Grid Interconnection Process – Lessons from Australia

March 2024

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Jarman

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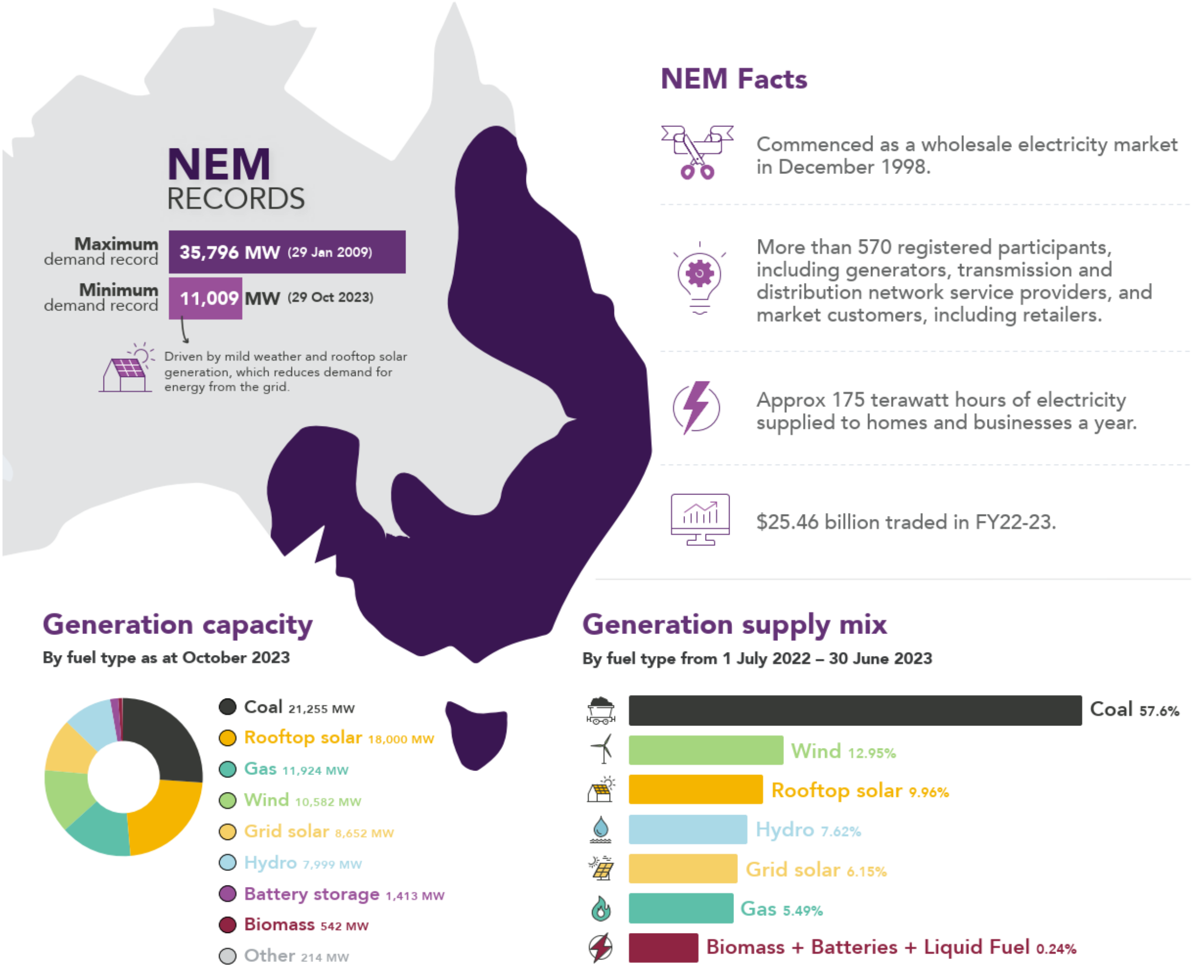
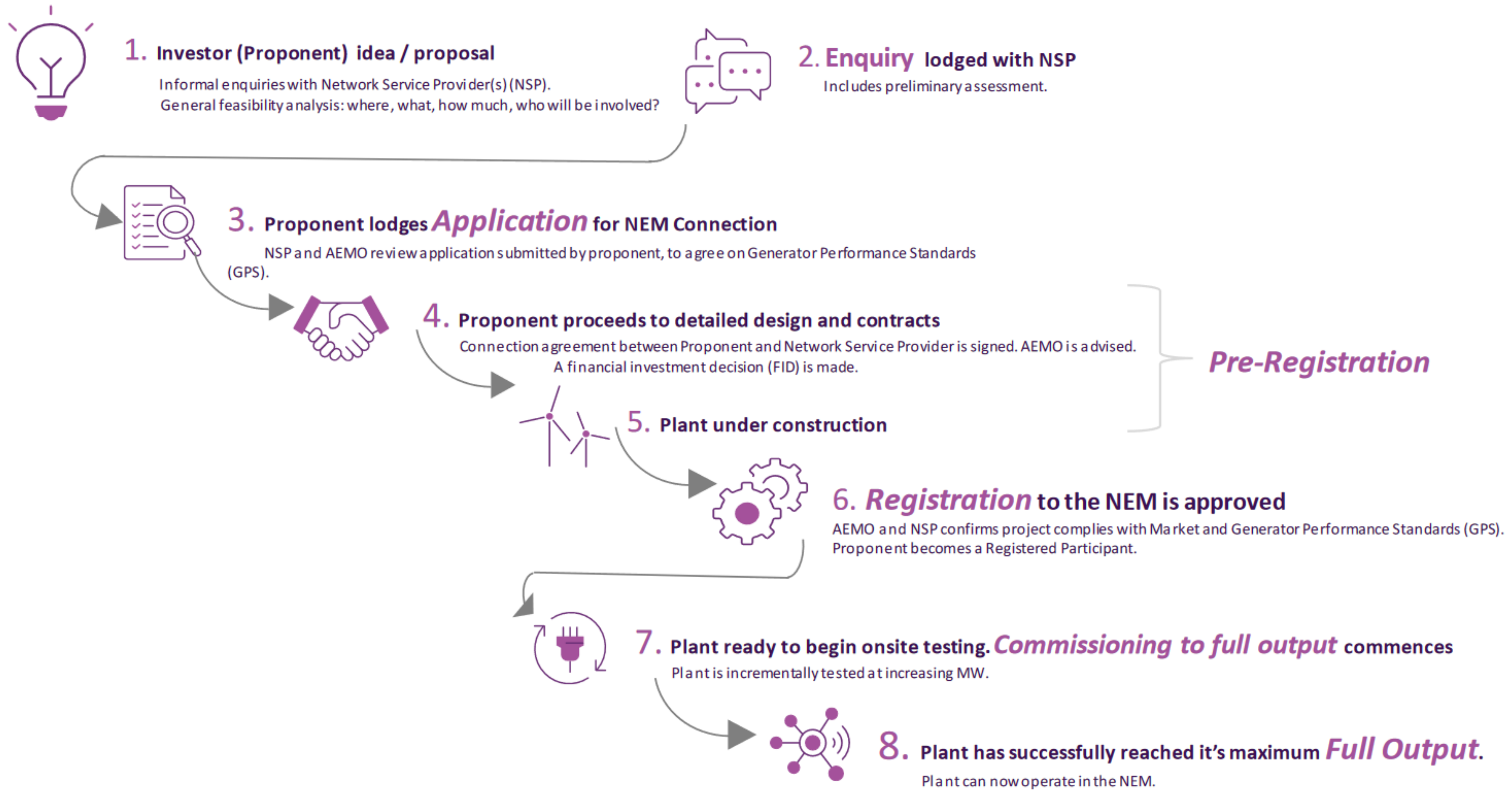
- **Introduction**
- **Part 1: Overview of AUS**
  - Overview of the National Electricity Market
  - Overview of the Grid Interconnection Process
- **Part 2: Lessons learned**
  - Lesson 1: Writing rules
  - Lesson 2: Standards and engineering discretion
  - Lesson 3: Sample studies
  - Lesson 4: Skillset and workforce

