noted that the application of CFD in hospitals will improve the design of the internal environment and contribute to the optimal prediction of air quality in the operating room.

**Keywords:** Operating room, CFD, Numerical analysis, thermal comfort

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# Cost Evaluation of Electricity Generation from a 35 MW Hybrid Solar Photovoltaic Plant Built in a Manisa Region Jeothermal Plant: A Unique Case Study

Hamit Topuz[1]

[1] hamittopuz@maltepe.edu.tr, Engineering and Natural Scieneces Faculty, Department of Industrial Engineering, Maltepe University, Turkey

Energy is all a critical and strategical matter for a country's sustainable economic development. This study assessed the technical feasibility and commercial profitability of commercial solar PV technology project in a private geothermal installation.

In this study, it is aimed to show technical and economical assessment of electricity cost of generation from a hybrid solar photovoltaic technology plant of 35 MW capacity in a case study picked up in the western part of the country. We use simulated climate data generated using PV Sol 4.0 simulation software. The design of 35 MW solar system was used to undertake and annual energy output of the system was generated to get climactic data of the selected location. In this study we picked up the levelized cost of electricity formulation as suggested by Muazu[1] . The findings from our study showed in pretty good agreement with the results derived that can be regarded in the same magnitude of electricity costing as arrived at by Muazu's work [1].

This system is designed by taking into consideration of various parameters such as electricity demand, load fluctuations, forecast errors and power plant outages as occur by environmental parameters.

**Keywords:** Solar Power, Energy Storage, Energy Production

# A Review of Turkey's Current Situation in Resource Utilization of Renewables and Energy Policies

Ipek Cetinbas[1], Bunyamin Tamyurek[2]

[1] ipekcetinbas@ogu.edu.tr, Department of Electrical and Electronics Engineering, Eskisehir Osmangazi University, Turkey
[2] Department of Electrical and Electronics Engineering, Eskisehir Osmangazi University, Turkey

Energy as a determining factor of stable growth and sustainable development is the main dynamic that defines the policies of the countries of the world. Accordingly, in order to overcome the external dependence on energy production, countries are working on policies and methods for effective and efficient use of energy produced by local resources and technologies. Many countries have turned to renewable energy sources, as it is a requirement for the new era to achieve the continuously changing dynamic consumption balance with sustainable energy resources. In this study, the current situation of electricity generation from solar and wind energy, which has significant potentials among renewable sources for Turkey, renewable energy policies, legal regulations on renewable energy resources and production and consumption awareness were examined. As a result, aligning the energy policies towards renewable energy and setting more realistic targets will be a long term solution to the dependency problem in energy production, which is also one of the cornerstones of economic independence. Therefore, consumers should be incentivized to invest in clean energy production with the aid of realistic clean energy policies.

# New Generation's Knowledge and Attitudes about Energy Usage of the World: A Research on Middle and High School Students

Ilker Citli[1], Sahin Uyaver[2]

[1] i.ilkercitli@gmail.com, Ministry of National Education, Turkey
[2] Turkish-German University, Turkey

Energy usage of the world is a multi-facetted issue with many macro and micro shareholders. Most of these shareholders has a consensus about harmful effects of energy usage on environment. For this reason, energy efficiency and green energy related issues are gaining importance in today's world. Governments, for-profit/non-profit organizations and also individuals are concerning about the energy usage of modern human. Concerned shareholders are trying to lower the energy usage by means of energy efficiency and/or green energy resources. These efforts are creating some significant results. But these results are not sufficient without a massive change on energy usage habits of people. Changing people's energy usage habits by changing their attitudes, may be an important component of lowering energy usage of world. Thus, rising new generations with a proper knowledge and positive attitude towards energy usage is an important facet of multifaceted energy usage issue. For this reason, this study was conducted with an exploratory spirit for understanding new generations knowledge about energy issues and their attitudes towards energy usage. In order to reach this aim, a survey have been conducted to 1190 students from Turkey. The relation between their knowledge about energy issues, their attitudes towards energy and demographic factors have been studied by this survey results. On last part of the study implications for educational staff and further research directions for researchers have been suggested.

# Hydropower as A Renewable Energy: A Case Study in South Marmara Basin

Idil Esra Elver[1], Ibrahim Yuksel[2]

[1] idil.esra.elver@gmail.com, Yildiz Technical University, Turkey
[2] Yildiz Technical University, Turkey

The growing population, industrialization and urbanization bring along increase energy consumption in the world and our country. In Turkey total energy consumption grows at an average rate of 5.9% per year. Particularly, meeting the increasing energy demand is of high importance in developing countries like Turkey. In terms of geographical location, Turkey is advantageous with renewable energy sources, yet more than half of energy needs have been provided by imports. South of Marmara Region, especially Canakkale and Balikesir provinces there is very few hydroelectric power plants. In these provinces most of the energy need is supplied from fossil fuel plants which were used import coal. These provinces also have a huge wind power potential. Against the global warming, to protect our nature to pollution and reducing greenhouse gas emissions we must place importance to the renewable energy sources.

**Keywords:** Renewable Energy, Hydropower, Clean energy, Energy Development

# A Study on the Electrical Energy Consumption of Our Country and Comparison with Other Countries

Ismail Ekmekci[1]

[1] ismail.ekmekci@gmail.com, Istanbul Commerce University, Turkey

It is researched if there is a relation between Gross National Product (GNP), population and exchange rates to model our country's electrical energy consumption in the most realistic way possible and to express the most optimal projections of planning the energy investments. In this manner, the energy consumption data and other related data between 1971-2012 have been gathered and hypothesis tests have been made for the gathered data and multiple regression equations based on the related dependent variables have been created. More realistic projections for the energy consumption will be made with the help of the obtained equations, and correspondingly, planning of energy investments and optimization studies can be made more realistically.

