FE–V

Future of Electricity Vietnam

POLICY NOTE

Points for consideration on the orientation of Vietnam's electricity sector under the energy transition, informed by Australian experience

20th June, 2023

Australian Government

About Future of Electricity Vietnam (FE-V)

Australia and Vietnam are neighbours and peers, facing the same regional challenges and sharing the same aspirations for sustainable, secure, and fair electricity services as the basis of prosperity and economic growth. Our power sectors: share many legacy issues on how energy is generated and transmitted; are blessed with high renewable energy (RE) potential and some of the fastest rates of RE deployment in the world; and are undertaking (or have recently undertaken) major structural reforms to the markets, governance arrangements and infrastructure that underpin the sector in order to take advantage of the opportunity presented by a sustainable energy transition.

Future of Electricity Vietnam (FE-V) is a science-to-policy program made up of policy dialogues aimed at leveraging the Australian experience in energy transition to support Vietnam in exploring practical and feasible interventions for a decarbonised, reliable and affordable power system.

Recognising 50 years of diplomatic relations between Australia and Vietnam, FE-V is an initiative of the Australian Embassy in Hanoi bringing Australian and Vietnamese experts together to share experiences and to co-develop knowledge products of prioritised topics relating to 5 main dimensions of the power sector (generation, fuels, consumption, grid and market) with support of the Central Economic Commission of the Communist Party of Vietnam (CEC). The FE-V initiative is divided into two phases. , on Vietnam's energy transition, including support to a review of Resolution 55three years'after its' approval .

FE-V is delivered by Australia's Partnerships for Infrastructure (P4I) and the Australia - Mekong Partnership for Environmental Resources & Energy Systems (AMPERES) together with the Australian National University (ANU) and Commonwealth Scientific Industrial Research Organisation (CSIRO). P4I is an Australian Government initiative partnering with Southeast Asia to drive sustainable, inclusive, and resilient growth through quality infrastructure. Led by the Australian Department of Foreign Affairs and Trade, P4I is implemented by EY, Adam Smith International, The Asia Foundation and Ninti One.

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Photo: The 15th Vietnam National Assembly's meeting. Photo courtesy of Van Diep – Vietnam News Agency.

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ABBREVIATION LIST

Abbreviation	Full name
AC	Alternating Current
ASEAN	Association of Southeast Asian Nations
BESS	Battery Energy Storage System
BOT	Build-Operate-Transfer
C&I	Commercial and Industrial
CEC	Central Economic Commission
COD	Commercial Operation Date
CSR	Corporate Social Responsibility
DC	Direct Current
DER	Distributed Energy Resources
ETS	Emission Trading System
EVN	Electricity Vietnam
EV	Electric vehicles
FCAS	Frequency Control Ancillary Services
FDI	Foreign Direct Investment
FE-V	Future of Electricity Vietnam
FiT	Feed-in-Tariffs
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GW	Gigawatt
IBR	Inverter-based Resources
ISP	Integrated System Plan
kWh	Kilowatt-hour
LCOE	Levelized Cost of Electricity
LNG	Liquefied Natural Gas
LRMC	Long-run Marginal Cost
MOF	Ministry of Finance
MOIT	Ministry of Industry and Trade
NEM	National Electricity Market
NLDC	National Load Dispatch Centre
PDP	Power Development Plan
PHES	Pumped Hydro Energy Storage
PPA	Power Purchase Agreement
RE	Renewable Energy
REZ	Renewable Energy Zone
RITs	Regulatory Investment Tests
RTS	Rooftop Solar
SMO	System Market Operator
SoE	State-owned Enterprise
The US	The United States of America
USc	US cent
VRE	Variable Renewable Energy
WEM	Wholesale Electricity Market

I STATUS AND CAUSES

Vietnam has been gone through a remarkable transition since it embarked on systematic economic reforms in the mid-1980s. In the three decades between 1990 and 2021, the country has experienced an average annual real GDP growth of 6.6 %.[1] Rapid export driven industrial growth and large capital inflows have been key drivers of economic growth, as Vietnam shifted towards market-based reforms, and incrementally opened its economy to trade and foreign investment. At the same time, it has undergone a socio-economic transformation, from one of the world's poorest countries to a middle-income economy within one generation. Per capita GDP has increased from US$ 95 in 1990 to US$ 3,694 in 2021, and poverty has declined from a rate of 52% in 1992 to 1.8% by 2018.[2] This was accompanied by dramatic social change marked by falling population growth, employment growth in the manufacturing and service sectors and rapid urbanisation.

With the transition to a middle-income, industrial economy, Vietnam has become increasingly energy intensive, and increasingly reliant on electricity. Ensuring energy supply, and power supply in particular, have been central prerequisites for rapid growth. Between 1990 and 2019, total energy supply increased, on average by 5.8% per year.[3] Electricity consumption, driven largely by rapid growth in the manufacturing sector and rapidly increasing commercial and residential consumption, has grown from only 6.84 TWh in 1990 to 242.72 TWh by 2022[4], equivalent to an average annual growth rate of around 12.8% per year, and almost double the rate of GDP growth.[5] At the same time, Vietnam has managed a remarkable expansion of electricity access, the proportion of households with access to electricity expanded from approximately 10% in 1990 to over 99% in 2019.[6] This growth was enabled by a large capital investment program which saw expansion of: (i) generating capacity from 1,165 MW to 69,344 MW between 1986 and 2019, (ii) 220 kV transmission grid from less than 1,000 Km in 1985 to over 18,477 Km by 2019, and (iii) 500 kV transmission lines to over 8,510 Km[7].

Despite the relative successes of Vietnam's power sector in enabling economic development and providing basic public services to a large majority of the population, it continues to face multiple challenges: growth in electricity demand continues to outpace growth of the economy; deployment of new fossil fuel generation capacity (coal and gas) were substantially behind the schedule targeted in the national power development planning process; development of a competitive electricity market was also behind schedule; legal regulations for the energy sector were inadequate and inconsistent with international best practice; there was a mismatch between energy policy and market reform; since 2015 Vietnam became a net energy importer with coal as the main import fuel; and some energy projects invested by state-owned Enterprises (SoEs) suffered losses requiring state subsidies, for example, in 2023, EVN estimated a historical lost of 3.92 billion USD due to increase in price of imported coal, gas, oil

[1] Figures obtained from World Bank, 2022, World Development Indicators Database. Retrieved from https://databank.worldbank.org/source/world-development-indicators#.

[2] Ibid. Note the poverty rate cited here is based upon the international poverty line of US$ 1.90 per day adjusted for purchasing power parity.

[3] IEA, 2020, IEA Energy and Carbon Tracker 2020. Retrieved from https://www.iea.org/countries/viet-nam

[4] Ministry of Industry and Trade, 'Bộ Công Thương công bố Kết quả kiểm tra chi phí sản xuất kinh doanh điện năm 2021 và năm 2022 của EVN', 31/3/2023. https://moit.gov.vn/tin-tuc/phat-trien-nang-luong/bo-cong-thuong-cong-bo-ket-qua-kiem-tra-chi-phi-san-xuat-kinh-doanh-dien-nam-2021-va-nam-2022-cua-evn.html

[5] Ibid.

[6] World Bank, 2022, World Development Indicators Database.

[7] NLDC presentation at AER-ERAV exchange workshop

in the 2022-2023 term.[8] In addition, there remains a persistent financial problem for the power sector whereby the long-term marginal cost (LRMC) for new generation is higher than average retail price (see the Points for consideration No.4).

Responding to these challenges, in February 2020, the Central Committee of the Communist Party of Vietnam approved a resolution of the Politburo: Resolution 55-NQ/TW *On Orientations of Vietnam's National Energy Development Strategy to 2030 and outlook to 2045* (hereafter Res. 55). Res. 55 sets an agenda for Vietnam's energy sector framed by the twin dilemma of energy security and energy affordability. The resolution established a number of key objectives which reorient the energy sector in response to this twin dilemma; ensuring energy sector development keeps ahead of persistent demand growth; diversification of energy sources, market reform to eliminate subsidies and lack of transparency, advancement of the digital transformation of the energy sector, and consideration of energy efficiency and environmental protection within energy sector development and planning. To achieve this vision Res. 55 outlines ten key solutions[9] and tasked responsible government agencies to implement accordingly.

After three years of implementation, the Economic Commission of the Central Committee (CEC) is undertaking a mid-term review of Res. 55. The review comes at a time of significant dynamism in the energy sector. Many of the existing issues remain, but a suite of new issues and new opportunities have emerged. Chief amongst these has been the rise of renewable energy, with solar and onshore wind growing to 26.8% of total installed capacity by 2022 based on generous feed-in-tariffs for wind, utility-scale solar and rooftop solar (RTS)[10]. This progress in deploying renewables was bolstered by a number of high-level commitments, including Prime Ministerial commitment to a net zero target by 2050 at COP 26 (2021), approval of a National Climate Change Strategy (2022) and the 8th National Power Development Plan (PDP8) (2023).

