

Frequently asked questions about CBECC-Com modeling for California's 2019 Building Energy Efficiency Standards, Title 24, Part 6.

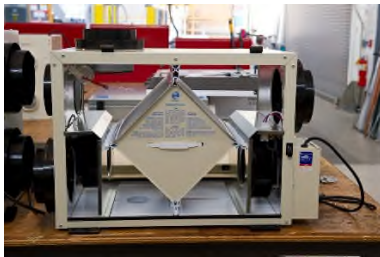


Image credits: Left: HRV unit - Photo by Dennis Schroeder, NREL 20186; Right: CBECC-Com software screenshot

## Q: How is heat recovery ventilation (HRV) modeled for high-rise residential buildings?

### Why HRV?

- Common way to achieve balanced ventilation in dwelling units
- Provides means to temper outside ventilation air through heat recovery
- Compatible with commonly used zonal systems that provide only heating and cooling (ex: heat pumps, VRF)
- Can use in-unit HRV or a central DOAS (dedicated outside air source) system
- Can also be used with HVAC systems in commercial buildings

### How to model HRV?

- Model a zonal system as *Ventilation Only*
- Select Ventilation Type as *Heat Recovery*
- Enter Rated Flow Capacity and Rated Power
- Select Certification Method and enter rating information
- Specify a separate zonal system for heating or cooling
- Under Thermal Zone data, assign ventilation system as Priority 1 and the Heating and Cooling System as Priority 2

**Heat Recovery Ventilators** – are units that provide tempered ventilation air, with balanced ventilation to each dwelling unit in a high-rise residential (HRR) building. The building can either have an HRV local to each dwelling unit, or a central dedicated outside air system (DOAS).

**Energy recovery ventilators (ERV)** – are a type of HRV unit that exchanges not only heat but also moisture between the supply and exhaust streams. While these can be used, they are more common in hot and humid climates, and less desirable in areas where moisture exchange between indoor air and colder, dry winter outside air is not desirable.

### From Ratings... to Model

There are two ratings procedures for HRV and ERV units, specified by the Heating and Ventilating Institute (HVI) and the Air Conditioning Heating and Ventilating Institute (AHRI). The HVI rating applies mainly to residential-scale units with airflows of 300 cfm or less, while AHRI rating applies to commercial scale units. Units can be rated with either Sensible Recovery Efficiency (SRE) or Apparent Sensible Efficiency (ASE). The SRE metric incorporates both fan efficiency and heat recovery efficiency into a single metric, while compliance software captures each of these performance effects distinctly. The ASE metric describes the sensible heat recovery efficiency and should be used as an input in the compliance model. Performance of HRV's is indicated by both the Apparent Sensible Effectiveness (ASE) and the rated fan power at the design airflow (W or W/cfm).

## Key Features & Limitations

### Why is this change important?

- Heat recovery ventilators are a common method to ensure balanced ventilation between supply and exhaust airflows. While exhaust only ventilation is possible under the code, the use of HRVs in each unit ensures balanced ventilation.
- Allows for adjusted compliance credit for HRV in dwelling units, reflecting performance. Energy performance depends upon both the climate, the pressure drop across the unit, and bypass and control capabilities.
- Impacts all newly constructed midrise and high-rise residential buildings at or above 4 stories that include dedicated ventilation for each unit.

### CBECC-Com Performance Baseline

The *standard design* or reference *baseline* has the below attributes. Refer to the published Energy Commission document “Nonresidential ACM Reference Manual” for a complete specification of the ruleset for the performance compliance approach.

- The standard design has ventilation type (supply only, exhaust only, or balanced ventilation), matching the proposed design with no heat recovery and a fixed fan power.
- HRV units may provide a compliance credit or penalty, depending on performance. The compliance credit is restricted to airflows up to 150% of the minimum required ventilation airflow.
- Proposed building energy models with HRV receive limited credit for HRV and ERV devices. The rated system performance is devalued slightly to account for real-world performance.

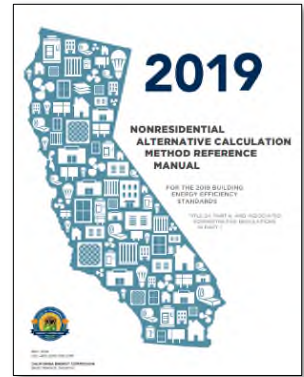
## HRV Inputs in CBECC-Com Software

### HRV Specific Inputs:

#### HRV Inputs from HVI Ratings

The following inputs are entered to the zone system data to characterize the HRV system performance. Different performance data is required for systems that use the AHRI rating instead of the HVI rating procedure.