Also, it is inspected if there are any characteristical similarities between our country and the other countries. In line with this target, the data has been collected for other countries, as well, and the similarities have been investigated. With the help of the data, the graphics have been drawn, the regression model equations have been obtained, the analyses of the equations have been done, it is investigated if the characteristical features of the countries with the similar regression models are in a similar relation and it is concluded that the energy densities are in line with each other with the countries that have similar characteristics.

**Keywords:** Electrical Energy Consumption, Energy Density, Statistical Analysis

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# Highly Resonant Wireless Power Transfer

Muhammed Amir[1], Syed Umaid Ali[2], Usman Akram[3], Shujahat Ali Khan[5], Arslan Saleemi[6], Muhammad Sulemain[7]

[1] muhammadaamir.buic@bahria.edu.pk, Bahria University, Pakistan
[2,3,4,5] Bahria University, Pakistan

Nowadays wired chargers are used to power electronic devices such as Mobile phones, laptops, electric vehicles and other electronics devices. Due to the limitations of wired charging like power losses, risk of short circuit, inconvenience etc. Wireless power transfer (WPT) holds the promise of freeing us from these restrictions. Inductive power transfer (IPT) technique is used in charging pads developed by different companies like Apple, Samsung etc. Which although charges the device wirelessly, but the pads are not portable due to the restriction of alignment along with very short range usually in millimeters which makes them less efficient. This paper presents a technique to improve the range and efficiency of wireless chargers and facilitate in adapting WPT as a permanent solution to wired charging, so in this paper we propose highly resonant wireless power transfer (HR-WPT) technique can be used to transmit power at greater distance and in a more efficient manner. In comparison of IPT with HR-WPT the range will increase from few millimeters to inches as well as the efficiency increases notably.

**Keywords:** Wireless power transfer (WPT), Inductive power transfer (IPT), Highly resonant wireless power transfer (HR-WPT), Wireless charging, Wired way.

# Effect of UV Irradiation on the Performance of Organic Solar Cells

Macide Canturk Rodop[1]

[1] mcrodop@gmail.com, Department of Physics, Yildiz Technical University, Turkey

Organic electronics, become a rapidly developing field with a wide variety of applications whose commercial potential is rather high. The discovery that organic materials which were known as insulators in the electronic industry become semiconductor or even conductor by proper doping has opened up a route. Since then, many conjugated polymers and molecules have been used in organic electronic devices. The low cost, light weight and easy processibility of organic materials can be seen as main advantages.

Organic materials have been used in light emitting diodes (OLED), field effect transistors (OFET), photodetector, sensor and solar cells. Among many organic electronic applications, organic solar cells are highly developed. Efficiency values of 0.5% achieved by Tang [1] has been increased to 13% [2], recently. Although a very rapid development has been achieved there are still some requirements for a successful commercialization. The limitations in the performance and stability of organic solar cells hinders the large scale production probability.

Efficiencies of organic solar cells fabricated from organic materials is less than the solar cells made from inorganic materials. The low efficiency can be attributed to many reasons. The ingridient needed to improve the performance and stability of organic solar cells is the detailed understanding and investigation of the physical and chemical properties of Molecular and polymer,c materials. In this study, we have fabricated organic solar cells and investigated the effect of UV irradiation on ITO and PEDOT:PSS on the device performance of organic solar cells in the form of ITO/PEDOT:PSS/Active Layer/Al. We have observed that UV irradiation on both ITO and PEDOT:PSS surface leads to an improvement on the performance of the herein investigated organic solar cells.

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# Environmental Management Paradox between the Metropolitan and County Municipalities

Mustafa Cem Celik[1], Eralp Ozil[2]

[1] cem@marmara.edu.tr, Marmara University, Turkey
[2] Zeta Bilgi Teknolojileri Ltd., Turkey

A SWOT analysis was carried out to launch carbon footprint report in one of the counties of Mugla Province. Embedded in the SWOT analysis was a series of questions to measure the environmental awareness of the county municipality's department heads. There were all together 16 questions towards environmental awareness measurement.

Some of the questions were involved with the infrastructure work and the relationship between the metropolitan municipality of Mugla (MMM) and the county municipality in question. Initial question is concerned with all the infrastructure work carried out by the GCMM. The second and third questions explored the inability to improve the quality of electricity, energy and water distribution and garbage and waste collection.According to the results of the analysis, department heads were not happy with MMM carrying out the related investments in their own county, but they seemed very happy to have no responsibility in these actives which is clearly a contradiction.

The results of this analysis show clearly that the existing legal status of metropolitan municipality's law must be revisited and greater responsibility should be given to county municipalities.

This paper also gives real data on the amount of solid waste and waste water collected in the county in question and it indicates clearly why there are changes needed for a better environmental management especially in tourism related provinces.