Australia has an open electricity market, large grid, small population, dwindling synchronous fleet and rapid renewables growth



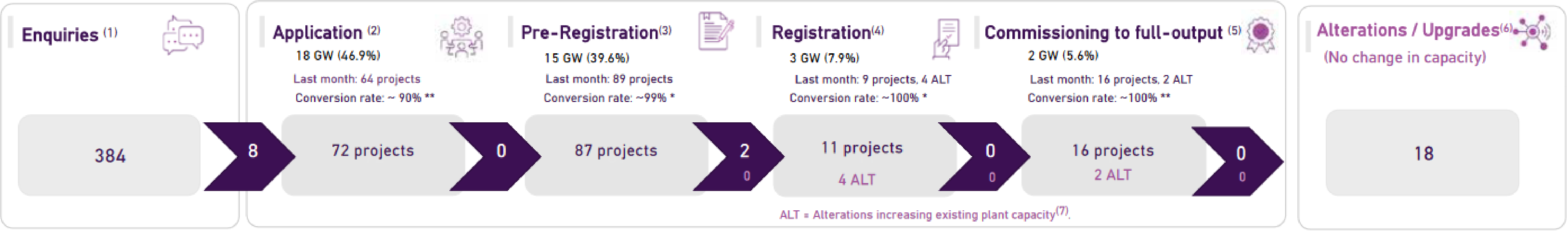
The Australian generation interconnection process is thorough and mostly standardised across the country



