nezo

Assumed Energy Benchmark

A bottom-up sanity check for the Northcote N12 simulation

96-apartment building · ~7,200 m² · Auckland · all-electric

What this document is — and is not

This is an **independent, assumption-based estimate** of how much energy a building of this size and apartment count should use in a year, built bottom-up from NZ benchmarks and the project's actual equipment schedules. It exists so you can hold it next to the Nezo OpenStudio output and ask one question: ***"is my simulation a few percent off, or is it off by hundreds of percent?"***

A few percent means tweak inputs. Hundreds of percent means a structural modelling error — and §6 lists exactly which ones to look for. **These figures are deliberately approximate (with ranges); they are a plausibility ruler, not a prediction or a compliance result.**

Contents

1. Basis of the estimate

The benchmark is built from the real building and its specified equipment, combined with published NZ residential energy intensities (BRANZ HEEP household study; typical all-electric apartment end-use splits). Key inputs:

Parameter	Value used
Apartments	96 (31 × 1-bed, 65 × 2-bed)
Conditioned floor area	~7,200 m² (≈75 m²/apartment incl. circulation share)
Assumed occupancy	~2.2 people/apartment (≈209 people total)
Climate	Auckland (H1 Zone 1) — mild, cooling-leaning, low heating
Space conditioning	Daikin single-split heat pump per apartment, ACOP ≈ 4.5
Hot water	Rheem 180 L electric cylinder per apartment (~45 L/p/day, 60 °C)
Apartment ventilation	Continuous mechanical extract (~80 L/s, 0.04 kW) + rangehood
Common services	2 lifts, corridor supply, CO-controlled carpark exhaust, common/exterior lighting
Energy source	All-electric (no gas)

All figures below are **delivered electricity** (kWh at the meter), so heat-pump space conditioning already has the COP applied — this is what the Nezo report's "Electricity" end-use total should resemble.

2. Expected energy per apartment

A single "average" apartment (~75 m², ~2.2 occupants). Hot water and appliances dominate; in Auckland, space conditioning is a minor end use.

End use	Expected (kWh/yr)	Plausible range	Share
Hot water (electric cylinder)	1,900	1,400 – 2,600	40%
Appliances / cooking / plug	1,600	1,100 – 2,400	34%
Space heating (heat pump)	400	150 – 800	9%
Space cooling (heat pump)	350	100 – 700	7%
Lighting (LED)	300	180 – 450	6%
Extract ventilation fan	150	80 – 250	3%
Per apartment total	**~4,700**	**3,000 – 7,200**	**100%**

Cross-check: an all-electric NZ apartment typically lands around 4,000–6,000 kWh/yr — lower than a standalone house because units are smaller, share heated walls, and benefit from neighbours' heat. ~4,700 kWh/yr sits squarely in that band.

3. Expected whole-building energy

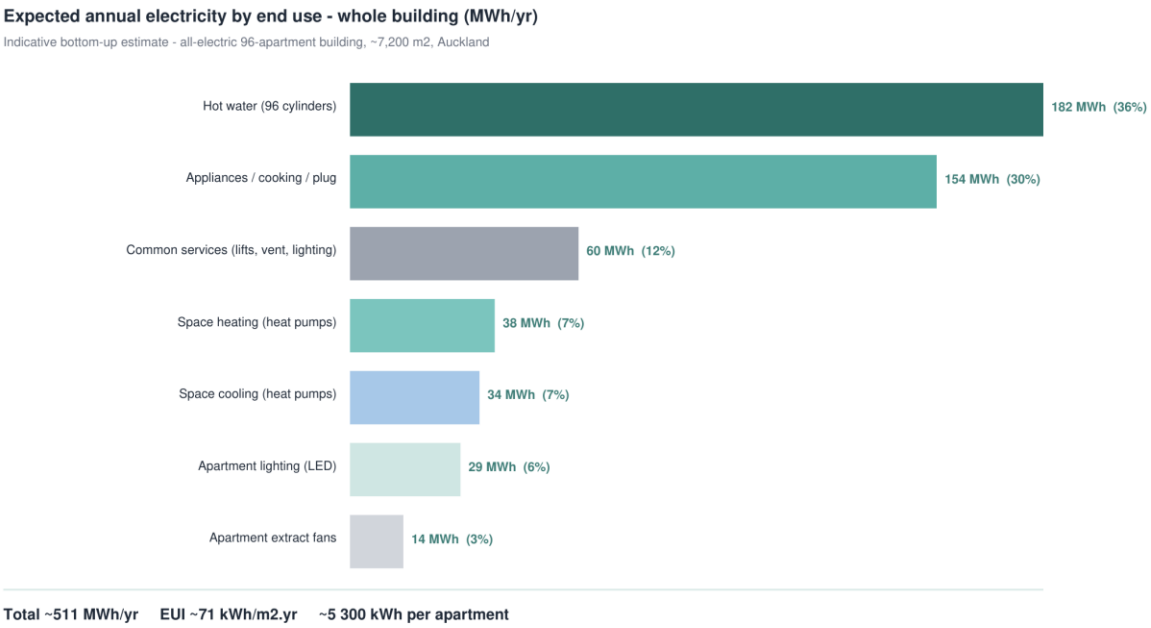

Figure. *Whole-building electricity by end use (expected case). Hot water and appliances together are two-thirds of the total; space conditioning is under 15%.*

Component	Expected (MWh/yr)	Range
Apartments (96 units)	451	290 – 690
Lifts (×2)	15	10 – 22
Corridor / common ventilation	12	8 – 18
Carpark exhaust (CO-controlled)	6	3 – 10
Common + carpark + exterior lighting	22	15 – 32
Pumps, controls, misc.	5	3 – 8
Common services subtotal	**60**	**45 – 80**
Whole building total	**~511**	**410 – 610**

Metric	Expected
Energy use intensity (EUI)	~71 kWh/m²·yr (range ~55 – 95)
Per apartment incl. common share	~5,300 kWh/yr
Whole-building annual electricity	~511 MWh/yr (≈ 0.5 GWh)

Context: NZ all-electric apartment buildings typically run ~60–110 kWh/m²·yr. ~71 is a reasonable, efficient-but-not-extreme result for an Auckland building with LED lighting, modern heat pumps and electric hot water.

