CONFERENCE REPORT

EPIC "THE ROLES OF ENGINEERING PHYSICS FOR SUSTAINABLE DEVELOPMENT GOALS" – ASTECHNOVA "INNOVATIONS FOR ENERGY SECURITY" 2021 INTERNATIONAL JOINT CONFERENCE

24th – 25th of August, 2021

Co-organised by Non-Aligned Movement Centre for South-South Technical Cooperation, Gadjah Mada University and Indonesian National Agency for Nuclear Energy

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Acknowledgements

This report is based on observation during international joint conference EPIC-ASTECHNOVA 2021 organised by the Universitas Gadjah Mada (UGM) in collaboration with the Non-Aligned Movement Centre for South-South Technical Cooperation (NAM CSSTC) and Indonesia National Agency for Nuclear Energy from 24th to 25th of August, 2021.

The organising institutions held the conference to help bridge and accommodate the scope of research and development in the field of renewable energy. A large number of academics, scientists, engineers and worldwide professionals are involved in this conference, who were spreading their latest ideas and experiences through informative research on technological progress, to guarantee national and global energy security.

At the conference, attendees were present, with experts from Bangladesh, Belgium, Germany, Indonesia, Japan, Malaysia, South Korea, United Arab Emirates and the USA. The Conference has included a total of 197 participants from Bangladesh, Canada, Germany, India, Indonesia, Japan, Malaysia, Singapore, South Korea, Taiwan, Thailand and the USA.

In addressing energy security concerns the conference offered numerous new insights and technologies. This was in line with one of NAM CSSTC's aims, as regards affordable and clean energy, relating to Sustainable Development Goals (SDGs) 7. The NAM CSSTC is aware that for all nations, especially developing countries, inclusivity is important. In order to

guarantee energy security, nationally and globally, innovation and technical advancement are thus necessary.

As a result NAM CSSTC is responsible and committed to encouraging energy resource development and use responsibly to address issues related to unequal access to energy across the Member Countries. NAM CSSTC will also continue, through various partnerships, to improve Member Countries' national capacities and their collective self-reliance.

Pangersaning Gusti B.A. from NAM CSSTC has developed this report and thanked the institutions that organised the Conference. Please visit NAM CSSTC's website on csstc.org for more information about the organisation and activities.

Introduction

In this year, together with the 3rd Engineering Physics International Conference (EPIC) 2021 the 6th ASTECHNOVA International Energy Conference took place as a Joint International Conference, at which both conferences share the same virtual location and timetable. The ASTECHNOVA supports the subject of "Innovations for Energy Security," whereas the EPIC promotes "The Roles of Engineering Physics for Sustainable Development Goals".

The world lacks safe, low-carbon and cheap large-scale energy alternatives to fossil fuels. Energy problems that receive the most attention are industry, transportation and greenhouse gas emissions. Regarding the International Energy Agency (IEA), it shows that transportation is the largest energy consumer, more than industrial sector, in both developed and developing countries.

These issues necessitate a shift to a sustainable and low-carbon system in the transport sector. If the transition is not done effectively, however, the process could lead to new challenges, such as infrastructural unpreparedness, a technological lock-in, and a risk for future stranded assets.

The EPIC-ASTECHNOVA 2021 International Joint Conference, in which broad access to, including renewables and instruments, was held from 24th to 25th of August 2021 by Universitas Gadjah Mada, Non-Aligned Movement Centre for South-South Technical Cooperation and Indonesia's National Agency of Nuclear Energy.

The specific aims of the Conference are to:

a. Identify the problem and challenge caused by a fossil fuel shortage and to discuss emerging innovations in order to ensure sustainable international and national energy security;
b. Enhance the potential of research collaboration to meet energy security challenges;
c. Initiate and enhance cooperation between universities, industry and public institutions;
d. Provide for national and global researchers in engineering and nuclear engineering scientific gatherings;
e. Increase the scientific publication of researchers in national and global engineering; and
f. Provide students and younger generations with the opportunities to interact with engineering, physics, and nuclear engineering activists from various countries.

