GREEN SEAL'S
Choose GREEN REPORT

SUMMER 1999

ROOM AIR CONDITIONING

- Overall, air conditioners in the US use over 50% of total electricity during summer usage peaks.
- Each year, the energy needed for residential room air conditioning in the U.S. is equivalent to the crude oil transported by 415 supertankers.
- Increasing residential room air conditioner efficiency by 20% would eliminate the need for 49 supertankers of oil.

The heat of the summer is simmering and the air conditioners around the country are going full swing. Approximately 20% of the country's commercial and 30% of the residential buildings use room air conditioners (RACs) as their current cooling method. This does not even include the thousands of packaged terminal air conditioners (PTACs) in use in hospitals, apartments, and hotels around the country. During the hottest part of the summer air conditioners can put a severe strain on the country's power plants.

During peak air conditioning use in the summer, electrical facilities need to produce greater amounts of electricity and therefore emit increased amounts of pollutants.

Coal is the most common fossil fuel burned for production of electricity and is known to release dangerous particulate pollutants. The most common pollutants are carbon monoxide, carbon dioxide, nitrogen oxides, hydrocarbons and various heavy metals. For this reason, manufacturers, the electrical production industry and the environmental community are all encouraging the procurement of high efficiency air conditioning units. Not only do these units cut down on wasted energy and pollution, but they also reduce usage costs by consumers.

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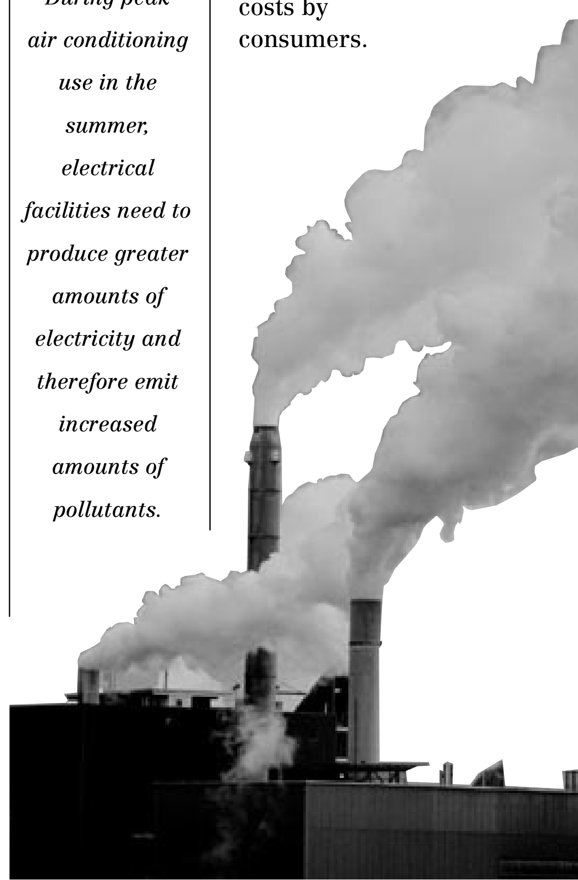

This *Choose Green Report* focuses on air conditioners which can be easily placed in an office space, hotel room, school, hospital or private residence. The two types of air conditioners reviewed are room air conditioners and packaged terminal air conditioners. PTACs are commonly found in hotel rooms and usually can provide both heating and cooling to the rooms by using centrally conditioned air or water. When reviewing these air conditioners Green Seal addressed the issues of cooling capacity, energy efficiency ratio, sensible heat ratio and refrigerant.

Getting Cool

Air conditioners use a combination of coils, refrigerant, compressor and fans to transfer heat from the inside to the outside of a building. A compressed chemical refrigerant absorbs the heat from the inside air and expands. This refrigerant is then pumped through a closed loop system to an outside compressor. It compresses the refrigerant and causes a large increase in temperature. The hot refrigerant then moves to a coil where a fan blows air over the coil and causes the refrigerant to transfer the trapped heat to the outside air. Some heat pump air conditioners have the ability to reverse the process. By absorbing heat from the outside air and transferring it to the inside air they provide heat during the cold season.

