

A high-angle photograph of two workers in a quarry. They are wearing brown jackets, high-visibility yellow-green vests, and hard hats (one yellow, one white). One worker is holding a tablet computer, and the other is pointing towards the ground. The ground is covered in dark soil and small rocks. The Hitachi logo is in the top right corner.

HITACHI
Inspire the Next

Sustainable Energy Solutions for an All-Electric Mine

Bernard Norton, Country Managing Director

Energy & Mines Australia Summit, June 2023

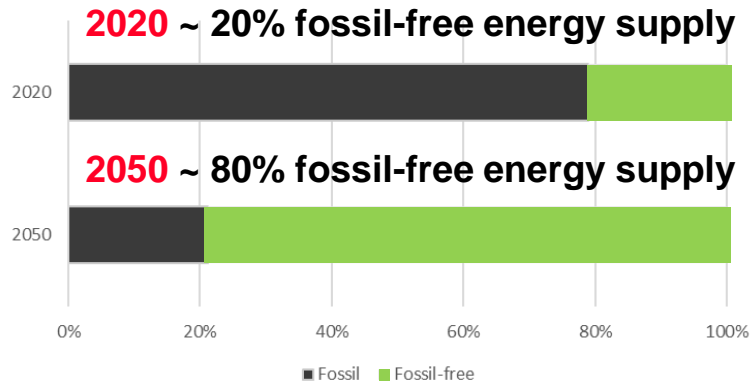
 **Hitachi Energy**

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- The energy transition
- Mining priorities and challenges
- Mine electrification – a holistic approach, from source to consumption
- 5 key considerations
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Shaping an evolving power system to accelerate the energy transition

Share of fossil-free energy:



Electricity demand growth to 2050:



Industries doubling to
>20 PWh



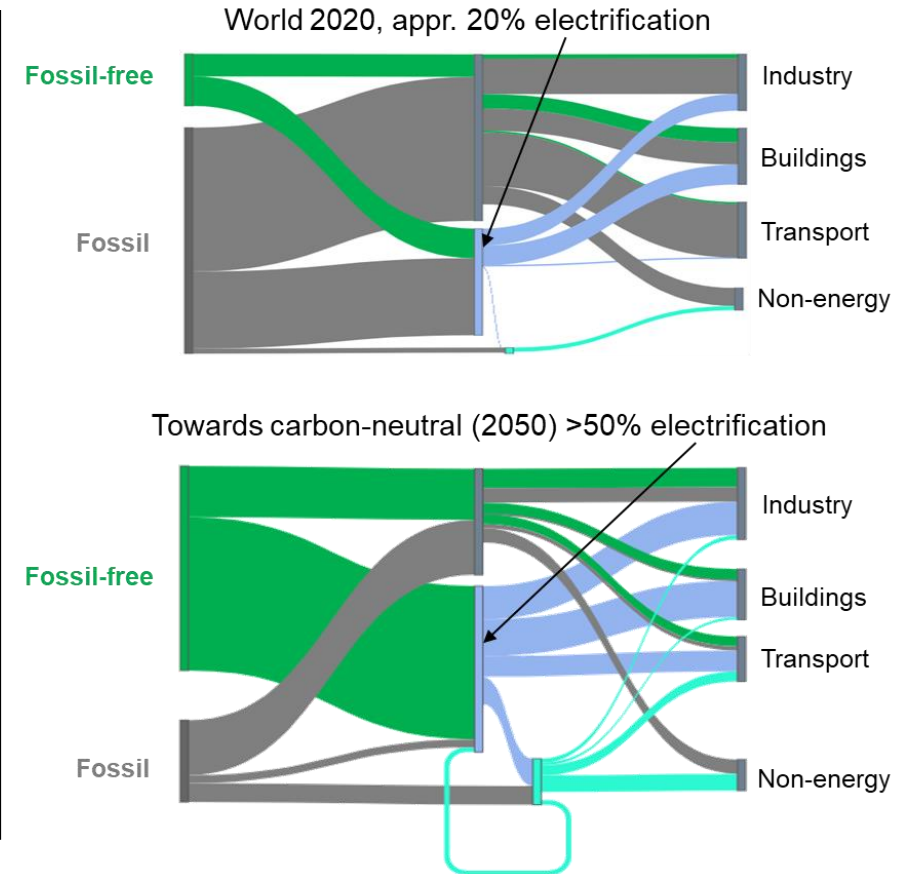
Buildings growing
~50% to >15 PWh



Transportation growing
>30x to ~10 PWh

(PWh: 1×10^{15} Wh)

