A Review of Sustain
Renewable Energy i

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Content

INTRODUCTION

- ASEAN, a collective population exceeding 650 million, has experienced rapid urbanization, industrialization, and escalating energy demand (IEA, 2023)
- As of 2020, fossil fuels predominated 85.8%, with the remaining 14.2% from renewable energy and other sources (ACE, 2023).
- ASEAN remains vulnerable to climate change and escalating greenhouse gas emissions (Ding & Beh, 2022)

- Renewable energy offers multifaceted advantages beyond mitigating climate change and curbing greenhouse gas emissions (Arent et al., 2011).
- Solar, wind, hydropower, geothermal, and bioenergy immense potential in the region (IRENA & ACE, 2022)
- investments in renewable power within ASEAN lag behind the region's abundant resource (IEA, 2023)

10. Implications and Future Research

- Required minimum of USD 200 billion is needed by 2030 (IEA, 2023).

- Business models are strategic frameworks guiding firms, how firms operate, generate revenue, and sustain competitiveness (Alibage & Ahn, 2018), and communication frameworks between organizations and investors for investment (Nielsen & Bukh, 2013).
- Renewable energy business models-rapidly evolving, offering policymakers and investors alternative approaches to

implementing emerging technologies or adapting established practices to new contexts (ADB, 2015).

RESEARCH GAPS

- COMPREHENSIVE LITERATURE REVIEW
  - Previous research has explored utility business models (Richter, 2012), trends, drivers, diffusion, and viable factors behind these business models in various regional markets (Fathoni & Boer, 2021; Ilham et al., 2022; Jupesta et al., 2011; Kamp et al., 2021; Koerner et al., 2022; Kokchang et al., 2020; Pandyaswargo et al., 2022; Prilandita et al., 2022; Setyawati, 2020; Sumarsono et al., 2023; Syahputra & Soesanti, 2021; Tongsopit et al., 2013).

- ASEAN FOCUS
  - Limited scholarly attention has been directed toward ASEAN's renewable energy business models (Erdiwansyah et al., 2023)
  - Existing research predominantly focuses on business models related to solar energy, particularly solar home systems (Kokchang et al., 2020; Tongsopit et al., 2013)

OBJECTIVES AND RESEARCH QUESTIONS

- This review aims to extensively analyze business models for renewable energy in ASEAN to understand as covered in the existing literature.

1. Which business models for renewable energy are currently being utilized in the ASEAN countries?

2. How do various stakeholder groups influence the development of renewable energy business models in ASEAN?

3. What is the potential of ASEAN's current renewable energy business models to achieve sustainable economic, social, and environmental goals/values?

RESEARCH METHODOLOGY

•Scopus search, examining titles, abstracts, and keywords using three search strings:

- Systematic literature review

- The method features a comprehensive synthesis of the evidence, documented, transparent, and reproducible search methodology that thoroughly understands the analyzed problem (Davis et al., 2014; Snyder, 2019;Tranfield et al., 2003).

1."Business model" AND "renewable energy" AND "ASEAN" OR "Southeast Asia“ (n=663)
2."Business models" AND "renewable energy" AND the name of an ASEAN country (a separate search string for each ASEAN country was conducted) (n=8) 3."Business models" OR synonyms for business models AND "renewable energy" OR the name of a specific renewable energy source or technology AND "ASEAN" OR "Southeast Asia" OR the names of all ASEAN countries (n=28)

