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Conference Book of

The 3rd ASEAN International Conference on Energy and Environment (AICEE)

in conjunction with

The ASEAN Energy Business Forum (AEBF) 2023 and
The 41st ASEAN Ministers on Energy Meeting (AMEM)

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Bali, Indonesia | 24 – 25 August 2023

Conference Book

3rd ASEAN International Conference on Energy and Environment (AICEE)

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Conference Book

The 3rd ASEAN International Conference on Energy and Environment (AICEE)

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About

The 3rd AICEE is hosted by the **ASEAN Centre for Energy (ACE)**, **Universitas Pendidikan Nasional (UNDIKNAS)**, and **University Teknologi Malaysia (UTM)**. The conference is in partnership with **Energy Research Institute (ERI)** of **Chulalongkorn University, Thailand**, **National Energy Technology Center (ENTEC)**, **Universiti Tenaga Nasional (UNITEN) Malaysia**, **Institute Teknologi Bandung (ITB)**, **Faculty of Engineering Universitas Indonesia (FTUI)**, **Universiti Brunei Darussalam (UBD)**, **ASEAN Climate Change and Energy Project (ACCEPT) II**, and **University of Hawai'i**. This year, the 3rd AICEE brings theme "Accelerating a Just, Secure and Resilient Energy Transition in ASEAN through Innovation and Interconnectivity ". This conference aims to facilitate discussions on interdisciplinary and cross-sectoral issues to promote the ASEAN Energy Blueprint and energy priorities of ASEAN Indonesia Chairmanship.

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Contents

Foreword	viii
Host Profile	x
Partners.....	xi
Energy Transition and New Emerging Technologies.....	1
Enhance the Resilience of the Gas Networks to Meet the Development Hydrogen Energy Hubs from Renewable Energy Sources	2
Electric Boats for Fisherman as a Substitute for Fuel Oil on the Belitung Island (Indonesia)	3
The Role of Thermodynamic Laws in Guiding Practical Energy Transition Strategies	4
The Role of Groundwater Advection on the Potential Improvement of Ground Source Heat Pump Performance in Tropical Climate.....	5
The Corporate Green Power Program: A Novel Approach to Promote Renewable Energy Use in Malaysia	6
Used Cooking Oil Methyl Esther (UCOME) Production on a Pilot Scale in Bali Island, Indonesia, and Its Utilization as a Component Blending for Bio-Marine Fuel Oil	7
Green Hydrogen Implementation Pathways for ASEAN Member States	8
A Review of Lithium Recovery from Salar Brine	9
Life Cycle Assessment in a Sugar Industrial Complex: Comparison Between Conventional and By-Product Valorization.....	10
Geospatial Assessment of Rooftop Solar Photovoltaic Potential in Thailand	11
Techno-economic study of post-combustion carbon capture in coal power plant in ASEAN: Case study in Indonesia	12
A Study on Factors Related to the Willingness to Pay for Renewable Green Energy Among Energy Focus University Students in Malaysia	13
Scenario Analysis to Balance Biofuel and Electric Vehicle for ASEAN Low-carbon Road Transportation	14

Bio-Briquettes Production from Spent Coffee Grounds, Composite-Organic Waste, and Coconut Shells by Using Carbonization Method for Increasing Waste to Energy Program.....	15
Analyzing the Environmental Performance of Coal Mining Companies in Indonesia: A Comparative Study of Sustainability Reports and Best Practices.....	17
Enabling Sustainable Energy Communities in ASEAN: A Systematic Approach to P2P Energy Transactions on Matakus Island Using IoT and Blockchain	18
Shifting Towards Clean Energy Technology: Assessing Viet Nam's Critical Minerals Demand and Domestic Resource Potential.....	19
Techno-Economic Comparison of Organic Rankine Cycle and Supercritical Carbon Dioxide Cycle to Utilize Brine Waste Heat in Ulubelu Geothermal Power Plant, Indonesia.....	21
Investigating The Consequence of Energy Transition in Protracted Displacement Setting: Solid Fuel Dependency and IDPs' Readiness	22
Indonesia's Energy Transition in Electricity Industry through PLN EPI Energy Outlook	23
Simulation of Rooftop Solar Photovoltaic for Tourist Accomodation Villa as a Mean to Promote Green Tourism in Bali – Indonesia.....	24
Potential Utilization of Tamblang Dam for Micro Hydro Power Plant to Increase Renewable Energy Mix for Indonesia.....	25
Development of Hydrogen Production for the Future Energy	26
Assessing the Impact of ASEAN's Ambitious Energy Efficiency Standards on AC Manufacturers	27
Energy Transition Strategic Partnership Investment, a Study Case of an Energy Investment Company	29
Stakeholder Consultation for Development of Sustainable Aviation Fuel (SAF) Strategies in ASEAN.....	30
The Demonstration on Microtrip Analysis for Using Electric Motorcycles as Public Motorcycle Taxis in Thailand	31

Hydrogen Blending with Natural Gas for Combustion Efficiency Improvement Toward Decarbonisation of Power Plants	32
A Quantum Leap: Drop-In Renewable Diesel Production (Hydrotreated Vegetable Oil) at PT Kilang Pertamina Internasional	33
Decarbonizing Commercial Vehicles: Life Cycle Assessment of Diesel, Petrol and Electric Trucks.....	34
Energy Transitions in Lao PDR: Opportunities for Green Hydrogen and Ammonia ..	35
Climate-Resilience Readiness of Emerging Clean Energy Technologies for India’s Energy Transition: A Deep Dive into Select Technologies.....	36
Progress on Biomass Coal Co-firing for Indonesia Power Plant.....	37
An Assessment of Indonesia’s Position on the Net Zero Emission Implementation	38
Thermodynamic and Economic Analysis of Combined Cycle Gas Turbine Performance Using Hydrogen-Natural Gas Mixed Fuels	40
Progress of Alternative Clean Fuel from Municipal for Co-firing in Indonesia Power Coal Fired Power Plant.....	41
Economic Feasibility of Carbon Capture, Utilization, and Storage (CCUS) in ASEAN	42
Interconnection Security and Accessibility	43
Long-Term Energy System Modelling of Mainland Southeast Asia’s Power Sector with Electricity Trading.....	44
Reinforcing Gender Equality in ASEAN Energy Transition.....	46
Towards a Green and Inclusive Power Sector in the Greater Mekong Subregion	47
Review and Analysis of Readiness, Challenges, And Potential Benefits of Power Grid Interconnection on Energy Security and Transition Pathways in ASEAN.....	49
Accelerating Power Grid Interconnectivity in Southeast Asia: A Private Sector Perspective	50
Empowering Local Heroes Leadership: How Cultural Understanding Can Enhance Energy Accessibility	52

Unlocking Stranded Renewable Energy Generation in Eastern Indonesia: Developing a Multi Criteria Decision Making Tool to Prioritise the Development of Interconnected Island Electricity Grids in Eastern Indonesia	54
Sustainability, Engineering, and Infrastructure	55
Sustainable Integrated Management Systems: A Proposed Framework for Electric Power Transmission Business.....	56
A Holistic Approach in Methane Emissions Management	57
State of the Art of Floating PV Development in the Indonesia Seas	58
Statistical Exploration and Geospatial Analysis of Air Quality Data using QGIS	60
A System Architecture for Early Wilt Detection in Hydroponic Crops: An Implementation and Assessment	61
Sustainability Challenges: How Public Transport Supports Eco-Tourism Industries	62
Exploring and Prioritizing ESG Factors for Organizational Sustainability: A Perspective of Institutional Investors on Malaysian Electricity Utilities Company...	63
An Assessment of Sustainability Practices in Environmental Program and Its Impact Toward Social Return of Investment (SROI)	65
Would Mobile Air Supply Unit Enhances Airflow Distribution in Office Environment?	67
Conquering the Challenge of Energy Inefficiency while Still Optimizing Profitability through Unit Idling: A Case Study at Pertamina Plaju Refinery	68
Leading the Transition from Halogen Refrigerants to Natural Refrigerants in Indonesia (Pertamina Plaju Refinery as a Pioneer).....	69
Green Building Certification in Educational Facility.....	71
Implementation of Green Behavior in Educational Building through Human-based Retrofits Based on Agent-Based Modeling (ABM)	72
Carbon Pricing and Green Investment.....	73
Conceptual Study of Seaweed Integrated Corporate Farming to Assess Blue Carbon Potential of Seaweed Culture in Lombok Island, Indonesia	74

Comparative Analysis of Indonesia’s Energy System Scenarios: Assessing Emissions Reduction Strategies and Cost-effectiveness.....	75
How Effective the Carbon Pricing Implementation in AMS To Reduce Regional Emissions	76
Assessing The Sectoral Economics Consequences of Carbon Pricing Using Price-output Model Analysis	77
Building a Robust International Carbon Crediting Framework: Insights from Indonesia's Joint Crediting Mechanism	78
Investigating The Impacts of Carbon Pricing Mechanism on the CCS Development in ASEAN Countries.....	79
Investigating Consumer’s Attitudes Toward New Carbon Tax Regulation in Indonesia.....	80
Environment, Policy, and Socioeconomics	82
The Potential Waste of Expired Child Restraint System (Crs) In Jakarta, Indonesia	83
Development of the National Cooling Action Plan of the Philippines	84
Interpretation of Fairness Concept and Economics Impact Analysis of Carbon Quota Allocation between Industries in Indonesia	86
Stakeholder Mapping to Facilitate Collaborations for Climate Adaptation Investment	88
Selection of Suitable Gridded Weather Dataset for Estimation of Evapotranspiration in Cambodia	89
Extreme Rainfall Projection in Cambodia Based on the New Climate Simulation Dataset of CMIP6	90
An Investigation of Time-dependent Ozone (O ₃) Concentration Using Geographic Information System: A Case Study in Central of Bangkok, Thailand.....	91
ROW Transmission Line in Sulawesi: Environmental Impacts and Solutions.....	92
Carbon Border Adjustment Mechanism (CBAM) Implementation on Reducing Emissions in ASEAN Energy Sector.....	93

Utilizing Unconventional Geothermal for ASEAN Member States: An Economic and Climate Analysis	94
"Afterall, we leave someone(s) behind": Investigating the discourses of Sustainable Development Goals (SDG) 7 in ASEAN	95
Unveiling the Influence of Financial Slack on Carbon Performance: Insights from Firms in Malaysia's Smart Cities	96
Methane Emissions in the ASEAN Oil and Gas Sector: A Nexus between ESG and Investment	97
The Asymmetry of ASEAN Law: Unsustainable Development Phenomenon of Transformative State Enterprise in Case of Cross-border Power Plant projects.....	98
ASEAN Financing Climate Policy: The Effect of Fossil Fuel Subsidies on CPI and GHGS	99
Assessing the Vulnerability of Phu Quoc Island's Natural and Socio-economic Systems to Climate Change	100
A Preliminary Investigation of Corporate E-waste Reporting Among Malaysia Public Listed Companies.....	101
Gender Mainstreaming in ASEAN's Just Energy Policies: Data-Driven Framework	102
Empowering ASEAN's Education for Renewable Energy Jobs: A Readiness Assessment.....	104
Energy and Digitalisation	105
A Day Ahead Load Forecasting Model for University Campus Using Artificial Neural Network.....	106
Data-Driven Gas Lift Control for Oil Wells Network Production Optimization using Neural Network-based Gas Lift Well Dynamics Model	108
Vehicle to Building (V2B) Peak Load Shaving and Tariff Analysis	109
The Impact of Digitalization Towards Energy Consumption and CO2 Emission in ASEAN Countries.....	110
Evaluation of Smart Grid for Renewables Integration in Southeast Asia: Qualitative Cost-Benefit Analysis	111

**Bioenergy, Land-based Mitigation, And Bioeconomy: Climate Resilient Development
in ASEAN in a Long-term Global Context 112**

**Design of Energy Storage System through Bus Energy Storage Cascade Analysis
(BESCA)..... 113**

Foreword



The 3rd ASEAN International Conference on Energy and Environment (AICEE) is held by ASEAN Centre for Energy (ACE) and co-hosted by Universitas Pendidikan Nasional (UNDIKNAS) and Universiti Teknologi Malaysia (UTM). This event also collaborates with Energy Research Institute (ERI) Chulalongkorn University, National Energy Technology Center (ENTEC) of NSTDA, Universiti Tenaga Nasional (UNITEN), ASEAN Climate Change and Energy Project (ACCEPT II), Faculty of Engineering of Universitas Indonesia (UI), Center for CO₂ and Flared Gas Utilization of Institut

Teknologi Bandung (ITB), Universiti Brunei Darussalam (UBD), and Hawaii Natural Energy Institute, University of Hawai'i as our academic partners. The event is in conjunction with the ASEAN Energy Business Forum (AEBF) 2023 and the 41st ASEAN Ministers on Energy Meeting (AMEM), which officially takes place in Nusa Dua, Bali, on 24 2023. Our conference aims to be an unparalleled platform that unites academics, practitioners, and government, fostering the exchange of perspectives and unveiling ingenious solutions to tackle the intricate challenges posed by today's energy and environmental landscapes.

This year, AICEE carries the theme of "Accelerating a Just, Secure and Resilient Energy Transition in ASEAN through Innovation and Interconnectivity". This theme is chosen to respond to the uncertainty of energy system towards energy transition pathway, which is in line with the ASEAN blueprint, the ASEAN Plan of Action for Energy Cooperation (APAEC) 2016-2025 Phase II 2021-2025, regarding energy resiliency as key elements through greater integration and cooperation. Under this theme, the conference will incorporate the discussion among interdisciplinary and cross-sectoral to promote this year's theme of ASEAN Indonesia Chairmanship, "ASEAN Matters: Epicentrum of Growth".

Strengthening energy resilience during the transition requires triple helix collaboration—academia, policymakers, and business sectors—from planning to executing the action in finding common ground and ensuring fair impacts in every aspect. Each sector plays remarkable parts in policy-making decision-making to bridge the gap between different scales of their innovations to increase the efficiency of energy transition projects. It is noted that the energy transition's framework must also be aligned with the pillars of energy security concepts, including a just principle, to optimize the decarbonization and net zero emissions roadmap.

We have received enthusiastic responses as more than 150 abstracts come from Southeast Asia and beyond, the majority of which are detailed in this Proceeding. The consolidated, extended abstracts are divided into thematic sub-topics, namely: (1) Energy Transition and New Emerging Technologies, (2) Interconnection: Security and Accessibility, (3) Sustainability, Engineering, and Infrastructure, (4) Carbon Pricing and Green Investment, (5) Energy and Digitalization, and (6) Environment, Policy, and Socioeconomics. The compiled full paper of the presented papers of the 3rd AICEE will be published in the IOP Conference Series: Earth and Environmental Science Journal by next year. The remaining will be published in UTM's Journal of Energy & Safety Technology (JEST).

As a regional think tank, catalyst, and knowledge centre, ACE initiated and hosted the 3rd AICEE to provide knowledge sharing for triple-helix agents to achieve strategic innovation. In this endeavour, we want to convey our inexhaustible gratitude to the co-hosts of the 3rd AICEE, UNDIKNAS and UTM, as they play a significant role in co-organizing this successful event. Along with other Academic Partners, these institutions have supported the 3rd AICEE by leading the Scientific Committee, which guarantees the scientific quality of this conference. We are also very thankful to our academic partners for their extensive contributions and notions to give meaningful output for the 3rd AICEE. Furthermore, I admire all the authors who have contributed to this conference, representing various facets of the community.

I sincerely hope the proceedings will serve as an invaluable resource and knowledge-sharing platform in advocating for multi-sectoral synergies among energy and environment agents. By bringing them together, we trust these conference results will support the region's shifts towards a just, secure and resilient energy transition. Last, I do really hope that this Proceeding might also emerge new collaboration or strengthen the existing partnerships among academia, policymakers, and the business sector.

Thank you.

Dr. Nuki Agya Utama
Executive Director, ASEAN Centre for Energy
Chair, Steering Committee of AICEE 2023

Host Profile

ASEAN Centre for Energy (ACE)



ASEAN Centre for Energy

One Community for Sustainable Energy

ASEAN Centre for Energy (ACE) is an intergovernmental organisation within the ASEAN structure that addresses the interests of 10 ASEAN Member States (AMS) in the energy sector. ACE was established on first January 1999. The organisation assumes a focal job in the ASEAN energy sector. It works intimately with energy specialists/services in the 10 AMS called the Sub-sector Networks (SSN) and the Specialised Energy Bodies (SEB) and with the ASEAN Secretariat, which goes about as the overseer and director of the Endowment reserve. Together, they carry out the ASEAN Plan of Action for Energy Cooperation (APAEC), a blueprint for better collaboration towards upgrading energy. Keeping the region's improvement, sustainable and harmless to the ecosystem is a fundamental concern of ASEAN's energy sector. This concern is shared as a typical subject of each Sub-sector Network in executing its programmes.

Established on 1 January 1999, the ASEAN Centre for Energy (ACE) is an intergovernmental organisation within ASEAN's structure that represents the 10 ASEAN Member States' (AMS) interests in the energy sector. By providing relevant information and expertise, the Centre strives for alignment of energy strategies within ASEAN to ensure that energy policies and programmes are in harmony with the economic growth and the environmental sustainability of the region. It is guided by a Governing Council that consists of Senior Officials on Energy leaders from each AMS and a representative from the ASEAN Secretariat as an ex-officio member. Hosted by the Ministry of Energy and Mineral Resources of Indonesia, ACE's office is located in Jakarta.

To support the energy cooperation agenda under the ASEAN Vision 2020 which binds ASEAN Member States in a partnership for dynamic development towards the year 2020, the first series of guiding policy documents was established in 1998. The document, known as the ASEAN Plan of Actions on Energy Cooperation (APAEC) which was endorsed in 1999, laid the foundation for sound policy frameworks and implementation strategies for energy cooperation with relevant dialogue partners and international organisations.

APAEC guides the implementation of multilateral energy cooperation to enhance regional integration through harmonising energy strategies amongst AMS and achieve connectivity goals in ASEAN. It also aims to enhance energy security, accessibility, affordability and sustainability under the framework of the AEC. The current blueprint, APAEC 2016 - 2025 highlights strategies on sustainability through, among others, the aspirational target of 23% renewable energy share of the primary energy mix by 2025, and 30% energy intensity reduction in 2025 based on 2005 levels.

