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iCREATE 2020
International Conference on Renewable Energy and Appropriate Technologies

REBUILDING BETTER
STRENGTHENING THE ROLE OF RENEWABLE ENERGY IN RECOVERY & DEVELOPMENT

DECEMBER 18, 2020 | 1-5 PM

Linked Events (Deep Dive Sessions)
December 11 | 1-4:00 PM
December 14 | 1-4:30 PM

For registration guidelines and updates, visit
http://recongress2020.thecentre.ph

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iCREATE 2020 International Conference on Renewable Energy and Appropriate Technologies

3rd Renewable Energy (RE) Congress
1st International Conference on Renewable Energy and Appropriate Technologies (iCREATE)

DEEP DIVE SESSION

RE projects in poor, typhoon-belt, and off-grid areas

14 December 2020 | 1:00PM – 4.30PM

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RENEWABLE ENERGY
CONGRESS & EXHIBIT

iCREATE 2020
International Conference on Renewable Energy and Appropriate Technologies

DECEMBER 18, 2020, 1-5PM

RE PROJECTS IN POOR, TYPHOON-BELT, AND OFF-GRID AREAS

DEEP DIVE SESSION

DECEMBER 14, 2020
1:00 - 4:30 PM

SESSION 1:

DEVELOPING DISTRIBUTED ENERGY RESOURCES IN SORSOGON

CASE PRESENTATION ABSTRACTS

iCREATE 2020 RE RENEWABLE ENERGY CONGRESS & EXHIBIT

MODERATOR

Dr. Buenaventura Dargantes

The session on **RE Projects in marginalized, typhoon-belt and off-grid areas** will discuss how distributed energy resources are developed in Sorsogon and Romblon where CentRE is collaborating with local stakeholders to assist them in localizing RE. Ongoing renewable energy initiatives in these two areas, most hit by recent typhoons, and emerging RE projects for transportation and livelihood shall be presented – how they lead to maximizing renewable energy resources' potential to increase energy access and could stimulate economic recovery and growth.

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Prof. Dr. Buenaventura B. Dargantes holds a Dr. sci. agr. degree in Agro-ecology in the Tropics and Subtropics and in Social Sciences in Agriculture from the University of Hohenheim. Before retirement in 1 January 2020, he taught graduate courses in Socio-ecology; Resource Management, Access and Benefit-Sharing; GIS for Social Sciences; and, Program Planning, Monitoring and Evaluation at the Visayas State University. He has served as in-country supervisor for graduate students from the University of Amsterdam, Wageningen University, and University of Hohenheim. He is active in research on water resources management, livelihood systems development, and post-disaster impacts.

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OPENING MESSAGE

Mayor Alfredo Cielo, Jr.

Mayor Alfredo J. Cielo, Jr. is the incumbent Chief Executive of the Local Government Unit of Irosin. He was a Councilor for 3 terms from 1998-2013, Vice Mayor for 1 term from 2013-2016, and Mayor for 2 terms from 2016 up to present in Irosin, Sorsogon.

Mayor Cielo has also had the following Achievements: Seal of Good Local Governance (SGLG) 2019, Most child-friendly municipality award 2016-2018, Good Financial Housekeeping Awardee 2019, 5th Gawad Gobernador sa Kapaligiran Awardee, and DENR V 18th Saringaya Special Awardee

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Lorenzo “Inso” Ubalde
Municipal Administrator
Local Government Unit of Irosin, Province of Sorsogon

Local Government Sustainable Energy Center (LoGoSEC): Irosin Lake and River RE-generation program

Renewable energy (RE) is a core development agenda of Irosin. With a mission to serve as the center on renewable energy in the province of Sorsogon, the Local Government Unit of Irosin has embarked on various initiatives to harness the energy potentials from its abundant natural resources. Given the mandate and mission to pursue renewable energy, the Local Government Sustainable Energy Center (LOGOSEC) was established in 2019 to explore and initiate various renewable energy projects that will support the socio-economic development in Irosin, in partnership with sectors inside and outside of the municipality including the CentRE and FES. Among the RE projects being developed since 2019 are the Own Use (Solar) Power Sharing, Irosin Lake and River RE-generation Program, and e-TAKSI (Transportasyong Akma at pang-Angat Kabuhayan ng Irosin) with solar charging station.

