Synergy's Battery Energy Storage System (BESS) Overview

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Future Energy

synergy

Synergy in a snapshot

WA's largest
electricity generator
and energy retailer

1.1 million +
electricity customers

Generate
~6,500 GWh
of electricity p.a

Workforce of 1,500+
employees
and contractors

WEM in a Snapshot

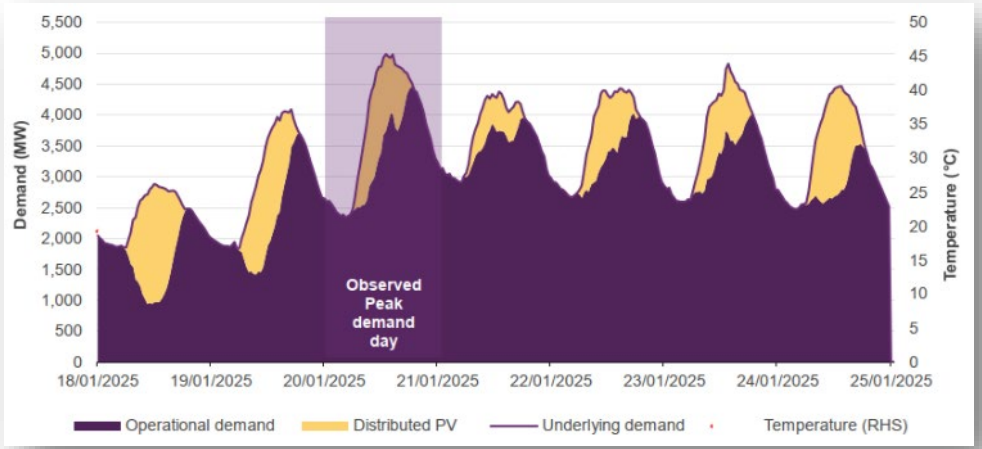
The SWIS faces record extremes — from 4,486 MW summer peaks to just 511 MW minimums — with rooftop PV reshaping consumption as residential demand is increasingly supplied behind the meter.

Demand (MW)

- **Peak** demand (record **actual**): **4,486 MW** at 6:30 pm, 20 Jan 2025.
- **Reserve Capacity Target** (27-28): **6,238 MW**
- **Minimum** demand (record **actual**): **511 MW** on 10 Nov 2024; unscheduled minimum 474 MW same day.
- **Minimum-demand outlook** falls from 402 MW (2024-25) to 25 MW (2028-29**) below zero from 2029-30** (conceptual net surplus PV available for storage).

Consumption (Energy)

- **Underlying annual consumption**: **~20** TWh
- **Rooftop PV** penetration: installed on **~40%** of SWIS homes & businesses.



Demand (MW) and temperature (ºC) profiles covering the observed peak demand day

WEM in a Snapshot

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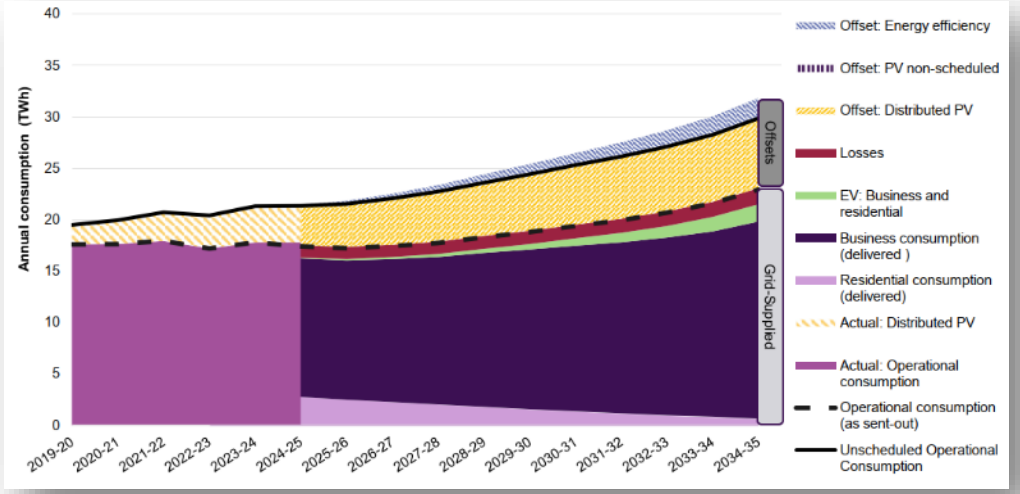