Choosing the Right Air Conditioner

One of the easiest ways to avoid inefficient cooling is to determine exactly how much ***cooling capacity*** you really need. This number is commonly expressed in BTU/hour units. An air conditioner that is too small for an area may run continuously without ever cooling effectively, while one that is too large for an area will continuously cycle on and off and actually increase energy usage. An oversize unit will also be unable to control humidity effectively.

Not only is it important to consider the location, size and other characteristics of the room, it is equally important to choose an air conditioner which has the highest efficiency available.

A good method to estimate the amount of cooling you need is shown in Table 1 below. This number can be affected both positively and negatively by some of the factors listed below. Several manufacturers and organizations have developed charts to help incorporate these characteristics into your procurement decision. Keep these characteristics in mind and mention them when purchasing your air conditioner.

Room Direction — Rooms that face either mostly south or west, or have many windows, gain the greatest amount of heat from the sun. These rooms will need an air conditioner with a greater cooling capacity.

Climate — Buildings in cooler and less humid northern climates need less cooling capacity than those in warmer, more humid climates.

Higher Level Rooms — Another important factor when calculating cooling capacity is what type of room is above the one to be cooled. Is it an occupied room that is cooled, or will it remain un-cooled?

TABLE 1:

CALCULATING COOLING CAPACITY

A good rule of thumb to estimate the amount of cooling capacity you need is to multiply the area of floor space (ft^2) by a factor of 10 and add 3,000.

For example, the amount of cooling capacity for a 20-foot by 20-foot room would be:

$$[400\ ft^2 \times 10] + 3{,}000 = 7{,}000\ \text{Btu/hour}$$

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Printed on Green Seal-certified Mohawk Satin Cool White Recycled paper, 30% postconsumer content

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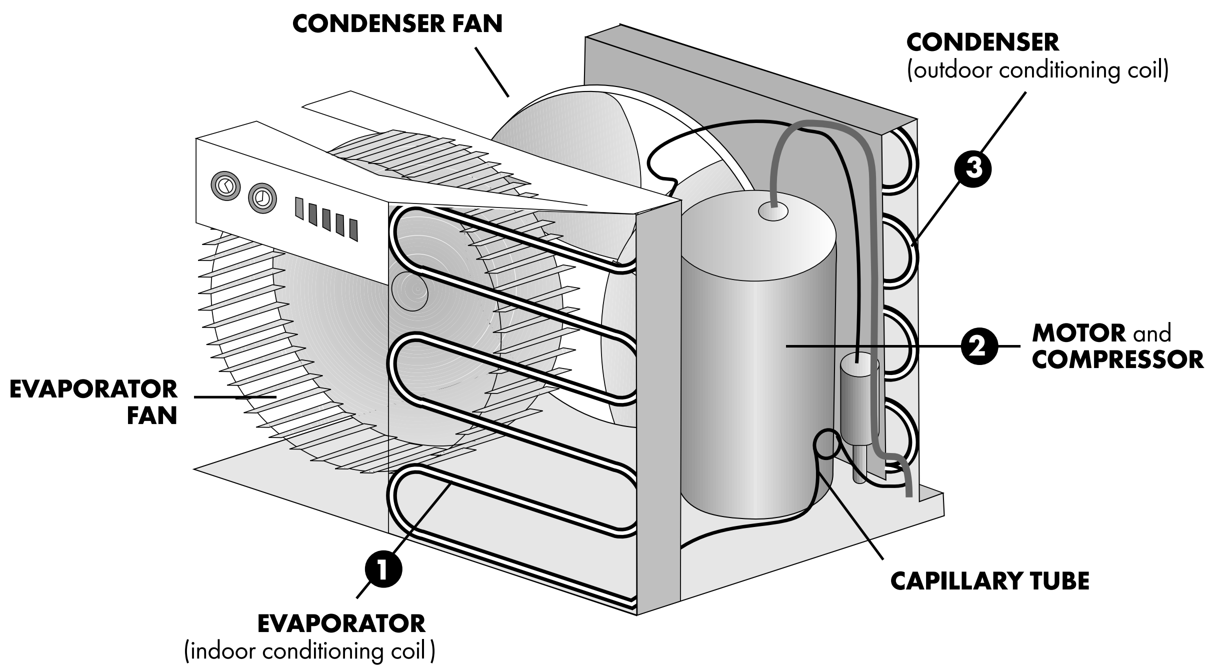
HOW A ROOM AIR CONDITIONER WORKS

