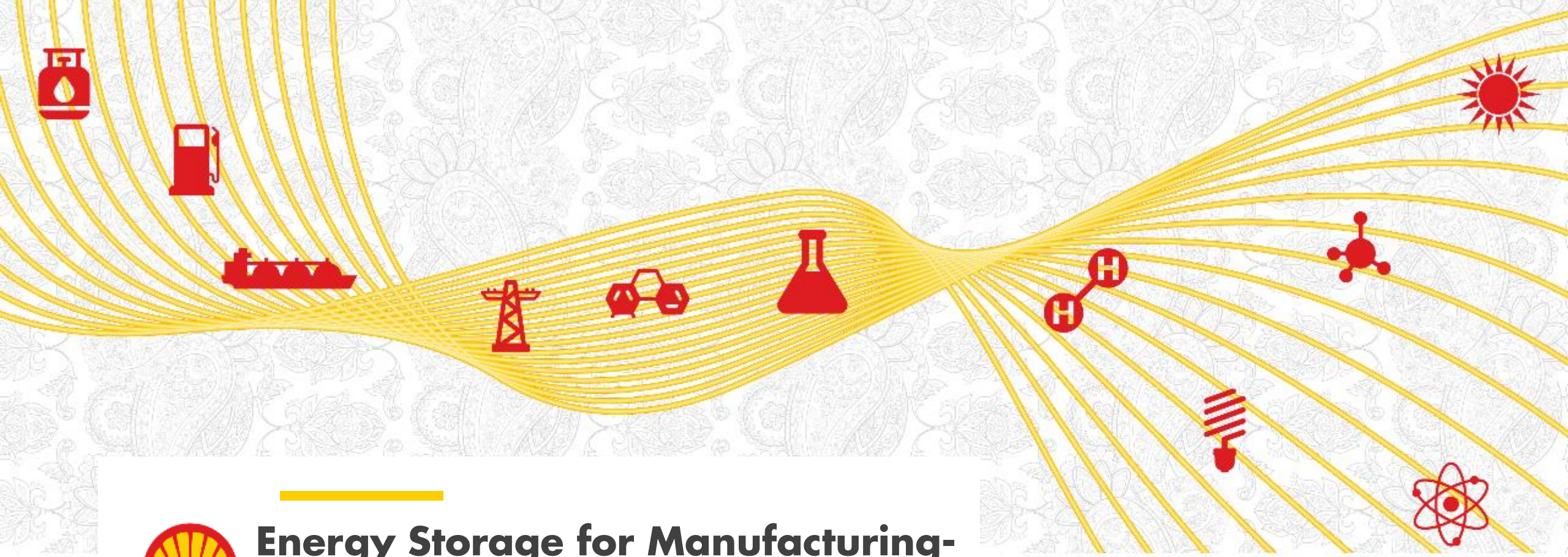

Energy Storage for Manufacturing- Petrochemical Industry Perspective

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Shell's operating plan, outlook and budgets are forecasted for a ten-year period and are updated every year. They reflect the current economic environment and what we can reasonably expect to see over the next ten years. Accordingly, Shell's operating plans, outlooks, budgets and pricing assumptions do not reflect our net-zero emissions target. In the future, as society moves towards net-zero emissions, we expect Shell's operating plans, outlooks, budgets and pricing assumptions to reflect this movement.