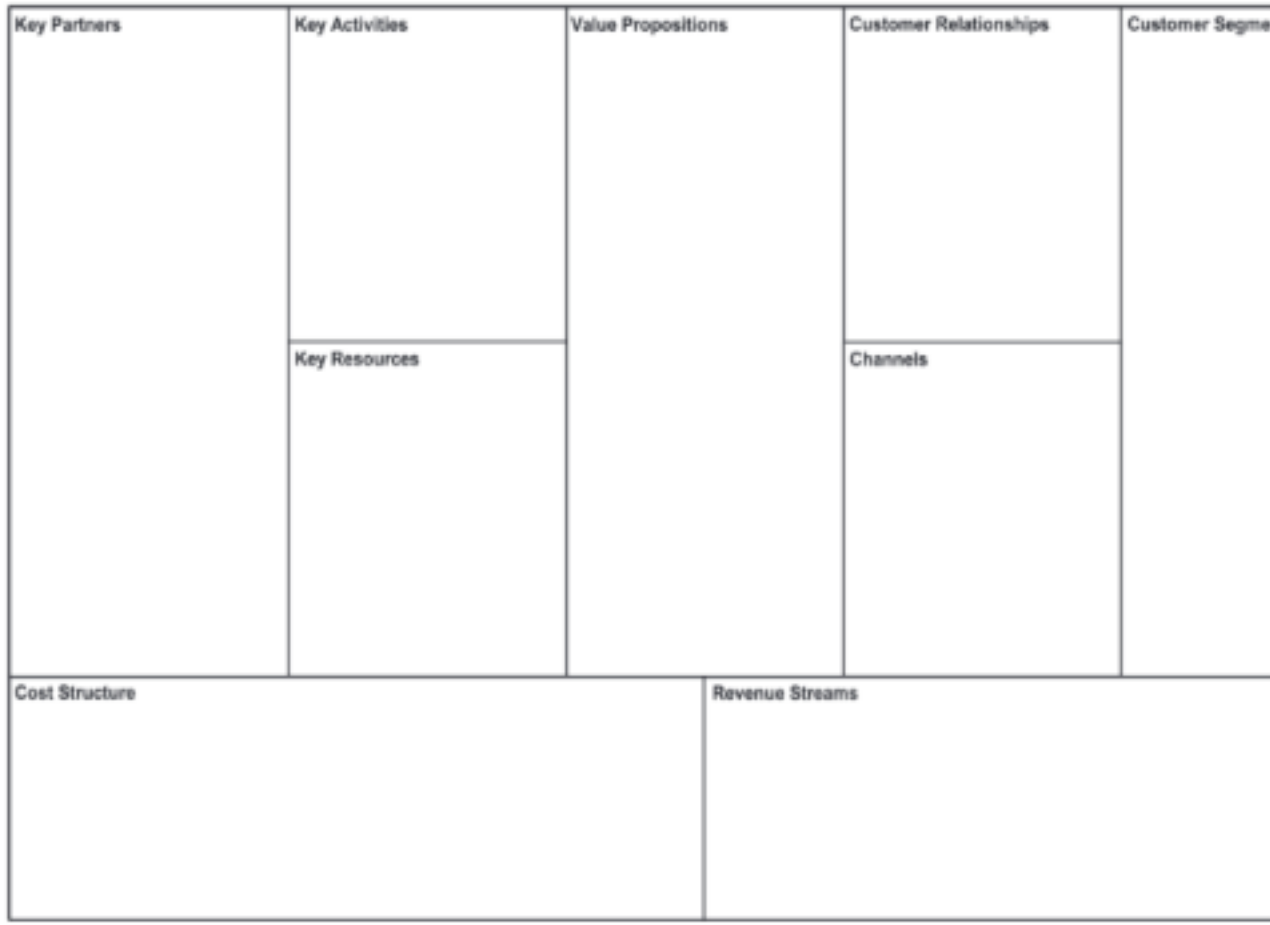
•Scopus document filter (n=699)
▪ Articles, conference papers, reviews, and book chapters
▪ Published in English only and open time
▪ Excluded (39) duplicates (n=660)
•Titles, abstracts, and keywords assessment excluded (575)
▪ Mentioned business model elements
▪ For any studies conducted across various regions, at least one case study must relate to an ASEAN country.

•Full-text articles assessment excluded (51), with reasons for not providing business model elements, could not be interpreted within a business model analytical framework, and combining results with other regions
•Final selected (n=35) studies to review

Analytical Framework

(Mukoro et al., 2022)

Business Model Canvas



Analyzed extracted 35 studies using the business model concept by Osterwalder and colleagues (2011).

The following four elements combined the nine blocks for a more efficient analysis.

