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ESG in Focus: Malaysia's Power Sector's Path Towards Net Zero

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Malaysia has ambition to achieve net zero by 2050. As the single largest source of carbon emitter by sector, addressing the power generation industry's green agenda can be one of the most effective levers that the government can pull to achieve the net zero goal.

Plans towards this objective include transitioning its generation assets towards green energy and installing emission mitigating mechanisms. On the demand side, incentives for businesses to develop green assets and for consumers to use electric vehicles are being pursued but more can be done to quicken the pace. Based on current emissions statistics, electricity generation and transportation together account for over half the total emissions of the country (see exhibit 1, below).

Power directly contributes 30%+ of National Emissions

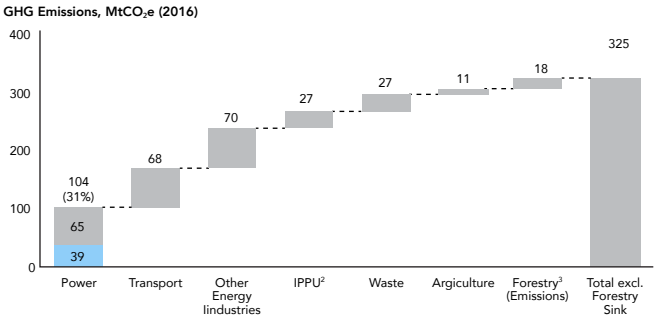

Exhibit 1, source: Tenaga, 2022

The Investment World Wants Green

In particular, Tenaga has seen institutional holdings especially those by foreign investors diminish (exhibit 2 below) in no small measure, over concerns that it was not doing enough to address its large carbon footprint, due to its large share of coal powered generators, which resulted in the valuation of the company being de-rated (exhibit 3).

Total foreign ownership (%)

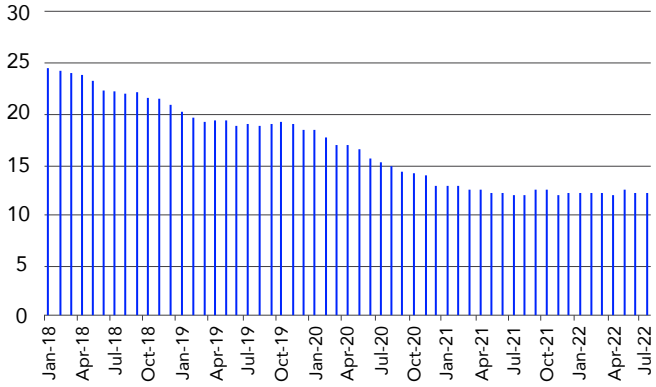

Exhibit 2, source: Tenaga, 2022

Tenaga's forward PE multiple on declining trend since end 2019

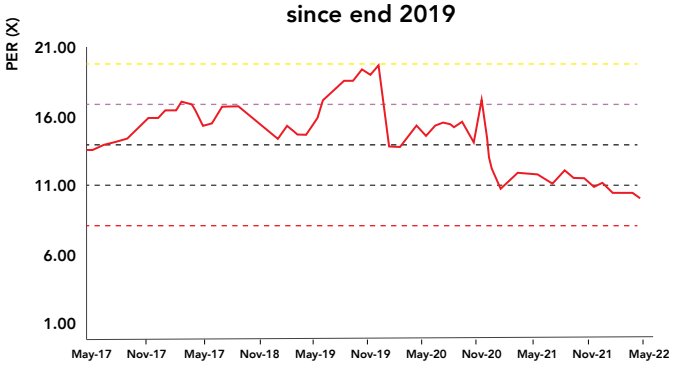

Exhibit 3, source: Bloomberg, Kenanga, 2022

And, it has underperformed the FBMKLCI consistently since 2019 (exhibit 4) when news surfaced that Blackrock was divesting on the grounds that the coal generation share of its total portfolio exceeded Blackrock's acceptable limit.

It became clear soon after that other developed market institutional investors were about to do the same so that even investors without climate obligations joined in the selling or steered clear from investing in power utilities.

Influential institutional investors, the likes of sovereign wealth funds are becoming increasingly demanding, setting higher standards of ESG compliance for investee companies to pursue in order to qualify for admission into their investible lists.

