

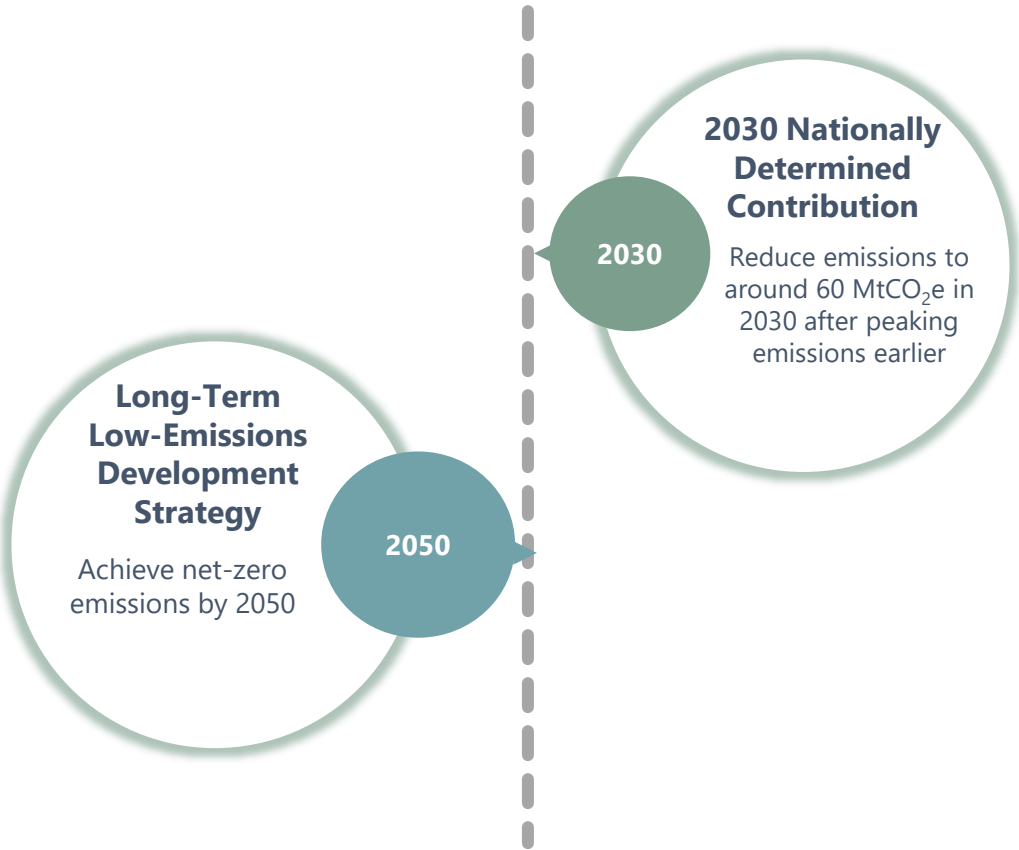
Energising Singapore

Singapore's Grid Transformation Plans Towards Net Zero

Eugene Toh, Assistant Chief Executive and Chief Commercial Officer
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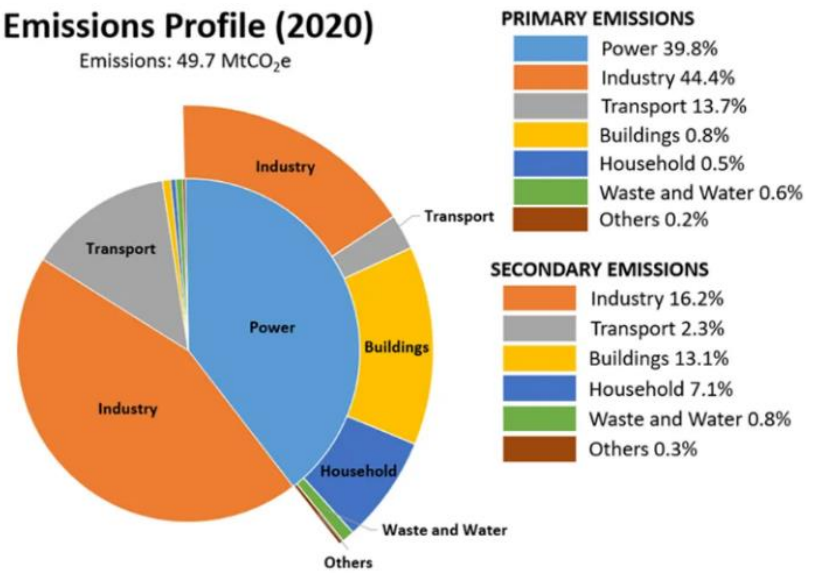


Climate change is an existential threat for all of us. Given that the power sector contributes about 40% of Singapore's emissions, we will need to decarbonise to power Singapore with low-carbon electricity.