Partners



The Energy University



FAKULTAS
TEKNIK



ACCEPT II
ASEAN Climate Change and Energy Project



HNEI
Hawai'i Natural Energy Institute
University of Hawai'i at Mānoa

Conference Agenda

The 3rd ASEAN International Conference on Energy and Environment

In Conjunction with the ASEAN Energy Business Forum (AEBF) 2023 and the 41st ASEAN Ministers on Energy Meeting (AMEM) Bali Nusa

Dua Convention Center, Bali, Indonesia

August 24-25, 2023

Day 1 - Thursday, 24 August 2023

Time (GMT+8)	Agenda					
08:00 - 10:00	Joint Opening Ceremony of the 41st AMEM and Associated Meetings and AEBF 2023 + Key Speeches					
10:00 - 10:30	AICEE Participants Group Photo + Coffee Break + Going to the Assigned Rooms					
Parallel	Room: Uluwatu 2	Room: Uluwatu 3	Room: Uluwatu 4	Room: Uluwatu 5	Room: Uluwatu 6	Room: Uluwatu 7
	Topic: Energy and Digitalisation	Topic: Interconnection, Energy Security and Accessibility	Topic: Carbon Pricing and Green Investment	Topic: Energy Transition and New Emerging Technologies	Topic: Environment, Policy, and Socioeconomics	Topic: Sustainability, Engineering, and Infrastructure
Opening Session						
10:30 - 10:45	Keynote Speech by Dr. Ho Wai Shin (UTM)	Keynote Speech by Dr Aqsha (ITB)	Keynote Speech by Prof. Indra Overland (NUPI)	Keynote Speech by Dr Haznan Abimanyu (BRIN)	Keynote Speech by Ir. Agus Putu Abiyasa, B.Eng., PhD (UNDIKNAS)	Keynote Speech by Prof. Scott Turns (University of Hawai'i)
Participants Presentation (each presenter will be given 10 minutes presentation and 5 minutes Q&A)						
Parallel	Chair: Lim Lek Keng (UTM) Subtopic: Energy Digitalisation	Chair: Dr Ambiyah Abdullah (ACE) Subtopic: Cross-Border Power Interconnection	Chair: Muhammad Shidiq (ACCEPT) Subtopic: Carbon Pricing	Chair: Dr Siti Indati Mustapa (UNITEN) Subtopic: Energy Transition	Chair: Ir. Dewa Ayu Putu Adhiya Garini Putri, ST, MT, IPM (UNDIKNAS) Subtopic: ESG	Chair: Dr. Visarn Lilavivat (NSTDA) Subtopic: Bioenergy
10:45 - 11:00	151 - Evaluation of Smart Grid for Renewables Integration in Southeast Asia: Qualitative Cost-Benefit Analysis	74 - Towards A Green and Inclusive Power Sector In The Greater Mekong Subregion Presenter: May Thida Maung	127 - Investigating the impacts of carbon pricing mechanism on the CCS development in ASEAN countries Presenter: Samantha Wibawa	85 - Indonesia's Energy Transition in Electricity Industry through PLN EPI Energy Outlook Presenter: Ignatius Rendroyoko	146 - A Preliminary Investigation of Corporate E-Waste Reporting Among Malaysia Public Listed Companies Presenter: Bakhtiar Alrazi	36 - Scenario Analysis to Balance Biofuel and Electric Vehicle for ASEAN Low-Carbon Road Transportation Presenter: Nuwong Chollacoop

	Presenter: Rika Safrina					
11:00 - 11:15	114 - Pioneering Energy Digitalisation: Revolutionizing Accessibility Initiated by Pertamina Plaju Presenter: Maulana Gusti Al Hakim	128 - The Asymmetry of ASEAN Law: Unsustainable Development Phenomenon of Transformative State Enterprise in Case of Cross-border Power Plant projects Presenter: Pimnada Luekitinan	94 - Assessing the Sectoral Economics Consequences of Carbon Pricing Using Price-Output Model Analysis Presenter: Syarifah Mardhiah	9 - The Role of Thermodynamic Laws in Guiding Practical Energy Transition Strategies Presenter: Lee Youri Mikhaelia	106 - An Assessment Of Sustainability Practices In Environmental Program And Its Impact Toward Social Return of Investment (SROI) Presenter: Siron Rusinah	79 - Simulation of Rooftop Solar Photovoltaic for Tourist Accomodation Villa as A Mean To Promote Green Tourism In Bali - Indonesia Presenter: Agus Putu Abiyasa
11:15 - 11:30	93 - Data-Driven Gas Lift Control for Oil Wells Network Production Optimization using Neural Network-based Gas Lift Well Dynamics Model Presenter: Ananda Cahyo Wibowo	6 - Long-Term Energy System Modeling of Mainland Southeast Asia's Power Sector with Electricity Trading Presenter: Saksucha Submakudom	78 - Unveiling the Influence of Financial Slack on Carbon Performance: Insights from Firms in Malaysia's Smart Cities Presenter: Noor Raida Abd Rahman	142 - An Assessment of Indonesia's Position on the Net Zero Emission Implementation Presenter: Adhitya Nugraha	84 - Exploring and Prioritizing ESG Factors for Organizational Sustainability: A Perspective of Institutional Investors on Malaysian Electricity Utilities Company Presenter: Muhummad Khairul Islam	153 - Bioenergy, land-based mitigation, and bioeconomy: climate resilient development in ASEAN in a long-term global context Presenter: Francis X. Johnson
11:30 - 11:45	119 - The Impact of Digitalization Towards Energy Consumption and CO2 Emission in ASEAN Countries Presenter: Ryan Wiratama Bhaskara	113 - Accelerating Power Grid Interconnectivity in Southeast Asia: A Private Sector Perspective Presenter: Jennifer Chen	70 - How effective the carbon pricing implementation in AMS to reduce regional emissions Presenter: Indira Pradnyaswari	109 - Hydrogen Blending With Natural Gas For Combustion Efficiency Improvement Toward Decarbonisation Of Power Plants Presenter: Ho Wai Shin	35 - A Study on Factors Related to the Willingness to Pay for Renewable Green Energy Among Energy Focus University Students in Malaysia Presenter: Amar Hisyam Jaffar	20 - Used Cooking Oil Methyl Esther (UCOME) Production on a Pilot Scale in Bali Island, Indonesia, and Its Utilization as a Component Blending for Bio-Marine Fuel Oil Presenter: Irma Nur Fitriani

11:45 - 12:00	56 - Enabling Sustainable Energy Communities in Asean: A Systematic Approach to P2p Energy Transactions On Matakus Island Using Iot And Blockchain Presenter: Emmanuel Tangka	138 - Unlocking Stranded Renewable Energy Generation in Eastern Indonesia: Developing a Multi Criteria Decision Making Tool to Prioritise the Development of Interconnected Island Electricity Grids in Eastern Indonesia Presenter: Tim Anderson	126 - Building a Robust International Carbon Crediting Framework: Insights from Indonesia's Joint Crediting Mechanism* Presenter: Wulan Kencana Adjani	137 - Climate-resilience readiness of emerging clean energy technologies for India's energy transition: A deep dive into select technologies Presenter: Manasvi Bansal	92 - Does Corruption Improve or Decrease Firm Performance? Empirical Evidence from Energy Companies in Emerging Market Countries Presenter: Prayudha Ananta	122 - A Quantum Leap: Drop-In Renewable Diesel Production (Hydrotreated Vegetable Oil) at PT Kilang Pertamina Internasional Presenter: Sakhundiyar
12:00 - 13:30	Lunch Break (Hall 2,3,4)					
Parallel	Chair: Dr. Ho Wai Shin (UTM) Subtopic: Data and Information System	Chair: Indira Pradnyaswari (ACCEPT) Subtopic: Energy Accessibility and Workforce	Chair: Dr. Ambiyah Abdullah (ACE) Subtopic: Energy Cost and Market	Chair: Assoc. Prof. Dr Bakhtiar Al-Razi (UNITEN) Subtopic: Emerging Technologies	Chair: Ir. Putu Indah Dianti Putri, ST, MT (UNDIKNAS) Subtopic: Environmental Impact	Chair: Dr Nuwong Chollacoop (NSTDA) Subtopic: Electric and Sustainable Transport
13:30 - 13:45	149 - Gender Mainstreaming in ASEAN's Just Energy Policies: Data-Driven Framework Presenter: Amira Bilqis	73 - "Afterall, we leave someone(s) behind": Investigating the discourses of Sustainable Development Goals (SDG) 7 in ASEAN Presenter: Ayu Pratiwi Muyasyaroh	31 - Life Cycle Assessment in a Sugar Industrial Complex: Comparison Between Conventional and By-Product Valorization Presenter: Michelle Almendrala	118 - Leading the Transition from Halogen Refrigerants to Natural Refrigerants in Indonesia (Pertamina Plaju Refinery as a Pioneer) Presenter: Faraj Sungkar	69 - Carbon Border Adjustment Mechanism (CBAM) Implementation on Reducing Emissions in ASEAN Energy Sector. Presenter: Muhammad Shidiq	154 - Design of Energy Storage System through Bus Energy Storage Cascade Analysis (BESCA) Presenter: Lek Keng Lim
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14:00 - 14:15	46 - Selection of Suitable Gridded Weather Dataset for Estimation of Evapotranspiration In Cambodia Presenter: Heng Chenghuy	27 - State of the Art of Floating PV Development in the Indonesia Seas Presenter: Maria Angelin Naiborhu	131 - Investigating Consumer's Attitudes Toward New Carbon Tax Regulation in Indonesia Presenter: Fitria Wulandari	139 - Progress on Biomass Coal Co-firing for Indonesia Power Plant Presenter: Ari Pasek	22 - The Potential Waste of Expired Child Restraint System (CRS) in Jakarta, Indonesia Presenter: Zeneth Thobarony	123 - DECARBONIZING COMMERCIAL VEHICLES: LIFE CYCLE ASSESSMENT OF DIESEL, PETROL AND ELECTRIC TRUCKS Presenter: Siti Indati Mustapa
14:15 - 14:30	47 - Extreme Rainfall Projection in Cambodia Based on the New Climate Simulation Dataset of CMIP6 Presenter: Nika CHHOM	75 - Investigating The Consequence of Energy Transition in Protracted Displacement Setting: Solid Fuel Dependency and IDPs' Readiness Presenter: Nadiya Pranindita	4 - Conceptual Study of Seaweed Integrated Corporate Farming to Assess Blue Carbon Potential of Seaweed Culture in Lombok Island, Indonesia Presenter: Irika Devi Anggraini	29 - A Review of Lithium Recovery from Salar Brine* Presenter: Michelle Almendrala	65 - ROW Transmission Line in Sulawesi: Environmental Impacts and Solutions Presenter: Andika Lesmana	98 - Stakeholder Consultation for Development of Sustainable Aviation Fuel (SAF) Strategies in ASEAN Presenter: Scott Turns
14:30 - 14:45	55 - An Investigation of Time-Dependent Ozone (O3) Concentration Using Geographic Information System: A Case Study In Central Of Bangkok, Thailand Presenter: I Gusti Ngurah Putu Dharmayasa	150 - Empowering ASEAN's Education for Renewable Energy Jobs: A Readiness Assessment Presenter: Amira Bilqis	15 - Comparative Analysis of Indonesia's Energy System Scenarios: Assessing Emissions Reduction Strategies and Cost-Effectiveness Presenter: Anindhita	83 - Development of Hydrogen Production for the Future Energy resenter: Visarn Lilavivat	39 - Interpretation of Fairness Concept and Economics Impact Analysis of Carbon Quota Allocation between Industries in Indonesia Presenter: Muhammad Hasan Imaduddin	82 - Sustainability Challenges: How Public Transport Supports Eco-Tourism Industries Presenter: Dewa Ayu Putu Adhiya Garini Putri

14:45 - 15:00	16 - The Corporate Green Power Program: A Novel Approach to Promote Renewable Energy Use in Malaysia Presenter: Aznan Ezraie Ariffin	116 - Empowering Local Heroes Leadership: How Cultural Understanding Can Enhance Energy Accessibility Presenter: Ahmad Suhendra	-	105 - Methane Emissions in the ASEAN Oil and Gas Sector: A Nexus between ESG and Investment Presenter: Adhityo Bhaskoro	132 - ASEAN Financing Climate Policy: The Effect of Fossil Fuel Subsidies on CPI and GHGS Presenter: Kwanruetai Boonyasana	3 - Electric Boats for Fisherman as a Substitute for Fuel Oil on The Belitung Island (Indonesia) Presenter: Sofwan Farisyi
15:00 - 15:15	Coffee Break					
Parallel	Chair: Lim Lek Keng (UTM) Subtopic: Techno-Economic Analysis and Forecasting	Chair: Amira Bilqis (ACE) Subtopic: Energy Security and Management	Chair: Muhammad Shidiq (ACCEPT) Subtopic: Energy Investment and Business	Chair: Assoc. Prof. Dr Rusinah Siron (UNITEN) Subtopic: Renewable Energy	Chair: Anak Agung Mia Intentilia, S.IP., MA (UNDIKNAS) Subtopic: Policy and Socioeconomics	Chair: Dr. Visarn Lilavivat (NSTDA) Subtopic: Building
15:15 - 15:30	33 - Techno-economic study of post-combustion carbon capture in coal power plant in ASEAN: Case study in Indonesia Presenter: Chaedar	64 - Shifting Towards Clean Energy Technology: Assessing Viet Nam's Critical Minerals Demand and Domestic Resource Potential Presenter: PHUNG QUOC HUY	34 - China's New MEPS Leads to Major AC Market Transformation Presenter: Lei Zeng	71 - Utilizing Unconventional Geothermal for ASEAN Member States: An Economic and Climate Analysis Presenter: Akbar Dwi Wahyono	91 - Assessing the Impact of ASEAN's Ambitious Energy Efficiency Standards on AC Manufacturers Presenter: Rio Jon Piter Silitonga	104 - VEHICLE TO BUILDING (V2B) PEAK LOAD SHAVING AND TARIFF ANALYSIS Presenter: Ho Wai Shin
15:30 - 15:45	147 - Thermodynamic and Economic Analysis of Combined Cycle Gas Turbine Performance Using Hydrogen-Natural Gas Mixed Fuels Presenter: Ari Pasek	103 - Review and analysis of readiness, challenges, and potential benefits of power grid interconnection on energy security and transition pathways in ASEAN Presenter: Ambiyah Abdullah	95 - Energy Transition Strategic Partnership Investment, A Study Case of an Energy Investment Company Presenter: Adisylva Yudhistiro	81 - Potential Utilization of Tamblang Dam for Micro Hydro Power Plant To Increase Renewable Energy Mix for Indonesia Presenter: Putu Indah Dianti	26 - Development of the National Cooling Action Plan of the Philippines Presenter: Aldrin Calderon	140 - GREEN BUILDING CERTIFICATION IN EDUCATIONAL FACILITY Presenter: Kartika Rahmasari

15:45 - 16:00	57 - A Day Ahead Load Forecasting Model for University Campus Using Artificial Neural Network Presenter: Saidatul Habsah Asman	14 - The Role of Groundwater Advection on the Potential Improvement of Ground Source Heat Pump Performance in Tropical Climate Presenter: Arif Widiatmojo	37 - Stakeholder Mapping to Facilitate Collaborations for Climate Adaptation Investment Presenter: Nuwong Chollacoop	32 - Geospatial Assessment of Rooftop Solar Photovoltaic Potential in Thailand Presenter: Linux Farungsang	135 - Assessing the Vulnerability of Phu Quoc Island's Natural and Socio-economic Systems to Climate Change Presenter: Manh Tri Dao	108 - WOULD MOBILE AIR SUPPLY UNIT ENHANCES AIRFLOW DISTRIBUTION IN OFFICE ENVIRONMENT Presenter: Ho Wai Shin
16:00 - 16:15	43 - Thermodynamic Metallurgical Analyses of a Sustainable Copper Production in Philippines Presenter: Michelle Almendrala	112 - The Performance, Adaptability, and Stability of the Local Government Units on Government Energy Management Program Implementation Presenter: Anabel Elmaga	18 - Sustainable integrated management systems: a proposed framework for electric power transmission business Presenter: Irvan Khairil Solin	28 - Green Hydrogen Implementation Pathways for ASEAN Member States Presenter: Suddhasatta Kundu	97 - REVISITING EU-ASEAN GREEN PARTNERSHIP: QUESTIONING THE COMPATIBILITY OF THE GREEN AGRICULTURE POLICY WITH INDONESIA Presenter: Audrey Chairunnisa	80 - A SYSTEM ARCHITECTURE FOR EARLY WILT DETECTION IN HYDROPONIC CROPS: AN IMPLEMENTATION AND ASSESSMENT Presenter: I Putu Widia Prasetia
16:15 - 16:30	62 - Techno-Economic Comparison of Organic Rankine Cycle and Supercritical Carbon Dioxide Cycle to Utilize Brine Waste Heat in Ulubelu Geothermal Power Plant, Indonesia Presenter: Vincentius Adven Brilian	25 - A Holistic Approach In Methane Emissions Management Presenter: Noor Arnida Talip	117 - Conquering the Challenge of Energy Inefficiency while Still Optimizing Profitability through Unit Idling: A Case Study at Pertamina Plaju Refinery Presenter: Daniswara Krisna Prabatha	50 - Bio-Briquettes Production from Spent Coffee Grounds, Composite-Organic Waste, and Coconut Shells by Using Carbonization Method for Increasing Waste to Energy Program Presenter: M Hasbi	-	143 - Implementation of Green Behavior in Educational Building through Human-based Retrofits Based on Agent-Based Modeling (ABM) Presenter: Gina Khairunnisa
16:30 - 16:45	-	-	-	125 - Energy Transitions in Lao PDR: Opportunities for Green Hydrogen and Ammonia Presenter: John Ward	-	148 - Progress of Alternative Clean Fuel from Municipal for Co-firing in Indonesia Power Coal Fired Power Plant Presenter: M Soleh
16:45 - 17:00	Closing Ceremony & the Way Forwards by Chair	Closing Ceremony & the Way Forwards by Chair	Closing Ceremony & the Way Forwards by Chair	Closing Ceremony & the Way Forwards by Chair	Closing Ceremony & the Way Forwards by Chair	Closing Ceremony & the Way Forwards by Chair

Energy Transition and New Emerging Technologies

Enhance the Resilience of the Gas Networks to Meet the Development Hydrogen Energy Hubs from Renewable Energy Sources

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ABSTRACT

In recent years, hydrogen application has received substantial interest as an alternative energy source to replace hydrocarbon-based energies, as well as its application in technologies such as fuel cell development, emerging renewables, and industrial scale electrolyzers that could lead to the realisation of a society based on this new energy source. The one that has numerous involved is the application of hydrogen that blend with methane from natural gas which utilise the developed gas networks in many regions. It is magnified with technological leaps in renewables for the energy source of hydrogen generation. Those facts emerge as the aims of this essay which will discuss the application of renewables to hydrogen-methane mixtures from literatures specifically in Indonesia's natural gas sources and infrastructure application. The heating value and the Wobbe Index (WI) are the parameters that will be influenced after mixtures, and those will be discussed in the outcomes. The resilience status of current natural gas pipeline infrastructures will also be considered because the introduction of hydrogen into the natural gas infrastructures deviates from normal operating standards. Altogether, this paper could be a pioneering study of blending hydrogen and methane with renewable energy in Indonesia which takes Cirebon infrastructures case study.

