AI data-centre power supply: 60 MW to 100 MW

Synthetic planning example. Numerical agreement is not engineering approval.

Decision and audience

For companies/startups planning AI infrastructure: what reinforcement is needed when total facility demand grows from 60 MW to 100 MW? Industry relevance is a project-selection criterion; controversy does not justify unsupported environmental, financial or reliability claims.

Result

Configuration	MW	Normal min pu	Normal max %	Worst outage pu	Worst outage %	Outages within limits
Existing · 2 × 80 MVA	60	0.986064	38.747	0.969255	78.688	13/13
Expanded · 2 × 80 MVA	100	0.975119	65.223	0.941021	134.639	9/13
Expanded · 2 × 125 MVA	100	0.983952	41.376	0.964312	84.159	13/13
Expanded · 3 × 80 MVA	100	0.984192	43.219	0.974966	65.234	15/15

The unchanged 100 MW supply converges normally, but its worst outage (Incoming circuit B out) reaches 134.639% and 0.941021 pu minimum. A successful normal load flow is not adequate evidence for expansion. Two 125 MVA transformers: 13/13 outages within the stated limits. Three 80 MVA transformers: 15/15. These are capacity-screening alternatives, not a least-cost recommendation; no construction or operating costs were supplied.

Model and assumptions

132/33 kV, 100 MVA base, 50 Hz. Four dual-fed aggregate hall buses, two MV sections and an explicitly closed steady-state bus tie. One shared upstream utility equivalent: incoming paths are NOT independent utility supplies. 60 MW = 48 MW IT +12 MW auxiliaries; 100 MW =80+20 MW. All loads are constant PQ at assumed 0.98 lagging PF. The overhead ratio is a snapshot assumption, not measured annual PUE. Every value is synthetic, including ratings. Transformer device-base R=.005 pu and X=.12 pu are converted to the 100 MVA system base. The complete input JSONs state line/tie impedances and ratings; no manufacturer capability is inferred. Normal and outage criteria: voltage

.95–1.05 pu; continuous MVA rating ≤100%. No emergency allowance, hidden curtailment, tap optimisation or unmodeled protection transfer. The bounded utility surrogate is not a real physical generator specification.

Numerical method and independence

58 normal/outage states use retained native saved-study receipts. Each is matched against the existing isolated pandapower 3.5.5 reference. Native nodal P/Q balance tolerance is 1e-4 MVA. Cross-solver tolerances: 1e-5 pu magnitude, 1e-5 rad relative angle, 1e-3 MVA terminal complex power. No disagreement is averaged away. Saved normal studies use NR tolerance1e-8/max50, no solver fallback, fixed transformer taps. Outage studies use their admitted native profile; their exact effective options are retained in the report JSON. Reopening and capture do not recalculate the results.

How to reproduce

1. Open one of the four .veragrid files in a compatible PowerSystem desktop.
2. Study Manager → Import handover…: select its *-saved-studies.zip. This creates a separate project and restores saved settings and retained results; no approval transfers.
3. Inspect the normal and branch-outage cases. Explicitly run a saved case only when you want a new calculation.
4. Compare operating-states.csv, comparison.json, full report JSON and checks/. The screenshot index identifies the actual rendered states.
5. Generator: scripts_native/ai_datacentre_showcase.py in the bound PowerSystem source; reuse its pinned product and reference runtimes. The native and reference implementation identities are retained with the receipts. The existing-case handover also retains a rejected initial outage setup (unsupported explicit AC options). Its corrected saved revision is the selected head. That request error is distinct from the calculated expansion overloads; no successful native calculation was replayed to conceal it.

Limitations

No real customer/site/utility data, engineering certification, UPS/battery model, transient AI-load response, harmonics, protection coordination, interconnection approval, full N-1 security or uninterrupted-service claim. Upstream utility failure, generator outages and common-mode failures are not covered. No cost, annual energy, carbon, water or regional grid-adequacy claim. A passing numerical check establishes agreement for matched equations; synthetic parameters remain unqualified for an actual installation.

