

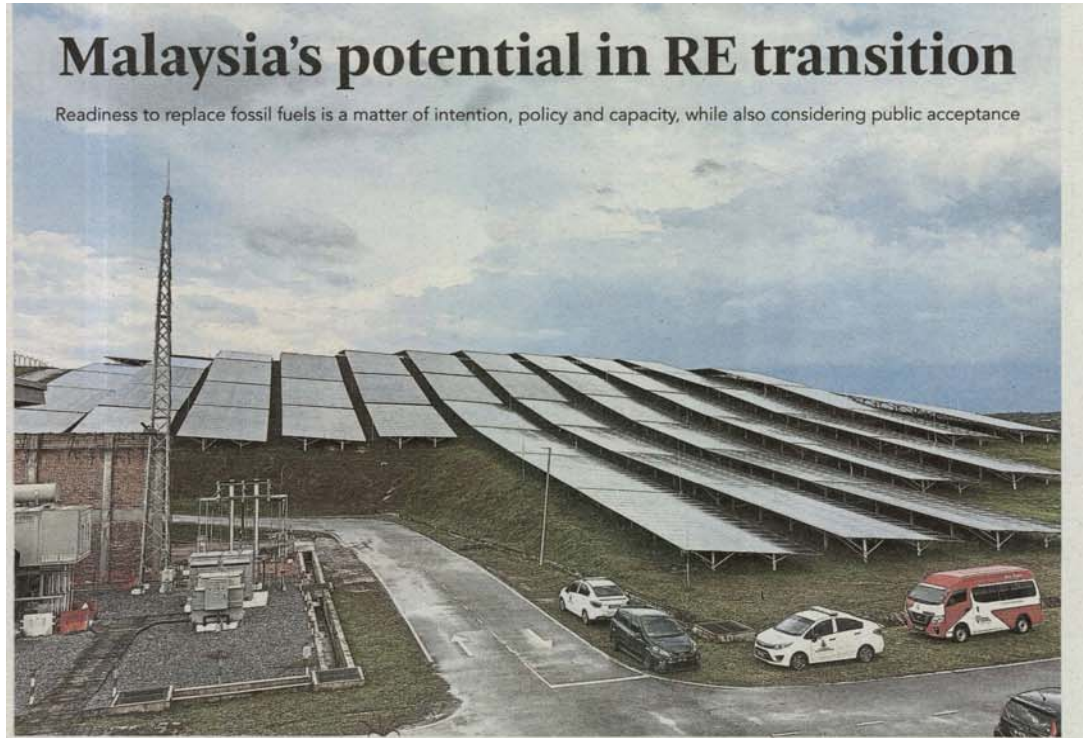
29 MAY, 2023

Malaysia's potential in RE transition

The Malaysian Reserve, Malaysia



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One of TNB's LSS solar farm at Bukit Selambau. Malaysia has a high level of solar irradiation, making it an ideal location for solar power generation

by AUFA MARDIAH

GENERATED from decomposed plants and animals over millions of years ago, fossil fuels are one of our main energy sources.

To show how powerful it is, Samantha Gross from Brookings said: "The fossil fuel energy system is the lifeblood of the modern economy. Fossil fuels powered the industrial revolution pulled millions out of poverty and shaped the modern world."

According to Rentar Environmental Solutions (rentar.com), it is impossible to replace fossil fuel with other available alternative sources due to its energy density and that there is no cleaner fuel as there are not yet carbon-emissions-free fuels in the making.

Agreeing with this, Universiti Putra Malaysia (UPM) Department of Environmental Management Assoc Prof Dr Zelina Zaiton Ibrahim said it is because all fossil fuels are dirty in relation to greenhouse gas (GHG) emissions.

Hence, she said efficiency, reduction and elimination within the use cycle is the correct approach in phasing out fossil fuel.

Furthermore, she agreed with Rentar Environmental Solutions that fossil fuels contribute to many of consumers' daily needs, saying that lifestyle change is more difficult to replace.