Keywords: Resilience, Renewable Energy, Blending, Hydrogen, Methane

ACKNOWLEDGEMENTS

N/A.

Electric Boats for Fisherman as a Substitute for Fuel Oil on the Belitung Island (Indonesia)

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ABSTRACT

Fishermen are one of the types of livelihood that are commonly carried out by Indonesian people who live on the coast. Indonesia has the longest coastline in the world, so fishermen should have good welfare and healthy living patterns. However, in reality, most traditional fishermen in Indonesia have not experienced it, they still carry out fishing activities in an inefficient way, because they only follow the work patterns that have been done by their predecessors, far from the touch of technological advancements that have an impact on high operational and maintenance costs during fishing. This is due to the use of energy that is wasteful, such as fuel and limited fuel availability. This research tries to find solutions to overcome the problem, especially on the use of more efficient technology, so that it can reduce expenses and make fishermen healthier from pollution when catching fish. The research can support sustainable development goals (SDGs) programs number 7, 8, and 13, which are clean and affordable energy, combating climate change, and sustainable economic growth.

Keywords: Electric Boat for Fisherman

ACKNOWLEDGEMENTS

N/A.

The Role of Thermodynamic Laws in Guiding Practical Energy Transition Strategies

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ABSTRACT

The energy transition is a global issue that must be addressed promptly to discover an alternative energy source to replace the existing primary source of energy, fossil energy, which is becoming increasingly scarce, while also taking into account international goals to attain net-zero emissions. This paper provides a perspective on one of the fundamental aspects of energy planning derived from thermodynamic theory. This study was carried out by taking a scientific approach to the first law of thermodynamics, which is concerned with energy conservation, and the second law of thermodynamics, which includes disorder or entropy. Furthermore, this research demonstrates the relationship between thermodynamic laws and the management of accessible energy in the universe. Energy planning must be done carefully and thoroughly to avoid negative consequences from choosing the wrong energy source. Based on the two principles of thermodynamics, nuclear energy is the most suitable energy to use as a practical solution for energy transitions.

Keywords: Energy transition, Thermodynamic Laws, EROI, Entropy, Control

ACKNOWLEDGEMENTS

N/A.

The Role of Groundwater Advection on the Potential Improvement of Ground Source Heat Pump Performance in Tropical Climate

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ABSTRACT

Southeast Asian electricity consumption exhibits an annual growth rate of approximately 6%, with space cooling experiencing the highest increase in electricity demand. The conventional air conditioning system, known as the Air Source Heat Pump (ASHP), is considered to have reached its maximum efficiency potential. In contrast, the Ground Source Heat Pump (GSHP) system has the potential to achieve higher thermal efficiency compared to ASHP. However, the performance of GSHP in tropical climates has not been extensively studied. This research paper explores the feasibility of implementing GSHP for space cooling by considering regional climate, ground temperature, and groundwater flow. The Ground Source Heat Pump (GSHP) application in tropical regions, such as Indonesia encounters two main challenges, high ground temperature and continuous heat rejection throughout the year. These challenges create uncertainty in the long-term application of the GSHP system. In this paper, we attempt to investigate the possible effect of groundwater flow in improving the GSHP performance by numerical simulation. The results suggest a positive correlation of heat transfer rate with the increasing groundwater flow velocity. The improved thermal performance is also beneficial for optimizing the depth of the borehole heat exchanger in order to reduce the initial installation cost.

Keywords: Ground Source Heat Pump, Space Cooling, Tropical Climate, Groundwater

ACKNOWLEDGEMENTS

N/A.

The Corporate Green Power Program: A Novel Approach to Promote Renewable Energy Use in Malaysia

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ABSTRACT

This paper examines the Corporate Green Power Programme introduced by the Malaysian Government to foster renewable energy usage, particularly solar power, within the corporate sector. This innovative initiative employs a virtual power purchase agreement mechanism, creating an operational triad that includes the Solar Power Producer, the Corporate Consumer, and the Electricity Utility Company. Under this program, consumers enter into a Corporate Green Power Agreement (CGPA) with Solar Power Producers. This mutual agreement not only encourages the proliferation of renewable energy use but also contribute to CO₂ emissions reduction. Moreover, it guarantees a secure and dependable power supply to businesses, backed by the utility company. The model put forth in the paper ensures consistent power availability, accommodating energy supply fluctuations. It allows for the arrangement of financial transactions based on the System Marginal Price (SMP) and the CGPA price. In addition, the model accommodates arrangements for earning credits or financial benefits that stem from the reduction of greenhouse gas emissions. The programme also presents guidelines to limit their export capacity and install battery energy storage systems (BESS). This proposal aims to optimise the utilisation of solar energy and foster energy management, paving the way for a sustainable future in corporate Malaysia.

Keywords: Solar Rooftop, Corporate Green Power Program, Government Policy and Incentive

ACKNOWLEDGEMENTS

N/A.

Used Cooking Oil Methyl Esther (UCOME) Production on a Pilot Scale in Bali Island, Indonesia, and Its Utilization as a Component Blending for Bio-Marine Fuel Oil

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ABSTRACT

Indonesia aims to achieve a New & Renewable Energy (NRE) mix of 23% by 2025. To achieve this target, it is necessary to have policies related to the use of complementary feedstocks in the biofuel development program in Indonesia. Used Cooking Oil (UCO) is a domestic waste with the potential to be utilized as a complementary feedstock due to its abundant availability and almost zero carbon emission. Therefore, UCO-based fuel has lower carbon emissions than Crude Palm Oil (CPO)-based fuel. However, to assess the sustainability of UCO utilization as a component blending for Bio-Marine Fuel Oil, it is necessary to identify UCO specifications, characteristics, and quality of UCOME, also the production cost impact. The 10,000 liters of UCO used as feed in the pilot-scale UCOME production came from the household sector and HoReCa (Hotels, Restaurants, and Cafes). The UCOME that was successfully produced has characteristics that comply with the standard of Marine Fuel Oil (MFO) ISO 8217 and SNI 7182 and has a price in the range of Rp.17,000 - 18,000. Therefore, the current results revealed that the UCO has the potential to be a feedstock for producing UCOME as a blending component for Bio-Marine Fuel Oil.

Keywords: Used Cooking Oil, biodiesel, biofuel, marine fuel oil, new & renewable energy, transesterification

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The authors would like to thank to Research & Technology Innovation - PT Pertamina (Persero) for research funding, PT Bali Hijau Biodiesel for the facilities, also Traction Energy Asia for the research collaboration.

Green Hydrogen Implementation Pathways for ASEAN Member States

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ABSTRACT

There is a growing sense of urgency in ASEAN Member States to decarbonize national energy systems to mitigate climate change impacts. The first step towards this objective is the electrification of various end-use sectors while generating electricity from renewable sources. However, this is not possible for all sectors due to limitations in technical applicability, cost economics, technical efficiency, or technological availability. As a result, interest in energy vectors such as green hydrogen, which can be used to decarbonize hard to abate sectors, is rising. However, the cost of green hydrogen is still a concern for wider adoption for commercial applications for achieving the decarbonization objective. With ASEAN Member States accelerating implementation of renewable energy with adequate policy measures and presence of huge network of natural gas pipelines and LNG liquefaction plants will facilitate in cost optimization for green hydrogen generation through reduction in RE procurement cost and cost of storage and transportation to end use sectors.

Keywords: Green Hydrogen; Renewable Energy; Policy; Cost

ACKNOWLEDGEMENTS

This paper is an outcome of the study on Implementation Pathways for Green and Blue Hydrogen in South-East Asia which was developed by RTI International India. I appreciate the insightful comments by the reviewers of the study. The remaining errors, if any, are the authors' own.

A Review of Lithium Recovery from Salar Brine

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ABSTRACT

The increased importance on green energy storage in recent years has led demand for lithium to soar to the point where it is now deemed a critical raw material. The majority of the world's lithium reserve base is found in the Lithium Triangle in South America. Lithium-rich brines are concentrated primarily via evaporation before being processed into end-products such as lithium carbonate and lithium hydroxide. Other methods of lithium extraction from salt-lake brines are explored in this paper, with particular focus in lithium selectivity over structurally similar magnesium ions. These alternative methods have received attention and increasing importance to reduce the environmental and social impacts of lithium mining. This extended abstract further explores valorisation of by-products of lithium extraction owing to the significant scale that these wastes are produced.

Keywords: Lithium extraction, Salar brines, Magnesium-lithium ratio, Selective lithium recovery

ACKNOWLEDGEMENTS

N/A.

Life Cycle Assessment in a Sugar Industrial Complex: Comparison Between Conventional and By-Product Valorization

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ABSTRACT

Sugarcane production involves its main product (sugar) and by-products (bagasse and molasses) essential for food and power generation in the global community. There has been an increasing demand for sugar worldwide annually. Sugarcane industries should maintain sustainability by considering their energy use and resources that can lead to environmental impacts. Employing a valorization method for these by-products can increase the sustainability of the sugar industry. This study aims to evaluate which of the two processes 1) conventional and 2) by-product valorization have the most significant environmental impact by using Life Cycle Assessment (LCA). Both processes have been modelled from OpenLCA 1.11 and Ecoinvent database to further assess their environmental performance. The study revealed a reduction of the environmental impact categories in the scenario with the Valorization of Molasses and Co-generation. Notably, electricity, fossil fuel, and water consumption are the flows that contributed the most to the Life Cycle Impact Assessment (LCIA). This paper has provided sustainable solutions that can be implemented to alleviate environmental concerns in sugar industries.

Keywords: Bagasse, Co-generation, Life-cycle Assessment, Molasses, Sugarcane

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N/A.

Geospatial Assessment of Rooftop Solar Photovoltaic Potential in Thailand

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ABSTRACT

This paper investigates the rooftop solar photovoltaic (PV) potential in Thailand through the utilization of open-source Geographic Information Systems (GIS) building footprint and land use data available online. Comprehensive geoprocessing techniques are implemented to assess the rooftop availability, building types, solar PV installation and alignment criteria. The findings reveal a substantial technical output of 50.44 TWh/year for total rooftop solar PV installations in Thailand, with the central regions exhibiting the highest potential. Notably, both residential and industrial sectors make significant contributions to the overall energy output, highlighting their promising growth potential. Hence, this research underscores the importance of incorporating rooftop solar PV in renewable energy policies as baseline data to accelerate the widespread renewable energy adoption in Thailand.

Keywords: Rooftop solar photovoltaic, Geographic Information Systems (GIS), Solar potential assessment

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Techno-economic study of post-combustion carbon capture in coal power plant in ASEAN: Case study in Indonesia

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ABSTRACT

Coal has been one of the most used energy sources in ASEAN, dominating 28% of the overall energy supply in 2020. There are several ways to reduce the adverse greenhouse gas emissions (GHG) from coal power plants, with carbon capture and storage as the most commercialized technology. Chemical absorption of CO₂ using amine as the solvent was frequently utilized due to its compatibility to absorb CO₂ and relatively low cost. In this study, a techno-economic assessment was performed by using Aspen HYSYS for a post-combustion carbon capture in coal-fired power plants in Indonesia. Flue gas data from supercritical and subcritical power plants was also assessed to determine the effect of carbon dioxide loading to the overall CO₂ abatement cost. The results show that number of stages in absorber greatly affect the abatement cost, while above 85% of CO₂ removal efficiency resulted in a significant increase in cost. The optimum parameters were found to be at 32 stages of an absorber column and 83% CO₂ removal efficiency. Additionally, the lowest abatement cost of the subcritical CFPP was estimated to be USD 8.24/ton CO₂.

Keywords: Coal power plant, carbon capture, Aspen HYSYS, Optimisation, Cost Estimation

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N/A.

A Study on Factors Related to the Willingness to Pay for Renewable Green Energy Among Energy Focus University Students in Malaysia

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ABSTRACT

Electricity generated from renewable sources can boost grid vitality and contribute to environmental sustainability. As the consumers of the future, university students in Malaysia were surveyed to determine how much they would be willing to pay for green electricity generated from renewable sources. In this study, we used a Multiple Regression Analysis to determine how much awareness of green electricity's benefits, government involvement, and knowledge predicts willingness to pay for green electricity and interest in purchasing energy-efficient appliances. A total of 260 students of energy focus university have responded to this survey, allowing researchers to examine the connection between the three variables. Industry and policymakers may use the results of this study to refine and fortify their strategy for making the switch to a more diverse energy generation mix.

Keywords: Energy Generation Mix; Knowledge and Awareness Level; Willingness to Pay for Green Electricity

ACKNOWLEDGEMENTS

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Scenario Analysis to Balance Biofuel and Electric Vehicle for ASEAN Low-carbon Road Transportation

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ABSTRACT

The transportation sector contributes most emissions compared to other sectors. Over the past few years, ASEAN countries have been actively promoting biofuels as a potential resource for reducing greenhouse gas (GHG) emissions. EVs have also gained significant interest in the automobile market as an alternative solution for reducing emissions. To ensure these two technologies complement each other instead of competing, it is crucial to develop the scenarios that incorporate a mix of EV and biofuel. This study examines various scenarios to see their implications and bridge the gaps between EVs and biofuels. Triangulation is employed utilizing literature data, focus group discussions, and expert consultations to ensure appropriateness and applicability of these scenarios to all ASEAN Member States (AMSs). The scenario selection is based on the quantitative approach and the selected scenarios are analyzed using the Low Emission Analysis Platform (LEAP) using bottom-up energy demand modeling approach. This analysis resulted in the following scenarios: updated AMSs and carbon neutral with land use, land-use change, and forestry (LULUCF) scenario. Additional policy actions are proposed for both EVs and biofuels, and the potential emission reduction is considered. Furthermore, these policy actions can be tailored to each member state for maximum effectiveness.

Keywords: Electric vehicle, Biofuel, Scenario analysis, Carbon neutrality

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N/A.

Bio-Briquettes Production from Spent Coffee Grounds, Composite-Organic Waste, and Coconut Shells by Using Carbonization Method for Increasing Waste to Energy Program

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ABSTRACT

Global energy demand is projected to rise in coming years due to a corresponding increase in the world's population. This increased demand highlights the importance of exploring alternative energy sources, particularly renewable energy. Among the various forms of renewable energy, biomass stands out as a consistently abundant and accessible source of renewable energy on a global scale. In Indonesia, there exist a significant abundance of organic waste, spent coffee grounds, and coconut shells. Each of these wastes has a high heating value, so it has potential to become the raw material of bio-briquette, an alternative source of renewable energy. By the method of carbonization, the study was intended to identify the characteristics of the bio-briquette composite using organic waste, coconut shells, and spent coffee grounds as raw material on proximate analysis parameters and heating value. Based on the results of the research, the best bio-briquette characteristics were obtained from sample APEK25 with the characteristic of 7.84% water content, 36.24% volatile matter, 9.38% ash content, 46.54% fixed carbon, and a heating value is 4637 cal/gr. These findings highlight the potential of bio-briquettes as a renewable energy, contributing to waste management for sustainable energy transition and addressing the increasing energy demand.

Keywords: alternative energy, energy transition, bio-briquettes, waste to energy

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Analyzing the Environmental Performance of Coal Mining Companies in Indonesia: A Comparative Study of Sustainability Reports and Best Practices

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ABSTRACT

The coal industry has long been associated with negative environmental impacts, including land clearance, pollution of river water, high energy consumption, and increased emissions. In response, governments and society are urging coal mining companies to adopt environmentally friendly practices. This research focuses on investigating whether coal mining companies in Indonesia are becoming more environmentally conscious and evaluates their performance. The study relies on sustainability reports from Indonesian coal mining companies spanning from 2020 to 2022. The research methodology involves comparing environmental parameters among these companies. Parameters such as coal production, energy consumption, and other parameters are analyzed. The research findings will be presented through graphical analysis, highlighting the performance comparison of each parameter over the recent years. The data suggests a positive trend in the implementation of environmentally friendly practices among coal mining companies. There is an overall reduction in greenhouse gas emissions and a decrease in energy consumption each year. These results indicate a heightened awareness and effort within the coal mining sector to minimize environmental impacts. By understanding the efforts of coal mining companies in adopting sustainable practices and assessing their performance, this study aims to guide and enhance the overall environmental performance of coal mining operations.

Keywords: Mining, Coal, Environment, Emissions, Sustainability

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Special thanks to all coal mining companies in Indonesia for the sustainability reports. They enable us to utilise the annual environmental sustainability report and provide us with the technical data support and expertise in conducting this research.

Enabling Sustainable Energy Communities in ASEAN: A Systematic Approach to P2P Energy Transactions on Matakus Island Using IoT and Blockchain

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ABSTRACT

This paper addresses the need for energy diversification and sustainable development in the ASEAN region by proposing a decentralized peer-to-peer (P2P) energy trading system. Power Chain, a peer-to-peer energy trading platform, is tailored as the designated medium for implementation. Power Chain harnesses the capabilities of blockchain technology and utilizes MQTT and HTTP protocols to ensure security, transparency, and user-IoT interaction. A case study was conducted on Matakus Island, a rural area in Indonesia with high solar power generation potential and a suitable demographic for the study. Currently reliant on diesel-based power generation, the island serves as an ideal location to evaluate the feasibility and benefits of transitioning to a RE-based P2P energy trading system. The P2P energy platform on Matakus Island enables direct energy trading, leveraging solar potential (4.77 kWh/m²/day). With 97 households, it enhances accessibility, efficiency, and reduces emissions. Estimated annual market transactions: 3.03 ETH, worth approximately 85,704,356.16 rupiah (exchange rate: 1 ETH = 28,264,716.67 rupiah). The integrated approach presented in this study demonstrates the viability of using IoT and blockchain technologies to transform the energy market structure and accelerate the transition towards cleaner and more efficient energy systems in ASEAN.

Keywords: ASEAN, Blockchain, IoT, Peer-to-peer Energy Scheme, Rural Electrification

ACKNOWLEDGEMENTS

N/A.

