MEDIA RELEASE

27 October 2021

Singapore's First Digital Twin for National Power Grid
Created in collaboration with government agencies, industry players and research experts to enhance power grid resilience

A brighter and more sustainable energy future – this is what Singapore's first digital twin for the power grid will enable. Supported by the Energy Market Authority (EMA), SP Group (SP) and the Science and Technology Policy and Plans Office (S&TPPO) under the Prime Minister's Office, the upcoming Grid Digital Twin will serve to enhance Singapore's grid resilience to ensure grid reliability and support the deployment of cleaner energy sources.

2   The Grid Digital Twin is a virtual representation of the physical power grid assets and network and operates using real-time and historical data. It comprises two key models:

- Asset Twin[1] for the health management of grid assets (such as substations, transformers, cables); and
- Network Twin[2] for the assessment of impact on the grid when connecting new energy sources or consumers to the grid.

The Grid Digital Twin is currently in a prototype stage and is expected to be fully developed over the next few years. When fully deployed, it will enable SP to better plan, operate and maintain the national power grid through modelling and simulations so that the actual works can be carried out in a more effective and efficient way. (Refer to Annex for more information.)

3   Key benefits of the Grid Digital Twin include improving network planning analysis and remote monitoring of asset conditions, thereby saving manpower resources in carrying out extensive physical inspections. As the Grid Digital Twin provides a more holistic model of the grid, it can facilitate planning of infrastructure for

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[1] The Asset Twin is underpinned by five research projects awarded by EMA to SP Group and Nanyang Technological University (NTU) under the SP Group - NTU Joint Laboratory.

[2] The Network Twin is being developed by the Institute of High Performance Computing (IHPC) at the Agency for Science, Technology and Research (A*STAR), together with its technology partner TUMCREATE Ltd. The project is funded by the Public Sector Science & Technology Policy & Plans Office (S&TPPO).

different needs (such as installation of electric vehicle chargers, and connection of solar photovoltaic systems and energy storage systems). Progressive enhancements to the Grid Digital Twin are in place to make it more accurate and efficient, as SP continues to digitise the existing electricity assets under the network.

4   In tandem with the Singapore Green Plan 2030, Singapore is looking to greener sources of energy and more diversification of energy supply, such as solar deployments, energy storage systems and vehicle-to-grid technologies. In addition, power grid operations will become more complex with increasing electrification and deployment of more distributed energy resources (DERs). Currently, the national power grid comprises over 18,000 transformers, with more than 27,000 km of underground cables interconnecting over 11,000 substations. The Grid Digital Twin will therefore help to future-proof our power grid, to ensure that it is well-equipped to manage such complexities while maintaining reliability of grid operations.

5   Mr Ngiam Shih Chun, Chief Executive of EMA, said, "The digital twin for our national power grid will help to enhance the reliability of our electricity supply and support our transition towards greater energy sustainability. With the pressing need to tackle climate change, the power grid needs to evolve to support a more complex power system that will connect to more diverse sources of cleaner energy as well as a growing network to meet rising demand."

6   Mr Stanley Huang, Group Chief Executive Officer of SP Group, said, "SP Group works closely with EMA to explore measures to improve Singapore's grid reliability and resilience. Harnessing the power of digitisation, the Grid Digital Twin enables us to monitor and test different scenarios based on a virtual replica of the grid. We can then effectively test potential upgrades and enhancements, and future-ready innovations such as the projects under the SP Group - NTU Joint Lab to support our ambition to empower the future of energy."

7   When completed, the Grid Digital Twin will be a key initiative in contributing towards Singapore's overall efforts for greater sustainability through enhanced grid network planning and operations.

Annex: Factsheet on the Singapore Power Grid Digital Twin

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About Energy Market Authority

The Energy Market Authority (EMA) is a statutory board under the Singapore Ministry of Trade and Industry. Through our work, we seek to forge a progressive energy landscape for sustained growth. We aim to ensure a reliable and secure energy

supply, promote effective competition in the energy market and develop a dynamic energy sector in Singapore. Visit www.ema.gov.sg for more information.

Instagram: @EMA_Singapore | Facebook: facebook.com/EnergyMarketAuthority | Twitter: @EMA_sg | LinkedIn: linkedin.com/company/energy-market-authority-ema-/

About SP Group

SP Group is a leading utilities group in the Asia Pacific, empowering the future of energy with low-carbon, smart energy solutions for its customers. It owns and operates electricity and gas transmission and distribution businesses in Singapore and Australia, and sustainable energy solutions in Singapore and China.

As Singapore's national grid operator, about 1.6 million industrial, commercial and residential customers benefit from its world-class transmission, distribution and market support services.

These networks are amongst the most reliable and cost-effective world-wide. Beyond traditional utilities services, SP Group provides a suite of sustainable and renewable energy solutions such as microgrids, cooling and heating systems for business districts and residential townships, solar energy solutions, electric vehicle fast charging and digital energy solutions for customers in Singapore and the region.

