Clean Energy Transition in Vietnam

Technical Analysis and Mobilizing Financing

November 2022

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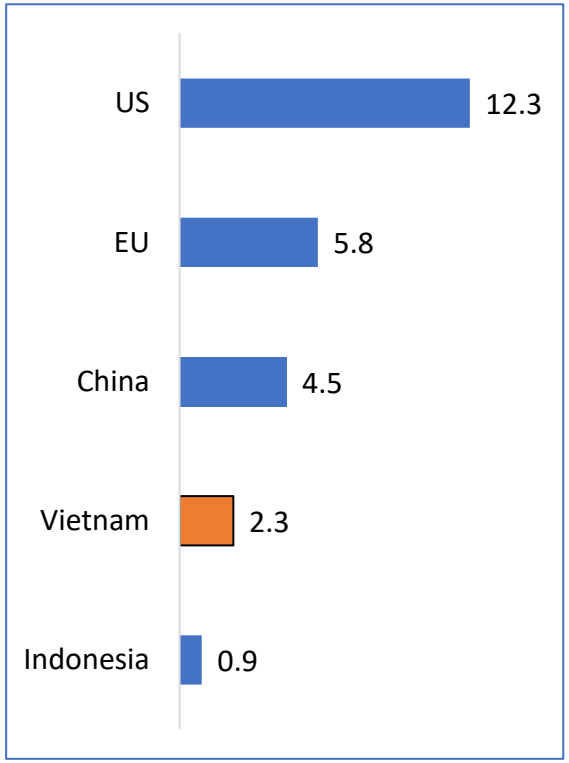
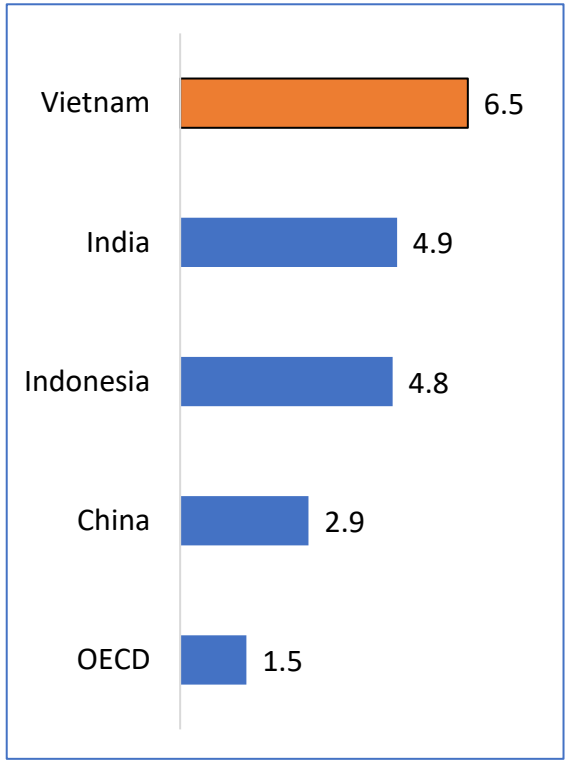
Vietnam is an emerging economy with fast-growing energy needs

Population	GDP	Electrification rate
98 million	271 billion	99.8%

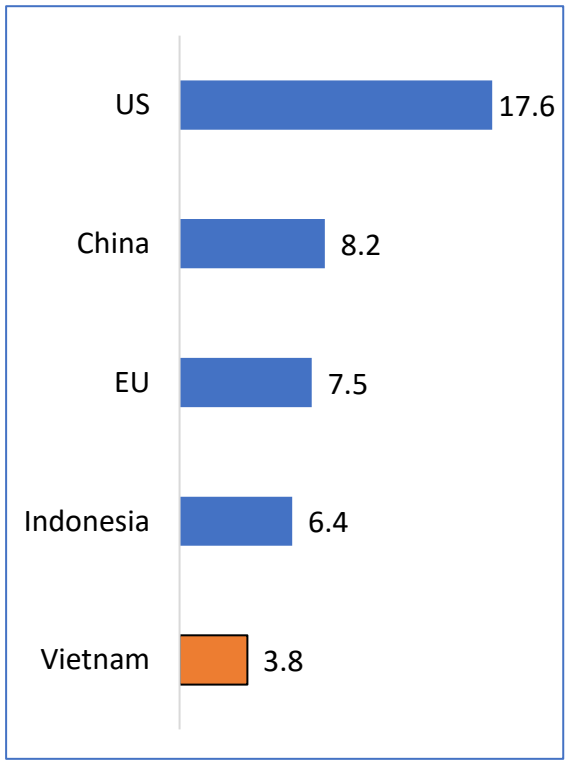
Electricity Consumption Per Capita
(MWh per year)