PDP8 is the roadmap for implementation of Res. 55 in the power sector and establishes targets for Renewable Energy (RE) penetration in the national power generation mix: 28.5%[11] by 2030 and 78.5%[12] by 2050. The majority of new RE capacity in the short term (pre-2030) will be wind (especially onshore wind), while in the long-term (post-2030) offshore wind and solar will be the largest sources of generation. However, in the short-term, the plan continues to rely heavily on coal and gas comprising a substantial program to build new fossil fuel powered plants, until 2030 after which there will be no new coal, and 2035 after which there will be no new gas. In the long term, almost all these fossil fuel plants are expected to be converted to biomass, ammonia and hydrogen.[13] A target for Rooftop Solar (RTS) of an additional 2.6 GWp and 50% of all rooftops with RTS by 2030 is also included in PDP8. However, tight restrictions are made on new grid connection allowing zero export of RTS generated solar into the grid. This means that the system-wide impact of RTS is limited only to a behind-the-meter reduction in electricity demand.

[8] Vietnam Investment Review, 'EVN could lose more than $3.92 billion in 2022-2023', 31st March, 2023. https://vir.com.vn/evn-could-lose-more-than-392-billion-in-2022-2023-100086.html

[9] The ten solutions in Res. 55 can be summarised as: (1) Enhancing diversity, efficiency, reliability and sustainability of power development; (2) modernisation of the power sector; (3) restructuring of energy consumption sectors in line with clean, efficient energy priorities; (4) development of sustainable energy ecosystem in manufacturing and services along energy supply chain; (5) restructuring and improved performance of SoEs; (5) reform mechanisms and policies to enable market reform with a socialist orientation; (6) developing science, technology and human resources for the energy sector; (8) strengthening international cooperation and investment in the energy sector; (9) introduce environmental protection policies (decarbonisation and circular economy); and (10) enhancing party leadership and effectiveness of State management.

[10] NLDC data, updated 2022

[11] Includes onshore wind, offshore wind, solar, biomass but not roof-top solar.

[12] Includes onshore wind, offshore wind, solar, biomass, hydrogen but not roof-top solar.

[13] PDP8 stipulates that only 7.9GW of natural gas will remain by 2050.

Vietnam's progress and plans for energy transition are not without issues. The use of a generous feed in tariff has seen GW's of new RE deployed between 2020 – 2022 but it has also created a range of infrastructure, investment, market and management challenges. Grid congestion, voltage and frequency fluctuation, generation curtailment, transmission investment deficits and a shift in the main sites of generation (north to south), a growing load centre in the north have all emerged as limitations on the implementation of PDP8.

A plan for market reform, enshrined in the 2004 Electricity Law, has also suffered from delays, with efforts to introduce competition into the generation sector through the implementation of a wholesale electricity market running behind schedule. As there are efforts to vertically unbundle governance and management of the electricity sector and to introduce a retail electricity market. A key challenge undermining the market reform agenda has been the lack of cost-reflective pricing for electricity – that is, the electricity tariff does not cover the true cost of electricity supply, causing significant financial challenges for entities involved in the generation, transmission and distribution of electricity services and requiring subsidies and other forms of governmental support. Competitive markets are unlikely to function effectively without cost reflective pricing and their absence will also undermine efforts to advance the energy transition and meet the governments net-zero target.

II RATIONALE

Australia is a regional neighbour and peer facing the same regional challenges and sharing the same aspirations for sustainable, secure and affordable, electricity services as the basis of prosperity and economic growth. Like Vietnam, Australia is highly vulnerable to climate change, and shares many legacy issues on how energy is generated and transmitted. Australia is blessed with immense renewable energy resources and is undergoing the fastest rate of renewable deployment in the world. There are also important differences between the Vietnamese and Australian power system: in Vietnam energy demand has sustained and will continue to maintain decades of rapid growth while energy demand in Australia has been stagnant. Australia has established a functional competitive retail market for electricity and operates dozens of energy markets for specific energy services (for example Frequency Control & Ancillary Services and capacity markets) while Vietnam's progress towards a retail electricity is behind schedule. Australia is a net exporter of energy whilst Vietnam has since 2015 become a net importer of energy.

Importantly, like Vietnam, Australia is also undertaking (or has recently undertaken) major structural reforms to markets, governance arrangements and infrastructure that underpin the sector. This commenced with the 2017 *Independent Review into the Future Security of the National Electricity Market* (known as the Finkel Review) which outlined the key reforms needed to ensure an orderly and efficient energy transition in Australia. The Finkel review has proven pivotal in establishing a systematic agenda for Australia's energy sector providing a roadmap for ongoing reforms, creation of an Energy Security Board, establishing the economic opportunity for energy transition, introducing an integrating system planning process and, following the change in Federal government in May 2022, the consideration of significant structural and policy changes.

Commemorating 50 years of diplomatic relations, Australia and Vietnam are strengthening cooperation toward a Comprehensive Strategic Partnership. Cooperation on energy and climate change is a core priority within this agenda. A range of cooperation initiatives are under discussion, the first being the Future of Electricity Vietnam (FE-V), a science–to–policy program aimed at leveraging Australia's energy transition experience to support Vietnam explore practical, feasible interventions in the power sector that ensure a decarbonised, reliable and affordable power system. The first phase (December 2022 – July 2023) focussed on collaboration with CEC to document and share Australia's energy transition experience in dialogue with Vietnamese stakeholders, and to support CEC during the mid-term review process of Res. 55.

This policy note draws on Australian perspectives on the energy transition, to take stock of the current structure and dynamics of the Vietnamese energy sector, and suggests points for consideration for the mid-term review of Res. 55 vis-à-vis strategic orientation of national energy development. These points for consideration are distilled from the five FEV thematic discussion papers[14], and the discussions between Vietnamese stakeholders during the FEV High-Level Policy Dialogue and FEV Technical Roundtable, held in June 2023. These solutions and points of consideration are submitted for consideration by CEC.

III OUTLOOK & ENTRY POINTS

Points for Consideration:

Vietnam could consider the reforms following on from the Finkel Review and revise the guiding perspective for the energy sector in Vietnam from a dilemma (energy security & affordability) to the trilemma of security, affordability, and sustainability. Establishing a clear environmental objective for development of the energy sector will provide a formal basis to embed the Government's net zero commitments into the dynamic ecosystem of policy, regulatory and planning instruments of governments and ensure Vietnam's net-zero aspirations guide infrastructure investment and development trajectories.

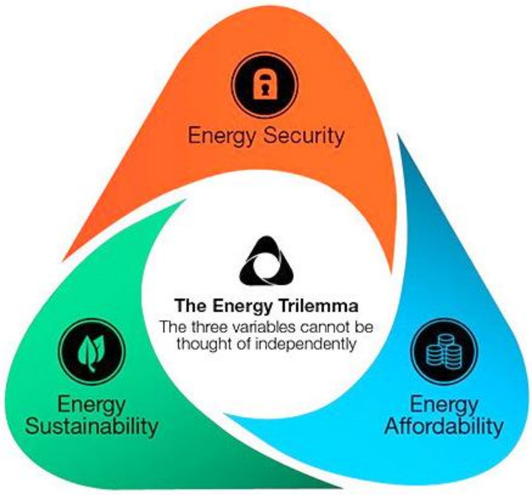
Justification: Vietnam's energy system has been the backbone of the nation's development trajectory; an essential ingredient for social wellbeing and prosperity; and a critical input for Vietnam's rapidly industrialising economy. Increasingly, it is also a driver of environmental change – particularly through the pollution created by its by-products like greenhouse gas (GHGs) emissions and other forms of air pollution, but also through the changes in land and water use/access for other sectors and the natural environment.

Res. 55 establishes an orientation for the power sector framed by the twin issues of energy security and electricity affordability. This framing of the problem was appropriate three years ago when there was a looming risk of power shortages and persistent financial issues for the sector as the cost of generating and transmitting electricity exceeded the tariff paid by the consumer.

While the potential for power shortages and the power sector financial deficits remain, Vietnam, recognising its own high levels of vulnerability to climate change, has elevated the importance of climate response through its commitments in the international arena, and the addition of tens of GWs of variable RE to the grid. Meeting these climate commitments and maintaining momentum in the deployment of RE will require a transformation in how Vietnam's energy sector sets priorities and delivers development in the energy sector.

[14] The FE-V team produced Discussion Papers documenting the Australian experience with energy transition under five themes: generation, fuels, grid, demand and markets.