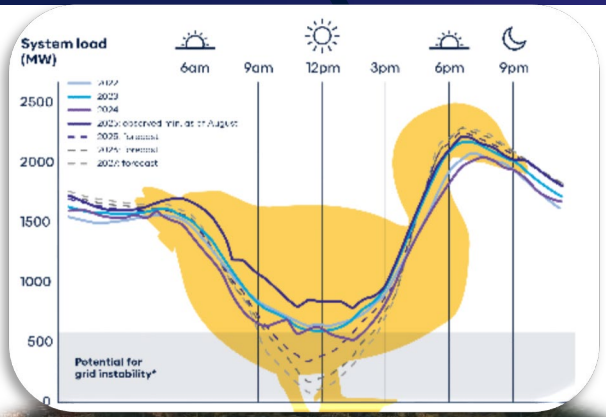
Actual and forecast underlying electricity consumption by component, Expected scenario, 2019-20 to 2034-35

Development to Delivery

The problem in 2021: SWIS Minimum Load

First steps for BESS in WA

- 23 Aug 2021 — AEMO warns SWIS could hit the **~700 MW minimum-demand** threshold between 2022–24, creating operability risk
- 16 Oct 2022 — New **record low** operational demand: **626 MW** (WEM).
- 14 Feb 2022 — WA introduces **Emergency Solar Management** (DPV turn-down) as a last-resort for extreme low-load events



KBESS 1

- **100MW / 200MWh** facility supported by the findings of the 2020 **Whole of System Plan**
- Delivered under a **typical turnkey EPC** contracting strategy:
  - Brownfield Site (Kwinana Power Station)
  - Hardware: **PowerElectronics** and **CATL** (EnerOne)

The Problem Continues in 2022

Minimum demand challenges from solar growth were now coupled with coal reliability concerns

- **Sept 2022**: Griffin **Coal enters receivership**—> Deloitte appointed to ensure continued coal supply amid system risk;
- **Dec 2022**: Two **50,000-tonne coal shipments arrive** for Synergy; coal blending underway
- **14 Jun 2022**: WA Government announces retirement of all **state-owned coal by 2030**; commits to **1,100 MW 4-hour** storage and **~810 MW wind**
- **27 Jun 2023**: AEMO **lifts Reserve Capacity Margin** to cover three largest contingencies, adding **~830 MW** to requirement

Delivery Model Shift

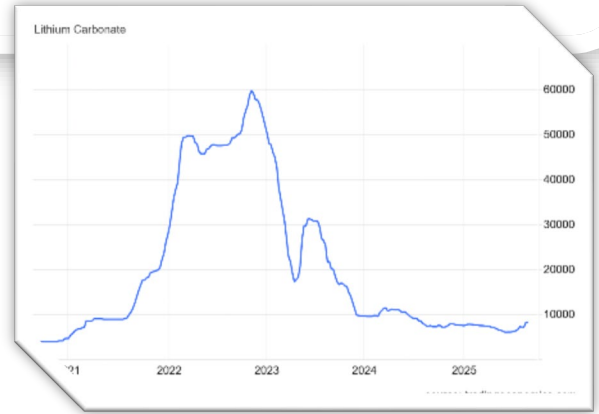
To meet urgent system needs, Synergy pivoted from a traditional EPC to an Integrator model — taking direct control of procurement and delivery to overcome supply chain and schedule risks

- Synergy took **direct control** of **design & procurement** under a split scope approach
- **Competitively tendered** to the **key equipment**
  - PowerElectronics: Gen3 PCSM
  - CATL: EnerC+
- Built **KBESS 2 and CBESS** built in **parallel** with staggered COD dates:
  - KBESS 2 (225MW / 1000 MWh) target COD Mar 2025
  - CBESS (500 MW / 2000MWh) target COD End of 2025

Top utility-scale inverter OEMs on what's behind lead time blow outs

Lead times for utility-scale inverter power stations have recently ballooned from around six months on average to as long as 18 months today. **Pv magazine Australia** spoke to top manufacturers, including SMA, Ingeteam, and others on the compounding causes of the blowouts and what's to be done.