1. Connections scorecard guide | AEMO | November 2023 [source]

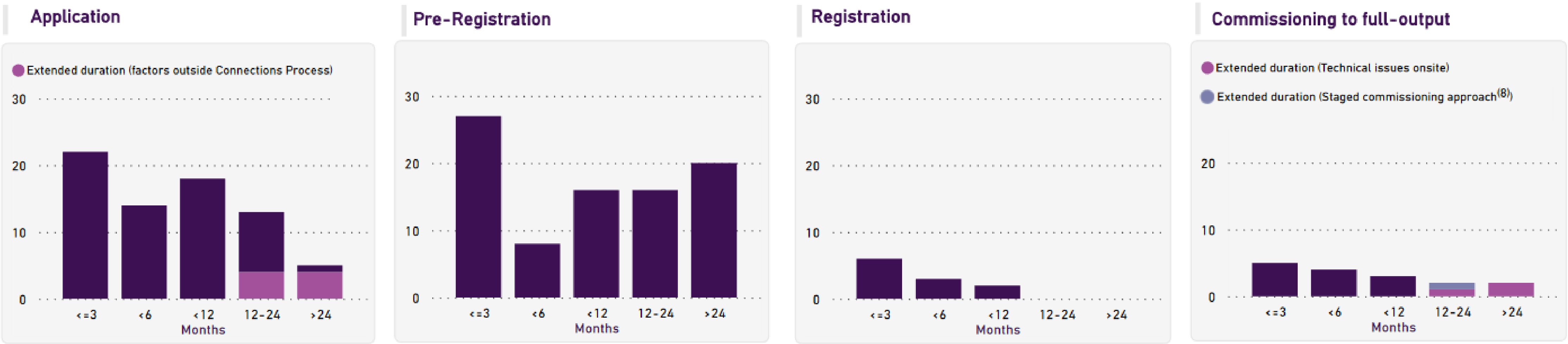
Australia has an installed capacity of ≈70GW, a queue of ≈100GW and is commissioning ≈3GW/year

Fig. 1 Connection projects underway - monthly changes



Signifies the number of projects moving from one stage to the next this month. * The conversion rate is an indicative MW % that will proceed through this stage based on historical data.

Fig. 3 - Current number of projects in each Stage by Duration



1. Connections scorecard | AEMO | January 2024 [source]

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Lesson 1: Define engineering terms when writing electricity rules

Asynchronous generating systems

⋮

(1) to assist the maintenance of *power system voltages* during the fault:

(i) capacitive reactive current in addition to its pre-disturbance level of at least 4% of the *maximum continuous current* of the *generating system* including all operating *asynchronous generating units* (in the absence of a disturbance) for each 1% reduction of *voltage* at the *connection point* below the relevant range in which a reactive current response must commence, as identified in subparagraph (g)(1), with the *performance standards* to record the required response agreed with *AEMO* and the *Network Service Provider*; and

1. National Electricity Rules v207 | AEMC | March 2024 [source]
2. Rule change - **Performance standards for reactive current response to disturbance | AEMC | May 2022** [**source**]

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maximum continuous current

In respect of a *generating system*:

(a) where assessed at the *connection point*, the current at the *connection point* corresponding to the largest amount of *apparent* power required by the *generating system's performance standard* under S5.2.5.1, at the *normal voltage*; and

1. National Electricity Rules v207 | AEMC | March 2024 [source]
2. Rule change - **Performance standards for reactive current response to disturbance | AEMC | May 2022** [source]