Mr. Lorenzo Ubalde, fondly called “Inso,” is municipal administrator of the Local Government Unit of Irosin, Province of Sorsogon. He obtained his Master in Development Management from the Asian Institute of Management, has extensive practical and professional knowledge in liaising with national and local governments, non-government and private organizations for networking, fund accessing, resource mobilization and multi-institutional partnerships and convergence programs in the areas of community development, local governance, environment and health. Prior to his return to Irosin as Municipal Administrator in 2019, Inso served as policy advocacy and adaptive replication program officer of Galing Pook for eleven years.

Engr. Melvin Romano

CEO, Enerpower Access Solutions Inc. (EASI)

The SPIDER (Solar Power-sharing for Irosin Distributed Energy Resources)

There are various approaches to renewable energy resource deployment. Among them is SPIDER, a community neighborhood cooperative roll-out that can either be self-financed by members, or thru LGU-initiated financing. The power plant is ultimately owned by the members, democratically.

The LGU provides the Guaranty to Financial Institutions (local or government banks, or private investors-both local and foreign). It serves as Community Choice Aggregator (with a local developer partner, called the Independent Service Operator-ISO) absorbing all excess KWHR-energy from the neighborhood cooperatives (called the Own-use Koops, or OK!) and assigns this excess energy to government locators or LGU instrumentalities for them to partake at same rate as the rest of the member koops – that is 10% less for the first 13 years, and less 30% for the next 12 years of the 25-year life of the solar power system. This promotes clean and green energy for inclusive growth to the communities, the LGU and its assignees for a WIN-WIN solution “at no cost to the government.”

The price is benchmarked on the present retail price of the Electric Cooperative. This works best on EC’s with very high retail electricity rates. For other EC’s, where retail prices are low, a different approach can be crafted to benefit the end-user MCO (member consumer owners). A system that brings benefits to end users directly (i.e., lower rates, incentives them to form “OKs!” while gradually, but rapidly, responding to the climate emergency for : economic growth, equitable power, and social and environmental justice!

Engr. Mel Romano is an independent energy consultant and advocate of “Solar Sharing in Neighborhoods” thru “Own-use Ko-ops”. A graduate of Mapua Institute of Technology in Manila, Mel practiced Electrical Engineering in USA, Canada and the Philippines. His experiences extend from the technical profession to business, having worked for lighting, power generation and transmission line construction for Philips Lighting, Caterpillar Power & Heavy Equipment, and HV Transmission Lines for Quezon Power Ltd in Mauban, Quezon under Bechtel Overseas Corporation,USA., respectively; Gained R.E. experiences from Nevada Power and IEEE, USA; Conducted energy efficiency audits and studies for EASI (Energy Automation Systems Inc.) for Nevada Hotels and Casinos; while doing electrical designing and investment research in USA. Mel authored a design research for the Bicol Grid on Regional Energy Autonomy, and engaged in the Renewable Energy for SolarShare Canada (TREC-Goodman project, Toronto);

Energy Conversion from Hot Springs, Irrigation Channels and River System in Irosin

D. Engr. Menandro S. Berana

College of Engineering, University of the Philippines, Diliman, Quezon City

This presentation highlights the efforts that have been done in assessing the hot spring, river, irrigation channel systems, and lake inflow and drainage systems of Irosin, Sorsogon and determining appropriate technologies for conversion of available heat and motion energy from water to electricity as part of the collaboration between CENTRE and Irosin LGU. While thermoelectric energy conversion has been identified for moderate temperature spring water in the temperature range of 40-50 degree Celsius, checking of other available springs with hotter temperature which is appropriate for micro-scale Organic Rankine Cycle power plants is in progress. Hydrokinetic in-stream turbines were selected for irrigation channels, a hot spring and the lake flood control and nourishment system, while two run-of-river power plant locations were identified along the Cadacan River.

