



Condensing Rooftop Unit Training w/ AEE Columbia River Chapter



Presenters



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Agenda

- Objectives
- What is a Condensing RTU?
- Where should a Condensing RTU be installed?
- Case Studies
- O&M Considerations
- Next Steps



Objectives

- Walk away with knowledge and familiarity of Condensing RTUs
- Debunk common myths about the technology
- Prepare you to talk to your customers about Condensing RTUs
- Identify potential pilot sites



★ Pop Quiz ★

Of all of natural gas used in the U.S. in 2016, how much was used in the commercial sector?

- A. 34%
- B. 20%
- C. 11%
- D. 3%



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What is a Condensing RTU
(C-RTU)?

What is a Condensing RTU?

We're all familiar with a
condensing furnace in
our residential homes



This is a condensing
rooftop unit for our
commercial buildings



What is a Condensing RTU?

- Packaged unit used for space heating, space cooling and ventilation
- Adds a secondary heat exchanger
- Requires condensate management

This is a condensing rooftop unit for our commercial buildings



Why do we care about C-RTUs?

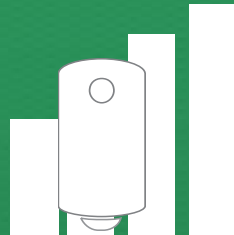


Current Market Strategy



Emerging Technologies

- Product development
- Lab and field testing
- Product feasibility and validation
- Manufacturer engagement



Market Development

- Technical training
- Sales training
- Marketing support
- Incentives



Research & Evaluation

- Market characterization
- Data acquisition



Codes & Standards

- Eliminate barriers to installation found in local codes

C-RTU Pictionary

How are your C-RTU drawing skills?

- Split into groups of 4 people each
- Your task? Draw the best condensing gas rooftop unit of your life
- After 2 minutes, we will compare drawings
- Winning team gets bragging rights for eternity



Here's one for comparison...