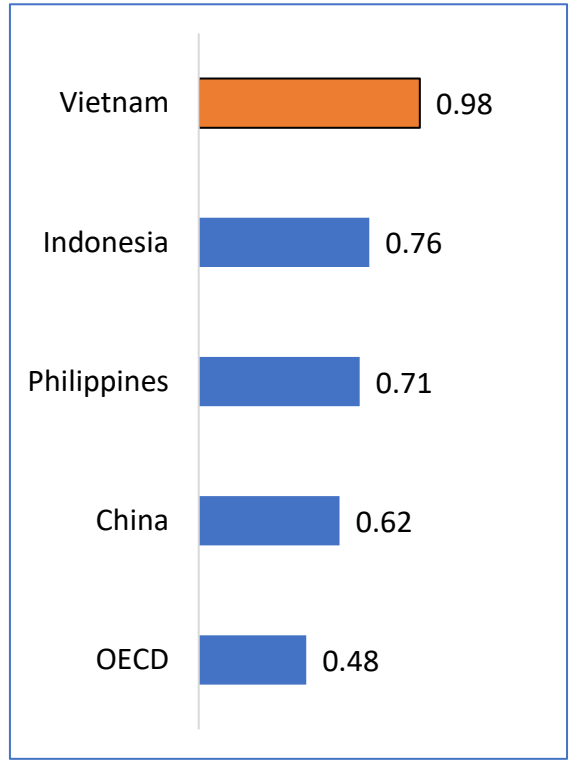
Electricity Demand Growth Forecast
(Percentage, 2020-30)



Emissions Per Capita
(tCO2eq per year)



Power Grid Emission Factor
(tCO2eq per MWh)

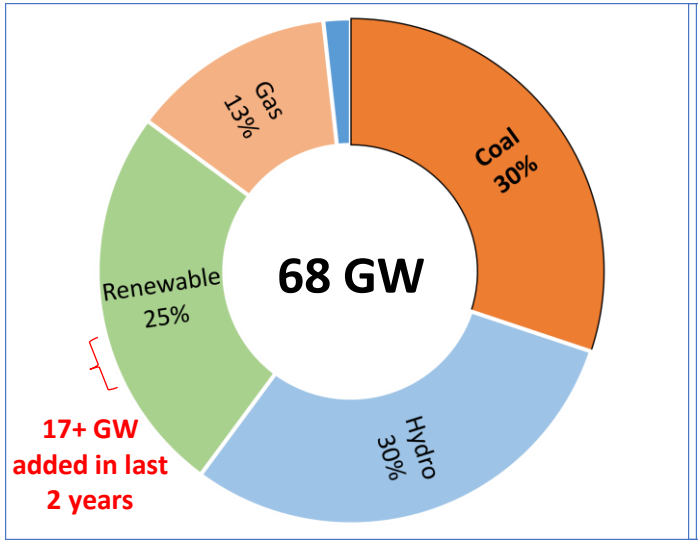


Electricity demand - despite aggressive energy efficiency gains - is expected to double every 10 years as the consumption is driven by growing incomes and new sources of demand (such as: digitalization, e-mobility).

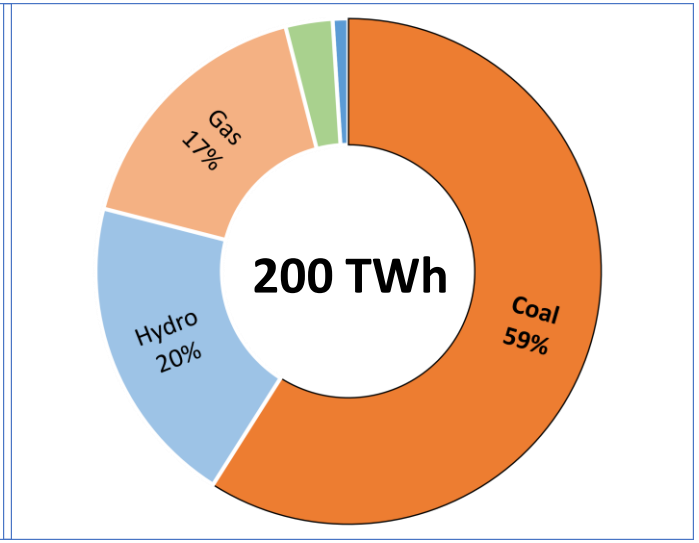
Recent trend of reliance on coal power has led to rapid growth of GHG emissions