A room air conditioner performs several functions: it cools the air and removes humidity; it circulates air and filters out dust; and in some cases it also provides heating. The diagram below shows how a RAC operates. A North American room air conditioner consists of components encased in a cabinet. This cabinet is segmented into indoor and outdoor sides, which are separated by an insulated divider wall designed to reduce heat transfer and noise. The evaporator and evaporator fan are on the indoor side. The outdoor-side components are the compressor, condenser, capillary tube, motor, and condenser fan.



1 A room air conditioner provides cooling by drawing warm air from the space or room over the **evaporator** (indoor coil). The air gives up its latent and sensible heat as it passes over this coil. Humidity is reduced, since air is cooled below its dewpoint, and water precipitates out of the air. Cooled, drier air then is delivered back to the space or room by the evaporator fan.

2 The **compressor** raises the pressure of the refrigerant, which increases its temperature to a level higher than that of the outside air.

3 Heated refrigerant vapor flows on to the **condenser** (outside coil), where it is cooled by a fan blowing outside air over the coils. When cooled, the refrigerant condenses to a high-pressure liquid. The resulting liquid refrigerant flows through a capillary tube where its pressure and temperature are reduced. The refrigerant then re-enters the **evaporator** – and the cycle repeats.

The **motor** operates both the evaporator fan and the condenser fan.

The graphic and description above are provided courtesy of E SOURCE, an information services company providing organizations with unbiased, independent analysis of retail energy markets, services and technologies.

Is the room above it a storage area that is insulated or un-insulated? Or perhaps the room to be cooled is directly below a hot roof.

Capacity — Lastly, consider the number of people that will occupy the space on a regular basis. A larger number of people in an area will need a greater cooling capacity to reach a comfort level.

Not only is it important to consider the location, size and other characteristics of the room, it is equally important to choose an air conditioner which has the highest efficiency available. In the past the most efficient machines were small because these machines had a higher ratio of coil size to capacity. Most manufacturers were limited by the amount they could increase the coil surface size and maintain a relatively small unit. However, recent advances in cooling technology have changed the efficiency trends and, as this *Choose Green Report* shows, any size air conditioner can be found with a high efficiency ratio!

The ***Energy Efficiency Ratio (EER)*** is the ratio of the cooling output divided by the power consumption; it is commonly expressed in BTU/Watts x hour units. The EER is probably the most important quantitative number in through-the-wall type of air conditioning. Any off-season energy usage is not included in EER calculations as it is in calculating efficiency in central cooling systems. By choosing an air conditioner with a high energy efficiency ratio you will be pleasantly surprised by the drop in your electricity bill. In fact, *Consumer Reports* found that a room air conditioner with an EER of 11 will cost 18 percent less to operate than one with an EER of 9!

TABLE 2:

GREEN SEAL AIR CONDITIONER EFFICIENCY GUIDELINES

TYPE	SIZE (BTU/HR)	EER
No Reverse Cycle	< 6,000	10.0
	6,000-7,999	10.0
	8,000-13,999	10.0
	14,000-19,999	10.5
	>=20,000	9.0
Reverse Cycle	All Sizes	9.5

Green Seal has developed recommendations for room air conditioner energy efficiency ratios. These recommendations can be found in Table 2 and any air conditioner recommended in this *Choose Green Report* meets or exceeds the efficiency level for its class. Choose a cooling unit which meets or exceeds these recommendations.