However, she dismissed the word "impossible" as mentioned by Rentar Environmental Solutions and said it does not consider future innovation and societal capacity for transformation.

"It constrains us to only consider a future following our present condition," she said to *The Malaysian Reserve* (TMR).

On whether we are ready to phase out fossil fuel, she said readiness to replace fossil fuels is a matter of intention, policy and capacity, while also considering public acceptance.

"The growth of the oil and gas (O&G) industry has brought many conveniences to society and we are only more recently understanding its undeniable impacts.

"Based on the IPCC AR6 Synthesis Report released in March 2023, it is clear that currently implemented policies are leading to a future with greater than 2°C global warming.

"To achieve the Paris Agreement goals of limiting global warming to 1.5°C or 2°C only, we must improve our Nationally Determined Contributions (NDCs) in 2030 and undertake rapid, deep and in most cases, immediate actions to reduce GHG emissions," she said.

Rentar Environmental Solutions also highlighted nuclear energy as one of the finest choices to consider when substituting fossil fuels because it is similarly rich in energy.

However, it said nuclear power is extremely volatile and risky.



Zelina says efficiency, reduction and elimination within the use cycle is the correct approach in phasing out fossil fuel

Zelina added that the high energy density of fossil fuels is related to its process of formation; meanwhile, nuclear fuel has an energy density about a couple of million times higher.

However, she noted that the issue with nuclear power is public fear.

"My opinion is that Malaysia should consider nuclear energy. In 2009, the government agreed to consider nuclear energy as a potential power resource. However, there has been some change in policy in the intervening time and political and industry leadership should include all considerations in the matter.

"The issue relates to national policy, technology, resources, capacity, public sentiment and increased understanding," she said.

On the energy sector front, the International Renewable Energy Agency (Irena) report on the Malaysia Energy Transition Outlook stated that Malaysia's total primary energy supply increased by 2.9% in 2019, reaching 4.1 exajoules (EJ).

Except for coal, which experienced a 5.5% decrease due to fewer coal imports — other fuels increased — natural gas accounted for 42% of the total primary energy supply in 2019, with crude oil, petroleum and others accounting for 33.3%, coal and coke accounting for 21.4% and renewables accounting for 3.4%.

By 2019, renewables' proportion of the total primary energy supply was dominated by hydropower (2.3%), with minor contributions from other renewables (1.1%).



Malaysia and major players in energy sector are committed to achieving net-zero emissions by 2050, says Mohd Zamri

Between 2012 and 2020, solar energy increased due to the rapid expansion of solar photovoltaic (PV) systems in the country.

Despite the significant growth of biofuels, hydropower remains the country's largest contributor to renewables, with a total output of 93 petajoules (PJ) in 2020.

In short, the report stated that Malaysia's energy supply is still heavily dominated by fossil fuels.

Meanwhile, on energy consumption, the report said Malaysia's total final energy consumption was 2.8 EJ in 2019, accounting for 65% of the total primary energy supply.

The transportation sector utilises the greatest energy (38% of total final energy consumption), followed by industry sector (28%).

However, when non-energy applications are included, the industry sector becomes the largest final energy user, accounting for 50% of total consumption.

Referencing the report, Zelina said Malaysia's target for renewable energy (RE), excluding hydropower, is 20% by 2025, on the back of 5% renewables currently.

Efforts Taken to Mitigate Climate Change

After years of discussing mitigating climate change — such as at the yearly conference of planet (COP) meeting as well as guidelines which have been set in place like the Paris Agreement — what changes are we seeing?

Zelina said despite the Intergovernmental Panel on Climate Change (IPCC) reports

stressing the impacts of continued GHG emissions on global warming and consequences, there is a large gap in mitigating GHG emissions as estimated in the 2022 Emissions Gap Report.

"Although the Paris Agreement is a legally binding international agreement, it is a treaty by consensus or a 'soft law', thus, unfortunately, there is no formal 'consequence' to a country for withdrawing or not complying to the agreement. Only one's reputation is affected.