In the global power system of 2050, we need four times of today's generation capacity and we will need to transfer three times as much electrical energy



Technologies
– enabling the
energy
transition



**Sustainable
products & solutions**



Power Electronics



**Digital technology
and services**

Building the foundation for a system of systems

**Advancing a
sustainable
energy future
for all**

Mining industry priorities



DIGITALISATION

- Managing the entire mining value chain
- Data-based decisions on CAPEX and OPEX
- Operation and prognostic maintenance (based on status and operational demand)
- Wearable sensors for safety and productivity
- Maintenance enabling support to a remote location from skilled personnel
- Artificial Intelligence (AI) - from support to human decisions to operating full autonomous vehicles



SUSTAINABILITY

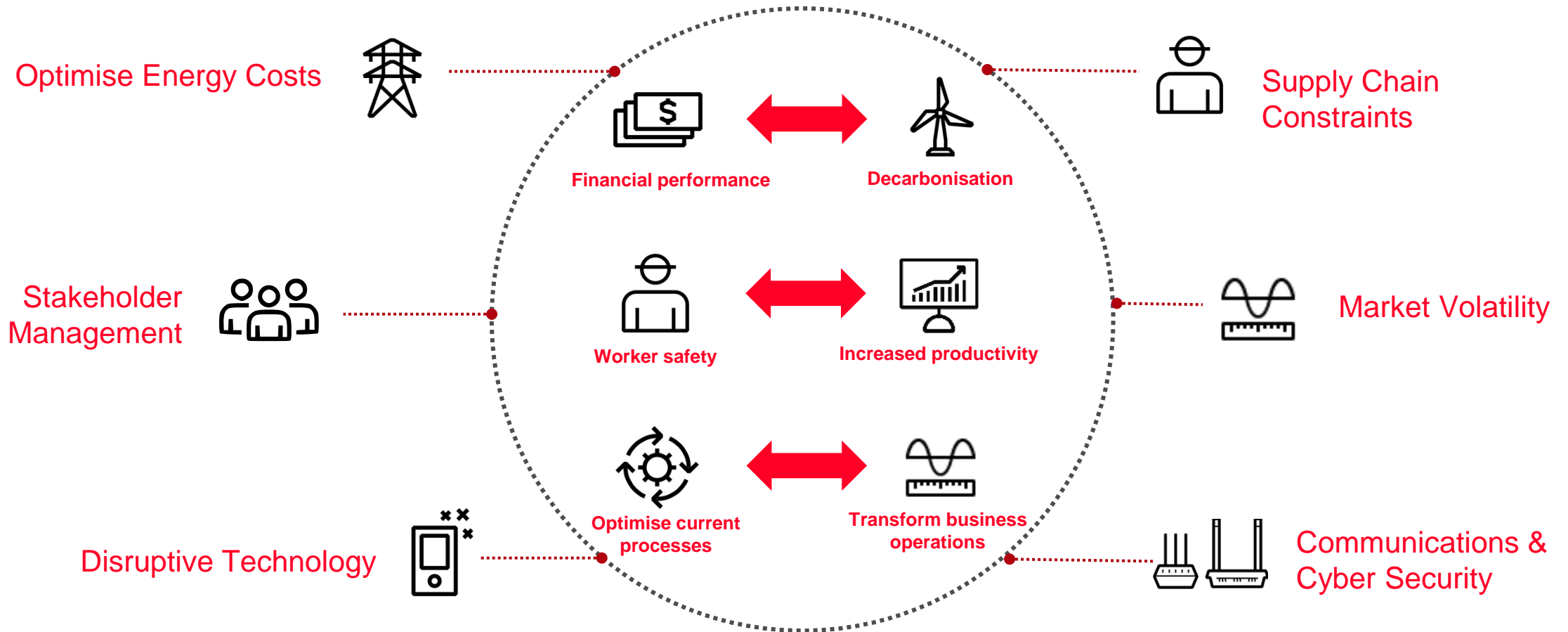
- Energy recovery, renewable energy, and carbon capture to supplement, replace, or mitigate the impacts of fossil fuel use
- Use of electricity from Renewables - purchase or generate
- Electrical transport and excavators - less need for oxygen and lower cost of ventilation
- Remote locations demanding consistent baseload via microgrid
- Application of H2 for reduction of iron ore
- Increasing production of steel from scrap