Shifting Towards Clean Energy Technology: Assessing Viet Nam's Critical Minerals Demand and Domestic Resource Potential

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ABSTRACT

Viet Nam is progressing toward an energy transition to achieve the 2050 net-zero emissions target by switching from fossil fuel-based to clean energy technologies. The demand for clean energy equipment, such as solar photovoltaic modules, wind turbines, and batteries, is expected to grow rapidly in Viet Nam as a result of the decarbonization pathways for the power and transportation sectors. The manufacturing of the required clean energy equipment will require substantial critical minerals. This study evaluates Viet Nam's demand for major critical minerals in clean energy technology development, including copper, cobalt, lithium, nickel, silicon, and rare earth elements. The critical minerals demand is estimated based on critical mineral intensities and the required capacity of clean energy equipment to be installed under Viet Nam's current policies. The results show that the total required critical minerals are estimated to increase approximately six-fold by 2030 and 31-fold by 2050. Therefore, Viet Nam needs to diversify the critical minerals supply chain, accelerating domestic production. Furthermore, the article reviews estimates of Viet Nam's critical mineral resources and the potential to provide the growing domestic and global requirements for those critical minerals in the coming years.

Keywords: Clean Energy Technology, Critical Minerals, Decarbonisation, Viet Nam, Energy Transition

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We would like to thank the Asia Pacific Energy Research Centre for providing financial support for this research. Without the generous support, this study would not have been

possible. We would also like to express our gratitude to the members of our research team in the Asia Pacific Energy Research Centre, who provided valuable input, insights, and assistance at every stage of the research. Their contributions were critical to the success of this research, and we are deeply grateful for their hard work and dedication.

Techno-Economic Comparison of Organic Rankine Cycle and Supercritical Carbon Dioxide Cycle to Utilize Brine Waste Heat in Ulubelu Geothermal Power Plant, Indonesia

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ABSTRACT

Ulubelu geothermal power plant (GPP) in Indonesia reinjects 2,577 t/h of brine in Cluster R2 with a temperature of 166°C and a pressure of 7.38 bara. Therefore, the brine still contains considerable waste heat that can be utilized through waste heat recovery (WHR) techniques. Organic Rankine cycle (ORC) and supercritical carbon dioxide (CO₂) Brayton cycle (SCBC) are technologies that can be used to convert waste heat into electricity. ORC is already widely used for WHR applications. Meanwhile, SCBC is an emerging technology with the advantage of using CO₂ as the working fluid in a closed-loop system. While CO₂ is inert and non-flammable, supercritical CO₂ has very high specific heat and density, so compact-sized equipment can be used. This study aims to compare the simple ORC, recuperative ORC, simple SCBC, and recuperative SCBC power cycle configurations for brine WHR at the Ulubelu GPP based on the technical and economic aspects. The results show that recuperative ORC produced the highest net output power and thermal efficiency (27,363 kW and 15.96%, respectively). Meanwhile, recuperative SCBC has the best economic performance with the lowest CAPEX (1,404 USD/kW-net), the highest NPV (414.7 million USD) and IRR (29%), and the shortest payback period (4.83 years).

Keywords: Geothermal Power Plant, Organic Rankine Cycle, Supercritical Carbon Dioxide Brayton Cycle, Waste Heat Recovery

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The authors would like to thank PT Pertamina Geothermal Energy Area Ulubelu for providing field data regarding the brine conditions in Cluster R2. The authors would also like to thank the Department of Mechanical and Industrial Engineering, Gadjah Mada University, for providing financial support under the departmental research grant schemes.

Investigating The Consequence of Energy Transition in Protracted Displacement Setting: Solid Fuel Dependency and IDPs' Readiness

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ABSTRACT

By gathering data from protracted temporary settlements inhabited since 2012 by those affected by the Mount Sinabung eruption in Karo Regency, Indonesia, this study aims to investigate the transition of IDPs to cleaner energy for cooking. The determination of energy choice for household scale was utilized as a framework to depict the overview of energy use for cooking practice, including the consequences of the transition progress. The case of Sinabung displacement offered a perspective of the prolonged IDPs on humanitarian energy interventions and the national ecosystem toward clean energy behaviour. Even though LPG penetration is subsidized, a protracted displacement situation in Sinabung still reveals solid fuel dependencies. The LPG subsidy program, which was poorly planned, and the lack of readiness of IDPs to purchase and use new alternative cooking energy were the biggest obstacles to the overall transition process and caused the fuel stacking phenomenon to persist.

Keywords: Clean Energy Cooking, Energy Security, Energy Transition, Protracted Displacement, Solid Fuel

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N/A.

Indonesia's Energy Transition in Electricity Industry through PLN EPI Energy Outlook

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ABSTRACT

The energy transition is the global energy sector's shift from fossil-based energy production and consumption systems – including oil, natural gas, and coal – towards renewable energy sources such as wind, solar, and hydro. The energy transition is a long process of reducing carbon emissions that can cause climate change. It is essential for the world and Indonesia, so the progress must be monitored accurately. The progress of the energy transition and energy use conditions can generally be known and monitored through study reports, analysis results, and energy outlook studies. This paper aims to discuss PLN EPI's contribution in informing the condition of primary energy use and informing the right strategy to pave the way towards an energy transition in Indonesia, especially in the electricity industry through programs using natural gas energy and the adoption of renewable energy in the form of biomass energy reported in the form of an energy outlook report. The energy outlook report from the electricity sector will complement the existing energy outlook studies and reports, namely the Indonesia energy outlook report from the National Energy Council and the energy outlook study from BPPT, which have become references for reference to national energy use.

Keywords: Energy Transition

ACKNOWLEDGEMENTS

N/A.

Simulation of Rooftop Solar Photovoltaic for Tourist Accommodation Villa as a Mean to Promote Green Tourism in Bali – Indonesia

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ABSTRACT

Indonesian government renewable energy mix can be accelerated if tourism industry also contributes to the generation of green electricity such as rooftop solar PV, especially for Bali Province as the world tourist destination with thousands of accommodations spread across the Bali Island. In this research, the feasibility analysis to implement rooftop solar PV in Sanctoo Suite and Villa located in Gianyar Regency, Bali Province was carried out using Helioscope software simulation. The design was aimed to maximizing the benefit of free rooftop space with financial investment cost of installation. It was determined to reduce electricity bill of 345 kVA load capacity of the villa operation. Based on the simulation, the solar rooftop capacity of 69.3 kWp was available. Furthermore, the energy output generated by the rooftop solar PV annually was around 106.4 MWh. From financial analysis, the monthly electricity bill saving achieved was on average around 12 %. Based on this, it was estimated that the payback period for the investment will be around 18 years. These results showed that installation of rooftop solar PV for tourist accommodation is feasible and will promote green tourism for the industry in Bali.

Keywords: Renewable Energy, Rooftop Solar PV, Green Tourism

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N/A.

Potential Utilization of Tamblang Dam for Micro Hydro Power Plant to Increase Renewable Energy Mix for Indonesia

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ABSTRACT

Abstract description Strategic Indonesian government's program of developing water retention dam also enable the construction of hydro power plant to achieve renewable energy mix target such as Tamblang Dam which is located in Bali Province. In this study, technical analysis was carried out to calculate potential electricity production of newly commissioned Tamblang Dam in early 2023. The hydrological data was collected and analysed to calculate the annual water resource potential discharge available. It was found that discharge rate of 450 litre per seconds could be utilized to drive turbine generator. Detailed elevation inspection of the water level and the discharge outlet obtained height difference of 60 meters. From these data, power generation of 2 x 0.25 MW and annual electricity production of 4.4 GWh were calculated, respectively. This showed the additional benefit of Tamblang Dam as renewable energy sources to achieve Indonesia's energy mix target.

Keywords: Renewable Energy, Dam, Micro Hydro Power Plant

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N/A.

Development of Hydrogen Production for the Future Energy

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ABSTRACT

The global trend is moving towards achieving "Carbon Neutrality" and "Zero Carbon Emission," as emphasized in COP meetings and the Sustainable Development Goal (SDG) framework. The international community is increasingly focused on harnessing renewable energy sources like solar PV and wind energy, as well as adopting energy storage systems and electric vehicles, to limit the global temperature, rise to 1.5 degrees Celsius. Hydrogen is recognized as a carbon-free energy carrier and has the potential to be used in various sectors such as power generation, transportation, and energy storage. Nevertheless, the origin of hydrogen can vary, leading to differing levels of carbon emissions associated with its production. Additionally, the pricing of hydrogen is influenced by its production method, which has been categorized using different colors. The ASEAN region is well-suited for the implementation of hydrogen production technologies utilizing biomass and biogas, primarily due to its significant agricultural production capabilities. Given the agricultural resources available in ASEAN countries, biomass can serve as a reliable feedstock for hydrogen production. Additionally, the climatic conditions within the ASEAN region are favorable for the process of biogas fermentation, further supporting the potential for efficient and sustainable hydrogen production.

Keywords: Hydrogen, Energy for the Future, Carbon Neutrality, Biogas

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N/A.

Assessing the Impact of ASEAN's Ambitious Energy Efficiency Standards on AC Manufacturers

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ABSTRACT

The residential sector in ASEAN is highly dependent on cooling as a primary energy use along with cooking, making up about 82% of the sector's demand in 2050. Air conditioner (AC) is one of the cooling appliances in ASEAN that will drive energy demand growth in ASEAN. Consequently, this surge in demand also contributes significantly to the region's CO₂ emissions. Recognizing the impact of AC utilisation, energy efficiency in AC is considered the most effective way to propose energy savings and environmental impacts. In order to improve energy efficiency in AC, ASEAN has committed to stringent Minimum Energy Performance Standards (MEPS) by achieving a target for a Cooling Seasonal Performance Factor (CSPF) of 3.7 by 2023 and 6.09 by 2025. However, an update of MEPS across the ASEAN region has key two challenges: Firstly, the financial investment required by manufacturers; and secondly, the development and evolution of AC technology. This study aims to utilise Techno-Economic Assessment (TEA) to evaluate the impact of increased MEPS on AC manufacturers in the ASEAN region, with MEPS levels forming the framework for the TEA. The findings from this study offer valuable insights to manufacturers and policymakers.

Keywords: Energy Efficiency, Sustainable Cooling, ASEAN

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We would like to express our gratitude to the Japan-ASEAN Integration Fund (JAIF) for their support of the "Promotion of Higher Efficient Air Conditioners in ASEAN through Harmonisation of Standards and Strengthening of Market Verification and Enforcement Capabilities (Phase I)," which forms the basis of this paper. Our appreciation extends to our programme partners, industry professionals, and academic institutes, whose invaluable

contributions made this study possible. Special acknowledgment goes to the groups and individuals championing environmentally friendly behaviors and the use of highly efficient technologies. Furthermore, we appreciate the insightful comments provided by the reviewers, which significantly enhanced the quality of our work. This endeavor exemplifies the collaborative effort necessary in the ASEAN region to construct a sustainable cooling future.

Energy Transition Strategic Partnership Investment, a Study Case of an Energy Investment Company

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ABSTRACT

As the largest carbon emitter in ASEAN, Indonesia has committed to reducing emissions and achieving net zero emissions by 2060. The commitments were issued at the G-20 leaders 'summit in 2022 through the JETP agreement to mobilize \$20 billion in funding from various sources like grants, loans, and private investments that support Indonesia's energy transition plan. However, inadequate investment policies in Indonesia have not attracted investors. This paper defines the role of successful energy investment companies under state-owned utilities in raising various type of funding as a mode of shared experience in Indonesia to accelerate renewable energy development and support reducing CO₂ emission program during the energy transition. A case study of various type power plant development through an adaptive investment scheme aims to demonstrate a revolution in power plant investments to address the energy transition. The results exhibit that, despite existing challenges and limitations, various financing models for strategic partnerships for energy investment can be implemented. This innovative strategy in power plant development through an adaptive investment scheme has excellent potential to be explored and attract investment to Indonesia, which will accelerate the energy transition and contribute to a sustainable energy transition in the long term.

Keywords: Energy Transition

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Stakeholder Consultation for Development of Sustainable Aviation Fuel (SAF) Strategies in ASEAN

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ABSTRACT

Sustainable Aviation Fuel (SAF) is a low-carbon fuel that can substitute (drop-in) for conventional jet fuel to decarbonize aviation sector during the transition, where energy density (both by volume and weight) of battery and/or hydrogen still much inferior to liquid fuel, especially for long haul flight. SAF can use existing supply chain and infrastructure of biofuel production and jet refueling at airport. Hawai'i Natural Energy Institute (HNEI) and National Energy Technology Center (ENTEC), under Federal Aviation Administration (FAA) program, initiated a stakeholder consultation workshop to develop SAF strategies in ASEAN attended by policy makers, academics, research institutes and private sectors. The workshop highlighted the necessity for sustainable funding models, addressed the lack of discussion on feedstock sustainability and economic viability, and emphasized the importance of infrastructure development of SAF production, storage, and distribution. The recommendations and way forward of SAF are to establish policies support, raise awareness through education initiatives, and implement long-term planning and monitoring mechanism to track progress and evaluate environmental and economic impacts. The findings provided valuable insight for policymakers, industry stakeholders, and researchers, facilitating the advancement of SAF adoption within the aviation industry and mitigating its environmental footprint.

Keywords: Sustainable Aviation Fuel (SAF), Strategies Development, Stakeholders Discussion, ASEAN

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N/A.

The Demonstration on Microtrip Analysis for Using Electric Motorcycles as Public Motorcycle Taxis in Thailand

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ABSTRACT

To mitigate global issue of climate change crisis by pushing forward to electric mobility, this work focuses on demonstrating electric motorcycle using as public motorcycle taxis in Thailand. This can promote public mass transport by solving a problem of first-/last- mile transportation with zero-tailpipe emission electric-motorcycle. The participated public motorcycle taxis have demonstrated a used of selected electric-motorcycle model with 3 kW rated power, two 1.6 kW battery packs (72V 22Ah), and more than 100 km driving length, for their service. The participated electric motorcycles were installed an electronic kit of Energy Consumption Tracking (ECT) box which can measure considered variables, i.e., electric voltage (V), electric current (A), accelerated pedal position (%), and GPS location. Therefore, the micro-trip analysis can apply with these inputs, and required information which were energy consumption, driving distance, driving behavior can be analyzed. The observed energy consumption was compared with fuel consumption of gasoline motorcycle with 125 cc 4-stroke engine. The results showed that the electric motorcycle can tolerate to be using as public motorcycle taxis of Thailand. The average daily-driving length are 79.13 km with electric consumption between 2.55 - 4.29 kWh/100km or 0.28 - 0.48 Lg.e./100km or one-third of compared gasoline motorcycle.

Keywords: Climate Change Crisis, Public Motorcycle Taxis, First-/Last- Mile Transportation, Electric Motorcycle, Litre of Gasoline Equivalent

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N/A.

Hydrogen Blending with Natural Gas for Combustion Efficiency Improvement Toward Decarbonisation of Power Plants

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ABSTRACT

The 12th Malaysia Plan highlighted Malaysia's commitment to reach net zero by 2050. To achieve this target, Malaysia has to decarbonise the energy sector as it is the primary emission source. Hydrogen combustion is clean and only produces water and energy. However, several studies identified that hydrogen combustion could produce NO_x , which is more harmful to the environment than CO_2 . Studies on hydrogen application in the energy sector in Malaysia are limited, and the implementation of total hydrogen fuel in power plants may not happen shortly. A fundamental study was proposed on the co-firing of hydrogen and natural gas fuel. This study aimed to examine co-firing characteristics such as temperature, pressure, and air-to-fuel ratio on GHG emission and energy release to find the optimum natural gas-to-hydrogen ratio. The model was developed using Aspen Plus, and hydrogen-natural gas blend percentages varied from 0% to 30%. The findings showed that increased operating temperature led to higher NO_x formation while varying pressures did not impact the CO_2 and NO_x formation. Pure natural gas combustion system was more sensitive towards air-to-fuel ratio changes, and an increase in air-to-fuel ratio to 1.5 led to 160 % higher NO_x formation due to an increase in nitrogen content.

Keywords: Hydrogen-Natural Gas Blending, Net Zero, GHG Emission, NO_x Formation, Applied System Analysis

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N/A.

A Quantum Leap: Drop-In Renewable Diesel Production (Hydrotreated Vegetable Oil) at PT Kilang Pertamina Internasional

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ABSTRACT

The Refinery Unit of PT Kilang Pertamina Internasional – Refining and Petrochemical Business of Pertamina (PT KPI) has successfully produced the first drop-in biofuels diesel on a commercial scale in Indonesia, beginning with commercial test runs at Dumai 2020 and Cilacap 2021 and concluding with mass production following an upgrade to the Thermal Distillate Hydro Treater (TDHT) Plant at Refinery Unit IV Cilacap 2021. RBDPO (Palm oil) was used as the feedstock; its production involves hydrodeoxygenation and hydro decarboxylation with the assistance of a catalyst and hydrogen gas. This product has ultra-low levels of oxygen, complete saturation, a high cetane number, ultra-low levels of sulphur, superior storage and oxidation stability, and a higher energy content than biodiesel. ISCC (International Sustainability and Carbon Certification) has granted TDHT HVO plant certification. The product satisfies the RED-II standard for renewable fuel, with a GHG reduction 70 percent compared to hydrocarbon fuel for the transportation sector. KPI intends to expand the production of this product as well as its capabilities to become the market leader in this renewable biofuel. This product will be marketed as the primary premium biofuel with both superior quality and lower GHG emissions in the domestic and global market.

Keywords: PT Kilang Pertamina Internasional, Pertamina Renewable Diesel, HVO, Drop in BioFuel

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N/A.

Decarbonizing Commercial Vehicles: Life Cycle Assessment of Diesel, Petrol and Electric Trucks

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ABSTRACT

The electric vehicle (EV) landscape in Malaysia is still trailing behind the more established internal combustion engine industry. However, the promotion of EVs has become an increasing priority, especially after committing to achieving net-zero emissions by 2050 as outlined in the 12th Malaysia Plan. Malaysia has set a target of having 1.5 million EVs by 2040, with a notable portion consisting of commercial EVs like buses and trucks. Developing the EV ecosystem and sustainable trucks in Malaysia faces challenges such as high costs and insufficient supporting infrastructure. This study aims to assess the CO₂ emissions and total cost of ownership (TCO) of diesel trucks (DT), petrol trucks (PT), and electric trucks (ET). The study employs a simplified life cycle assessment (LCA) and a TCO assessment method. The results indicate that the average CO₂ emissions of ET are 20% lower than those of DT, and 29% lower than PT. Furthermore, the TCO of ET is 21% and 39% lower than that of DT and PT, respectively. The study concludes that electric trucks (ET) demonstrate the best performance in terms of cost savings and CO₂ emission reduction. Moreover, ET exhibits more advantages over DT, especially when the frequency of driving is higher.