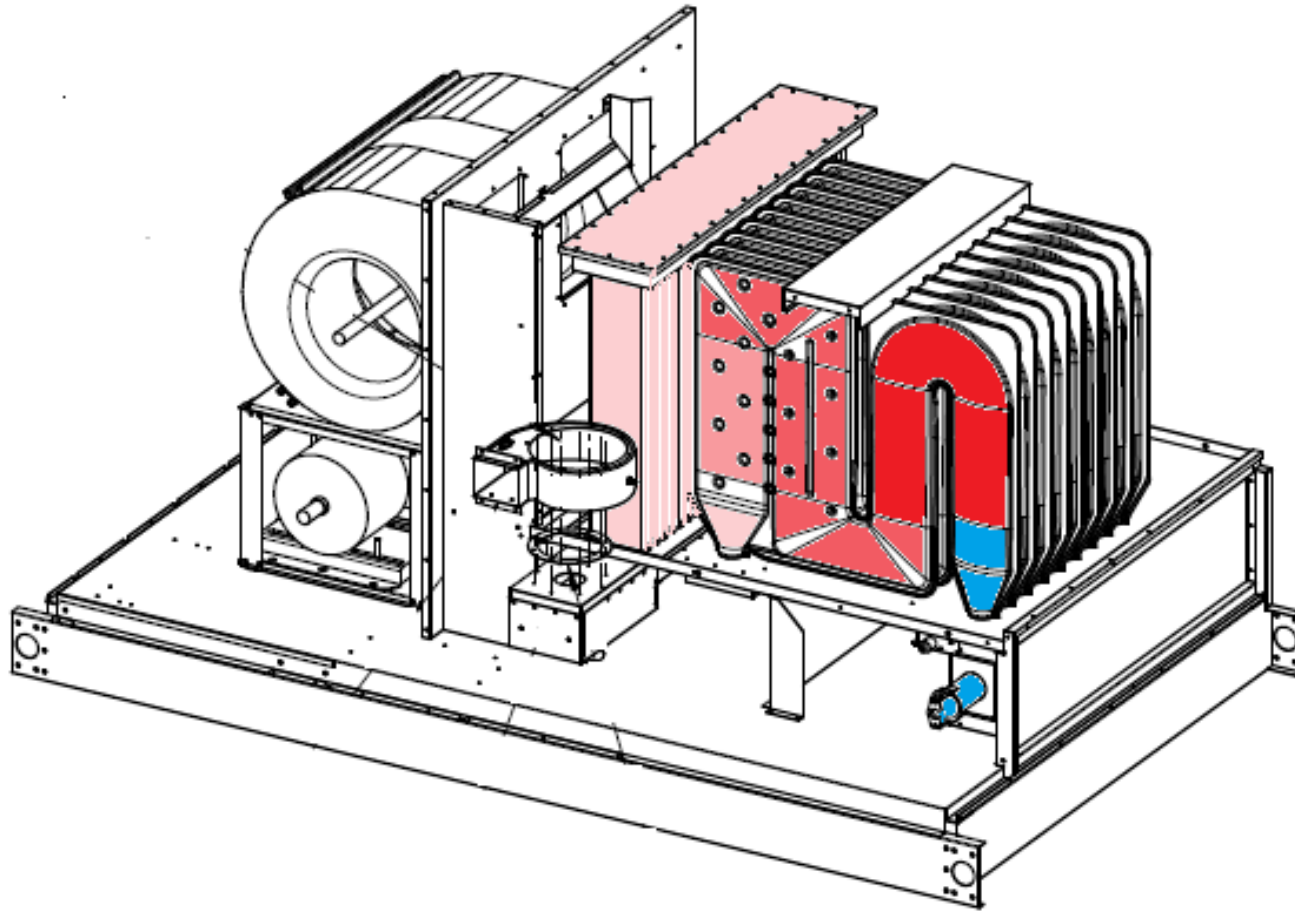


Image Credit: John McKissack, Nortek Reznor RHH Model C-RTU

Where Should a C-RTU be
Installed?

What do these buildings have in common?



Retail



Medical / Healthcare



Gyms

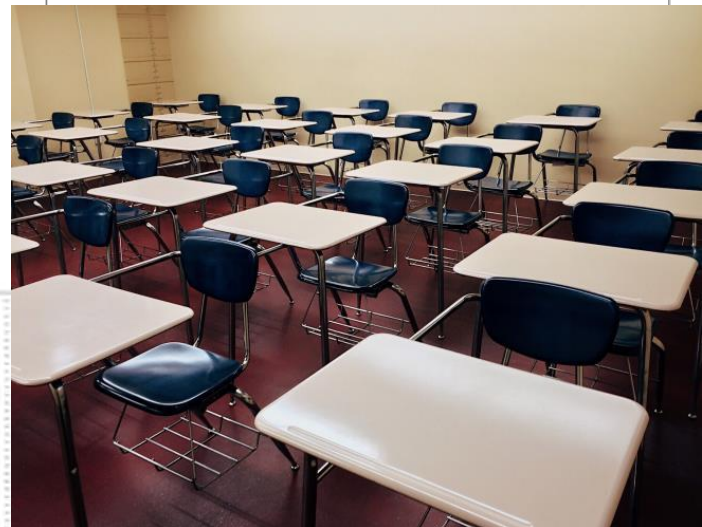
Commercial Kitchens



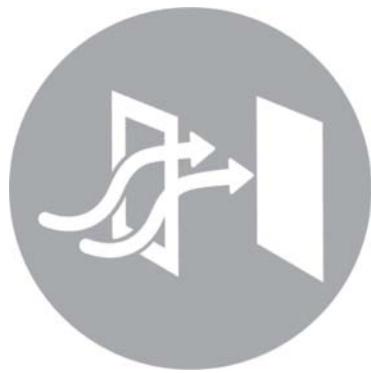
Hotels



Schools / Child Care



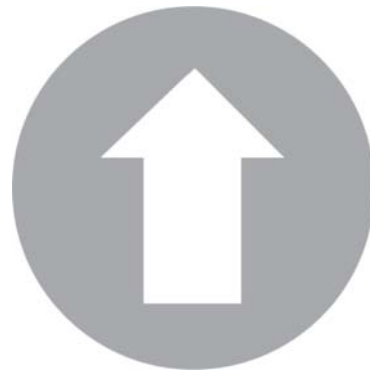
Ideal Building Candidates for C-RTUs



Lots of
ventilation



Long
runtimes



High
heating
loads



Building
has gas



Pop Quiz



A retail store brings in 100% outdoor air for ventilation and utilizes an old gas unit to heat its space 6 months out of the year for its 24/7 operations.