Installed capacity of coal	→	Installed capacity of coal
5 GW in 2010		20 GW in 2020

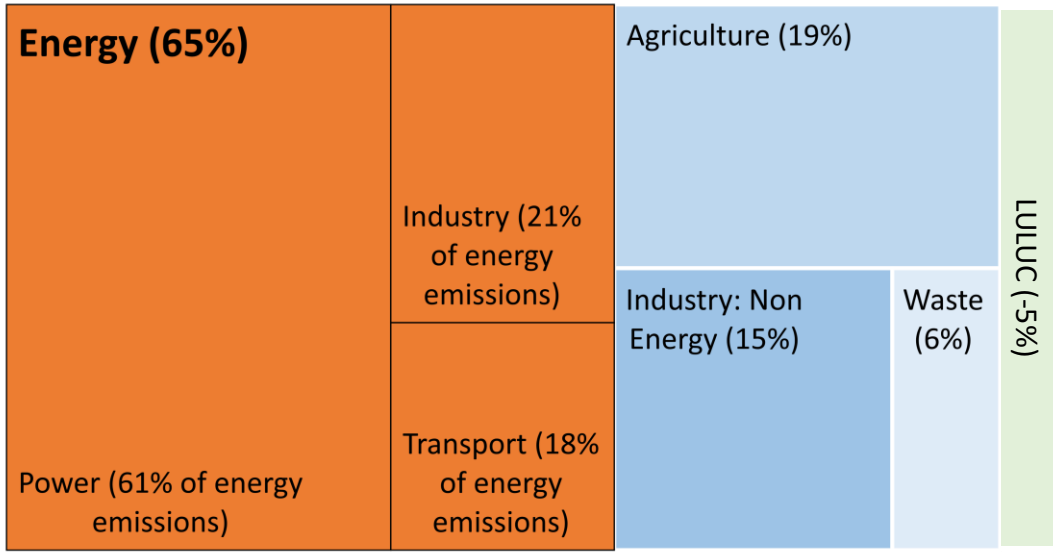
Installed Power Capacity by Fuel Type
(Percentage, 2020)



Electricity Produced by Fuel Type
(Percentage, 2020)



Sector-wise GHG Emissions
(Percentage, 2020)