1. Value Proposition: Including the product or service offering

2. Demand-side: Including customer segments, customer relationships, and channels

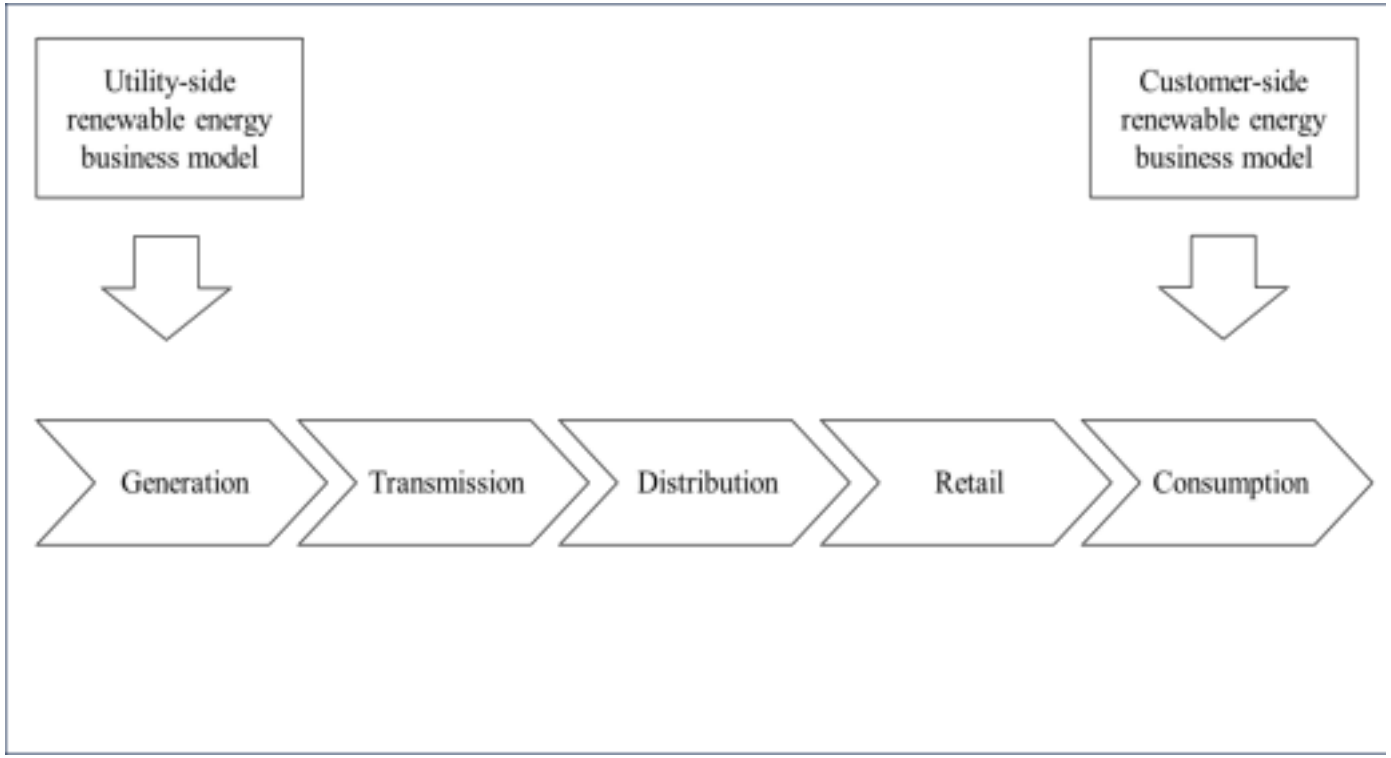
3. Supply-side: Including key partnerships, key resources, and key activities

4. Financial Aspects: Including the revenue model and cost structure

Note. Adapted from "Business model generation: a handbook for visionaries, game changers, and challengers" by

Osterwalder, A., & Pigneur, Y. (2010)