The conference was attended by national and international academics who presented their research to share their expertise in producing innovation to tackle energy security issues.

Discussion

Alternative Building

According to the sources of data, population increased 4-fold throughout the 20th century, the economy increased 20-fold, while energy consumption rose 40-fold. This reveals that the most significant increases have occurred in energy usage. It might potentially cause global competitiveness and future challenges, leading to shortages, worsening of climate change and security.

80% of the total population is predicted to reside in town by 2050 and will contribute significantly to greenhouse gas emissions (GHGs). In order to maintain average warming at 1-2 degrees Celsius, people need to reduce GHGs by 75% by 2050. Indeed, it is yet uncertain how we do that. A number of recommendations to reduce emissions of GHGs include: i) high-performance design; ii) renewable energies; and iii) renewable energy acquisition. It estimates that 50% of energy savings might be saved. Hopefully, the international community's aim to reduce carbon dioxide by 100 percent for buildings by 2030 could be achieved.

Topic presented by participants during the discussion session:

> *The notion that the solution is actually to use alternative building, but also to consider climate change, how can this be overcome?*
>
> *Answer:* The alternative building should depend on the location. Naturally, with rural areas, weather in the metropolitan areas would vary. Thus, the installation in alternative structures, such as the usage of AC or other, also needs to be modified to its location.

Selection of Materials for Green Construction

There are various impacts of climate change worldwide, especially tropical countries. The effect on tropical regions of the global climate change is at danger of significant heat wave increases. Heat risk adaptation methods will definitely lead to an increase in use of AC, an increase in energy consumption, and also an increase in GHG emissions. A plan is needed to develop thermally-adaptive living spaces in tropical climates with minimum costs.

In many Asian countries, such as Bangladesh, Indonesia, India, Malaysia, Mongolia, and Pakistan, there were significant studies and projects to build a sustainable environment.

There are a number of topics presented by participants during the discussion session:

1. *How much is a zero-energy building cost in comparison to traditional construction?*

   Answer: Sometimes costs may be lowered in some aspects. But it also depends on the construction's design and materials.

2. *Can a Smart House be used in various nations with diverse needs?*

   Answer: Yes, the design of the smart house should be adapted to the conditions and requirements of any country. It should certainly depend on a climate.

3. *Is there a better selection of materials for green construction, especially in dense population centres, with respect to green building building materials?*

   Answer: The principle of materials construction is really different. Some materials cannot be utilised anymore since many fuels are consumed. But this type of concept could be revised in the future.

Lessons Acquired from the United Arab Emirates Nuclear Strategy

From 2006 through 2020, nuclear power has increased. In April 2008 the United Arab Emirates (UAE) published a Policy on "The Evaluation and Potential Development of Peaceful Nuclear Energy". This policy is based on the most stringent safety, transparency and security criteria. The country becomes a global paradigm for the development of nuclear energy. Some lessons acquired from the UAE nuclear strategy are: i) strong backing from the government; ii) defined, long-term nuclear energy policy; iii) strong intergovernmental co-operation; and iv) high acceptance of the people.

At the universities of the UAE, notably the University of Sharjah, nuclear energy is also studied as a Nuclear Engineering Academic. It was established in 2012, and has 120 students registered under the Accreditation Board for Engineering and Technology (ABET)

accreditation and the UAE Education Ministry. The institution is actively engaged in research in international partnership to boost nuclear energy in the UAE.

The conclusion is that nuclear energy cannot be avoided in order to promote power in the UAE. For newbie countries the UAE model can be implemented to create the nuclear energy programme.

There are a number of topics presented by participants during the discussion session:

1. *How does the government persuade the people of nuclear energy?*
   Answer: The people of the UAE have a great trust in their government, which is the main aspect of building government-public relations.

2. *Is there an alternative energy plant that can be fused with nuclear power in today's nuclear processing to make it clean?*
   Answer: The key is how to make breaks even, but people still don't have a plasma temperature to get fusion. People are still advancing in this, and maybe fusion will be reliable in around fifty years. It could be the only option in the future to produce clean energy.