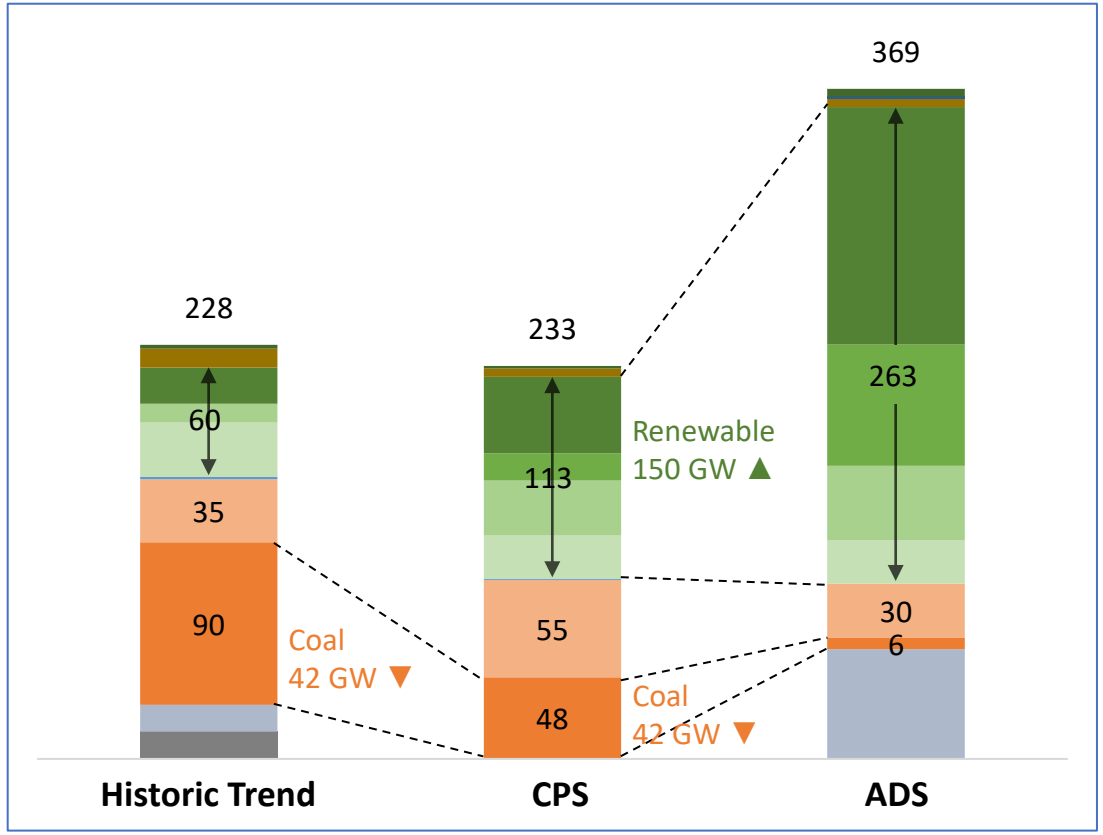


Annual coal consumption in 2020 was 88 million tons (1% of global consumption).

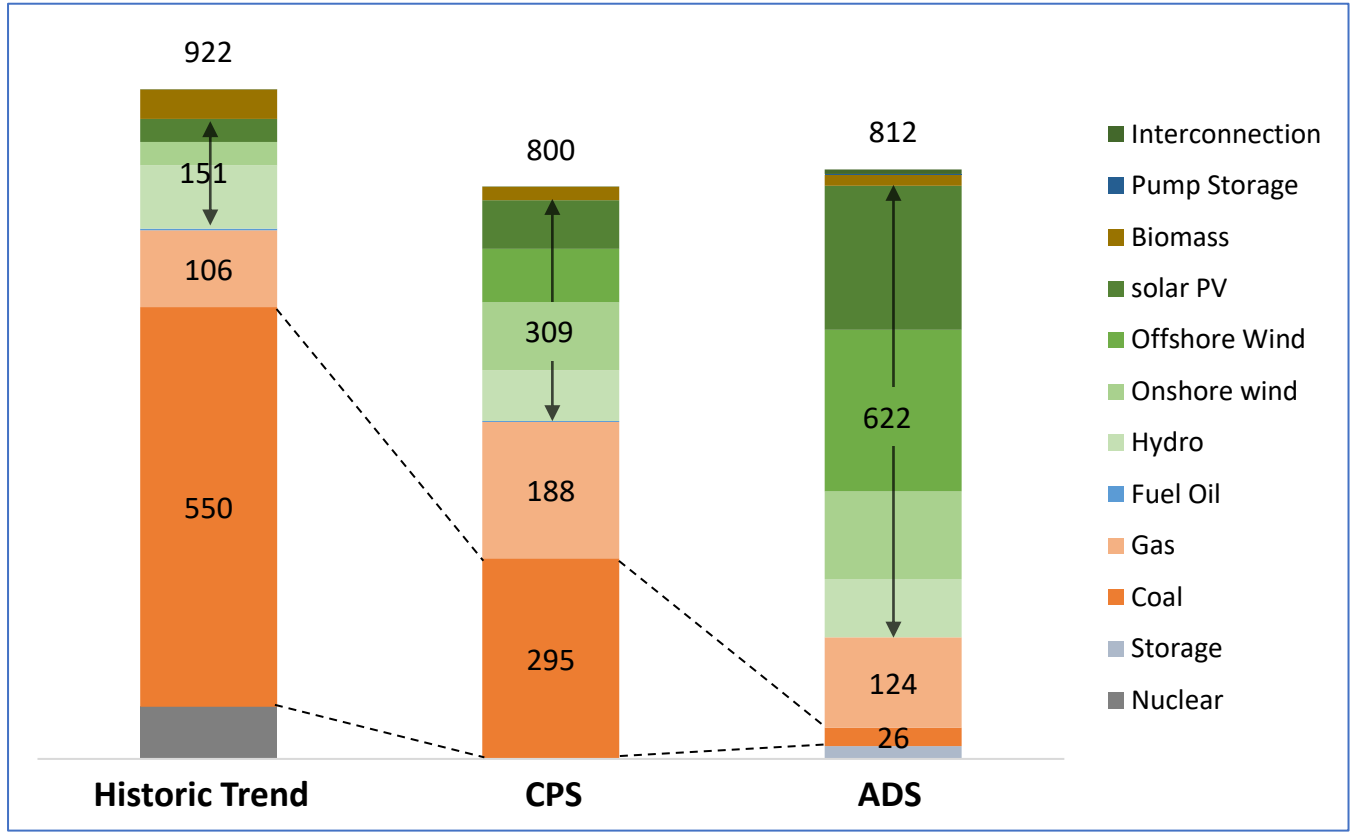
Planning sets the stage for investment needs