# Dalaman River: Long Term Flow Data Analysis and the Effect of Akkopru Dam on Electricity Production

Mustafa Cem Celik[1], Eralp Ozil[2], Barbaros Batur[3]

[1] cem@marmara.edu.tr, Marmara University, Turkey
[2] Zeta Bilgi Teknolojileri Ltd., Turkey
[3] Yildiz Technical University, Turkey

Hydropower is the largest renewable source and proves a great potential for electricity production in the World. Until 1990's, hydropower had the biggest installed capacity in Turkey. Nowadays, fossil fuel sources, especially natural gas and coal are used mostly in the electricity production in Turkey. Consequently, the adverse effects like; air pollution, greenhouse gas emissions, energy dependence and foreign trade deficit have become major issues. Hydropower is the first renewable option considered against these unfavorable results. Turkey's hydroelectric potential has to be reevaluated and in order to harness the hydropower in an environmentally friendly way, extensive analysis has to be conducted. For the existing and the new hydropower plants, exact capacity determination, river basin management, production planning and optimal operation conditions are the most important topics to be evaluated initially. Production planning process of hydropower plants on a river is a complicated optimization problem. Flow rate in the river is the fuel of the system and it is related to meteorological events. On the other hand, the production management has to determine the amount of energy produced, considering environmental factors, irrigation needs and flood or drought conditions. In this study, long term flow data were investigated in order to examine the hydropower plants on the Lower Dalaman basin. A flow duration curve has been presented based on the flow data between 1964 and 2010. Various turbine setups, exit flow rates, existing and possible production plans and alternatives for power plants were analyzed. The cascade power plants on the Dalaman River and their interdependence were also investigated.

# Study of Antioxidant Capacity in Propolis of Southern Algeria Using Electrochemical Techniques

Mohamed Lakhdar Belfar[1], Hadef Derraji[2], Abdekarim Rebiai[3], Touhami Lanez[4]

[1] mbelfar@gmail.com, Laboratory V.P.R.S, Ouargla University, Algeria
[2] Laboratory V.P.R.S, Ouargla University, Algeria
[3,4] VTRS Laboratory, University of El-Oued, Algeria

The aim of this work is the evaluation of the antioxidant power of honey bee products: propolis and pollen grains from various regions of Algeria (south, north, east and west). The method of determining antioxidant potency is based on the reaction of the superoxide free ionic radical $O_2^{(\bullet -)}$ and the product under study. The evaluation of the amount of polyphenols contained in the methanolic extracts of the products studied was carried out using the "Folin-Ciocalteu reagent" test. The results show that the samples studied include significant amounts of polyphenols. The evaluation of the antioxidant power of the extracts studied is determined by the method of consumption of the free superoxide ionic radical $O_2^{(\bullet -)}$ produced by electrochemical reaction by the technique of cyclic voltammetry from the values of (TAC) indicating the power. The results show that the products of the beehive studied have important antioxidant powers exceeding, for certain products, the activity of $\alpha$-tocopherol. considered a reference compound for the determination of the antioxidant power.

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# Disruptive Technologies in Logistics and Their Positive Environmental Consequences

Nagehan Uca[1], Mustafa Emre Civelek[2]

[1] nuca@ticaret.edu.tr, Istanbul Commerce University, Turkey
[2] Istanbul Commerce University, Turkey

Environmental aspect of the logistics has recently important. Governments around the world are under pressure because of the world public opinion and forced to take some measures regarding the protection of the environment. Nowadays, technology is developing faster than ever. Advent of the disruptive technologies causes the business processes to be redesigned. In the context of increasing environmental problems, it is expected that the implementation of some of these technologies in Logistics processes would have some positive effects. In this study, disruptive technologies with positive environmental effects were examined and their possible results were evaluated.

**Keywords:** Disruptive Technologies, Logistics, Environmental Consequences

# Critical Review of Sustainability Reports of Banking Sector in Turkey

Ozlem Yurtsever[1], Eralp Ozil[2]

[1] ozlem.yurtsever@marmara.edu.tr, Marmara University, Turkey
[2] Zeta Bilgi Teknolojileri Ltd., Turkey

One of the important sectors fighting the global warming is the banking sector. Banks can affect and lead all the other sectors by providing investing and lending choices. Especially of interest are energy investments than can affect the environment.

When all the employees of the bank and branches are considered, the banks themselves have to fight climate change as an organization as well. Sustainability reports published annually is perhaps the best indicator for researchers to decide how well a certain bank has achieved this endeavor.

According to total assets of the Turkish banks in March 2018, seven out of ten biggest bank have been publishing their sustainability reports annually for the last five years. However, only four banks include the emissions from branches whereas three banks cover the general directorate only. A closer look at these four banks show that they all report Scope 1 and Scope 2 emissions and only three report Scope 3 emissions. Scope 1 emissions are direct emissions from equipment and processes owned or directly controlled by the company. Scope 2 emissions are indirect emissions from energy related and emanating mainly from electricity or from district heating purchased from third parties. Scope 3 emissions are other indirect emissions related to a company's activities, but from sources not owned or controlled by the company such as transportation.

This paper presents a critical overview of the major Turkish Banks and suggest a more complete lists of emission sources and a more integrated approach to the problem of environmental sustainability.

# An Administrative Comparison in Between General Business Type and Energy Companies: Case Study in Biomass Energy

Pinar Basar[1], Melike Uzun[2]

[1] Istanbul Commerce University, Turkey
[2] melikeuzun94@gmail.com, Istanbul Commerce University, Turkey

In this study, the principles and principles encountered in the management of business in the universal sense and the management differences between the biomass energy production organization in an energy sector are put forward. Considering the factors of operation one by one, it is seen that there are important divergences within the supply chain. Although the differences in the management approach towards the basic operating factors are seen less, the differences in the details become more apparent.