Is this building a good candidate for a C-RTU?

- A. Yes!
- B. Maybe?
- C. No.



Pop Quiz



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- A. **Yes!**
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- C. No.



Pop Quiz



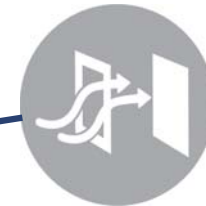
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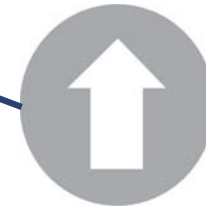
for its 24/7 operations.



Lots of ventilation



Building has gas



Lots of heating



Long runtimes

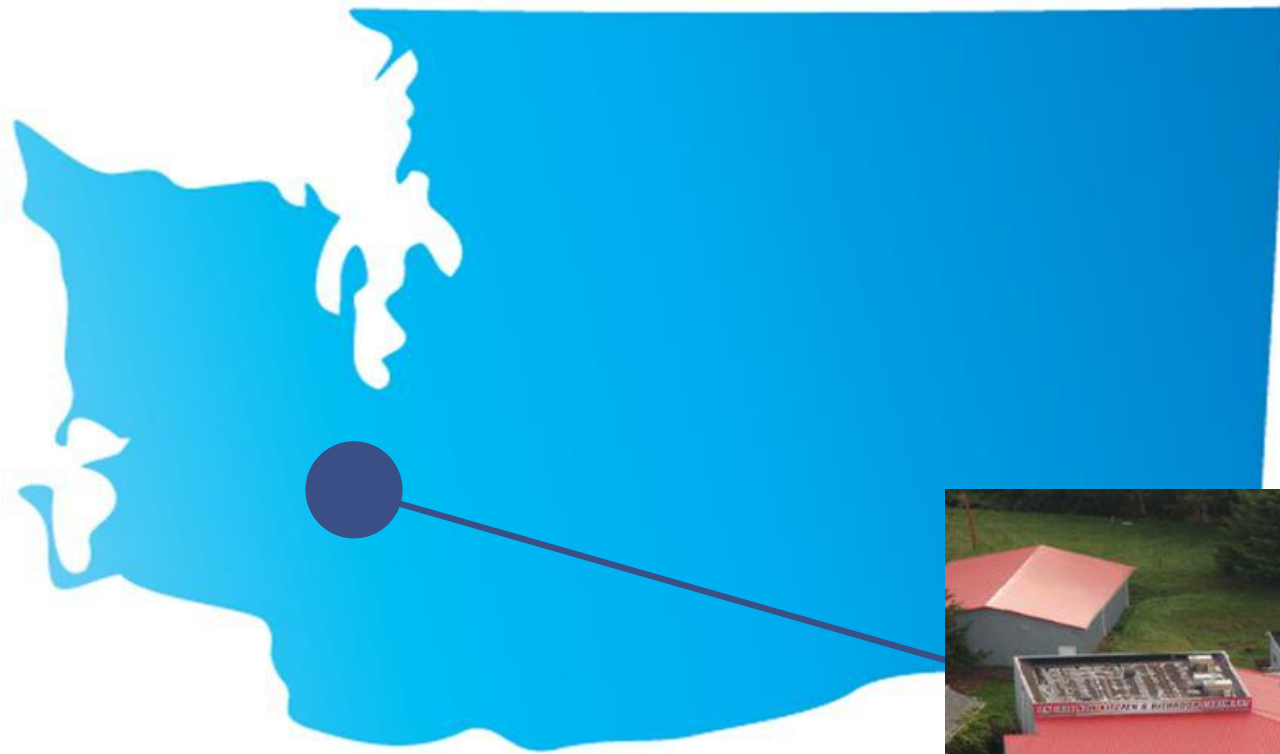


Case Studies

Case Study 1

Retail Showroom in Chehalis, WA

30% Outside Air



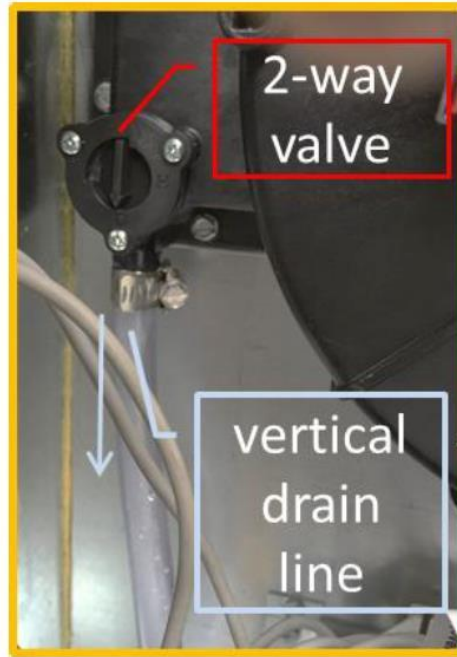
Case Study 1

Retail Showroom in Chehalis, WA

30% Outside Air



Condensing
Gas RTU



Vertical Condensate System Drain
(clear flexible tube with 2-way
valve in vertical vs horizontal drain
position)



Horizontal Flue
(white PVC)

Case Study 1

Retail Showroom in Chehalis, WA

30% Outside Air



Case Study 1

Retail Showroom in Chehalis, WA

30% Outside Air

C-RTU Costs and Paybacks	Full 2015/2016 Heating Season
Annual Gas Savings (therms)	462
Annual Gas Cost Savings (\$)	\$392
Annual Electric Savings (kWh)	4,654
Annual Electric Cost Savings (\$)	\$423
Net Energy Cost Savings (\$)	\$815
Total Incremental Installed Cost (\$)	\$1,787
Payback of Incremental Cost (years)	2.2