- Heat Exchanger Type: either Plate for a Sensible-Only heat exchanger or Wheel for an Energy Recovery Ventilator (Enthalpy).
- Rated Flow Capacity: flow rate through HRV in cfm. Typically matches ventilation provided.
- Rated Power: power rating at design airflow.
- Heat Recovery Effectiveness: (for plate type): apparent sensible effectiveness as a fraction, between 0 and 1.
- Heat Recovery Effectiveness: (for wheel type): recovery effectiveness between 0 and 1).
  - Heating: Sensible / Latent / Total
  - Cooling: Sensible / Latent / Total



### 2019 Nonresidential Alternative Calculation Method Reference Manual

Find the Manual here:  
[energy.ca.gov/2019publications/CEC-400-2019-006/CEC-400-2019-006-CMF.pdf](https://energy.ca.gov/2019publications/CEC-400-2019-006/CEC-400-2019-006-CMF.pdf)

### Additional Resources:

CalBEM: [calbem.ibpsa.us/](http://calbem.ibpsa.us/)

CBECC-Com: [bees.archenergy.com/](http://bees.archenergy.com/)

Energy Code Hotline:  
1-800-772-3300 (Free) or  
[Title24@energy.ca.gov](mailto:Title24@energy.ca.gov)

CEC Online Resource Center:  
[energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/online-resource-center](https://energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/online-resource-center)

2019 NR Compliance Manual:  
[energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/2019-building-energy-efficiency-1](https://energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/2019-building-energy-efficiency-1)

Energy Code Ace:  
[energycodeace.com](http://energycodeace.com)

## HRV with AHRI Ratings Specification

For units with AHRI ratings, there are a few additional inputs to the model. Sensible effectiveness ratings for heating and cooling mode are entered separately. If the unit is an energy recovery ventilator, latent effectiveness is also entered. There is an option for these units to include a bypass of the heat exchanger when outside air conditions are suitable for direct ventilation. The rated power and flow capacity are also entered for the heat recovery device.

The screenshot shows the 'Building Model Data' window with the 'Zone System Data' tab selected. The 'Currently Active Zone System' is 'ZoneSystem 1 Vent'. The 'Name' is 'ZoneSystem 1 Vent', 'Type' is 'VentilationOnly', 'Status' is 'New', 'Vent. Type' is 'HeatRecovery', and 'Count' is '2'. The 'Heat Exch. Type' is 'Plate'. The 'Rated Flow Capacity' is '179 cfm', 'Rated Power' is '144 W' and '0.800 W/cfm'. The 'Total Zone Vent. Flow' is '179 cfm' for both 'Design' and 'Minimum Req.'. The 'Heat Recovery' section is set to 'AHRI' certification method, 'Total' recovery type, and 'No' bypass. The '100% Flow' table shows: Heating: Sensible 0.69, Latent 0.54, Total 0.64; Cooling: Sensible 0.69, Latent 0.43, Total 0.69. Other settings include 'Temp. Control: None', 'Fixed Supply Temp.: °F', 'Supply Temp. Sch.: - none -', and 'Defrost Control: None', 'Def. Temp.: °F'. An 'OK' button is at the bottom right.

Image: CBECC-Com software screenshot showing AHRI settings for HRV code compliance simulation

### For More Information

More advanced technical and design application information about HRVs is available at the following external websites. Please note that CalBEM does not endorse any company or product manufacturer.

#### Efficiency First Solutions:

<https://efficiencyfirstsolutions.com/ventilation/what-are-hrvs/>

#### Small Planet Supply:

<https://www.smallplanetsupply.com/small-planet-blog/2020/4/3/hrvs-and-how-they-help-achieve-californias-title-24-code-compliance#:~:text=HRV%20IMPACT%20IN%20MULTIFAMILY%20PROJECTS&text=The%20new%20code%20further%20requires%20balanced%20ventilation%20in%20all%20multifamily,are%20well%20suited%20to%20meeting>

#### Green Building Advisor:

<https://www.greenbuildingadvisor.com/question/comparing-hvi-and-ahri-test-results-for-ervs>