ELECTRICITY VALUE CHAIN AND TWO GENERIC BUSINESS MODELS



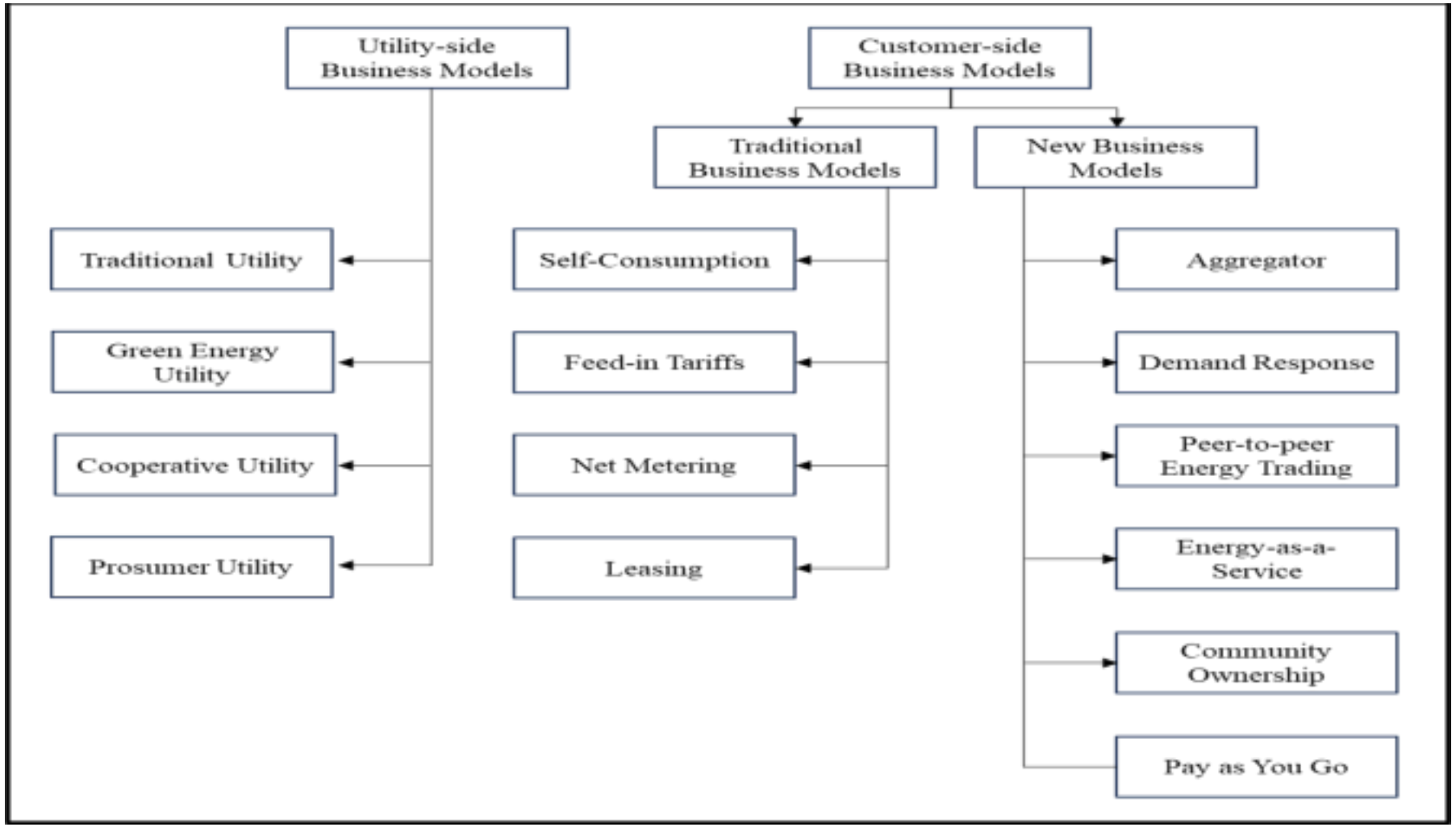
- A framework that describes the electricity from generation to consumption
- Utility side -the value proposition is closely related to bulk electricity generation feeding into the grid. (Gsodam et al., 2015; Richter, 2013).
- Customer-side - the value proposition on the customer side focuses on customized solutions and energy-related services which are small-scale, customer-centric renewable energy projects (Richter, 2013).

Note Adapted from "Utilities' business models for renewable energy: A review" by Richter, M. (2012). Renewable and Sustainable Energy Reviews, 16(5), 2483-2493

RESEARCH QUESTION 1.

Which business models for renewable energy are currently being utilized in the ASEAN countries?

BUSINESS MODELS FOR RENEWABLE ENERGY



Note. Adapted from "The typologies of power: Energy utility business models in an increasingly renewable sector" by Bryant, S. T., Straker, K., & Wrigley, C. (2018). Journal of Cleaner Production, 195, 1032-1046. & "Enablers and barriers for energy prosumption: Conceptual review and an integrated analysis of business models" by Siksnelyte-Butkiene, I., Streimikiene, D., Balezentis, T., & Volkov, A. (2023). Sustainable Energy Technologies and Assessments, 57, 103163.

UTILITY-SIDE BUSINESS MODEL

Traditional Utility Green Energy Utility Cooperative Utility Prosumer utility

Value proposition: Provision of low-cost, efficient, reliable energy supply to customers, and reflects its traditional and perceived role as a key component required to keep the energy system running.

