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20TH



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ANNIVERSARY



20 YEARS OF THE NATIONAL ELECTRICITY MARKET OF SINGAPORE



Ngiam Shih Chun

Foreword

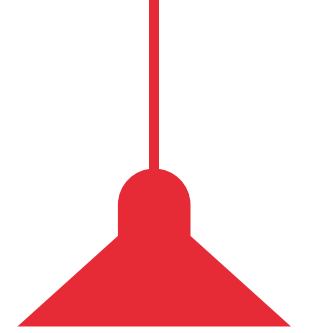
Singapore is transitioning towards a more sustainable energy future and the energy sector plays a vital role in helping to achieve our net-zero emissions goal. Over the years, we have developed a sustainable energy sector. We switched from oil to natural gas for power generation, built the liquefied natural gas terminal to further diversify our natural gas sources and most recently completed the full liberalisation of the electricity market.

In the decades ahead, we will press forward with the greening of our energy sector. As outlined in Our Energy Story, Singapore's energy future will be guided by the four energy supply switches – natural gas, solar, regional power grids and low-carbon alternatives – to transform our energy supply while promoting energy efficiency to reduce demand. We are now scaling up clean energy sources such as solar and green electricity imports while exploring emerging alternatives such as low-carbon hydrogen and geothermal energy.

To succeed in our green energy transition, we will require strong collaboration and teamwork among many stakeholders. The partnership between the Energy Market Authority (EMA) and the Energy Market Company (EMC) is one example. Both EMA and EMC work alongside power generation companies and market participants to build an energy market that provides a secure, reliable supply of energy that is competitively priced and sustainable. At the same time, EMC continues to ensure that the National Electricity Market of Singapore (NEMS) remains a transparent and competitive platform for wholesale electricity trading. This strong partnership, built on foundations set over the past two decades, will enable us to achieve our clean energy future.

As we commemorate the NEMS' 20th anniversary, I would like to commend EMC on its success in establishing an efficient and reliable energy market. I look forward to many more years of working closely together with EMC.

Ngiam Shih Chun
Chief Executive, Energy Market Authority



Message

Much has changed in our energy market over the last two decades. From manually checking through settlement data with a ruler and pen to running the checks through advanced automation systems. From a market that traded largely fuel oil to one that has diversified sources of piped natural gas, liquefied natural gas and renewables.

As we commemorate the 20th anniversary of the National Electricity Market of Singapore (NEMS), I am heartened by our progress. Our journey at the Energy Market Company (EMC) can be split into three phases: construction, maintenance and evolution.

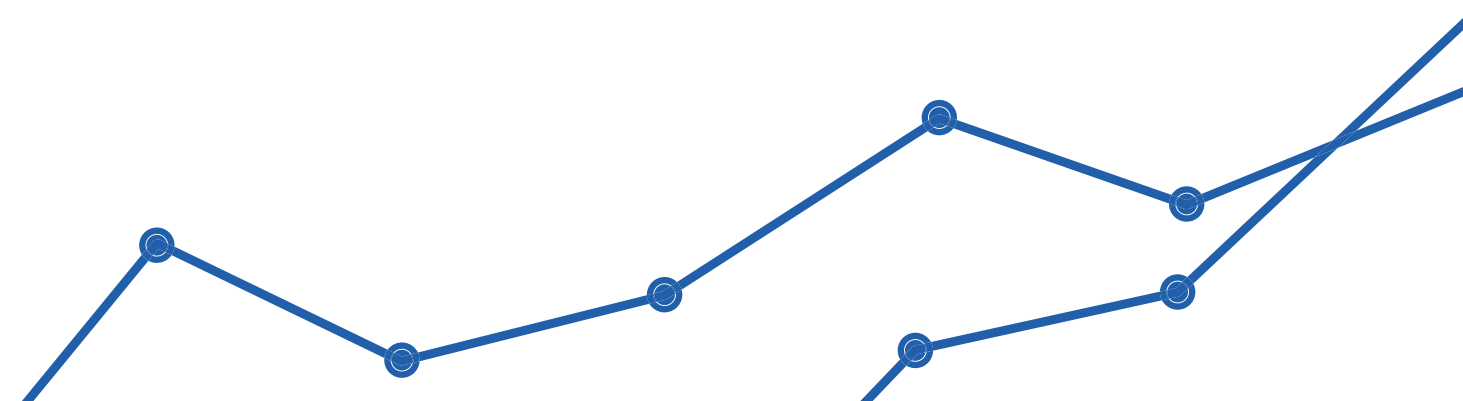
Our first CEO Allan Dawson built the foundation for the NEMS to be a transparent and competitive trading platform; his successor Dave Carlson stabilised and maintained the market; and now my task will be to navigate the changes brought on by decarbonisation and digitalisation.

