POLICY PAPER

Identifying where renewable-based hydrogen adds value: Strategic priorities for Thailand's energy sector

Imprint

Analysis

Policy Brief - Identifying where Renewable-Based Hydrogen Adds Value:
Strategic Priorities for Thailand's Energy Sector.

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The project Clean, Affordable and Secure Energy for Southeast Asia (CASE) supports power sector transitions in Indonesia, Thailand, Viet Nam and the Philippines through evidence-based analysis and narrative change. The project supports decision-makers, industry leaders and consumers in enacting strategic reforms in the power sector in pursuit of the Paris Agreement goals and a just transition.

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Acronyms

AEDP	Thailand's Alternative Energy Development Plan
ASEAN	Association of Southeast Asian Nations
BESS	Battery Energy Storage System
BEVs	Battery Electric Vehicles
BIG	Bangkok Industrial Gas
BOI	Thailand's Board of Investment
CAPEX	Capital Expenditure
CASE	Clean, Affordable and Secure Energy (for Southeast Asia)
CCS	Carbon Capture and Storage
CCUS	Carbon Capture, Utilization, and Storage
CEPA	Committee on Energy Policy Administration
CO_2	Carbon Dioxide
DCCE	Department of Climate Change and Environment
DEDE	Department of Alternative Energy Development and Efficiency
DOEB	Department of Energy Business
DRI	Direct Reduction of Iron
EAF	Electric Arc Furnace
EEC	Eastern Economic Corridor
EGAT	Electricity Generating Authority of Thailand
EPPO	Energy Policy and Planning Office
ERIA	Economic Research Institute for ASEAN and East Asia
FCEV	Fuel Cell Electric Vehicle
FTI	Federation of Thai Industries
FY	Fiscal Year
GHG	Greenhouse Gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GW	Gigawatt
GX	Gre en Transformation
H_2	Hydrogen
IEA	International Energy Agency
IRENA	International Renewable Energy Agency
KTOE	Kilotonne of Oil Equivalent
LCOH	Levelized Cost of Hydrogen
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
LT-LEDS	Long-term Low Greenhouse Gas Emission Development Strategy

MHI	Mitsubishi Heavy Industries, Ltd.
MMBtu	Million British Thermal Units
MOU	Memorandum of Understanding
NDC	Nationally Determined Contribution
NEP	Thailand's National Energy Plans
NEPC	National Energy Policy Council
NH_3	Ammonia
ONEP	Office of Natural Resources and Environmental Policy and Planning
OPEX	Operational Expenditure
PDP	Thailand's Power Development Plan
PPAs	Power Purchase Agreements
PTT	PTT Public Company Limited (formerly Petroleum Authority of Thailand)
PV	Photovoltaic
R&D	Research and Development
SAF	Sustainable Aviation Fuel
SMR	Small Modular Reactor
TCO	Total Cost of Ownership
tCO_{2eq}	Tonnes of Carbon Dioxide Equivalent
UNFCCC	United Nations Framework Convention on Climate Change
ZEVs	Zero-Emission Vehicles

Key Messages

1. **Thailand's NDC 3.0 and energy plan revisions present a critical opportunity to define a role for renewable-based hydrogen in applications that add-value to the energy sector.** Clear policy direction can align hydrogen deployment with energy security and industrial decarbonisation goals while avoiding inefficient, non-targeted uses. Without prioritisation, widespread hydrogen application across sectors could increase electricity demand by around 75% by 2050, adding system-level cost, potential hydrogen imports dependency and planning challenges.

2. **Accelerating renewable energy deployment is cost-effective to decarbonise the power sector and enable affordable renewable-based hydrogen**. Electricity accounts for around 50% of hydrogen production costs, making rapid renewable scale-up essential to reaching projected hydrogen costs of USD 5–7 per kilogram by 2030. In contrast, hydrogen blending in gas power plants delivers limited emissions reductions while increasing electricity costs.

3. **The refining industry offers an immediate anchor for renewable-based hydrogen and a pathway to build a domestic green chemicals industry.** As Thailand's largest hydrogen consumer, with annual demand exceeding 300,000 tonnes, the refining sector can drive early adoption of renewable-based hydrogen to meet net-zero targets. This can also support domestic production of green ammonia, fertilisers, and methanol, strengthening supply-chain resilience and reducing reliance on imports.

4. **In the longer term, renewable-based hydrogen can complement direct electrification in hard-to-abate sectors and position Thailand as a regional green industry hub.** Targeted deployment in sectors such as steel and alternative fuels can enable deeper emissions cuts, diversify industrial supply chains, and deliver socio-economic benefits. Over time, this strategy can position Thailand to tap into growing East Asian demand for green industrial products.

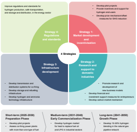
1. Introduction

Thailand is developing a long-term hydrogen development roadmap for the energy sector 2025-2050 and a short-term action plan for 2025-2030.

In September 2024, the Ministry of Energy proposed to the Committee on Energy Policy Administration (CEPA) the draft *Hydrogen Production and Usage Development Plan for the Energy Sector 2025–2050* and *Short-Term Action Plan (2025-2030)*. These plans are referred to as "Thailand's Hydrogen Roadmap Plans" in this brief.

The draft 25-year long-term plan (2025-2050) outlines a vision for Thailand to be commercially ready for hydrogen use in the energy sector by 2030 and to support the sustainable growth of hydrogen as an alternative fuel towards carbon neutrality. Figure 1 outlines three phases of the implementation priorities and four key strategies to support hydrogen production and usage in the energy sector. In addition, the planned implementation of four strategies for power generation, industrial and transport sectors in the draft short-term action plan (2025-2030) is summarised in Appendix 1. Thailand's Hydrogen Roadmap Plans are in the final stage of development and are expected to be submitted to the National Energy Policy Council (NEPC) for approval in 2026.

Figure 1 Summary of Draft Hydrogen Production and Usage Development Plan for the Energy Sector 2025-2050



Source: Information from Thansettakij (2025) and Senate's Subcommittee (2025)

Thailand remains in the early stages of hydrogen development. The implementation of pilot projects across the energy sector marks a crucial shift from exploratory R&D to pilot-scale commercialisation.

Thailand currently produces hydrogen mainly from fossil gas for use in refineries. The country is exploring low-carbon hydrogen production such as renewable-based and fossil-based, hydrogen with carbon capture and storage (CCS), as decarbonisation pathways. However, projects entering pilot-scale commercialisation focus on renewable-based hydrogen, demonstrating tangible progress toward industrial-scale adoption.

Major Thai energy players such as The Electricity Generating Authority of Thailand (EGAT), PTT Public Company Limited (PTT) and Bangkok Industrial Gas (BIG), are driving these pilot projects in power, industrial and transport sectors in coordination with international partners such as Japan, Germany, and South Korea.

Ongoing initiatives include:

- a 300-kilowatt wind–hydrogen hybrid demonstration project at Lam Takhong Dam;
- a green hydrogen and ammonia production pilot project in Krabi;
- a feasibility study on hydrogen co-firing technologies in power generation with a signed MOU between EGAT and Mitsubishi Heavy Industries, Ltd. (MHI) of Japan;
- the Saraburi Green Industrial Cluster Feasibility Study exploring low-carbon methanol using renewable hydrogen and CO_2 from the cement sector;
- the Japan-Thailand Green Transformation (GX) Partnership supporting hydrogen value-chain development;
- transport sector pilots, including the PTT–BIG–Toyota collaboration to establish commercial hydrogen supply for industrial users and mobility pilots, including a hydrogen refuelling station pilot, supporting the use of various Fuel Cell Electric Vehicles (FCEV) like heavy-duty trucks, buses, and forklifts in Chonburi and Rayong.

On the demand side, current hydrogen consumption is concentrated in the industrial sector, particularly in oil refineries. There is no large-scale hydrogen demand for the energy sector, including transport, industrial and power sectors. Development of hydrogen demand in these sectors requires government support through both policy and regulatory instruments.

[1] Today, around 99% of global hydrogen production uses unabated fossil fuels, primarily fossil gas and coal (IEA, 2025). The most common process is steam-methane reforming (SMR), which uses fossil gas as feedstock. In certain regions where coal is widely available, gasification of coal is also used for hydrogen production.

Collaboration between government and the private sector is crucial for shaping hydrogen policies and market development.

The Hydrogen Thailand Association (formerly the Hydrogen Thailand Club[2]), established by the government and private stakeholders, is expected to play a key role in shaping regulations, policies, roadmap, and the development of Thailand's hydrogen market. In 2023, The Ministry of Energy established a working group, chaired by the EPPO Director-General and comprising government agencies, EGAT, PTT, The Federation of Thai Industries (FTI) and the Hydrogen Thailand Associatio[n].

The working group is tasked with developing a hydrogen short-term action plan (2025–2030) and necessary regulations and standards for hydrogen production and use in the energy sector as well as facilitating the implementation of hydrogen-related pilot projects and studies. It acts as a key mechanism for inter-ministerial coordination (e.g., Ministry of Energy, Ministry of Natural Resources and Environment, and National Economic and Social Development Council) to integrate hydrogen development targets and ensure cross-sectoral harmonisation across energy, industry, and transport planning.

Thailand has officially recognized hydrogen as a fuel–a key step for establishing necessary legislation governing its use.

In October 2025, a Ministerial announcement was issued designating Hydrogen and Ammonia as 'fuel oils' to pave the way for development of safety regulations as fuel uses for electricity generation, industrial heating and the transport sector. The Department of Energy Business (DOEB) will draft regulations during the fiscal year 2026-2027, covering necessary legislation for storage depots, pipelines, transport tanks, service stations and facilities using hydrogen and ammonia. Engineering safety and environmental legislation to ensure safe and sustainable use of hydrogen and ammonia fuels will be drafted during FY 2027-2029.