Figure 1 | The energy trilemma



Australia is currently engaged in a process to include an environmental objective (aimed at reducing greenhouse gas emissions)[15] in the National Electricity Objectives of the National Electricity Law[16]. The CEC should likewise raise the profile of sustainability in any revisions to of Res. 55. It can do so by expanding the energy dilemma into a trilemma by also including an environmental objective to decarbonise the economy. Vietnam's future energy system should find a balance between the social, economic and environmental objectives which guide development of the national energy system. The energy trilemma provides a framework to interpret this:

- **Energy security** is the effective, reliable management of energy supply to ensure it meets demand both today and in the future, both under normal circumstances and in times of crisis. For Vietnam this includes ensuring sufficient new generation capacity each year to keep up with rising demand, sufficient installed capacity to meet seasonal peak demands, diversification of generation sources to manage the variability of energy resources and reduction of Vietnam's dependency on energy imports which are subject to volatile global electricity markets or geopolitical tensions.
- **Energy affordability** is the cost of electricity relative to the earning capacity of electricity consumers. For Vietnam, where electricity is a public good, this is first a social concern to ensure a fair cost of living to all citizens in the country, but also a commitment to keep the cost of electricity low to sustain productive economic uses of electricity in factories and commercial facilities throughout the country.
- **Energy sustainability** is the effective minimisation of adverse environmental impacts caused by energy infrastructure or the by-products of energy generation and consumption. For Vietnam this is first and foremost aligning the energy sector to adhere to the net-zero commitments which the country has made at the highest level, but it also considers improved air quality in Vietnam's cities and reduced competition between energy infrastructure and other land and water users through integrated planning and equitable benefit sharing mechanisms.

[15] Department of Climate Change, Energy, the Environment and Water (DCCEEW), 'Incorporate an emissions reduction objective into the national energy objectives', 2022, accessed June 2023. https://www.energy.gov.au/government-priorities/energy-and-climate-change-ministerial-council/priorities/national-energy-transformation-partnership/consultation-proposed-legislative-changes-incorporate-emissions-reduction-objective-national-energy-objectives
[16] Australian Energy Market Commission (AEMC), 'National Energy Objectives', 2023, accessed April 2023. https://www.aemc.gov.au/regulation/neo

IV SOLUTIONS & POINTS FOR CONSIDERATION

Embedding the energy trilemma in Vietnam's energy sector will enable Vietnam's energy transition but it requires wide-ranging reform in policy, regulations, planning and infrastructure and investment space. Based on Australia's experience, we propose 10 points for CEC's consideration, 10 key reforms which are of highest priority in the short-term (Table 1).

The ten opportunities presented in this policy note have been distilled from a series of five Energy Transition Discussion papers which document the Australian experience with the energy transition for: fuels, generation, grid, demand, and market. The discussion papers were produced by the FE-V team between December 2022 – June 2023. The suggestions also draw on the discussions and conclusions which arose during the high-level FE-V Policy Dialogue (June 2023) and associated roundtable events.

Table 1 | Strategic security, affordability, and sustainability relevance of the 10 points for consideration (Dark colours shows high significance, and light colours low significance)

Scale		**Points for consideration**	*Security*	*Affordability*	*Sustainability*
National socio-economy	1	Enabling economic growth while minimising the impacts onenergy demand	Highly significant	Critical	Highly significant
National socio-economy	2	Reform towards integrated and inclusive planning	Critical	Highly significant	Highly significant
National socio-economy	3	Introduce a cost for negative environmental and social externalities of the power system	Highly significant	Significant	Critical
Electricty sector	4	Close the gap between the cost of electricity production and retail cost of consumption	Significant	Critical	Highly significant
Electricty sector	5	Diversify markets, not just market reform	Critical	Significant	Significant
Electricty sector	6	Modernise the grid to accommodate high penetration of renewables	Highly significant	Significant	Critical
Electricity subsectors	7	Establish gas as flexible balancing fuel to accelerate further renewables, not as a replacement baseload for coal	Highly significant	Significant	Critical
Electricity subsectors	8	Prioritise targeted flexible power sources before 2030	Highly significant	Highly significant	Critical
Electricity subsectors	9	Enable price discovery and accelerate the implementation of a competitive, open wholesale electricity market	Significant	Critical	Critical
Electricity subsectors	10	Manage DERs as a network asset not just as a electricity consumer asset	Highly significant	Significant	Critical

Importance

- Critical for the energy trilemma
- Highly significant for the energy trilemma
- Significant for the energy trilemma

The opportunities are ranked by importance (orange) and scale (green). Importance is determined based on the relevance of the opportunity to each dimension of the energy trilemma. Scale characterises the opportunities based on their relevance to national socio-economic development (high), the whole electricity sector(medium) or one or more of the subsectors in the electricity system.

1 Enabling economic growth while minimising the impact on energy demand

For the past two decades, Vietnam's electricity demand has grown significantly faster than the national economy[17], reflecting a transformation in Vietnam's economic structure as it moves from an agricultural to an industrial and service economy. The strong and persistent demand for electricity means that the economic performance of the country is strongly dependent on the performance of the power sector and its ability to continue to meet rising demand. In Australia, a key milestone for the power sector was the decoupling of electricity demand growth from economic growth. This occurred in the mid-1990s when efforts in demand management and energy efficiency were able to curtail growth in demand without impinging economic growth. Indeed, many energy efficiency strategies are revenue-positive with minimal transaction costs.

Points for consideration:

Vietnam should establish a goal to decouple economic growth from electricity demand growth as a key energy security goal of sector development planning. Achieving this target will require clear and practical strategies to improve energy efficiency, optimise system benefits of Distributed Energy Resources (DERs) and establish a fair and financially sustainable electricity tariff:

i. *Energy Efficiency:* Vietnam is amongst the most energy intensive economies in Southeast Asia consuming more energy per unit of GDP than other ASEAN countries[1]. Improving the efficiency of energy consumption – especially for commercial and industrial (C&I) users is essential to the long-term security of the energy system. Vietnam has previously promoted energy efficiency measures[18], but – as Australia did in the 1990s – these efforts should be consolidated and expanded into an all-of-government strategy backed by policy reforms and market measures to scale progress on energy efficiency.

ii. *Distributed Energy Resources (DERs):* PDP8 endorses an ambition to install Roof-top Solar systems on 50% of office buildings and residential homes by 2030. While PDP8 removes barriers and allows RTS, it does not incentivise DERs. Achieving this target for RTS could have a strategic impact on curbing energy consumption but can also lead to impacts on peak demand. Vietnam should develop a strategy that incentivises RTS and other DERs to achieve system benefits including the reduction in demand (see Points for consideration 4 below).

iii. *Electricity tariff:* Vietnam's power sector suffers from a persistent, long-standing issue – the long term marginal cost of generation is higher than the retail tariff for electricity. This has caused financial issues, presents a barrier to attracting much needed investment in new generation and effectively disincentivises investment in energy efficiency. Addressing this is a strategic priority for the sector and requires efforts to both enable price discovery for new generation investments (Points for consideration 3) and to advance cost-reflective pricing (Points for consideration 9). The increase in the electricity tariff will also increase the energy conservation from end users, hence has positive impact on reducing energy demand. On 9th November 2023, Vietnam increased

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17 Vietnam's elasticity of electricity to GDP has averaged 1.5 – 2.0 since the early 2000s. See Le. P.V. Energy demand and factor substitution in Vietnam: evidence from two recent enterprise surveys. Journal of Economic Structures, 2019. https://doi.org/10.1186/s40008-019-0168-9

18 Vietnam has promulgated a Law on Energy Efficiency and Energy saving in 2010, supported by government decrees to support its implementation. A National Program on Energy Efficiency and Energy Saving Use has also been developed and under implementation over the last decade.

electricity tariff for the 2nd time in the year by 4.5%. However, the electricity production cost in 2023 is estimated at 2,098 VND/kWh which is still higher than the average retail tariff (2,006.79 VND/kWh).[19]

2 Reform towards integrated and inclusive planning

The national Power Development Plan (PDP), currently in its eighth version, is the peak planning document for the power sector in Vietnam. The plan is developed approximately every five years following a logic of bulk supply-demand balance.[20] For each plan the Ministry of Industry and Trade (MOIT) models future electricity demand. Public and private investors then propose individual electricity generation plants, and the government prepares an authorised list of generation projects to meet demand projections. The priority projects are in specific locations with current or planned grid access. This is the primary means of staging development of power sources. Developers seek to get projects listed as a means of indicating project feasibility to potential investors.