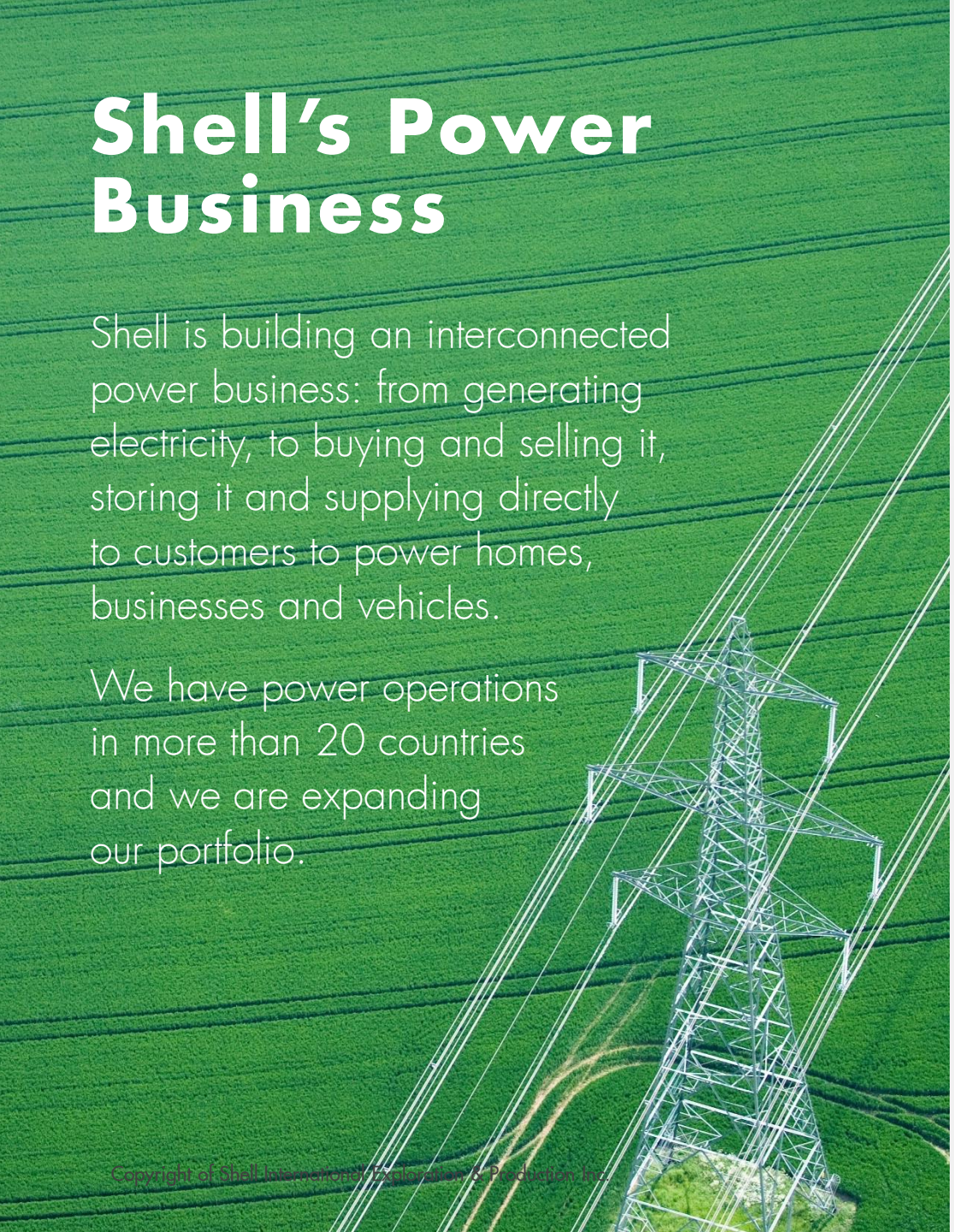
Also, in this presentation we may refer to Shell's "Net Carbon Footprint", which includes Shell's carbon emissions from the production of our energy products, our suppliers' carbon emissions in supplying energy for that production and our customers' carbon emissions associated with their use of the energy products we sell. Shell only controls its own emissions. The use of the term Shell's "Net Carbon Footprint" is for convenience only and not intended to suggest these emissions are those of Shell or its subsidiaries.

WORKING TOGETHER TO **DECARBONISE ELECTRICITY AND EXPAND ITS USE**

Shell's Power Business

Shell is building an interconnected power business: from generating electricity, to buying and selling it, storing it and supplying directly to customers to power homes, businesses and vehicles.

We have power operations in more than 20 countries and we are expanding our portfolio.



Generating and storing clean electricity

- Shell is increasing our renewable power business in terms of wind and solar power. At the end of 2020, the total Shell share of installed capacity is more than 900 MW with more than 3.5 GW in development.
- Partner companies link Shell to more than 150 solar projects in 12 countries.

Trading and supplying power

- One of the USA's largest wholesale marketers of power (through Shell Energy North America).
- In Europe, we have traded power for almost 20 years. We now trade in more than 10 European markets and supply customers in five.

Customer-facing products and services

- E-mobility: growing our network of operated electric-vehicle charge points from 60 000 to 500 000 by 2025.
- Shell Energy Australia is the second largest electricity provider to commercial businesses.
- We are supplying renewable power to business customers such as Amazon and Microsoft.