As the Energy Market Authority (EMA) innovates to keep the lights on, we too will need to evolve to stay relevant, be it through incorporating more forms of low-carbon fuels in the future, regional imports or batteries. We must continue to be responsive and nimble, to further enhance the efficiency of the market.

The future will no doubt be challenging as we try to balance sustainability, security and affordability. We might stumble along the way, but each time we will pick ourselves up and do even better. What is most important is that we continue to work as a team, alongside EMA and our industry partners.

I wish to express my appreciation and gratitude to past Board Members, management and staff of EMC for your dedication and hard work over the years. To current and future generations of EMC: Let us build on their efforts to foster a resilient energy market, together.

Toh Seong Wah
Chief Executive Officer, Energy Market Company



Toh Seong Wah



Making the Switch: Building the Foundation for a Half-Hourly Market



Henry Gan held his breath as the clock struck midnight on January 1, 2003. At that moment, the energy dispatch schedule that his team had been preparing appeared.

Produced by an algorithm that balances factors including real-time consumption, supply, price, power system security and transmission constraints, it determines which power generation company (genco) should be supplying electricity, and at what price and quantity. This signals the start of the flow of electricity to the grid and, in turn, consumers.

As a young engineer specialising in market operations at the Energy Market Company (EMC), and before that Singapore Power's PowerGrid, he had produced such schedules countless times. But that day was different.

For the first time, Singapore's electricity market – which works as a spot market where power supply and demand are matched simultaneously – would be trading electricity every half-hour instead of based on contracts determined the day before. It marked the debut of the National Electricity Market of Singapore (NEMS), and the closure of its predecessor the Singapore Electricity Pool – a day-ahead market.

A smooth transition was crucial as any slip-ups would mean a possible power disruption in Singapore. "We did not want a situation where a scheduled generation unit had to suddenly shut down and we would have to scramble to start up another," said Gan, who is currently Senior Vice President, Markets and Operations, at EMC.

After a few hours of monitoring with no incident, Gan and his team – all holed up in their respective offices – finally declared the launch of the NEMS a success. At 3am, they left for home smiling, proud to be part of a momentous moment in Singapore's energy market's history.

The early 2000s were a time of reform for Singapore's energy sector, as it sought to create a more competitive and efficient electricity market for both households and businesses.

Laying the groundwork

At the turn of the millennium, countries around the world, such as Australia, the United States, Britain and New Zealand, started to liberalise their energy markets to inject competition and deliver competitive prices to consumers. For some, it meant privatising their utility companies. In Singapore, it started with the formation of the NEMS.

Gan, having just started at EMC the year before, was tasked to lead the transition. A major part of the preparation was educating the gencos about the change. His team developed controlled-environment simulations, where the gencos were provided with a hypothetical schedule, which they would then follow as they fed their supply into the market. They were also given emergency scenarios where a generator would trip, to guide them on how to react and comply with the market rules.

EMC also had to engender trust among both suppliers and buyers, referred to collectively as market participants. Changing to a half-hourly market meant that prices could shift up or down every 30 minutes, unlike in a day-ahead market where prices are fixed for 24 hours a day prior.