ESG

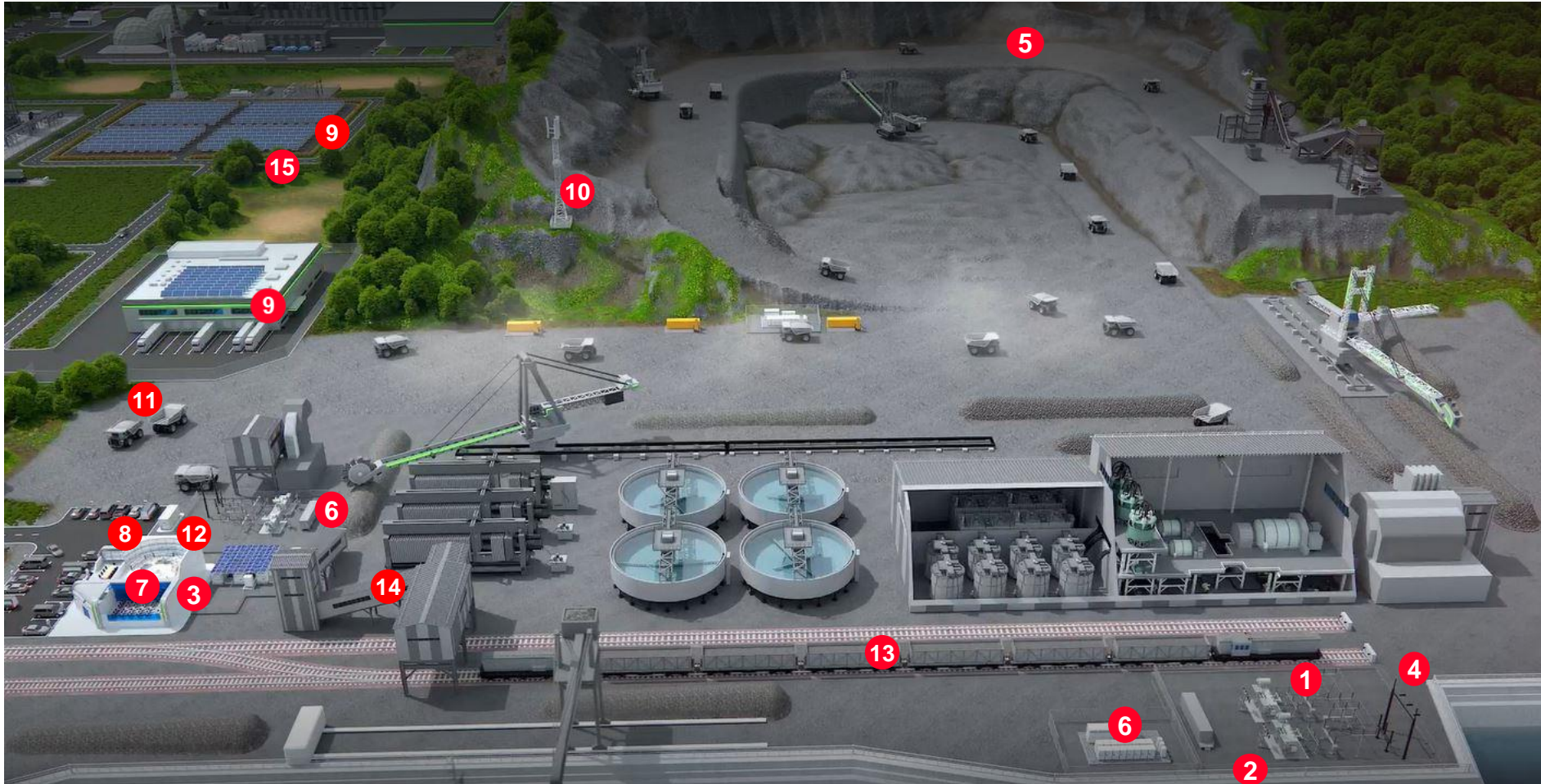
- Balance the benefits to the planet, people and profit successfully
- Unmanned vehicles to reduce the number of people underground
- “Safety first” mandates
- H&S for workers and communities close to mines
- Enhanced living conditions: Construction of social projects, e.g. housing, schools, hospitals, etc.
- Water desalination plants together with dry technologies in beneficiation to reduce use of spring water
- Purification of the wastewater