Thailand's new NDC 3.0 and revisions to national energy plans create a strategic opportunity to clearly define no-regret uses of hydrogen in the energy sector.

In November 2025, Thailand submitted its updated NDC 3.0 to the UNFCCC, a net-zero emissions target for 2050 and a milestone target to reduce net greenhouse gas emissions to 152 million tCO2eq by 2035. Thailand has listed various hydrogen-related technologies for investment needs and prioritization to help decarbonize the energy sector in the near term (2031–2035), specifically for co-firing in power plants and hydrogen uses in transport sector (ships, trucks, and trains). As these technologies are currently defined as non-commercial or commercially emerging, the country is opening opportunities for international support. For 2050, Thailand's Long-Term Low Greenhouse Gas Emission Development Strategy (LT-LEDS, submitted in 2022) targets renewable hydrogen uses in hard-to-abate industrial sectors by 2045, including iron and steel, aluminium, and cement. This LT-LEDS may be revised to reflect more ambitious hydrogen targets to achieve the newly announced net-zero by

[2] Established in 2019 to promote hydrogen technology in the country with over 80 member organisations including PTT, Toyota Motor, BIG, Department of Alternative Energy Development and Efficiency (DEDE), Energy Policy and Planning Office (EPPO), Chiang Mai University, and GIZ. The club has just transitioned into a new association in October 2025.

Following the official appointment of the new Energy Minister in September 2025, Thailand is updating its national energy plans (NEP) to align with the NDC 3.0. The NEP is a comprehensive framework for energy sector that includes the Power Development Plan (PDP) and the Alternative Energy Development Plan (AEDP). The upcoming PDP is expected to incorporate a 5% blend of hydrogen with natural gas for power generation starting in 2030 (with the blending proportion reviewed every ten years). Concurrently, the upcoming AEDP aims to promote hydrogen as an alternative fuel for industrial heat (about 10 KTOE) and the transport sector (about 4 KTOE) by 2037 (Energy News Center, 2025; Prakobchart, 2025). The ongoing finalisation of the Thailand Hydrogen Roadmap Plans and the updates of PDP and AEDP offer a crucial opportunity to strategically define the long-term role of hydrogen in the energy sector and clearly set no-regret targets that support Thailand's energy transition efficiently and cost-effectively on the path to net-zero.

This policy brief aims to provide a comprehensive overview of no-regret uses of hydrogen in Thailand's energy transition.

- **Section 2,** "The role of climate-neutral hydrogen in achieving net-zero" outlines global trend in hydrogen development and the role of hydrogen in achieving a net-zero future in Thailand.
- **Section 3,** "Suggestions towards no-regret hydrogen applications in Thailand" highlights suggestions for no-regret hydrogen applications.
- **Section 4,** "Policy Recommendations: No-Regret Strategies for Thailand's Hydrogen Deployment in Energy Sector" summarises a proposed policy suggestions for hydrogen building on existing draft Thailand Hydrogen Roadmap Plans and offers guidance for policymakers and stakeholders based on no-regret uses of hydroge

2. The role of climate-neutral hydrogen in achieving net-zero

Renewables and direct electrification will play a more prominent role in achieving net-zero globally.

Global energy scenarios estimate that renewables and direct electrification can mitigate around 50% of total emissions, positioning them as the main drivers for a net-zero future. Low-carbon hydrogen can mitigate around 12% of total emissions (Agora Industry, ICCT and RAP, 2025), positioning it as an important but secondary carbon abatement strategy to direct electrification. Global energy scenarios project hydrogen's share in final energy demand to increase in a range between 5% to 14% by 2050 (Agora Industry, ICCT and RAP, 2025). For Southeast Asia, the projections are in line with global scenarios, with direct electrification accounting for around 52% of total final energy consumption in 2050, compared to only 4% for hydrogen in the same timeline (Agora Energiewende and Agora Industry, 2024).

Although low-carbon hydrogen is essential to achieving net-zero, its global deployment is progressing more slowly than anticipated.

Current limitations in the supply chain suggest that large-scale availability is limited in the short-term, highlighting the importance of realistic planning and prioritisation of its use. For example, based on projects that have already reached the final investment decision or are currently under construction, global electrolysis capacity is projected to expand from about 2 GW in 2024 to roughly 26 GW by 2030 (IEA, 2025). The scaling-up of a hydrogen economy in different geographies is affected by a few important factors: regulatory and demand uncertainty, delays in implementing support schemes, licensing and permitting issues, and operational challenges when scaling up technologies (IEA, 2024).

2.1 Strategic Use of Hydrogen: No-Regret Applications and Infrastructure Implications

Hydrogen should be prioritised for no-regret applications where electrification is not feasible.

A slower-than-expected scale-up of hydrogen is prompting a more pragmatic view of where it can add real value. Because supply will remain limited in the near term, hydrogen needs to be used selectively to ensure infrastructure investments are efficient and the benefits of a hydrogen economy are realised. Direct electrification should remain the primary decarbonisation route wherever it is technically and economically feasible, with hydrogen focused only on applications that are difficult to electrify or that clearly qualify as no-regret. *Figure 2* provides guidance for policymakers on no-regret hydrogen applications in different sectors with a long-term perspective to 2050. While some of these applications are not particularly relevant to the Thai context (e.g. heating grids and building-level heating), this paper will discuss others in more detail, such as those in the industry, power and transport sectors.

Figure 2 Prioritization for low-carbon hydrogen applications for climate neutrality by 2050

Green molecules needed for climate neutrality by 2050?	Industry	Transport	Power sector	Buildings
No-regret	Non-energy use[1]: • Feedstock: ammonia, chemicals, fertilisers • Reaction agents: DRI steel	• Long-haul aviation • Maritime shipping	• Renewable energy back-up, depending on wind and photovoltaic share and seasonal demand structure	• Heating grids (residual heat load[2])
Controversial	• High-temperature heat	• Trucks and buses[3] • Short-haul aviation and shipping • Trains[4] • Non-road mobile machinery	• Absolute size of need given other flexibility and storage options	–
Bad idea	• Low-temperature heat	• Cars • Light-duty vehicles • Two- and three-wheelers	–	• Building-level heating

Agora Energiewende and Agora Industry (2023).
[1] Hydrogen may also be used as a reaction agent and/or feedstock in bio-refineries.
[2] After using renewable energy, ambient and waste heat as much as possible. Especially relevant for large, existing district heating systems with high flow temperatures. Note that according to the UNFCCC Common Reporting Format, district heating is classified as being part of the power sector.
[3] Series production currently more advanced on electric than on hydrogen for heavy-duty vehicles and buses. Hydrogen heavy-duty to be deployed currently in time only in locations with synergies (ports, mines, industry clusters).
[4] Depending on distance, frequency and energy supply options.

The magnitude of hydrogen production and use should be planned strategically against the implications on energy resources and infrastructures.

The production of hydrogen will have a significant impact on Thailand's energy resources. Producing hydrogen from fossil fuels with CCS could increase vulnerabilities around energy security and dependency on fossil gas imports. Conversely, the no-targeted use of renewable-based hydrogen could imply a misuse of renewable energy resources, limiting their use for other necessary applications in power generation. Therefore, failing to prioritise hydrogen applications[3] in Thailand could lead to power demand being 20% higher in 2030 and 75% higher in 2050 compared to a scenario that prioritises electrification (Müller et. al., 2024). To meet the significantly higher power demand for hydrogen production in a scenario where electrification is not a priority, Thailand would need to deploy renewables at an unprecedented pace (Agora Energiewende and Agora Industry, 2024). The additional domestic hydrogen production would require 155% more wind, as solar photovoltaic (PV) increase reaches the limits of the considered PV potentials within this scenario. Therefore, Thailand would need to import hydrogen to meet demand (Müller et. al., 2024).

Countries are shifting from broad hydrogen commitments to the rollout of concrete support schemes, auctions, and deployment initiatives. Many are beginning to operationalise their hydrogen strategies across the entire value chain—ranging from production incentives to infrastructure planning and end-use pilots. As shown in *Table 1*, governments are adopting diverse approaches depending on their resource base, industrial structure, and anticipated role in future hydrogen markets. These international developments provide relevant insights for Thailand as it considers how to prioritise hydrogen within its broader energy transition.

[3] The modelling exercise uses a scenario where hydrogen needs to be used increasingly in all applications where this is a viable option (e.g. higher share of fuel cell trucks and industrial hydrogen boilers instead of battery electric vehicles and heat pumps) (Müller et. al., 2024).

Table 1. Hydrogen policies on production and application in selected countries[4]

Country	Policy framework & instruments	Importer / Exporter	Production target & source	Key applications (by sector)
United States	National Clean Hydrogen Strategy & Roadmap (2023); IRA 45V production tax credit; federal hubs & Department of Energy program.	Potential exporter	10 MMT by 2030, 20 MMT by 2040, 50 MMT by 2050; include both renewables-based and fossil + CCS.	2030 focus on refinery and petrochemicals, long-term on heavy industry (steel, refining), long-haul transport, energy storage.
Germany	National Hydrogen Strategy (2023); H2Global auctions; Development of a hydrogen transmission grid of more than 9 700 km by 2032. Develop R&D and build strong international partnerships.	Importer (limited domestic)	Target 10 GW electrolysis by 2030 (domestic)	Steel & chemicals, transport (H_2/FCEV), power balancing; infrastructure build-out.
Australia	National Hydrogen Strategy (2024); export corridors; hubs; state strategies.	Exporter	Government signaling: 200 kt/yr by 2030 (export) and ≥15 Mt/yr by 2050 (renewable H_2).	Exports (Japan/Korea), green ammonia/methanol, industrial fuel switching, mobility pilots.
Japan	National Hydrogen Strategy (2023); public-private ¥15T program; power sector ammonia co-firing pilots.	Importer	3 Mt/yr by 2030; ~12 Mt/yr by 2040; ~20 Mt/yr by 2050; diversified sources incl. renewable based, fossil CCS, and NH_3.	Power (coal/NH_3 co-firing), industry & mobility (FCEVs), import chains.

