

Managing grid-scale renewable energy for a Distribution System Operator (DSO)



An Australian DSO partnered with CGI to develop a Distributed Energy Resource (DER) Constraint Manager solution to deploy Dynamic Operating Envelopes (DOEs). The solution ensures safe operations and network stability whilst maximising renewable energy exports and associated revenue for our client.

Context

The energy sector is going through a revolution that will completely change the way we produce and consume energy for years to come. The increasing uptake of rooftop PV, battery energy storage systems and embedded generators, along with the progressive increase of electric vehicle adoption will not only impact the operation of the network, it will also have considerable impact on the need for new infrastructure and corresponding capital expenditure.

DSOs are investing in projects aimed at increasing hosting capacity and that provide support for a variety of DER services whilst ensuring safe operations, network reliability and energy affordability as well as maximising customer renewable energy exports.

Industry expert collaboration

When a large Australian DSO joined forces with CGI, they brought with them a wealth of research, network engineering capability, functional criteria and field verification which proved vital. The DER Constraint Manager application is a product of the DSO's thought leadership and CGI's Remote Telemetry Unit (RTU) and Operational Technology (OT) capabilities. The result is an intelligent and robust DER Constraint Management solution for DSOs.

Solution delivered

Automation

The automation software has the flexibility to manage both batteries and generators (e.g. solar, wind, rotating machines).

During normal operations, the DOE is published to the CGI RTU from a centralised DERMS or SCADA/ADMS, but the solution is able to enforce seasonal constraints autonomously if connections are lost.



Business outcomes

- DERs operate within network constraints to minimise risks.
- Contributes to the addressing of minimum demand challenges and supports the renewable energy targets of various Government bodies.
- Supports the DSO's DER integration strategy to advance the uptake of solar energy and other DER through a flexible, cost effective and rapidly deployable solution.
- DOEs improve the management of daily power flow fluctuations that can impact network capacity, the quality of supply and in some cases, the broader stability of the electricity system.
- Improved network reliability through autonomous ramping curtailment requests and network protection.

Remote Constraint Calculator

A remote DERMS calculates constraints (Load & Generation) and publishes these to the RTU via DNP3 analogue set-points. These constraints are updated on a delta shift in value of a constraint, and a periodic schedule (5 minutes) or if the RTU constraint value differs from the DERMS published value. In the future, it is expected that the IEEE 2030.5 protocol will increasingly replace DNP3 to communicate to upstream solutions.

Seasonal Timetable

The seasonal timetable allows constraint registers to be set using time-of-day and day-of-season to determine the value. Separate schedules and associated constraint values are available for both Load and Generation.

DOE Manager

This solution uses the active constraint values to evaluate real-time metered value and status in order to:

- Establish and validate the appropriate constraint mode (DERMS or Timetable) to be applied to each individual constraint;
- Determine whether a constraint has been violated, for SCADA reporting and management;
- Calculate the DER Operating Envelope;
- Publish the DOE (limit values) to the DER Asset;
- Monitor the DER connection point against the Operating Envelope.

Connection Manager

This application orchestrates a curtailment scheme that is designed to limit the import or export of a DER within the published Operating Envelope. It is the load at the connection point that is managed, which in turn should manage the actual related constraint.

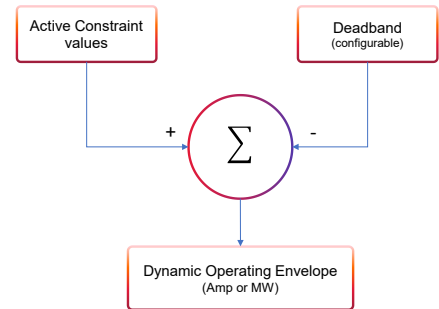
A variety of curtailment schemes are available, with selection determined by the customer agreement, the type of customer and the constraints or situations being managed by the DSO. The violation of Operating Envelope constraints can be configured to trigger one or more of the following:

- Raising of an alarm to the DSO operational control centre
- Issue of a curtailment request to the customer (ramp down request)
- Notification of a pending trip control
- Issue of a delayed trip control
- Issue of a specified time fast trip control

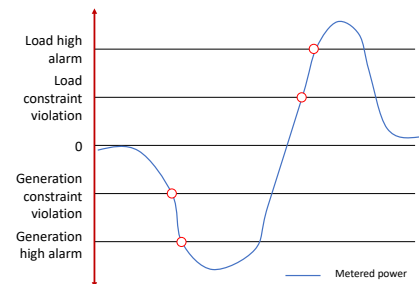
Determination of DER Mode (Load or Generation)

The DER Mode is based on metered power transfer at the connection point and feedback from the DER asset. Any misalignment outside of set thresholds will raise a DER Mode alarm for SCADA reporting.

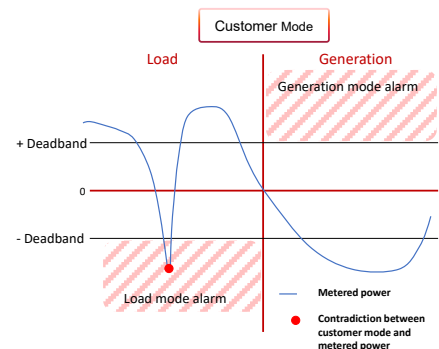
Calculated DOE is published to customers in Amperes or MW



Dynamic alarming of Load and Generation constraint violations



DER Mode Alarming



About CGI

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We are insights-driven and outcomes-based to help accelerate returns on your investments. Across hundreds of locations worldwide, including Australia, we provide comprehensive, scalable and sustainable IT and business consulting services that are informed globally and delivered locally.

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