Internal and external challenges facing the industry



Operational complexity and market volatility drive the need to increase efficiency and simultaneously reduce risk

Components of an all-electric mine



- 1 Digital Substation
- 2 Transmission
- 3 Energy / Carbon Trading
- 4 Substation Automation
- 5 Drone Monitoring
- 6 Energy Storage
- 7 Intelligent Software
- 8 Control & Data Acquisition

- 9 Microgrids
- 10 Communications
- 11 Fleet Management
- 12 Network Control
- 13 Electrified Rail

- 14 Automated conveyers
- 15 Consulting

Where we fit in the value chain

Upstream Mining

- Open Pit and Underground
- Remote or Not
- Self-generating or Connected
- During Design, Prospection or Operation

Fast Recharging Systems for Electrical Excavators

Energy Delivery to Electrical Mining Trucks

Grid Edge Solutions

Reliable Energy for Ventilation and Hoisting

VSD Transformers

Beneficiation

- For All Process Types
- During Design or Operation

Energy Delivery to Crushing, Grinding and Milling

Energy Delivery to Desalination Plant

Energy delivery to Electrowinning and other DC and AC processes

Transformation

- High Installed Power
- High Embodied Energy

Transformers for Energy Delivery to AC and DC Arc Furnace, Ladle Furnace, Induction Furnace, Mill, etc

VSD Transformers

Power Quality Management



Microgrid with integration of Renewables



Digital and Traditional Substations



Digital solutions in design and O&M



Compensation of long OHTL



Voltage stabilisation, Power factor correction, Harmonic and flicker suppression

Delivering reliable, efficient and green energy systems that shape a sustainable future

The electric mine – 5 key considerations

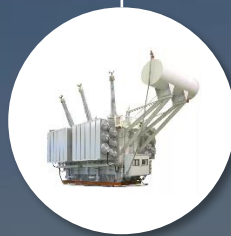
1. Reliable, stable and sustainable electricity networks

2. Integration of renewables

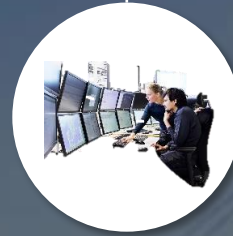
3. Flexible electrification and automation

4. Understanding and using data

1.



Eco-efficient transformers



Digital, automated substations

2.



On site renewable energy

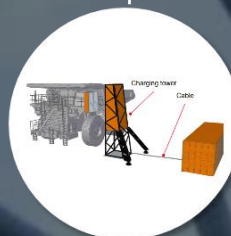


BESS & advanced inverters



Improved power quality, grid stabilisation

3.



Electric, hybrid vehicles & equipment



Digitalisation



Future-proof electricity networks

4.



Optimised asset management



Live monitoring



Emissions tracking, reporting & trading

The electric mine – 5 key considerations

5. Co-creation



Co-created solutions to address environmental, social and governance challenges



Demand side tailwinds

Transmission upgrades, transport electrification, long-term partnerships

Supply side headwinds

Inflation, commodities, trade and logistics



Virtual Synchronous Machines – spinning reserve & system strength

Goodwyn (Woodside) *

- 2.8MVA/1.43MWh VSM
- Offshore Platform
- Commissioned 2019



Northstar/Soloman (FMG) *

- 30MVA/8MWh VSM & 20MVA/5MWh VSM
- NWIS/Private Network
- Commissioning 2022



Newman (Alinta) *

- 35MVA/8MWh VSM
- NWIS/Private Network
- Operating since 2017



Kalbarri (Western Power)