Historic Trend - PDP7	Current Policy Scenario (CPS) - PDP8 (Oct 21)	Accelerated Decarbonization Scenario (ADS)
Base case emissions Coal power increases by 3x by 2030	**Emissions reduce by 40% by 2040** compared to historic trend	**Emissions reduce by 80% by 2040** compared to CPS, coal power peaks in 2025

Installed Capacity in 2040 (GW)



Electricity Generated in 2040 (TWh)



CPS: aligns with NDCs, i.e., 27% reduction (international support), 9% reduction (domestic resources) by 2030.
ADS: aligns with Vietnam's target of net-zero emissions by 2050 (announced at COP-26).

The importance of least-cost top-down planning

Power System Modeling

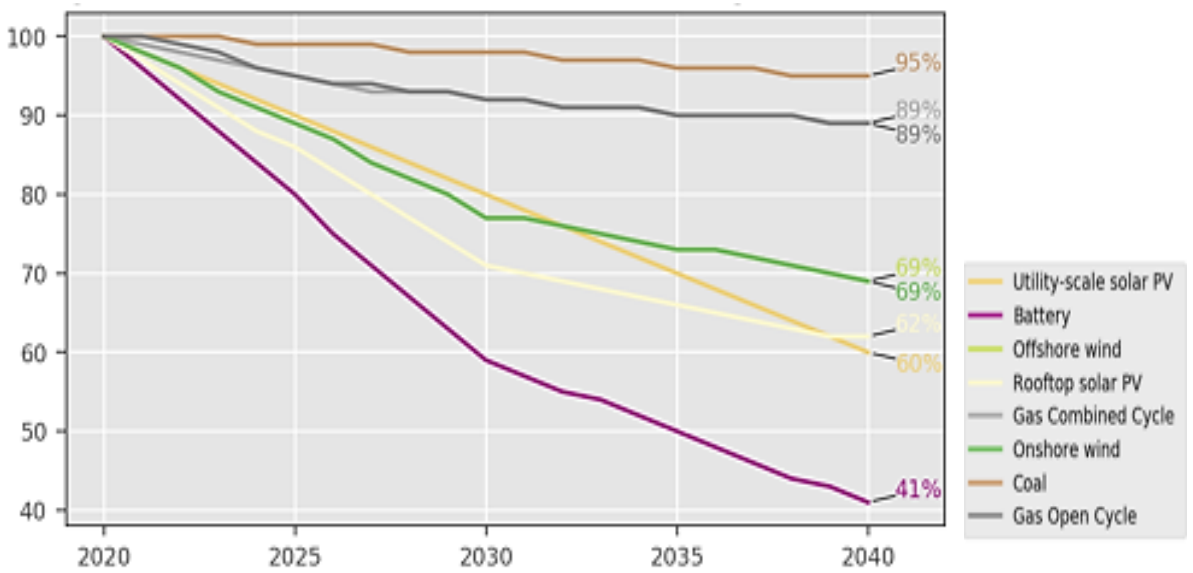
- **Model used**: Electricity Planning Model (EPM) - developed in-house by the World Bank's Global Knowledge Unit (using industry standard optimization tools).
- **Data inputs:** Reflects the latest power sector demand and supply situation in Vietnam (using verified government data sources). IEA + 2021 Vietnam Technology Catalogue.
- **Technology neutrality:** Generation resources compete on a level playing field with optimistic (best international practice) cost reduction projections/assumptions.
- **Electricity demand growth:** Based on economic growth and declining income elasticity - with aggressive energy efficiency assumptions - and new areas of demand growth (such as digitalization, e-mobility). Annual and peak demand: 6.3%/year.
- **Top-down/Least cost investment plan:** Model selects generation resources based on total system financing requirement (not individual assets) within emission constraints.
- **Sector emission profiling:** Scenarios are based on emissions constraints ranging from 20%-80% reduction targets. Power supply mix for each emission reduction scenario is least-cost within this emission constraint.
- **Ongoing assessment**: Planning process is periodically updated, and new investment decisions can be made based on underlying evolution of market conditions.

