RTU-1 / RTU-2 After-Hours Shutdown Feasibility

Office Building Use Case
Technical feasibility, risks, nuisance drivers, and pilot shutdown sequence

Bottom line	Proceed with an after-hours shutdown pilot for RTU-1 and RTU-2. Use scheduled OFF with controlled restart exceptions, not a blind hard shutdown.
Design basis	RTU-1 and RTU-2 are both 45,000 cfm rooftop units. RTU-1 design outside air is 7,500 cfm; RTU-2 design outside air is 6,000 cfm.
Main implementation risk	Pressure and air-balance coordination. The RTU schematic 'exhaust fan' must be interpreted as the return / relief path.
Main controls risk	A small number of nuisance VAVs can falsely hold the RTUs on after hours through reheat, airflow, or reset suppression.
Management decision	The burden of proof is no longer 'prove they can be shut off.' The burden is 'prove why they must stay on.' Current evidence does not justify continuous overnight operation.

Purpose. This report consolidates the uploaded RTU screens, VAV overview and balancing pages, floor maps, SAT trends, and the as-built design basis to answer one practical question: can RTU-1 and RTU-2 be shut off after hours without causing pressure, comfort, or restart problems?

1. Scope and follow-up clarifications incorporated

- The building is treated as an office building. No hospital-style 24/7 ventilation, critical-pressure, or critical-airside assumptions are applied.
- RTU-1 and RTU-2 schematic 'exhaust fan' points are treated as the return / relief path for these rooftop units, per user clarification.
- South and west exposures are treated as the highest solar-gain zones and therefore the highest morning recovery risk.
- The as-built outside-air schedule is used as the design ventilation basis for each RTU.
- The VAV-to-RTU crosswalk is based on the ACM trunk / overview pages, balancing data pages, RTU screens, and the floor maps uploaded in this project.
- This report uses the earlier TOB project context: office-building use, TOB operating history, and the goal of evaluating after-hours RTU shutdown rather than continuous overnight operation.

2. Design basis and why it matters

The as-built basis is strong support for after-hours shutdown feasibility. Both units are standard 45,000 cfm office rooftop systems with ordinary outside-air requirements, not specialty 24/7 process or critical-care systems.

RTU	Supply air total with diversity	System OA fraction	OSA total	Interpretation
RTU-1	45,000 cfm	0.167	7,500 cfm	Standard office RTU; does not support a default 24/7 run position.
RTU-2	45,000 cfm	0.133	6,000 cfm	Standard office RTU; lower OA fraction than RTU-1 and no evidence of all-night ventilation need.

Engineering meaning. The systems were designed as office RTUs with finite minimum ventilation requirements. That shifts the decision framework. The default condition should be scheduled OFF after hours unless a specific exception, sequence, or tenant use proves otherwise.

3. Served-zone structure and exposure logic

What the uploaded maps and overview pages establish. The served spaces are primarily open offices, private offices, conference rooms, corridors, lobbies, lounge / support areas, and similar office-type zones. That is compatible with shutdown plus exceptions.

RTU	Typical served spaces	Directional note	Shutdown implication
RTU-1	Large conference, offices, open offices, med conference, support spaces	Includes south and west solar-exposed areas	Feasible to shut down after hours, but requires good pre-start and nuisance-box cleanup.

RTU-2	Open offices, offices, trash, SES, med conference, support spaces	Also includes perimeter solar exposure but appears slightly easier to manage	Feasible to shut down after hours with the same controls guardrails and pressure verification.

Directional clarification. South and west solar gain must not be confused with a need for all-night operation. It is a morning recovery and pre-cool problem, not proof that the RTUs must run continuously overnight.

