

HVAC: Room Air Conditioners

A room air conditioner (RAC) cools the air, removes humidity, circulates air, filters out dust, and in some cases also provides heating. Although most RACs are designed for the residential market, about 20 percent of commercial buildings are cooled by them as well. Building operators and managers purchase RACs for one of several reasons:

- They want to cool selected rooms in an otherwise uncooled building.
- It isn't feasible to install central cooling in their building.
- They want to completely isolate one room from another (to avoid mixing air between rooms, so that each room has complete controls autonomy, so that each room can be billed separately, or all of the above).
- They want to replace a failed RAC.

Commercial and industrial RAC consumers often waste money by not paying attention to efficiency ratings. New RACs in the U.S. range from about \$200 to over \$1,000 and have energy efficiency ratios (EER) that range from 8.0 to 12. More efficient units are often more expensive than less efficient units, but not always. Smart consumers can save money in the long run by accounting for both first cost and operating cost, and then selecting the unit with the lowest lifecycle cost.

What Are the Options?

Most room air conditioners in North America are installed in windows. Basic window models are used in ordinary, double-hung windows up to 40 inches wide and can be installed by the user.

Special-application models are cooling-only units used in narrow, vertical windows. Installation usually requires removal of a window panel.

Through-the-wall models are installed in an outside wall, usually during construction or remodeling, and generally require an experienced installer.

Some manufacturers, including Carrier and Fedders, offer portable units that roll on wheels and cool a single room (up to about 450 square feet in some cases). The exhaust hose vents out a window equipped with the manufacturer's sash kit.

How to Make the Best Choice

To find the most cost-effective RAC for your needs, follow these steps:

Air-Conditioning Terms

Here are some terms you may encounter as you're comparing models.

Capacity indicates the amount of cooling a unit can produce and is expressed in British thermal units per hour (Btu/h) or in kilowatts (kW). Models on the North American market range from 4,200 to 35,000 Btu per hour.

Efficiency in the U.S. and Canada is designated by an energy efficiency ratio (EER), which is calculated by dividing Btu per hour (the measured cooling capacity) by watts (electricity input).

Coefficient of performance, another measure of efficiency used in some nations, is the ratio of the rate of heat removal to the rate of energy input.

1. Select the right size. An undersized unit won't be able to cool a large room, while an oversized unit will cycle on and off frequently, which increases electricity consumption and decreases the unit's overall efficiency. An oversized unit may also cycle off too quickly to extract sufficient humidity from the air. You can calculate appropriate size yourself, have an HVAC contractor do the calculation for you, or use the rules-of-thumb chart that follows (Table 1).

3. Determine which unit is most cost-effective. Although you'll want an efficient air conditioner, you may not need the most efficient one on the market, especially if you live in an arid climate with few months of cooling needs. Consider both the initial price and annual operating costs (see sidebar) as you compare models so you can determine the lifecycle cost. If the annual operating cost savings add up in a reasonable number of years to the additional cost of the more efficient unit, the more efficient unit will be the better buy.

Here are some other issues to keep in mind as you're shopping:

- Look for an "energy-saver" switch. The energy-saver switch causes the air conditioner's fan and compressor to cycle on and off together, reducing energy use.
- Verify that you'll get good moisture removal if you live in a humid climate. Manufacturers label the dehumidifying capacity of room air conditioners according to moisture removal in pints per hour. An HVAC contractor can calculate how much dehumidifying capacity you'll need. Be aware that increased efficiency can decrease dehumidification capacity.

Calculating Annual Operating Costs

To figure out which of two room air conditioners is the better buy, calculate the annual operating cost for each unit: Multiply their capacity (in Btu/hr) times your local electric rate (\$/kWh) times the number of operating hours, and divide by the efficiency (EER) and 1,000 (converting watts to kilowatts). If you don't know the annual operating hours, refer to the map in Figure 2.

Table 1: Capacity rules of thumb for room air conditioners

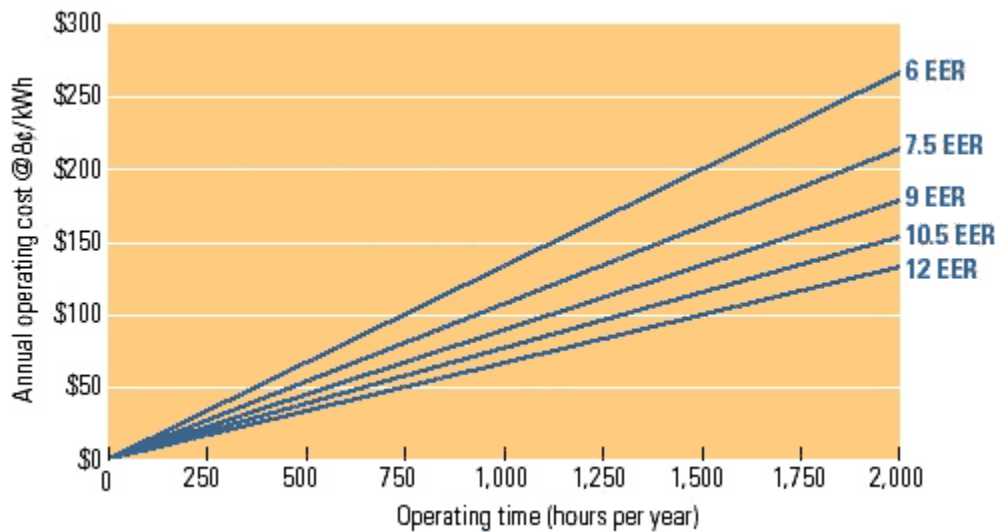
Rules of thumb for estimating air conditioner size vary by manufacturer. This example, from Carrier, includes the following suggestions for adjustments: If a room is heavily shaded, reduce capacity by 10 percent; if the room is very sunny, increase by 10 percent; and if using the unit in a kitchen, increase capacity by 4,000 Btu per hour.

Room area (ft ²)	Capacity (Btu/h)
100 to 150	5,000
150 to 250	6,000
250 to 300	7,000
300 to 350	8,000
350 to 400	9,000
400 to 450	10,000
450 to 550	12,000
550 to 700	14,000
700 to 1,000	18,000

Source: Platts

Figure 1: Operating cost for 10,000 Btu per hour room air conditioner

Other factors being equal, the higher the EER, the lower the operating cost. In addition, savings from higher-efficiency room air conditioners are much more substantial where operating hours are longer.



Source: Platts

What's on the Horizon?

All RACs sold in the U.S. after October 1, 2000, will have to comply with new Department of Energy efficiency standards, which will reduce average energy use by about 10 percent. For the most commonly sold models, efficiency will increase from their current minimum standard of 9.0 EER to a new minimum of 9.8 EER. Meanwhile, look for efficiencies to increase slowly as manufacturers continue to incorporate better compressors, heat exchangers, and fan motors into their products.

