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UTILITIES COMMISSION

BEFORE THE IDAHO PUBLIC UTILITIES COMMISSION

IN THE MATTER OF THE APPLICATION OF IDAHO POWER COMPANY FOR AUTHORITY TO IMPLEMENT A RESIDENTIAL AIR CONDITIONER CYCLING PILOT PROGRAM.	CASE NO. IPC-E-02-13 IDAHO POWER COMPANY'S RESPONSE TO COMMENTS

COMES NOW, Idaho Power Company ("Idaho Power" or "the Company"), by and through its attorney of record, and, in response to the comments of the Commission Staff and the NW Energy Coalition, Idaho Rivers United and Advocates for the West (collectively referred to as the "NW Energy Coalition"), hereby submits the following reply comments.

COMMENTS OF THE COMMISSION STAFF
AND
NW ENERGY COALITION

The Company will address the comments made by Staff and the NW Energy Coalition in reference to the Residential Air Conditioner Cycling Pilot Program and Tariff Schedule 81.

1. <u>Metering</u>

Throughout Staff's comments, the Staff identifies the meters that the Company proposes to use for the AC Cycling Pilot Program ("the Program") as time-of-use (TOU) meters. TOU meters record kilowatt-hour data in time blocks that are preprogrammed into the meter. Instead, the Company proposes to use a mass memory meter capable of recording and storing interval load data and monthly kilowatt hour data for billing purposes.

2. <u>Proposed Cycling Options</u>

The Staff recommends that Idaho Power implement and evaluate all of the AC cycling options listed in the tariff. The three cycling routines proposed in the tariff are:

- Cycle the Central Air Conditioning compressor for a specified length of time on a percentage basis.
- Cycle the Central Air Conditioning compressor until a specified temperature change is attained.
- Change the temperature set point on the thermostat for a specified length of time.

If all the cycling routines are not tested, Staff prefers that the temperature set point method be implemented in the pilot.

The Company shares the Staff's concerns about participants' comfort and satisfaction. At the same time, Idaho Power believes that it can learn from the experience of other utilities and the advice of the vendors of load control systems who describe these recommendations and experiences. The Company should not be limited to exploring strategies that have been shown to be less optimal elsewhere or to ignore new system capabilities that have the potential to increase load reduction and/or improve participant comfort. The Company has defined AC cycling broadly in the tariff in order to maintain flexibility in this pilot to enable the Company to test different routines.

Idaho Power has recently selected a vendor to provide thermostats and provide support for this Program. Representatives of this vendor recommend that, because of Idaho's hot dry climate, the routine that is likely to be the most successful for Idaho Power would be a fifty percent cycling routine, that is, cycling for a specified length of time on a percentage basis. This routine would turn off a customer's AC compressor fifteen minutes out of every thirty minutes during a cycling event.

The thermostat purveyors and other utilities report that the temperature set point routine is a less effective cycling routine for reducing peak load over a set period of hours. Under this cycling routine, the load is immediately reduced as it is in the other routines, but electrical load reduction gradually decreases as the cycling event progresses. Idaho Power does not discount this option given the need to balance customer comfort and load reduction. As Idaho Power stated to Staff in response to an email dated February 18, 2003, "the flexibility to try different strategies may improve our chances for success in establishing the feasibility of an AC cycling program." Idaho Power, with input from the Energy Efficiency Advisory Group ("EEAG"), has attempted to design, and hopes to test, a pilot program that will achieve maximum load reduction at the minimum cost with the highest customer satisfaction.

3. Effects on AC compressor life

In reference to the Air Conditioning & Refrigeration Institute (ARI) Guideline For Energy Management Systems and Load Management Through Duty Cycling (Attachment A), Staff states "The Company dismisses this concern." The Company does not dismiss this concern. Instead, the Company draws different conclusions from this report and other evidence the Company has gathered concerning premature wear on AC compressors than does Staff.

The Staff states "Idaho Power dismisses the reported detrimental effect because DOE's purpose was to report the effect of over-sizing rather than utility controlled cycling." The Company did not dismiss the DOE report entitled, Energy-Efficient Air Conditioning (Attachment B). The Company pointed out that the emphasis of this report was on the sizing of AC units. The report does not address load control cycling. In fact, this report affirms that if a customer's AC compressor is oversized, it will 'over cycle' whether the customer is a participant in this Pilot Program or not. Thus, load control cycling will not be detrimental, but over sizing would be. An oversized air conditioner cycles more often for many days on end while load control cycling occurs infrequently and for limited time periods.

If a fifty percent cycling routine is used, the AC compressor will turn off only twice per hour. This operation is well within the industry guidelines. (See Guideline Number 4, cycle rate, in Attachment A.) A properly sized air conditioner would likely operate continuously during extreme heat and, thus, exhibit no cycling. The same air conditioner would cycle a number of times per hour during less than extreme periods. Frequent cycling during moderate temperatures is normal and should not decrease the life of the air conditioner. The proposed Program is designed to prevent "short cycling" in which the compressor is commanded to come on prior to a reasonable cooling down period after it was last shut off.

