Policy brief

Vietnam's Energy Pathways

Executive statement

This policy brief provides the Government of Vietnam with insights and suggested policy recommendations for a practical, clean, and least cost energy mix, whilst meeting the country's growing demand.

About the Study

This brief summarizes the findings of an energy modelling study conducted by the Climate Compatible Growth (CCG) programme. Through OSeMOSYS[1] and FlexTool[2], the following research questions were implemented:

1. What are the costs and risks related to a continued and growing reliance on importing (e.g., variability, lock-in) versus renewable energy options?
2. In scenarios where there is a renewables-heavy energy mix, do they provide reliable baseload replacement were coal to be substituted out?
3. What energy mix would provide the least cost mix against a range of future scenarios (i.e., what achievable mix could hedge against multiple scenarios)?

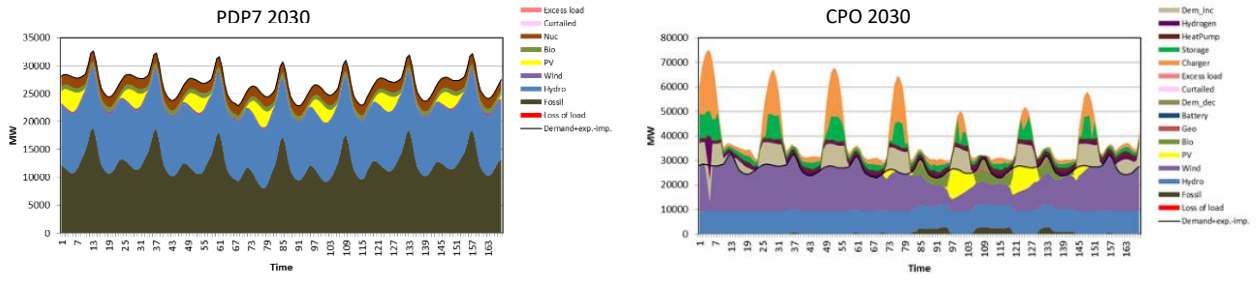
To help answer the above questions, five scenarios were adopted in this study. These are listed below:

1. Power Development Plan 7 (PDP7) – a scenario which follows PDP7 (revised), and relies heavily on foreign coal
2. Coal Phase-Out (CPO) – a scenario which follows Vietnam's COP6 commitment on a coal phase-out by 2040 and net zero by 2050
3. Renewables-Led Pathway (RLP) – a scenario which follows a McKinsey[3] report on wind and solar buildouts, supplemented by gas and battery storage
4. Clean, Efficient Energy Transition (CEET) – a scenario which follows Vietnam's COP26 commitments, with a fossil fuel phase-out by 2050 and high market penetration of energy efficiency technologies.

Study results, conclusions and recommendations

System flexibility

Weekly demand profiles for each scenario (2030) are shown. In the PDP7 scenario, the share is dominated by coal and hydropower, with minimal amounts of solar to meet varying demand. There is no curtailment or loss of load. Thus, this system is already balanced and there is no need for additional infrastructure such as electric vehicles.

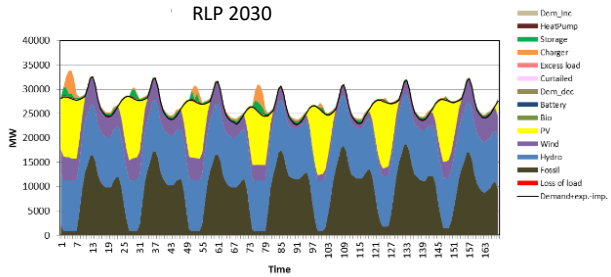


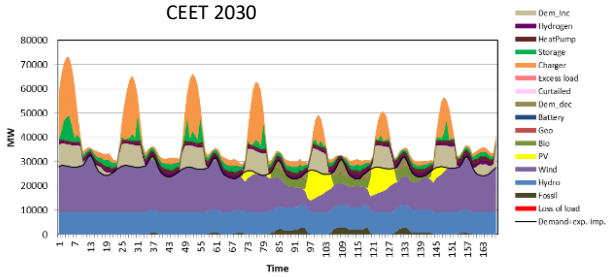
[1] Linear energy optimization supply model for long-run integrated assessment and energy planning
[2] IAEA tool to assess power system flexibility based on national capacity investment plans and forecasts
[3] https://www.mckinsey.com/featured-insights/asia-pacific/exploring-an-alternative-pathway-for-vietnams-energy-future

In the CPO scenario, peak demand is met by the renewable-heavy system. However, due to the intermittency of renewable energy technologies, there is curtailment of energy within this system. This can be addressed with electric vehicles, storage, heat pumps, green hydrogen, and demand response.