Dr. Menandro "Maynard" Berana is professor and HVACR Lab. Head at the Department of Mechanical Engineering, University of the Philippines-Diliman where he earned his Bachelor of Science degree in Mechanical Engineering. Maynard is a fellow of the Center for Integrative and Development Studies – Political Economy Program, and Action for Economic Reforms – Industrial Policy Team. He received his Master and Doctoral degrees, Major in Mechanical Engineering from Toyohashi University of Technology in Japan. For three years now since 2018, Maynard has been a Lim Seh Leng Mechanical Engineering Centennial Professorial Chair Awardee, while for five years, until 2019, he was UP Diliman project leader of DOST-Engineering Research and Development for Technology (ERDT) Human Resource Development. His specialization is on alternative refrigeration systems, renewable energy and two-ohase flows while his research interests include cooling and power generation from recoverable heat and other energy sources, energy efficiency, automation and manufacturing systems.

Esther Pauline Bacay

Juan Paolo "JP" Paeldon

Engr. Marion Tan

Solar thermal dryer

Irosin is considered the "Rice Granary of Sorsogon." Forty-six per cent of workers are in agriculture. While the rice industry accounts for 39% of the total value of its local agriculture industry, the rice industry continues to experience 14% production losses on the average per season mainly due to premature spoiling of the fresh produce. Complete drying is required to prolong the storage life of harvested rice. However, standard drying methods and equipment either take up too much time or are not affordable for small-scale farmers, who make up 75% of Irosin's total farmers population. This study looks into an appropriate design for a dryer, using solar, in order to fulfill the drying needs of Irosin's agricultural sector. Solar thermal dryers convert radiant energy from the sun into thermal energy to dry crops. The design being studied in particular is the Solar Inclined Tunnel Dryer, which combines elements of a Seesaw Dryer and Solar Tunnel Dryer. The main parts of the design are the Solar Collector and the Drying Area. The Solar Collector collects radiant energy that can power the blowers which facilitate air flow, and heat up the air inflow simultaneously. Initial assessment shows that this solar dryer is low-cost and more sustainable than other standard dryers. It is also portable, thus can be easily shared with other farmers or cooperatives.

Marion Tan, Esther Bacay, and JP Paeldon are currently doing their internship with CentRE, undertaking studies on RE technologies that may be applied in the CentRE RE pilot areas, particularly in Irosin, Sorsogon, to support the livelihood and sustainable economic development goals of the LGU.

Marion is a new mechanical engineer, a graduate of De La Salle University in Manila, while Esther and JP are BS Chemical Engineering students in the University of the Philippines-Diliman. Esther, vice president of UP KEM, is part of Alamat UP whose project idea "Tracking and Reducing CO2 Emissions" won the recent Global Finals for Shell Eco Marathon Pitch the Future, besting other 84 teams across the world. JP, a member of Agham Youth, is an advocate of Science and Technology for the Filipino people.

Miguel Antonio Apolinar
De La Salle University

Lucy Bael University of the Philippines - Diliman

Feasibility of Implementing an Off-Grid Energy System in Irosin Using Vertical Axis Wind Turbines

With increasing resolve to generate new renewable energy sources, researchers, scientists, and engineers have developed wind turbines to harvest energy from the winds over the past century. The issue wind turbines holds now is how to design one for a specific area of application that would maximize the wind covered in the location, and be economical and easy to maintain at the same time.

In the Philippines, existing windmills such as in Bangui have proven that a wind farm is feasible. Thorough research was conducted to realize these, such as design of wind turbines, landscape and environmental impact, as well as the windmills' economic benefits. The structures do not interfere with anything -- the nearby residential communities, roads and infrastructures, ecosystem and the people's livelihood.