Case Study 2

Restaurant in Spokane, WA

100% Makeup Air



Case Study 2

Restaurant in Spokane, WA
100% Makeup Air



Condensing
Gas RTU

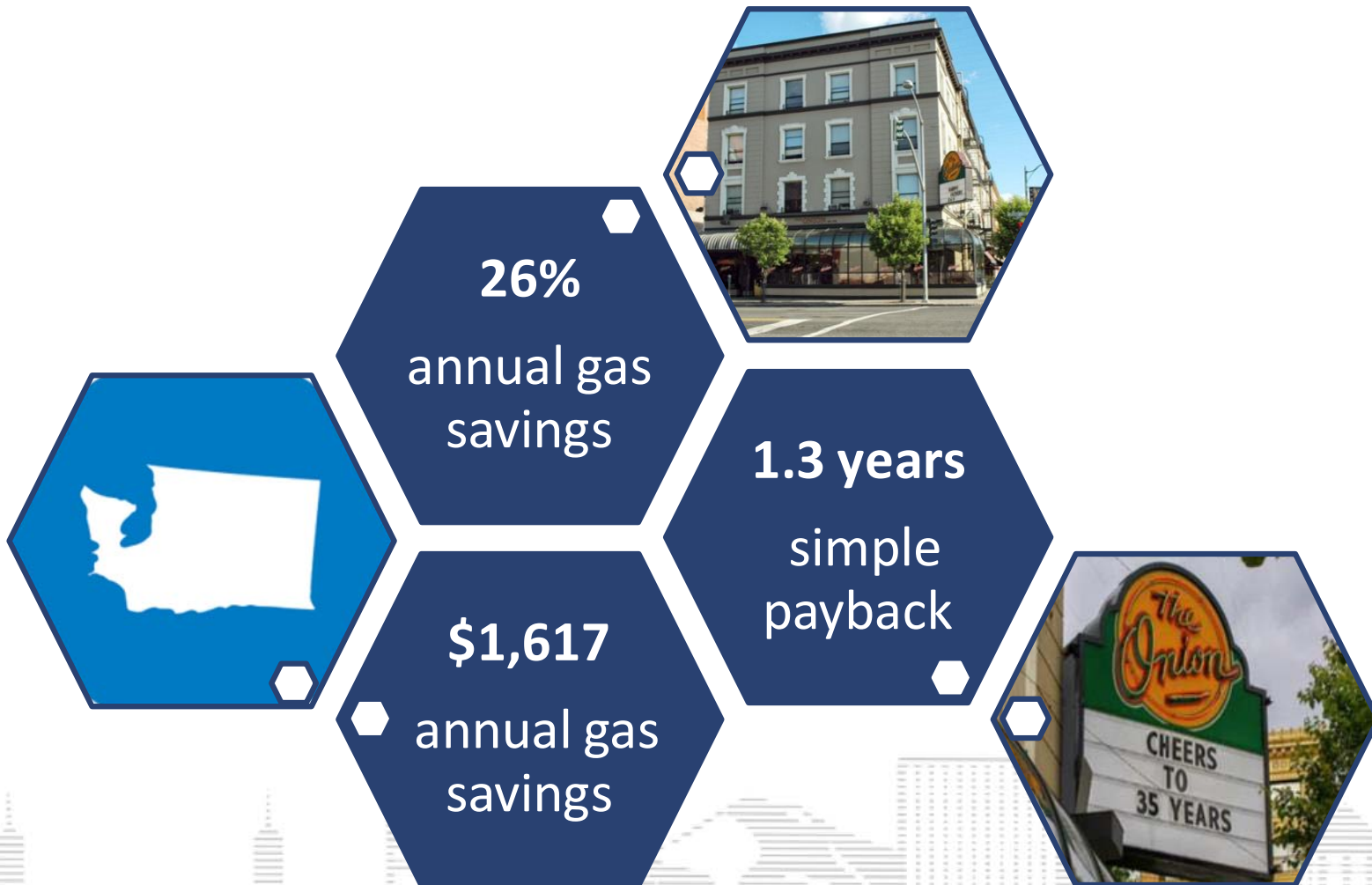


Condensate System
Drain in RTU

Case Study 2

Restaurant in Spokane, WA

100% Makeup Air



Case Study 2

Restaurant in Spokane, WA

100% Makeup Air



"We are very satisfied with the new rooftop unit. I personally spend 30+ hours a week in the kitchen and over the past year we noticed cooler summers and more comfortable winters with the fresh air coming in. For the first time since I've been here, we were even able to shut off the swamp cooler we purchased a few years ago entirely." – Daniel, Kitchen Manager at The Onion Bar & Grill.

"Those secondary heat exchangers really make these units head-and-shoulders above noncondensing units in terms of efficiency. While they require more work on our part with regard to condensate piping and freeze protection, the customer gets a lot more out of the unit. From a strictly energy efficiency standpoint, the potential is there." – Chris, Project Manager at Holliday Heating