In the RLP scenario, there are significant amounts of fossil fuel, hydropower, and solar. There is slight curtailment in the system, which can be addressed with electric vehicles, storage, and heat pumps.

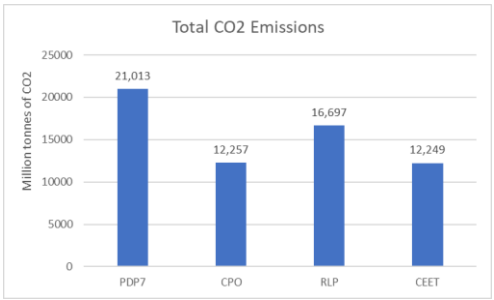
In the CEET scenario, the base load is comprised of hydropower technologies. There is also a large share of wind technologies, with solar meeting varying demand. However, there is curtailment of energy and loss of load. To address this, electric vehicles, storage, heat pumps, green hydrogen, and demand response should be incorporated. Electric two-way charging from EVs could also be implemented to address loss of load.





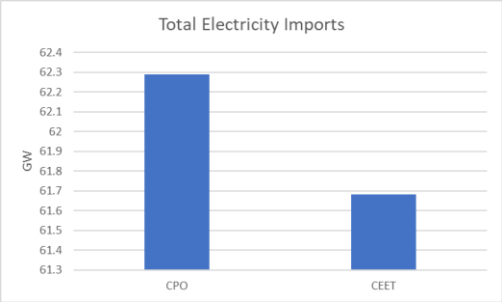
Emissions

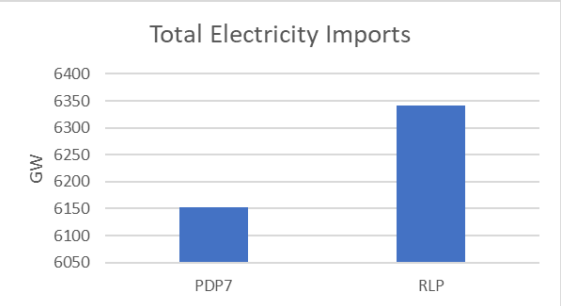
Overall, the PDP7 scenario emits the most CO_2 from 2015 to 2017. On the other hand, the CEET scenario emits the least amount of CO_2. This can be explained by the adoption of a large share of renewable energy technologies, as well as the closure of coal powered plants. A renewable heavy energy mix is therefore important in achieving Vietnam's climate commitments.



Imports

Modelling shows that the PDP7 and RLP scenarios will import high levels of electricity due to the increasing levels of fossil fuel in the system. On the other hand, renewable electricity can be obtained within the nation and thus import levels are low for the CPO and CEET scenarios. Thus, due to this low level, we can conclude that the CPO and CEET scenarios will rely less on imports and contribute to energy security within the country. Alternatively, the PDP7 and RLP scenarios may have risks regarding blackouts and price shocks.

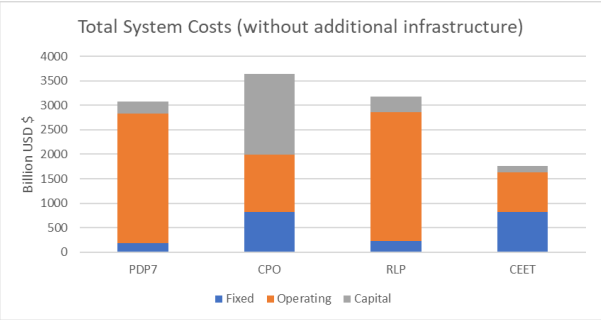


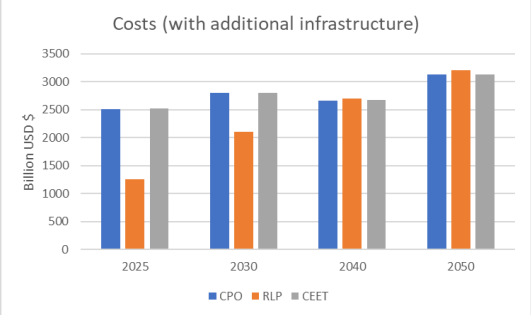


Costs

At first glance, the CPO scenario is the most expensive scenario and the CEET scenario is the cheapest scenario. The latter could be due to deep energy efficiency penetration reducing consumption rates, and therefore overall cost rates. However, when considering EVs, storage, heat pumps, and green hydrogen, the PDP7 scenario is cheapest. The CPO and CEET scenarios are also expensive in the

short-term, but cheaper in the long-term compared to the RLP scenario. Nonetheless, adopting the cheaper PDP7 scenario will bring about possible issues such as energy insecurity and price shocks (due to the high amount of fossil fuel imports), and will not allow Vietnam to reach its climate goals.