4. Cross-check against the H1/VM1 run

The independent IES VE compliance model gives a useful second anchor for the **space-conditioning** slice only (it excludes hot water, ventilation and plug energy). Its proposed heating + cooling *load* is 32.3 kWh/m²·yr. Dividing by the heat-pump COP (~4.3) gives delivered electricity:

Space conditioning	Load (kWh/m²·yr)	≈ Electricity
H1 proposed (heating + cooling)	32.3	~7.5 kWh/m²·yr
→ whole building	—	~54 MWh/yr
This benchmark (heating + cooling)	—	**~72 MWh/yr**

The two agree to within the same order of magnitude (~54 vs ~72 MWh). The benchmark sits a little above the H1 figure, which is expected: H1 models the bare 18/25 °C regime, while real occupants condition a bit more. **If your Nezo space-conditioning electricity is anywhere near 50–80 MWh/yr you are on track; if it reads single-digit MWh or several hundred MWh, something is wrong.**

5. Reading your Nezo simulation against this

When the OpenStudio run finishes, open the Nezo report's end-use table and compare it line-by-line with §2–§3. Use these tolerance bands:

Agreement	Verdict	Action
Within ±20% of total	On the money	Calibrate inputs only — you're essentially done.
±20–50% on total	Plausible, needs tuning	Find which end use drives the gap; check that input (DHW draw, plug density, setpoints).
A single end use 2–4× off	Input error	One assumption is wrong (e.g. DHW litres, fan power). Fix that line.
Total or a line 10×+ off	Structural error	Stop and check §6 — geometry, multipliers or scope is wrong.

Map the Nezo end uses to this benchmark as follows: **Water Systems** ↔ hot water; **Interior Equipment** ↔ appliances/plug; **Heating / Cooling** ↔ space conditioning; **Interior Lighting** ↔ lighting; **Fans / Pumps / Exterior Lighting** ↔ ventilation and common services.

6. Red-flag checklist — the "hundreds of percent" errors

If the total is off by an order of magnitude, it is almost always one of these. Each is quick to confirm.

Too LOW by ~5–10× (e.g. total reads ~50–100 MWh)

- **Zone multipliers not applied.** Only the six drawn plates are being counted, not the ×2 and ×3 copies. Confirm Typical-A zones = ×2 and Typical-B = ×3 — this alone scales the apartment count from ~50 modelled to 96 real.
- **Full scope not enabled.** If hot water reads zero, the measure is in H1-compliance scope (DHW + ventilation are deliberately excluded). Switch to full operational to see the ~182 MWh hot-water load.
- **HVAC/thermostats not attached, or no EPW.** Heating and cooling near zero everywhere → equipment didn't bind to zones, or the Auckland weather file isn't loaded.

Too HIGH by ~2× or cooling enormous

- **Plug load left at the H1 default (24.5 W/m²).** This is the classic trap. 24.5 W/m² × 7,200 m² × 8,760 h at ~40% diversity ≈ 620 MWh of plug energy alone — it more than doubles the building and dumps huge internal heat into the apartments, inflating cooling too. Use a realistic ~4–8 W/m² for the operational run.
- **Conditioning the buffers.** If corridors, lift cores, loading bay or carpark received thermostats/HVAC, you're heating/cooling unconditioned volume. They should have no equipment.
- **Multiplier applied twice** (e.g. floors both copied AND multiplied) double-counts those levels.

Right shape, wrong scale

- **Floor area mismatch.** If totals look plausible but EUI is far from ~71 kWh/m², the conditioned floor area reported by EnergyPlus is wrong (multiplier not reflected in area, or buffers counted as conditioned).
- **DHW people count.** Hot water is litres/person/day × people. If occupancy resolved to the wrong head-count (or zero), DHW will be wildly off in either direction.

7. Assumptions log

So the numbers can be challenged and refined on the next building:

- Hot water ≈ 1,900 kWh/yr per unit assumes electric resistance cylinder, ~45 L/person/day at 60 °C, ~2.2 people, standing loss included. A heat-pump cylinder would cut this ~2–3×.
- Appliances/plug ≈ 1,600 kWh/yr per unit is a diversified real-use figure (fridge, laundry, cooking, electronics) — not the H1 24.5 W/m² compliance value.
- Space heating/cooling per unit derived from the Auckland climate and the H1 load result, scaled up modestly for real occupant behaviour, COP ≈ 4.5.
- Lifts ≈ 7,500 kWh/yr each (geared traction MURB lift, moderate traffic).
- Common/exterior + carpark lighting ≈ 22 MWh/yr assumes LED throughout with carpark on daylight/occupancy control.
- Ranges are roughly ±30–50% to reflect genuine uncertainty in occupancy and behaviour; treat the midpoints as a target, not a forecast.

Companion document

See ***"Nezo Operational Energy Model — Northcote N12 Modelling Guide"*** for the modelling methodology, zoning decisions and the build workflow that produces the simulation this benchmark is checking.