



# Policy framework for a sustainable energy transition in Viet Nam – Key policy recommendations

15 December 2021

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Ministry of Industry and Trade



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# An international expert consortium to support Viet Nam in navigating the energy transition



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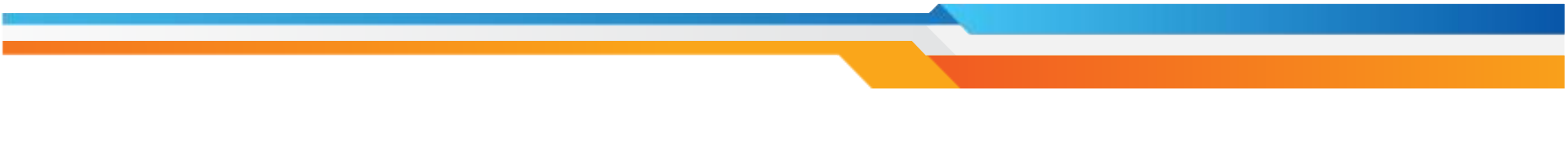


# Experts

- Toby D. Couture and Dr. David Jacobs have been working closely with Viet Nam since 2014, including FIT for wind power, the solar PV
- They are now leading a project on the energy transition in Viet Nam, in partnership with several other consortium partners



# Topics and agenda

- 1. Aligning Viet Nam's national development strategy with a long-term decarbonization objectives (targeting net zero by 2050)**
  - 2. Deploying renewable energy consistently over time – steady, annual capacity additions to build a strong national industry**
  - 3. Adjusting investments in fossil fuels to align with Viet Nam's net zero 2050 plan**
  - 4. Developing consistent decarbonization pathways for the transport sector**
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# The impacts of climate change are being felt directly in Viet Nam

- **More than 40% of Ho Chi Minh City is less than 1 meter above sea level**
- **Extreme flooding events are expected to become much worse in Viet Nam, with HCMC bring hit particularly hard**



Source: <https://floodlist.com/asia/ho-chi-minh-city-flood>

Source: <https://www.channelnewsasia.com/asia/vietnam-climate-change-flooding-1338896>

# Key Messages

- **The world is changing at an unprecedented pace:** climate change is accelerating, environmental awareness is growing
  - At the same time, **renewable energy sources (including solar PV) have never been more affordable**
  - **Governments need to take a holistic view of the energy transition**, specifically to mitigate the risk of stranded assets
  - **Viet Nam needs to sharpen its policy and planning, and increase its level of ambition** (include a greater focus on transport, industry, and heating/cooling)
  - In so doing, **Viet Nam can become a regional leader in the energy transition** and harness a wide range of socio-economic benefits
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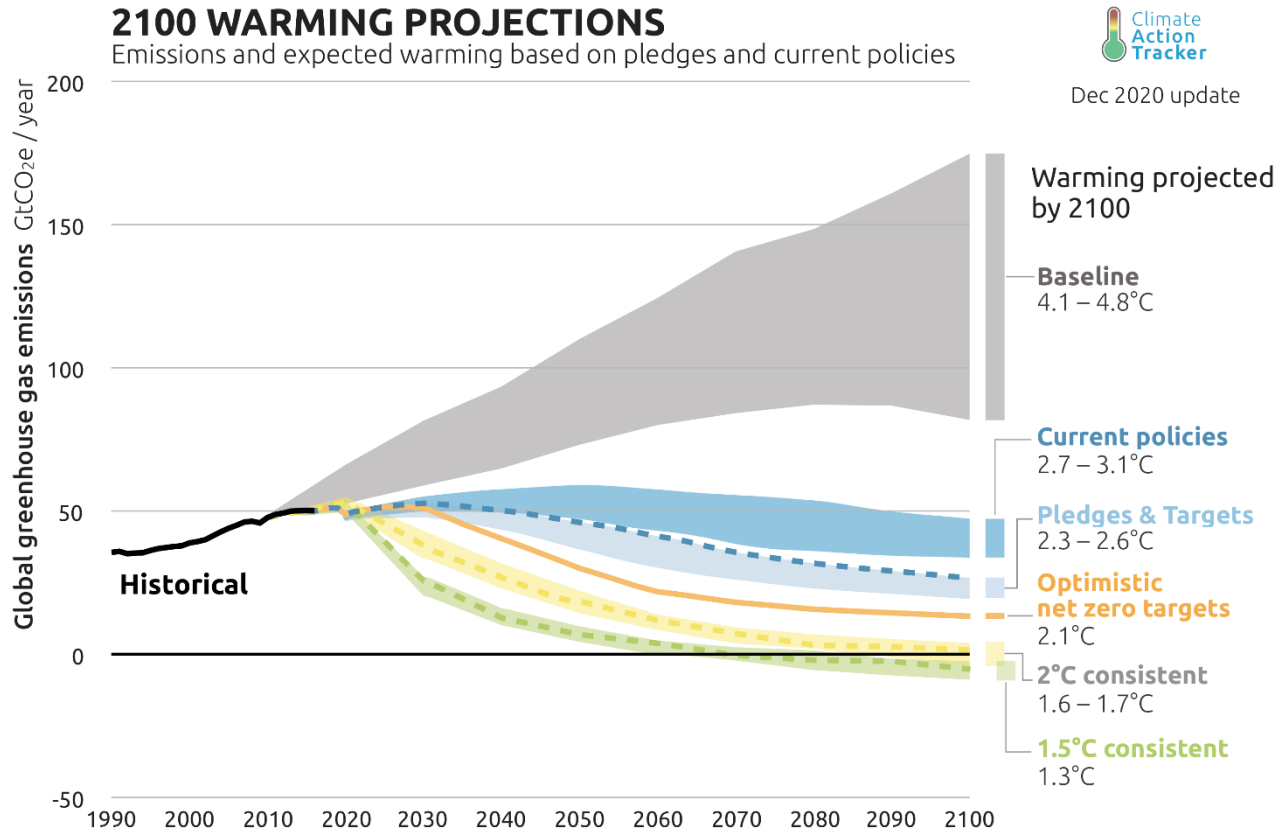
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# 1. Aligning Vietnam's national development strategy with a long-term decarbonization objectives (targeting net zero by 2050)

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# Predicted Global Temperature Increase