CASE STUDIES: ON-SITE RENEWABLE ENERGY

ENERGY STORAGE — CORUNNA, ONTARIO

Customer: Sarnia Manufacturing Center

Status: Operational. Completed Feb 2020

Use Case: Behind the Meter Peak Demand Management

Size: 10MW | 20MWh

Technology: Lithium Ion

Interconnection: 27.6 kV

Benefit: This energy storage system will reduce Global Adjustment peak demand charges for the Sarnia Manufacturing Center

ENERGY STORAGE — BROCKVILLE, ONTARIO

Customer: Brockville Lubricants Oil Blending Plant

Status: Operational. Completed Feb 2020

Use Case: Behind the Meter Peak Demand Management

Size: 0.6MW | 1.2MWh

Technology: Lithium Ion

Interconnection: 4.16 kV

Benefit: This energy storage system will reduce Global Adjustment peak demand charges for Brockville LOBP

MICROGRID — HOUSTON, TEXAS

Customer: Shell Technology Center

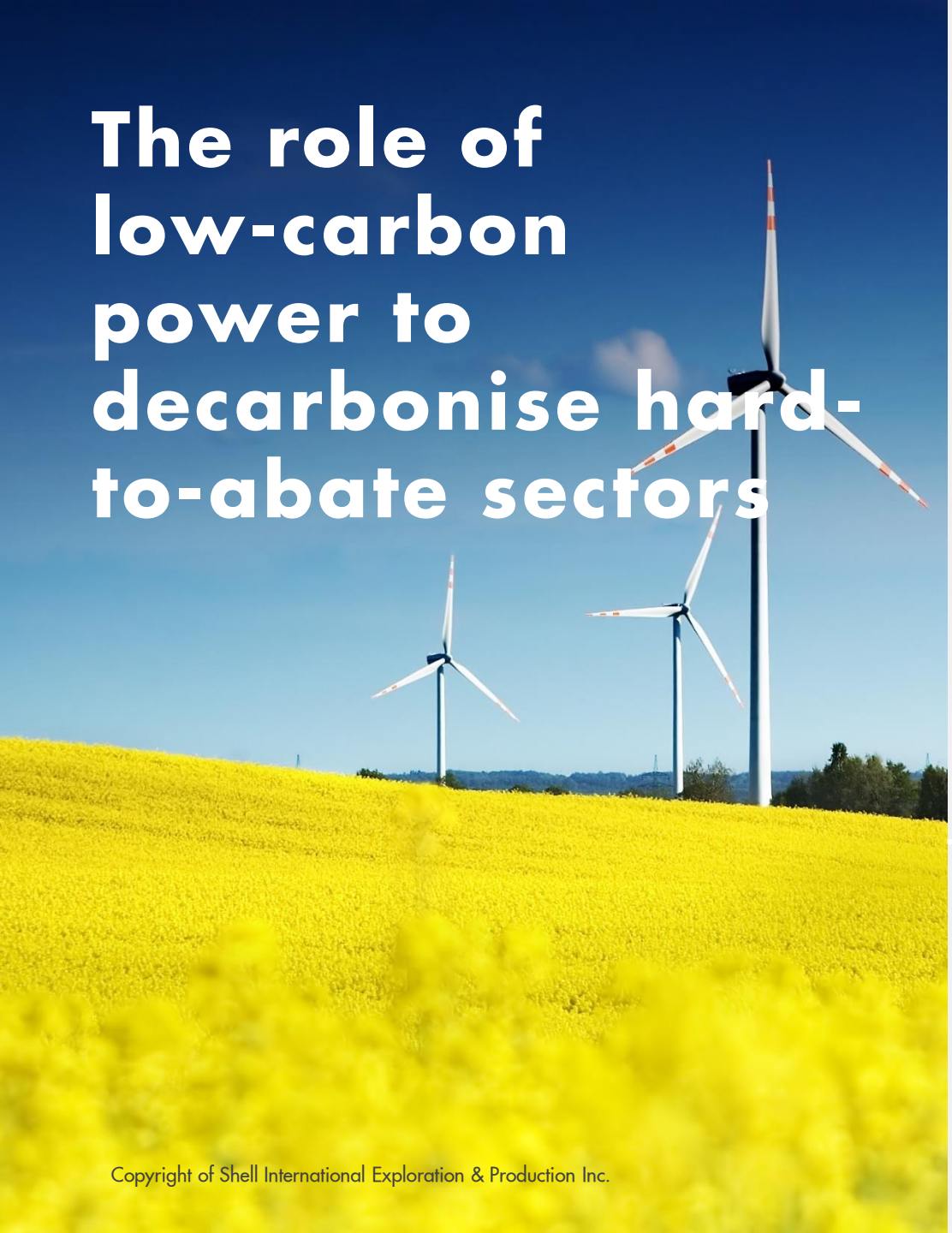
Status: Operational. Completed Aug 2018

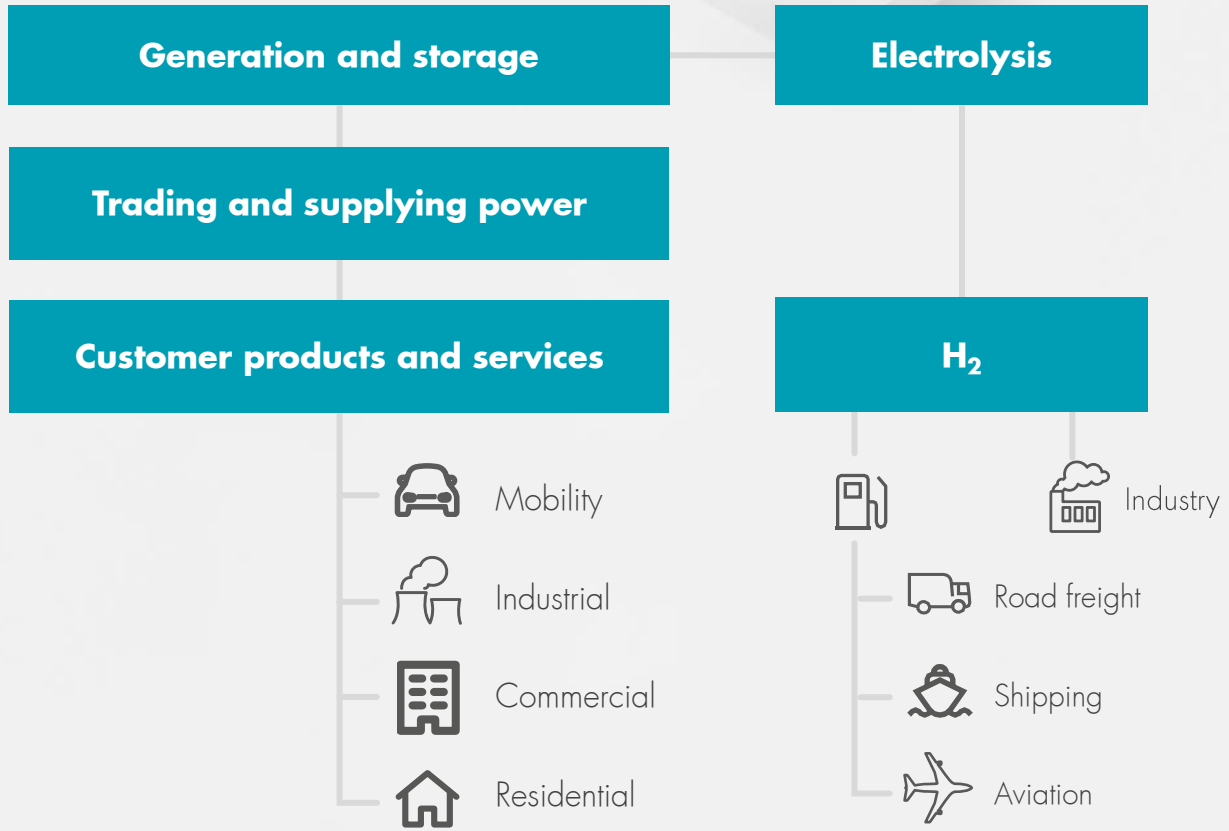
Use Case: Full integration of renewables and flexible resources

Technology: 345kW Ground-mount Solar PV, 250kW / 1 MWh Li-ion, 250 kVA Load Bank, 127 kW Natural Gas Genset, (2)30kW V2G DC-Fast Chargers

Benefit: Renewable energy integration, power quality, demand management, provision of ancillary services (i.e., frequency regulation, fast frequency response)