Keywords: CO₂ Emissions; Electric Trucks; Energy; Life Cycle Assessment; Total Cost of Ownership

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Energy Transitions in Lao PDR: Opportunities for Green Hydrogen and Ammonia

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ABSTRACT

We report the results of a systematic evaluation of surplus hydropower electricity to produce green hydrogen (H₂), ammonia (NH₃) and urea (CH₄N₂O) in Lao PDR. Participatory system mapping (PSM) workshops convened across multiple GoL ministries revealed direct and indirect opportunities and risks as probable consequences of green H₂, NH₃ and urea production. Participants debated and prioritized green urea fertilizer to replace “grey” imports; coal co-firing; and fuel cells as the products that contribute to the opportunities and risks identified by the PSM. Techno-economic modelling indicates the levelized cost of urea (US\$467/tonne) is competitive with Thai imports, associated with opportunities for trading carbon offsets. Carbon credits were not sufficient to offset the additional co-firing costs of coal generation, and fuel cells are a likely future enterprise. A targeted capacity building and training program was a central pillar of a systems-based dissemination strategy to develop necessary technical and planning skills and community and GoL awareness raising. The collated research results represent an integrated foundation to draft the Lao PDR National H₂ and NH₃ road map and action plan, and a cross-sectoral revision of energy transition development plans. The research design and participatory processes can be readily adapted and deployed in other ASEAN countries.

Keywords: Hydropower, Green Hydrogen and Ammonia, Lao PDR, Techno-economic Models, Participatory System Maps

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Climate-Resilience Readiness of Emerging Clean Energy Technologies for India's Energy Transition: A Deep Dive into Select Technologies

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ABSTRACT

Sustainability and decarbonization need to be a central component of economic development in the backdrop of climate change, mandates and stakeholder pressures. Climate-resilient infrastructure can significantly contribute to this sustainable and clean development. As energy lies at the heart of decarbonization, study focuses on one of the critical infrastructures - energy sector and examines climate-resilience readiness of select clean technologies in light of India's decarbonization challenge. Battery Energy Storage System (BESS); offshore wind and green hydrogen are studied based on secondary data, incorporating an exploratory and descriptive research design, while using logic of deduction. Research sets out barriers faced by India's energy sector in climate-resiliency transition, identifies indicators for measuring climate-resilience and assesses select technologies for their climate-resilience readiness for India's energy transition. Barriers fall under 5 key categories - governance, monetary, technical, social and data. Indicators for resilience measurement encompass themes of reliability, robustness and resourcefulness. Resilience assessment reveals that BESS, offshore wind and green hydrogen are climate-resilient technologies, albeit, not without gaps which demand policy interventions. Although climate-resilience readiness of clean energy technologies will be of significance, the four levers of energy transition will hold equal value - policy and regulations, technology, sustainable financing and ESG considerations.

Keywords: Energy, Transition, Decarbonization, Climate-resilient, Clean

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Progress on Biomass Coal Co-firing for Indonesia Power Plant

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ABSTRACT

PT. PLN Indonesia Power (PLN IP) collaborated with other research institutions has conducted several studies to investigate the possibility of using biomass for co-firing with biomass in coal power plant. This review paper integrates results of the previous study results carried out by the authors. Biomass has some disguise disadvantageous such as low energy density, high alkaline metals, high volatile mater, handling difficulties, which may cause derating in power plant and some problem in the combustion facilities such as slagging, corrosion, abrasion, and agglomeration. The investigation carried out reveals that the use of multi-type biomass could eliminate the derating. The pre-treatment of the biomass such as drying and pelletizing could improve not only the energy density but also diminishing the slagging potential.

Keywords: Biomass, Co-firing, Carbon Neutrality

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An Assessment of Indonesia's Position on the Net Zero Emission Implementation

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ABSTRACT

There are two distinct paths to envision a future world: one represents the world we are currently shaping, marked by the absence of decisive emissions reduction efforts by 2050, while the other signifies the world we must strive to create, where global temperatures remain on track to increase by no more than 1.5°C.

Currently, most government pledges focus on the year of achieving net zero, but there is less attention paid to how important emissions pathways are in determining climate outcomes. More than 50% of G-20 countries, including Indonesia, have not shown sufficient commitment to reducing emissions targets. Indonesia is projected to be slower than the global average in achieving net-zero greenhouse gas and CO₂ emissions. Fossil fuel-dependent countries, including Indonesia, are most vulnerable to the net-zero transition, as they need to invest more in physical assets, decarbonization, and low-carbon growth.

This paper conducts an assessment of Indonesia's position and characteristics against other countries in the world related to Net Zero Emissions as a potential contribution. It encounters the Environmental Kuznets Curve Theory which relates a country's income per capita and its environmental conditions per capita. It shows environmental degradation tends to increase in the early stages of economic development. However, as income per capita surpasses a certain threshold, environmental degradation starts to decrease, illustrating a connection between economic prosperity and sustainable practices.

The research methodology uses a quantitative approach using cluster analysis. This analysis is a multivariate technique that aims to group objects based on their characteristics into several clusters, creating similarities between objects in the same cluster. Cluster analysis aims to maximize the homogeneity of objects in one cluster and maximize heterogeneity between one cluster and another. The data is simplified into several groups with specific

characteristics resulting from the cluster analysis. In addition, cluster analysis can clearly distinguish between the formed groups. The modeling steps of cluster analysis consist of six stages, which are a determination of analysis objectives, research design in cluster analysis, assumption fulfillment, clustering formation, interpretation, validation, and profiling of clusters.

Data sources to support the research include more than 100 countries obtained from Country Data Tool and Climatescope. Country Data Tools to compare climate-related investments. Climatescope to conduct assessments of each country's readiness for energy transition investments, providing an overview of current clean energy policies, financial conditions, and future capital and investment development.

Preliminary findings show that the transition towards net zero will mostly impact low-income countries. Countries with lower GDP per capita and abundant fossil fuel resources stand at a critical crossroads. The journey towards net-zero emissions demands these countries put significant investments to not only reduce emissions but also to cultivate a low-carbon economy that can drive sustainable economic development while having a risk of conventional assets not being reused. This condition reinforces the essence of global cooperation. In addition, among emerging markets, clean energy

Financing is even more concentrated in a small number of nations including Indonesia for 89% of 2021 investment. In contrast, the Philippines and Indonesia have seen their reliance on coal rise most over the past decade. In both nations, coal has been nearly the only source meeting fast-growing demand. Renewables have seen limited progress by comparison. Asian markets (Vietnam, Philippines, Uzbekistan, Pakistan, Indonesia, and Japan) are among the top 10 countries for coal additions, representing 14% of the total.

Keywords: Net Zero Emissions, Kuznets Curve Theory, Cluster Analysis

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Thermodynamic and Economic Analysis of Combined Cycle Gas Turbine Performance Using Hydrogen-Natural Gas Mixed Fuels

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ABSTRACT

This study analyzes the combined cycle gas turbine (CCGT) performance characteristics when utilizing a mixture of natural gas and hydrogen as fuel. Modeling and simulation of the combustion process is carried out using Aspen HYSYS software on the Keramasan CCGT power plant. The analysis involves thermodynamic and economic assessments under two combustion scenarios: constant air mass flow rate and constant oxygen excess. Thermodynamic analysis focuses on the resulting exhaust emissions, combustion temperature, generated power, and efficiency. The economic study estimates the investment feasibility through net present value calculations. The results demonstrate that hydrogen as mixed fuel reduces CO₂ emissions but increases combustion temperature and NO_x generation. Power output rises with hydrogen fraction despite a lower efficiency decline. The investment exhibits negative returns across varied hydrogen types and compositions. However, applying carbon credit incentives significantly improves financial yield. The optimal scenario entails burning 10% grey hydrogen by leveraging carbon credits, reducing CO₂ by 2.59% and achieving payback period of 10.1 years.

Keywords: Combine Cycle, Gas Turbine, Co-firing, Hydrogen

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Progress of Alternative Clean Fuel from Municipal for Co-firing in Indonesia Power Coal Fired Power Plant

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ABSTRACT

PLN IP, in supporting net zero CO₂ emission, has been developing SRF as a clean fuel alternative for coal-biomass co-firing in their power plants. SRF has been produced in several locations, such as Lombok City, Saguling Reservoir, Tangerang City, and Cilegon City. The SRF produced shows class 2 or 3 SRF qualities based on SNI 8966-2021. The SRF has been through several tests, including laboratory tests, simulation, and performance tests in several power plants. The test shows no significant operation parameter anomaly, thus indicating that SRF can be used as an alternative clean fuel for partial coal substitution in power plants.

Keywords: Coal-fired Power Plant, Srf, Co-firing

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N/A.

Economic Feasibility of Carbon Capture, Utilization, and Storage (CCUS) in ASEAN

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ABSTRACT

The Association of Southeast Asian Nations (ASEAN) countries have committed to an energy transition, with almost all member states announcing targets to achieve net zero or carbon neutrality. Carbon Capture, Utilization, and Storage (CCUS) are considered potential solutions to support the climate ambitions of ASEAN countries, used to store carbon emissions and mitigate their impact on the environment. This paper aims to assess the economic feasibility of CCUS implementation in the region, considering the significant capital investment required and the necessity of supportive policies or regulatory frameworks. The analysis will focus on the cost structure of CCUS projects, explore the potential for regional collaboration, and evaluate the value of CO₂ emissions reductions. To evaluate economic feasibility, the research develops financial models that consider capital investment, operational costs, revenue streams from CO₂ utilization, and potential carbon pricing mechanisms. Sensitivity analyses are conducted to account for uncertainties related to technology costs, and policy changes. By examining the current state of CCUS research and development in the ASEAN region, this paper seeks to provide insights and recommendations for policymakers and stakeholders to overcome barriers and unlock the full potential of CCUS as a key solution for achieving a low-carbon future in the region.

Keywords: CCUS, ASEAN, Carbon Emissions, CO₂

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Interconnection Security and Accessibility

Long-Term Energy System Modelling of Mainland Southeast Asia's Power Sector with Electricity Trading

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ABSTRACT

Electricity is essential to any well-functioning society, but it is also the biggest contributor to climate change. This paper investigates the effects of regional electricity trading on power sector in mainland ASEAN and Singapore from 2020 to 2060, using least-cost optimization approach with LEAP and NEMO software. The model was built from open-sourced data with 6 scenarios from 2 outlooks: Business-As-Usual (BAU) with no constraints and Carbon Neutral (CN) as announced in the Nationally determined contributions (NDCs) of each country, and 3 interconnection levels: No interconnection, Existing interconnections, and Interconnection expansion. The results show that under BAU scenarios, more interconnections lower the total system cost while enabling more renewable energy and reducing the total Greenhouse gases (GHG) emissions. The CN scenarios show that climate goals pledged in NDCs are possible, which interconnections greatly reduce the total system cost by enabling more Biomass and Hydro while reducing the share of Solar and Nuclear. Surprisingly, interconnection expansion allows the nation without net-zero target to export more electricity and increase the overall system GHG emissions. Overall, the interconnection expansion can benefit all countries involved, but a regional net-zero target could further minimize environmental impacts of ASEAN's power system.

Keywords: Energy System Modelling, ASEAN Power Grid, Decarbonization, Interconnection, Climate Goals

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Reinforcing Gender Equality in ASEAN Energy Transition

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ABSTRACT

ASEAN faces the challenge of energy security. One of the key concerns is developing energy transition. The energy sector is influenced by a set of persistent gender inequalities, which can be gender gaps in energy access and decision-making. The number of women who hold management positions in the ASEAN energy sector is low. Framing of ASEAN Plan of Action for Energy Cooperation is regarded as a guideline to accelerate energy transition. This paper will analyze regulations and implementation of gender equality in the energy sector in ASEAN. This paper uses a qualitative methodological approach to analyze concept and regulation on energy transition. It is followed by comparative study to Norwegian energy policy as the best practice. The study finds that ASEAN has 7 energy programmes in APAEC and it should promote opportunities for women, including access and opportunities to hold management positions in the energy sector. It is the same as Norway has been implementing energy policy by gender equality. It is necessary to consider the existence of gender equality in the energy sector and women's participation as a catalyst to achieve the ASEAN target in energy transition.

Keywords: Gender Equality, Energy Transition, Renewable Energy, Policy Making, ASEAN.

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This article is written by academician at Universitas Airlangga. The views expressed here are the personal views of the authors and do not necessarily represent the authors institution.

Towards a Green and Inclusive Power Sector in the Greater Mekong Subregion

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ABSTRACT

This paper examines the power sector and electricity market in the Greater Mekong subregion (GMS) and explores potential pathways for low-cost, low-carbon, and low-conflict development of the sector. The results show that implementing a smartly-designed regional power grid, combined with enhanced cross-border trade, can facilitate a transition to a 100 percent renewable electricity supply. It projects a three-fold increase in energy demand by 2050 and highlights the need for a transition to low-impact renewable electricity sources. It utilizes modeling tools to analyze four scenarios and assess their impacts on electricity cost, carbon emissions, and environmental and social aspects. Results indicate that a scenario combining an expanded regional grid and cross-border trade, increased share of non-hydro renewable energy sources, and energy efficiency measures yields the best outcomes. This approach reduces sectoral emissions, lowers costs, and minimizes conflicts. The paper recommends establishing coordinated and functional regional institutions, ratifying a regional grid code, and promoting standardized cross-border power trade arrangements. In conclusion, the report highlights the relevance of a well-designed regional power grid and cross-border trade for a successful transition. Implementing the recommended measures can lead to a greener and more inclusive power sector, ensuring the region's long-term energy security and environmental sustainability.

Keywords: Interconnection, Power trade, Decarbonization, Low conflict, Sustainability, Renewable Electricity, Energy Transition

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Review and Analysis of Readiness, Challenges, And Potential Benefits of Power Grid Interconnection on Energy Security and Transition Pathways in ASEAN

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ABSTRACT

ASEAN energy demand in 2050 is predicted to increase up to three times of the 2020 value due to significant economic and population growth. According to the AEO7 Outlook, energy supply in the region would need to increase up to four times of the 2020 level to meet the projected energy demand in 2050. Power grid interconnection provides a promising alternative pathway for not only energy security but also energy transition in the region. However, power grid integration across the border requires more complex regulation, stakeholders, technical harmonization, and political agreement. This study aims to review and analyse the readiness, challenges, and potential benefits of power grid interconnection on energy security and transition pathways in ASEAN. To meet the objectives of the study, we analyse the existing readiness, challenges, and potential benefits of power grid interconnection on energy security and transition pathways in ASEAN using the existing literature reviews and policy documents, and Multi-Criteria Decision Analysis (MCDA). The findings of this study would enable us to identify gaps and potential policy recommendations to fill the current gaps in the implementation of power grid interconnection on energy security and transition pathways in ASEAN.

Keywords: Power Grid Interconnection, Energy Security, Energy Transition, ASEAN, Multi-criteria Decision Analysis

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Accelerating Power Grid Interconnectivity in Southeast Asia: A Private Sector Perspective

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ABSTRACT

Building an integrated regional power system between member states of the Association of Southeast Asian Nations (ASEAN) can facilitate economic growth for the region and enable businesses to cost-effectively procure reliable, clean electricity. As corporations strengthen their clean energy commitments, the grid becomes an important enabler of power sector emissions reductions as well as economic development. A new paper from the Asia Clean Energy Coalition (ACEC) offers a private sector perspective on the importance of renewing the Memorandum of Understanding (MOU) on the ASEAN Power Grid, focusing on its accelerated implementation to expand multilateral power trade and cross-border grid interconnections. ACEC consists of world-leading clean energy buyers, sellers, and financiers that drive investments supporting long-term economic growth by unlocking the opportunities of clean energy deployment in the region. ACEC supports strengthening the ASEAN Power Grid MOU to recognise the importance of conducting regional grid planning holistically and regularly prioritising interconnectors that boost clean energy penetration, harmonising regulatory and technical frameworks and making data accessible to facilitate multilateral power trade and clean energy tracking, and acknowledging regulators have a role to play in ensuring all stakeholders interests are safeguarded.

Keywords: Corporate Clean Energy Buyers, Economic Development, Regional Grid Integration

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Empowering Local Heroes Leadership: How Cultural Understanding Can Enhance Energy Accessibility

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ABSTRACT

In 2021, Indonesia achieved electrification ratio of 99.4%, a significant milestone in providing electricity to most of its population. However, 32 villages in South Sumatera still face challenges in accessing electricity due to geographical constraints. To address this issue, Pertamina Plaju launched the "Independent Energy Village" CSR program, aiming to resolve this problem. The primary objective of the program is to empower these communities by providing and maintaining renewable energy sources, such as solar panels and micro-hydro power plants. Pertamina collaborates with various stakeholders, utilizes specialized technical teams, and emphasizes community involvement to effectively implement the program. Understanding the cultural context, Indonesian society tends to exhibit a high-power distance culture, where certain individuals are perceived as superior based on social status, gender, race, age, education, achievements, and family background. Hierarchical orientations may exist within some communities, with respect and deference shown to elders or respected figures sought for advice by other villagers. Conducting field observations, we explored how empowering local-level leadership, represented by "Local Heroes," can enhance energy accessibility through the Independent Energy Village program. Our research aimed to understand the program's impact on the community and its effectiveness in addressing the energy challenges faced by these rural areas.

Keywords: Energy Accessibility, Independent Energy Village, CSR, Local Heroes, Energy Facilities, Renewable Energy, Leadership

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Thank you to the community of Merbau Village, South Sumatera, Indonesia, for being an inspiration in doing this research.

Unlocking Stranded Renewable Energy Generation in Eastern Indonesia: Developing a Multi Criteria Decision Making Tool to Prioritise the Development of Interconnected Island Electricity Grids in Eastern Indonesia

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ABSTRACT

Indonesia, the world's largest archipelago, faces challenges in ensuring reliable electricity access across all of its island grids. Most islands still rely on local power generation systems, which can be inefficient, expensive and not environmentally friendly. Conversely there are islands with abundant renewable energy power generation potential but very little local demand leaving stranded generation unless the excess power can be exported. With Indonesia promoting the growth of green industries, that often require electricity supply from renewable energy sources, the demand for electricity in several regions of Eastern Indonesia is expected to increase. Advances in subsea cable electricity transmission systems can now enable inaccessible regions to be interconnected affordably and efficiently. With numerous potential interconnector projects that could be developed in Eastern Indonesia, stakeholders need to weigh up all relevant technical, social/environmental, financial, and regulatory factors to unlock projects of highest economic impact and drive investment. This paper considers these factors to develop a prioritisation tool using Multi Criteria Decision Making (MCDM) methods to be applied to the development of interconnector projects and applying those criteria to case studies from Eastern Indonesia, thereby enabling stakeholders to unlock potential investment in the highest potential stranded renewable energy interconnector projects.