Model Assumptions

Capital cost of technologies
(US$M, 2020)

Technology	Capital Cost
Coal	1.6 per MW
Gas	0.8 per MW
Storage	0.3 per MWh
Wind - Onshore	1.2 per MW
Wind - Offshore	2.5 per MW
Solar PV	0.7 per MW

Capital cost reduction trajectories
(Real percentage changes)



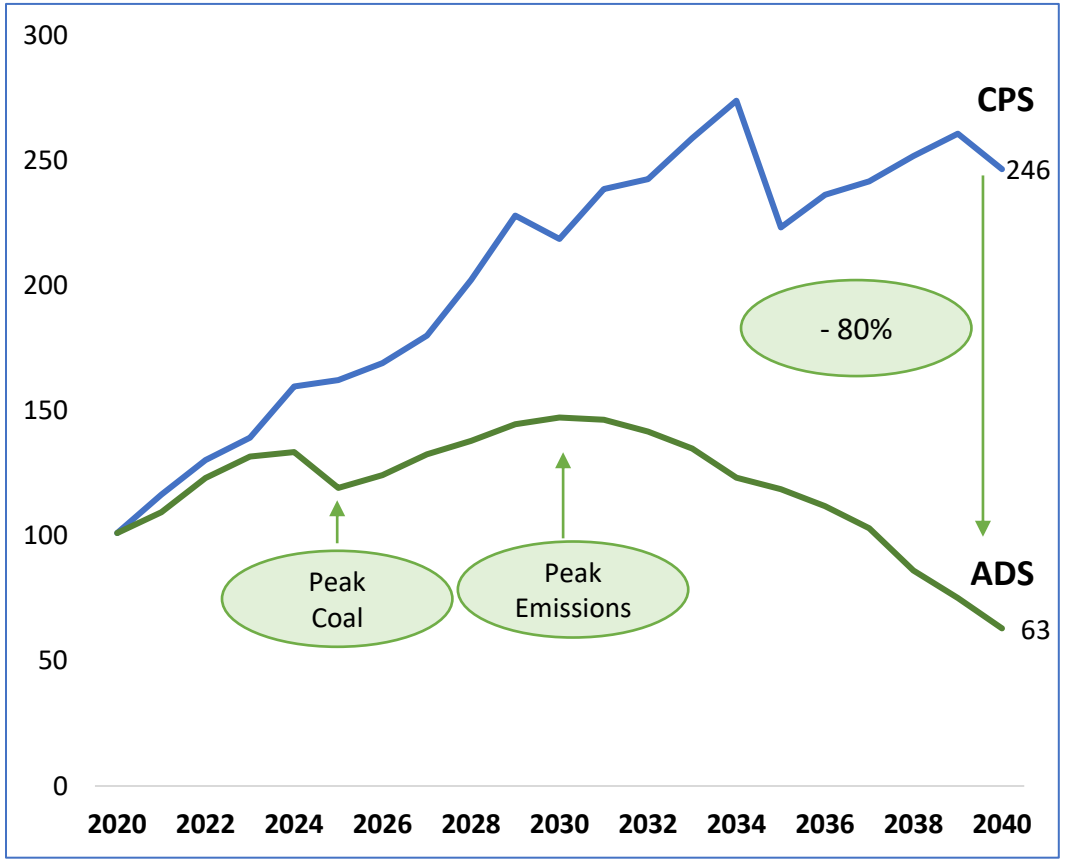
EPM cost reduction trajectories are based on IEA data and standard industry projections

Power system modeling tool provides dynamic investment decision support for policy makers.
It is also an input for macro-modeling efforts (e.g., using CGE tools).

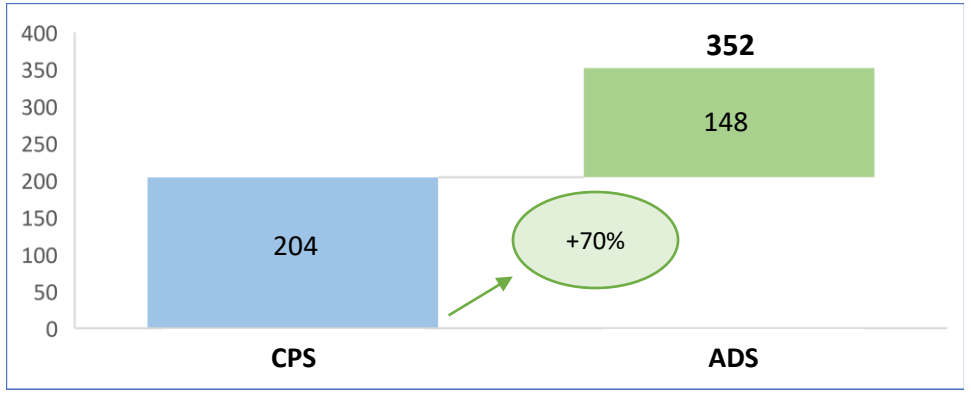
Costing the transition

Current Policy Scenario (CPS) - PDP8	Accelerated Decarbonization Scenario (ADS)
'Total' system cost: $264 B (net present value of capex, opex, fuel costs)	'Total' system cost: $297 B (net present value of capex, opex, fuel costs)