Forums were held, where Gan and his team explained the inner workings of the algorithm used to establish the dispatch schedule, showing them examples of how changes in demand and supply impacted the corresponding prices. For instance, prices might be higher if a more expensive generator had to be tapped due to supply or transmission network constraints.

"We were very open because we needed to assure the market participants that the prices determined by the market algorithm were valid," he said. These steps were vital in allowing the transition to the NEMS to proceed without a hitch, ushering in an era of highly responsive supply and demand of electricity.



Henry Gan



The delivery of the NEMS was truly a team effort that many should be proud of. Those early years were full of stories, personalities and not insignificant challenges – too many to cover in my allotted words; it is hard to believe that it has been 20 years. I am very proud of what we all achieved in Singapore and most proud of the fact that the heart of the NEMS has stood the test of time.”

Allan Dawson, Chief Executive Officer, EMC, from 2001-2005, reflecting on the 20th anniversary of the NEMS.

More accurate price signals, more efficient market

Whether the next day is going to be warm or cool cannot be guaranteed, which made it challenging for the day-ahead dispatch schedule to be completely accurate as demand for electricity differs according to weather conditions. And once the schedule is locked in, so are prices.

The unpredictable weather patterns meant that gencos could end up selling above or below the optimal price, since demand could not always be perfectly forecasted. But with the half-hourly market, the margin of error became much smaller, and power suppliers could alter their supplies and prices according to market conditions. The half-hourly market could also capture the dynamics of the transmission network, such as when cables are disconnected for maintenance. This allowed for more accurate and operationally feasible generation schedules, and overall a more efficient market, said Gan.

Now 20 years on, this has provided the market responsiveness needed to deal with the intermittency of solar energy. While it is the most viable source of renewable energy for Singapore, cloud cover often impacts the consistency of supply. As demand and supply are re-evaluated every half-hour, it allows for the supply of electricity from other sources, such as gas-fired generating units, to be ramped up to meet the shortfall.

But of course, the scheduling can be further finetuned to an even more granular level, said Gan. The next goal – a five-minute spot market.



Market Enhancement: Navigating Liberalisation, Diversification of Energy Sources

In November 2003, workers discovered a leak in an undersea pipe that carried natural gas from Indonesia to Singapore. Supplies of the fuel to power plants in Singapore were disrupted.

As divers worked to locate and fix the fault in the pipeline, which carried gas from West Natuna, Singapore’s wholesale electricity prices went into overdrive. Wholesale electricity prices shot up by more than 50 per cent – from the average price of about \$90 per megawatt-hour that year to about \$140 per megawatt-hour – as the market reacted to the tightened supply and the use of more expensive fuel alternatives. Some power generators started burning diesel as an alternative to gas.

The gas disruption was one of the bigger shocks to Singapore’s power sector that year. It was also a chance for the new National Electricity Market of Singapore (NEMS), which had just begun operations on January 1 that year, to show its mettle.

And it did. The wholesale market, after all, had been responding efficiently by sending the right price signals to reflect the demand and supply conditions since its opening for real-time trading, and this time was no different.

“It was pleasing to observe that, even at times when the market came under stress... price signals gave appropriate incentives to generators to offer additional capacity, and, as a result, system security was not compromised,” observed Tan Soo Kiang, then-chairman of the Energy Market Company (EMC), in a 2003 market report.

The NEMS was designed to make electricity more competitively priced and promote efficient practices. It was a crucial step in Singapore’s journey to liberalise its electricity market, following reforms in Australia and countries in North America and Europe.

“Both EMC and the NEMS play important roles in the energy sector to ensure we have a transparent, professional and cost-effective trading platform for market participants,” said the Energy Market Authority’s (EMA) Assistant Chief Executive Soh Sai Bor, who helped establish both entities. “I had the privilege to participate in the design, development and implementation of the legal and regulatory framework to liberalise the electricity market at the onset.”

“One satisfying career moment was to see the NEMS finally commencing operations after years of careful planning, development and operationalising the regulatory policies, market rules and processes with the buy-in of key stakeholders,” he added.