[4] Source: The United States – U.S. National Clean Hydrogen Strategy and Roadmap; Germany – National Hydrogen Strategy Update, Factsheet Germany's National Hydrogen Strategy Update 2023_0.pdf, Germany | European Hydrogen Observatory; Australia – Australia's National Hydrogen Strategy - DCCEEW, Labor's new 'renewable hydrogen' targets aim for Australia to produce 15m tonnes by 2050 | Hydrogen power | The Guardian; Japan – 20230606_5.pdf, JERA ends ammonia co-firing trial at coal power station with positive results | Reuters; Singapore – Singapore Launches National Hydrogen Strategy to Accelerate Transition to Net Zero Emissions and Strengthen Energy Security, [illegible]; Singapore National Hydrogen Strategy Oct 2022.pdf; Indonesia – Indonesia's national hydrogen strategy sets stage for pilot projects, new investment | S&P Global; Vietnam – Vietnam aims to produce 100,000-500,000 tons of hydrogen a year by 2030 | Reuters, Decision 165/QD-TTg 2024 approve Vietnam's Hydrogen Energy Development Strategy through 2030; Malaysia – meesty.sarawak.gov.my/web/attachment/show?docid=[illegible]

Country	Policy framework & instruments	Importer / Exporter	Production target & source	Key applications (by sector)
Singapore	National Hydrogen Strategy (2022); ammonia bunkering; R&D "pathfinder" projects; S-Hub CCS planning.	Importer / trading hub	Hydrogen could supply up to ~50% of power by 2050 (mainly via ammonia).	Industry, aviation, shipping, and power.
Indonesia	National Hydrogen Strategy (2023) + Hydrogen & Ammonia Roadmap (2024); emerging CCS hubs.	Mixed; potential exporter	Pilot projects from solar and geothermal.	Fertiliser/ammonia, refining, power peaking, transport; export hydrogen derivatives.
Vietnam	Hydrogen Strategy (Decision 165/QĐ-TTg, Feb 7 2024).	Potential exporter and domestic use	100–500 kt/yr by 2030; 10–20 Mt/yr by 2050; prioritizes renewable based hydrogen.	Fertiliser and petrochemical sector, steel. Pilot on power (ammonia cofiring)
Malaysia	Hydrogen Economy and Technology Roadmap (2022–2030); Sarawak hydrogen strategy; active CCS partnerships	Exporter	Renewable and fossil CCS hydrogen (Sarawak flagship projects).	Fertiliser, chemical, and methanol sector, 20% blending with fossil gas in power generation

A shift towards more hydrogen production and use will have implications on existing and new energy infrastructure.

For use in the power plants, gas turbines and combustion systems needs to be retrofitted to accommodate the unique combustion characteristics of hydrogen (such as high flame speed, low energy density, high diffusivity and corrosiveness) with retrofit requirements increasing hydrogen co-firing or blending ratios rise.

Gas pipelines and storage infrastructure also require upgrades or new additions to address safety and combustibility concerns. While retrofitting gas pipelines into hydrogen is significantly cheaper than new builds, the usable capacity drops to around 60% of the original pipeline rating due to technical constraints (IEI, 2025).

Adapting Liquefied Natural Gas (LNG)-based infrastructure to one adapted to liquid hydrogen and low-carbon ammonia is currently subject to several technical and economic uncertainties, and most probably will incur in extra costs for its adaptation (Agora Energiewende and Agora Industry, 2024).

New midsize LNG terminals cost between USD 5-8 billion (EPC Intel, 2024), and if they are planned to be hydrogen-ready, the initial Capital Expenditure (CAPEX) of LNG terminals is estimated to increase by 10% to 20% (Riemer et al., 2022).

Given the high upfront capital investment and cross-sectoral interaction as well as declining long-term gas demand (driven by LNG availability and competitive renewables), countries must carefully assess the interaction from a system perspective. This helps ensure hydrogen production is not disproportionately prioritised in ways that adds burden to grid infrastructure.

Thailand can carefully assess and plan hydrogen production to efficiently develop necessary hydrogen transport and storage infrastructure.

First, there is a need to evaluate the potential of geological storage (salt caverns) in Thailand as the most cost-effective hydrogen storage option. To date, there are only preliminary studies highlighting this potential in the Northeast (Pajonpai, et.al, 2022), a region far from major industrial users. A clearer understanding of this potential would help identify areas for renewable-based hydrogen production and assess synergies with power, industry and trade infrastructure. Coordinated planning and investment across energy and industrial infrastructures can mitigate extra transport cost for hydrogen via pipelines. It can also open opportunities for new industrial and commercial zones in regions with strong renewable resources, viable geological storage, and other beneficial aspects such as availability of carbon and ports for trade of hydrogen-based industrial products (see Section 3.2).

2.2 Renewable-based hydrogen to enhance energy security in Thailand

Promoting fossil-based hydrogen with CCS in Thailand increases vulnerability to the volatile global gas market.

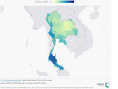
Thailand's domestic fossil gas resources are fundamentally limited, making reliance on the global LNG market a source of price volatility and geopolitical risks (CASE, 2025). For instance, following Russia's war against Ukraine in 2022, the price of LNG imports exceeded USD 50/MMBtu, which is three times higher than the prices in June 2025 (USD 13/MMBtu) (CASE, 2025). These price spikes for LNG imports directly impact hydrogen costs, as fossil gas is the main feedstock in its production, representing 70-90% of the cost. For instance, the cost estimations for fossil-based hydrogen with CCS in Thailand, using LNG imports, reached values over USD 7 per kg of H2 during the months with gas peak prices in 2022 and 2023 (see Appendix 2 for assumptions on the calculation). This vulnerability to price shocks will persist, particularly given the current geopolitical landscape and the ongoing tensions in the Middle East, which threaten the global supply of fossil gas and could therefore have significant implications for Thailand's energy security.

Renewable energy in Thailand offers a pathway to reduce the cost of renewable-based hydrogen.

Electricity accounts for around half of the cost of renewable-based hydrogen in Thailand. These costs could be reduced through cheaper generation from technologies such as solar PV which will potentially dominate the renewable power generation for electrolytic hydrogen production in Thailand.

Figure 3 shows the spatial distribution of the cost-optimal LCOH for hybrid renewable (solar PV–wind) hydrogen production across Thailand in 2030 (the map colours represent the LCOH only and do not show whether hydrogen is produced from solar or wind; the PV–wind split varies by province and is determined by the optimisation). The modelling analysis of this study shows solar PV will provide most of the electricity supply in the least-cost configurations across Thailand, with meaningful wind contributions only in the southern provinces of Chumphon and Ranong, where solar generation accounts for 79% and 87% of the power supply, respectively. In those few provinces, adding wind power capacity will help balance the system — but in most places, solar power alone will provide the lowest Levelized Cost of Hydrogen (LCOH) in Thailand. Another factor is access to cheaper electrolyser technology from China due to geographical proximity, compared to technology from Western countries. Taking these factors into account, the cost of renewable-based hydrogen in Thailand could be between USD 5-7 per kg H_2 by 2030 (see *Figure 3*)

Figure 3. LCOH for hybrid (photovoltaic and wind) production in Thailand, 2030



While the development of a domestic renewable hydrogen industry offers substantial energy security advantages by reducing reliance on volatile international gas markets (which is the key feedstock for gas-based hydrogen production), the staggering cost difference presents a major barrier. The cost of renewable-based hydrogen from solar PV electrolysis is estimated to be around USD 8-10/kg in 2025 compared to approximately USD 2.0-2.5/kg for fossil-based hydrogen which is currently used in refineries. Nevertheless, the volatility of gas prices, as observed in 2022 has result in a fossil-based hydrogen price of USD 7-12/kg, comparable with renewable-based hydrogen. (H2Uppp, 2023; Agora Industry, 2025).

The Board of Investment (BOI) has offered up to eight years of corporate income tax exemption for all technological routes for hydrogen production (with no cap for renewable-based hydrogen), import duty exemptions on new equipment, and land ownership rights for foreign business entities—but interest remains limited. The lack of hydrogen projects using electrolysis powered by solar energy is primarily because the venture is not economically competitive, even after accounting for all available benefits, compared to the returns from selling solar electricity directly to the grid (Senate's Subcommittee, 2025a).

In the long run, production of renewable-based hydrogen or fossil-based hydrogen with CCS could become more viable if market-based instruments (such as carbon pricing mechanisms and green certificate markets), de-risking instruments (such as contracts-for-difference, investment and production tax credits) and regulatory measures (such as streamlined approval practices, preferential grid connections, etc.) are effectively implemented. Additionally, it should be considered that any additional gas demand for fossil-based hydrogen with a CCS route, would likely increase reliance on imported gas as domestic natural gas production supplied 55% of national demand in 2023.

The solar PV potential across Thailand creates opportunities for renewable-based hydrogen production, enabling the identification of potential green industrial hubs.

Solar PV availability across the country will be key to renewable-based hydrogen production, enabling the identification as well as the development of new green industrial zones. As discussed in *Section 2.1*, this can facilitate the development of necessary infrastructure for the uptake of renewable-based hydrogen in the country.

For example, provinces within the Eastern Economic Corridor (EEC) host some of the largest refineries in the country and could potentially achieve LCOH values below USD 6 per kg H_2 by 2030 (see *Figure 3*, based on a dedicated renewables plant for hydrogen production). This would facilitate the adoption of renewable-based hydrogen by the Thai refining and chemical sectors (see *Section 3.2*), if hydrogen hubs are to be developed in the area. The Central area of Thailand shows similar LCOH values to the EEC and can potentially enable the uptake of renewable-based hydrogen to existing industries in the area.