4. What the current snapshots say

1. RTU-1 daytime snapshot shows a hard cooling posture: outside air about 82.5°F, supply fan about 61%, SAT about 54.8-55.6°F, static about 1.9 in.w.c., and cooling active around 44%.
2. RTU-2 daytime snapshot shows similar occupied cooling behavior: outside air about 82.6-82.7°F, supply fan about 42-46%, SAT about 56.7°F with 60°F active setpoint, static about 1.49-1.50 in.w.c., and cooling active around 44%.
3. Those observations prove daytime load is real. They do not prove all-night necessity.
4. The building monitoring screen shows positive building pressure while EF-1 and EF-2 are running. That is the main implementation caution because RTU shutdown must not leave exhaust without a coordinated return / relief path.

5. Feasibility decision by RTU

RTU	Feasible to shut down after hours?	Confidence	Main risk	Engineering position
RTU-1	Yes	High	Pressure / relief coordination and nuisance VAVs	Proceed with a pilot. Do not use a blind hard shutdown. Use scheduled OFF with restart exceptions and fix the worst boxes.
RTU-2	Yes	High	Pressure / relief coordination and nuisance VAVs	Proceed with a pilot. RTU-2 appears slightly easier than RTU-1, but still requires the same controls discipline.

Plain answer. The current package does not justify running both 45,000 cfm office RTUs all night. It supports shutting them off after hours and handling true exceptions with explicit logic.

6. Main risks that can break the strategy

Risk	Why it matters	Likelihood	Mitigation
Building goes negative	If EF-1 / EF-2 continue to pull while RTUs are off and return / relief is not coordinated, pressure can collapse.	High	Trend overnight pressure and coordinate RTU return / relief with exhaust schedules and speeds.
Bad VAVs wake the whole RTU	A few reheating or false-demand boxes can restart a full RTU after hours.	High	Inspect, trend, and if needed temporarily exclude top nuisance boxes from reset influence during the pilot.
Morning recovery too slow	South and west exposures can be late to recover if pre-start is too short.	High	Use staggered pre-start and tune it from the first one to two weeks of trends.
Single-zone logic is too permissive	One bad box should not wake a 45,000 cfm RTU.	Medium	Use existing threshold logic, minimum runtime, and anti-short-cycle lockout.

7. Priority nuisance VAV list

These are priority suspects, not permanent convictions. They deserve first inspection because the snapshot behavior is inconsistent with normal low-load office operation or because they are influential enough to suppress reset and drive restart.

RTU	VAV	Space	Observed issue	Why it matters	Priority action
RTU-1	VAV-3-39	Office 3136	Supply temp about 97°F and EDH output 100%	Top artificial-load / reset-suppression suspect	Inspect immediately; consider temporary exclusion from reset voting until verified
RTU-1	VAV-1-34	Large Conference 1110	High influence box with ventilation and EDH impact	Can legitimately influence load, but can also hold reset up	Verify conference occupancy logic and reset participation
RTU-1	VAV-2-37	Open Office 2138	Meaningful reheat and airflow influence	Can falsely hold RTU on after hours	Inspect and trend during pilot week
RTU-1	VAV-2-35 / 2-36	Offices 2126 / 2142	Reheat seen in ordinary office zones	Artificial load risk	Inspect deadband, min cfm, and reheat enable logic
RTU-1	VAV-1-40 / 1-44	Conference / office	Notable EDH output	Potential nuisance influence	Inspect and trend during pilot week
RTU-2	VAV-2-11	Open Office 2222	EDH output 100%	Top nuisance actor candidate	Inspect immediately
RTU-2	VAV-1-21	Office 1232	EDH output 100%	Top nuisance actor candidate	Inspect immediately
RTU-2	VAV-1-05	Trash 1258	Meaningful reheat and damper position	A trash room should not wake a whole RTU without justification	Define whether it is a true after-hours exception
RTU-2	VAV-2-15 / 2-17	Offices 2240 / 2227	Notable EDH output	Artificial load aggregation risk	Inspect and trend
RTU-2	VAV-1-10 / 1-11 / 1-14 / 1-22	Office / open office	Notable EDH output	Several modest nuisance drivers can add up	Inspect and trend

8. Recommended after-hours sequence of operation

Base rule. Occupied = normal schedule. Unoccupied = RTU-1 OFF and RTU-2 OFF. Do not leave fans on simply because the building was historically left on.

