Historical Codebase Sims, validation of the 35 neighbourhood units: Zone 5, Toronto (Ontario)

Vintage arm `CAN_Z5_1983`, baseline scenario (`EEM_J_DEFAULT`), all 35 neighbourhoods, from the master `HIST_NU_CAN_Z5_1983_20261020_master.csv` (560 rows; the 48 rows of CC-S2, IC-DC and MU-W2 are the 20260924 results carried over). The 1983 arm is a Quebec-1983 equivalent stock level, stock window 1975 to 1995, not Ontario's own 1983 code.

Generated by `scripts/NUs/qc1983_nu_validation_all35.py` (zone mode, Historical Codebase Sims V-3); every value is read from a result file or a reference document at run time. No simulated arm is compared against another simulated arm in this document: the vintage-over-current comparison belongs to the gates document `results/Z5/HIST_Z5_gates.md`.

Are these results acceptable?

This document cannot say whether Toronto's 1983-level stock lands inside an external band, and it does not pretend to. The one benchmark the plan allows for Ontario is the provincial residential stock EUI of NRCan SHEU 2019 (check 2), and `RZ02` holds no such figure, so that check stops with the finding "absent". Check 1 stops too: there is no single-building fleet for this zone. The Montreal composites are Quebec figures and are not applied.

What the existing material does support:

- the model side is complete for all 35 neighbourhoods (32 with a tabular report, 3 carried, master only), and the master agrees with the tabular report to 0.0055 per cent;
- check 3 (the Quebec-sourced R13 medians, applied unchanged): median ratio 0.763 over the 9 RC neighbourhoods, 4 of 9 within band, which is a consistency figure against the Montreal chapter, not a validation for Ontario;
- check 4 (the ladder against the zone's own current-code arm): the envelope measure returns a median -26.4% on the 1983 arm against -7.7% on the current-code arm, the expected direction.

The one point to carry into any use of the numbers is direction. The model is an as-built 1983-level stock; surveys describe survivors with decades of retrofit. A faithful as-built model should therefore sit above survey medians, so a ratio below 1.0 would be the direction that needs explaining.

1. The four V-3 checks and what each one needs

Plan Stage 4, V-3: the four checks of the Montreal external validation with the benchmark swapped per province, provincial figures only from the existing responses RZ01, RZ02, RZ04 and RZ05. A figure absent there is recorded as absent and the check stops; nothing is retrieved, and no Quebec number is applied to another province in its place.

#	Check	Benchmark it needs	Status here	Result
1	Current-code arm against the zone's own NECB 2017 single-building fleet	an Option 7i fleet baseline for CAN_Z5	**absent**, search in section 1.2	stopped, not run
2	1983 arm against the provincial residential stock EUI, NRCan SHEU 2019, band 0.80 to 1.15	a Ontario stock EUI figure in `RZ02_ontario_toronto_z5.md`	**absent**, search in section 1.1	stopped, not run
3	RC family, 1983 arm against the R13 per-archetype measured medians, area weighted	`LMN1983_validation_benchmark.csv`, **Quebec-sourced** (SHEU 2019 Quebec cut, SCIEU Quebec), applied unchanged because the plan says "checks 3 and 4 as in Montreal"	computed, section 4	median ratio 0.763 over 9 neighbourhoods, 4 within band
4	EEM scenario ladder, 1983 arm against the current-code arm of the same zone	the zone's rows of `LMN_national_NU_master.csv` (post-fix)	computed, section 5	see section 5

1.1 Check 2: no stock EUI figure in RZ02

`RZ02_ontario_toronto_z5.md` (262 lines) was searched for a number followed by an energy-intensity unit (kWh/m2, ekWh, GJ/, MJ/m2, kBtu/, kWh per, GJ per): **0** such figures. It names SHEU on 9 lines, shortened here: line 85, "...rier, wood/brick exterior cladding. Framing fraction: 15-18%. / NRCan SHEU; Builder Practice Audits / Tier 2 / High /..."; line 86, "...R-20 to R-30), 1/2" drywall ceiling. Framing fraction: 8-10%. / NRCan SHEU; OBC 1983 / Tier 2 / High /..."; line 88, "...ed stone base. Uninsulated except at perimeter in rare cases. / NRCan SHEU; Market Surveys / Tier 2 / High /..."; line 123, "...l envelope surface area at 4 Pa baseline pressure difference. / NRCan SHEU; CMHC Housing Data / Tier 1 / High /..."; line 124, "...0 houses / **0.15-0.21 L/s per m2** of envelope area at 4 Pa. / NRCan SHEU;

R-2000 Benchmarks / Tier 1 / High /..."; line 153, "...ck (<5% R-2000 penetration). / Supply fan: 0.40-0.60 W/(L/s). / NRCan SHEU; Enbridge Load Research / Tier 1 / High /...". No line uses the unit kWh at all.

