

Hydrogen Demand and Supply in ASEAN's Industry Sector: Current Situation and the Potential of a Greener Future

Edited by

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Foreword

Climate change and the energy transition have made research and development in clean energy a priority as countries aim to reach net zero in the next decades. Hydrogen, singled out as a possible source of energy in the not-too-distant future, has emerged as a primary focus of discussion on the transition to sustainable energy. It is widely used for many applications including refining ammonia and petroleum, and the production of methanol and synthetic fuels. These applications accounted for more than 93% of global hydrogen consumption in 2020.

In the Association of Southeast Asian Nations (ASEAN) countries, currently, hydrogen is used mostly as feedstock for fertiliser in agriculture, and in methanol production, the steel industry, and oil refining. However, most hydrogen in use in the world today is not 'green' or 'low carbon' hydrogen, which is produced from renewable resources.

Most ASEAN Member States have realised the importance and potential of hydrogen as an alternative to fossil fuels and that can be employed across industries, power generation, and transport. Therefore, these countries have begun implementing their own hydrogen strategies to initiate the development of the hydrogen economy that will become an essential and crucial aspect of their energy transition process in the future.

With this research, the Economic Research Institute for ASEAN and East Asia (ERIA) tries to show the potential role of hydrogen in the industry sectors in ASEAN in the context of decarbonisation, an area that has hitherto received limited analysis and remains largely unexplored. ASEAN Member States should have an in-depth look at the findings of this research that can be considered as important elements to complete and to improve their current hydrogen strategies.



Tetsuya Watanabe

President, Economic Research Institute
for ASEAN and East Asia

Preface

Recognising that the current utilisation of hydrogen in the Association of Southeast Asian Nations (ASEAN) countries is predominantly confined to the industrial sector, primarily through conventional steam methane reforming with high carbon intensity, this study seeks to provide insights for an optimal hydrogen market development strategy in the region. The significance of this strategy is paramount, given the pivotal role hydrogen is poised to play in ASEAN's energy transition towards achieving carbon neutrality by the middle of the century.

The specific goal of this study is to provide a set of policy recommendations for policymakers in the ASEAN Member States to accelerate the process of obtaining lower carbon intensity of hydrogen supply in the industry sector, as part of an optimal hydrogen market development strategy for the ASEAN region.

This goal is attained via two pathways. First, by understanding hydrogen use in the ASEAN countries for the last 5 to 10 years and its current and future demand and supply to the industry sector, and second by analysing how the supply of hydrogen in the ASEAN countries can become greener or less carbon intensive. This includes an analysis of future production, storage, transport costs, and capacity development along the different low-carbon hydrogen production routes.

To accelerate the process of obtaining low-carbon hydrogen supply in the industry sector, this study recommends the governments of ASEAN Member States to proceed with the following:

- Continue to increase renewable electricity generation's share and reduce transmission costs.
- From the perspective of sectoral, regional, and international political economy, formulate strategies and manage the horizontal and vertical institutional interactions to gain maximum support for the greening of hydrogen production for key industrial applications in the ASEAN region.
- Elaborate policies on how to combine public sector co-financing, subsidies, and/or tax breaks with optimal carbon pricing to incentivise the production of low-carbon (green) hydrogen in the near term.
- Launch low-carbon hydrogen pilot projects, such as producing it from the surplus electricity generated by variable renewable energy resources including solar photovoltaic and geothermal or producing it from electricity generated by variable renewable energy in remote areas where electricity demand is negligible. Along these production pathways, hydrogen plays the role of batteries and/or transportable batteries, thus facilitating penetration of variable renewable electricity.

The authors hope that this study will provide new insights on an optimal hydrogen market development strategy for the ASEAN region.

Alloysius Joko Purwanto

Project Leader

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This study was undertaken in close collaboration with the working group members that come from different institutions representing expertise in five industry subsectors in ASEAN, i.e. oil refining, ammonia, methanol, iron and steel, and chemical industries.

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As a disclaimer, all errors and mistakes are the authors' responsibility.

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List of Abbreviations and Acronyms

ACE	ASEAN Centre for Energy
AEO	ASEAN Energy Outlook
AHEAD	Advanced Hydrogen Energy Chain Association for Technology Development
AMS	ASEAN Member States
APAEC	ASEAN Plan of Action for Energy Cooperation
APS	Announced Pledges Scenario
ASEAN	Association of Southeast Asian Nations
ATR	Autothermal Reforming
ATS	AMS Targets Scenario
BAU	Business-As-Usual
BECCS	Bioenergy with Carbon Capture and Storage
BEV	Battery Electric Vehicle
BF-BOF	Blast Furnace–Basic Oxygen Furnace
CAGR	Cumulative Annual Growth Rate
CCS	Carbon Capture and Storage
CCUS	Carbon Capture Utilisation and Storage
CN	Carbon Neutral
CO₂	Carbon Dioxide
COP	Conference of the Parties
COVID	Novel Coronavirus Disease
DAC	Direct Air Capture
DACCS	Direct Air Capture with Carbon Capture and Storage
DNV	Det Norske Veritas

DRI	Direct Reduced Iron
DRI-EAF	Direct Reduced Iron-Electric Arc Furnace
EE	Energy Efficiency
EJ	Exajoule
ERIA	Economic Research Institute for ASEAN and East Asia
EUR	Euro
EV	Electric Vehicle
FCEV	Fuel Cell Electric Vehicle
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GW	Gigawatt
HBI	Hot Briquetted Iron
HDF	Hydrogene De France
IEA	International Energy Agency
IEEJ	Institute of Energy Economics Japan
IESR	Institute for Essential Services Reform
IISIA	Indonesian Iron and Steel Industry Association
INDC	Intended Nationally Determined Contribution
IRENA	International Renewable Energy Agency
ISOM	Isomerisation
JETP	Just Energy Transition Partnership
KBPD	Thousand Barrels per Day
KTPA	Kilo Tons per Annum

Lao PDR	Lao People's Democratic Republic
LCOE	Levelized Cost of Electricity
LED	Light Emitting Diode
LNG	Liquefied Natural Gas
LS	Likely Scenario
MEA	Mono-ethanolamine
MEMR	Ministry of Energy and Mineral Resources
METI	Ministry of Economy, Trade and Industry
MOU	Memorandum of Understanding
MT	Million Tons
MTBE	Methyl Tertiary Butyl Ether
MTPA	Million Tons per Annum
MW	Megawatt
NDC	Nationally Determined Contribution
NZE	Net-Zero Emissions
OGJ	Oil and Gas Journal
PEM	Proton Exchange Membrane
PLN	PT Perusahaan Listrik Negara
PNOC	Philippine National Oil Company
PT	Perseroan Terbatas
PTT	Petroleum Authority of Thailand
PV	Photovoltaic
RE	Renewable Energy

SDG	Sustainable Development Goals
SDS	Sustainable Development Scenario
SEA	Southeast Asia
SEAISI	Southeast Asia Iron & Steel Institute
SMR	Steam Methane Reforming
STEPS	Stated Policies Scenario
TPA	Tons per Annum
TWh	Terawatt Hour
US	United States
US\$	United States Dollar
USGS	United States Geological Survey
VRE	Variable Renewable Energy
WEO	World Energy Outlook