For more information, please visit spgroup.com.sg or for follow us on Facebook at fb.com/SPGroupSG, on LinkedIn at spgrp.sg/linkedin and on Twitter @SPGroupSG.

FACTSHEET ON THE SINGAPORE POWER GRID DIGITAL TWIN

A digital twin is a virtual model of physical infrastructure, processes and systems that can carry out various functions such as intelligent data analysis, computer modelling and simulation and machine learning to support users in improving planning and decision-making processes.

2   The digital twin of Singapore's power grid will comprise two key models:

a. **Asset Twin** to optimise the planning, operations and maintenance of SP's grid assets (such as substations, transformers, switchgears and cables). The Asset Twin is able to remotely monitor and analyse the condition and performance of assets and identify potential risks in grid operations early. This allows SP Group (SP) to make informed decisions on renewal and maintenance plans accordingly.

   The Asset Twin is underpinned by five research projects awarded by the Energy Market Authority (EMA) to SP and Nanyang Technological University (NTU) under the SP Group - NTU Joint Laboratory[3].

b. **Network Twin** for impact assessment on grid. This uses modelling and simulations to determine the impact of additional loads (such as charging of electric vehicles) and distributed energy resources (such as solar photovoltaics and energy storage systems) on the grid.
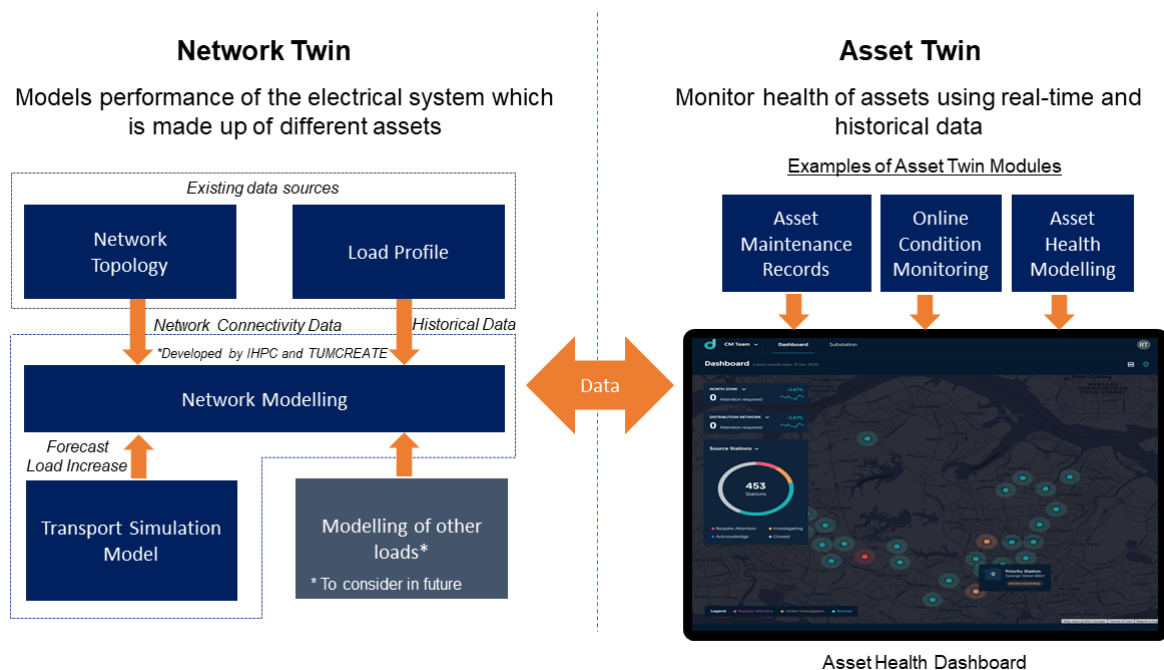
   Using an advanced software framework known as the Multi Energy System Modelling & Optimisation (MESMO)[4], the Network Twin is able to provide SP with a high-level assessment of the impact of demands on the grid and any upgrades required for different scenarios.

   The Network Twin is being developed by the Institute of High Performance Computing (IHPC) at the Agency for Science, Technology and Research (A*STAR), together with its technology partner TUMCREATE Ltd. The project is funded by the Public Sector Science & Technology Policy & Plans Office (S&TPPO).

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[3] The SP Group - NTU Joint Lab was established between SP Group and NTU in 2020, to explore energy-related projects in the areas of asset management and network operations.
[4] MESMO is one of two primary simulation technologies that is used in the Singapore Integrated Transport Energy Model (SITEM) project. More details on SITEM can be found on A*STAR's website: www.a-star.edu.sg/News-and-Events/a-star-news/news/press-releases/supporting-singapore-s-transition-to-electric-vehicles.

