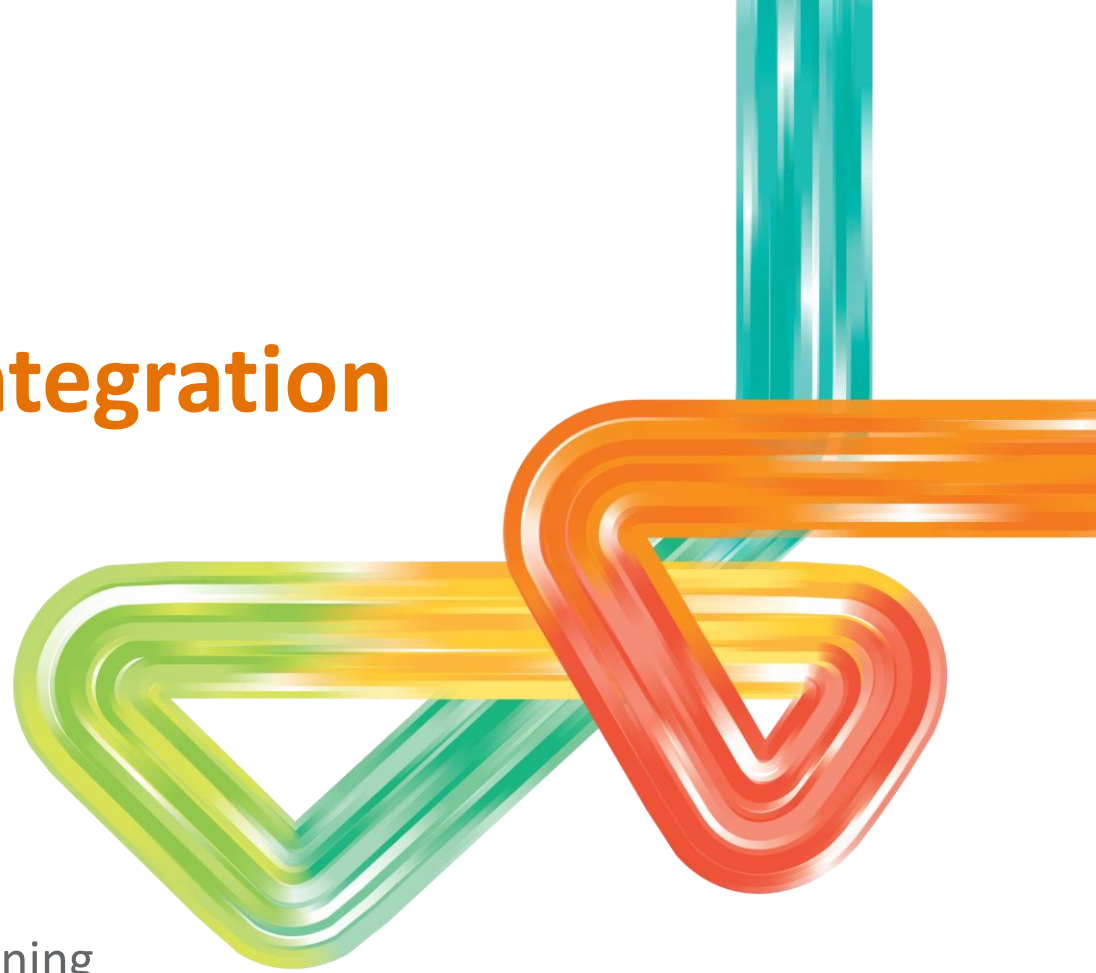
Supporting DER integration onto the grid



Nigel Wilmot, Principal Engineer,
Distribution Grid Strategy and Planning

Western Power acknowledges the Traditional Owners of the land on which we meet,
and we recognise their continuing connection to lands, waters, and communities.
We also pay our respects to Elders past, present and emerging.