However, the system encourages lack of transparency in the selection of projects as it allows for developers to bargain with officials and against each other for inclusion in the list. It also lacks flexibility in allocating sites to least cost sources. Developers prefer this process as it gives them a degree of certainty within their own project cycle, but the social cost is in lack of transparency leading to inefficient selection of projects. This approach has been successful in the past, but the rapid introduction of renewables into the power system has caused issues for this bulk supply-demand logic. The rapid deployment of renewables was concentrated in a few discrete locations of Vietnam, with historically limited demand for causing issues of grid congestion and curtailment, while the rapid uptake of rooftop solar changed the net demand profile in high demand commercial and industrial areas. These challenges, amongst others, have exposed weaknesses in the PDP process initiating some reform for the eighth plan between 2019 and 2020, making the planning process more strategic and transparent which is then supported by an annual implementation plan listing specific projects for developing each year.

In 2018, in response to the challenges facing the energy transition in the National Electricity Market (NEM) and Western Australia's Wholesale Electricity Market (WEM), Australia introduced an Integrated System Plan (ISP) as a whole-of-system spatio-temporal planning process, supplemented by other planning mechanisms like Renewable Energy Zones (REZs). These processes continue alongside mechanisms such as Regulatory Investment Tests (RITs) for network infrastructure expenditure and development of transmission lines, a Capacity Investment Scheme[21] that includes storage to support renewables, and industry and public consultation mechanisms. Collectively these mechanisms provide a whole-of-system approach to planning that is better suited to the complexity of energy planning for systems under transition with complex geographical interconnections.

Further, the ISP is reviewed every two years via a consultation process. The National Electricity Rules require AEMO to develop, consult and publish the ISP Methodology in accordance with the Australian Energy Regulator's (AER's) Forecasting Best Practice Guidelines. In developing

[19] https://hanoitimes.vn/power-price-increase-has-minor-impact-on-socio-economic-conditions-325332.html#:~:text=On%20November%209%2C%20the%20ministry,920.37%20(%240.079)%20per%20kWh.

[20] This outline of the PDP process is summarised from HD Minh, "Decentralized renewable energy broke Vietnam's power planning logic", CIRED Working Papers hal-03197064, HAL, 2021. https://ideas.repec.org/p/hal/ciredw/hal-03197064.html

[21] Australian Government, Capacity investment scheme, n.d., accessed 10th July 2023. https://www.energy.gov.au/government-priorities/energy-supply/capacity-investment-scheme

the ISP Methodology, AEMO sought stakeholder input and feedback through workshops as well as written submissions[22].

The development of new generation in the REZs is contingent upon the developer competing for a share in the market, rather than being included in a list of approved projects as undertaken in PDP8.

Points for Consideration:

Vietnam should continue reviewing and improving the PDP process, including the PDP itself and the annual implementation plan supporting its implementation, to better integrate geospatial planning that accounts for both generation and network investment, and inclusive consultation into the process. In addition to improving integration and inclusivity, the PDP process should also improve accountability of plan implementation, for example establishing a regular (e.g., every two years) public monitoring and reporting process to document and share progress. Reforms to the PDP process should also account for multiple uses of land (for example agri-photovoltaics) and the environmental costs of energy development by formally integrating environmental assessment processes into strategic decision making.

3 Introduce a cost for negative environmental and social externalities of the power system

As the competitiveness of technologies can change rapidly with time, continuous opportunities for price discovery are needed to enable the cheapest technologies to be adopted. An important element in comparing generation prices is the inclusion of the cost of negative externalities, especially environmental costs such as greenhouse gas emissions causing climate change. Ideally, an economy-wide carbon price would enable such comparison, however, this has been politically impossible in Australia. For the two years that Australia did have a carbon price (2012 – 2014) a noticeable decrease in emissions occurred that was directly attributable to the introduction of the carbon tax, as evidenced by the rapid decline in brown coal generation which was the most heavily-emitting generator. Following removal of the carbon tax, brown coal generation immediately increased, with a commensurate increase in electricity emissions, thereby demonstrating the effectiveness of carbon pricing[23].

Vietnam, along with other countries with open economies, see trade barriers being erected through Carbon Border Adjustment Mechanisms. The best response, and one that keeps those fees and taxes in country, is to create national emissions trading and carbon pricing systems. Decree-06/2022/ND-CP on Greenhouse Gas Emissions and Ozone layer Protection authorizes creation of an Emissions Trading System in Vietnam. The MOF is also researching the feasibility of creating a Carbon Tax. However, we note that currently, PDP8 does not consider applying carbon pricing to the electricity sector.

The World Bank has suggested that a tax of $12 USD per ton of CO_2 would be equivalent to the weighted average cost of the Environmental Protection Tax on coal, gasoline, and diesel. If the cost of these taxes over time can be built into the LCOE for generation by source, the actual cost of coal thermal power and LNG to power relative to renewable sources would become more transparent – thereby enhancing price discovery. Revenue from the sale of Emissions Allowances and Carbon Taxes could also be used to finance the transition to a lower carbon

[22] Australian Electricity Market Operator (AEMO), Consultation on IPS methodology, July 2021, accessed 27th 2023, https://aemo.com.au/en/consultations/current-and-closed-consultations/isp-methodology
[23] 23 See Discussion paper "Future Demand"-FEV, Issue 4, section B2

economy and support vulnerable communities.

Points for Consideration

Vietnam should investigate options for carbon pricing in the electricity sector (or more broadly across all sectors of the economy) as a least-cost way of supporting price discovery and of encouraging decarbonisation by reflecting the true cost of emissions and discentivise the use of fossil fuels. In addition, currently, Vietnam issued decree 06 on Mitigation of GHG and Ozone layer projection protection which will set foundation to set cap on total carbon emission and allow entities to trade credits according to their usages through Emission Trading System (ETS).

The two mechanisms should be both introduced in Vietnam as two type of carbon pricing have been proven to be effectively reduce the externalities of energy system. However, Vietnam should consider carefully whether the carbon tax will be overlapped with the current "Environment protection tax" which is already imposed on fossil fuels.

4 Enabling greater cost recovery by closing the gap between the cost of supply and retail tariffs

Having a credible long-term pathway towards higher levels of cost recovery and more cost reflective tariffs is both a challenging but essential component of reform. It is:

- *Essential* – because proposed reforms targeting increased efficiency and competition, increased private investment, and investment in new technologies to achieve sustainability are unlikely to be achievable without a credible pathway to higher levels of cost recovery and thus more cost reflective tariffs
- *Challenging* – because closing the gap between underlying supply costs and electricity tariffs whilst delivering on reliability and sustainability goals is in conflict with the objective of affordability. More cost reflective tariffs to achieve higher levels of cost recovery directly challenge other vitally important socio-economic goals and policies (e.g., social stability and economic development). All countries have found balancing the need to have more cost reflective tariffs with these goals extremely challenging, including Australia. Most regions are managing this balance through a range of fuel supply subsidies, government contracting for energy supplies, direct investment in generation and transmission projects, wholesale market price caps, various forms of network and electricity tariff cross subsidisation and support to specific customer classes through social welfare or direct co-payments.

There are a range of methods by which to develop a credible pathway that over the longer term appropriately balances meeting these objectives whilst mitigating the impacts of more cost reflective tariffs, some of which are outlined below. These pathways all involve a transparent and balanced level of government control of tariff policy to manage the process and retain the capacity to make policy adjustments if socio-economic goals and polices are being unduly impacted. In this respect, the long-term pathway is unlikely to have a determinate endpoint, because as circumstances change, so do priorities. However, a transparent credible pathway will be a strong indicator of policy direction and give confidence to potential investors.

Vietnam's average retail tariff remains considerably lower than the estimated long-run marginal cost (LRMC) of supply (i.e. the level needed to ensure sufficient investment in system expansion).[24] Currently, the average retail tariff is estimated to be approximately USc 8.2 per kWh (1,920.4 VND) (excluding the value added tax-updated in May 2023),[25] compared to an estimated LRMC of around USc 13 per kWh by 2030.[26] To put this into context, prior to the rise in electricity tariffs driven by the conflict in Ukraine, the average world retail tariff in 2021 was USc 12.4 per kWh, and in the region the Philippines had a retail tariff of USc 17.2 per kWh.[27] For comparison to Australia, average tariffs were estimated to range from USc 14 per kWh in Victoria to USc 25 per kWh in South Australia. Since the mid-1990s, in numerous agreements with International Financial Institutions (IFIs), Vietnam has considered increasing end user tariffs to a level which better reflect costs and put the sector on a sustainable financial footing. However, raising end user tariffs has proven politically difficult and there remain concerns that increased electricity prices may drive up inflation.