However, heavy reliance on solar power requires greater use of hydrogen and battery storage to ensure a reliable supply for industrial users, which can increase LCOH by 10-20%, depending on the availability of the storage options in each region. This reinforces the importance of assessing the country's geological storage potential and aligning it with potential future hydrogen demand.

3. Suggestions towards no-regret hydrogen applications in Thailand

3.1 Renewables should be prioritised in decarbonising Thailand's power sector

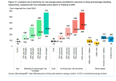
3.1.1 Accelerating renewable electricity deployment as key priority to reduce costs

As the direct use of renewable electricity is already a more economical option compared to hydrogen or fossil power plants, policy efforts should focus on accelerating its deployment.

Renewable energy sources such as solar and wind are now cheaper than fossil fuels and far more cost-effective in achieving Thailand's development goals (see *Figure 4*). Further deployment will directly reduce emissions while strengthening energy security. As electricity constitutes half of the total renewable-based hydrogen cost in Thailand, economies of scale from renewables deployment is expected to further reduce cost of electricity and renewable hydrogen. Funding should be prioritised for renewable energy, energy storage, and demand-side flexibility—which will provide more cost-effective returns in the near term.

Building on Thailand's strong investor readiness and large pool of potential bidders, transitioning to competitive auctions could lower the cost of renewable energy contracts, favouring electricity prices. Successful examples can be found in IRENA and CEM (2015) and recent experiences in the Philippines Green Energy Auction programme (Aurora, 2025). Transparent communication regarding new auction rounds—including their application and selection processes—would be beneficial to effectively solicit bids and increase investor certainty. Additionally, stronger coordination between policymakers, the regulator, and the three utilities (EGAT, Metropolitan Electricity Authority, and Provincial Electricity Authority) would help ensure that capacity planning for renewable energy is adequately reflected in the procurement schedule and supported with the necessary grid investments.

Figure 4 Levelized cost of electricity for coal and gas plants with cofiring compared with renewables



3.1.2 Hydrogen can play role as enabler of flexibility in the long-term

Hydrogen should be used as an enabler of flexibility and long-term storage in the power sector, not to be used for baseload.

Hydrogen contributes to renewable energy integration by long-duration storage and potentially peak load coverage in very specific cases. Similar to battery storage, hydrogen can be produced to store excess solar generation, mitigating renewable curtailment and providing flexible supply during peak demand. The resulting renewable-based hydrogen can be used by other sectors or as dispatchable power.

However, from an investor perspective, hydrogen plants cannot rely solely on excess electricity, due to the limited number of surplus-hours available throughout the year. For hydrogen production to be economically viable, the electrolyser needs consistently high utilization rates. Given the scarcity and high costs, renewable-based hydrogen use in the power sector should be reserved for situations when the grid needs it the most: as long-duration power storage when short-term balancing from renewable and battery storage is insufficient. Hydrogen peaker plants with few running hours can provide this function, providing short-term flexibility and ancillary services. Several long-term energy planning studies for Thailand suggest that a small capacity of hydrogen for long-term storage can be relevant at a later stage when the share of solar PV is very high (e.g., 3 times the inflexible power demand) (CASE, 2022; BNEF, 2025). However, there is a range of technologies that can provide such flexibility and ancillary services to the power sector. Thailand would therefore need to assess carefully whether hydrogen peaker plants are the most cost-competitive option in the long term.

Infobox 1. Is the use of hydrogen as storage in the power sector commercially viable?

Hydrogen as power storage still has limited commercial viability

Hydrogen for power storage remains in its early pilot stage globally. Pilot projects like RH2-PTG in Germany which integrate wind energy and hydrogen storage; Japan AHEAD project which ships liquefied hydrogen from Brunei to be used in Japan gas power plant; and Hydrogen Park in South Australia demonstrate technical feasibility. However, no country has reached large-scale, commercial use due to high costs, low efficiency, and the availability of more cost-effective alternatives such as batteries. As a result, current hydrogen development continues to prioritise industrial use, transport, and hydrogen as an export commodity rather than as a primary energy storage for electricity grids.

Hydrogen case in Germany: Back-up for "Dunkleflaute"

Germany experiences significant fluctuations in renewable energy generation directly tied to the weather. In winter, periods with limited wind and sunlight, known as "Dunkelflaute" (dark doldrums), reduce renewable electricity supply, thereby increasing fossil fuel use and driving up electricity prices. To address these seasonal variations, Germany is implementing measures to increase system flexibility: cross-border interconnections, battery storage and expanded renewable deployment (CLEW, 2024). To ensure dispatchable, fossil-free power, Germany plans to build new gas-fired power plants that can eventually switch to renewable hydrogen. In this approach, hydrogen produced or imported in the summer could be stored and used in the winter to stabilise the grid

However, this approach is very expensive. Underground hydrogen storage and reconversion is expensive, and round-trip efficiency is poor compared to batteries or flexible renewables. Therefore, only countries with severe seasonal variability and high industrial electricity demand—like Germany—may find hydrogen-based power backup indispensable. In regions with more stable renewable resources, such as Southeast Asia, cost-effective decarbonisation pathways rely on expanding renewables, batteries, and grid flexibility, avoiding the costly reliance on hydrogen for large-scale power storage.

Unlocking flexibility mechanisms to support the uptake of hydrogen as seasonal storage, along with other flexibility providers.

Thailand's long-term power system needs will evolve as the share of renewables increases. The Thai power system will need to expand to broader flexibility options and invest in power plants, storage, grids and demand-side flexibility. As gas power plants will move from baseload to backup and peaking capacity, hydrogen may play a role in seasonal storage (CASE, 2025)—but not before 2045–2050. Even then, several Thai energy system models show a maximum of 3% hydrogen in the power sector. Under seasonal storage or other flexibility options, these gas power plants will be used less frequently (ranging from 30% for old plants to 5% for new plants). This new way of operating for only a few hours will require a new compensation model to pay back the investments.

As system flexibility needs increase, policies and plans should focus on how the flexibility services are remunerated and unlock the existing flexibility potential in gas power plant. This includes redesigned power purchase agreements (PPAs) for conventional assets with more flexible terms, including higher ramp rates, lower minimum generation levels and shorter start-up times to allow for greater operational flexibility. Additionally, providing incentives to integrate new flexibility sources: Battery Energy Storage System (BESS), demand-side flexibility and pump storage hydropower.

The proposed policy to blend 5% hydrogen into the gas grid is costly, inefficient, and yields minimal emission reductions.

As Thailand progresses toward net-zero emissions, hydrogen is increasingly being considered within power sector planning. Current policy proposals include blending 5% hydrogen at gas-fired power plants by 2030 in the PDP and a 10-20% blended in gas pipeline by 2050 in the Hydrogen Thailand Roadmap Plans. However, this measure is costly, inefficient, and yields minimal emissions reductions. This policy is assessed based on several factors presented in Table 2.

Table 2 Analysis on a 5%-blended hydrogen in the power sector

Country	Explanations
Cost-efficiency	Blending 5% low-carbon hydrogen into Thailand's gas-fired power generation by 2030 would require between 0.18 – 0.35 Mt of H_2 annually, depending on the underlying assumptions for gas demand (BNEF, 2025; own analysis). Based on BNEF cost estimates, this would impose an annual cost of around USD 700 million, equivalent to 1.4% of Thailand's energy-sector expenditure or 0.4% of national GDP, comparable to five years of energy-efficiency investment. Producing the higher end of this hydrogen volume domestically would also be highly resource-intensive: supplying 0.35 Mt H_2 from solar PV alone would require close to 10 GW of new PV capacity—roughly double Thailand's current (2023) installed solar capacity. Yet even with this scale of investment, a 5% blending target would reduce emissions from gas power plants by less than 2%, raising significant concerns about cost-effectiveness and overall system value.
Emission reduction	A 5% blending option provides negligible decarbonisation. Full emissions abatement would require a high blending rate, and, with 100% renewable-based hydrogen, which provides only fractional gains at high cost especially when comparing with other available options such as renewable energy.

Country	Explanations
Efficiency	Producing this hydrogen from renewable energy would require 5-10 GW of solar PV capacity. To put this number in context, the installed Solar PV capacity in Thailand was 5 GW in 2023 (Ministry of Energy, 2024), yet over 40% of the energy is lost in conversion and blending. Direct use of the electricity from the same solar PV capacity means meeting 5% of annual national demand with zero emissions electricity.
Cost distribution	Implementing such broad quotas may affect consumers depending on how the cost is distributed. For example, the price of gas and electricity would increase for all consumers. This would have the greatest impact on households, as they would effectively be financing the use of hydrogen for other consumers. For example, a German case study on effectiveness of hydrogen quota showed an increase of 25% for household gas price by 2040 (Agora, 2025).
Gas grid infrastructure	Technical concerns include pipeline embrittlement, hydrogen storage leakage, and compressor breakdown. Studies show that hydrogen blending above 10% risks reducing pipeline lifespan by 20–50% and requires significant retrofitting (Fraunhofer, 2022; Fan, 2025). Hydrogen blending also carries delivery risk, which may stem from gas grid operators imposing blending restrictions due to safety concerns and operational limitations (Oxford, 2025).

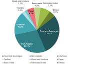
Colocation policy for a more efficient and consistent uptake of hydrogen.

Instead of adopting a blanket policy such as hydrogen blending, having a strategic and targeted policy (e.g. listing a specific co-location for hydrogen production and use in PDP or energy plan), may provide better returns due to several factors. This approach may suit Thailand, where solar PV potential is spread across the country. It ensures a consistent offtake of hydrogen by industrial users (due to its cost effectiveness) and a coordinated action for enhancing flexibility in the power sector. This is needed to ensure cost return for the hydrogen during the ramp-up period, enabling an efficient use of infrastructure, and reducing delivery risks.