Case Study 2

Restaurant in Spokane, WA

100% Makeup Air

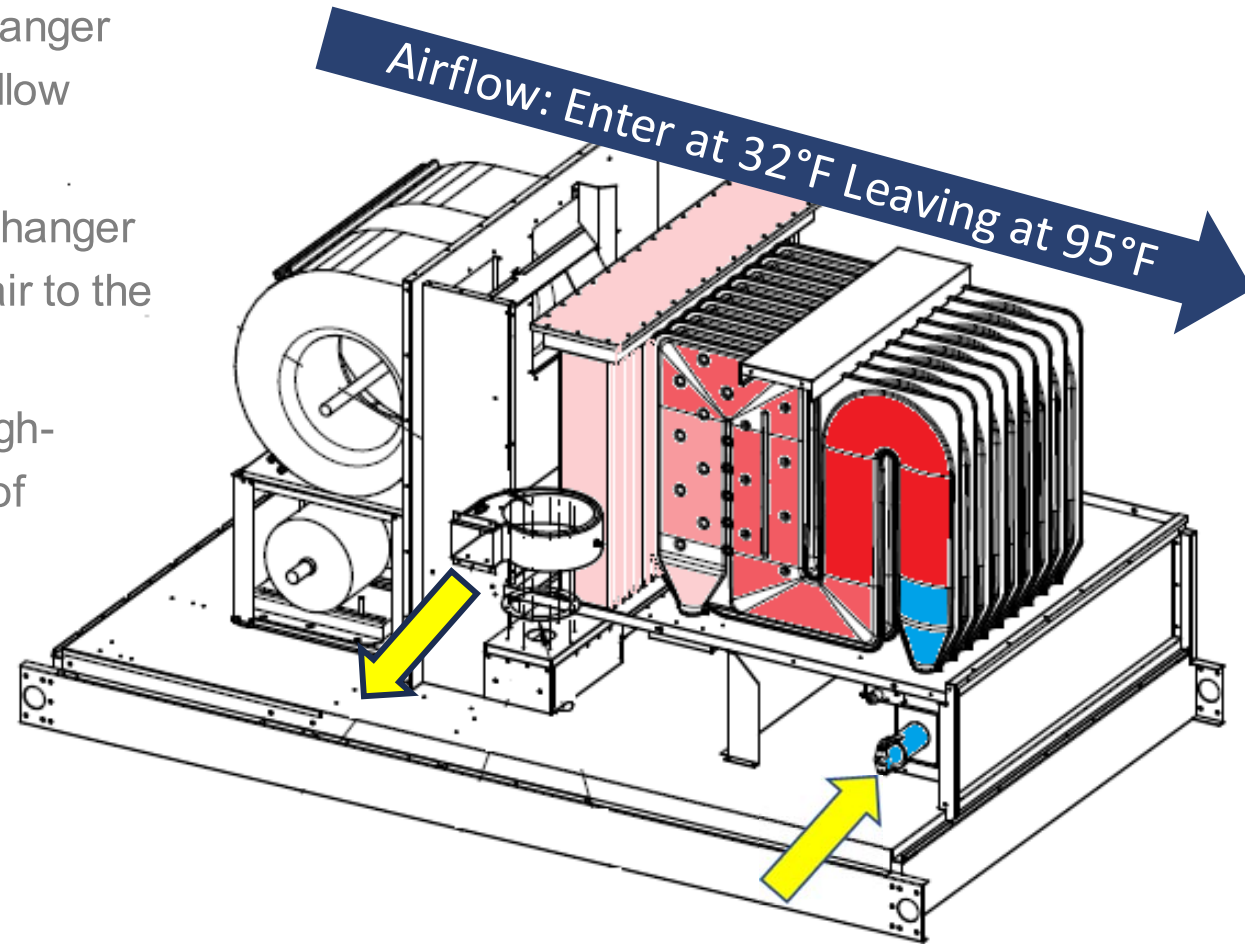
C-RTU Costs and Paybacks	Full 2015/2016 Heating Season
Annual Gas Savings (therms)	1,902
Annual Gas Cost Savings (\$)	\$1,617
Annual Electric Savings (kWh)	3,003
Annual Electric Cost Savings (\$)	\$273
Net Energy Cost Savings (\$)	\$1,890
Total Incremental Installed Cost (\$)	\$2,529
Payback of Incremental Cost (years)	1.3

C-RTU

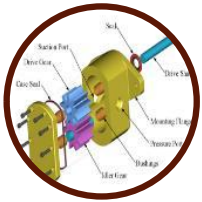
O&M Considerations

Step by Step Operations

- Flame (blue) runs through heat exchanger (pink) until gas leaves out of flue (yellow arrows)
- Fan sends cold air over hot heat exchanger unit it leaves at 95°F, delivering hot air to the space
- Water management plays into the high-efficiency unit, and the temperature of exhaust fumes varies as well:
 - @ 80% Efficiency:
Air Temp is > 200°F,
No Water
 - @ 90% Efficiency:
Air Temp is < 130°F,
Lot of Water