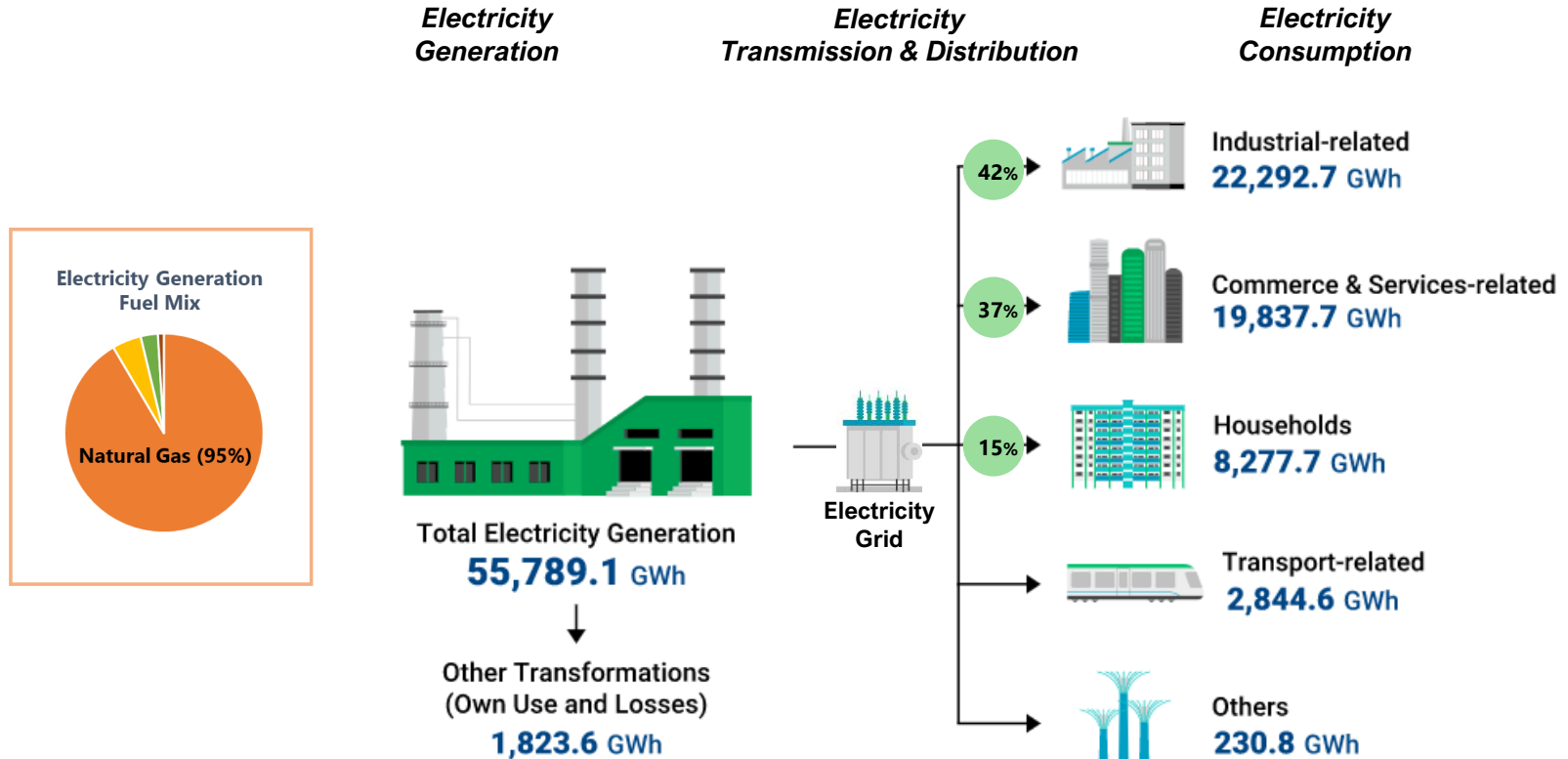


Emissions Profile (2020)