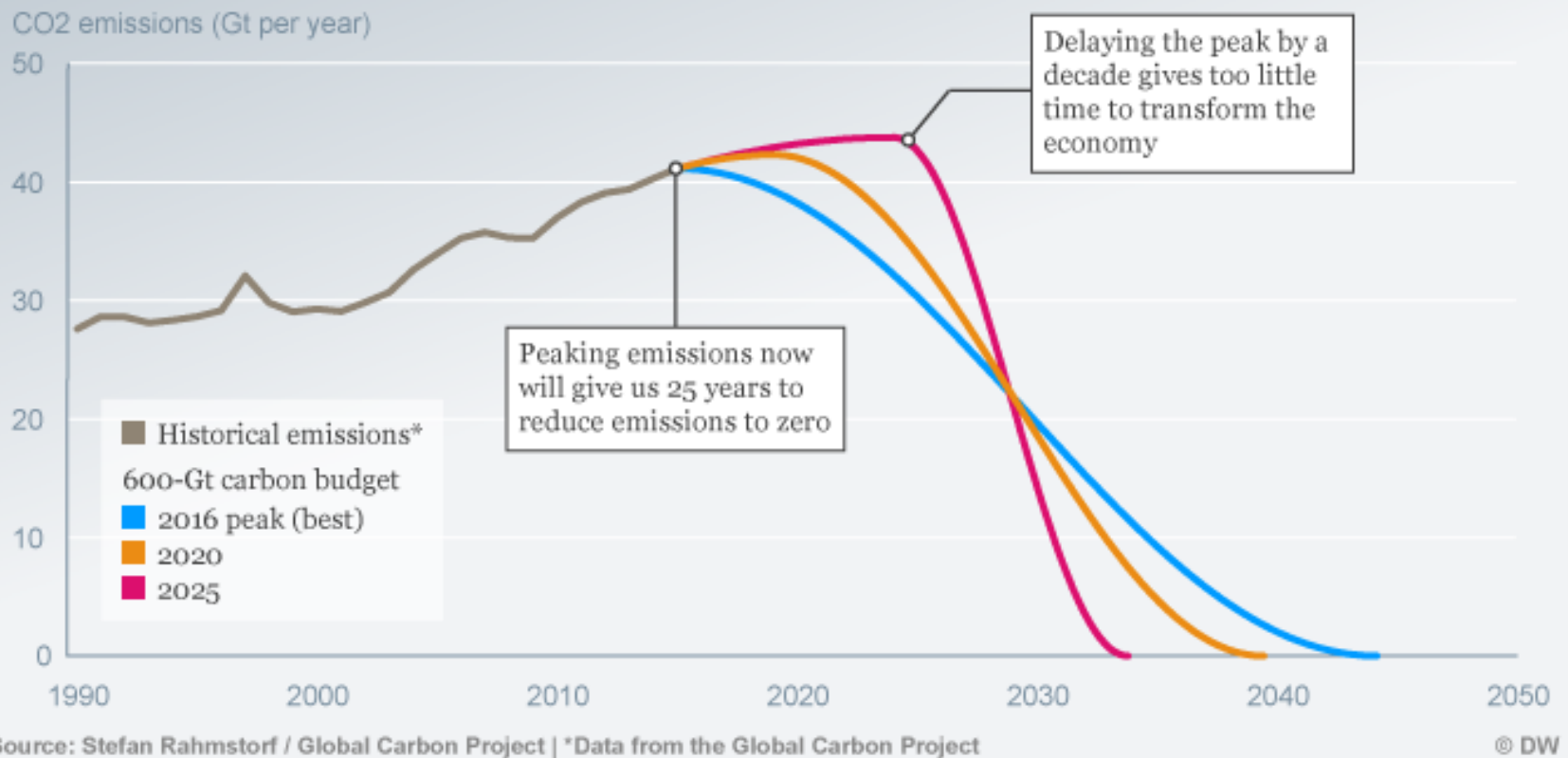


Source: <https://climateactiontracker.org/global/temperatures/>



# The sooner we ACT, the easier it will be

## Carbon crunch

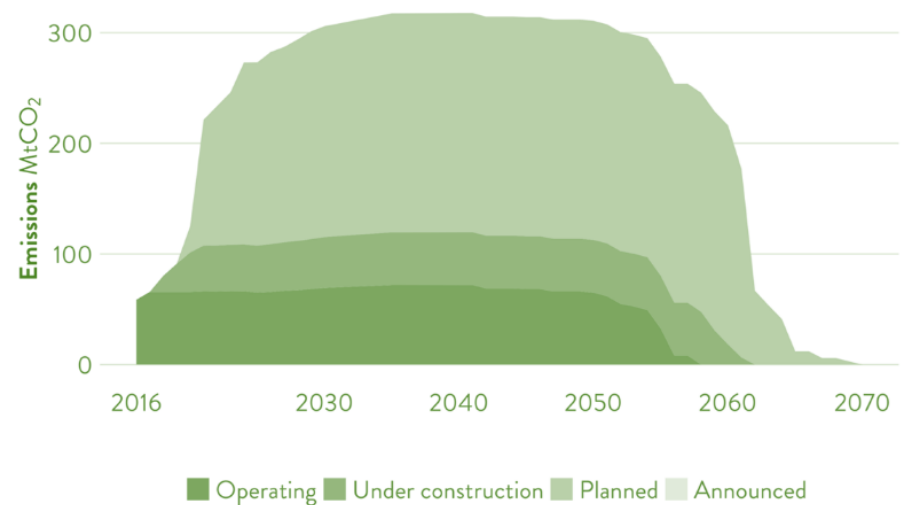


# Carbon intensity of the power : Status in Vietnam

- Greenhouse gas (GHG) emissions have increased rapidly in the energy sector over the last decades, reflecting Viet Nam's high growth rates in GDP and energy use.
- CO<sub>2</sub> emissions intensity also increased rapidly, largely because of a growing dominance of coal in the energy mix.

## Committed emissions from Viet Nam's coal plants (2019 status)

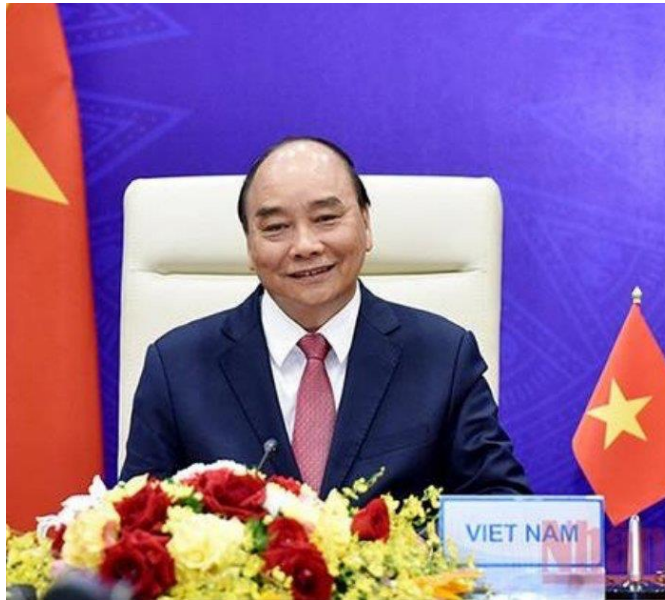
Figure XX: Committed emissions from Viet Nam's coal plants (2019 status)



Source: Carbon Analytics (2019)

# International Background: Decarbonization pledges from around the world

- Already 136 national governments have pledged to achieve net zero emissions in the coming decades (mostly between 2040 – 2060)



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*Transitioning to a green, net-zero emission economy is an inevitable trend and imperative to limiting global warming to 1.5°C. This process will not be without challenge, but will certainly bring huge opportunities and benefits in **creating jobs, ensuring energy security, and enhancing economic competitiveness and sustainability.***

NGUYEN XUAN PHUC  
PRESIDENT OF THE SOCIALIST REPUBLIC OF VIETNAM

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Sources: <https://www.zerotracker.net/>  
<https://www.wri.org/insights/what-cop26-means-forests-climate>

# Carbon Border Adjustment Mechanism (CBAM): Future risks for Vietnamese economy

- Several countries, including the EU as a whole, is currently considering **introducing carbon border adjustments**. Countries with high-carbon economies would be at a **strategic disadvantage in global trade**.
- The **carbon intensity** of the Vietnamese economy will **determine to what extent Vietnamese products will be subject to import duties**, and how competitive the Vietnamese economy will be in terms of global trade



# Deep Decarbonization Pathways

	Recommendations	Level of importance	Timing
<b>1</b>	Develop <b>long-term targets for deep and full decarbonization</b> (net zero carbon target).	HIGH	Immediate ACTION (0-5 yrs)
<b>2</b>	Develop <b>sectoral targets</b> in line with long-term carbon reduction targets can be helpful to understand what type of (additional) measures are necessary in Viet Nam.	MEDIUM	MEDIUM-term action (5-10 yrs)
<b>3</b>	Develop <b>special industry and deployment strategies</b> for emerging technologies (e.g. batteries, tidal, offshore wind, hydrogen), to harness socio-economic benefits.	HIGH	MEDIUM-term action (5-10 yrs)



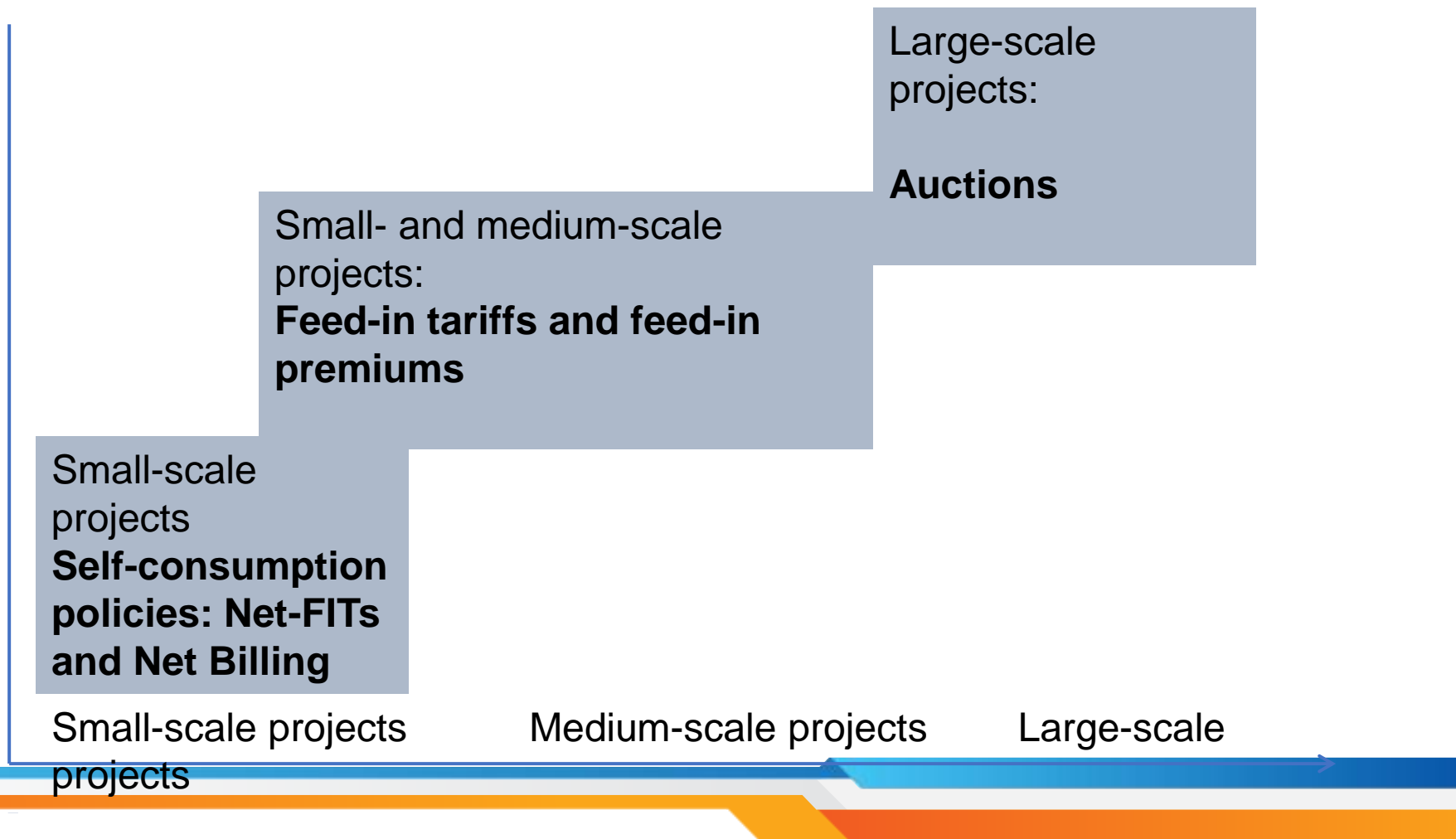


## 2. Deploying renewable energy consistently over time – steady, annual capacity additions to build a strong national industry

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# Parallel Policies for Different Market Segments



# RE Deployment Targets

	Raise the level of ambition of the existing renewable energy targets to ensure that Viet Nam's energy transition remains in line with the goals of the Paris Climate Accord, and in line with other countries in the region.	HIGH	MEDIUM-TERM (5-10yrs)
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- Currently, Viet Nam's targets envisioned under PDP-8 remain relatively modest, both internationally and compared to other countries in the region
- **Efforts should be made to increase the level of ambition:** Viet Nam needs GW-scale development each year to meet decarbonization targets
- **Halting RE growth is not advisable: Stable annual capacity additions are needed to build a strong and resilient RE industry**
- Renewables now offer **low-cost energy** and can help fuel **green energy jobs** in the country