Keywords: Stranded Generation, Inter- Island Electricity Grids, Variable Renewable Energy, HVDC Subsea Cables, Eastern Indonesia, Multi-criteria Decision Making Tools, BESS

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Sustainability, Engineering, and Infrastructure

Sustainable Integrated Management Systems: A Proposed Framework for Electric Power Transmission Business

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ABSTRACT

An electric power transmission business faces the challenge of managing operations and investments in a sustainable manner while demand for electricity and awareness of sustainability increase. To address this challenge, research provides a framework for integrated management systems that is both sustainable and developed for an electric power transmission business. Sustainable integrated management systems seek to integrate multiple management systems into a singular system that embraces an approach toward the future by taking into account contributions to sustainable development goals as well as the achievement of environmental, social, and governance criteria. An electric power transmission business can improve corporate sustainability performance while addressing the demands and expectations of interested parties through the deployment of a proposed sustainable integrated management systems framework.

Keywords: SDGs, ESG, Sustainable Integrated Management Systems, Corporate Sustainability Performance, Electric Power Transmission Business

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A Holistic Approach in Methane Emissions Management

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ABSTRACT

Methane concentration in the atmosphere is increasing steadily and this increment is driving climate change and continue to rise. In Malaysia, the Energy Sector including Oil and Gas Industry contributes ~20% of GHG emissions out of total GHG emissions as of 2020, majorly from main sources coming from flaring, venting and combustion. Other methane sources, like fugitive emission is currently quantified by high level estimation while from other small intended sources such as compressor seals and pneumatic devices are usually not quantified and reported. Therefore, for PETRONAS to meet stakeholders' expectations and be on par with other global peers, a comprehensive and sustainable methane emissions management is required to accurately quantify and reduce methane emissions. Methane emissions was calculated based on Scope 1 emissions from gas value chain facilities. Since 2020, PETRONAS have conducted methane emissions quantification baseline study on LNG, gas processing, gas transmission plants as well as upstream facilities using process information and ground measurement data. Based on the studies, it is proven that about 70-80% methane emissions were from venting, flaring and stationary combustion. Comprehensive methane emissions will provide a better purview on methane contributions which will facilitate further actions on reductions.

Keywords: Methane Emissions, GHG, Greenhouse Gas

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State of the Art of Floating PV Development in the Indonesia Seas

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ABSTRACT

In recent years, there has been a growing emphasis on reducing Indonesia's reliance on fossil fuels for electricity generation by promoting the development of renewable energy-based power plants. Among the renewable energy sources, solar energy holds great potential in Indonesia, given its abundant availability throughout the year. This presents favourable prospects for the establishment of solar photovoltaic (PV) power plants, both in ground-mounted and floating configurations. However, the deployment of ground-mounted PV plants raises concerns regarding land usage, particularly for large-scale installations. Moreover, the environmental temperature can adversely affect the efficiency of PV panels in land installations. Water bodies offer an alternative location to mitigate these challenges. Nevertheless, the use of inland water bodies for PV installations is restricted by Indonesian government regulations. Considering Indonesia's archipelago geography, seas emerge as an attractive option for the development of large-scale floating PV (FPV) power plants. However, numerous challenges arise when implementing FPV technology on the open seas. This paper explores the ongoing advancements in FPV technology and addresses the challenges associated with installing FPV systems in Indonesian waters. These efforts aim to support the fundamental development of the country's electricity infrastructure, encompassing aspects such as supply security, affordability, and social acceptability.

Keywords: Floating PV, Solar Energy

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Statistical Exploration and Geospatial Analysis of Air Quality Data using QGIS

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ABSTRACT

Insufficient studies have been conducted to explore possible correlations between PM2.5 and CO, especially in a highly urban environment. Thus, the goal of this paper is to assess the occurrence and presence of these pollutants and try to understand how the concentration changes across the geography concerned which is the United States of America. The main goals of this campaign at this stage are as follows. 1) to provide a comprehensive inventory of CO and PM2.5, which are chosen as variables of interest. 2) to attempt and establish a correlation between them by means of spatial mapping. 3) to perform exploratory data analysis and understand the obtained results of the distribution parameters of variables of interest. Visualization of the cleansed data was made in quantum geographic information system (QGIS) geographical software and presented in three different versions covering the whole sampling area of the USA, including the states of Alaska and Hawaii.

Keywords: Carbon Monoxide, PM2.5, Quantum Geographic Information System

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N/A.

A System Architecture for Early Wilt Detection in Hydroponic Crops: An Implementation and Assessment

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ABSTRACT

Hydroponic farming systems, reliant exclusively on mineral-enriched water for plant nourishment, are susceptible to significant failure risks in the event of a disaster. One particular challenge is the rapid identification and mitigation of plant wilt, as its delayed recognition can induce plant stress and potentially lead to crop failure. Consequently, an early warning system that can promptly provide disaster information to farmers is beneficial. This study presents the design and implementation of a system architecture purposed for the early detection of wilt in hydroponic vegetable crops. Utilizing an OV2640 image sensor, ESP32-S system-on-chip, Internet of Things (IoT) technologies, convolutional neural networks (CNN)-based deep learning, and cloud computing, the system aims to provide a robust and cost-effective remote plant condition monitoring solution. A prototype of the system was built to provide a proof-of-concept and evaluate its robustness and effectiveness. Performance tests reveal the system to function satisfactorily, with an accuracy of wilt detection of up to 90.90%. This was determined through trials on samples of mustard plants within a hydroponic greenhouse setting. These findings suggest the proposed system is capable of effectively monitoring plant conditions remotely, offering valuable support for risk management in hydroponic farming.

Keywords: Sustainable agriculture, Intelligent System Architecture, Remote Plant Condition Monitoring, Hydroponic Farming

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Sustainability Challenges: How Public Transport Supports Eco-Tourism Industries

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ABSTRACT

The public transport system is an essential aspect of the management of sustainable tourist destinations. A more efficient public transportation system enables better optimization to maximize economic earnings and support environmental and resource conservation. This paper presents a study analysing the design of public transportation modes to support Eco-tourism industries in Gianyar Regency. This study employs the distribution of tourist destinations, tourist potential demand, and route optimization in eco-tourism tourist destinations using Vehicle Routing Problem. Additionally, a comprehensive analysis is undertaken to determine the emission cost of private vehicles and public vehicles. The results suggest that the planned tourist transportation involves using a medium size bus to travel from the tourist destination Yeh Pulu to Pura Tirta Empul with a total distance of 26.7 kilometres in the northern direction. Furthermore, the utilization of public transport in tourist destinations plays a vital role in mitigating traffic congestion and reducing the carbon footprint within the area. This is supported by the significant annual financial losses amounting to USD 341,303, which can be directly attributed to the emissions generated by private vehicles.

Keywords: Emission, Modes, Public Transport, Sustainability

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N/A.

Exploring and Prioritizing ESG Factors for Organizational Sustainability: A Perspective of Institutional Investors on Malaysian Electricity Utilities Company

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ABSTRACT

This research examines the Environmental, Social, and Governance (ESG) elements that are essential for improving the sustainability of Malaysian electricity utilities company from an institutional investor perspective. This research consists of several stages of data collection, including benchmarking analysis including literature review for developing ESG factors, focus group discussions (FGDs), and a questionnaire survey. This study employs a multi-stage analysis process as well, including content analysis, prioritizing the factors using Analytic Hierarchy Process (AHP), and Quality Function Deployment (QFD). These analytical methods enabled a comprehensive assessment to accomplish the study's goals. The results emphasize 19 factors in five categories within the Environmental (E) domain, 19 factors in four categories within the Social (S) domain, and 24 factors in six categories related to Governance and the Economy (G) domain. These elements are essential considerations for Malaysian utilities companies that are striving to improve their sustainability. This study provides a thorough comprehension of prioritized ESG factors that should be to ensure organizational sustainability and are beneficial for both practitioners and policymakers in the electricity utility sector. By incorporating these findings into their operations and decision-making processes, Malaysian utilities company can strengthen their long-term sustainability and help create a sustainable future.

Keywords: ESF Factor, Organizational Sustainability

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An Assessment of Sustainability Practices in Environmental Program and Its Impact Toward Social Return of Investment (SROI)

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ABSTRACT

Sustainable practices are the processes services employ to maintain the qualities that are valued in the physical environment. and it needs to focus on long-term strategies for making a positive impact on Social Return of Investment (SROI). This research was conducted with the main objectives are to evaluate an environmental program carried out by one of the Government Link Company (GLC), Malaysia in energy industry that is Tenaga Nasional Berhad (TNB) of their Corporate Social Responsibility (CSR) program precisely in environmental program towards Social Return on Investment (SROI). For this research, one of TNB CSR in environmental program was Tree for Tree Program is selected to do assessment on the impact of the program towards TNB Social Return on Investment (SROI). The research findings are presented based on the research objectives that showed the strength of impact of the research dimensions towards Social Return on Investment (SROI) is strongly impactful with the r -value of correlation are above 0.5. The overall research dimensions namely as the environmental management practices, environmental management governance, generative green management and value-based program for community got the mean score value of 4.11 with the interpretation of substantial level on medium priority of funding.

Keywords: Sustainability

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Would Mobile Air Supply Unit Enhances Airflow Distribution in Office Environment?

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ABSTRACT

Proper airflow distribution in an office environment could promote good indoor air quality and thermal comfort for the occupants. Poor airflow distribution has been linked to the tendency of occupants to contract airborne infection. The present study aims to examine the effect of installing a mobile air supply unit on enhancing the airflow condition in the office environment. A k- ϵ model based on Reynold-Averaged Navier-Stokes equations was utilised to predict the airflow distribution. An onsite measurement was performed prior to the simulation. The purposes of onsite measurement are: (i) to obtain the boundary conditions for simulation, and (ii) to validate the simulated airflow result. In the present work, the simulated airflow result has a good agreement with measured airflow data, with a relative error of 5.5 %. Study shows that the locations of installing the mobile air supply unit do not affect the airflow distribution around the occupants. The airflow supplied by the baseline air-conditioning unit was found dominant in the airflow distribution, with an average velocity of > 0.15 m/s. Also, the supplied air was flowing in a downward direction, which could reduce the timing of infectious particles to remain as airborne.

Keywords: Airflow Distribution

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Conquering the Challenge of Energy Inefficiency while Still Optimizing Profitability through Unit Idling: A Case Study at Pertamina Plaju Refinery

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ABSTRACT

The Pertamina Plaju Refinery, with its 100-year-old technology, faces challenges in maintaining efficiency and competitiveness compared to modern refineries in Indonesia. The outdated technology and changes in crude oil quality necessitated adjustments to ensure energy efficiency and maintain product quality and continuity. One of the hotspots in the Plaju refinery system was identified in the Gas Processing Area, particularly in the Butane-Butylene/BB Distiller system. The study identified two root causes of the hotspot: changes in CDU's gas properties due to variations in crude oil quality and the use of outdated furnace technology, resulting in energy inefficiency. To address this, a comprehensive approach was adopted, including Root Cause Analysis, Cost-Benefit Analysis, and Process Simulation using Aspen Hysys Software to ensure technical and economic viability. Key actions were implemented, including process integration to ensure feedstock availability for Alkylation Unit from other sources, which finally resulted in idling the BB-Dist Unit. These changes led to significant impacts, reducing CO₂ emissions by 12,882 tonnes per year and saving 36,499 BSRF of fuel gas consumption. The market value of spent propane and residual butane-butylene could be increased by up to 65% as feedstock for the Alkylation Unit, previously considered only as Liquefied Petroleum Gas (LPG).

Keywords: Refinery, Gas Processing Unit, Maximize Profitability, System Efficiency, Energy Efficiency, Sustainable Development Goals, Greenhouse Gas Emission Reduction, Idling Unit.

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N/A.

Leading the Transition from Halogen Refrigerants to Natural Refrigerants in Indonesia (Pertamina Plaju Refinery as a Pioneer)

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ABSTRACT

Climate change has become a worldwide concern, prompting Indonesia to take ambitious actions to reduce emissions and control rising temperatures. The rapid growth of the Refrigeration and Air Conditioning (RAC) industry in Indonesia has led to higher greenhouse gas emissions. To tackle these environmental challenges, Pertamina Plaju Refinery is manufacturing natural refrigerants, specifically Musicool (Propane) and Breezone (Propylene), providing sustainable replacements for R-22 and R-32. Pertamina Plaju Refinery has made several process modifications and optimizations to support the production of Musicool and Breezone in the Alkylation and Purification Units. These modifications involve optimizing operating conditions and implementing necessary infrastructure changes. In general, Pertamina's natural refrigerants consume 20-30% less energy than halogen refrigerants while offering similar cooling capacity to R-22 and R-32. Propane and Propylene-based refrigerants have the lowest impact on global warming and are eco-friendly due to their easy degradation process. Musicool and Breezone, having an ODP of 0.0, with maximum GWP of 3.3, indicating minimal contribution to ozone depletion. Pertamina's efforts to engage and reach potential customers on these natural refrigerants, involve collaborative efforts among various organizations, including with all District Office Plaju, South Sumatra.

Keywords: Natural Refrigerant, Hydrocarbon Refrigerant, Ecofriendly Refrigerant, Climate Action, Refinery, Gas Processing, Sustainable Development Goals

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We extend our gratitude to PT Kilang Pertamina Internasional, Refinery Unit III, especially the Production Section and Engineering and Development Section, for giving us the chance to improve the configuration of the gas processing unit.

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Green Building Certification in Educational Facility

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ABSTRACT

This study promotes energy saving in campus facilities towards green building certification through existing energy and water consumption and material usage evaluation. It promotes the green building movement primarily from the education sector to respond to government regulations, PP No. 16/2021. The evaluation was conducted by EDGE-App, an open-access building performance software developed by IFC, in the Integrated Creative Education Learning Laboratory (i-CELL) Building. EDGE-App calculates the energy savings in the building by comparing the difference between EDGE's base case and the improved case. The variables calculated in this research are energy consumption, water conservation, and material recovery. This study makes three original contributions: (1) The results of implementing green building technologies in the campus environment towards green building certification, (2) The research of potential development towards Net Zero Energy Buildings, and (3) Lessons learned from the green building certification process. Furthermore, this study can inform engineers, designers, developers, and other parties about ways to save energy and optimize the use of water and recyclable material in campus facilities. As a result, this building performs 70% energy savings, 42% water savings, and 48% less embodied energy in materials. Thus, the building was granted an EDGE Advanced Green Building Certification.

Keywords: Energy Saving, Water Saving, Material Recovery, EDGE Certification, Green Building

ACKNOWLEDGEMENTS

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Implementation of Green Behavior in Educational Building through Human-based Retrofits Based on Agent-Based Modeling (ABM)

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ABSTRACT

This study examines the relationship between knowledge, intention, and implementation possessed by individuals or groups within a specific area, and their influence on the environmentally friendly behavior of other building users. The research analyzes the role of users who have control over the AC (Air Conditioning) system in influencing environmentally friendly behavior. The method questionnaire survey used included items related to the participants' floor usage, knowledge about green behavior, intentions toward green behavior, and ability of AC control in educational buildings. NetLogo software was utilized to process and model the data gathered from the questionnaires. The software programmed the influence that agents who have implemented green behavior can exert on others within their vicinity. The findings show that after random probability programming, ideally, the probability of agents who have implemented green behavior in the Engineering Center (EC) Building is 43.91% - 87.28% after the agents who currently have green behavior influenced the green behavior of the whole building user. The information obtained by building users influences individuals' decision-making process in implementing green behavior. The outcomes of this study contributes to the understanding of green behavior promotion and the development of enhanced sustainable practices in educational buildings.

Keywords: Energy Consumption, Human-Based Retrofit, Agent-Based Modelling (ABM), Educational Building, Green Behavior,

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Carbon Pricing and Green Investment

Conceptual Study of Seaweed Integrated Corporate Farming to Assess Blue Carbon Potential of Seaweed Culture in Lombok Island, Indonesia

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ABSTRACT

Blue Carbon has become an agenda for the Enhanced Nationally Determined Contribution (NDC) commitment in Indonesia. However, the related programs are mostly focused on mangrove conservation while in fact seaweed farming also has the potential to assimilate carbon of 173 Tg C/year. Even though Indonesia has been known as the second biggest producer of carrageenan and agar based seaweed, fluctuated annual seaweed production are observed, partly due to poor quality of seedlings used by farmer. An integrated management system through Corporate Farming Scheme is believed to be one of the solutions to boost the seaweed production by providing a sustainable supply of good quality seaweed seedlings. From the conceptual study that has been conducted, 10 Ha seaweed farm consisting of 40 longline units supported by tissue culture laboratory are able to produce 120-150 ton/ha/year wet weight of seaweed. Techno-economic analysis was also carried out to assess the feasibility of this scheme using existing activity in Lombok and Makassar as basis. From the analysis, this project is profitable and feasible to be conducted assuming the seaweed seedlings price of Rp5000,00 per kg wet biomass and price of dried seaweed Rp35.000,00-40.000,00 per kg. CO₂sequestration was estimated at 352.8 tons/C/ha/year.

Keywords: Blue Carbon

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Comparative Analysis of Indonesia's Energy System Scenarios: Assessing Emissions Reduction Strategies and Cost-effectiveness

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ABSTRACT

This research conducts a comprehensive comparative analysis of energy system scenarios in Indonesia, examining their emissions reduction strategies and cost-effectiveness. The study utilizes the least-cost optimization approach using LEAP (Long-range Energy Alternatives Planning System) and NEMO (Next Energy Modeling system for Optimization). Four distinct scenarios are evaluated: Business as Usual (BAU), Zero Emissions (ZER), Demand Reduction (DMR), and Net Zero Emission (NZE). The findings suggest that while the ZER scenario may achieve significant emission reductions compared to BAU, with an average of 382.9 million tons CO₂e/year, it comes at a higher cost per unit of emission mitigated by the average of 170.8 USD/tons CO₂e. On the other hand, the DMR scenario, with its focus on demand-side management, offers a more cost-effective approach to emission mitigation, reaching 81.0 USD/tons CO₂e. Combining both strategies, the NZE scenario proves to be the most effective in emission mitigation and cost, with 693.7 million tons CO₂e/year and 54.0 USD/tons CO₂e, respectively. Overall, this research seeks to inform Indonesian policymakers, energy planners, and stakeholders in their efforts to develop sustainable energy systems that effectively reduce emissions while considering economic feasibility.