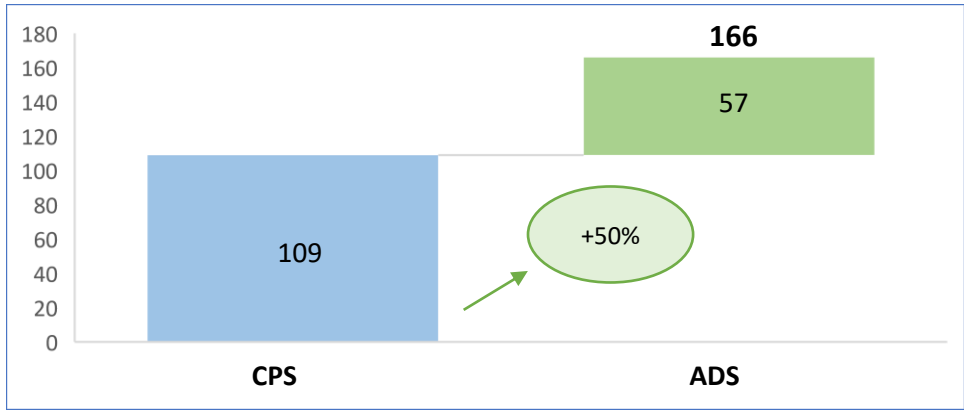
Power Sector GHG Emissions (MtCO2e, 2020-2040)



Upfront capital costs (US$ billion, 2020-2040)



Upfront capital costs in present value (US$ billion, 2020-2040)



ADS Additional Considerations:

- $12 billion cost of retirement (max 20-year lifetime) of 15 GW of coal plants (for dealing with stranded assets).
- Impact to domestic coal industry and cost of 'Just Transition'.

ADS: cost of electricity increases by 16% on average (25% higher in year 2040) compared to CPS.
ADS: estimate of $19 billion in concessional finance needed (in PV terms) for cost of electricity to be at par with CPS.

Syndicating large scale financing for the energy transition: challenges

ADS requires the following for regulated segments

Additional requirements for policy reforms and de-regulated segments

Total Capex Need

Power generation related		Power grid related	
Mainly private sector sources		Mainly public sector sources	
Smaller projects (< 500 MW) Typically, corporate financed Local and regional investors	**Larger** projects (> 500 MW) Typically, project financed International institutional lenders	**Greenfield**, point-point lines Can be project financed Can attract private financing	**Brownfield** and linked grid EVN corporate self-financing Complemented by borrowing

Impediments

Planning	Approval status under remains unclear			
Procurement	No transparency, ad-hoc negotiations		Need regulatory updates	✓ Enterprise Law Decree 114*
Financing	Risk allocation shortcomings	Risk allocation shortcomings No clarity on sovereign support	Risk allocation to be defined Sovereign support need likely	Need for cost-reflective tariff Single borrower limits
Concessional Funds	No blending mechanisms (or very limited)	Need clear PPP procedures	Need clear PPP procedures	On-lending (Decrees 79 and 97) Mis-matched timing of approval

*outstanding implementation challenges

There remain systematic constraints to mobilizing public and private financing.
This not only threatens energy transition but also energy security for development and growth ambitions.

Global experience and local expertise can overcome challenges

ADS requires the following for regulated segments

Additional requirements for policy reforms and de-regulated segments

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Solutions				
Planning	Issue PDP8 with clear capacity targets – and ensure alignment with SEDP and COP-26 commitments			
Procurement	Launch competitive auctions for power projects Implement wholesale electricity market reforms over time		Reforms of electricity Law Third party access over time	✓
Financing	Issue market-based PPAs Recycle/equitize assets	Issue market-based PPAs Provide guarantees for IPPs Recycle/equitize assets	Issue market-based PTAs Provide guarantees for IPTs	Continue tariff reforms Issue international bonds
Concessional Funds	Allow financial intermediary structures for ODA	Implement PPP Law with streamlined ODA procedures	Implement PPP Law with streamlined ODA procedures	Allow direct ODA access for EVN Accommodate donor procedure

In general, there is no lack of available financing – reforms and development partner support can unlock the potential. Additional opportunities for sectoral policy lending, results-based financing, carbon pricing instruments.