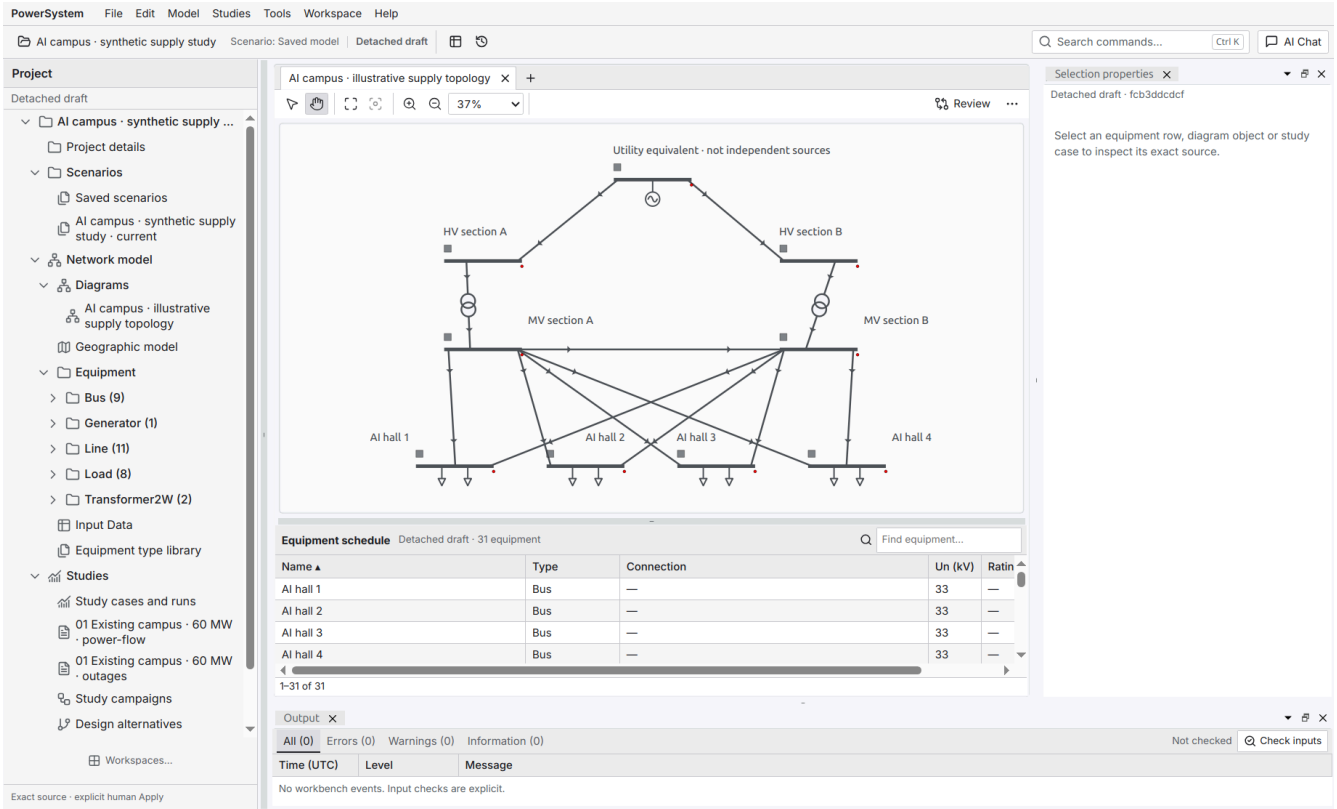
Sources and rights

Context: IEA (2025), Energy and AI, https://www.iea.org/reports/energy-and-ai/energy-demand-from-ai . Global projections do not determine the campus inputs. Model and scenarios are original synthetic examples. No third-party customer model or vendor screenshot is distributed. PowerSystem/VeraGrid and the independent reference retain their own software licenses; no runtime or installer is included. Included reproduction scripts are PowerSystem source under GPL-3.0-only; see LICENSE.txt. This package does not include the numerical libraries or their runtime installations.