Keywords: Energy System Modelling, Net Zero Emission, Cost Effectiveness, Demand Side Management, Power Plant Optimization

ACKNOWLEDGEMENTS

N/A.

How Effective the Carbon Pricing Implementation in AMS To Reduce Regional Emissions

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ABSTRACT

At COP 27, ASEAN Member States (AMS) reaffirmed their commitment to the Paris Agreement by pledging to achieve net zero targets by 2050. This will require AMS to scale up their efforts to reach their GHG emission target, and one of them is by introducing carbon pricing as a new fiscal regime to smoothen the transition by encouraging more renewable energy use. Currently, some AMS has introduced or proposed direct carbon pricing. Singapore has introduced carbon tax implementation since 2019. Indonesia has been stepping up its commitment to enforce both carbon tax and an Emission Trading System (ETS) by introducing numerous supporting policies. Malaysia, Thailand, and Vietnam are anticipating launching ETS as their latest climate action plan. A question on how effective of carbon pricing implementation to reduce regional emission may come up. To answer this question, this paper sheds light on how effective the carbon pricing implementations in Southeast Asia to reduce its carbon emissions through expert interviews and literature reviews. The preliminary findings indicate that carbon pricing implementation may result in comprehensive mitigation action to reduce emission from power generation and manufacturing industry and support transition to low-carbon economy to help region achieving net zero targets by 2050.

Keywords: Southeast Asian, Carbon Pricing, Emission

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Assessing The Sectoral Economics Consequences of Carbon Pricing Using Price-output Model Analysis

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ABSTRACT

Malaysia aspires to achieve carbon neutrality by 2050 and gradually transition into a low-carbon nation in 2040. Although carbon pricing has not been implemented in Malaysia thus far, the potential of this tool to reduce greenhouse gas (GHG) emissions has been highlighted in the Twelfth Malaysian Plan. To assess carbon pricing effectively, it is essential to adopt a fair and rational approach towards each economic sector, considering that certain sectors may face potential risks resulting from policy changes. In this study, price and output model analysis are used to assess the impact of carbon pricing on price and output to industries due to carbon pricing. The expected finding indicates that transportation, agriculture, utilities, and chemicals are the most responsive sectors to price changes when carbon pricing is implemented. Conversely, transportation and the services sector are projected to be the most impacted sectors in terms of revenue when carbon price is implemented. Understanding the potential effects on output and prices is vital for the successful implementation of climate policies and the attainment of Malaysia's climate objectives. By identifying vulnerable sectors, policymakers can develop targeted strategies to mitigate disruptions, ensure a smooth transition towards carbon pricing policy, and foster sustainable economic development.

Keywords: Carbon Tax, Price Model, Energy, Output Model, Input-output, Carbon Price

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This work was supported by Dato' Low Tuck Kwong International Energy Transition Grant under project code 202204001ETG.

Building a Robust International Carbon Crediting Framework: Insights from Indonesia's Joint Crediting Mechanism

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ABSTRACT

This research explores the Joint Crediting Mechanism (JCM) implementation and effectiveness in Indonesia, a program adopted by Japan for carbon emissions reduction and climate change mitigation. Using a quantitative case study methodology, we combine primary and secondary resources to gain insights into the mechanism's impact on low-carbon development. Findings reveal challenges in government commitment to green energy promotion and financial losses in the solar power sector. Future agreements must consider past implementation and develop a clear framework for Internationally Transferred Mitigation Outcomes (ITMOs) to yield mutual benefits. The study emphasizes ITMOs as a potential future for cross-border carbon credit transactions, offering pathways for constructing a beneficial international carbon crediting mechanism.

Keywords: Joint Crediting Mechanism (JCM), Internationally Transferred Mitigation Outcomes (ITMOs), cross-border carbon credit transactions, carbon emissions reduction

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Investigating The Impacts of Carbon Pricing Mechanism on the CCS Development in ASEAN Countries

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ABSTRACT

Carbon Capture Storage (CCS) is a technology that contributes toward a reduction in carbon dioxide (CO₂) emissions from large point sources. It has been proven to be a crucial technology to decarbonise ASEAN hard-to-abate industry sector. ASEAN countries are a concentrated cluster, contributing to significant emissions, and provide the potential for suitable geological storage for CCS according to current studies. This article discussed the impact of carbon pricing on CCS development in ASEAN countries. Our study provides an analysis of factors that enable successful CCS projects. Causal Loop Diagram (CLD) as a part of system dynamics, was employed as an analytical tool to identify and visualize the key variables, system structure, and network of the existing carbon pricing mechanism and other financing instruments needed in CCS deployment. The results of this study indicate that strong public and private finance, the development of carbon markets, and carbon pricing policies are the key enablers for CCS projects in ASEAN. Carbon pricing should be viewed as an effective catalyst that helps the growth of CCS with the right policies in place, government and regulatory support, and market forces.

Keywords: Carbon Pricing, CCUS, ASEAN, Causal Loop Diagram, System Dynamics

ACKNOWLEDGEMENTS

This study is fully supported by the Economic Research Institute for ASEAN and East Asia (ERIA).

Investigating Consumer's Attitudes Toward New Carbon Tax Regulation in Indonesia

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ABSTRACT

The Indonesian Government's 2021 initiative to curb carbon emissions through carbon tax aims to influence the behavior of firms and consumers, particularly, those reliant on fossil fuels. Simultaneously, the carbon tax is envisaged as a means of generating state income and facilitating environmental investments. This research investigates Indonesian consumers' attitudes toward the carbon tax through a representative survey, analyzing awareness, acceptance, and support levels as indicators and utilizing Structural Equation Modelling (SEM) with Partial Least Squares (PLS) program. The study explores opinions on the climate crisis and carbon tax, with a focus on Greater Jakarta. Preconceptions of climate change and their influence on attitudes are examined, along with socio-demographic characteristics shaping consumer behaviors. Findings reveal a heightened climate crisis awareness among the participants, however, a quarter remain unaware of the carbon tax enactment. Most consumers accept the tax, recognizing personal and industry responsibility for carbon reduction. Many are willing to contribute with tax rates of 1% to 3%. Policy recommendations include fostering political trust, progressive taxation on fossil fuels, and government incentives for carbon reduction. The study underscores the link between awareness, acceptance, and support for carbon tax implementation, suggesting further research on additional support indicators, including political trust.

Keywords: Carbon Tax; Consumer's Attitude; Carbon Emissions; Structural Equation Modelling; Green Policy

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support for this research. Lastly, I want to express my appreciation to the respondents who willingly shared their valuable insights in response to the questionnaire of this study.

Environment, Policy, and Socioeconomics

The Potential Waste of Expired Child Restraint System (CrS) In Jakarta, Indonesia

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ABSTRACT

There are no safety regulations for Child Restraint System (CRS) in Indonesia though the children fatalities victim of road accidents quite high. Despite, there is a significant amount of CRS consumer. Damage and expired CRS cannot be used furthermore due to decayed and degraded component material. It leads to CRS disposal decision by consumer. There are no CRS waste management due to unfamiliarity by the stakeholder and industry which leads to landfill disposal only. 4 of 5 materials of expired CRS during CRS dismantling was petroleum-based plastic, which is recycled potential. Expired CRS were estimated generated 3880,81 kg/month, consisting with metal, plastic, and fabric. 3675,13 kg/month of metal and plastic have recycled potential. 95,76 kg/month consist of fabric and blended material will end in incinerator. The huge amount of recycled material has high potential for circular economy. There are two potential stakeholders: Jagatera and DLH (Jakarta Environmental Agency), were considered to collaborate furthermore. The proposition scheme will put stakeholders as drop point and dismantling workshop. They will be expected to allocate recycled material to industries, respectively, while disposal the rest in incinerator. The robust collaboration between consumer, stakeholders, businesses, and policy maker is required to establish circular economy.

Keywords: Child Restraint System, CRS Dismantling, Expired CRS, Recycled, Waste Generation

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Development of the National Cooling Action Plan of the Philippines

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ABSTRACT

The Philippines NCAP was developed to account for the environmental impacts of energy consumption (indirect impacts) and use of high-GWP refrigerants (direct impacts) from RAC Sector that can be mitigated by transitioning to a more climate friendly and higher efficiency refrigerants. Utilizing the NCAP Methodology developed by the UNEP-led Cool Coalition, UN ESCAP in collaboration with Alliance for an Energy Efficient Economy (AEEE) together with and built on the expertise of the Cool Coalition's NCAP Working Group facilitated by The Kigali Cooling Efficiency Programme (K-CEP), the Philippines NCAP was launched by the Philippines Department of Energy - Energy Utilization and Management Bureau, Department of Environment and Natural Resources, and United Nations Development Programme (Philippines Country Office). This paper presented the Reference Cooling Scenario (RCS) and the Sustainable Cooling Scenario (SCS) adopting from the business-as-usual (BAU) and Clean Energy Scenario (CES) of the Philippine Energy Outlook. With these assumptions on RCS and SCS, the domestic refrigeration sector will save 4.41 TWh while residential cooling sector will save 12.15 TWh. There is a net effect in total emission reduction estimates of 10.68 MT CO₂ equivalent which is close to 12 % of the unconditional target submitted to UNFCCC.

Keywords: Cooling, Efficiency, Refrigerant

ACKNOWLEDGEMENTS

This report is the result of analytical data assessment process, sectoral consultations, and comprehensive policy review of the cooling sector within the project Enhancing Energy Capacities of the Philippines referenced to Project Number: 00111467 Linking the Kigali Amendment with EE in the RAC sector. The development of the NCAP is implemented by

UNDP and funded by K-CEP with the goal to “significantly increase and accelerate the climate and development benefits of the Montreal Protocol refrigerant transition by maximizing a simultaneous improvement in the energy efficiency of cooling”.

Interpretation of Fairness Concept and Economics Impact Analysis of Carbon Quota Allocation between Industries in Indonesia

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ABSTRACT

Quota allocation is critical in implementing policy-based carbon reduction efforts, such as the emission trading scheme. Depending on the allocation rules, certain company types may benefit more economically. Inequality conditions can happen and reduce the willingness to participate in sustainability efforts. This study aims to propose fairness interpretations in the context of carbon quota allocation. Four industries in Indonesia with inherently different emission and financial profiles were selected as case studies: energy, oil palm, basic materials, and finance. Fairness principles were analyzed to represent the interest of companies based on their financial and environmental performance. Indicators were selected to quantify equality principles and aggregated into a Comprehensive Index (CI) for quota allocation, where the companies' quota surplus/deficit is quantified into monetary value to estimate the economic impact with varying reduction targets. According to our Gini-index (Lorenz curve) analysis, the sectoral advantages/disadvantages would depend on the viewpoint of fairness principles, and the oil palm and financial sectors be less impacted than the basic materials and energy sectors with increased emission reduction targets. The sensitivity analysis suggests that the polluter pays, historical responsibility, and vertical principles are more sensitive to weighting than the basic needs, merit and horizontal principles.

Keywords: Carbon Inequality, Quota Allocation, Gini-index, Sectoral Emission

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Stakeholder Mapping to Facilitate Collaborations for Climate Adaptation Investment

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ABSTRACT

Climate change is currently ranked as the most important global environmental concern, leading to a collective demand for climate actions. Climate adaptation investments have been made in countries using national budget and private support. Though projects and academic works related to climate adaptation are conducted, the climate financing is unlikely successful in time due to delay in implementation and difficulty in forming collaborative actors and types of collaboratives arrangements. Thus, this study aims to develop a stakeholder mapping, related to climate adaptation investment in transport sector, to facilitate the stakeholders the accessibility to finance and timely implementation of a project. As a result of documentation studies and a series of organization interviews, a stakeholder mapping related to climate adaptation in transport sector was created. Four main groups of responsible stakeholders, including national policy and direction actors, national and international budget and finance actors, implementation and operation actors, and technical and information support actors, were identified to fulfill their roles to the investment. The stakeholder map was utilized to provide opportunities to form a collaboration in a meeting held in Lopburi. The role of stakeholders, international finance, and steps forward were discussed.

Keywords: Climate Change, Environment, Climate Adaptation Investment, Stakeholder Mapping, Stakeholder Collaboration

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Selection of Suitable Gridded Weather Dataset for Estimation of Evapotranspiration in Cambodia

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ABSTRACT

This study aims to find the most suitable crop reference evapotranspiration (ET₀) gridded dataset derived from freely available datasets for Cambodia and regions in the main river basin group (RBGs) by assessing the ET₀ estimated by CFS, CPC UPP, ERA5, ERA5 Ag, and MERRA2 reanalysis product. Given the challenges of measuring this parameter in the field, the opportunity for Cambodian water managers and irrigation planners to estimate evapotranspiration via satellite offers an intriguing option. For this purpose, the surface meteorological elements such as daily maximum and minimum air temperatures, relative air humidity, wind speed, and solar radiation from Automatic Weather Stations installed by United Nations Development Programme (UNDP) were used in ET₀ Calculator by using the FAO Penman-Monteith equation developed by Food and Agriculture Organization of the United Nations (FAO) to obtain gauge-based ET₀. Statistical indicators include Pearson correlation coefficient (R), Percent bias (PBias), Nash Sutcliffe model efficiency coefficient (NSE), and root mean square error (RMSE). The overall result shows ERA5 has the highest correlation, best fit, and accuracy, followed by ERA5 Ag and CPC UPP. However, Pbias the ERA5 does not stand out among the other datasets.

Keywords: Evapotranspiration, Penman-Monteith equation, Ground-based ET₀

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Extreme Rainfall Projection in Cambodia Based on the New Climate Simulation Dataset of CMIP6

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ABSTRACT

Climate change is a major threat to Cambodia, and one of the most serious consequences is the increase in extreme rainfall events. This study investigated the extreme rainfall events in Cambodia using the NEX-GDDP-CMIP6 dataset. The study found that there are significant spatial changes in extreme rainfall in Cambodia under future climate scenarios. The overall trend is decreasing for CDD, while CWD and Rx1day increase. However, there is significant variation in these trends across the country, with some areas experiencing the opposite trends. The results of this study suggest that Cambodia is likely to experience more extreme rainfall events in the future. This could have significant impacts to the country's water resources, agriculture, and infrastructure. Further research is needed to better understand the specific impacts of climate change on extreme rainfall in Cambodia and to develop adaptation strategies.

Keywords: Climate Change, Extreme Rainfall, Cambodia, NEX-GDDP-CMIP6

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An Investigation of Time-dependent Ozone (O₃) Concentration Using Geographic Information System: A Case Study in Central of Bangkok, Thailand

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ABSTRACT

The World Health Organization (WHO) estimates that approximately 7 million people die each year due to exposure to polluted air. Ground-level ozone is one of the air pollutants that forms as a result of chemical reactions, specifically through photochemical processes. This study utilized GIS to investigate the ozone concentration in 29 districts in Central Bangkok, Thailand, aiming to assess the health risks associated with ozone and compare them with standard values. According to this study, the ozone concentration in the Bangkok area is generally low during the time range of 01:00 - 08:00 and 17:00 - 00:00, while it tends to be high during the daytime (from 9:00 - 16:00). The highest ozone concentration exceeding the defined safe limit (> 100 ppb) for a short duration (1 hour) occurred in Pubpla during the study period. Additionally, some districts, namely Bang Na, Phra Khanong, Suan Luang, Bang Kapi, and Wang Thonglang, experienced ozone concentrations surpassing the average standard limit (>70 ppb) over an 8-hour period. The high ozone concentrations in these areas can be attributed to their dense population. The increased usage of motor vehicles and high temperatures during working hours contribute to the ease of ozone formation at the surface.

Keywords: Ozone Concentration, GIS, Bangkok, Thailand

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ROW Transmission Line in Sulawesi: Environmental Impacts and Solutions

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ABSTRACT

The construction of smelters in Sulawesi has demanded PLN (the Indonesian state-owned electricity company) to quickly provide additional infrastructure, including power plants, substations, and transmission lines. In the construction process, it is commonly known that the clearing of the right-of-way (ROW) along the transmission line is required to meet technical and safety requirements. The ROW clearance inevitably forces PLN to cut down numerous trees along the constructed transmission line. Consequently, a significant amount of carbon absorption potential is lost or needs to be compensated by planting trees in other locations, which requires time for the trees to mature. PLN has implemented several solutions, although they are still sporadic due to technical limitations, financial constraints, and local regulations. This paper presents several steps that PLN UIP Sulawesi has taken and will take to reduce the impact of tree clearing along the ROW from an environmental perspective. It is accompanied by technical and financial studies as a form of constructive collaboration in the development of electricity infrastructure in Sulawesi.

Keywords: Row, Tree/Forest, infrastructure

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Carbon Border Adjustment Mechanism (CBAM) Implementation on Reducing Emissions in ASEAN Energy Sector

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ABSTRACT

EU has introduced the Carbon Border Adjustment Mechanism (CBAM) aiming to address carbon leakage from high-emitting industries and ensure fair conditions for European industries. 7th ASEAN Energy Outlook is projected GHG in ASEAN reaching 6,704 Mt CO₂-eq by 2050 compared to a baseline scenario of 1,815 Mt CO₂-eq in 2020. Consequently, ASEAN has recognized the urgency to earnestly reduce its emissions. CBAM implementation has prompted ASEAN Member States (AMS) exporting goods to the EU and beyond, to consider the adoption of CBAM policies. This study examines potential implications of CBAM for the emission reduction in energy-intensive industries in ASEAN. The preliminary findings indicate that CBAM implementation may result in higher product prices for the industries, as they will be required to account for the climate footprint of their manufacturing activities through additional fees. However, it also presents an opportunity for emission reductions within the industries by incentivizing renewable energy sources adoption to mitigate their carbon footprint during manufacturing processes. To effectively respond CBAM implementation, ASEAN should adopt three key strategies: 1) active participation in and implementation of carbon pricing mechanisms, 2) increased investments in green technologies, and 3) establishment of strategic partnerships to enhance trade relations between EU and ASEAN.