More recently, the world's largest wealth fund Norges Bank Investment Management, had in September 2022, declared that it would decarbonize its holdings by pushing firms to cut their greenhouse gas emissions to nil by 2050, in line with the Paris Agreement. It would engage the companies to set credible achievable targets to reach net zero by creating workable plans to reduce greenhouse gas emissions.

The outcomes from successfully pursuing Sustainability goals for companies like Tenaga are immensely positive on multiple fronts. These include value addition to net worth in a sustainable way besides contributing to the planet's salvation and humanity's well-being. Partly in recognition of this and perhaps more so that the burden – both financial and moral - falls squarely on it as the entity that has the greatest leverage to make a positive difference on Malaysia's path to net zero, Tenaga finds itself with no choice but to urgently set a long term de-carbonization plan towards net zero by 2050.

But what challenges stand in the way of successfully executing this transition? How will it deal with disruption risks? There is also a social dimension to this transition – how will it manage the disruptions to the workforce involved in coal-fired generation?

Are there reassignment and reskilling opportunities or fund for workers who have to be displaced?

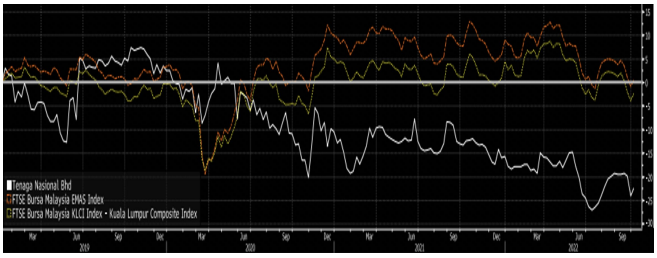

Exhibit 4: Tenaga's underperformance versus the FBMKLCI and the FBMEmas, 2022

Not short of financing for Green projects

With increasing preference for sustainable investing, the incremental financial burden in pursuit of green solutions may well be relieved by larger available pools of financing via ESG-type bonds - Green bonds, Sustainability bonds or Sustainability-linked bonds are some examples and Sustainability-themed funds. And specifically for Tenaga, Transition bonds (which specially raises capital to finance transition for 'brown' industries to transition towards greener industries) may well become an attractive debt financing option in future.

The fossil-fuel vs RE investment conundrum

The impact of the pandemic, the war in Ukraine and years of stimulative policies have magnified the impact of under-investments in hydrocarbons at a time when alternatives to fossil fuels were not yet readily available. Aramco stated in a Sep 2022 Reuters report that the effective global spare capacity is just at about 1.5% of global demand but the fear of the shift to green energy has prevented critical oil and gas investments, causing the long term pipeline of hydrocarbon investments to shrink. We see this situation as one calling with greater urgency, for the acceleration of research and investments in renewables and carbon capture technologies.

Power generation is the biggest carbon emitter along the power supply chain and the biggest cost component of tariff. For the Malaysian power sector, some key considerations to assess in this transition journey are as follows:

Solar and Wind are proven technologies which are commercially viable but intermittency has to be dealt with

Malaysia's geographical characteristics do not make it as suitable to develop wind power compared to solar power. One disadvantage with both solar or wind is intermittency. In the case of solar, output is generated only when the sun shines. In addition to daily fluctuations caused by sunrise and sunset, the output from solar panels can also change due to clouds. Until the appropriate energy storage technology is developed, grid operator Tenaga will need to ensure that its power plants generate the right amount of electricity in a timely manner to match the required demand at any particular moment.

This balance between supply and demand must be maintained at all times to avoid blackouts and other cascading problem. The current share of solar generation makes up only less than 5% of the total capacity, but as it reaches its net zero timeline, Malaysia aims to install 32MW of solar capacity by 2050 (exhibit 5 below). With over 40% share of generation capacity by then, intermittency management for solar will become crucial. Complimenting intermittent renewables' fluctuating supply with stable generators means having to adjust its day-ahead, hour-ahead and real time operating procedures.