Emissions: 49.7 MtCO₂e

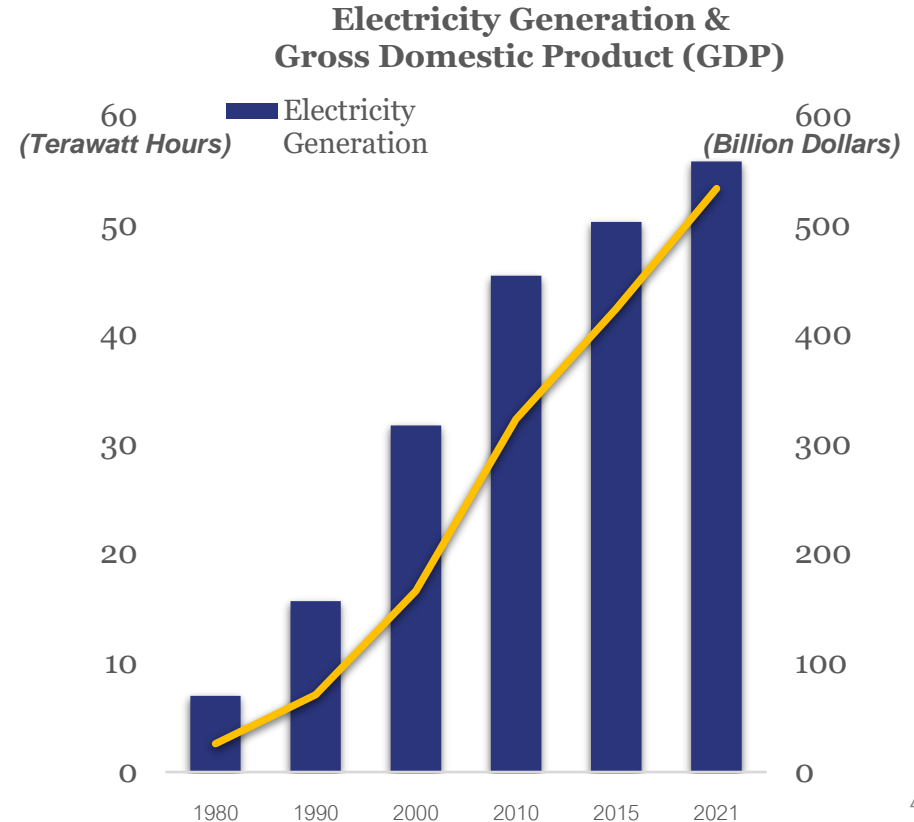


Electricity is critical to support Singapore's economy and our citizens' lifestyle. Singapore has taken efforts across the years to make the sector more sustainable.



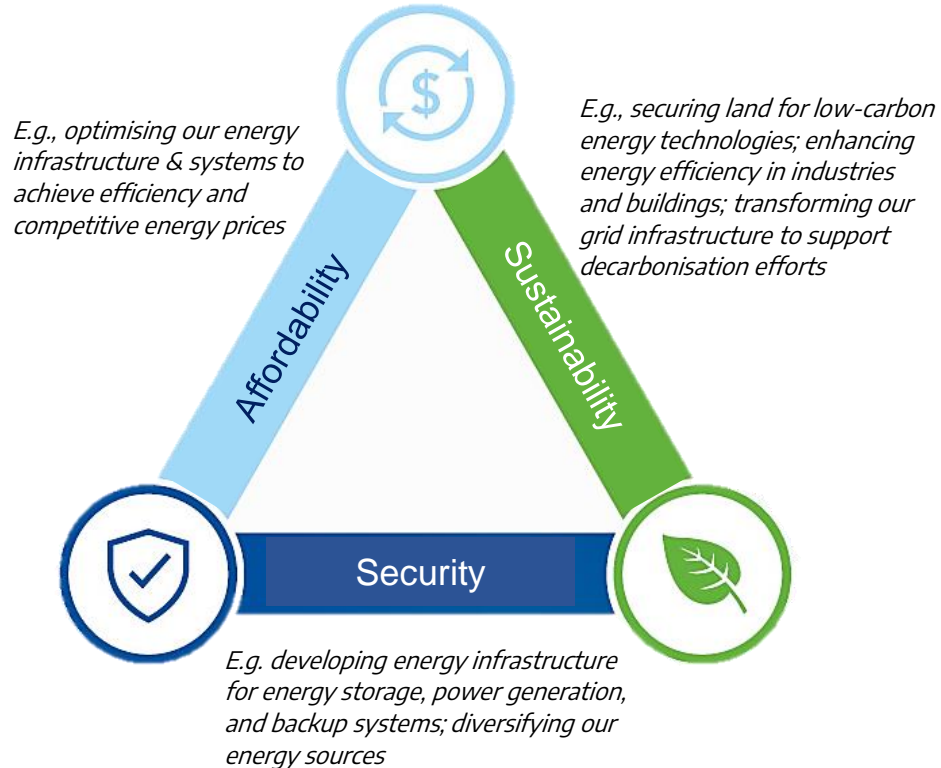
Electricity demand is expected to keep growing to support Singapore's continued economic growth, which further necessitates a reliable and affordable energy system for us to maintain our competitive advantage