Result: the Ontario provincial residential stock EUI is absent from the existing RZ02, so check 2 stops here. The plan allows one targeted, machine-checked retrieval for a figure genuinely absent; the instruction for this run was to record "absent" and stop, so none was made. Whoever resumes this needs the NRCan SHEU 2019 provincial table for Ontario (or the Comprehensive Energy Use Database residential tables) and the same 0.80 to 1.15 ratio band.

1.2 Check 1: no single-building fleet for CAN_Z5

Check 1 needs the Option 7i NECB 2017 single-building baseline EUI of every archetype for this zone. The fleet in `docs_BEM_Explanation/EEM_setup.md` is run for CAN_MTL and CAN_CLG only. Search for the tokens `CAN_Z5`, `Toronto`: **0** lines in `EEM_setup.md`, **0** entries in `0_BEM_Setup/SimResults_modified/`. **Result: absent, check 1 stops here.** The B-4 smoke runs of 2026-09-17 covered two archetypes under the vintage arm only.

1.3 What is deliberately not done

The Montreal validation compares each family against composites built from Quebec sources (SCIEU 2014 Quebec, SHEU 2019 Quebec cut, Ville de Montreal 21-042 disclosure, MEQ school benchmarks, Hydro-Quebec load research, Energir sales). None of them describes Ontario, so **no family ratio, no agreement label and no peak target is computed here**. That would be a Quebec number applied to another province, which the plan rules out.

2. Results

One row per neighbourhood, `EEM_J_DEFAULT` cell. `Site EUI (GFA)` is on the **gross floor area** basis, the basis every external benchmark is stated on. `Site EUI (cond.)` is the master's conditioned-area figure. Both come from the same simulation: they differ only in the denominator (section 6). `Peak` is not available: the hourly demand series lived in `eplusout.sql`, deleted on 2026-10-20.

NU	Family	Buildings	GFA (m2)	Site EUI (GFA)	Site EUI (cond.)	Cond. share	Gas	Peak	Benchmark	Tabular source
RC-D	RC	48	21201	99.1	198.2	0.50	63%	n/a	absent	eplustbl.csv
RC-HR1	RC	6	28211	186.7	207.2	0.90	67%	n/a	absent	eplustbl.csv
RC-HR2	RC	4	31346	181.1	201.1	0.90	60%	n/a	absent	eplustbl.csv
RC-ML	RC	28	20681	97.1	194.2	0.50	61%	n/a	absent	eplustbl.csv
RC-MR1	RC	8	22618	124.2	172.0	0.72	63%	n/a	absent	eplustbl.csv
RC-MR2	RC	8	25077	197.4	219.1	0.90	75%	n/a	absent	eplustbl.csv
RC-MR3	RC	12	37615	198.6	220.5	0.90	76%	n/a	absent	eplustbl.csv
RC-R	RC	24	10600	98.8	197.5	0.50	62%	n/a	absent	eplustbl.csv
RC-T	RC	8	20162	95.0	189.9	0.50	59%	n/a	absent	eplustbl.csv
RS-I1	RS	9	19134	217.4	265.3	0.82	72%	n/a	absent	eplustbl.csv
RS-I2	RS	11	32096	214.0	224.9	0.95	63%	n/a	absent	eplustbl.csv
RS-I3	RS	7	14139	161.5	251.0	0.64	61%	n/a	absent	eplustbl.csv
RS-I4	RS	8	26092	217.9	231.7	0.94	68%	n/a	absent	eplustbl.csv
RS-S	RS	20	17024	136.5	248.9	0.55	59%	n/a	absent	eplustbl.csv
MU-C1	MU	12	80328	244.7	260.8	0.94	50%	n/a	absent	eplustbl.csv
MU-C2	MU	11	124138	188.5	198.4	0.95	57%	n/a	absent	eplustbl.csv
MU-HC	MU	10	35876	225.2	241.8	0.93	58%	n/a	absent	eplustbl.csv