This study explores an off-grid energy system that uses small-scale vertical axis wind turbines (VAWT) that could be implemented in open space, low-wind velocity, and elevated rural areas to maximize the wind passing through. The proposed location is in Irosin, Sorsogon, which is known for its valley surrounded by mountains. Wind power is computed by using two sources - actual wind speed data from the Irosin LGU, and online data mapping tool. The resulting wind speed, wind power, and percentage slope are used to determine the best location in Irosin for a VAWT. This research will compare with the existing vertical axis wind turbine researches made by numerous engineers and scientists worldwide the feasibility of having a vertical axis type wind farm in the Philippines.

Miguel Apolinar obtained his degree in Bachelor of Science in Mechanical Engineering from De La Salle University.

Lucy Bael is a BS Electrical Engineering graduating student from the University of the Philippines Diliman. She finished her undergraduate thesis which focuses on modeling the uncertainties brought about by the penetration of RE Resources in the power system in the Electricity Market Research Laboratory. Her student organizations include IIEE-CSC-UPD and UP Engineering Radio Guild. She has previously interned in the Benguet Electric Cooperative, Inc (BENECO.

Miguel and Lucy are both interns/associates at the Center for Empowerment, Innovation and Training on Renewable Energy (CentRE), focusing on developing distributed energy resources that may be applied in the CentRE's pilot areas for localizing RE.

SESSION 2:
RE-volutionizing Romblon

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Engr. Rene M. Fajilagutan

General Manager, Romblon Electric Cooperative

President, Association of Isolated Electric Cooperatives

The 90-10 RE vision for Rombon

The presentation is about the experience of Romblon Electric Cooperative (ROMELCO) in developing renewable energy in Romblon islands towards achieving its 90-10 RE vision. This vision is aligned with ROMELCO's and the rest of electric cooperatives' mandate to energize rural areas in the Philippines – a mandate that is more challenging for electric cooperatives operating in off-grid areas like ROMELCO. With frequent brownouts in the islands, ROMELCO has not stopped looking for solutions to this by developing other technologies. Its first RE project brought significant improvement in the lives of people, thus motivated with these goals: to provide reliable electric service, reduce generation cost, democratize ownership of power generation facilities, transition from conventional power source to clean and renewable energy, and generate additional revenue.

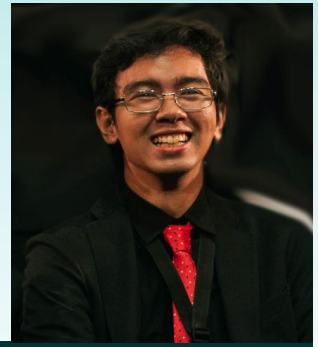
The RE projects of ROMELCO include the 1350kw Cantingas minihydro power plant, the 30-kw Cobrador solar hybrid power plant, 900-kw wind-diesel hybrid power plant; 200-kw grid tied distributed solar rooftop power plant, and 22 kw biomass gasifier power plant. Despite these achievements, ROMELCO continues to develop more RE not only for household electrification, but also for the electrification of transportation.

Rene M. Fajilagutan has more than 30 years' experience in the rural electrification. He is currently the General Manager of the Romblon Electric Cooperative, Inc. (ROMELCO) and Chairman/CEO of the Cantingas Mini-Hydro Power Corporation (CHPC), a wholly owned Subsidiary Corporation of ROMELCO. He is also the President of the Association of Isolated Electric Cooperatives, Inc. (AIEC), an association of forty (40) electric cooperatives mostly located in the Island Provinces of the Philippines. His professional life as an engineer, Rene has worked in the rural electrification in the Island Province of Romblon where he held several positions in ROMELCO and in neighboring cooperative, the Tablas Island Electric Cooperative, Inc. (TIELCO) where he experience enormous challenges in the operation of an isolated electric cooperative particularly in the power generation

He also pioneers the construction of the electric distribution lines in ROMELCO's franchise area. He is instrumental for the development of the Cantingas Mini-Hydro Power Plant in Sibuyan Island in the Province of Romblon, which became operational on December 2009. As President of the Isolated Electric Cooperatives, Rene is actively participating in the policy formulation for the operation of the renewable power source, especially in advocating for the maximum penetration of Renewable Energy in the island grids. Rene has earned his degree in Electrical Engineering at the Polytechnic University of the Philippines, with post graduate certificate on Management Development Course at the Ateneo de Manila University.