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Annex

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Recommendations for energy transition policy framework

1 Use power system planning as a flexible policy and investment decision guidance tool

- **Continuously re-assess and recalibrate power generation investments** - within clear long-term policy targets (e.g., emission reduction).
- **Improve transparency for all stakeholders and investors** - including standardizing the procurement and licensing process of power projects.

2 Accelerate renewable energy deployment – in particular, offshore wind

- **Phase out sub-optimal premium pricing under feed-in-tariff schemes** - a transparent and competitive auction-based scheme will be most economic for Vietnam.
- **Develop and implement offshore wind program** - take a comprehensive policy and planning view, including marine spatial planning, port and supply network development.

3 Expand and modernize the power grid to integrate variable renewable energy at scale

- **Upgrade the power capacity and flexibility of the grid** - to absorb variable renewable energy.
- **Improve regulatory framework for energy storage systems (such as batteries, pumped hydropower)** - and for ancillary services (voltage, frequency management, peak shaving).

4 Achieve timely development of natural gas supply needed to substitute coal development

- **Implement gas supply chain policy reforms** - criteria for gas supply procurement; select and develop LNG receiving ports and LNG processing and storage facilities.
- **Update regulatory framework for gas-to-power industry** - safe handling and use of gas supply; pass-through pricing policy for sale of gas to power plants.

5 Intensify energy efficiency and demand moderation measures

- **Provide market making support for EE services and financing** - preferential credit and taxation schemes; regulatory incentives; capacity development.
- **Implement demand measures** - time-of-use tariffs; consumer appliances and industrial technology standards; intensify EE promotion awareness campaigns.

6 Mobilize private sector financing with targeted public sector support

- **Establish clear and consistent criteria for public provision of off-take guarantees** for private sector energy transition investments.
- **Create systems to certify and monitor green investments** - this can incentivize institutional investors to provide green loans and purchase green bonds.
- **Continued electricity tariff reforms are needed** - ensure that revenue requirements are based on full cost of supply while protecting the most vulnerable consumers.

Summary of analysis and key takeaways

Balancing development and climate objectives is critical

- **Electricity demand could increase by 4x by 2040 (from the 2020 levels)** - in line with Vietnam's growth and development objectives.
- **Lower carbon electricity supply will require choosing higher capital cost solutions now.**
  - For instance, plan on investing 2% of GDP for 40% less power sector emissions (CPS) - or investing 3.3% of PV GDP for 80% less emissions (ADS).

Mobilizing the requisite scale of financing is challenging - as is the question of who pays for these higher costs

- **Default: costs passed to electricity consumers with 25% increase in average tariff** (some consumer categories may see higher or lower increases).
  - How to mitigate tariff impact on vulnerable consumers and on economic competitiveness?
- **Other options: costs passed on to consumers and taxpayers, carbon funds, external concessional resources.**

Evolution of technology and costs influence choice & re-calibration of future supply pathways - but many investment decisions need to be made now

- **Despite fast growth of renewables, coal will only be stranded by aggressive decarbonization policies** (at higher cost).
- **Gas plays a dual role in decarbonization**: (i) smooth integration of fluctuating renewables, (ii) rapid backup/response if renewable energy is unavailable.
  - Gas assets stranded only if technologies (batteries, hydrogen, carbon capture) become cheaper for peaking, mid-merit, and baseload dispatch.
  - International cost projections indicate these technologies are currently not cost competitive to fully displace natural gas.

Domestic and international private sector can play a leading role in investments - however, complementary public support is needed

- **Investment mobilization support:** public sector resources for de-risking projects, credit-worthy off-take agreements, market and regulatory guarantees.
- **Upgrading power grid to absorb renewable energy supply at-scale:** public investment for grid capacity and flexibility improvements, modernization and optimization of dispatch, development of storage and ancillary services.

Imbalanced implementation of energy transition priorities can create a risk of retreat to coal

- **Mismatch of timing**, e.g., inadequate scale-up of renewable energy to compensate for reduction in coal capacity can create energy security concerns.
- **Lack of support for transition fuels**, such as natural gas, could mean that reliance on coal could continue (as other technologies are still developing).