# RE Deployment Targets

	Devolve the responsibility for achieving the renewable energy targets in the electricity sector onto utilities, or load-serving entities, and introduce monetary penalties for non-compliance.	MEDIUM	MEDIUM-TERM (5-10yrs)
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- There can be **advantages** in terms of target achievement in **devolving the targets onto utilities** (e.g. onto EVN): government sets the target, the utility is required to meet it.
- **In the U.S.**, where utilities are responsible to meet targets, or pay fines for every MWh of shortfall, **target achievement is exceptionally high**

See LBNL (2021): [https://eta-publications.lbl.gov/sites/default/files/rps\\_status\\_update-2021\\_early\\_release.pdf](https://eta-publications.lbl.gov/sites/default/files/rps_status_update-2021_early_release.pdf)



# Rooftop Solar Policies

	After the boom year of 2020 in Viet Nam, policymakers should resist the temptation to clamp down on the market and develop ways of establishing a greater degree of continuity and predictability to the market.	HIGH	IMMEDIATE Action (0-5 yrs)
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- Viet Nam experienced a record-breaking year for rooftop solar installations in 2020
- **The challenge now is to adjust the policy framework without destabilizing the market,**
- **Avoid retroactive policy changes**
- **Tighten the approval and permitting process**





### 3. Adjusting planned investments in fossil fuels to Viet Nam's net zero 2050 plan

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# Planning the reduction of the use of coal

1. Shorten planned lifetime of coal assets (phase out by 2040)
2. Retrofit conventional coal power plants with CCS to reduce their CO2 emissions
3. Retrofitting exi

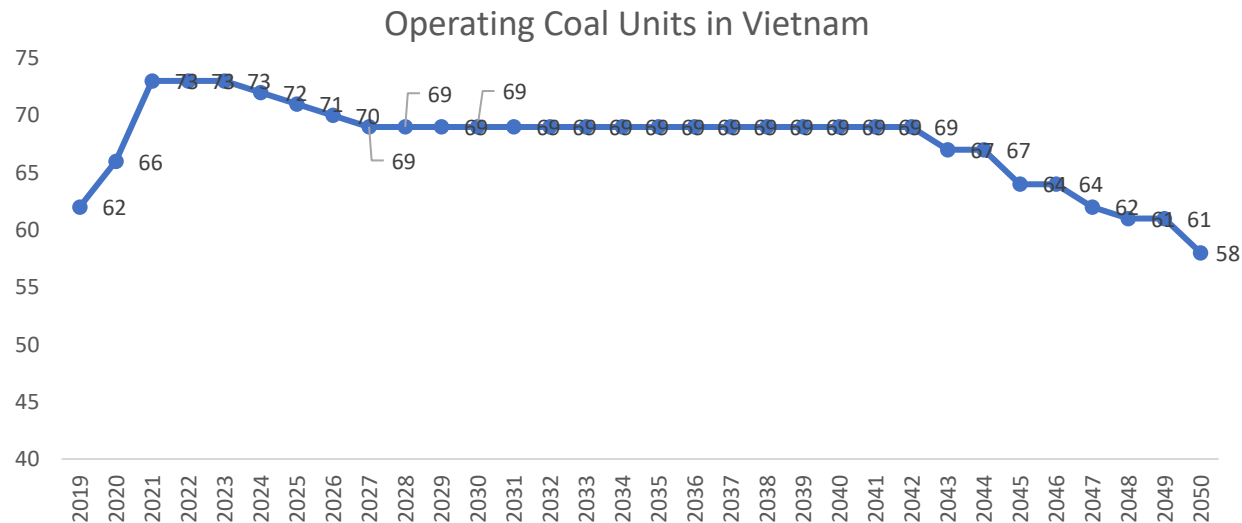



Figure XX: Viet Nam's coal-fired operating units evolution scenario

# International Background: Gas as a bridging technology?

- As a “**bridging technology**”, in the electricity sector natural gas/LNG can help countries to move from a coal-dominated system towards a 100% renewable energy based system.
  - However, the **window for using natural gas** in the electricity sector is relatively short, since by **2040 or 2050** the power system already needs to be **fully decarbonized**.
  - From international experience, the **risk of stranded investments is high**.
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## International Background: Sharp reduction of gas required

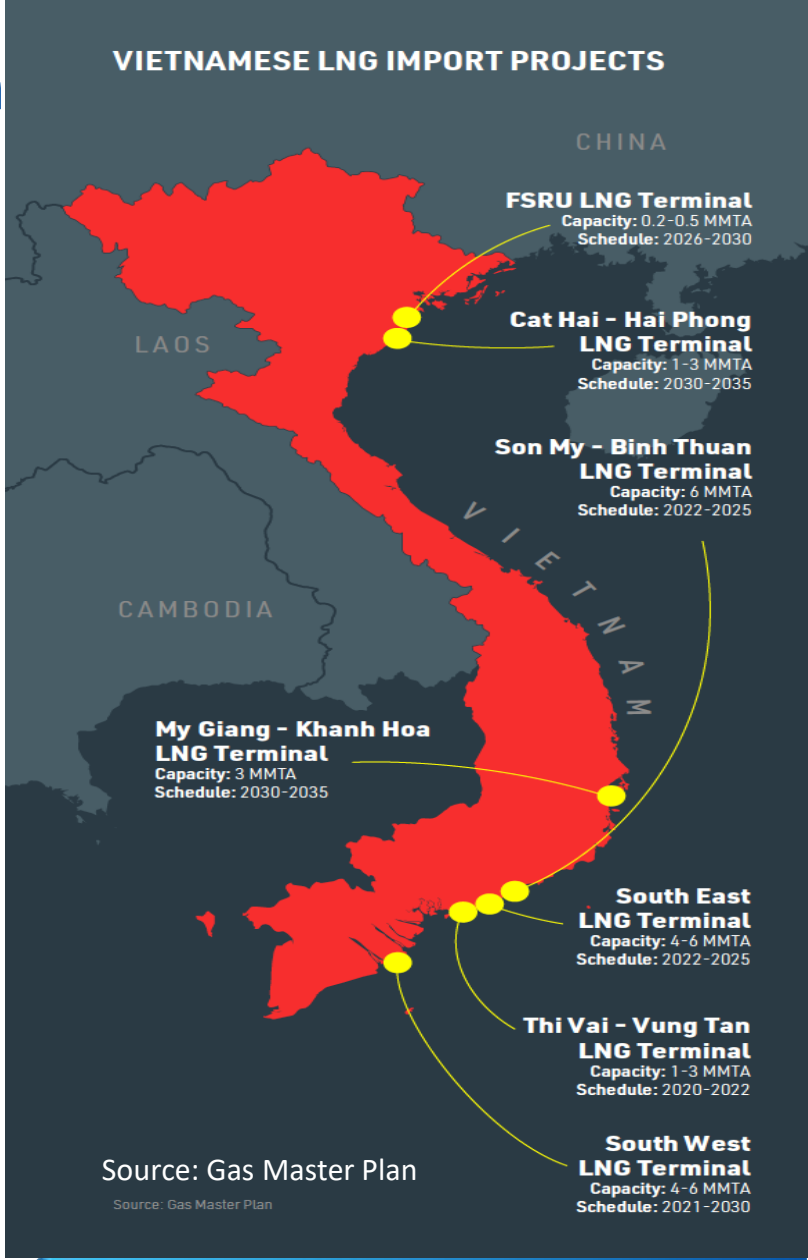
- According to the **Intergovernmental Panel on Climate Change (IPCC)**, the safest and surest way to reach the 1.5°C goal would require a **15% decline in gas use by 2030** and a **fall of 43% by 2040**



# LNG Expansion: Status in Vietnam

- PDP8 foresees a shift from coal to gas/LNG
- Plans for LNG import terminals (agreement with US and Japan)

*Note: Due to image illustration, Truong Sa & Hoang Sa Islands could not be included*



# Assessing the risk of stranded assets

## Assess the risk of stranded assets for different

- Higher risk for **LNG terminals and import pipelines**
- **Distribution gas network infrastructure and gas storage** facilities are less prone to being stranded because of the **multiple use options**
- The risk of stranded assets in **gas-fired power plants** is relatively low (**relatively low share of fixed costs**)

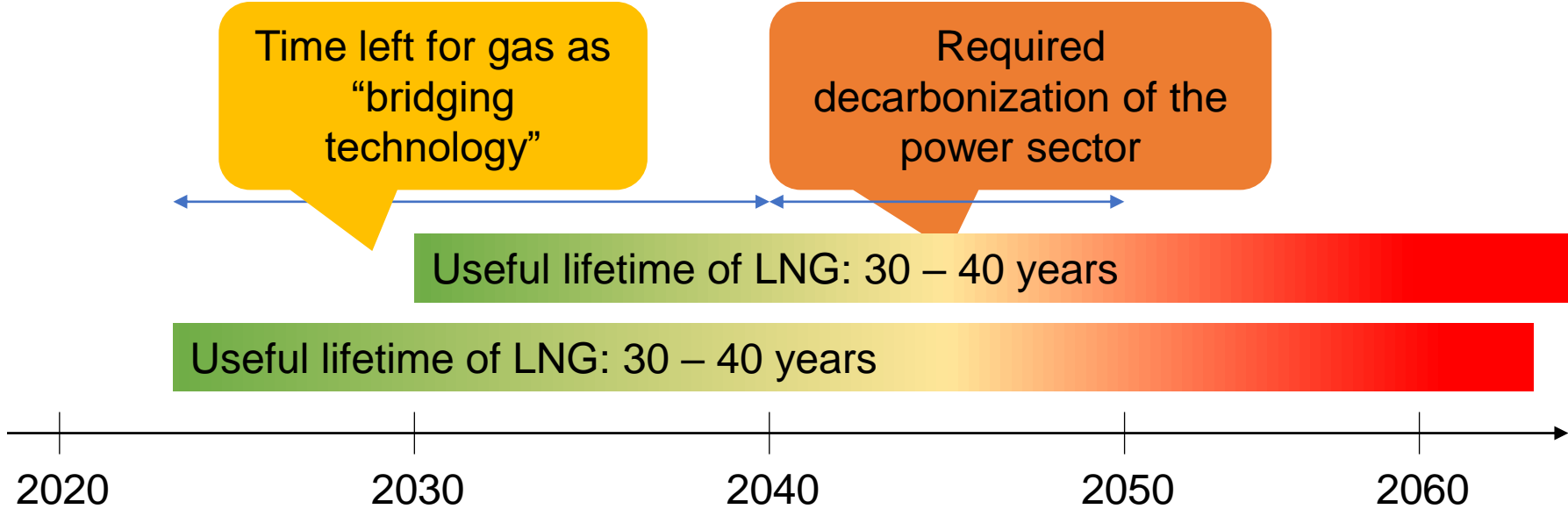
## Advanced energy system planning:

- Include costs for retrofitting in cost assessments
  - Assess the risk of stranded assets against potential decarbonisation scenarios
- 



# Foresee retrofitting of new gas infrastructure for clean gases

	Ensure <b>current LNG plans are aligned with long-term decarbonization strategies.</b>	HIGH	IMMEDIATE Action (0-5 yrs)
	Focus on LNG terminals with fast completion times and scrutinize longer-term plans (> 7 years) for their <b>risk of stranded assets.</b>	HIGH	IMMEDIATE Action (0-5 yrs)

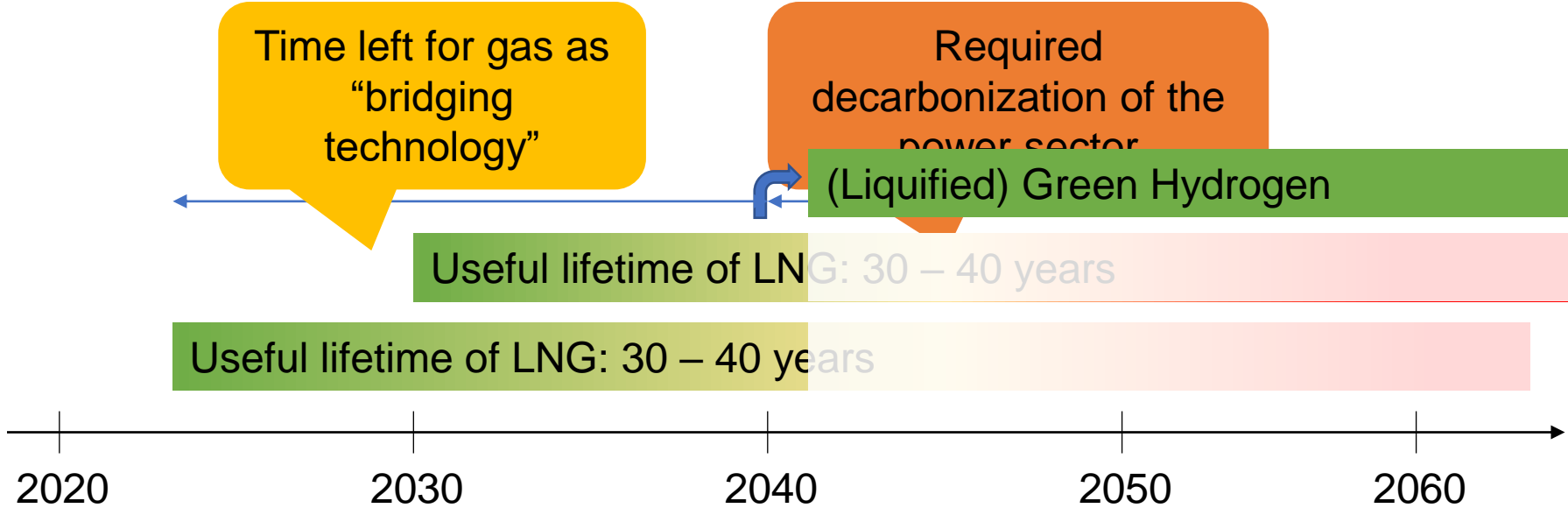


# Foresee retrofitting of new gas infrastructure for clean gases

Include the risk of stranded assets as well as the repurposing of LNG infrastructure (e.g. to liquified hydrogen) in these long-term planning studies. **Repeatedly assess the risk exposure** based on international developments for alternative fuels (e.g. hydrogen) and delays in LNG infrastructure deployment.

HIGH

MEDIUM-term action (5-10 yrs)



# Introduce Carbon Pricing Policies

	Recommendations	Level of importance	Timing
1	Introduce a carbon tax (e.g. starting at 10 USD/tCO <sub>2</sub> e), focusing on the electricity and transport sectors.	HIGH	MEDIUM-term action (5-10 yrs)
2	Potentially include tax exemptions for industries where adjustment processes might take longer (grandfathering).	HIGH	MEDIUM-term action (5-10 yrs)
3	Increase the scope of carbon taxes, including more and more sectors (e.g., transport sector, industry sectors).	MEDIUM	LONGER-term strategy (10+yrs)
4	Revenues from the carbon tax should be invested in developing low-carbon industries and technologies in order to generate additional socio-economic benefits.	HIGH	MEDIUM-term action (5-10 yrs)
5	Define a clear schedule for carbon tax increases over time in order to align the price level to the objectives of the Paris Agreement (i.e. US\$50–100/tCO <sub>2</sub> e by 2030).	HIGH	LONGER-term strategy (10+yrs)



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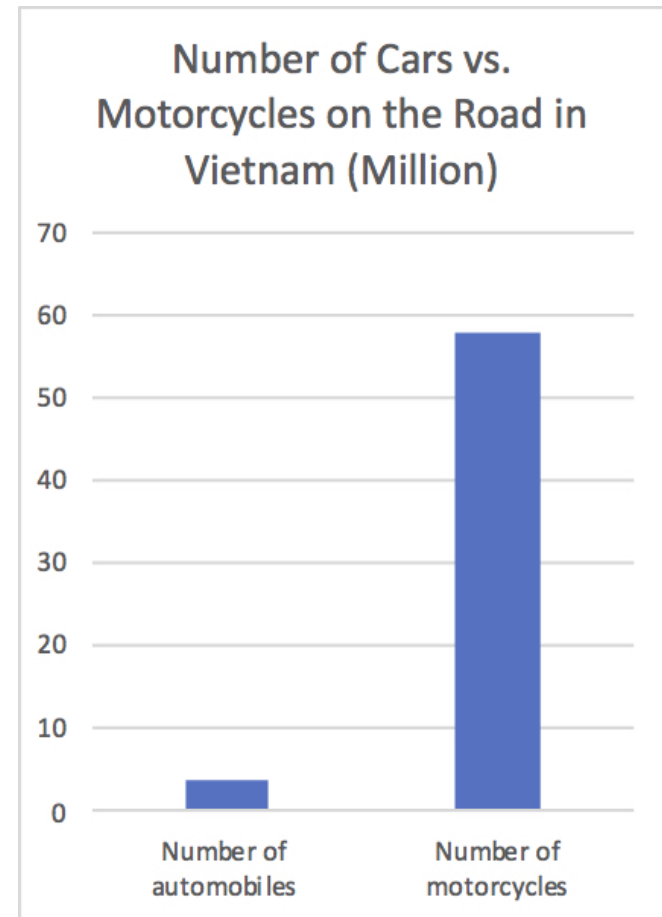
### 3. Developing consistent decarbonization pathways for the transport sector

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# Transport Policies should focus on electrification of two/three wheelers

- Given the predominance of two- and three-wheelers, **Vietnam needs to focus on policies to drive the transition for two- and three-wheelers**



Do, Thang Nam (March 30 2020). Viet Nam's Big Air Pollution Challenge. The Diplomat. Available from: <https://thediplomat.com/2020/03/Viet-Nams-big-air-pollution-challenge/>

# Transportation Policies

- **A central part of encouraging the energy transition in the transport sector is to make it cheaper, and make it easy:**
- **Easy-to-use charging and digital payments infrastructure are key**



# Transportation Policies

Viet Nam should develop a comprehensive policy package to encourage the transition to cleaner modes of transport, including specifically for electric vehicles and electric two-and-three wheelers.

High

IMMEDIATE  
Action  
(0-5 yrs)

- Clean transportation technologies are already cost-competitive with fossil-fuel alternatives and provide a range of other benefits in terms of improved air quality.
- This **comprehensive policy package** should include specific incentives for electric two-and-three wheelers, targeted incentives for the construction of charging stations, streamlined regulations and processes for the siting of electric charging stations, special tax incentives for electric **car sharing platforms**, lower cost or zero-cost parking for EVs in urban areas, as well as other benefits such as reduced vehicle registration fees

# Bans on old, polluting vehicle types can help accelerate the transition

Introduce a regulation phasing-out the sale of new internal combustion engine two-and-three wheelers by a certain date (e.g. 2027) with a separate date for the phase-out of the sale of new cars and trucks with internal combustion engines (e.g. 2030-32).