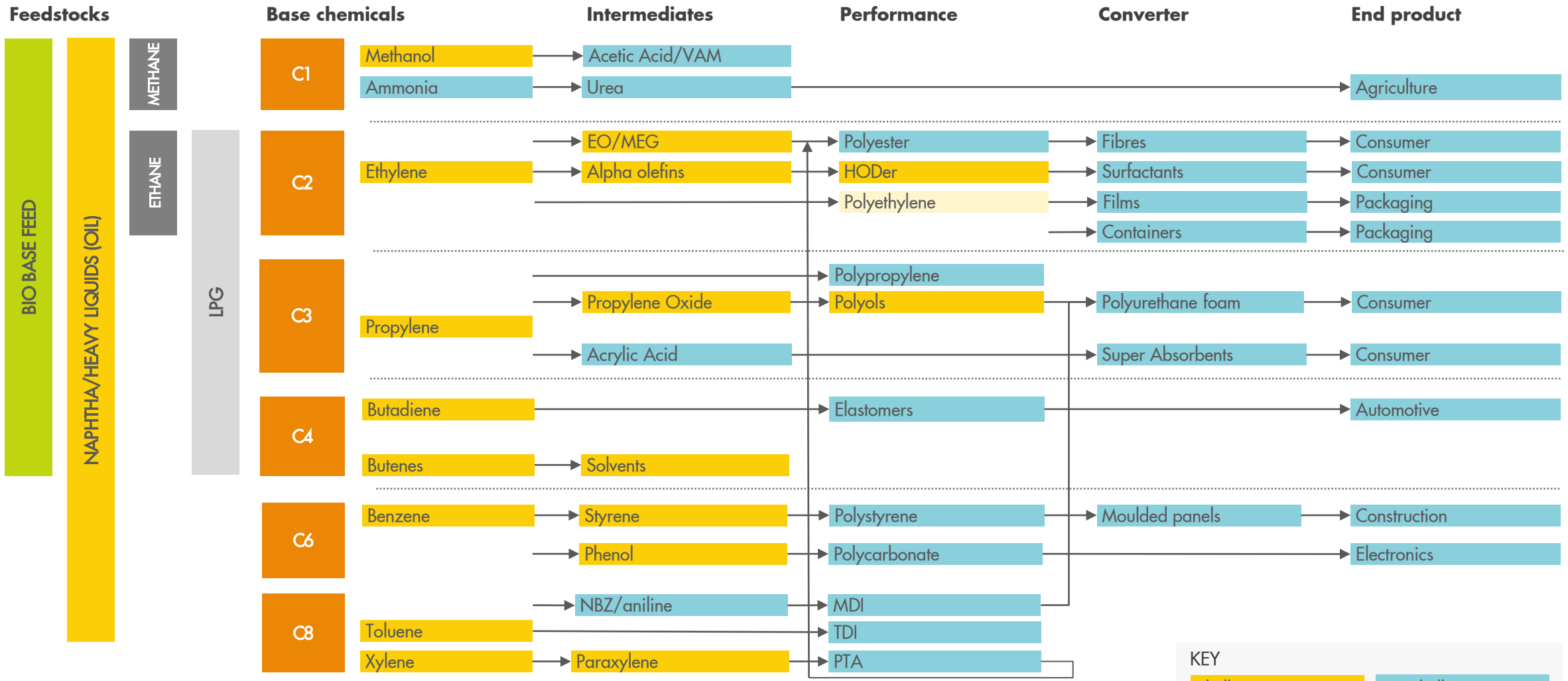
The role of low-carbon power to decarbonise hard-to-abate sectors





- Electrons already power some passenger transport and parts of industry.
- Electrons are crucial to making green hydrogen that will power sectors for which direct electrification is less feasible – such as heavy-duty road freight, shipping, and possibly, aviation.