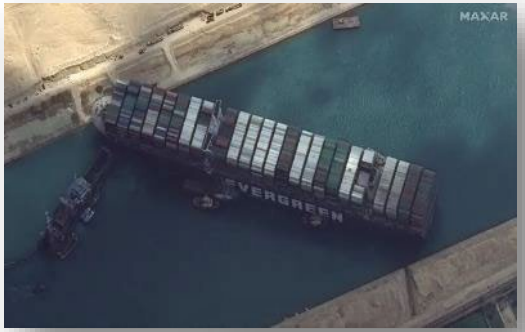
JUNE 21, 2023 BELLA PEACOCK



Integrated Project Management Team (IPMT)

Through an Integrated Project Management Team with GHD, Synergy rapidly scaled resources, unified delivery across sites, and transferred lessons in real time to accelerate KBESS 2 and CBESS

- Partnership with **GHD** to from **IPMT** to scale quickly
- **Design** and **execution** occurring in **parallel**.
- **Decisions** could be made in **real time** with a clear understanding of risk and associated impacts.
- **Consistent processes** across projects
- Faster **knowledge transfer** between **KBESS 2** and **CBESS**.
- **Deeper** operational **insight** into plant **performance** and **capabilities**



Asset management

Asset overview

Sites	KBESS-1	KBESS-2	CBESS
MW	100	225	500
MWh	200	900	2,000
COD	Oct-2023	Mar-2025	Late 2025
No. of Batteries	608	288	640
~Tonnes of LiFePo4		9,000	23,000
~Equiv. EVs	5,000	20,000	45,000
~Equiv. Homes	160,000/2h	354,872/4h	785,000/4h

Synergy's Kwinana Battery Energy Storage System – Stage 2 (KBESS2)

Pillars of operational readiness

Organisational readiness

The activities of the support functions within Synergy need to undertake to be ready to support a new operational asset. This includes having budgets approved for additional headcount, a schedule of readiness activities, a review of risks and the onboarding of the necessary new resources.

Asset readiness

The activities, documentation and testing required for safe and effective handover of the asset from the project team to operations. This includes asset operating philosophies, plans and manuals. Process Safety requirements are established and maintained for asset management.

System readiness

The documents, systems, controls and data required to effectively operate and maintain the asset.

People readiness

Refers to the recruitment, training and development of personnel to ensure they can carry out their roles and are familiar with the processes and systems that are to be used.

Market readiness

Encompasses the key market related requirements of the asset (e.g. registration, testing and compliance).

Synergy's Collie Battery Energy Storage System – in construction

Asset management

Asset Management services are comprised of:

- Workplace health, safety and environment:
  - WHSEMP
- O&M agreement-related management:
  - D2D, ROC, SCADA, performance, procurement etc.
- Generation management services:
  - Production, TNSP, AEMO, ERA etc.
- Site services:
  - Oversight, SOCI, audit/inspections etc.
- Technical management services:
  - Warranty, quality, degradation, continuous improvement etc.
- Stakeholder management services:
  - Contract management, PPA, sub-contractors (OEM, HV, SCADA, security, cleaning etc.)

Asset Management planning:

- Plan:
  - Policies
  - Regulatory requirements
  - Health and safety
  - Environmental
  - Resource management
  - Operational requirements
  - Performance targets
- Do:
  - Operating strategy
  - Maintenance strategy
  - Outage strategy
  - Spares strategy
  - OPEX and CAPEX strategy
  - Asset retirement strategy
  - Continuous improvement strategy
- Check:
  - Asset performance
  - Asset condition
  - Engineering management
  - Reliability analysis
  - Risk
- Act:
  - Projects
  - Actions

Operations

Major plant equipment

Switch yard equipment
- 250 MVA HV Transformer
- Current, voltage and earthing transformers
- Protection devices (surge arresters, disconnectors, circuit breakers)

Control and switch room
- Switch boards and distribution boards
- Transformer protection and metering panels
- Communication SCADA and PPC panels
- 110 VDC & UPS System.