High

IMMEDIATE  
Action  
(0-5 yrs)


- Vehicle bans are emerging as a major policy tool in efforts to accelerate the transition of the transport sector
- Bans on internal combustion engines are growing rapidly
- Bans provide a clear signal to the market, and can help catalyze investments in cleaner transportation solutions





## Targets can provide clear signals for consumers as well as for industry (e.g. charging stations)

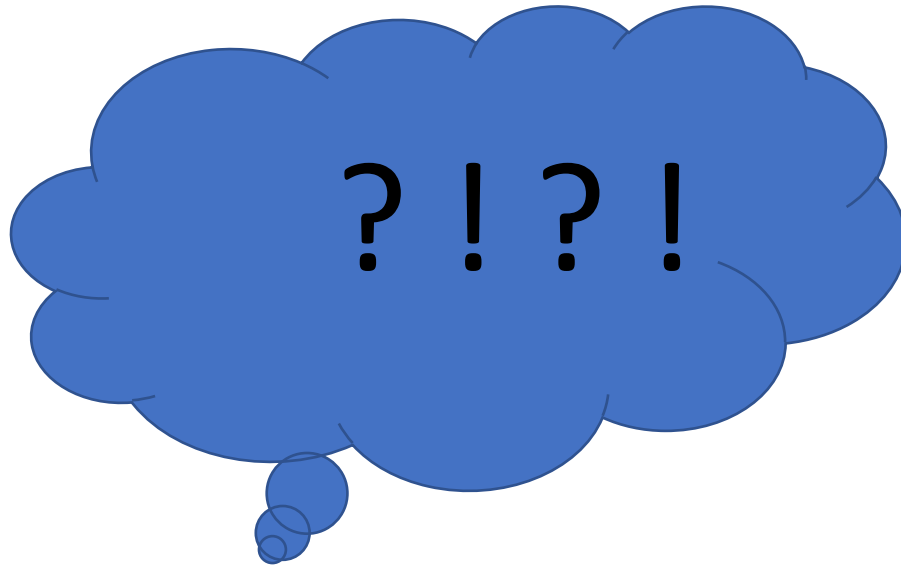
Adopt targets and mandates for electric vehicles, or clean energy vehicles	High	IMMEDIATE Action (0-5 yrs)
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- Targets and mandates can help drive the introduction and sale of electric and other clean vehicle models
  - Many jurisdictions are now starting to adopt stricter targets, yielding a wide range of co-benefits in terms of cleaner air, and quieter streets
  - Explore the adoption of special electricity tariffs categories for EV charging (including time-of-use factors, and allowing for real-time adjustment to help mitigate grid congestion)
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# Decarbonizing Transport

	Recommendations	Level of importance	Timing
1	<b>Ban the <u>use</u> of internal combustion engine vehicles by a certain date</b> , starting with a ban on the <u>sale</u> of two- and three-wheelers (e.g. 2030), a subsequent ban on their <u>use</u> in urban areas (e.g. 2035), followed by a wider-ranging ban on the sale and use of all internal combustion engine vehicles.	MEDIUM	Immediate ACTION
2	<b>Introduce a scrappage program to buy-back inefficient two- and three-wheelers.</b>	LOW	MEDIUM-term action (5-10 yrs)
3	<b>Expand the vehicle scrappage program to cars and other light vehicles.</b>	LOW	MEDIUM-term action (5-10 yrs)
4	<b>Lead by example and discontinue the purchase of internal combustion engine vehicles for all public vehicles (government, police, etc.) by a certain date (e.g. 2022).</b>	HIGH	Immediate ACTION
5	<b>Use the tax system to make conventional transport fuels and vehicles more expensive and encourage the transition to new energy vehicles.</b>	MEDIUM	MEDIUM-term action (5-10 yrs)

Questions, comments?



# Discussion

Thank you very much for your attention!



# Annexes: Policies for RE development

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# Auction Design

	Recommendations	Level of importance	Timing
1	<b>Auctions should include a clear calendar with multiple auction rounds, rather than a single auction round, in order give a long-term outlook for investors.</b>	MEDIUM	IMMEDIATE Action (0-5 yrs)
2	<b>Ensure that the pre-qualification requirements are sufficiently high to deter non-serious bidders (e.g. via bid bonds).</b> A reasonable middle range would be around USD 20 per kW.	HIGH	IMMEDIATE Action (0-5 yrs)
3	<b>Ensure that penalties for non-completion are sufficiently high to ensure high realization rates.</b> This can include losing the bid bond entirely, or other measures such as facing a reduction in the agreed-upon purchase price for every month of delay for COD.	HIGH	IMMEDIATE Action (0-5 yrs)

# Rooftop Solar Policies

	Recommendations	Level of importance	Timing
1	After the boom year of 2020 in Viet Nam, policymakers should resist the temptation to clamp down on the market and develop ways of establishing a greater degree of continuity and predictability to the market.	HIGH	IMMEDIATE Action (0-5 yrs)
2	Transition the rooftop solar policy framework to link the price paid for exported generation to a time-differentiated rate starting in 2022. Existing projects should be explicitly grandfathered in order to avoid retroactive changes.	Medium	IMMEDIATE Action (0-5 yrs)
3	Introduce clearer eligibility rules for future rooftop solar projects in order to prevent gaming. The eligibility rules could be adjusted to require site visits to ensure conformity with the new regulations.	High	IMMEDIATE Action (0-5 yrs)
4	Introduce, on a pilot basis, a series of energy storage systems integrated into solar and/or any RE power generation to contribute to system stability and monitor the contribution and performance of storage systems.	Medium	MEDIUM- term action (5-10 yrs)

# Flexibility Provision with Renewable Energies

	Recommendations	Level of importance	Timing
1	Follow <b>international best practices on grid code development</b> and regularly update the national requirements for renewable and conventional generators. Ensure conformity through appropriate compliance mechanisms.	HIGH	IMMEDIATE Action (0-5 yrs)
2	Develop and maintain a <b>national registry of all renewable power plants</b> . Use this accurate database to improve renewable energy forecasts.	HIGH	IMMEDIATE Action (0-5 yrs.)
3	<b>Consider unbundling</b> of energy generation and grid operation or develop strategies to combat conflicts of interest with the connection of new IPP generation.	LOW	LONGER-term strategy (10+yrs)
4	<b>Establish open markets for ancillary services</b> that allow the participation of renewables. Enabling renewables to participate in the provision of ancillary services can help create the right incentives for a range of system- and grid-friendly investments both for new renewable energy projects as well as triggering changes to existing plants that can smooth their integration into the grid.	MEDIUM	MEDIUM-term action (5-10 yrs)



# Flexibility Provision with Renewable Energies

Follow **international best practices on grid code development** and regularly update the national requirements for renewable and conventional generators. Ensure conformity through appropriate compliance mechanisms.

HIGH

IMMEDIATE Action (0-5 yrs)

Grid Codes govern the behavior of both VRE and conventional generators and are critical for correct operation of the power system. They define:

- Fault ride through behavior
- Reactive power control / voltage response
- Active power control / frequency response
- Communication capabilities

Good practice for distributed generation: [IEEE 1547-2018](#)

Good practice for utility-scale: Refer to VRE leader countries (e.g. Ireland, Germany, Australia, California)

Further reading:

[IRENA, Scaling up Variable Renewable Power: The Role of Grid Codes, 2016](#)

IRENA, The role of grid codes in integration of variable renewables, forthcoming Q3/2021

# Flexibility Provision with Renewable Energies

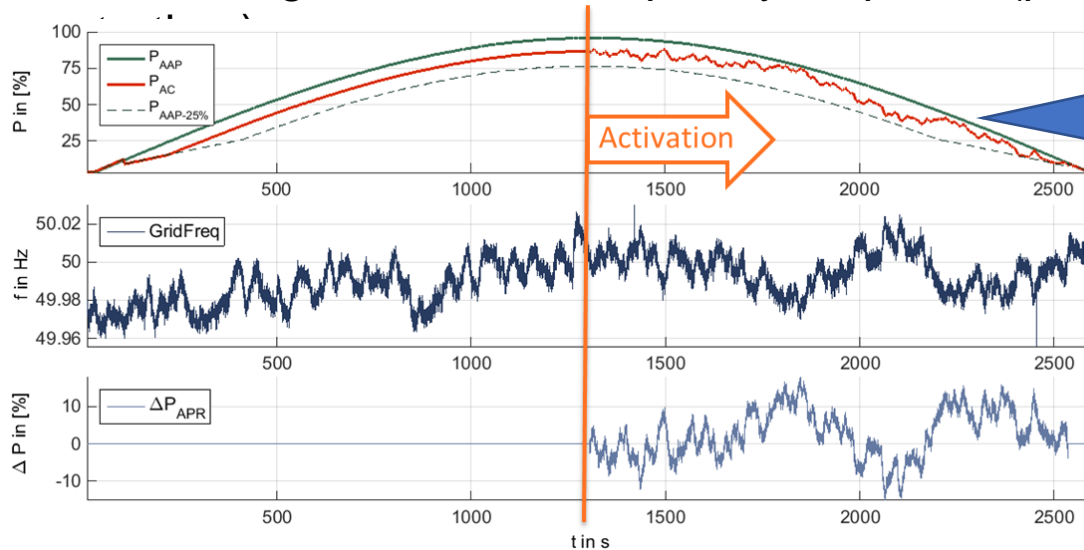
Establish open markets for ancillary services that allow the participation of renewables. Enabling renewables to participate in the provision of ancillary services can help create the right incentives for a range of system- and grid-friendly investments both for new renewable energy projects as well as triggering changes to existing plants that can smooth their integration into the grid.

MEDIUM

MEDIUM-term action  
(5-10 yrs)

## Common ancillary service markets:

- Balancing markets for frequency response (primary, secondary,



Example of frequency response from PV power plant

Possible Ways Forward for Solar PV Contribution to Coping with Impact of High Penetration, 16th Wind Integration Workshop, Berlin, 2017

# Flexibility Provision with Renewable Energies

**Establish open markets for ancillary services** that allow the participation of renewables. Enabling renewables to participate in the provision of ancillary services can help create the right incentives for a range of system- and grid-friendly investments both for new renewable energy projects as well as triggering changes to existing plants that can smooth their integration into the grid.