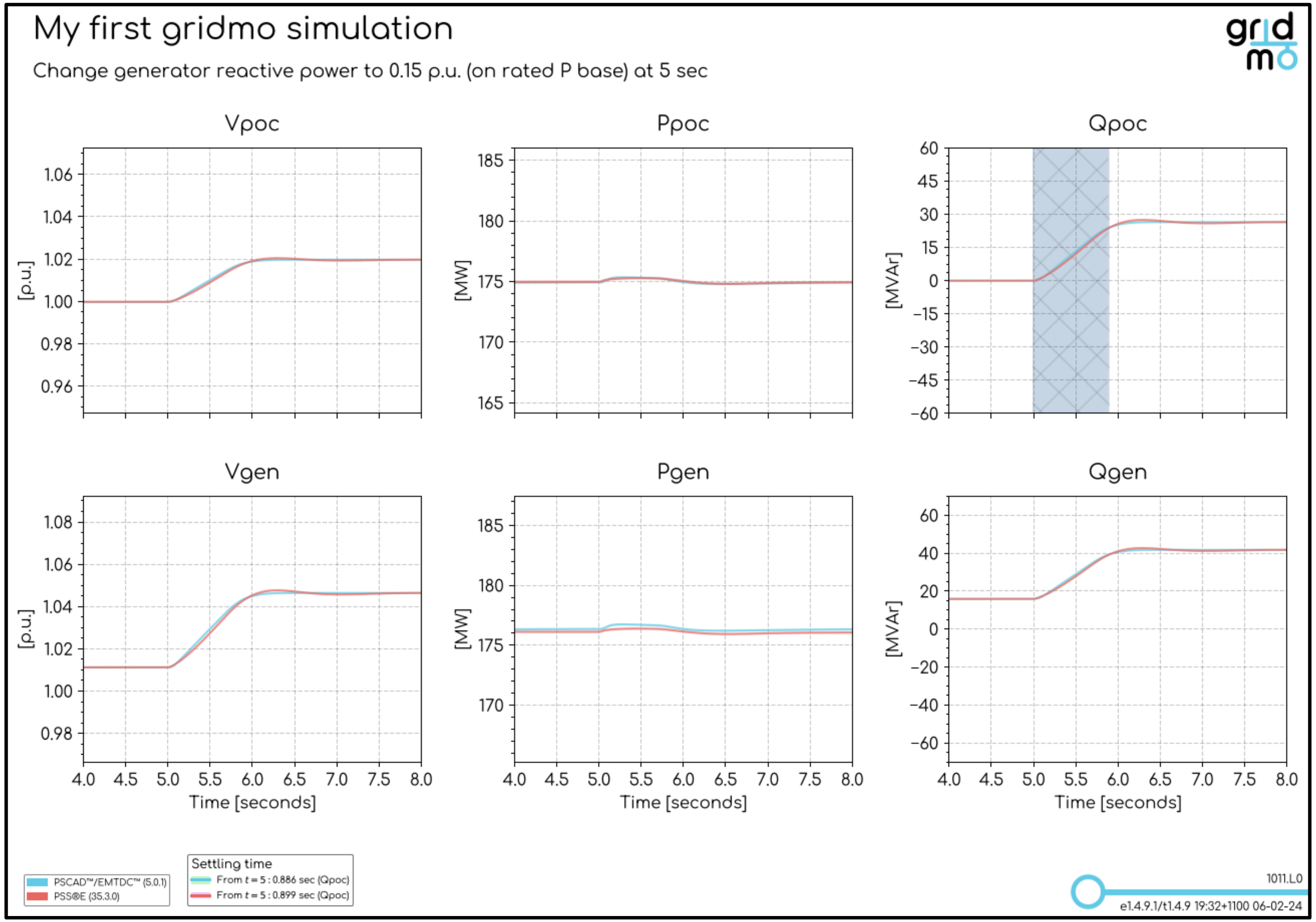
Lesson 2: Electricity rules should encourage efficiency but leave room for engineering discretion

Generator Performance Standards can have three levels:

- **Minimum Access Standard (MAS)**
- **Negotiated Access Standard (NAS)**
- **Automatic Access Standard (AAS)**

1. National Electricity Rules v207 | AEMC | March 2024 [source]

Lesson 3: Complete a sample interconnection study each time when introducing new electricity rules



PSS®E Static

PSS®E Dynamic

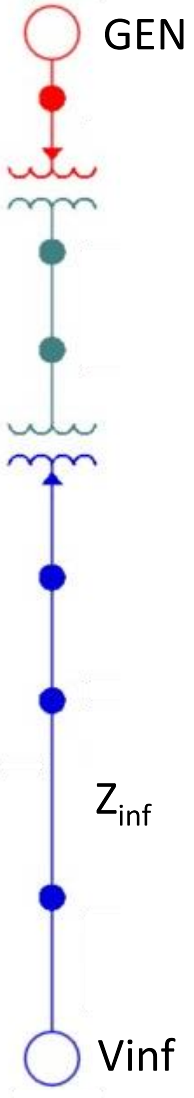
PSCAD™

Data

Plotting

Table

Analysis



Lesson 4: Software engineering ≠ power systems engineering. Ensure the growing workforce is developing power systems knowledge

Power systems software:

MHI PSCAD/EMTDC

Siemens PTI PSS®E

Use cases:

Grid connection studies

500 tests X 2 software X 5 scenarios X 2 submissions

X 5 iterations

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