- Electricity demand is projected to increase steadily over the next decade, driven by economic and population growth.
- This is further exacerbated by the wider trends of digitalisation and electrification, including the growth of new sectors like semiconductors, data centres, agritech, EVs, etc.



EMA balances trade-offs across the Energy Trilemma in our energy plans & policies.

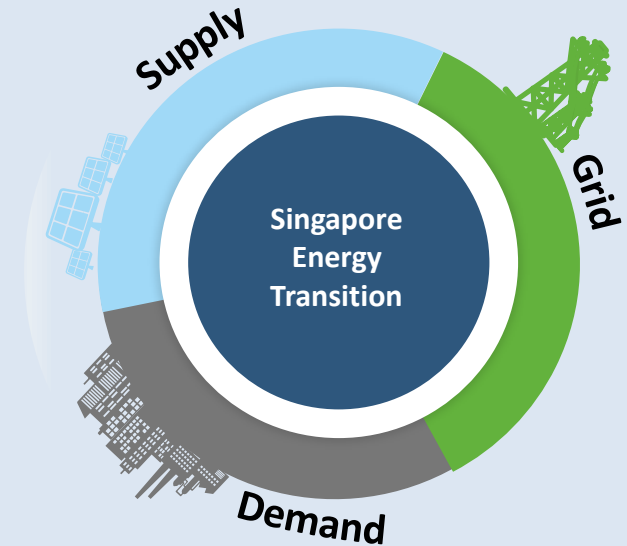
- Even as we transition towards a low-carbon energy future, we need to manage competing demands of security and affordability.
- Singapore is a small city state with limited natural resources. Achieving sustainability while ensuring security and affordability is complex and challenging.
- The energy transition will require transformational changes across the entire energy value chain, and involve challenges and inevitable trade-offs.



SINGAPORE ENERGY TRANSITION

The Singapore Energy Transition is a multi-pronged strategy that outlines the key paths for Singapore's transition towards a more sustainable future.

It aims to reduce the power sector's emissions, through supply, grid, and demand measures while ensuring that Singapore's power system remains secure, reliable, and sustainable.



To transform the energy value chain, we will need to balance the potential challenges of the various options.



SUPPLY

Natural Gas



Secure energy supply but will not meet climate change target if emissions are unabated

Solar



Renewable but land-intensive and intermittent

Regional Power Grids



Additional source of low-carbon electricity but may pose energy security risks

Low-Carbon Alternatives



Potentially a key needle mover in reducing emissions but unlikely to be deployed on a commercial scale in the near & medium term.



GRID



Reduced system reliability and increased cyber vulnerabilities from increased grid connections and digitalisation



DEMAND



Fast growing electricity demand and uncertain consumption profile

Natural Gas. Continue to diversify our gas sources and improve efficiency of power generation.

Singapore will need to depend on NG for the next few decades as it is a dependable, reliable fuel, even as we transition to cleaner sources.

EMA continues to work closely with the industry to:

- Improve efficiency of gas-fired generation plants
- Ensure security and reliability of gas supplies



The SLNG terminal can receive, store, and regasify LNG shipped in by tankers from all around the world.



Solar. Maximise solar deployment and use ESS to manage solar intermittency.

Solar is Singapore's most promising renewable energy.

We are one of the most solar dense cities in the world and have creatively deployed solar in land-scarce Singapore. Today, over 500 MWp of solar has been installed and we are on track to meeting our 2025 target.

SERIS assessed that Singapore's technical potential of solar energy is ~8 GWp in 2050.

Solar intermittency is a major issue as solar deployment scales up. EMA also aims to deploy ESS to manage this.