In the first part of the study, the universal understanding of supply chain management in general is addressed. In the second part, observational studies related to sub-sectors will be included by revealing the structure of business in the energy sector. In the last chapter, the issues of management approach, which are generally discussed in terms of business factors, are discussed. In this section, a qualitative study based on field work is carried out with an enterprise that produces biomass energy. The methodology of the study was observed as observations and literature studies. Finally, it is concluded that there are differences in some factors in the energy sector with the management approach that exists in universal management, and it has been concluded that efficiency and profitability analyses should be re-evaluated in the energy sector.

**Keywords:** Business Management, Information Systems, Biomass, Energy Efficiency, Energy Sector

# Investigation of Some Radioactive Materials Effect on Human Health in the Nuclear Physics Laboratory Area

Sule Citci[1]

[1] sule.citci@ogr.sakarya.edu.tr, Sakarya University, Turkey

Scientists have studied energies from solar, water, wind and nuclear since old times. The studies are so important all over the world for sustainable energies. Solar, water and wind energies are not only recycling energies, but also these are clean energies. 450 nuclear reactors in 31 countries from all over the world are worked at this moment, same reactors are also established in 16 countries. Membership of Greenpeace object to installation and get used nuclear reactors. Because the reactors spread out toxic emissions and contaminant is formed after nuclear reaction. However, development countries have used this kind of energy for years. For example, USA, France, Russian and China have got 99, 58, 36 and 36 nuclear reactors, respectively. All of nuclear reactors are worked with Uranium. This radioactive element is not found formed of free, although it is present huge amount under earth. Australia, Kazakhstan, Russia, Canada, South Africa, Niger, Namibia and China are the richest countries with respect to Uranium. Uranium-238 is the most stable isotope of Uranium, with a half-life about 4,468x$10^9$ years. Uranium-235 has a life of about 7.13x$10^8$ years.

In this study, it is worked with Sr, Cs, Co and Am radioactive elements at Nuclear Physics Laboratuary in Sakarya University. The half-life of Sr-90, Cs-137, Co-60 and Na-22 has been measured 28.8 years, 30.15 years, 5.2747 years and 2.6 years, respectively. Activities of the radioactive materials are 7.4x$10^4$ Bq (2x$10^6$ Ci), separately.

Sr-90 emits electron radiation with $\tilde{0}$.546 MeV (100%) $^{90}_{38}\mathrm{Sr} \longrightarrow {}^{90}_{39}\mathrm{Y} + \mathrm{e}^-$ and output element also emits electron with 2.28 MeV (100%) $^{90}_{39}\mathrm{Y} \longrightarrow {}^{90}_{40}\mathrm{Zr} + \mathrm{e}^-$ Cs-137 emits electrons with $\tilde{0}$.514 MeV (95%) and $\tilde{1}$.17 MeV (5%) $^{137}_{55}\mathrm{Cs} \longrightarrow {}^{137}_{56}\mathrm{Ba} + \mathrm{e}^-$ and then output element emits gamma with $\tilde{0}$.662 MeV $^{137}_{56}\mathrm{Ba} \longrightarrow {}^{137}_{56}\mathrm{Ba} + \gamma$. Co-60 emits electrons with $\tilde{0}$.32 MeV (99.88%) and 1.48 MeV (0.12%) $^{60}_{27}\mathrm{Co} \longrightarrow {}^{60}_{28}\mathrm{Ni} + \mathrm{e}^-$ and output element emits gamma with $\tilde{1}$.17 MeV (99.85%) and 1.33 MeV (0.24%) $^{60}_{28}\mathrm{Ni} \longrightarrow {}^{60}_{28}\mathrm{Ni} + \gamma$. Na-22 emits positron with $\tilde{0}$.544 MeV (90.32) and $\tilde{1}$.821 MeV (0.056%) $^{22}_{11}\mathrm{Na} \longrightarrow {}^{22}_{10}\mathrm{Ne} + \mathrm{e}^+$. and output element emits gamma with 1.275 MeV (99.941%). Emitted radiations are counted with Geiger Müller Counter and recorded during one lesson in every week for one semester and this study were repeated other times for comparing each other. And then, energies of emitted radiations are calculated according to arrive different part of human organism and then investigated to damage on. As a result, radiations are so destructive for human. These effects depend on radiations energy. To protect healthy of all creatures, it was taken some preventive precautions. In this laboratory, it was designed and used a lead case, thickness with 1.3 cm, for shielding.

# Photo(electro)catalytic Activity of Magnetically Modified $TiO_2$ Nanoparticles

Seda Yilmaz[1], Ozge Kerkez Kuyumcu[2], Atif Koca[3], Duygu Akyuz[4], Rana Zunain Ayaz[5]

[1] sedadavulcu@gmail.com, Department of Chemical Engineering, Marmara University, Turkey

[2,3,4,5] Department of Chemical Engineering, Marmara University, Turkey

Today, scientists search solutions for energy demand and clean water supply problems which constitute a serious threat for the humanity in the world.The studies about the production and storage of future's promising energy source hydrogen has gained huge importance. The production of hydrogen using renewable energy sources which have recently attracted much interest.