Key activities: typically sourced via self-owned, large-scale, stable fossil fuel-based generation assets and sale of electricity

Value Proposition Provision of predominantly green/renewable electricity & gas at a cost-competitive price, reliably

Key Activities Green electricity generation, deployment of new renewable capacity, energy trading, retail sale of green gas & and green electricity

Value Proposition: Provision of green/renewable electricity & and gas to coop members for zero or near-zero margin while supporting the local community

Key Activities Green electricity generation, deployment of new renewable capacity, energy trading, retail sale green gas & green electricity

Value Proposition: Green/local energy produced by locals for locals using customer owned/leased products

Key Activities Development and operation of P2P/VPP platform, signing up prosumers into the network, provision of kit (solar PV, storage)

Reference: Bryant, S. T., Straker, K., & Wrigley, C. (2018). The typologies of power: Energy utility business models in an increasingly renewable sector. Journal of Cleaner Production, 195, 1032-1046.

EXPLORING RENEWABLE BUSINESS MDOELS IN ASEAN

Business Model Typologies Renewable Energy Technologies
Country No. of studies References

Customer-side Pay as You Go (PAYG) Solar ASEAN
1
Indonesia
1
Philippines
2

Biomass Cambodia

2

Myanmar
1
Thailand
1
Yosiyana & Simarangkir (2015) Sovacool (2018)
Brooks & Urmee (2014) Lozano & Taboada (2021) Abe et al.(2007)
Pode et al.(2015)
Pode et al.(2016)
Vongchan et al.(2020)

Hydro Indonesia 1 Isa et al.(2021)

Hybrid Indonesia
1
Philippines
1
Wen et al.(2022) Pascasio et al.(2021)

Pay as You Go (PAYG) & Community Ownership Solar Thailand 1 Tongsopit et al.(2016)

Community Ownership Solar Indonesia
1
Myanmar
3

Thailand
2
Fathoni et al.(2021) Pascale et al. (2016) Numata et al.(2020)
Chen (2023)
Green (2004)

Veilleux et al.(2020)

Hydro Malaysia 2 Murni et al.(2013) Yah et al.(2017)
Hybrid Indonesia Derks & Romijn.(2019) Wirawan et
2 al.(2021) Bertheau (2020)

Philippines

1

Peer-to-peer Solar Hybrid Junlakarn et al.(2022)
1
Malaysia Malaysia Heng et al.(2022)
3 1
Thailand Kokchang et al.(2020) Ilham et al.(2022)
Pinyo et al.(2021)
(2008) Self Consumption, Feed-in Tariff &Net Metering Solar Malaysia 1 Koerner et al.(2022)

Summary of the business models in the reviewed studies

Self-Consumption Hydro Malaysia 1 Kadier et al.(2018) Feed-in Tariff Biomass ASEAN 1 Carlos & Khang Utility-side Green Utility Biomass Malaysia 2 Aghamohammadi et al.(2016) Zamri et al.(2022)
Utility-side Green Utility Hybrid Laos Budi & Hadi (2022)
1
Indonesia
1 12
Käkönen & Kaisti(2012)

CUSTOMER-SIDE BUSINESS MODEL 1 Study

11 Studies

11 Studies 1 Study Combined

5 Studies traditional-1

Study

UTILITY-SIDE BUSINESS MODEL

Business Model Typologies Renewable

Energy Technologies

Country No. of studies

References Value

Proposition

Utility-side Green Utility Biomass Malaysia 2 Aghamohammadi et al.(2016)
Zamri et al.(2022)

Large-scale biomass combined heat and power (CHP) plant with 50 MW to generate electricity from palm biomass. supply to the grid, contributing to renewable energy production and mitigating GHG emissions.