MEDIUM

MEDIUM-term action  
(5-10 yrs)

Common ancillary service markets:

- Balancing markets for frequency response (primary, secondary, tertiary)

New ancillary service markets currently tested in some countries:

- Fast frequency response (full activation within 1-2 seconds)
  - relevant for very high VRE shares (e.g. Ireland)
- Local flexibility markets (reduce congestion)
  - relevant if uneven distribution of VRE (such as the case for Vietnam)

# Flexibility Provision with Renewable Energies

**Consider unbundling** of energy generation and grid operation or develop strategies to combat conflicts of interest with the connection of new IPP generation.

LOW

LONGER-term strategy (10+yrs)

- Create level playing field for all grid users (conventional and renewable generators, storage, demand response)
- For example, by allowing the participation of all of them in ancillary service markets



# Transport Policies

- 1** Viet Nam should develop a comprehensive policy package to encourage the transition to cleaner modes of transport
- 2** Introduce a regulation phasing-out the sale of internal combustion engine two-and-three wheelers by a certain date (e.g. 2027)
- 3** Lead by example by setting out a clear plan to scale-up government purchases of electric vehicles and other zero-emissions vehicles (e.g. hydrogen) as part of the
- 4** Introduce mandates requiring buildings larger than a certain total floor space (e.g. 1.000 square meters) to install electric vehicle charging infrastructure
- 5** Adopt targets for the number of electric two-and-three wheelers as well as electric cars and trucks on the road by a certain date.
- 6** Introduce requirements on companies with large numbers of fleet vehicles (e.g. taxi companies, logistics companies, and large firms such as EVN) to procure EVs or other zero-emissions technologies on a priority basis for all future procurement.
- 7** Introduce mandates on vehicle retailers to sell a certain minimum share of electric models, with the share growing over time (e.g. 5% in 2022, 25% in 2025, 50% in 2030).



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# Annex: Decarbonisation

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# The Role of Energy Efficiency

	Recommendations	Level of importance	Timing
1	<b>Expand the PDP to make it a genuine Integrated Resource Plan</b> , as has been adopted widely throughout the US and in other jurisdictions around the world such as South Africa.	HIGH	Immediate ACTION (0-5 yrs)
2	<b>Lead by example by increasing government investment in energy efficiency in public buildings.</b>	HIGH	Immediate ACTION (0-5 yrs)
3	<b>Establish a super-ESCO</b> to catalyze investment in energy efficiency country-wide, offering services both to government facilities as well as to the private sector.	MEDIUM	MEDIUM-term action (5-10 yrs)
4	<b>Introduce targeted tax benefits for energy service companies</b> , including tax holidays and improved depreciation rules.	MEDIUM	Immediate ACTION (0-5 yrs)
5	<b>Introduce targeted tax benefits for medium and large industries</b> in Viet Nam.	MEDIUM	Immediate ACTION (0-5 yrs)
6	<b>Implement a series of demand response programs</b> in partnership with industrial and commercial companies in Viet Nam.	MEDIUM	Immediate ACTION

# Socio-Economic Impacts

	Recommendations	Level of importance	Timing
1	Establish <b>local actions plans</b> in coal regions. In each location affected by the transition, an analysis of the value creation linked to fossil fuel, the work force (e.g. skill levels and age structure) and alternative economic pathways can be planned. This will help to determine re-skilling measures.	LOW	LONGER-term strategy (10+yrs)
2	Creating a <b>taskforce to negotiate an overarching framework for a transition out of coal</b> . The objective is to build a social compact between the key parties (local governments, national government, labor unions, etc.), to manage the conflicts that can emerge over a transition out of coal, like job losses.	LOW	LONGER-term strategy (10+yrs)
3	<b>Diversifying the regional economy</b> creating new jobs beyond coal. Other energy transition technologies (solar PV, energy efficiency, batteries) can create new jobs and help to diversify (regional and national) economies.	MEDIUM	MEDIUM-term action (5-10 yrs)



# Transitioning the Labor Market

	Recommendations	Level of importance	Timing
1	<b>Drive job creation through roof-top PV programs.</b>	HIGH	IMMEDIATE Action (0-5 yrs)
2	<b>Encourage skills development to meet future demand for clean energy workers.</b> Developing adequate education and training programs will be crucial for Viet Nam in the coming years.	HIGH	MEDIUM-term action (5-10 yrs)
3	<b>Re-skilling workers from the fossil fuel sector</b> will be crucial on the long-term. In particular the number of employees in coal-fired power plants and coal mining will like decline rapidly over the coming decades. This process will be primary triggered by an increasing automation of processes in the coal sector.	MEDIUM	LONGER-term strategy (10+yrs)



# Annex: The Roles of Infrastructure

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# Infrastructure Needs for the Distribution System

	Recommendations	Level of importance	Timing
5	Further <b>standardize interconnection application procedures</b> for small PV installations and EV charging stations. Ensure appropriate <b>data collection through a national registry</b> of renewable power plant installations and electric vehicle charging stations.	HIGH	IMMEDIATE Action (0-5 yrs)
6	Utilities should be required to develop and publish periodic <b>assessments of PV and EV hosting capacities in distribution grids</b> , and to report on grid congestion and other factors, to provide clearer signals to the market and to developers of EV charging stations.	MEDIUM	IMMEDIATE Action (0-5 yrs)
7	Closely monitor international developments on <b>smart charging solutions for electric vehicles</b> and adopt them as soon as becoming available. Incentivize load management solutions at charging hubs for fleet vehicles, adjusting charging times to local grid conditions and renewable energy generation. Develop a long-term perspective on EV smart charging and <b>dynamic pricing for private (household) charging</b> .	MEDIUM	MEDIUM-term action (5-10 yrs)

# Infrastructure Needs for the Distribution System

	Recommendations	Level of importance	Timing
	Require <b>remote curtailment capabilities</b> or <b>basic controllability</b> of at least any low voltage-connected PV installations that are not covered by the sizing restriction for new power plants.	HIGH	IMMEDIATE Action (0-5 yrs)
	Require <b>reactive power control modes</b> for all renewable generation units, including rooftop PV, as well as DC charging stations <b>in the respective grid code</b> documents.	HIGH	IMMEDIATE Action (0-5 yrs)

REQUIREMENTS ON INVERTER CAPABILITY	RECOMMENDED CAPABILITY
Low/high frequency ride-through	++
Frequency response	++
Low/high voltage ride-through	++
Reactive power provision	++
Reactive power control modes	++
Active power control modes	++
Ramp rate limitations	+
Basic communication & controllability capability	++

Recommended standard: [IEEE 1547-2018](#)

# Infrastructure Needs for the Transmission System

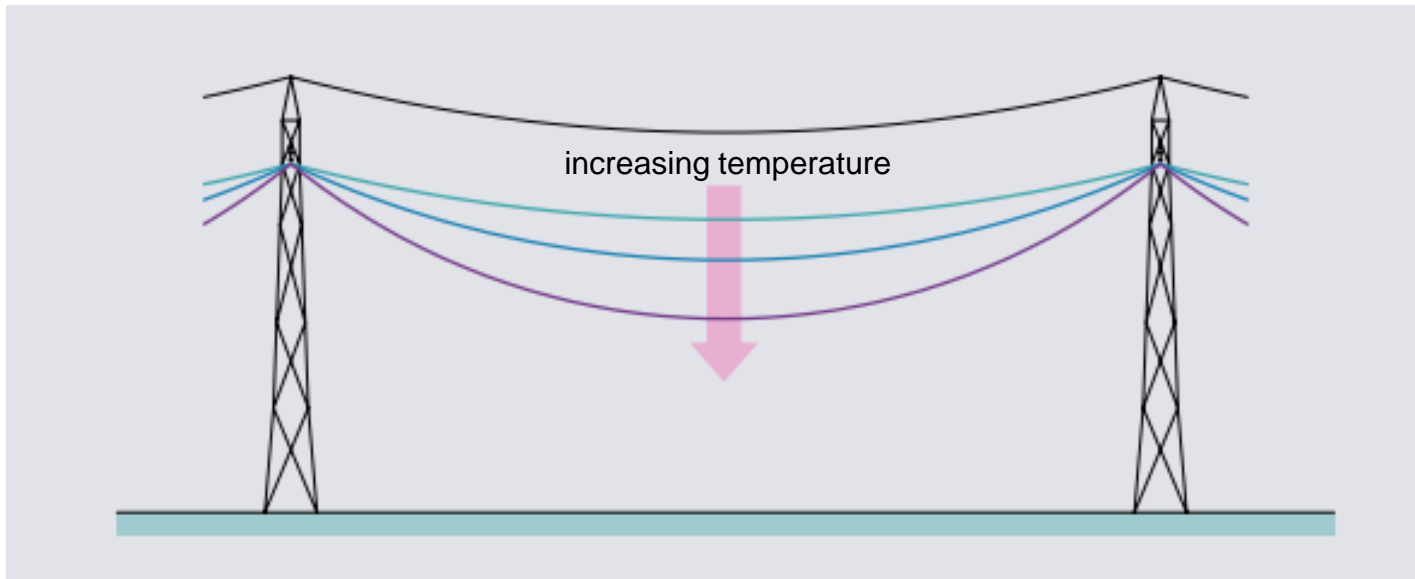
	Recommendations	Level of importance	Timing
1	Consider <b>shorter term adjustments of planning</b> next to the 10 year planning process of the PDP in order to enable a faster response to a changing environment in renewable energy development and energy storage cost and thus a better alignment of build-out in transmission assets and renewable power plants.	HIGH	IMMEDIATE Action (0-5 yrs)
2	Run multiple pilot projects with short-term mitigation <b>measures to cope with congestion limits</b> such as dynamic line rating, grid boosters, high temperature low sag conductors, or power flow controllers. Update planning processes to standardize the utilization of such measures.	MEDIUM	IMMEDIATE Action (0-5 yrs)
3	Define <b>clear regulation on renewable energy curtailment</b> with full or partial financial compensation for curtailed energy of renewable energy power plants. This can include putting clear <b>caps on the total allowable curtailment amounts</b> .	HIGH	IMMEDIATE Action (0-5 yrs)
4	Promote unbundling, especially the separation of the transmission network from EVN. This transmission system operator (TSO) entity should also promote the transmission of offshore wind power to the national system and investigate the possibility of DC hubs for the offshore transmission system.	MEDIUM	LONG-TERM Action (10 yrs)

# Infrastructure Needs for the Transmission System

Run multiple pilot projects with short-term mitigation **measures to cope with congestion limits** such as **dynamic line rating**, grid boosters, **high temperature low sag conductors**, or **power flow controllers**. Update planning processes to standardize the utilization of such measures.