Maintaining subsidised tariffs is, however, becoming increasingly difficult. Demand growth means the amount spent on subsidising the tariff places an increasing burden on public finances to the point that it will be unsustainable.[28]

Although the government has issued several rules and regulations to guide the tariff adjustments, actual implementation of the increase (i.e., when to increase, the increase level and targeted consumer groups) is strictly controlled by the government and is only approved with serious consideration of its potential socioeconomic impacts and when approved, the approved increase was usually minimal and did not reflect the required increase to lift tariff levels to fully reflect the costs of production. For example, the most recent approved increase was 3%, while the proposed level that reflected the increase in production cost was much higher. While this control may have benefits in the short-term, for the economy and people living in terms of having a low and stable electricity tariff, in the long term it jeopardises supply security as it acts to discourage investment.

The ultimate solutions that are suitable for closing the gap between the cost of supply and end-user retail electricity price tariffs will be specific to the situation in Vietnam. Some examples of the Australian experience may be informative to help guide analysis of options and timetables for reforms.

Australia is a federation of six states which, together with two self-governing territories, have their own constitutions, parliaments, governments and laws. As such, there have been different solutions applied in the different regions which best suit the regulatory, policy, industry and population in those regions. For example, some state governments in Australia maintain uniform tariff policies where all small-use customers pay the same retail electricity tariff. In such cases, the cost of the subsidy is reported publicly each year, and it is transparent as to how the subsidy will be funded. Under the Western Australia Uniform Tariff Policy[29], the costs of subsidising electricity prices for remote regions (where the costs of supply are higher) are partially funded by a Tariff Equalisation Contribution fund, collected through electricity network charges paid by customers in the more densely populated areas of the State. These amounts are published annually in State Budget Papers, with the Tariff Equalisation Contribution (i.e., the

[24] The marginal cost is the cost to supply an additional increment of a good, long run marginal costs for the power sector incorporate the costs of network and generation system expansion assuming all factors of production can be varied.

[25] Vietnam Investment Review, 'Reliability remains issue in Vietnam electricity policy', 18th May 2023, accessed 26th July 2023. https://vir.com.vn/reliability-remains-issue-in-vietnams-electricity-policy-101924.html

[26] Explanatory report of PDP8, version April 2022

[27] EVN (2021), 'Where is the average electricity tariff of Vietnam compared to the world?', access 14th July 2023.

[28] Expected growth in demand is 8-8.5%/year to 2030 and 4.0%/year in the period from 2030-2045.

[29] Government of Western Australia, 'Household electricity pricing', 1st July 2023. https://www.wa.gov.au/organisation/energy-policy-wa/household-electricity-pricing#:~:text=The%20Uniform%20Tariff%20Policy%20means,supply%20electricity%20are%20considerably%20higher.

annual subsidy) estimated to be AUD 175 million in 2022-23.[30] Similarly, under Queensland's Uniform Tariff Policy, the cost of subsidising electricity prices for rural and remote customers is paid by the Queensland Government as a Community Service Obligation (CSO) payment directly to Ergon Energy (i.e. the network operator and retailer). In 2022-23, the annual CSO was estimated to be AUD 635 million.[31] This subsidy is effectively funded from the distribution of profits received from ownership of generation assets. However, as a result of these two examples, there is no competition between electricity retailers for small-use customers in rural and remote Western Australia and Queensland.

In other parts of Australia, full retail competition and fully deregulated tariffs have been adopted through a careful and staged process of removing regulation and introducing competition in each market. Typically, competition is only introduced when there is sufficient depth in the number and scale of retailers, and measures are introduced first for large customers before small customers. Despite the appearance of fully deregulated electricity tariffs, Australian government regulators regularly review the state of competition and have re-introduced forms of retail price regulation where insufficient competition has not delivered the intended outcomes for customers. Since 2013, the Australian Energy Regulator[32] has undertaken annual reviews of retail energy competition in the NEM to assess whether there is effective competition. Since 2019, the Australian Energy Regulator has set a Default Market Offer (i.e. effectively a regulated retail price cap) in some markets to act as a reference price cap for residential and small business offers.

Even more targeted approaches to providing safeguards for vulnerable customers are actively applied in fully liberalised markets. Governments in Australia also offer direct rebates on electricity prices to pensioners and vulnerable customers through the social welfare system which are funded through general taxation and transparent government budgeting processes.

In Australia, the reforms to liberalise the electricity sector that commenced in the 1990s were driven by objectives to improve the efficiency, competitiveness and financial sustainability of the electricity sector.

The sooner a credible roadmap to tariff reform is adopted in Vietnam the better, avoiding the potential for a damaging crisis in the sector. In many ways this is a political problem, especially when the sector largely remains under the ownership and control of the state. Solutions to the problem are political and institutional, and related to governance of the sector. There will remain a strong case for subsidising electricity consumption amongst the poorest users, but in so far as is possible this should be managed in a way that does not affect the key cost-discovery function of sector reforms or affect the financial sustainability of the sector.

Points for consideration

Vietnam could consider developing a credible, long-term pathway to higher levels of cost recovery and more cost-reflective tariffs. The broad approach could be similar to that adopted by Australia and other countries, but be tailored for the local Vietnamese context. This includes:

i. Understand the status and progress towards cost recovery and specify targets and time-frames for achieving more cost *reflective* tariffs

[30] Western Australia State Budget 2023-24, Budget Paper No.1, Volume 2, page 805. Available online at https://www.ourstatebudget.wa.gov.au/2023-24/budget-papers/bp2/2023-24-wa-state-budget-bp2-vol2.pdf
[31] Queensland Competition Authority, Regulated retail electricity prices in regional Queensland 2023-24 – Final determination, June 2023, page 10. Available online at https://www.qca.org.au/wp-content/uploads/2022/12/notified-prices-final-determination-june-2023.pdf
[32] The Australian Energy Regulator collaborates with the efforts of the state based energy regulatory bodies and the national Australian Energy Market Commission to establish an effective upper bound, or retail electricity price cap as a customer safety net. This is called the Default Market Offer.

ii. Develop a broader strategy to get there with tangible objectives and constraints (i.e., decision rules) on the process. In other words, strong government control over the process and rules on what will and will not be tolerated in terms of customer price impacts (e.g. no more than X% price increases in a year for customer segment Y)

iii. Integrate that strategy with the broader energy reform program to achieve greater reliability and sustainability, as parts of that broader energy reform program will create opportunities and risks, for moving toward greater cost recovery

iv. With that context a credible long-term pathway to greater cost recovery and more cost reflective tariffs will likely have the following key features:

   a. Use the broader social welfare system, wherever possible to protect vulnerable customers.
   b. Where the social welfare system is unable to do that effectively (which is often particularly the case in rapidly developing economies), relying on tariff policies.
   c. Where tariff policies are relied on targeting those policies as much as possible to the customers you are seeking to protect (e.g., this includes industry, particularly trade exposed industry). Such tariff policies have typically included the following features:
      - Using more cost-reflective tariffs generally but providing rebates wherever possible to the customers you want to protect.
      - Where rebates are not fully effective, using less cost reflective tariffs but including long term adjustment mechanisms to move to more cost reflective tariffs.
      - Where tariffs are used, ensuring subsidies are embedded in network tariffs to minimise the distortion on the competitive parts of the supply chain (i.e., generation) and thus distorting investment decisions.

5 Diversify markets, not just wholesale electricity market reform

The primary objectives of establishing competitive energy markets in Australia were the same as many other markets around the world to: (i) facilitate competition. (ii) allow customers to choose their trading partners, (iii) provide fair access to the market, (iv) remove barriers to entry, (v) eliminate discrimination between energy sources and technologies, (vi) facilitate trading between and within regions, (vii) stimulate innovation, and (viii) ultimately to deliverer lowest cost of energy supply.

In Australia a core principle that guided the proposed structure of the NEM and WEM market design was to establish market mechanisms only where there was likely to be sufficient depth in supply options to enable adequate competition. The scale of the NEM power system enabled adequate competition for the provision of energy and for the provision of frequency keeping services. The disaggregation of generation assets into multiple competing portfolios suggested that a gross-pool energy only market design could work. This was supported through a number of trial markets in the lead up to market start. From the outset, the NEM design incorporated real-time markets for energy and eight frequency control ancillary services (FCAS) markets.

The Law on Electricity (2004) set a road map for liberalisation and reform of the Vietnamese power sector towards a single buyer competitive generation market (2009), wholesale electricity market (2022), and a retail electricity market (2024). Progress has been slower than planned. As noted above the lack of transparency and competition in Vietnam's energy market compromises the ability of Vietnam's power system to achieve all three objectives of the trilemma. Points for Consideration 3 identifies solutions to enable price discovery in the short term to alleviate slow market progress, and in the long term accelerate implementation of a competitive, transparent market. The market design in Vietnam is based on the gross pool market principles with the objective to optimize electricity price during each bidding cycle and within the technical operating limits of the system. From the outset, the intention is to have greater participation from various power plants including: Build-Operate-Transfer (BOT) power plants, strategic multi-purposed hydro power plants and also RE power plants.