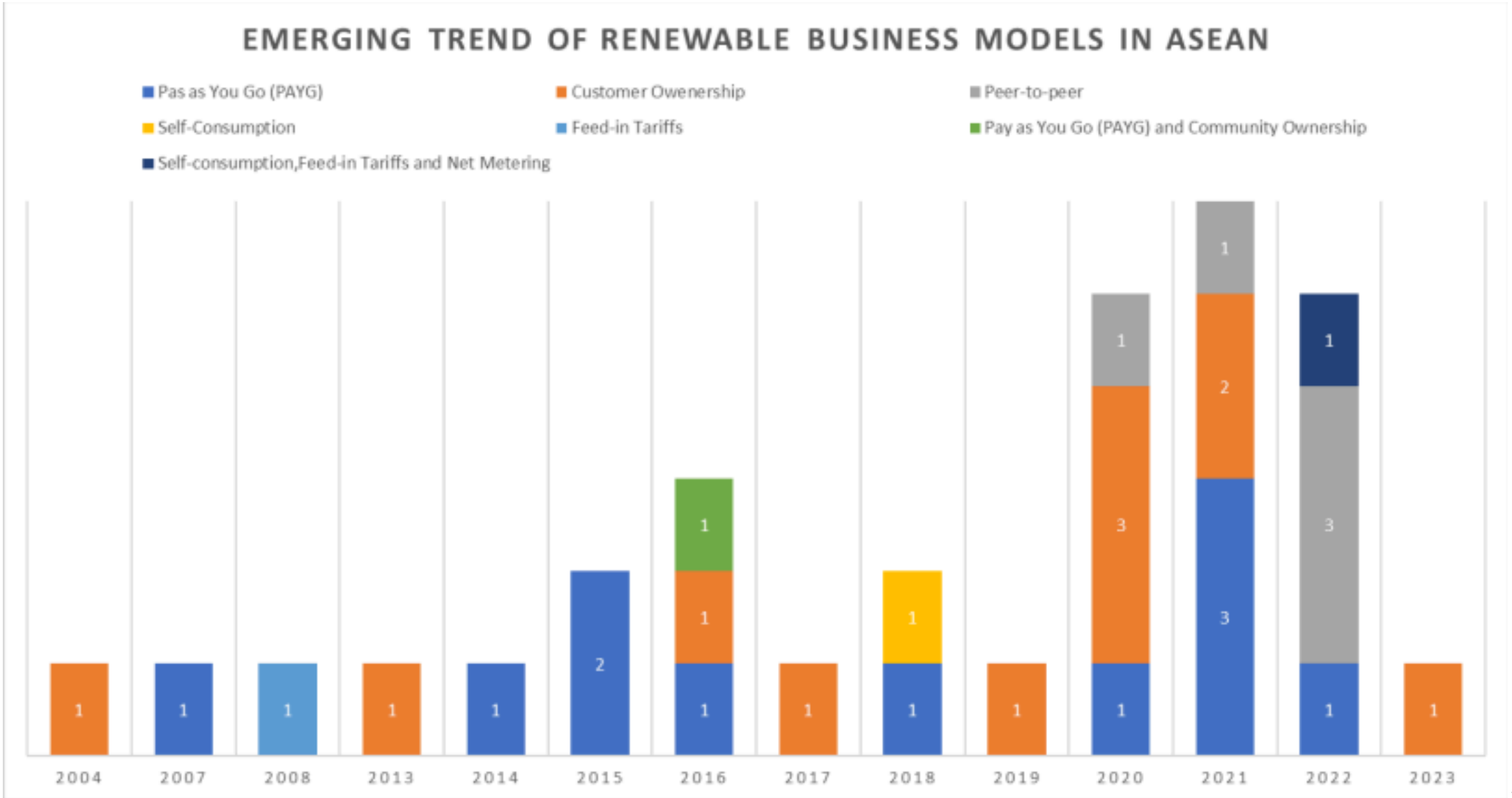
Utility-side Green Utility Hybrid Laos 1 Käkönen& Kaisti(2012)

Nam Theun2 large-scale hydropower project is associated with creating long-term infrastructure for generating reliable renewable energy that can be supplied to the grid and exported to neighboring countries, thereby generating income for Laos

Indonesia 1 Budi & Hadi (2022)

An optimal PPA value that would benefit both Utility and IPPs, reduce the Government's financial burden and promote renewable energy.

EMERGING TRENDS


EMERGING TREND OF RENEWABLE BUSINESS MODELS IN ASEAN
Pas as You Go (PAYG)
Customer Owenership
Peer-to-peer
Self-Consumption
Feed-in Tariffs
Pay as You Go (PAYG) and Community Ownership
Self-consumption,Feed-in Tariffs and Net Metering
2004
2007
2008
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023