Temasek divests gencos

Over the next few years, Singapore continued to liberalise its electricity market. In 2008, government-owned company Temasek Holdings divested itself of three large generation companies (gencos) – Tuas Power, Senoko Power and PowerSeraya – which were all bought by overseas groups.

More gencos and wholesale traders had also entered the field since the divestments. Vesting contracts, introduced in 2004, prevented the dominant players from exerting excessive market power during tight supply situations. The upshot: with more competition between the market participants, there would be more competitive electricity prices, and a more efficient power sector.

“Together with the new players that entered the market, it created a more vibrant energy market resulting in more competitive electricity prices and a more efficient power industry,” said Soh.

First LNG terminal

The country’s efforts at diversification meant a more secure power system and market, too. By 2004, it was clear that the island state was too reliant on its neighbours for its energy needs. Supplies of Indonesian gas to Singapore were disrupted again that year, resulting in a rare partial blackout in parts of Singapore.

Singapore had to cast its net wider. And so in 2006, the Government decided to build the nation’s first liquefied natural gas (LNG) terminal. This would allow more options for Singapore to import natural gas from around the world. The \$1.7 billion terminal on Jurong Island, spanning 30ha with towering LNG tanks, welcomed its first commercial cargo in mid-2013.

“Some of our gas is coming from Trinidad and Tobago, and it is hard to imagine a source further away than that,” Prime Minister Lee Hsien Loong remarked at the official launch a year later. “And because there are more suppliers vying for our business, we can obtain more competitive prices. And with more gas available, and new generation capacity entering the market, electricity generation becomes more competitive, which will benefit consumers.”

Leaner and cleaner

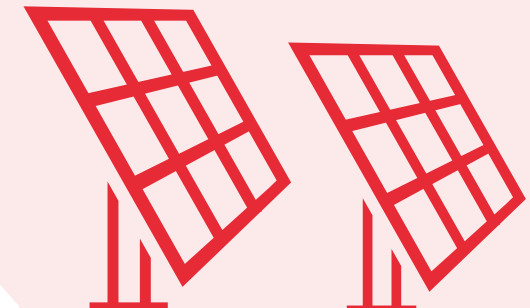
As the market becomes more liberalised, it also spurs industry players to be more efficient and competitive in the way they generate power. This is partly why Singapore’s gencos, over time, made the switch from oil-fired steam plants to cleaner and more efficient combined-cycle gas turbine ones. Those became the main source of power generation in the nation, with a then-market-share high of 97.9 per cent in 2018.

As gencos got more efficient, they were better placed to compete with each other. The combined share of the top three gencos in the generation market fell to 69.7 per cent in 2013, slipping below 75 per cent for the first time. Things also heated up in the retail market, with Keppel Electric making substantial gains, trailing Seraya Energy – the biggest ‘retailer’ after SP Services – in market share.

All in all, a sign of healthy competition in the market – just as EMA had envisioned.



Soh Sai Bor



It was challenging to balance the diverse and often conflicting commercial interests of many parties to work towards introducing competition in the electricity market. EMA worked closely with international experts to establish EMC in April 2001 for developing and operating the NEMS.”

Yeo Yek Seng, former Deputy Chief Executive (Regulation), EMA, on the obstacles faced in establishing the NEMS.

The Shifting of Electricity Demand: Spearheading Demand-Side Response

Whenever Wang Jing's children want to shower, they usually ask for her permission to turn on the water heater.

The reason is simple: the price of electricity changes every half-hour. In 2022, during the pandemic, the daily average of wholesale electricity prices dipped to \$112.19 per megawatt-hour and swung to as high as \$1,054.62 per megawatt-hour. "Before they turn the heater on, I always say, 'Wait, let me check the price first,'" said the Vice President of Market Administration at the Energy Market Company (EMC) with a chuckle. "Now, my sons have realised the value of using the water heater at different timings."