MEDIUM

IMMEDIATE  
Action (0-5  
yrs)



- Dynamic line rating (cooling effect from wind → more transmission capacity)
- High temperature low sag conductors (→ higher transmission capacity)
- Power flow controllers (e.g. [Smart Wires](#))

# Infrastructure Needs for the Transmission System

Run multiple pilot projects with short-term mitigation **measures to cope with congestion limits** such as dynamic line rating, **grid boosters**, high temperature low sag conductors, or power flow controllers. Update planning processes to standardize the utilization of such measures.

MEDIUM

IMMEDIATE  
Action (0-5  
yrs)

- Grid boosters with batteries

Typically, maximum load limited to 50%:

Load (n-0): 50%

Load (n-1): 100%

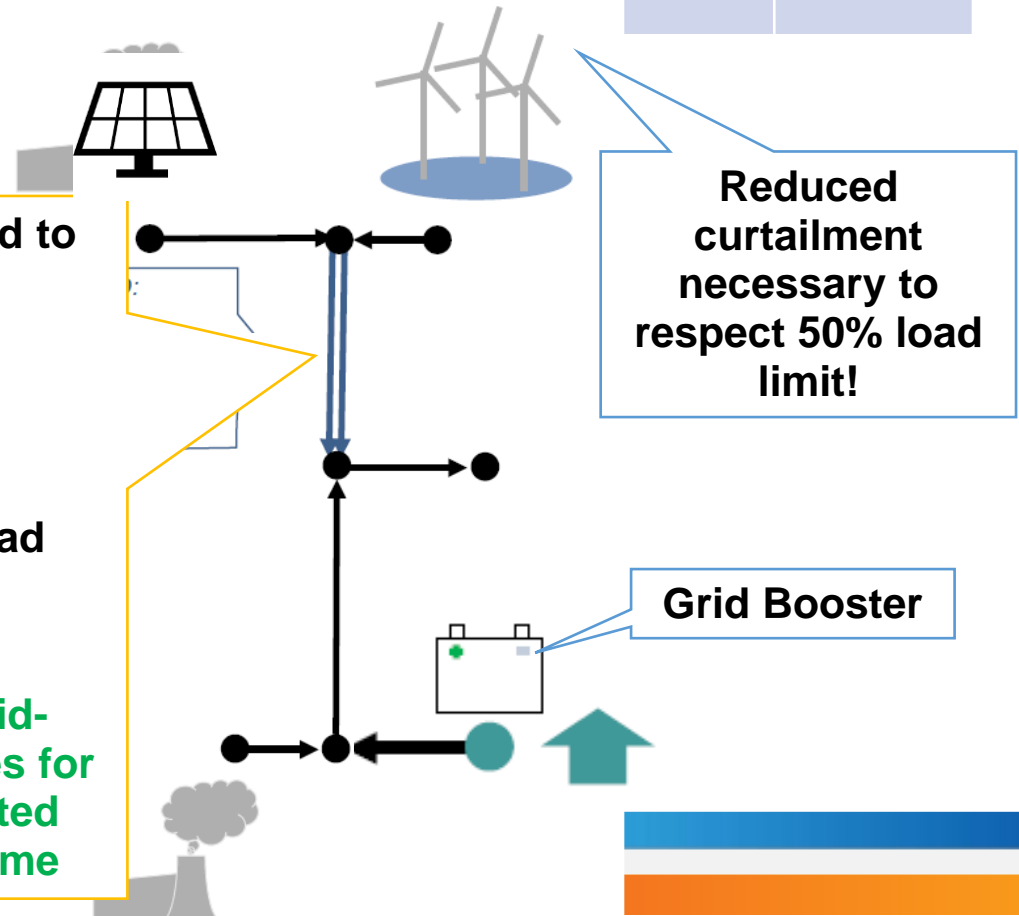
With grid booster, maximum load increased to 100%:

Load (n-0): 100%

Load (n-1): 100% →

**grid booster**

**Grid-  
compensates for  
load for limited  
amount of time**



# Infrastructure Needs for the Transmission System

Define **clear regulation on renewable energy curtailment** with full or partial financial compensation for curtailed energy of renewable energy power plants. This can include putting clear **caps on the total allowable curtailment amounts**.

HIGH

IMMEDIATE  
Action (0-5  
yrs)

**Financial compensation for curtailment (if greater than e.g. 3%)**

**Reduced curtailment necessary to respect 50% load limit!**

**Grid Booster**

Typically, maximum load limited to 50%:

Load (n-0): 50%

Load (n-1): 100%

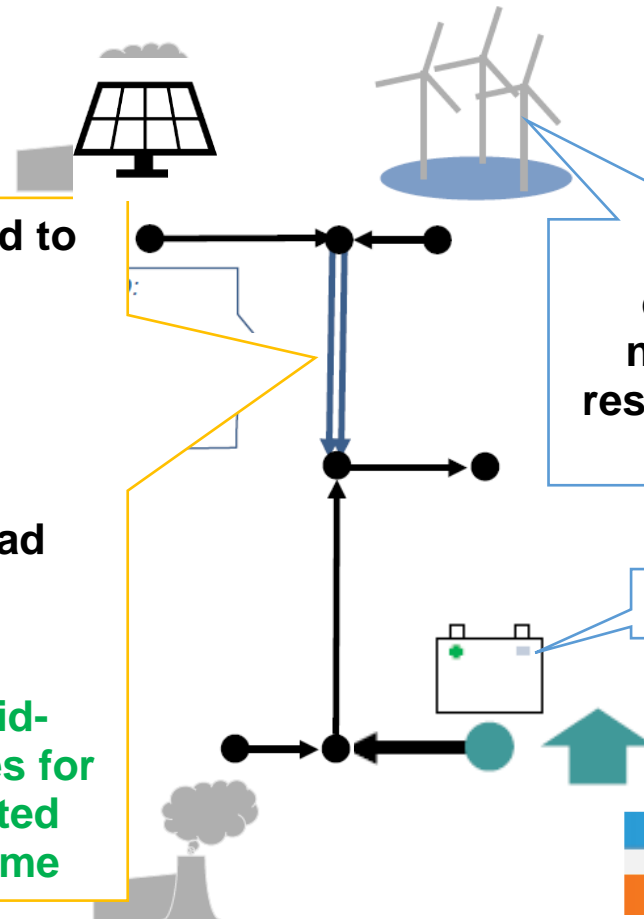
With grid booster, maximum load increased to 100%:

Load (n-0): 100%

Load (n-1): 100% →

**booster**

**Grid-booster compensates for load for limited amount of time**





# Infrastructure Needs for the Development of Smart Grids

	Recommendations	Level of importance	Timing
	Implementation of a <b>national registry for renewable energy power plants.</b>	HIGH	IMMEDIATE Action (0-5 yrs)
	Include all renewable power plants in the <b>centralized renewable energy forecast</b> (not only large plants). Consider deleting the requirement of an individual forecast of each RE producer due to limited value and high inaccuracy.	HIGH	IMMEDIATE Action (0-5 yrs)
	Require large-scale renewable energy plants (onshore wind, offshore wind, solar PV, and hydro power in particular) to provide <b>real-time information for improving forecast accuracy.</b>	MEDIUM	IMMEDIATE Action (0-5 yrs)
	Improve <b>forecasting accuracy</b> through the <b>weighted input of multiple numerical weather prediction models</b>	MEDIUM	IMMEDIATE Action (0-5 yrs)
	Consider opening up the operation of aggregated distributed energy resources and controllable demand to <b>virtual power plant (VPP) operators.</b>	MEDIUM	MEDIUM-term action (5-10 yrs)



# Infrastructure Needs for the Development of Smart Grids

Include all renewable power plants in the **centralized renewable energy forecast** (not only large plants). Consider deleting the requirement of an individual forecast of each RE producer due to limited value and high inaccuracy.

HIGH

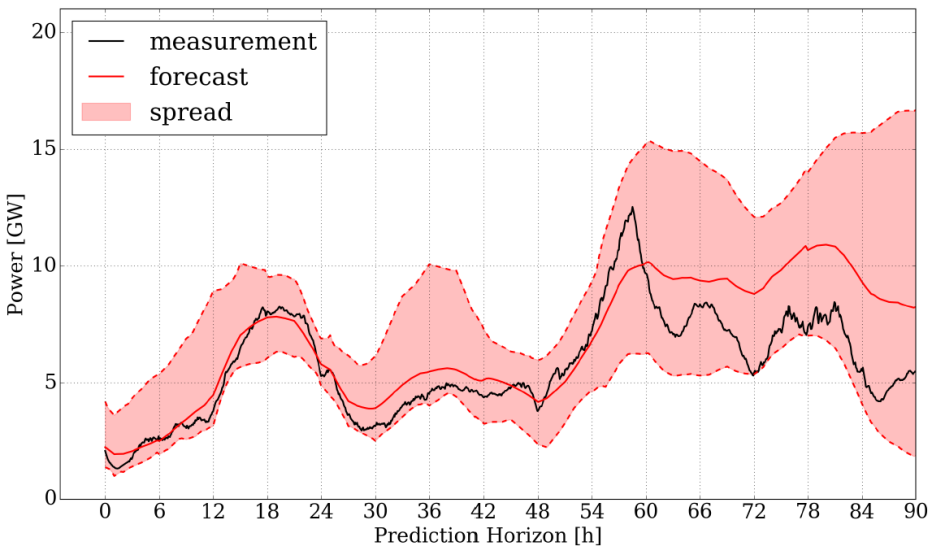
IMMEDIATE Action (0-5 yrs)

Require large-scale renewable energy plants (onshore wind, offshore wind, solar PV, and hydro power in particular) to provide **real-time information for improving forecast accuracy**.