Each auxiliary power skid is composed of:
- Ring main unit for 33 kV power distribution and protection cubical separate to auxiliary skid
- MV transformer cubical
- Communication cubical
- Feeders and protections system

Functions:
- Supply LV essential and non-essential supply to respective power group
- Act as a communication bridge between PPC and BCI

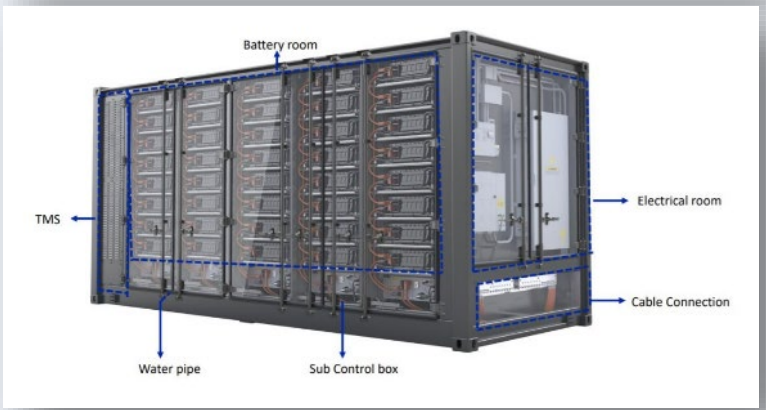
Major plant equipment

Each PE PCSM consists of:

- Power conversion system: X No of Modules (e.g.,one for each battery container) are present to convert 690V AC power to up to 1500V DC and vice versa.
- Transformer: to step up the voltage to 33kV.
- Ring main unit (RMU): To protect during faults and distribute medium-voltage power.
- Central control PCB (PCBU) and battery controller interface (BCI) for communication and control purposes.
- Imp: rated power of PCSM XX MVA at XX°C

Each battery container consists of:

- N.XXX x 20ft X.X C containerized modules – 2.4m X 6.1m X 2.9m, N.X parallel racks per container, N.X modules per rack, N.XX 306Ah cells per module.
- Thermal management system to keep batteries temperature under limits.
- Fire suppression system.
- Battery management system for control and communication.



Major plant equipment

Fire suppression system

Detection system:

- Equipped with different types of detectors, such as smoke detectors, heat detectors and gas detectors.
- All detection signals are received and processed by the fire control panel connected to site master FIP, and the hydrogen (H2) detector can be linked with the explosion-proof fan system.

Explosion-proof fan system:

- When the combustible gas in the container accumulates, the explosion-proof fan system is started to prevent a potential explosive atmosphere.

Major plant equipment

BPC/PPC – power plant controller

The PPC must manage:

- Grid-forming or grid-following inverter behaviour.
- Dynamic dispatch of active/reactive power.
- Compliance with grid cods and frequency/voltage support.
- Coordination with EMS, SCADA and site-level controllers.

In high-renewable environments, the PPC faces challenges such as:

- Rapid response to grid disturbances (e.g., faults, frequency excursions).
- Maintaining system stability during transitions between grid-forming and grid-following modes.
- Latency and communication delays between BESS components and external systems.
- Cyber-security risks due to increased connectivity.

BMS – battery management system

Measure:

- Cell voltage.
- Cell temperature.
- Current in cell string.

Compute:

- State of charge (SOC).
- State of health (SOH).
- Charge/discharge current limit.

Main function:

- Protection from over current, over/under voltage, over/under temperature, ground fault or leakage current detection.
- Cell balancing.
- Diagnostic (relay, fuse, current sensor…).
- Thermal management.