It is a practice she hopes to replicate at scale in Singapore's energy market. More intelligent energy use reduces the burden on energy supply, in turn protecting the environment by allowing less efficient power plants to be switched off. Consumers like businesses and other large electricity users also benefit by saving on power bills.

"We understand it's not practical to ask consumers to plan their consumption so precisely," she acknowledged – which is why her tool of choice is the market itself. Through a combination of incentives and market rules,

Wang hopes to encourage consumers to play a more active role in managing demand, especially during peak periods.

But whatever happens must happen fast. As supplies continue to tighten and prices inch upward, fuelled by a potent cocktail of factors from geopolitical conflict to sustainability targets, ensuring that the market functions efficiently is critical to stabilising the energy sector. To do this, getting consumers onboard is key.

Industrial consumers may be limited by operational constraints, such as needing a constant power supply. They may also not be aware that a demand response programme exists, and in some cases, they may not be sufficiently incentivised to participate."

Chen Li Qin, Senior Market Clearing Engine Specialist, Market Operations, EMC, on difficulties faced in adopting demand response.

A tailored approach

Managing demand is not a new concept – it has been on the radar of the Energy Market Authority (EMA) since the interruptible load (IL) programme and the demand response (DR) programme were launched in 2004 and 2016 respectively.

Under the IL programme, large-scale consumers such as businesses can offer to be on standby to reduce their loads at the request of the Power System Operator. Participants on standby will be financially compensated as reserves and will be activated to curtail their loads to stabilise the system when there is a contingency event.

With the DR programme, businesses can participate in the wholesale electricity market by offering to reduce their electricity consumption voluntarily to lower electricity prices. In return, they will receive payments based on how much electricity prices decreased.

In theory, both programmes sound like attractive propositions. But take-up rates have been low due to concerns about how the programme may affect existing operations and the stringent penalty regime.

"We didn't know enough about demand – about consumers' own constraints, or how needs would differ among industries," said Wang. For example, commercial buildings such as malls and hotels can afford to be more flexible in their demand by reducing their cooling needs for a short duration. Meanwhile, manufacturers have to assess the impact on their processes before switching on or turning off their plants.

To address industry concerns, EMA announced a regulatory sandbox scheme in 2022, which Wang has been helping to implement in the National Electricity Market of Singapore (NEMS). Under the two-year scheme which runs from January 2023 to end-2024, EMA has streamlined and reduced the penalty thresholds to encourage participation in the demand-side management programmes.

Wang Jing



It is an experiment of sorts, the results of which will be closely monitored. “We recognise that we may not be able to rely on one uniform type of programme to cater for all potential participants,” said Wang. “The sandbox scheme allows more consumers to see if participating in the market is suitable for them. Meanwhile, we can learn from what happens.”

Consumers play a crucial role

As the world continues to grapple with the energy crisis and the transition towards renewable energy, new and innovative solutions will undoubtedly arrive on the scene. There is no shortage of these, from the Small Modular Reactors revolutionising nuclear energy in the United States to the battery energy storage systems that are already being used to manage solar intermittency in Singapore.

But sometimes, solutions can appear in the form of taking a new approach to old situations. Perhaps nothing illustrates this better than demand-side response.

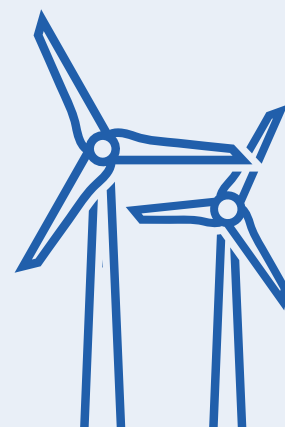
“NEMS used to be purely a supplier’s market – suppliers set the price for consumers,” said Wang. “We always thought demand was inelastic, meaning it can’t be controlled. But now, we’ve realised that demand can be flexible to a certain degree, and innovative solutions are available to make that happen.”