Western Power today

3,500
strong workforce

2.3 million
customers connected

2.2GW
grid connected solar

14
community batteries

238 stand-alone power systems

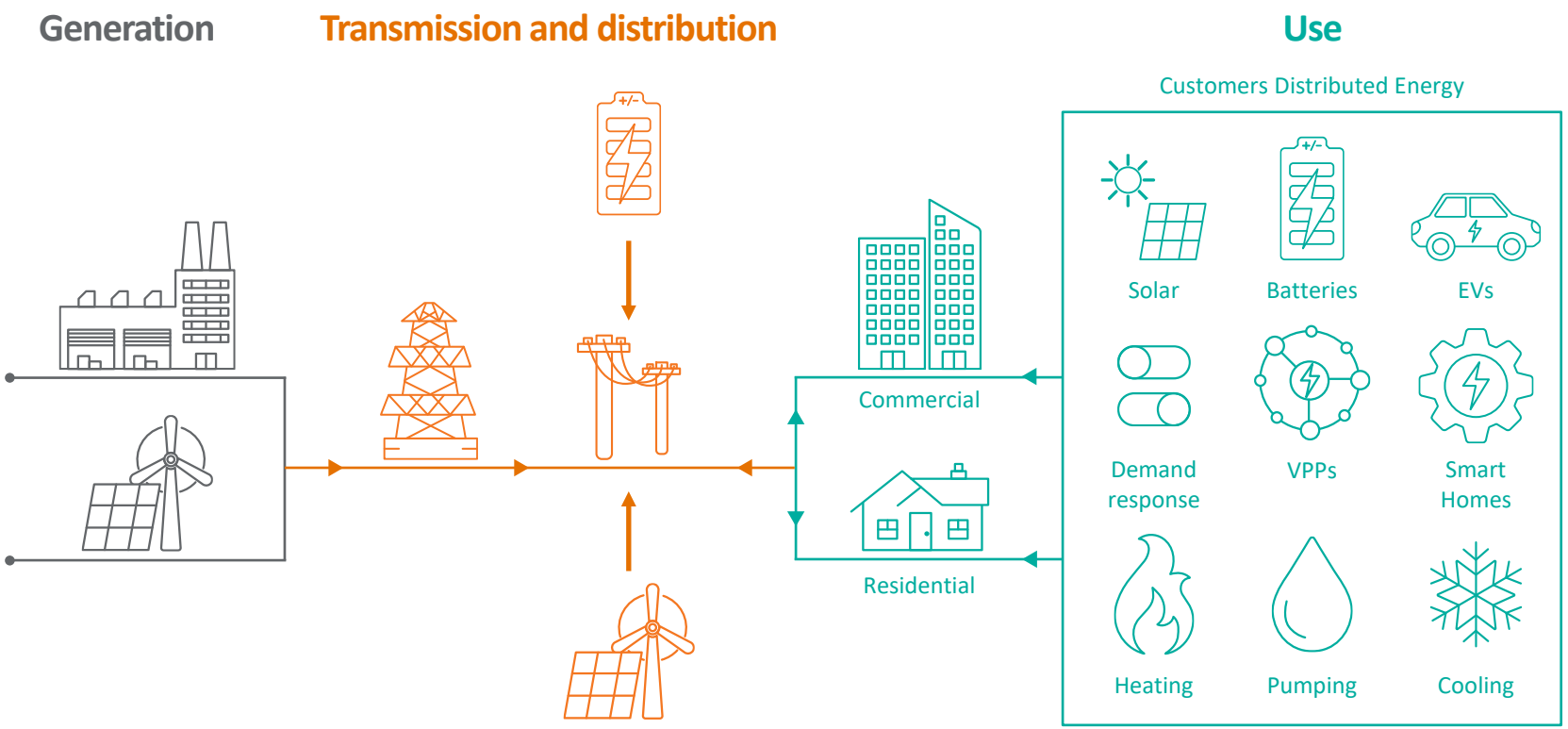
104,000km
of power lines

280,000
streetlights

30,000km
of underground Dx network

Figures current as of December 2024

What we do


Generation
Transmission and distribution
Use
Customers Distributed Energy
Commercial
Residential
Solar
Batteries
EVs
Demand response
VPPs
Smart Homes
Heating
Pumping
Cooling

What's new

- AS/NZS 4777.1 “Grid connection of energy system via inverters – installation requirements” published and are now mandatory:
  - Supplementary supplies and alternative supplies
  - Multiple mode inverters – i.e., inverters with batteries
  - Phase balancing requirements
  - Interface protection requirements

Supply types terminology

- AS/NZS 4777.1 updated to align terminology with AS/NZS 3000
- Can simplify understanding what installation practices are needed
- Inverters that provide an alternative supply
  - Mandatory to use RCD's on all final subcircuits to provide fault protection (clause 5.3.6.4)
  - Separate alternative supply switchboard (clause 5.3.6.1, exception possible)

Three-phase balance requirements

Use of unbalanced single-phase IES on a 3-phase connection service = increased risk of electric shock

- Increased voltage on the neutral & earth ➔ electric shock and tingles
- Summation of current in neutral
  - Overloading of 6 mm^2 neutral conductor in consumers mains
  - Thermal failure of neutral conductor or connections

Interface protection - update

- Interface protection no longer required for eligible sites between 30 kVA and 200kVA
- Streamlined approvals – Network studies and commissioning windows now only apply to systems over 200kVA (was 150kVA)
- Improved support – updated Technical Schedules and Testing & Commissioning templates provide clearer submission guidance.