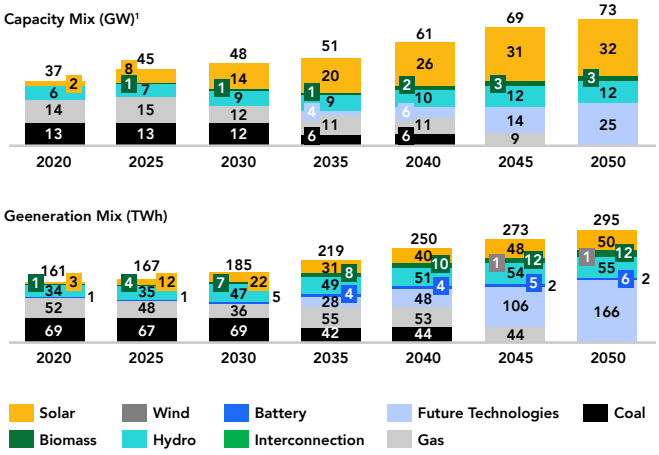

Exhibit 5, source: Tenaga, 2022

Will emerging technologies such as blue and green hydrogen power generation become cost competitive in 10 years?

A key question is how will Tenaga's transition to renewable power generation impact tariffs in the future. Currently at least, the per kWh costs of generating electricity from solar and wind are competitive against conventional sources – a case made even more with elevated oil prices. However, as the world crowds in to renewable sources of energy in pursuit of net zero, there is a risk that costs of solar cells and hydrogen for example, will escalate quickly unless supply keeps pace. But due to the environmental calamities faced in recent years, namely record summer temperatures in Europe and China, forest fires and frequent severe flooding in Asia, the call to action has never been more urgent after having experienced the adverse impacts of climate change. Climate change policies with respect to implementation of carbon tax or carbon credit trade are accelerating so that costs of electricity generated from fossil fuels will have to increase. The adverse externalities caused by carbon emitting sources of energy would be eventually internalized and priced in sufficiently so that this gives green energy a running chance of becoming the energy of choice.

Higher reserve margin is needed to balance the grid

According to the Scientific American, fast fluctuations in output from solar energy disrupts not only hourly load-following phase of grid planning, but also the second-to-second balance between total electric supply and demand. Because solar increases the magnitude of sudden power generation shortfalls or excesses the grid operator requires more reserve power ready to respond instantly to ensure the grid remains balanced. While it looks like challenging second-to-second supply-demand matching exercise, it turns out that renewable energy becomes more predictable as the number of generators connected to the grid increases thanks to the likelihood of fluctuations being evened out by the large numbers spread over geographically diverse locations.

Tenaga's current roadmap towards Net Zero

In its quest towards net zero 2050, Tenaga presented 2 pathways - Scenarios 1 and 2.

Under Scenario 1 of Net Zero Malaysia

1) Sequestration via carbon absorption by rainforests offset is considered by Tenaga as contributing to the achievement of a net zero pathway (but as we shall argue below, the claim of Nature-based Solutions can be exploited by polluters as an adequate carbon sink when state-owned rainforests are a public good not beholden to sequester any specific source of emission);

2) Gas generation continues to dominate the generation mix but it is not a perfect solution given that natural gas is still an emitting source of carbon. It is used only because it is regarded as the cleanest fossil fuel available. Employing large carbon capture mechanisms (not relying on absorption by rainforests) are likely a necessary part of the infrastructure if this is to be an effective net zero set up.

Excluding the impact of natural sequestration, we estimate the Scenario 1 pathway to yield a residual but much reduced GHG emission rate of about 0.3kg CO2e/kWh by 2050. While this represents a 40% reduction from 0.5kg CO2/kWh currently (see exhibit 6), it still leaves a gap of nearly 90m tonnes of annual CO2 emission by 2050 by our estimates.

Under Scenario 2 of Net Zero Power Sector

1) Nature based sequestration is not included by Tenaga in net zero calculation – a 'higher bar' approach which we agree with.