In comparison with Australia's market, the proportion of power plants that directly participate in the market is not high, approximately 36%. Vietnam also does not have sufficient conditions in terms of governance structure (establishment of independent System Market Operator (SMO) or IT infrastructure to reach a mature stage of development as Australia has). For the wholesale market, Vietnam only has an energy-only market, while Australia has energy markets (NEM, WEM) and numerous other markets, including eight frequency control ancillary services (FCAS) markets at various timescales to support the system reliability. In addition, a capacity market to deliver flexible renewable supply is being developed for the NEM and has been a feature of the WEM from the outset of market formation in 2006.

Importantly, Australia has a mature financial market to facilitate investors managing their risks through various hedging methods. The financial market in Vietnam is currently at the stage of analysis for pilot implementation. The transparency of the market is also a key point for Vietnam to consider increasing the attractiveness for the private sector.

Points for Consideration:

Market reform in Vietnam should extend beyond a competitive energy-only market and consider establishing additional markets for Frequency Control Ancillary Services (FCAS) as well as exploring capacity markets and financial markets. These markets value services and products that are essential for power systems experiencing a high level of variable renewable energy penetration: for example, frequency/voltage regulation, and short/long duration storage.

6 Modernise the grid to accommodate high penetration of Renewables

The key technical grid issues for the future of electrical power systems, as the change in dominant generation technology shifts from synchronous generation to inverter-based generation, and from dispatchable to intermittent energy supplies, are grid stability and energy reliability. Grid stability amounts to the ability of the electrical power system to maintain a balance between total generation and load on short term time scales of the order of minutes to fractions of a second. These must be kept in balance within tight tolerance limits to prevent synchronous generators from disconnecting, which could result in a chain reaction and system blackout. Energy reliability is dependent on grid stability, but further also always requires an adequate quantity of energy resources, and capacity of the transmission network, to supply total demand.

Points for Consideration:

Considering that wind and solar will increasingly dominate the system, Vietnam could consider the following:

i. Identify renewable energy zones to guide the development of the transmission grid, including common grid infrastructure.
ii. Take a systematic approach to develop the backbone network (considering the relative merits of a higher voltage AC network or high voltage DC network)
iii. Enable private actors to make investments in and operation of specific transmission lines. Consider incentivising investment by clarifying the process of investment and by providing guaranteed revenue streams, while protecting electricity customers by limiting permitted prices or total costs[33] .
iv. Develop battery storage systems to enhance power quality by providing FCAS.
v. Develop pumped hydro energy storage (PHES) to balance fluctuations in wind and solar resource availability (consistent with PDP8 projections of requirements for 30650-45550 MW power storage by 2050)
vi. Consider the potential for battery electric vehicles to provide flexible demand, or contribute to energy storage to supply consumers at times of high electricity demand (vehicle to home or vehicle to grid. Retail tariffs that vary by time of day may be sufficient to encourage use of electric vehicles for electricity storage.
vii. For faster time scale contributions to frequency stability, ancillary markets are one way to incentivise end-users.
viii. Enhance the visibility of RTS for the system operator to plan ahead through, for example, establishing a mandatory small scale generation register tied to the approval process and by allowing the network operator to monitor and control inverter based resources.
ix. Consider the development of virtual power plants to take advantage of existing RTS particularly when they are equipped with battery storage systems that can also provide ancillary services.
x. Consider the export of rooftop solar to the grid within the distribution network (see Points for Consideration 4 above).

7 Establish Gas as a flexible balancing fuel to accelerate further renewables, not as a replacement baseload for coal

In some countries, natural gas has in the past played a transitional role in the pathway to a net-zero emissions energy system by providing a lower carbon substitute for higher CO2 content coal and oil generation[34], and then being replaced by renewables. Natural gas is a cleaner alternative to coal and oil, and its use has already contributed to a reduction in greenhouse gas emissions in some parts of the world. However, it still emits carbon dioxide when burned, and its production and transport can also result in methane emissions. As such, it is not considered a long-term solution to achieving net-zero emissions. In Australia, retiring coal power stations are replaced with renewables without transitioning through gas. Gas is, therefore, not a transition fuel, but it continues to play a role in the Australian electricity system for firming and peaking supply. In a few isolated instances, coal power stations were used for both electricity and heat which has seen these power stations replaced with base-load gas plants. In the US, cheap, plentiful supplies of unconventional gas over the past two decades have initially

[33] See FEV Discussion paper, Future Grids, Issue 3, especially B3
[34] Gursan, C., de Gooyert, V. 2021. 'The systematic impact of a transition fuel: Does natural gas help or hinder the energy transition.', *Renewable & Sustainable Energy Reviews*. Vol. 138 March 2021, 110552 https://doi.org/10.1016/j.rser.2020.110552

replaced coal-fired generation in the electricity system, and then more recently have been joined by solar and wind.[35] In Australia, gas-fired electricity generation has declined over the past decade or so, from a peak of nearly 22% in 2013-14 to around 18% currently[36]. When coal-fired generators have retired, they have been replaced directly by solar and wind - without a transition through gas. This is because the excellent solar and wind resource in Australia combined with decreasing costs of installation have meant that solar and wind have been the cheapest form of new electricity generation for much of the past decade[37].

To date there has been limited deployment of gas generation in Vietnam, despite the country having domestic gas resources. Currently, less than 13% of generation capacity is gas. Deployment has been slow because of delays and barriers along the entire gas supply chain from the development of off-shore gas fields to investment in gas-fired power stations. However, PDP8 places the highest importance on new gas as a short-term solution to meeting additional capacity needs. By 2030 capacity additions will see installed capacity of gas reaching 37.3GW[38] making it the single largest generation technology in the power system. By 2035 there will be no new gas added to the system and by 2050, installed gas capacity will reduce to just 7.9GW, with 7GW of gas converted to hydrogen and the remainder taken offline.

Points for consideration

The majority of the substantial investment in gas infrastructure expected before 2035 is intended to gradually transition to hydrogen by 2050. Fuel switching to hydrogen is possible, but it is not necessarily technically or economically viable, so there is a risk of stranded gas assets. To avoid the risk of stranded gas assets and to ensure fuel switching is successful, Vietnam should:

i. Ensure that gas power stations are designed and built as flexible, peaking power sources, not as replacements for baseload coal. They also should be designed and built to be ready for switching to zero emissions fuels such as renewable hydrogen.
ii. Ensure planning for gas build-out is coordinated with the development of a national hydrogen strategy so that gas infrastructure is built in locations appropriate for hydrogen hubs.
iii. Invest in hydrogen-ready pipeline infrastructure. Natural gas pipelines are still being built to expand existing capacity or to connect new areas. It is vital that developers of this new infrastructure consider the potential to make these pipelines hydrogen-ready at the design phase to reduce future repurposing costs and minimise the risk of stranded assets. Making access to public funding conditional on such design requirements is one approach.
iv. Consideration should also be given to whether pipelines or trucking will be more appropriate, or pipelines could be smaller sized with larger storage close to the generator.[39]
v. Ensure that contract structures are consistent with using gas as a firming capacity for renewables rather than as a baseload replacement of coal.

[35] US Energy Information Administration (EIA), 'Electricity explained, Electricity in the United States', 2022, accessed April 2023. https://www.eia.gov/energyexplained/electricity/electricity-in-the-us.php Accessed April 2023
[36] DCCEEW, Australian Energy Statistics, 2022 edition, accessed April 2023. https://www.energy.gov.au/news-media/news/australian-energy-statistics-2022-edition
[37] P Graham, J Hayward, J Foster and L Havas, 'GenCost project data. V9. CSIRO Data Collection.', *CSIRO*, 2022. https://doi.org/10.25919/p7nf-9k21
[38] Including domestic and imported LNG
[39] See FEV Discussion Paper- Future Fuel, section "Reduce reliance on natural gas"

8 Prioritise targeted flexible power sources before 2030

Historically Vietnam's electricity mix was dominated by coal and hydropower which provided sufficient inertia for grid stability; while hydropower, oil and gas provided dispatchable generation capable of providing flexibility in response to variations in demand. However, since 2020 Feed-in-Tariffs for solar, rooftop solar and onshore wind have seen variable renewable energy connected to the Vietnamese grids at world-leading rates. In 2019 there was only 377 MW wind and 4,696 MW solar on Vietnamese grid. By the end of 2021, the capacity of wind energy reached 4,126 MW, solar power reached 16,564 MW including 7,660 MW of RTS and total RE accounted for 26.49% of the energy mix[40]. The solar and wind Feed-in tariffs were closed in December 2020 and November 2021 respectively. Since then, no significant additional VRE has been added to the VN system; in fact there are 85 solar and wind projects (so called 'transitional RE projects') which are already under development but did not meet the FIT commissioning deadline, which represents 4.7 GW of unutilised capacity waiting to connect to the grid. By 21 July 2023, 72 of the 85 transitional projects sent required documents to negotiate purchasing electricity price in which 60 projects with total capacity of 3,331.41 MW proposed to sell at temporary 50% of ceiling price according to Decision 21/QD-BCT issued on 7th January 2023 and only 15 projects with total capacity of 734.92 MW completed COD to connect to the national grid[41].