Chemicals value chains



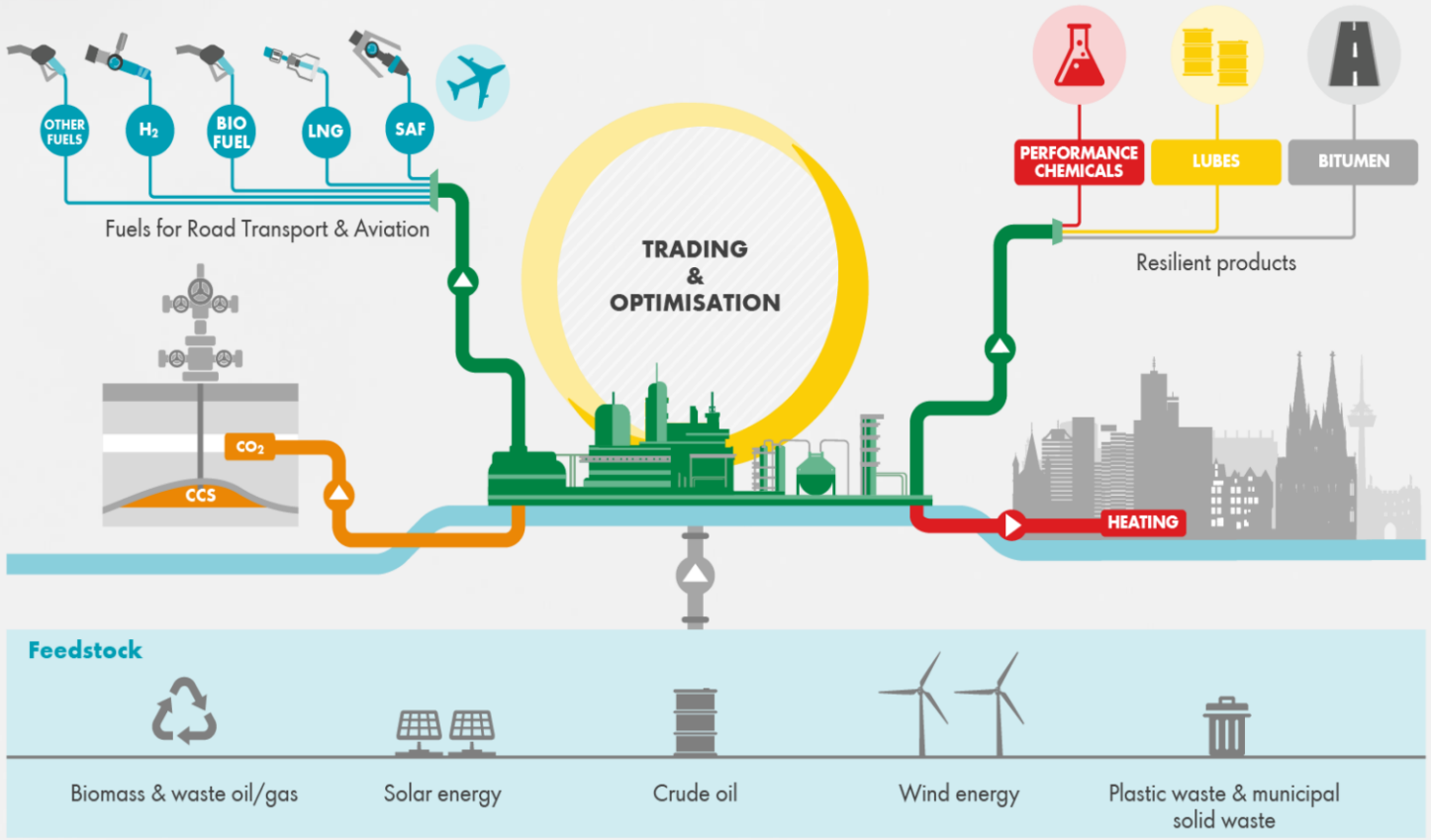
Source: Chemicals investor briefing October 13, 2017

CHEMICALS AND PRODUCTS

DELIVERING LOW-CARBON SOLUTIONS THROUGH INTEGRATED ENERGY AND CHEMICALS PARKS

Transition to 6 core Energy and Chemicals Parks

- Delivering synergies through integrating Refining and Chemicals, bringing customers and assets together
- Expanding to low-carbon product offerings
- Utilising existing infrastructure and assets enables a faster and more efficient transition
- Progress made on transforming 6 core assets to low-carbon solutions driven by customer demand:
  - Divestment of Martinez and Fredericia
  - Conversion of Tabangao
  - Closure of Convent
  - Rightsizing capacity at Bukom
  - Porthos CCS at Pernis
- Selective growth in Chemicals



Transformation of 6 core Energy and Chemicals parks driven by pace of energy transition and customer demand. Aim to complete before end of this decade.

Electricity in the industrial sector

Historically limited to processes at intersection of low-cost power, critical products & practical driving forces