2) Both coal and gas generators are phased out completely and replaced by blended H2 & gas + carbon capture and storage (or CCS) and H2 + CCS

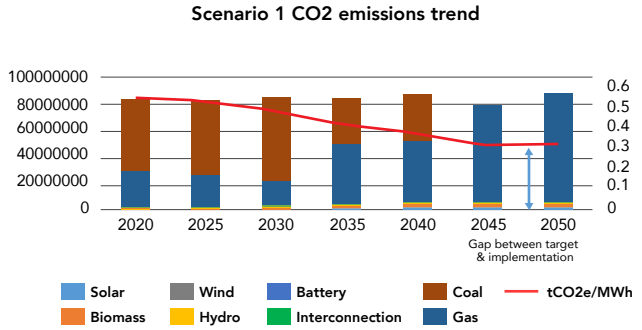

Exhibit 6, source: Tenaga, MAMG estimates, Intergovernmental Panel on Climate Change, 2022

The success or failure of Scenario 2 would depend on whether future technologies in hydrogen and carbon capture can prove to be commercially feasible heading towards 2050. As validated by Tenaga during a recent meeting, Scenario 2 is the path currently pursued and Scenario 1 is the back-up option. While Tenaga is currently embarking on the initial phase of its transition which is common to the two pathways, we should by sometime around 2028-30, know which of the two scenarios is the feasible path to take. In the meantime, Tenaga has leveraged on the resources of Petronas by jointly conducting a collaborative study for developing a green hydrogen ecosystem and carbon capture and storage (CCS) technology.

If the power sector's scenario 2 pathway is successful, the impact of reduced carbon emission is far more significant compared to what can be achieved via scenario 1 (exhibit 7). We estimate the gap between target and implementation by 2050 would be around 7m tonnes of annual CO2 emissions only compared to 90m tonnes estimated for scenario 1. The residual emission of 7m tonnes would require CCS infrastructure to remove if net zero is to be achieved.

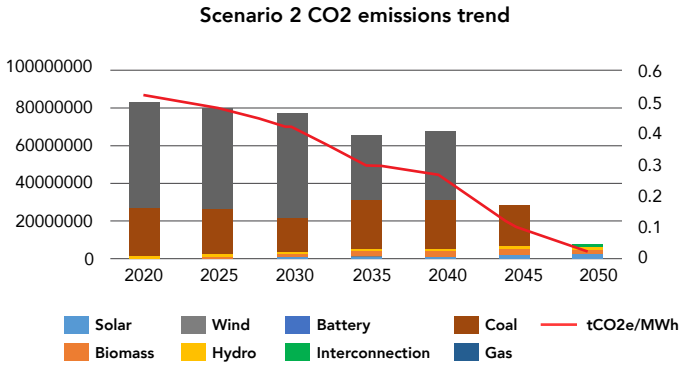

Exhibit 7, source: Tenaga, MAMG estimates, IPCC, 2022

Based on present technology, natural gas combined cycle gas turbines can be retrofitted and converted to operate on hydrogen fuel blends. But according to General Electric, while low carbon hydrogen fuel costs are trending lower, they are expected to remain 2-10X more expensive than natural gas at least through the end of the decade. This challenge remains a formidable one to overcome given that huge quantities of hydrogen fuel will be needed for power plants and questions remain about the timing of sufficient supply of cost-competitive hydrogen for the power sector. Despite these challenges, GE is partnering with customers on both hydrogen demonstration and commercial projects across the world.

GE's most advanced gas turbines (the 7HAs and 9HAs) are capable of burning as much as 50:50 hydrogen and natural gas blend and work is underway to increase hydrogen burning capability across its portfolio, with a specific goal of achieving 100% capability (exhibit 8).

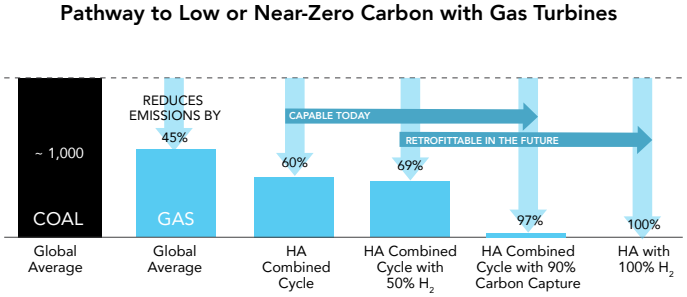

Exhibit 8, source: General Electric, 2022

The commonalities of the 2 scenarios are that coal-fired generators are phased out completely by 2045. TNB reports that it owns 9,080 MW of coal generators compared to 13,000 MW for the industry. There are no longer any plans for coal generation PPAs in future. Coal-fired IPPs will eventually be phased out once the current PPAs expire.