When faced with the challenge of achieving higher EERs some manufacturers increased their efficiency by using warmer and larger evaporators. This reduced the ability of the air conditioner to dehumidify the air efficiently. In effect, the highest efficiency air conditioners could actually use more energy than lower EER units because they have to run longer. ***The Sensible Heat Ratio (SHR)*** was developed to put a limit on the amount of energy a unit could use to cool the air. When cooling air two actions must be taken: the cooling of the air and the dehumidification of the air. The act of cooling the air is commonly referred to as the sensible effect. The act of dehumidifying the air is the latent effect and consumes much larger amounts of energy. The SHR is the ratio of the air conditioner's sensible cooling capacity to the sensible cooling plus the latent cooling capacity. Green Seal recommends that the SHR on any unit not exceed 0.78 (78%); this limits the amount of energy the unit can use to achieve both cooling and dehumidification. SHR can be a significant issue for facilities that commonly have many PTACs operating in one building. However, since many manufacturers do not calculate the SHR for room air conditioners, it will be difficult for residential RAC users to find this information.

Refrigerant — In the past the most common refrigerant used in stationary air conditioners was an ozone depleting group of chemicals called Chlorofluorocarbons (CFCs). Currently another group of chemicals, Hydrochlorofluoro-carbons (HCFCs), is used as the replacement for the former CFC refrigerants. HCFC-22, also known as R-22, is the most common refrigerant used in room air conditioners. It also has some ozone depleting effect but it is 1/20th that of its traditional CFC counterpart and is rated at an ozone depletion ratio of 0.05. HCFC-22 will be available in new equipment until 2010 and will be totally phased out by 2020. While HCFC-22 is the most common refrigerant on the market today, the future will bring less damaging options which should be chosen when available.

Reverse Cycle — Many consumers assume that air conditioners are simply cooling units. However, there is a section of the air conditioning market that manufactures units that utilize heat pumps to provide mild heating through a reverse cycle process. Because the process of absorbing heat from the air and transferring to the other side of the wall can simply be reversed, it can easily be seen why these units are referred to as reverse cycle. While these units are useful in temperate climates, their heating effect is limited and should not be used in areas that commonly endure sustained temperatures below 32°F. In some cases, manufacturers offer consumers the option of electric heat to supplement. Units that are dedicated to cooling often have higher efficiencies than reverse cycle units. Therefore, a dedicated system should be chosen when appropriate to environmental conditions. However, if a reverse cycle air conditioner is necessary be sure to purchase one with a high EER.

WHAT TO LOOK FOR IN AN AIR CONDITIONER

- ❑ A cooling capacity that is appropriate to the size and other conditions of the room to be cooled.
- ❑ An Energy Efficiency Ratio (EER) that meets or exceeds the Green Seal recommendations.
- ❑ A Sensible Heat Ratio (SHR) no greater than 0.78 (for PTACs or when available for RACs)

HOW MUCH ENERGY ARE YOU USING?

Use the equation below to calculate how much energy you are currently using— and how large your savings would be if you replaced your old air conditioner with a higher efficiency air conditioner.

$$\textbf{ANNUAL ENERGY USE} = \frac{\textbf{CAPACITY} \times \textbf{OPERATING TIME}}{\textbf{ENERGY EFFICIENCY RATIO}}$$

For example: A person running a room air conditioner in Orlando, Florida, has an average operating time of 1500 hours each year. If the air conditioner has a capacity of 15 kBtu/hour (15,000 Btu/hour) and an Energy Efficiency Ratio (EER) of 7 Btu/hour per Watt, then the equation would look like this:

$$\textbf{ANNUAL ENERGY USE} = \frac{15 \text{ kBtu/hour} \times 1500 \text{ hours}}{7 \text{ Btu/hour per Watt}} = \textbf{3214 kWh}$$

At an average charge of $0.10 per kWh, the annual cost to run the air conditioner (for 1500 hours) would be $322. If the same consumer upgraded to an air conditioner with an EER of 11, *annual energy use* would drop to 2045 kWh — and the annual cost to run the machine would drop to $205, a savings of more than 36%!