3.2 Low-carbon hydrogen can boost a green development of the Thai industrial sector

3.2.1 The Thai chemical sector can remain the primary hydrogen consumer while exploring new potential applications

Figure 5. Final energy consumption by manufacturing industry in Thailand, 2023



Source: The Department of Alternative Energy Development and Efficiency (DEDE) (2023): Energy Balance of Thailand 2023

Refineries can contribute to scaling up renewable-based hydrogen while decarbonising the sector. The chemical sector in Thailand is dominated by refineries and is the third largest manufacturing industry in Thailand, accounting for 10% of the final energy consumption (DEDE, 2023). Petroleum products used within the refinery sector represent approximately 3–5%[6] of Thailand's total final energy consumption, as of January 2025 (DEDE,2025).

[6] The 3–5% range reflects differences in the energy content of petroleum products and the conversion factors used to express them in energy units.

Refineries are currently the largest consumers of hydrogen in the country using around 300,000 tonnes of H_2 in 2024 (IEA, 2025), which is produced from fossil gas. It is mostly used as feedstock in hydrocracking (fuel production) and hydrotreating (desulphurisation and denitrification), and to a lesser extent in isomerisation and de-aromatisation (ERIA, 2024a). These processes allow the blending of renewable-based hydrogen, particularly in cases where captive hydrogen is insufficient and hydrogen must be purchased from merchant producers. In addition, as discussed in Section 2.2, the provinces hosting most of the refineries in the country, part of the EEC special economic zone, can present some of the most competitive hydrogen[6] costs by 2030, with LCOH values below USD 6 per kg of H_2 (see *Figure 3*).

Renewable-based hydrogen can help to diversify the Thai refining sector, especially in light of the lower future demand for refining products in the country.

As electrification strategies play a more prominent role in the transport sector, and there is a shift away from diesel and fuel oil, this will diminish the domestic demand for these products in the medium and long term, which will have significant implications for the country's refining sector. Therefore, it will be important for refineries to look for diversifying their production and take advantage of potential new opportunities. For example, the production of Sustainable Aviation Fuels (SAF) and alternative shipping fuels can be an attractive new production that can used the technical expertise from refineries and contribute to diversify the production with alternative fuels in the sector. This will also go in line with Thailand's investment needs and prioritization of hydrogen-related technologies (such as hydrogen ship cargo and hydrogen ferry and cruise passenger) in the shipping sector by 2035 under NDC 3.0 and the target for hydrogen production and use of alternative fuels for aviation by 2037.

Promoting renewable domestic production in Thailand could help to reduce the need for imports of ammonia and fertilisers.[7]

Thailand's demand for nitrogen fertilisers, which is 1.4 Mt per year, is supplied entirely by imports, leaving the country exposed to the volatile global market. The strong influence of fossil gas prices on global ammonia production has led to peak prices in recent years, impacting the country's policies, including subsidies and capped prices on fertilisers, to help farmers purchase them (Agora Industry, 2025a). Thailand could promote the domestic production of renewable ammonia and nitrogen fertilisers in the mid-term, which could achieve costs below USD 1000 per tonne of nitrogen[8] by 2035 (Oeko-Institut et. al.,2024). This price would be comparable to the current retail price of fossil-based fertilisers in agricultural regions such as Lopburi.[9] Such a domestic green production can reinforce the supply chain, promote low-carbon industrial development and reduce fiscal spending on subsidies (Agora Industry, 2025a).

6 Hydrogen is produced on site in refineries. In Southeast Asia in 2021, around 87% of the industrial hydrogen demand was met by captive hydrogen, with refineries supplying 80-90% of this through on-site production (ERIA, 2024a).

7 Domestic production of fertilisers should not promote overuse of these products to avoid risks such as acidifying soils, reducing soil health and microbial diversity, as well as limiting the release of nitrogen to the atmosphere, resulting in greenhouse gas emissions. The priority is to increase the efficiency of nutrient use through modern technology, knowledge, and policy reform, not increased fertiliser use (Agora Industry, 2025a).

8 This price is given in cost of nitrogen, making it independent on the final fertiliser product to be chosen and facilitating its comparison with retail prices for fossil-based fertilisers.

9 Retail prices for fossil-based nitrogen fertilisers in Thailand are reported to be around USD 920-1200/t nitrogen in 2025 (Agora Industry, 2025a)

Domestic production of renewable methanol could strengthen Thailand's supply chain.

Thailand is a net importer of methanol with a demand of around 700,000 tonnes per year, which is increasing due to the growth of manufacturing industries and the expanding economy, mirroring other countries in Southeast Asia, such as Indonesia and Vietnam (ERIA, 2024a). Methanol is an important precursor and intermediate in the production of other chemical products such as polymers, solvents, and others. If produced with renewable-based hydrogen and a sustainable carbon source, renewable methanol can be a key component in reducing the use of fossil fuels in the chemical industry. Thailand could explore synergies with the pulp and paper, and sugarcane industry as a potential provider of biogenic carbon for the production of renewable methanol. This strategy has the potential to boost the chemical sector in Thailand, reduce the country's reliance on methanol imports and explore the use of methanol as a fuel source, such as in the maritime sector. Domestic production of green ammonia, fertilisers and methanol can benefit the diversification of the supply chain for these industrial products, reinforcing the security of supply and opening opportunities for industrial development in Thailand. It can serve as a complementary strategy to strengthening the current supply chain coming from neighbouring countries such as Singapore, Indonesia and Malaysia.

Figure 6. Costs of exporting green ammonia to Japan in 2040

Source: Deloitte Institut, Agora Industry & Agora Energiewende (2024): PTX Business Opportunity Analyser 2.1.1

Producing renewable ammonia, methanol, and Sustainable Aviation Fuel (SAF) in Thailand opens up new trade opportunities with East Asian countries, but it should be balanced with the need to satisfy domestic demand.

Japan and South Korea have already expressed interest in importing green products to decarbonise their industry and power sectors. Given their proximity to Southeast Asian countries, renewable ammonia and methanol present attractive trade opportunities for both countries. However, as shown in *Figure 6*, Thailand would need to compete with other countries, such as Chile, Australia, and those in the Middle East.

At the same time, the aviation sector is positioning itself as an important offtaker of SAF, to achieve climate commitments. These new opportunities highlight the importance of Thailand assessing its potential role in trade of green products to attract investment and promote industrial development in this area. This is to avoid overestimating its role in the global market for green chemicals and prioritising its use locally in the country.

3.2.2 Renewable-based hydrogen can open new opportunities for production of green steel in Thailand

The steel production landscape in Thailand: fit for future switching to hydrogen-based Direct Reduction of Iron (DRI)

Thailand has an intermediate steel industry, specialising in the manufacture of semi-finished steel products. The main steel production route is secondary steel, dominated by Electric Arc Furnaces (EAF) that use recycled scrap metal. Given that the country relies predominantly on EAF technology, the main decarbonisation lever for this route will be the deployment of renewable electricity, which can significantly reduce emissions in the electricity-intensive EAF process. At the same time, as regional steel demand is expected to grow (Agora Industry and Agora Energiewende, 2025), the future need for hydrogen-based Direct Reduced Iron (H_2-DRI) technologies will increase, particularly for producing primary steel. The Thai steel production route, coupled with existing gas production, provides opportunities for embarking into H_2-DRI-EAF route, a low carbon steel making process which expected to be market ready by 2030. This route allows for flexible hydrogen uptake, e.g., using fossil gas before switching to renewable hydrogen. This approach is already piloted in Thailand: The Meranti project[10] which demonstrate a proactive supply chain and offtake-driven strategy, underpinned by midstream policies that facilitate technology deployment, renewable energy access and foreign investment (Agora Industry and Agora Energiewende, 2025).

As far as the H_2-DRI route is concerned with hydrogen as reducing agent, having a clear and resilient long-term green renewable-based hydrogen roadmap and policy can attract investors and increase local value creation. This includes a targeted set of no regret hydrogen applications, for example, explicit targets for low carbon steel, as part of the hydrogen strategies. Introducing renewable-based hydrogen quotas for raw materials (e.g. primary steel and ethylene) in intermediate and end industrial products could create demand in important industrial sectors. This approach would also help to establish lead markets for green products, reducing the need for subsidies. The additional costs to consumers would amount to only a few percent of the total price of many products (e.g., less than a 1% extra for a car made from green steel) (Agora Energiewende, 2025).

Additionally, most low-carbon steel technologies require access to renewable energy and electricity, reinforcing the importance of scaling up low-cost, abundant renewable electricity across Thailand to enable meaningful decarbonisation of both EAF and future H_2-DRI production.

[10] The company is developing a DRI-EAF facility powered by renewable energy, with technology provided by Danieli and raw material secured through partnerships with Australia. Crucially, the project has concluded offtake agreements with European buyers such as Interfer Edelstahl, as well as a commercial partnership with Steelinvest NV to widen market access.

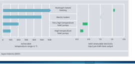
3.2.3 Electrification, technologies for decarbonising industrial heat are ready, whereas hydrogen is reserved for very specific cases.

More than 50% of industrial energy demand comes from low- to medium-temperature heat applications, for which electrification technologies already exist.

As shown in *Figure 5*, the food and beverage sector—along with pulp and paper, machinery, textiles, and wood—accounts for most Thailand's industrial energy demand. In these industries, process heat does not require temperatures higher than 400°C. This low-temperature heat represents 10% of Thailand's gas demand, in addition to other fossil fuels such as oil and coal (CASE, 2022). Existing electrification technologies, such as heat pumps and electric boilers, can easily be implemented in these industries to supply low-to-medium-temperature heat in a cost-efficient manner, providing a carbon-neutral solution for the industry sector. Adopting such technologies can also mitigate demand for fossil gas in the sector, enhancing security of supply given the constrained availability of fossil gas resources in the country (see Section 2.2). It is expected that, by 2050, 67% of industrial heat in Thailand will be supplied by electricity (CASE, 2022).