The controversy around carbon offsets

Between the 2 pathways, Scenario 2 is clearly the more effective transition path. Scenario 1 falls back on natural carbon offsets namely, forest cover, to make the model work. (Officially, a carbon offset is a certificate or voucher that a company buys that represents the reduction of a metric ton – or 2,205 pounds – of CO2 emissions. If a company is unable to eliminate the release of GHG in the operations, they may purchase a carbon offset to compensate for their emissions.) But carbon offsets justified by already existing natural forest cover stands guilty of lack of "additionality" in that trees were never meant to be in danger of being cut down in the first place. Another example of failure in carbon offset projects is the questionable permanence of these offset solutions as there is appreciable chance of jeopardy. For example, coastal restoration for mangroves in countries like Bangladesh were jeopardized when floods devastated the country. In order for carbon offsets to really work, there must be enough transparency or accountability on the system set up.

Carbon Capture, Utilisation and Storage (CCUS) technology can make a positive difference but costs must fall

Whether the power sector takes the scenario 1 or 2 pathway or a combination of both, achieving the net zero target by 2050 is still possible if carbon capture, utilization and storage (CCUS) technologies can be developed successfully to be cost competitive. Despite the crucial part CCUS can contribute in achieving clean energy, its deployment has hardly taken off globally mainly on the argument that CCUS are still cost prohibitive. It is often said CCUS cannot compete with solar and wind electricity given the dramatic fall in costs over the last decade or so, while climate regulation such as carbon pricing have not been high enough to make CCUS economically attractive. According to an IEA report, CCUS applications do not all have the same cost. The cost of carbon capture can vary greatly depending on the source of CO2 from a range of US$15-25/t CO2 for industrial processes producing pure or highly concentrated CO2 streams (eg. ethanol production or natural gas processing) to US$40-120/t CO2 for processes with dilute gas streams such as cement production and power generation (exhibit 9).

There is also to consider, the cost of transport and storage which again, can vary greatly depending on gas volumes, transport distances and storage conditions. For example, the cost of onshore pipeline transport in the US can range between $2-14/t CO2 while over half of onshore storage capacity is available below $10/t CO2. It would appear that the average total cost of CCUS per tCO2 would hover at around $80-90. We estimate that this translates to a cost of $0.04 per kWh of electricity generated by a gas power plant. Assuming these costs can apply to Malaysia, at current exchange rate, it would cost Tenaga or the consumer an additional 19 sen to absorb CO2 emitted by each kWh of electricity generated by a gas source. And, it would be nearly twice as much for coal. 19 sen/kWh carbon capture cost can be considered expensive given that residential tariffs in Malaysia starts at 21.8 sen/kWh for the first 200 kWh consumed monthly and rises to 54.6 sen/kWh for the highest band.

Levelised cost of CO2 capture by sector and initial CO2 concentration, 2019

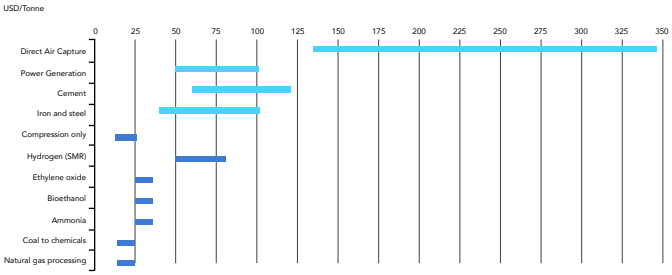

Exhibit 9, source: International Energy Agency, 2022

Given the prohibitive cost of CCUS currently, regulators would have to impose a rather punitive carbon pricing in order to drive investment into CCUS infrastructure. As exhibit 10 shows, nearly 80% of countries that impose carbon tax are charging less than $80 per tonne. As things stand, the financial costs of emissions through carbon taxes where they exist, are not high enough to deter fossil fuel power generation based on current economics of CCUS.