The pause in the deployment of additional VRE capacity since the end of 2021 is in part due to grid congestion issues which are acute in south central Vietnam, but primarily due to: (i) the grid-wide stability and energy reliability issues that higher penetration VRE would induce and for which Vietnam's historical experience provides no solutions, (ii) the delay in the approval of PDP8 and the associated absence of any targets for further RE deployment, and (iii) the absence of alternative investment and pricing schemes.

PDP8 responds to these challenges by deferring the majority of planned renewables deployment until after 2030. Before 2030, PDP8 frontloads fossil fuels (coal and gas) supported by onshore wind, and then after 2030 focuses on solar, offshore wind and fuel switching for coal and gas power stations.

Reflecting on the Australian experience with these same issues, Vietnam's grid needs more zero carbon dispatchable power. Australia utilises both pumped hydro energy storage and battery energy storage to maintain grid stability and provide additional energy reliability, and is projecting significant increases in the quantities of both. Vietnam has strong potential for both these solutions, however these technologies function differently to coal and hydro which were the historic solutions; and therefore, two recommendations are made to unlock zero carbon dispatchable power in Vietnam.

The changing mix of electricity generation capacity means that maintaining grid stability, energy reliability, and restoring electricity supply after a black out, must all be managed differently. Energy reliability is more challenging to manage because wind and solar renewable energy is variable rather than dispatchable, and grid stability must be managed differently because wind and solar power is inverter-based (asynchronous) rather than synchronous. Battery storage represents one possible technological solution to helping to manage energy reliability, by smoothing out generation variability. Batteries are also an inverter-based resource[42].

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[40] NLDC annual report 2021 on the national power system operation.
[41] Vietnam Electricity (EVN), Status of transitional project updated by 21 July 2023, n.d., accessed. https://www.evn.com.vn/c3/nang-luong-tai-tao/Cac-du-an-NLTT-chuyen-tiep--141-2014.aspx
[42] B-MS Hodge et al, "Addressing technical challenges in 100% variable inverter-based renewable energy power systems", *Wiley Interdisciplinary Reviews: Energy and Environment*, 2020, accessed 27 April 2023. https://www.osti.gov/pages/biblio/1660215

Australia has utilised utility-scale batteries (e.g., Hornsdale) and pumped hydro energy storage (e.g., Tumut 3) to provide flexible power sources in the NEM. Both these technologies have high potential in Vietnam. The Bac Ai pumped hydro energy storage (1,200 MW PHES project is Vietnam's first PHES project and constitutes half of the installed capacity to be developed before 2030, whilst only 300MW of battery storage is projected by PDP8 before 2030.

Points for consideration

i. For energy reliability, Vietnam should urgently accelerate the deployment of Pumped hydro energy storage (PHES) and ensure that power purchase agreements (PPAs) reflect a usage profile compatible with VREs to guarantee dispatchable supply. A detailed strategy to scale the deployment of PHES to the GW-scale should be developed and integrated into the PDP process, including the techno-economic scoping and integration of practical PHES options into PDPs annual implementation plans.

ii. For grid stability, utility-scale batteries provide a proven solution for managing variability at short time-scales, and also provide local solutions to grid congestion. Vietnam should consider deployment of several large batteries especially in locations near high quality renewable energy resources such as southern and central Vietnam[43], first to balance variability of existing and transitional wind and solar projects, and then to unlock future deployment of VRE in the south. In locations where inverter-based resources (IBR) density leads to system strength deficiencies, or when inertia shortfalls may occur, synchronous condensers may provide a lower cost solution.

iii. Finally, Vietnam has a large fleet of existing hydropower projects. Designing operations to compensate for renewable resource variability, both on short time scales to support frequency stability and on longer time scales to support energy reliability, and contractual arrangements to reward them for doing so could provide some of the dispatchable power capacity that the power system requires. This can be achieved through establishing a market for ancillary services or direct contracting for provision of ancillary services.[44]

9 In the short term, enable price discovery for new generation deployment, and in the long term accelerate establishment of an open, transparent wholesale electricity market

In Australia, solar and wind are now the cheapest form of electricity generation, and for this reason they comprise the overwhelming majority of the new generating capacity installed. The declining cost of solar panels is a global phenomenon, in 2021 the global weighted average levelized cost of electricity (LCOE) of renewables was 11 - 39% lower than the cheapest new fossil fuel-fired option[45]. Vietnam should have deeper research on why the LCOEs for these power sources in Vietnam are much higher than the Australian and indeed global cases. Feed in Tariffs (FiT) are an obvious factor, but they are not the only factor. From the investor perspective, high FiTs, initially starting at $0.0935 USD per kWh compensated for lack of a

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[43] See FEV Discussion Paper "Future Grid" Issue 1, section B5
[44] Yang, W., Norrlund, P., Saarinen, L. et al. Burden on hydropower units for short-term balancing of renewable power systems. Nat Commun 9, 2633 (2018). https://doi.org/10.1038/s41467-018-05060-4
[45] 11% lower for utility solar PV and 39% lower for onshore wind, as cited in: IRENA, Renewable Power Generation Costs in 2021, International Renewable Energy Agency, 2022. https://www.irena.org/publications/2022/Jul/Renewable-Power-Generation-Costs-in-2021

bankable Power Purchase Agreement (PPA), high administrative cost for investment licensing and project permits, and unofficial facilitation fees. The business community has argued that lower FiTs, even no FiTs, are acceptable if time to market is reasonable and Electricity Vietnam (EVN) shares operational risk. This would mean, in practical terms, standardized PPAs that limit curtailment risk and standardized permitting processes that reduce time to Commercial Operation Date (COD). In Australia, the average processing time for connection application is 11 months, average preparing for registration is 5.2 months, and average commissioning approval is 8.4 month. [46] AEMO also will receive funding to accelerate generation connection across NEM for summer 2023-2024.[47] The result would be lower cost to investors and lower cost to power consumers.

We note that policy approaches for transitioning to renewable generation can be laid over the top of existing generation rather than mandating the closure of incumbent fossil fuel generators. This then enables competition e.g., in the wholesale market, that allows the energy transition to play out.

Points for Consideration:

In the short term (pre-2030), until Vietnam has a fully functional, transparent, and competitive wholesale electricity market to meet the vast majority of demand, Vietnam could focus on initiating new mechanisms for price discovery to reduce the cost of new generation investment and the risk of stranded assets. Price discovery mechanisms reveal the changing price of generation to both consumers and regulators as learning rates evolve, thereby providing a least-cost approach to the energy transition. This can be achieved through internationally validated mechanisms like, for example, reverse auctions with contract-for-difference which can enable price discovery before the development of fully-fledged spot markets. We note that in PDP8 there is a requirement to research and develop an auction mechanism, which is consistent with our point for consideration. There is also the opportunity to support such mechanisms using Renewable Energy Targets with tradeable certificates as has been undertaken in Australia.

Reverse auctions, which have been successful tools for price discovery in Australia and many other places globally, will require revision of laws related to procurement in Vietnam. Current laws reflect a normal bidding process in which a seller puts up an item and buyers place bids until the item goes to the highest bidder. In a reverse auction, sellers bid for the prices at which they are willing to sell their goods and services, with buyers selecting the lowest price. The research and development of schemes for reverse auctions proposed in PDP8 will be essential to enable price discovery for all forms of electricity generation as an adjunct on the way to expanding the fraction of total generation competing in the wholesale electricity market.

In the long term (post-2030), Vietnam should accelerate the introduction of a fully competitive wholesale electricity market, thereby encouraging the market to help determine which new generation sources are added to the system. Empowering the market in this way will align Vietnam with other markets globally where we see that in open competitive environments, cheaper renewables dominate new capacity additions with important positive benefits on power system economics and environmental outcomes. Given the considerable delays to date in market reform, accelerating market reforms will require an immediate systematic review and

[46] AEMO, Connection scorecard, June 2023, accessed 27th July 2023. https://aemo.com.au/en/energy-systems/electricity/national-electricity-market-nem/participate-in-the-market/network-connections/connections-scorecard

[47] AEMO, AEMO funded to accelerate generation connection cross NEM for summer 2023-2024, 16th June 2023, accessed 27th July 2023. https://aemo.com.au/en/newsroom/media-release/aemo-funded-to-accelerate-generation-connections-across-nem-for-summer-2023-24

understanding of the barriers inhibiting the reform process so that an effective, practice action plan for acceleration can be developed and commenced from the present.