Question: How much would you save if you bought a more efficient air conditioner?

Measurement terms: Kwh = KiloWatt-hour; kBtu = Kilo British Thermal Unit

Recommended Room Air Conditioners

MANUFACTURER	PRODUCT NUMBER	TYPE	CAPACITY (BTU/h)	EER	NOTES
Amana	5M11TA	No Reverse Cycle	5,100	10.0	Voltage: 115V
Friedrich	SQ05J10	No Reverse Cycle	5,600	10.0	Voltage: 115V
GE	AMH06LA	No Reverse Cycle	5,800	10.0	
Friedrich	YQ06J10	Reverse Cycle	6,200	10.0	Voltage: 115V
Amana	7M11TA	No Reverse Cycle	6,600	10.0	Voltage: 115V
Friedrich	SQ06J10	No Reverse Cycle	6,600	10.0	Voltage: 115V
Friedrich	SQ07J10	No Reverse Cycle	7,100	10.3	Voltage: 115V
GE	AGH08FA	No Reverse Cycle	7,800	10.0	
Friedrich	SQ08J10A*	No Reverse Cycle	8,000	10.0	Voltage: 115V
Friedrich	SS08J10A	No Reverse Cycle	8,200	10.8	Voltage: 115V
Friedrich	YQ09J10	Reverse Cycle	9,000	11.5	Voltage: 115V
Amana	9M12TA	No Reverse Cycle	9,100	10.0	Voltage: 115V
Friedrich	SS09J10A	No Reverse Cycle	9,200	11.5	Voltage: 115V
Amana	10M12TA	No Reverse Cycle	10,000	10.0	Voltage: 115V
GE	AMH10AA	No Reverse Cycle	10,000	10.0	
Friedrich	SS10J10A	No Reverse Cycle	10,200	11.7	Voltage: 115V
GE	AMH12AC	No Reverse Cycle	11,500	10.0	
Amana	12M12TA	No Reverse Cycle	11,800	10.0	Voltage: 115V
Amana	12M22PA	No Reverse Cycle	11,800	10.0	Voltage: 230/208V
Friedrich	ES12J33	Reverse Cycle	12,000	10.5	Voltage: 230/208V
Friedrich	SS12J10A	No Reverse Cycle	12,000	10.5	Voltage: 115V
Amana	14M13TA	No Reverse Cycle	13,800	10.0	Voltage: 115V
GE	AGN14AA	No Reverse Cycle	13,800	10.0	
Frigidaire	FAV157W1A	No Reverse Cycle	15,000	10.5	
Amana	18M23TA	No Reverse Cycle	18,000	10.0	Voltage: 230/208V
Amana	21M23PA	No Reverse Cycle	21,000	9.2	Voltage: 230/208V
Friedrich	EL24J35	Reverse Cycle	24,000	12.0	Voltage: 230/208V
Friedrich	SL24J30	No Reverse Cycle	24,000	9.2	Voltage: 230/208V
Amana	24M33PA	No Reverse Cycle	25,000	9.2	Voltage: 230/208V
Friedrich	SL28J30	No Reverse Cycle	28,000	9.0	Voltage: 230/208V
Friedrich	SL33J30	No Reverse Cycle	33,000	9.0	Voltage: 230/208V

NOTE: The capacity and efficiency levels provided apply only to the cooling cycle. When the heating options are in use, the capacity and efficiency levels are slightly lower.