BESS operations in WA context and market

Generation impact

Figure 104 Lower coal generation replaced by distributed PV, gas and batteries

Change in quarterly average generation – Q4 2023 vs Q4 2024

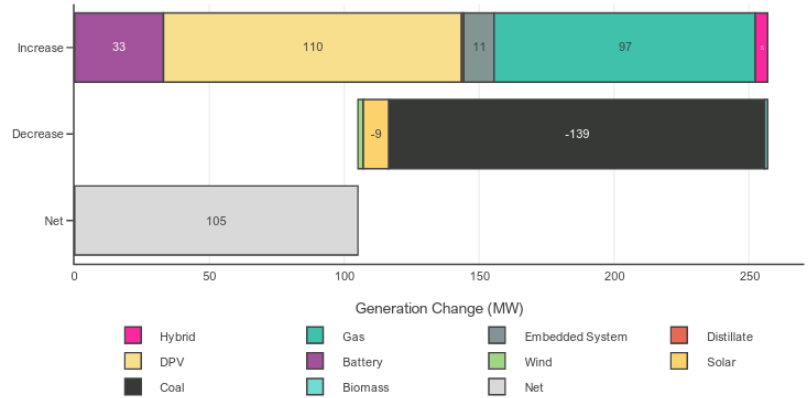


Table 10 WEM fuel mix Q4 2023 and Q4 2024

Quarter	Coal	Gas	Distillate	Grid Solar	Wind	Biomass	Battery	Hybrid	Distributed PV
Q4 2023	29.4%	27.6%	0.0%	2.2%	17.8%	0.4%	0.1%	0%	22.3%
Q4 2024	22.7%	30.2%	0.1%	1.7%	17.0%	0.3%	1.4%	0.2%	25.8%
Change	-6.7%	2.6%	0.1%	-0.5%	-0.8%	-0.1%	1.3%	0.2%	3.5%

Source: AEMO Quarterly Energy Dynamics Q4 2024

Synergy's Kwinana Battery Energy Storage System – Stage 1 (KBESS2)

FCESS (FCAS) impact

Figure 110 Batteries capture FCESS market share

FCESS volume market share by market and fuel type – Q4 2024

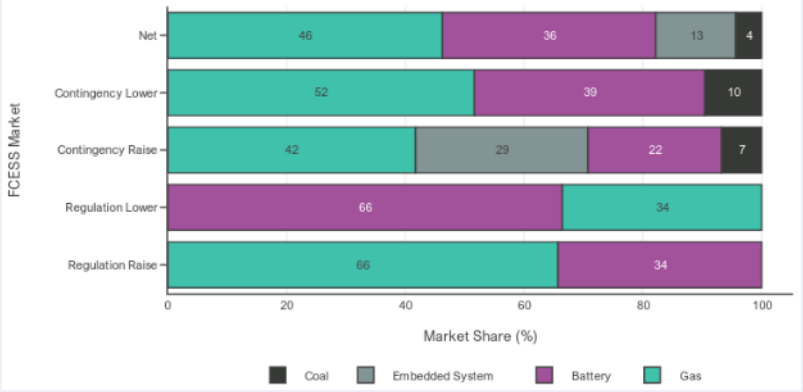


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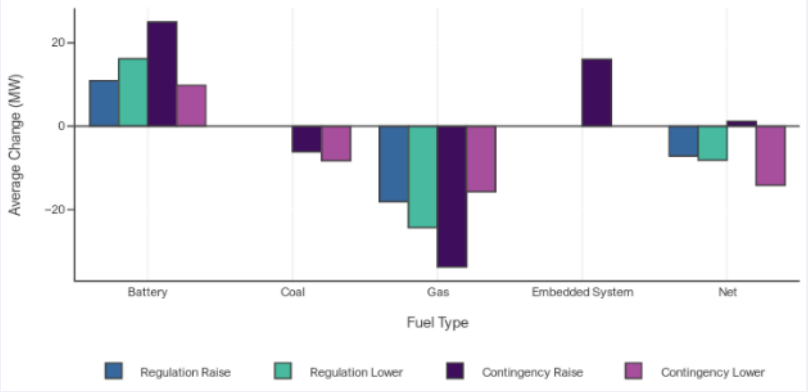
Figure 109 Higher enablement for batteries in FCESS markets

Change in FCESS enablement by fuel type – Q4 2023 vs Q4 2024



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Thank you