The aim of this study is to synthesize photocatalysts with high photo(electro)-catalytic activity and easy separation property from the medium; for facile and sustainable hydrogen generation. $TiO_2$, is one of the important semiconductive material which is used in photocatalytic applications because of the its long term chemical stability against photo-corrosion, non-toxicity and low cost. However, $TiO_2$ has some difficulties which is to reuse in the reaction medium, rapid electron-hole recombination and wide band gap. It is required to develop a modified $TiO_2$ to reduce the band gap and to reuse it in the photocatalytic applications. Therefore, we have investigated about magnetic core ($Fe_xO_y$),($NiFe_2O_4$) / $TiO_2$ shell structured photocatalysts. The samples were characterized by XRD, Raman spectroscopy, SEM and UV-DRS analysis. To analyze the photo(electro)catalytic activity of the magnetic photocatalysts, linear sweep voltammetry and chronoamperometry tests have been used under visible light.

The results showed that the $NiFe_2O_4$ / $TiO_2$ nanocomposites showed better photo(electro)catalytic activity in the visible region and easily separable from the reaction medium.

**Keywords:** Core-shell structure, photo(electro)catalysis, $TiO_2$, magnetic separation

# Microplastic Bioaccumulation in Rainbow Trout (Oncorhynchus Mykiss)

Samaneh Karbalaei[1], Parichehr Hanachi[2], Tony R. Walker[3]

[1] samaneh.karbalaei@gmail.com, Department of Biotechnology, Faculty of Biological Science, Alzahra University, Iran
[2] Department of Biotechnology, Faculty of Biological Science, Alzahra University, Iran
[3] School for Resource and Environmental Studies, Dalhousie University, Canada

The ubiquitous presence and persistency of microplastics contamination in aquatic ecosystems are considered a growing problem. The ingestion of microplastics has been reported in a variety of aquatic animals. The aim of this study was to investigate bioaccumulation of polystyrene (PS) microplastics in gill and gastrointestinal tract of rainbow trout *(Oncorhynchus mykiss)*. Virgin PS (30 or 300 µg/L) were exposed to the fish for 14 days. The particles were analysed using micro-Raman spectroscopy. A total of 32 microplastics were found in both gill and gastrointestinal tract of fish. Under exposure to PS microplastics, however, accumulation of microplastics in the gill and gastrointestinal tract of fish increased with increasing MP concentrations. In both treatments, the concentration of PS microplastics was higher in gill compared to gastrointestinal tract. The results indicate the ingestion and accumulation of microplastics in tissues of fish should be considered in environmental risk assessment. This study also suggests using O. mykiss as promising indicator species for monitoring environmental contaminants such as microplastics.

# Renewable Energy, Growth and Employment Relations: A Case Study in Turkey

Sabri Oz[1], Rehsan Teker[2]

[1] soz@ticaret.edu.tr, Istanbul Commerce University, Turkey
[2] Istanbul Commerce University, Turkey

This study on linking the existing relationship between employment and economic growth with renewable energy is investigating the relationship between Arthur Okun law and an addendum. The research work in Turkey particularly, analysis of the data obtained was evaluated using TUIK data and an examination of the primary data. A theoretical study of the literature related to renewable energy made before, and then it is referred to in relation to employment and growth at the macro level in Turkey and has investigated whether there is a relationship between renewable energy and finally read the law. Renewable energy consumption and production are considered separately in this study, considering separately, the relationship between renewable energy and employment directly indirect and "chain fiction" in the form of three different headings was examined. Energy consumption for one dependent on foreign emerging as Turkey and energy countries on the one hand could be seen as a sign of growth, it also will reveal the workforce inefficiencies if they fulfill the structural transformation for employment in the state. The study evaluated such paradoxical approaches and examined the issue of compliance with developing countries for a labor intensive transformation in renewable energy production according to the Heckscher-Ohlin Model.

**Keywords:** Renewable Energy, Employment, Economic Growth, Okun Law, Heckscher-Ohlin

# Public Private Partnership (PPP) on Renewable Energy: Turkey Case

Sabri Oz[1], Enes Erarslan[2]

[1] soz@ticaret.edu.tr, Istanbul Commerce University, Turkey
[2] Istanbul Commerce University, Turkey

The public private partnership which is abbreviated as PPP, is a newer approach for Turkey's economic system with respect to the world. Turkey and the world are in search of new sources of energy. Energy investment is worth millions of dollars and a mid-size project is foreseen for a minimum of 5-year feasibility. The government plays an important role in the services that should be provided based on the size of the investment and the length of the return period. In general, in many areas, the investments that the private sector does not dare and the risk is high and the return period is long, is made by the state.

Entering the private sector for logistics and operations management and business risks are high for investments related to renewable energy sources in Turkey. For these sectors, infrastructure works are being carried out for build-operate-transfer model, purchase-guaranteed investments and public real sector collaborations. PPP style models, especially legislation, the issue of financing, property issue, subcontracting structure, is seen the most important points of this sector. The current approaches and statistics of these models are included in the study.

**Keywords:** Renewable Energy, Public Private Partnership, Energy Map, Sustainability, Risk Management

# Sociological Perspective to Sustainable Energy

Ummu Bulut[1]

[1] ummu.bulut@hotmail.com, Mugla Sitki Kocman University, Turkey

Today, we see that the resources of basic energy sources (oil, coal, natural gas, etc.) are consumed rapidly and also environmental problems arise during the production of basic energy resources. Both in this context and for the quality of life of individuals and societies, it has become a necessity to turn to alternative / sustainable energy sources. The determination of plans, projects and policies for sustainable energy concerns not only a certain segment, but the whole world community. Although scientific studies on this field have increased, the subject of sustainable energy today concerns social sciences as well as natural sciences, science and engineering.