Although renewable-based hydrogen is a carbon-neutral option for decarbonising heat use in industrial applications, other electrification technologies are more efficient and cost-effective, particularly given the temperatures required in Thai industry. *Figure 7* shows the necessary electricity input required to generate various temperature ranges for carbon-neutral technologies. Hydrogen production requires the largest amount of electricity due to the electrolysis process, particularly compared to the efficiency of heat pumps. The increased demand for electricity for heat supply will put pressure on the power sector and maximise efforts to scale up renewable technologies. For these reasons, more efficient electrification technologies should be prioritised. Similarly, given the cost of hydrogen, it is expected that other electrification technologies will be more cost-effective in the medium-term. For example, by 2030, low- and medium-temperature heat from hydrogen boilers in Thailand will be twice as expensive as electric boilers and three times more expensive than heat pumps (Agora Industry, 2025). Therefore, the use of hydrogen for industrial heating should be limited to high-temperature applications where electrification or other climate neutral technologies such as biomass are unavailable, or where hydrogen is already being used, such as in the steel and chemical sectors.

Figure 7. Achievable temperature ranges and electricity requirements of electricity-based technology options for climate-neutral heat



Infobox 2: Brazil and Germany represent two distinct yet complementary approaches to hydrogen development.

Brazil: Supply and industrial policy integration

Leveraging its abundance of renewable resources and positioning itself as major exporter of hydrogen, Brazil is closely aligning its hydrogen development with industrial policy, focusing on no-regret applications—particularly hydrogen as a feedstock and reducing agent in industry. A key initiative is the National Hydrogen Program (PNH2), which outlines strategic steps for adopting low-carbon hydrogen. These include the establishment of a regulatory framework (Law 14.948, August 2024) and a financing mechanism. Current regulatory efforts focus on defining subsidies, tax incentives, and other measures to support goals such as deploying hydrogen pilot plants nationwide by 2025, positioning Brazil as the world's most competitive hydrogen producer by 2030, and consolidating hydrogen hubs by 2035.

In connection with PNH2, the Ministry of Mines and Energy has launched a public call that identified 12 low-carbon hydrogen hubs aimed at decarbonising key industrial sectors including steel, chemicals, fertilisers, among others. The initiative seeks to leverage Climate Investment Fund resources to help these projects reach their final investment decisions. The New Industry Brazil Program (NIB), led by the Ministry of Development, Industry, Trade, and Services, was launched in 2024 to guide industrial development through 2033, targeting R$300 billion in investment by 2026 across six strategic missions. These include energy transition, bioeconomy, and decarbonisation.

Germany: Demand creation through targeted quotas

Germany, by contrast, approaches hydrogen through policy mechanisms designed to stimulate demand and create markets in a context of limited renewable resources. A current debate centres on hydrogen quotas, which would mandate a minimum share of renewable-based hydrogen and green gases (such as biomethane) in overall gas consumption (Agora Energiewende, 2025). While attractive for being budget-neutral for the state—since costs are distributed among all gas consumers—broad quotas risk favouring cheaper alternatives like biomethane over hydrogen, and they do not directly foster hydrogen infrastructure or markets for green industrial products. Moreover, blanket quotas would disproportionately raise household gas bills, potentially increasing heating costs by around 25% by 2040, while cross-subsidising hydrogen use in power and industry.

The result of a policy analysis recommends a more targeted approach: sector-specific quotas in hard-to-abate industries. By requiring renewable hydrogen use in raw materials such as primary steel and ethylene, Germany could stimulate demand where hydrogen is truly indispensable while avoiding excessive burdens on households (Agora Energiewende, 2025). Such sectoral quotas would help establish lead markets for green industrial products, reduce the reliance on subsidies, and limit cost impacts for consumers—adding less than 1% to the final price of a car made with green steel, for example. This targeted, demand-driven strategy would reflect Germany's broader approach: fostering hydrogen markets through carefully designed policy instruments rather than blanket obligations, ensuring hydrogen plays a meaningful role in industrial decarbonisation while keeping social costs manageable.

3.3 The use of hydrogen in road transport will be limited in Thailand, with trucks being the only potential users.

Direct electrification through Battery Electric Vehicles (BEVs) will be the main decarbonisation strategy for road transport in Thailand, especially for passenger vehicles.

The current decarbonisation policy for road transport in Thailand prioritises the use of BEVs with the policy framework prioritising market development for battery electrification. For instance, the "30@30" policy sets a target for Zero Emission Vehicles (ZEVs) to comprise 30% of domestic vehicles production by 2030 (BOI, 2023). This target is supported by financial mechanisms under the EV 3.5 package, which offers subsidies and tax reductions to make BEVs more affordable and to stimulate local manufacturing (BOI, 2023). This policy framework defines ZEVs for passenger cars exclusively as battery-electric, with no specific targets or support mechanisms for fuel cell electric vehicles (or hydrogen-powered cars, FCEVs) (BOI, 2023). However, Thailand has planned a target use of hydrogen in the transport sector of about 4 KTOE by 2037 under the upcoming AEDP. Thailand's policy for passenger vehicles favours a decarbonisation strategy that is more energy efficient, as the BEVs can be almost three times more efficient than FCEVs for passenger cars (Agora Energiewende and Agora Industry, 2024) and currently two times more efficient in the trucks segment (Agora Industry, ICCT and RAP, 2025). The latter also present higher costs, which are linked to the cost of hydrogen production.

Decarbonising the truck sector of road transportation involves a more diverse range of technologies, including electrification, biofuels, and hydrogen, due to their varied operational demands.

The truck sector spans a wide range of use cases from short-haul urban delivery to long-distance, heavy-payload freight. For urban and regional logistics with predictable routes and return-to-base operations, battery-electric trucks are the most efficient and economical solution (ERIA, 2024). Biofuels offer a transitional, lower-carbon option that can utilise existing diesel infrastructure. While hydrogen, enters the market via hydrogen powered vehicles for the most demanding applications where the operational profile challenges the limits of current battery technology.[11] This will lead to fierce competition, as different technologies via for the attention of different sectors of the truck market, depending on which can better adapt to a specific use cases.

Hydrogen's role in road transport is limited to a specific market within the heavy-duty truck segment.

This specific focus is expected due to significant economic and logistical hurdles associated with hydrogen use. The business case for hydrogen trucks requires two simultaneous and costly developments: a competitive price for renewable-based hydrogen and the development of a vast national refuelling infrastructure (GIZ, 2024; IEA, 2024). These combined constraints confine the potential of hydrogen trucks to the specific niche of long-haul, heavy-duty trucking—especially for long distance trips with specific geographic conditions—as well as in future industrial areas where hydrogen will be produced and available. Within this niche, however, the unique operational advantages of hydrogen trucks are what can justify their significant premium over other decarbonisation options.

[11] It is important to monitor the rapid development of battery technology, as it could become the most viable technology in the future.

Policy should initially focus on strategically defining the specific role of heavy-duty hydrogen trucks in Thailand through an evidence-based approach.

The immediate priority for the short-to-medium term should be to monitor and learn from the ongoing pilot projects—such as the Nex Point FCEV prototype development and Hydrogen Thailand Association by PTT, Toyota Motor Thailand, and BIG (Patarapong & Peera, 2024). These pilots are used to collect crucial, real-world data on Total Cost Ownership (TCO)[12], operational reliability, and supply chain logistics under local conditions. This data will enable policymakers to precisely identify the operational thresholds, in terms of daily routes and payloads, where hydrogen trucks could potentially offer a tangible advantage over other technological options. These pilot projects can provide valuable insights into the potential role of hydrogen trucks within the national transport framework, enabling the development of targeted policies for the sector.

Future policy instruments should address infrastructure, technological competitiveness and fuel costs strategically.

Identifying the specific use cases where hydrogen trucks are most viable will allow policy makers to create a framework that provides investors with certainty. At the same time, regulations should set out well-defined safety and technical standards. Regarding infrastructure, the long-term vision should focus on the strategic deployment of refuelling infrastructure, where necessary, taking into account the transport of hydrogen between key industrial production hubs and logistics corridors. Therefore, assessing the development of a permanent backbone, such as hydrogen pipelines, will be important to avoid becoming a bottleneck for the decarbonisation of the heavy road transport sector. Ensuring a fuel supply in specific logistics corridors can reduce long-term fuel logistics costs, which are a key component of TCO (IEA, 2024). Other policy instruments that support the competitiveness of the technology can use pilot data to improve TCO and operational advantage. These strategies align with Thailand's Net Zero GHG emission timeline for the transport sector, which foresees the deployment of hydrogen trucks by 2045 (ERIA, 2024).

[12] Costs of owning and operating a vehicle along the entire supply chain, including purchase costs, ongoing costs such as fueling and maintenance, and financing costs. TCO provides complete lifecycle costs of a vehicle for business optimization and cost efficiency.

4. Policy suggestions for Thailand's hydrogen deployment in energy sector

In October 2025, the new Minister of Energy announced a new policy directive to revise Thailand's Power Development Plan (PDP), to integrate hydrogen and its derivatives as part of the long-term clean energy mix. The revision of the National Energy Plan (NEP) also aims to integrate hydrogen development targets that align with the updated PDP and Alternative Energy Development Plan (AEDP) strategies for hydrogen contribution to carbon neutrality and net-zero by 2050.

The forthcoming Thailand Hydrogen Roadmap Plans will include an explicit hydrogen roadmap for power generation, industry, and transport. They will emphasise low-carbon hydrogen development, domestic value creation, and industrial hub development. The new policy direction underscores Thailand's ambition to move beyond pilot projects, towards commercial hydrogen applications, particularly in industry and transport. It also highlights the aim to integrate renewable hydrogen hubs into industrial zones, and renewable parks, while strengthening regional cooperation (for example, through the ASEAN Hydrogen Working group and strategic partnerships with Japan, Germany, and Korea). The Ministry of Energy also aims to strengthen national coordination across departments and ministries and bring harmonisation across sectoral plans.