Kasel Balubal

Fiona Pangilinan



Miguel Apolinar

“Project REEF (Renewable Energy Empowering Fishermen), an Electric Fishing Boat with Solar Charging Station”

The use of renewable energy in Romblon has emerged triumphantly due to ROMELCO’s 90-10 RE vision and their initiatives in building and developing RE facilities to provide better electricity accessibility throughout the archipelagic province. ROMELCO also envisions the islands to be the center of RE in the Philippines, hence venturing into the electrification of vehicles including boats, which are essential for the islands’ fishing livelihood. The REEF, which stands for Renewable Energy Empowering Fishermen, is a conceptual project covering the redesigning of an existing municipal fishing boat to one that is made of fiberglass and powered by solar energy. The proposed 18 ft boat operates on a 45 lb thrust electric trolling motor and lithium ion phosphate (LFP) batteries wherein the charge comes from solar energy. To ensure the safety of the fishermen, the photovoltaic modules will be mounted on the rooftops of the facilities and warehouses near the fishing port instead of direct installation on the boat. The total daily and annual energy requirements of the fishing boat was calculated to have the values of 2.57 kWh/day and 937.95 kWh.year respectively. To accommodate this, the solar charging station would require 38 pieces of 100 W modules with a total system size of 3.79 kW. Costing of the boat was also done and it yielded a total cost equal to Php 80,493.33 for the boat, and a total estimate of Php 356,963.73 including the solar charging station.

The project is currently in the proposal stage. Its limitations include the given boat dimensions which are fixed and used as a basis to simplify the calculations, the applied theoretical and assumed parameters for the boat specifications, the trolling motor which could only run at speeds not higher than 85% to prevent damaging the motor, the availability of the engine and batteries in the market of the area, and the cost of materials which were obtained from virtual stores. Furthermore, the total cost of the project could further be subjected to optimization. The use of the solar powered fishing boat yields great and significant benefits such as its low environmental impact, promotion of sustainable practices, low cost of energy, potential for upscaling to passenger boats for tourism and inter-island transportation, empowerment of the Filipino fishermen, and advancement of the fishing industry.

Miguel Apolinar obtained his degree in Bachelor of Science in Mechanical Engineering from De La Salle University, while Kasel Balubal graduated with a Bachelor's Degree in Metallurgical Engineering from the University of the Philippines in Diliman. Fiona Marian Pangilinan is a graduating chemical engineering student from De La Salle University. Miguel, Fiona and Kasel are currently doing their internship with CentRE, undertaking studies on how RE can support the livelihood of locals, particularly of fishermen in Romblon.

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SESSION 3:
iCREATE PAPER PRESENTATIONS
ABSTRACTS

iCREATE 2020 RE RENEWABLE ENERGY CONGRESS & EXHIBIT

MODERATOR

Engr. Jason Occidental

Engr. Jason Occidental is Assistant Professor of Computer Engineering at the Ateneo de Davao University. Jason is a data scientist specializing in computer vision and AI. He is also a biomedical engineer working with nanobiosensors, and an electrical engineer working on renewable energy. Jason obtained his degree in BS Computer Engineering at Ateneo de Davao Univesity, and his Master of Business and Science in Biomedical Engineering at Rutgers University.

Fr. Daniel McNamara S.J

Ateneo de Davao University

OTEC – Ocean Thermal Energy Conversion 2009 update 2020

Fr. Daniel McNamara
Manila Observatory
daniel@observatory.ph, dmcnamara@ateneo.edu

The presentation will cover updates on earlier investigation into Ocean Thermal Energy Conversion (OTEC) for the Philippines.

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Fr. Daniel J. McNamara, S.J., PH.D. is program coordinator of Aerospace Engineering and Physics coordinator in Ateneo de Davao University. He came to the Philippines in 1964 from Chicago, United States. Fr. McNamara has been teaching physics at the basic and upper-level education in the country since 1965 until the present. His research interest is in solar energy. He also served as director of Manila Observatory for 12 years in the late 20th century.