With strong headwinds ahead for Singapore, which relies on natural gas for over 95 per cent of its electricity supply, this shift in thinking is significant. Building an affordable, sustainable and resilient market will not be easy – but consumers play an important role.

There is still some way to go. It is Wang’s hope that demand-side response can become a natural feature of the market, and that consumers will no

longer rely on incentives to participate but do so to cut emissions, improve energy resilience and lower costs for themselves. “I hope people realise that how they use energy has an impact,” she said.

After almost two decades at EMC, she is optimistic. And no wonder, too. Over the past 18 years of her career, she has watched the NEMS navigate the ups and downs of the global energy market, working to keep pace with the times and keep Singapore’s electricity market humming along.



“During times of tight electricity supply, we activate the ice thermal energy storage systems to curtail electricity load without affecting chilled water supply to our customers. Positioned to be Singapore’s largest Demand Response aggregator, we provide operational expertise to help electricity-intensive facilities meet their energy-efficiency goals. We see the programme’s potential to mitigate high prices during peak demand and to facilitate the integration of renewables into our energy mix.”

Foo Yang Kwang, Chief Engineer, SP Group, on how SP Group’s district cooling operations at Marina Bay contribute to demand response.

Driving Innovation: Giving Efficiency, Productivity and Accuracy a Boost



Standing before his team of experienced market analysts and optimisation specialists each day, Chen Jianhong would say: “Let’s get to work.” Without missing a beat, they would whip out two essential items each: an A4-sized printout and a trusty pen.

Such digitalisation efforts are key to the NEMS’ development, given the proliferation of market participants. From a humble 11 market participants in 2003, the number jumped sixfold to 60 in 2021 before stabilising at about 50 in 2023.

Recounting this past routine elicited a laugh from him. “We manually ticked through a hardcopy checklist to conduct our daily sanity checks: Is the market system healthy? Can prices be explained? Any missing results? A lot of mission-critical processes were checked through eyeballing,” he recalled.

As Vice President of Projects and Market Systems at the Energy Market Company (EMC), he oversees two crucial steps in the daily running of the National Electricity Market of Singapore (NEMS) market system, through which the entire nation’s electricity is bought and sold.

First, he and his team must determine how much electricity the NEMS requires from each generation company it buys from, at the lowest possible cost, before deciding on the prices at which to sell this supply to retailers. Next, they must ensure that transactions are settled accurately between generation companies and retailers.

But things have changed since 2003, when the NEMS opened for trading. Checks have been fully automated on the NEMS since 2016, and analysts only step in to confirm that everything is in order or address any abnormalities flagged.

“When it launched, the NEMS was at the forefront of international electricity markets as the first of its kind to integrate and co-optimize energy, reserves and regulation control, before introducing demand-side participation and vesting contracts. But continual innovation will be essential to ensuring its relevance, including shortening trading and dispatch periods to allow fast-responding technologies and intermittent renewables to play a greater role in the market.”

Dave Carlson, Chief Executive Officer, EMC from 2006-2015, on the need for the NEMS to innovate and modernise.



Chen Jianhong



There is a crucial need for generation companies to innovate and adopt new technologies to harness the four supply switches – solar, regional power grids, low-carbon alternatives and natural gas – for sector decarbonisation and energy efficiency. We have embarked on this journey with key initiatives, such as importing 100MW of electricity from Malaysia, and are exploring the feasibility of hydrogen- and ammonia-fired power plants.”

John Ng, Chief Executive Officer, YTL PowerSeraya, on how generation companies are keeping up with change in the energy market.

“Our resources didn’t have to increase at the same pace to keep up with the volume of market participants. We started off with 13 staff members; today we have 18. Automation is the reason we are able to survive,” he said.

A work in progress since day one

Having joined EMC in March 2003, shortly after the NEMS opened, Chen has personally witnessed its transformation.

In the past, statements and invoices issued during the settlement process used to be generated by an accounting software, before being printed out for filing and sent to market participants via email. But this made his team overly dependent on the software, a situation that was unsustainable as the number of market participants started to increase. This was compounded by the fact that the task had to be completed by 5pm sharp every business day.