Conclusion

Overall, a scenario with high amounts of renewable energy and energy efficiency technologies within the nation will be beneficial to Vietnam. A scenario much like the CPO and CEET scenarios will allow Vietnam to meet its climate commitments. No reliance on imported fossil fuel by 2050 will also provide the country with energy security and lower the risks of price shocks. Although a high upfront investment in the short-term due to additional infrastructure, a scenario like these could sustain Vietnam's power growth and could be the backbone to Vietnam's economic recovery from Covid-19.

Note that there are some data gaps in the study. Thus, future research should include the use of Vietnam specific data, incorporate more nodes in FlexTool to represent different regions, study the important of emergency power, and investigate the scenarios with the Climate, Land (food), Energy, Water strategies (CLEWs) tool to understand the interactions between energy production, land resource and water. Nonetheless, this study's data and methods has been internally checked and deemed acceptable. Paired with future national partnerships support and further research from CCG, this study could be improved in the ways mentioned above to provide a more detailed and reliable study which could prove beneficial in helping Vietnam develop economic strategies, plans, and policies to attract investment into low-carbon growth opportunities across multiple sectors.

Recommendations

Renewable energy prioritization: With decreasing costs, renewable energy could be prioritized in the final PDP8, and this could be backed up with long-term plans and targets. Such targets may include a large deployment of solar and wind, with hydropower as baseload for supply. To support this, it is suggested that renewable energy developers are exposed to competition to drive manufacturing costs and electricity prices down. A one-stop shop where developers have a single point of contact could also be considered. Additionally, cost reflective tariffs could be adopted and subsidies could be made explicit and transparent. Lastly, enhancing awareness of local communities and stakeholders to ensure acceptance could be considered.

Energy efficiency prioritization: Similar to the above, energy efficiency could be prioritized in the final PDP8. This may include a long-term plan for energy efficiency to reach 100% market penetration by 2050, and minimum efficiency performance standards could be adopted around the nation to maintain this. To support this recommendation, utility companies could be made co-responsible for energy savings in a legal manner. This may ensure the uptake and continuation of energy efficiency practice. Voluntary agreement schemes with fiscal and financial incentives could also be considered to present an attractive image of energy efficiency. The introduction of an energy savings certificate and the option of trading obligations and savings may also create a large market for energy efficiency. Energy efficiency technologies could also be exposed to competition to reduce costs, increasing access to the public. Following this, institutional strengthening and digitization may be implemented to allow real-time monitoring, verification, evaluation, and improvement of energy productivity.

Electric vehicle, battery storage, heat pump, and green hydrogen uptake: To address curtailment in a renewable heavy scenario, additional infrastructure such as electric vehicles, storage, heat pumps, and green hydrogen could be implemented. To support this, city fleets could be electrified to accelerate the electric vehicle market. There could also be a plan and end date for internal combustion engine buses, taxis, and rails. Financial incentives could be considered to encourage uptake of electric vehicles until they reach the same level of competition with internal combustion engine vehicles.

To support battery storage, a fund could be set up to award projects that are developing innovative energy storage technologies. Developing a government-backed competition may also increase the awareness of storage technologies, as well as drive the market. A long-term plan and targets for storage implementation in the country could also be developed to help support a renewable heavy scenario.

With a growing demand for air-conditioning, heat pumps will be very beneficial in Vietnam. To support the implementation of heat pumps, construction standards could be upgraded to include heat pumps in new buildings. This may allow the technology to be more competitive. Subsidies could also be adopted to offset the upfront cost.

To support hydrogen technologies in the country, tax exemptions for hydrogen vehicles could be provided. Additionally, clean hydrogen targets may be set to boost liquidity and unlock the rollout of clean hydrogen technologies. A certification system for all hydrogen types could also be considered to incentivize market development.

Fossil fuel phase-out: To support the uptake of renewable energy and energy efficiency, modelling suggests that investments in new coal and natural gas power generators should stop. This could be backed with a cost-optimal retirement schedule. Introducing taxation on coal and oil and promoting energy efficiency technologies via economic incentives and minimum efficiency standards may also help achieve this action.

Emission limits reinforcement: Research shows that CO_2 emissions from the energy sector are increasing quickly, with coal as the main source. Therefore, to align with Vietnam's COP26 commitment of net zero by 2050, continuous monitoring and comparison of renewable energy, energy efficiency, and greenhouse gas targets could be implemented in the energy sector. For example, a national evaluation and monitoring program may be developed, providing decision-makers at all levels with data and information on climate trends and variability. Furthermore, renewable energy policies could be considered so that all developers are legally required to undergo an environmental impact assessment before construction. The achievement of targets could also be supported by the introduction of a carbon tax and emission trading schemes. Lastly, the effects of coal on climate change and health could be made public. Health costs of air pollution may be included in energy modelling reports and planning, and real-time data such as CO2 and PM2.5 could be advertised and encouraged to the public.