Korea's Commitment to Address the Issue of Climate Change

Korea has increased energy consumption and CO_2 emissions discharge. In addition, the energy needed to achieve economic progress is immense. Korea committed itself to a number of policies to address the issue of climate change, from November 2009 to December 2020.

The '2050 Carbon Neutral Strategy of Republic of Korea' strategy has been one of the most recent missions. In this regard, several municipal governments support various practical measures. This national strategy still faces numerous obstacles, such as technology, law, industry and others. Nevertheless, the government continues to work with industry and other sectors to achieve its objectives.

ASTECHNOVA Parallel Session 1: 24th of August, 2021

The main elements relating to new and renewable energy in this session are as follows:

a. The use of technology, especially with the use of solar and wind energy is greatly promoted;
b. Indonesia could focus on utilising technology from the sunray, since sun radiation is widely accessible in Indonesia. Solar could be combined with other technology, such as wind energy;
c. It is estimated that 100% renewable energy usage in the future is possible. We can maximize the energy sources found in various regions in Indonesia, such as installation of wind energy infrastructure located on the southern beach and also installation of giant photovoltaic in Nusa Tenggara. Through these sources, we can produce big source of energy and therefore we can supply our energy demand; and
d. A charcoal can be processed in special forms to create new, comparable energy sources to conventional.

EPIC Parallel Session 1: 24th of August, 2021

The main aspects connected to material science for this session are as follows:

a. Since the most commonly conducted activity is normal walking, researchers have been able to carry on a number of numerical analysis experiments on numeric implants using actual loads;
b. As an electrochemical material a long microrod VSB-5 has been hydrothermal processed successfully;
c. Despite its shortcoming, moulded salt synthesis, such as the high recombination rate of the electron-hole pair, was shown as a photocatalyst; and
d. Triethylamine is a modulator example that can influence the synthesis process by changing the coordination and the development of the crystals.

EPIC Parallel Session 2: 24th of August, 2021

The main aspects connected to materials science for this session are as follows:

a. The replacement of the plastic-based fibre with natural fibres is one of the solutions to reduce the use of plastic fibres;

b. ZnO as a promising material for the application of gas sensor can use its enhanced performance and ZnO-morphology to form the monolayer structure;
c. Advanced Oxidation process is one of the strategies used to reducing the amount of organic pollutants generated by liquid waste; and
d. In the efficiency of Dye Sensitized Solar Cells, titanium dioxide coating on the conductive glass surface plays a significant role.

EPIC Panel Session 1: 25th of August, 2021

Smart Sensors

A sensor is a device which senses quantity changes. Not only should the sensor include the detecting device, but also signal transmission and signal condition. Light, heat, movement, gas and pressure might be the particular quantity. Most of the today's sensors can be connected to the measurement, computation and recording electronic device. Sensors are therefore employed quickly in our lives. As sensor technology advances, it can provide better data to improve operations, efficiency and comprehension.

Industry 4.0 is a future project and part of a high-tech plan that businesses, scientists and decision-makers typically follow. It focused not only on meeting the economic but also on the particular environmental demands of green manufacturing processes. This industry involves transdisciplinary knowledge, which covers mechanical, electrical, scientific and all other artificial intelligence applications (AI). That is why we have to have sensor.

There are several issues mentioned by the participants during the discussion session:

1. *Is it possible for smart sensors to become commonplace and for the transmission process to be marketed?*

   Answer: It would be rather controversial to market, but, of course, there is a high probability that intelligent sensors are the 4.0 industry standard. Since it has many advantages, digital items will become a requirement. However, we must be very vigilant when it comes to digital. We must be smart about which technologies are genuinely important for certain sectors to adopt. Advanced technology will surely

bring a lot of benefits at the huge corporate level, but when it is still small to medium-sized, it seems that it is not working.

2. *How can we assure we are not hijacked by the sensor system we have used?*

   Answer: A high degree of security is the term for preventing it. Someone else can hide the sensor system in order to create a confusion or sabotage it. We need more than one sensor to anticipate it (multi sensors). We can even employ several sensors to measure the same identical item. This allows it to be backed up with other sensors if one of the sensors is problematic.