By 2025

1.5 GWp of solar, which can power around 260,000 households

Beyond 2025

At least 200MW of ESS

By 2030

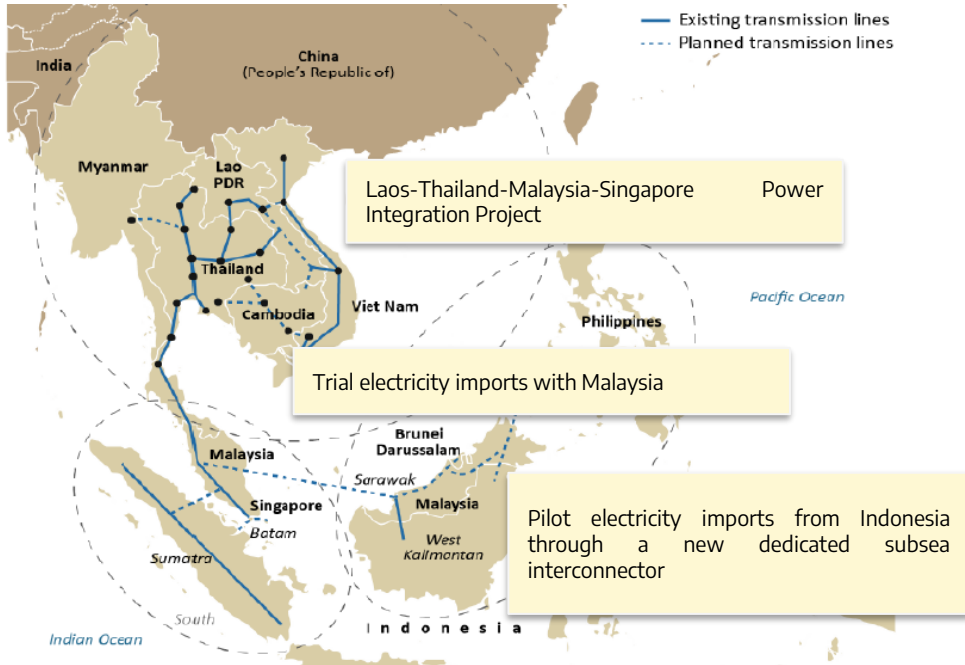
At least **2 GWp of solar**, which can power around 350,000 households



Regional Power Grids.

Pursue adoption of electricity imports to access cleaner and cost-effective energy options beyond Singapore's borders.

Tapping on regional power grids will allow us to overcome our geographical constraints and access cleaner energy resources to decarbonise the power sector.



To pave the way for these electricity imports, EMA has also been working with partners on small-scale import trials.

In 2022, Singapore successfully imported our first renewable-based electricity from Lao PDR, via the LTMS-PIP.

In Mar 2023, EMA has conditionally approval for Keppel Energy to import 1 GW of electricity from Cambodia to Singapore

To meet future increased electricity demand as well as our climate change commitments, Singapore is bringing in large-scale imports of **4 GW by 2035**, or ~30% of Singapore's energy supply.

Hydrogen. Develop the use of low-carbon hydrogen for power generation.

H₂ could play a major role in the future supply mix and is gaining global interest. Low-carbon hydrogen can potentially support **up to 50% of power needs by 2050**.

In order for H₂ to become viable, it requires:

- Established global supply chain
- Adequate import/transport infra
- H₂ costs need to drop substantially



Develop local H₂ capabilities and infrastructure to readily integrate H₂ when it becomes commercially viable.



Develop H₂ as a major decarbonisation pathway to support Singapore's climate ambitions