This section summarises recommendations for no-regret hydrogen strategies for Thailand's energy sector, drawing from international best practices and preliminary analysis based on existing evidence. The objective is to provide constructive suggestions that complement and strengthen Thailand Hydrogen Roadmap Plans, contributing additional perspectives and global lessons to enhance the strategic role of hydrogen in achieving net-zero target by 2050. Table 3 summarises policy suggestions for no-regret strategies for hydrogen development in the Thai energy sector, building on existing draft short-term action plans for hydrogen development from 2025 to 2030.

Key considerations:

- Hydrogen could be targeted as an enabler of flexibility and long-term power storage in the power sector, as feedstock or reducing agent in energy-intensive industrial sectors (such as chemical refineries, chemicals and steel sectors) and niche segments for road transport such as heavy-duty vehicles.
- Renewable-based hydrogen from solar PV and wind is not yet cost-competitive compared to fossil-based hydrogen used in refineries, but renewable-based hydrogen could offer lower costs in the long-term. It also offers substantial energy security advantages, reducing reliance on volatile international coal and gas markets. Fossil fuel-based hydrogen with CCS may expand domestic supply but requires large upfront investment in carbon infrastructure and risks locking Thailand into continued exposure to volatile fossil-gas markets. This could raise prices in the long-term electricity tariffs.
- Co-ordinated planning between energy and industrial infrastructure could mitigate extra transport costs for hydrogen via pipelines, and open opportunities for new industrial and commercial zones in regions with high renewable availability, geological storage potential, and other aspects such as port access for trade of hydrogen-based industrial products.

Table 3 Policy suggestions for Thailand Hydrogen Roadmap Plans

<table>
<tr><th>Sectors</th><th colspan="2">Policy suggestions</th></tr>
<tr><td rowspan="2">Power generation</td><td colspan="2">Hydrogen should be an enabler of flexibility and long-term power storage in the power sector.
• Renewable hydrogen use in the power sector should be reserved as long-term duration seasonal storage in the long-term complementing when short-term balancing from renewables and battery storage is not enough.
• The hydrogen demand for blending with gas-fired power plants at 5% by 2030 and at 10-20% by 2050 could be costly, inefficient and yields minimal emissions reductions compared to targeted use of renewable-based hydrogen in the mid- and long- term with clear targets.</td></tr>
<tr><td>Short-term (2025-2030)
• Re-evaluate the PDP target to blend 5% hydrogen into fossil gas pipeline by 2030 to reflect the concerns on technical feasibility, efficiency in reducing emissions and long-term cost burdens.
• Assess the technical and economic potential role of renewable-based hydrogen as seasonal storage to provide flexibility for the power sector in the long term, complementing short-term balancing from renewable sources and battery storage.</td><td>Long-term (2031-2050)
• Assess needs for hydrogen peaker plants and storage in strategic area including remote islands not connected to national grids.
• Include the long-term target for renewable-based hydrogen use in the power sector in the PDP. This should be aligned with the need to accelerate solar and wind before 2030 to reduce the cost of renewable-based hydrogen.
• Scale up renewable energy capacity installations while ensuring their effective integration.
• Reform power purchase agreements (PPAs) by introducing flexible terms—faster ramp rates, lower minimum generation, and shorter startup time.
• Strengthen power system flexibility by adopting a technology-neutral policy to incentivise flexibility services.</td></tr>
</table>

Sectors	Policy suggestions
Industry	**Hydrogen should be targeted as a feedstock or reducing agent in energy intensive industries such as refineries, chemical and steel sectors.** • Hydrogen use should be targeted as a feedstock in chemical sector (including refineries) and as reducing agent in the steel sector as well as high-temperature industrial heats (e.g., industrial boilers and stream generation) where electrification and other climate-neutral technologies (like biomass) solutions are not available. • Hydrogen demand projections should be reassessed to focus on its use in the chemical and steel sectors where hydrogen may be the most viable decarbonization option. Introducing renewable-based quotas for raw materials in intermediate and end industrial products could create demand in important industrial sectors, establishing market demand for green products. • Renewable-based hydrogen can help to diversify the Thai refining sector with potential opportunities to produce alternative fuels such as sustainable aviation fuels (SAF) and renewable methanol as shipping fuel, facilitating the transition of these sectors. • Domestic production of green ammonia, fertilisers and methanol can help diversify the supply chain of these industrial products and reduce the need to import them as is currently the case. It will also enhance resilient of the Thai chemical sector and protect the country from price shock in the global markets of these products. • Renewable ammonia, methanol and SAF could open up new trade opportunities with East Asian countries such as Japan and South Korea that would be interested in importing green products.

Sectors	Policy suggestions	
	Short-term (2025-2030) • Include renewable-based hydrogen in decarbonisation strategies and industrial policy and supporting mechanisms, prioritising the refining and chemical sector. • Assess the feasibility of and develop pilot projects for renewable-based hydrogen at refineries and chemical production plants. • Identify potential areas and create support mechanisms for the creation of renewable-based hydrogen linked to industrial hubs. • Develop roadmaps for expanding plans for the chemical and refining sectors supplying renewable-based hydrogen derivates such as ammonia, methanol, fertilisers, SAF, among others. • Assess market for green chemical products, with focus on fully imported products such as ammonia, fertilisers and methanol. • Map potential trade opportunities for green industrial products with East Asian countries and other regions.	**Long-term (2031-2050)** • Continue to develop pilots and development for renewable-based hydrogen industrial hubs • Facilitate the scaling up of pilot projects to accelerate mitigating emissions in the chemical sector. • Start domestic production of chemical products such as ammonia, fertilisers and methanol that are currently only being imported. • Start domestic production of SAF for domestic use and potential trade. • Establish strategic partnerships for the trade of green industrial products

Sectors	Policy suggestions
Road transport	**Hydrogen should be targeted for niche segments for road transport such as heavy-duty vehicles.** • Hydrogen demand should be created in niche segments where direct electrification is not a priority given by geographic and infrastructure constraints. Without clearly defining these segments, hydrogen could be used in applications better suited for electrification, resulting in the misuse of renewable energy resources and lead to significant inefficient higher power demand for hydrogen. • Hydrogen demand for road transport should not be prioritised in passenger vehicles where direct electrification with battery electric vehicles is more efficient and cost-effective. The government should mandate continuous monitoring and comprehensive data collection from ongoing FCEV and refuelling station pilot projects to redefine the role of hydrogen in the heavy truck sector as needed. • Improvement in fuel economy of BEV in truck could change the competitiveness of FCEV in this segment (e.g., in regions with good road infrastructure and mandates for drivers to take a break every four hours like in Europe). However, in other regions like Thailand where there is more complex geography and less-developed road infrastructure, hydrogen trucks could still offer potential demand to decarbonize the road heavy-transport sector.

Sectors	Policy suggestions	
	Short-term (2025-2030) • Monitor and review pilot projects on hydrogen-fuelled trucks, identifying potential areas of use. • Assess required regulatory framework for the use of hydrogen as a fuel in the transport sector, including technical and safety standards. • Define the role of hydrogen in the heavy truck sector, aligned with cross sectoral planning, e.g., use of hydrogen-fuelled trucks in industrial hubs. • Include heavy duty vehicles in energy and industrial plans, assessing synergies for its development.	**Long-term (2031-2050)** • Create clear policy that enables infrastructure development for the use of hydrogen-fuelled trucks in those identified segments.

Sectors	Policy suggestions
Hydrogen production and infrastructure	**The direction to accelerate renewable electricity deployment, together with strategic planning of hydrogen production, storage, and transport is essential to minimise costs, avoid fossil lock-in, and ensure energy security benefits.** • Prioritising the acceleration of renewable deployment is key to reduce the costs of renewable-based hydrogen. As electricity accounts for around 50% of renewable-based hydrogen costs, so expanding a more economical renewable generation will be critical to achieving lower costs of renewable-based hydrogen. • Supporting low-carbon hydrogen production pilot projects could help Thailand to rapidly scale up low-carbon hydrogen supply while gathering essential data to determine which pathway is the most cost-effective, scalable, and commercially ready for long-term incentives. • Fossil-based hydrogen production with CCS/CCUS (e.g., hydrogen produced from fossil gas) could leverage the existing fossil-gas infrastructure, however should be treated as a transitional fuel to renewable hydrogen given risks exposure to the volatile global gas market, financial burdens on future electricity tariffs. It should also be acknowledged that the availability of highly efficient carbon capture technologies at scale and reasonable cost is a bottleneck in the fossil based 'low- carbon' hydrogen route. • Renewable-based hydrogen production should be strategically planned based on resource availability and infrastructure capacity, with production located close to industrial cluster, demand centers, and export hubs, and prioritising the use of low-cost renewables to minimise transport and infrastructure cost • Pipeline development should be carefully planned to avoid lock-in to fossil-based hydrogen pathways and ensure compatibility with future renewable-based supply. The repurposing of existing gas infrastructure should be assessed on a case-by-case basis, considering safety, cost-effectiveness, and long-term energy security. • Geological hydrogen storage options, such as salt caverns, should be identified early and developed in parallel with production planning to minimise system costs. Storage facilities must be designed and operated under leak-tight conditions to prevent hydrogen losses and associated indirect climate impacts. Robust monitoring and regulatory frameworks are therefore essential to ensure environmental integrity and public confidence offer potential demand to decarbonize the road heavy-transport sector.