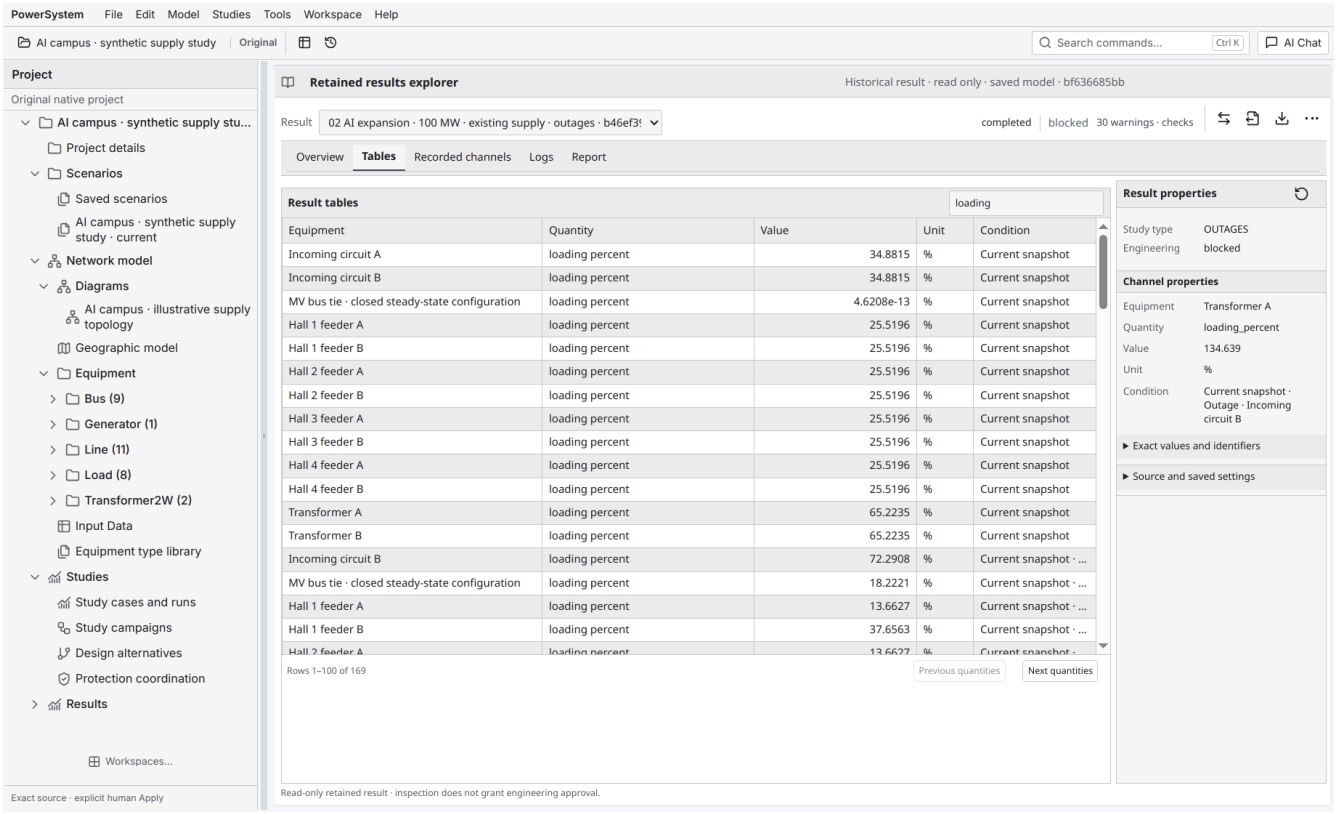
Creation evidence

Raw solver/native receipts, exact inputs, comparison quantities and original actual-app screenshots are retained. Harness-only failures are preserved in the private delivery evidence; successful native calculations were resumed by identity, not silently replayed.