Fukushima Innovation Coast Framework

The Japanese government has a national programme for the establishment of a new industrial base to reclaim lost industries in the Fukushima coastal area to prevent tsunami and earthquake attacks in Japan, particularly in Fukushima. The initiative "Fukushima Innovation Coast Framework." Japanese academics also build Tokyo Tech "Revitalizics" for Fukushima local area reconstruction and recovery from nuclear disaster that also linked with SDGs point.

Japan will be able to do something towards SDGs every day from now on in the Fukushima area. Renewable energy is something. One of these is the revolutionary Night-time solar heat storage system with a stream generator (CL-CSP). Secondly, there is a daytime novel PV generation system (CRO).

Electric power generation has a large number of sunlight and concentration systems that play a key role in the Cross Linear Concentration System Process (CL-CSP). Even during winter season, CL-CSP has a great concentration efficiency. Meanwhile revolutionary "photovoltaic" power production method is the 'cross-over sun tracking solar system.' The PV generation follows the location of the sun and rotates for high energy.

Structural Health Monitoring

Structural health monitoring benefits in certain ways include ensuring integrity and safety, detection of damage development and prediction of the closure of infrastructure repair. Furthermore, it prevents fatalities and injuries, function loss and the unplanned closure, releases

of inflammable or dangerous gases, causes the petrol tankers to sink into big oil deposits and contributes to financial losses.

Acoustic emission (AE) testing is a non-destructive technique that identifies and monitors the discharge from localised sources of ultrasonic stress waves if a material is stress-deformed. Example AE application is for examination without opening and cleaning of tank floor. Tank floor inspection can also be used for valve leak detection.

The application of AE technologies in structural surveillance can reduce inspection time, but appropriate information of acoustic waves must be available from the AE operator. Due to noise from the surroundings as rain or high gusts, misinterpretations may arise in some circumstances. Apart from the cost of expensive equipment, adequate training should be given.

EPIC Panel Session 2: 25th of August, 2021

Nanomaterial Technologies for Tribo-Electric Nano Generator

Water without chemicals is the hydrophobicity of 2D materials on an insoluble material. On the other hand, water is cheap and clean universal solvent. Consequently, 2D materials without environmental degradation may be created in big volumes at low cost.

MoS2 peaks can be seen during the sonification process by XPS analysis. During the sonication process, oxidation may also occur. Oxidation and functioning of MoS2 have occurred following water dispersion.

Water molecules and hydroxyl groups are absorbed during the dispersion of MoS2 in pure water. MoO3 is also manufactured. Hydroxyl groups and MoO3 vanish after the annealing process. MoS2 is water-dispersed and displays improved functionality. The functionality with oxygen-based groups and MoO3 is credited. Tribo-Electric Nano Generator (TENG) can be improved with water-dispersed MoS2. In the context of sustainable and economical mass production it shows potential for TENG application.

There are several issues mentioned by the participants during the discussion session:

1. *How much energy can be created by using TENG in the renewable energy system?*

Answer: It is difficult to say because it depends on the amount of target we are using. We may compare the growth of power with electrons in our test and the outcome is 4 times more.

2. *Can you forecast the implementation of this notion of renewables in real-life industries?*
   Answer: This is somewhat difficult since a lot of the rare elements that the agency or firm in question needs to obtain. But perhaps an alternative could be considered in future TENG water production.

Ultrafast Lasers

The term 'laser' means Light Amplification by Stimulated Emission of Radiation. A laser is regarded a coherent, optical amplification light-emitting device, one of the varieties is ultra-fast laser. Ultrafast lasers have a small shock wave and so flawless nanostructures can be made without hurting the surroundings in many materials. Ultrafast lasers have significant promise in a dynamic scientific and technological field. The ultra-fast application is very economical for the industry.

Metal Organic Frameworks (MOFs)

The biosensors consist of displays, microcontrollers, amplifiers, biomaterials and transductors. By manipulating MOFs, we cause defects on their surfaces, which open active sites, change the surface and boost catalytic activity.