Condensate Management



- Get the piping right
- Install condensate pump for drainage
- Neutralize the condensate before disposing
- Plan for freezing temps and freeze protection
- Organize proper proactive maintenance

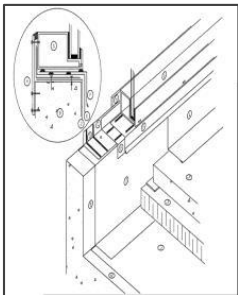
Get the Piping Right



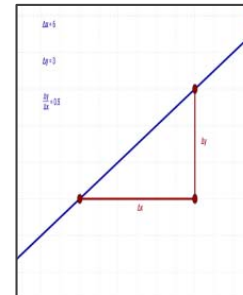
Use PVC/CPVC that meet appropriate ASTM/CSA specifications



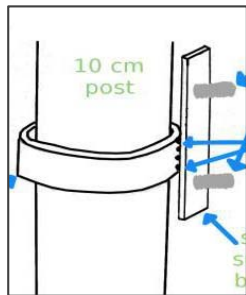
Configure drain lines such that future cleanout and clearing of blockages will not require the drain line to be cut



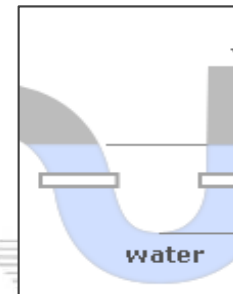
Route drain lines inside curbs and inside the building when possible



Provide a minimum slope of 2% for gravity-driven drainage. This is equal to a slope of 1/4" per foot.

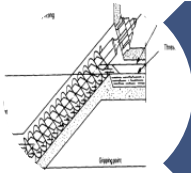


Space support hangers or brackets at a minimum of every three feet along the run of a suspended pipe



Provide a condensate trap (at least 6" high unless using a waterless trap) directly after the C-RTU drain outlet to prevent air from entering the unit. Ensure the trap is in conditioned space to prevent freezing.

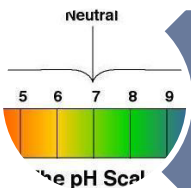
Install Condensate Pump for Drainage



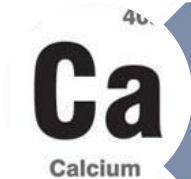
Install a condensate pump where gravity will not sufficiently provide condensate drainage



Ensure that the pump is correctly sized to handle two to three times the volume of condensate that will be produced in order to avoid 100% run times during cold weather



Ensure that the pump is either rated to handle acidic condensate or has integrated neutralization capability



Place the condensate pump up-stream of the neutralizer to avoid calcium deposit build-up in the pump



Install fault detection such that when the pump fails the unit will stop operating

Neutralize the Condensate Before Disposing



Neutralize condensate to a pH of 5 or above before depositing into sanitary or drain lines

Select a neutralizer that is designed to handle the estimated flow rate produced at peak heating conditions

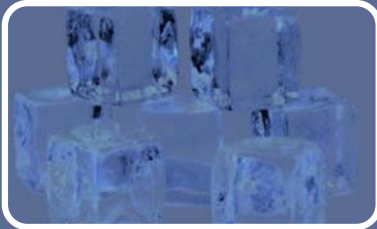


Choose a neutralization media that contains a minimum of 90% calcium carbonate

Plan for Freezing Temps & Freeze Protection



Install outdoor condensing equipment on a curb. Slab mounting is not recommended.



Install frost free traps immediately after the condensing unit drain output.



Install heat trace along the pipe where exposed to outside temperatures. In extremely cold areas install heat trace even when piping is routed inside the curb.



Do not drain the condensate onto the roof area.

Organize Proper Proactive Maintenance



Scheduled preventative maintenance is critical. Failure to regularly service neutralizers, pumps, and drain lines can lead to system failure and building damage.