A settlement (village, town, city) is a whole which contains the potentials like social, economic, political and so on. Especially when it is considered in the towns axis, potentials can be determined in towns compared to cities and they are more applicable in a number of plans, projects and applications. Plans, projects and policies for sustainable energy should be determined and implemented from local to global. Here, the issue of sustainable energy will be examined sociologically; the relationship between sustainable energy and social structure (within the scope of towns) will be evaluated on the case of Köycegiz.

# Solar Based Seed Sowing Robot

Zeeshan Ahmed[1], Muhammad Talal Rafique[2], Muhammad Usman Tayyab[3]

[1] ahmedzeeshanzz86@gmail.com, Department of Electrical Engineering, Bahria University, Pakistan
[2,3] Department of Electrical Engineering, Bahria University, Pakistan

In Pakistan, there is a dire need of agricultural advancements as farmers are still used to the conventional seed sowing techniques which are reaping less benefits. So the agricultural system should be made advanced in Pakistan to reduce the efforts of farmers in order to increase efficiency and productivity and to minimize the energy consumption in crop operations. Precision farming is given more importance now a days so there a need to shift to this trend. This paper will give a better solution which focuses on maximization of production yield.

With the advent of technology new facilities are created for creating ease in agricultural methods. Technologists are trying to develop new systems based on automation, which works very effectively and based on real time technology. New technologies of seed sowing has an extraordinary impact on the cost and yield of agriculture product. These technologies improves the living standard of farmers. The prime purpose of seed sowing with autonomous robot is to measure precise depth and proper spacing between the holes and cover the seed with soil to provide a good compaction for the seed. The aim of this project is to design and fabricate a robot which would be completely autonomous, based on solar energy. It would be affordable to all the farmers on very cheaper rate.

**Keywords:** IOT, MPPT, DC Motors, Sensors, Agriculture, Robot, Automation, Solar Panel

# Influence Of UV Irradiated ITO/PEDOT:PSS Substrates on the Morphological, Spectroscopical And Photovoltaic Properties of Organic/Hybrid Solar Cells

Cihangir Kahveci[1], Macide Canturk Rodop[2]

[1] mcrodop@gmail.com, Department of Physics, Yildiz Technical University, Turkey
[2] Department of Physics, Yildiz Technical University, Turkey

Recently, organic and hybrid solar cells drew great attention due to easy tailoring of the organic materials via synthetic routes, flexibility and low cost. An organic solar cell consists of an organic electron donor and an acceptor sandwiched between two metal electrodes whereas a hybrid solar cell comprises of a combination of an organic and inorganic electron acceptor and donor materials sandwiched between two metal electrodes. Although organic and hybrid solar cells have several advantages, their power conversion efficiencies (PCE)s and stabilities are still low as compared to that of their inorganic counterparts. Several routes have been followed to improve the PCEs such as synthesis of novel organic semiconductors, morphology and device optimization. In this study, we investigated the influence of UV irradiated ITO/PEDOT:PSS substrates on the morphological, spectroscopical and photovoltaic properties of organic solar cells with the device configuration of ITO/PEDOT:PSS/P3HT:PCBM/Al and ITO/TiO2/P3HT:PCBM/PEDOT:PSS:IPA/Ag. We have observed that UV irradiation improved the device performance. We optimized the exposure time and intensity of UV irradiation and achieved PCEs over 2% under ambient conditions.

# Chemical Composition of Essential Oil from Algeria Plant Origanum Vulgare L

Hadef Derradji[1], Mohamed Lakhdar Belfar[2], M. Dekmouche[3]

[1] haderradji@yahoo.fr, Laboratory V.P.R.S, Ouargla University, Algeria
[2,3] Laboratory V.P.R.S, Ouargla University, Algeria

The aim of this study is focused in extraction of essential oil of leaves of medicinal plant (collected at the region east of Algeria-Tebessa). Essential oils are very complex mixture of components and their composition may vary in different species or varieties or even within the same variety. Origanum vulgare L. subsp. vulgare is one of the most distributed subspecies within the genus Origanum and has been found to be a poor-oil, categorized in cymyl, bornane or sabinylchemotypes with higher proportion of sesquiterpenes. The extraction by steam distillation was used to extract the essential oil. CPG spectrometry was used for the identification of the essential oil composition. The results of the CPG analysis showed that "thymol" chemotype with the main components as thymol (27.82%) is the most abundant compound for Origanum vulgare L. This essential oil also contained smaller quantities of 2,3-diethylpyrazine (5.66%), octanal (7.35%), Myrcene (4.20%), chrysanthenole (6.15%), Phellandrene (3.45%), Benzyl formate (3.70%) and Anis aldehyde (2.36%).

**Keywords:** CPG, essential oil, Origanum vulgare L, Hydrodistillation, thymol

# Potential Sources of Pollution in Urban, Rural and Forested Area in Northern Algeria Using Some Diagnostic Ratios

Hadef Derradji[1], Moussaoui Yacine[2], Ceccinato Angelo[3]

[1] V.P.R.S Laboratory, Faculty of Mathematics and Matter Sciences, University of Ouargla, Algeria
[2] yacine.moussaoui@gmail.com, Faculty of Medicine, University of Ouargla, Algeria
[3] National Research Council of Italy, Institute of Atmospheric Pollution Research (CNR-IIA), Monterotondo RM, Italy

The organic fraction collected at urban, rural and forested area in Northern Algeria was extracted with soxhlet, fractioned and cleaned-up through chromatography column on alumina, and then processed by gas chromatography combined with flame ionization and mass spectrometry detectors. Chemical analyses allowed characterizing a set of groups of compounds, namely n-alkanes, n-alkanoic acids, dicarboxylic acids, polycyclic aromatic hydrocarbons (PAHs), nitrated polycyclic aromatic hydrocarbons (NPAHs), and highly-polar chemicals including caffeine, nicotine and oxygenated-PAHs.