NU	Family	Buildings	GFA (m2)	Site EUI (GFA)	Site EUI (cond.)	Cond. share	Gas	Peak	Benchmark	Tabular source
MU-HS	MU	11	20283	236.4	284.8	0.83	65%	n/a	absent	eplustbl.csv
MU-L	MU	12	15828	242.9	263.6	0.92	65%	n/a	absent	eplustbl.csv
MU-S1	MU	13	30540	257.6	274.1	0.94	59%	n/a	absent	eplustbl.csv
MU-S2	MU	9	21079	266.0	287.2	0.93	62%	n/a	absent	eplustbl.csv
MU-U1	MU	8	111771	166.8	176.6	0.94	52%	n/a	absent	eplustbl.csv
MU-W	MU	7	12470	232.7	244.9	0.95	72%	n/a	absent	eplustbl.csv
MU-W2 (carried)	MU	12	n/a	n/a	232.6	n/a	n/a	n/a	absent	master only (carried cell, no tabular report)
CC-B	CC	7	67775	200.5	200.5	1.00	48%	n/a	absent	eplustbl.csv
CC-E1 [IT]	CC	10	76149	161.1	162.2	0.99	35%	n/a	absent	eplustbl.htm
CC-E2 [IT]	CC	12	37815	378.3	382.9	0.99	59%	n/a	absent	eplustbl.htm
CC-E3 [IT]	CC	13	42637	368.7	378.3	0.97	61%	n/a	absent	eplustbl.htm
CC-FD1	CC	9	218365	212.9	213.2	1.00	56%	n/a	absent	eplustbl.htm
CC-FD2	CC	10	127315	190.5	190.9	1.00	48%	n/a	absent	eplustbl.csv
CC-FD3	CC	10	155849	214.8	214.8	1.00	54%	n/a	absent	eplustbl.csv
CC-S1	CC	9	11634	312.9	312.9	1.00	39%	n/a	absent	eplustbl.htm
CC-S2 (carried)	CC	6	n/a	n/a	423.5	n/a	n/a	n/a	absent	master only (carried cell, no tabular report)
IC-DC [IT] (carried)	IC	11	n/a	n/a	3719.9	n/a	n/a	n/a	absent	master only (carried cell, no tabular report)
IC-DE [IT]	IC	10	11209	12003.5	12003.5	1.00	1%	n/a	absent	eplustbl.htm

`[IT]` marks a neighbourhood containing a data centre and `[lab]` one containing a research laboratory (their intensity is set by IT load or by process loads, not by envelope or climate). `(carried)` marks the three neighbourhoods whose rows are the 20260924 results: their run folders, and so their tabular reports, were deleted on 2026-10-20, which leaves GFA, the gross-basis EUI and the gas share unavailable for them (`n/a`); the conditioned-basis EUI comes from the master and is complete.

3. Family medians, model only

No external benchmark is attached; the medians are the model's own, for the neighbourhoods that have a gross-basis value.

Family	Neighbourhoods	With gross-basis value	Median site EUI (GFA)	Median site EUI (cond., all)	Median gas share
Residential Core (RC)	9	9	124.2	198.2	63%
Residential Sector (RS)	5	5	214.0	248.9	63%
Mixed Use (MU)	10	9	236.4	252.8	59%
Commercial Centre (CC)	9	8	213.8	214.8	51%
Institutional / Campus (IC)	2	1	12003.5	7861.7	1%

4. Check 3, RC family against the R13 per-archetype medians

Method as in the Montreal external validation: each neighbourhood is judged against a floor-area weighted composite of the measured median EUI of the archetypes it contains; unit areas are fixed by the single-archetype neighbourhoods and closure-tested; gross-floor-area basis on both sides; ratio bands 0.80 to 1.15 within, 0.65 to 1.30 flagged (RN02 section F.2, read at run time). **The R13 medians are Quebec-sourced (`benchmark_source`: NRCan SHEU 2019 Quebec cut for the houses, SCIEU 2014 Quebec for the apartment blocks) and are applied here unchanged only because the plan says so; read the ratio as a consistency check against the Montreal chapter, not as a validation for Ontario.**