What Western Power is doing

- Updated Basic EG Connection Technical Requirements
  - Draft available for public consultation and review
  - Closes 30th May 2025
  - Community consultation
- Capacity increases
- Phase balancing
- Generation limits
- Export limits and DER management

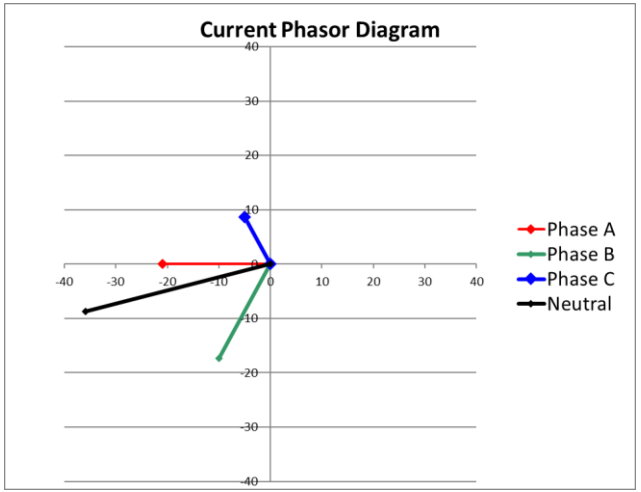
Capacity increases

- Up to 10 kVA single-phase inverters can now be used
- Mandatory export limits
  - Static limit of 1.5 kW
  - Maximum limit of 5 kW (subject to DOE's)
- Generation limits may also apply
- For 3 phase connection service with single phase IES
  - Max of 3 kVA for PV only IES (current requirement)
  - Up to 5 kVA* unbalance between phases for IES w/battery system connected at installation (new) *subject to compliance with AS/NZS 4777.1
  - Additional phase balance requirements

Phase balancing 1ph IES with batteries

These requirements (4.2.2) are in addition to net export limits and generation limits

- Consumers mains not to be overloaded (actives and neutral)
  - 6 mm^2 consumers mains = 32 A nominal rating
  - 10 kVA inverter = 40 A
  - Unbalance between load and generation = neutral current > active current
- 3 options provided by updated basic EG
  1. Per phase export limit of 5 kW;
  2. Generation limit to 5 kVA IES with batteries; or
  3. AS/NZS 4777.2 phase balance of 21.7 A



Generation limits

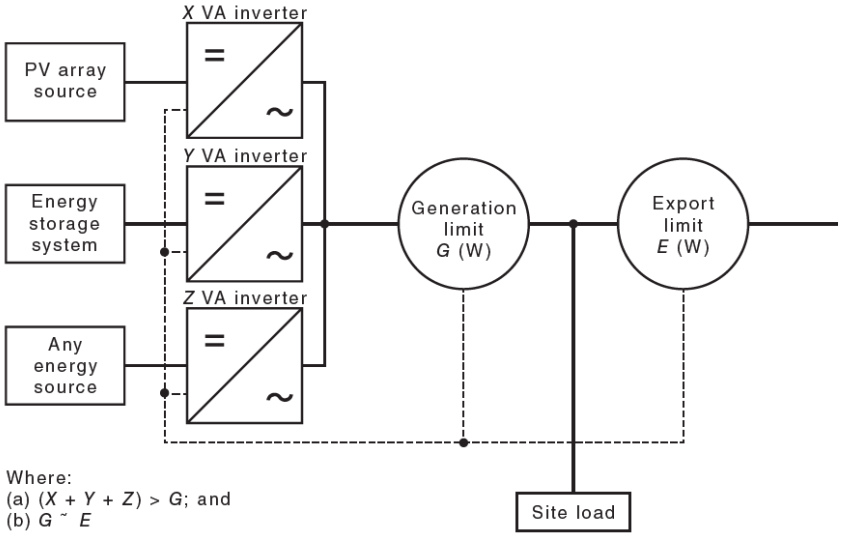
Generation limits(4.3.2) make a single inverter, or a combination of inverters behave like a smaller single inverter.