The potential sources of pollution in urban, rural and forested area in Northern Algeria were investigated by analyzing the n-alkane carbon preference index (CPI) and selected diagnostic ratios among PAH and NPAH concentrations. Despite their recognized semi-volatile properties both caffeine and nicotine, identified respectively as tracers of recreational drink and tobacco smoke.

**Keywords:** Diagnostic ratios, CPI, Molecular tracer, Particulate organic matter, Northern Algeria.

# Marine Corrosion Protection via Nanocoatings

Ismail Guler[1], Yasin Arslanoglu[2], Serdar Beji[3]

[1] guleri@itu.edu.tr, Faculty of Naval Architecture and Ocean Engineering, Istanbul Technical University, Turkey
[2] Maritime Faculty, Istanbul Technical University, Turkey
[3] Faculty of Naval Architecture and Ocean Engineering, Istanbul Technical University, Turkey

The most important force that prevents a ship from moving in the sea is the friction between the sea and the surface of the ship which is in direct contact with sea water. The surface roughness of the vessels increases as a result of the corrosion of the metal surfaces on the ships and the deformation of the biological surfaces, especially when immobilized. There are basically two principles in the protection of marine structures from the corrosive effects of the sea. The first is to cut the relationship of the metal surface with the sea with an insulating coating and the second is to apply a method to prevent the metal from being dissolved in the sea, to protect it cathodically.

The need for fuel-saving, low-emission and low-costing have made it compulsory for the coating systems to be more sturdy and more user-friendly in terms of practice according to new regulations. With rapid developments, coatings technology has been adapted to the environment to follow new health and safety trends.

In this study, literature study has been made on understanding controlling corrosion and coating techniques that can be used to limit the effects of corrosion in addition to standard applications on marine structures. The concerted efforts due to develop environmentally friendly and cost effective marine nanocoatings are gleaned. An investigation has been made in order to evaluate the efficiency of superhydrophobic and hydrophobic coatings on the steel and aluminum plates by coating them in order to reduce corrosion in a variety of circumstances.

# Facile Synthesis of CZTS Absorber Layer by Chemical Bath Method for Solar Cells Applications

Nezehat Can[1], Bunyamin Sahin[2]

[1] bsahin@mku.edu.tr, Department of Physics, Graduate School of Natural and Applied Sciences, Mustafa Kemal University, Turkey
[2] Department of Physics, Faculty of Arts and Sciences, Mustafa Kemal University, Turkey

Nanostructured Copper Zinc Tin Sulfide (CZTS) is one of the promising absorber materials in thin film solar cell industry due to their superior material properties for obtaining high efficiency. Herein, $Cu_2ZnSnS_4$ (CZTS) powder was produced by using the Chemical Bath Method at two different temperatures (60 and 80°C) using 0.06M $CuCl_2$, 0.03M $SnCl_2$, 0.03M $ZnCl_2$ and 0.12M $Na_2S$ compounds. The obtained CZTS samples were annealed at 500°C temperature with 0.5 and 2.0 g of sulfur and subsequently studied for structural, morphological and optical properties. XRD analysis exhibited that the characteristic peaks at (101), (400) and (220) planes which correspond to CZTS structure. Raman analysis of annealed powders with 0.5 g sulfur at 500°C in particular showed increase in the intensity of CZTS peaks. In micro dimensions, the change in particle size of the samples with annealing temperature was provided with SEM. The optical band gap energy values of the powders were also estimated via UV-vis Spectrometer. It has been observed that the optical band gap energy values of the CZTS samples have a good agreement with the previous studies.

**Keywords:** CZTS,CBD, Annealing effects, Optical properties

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# Optical Properties of $TiO_2$ and $TiO_2$/MPS-Capped CdS Quantum Dots Mixture Thin Films: Influence of Heat Treatment

Ozgur Akcali[1], Kenan Koc[2], E. Az[3]

[1] akcali@yildiz.edu.tr, Department of Physics, Yildiz Technical University, Turkey
[2,3] Department of Physics, Yildiz Technical University, Turkey

The present study aimed at preparation and characterization of the $TiO_2$ and $TiO_2$/CdS quantum dots (QDs) mixture thin films for optical applications. $TiO_2$ sol was synthesized by using titanium(IV) butoxide and then was deposited on a glass substrate by spin coating process. The $TiO_2$ sol coated on the substrate were heat treated at 250, 350, 450 and 550°C for 15 min. Transmittance and reflectance spectra of the films were collected between 280 and 1000 nm wavelengths in the s polarization at 30° angle of incidence by an NKD-7000 model spectrophotometer. Pro-Optix$^{TM}$ software was used to extract refractive index (n), extinction coefficient (k) and thickness of the films from transmittance and reflectance data. The refractive index of the films at 550 nm were found in between 1.9 and 2.1. The results show that increasing heat treatment temperature gives rise to both a decrease in the thickness and an increase in the refractive index values of the films, which makes the films favorable for optical filter applications.