Today, the NEMS has a few more tricks up its sleeve. For instance, significant enhancements in the NEMS market system were introduced to mimic how accounting systems

work, producing invoices directly. “Invoices require knowledge on things like GST handling and input-output tax, so we implemented the same logic in the NEMS. This really solved our previous bottleneck issues,” he said.

And while invoices used to be sent through email, which was inefficient and risked data leakages, confidential information is now exchanged directly through the NEMS, which doubles up as a one-stop portal to facilitate interactions between EMC and market participants.

This was no easy feat. Chen recalled that this was just one part of a two-year project from 2014 to 2016, which saw their vendors shuttling between numerous project managers just to keep the project going.

But gritting their teeth paid off. “We have a scheme that measures pricing and settlement accuracy. Over so many years, we have always achieved 100 per cent or close to it, meaning the prices we discover and the settlements we perform accurately reflect market rule formulations,” he added with pride.

Rewiring the grid for the future

As befitting an engineer, he is already looking forward to the next chapter for the NEMS. One area concerns large-scale electricity imports. Currently, Singapore has embarked on a trial to import 100 megawatts of electricity from Laos. While this is but a fraction of the average of 6,000 to 7,000 megawatts from local generation companies, it is a promising trial that will set the foundation for Singapore to incorporate larger imports from elsewhere, including Malaysia, Indonesia and Cambodia.

These will ultimately contribute to Singapore’s goal of importing 4 gigawatts of low-carbon electricity by 2035 – which will make up 30 per cent of the country’s electricity supply – in an effort to decarbonise its power sector and diversify its energy sources.

Another project that Chen is looking forward to is battery modelling. Prior to 2022, when Sembcorp opened Southeast Asia’s largest Energy Storage System (ESS), Singapore did not have significant battery energy storage capacities.

A major advantage that batteries have over conventional generators is the ability to mitigate intermittencies. While solar generators are beholden to the weather – they produce output only when it is sunny – batteries both store and release energy. When demand in the market is low, batteries can store excess supply until it is time to release it.

“Typically, in other countries, solar generators are coupled with batteries to deliver stable output. Now, we need to figure out what modelling changes are required (to account for how batteries function), and how we can potentially incorporate the impact of carbon emissions,” said Chen.

Indeed, these moves are timely, and the NEMS may just be one of the key components in Singapore’s green transition.



More than two decades ago, Sembcorp played a pivotal role in Singapore’s first energy transition, replacing fuel oil with imported piped natural gas for cleaner power generation. Today, we offer a full spectrum of solar capabilities to help partners on their sustainability journey, with our 285 megawatt-hour ESS further enhancing grid resilience and stability. We will continue to work with stakeholders to help Singapore achieve its energy transition targets.

Koh Chiap Khiong, Chief Executive Officer, Singapore & Southeast Asia, Sembcorp Industries, on the future of Energy Storage Systems.

Leading the Decarbonisation Charge: The Transition to Low-Carbon Alternatives

If the energy market of today were a ship venturing into choppy, uncharted waters, then its days a decade ago would be best described as a stable cruise across placid seas.

Recalling the time he joined the Energy Market Company (EMC) as Senior Vice President of Market Operations and Information Technology in 2011, Toh Seong Wah said the mantra then was to keep the lights on but not rock the boat. “There was little need for change and the creation of new products.”

Now, as EMC’s Chief Executive Officer, the horizon cannot be more different. The calm waters have been replaced by the occasional choppy seas stirred by uncertain decarbonisation pathways.

He is often confronted with new fuel sources and technologies and his task is thinking of ways to integrate them into the Singapore energy market. “There is a constant need to evolve the market to meet new needs and goals,” he said.

Looking ahead, Toh outlined three key trends that EMC and the National Electricity Market of Singapore (NEMS) will have to navigate: low-carbon fuels, digitalisation and the decentralisation of energy generation. To stay resilient and relevant, new market mechanisms are needed.