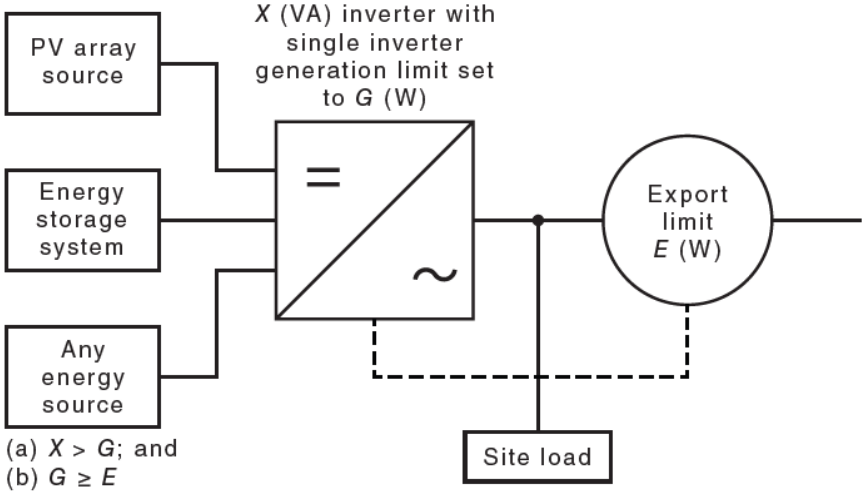
- For basic EG system max generation limit is 15 kVA
- Can be a combination of PV and/or BS inverters
- There are already inverter makes/brands with this capability available

Note: need to ensure that both generation and export limits can be managed at the same time → otherwise never exceed the 15 kVA Rated

Generation limits

- These 2 systems behave the same and generate to a max of G kW
- (figure source AS/NZS 4777.2 Appendix L)





Distributed System Operator Vision

The Distributed System Operator (DSO) will enable orchestrated Distributed Energy Resources (DER) to deliver social, environmental, and economic benefits for our community while maintaining a safe and reliable energy supply.

DER management

- DER management initially supported Emergency Solar Management (ESM) requirements of AEMO and Synergy
  - This is now called Emergency DER management
- DER Management (4.3.3) now has
  - Advanced DER management (4.3.3.2) → supporting VPP and Dynamic operating envelopes
  - Emergency DER management (4.3.3.3) → Supporting ESM

Export limits

Export limits (4.3.1) allow larger IES and increased self-consumption while managing the impact to the local LV grid and overall Western Power GRID

- For all Basic EG systems they now have static limits (1.5 kW); Fail safe limit (1.5 kW); Maximum limit (5 kW)
- Limits that apply depend on your energy retailer agreement
  - Offtake with VPP
  - Offtake with Emergency DER management or
  - No offtake
- EL apply to existing systems when upgrading i.e., whole site
  - This is needed to enable VPP functionality

Enabling DOE

Dynamic operating envelopes (DOE)

- An operating limit at a connection point based on available grid capacity that may vary over a period
- Enables the curtailment or increase of energy from a basic EG system up to the maximum limit when needed
- VPP aggregator (Authorised Agent) is sent the DOE from Western Power
- Depends on comms from the VPP aggregator to each connection point

Streamlining our applications processes

- Enhanced automation for <30kVA applications to enable larger DER connections, with pre-liminary approval provided for basic battery applications the same day, to be implemented from 1st July
- Updated Commercial Solar process for >30kVA to 200kVA connections

What else is coming up?

- LV EG guidelines
  - These will cover systems up to 1 MVA
  - Will supersede the Technical Rules for these sized generators
- Electricity System Market Rules (ESMR)
  - New state government regulation consolidating and updating existing regulations to supports the DER transition
  - Enables Western Power EG connection technical requirements documents
  - Eventually will replace Western Power Technical Rules

What we need from you

- Perform quality compliant installations
- Ensure inverters connected to OEM or VPP aggregator systems through approved DER management methods
- Stay up to date with changes
  - Australian Standards
  - WP EG Connection Technical Requirements
  - WP Industry News and Website
  - Authorised Agent requirements

Resources

- Distribution network documentation
- WA Residential Battery Scheme
- Synergy DER – Industry Resources

Perth Office
363 Wellington Street
Perth WA 6000
westernpower.com.au