- 1892 — Chlor Alkali
- 1888 — Aluminum
- 1902 — Air separation

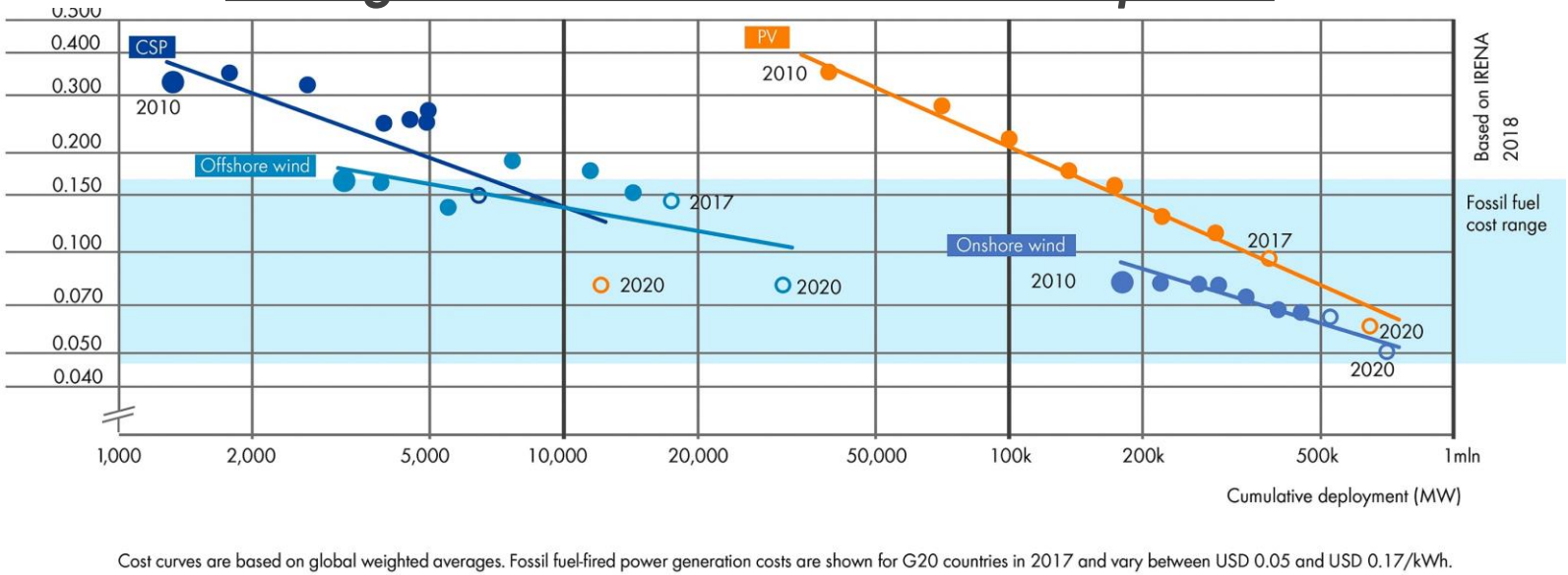
+

- Hydrogen
- Base Chemicals
- Specialty Chemicals

What will this require?

While industrial electrification is not new, the paradigms for future processes could be, if storage costs decline & process flexibility increases

Price declines for electricity begin to close historical gap among fuels on an MMBTU basis for power



Cost curves are based on global weighted averages. Fossil fuel-fired power generation costs are shown for G20 countries in 2017 and vary between USD 0.05 and USD 0.17/kWh.