Flexible generation to manage solar intermittency
As Singapore trudges on towards its goal of generating at least 2 gigawatt-peak of solar power by 2030 – enough to meet the annual electricity needs of around 350,000 households – it will face a persistent obstacle: intermittency.



“In the global race to curb emissions and tackle global warming, the solar industry plays a critical role in decarbonising the energy grid. The journey to net zero will be a challenging one, but we are optimistic given Singapore’s determined commitment to sustainability. There is much more potential to unlock and we look forward to further collaborations with EMC in accelerating the energy transition and keeping the NEMS resilient and relevant for a sustainable energy-driven future.”

Charles Wong, Chief Executive Officer, Terrenus Energy, on how solar energy will play an increasingly large role in Singapore’s energy supply.

Not much can be done about cloud cover, but the market can adapt to ensure that energy supply remains stable and reliable. One solution is flexible generation, which could mean incentivising generation units capable of adjusting their generation to match solar intermittency. Said Toh: “If you are flexible and fast, and I can call on you quickly, on demand, I will consider paying you a higher premium.”

Another concern is how to ensure that Singapore continues to have sufficient back-up capacity. As solar energy and other low-carbon fuels become affordable, they will start to replace traditional fossil fuels such as natural gas.

Since power generators are paid based on how much they generate, some would naturally start to decommission some of their units. But there is still a need to keep a few units as back-up to ensure continuous supply during exigencies. This could require a new market mechanism within the NEMS, where generation companies (gencos) are paid to keep capacity in case of a prolonged fall in supply, said Toh.

Harnessing data for more accurate price signals
With advanced meters and smart grids, data on Singaporeans’ electricity consumption patterns can now be easily collected, at a more granular level, and at a higher frequency. There is hence potential to further shorten the energy dispatch schedule from 30 minutes to five minutes, to further reduce the ancillary services requirements necessary to manage the power grid.

“With an interval of five minutes, we can deal with intermittency more by reducing the errors in forecasting ancillary requirements and thereby improve the price signals, even attaching different values to different levels of generation flexibility, time of generation and so on,” said Toh.

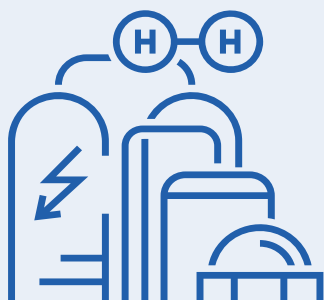


Toh Seong Wah

These will also guide real-time generation and consumption decisions, further enhancing demand-side response. Consumers may, for instance, decide to use a fan instead of an air conditioner when prices are higher.

Decentralised energy calls for new market models

Increasingly, it will not just be the gencos that produce energy but also average consumers, otherwise known as prosumers. The concept of decentralised energy has grown in popularity recently, where prosumers will, for instance, sell electricity produced by their home's rooftop solar panels or from their electric car batteries.



“With a global energy transition to a low-carbon future underway, it is both a nerve-wracking yet exciting time for the energy sector. As a young person in the field, I am glad to be part of the journey, and have the opportunity to contribute to the evolution of the NEMS to incorporate energy storage systems, renewable energy sources and more.”

Suganthi Gunasagaran, Senior Security Analyst, Technology, EMC, on her aspirations for the future.

Generally, such small-time sellers do not participate in the wholesale market themselves but through an aggregator, which is typically a company. Current market participants either sell as a supplier or buy as a consumer in the NEMS. “But with decentralised energy production, an individual or entity can be both a consumer and a generation source, and new models such as a ‘Virtual Power Plant’ may be required to integrate them into the wholesale market,” Toh explained.

While the journey ahead for the NEMS might be turbulent at times, Toh and his team are ready to weather the conditions. He jokes that he has aged with the company, his black hair now greying after 10 years of service. But he is grateful for the team behind him.

“It’s more satisfying when it’s not just me but a group of us all working together, and ageing together,” he said with a laugh.

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