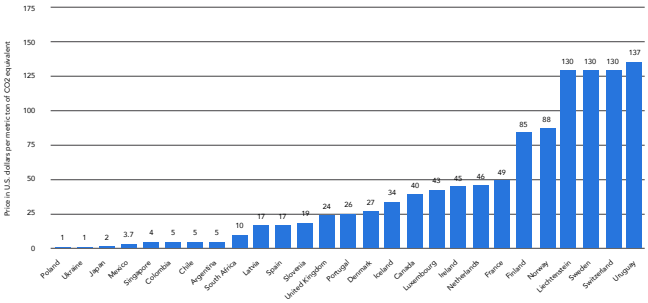

Exhibit 10, carbon tax worldwide as of April 2022 by country in $/tCO2, source: Statista.com, 2022

In Malaysia, we are nowhere near implementing a carbon tax regime, although a passing mention was made recently by the Minister of Finance, without commitment to an implementation timeline, during the tabling of Budget 2023.

EV development is an ESG opportunity for Tenaga

Tenaga can find itself better off if future regulations is crafted around not just greening the power supply but also around reducing carbon intensive energy consumption. This includes mandating the use of LEDs in public lighting, encourage and educate consumers to use more energy efficient power appliances including encouraging the transition to electric vehicles or EVs. For a sound EV plan to be effective, Tenaga has to as a matter of priority, accelerate the provision of renewable power supply that keeps pace with cars transitioning to electricity as the primary power source.

The transition of Malaysia's transportation system to EV is an ESG opportunity that can contribute not only towards the green agenda but also profitability of power suppliers. The EV megatrend presents an enormous new market opportunity for electrical utilities globally. In Malaysia, we estimate that the daily consumption of energy from gasoline use of 418 GWh is equivalent to about 80% of the daily electrical energy output of the country. Assuming that half of the passenger vehicles population eventually transitions to electric vehicles (of the Battery Electric Vehicle type or BEV) by 2050, the incremental annual demand from EV could potentially raise Tenaga's compound growth annual rate (CAGR) sales growth from 3% pa to 4% (exhibit 11).

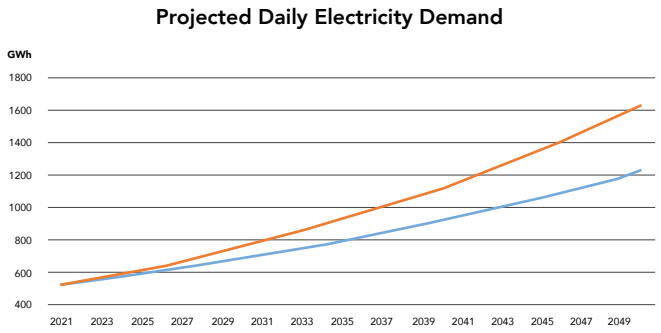

Exhibit 11, source: GlobalEconomy.com, MAMG estimates, 2022

In order to achieve full EV implementation, barriers to setting up EV infrastructure must be overcome, the most important of which is the network of EV charging stations has to be rolled out. It would require deep pockets and financial resilience for private investors toundertake a comprehensive nationwide charging station network given that this is a scale game with long gestation period to profitability. It requires coordinated execution in partnership with the government (to be committed to pushing EV adoption via policy and fiscal incentives), the power supply network (Tenaga and IPPs to keep pace with greening power supply), financiers and perhaps not few but several private sector investors to roll out charging infrastructure (to share the risk and rewards) with a long term commitment to the project. As it is, there is no policy directive or timeline yet to phase out ICE vehicles in Malaysia unlike some Asean peers namely Thailand, Singapore and Indonesia that have announced plans to ban sales of ICEVs by 2035-40.

Conclusion

With a transition roadmap, Tenaga is leading the power sector towards net zero it hopes to achieve by 2050. While we applaud its initiative in engaging the public, in particular investors on its intention, we are cognizant of the challenges that it needs to overcome, many of which may not be within its control. While we look forward to the fruition of green hydrogen generators, R&D breakthroughs and more financial resources will need to be invested to reduce cost of hydrogen production and carbon capture technologies if the power sector's net zero ambition is to be realized. Governments have a part to play in incentivizing the adoption of clean energy through tax incentives and policies, or properly internalizing the externality cost of emission via carbon pricing, be it through a carbon tax or creating a market for carbon trade. These measures will help to improve the economics of new renewable energy versus polluting fossil fuels.

Removing coal plants from its generation portfolio is a necessary starting point in this transition. We see a reasonable chance of the sector fully adopting Scenario 2 by 2050, the chances of such a possibility will be clearer by 2030.

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