An example of MOF application is the MOF-based detection of the hepatitis B virus. Hepatitis B is an extremely severe liver and cancer illness. The technique aims to regulate the Cu-MOF nano sphere with amino functional ligand as a platform of biosensing for the detection of antigen surface of Hepatitis B. The usage of dengue fever employing triethanolamine control Cu-MOF morphology for Dengue Virus Serotype 3 (DENV-3) is another example of utilisation of MOFs.

To conclude, MOFs are highly capable of directly being used as a sensitive biosensor material. Its physicochemical features include morphology determine the performance of MOFs itself. The modular use such as TEA, TEOA and PVP is possible to modify MOF morphology.

There are several issues mentioned by the participants during the discussion session:

1. *What is the Cu-BDC selected for HBsAG in antigen hepatitis or DENV3? How do someone choose an appropriate MOF for any particular sensing application?*

   Answer: Because the MOFs have metals and certain metal data are regarded to be used, we are therefore using MOFs. However, numerous kinds of metal can actually be used. We follow the existing facts and assess the advantages and downsides. We know that MOFs has a large surface, so it has greater in sensing too.
2. *How is it possible for MOFs to be used for COVID-19?*

   Answer: In fact, we tried to use three electrochemical sensor approaches for COVID-19. This COVID-19 virus does, however, have a problem with its speed. Sometimes compared with other academics or researchers with significantly greater resources, we have difficulties keeping up with the speed. We actually have good results, but we have to be able to perfect the system we employ for pretty considerable period.

Transition to Green Energy

Germany has an energy transition target which began, step by step, with the goals being 50 percent less primary energy use, and closure of the final nuclear power plants, commencing in 2020 and schedule to end in 2050. Weather-based, expensive storage and delivery of concentration sources in Northern Germany, but consumption in Southern Germany, present the obstacles of using green power in Germany. Digitalisation for energy transition is one of the approaches needed now in Germany to tackle these issues.

Demand response is a shift in energy consumption by end users in reaction to changes in electricity prices over time or in incentives paid to lead to a lower consumption of electricity. The aim of the reaction to demand is to move peak demand to the peak period of renewable energy availability, i.e. energy waste reduction.

This topic concerns numerous aspects from the SDG: i) Affordable and Clean Energy (SDG 7); ii) Responsible Consumption and Production (SDG 12); and iii) Climate Action (SDG 13).

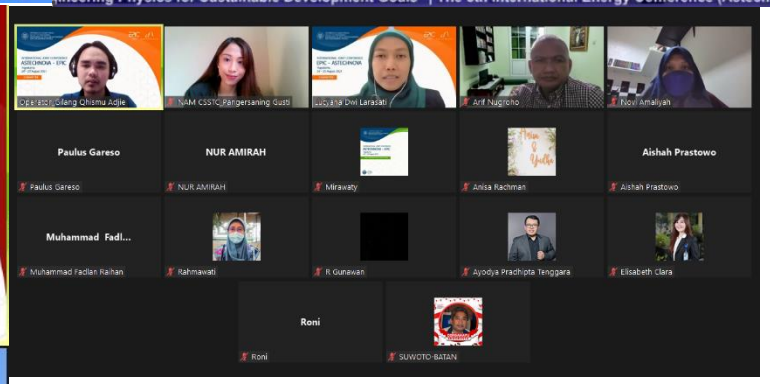
EPIC Parallel Session 2: 25th of August, 2021

The essential aspects connected to material science for this session are:

a. The potential of a Fe2O3-LaFeO3-La2O2 to be utilised as a material gas sensor, especially for ethanol gases;
b. Development of biodegradable and biocompatible products as a material is very important for reduction of environmental pollution; and
c. The adsorption approach is utilised to alleviate environmental contamination produced by waste dyes and the mesoporous surfactant MCM-48 is promising for application as a dye absorber.

PHOTO DOCUMENTATION

Day 1: 24th of August, 2021



Day 2: 25th of August, 2021