NU	Composition	Composite R13 median	1983 site EUI (GFA)	Ratio	Position
RC-D	48 Detached Houses	137.7	99.1	0.720	Below band
RC-HR1	2 ApartmentHighRise, 4 ApartmentMidRise	202.1	186.7	0.924	Within band
RC-HR2	4 ApartmentHighRise	208.3	181.1	0.870	Within band
RC-ML	4 Attached Houses, 24 Detached Houses	131.2	97.1	0.740	Below band
RC-MR1	4 ApartmentMidRise, 4 Attached Houses	163.2	124.2	0.761	Below band
RC-MR2	8 ApartmentMidRise	194.4	197.4	1.016	Within band
RC-MR3	12 ApartmentMidRise	194.4	198.6	1.022	Within band
RC-R	24 Detached Houses	137.7	98.8	0.717	Below band
RC-T	8 Attached Houses	124.4	95.0	0.763	Below band
median				**0.763**	**Below band**

Floor-area closure behind the weights (unit areas fixed by the single-archetype neighbourhoods, then predicted for the rest):

- RC-D predicted 21200.6 m2 against 21200.6 m2 reported, 0.000% error
- RC-HR1 predicted 28211.4 m2 against 28211.4 m2 reported, 0.000% error
- RC-HR2 predicted 31345.9 m2 against 31345.9 m2 reported, 0.000% error
- RC-ML predicted 20681.3 m2 against 20681.3 m2 reported, 0.000% error
- RC-MR1 predicted 22619.4 m2 against 22618.5 m2 reported, 0.004% error
- RC-MR2 predicted 25076.9 m2 against 25076.9 m2 reported, 0.000% error
- RC-MR3 predicted 37615.4 m2 against 37615.4 m2 reported, 0.000% error
- RC-R predicted 10600.3 m2 against 10600.3 m2 reported, 0.000% error
- RC-T predicted 20162.0 m2 against 20162.0 m2 reported, 0.000% error

5. Check 4, the EEM scenario ladder, 1983 arm against the current-code arm

The Montreal chapter compared the 1983 ladder with the published 2017 Option 9i tables of `EEM_setup.md`. For this zone the like-for-like comparison is the zone's own current-code arm, `CAN_Z5` rows of `LMN_national_NU_master.csv`, on the same conditioned-area basis. `n/a` means the cell exists on one side only (the EEM4-only cell is not simulated for the multifamily neighbourhoods on the current-code arm).

5.1 Cumulative ladder, site EUI in kWh/m2.yr, 1983 beside current code

NU	Baseline 1983	Baseline current	EEM1 1983	EEM1 current	EEM2 1983	EEM2 current	EEM3 1983	EEM3 current	EEM4 1983	EEM4 current
RC-D	198.2	125.6	145.9	100.8	119.5	89.8	99.0	77.6	71.4	57.4
RC-HR1	207.2	104.5	135.3	99.4	116.8	98.6	88.2	66.1	70.2	50.5

NU	Baseline 1983	Baseline current	EEM1 1983	EEM1 current	EEM2 1983	EEM2 current	EEM3 1983	EEM3 current	EEM4 1983	EEM4 current
RC-HR2	201.1	110.1	133.9	105.4	122.4	105.1	101.6	67.7	82.1	51.4
RC-ML	194.2	126.4	146.7	104.5	125.0	96.9	103.9	83.4	74.4	60.5
RC-MR1	172.0	104.8	132.3	96.7	114.9	95.4	82.2	72.9	61.2	54.4
RC-MR2	219.1	99.8	138.1	93.4	110.0	91.1	71.6	64.6	56.0	50.1
RC-MR3	220.5	99.7	138.2	93.1	109.8	90.6	71.3	64.1	55.9	49.6
RC-R	197.5	125.2	145.5	100.5	119.8	90.0	99.3	77.8	71.7	57.5
RC-T	189.9	127.2	147.6	108.4	130.9	104.3	109.0	89.5	77.6	63.8
median	**198.2**	**110.1**	**138.2**	**100.5**	**119.5**	**95.4**	**99.0**	**72.9**	**71.4**	**54.4**

