WHT ENTERPRISE · HIGH TECH SOLUTIONS

Data Renoversity™ H -2.0.1 — Validation framework

Non-confidential technical note · how design targets become pass/fail criteria, and how they are verified

1. Purpose

Data Renoversity figures (cooling energy of −2 / 0 / +1 % of IT load, design PUE 1.08, no evaporated water, near-zero grid exchange) are **design targets** from an hourly screening model of a 100 MW IT reference campus. They are not measured results. This note sets out how each target is turned into an acceptance criterion with a defined measurement point, a pass/fail limit and a recovery requirement, and who verifies it. The cooling and energy-plant method itself is not described here; it is shared under NDA.

2. Four validation layers

Layer	What it shows	Method	Output
1 · Energy balance	The campus meets its annual targets across a full year: low-wind and low-sun periods, summer peaks, battery losses, firm-unit and standby operation.	8,760-hour model per site on site weather and cooling-resource data; sensitivity on dry years, heat waves, unit outages.	Annual and hourly balance, KPI forecast, risk register.
2 · Dynamic studies	What an hourly balance cannot show: AI load steps and training swings, cooling peaks, storage and firm-unit transitions, loss of grid or of the largest unit, recovery from degraded states.	Electrical RMS/EMT studies (ms–s), control-loop and frequency studies, thermal transient model of the cooling loop (s–min).	Test matrix with predicted values against each criterion.
3 · Integrated systems testing	The same events, live, at full IT load (load banks), with every subsystem in automatic mode.	Commissioning to ASHRAE Guideline 0 / Level 5 integrated systems test, witnessed by the independent verifier.	Signed test records, recorded waveforms and temperatures.
4 · Measured operation	That the annual targets hold in real operation.	12 months of revenue-grade metering at fixed boundaries; independent review of data and calculation.	Verified annual KPI report.

3. Measurement boundaries and KPIs

- **PUE** — ISO/IEC 30134-2, annual, total facility energy at the campus boundary over IT energy at the IT input (rack power shelves / PDUs). Category 3 metering.
- **Cooling energy share** — all energy for heat removal (pumps, chillers, heat exchangers, fans) over IT energy, same boundary.
- **WUE** — ISO/IEC 30134-9; evaporative and process water separated from domestic water.
- **Renewable energy factor** — ISO/IEC 30134-3, plus an **hourly** match: share of each hour's load met by energy produced or stored on site.
- **Grid exchange** — import and export at the point of connection, annual totals and hourly profile.
- Metering: IEC 62053-22 class 0.5S electrical meters, 15-min intervals; power-quality recorders ≥ 10 kHz at the IT bus during tests; temperatures at rack inlet and coolant supply at 1 s.

4. Acceptance criteria — annual (layer 4)

KPI	Pass criterion (set per site at concept, frozen at basic design)
PUE (annual)	≤ design value + 0.03
Cooling energy share	≤ site design value + 0.5 percentage points
Evaporative water	0 m^3 (closed loop); domestic and boiler make-up water reported separately
Grid exchange	Annual net import ≤ site limit (% of IT energy); 95th-percentile hourly import ≤ site limit (MW)

Hourly matching	Share of hours fully supplied from on-site production or storage ≥ site target
Availability	No IT interruption attributable to the energy or cooling plant

5. Transient and recovery tests — pass/fail (layers 2 and 3)

Each test at 100 % IT load unless stated, repeated three times; a test passes only if every repetition passes. Limits shown are the reference values; each site confirms them against the IT supplier's input tolerances before basic design.

Test	Initiating event	Pass criteria (during the event)	Recovery criterion
T1 Loss of grid	Standby grid supply opens without warning	No IT interruption; IT bus voltage within the ITIC/CBEMA envelope (AC) or ±5 % of nominal (DC bus); no protection trip outside the event zone	Stable island, frequency 50 ± 0.2 Hz within 10 s
T2 Loss of the largest on-site unit	Trip of the largest generating unit or battery block	Frequency nadir ≥ 49.0 Hz; RoCoF ≤ 1 Hz/s over 500 ms; no shedding of IT load	50 ± 0.2 Hz within 30 s; reserves restored within 15 min
T3 AI load step and swing	0 → 100 % and 100 → 20 % IT load in ≤ 1 s; periodic swing ±30 % at 0.1–20 Hz	Bus voltage within ±5 %; frequency within ±0.5 Hz; no amplification of plant or grid modes (damping ratio ≥ 5 %); no trips	Steady state within 5 s after each step
T4 Duty cooling pump trip	Trip of the running coolant pump	Rack inlet ≤ 32 °C (ASHRAE A1 allowable); coolant supply ≤ design + 3 K; no IT thermal throttling	Standby pump at duty within 15 s; design set-point within 5 min
T5 Loss of a cooling source	Trip of a chiller / heat-rejection path, or source at design-maximum temperature	Same thermal limits as T4	Design set-point within 15 min
T6 Low storage, low renewables	Battery at reserve state of charge with no wind or sun	Firm units started and loaded before reserve SoC is reached; no IT interruption; reserve SoC ≥ ride-through minimum	Normal dispatch within 30 min
T7 Black start	Total loss of supply to the campus plant	First source energises the bus without the grid; critical cooling before IT restart	Critical IT load restored within the site limit (reference 30 min)
T8 Control / communication loss	Loss of the plant controller or its network	Plant goes to its defined safe state; no IT interruption	Automatic return to normal on restoration
T9 Re-synchronisation	Return from island to standby grid	IT bus within T1 limits; no reverse power beyond the export limit	Grid-standby mode within 60 s

6. How the criteria are set and verified

- **Sources of the limits:** IT supplier input tolerances (power supply ride-through, voltage window), ASHRAE TC 9.9 thermal guidelines, IEC 62040-3 classification for UPS/storage output, the applicable grid code (EU: Requirements for Generators) for frequency behaviour, and the availability class chosen under EN 50600.
- **Freeze points:** criteria proposed at concept, frozen at basic design, unchanged at commissioning except by written change agreed with the owner and the verifier.
- **Predicted vs measured:** layer 2 predicts each value; layer 3 measures it; deviations above 20 % of the margin trigger a root-cause review before acceptance.
- **Independence:** an independent verifier (inspection body or owner's engineer not involved in the design) witnesses layer 3 and reviews layer 4 data and calculations; results are reported against this table.

Limits are reference values for discussion; each site sets and verifies its own criteria. Architecture protected — patent application filed. This note contains no confidential design information.