Sectors	Policy suggestions	
	Short-term (2025-2030) • Plan the scale of hydrogen production based on energy resource implications and infrastructure capacity. • Support renewable-based hydrogen production by providing incentives and unblocking regulatory obstacles to accelerate renewable energy deployment, such as shifting from feed-in tariff to a competitive auction. • Explore and support pilot production projects for other low-carbon hydrogen types (e.g., fossil gas hydrogen with CCS/CCUS). • Establish clear, standardised data reporting on the price and quantity of all low-carbon hydrogen types and monitoring framework for hydrogen production. • Evaluate the geological hydrogen storage options in Thailand by mapping areas for renewable based-hydrogen production and finding synergies with power, industry and trade infrastructure and demand. • Set up a hydrogen committee that coordinates planning between energy and industrial infrastructure across ministries, including Thailand Hydrogen Association. • Develop a long-term infrastructure vision for deployment of refuelling infrastructure, ensuring the network is optimised for efficient hydrogen transport between industrial production hubs and logistics corridors.	**Long-term (2031-2050)** • Implement a hydrogen geological storage pilot project (if study shows economically feasible). • Implement and closely monitor long-term hydrogen production strategies with incentive package. Revise the plan if needed. • Continue the development of hydrogen infrastructure (pipe network and storage facilities). • Develop policy measures to incentivise the deployment of renewable-based hydrogen and low-carbon hydrogen projects (where economically feasible) through market-based instruments (such as carbon pricing mechanisms and green certificate markets), de-risking instruments (such as contracts-for-difference, investment and production tax credits), and regulatory measures (such as streamlined approval practices, preferential grid connections, etc.).

Sectors	Policy suggestions
Cross-sectoral	**Strong inter-ministerial coordination, supportive regulation, and long-term capacity building across the whole value chain can unlock hydrogen development in Thailand.** • Establish clear governance and coordination mechanisms for hydrogen development, including defined institutional roles, an inter-ministerial committee, data-sharing systems, and regular monitoring and revision of development plans and roadmaps. • Enable conditions for a low-carbon hydrogen value chain by updating regulations, codes, and safety standards; planning potential hubs and infrastructure for production, storage, and transport; and adjusting support measures in line with market progress. • Invest in human resources and partnerships by prioritising human resource development for the hydrogen industry and actively engaging in regional and international cooperation platforms.

Sectors	Policy suggestions	
	Short-term (2025-2030) • Set specific targets for no-regret applications of low carbon hydrogen in each sector under Thailand Hydrogen Roadmap Plans. • Identify and assign clear roles for ministries and agencies responsible for each key action plan. • Establish and authorise a dedicated inter-ministerial hydrogen committee to oversee and coordinate the implementation of hydrogen development plans. • Support the Thailand Hydrogen Association to act as Thailand focal point for hydrogen development and international cooperation. • Establish a mechanism to monitor implementation progress of the Thailand Hydrogen Roadmap Plans. • Develop a detailed technology roadmap covering the entire hydrogen value chain (production, transportation, storage, and utilization), to maintain technology foresight and focus R&D efforts. • Prioritise hydrogen data sharing across all stakeholders and invest in the Energy Data Lake. • Expedite the update of regulations, codes, and safety standards applicable to the entire low-carbon hydrogen value chain.	**Long-term (2031-2050)** • Implement a hydrogen geological storage pilot project (if study shows economically feasible). • Implement and closely monitor long-term hydrogen production strategies with incentive package. Revise the plan if needed. • Continue the development of hydrogen infrastructure (pipe network and storage facilities). • Develop policy measures to incentivise the deployment of renewable-based hydrogen and low-carbon hydrogen projects (where economically feasible) through market-based instruments (such as carbon pricing mechanisms and green certificate markets), de-risking instruments (such as contracts-for-difference, investment and production tax credits), and regulatory measures (such as streamlined approval practices, preferential grid connections, etc.).

Sectors	Policy suggestions	
	• Integrate potential hydrogen hubs and infrastructure needs in energy and industrial planning, considering storage and transport of hydrogen. • Participate in regional hydrogen cooperation (e.g., ASEAN Hydrogen Working Group and Japan's GX Asia Initiative).	

Appendix 1: Thailand's Short-Term Hydrogen Action Plan for 2026-2030 (Draft version)

Strategies	Power generation	Industry	Transport	Key stakeholders
1. Market development and incentivization	• Assess technical and economic potential for hydrogen use in power generation. • Test and adjust power plant equipment • Develop a fuel price structure incorporating GHG emission conditions. • Create financial incentives and regulatory measures	• Conduct system checks on gas pipelines using H_2NG. • Perform system checks on boilers and furnaces utilizing H_2NG. • Assess the impacts and challenges arising from hydrogen pricing on industrial users • Provide recommendations for accelerating hydrogen deployment across industrial sectors.	• Conduct studies on the viability and potential of hydrogen fuel cell technology across various transport modes • Develop a comprehensive national strategy for hydrogen integration in transportation sector. • Create financial incentives and regulatory measures	EPPO, DEDE, ERC, EGAT, PTT, BOI, TISI, DCCE, Ministry of Finance, Power Producers
2. Industrial research and development	• Establish a pilot project for methane synthesis from RE • Develop policy measures to foster the growth of the domestic carbon credit market • Develop and implement hydrogen production pilot projects	• Support hydrogen technology R&D • Conduct a labour market survey and establish a comprehensive hydrogen-related human resources development plan. • Develop a strategic hydrogen industry investment plan to guide private capital. • Create a focused national hydrogen research plan to address industrial knowledge gaps.	• Develop a detailed hydrogen procurement plan for the transport sector • Conduct a labour market survey and analyse business models for hydrogen production, procurement, storage, transportation, and use • Establish a human resources development plan covering the entire hydrogen transport value chain	EPPO, DOEB, DEDE, PTT, BOI, DCCE, ONEP, Ministry of Finance, FTI

Thailand's Short-Term Hydrogen Action Plan for 2026-2030 (Draft version)

Strategies	Power generation	Industry	Transport	Key stakeholders
3. Infrastructure development	• Feasibility assessment of CCS/CCUS and low-carbon hydrogen production. • Establish a national hydrogen transportation system. • Create a strategic development plan for hydrogen import piers and facilities.	• Suggest a suitable hydrogen transportation model for industrial supply. • Conduct a feasibility study for infrastructure investment for hydrogen imports. • Conduct a feasibility study for CCS/CCUS and low-carbon hydrogen production infrastructure.	• Develop a plan detailing storage quantity, targeted location, and logistics for hydrogen supply. • Analyse and determine the most suitable transportation modes for hydrogen within the country • Conduct system checks for hydrogen refuelling stations, storage facilities, and transportation methods.	EPPO, DEB, DEDE, DMF, ERC, EGAT, PTT, BOI, ONEP
4. Regulations and standards development	• Establish regulations governing hydrogen supply chain: production, transportation, storage, and end-use. • Develop specific standards and regulations for the quality of hydrogen blended with natural gas (H_2NG).	• Improve existing laws and regulations to effectively support the adoption of hydrogen fuel. • Review and update standards and regulations to ensure the safety of the hydrogen industry.	• Conduct studies on the viability and potential of hydrogen fuel cell technology across various transport modes • Develop a comprehensive national strategy for hydrogen integration in transportation sector. • Create financial incentives and regulatory measures	EPPO, DMF, ERC, PTT, ONEP

Note: EPPO—Energy Policy and Planning Office; DEDE— Department of Alternative Energy Development and Efficiency; ERC— Energy Regulatory Commission of Thailand; EGAT—Electricity Generation Authority of Thailand; BOI—Board of Investment; TISI— Thai Industrial Standards Institute, DCCE— Department of Climate Change and Environment; DOEB—Department of Energy Business; ONEP—Office of Natural Resources and Environmental Policy Planning; FTI— Federation of Thai Industries; DMF—Department of Mineral Fuels
Source: Prakobchart (2025) and Senate's Subcommittee (2025)

Thailand's Short-Term Hydrogen Action Plan for 2026-2030 (Draft version)

Prioritized hydrogen-related technologies in the NDC 3.0 plan

Prioritised Hydrogen Technology	Investment Cost (million USD)	Mitigation Potential (2030 - 2035) (MtCO2eq)	Abatement Cost (USD/tCO2)
Hydrogen Co-Firing Power Plant	112.50	0.50	225.00
Hydrogen Ship Cargo	0.12	0.30	0.41
Hydrogen Truck	888.02	0.90	986.69
Hydrogen Ferry and Cruise Passenger	0.18	0.30	0.60
Hydrogen-powered train	320.39	0.60	533.99

Source: DCCE (2025)

Appendix 2: Assumptions for the Techno-Economic Assessment

This section presents an overview of the assumptions applied in the calculations used in this report. More detailed information about the methodology can be found in Agora Industry, Agora Energiewende (2024a).

Technology	Parameter	Value	Unit	Source
Photovoltaic	Capital Expenditure (CAPEX)	560	USD_{2023}/kW	IRENA (2023)
Photovoltaic	Operational Expenditure (OPEX)	26	USD_{2023}/kW-a	IRENA (2023)
Wind	CAPEX	1400	USD_{2023}/kW	IRENA (2023)
Wind	OPEX	67	USD_{2023}/kW-a	IRENA (2023)
Electrolyser (Chinese)	CAPEX	648	USD_{2023}/kW	IEA (2025)
Electrolyser	OPEX	13	USD_{2023}/kW-a	IEA (2025)
Electrolyser	Stack replacement	31	% of CAPEX	BNEF (2023)
Electrolyser	Stack lifetime	10	years	BNEF (2023)
Natural gas reforming with CCUS	CAPEX	1420	USD 2023 / kW H_2	IEA (2025)
Natural Gas Prices	LNG imports	Monthly Average	MMBTU	ERC (2024)
Battery Storage (2030)	CAPEX	223	USD_{2023}/kW_e	Fasihi et al. (2021)
Storage H_2 Storage (Underground pipeline)	CAPEX	14 240	USD_{2023}/kW_e	Fasihi et al. (2021)
WACC (2023)	Equity Risk Premium	6.94%	%	Damodaran (2024)

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