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Engr. Mark Anthony Rotor

Mechanical Engineering Department,
Ateneo de Davao University

Advances in Design Optimization of Horizontal Axis Tidal Turbine (HATT) Blades for Low Velocity Conditions

Mark Anthony Rotor1,2, Hamid Hefazi1

1Mechanical Engineering Department, State University of New York, Korea
2Mechanical Engineering Department, School of Engineering and Architecture, Ateneo de Davao University, Philippines
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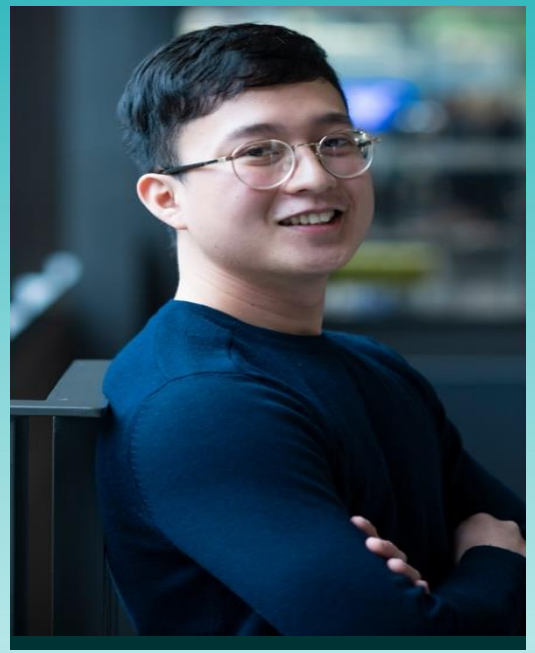
The Horizontal Axis Tidal Turbine (HATT) is one of the emerging technologies to extract tidal stream energy from the ocean current flow. To efficiently utilize the energy from the ocean tides, especially in tropical regions, such as the Philippines, where the flows are relatively low, blade optimization is an essential element of tidal turbine design. Blade geometry plays an important role in the hydrodynamic efficiency of HATTs, as well as on the structural loads on the blade, which in turn affects the structural design and life cycle cost of the units. Therefore , the design optimization process, in general, consists of multiple disciplines that one must be familiarized and various subsystems in the system design that needs to be studied. In this presentation, tidal turbine blade design and optimization procedures are reviewed particularly in the application of tidal site characterization, hydrofoil selection and design, tidal turbine model representation, and tidal turbine blade hydrodynamic performance calculations. Also, different optimization algorithms that are suitable for this application are discussed. Furthermore, a novel robust design and optimization framework is presented. Major elements of this technique include the use of advanced single-objective algorithms such as the Particle Swarm Optimization (PSO), as well as applying machine learning algorithms such as Artificial Neural Networks (ANN) for response surface modeling. .

Mark received his Bachelor's and Master's degrees in Mechanical Engineering from the Ateneo de Davao University, Philippines in 2013 and 2016, respectively. He is also an assistant professor with the Mechanical Engineering Department, Ateneo de Davao University, Philippines. He has experience in the field of Building Science, specifically in Indoor Environmental Quality (IEQ) Assessment, Building Information Modeling (BIM), and Advance HVAC Systems such as Hospital Clean Room Design. Currently, Mark is a Ph.D. candidate at State University of New York (SUNY), Korea, in the program of Mechanical Engineering with a major in Thermal Science and Fluid Mechanics. He is currently working on multi-objective optimization of tidal turbine blade applied to tropical regions. This includes the hydrodynamic modeling and characterization of the selected sites as well as using meta-heuristic optimization techniques and machine learning algorithms for more efficient optimization procedures. His research interests include: Hydrodynamics, Meta-heuristic Optimization, Computational Fluid Dynamics (CFD), Finite Element Analysis (FEA), Renewable Energy, and Building Science.