"The consequence, rather, is to the world, which will face greater extreme weather events, atmospheric and oceanic warming, sea level rise and the associated impacts.

"Unfortunately, the most vulnerable countries will likely face severe consequences," she said.

She added that the global impact of the Paris Agreement goes beyond individual governments, and this is evidenced by the reaction of Americans in response to US former President Donald Trump's withdrawal of the US from the Paris Agreement in 2016 — where more drastic changes were seen in the US such as the increase in RE generation and many US corporates pledged to consume RE by 2050.

Depth on Malaysia's RE Generation

Last year, Peninsular Malaysia's electricity was generated from a mix of sources, including coal (55.9%), gas (37.2%), hydroelectricity (5.2%), solar (1.2%) and oil and distillate (0.5%).

As Malaysia's main utility company, Tenaga Nasional Bhd (TNB) Sustainability Pathway aims to transition to net-zero emissions, in line with Malaysia's agenda to tackle climate change, as part of its environmental, social and governance (ESG) commitment.

TNB said Malaysia currently intends to focus on other RE sources and some of the most promising alternatives include solar energy, hydropower and biomass energy.

"Malaysia has a high level of solar irradiation, making it an ideal location for solar power generation. Solar panels can be installed on rooftops, lakes, or in solar farms.

"For hydropower, Malaysia has several rivers that could be used. Hydropower is a reliable, efficient source of energy and a key RE in Malaysia. Its benefits include the ability to regulate and reduce flood risks in flood-prone areas.

"Meanwhile, biomass is organic material that can be burned to generate heat or electricity. It can be sourced from a variety of materials, including wood, agricultural waste and municipal waste," TNB told TMR.

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To generate these, TNB has its large-scale solar (LSS) solar farm in Sepang, Selangor, with a capacity of 50MWac, Bukit Selambau (Kedah) with 30MWac and LSS Mentari's (LSS4) capacity is 50MWac which is expected to achieve commercial operations in December 2023.

For floating solar, TNB made use of its ash pool at Sultan Azlan Shah Power Station in Manjung, Perak, to construct its pilot floating solar plant with an installed capacity of 105.12 kW.

For hydropower generation, TNB received approval from the Energy Commission (EC) in 2022 for its Hydro Life Extension Programme, which covers six power stations in the Sungai Perak Hydro Scheme in Perak, with a total capacity of 650.75 MW.

The project commenced last year with a total investment of RM5.8 billion and will be operated under a new power purchase agreement for 40 years. The first unit is expected to begin commercial operations in 2025.

TNB has also commenced the construction of the 300MW Nenggiri Hydroelectric Power Plant in Kelantan, which is scheduled for commercial operations in 2027.

On the other hand, feasibility studies of coal plants co-firing with ammonia, biomass and coal are ongoing for Jimah East Power (JEP) 2,000MW, Kapar Energy Ventures 2,200MW and Janamanjung 4,080MW.

"We aim to grow our RE generation capacity in a sustainable manner where we will instil technical and commercial excellence across all our activities from development to operation of different types of RE technologies.

"This will enable us to deliver sustainable and above-market or market-comparable returns from our portfolio of international and domestic RE assets," TNB added.

The national utility company is concentrating its RE generation capacity on LSS, solar rooftop, hydropower and Green Electricity Tariff (GET).

TNB's RE portfolio had 3,907MW as of January 2023, accounting for about half of the target of 8,300MW, with 2,914MW domestic and 993MW abroad.

It also told TMR that Peninsular Malaysia now has a total gross hydropower potential of 1,800MW.

The group plans to work with the Natural Resources, Environment and Climate Change Ministry (NRECC) to develop hydropower, which will include 1,650MW of additional pump storage capacity.

TNB believed that with the continuing development of the 300MW Nenggiri project, the possibility to develop other potential hydropower will strategically support government efforts to meet the national target of 31% RE capacity mix by 2025 while becoming a carbon neutral country.