Replace neutralization media annually to avoid blockage from build-up of dissolved media in piping.



Inspect and clean condensate pumps. Ensure that all calcium deposits are removed.

Curbs & Adapters

- Each brand of RTU has a different style/version of curbs. When a new RTU is installed, a curb “adapter” is sometimes needed so the unit fits on the building.
- **KEY POINT TO REMEMBER** – The condensate piping has to route properly through the curb otherwise it can freeze and the unit will break.
- Make sure the installer routes condensate drain lines inside curbs and inside the building when possible.



*The edge at the bottom of RTUs? That's a **curb**.*

★ Pop Quiz ★

How do you make sure the condensate in your C-RTU doesn't freeze?

- A. Get the piping right
- B. Install condensate pump for drainage
- C. Neutralize the condensate before disposing
- D. Plan for freezing temps and freeze protection
- E. Organize proper proactive maintenance



★ Pop Quiz ★

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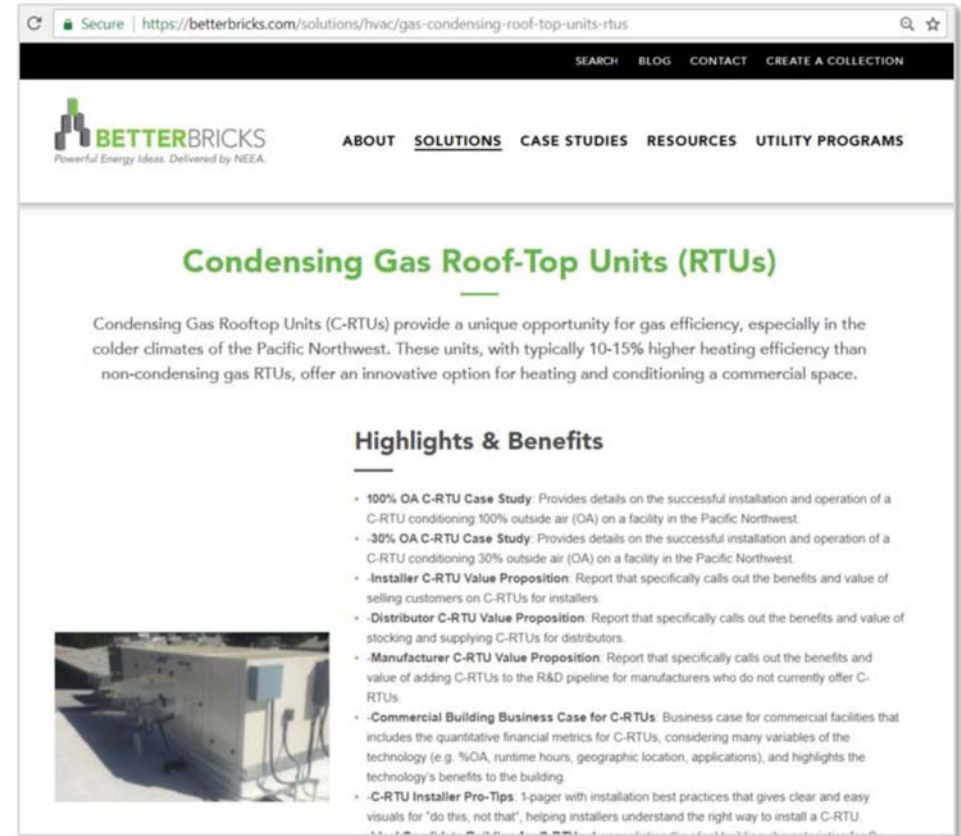
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Next Steps

Next Steps

- Pilot a C-RTU with us!
- Contact Christine Riegler with questions or feedback
- Download and share resources from the [BetterBricks C-RTU](https://betterbricks.com/solutions/hvac/gas-condensing-roof-top-units-rtus) site
- Ask your contractor and engineer teams about C-RTUs for commercial projects



<https://betterbricks.com/solutions/hvac/gas-condensing-roof-top-units-rtus>

Contact Information



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Thank you!