Whatever path is chosen, Vietnam should plan for a consistent policy trajectory and avoid government policy uncertainty, in order to de-risk investment in new generation and reduce the cost of the energy transition.

10 Manage DERs as a network asset as well as a consumer asset

Distributed Energy Resources (DER) are energy generation and storage assets that are located close to the site of consumption, often behind-the-meter, including for example rooftop solar (RTS), battery energy storage systems (BESS), electric vehicles, fuel cells, reciprocating engines (small diesel/oil generators) and heat pumps. They are typically small in size when compared to conventional generation plants and individually they have limited impact on the power system, however, as a whole but aggregated they can have system-wide positive and negative implications. In the Australian NEM, distributed RTS (14GW) is the largest single generator[48].

Vietnam already has significant experience with renewable DER through RTS. Backed by a generous Feed-in-Tariff (FiT), by 2020, Vietnam has more than 105,212 RTS systems across industrial, commercial, administrative and residential roofs, providing a combined installed capacity of 9.7GWp[49]. 84% of capacity is installed on commercial and industrial (C&I) roofs, concentrating DERs in industrial areas; and the vast majority of all RTS was connected within a short period of a few years. Residential consumers in Vietnam have installed RTS to reduce their energy bills. For C&I customers the value proposition is multiple and includes a Corporate Social Responsibility (CSR) benefit of achieving corporate net zero commitments, but increasingly also energy security as power outages can significantly affect production in factories. However, there is negligible experience with other renewable DERs in Vietnam such as battery energy storage (BESS) or electric vehicles (EVs).

The rapid development of RTS in Vietnam has created several management challenges. For EVN the uptake has far exceeded the expected deployment which has caused financial strain. For system reliability, as solar production ramps up with the sunrise it brings net demand down. Peak solar production occurs around midday, resulting in minimum net demand from the electricity network. As solar production decreases towards sunset, demand from the network increases. This change in demand throughout the day is referred to as the “duck curve”, due to the profile it creates. Over time, as additional solar PV is added to the network, the duck curve becomes more and more pronounced, as additional solar PV increases the minimum demand during the day. In addition, cloudy days or periods of cloud cover can see RTS systems switch reliance back to the grid causing rapid spikes and fluctuations in grid demand.

PDP8 adopts a risk–averse approach to RTS. It allows RTS to proceed without limit so long as the system ensures zero export to the grid. PDP8 sets a target of 50% of office and residential roofs with RTS installed by 2030, predicted to inject an additional 2.6GWp. Short-term targets for utility batteries are even more modest with just 300MW targeted for deployment by 2030, increasing to 30.65 – 45.55 GW by 2050 (including pumped hydro energy storage as well).

[48] AEMO, National Energy Market Factsheet, December 2021, accessed 31st May 2023. https://www.aemo.com.au/-/media/files/electricity/nem/national-electricity-market-fact-sheet.pdf
[49] Vietnam Energy Partnership Group, Factsheet on RTS development 2020, December 2020, accessed 26th July 2023. http://vepg.vn/wp-content/uploads/2021/02/VEPG_RTS_Factfile_Dec_2020_EN_fin.pdf

Australia has world leading experience with RTS with 3.44 million RTS installations combining for a total capacity of 15GWp in 2022.[50] For similar size power systems (Australia's grid has ~65GWp in 2021[51] and Vietnam's grids have 80.7GW of total installed capacity in 2022) this amounts to more than 1.5 times as much RTS in Australia compared to Vietnam (about 7.7GW by 2022[52]), which means the challenges of managing RTS are significantly more pronounced in Australia.

Australia also has some deployment of other DER, including battery energy storage systems (BESS). By 2021 Australia had surpassed more than 1GWh of total storage deployments (including utility-scale big batteries, distribution-scale community batteries and residential batteries). In 2022, the capacity almost doubled with 47,100 residential batteries installed in that year, almost doubling total capacity to 1.92GWh[53]. In addition, there is ~66GWh of pumped hydro storage with significantly more planned. At both the grid and consumer scale, the rapid uptake of batteries in Australia is in response to consumers wanting to maximise the economic benefits of self-consumption and grid operators seeking to manage the high penetration of variable renewable energy (VRE) (utility solar and wind, and RTS) in the Australian power system. There are at present few incentives to invest in utility scale storage, although the new Capacity Investment Scheme (CIS) will provide a national framework to drive new dispatchable renewable capacity incorporating storage[54] . In Australia, investment in storage is recovered by revenue from wholesale market arbitrage, buying when the price is low and selling when it is high. Additional revenue is also derived from the FCAS market, that is, short term injections and absorptions of power around the average demand in each wholesale trading interval.

In recent years, battery storage has derived more revenue from the FCAS market than wholesale arbitrage.[55]

The Australian experience suggests that ensuring visibility and control of DERs for network operators through inverter and meter monitoring can assist the optimisation of system-wide benefits.

Points for Consideration:

The energy transition is changing the generation mix, but it is also changing the structure and functioning of grid systems as electricity consumers take advantage of new clean technologies to build distributed generation (i.e., RTS) and storage assets (BESS) behind-the-meter and, while grid operators build storage within the distribution network. Embracing the arrival of DER will provide the Vietnamese grid with an important system asset. Vietnam should revise its approach towards DER to promote them as a network asset and discourage conflict between consumer and network use of DER. Vietnam should develop a DER strategy for all five distribution networks in Vietnam, the strategy should cover at a minimum:

i. Targets to accelerate RTS deployment and a practical strategy to reach RTS on 50% of offices, households and factories.

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[50] As of 2022, see Discussion paper "Future Demand".
[51] AEMO, National Energy Market Factsheet, December 2021, accessed 31st May 2023. https://www.aemo.com.au/-/media/files/electricity/nem/national-electricity-market-fact-sheet.pdf
[52] Vietnam Investment Review, Vietnam and Germany promote rooftop solar in commercial and industrial sectors, April 16, 2023, accessed 14 July 2023. https://vir.com.vn/vietnam-and-germany-promote-rooftop-solar-in-commercial-and-industrial-sectors-92721.html
[53] Energy Storage News, Australia had over 2GWh of large-scale battery storage under construction at end of 2022, 18th April 2023, accessed 27th July 2023. https://www.energy-storage.news/australia-had-over-2gwh-of-large-scale-battery-storage-under-construction-at-end-of-2022/
[54] DCCEEW, Capacity Investment Scheme to power Australian energy market transformation, 9th December 2022, accessed 26th July 2023. https://www.energy.gov.au/news-media/news/capacity-investment-scheme-power-australian-energy-market-transformation
[55] Energy Synapse, 'Batteries earn record energy arbitrage revenue in 2022, but FCAS still dominates' 30th January 2023. https://energysynapse.com.au/batteries-earn-record-energy-arbitrage-revenue-in-2022-but-fcas-still-dominates/

ii. Consider the potential of allowing limited export of rooftop solar to the grid within the distribution network, up to the technical capacity of the distribution network to absorb and transport the exported solar power. This could relieve some of the requirement for investment in centralised generation capacity, utility-scale storage, and new transmission and distribution networks, especially if combined with distributed battery storage systems (both utility-scale and behind-the-meter customer scale) to enable supply during times of peak demand. While PDP8 encourages rooftop power for self-consumption, allowing grid export up to the technical limits of the distribution network is part of a least cost electricity supply solution. Various alternative pricing mechanisms are possible, with various alternative metering requirements and ease of forecasting, including fixed feed-in tariff, time-of-generation tariff, exposure to the wholesale market or via an intermediary aggregation entity.
iii. Efforts to diversify DER deployment and promote, in particular, battery energy storage at the individual building household and community scales.
iv. Network operator monitoring and control of DER through inverter settings and smart metering.
v. More extensive monitoring of power flows within the distribution network by distribution network infrastructure owners, using standard existing metering technology. This will enable more accurate determination of technical capacity and forecasting of capacity augmentation needs.[56]
vi. Encourage the integration of DER into multiple land-use contexts such as agrivoltaics.

[56] Australian Renewable Energy Agency, 'Increasing Visibility of Distribution Networks', n.d., accessed 26th July 2023. https://arena.gov.au/projects/increasing-visibility-of-distribution-networks/

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