Aside from RE generation, TNB will invest around RM20 billion per year as capital expenditure (capex) over the next 28 years to accelerate its Energy Transition Plan, which aims to lower its emissions intensity to net zero.

"TNB will continue to invest in the Grid of the Future while simultaneously pursuing a Regional Interconnection that will allow for a greater reallocation of RE resources, helping to decarbonise the Asian power system and increase supply security," TNB added.

Phasing Out Fossil Fuel

On the other hand, Universiti Tenaga Nasional (Uniten) deputy VC of Research and Innovation Prof Datuk Dr Mohd Zamri Yusoff said Malaysia and all major players in the energy sector have committed to achieving net-zero emissions by 2050.

"I think we are ready to commit, various strategies are being drafted to ensure that we meet the target. The most important thing is that we have to be pragmatic.

"At the moment, based on the 2022 data, approximately 59% of our electricity generation is from coal. We cannot really remove this completely immediately, we need to have a proper plan on how to actually phase out fossil fuel.

"For instance, TNB has set a target that by 2035, it will reduce emissions intensity by 35% based on the 2020 reference data. Also, by 2035, TNB plans to cut half the electricity generation from coal and by 2045, there will not be any coal power plants anymore," he said to TMR.

Furthermore, Uniten's Institute of Sustainable Energy director Prof Ir Dr Tiong Sieh Kiong said the government and TNB are committed to phasing out fossil fuel gradually.

"There are pipelines such as stepping up the capacity of solar and hydropower, increasing the bioenergy for power generation and utilising clean gas solutions such as ammonia and hydrogen for power generation.

"Our country is making plans and strategies towards the direction of reducing emissions by replacing coal with green alternative sources. On looking into diversifying the energy mix, Malaysia at the same time has to ensure energy security," he told TMR.

Mohd Zamri said other alternatives suitable to replace fossil fuel are solar, hydro, biomass, wind and nuclear energy.

"I think solar PV will play a very important role moving forward, but of course due to limitations, it has to be complemented by battery storage for example. In a day, the effective solar hour is only about four hours, hence we need to support that with energy storage, battery storage and also the grid has to be smart. Uniten has teams working on how to make sure that our grid is resilient enough to actually take in the intermittent RE.

"Apart from that, biomass also a big potential of RE in Malaysia, but needs more sorting on the related issue first — namely the feedstock issue in making sure we have enough for our power plant — which normally uses a lot of biomass resources," he said.

On wind, he said due to Malaysia being on the equator, the speed is low.

"Hence, we have to develop technology which can extract energy from low-speed wind, which we also have our team working on," he added.

Thorium Reactor

On nuclear energy, Uniten Institute of Nuclear Energy director Dr Mohd Syukri Yahya said Malaysia has the capacity and capability to fully embrace nuclear energy based on previous national nuclear power programmes — despite Malaysia having no local uranium reserve.

"State-of-the-art nuclear power stations use uranium fuels. Therefore, should we embrace nuclear power, we would have to naturally import uranium fuels.

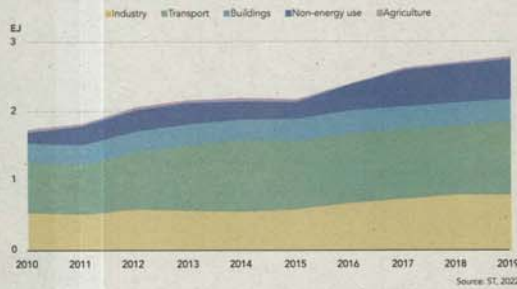
"Nuclear fuels are typically replaced between three and five years, hence nuclear power reactors do not require much fuel. Therefore, even if we must import it, nuclear fuel procurement may not be as volatile as fossil fuel," he said.

He added that there are also innovative reactor designs in the work that consumes thorium rather than uranium.