5.2 Isolated measure savings, per cent of the cell's own DEFAULT

NU	Envelope 1983	Envelope current	HVAC 1983	HVAC current	DHW 1983	DHW current	EEM4 1983	EEM4 current
RC-D	-26.4%	-19.8%	-33.2%	-22.7%	-10.7%	-10.1%	-8.9%	-11.9%
RC-HR1	-34.7%	-4.9%	-33.6%	-7.1%	-13.4%	-31.0%	-2.8%	n/a
RC-HR2	-33.4%	-4.2%	-28.4%	-6.8%	-10.0%	-34.2%	-1.9%	n/a
RC-ML	-24.4%	-17.3%	-29.6%	-18.2%	-11.2%	-11.2%	-9.9%	-13.5%
RC-MR1	-23.1%	-7.7%	-27.1%	-8.3%	-18.8%	-21.3%	-8.2%	n/a
RC-MR2	-37.0%	-6.4%	-40.2%	-8.7%	-17.2%	-25.9%	-3.4%	n/a
RC-MR3	-37.3%	-6.6%	-40.6%	-9.0%	-17.0%	-25.9%	-3.2%	n/a
RC-R	-26.4%	-19.7%	-32.8%	-22.3%	-10.7%	-10.2%	-9.0%	-12.0%
RC-T	-22.3%	-14.8%	-25.6%	-13.6%	-11.8%	-12.2%	-10.9%	-15.1%
median	**-26.4%**	**-7.7%**	**-32.8%**	**-9.0%**	**-11.8%**	**-21.3%**	**-8.2%**	**-12.8%**

Reading, computed from the tables: the envelope measure returns a median -26.4% on the 1983 arm against -7.7% on the current-code arm, and the DHW measure -11.8% against -21.3%. The envelope saves a larger share of the larger 1983 baseline, the expected shape: the envelope is what 1983 got wrong. The water heater is the same appliance on both arms, so its saving is smaller as a share of the larger 1983 baseline.

6. Model-side integrity

- **Denominators.** Site EUI is reported on two bases, `Energy Per Total Building Area` (gross floor area) and `Energy Per Conditioned Building Area`. For the pure-house neighbourhoods they differ by a factor of about 2, because the attic and the unheated basement are half the total area (conditioned share in section 2). Every external benchmark is stated on gross floor area, so comparisons against outside figures use the gross basis; the master and the website use the conditioned basis. The percentage deltas between arms are unaffected, because both arms share the denominator.
- **Master against the tabular report.** For the 32 neighbourhoods with a tabular report (26 csv, 6 html), the conditioned-basis EUI read from `eplustbl` differs from the master's `EUI_total_kWh_m2` by at most 0.0055 per cent (largest of 32). The master is written from `eplusout.sql`; the tabular report is an independent read of the same run.
- **Carried rows.** The 48 rows of CC-S2, IC-DC and MU-W2 are the 20260924 results, identical to the old master (checked at collection, 48 of 48). Their tabular reports no longer exist, so the gross-basis columns are `n/a` for them rather than estimated.
- **Peaks.** Not extracted; see section 2.

7. Sources

#	Source	Used for
1	`docs_ACTIVE/HistoricalCodebaseSims/results/HIST_NU_CAN_Z5_1983_20261020_master.csv`	the model side, 560 rows
2	`eplustbl.csv` / `eplustbl.htm` of the 32 re-run DEFAULT cells, from `results/archive/hist_nu_z5_fanfix_slim.tar.gz`	areas, gross-basis EUI, fuel split
3	`docs_DONE/docs_LMN_web/LMN-1983/DeepResearch/buildingNECB4-8/responses/RZ02_ontario_toronto_z5.md`	searched for the provincial stock EUI (check 2): absent
4	`docs_BEM_Explanation/EEM_setup.md` and `0_BEM_Setup/SimResults_modified/`	searched for a zone fleet (check 1): absent
5	`docs_DONE/docs_LMN_web/LMN-1983/outputs/building/csv/LMN1983_validation_benchmark.csv` (R13)	the per-archetype medians of check 3, Quebec-sourced
6	`docs_DONE/docs_LMN_web/LMN-1983/DeepResearch/NUs/responses/RN02_district_benchmarks.md` section F.2	the 0.80 to 1.15 and 0.65 to 1.30 ratio bands only
7	`docs_DONE/docs_LMN_web/default_sims_fix/results/LMN_national_NU_master.csv`	the current-code ladder of check 4
8	`Content/neighbourhoods/neighbourhood_registry.py`	composition of each neighbourhood