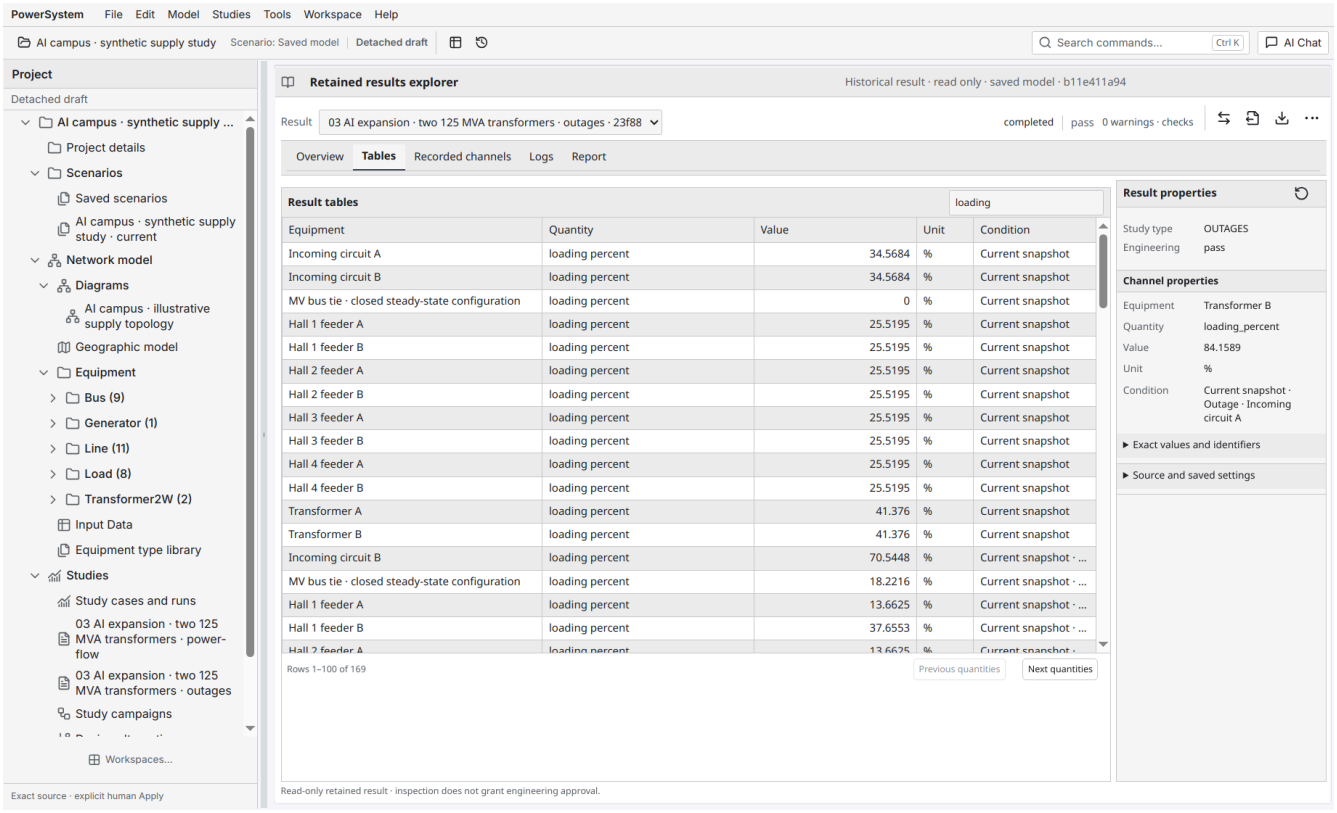
Actual application evidence



01 - ACTUAL APP - AI campus supply topology.png · original source-native capture, no inference; not a customer installation receipt.



05 - ACTUAL APP - expanded retained results.png · original source-native capture, no inference; not a customer installation receipt.



06 - ACTUAL APP - uprated retained results.png · original source-native capture, no inference; not a customer installation receipt.