COMPARATIVE ANALYSIS ACROSS COUNTRIES

Country	Business Model Typologies	RE Technologies	Energy Landscape
Cambodia	2 Pay as You Go	Biomass	Master Plan Study on Rural Electrification (2012)-renewable energy vital for rural development Electrification-Lower than 65%, with urban-rural disparity (100% and 35%, respectively)
Indonesia	3 Pay as You Go 3 Community Ownership 1 Green Utility	Solar, Hydro, Hybrid	National Energy Plan 2014 (NEP14)-transform the energy mix by 2025 Archipelagic nature challenges providing reliable electricity across diverse regions
Laos	1 Green Utility	Hydro	Policy Hydropower - reliable, affordable, and sustainable electricity to foster economic growth and alleviate poverty
Malaysia	1 Self-consumption 1 Combined study 1 Community Ownership 2 Peer-to-peer	Hydro Solar Hybrid	Ease of getting electricity ranked fourth globally in 2019 Renewable Energy Act (Act 725) in 2011 introduced the Feed-in Tariff (FiT) and renewable grid integration framework
Myanmar	1 Pay as You Go 3 Community Ownership	Biomass Solar	National Energy Policy-100% household electrification by 2030 Electrification-72.5% population in 2021, a significant urban-rural gap

Philippines	1 Pay as You Go 1 Community Ownership	Solar Hybrid	Renewable Energy Act 2008 - policy framework for RE development Archipelagic nature-to provide reliable electricity to remote islands
Thailand	1 Pay as You Go 2 Community Ownership 3 Peer-to-peer	Biomass Solar	Power Development Plan and Alternative Energy Development Plan (AEDP) Targeting 18,176 MW of total renewable energy contract capacity by 2037 Sixth globally for ease of electricity supply in 2019

RESEARCH QUESTION 2.

How do various stakeholder groups influence the development of renewable energy business models in ASEAN?

KEY PLAYERS AND THEIR INFLUENCES Power Level

of Stakeholders in

Renewable Energy
Business Models

Government Entities and Agencies

Supply chain companies

Technology and Energy Companies

Community and Local Entities
Academic and Research Institutions

Utilities and Energy Authorities

KEY PLAYERS AND THEIR INFLUENCES

Stakeholder Groups	Power Level	Rationales
Government Entities and Agencies	High	Regulatory and policy-making authority, influencing energy plans, setting targets, and providing incentives for renewable energy initiatives.
Utilities and Energy Authorities	High	Control the energy infrastructure and hold regulatory authority. Decisions impact grid integration, pricing structures, and overall energy distribution.

Community and Local Entities	High (Vary)	Especially in decentralized projects, acceptance, support, or opposition can shape the success of renewable energy initiatives.
Technology and Energy Companies	High	Technological expertise and drive project implementation. Innovations, investments, and partnerships influence the overall industry.
Financial Institutions	Moderate	Providing funding and investment for renewable energy projects, influencing the feasibility and success of initiatives.
Non-Governmental Organizations (NGOs)	Moderate	Advocate for sustainable practices, ensuring community interests. Influence policies, provide local insights, and promote social and environmental responsibility.
International Organizations	Moderate	Contributing financial aid, technological support, and policy guidance, influencing the adoption and development of renewable energy across borders.
Commercial and Industrial Entities	Moderate	Influence the demand for renewable energy. Adoption of sustainable practices can drive the market and promote innovation.

RESEARCH QUESTION 3.

Do ASEAN's renewable energy business models provide sustainable economic, social, and environmental values?

SUSTAINABLITY VALUES

Analyze
- Demand side: customer segments, customer relationships, and channels
- Interpret from value propositions.

Social

Analyze
- Financial aspect: revenue model and cost structure
- Not explicitly details of financial data
- Interpret from available data

Economic

Analyze
- Mostly mentioned in the "Introduction"
- Not explicitly exploring environmental impact

Environmental

IMPLICATIONS FOR PRACTITIONERS

- Community Engagement and Empowerment (Green, 2004; Chen, 2023)
- Capacity Building (Brooks & Urmee, 2014; Sovacool, 2018)
- Deregulation (Budi & Hadi, 2022)
- Environment Impacts of Renewable Energy Business Models (Aghamohammadi et al., .2016; Carlos & Khang, 2008)

FUTURE RESEARCH

- Explore how community engagement strategies affect the success and long-term sustainability of renewable energy projects in diverse socio-cultural contexts within ASEAN.
- Conduct a comprehensive study explicitly on the environmental sustainability of different renewable energy business models in ASEAN
- Investigate how government incentives, regulations, and support mechanisms influence the viability and

scalability of renewable energy business models in ASEAN countries.

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