8.1 Restart exceptions

- After-hours occupancy request or VAV after-hours timer.
- Minimum number of after-hours occupied VAVs required to allow RTU to run: start with the existing threshold of 5.
- High space temperature exception: about 78°F to 80°F with a hold time of at least 15 minutes.
- Low space temperature exception: about 65°F to 67°F with a hold time of at least 15 minutes.
- Pressure exception only if trend review proves it is required. Do not use pressure logic to hide poor exhaust scheduling.

8.2 Restart behavior

- On valid restart, start fan, establish return / relief behavior, and then allow cooling or heating only as needed.
- Use minimum runtime of about 30 to 60 minutes.
- Use anti-short-cycle lockout of at least 30 minutes.

8.3 Morning recovery

Recommended starting point. Because south and west are the highest solar-gain directions, pre-start should be staged rather than uniform.

Unit	Recommended pre-start	Reason
RTU-1	1.5 to 2.0 hours before occupancy	Higher concern for nuisance boxes and solar-driven recovery in its served areas.
RTU-2	1.0 to 1.5 hours before occupancy	Still requires pre-cool, but appears slightly easier to manage than RTU-1.

9. Pressure and exhaust / relief coordination

- This is the single most important implementation caution in the whole package.
- The RTU schematic 'exhaust fan' must be read as the return / relief path, not as an unrelated general exhaust fan.
- Before finalizing the shutdown schedule, verify what EF-1 and EF-2 do during unoccupied hours and what happens to building pressure when RTUs are OFF.
- If the building goes negative, the shutdown strategy itself is not necessarily wrong. The likely problem is poor coordination between RTU return / relief behavior and exhaust operation.

10. Pilot test plan

10.1 Baseline period

- Trend RTU-1 and RTU-2 supply fan %, SAT, SAT setpoint, static, and static setpoint.
- Trend building pressure and EF-1 / EF-2 status / speed.
- Trend after-hours requests and representative south / west zone temperatures.
- Trend EDH / SCR output and box supply temperature for priority nuisance VAVs.

10.2 Pilot period

- Set RTU-1 and RTU-2 to scheduled OFF after hours.

- Allow restart only by the explicit exception logic above.
- Review every overnight restart and identify which VAV or condition caused it.
- Record morning recovery and complaint history daily during the first one to two weeks.

10.3 What counts as a pass

- RTUs remain OFF after hours except for legitimate, explainable exceptions.
- Building pressure remains acceptable overnight.
- Morning comfort is reached by occupancy start.
- Only a limited set of nuisance VAVs trigger investigation rather than widespread system instability.

11. Final engineering position

Final position. The evidence does not support continuous overnight operation of RTU-1 and RTU-2 in this office building. The evidence does support a controlled after-hours shutdown pilot with return / relief coordination, explicit restart exceptions, staggered pre-start, and targeted nuisance-VAV cleanup.

In plain language. Shut them off after hours, but do it correctly. Do not let a handful of bad boxes or poor exhaust coordination become the excuse for keeping two large office RTUs running all night.

Appendix A. Follow-up clarifications explicitly incorporated

Clarification	How it was incorporated
This is not a hospital; it is used as an office building.	The entire report uses office-building logic, assumptions, and shutdown standards.
Most solar gain is from south and west.	The report treats south / west as the highest morning recovery and solar-load risk.
RTU-1 and RTU-2 schematic 'exhaust fan' is technically the return fan.	The report treats that path as return / relief and centers pressure coordination around it.
Use the other TOB work in this project as context.	The report is aligned with the prior TOB analysis direction and the goal of evaluating after-hours RTU shutdown feasibility.
Add the follow-up clarifications without prompts.	They are included directly in scope, design basis, risk analysis, sequence logic, and appendix form in this document.