The CdS QDs were synthesized by using (3-mercaptopropyl) trimethoxysilane (MPS). After that, $TiO_2$ sol and colloidal MPS-capped CdS QDs were mixed and then were deposited on a glass substrate by spin coating process. Produced $TiO_2$/CdS QDs mixture thin films were heat treated in between 250°C and 350°C. The optical absorption of the mixture films was determined and recorded by a UV-Vis spectrophotometer. The results showed that the first exciton peak energy $E_1s_1s$ values of the samples changed from 2.9 eV to 2.7 eV in this temperature interval and values of $E_1s_1s$ decrease with the increasing heat treatment temperature.

# Structural, Morphological and Optical Properties of Pristine and Cr-Doped CuO Films for Potential Application in Solar Cell

Serdar Dinc[1], Bunyamin Sahin[2]

[1] bsahin@mku.edu.tr, Department of Physics, Graduate School of Natural and Applied Sciences, Mustafa Kemal University, Turkey
[2] Department of Physics, Faculty of Arts and Sciences, Mustafa Kemal University, Turkey

Nanostructured pristine copper oxide (CuO) and Cr-doped CuO thin films were synthesized by the solution based SILAR method. The impact of Cr-doping content in the growth solution on the structural, morphological and optical properties of nanostructured CuO films were investigated by field emission scanning electron microscopy (FESEM), X-ray diffraction (XRD), and UV-visiblespectrophotometer measurements. It was observed that Cr-doping percentage considerably influences the growth process, alters the surface morphology, particle size, crystallinty quality and tunings the optical band gap energy of the CuO films. The main significant conclusion of this research is that we have presented the effect of Cr-doping concentration as a regulator on the optical band gap energy and transmittance values of nanostructured CuO thin films.

**Keywords:** Cr-doping, SILAR, CuO, Annealing effects, Optical properties

**Acknowledgements:** This work is financially supported by Scientific Research Projects Commission of the Mustafa Kemal University (Project No: 18.YL.088).

# Infographic Posters for Environmental Awareness

Sedef Komurcu[1], Saha Baygul Ozpinar[2]

[1] saha.ozpinar@uskudar.edu.tr, Uskudar University, Turkey
[2] Uskudar University, Turkey

One of the problems among young receivers of environmental messages is their increasing exposure to content. It is overwhelming for young people to understand green content among all the mass media commercial messages. Thus it is hard to entwine green awareness and acts into their lives. Breaking through the clutter is critical to environmental messages' reach. One way to do this is to create visual stories. Humans started to draw pictures on the walls of caves 35,000 years ago. Since then, the pictures ruled as a way to communicate. Also, the literature contains numerous claims that most of the information transmitted to our brains is visual. Information graphics or infographics are a new method of visualisation tool. They blend information with visuals to effectively communicate ideas to the audience and make the data easily understandable at a glance. Some other benefits associated with using infographics as a communication tool includes the opportunity to develop relationships with individuals and to engage the audience with the infographic content. It is easier to create interactivity with visuals. In the social media era, young people tend to communicate visually and are likely to share infographics rather than texts. This poster presentation aims to demonstrate how environmental messages can be more understandable, captivating and memorable through the use of infographics.

# Nitrates Reduction from Photovoltaic Industry by Continuous Electrocoagulation

Tounsi Hanane[1], Hecini Mouna[2], Derouiche Nadhjib[3], Chaabane Toufik[4]

[1] tounsi_hanane@hotmail.fr, Semiconductor Technology Research Center for Energetics, Algeria

[2,3] Semiconductor Technology Research Center for Energetics, Algeria

[4] Department of Enviromental Enigneering, University of Sciences and Technology Houari Boumediene, Algeria

The liquid effluents generated by the various photovoltaic cell manufacturing processes, in particular the surface treatment of the silicon wafers (pickling, degreasing) as well as the chemical etching require large quantities of reagents such as nitric acid, fluoridic acid and acetic acid, and consequently the generation of large amounts of liquid discharges rich in nitrate and fluoride ions which are often toxic to man and the environment. Several physicochemical and biological processes have been proposed in order to solve the nitrate problem. Continuous electrocoagulation is one of the electrochemical processes that have been tested for its effectiveness on synthetic aqueous nitrate solutions simulating effluents from the photovoltaic industry. Several parameters such as pH, amperage and nitrate concentration were studied. The results obtained showed that the maximum nitrate removal is 51.67% for a volume of solution to be treated of 3 liters for a concentration of 100 mg. L-1 and a pH=7.

# Static Structure and Ionic Diffusion of Liquid Magnesium Nitrate

Unsal Akdere[1], Yenal Aydin[2], Seckin D. Gunay[3], Cetin Tasseven[4]

[1] akder@yildiz.edu.tr, Department of Physics, Yildiz Technical University, Turkey
[2,3,4] Department of Physics, Yildiz Technical University, Turkey

Liquid form of magnesium pnictides, $Mg_3X_2$ (X=N, P, As, Sb, Bi) is of great importance due to its potential technological and industrial applications as an electrolyte in the energy storage system called ambipolar electrolysis cell [1]. In addition, semiconductors $Mg_3X_2$ have been extensively examined as a high performance thermoelectric material with a low thermal conductivity [2]. In this paper, we present preliminary results on static structure and ionic transport of liquid magnesium nitrate $Mg_3X_2$ from Hypernetted Chain Theory and Molecular Dynamics Simulation.

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# Author Index