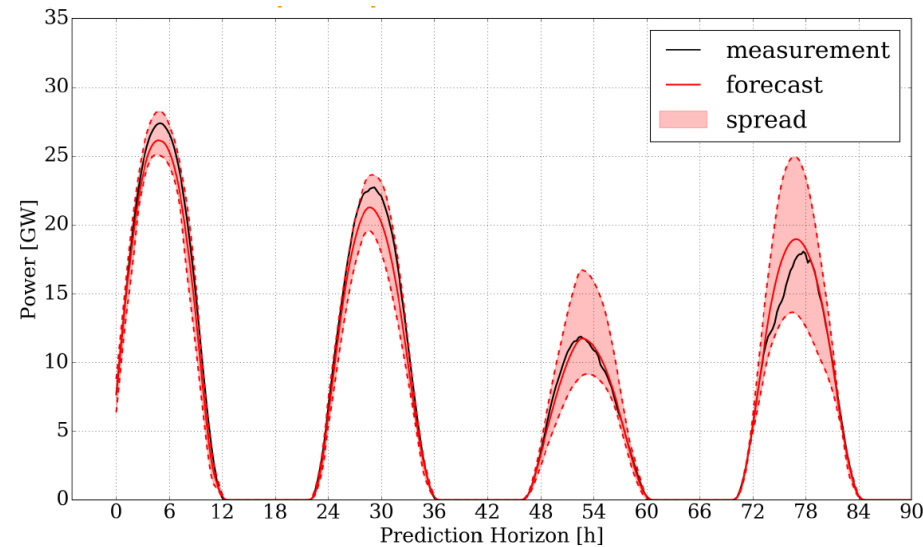
MEDIUM

IMMEDIATE Action (0-5 yrs)

## Wind power forecast



## Solar power forecast



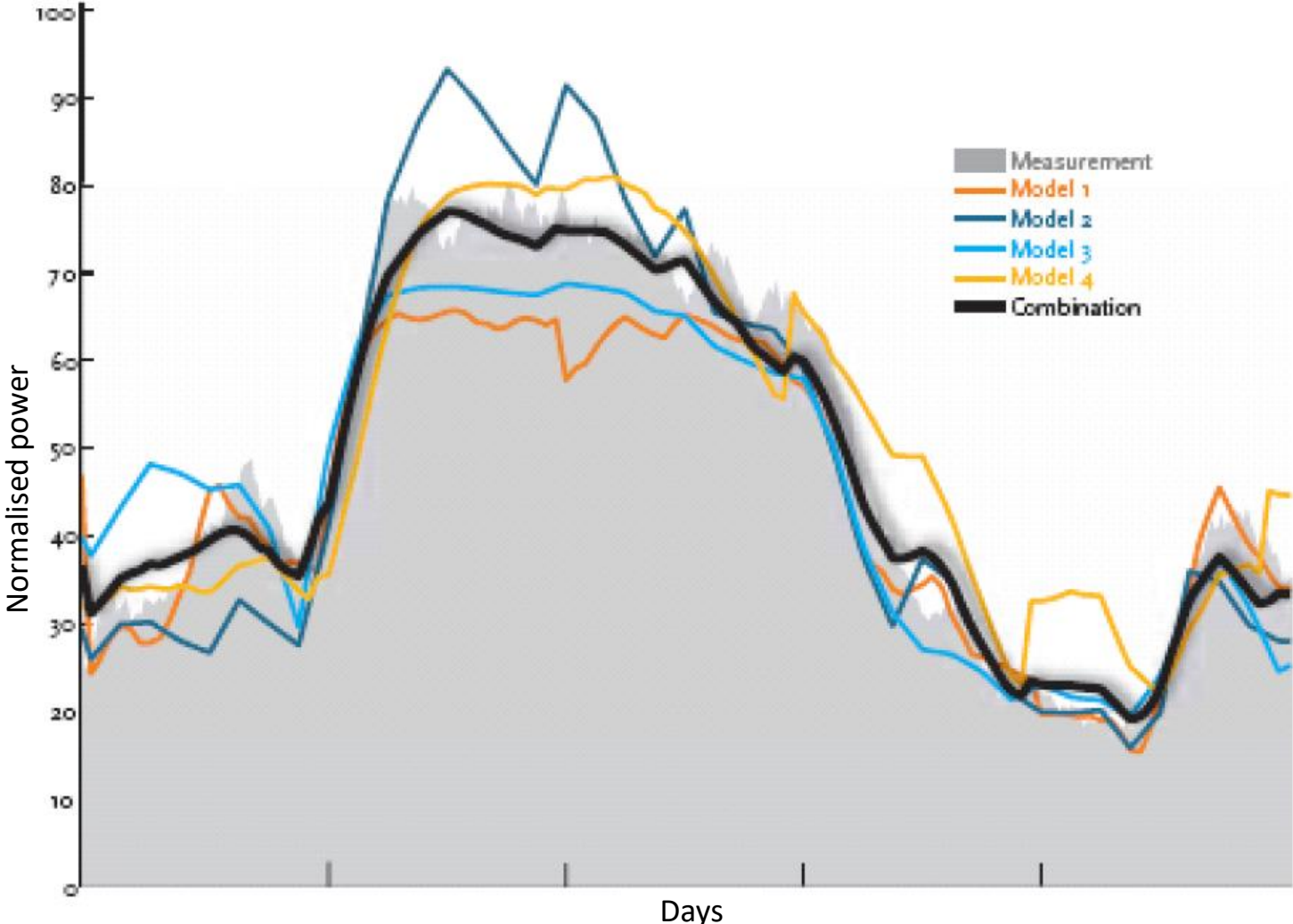
Source: energy&meteo systems

# Infrastructure Needs for the Development of Smart Grids

Improve forecasting accuracy through the weighted input of multiple numerical weather prediction models

MEDIUM

IMMEDIATE Action (0-5 yrs)



Source: energy&meteo systems



# Energy Storage and Flexibility Options

	Recommendations	Level of importance	Timing
	Progressively <b>reduce the guaranteed full-load hours of conventional, inflexible coal-fired power plants</b> in order to increase the overall share of flexible resources in the Vietnamese power system;	MEDIUM	IMMEDIATE Action (0-5 yrs)
	Provide clear incentives and requirements for <b>flexible operation in new fossil fuel based generation.</b>	HIGH	IMMEDIATE Action (0-5 yrs)
	Provide <b>targeted incentives for fast-ramping technologies, with a focus on demand-side and storage resources</b> that can provide a rapid and dispatchable new source of flexibility to the system, including the provision of frequency response through batteries.	MEDIUM	Immediate action (0-5 yrs)
	Conduct <b>long-term strategies</b> , taking into account different flexibility and storage options.	MEDIUM	IMMEDIATE Action (0-5 yrs)
	Investigate the <b>options for more pumped-storage hydro in Viet Nam</b> and sharing flexibility sources and storage solutions with neighboring countries through <b>increased cross-border exchange.</b>	MEDIUM	MEDIUM-term action (5-10 yrs)
	Set up a <b>working group to closely monitor hydrogen developments</b> around the world. Incentivize green hydrogen production plants linked to renewable energy generation as soon as commercialization is in sight.	MEDIUM	MEDIUM-term action (5-10 yrs)

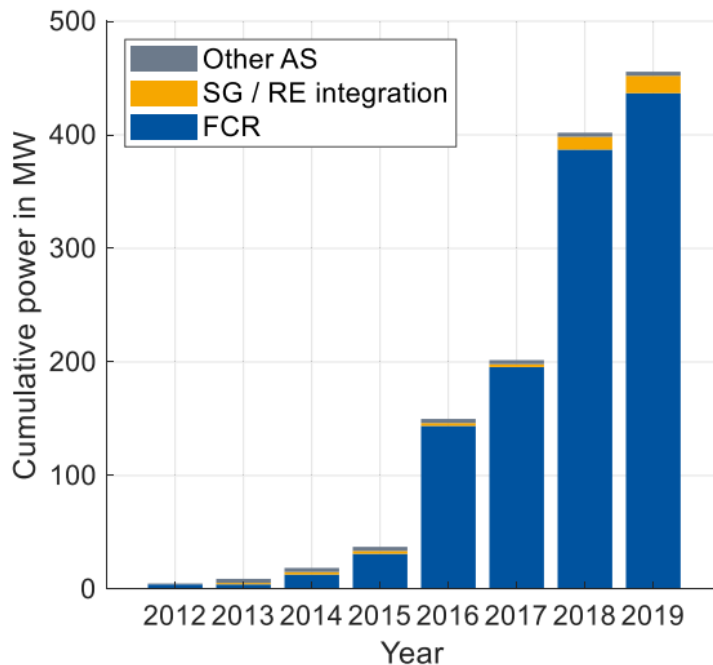


# Energy Storage and Flexibility Options

Provide **targeted incentives for fast-ramping technologies, with a focus on demand-side and storage resources** that can provide a rapid and dispatchable new source of flexibility to the system, including the provision of frequency response through batteries.

MEDIUM

Immediate action (0-5 yrs)



**Large-scale batteries** in Germany primarily used **for frequency response** (FCR: Frequency Containment Reserve). Similar developments in UK, Ireland, Australia, California, ...

Batteries are ideally suited for this (very high response time, cheaper than other sources for primary frequency response)

J. Figgner et al., "The development of stationary battery storage systems in Germany – status 2020," J. Energy Storage, 2021