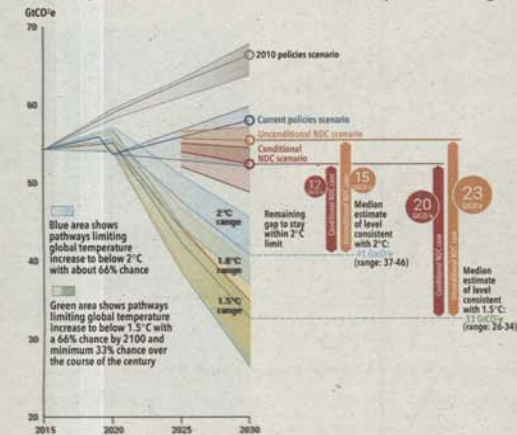
Fortunately, Malaysia has local thorium resources as it can exist from residues of mineral and rare earth production, such as a by-product of tin mining.

In fact, he said, the Cabinet in 2012 had decided to form a committee to study thorium as a future energy resource.

Total final energy consumption in Malaysia, by sector, 2010 to 2019



GHG emissions under different scenarios and the emissions gap in 2030 (median estimate and tenth to ninetieth percentile range)



Uniten Institute of Nuclear Energy is also working with Universiti Kebangsaan Malaysia (UKM) on studies related to thorium extraction from Malaysian monazite and rare earth ores.

"The results are promising, but thorium reactor design needs to be further researched," he said.

Uniten is also doing a study on the impact of energy transition options on the whole value chain, as well as the impact on the GDP and employment, among others.

"The plan has been laid out. TNB is committed where the last coal power plant, the Jimah East power plant, will retire in 2044. Some of TNB's existing coal plants have also made a commitment to be retired one year ahead of the power purchase agreement end date.

"Slowly we have to introduce new sources of energy. TNB is seriously looking into introducing hydrogen repowering — starting with repowering its gas turbine power plant, as well as mixing of coal with ammonia, so that the amount of emissions directly related to coal will be reduced," he said.

Mohd Zamri elaborated that all of this has to be done pragmatically.

"What is important is that we need to strategise and study it properly to make sure that the transition is just for industries involved

(supportive policy measures)," he added.

Moreover, Uniten Institute of Energy Policy and Research (IEPR) director, Dr Nora Yusma Mohamed Yusop said Prime Minister (PM) Datuk Seri Anwar Ibrahim's recent announcement regarding the withdrawal of petrol and electricity subsidy for the top 20% income group (T20) is a serious indication that the government is looking into RE transition.

Net-zero by 2050

Meanwhile, Petrolia Nasional Bhd (Petronas) aspires to achieve net-zero carbon emissions by 2050 via an energy transition pathway.

It is believed that energy development and transition must strike a balance between energy security, affordability and sustainability. "Petronas will produce energy from its core portfolio and cleaner energy solutions as differentiated products that are aimed to be safe, reliable, cost-optimised and emissions abated.

"We will focus on reducing our emissions by minimising flaring and venting from our operations. We will also continue investing in technology and innovation to ensure that we can scale up and accelerate the deployment of lower-carbon solutions for our customers," it said to TMR.

Petronas will also pursue carbon capture and storage technology projects while employing nature-based climate solutions to reduce and offset hardest-to-abate emissions and concurrently promote the conservation of nature and biodiversity.

In addition to these initiatives, the group has established Gentari Sdn Bhd, to capture possibilities in the energy transition alongside its core portfolio.

Gentari is anticipated to provide lower-carbon solutions to customers through renewables, hydrogen, and green mobility.

It aspires to be a leading utility-scale RE developer to achieve 30 to 40GW capacity by 2030, serving commercial, industrial and retail customers; a scale producer of clean hydrogen to supply the world with up to 1.2 million tonnes per year by 2030, serving industrial, power and transportation customers.

Petronas is also entering the biofuels market with the anticipated building of a greenfield biorefinery and co-processing at its existing facilities.

Once it begins operations in 2025, the biorefinery will be positioned to give operational flexibility for sustainable aviation fuel while also producing hydrogenated vegetable oil or renewable diesel.



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