Engr. Rapha Julysses Perez

Center for Renewable Energy and Appropriate Technologies, Ateneo de Davao University

Analysis of Green Hydrogen Transportation Fuel from Renewable Energy in New Zealand

This study examined the feasibility of green hydrogen as a transport fuel for the very heavy vehicle (VHV) fleet in New Zealand. Green hydrogen is assumed to be produced through water electrolysis using purely renewable energy (RE) as an electricity source. This study chose very heavy vehicles as a potential market for green hydrogen, because it is considered “low-hanging fruit” for hydrogen fuel in a sector where battery electrification is less feasible. The study assumed a large-scale, decentralized, embedded (dedicated) grid-connected hydrogen system of production using polymer electrolytic membrane (PEM) electrolysers. The analysis comprised three steps. First, the hydrogen demand was calculated. Second, the additional RE requirement was determined and compared with consented, but unbuilt, capacity. Finally, the hydrogen production cost was calculated using the concept of levelized cost. A sensitivity analysis, cost reduction scenarios, and the implications for truck ownership costs were also undertaken.

The results indicate an overall green hydrogen demand for VHVs of 71 million kg, or 8.5 PJ, per year, compared to the 14.7 PJ of diesel fuel demand for the same VHV travelled kilometres. This overall demand is about 60% of the equivalent diesel consumption, due to the increased efficiency of a hydrogen fuel cell compared to a diesel internal combustion engine. The results also indicate that the estimated 9,824 GWh of RE electricity from consented, yet unbuilt, RE projects is greater than the electricity demand for green hydrogen production, which was calculated to be 4,492 GWh. Hydrogen demand is naturally greatest in populous regions. Most of the hydrogen demand and consented renewable generating plants are located on the North Island, since most of New Zealand’s road freight activities occur where production and industrial activities, as well as the concentration of population, are located (ANZ, 2019). The calculated levelized hydrogen cost is NZ$ 8.42/kg. Electricity cost was found to be the most significant cost parameter for green hydrogen production. A combined annual cost reduction rate of 3% for CAPEX and 4% for electricity translates to a hydrogen cost reduction of 30% in 10 years and more than 50% in 20 years.

Rapha Julysses Perez is a faculty at the Ateneo de Davao University – School of Engineering and Architecture. He is also a research at the Ateneo de Davao Center for Renewable Energy and Appropriate Technologies (CREATE). He finished his bachelor’s degree in Electrical Engineering at the University of Southeastern Philippines and his master’s degree in Electronics and Computer Systems at Victoria University of Wellington under a New Zealand Aid Scholarship

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Dr. Randell U. Espina

Dean, College of Engineering and Architecture, Ateneo de Davao University

Solar-PV charging facility for large-scale disaster relief

Nelson H. Enano, Jr.[1] and Randell U. Espina[2]
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[1,2]Ateneo de Davao University

This paper presents the potential of a solar-photovoltaic charging facility as an important technological intervention in times of large-scale disaster relief operation. The study was conducted after tropical storm Bopha, locally known as 'Pablo', hits the central eastern part of Mindanao, the Philippines. Twenty-four (24) partners in the Davao region, which were devastated by the typhoon, were identified and selected as beneficiaries. The solar-photovoltaic charging facilities were installed at the Barangay halls, local schools, gymnasiums, centers and a church.

Solar-photovoltaic charging facility has an indispensable role in risk management, response and recovery efforts. In times of natural disasters, provision for electricity even if limited only for lighting and communication purposes was found to be very significant to the lives of the peoples in the affected areas. The study recommends that solar-photovoltaic or other renewable energy technologies should be included into integrated emergency, climate adaptation and resilience strategies. To address some of the identified contextual factors, such as lack of technical expertise, high cost of the technology, and political dynamics in the locality, it is highly recommended that a private-public partnership be initiated and forged by the vital offices and organizations in the affected communities.

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Dr. Randell Espina is an Electronics and Electrical Engineer with a Master's Degree in Systems Engineering. He is a full-fledged professor and currently the Dean of the School of Engineering and Architecture of the Ateneo de Davao University. He is the lead researcher on renewable energy technologies at the University.