3   Key benefits of the Grid Digital Twin are:

a. **Enhanced condition monitoring of assets and prioritisation of asset renewal**, by having a decision tool that can identify risks and prioritise grid assets renewal plans. The tool will take into account health, utilisation and failure history of the grid assets.

b. **Improvement in carrying out network planning analysis** by having a better network utilisation when balancing new or peak electricity loads.

c. **Optimisation of asset investment**, by identifying potential synergies between asset renewal and upgrades for load growth without compromising grid resilience.
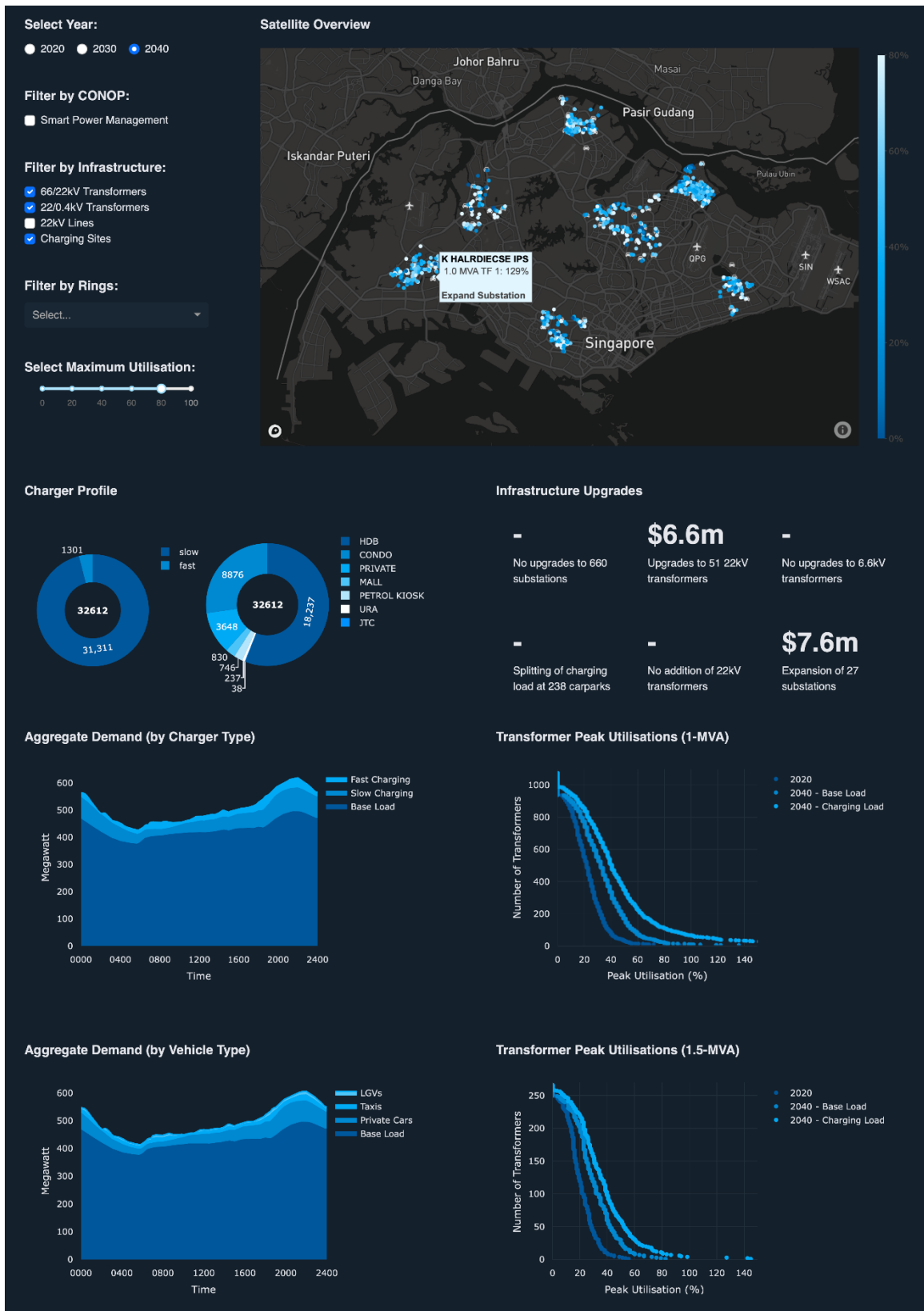

Grid Digital Twin comprising the Asset Twin and Network Twin
(Image Credit: Energy Market Authority)

KEY VISUAL FOR ASSET TWIN

Overview of Asset Health and Criticality Index for the Distribution Network
(Image Credit: SP Group-NTU Joint Laboratory)

KEY VISUAL OF NETWORK TWIN

*Dashboard for analysing electric vehicle charging impact on
the distribution grid using the Network Twin
(Image Credit: Institute of High Performance Computing and TUMCREATE)*