MANUFACTURER CONTACT INFORMATION

Amana 931-438-2136
GE 800-626-2000
Friedrich . . . . 800-541-6645, ext. 201
Frigidaire 732-287-2000
Trane 931-645-6471
Whalen 410-822-9200

Recommended Packaged Terminal Air Conditioners

MANUFACTURER	PRODUCT NUMBER	TYPE	CAPACITY (BTU/h)	EER	SENSIBLE HEAT RATIO	NOTES
GE	AZ31H06E3C	Reverse Cycle	6,100	10.0	0.76	
GE	AZ21E06D3C	No Reverse Cycle	6,300	10.0	0.76	AC w/Electric Heat
GE	AZ26E06EBC (Also DBC)	No Reverse Cycle	6,300	10.0	0.78	AC w/Electric Heat
GE	AZ22E07E4P (Also 3P, 2P)	No Reverse Cycle	6,800	11.1	0.67	AC w/Electric Heat
Trane	PTEC	No Reverse Cycle	7,100	11.6	0.75	AC w/Electric Heat
Trane	PTHC	No Reverse Cycle	7,100	11.5	0.75	Heat Pump w/Electric Heat
GE	AZ22E09D3P (Also D2P)	No Reverse Cycle	8,600	10.8	0.57	AC w/Electric Heat
GE	AZ22E09E4P (Also 3P, 2P)	No Reverse Cycle	8,600	10.8	0.57	AC w/Electric Heat
Whalen	VI-**-301	Reverse Cycle	8,900	11.3	0.73	Water Source AC
Trane	PTHC	No Reverse Cycle	9,000	11.2	0.65	Heat Pump w/Electric Heat
Trane	PTEC	No Reverse Cycle	9,100	11.3	0.65	AC w/Electric Heat
Friedrich	TEC09K	No Reverse Cycle	9,200	11.0	0.77	Voltage: 230/208V
Friedrich	TEC09R	No Reverse Cycle	9,200	11.0	0.77	Voltage: 265V
Friedrich	THC09K	Reverse Cycle	9,200	11.0	0.77	Voltage: 230/208V
Friedrich	THC09R	Reverse Cycle	9,200	11.0	0.77	Voltage: 265V
GE	AZ22E12D3P (Also 2P)	No Reverse Cycle	11,200	10.2	0.54	AC w/Electric Heat
GE	AZ22E12E4P (Also 3P, 2P)	No Reverse Cycle	11,200	10.2	0.54	AC w/Electric Heat
Friedrich	TEC12K	No Reverse Cycle	11,700	10.0	0.76	Voltage: 230/208V
Friedrich	THC12K	Reverse Cycle	11,700	10.0	0.76	Voltage: 230/208V
Trane	PTEC	No Reverse Cycle	12,000	10.7	0.67	AC w/Electric Heat
Trane	PTHC	No Reverse Cycle	12,000	10.7	0.68	Heat Pump w/Electric Heat
Whalen	VI-**-401	Reverse Cycle	12,300	11.1	0.74	Water Source AC
Whalen	VI-**-601	Reverse Cycle	18,900	11.6	0.77	Water Source AC
Whalen	VI-**-801	Reverse Cycle	24,200	11.5	0.76	Water Source AC

NOTE: The capacity and efficiency levels provided apply only to the cooling cycle. When the heating options are in use, the capacity and efficiency levels are slightly lower.

MANUFACTURER CONTACT INFORMATION

Amana 931-438-2136
GE 800-626-2000
Friedrich . . . . 800-541-6645, ext. 201
Frigidaire 732-287-2000
Trane 931-645-6471
Whalen 410-822-9200

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GREEN SEAL TEAMS UP WITH THE EARTH DAY NETWORK

Green Seal and the Earth Day Network have forged a partnership to encourage the procurement of energy-efficient products for their **Earth Day 2000 campaign**. Earth Day Network (EDN) is a worldwide alliance to promote a healthy environment and peaceful, just, sustainable world by organizing events, activities and annual campaigns. EDN's Earth Day 2000 clean energy campaign will spark a rapid transition from outdated polluting fossil fuels and nuclear energy to clean, safe, renewable energy sources like solar and wind power. For more information see the EDN website at **www.earthday.net**