Notional power cost thresholds for large-scale electrification

Cement: $25-50/MWh

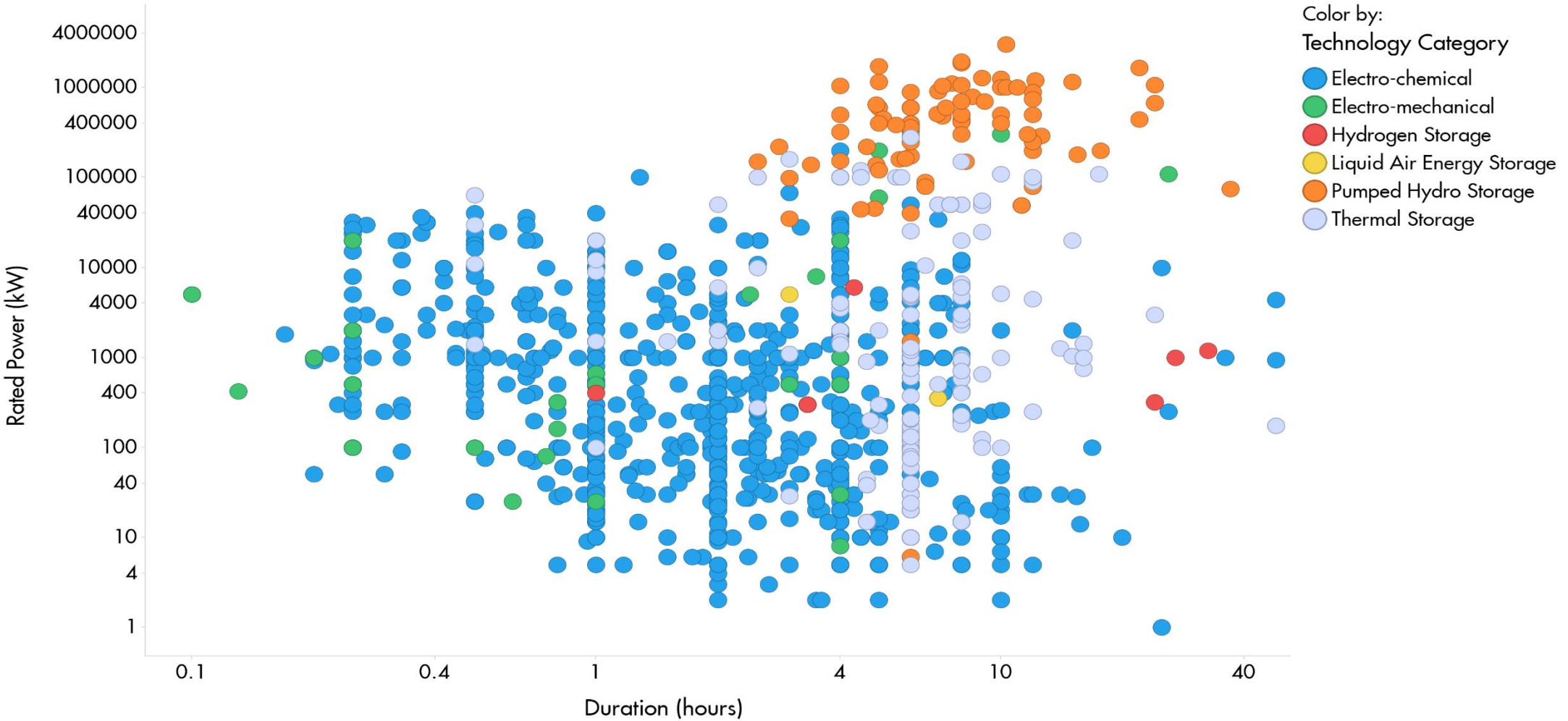
Steel (via H_2): $25-40/MWh

Ethylene: $15-$25/MWh

Sources: https://doi.org/10.1016/B978-0-08-031141-8.50020-3; *Mission Possible, ETC, Nov 2018;* McKinsey 2018, *Decarbonization of industrial sectors: the next frontier*

Range of Energy Storage Technologies Used for Different Applications

Key needs: larger scale, longer duration, multi-modal, lower cost

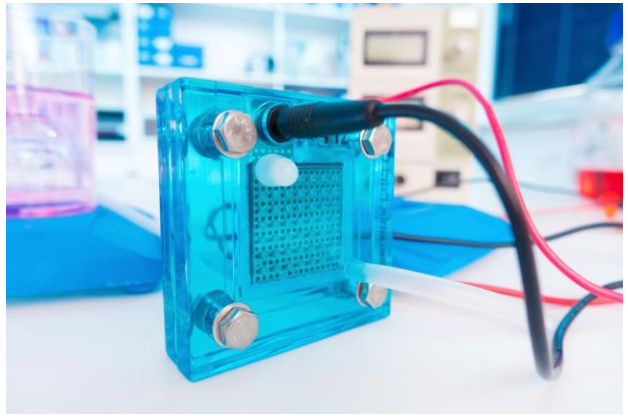


Source: US DoE Energy Storage Database, November 2020, https://www.energystorageexchange.org/

Key Challenges for Storage

Sometimes readily apparent, other times less so

- *Is it better?*
  - Technical parameters: energy density, efficiency, charge/discharge capability, cycle life, self-discharge/storage losses
- *Is it valuable?*
  - Clear application that meets a need and can be remunerated
  - Accelerating designs for emerging needs that go beyond today
- *Is it scalable?*
  - Cost (upfront & LCOS), footprint, supply chains, and customer adoption
  - Multiple dimensions of sustainability



Goal: De-risked product that can be financed and operated safely & reliably to meet premises

Closing thoughts

- History strongly suggests that there are multiple paths & no easy answers
- Research can benefit deployments through advancing the guiding questions
  - "Is it better?": Bridging the current power-energy paradox, ensuring adjacent technologies are ready and compatible
  - "Is it valuable?": Capacity, dispatchability, & energy at large scale
  - "Is it scalable?" Accounting for maturation in a highly dynamic environment
- Thank you for your attention!