- 5MVA/2.5MWh VSM
- SWIN
- Operating since 2021



Tom Price (Rio Tinto) *

- 45MVA/12MWh VSM
- Private Network
- Commissioning 2022



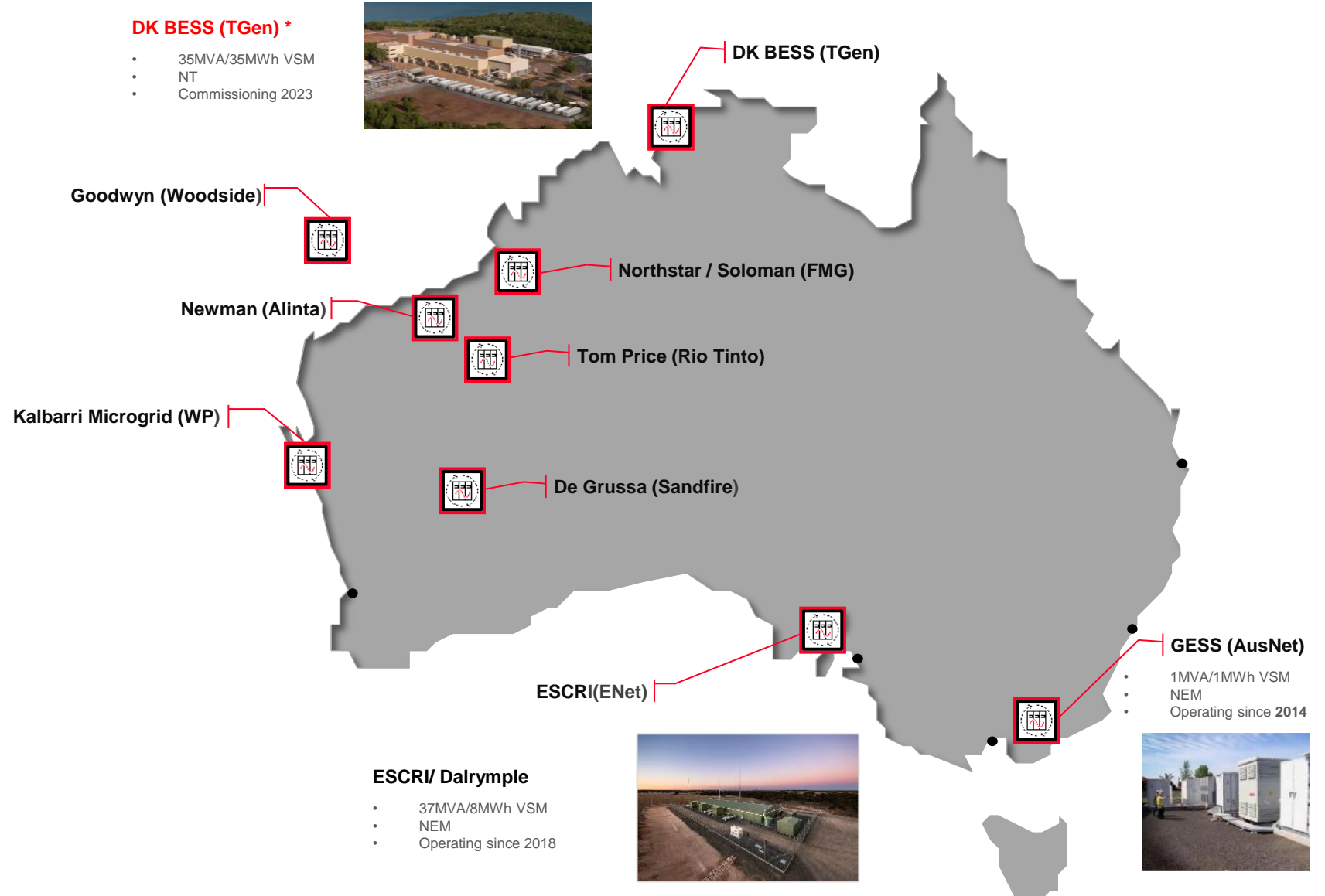
De Grussa (Sandfire)

- 6MVA/2MWh VSM
- Private Network
- Operating since 2017



DK BESS (TGen) *

- 35MVA/35MWh VSM
- NT
- Commissioning 2023



Goodwyn (Woodside)

Newman (Alinta)

Kalbarri Microgrid (WP)

De Grussa (Sandfire)

ESCR I(ENet)

ESCR I/ Dalrymple

- 37MVA/8MWh VSM
- NEM
- Operating since 2018

DK BESS (TGen)

Northstar / Soloman (FMG)

Tom Price (Rio Tinto)

GESS (AusNet)

- 1MVA/1MWh VSM
- NEM
- Operating since 2014



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