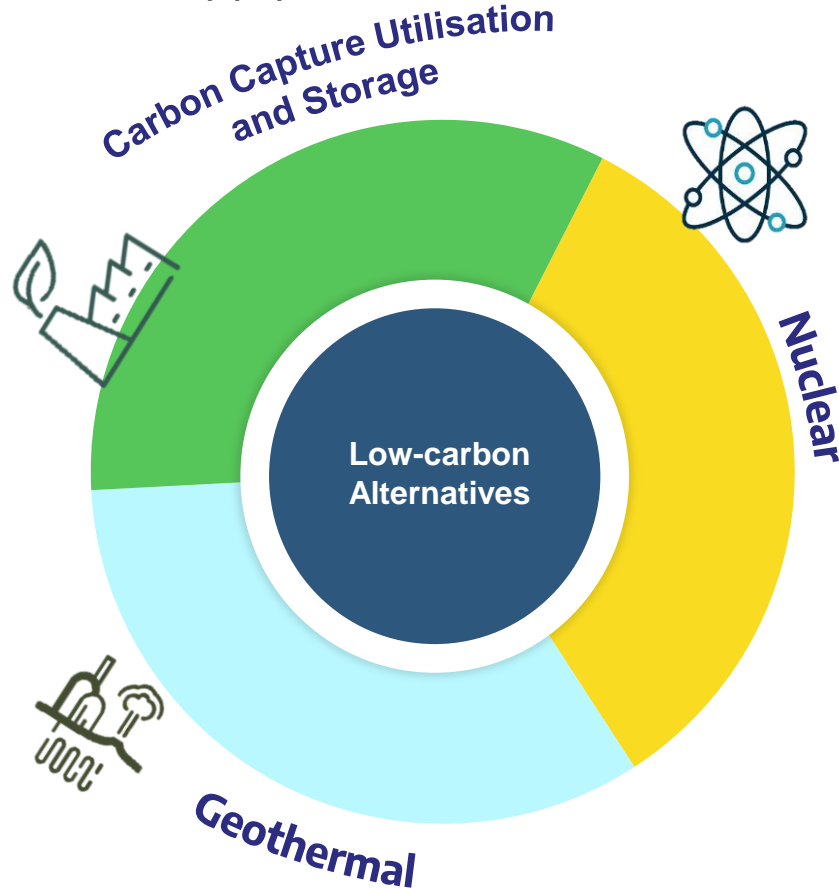


Work with international partners to develop a robust and competitive H₂ supply chain



Embark on R&D and develop pilots to develop H₂ solutions

Other Low Carbon Alternatives. Pre-position Singapore for new low-carbon supply alternatives.



Low-carbon alternatives allow the power sector to undergo deep decarbonisation.

We are actively looking into low-carbon options so that we can tap on these technologies as they become commercially and technically viable over time.

The Future Grid will need to evolve to cater for new supply sources and demand patterns and an increasingly complex system, while managing grid network costs to keep energy prices affordable

We have one of the most reliable electricity grids in the world but more will need to be done to strengthen the grid to keep pace with increasing complexity in the system

To do so, we need to increasingly tap on digital technologies to optimise the planning and operations of the grid, while also keeping grid costs affordable for consumers



As part of our efforts to build **sustainable energy systems**, we will need to evolve our grid to **enable the various changes to supply & demand**



To ensure that our energy systems maintain **world-class reliability levels**, our grid will be enhanced to **managed the increased complexity from the growing number of solar PVs, electric vehicles, and energy storage systems**



In order to build efficient energy markets and systems that deliver affordable energy prices to consumers, we will tap on digital technologies to **optimise our grid network plans**

Demand management can act as a relief to address near-term supply/demand imbalances. In the long run, it can serve to optimise capacity planning

Leveraging on digital solutions and flexible demand solutions like ESS and EVs, consumers can become active participants in the energy market, instead of being solely passive users.

Active demand management can help to provide alternative and potentially more cost-effective flexibility options, and manage the introduction of new solutions on the supply-side and the grid.



Continue building on **energy efficiency** and **energy conservation** efforts.



Develop the **flexibility of demand** to optimise supply and grid capacities.



Enhance the market design to provide price signals and incentivise behaviour change among end users

The electricity market has two demand side management programmes, Demand Response (DR) and Interruptible Load (IL), for consumers to participate in. To increase participation, EMA is currently implementing a new DR/IL Sandbox

Demand Response Programme

- Triggered when USEP prices are high, participating loads bid to reduce consumption during periods of high USEP
- ~44MW of registered DR capacity today

Interruptible Load Programme

- Triggered when there is a contingency event (e.g. outage), participating loads bid to provide reserves.
- Dispatched IL loads paid to be on standby.
- ~22MW of registered IL capacity today

DR and IL Sandboxes

- Launched for 1 Jan 2023 to 31 Dec 2024
- Under the sandboxes, certain rules will be relaxed to enhance participation in our DR and IL programmes
- Companies who are interested to participate in the sandbox can write to pearl_tan@ema.gov.sg or access the online form using the following QR code:



In conclusion:

- Singapore has taken a decisive move to achieve net-zero emissions and the power sector has to decarbonise to support this ambition.
- Even as we transition towards a low-carbon energy future, we need to manage the competing demands of security and affordability to support Singapore's continued economic growth.
- The Singapore Energy Transition requires transformational changes across the energy value chain and has implications to long-term land and infrastructure requirements and planning – this requires a systems-level planning approach to optimise our resources and achieve sustainability, security, and affordability.

Thank you