Keywords: High Emitting Industry, Carbon Border Adjustment Mechanism, Southeast Asian

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Utilizing Unconventional Geothermal for ASEAN Member States: An Economic and Climate Analysis

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ABSTRACT

The next expansion of geothermal utilization is unconventional geothermal resources which is compatible to be utilized for the ASEAN Member States particularly to solve the post-harvest losses due to a lack of affordable energy for agriculture and food processing. There is a strong economic case for deployment of geothermal energy. Costs for electricity generation and direct heat utilization from geothermal technologies are becoming increasingly competitive, and they are expected to continue to drop through 2050. Geothermal is well-known to be very low CO₂ emission. Against this background, this paper aims to increase stakeholder awareness and provide policy recommendations for expanding the utilization of unconventional geothermal for agriculture and agro-industry sectors within the region. In advance, this paper also provided an economic and climate analysis of implementing the unconventional geothermal in the region. Systematic and deep-diving literature review is used as methodology for this study. Based on findings analysis, 1) increasing stakeholder and public awareness to promote potential of unconventional geothermal is greatly important, 2) a robust and systematic policy and regulation to unlock the unconventional geothermal is needed, and 3) utilizing more unconventional geothermal is practicable to be implemented in Southeast Asian countries considering both economic feasibility and low emission capability.

Keywords: Geothermal, Southeast Asia, Emission, Agriculture

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"Afterall, we leave someone(s) behind": Investigating the discourses of Sustainable Development Goals (SDG) 7 in ASEAN

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ABSTRACT

This study examined how SDG 7 can achieve its goal in ASEAN, which is to ensure that everyone in the region has access to affordable, dependable, sustainable, and modern energy. To achieve the objective of this study, three SDG 7 indicators were chosen: (i) The proportion of the population with access to electricity; (ii) the fraction of renewable energy in total final energy consumption; and (iii) energy intensity as measured by primary energy and GDP. Critical Discourse Analysis (CDA) was employed as an approach in this study. According to the findings of this study, the discourses around SDG 7 have not adequately promoted collaborative efforts among stakeholders. As a result, SDG 7 may fall short of its goal of providing everyone with access to affordable, dependable, sustainable, and modern energy, leaving someone(s) behind. As a result, it is critical to shift the discourse surrounding SDG 7 to support the collective efforts by bringing together multiple backgrounds, interests, and disciplines using an interdisciplinary approach.

Keywords: SDG 7, Discourses, Energy, ASEAN, Interdisciplinary

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Unveiling the Influence of Financial Slack on Carbon Performance: Insights from Firms in Malaysia's Smart Cities

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ABSTRACT

As carbon emissions in developing countries are projected to rise and surpass those of developed countries, developing nations face mounting political pressure to fulfil their commitments under international agreements. As a key participant in carbon emissions abatement, companies can have a strong effect on carbon emissions reduction. However, the successful implementation of carbon emission reductions may hinge on the financial slack of firms. This study investigates the impact of financial slack on the carbon performance of Malaysian smart city companies. The sample includes 64 companies located in four smart cities within the ASEAN Smart City Network (ASCN). The analysis is based on data compiled in 2021, with carbon performance data obtained from the annual reports of companies and financial data obtained from the DataStream Refinitiv Eikon platform. Using regression analysis, the results indicate that financial slack has no significant effect on the carbon performance of Malaysian smart city companies. This study contributes to the growing body of knowledge on financial slack and carbon performance in smart cities. The findings could be beneficial for practitioners and policymakers concerned with improving financial flexibility and reducing carbon emissions.

Keywords: Carbon Performance, Carbon Emissions, Financial Slack, GHG, Smart Cities

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Methane Emissions in the ASEAN Oil and Gas Sector: A Nexus between ESG and Investment

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ABSTRACT

The ASEAN region has witnessed significant growth in oil and gas use, contributing to economic development and energy security. However, the oil and gas industry's environmental impact, particularly methane emissions, has raised concerns due to its potent greenhouse gas effect. This paper aims to explore the relationship between methane emissions in the ASEAN oil and gas sector and the growing emphasis on Environmental, Social, and Governance (ESG) factors in investment decisions. This research quantifies methane emissions in the ASEAN oil and gas sector, highlighting their contribution to climate change. It also explores the link between ESG considerations and investment decisions in the sector, revealing a growing importance of ESG frameworks. Investors prioritize companies with strong ESG frameworks due to the potential impact of methane emissions on financial performance and reputation, leading to a rise in ESG-integrated investment strategies. In conclusion, this research underscores the need for the ASEAN oil and gas sector to address methane emissions, aligning with global sustainability goals and investor expectations focused on ESG considerations. By implementing comprehensive mitigation strategies, companies can enhance their environmental performance, and attract responsible investments that foster sustainable growth while addressing climate change challenges.

Keywords: Methane Emissions, Oil and Gas, Investment, ESG

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The Asymmetry of ASEAN Law: Unsustainable Development Phenomenon of Transformative State Enterprise in Case of Cross-border Power Plant projects

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ABSTRACT

This article aimed to study regional law related to manipulating cross-border environmental impact from the phenomenon of cross-border power plants invested by Thai state enterprise. Writer used qualitative research methods by using 3 case studies of cross-border power plants which are concreted and located on the neighboring countries' border with Thailand. Any action of these phenomenon has no abuse of sovereignty and no responsibility at the regional level, although, many researchers have shown that the power plant is a cause of gigantic environmental impact. This article showed how state enterprise become a transformative state enterprise, and how asymmetry of ASEAN law between the transnational economics and the cross-border environmental impact.

Keywords: Transformative State Enterprise, Sovereignty, Cross-border Power Plant, Business and Human Rights

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ASEAN Financing Climate Policy: The Effect of Fossil Fuel Subsidies on CPI and GHGS

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ABSTRACT

The Association of Southeast Asian Nations (ASEAN) employs fossil fuel subsidies to promote economic development, although such action may have a negative effect on the environment. This study employs panel data analysis to examine whether ASEAN's fossil fuel (oil, gas, coal, and electricity) subsidies decrease consumer price index (Model 1) and, on the other hand, increase greenhouse gas emissions (Model 2) from energy levels, using yearly data of five ASEAN countries from 2010 to 2021. Surprisingly, electricity subsidy shows a highly significant positive relationship with CPI. This might be due to the fact that the short-term effect of the government electricity subsidy may not be evident over a longer period as other factors push up the CPI. In addition, oil subsidy shows a significant negative relationship with GHGs, opposing the expectation. This may be because the government oil subsidy should increase the use of oil products thus reducing the use of coal products that are more polluting than oil. Therefore, it appears there are important points for policymakers to consider for the goal of reducing GHGs in this region.

Keywords: Subsidy, Fossil Fuel, Consumer Price Index (CPI), Greenhouse Gas Emissions (Ghgs), ASEAN

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Assessing the Vulnerability of Phu Quoc Island's Natural and Socio-economic Systems to Climate Change

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ABSTRACT

This study explores the significant impacts of climate change and sea-level rise on the natural and socio-economic systems of Phu Quoc island, a crucial tourism hub in Vietnam. Utilizing a combination of interdisciplinary research methods, remote sensing, and geographic information systems, the research mapped vulnerability indices for different scenarios of sea level rise (50 cm and 100 cm). The findings show that Duong Dong and An Thoi regions are among the most vulnerable to these changes, with significant repercussions for tourism and services. The coastal areas like Cua Can commune, Duong Dong town, and Duong To commune see notable damage, affecting up to 40% of the island's area in the 100 cm sea-level rise scenario. To mitigate these impacts, the study proposes the integration of climate change considerations into the island's socio-economic planning, alongside technical and community solutions. It underscores the importance of proactive strategies for conservation, sustainable resource exploitation, infrastructural development, culture preservation, and the use of green technology to foster sustainable tourism and protect rare natural areas. The research holds potential guidance for climate adaptation strategies in similar coastal and island regions.

Keywords: Climate Change, Vulnerability, Sea Level Rise, Phu Quoc

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A Preliminary Investigation of Corporate E-waste Reporting Among Malaysia Public Listed Companies

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ABSTRACT

The accumulation of global e-waste could be detrimental to the environment and to human health. This, in turn, poses significant challenge to the achievement of the Sustainable Development Goals. The increasing trend of e-waste generation calls for a concerted effort from parties at all levels, including business organisations. This research aims to investigate the extent of corporate e-waste reporting among public listed companies (PLCs) in Malaysia. Content analysis of corporate reports of 778 PLCs for the most recent year was conducted. Of these companies, about 15 percent provided e-waste information, with an average of two sentences per company. The information also were predominantly declarative (non-quantitative), inclined towards portraying good corporate image and located in the sustainability statement (within the annual/integrated reports) and stand-alone sustainability reports. This scenario could be due to the absence of detailed guidelines as to how e-waste information needs to be reported. There is a pressing need for such a guideline to ensure more systematic and comparable corporate e-waste reporting in the future.

Keywords: Content Analysis, Corporate Reports, E-waste, Malaysia, Public Listed Companies

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Gender Mainstreaming in ASEAN's Just Energy Policies: Data-Driven Framework

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ABSTRACT

The energy and gender nexus is gaining momentum in ASEAN as part of the just energy transition agenda. The region has taken significant steps by launching the Roadmap on Accelerating ASEAN Renewable Energy Development through Gender-Responsive Energy Policy (ASEAN RE-Gender Roadmap) and working towards its implementation. However, effectively integrating gender into renewable energy policies requires gender data to allow policymakers to make informed decisions. This study proposes a data-driven framework to guide ASEAN policy makers in identifying key data sets and designing effective policies and strategies to mainstream gender into ASEAN's just energy transition policies. The study further highlights the importance and role of a regional database in optimising regional cooperation for gender mainstreaming in the energy sector. Using a mixed-methods approach, including surveys, this paper examines essential pillars, indicators, and data elements required, with a specific focus on the job market. The findings reveal key pillars such as education-to-work transitions, recruitment and workforce, entrepreneurship and financial inclusion, which serve as the foundation and insight for the data element frameworks. By providing suggestions on acquiring, analysing, and utilising the comprehensive data, the study contributes to the development of more inclusive and gender-sensitive energy policies, encouraging a data-driven approach to decision-making.

Keywords: ASEAN, Energy Transition, Energy Policy, Gender, Data

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Empowering ASEAN's Education for Renewable Energy Jobs: A Readiness Assessment

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ABSTRACT

The rise of climate change and the depletion of conventional energy sources have driven global attention to a significant shift towards a sustainable and environmentally friendly energy transformation. Recognising this, ASEAN Member States (AMS) embark on a journey towards energy transition toward green economy. To support this energy transition, huge number of jobs will be generated, which need to be prepared for. In this context, the readiness of formal educational institutions in the ASEAN region to prepare and equip students with the knowledge and skills needed for green energy jobs is imperative. This paper provides a comprehensive analysis of the readiness of the formal education system in the Southeast Asia region in nurturing skilled workforce candidates to meet the growing demand for green energy jobs. Through an extensive review of existing literature, policies, and curricula, this study examines the current state of green energy education in the ASEAN region. Addressing the gaps, the study would provide recommendations for policy makers.

Keywords: ASEAN, Energy Transition, Green Jobs, Energy Curricula

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Energy and Digitalisation

A Day Ahead Load Forecasting Model for University Campus Using Artificial Neural Network

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ABSTRACT

A day ahead load forecasting is an essential aspect of power system planning, operation and control, utilized by a range of industry players, including utilities, system operators, generators, and power marketers. In this study, Seasonal Autoregressive Integrated Moving Average (SARIMA) and Artificial Neural Network (ANN) were employed and compared to conduct load forecasting. Given the differing load profiles for weekdays and weekends, the time-series and neural network were trained separately for these periods to improve forecasting accuracy. The Univariate SARIMA model is used for making predictions, with a configuration of (10,0,1) for the non-seasonal part and (10,0,1,48) for the seasonal part. Furthermore, load forecasting was then carried out individually for weekdays and weekends using a neural network toolbox comprising 5 input neurons, 50 hidden neurons, and 1 output neuron. A 30-minutes time interval load data of a university campus buildings were collected from smart meters between 7th November 2022 until 14th November 2022. The simulation results were analyzed by comparing the actual and forecasted load data, and the performance was evaluated using the Mean Absolute Percentage Error (MAPE). Results show that the ANN model outperform SARIMA in every score.

Keywords: Load forecasting, Seasonal Autoregressive Integrated Moving Average (SARIMA), Artificial Neural Network (ANN), Mean Absolute Percentage Error (MAPE)

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Data-Driven Gas Lift Control for Oil Wells Network Production Optimization using Neural Network-based Gas Lift Well Dynamics Model

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ABSTRACT

Determined to smoothen the energy transition, SKK MIGAS has a vision to achieve a production target of 1 million barrels per day (BOPD) in 2030 with a strategy to optimize the production of existing fields/old wells. However, artificial lift technology, especially gas lift, in maximizing oil production rate has inefficient long workflow. The process of adjusting the optimal Gas Lift Injection Rate (GLIR) based on the Gas Lift Performance Curve (GLPC) of the oil well is still done manually with a constant value - which should be changing over time since the well behavior is dynamic. In this paper, adaptive control is designed and simulated to increase oil production from a gas lift-assisted well network. The oil flow rate dynamics of OA - 11 and OA - 12 wells are modeled using Neural Network method based on reservoir input measurement gained from production well testing data of field "X". The optimal GLIR recommendation is obtained based on the estimated GLPC curve from real-time measurement using the 2nd order polynomial regression algorithm and SLSQP optimization. This study successfully estimated an average oil production increase in the range of 13-20% with the accuracy of the oil well model R2 value between 88-92%.

Keywords: Gas Lift Optimization, Hardware-in-the-loop, Neural Network System Identification

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Vehicle to Building (V2B) Peak Load Shaving and Tariff Analysis

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ABSTRACT

Commercial buildings are essentially important energy consumers as their economic contribute directly to keep up the national gross domestic product (GDP). Soaring load demand from commercial buildings usually occurs within few hours on peak business hour. Electricity grid infrastructure designed to support maximum demand of the system but underutilize most of the time outside the peak session. Growing number of EV penetration in local market can serve as mobile energy storage for Vehicle to Building (V2B) energy integration thus enable peak load shaving to minimize maximum demand during peak period. This study presents a feasible methodology approach on determining the suitable V2B tariff on several peak load shaving scenarios to provide attractive return to building owner and discounted off-peak tariff to accommodate lower EV owner's charging cost. By having the combination of attractive V2B and off-peak tariff that benefits both sides, subsequently increase EV penetration for V2B. It may also charm EV markets as it minimizes the total cost of EV ownership and reduce maximum demand from electricity grid. Hence it reduces the transportation CO₂ emissions and contribution toward optimization of grid network electrical infrastructure of transmission and distribution systems design with lower maximum design system requirement.

Keywords: Electric Vehicle, Peak Load Shaving, Vehicle-to-Building

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The Impact of Digitalization Towards Energy Consumption and CO₂ Emission in ASEAN Countries

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ABSTRACT

As an emerging economic region, ASEAN countries has been undergoing a significant increase in the rate of digitalization. On one hand, it can engender an indirect escalation of energy usage by promoting the adoption of energy-intensive appliances and hardware. On the other hand, it can facilitate an indirect reduction in energy consumption through the promotion of energy efficiency measures and the cultivation of behavior change among energy consumers. This study aims to analyse this effect of digitalization towards energy consumption (and to which direction), across the ASEAN countries. Panel data of ASEAN-10 countries is analysed using cross-sectionally augmented autoregressive distributed lags (CS-ARDL) to accommodate for the cross-sectional nature of the panel. the outcomes of this study hold the potential to redirect attention towards advocating for digitalization to mitigate energy demand, thereby illuminating its significance in the effort to drive down energy consumption in emerging economies.

Keywords: Digitalization, Energy Consumption, CO₂ Emission, ASEAN, Statistical Analysis

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Evaluation of Smart Grid for Renewables Integration in Southeast Asia: Qualitative Cost-Benefit Analysis

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ABSTRACT

The Industrial Revolution 4.0 has impacted many life aspects globally, including the energy sector in Southeast Asia. The ICT applications, such as AI and IoT, in the electricity system can make the power grid smart. Smart grids help to reduce the curtailment of variable renewable energy (RE) and the operational expenditure. However, there are significant high costs to invest these emerging digital technologies up-front. Other than financial perspectives, secondary social factors also need to be considered, such as the smart grids impact on the workers and environment. The study aims to evaluate the importance and needs of smart grids in ASEAN countries to support realising each national RE targets. This research conducts a qualitative cost-benefits analysis of installing smart grids for all stakeholders in the power sector. It identifies the benefits of smart grid, estimates the economic value and costs, and analyses the focus and drivers of Southeast Asian countries in developing smart grids. Initial findings reveal that digitalisation is an enabling technology to pursue by all nations in the region to penetrate more RE into their central grid. Several policy recommendations then are provided for the Southeast Asian governments to create more attractive regulatory frameworks to accelerate these technologies.

Keywords: Smart Grid, Digitalisation, Cost-Benefit Analysis

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Bioenergy, Land-based Mitigation, And Bioeconomy: Climate Resilient Development in ASEAN in a Long-term Global Context

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ABSTRACT

The ASEAN region depends significantly on land sectors, namely agriculture, forestry and livestock, with considerable foreign direct investment in these sectors. The land sectors have also been the main source of GHG emissions, with land use change and land degradation associated with agricultural burning and deforestation also contributing to air pollution and other development dis-benefits. ASEAN is also home to some of the world's richest biodiversity, but this has been threatened by rapid development. The region with its long coastlines and sensitive ecosystems is also highly vulnerable to climate change. The challenge is to address the triple crisis of biodiversity loss, climate impacts and energy security and this will require a highly integrated approach to ensuring sustainable use of land and biomass by developing a diverse, inclusive, efficient and sustainable bioeconomy. The approach needs to recognise complementarity in capacity and bio-resources, so that ASEAN cooperation can offer strategic win-win scenarios. A sustainable bioeconomy in ASEAN improves energy security, carbon sinks and biodiversity. In this paper, we provide a detailed synthesis of the challenges and opportunities for the terrestrial bioeconomy in ASEAN under long-term pathways for land mitigation and climate resilient development, within the context of the Paris Agreement.

Keywords: Bioeconomy, Bioenergy, Land-based Mitigation, Climate Resilience, ASEAN

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Design of Energy Storage System through Bus Energy Storage Cascade Analysis (BESCA)

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ABSTRACT

This paper modifies the Electricity System Cascading Analysis (ESCA) into Bus Energy Storage Cascading Analysis (BESCA) to be applied in the electric bus transportation system. Pinch analysis principle is applied in the BESCA and suitable to determine the minimum energy storage based on the existing bus schedule and charging system. BESCA can also be used to shift the additional charging load to non-operational period. BESCA is a simplified method to determine the minimum battery capacity and the result can be visualised in the graph. The results show that charging rate will affect the battery energy storage capacity. Application of BESCA on the bus system indicates that minimum power capacity required of the electric bus is 74.28 kWh by using 15.36 kW charging pole.

Keywords: Electric Bus, Pinch Analysis, Energy Storage, Green Transport

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