Staff suggests that Idaho Power provide each Program participant with a copy the DOE Energy Efficient Air Conditioning report and ARI Guideline A. Idaho Power believes that by providing participants with these reports, Idaho Power would be implying that the Company has concerns with the proposed program when, in fact, it has no such concerns. Idaho Power would not choose to implement this Program if the Company believed the Program could cause damage to a customer's air conditioner compressor. Other utilities operating air conditioner cycling programs in the United States report that damage to air conditioning units has not been a problem despite the fact that these programs have been in operation for over 20 years.

In their comments, Staff states "Staff believes the option of adjusting the thermostat's temperature set-point will not have this effect because it will not cause compressors to cycle more frequently." The Company disagrees. At a fifty percent cycle, a customer's AC compressor, if running, will be turned off twice an hour, once every fifteen minutes. Under this percentage cycling routine, the Company would be cycling AC compressors within normal industry standards. By changing the temperature set point, the Company has no idea how many cycling events would occur.

The number of cycling events may be more or less than the unit would normally cycle. This would only add uncertainty to the Program.

4. Evaluate Effects of Programmable Thermostats

In its comments, Staff recommends evaluating the effects of the advanced programmable thermostats. The primary goal of this pilot program is to reduce summer peak loads by cycling residential customers' AC compressors. The cycling will provide an immediate dispatchable load reduction. Through analysis of data stored in the mass memory meters and data stored in the thermostats, the Company will be able to aggregate the information and estimate the peak demand reduction by participants in this Program due to the AC cycling. Evaluating the effects of programmable thermostats on either energy consumption or average demand is not within the scope of this pilot. When the Company stated that these thermostats "may reduce overall energy use" it was identifying a possible secondary potential benefit of the Program. Some of the energy savings participants may obtain from these sophisticated thermostats may be attributed to potential reduced heating costs in the winter months in the form of reduced use of fuels other than electricity which the Company has no ability or desire to monitor.

5. Importance of Reporting

The Company agrees with Staff that information gathering is the primary goal of a pilot program. However, the Company believes that the information gathered, analyzed and reported in a pilot program should be directed at the viability of the pilot program's objectives and scope. Idaho Power, with input from the EEAG, has designed a pilot program to test the feasibility of deploying a residential air conditioner cycling program. The pilot program analysis has been designed to target the issues that are significant, measurable and reportable. Adding participants, testing more and different Demand Side Management programs, or enlarging the scope of this pilot could delay the deployment of this Program and the analysis of the data collected and ultimately not satisfy the test of feasibility for an ongoing AC cycling program. The Company believes that the additional analyses and reporting recommended by Staff are not related to the goal of the Program, will not be beneficial to its overall evaluation and will likely delay the Program.

In its comments, Staff notes "it has still not received a full report for the Company's 1999 Idaho City automated meter reading trial." The 1999 Idaho City automated meter reading (AMR) trial was intended to test Two-Way Automated Communication System (TWACS) power line technology to see if it would work on Idaho Power's system. The Company did not make a filing with the Idaho Public Utilities Commission for this trial nor did the Company have any reporting obligation on the Idaho City AMR trial. Nevertheless, Idaho Power informed the Staff of this program. On March 30, 1998, Idaho Power personnel met with Stephanie Miller and other Commission Staff and made a presentation concerning the Idaho City AMR trial. On April 18, 1998, several Commission Staff members including Beverly Barker, Randy Lobb and Rick Sterling visited Idaho Power's headquarters to receive an overview of the AMR trial, to see the two types of meters used and to watch a demonstration of how information inputs and outputs were conducted. They received information regarding outage detection, outage magnitude, restoration and reliability reporting by AMR. At this demonstration, Staff members operated the AMR system to access actual meter information. Idaho Power believes that it has acted in good faith and has been forthcoming in all matters related to the 1999 Idaho City AMR trial.

6. Control Groups

In addition to the participant group, Staff proposes evaluating multiple control groups. The attached spreadsheets (Attachment C) illustrate the expected levels of precision that might be achieved under ideal conditions comparing a non-cycling control group as recommended by Staff with the participant group. Assuming at the end of the first year there are 200 participants and 200 non-participants in a control group, the margin of error in a comparison of the groups' loads for an hour would be roughly plus or minus 39%. Assuming later in the program there are 500 participants and 500 customers in a control group, the margin of error would drop to plus or minus 24%. The differences in load reductions between control groups may well be within the margin of error. Given the relatively large margin of error in these estimates, it is unlikely that the additional cost of control groups would yield results of significance and value.

Control groups, however, would add significant costs to the project. The budgeted installed costs for mass memory meters to store interval data is approximately $39,000 the first year and an additional $58,000 the second year. (See Attachment D). Similar metering costs for control groups can be avoided by using participants' data from non-cycling days, which is the methodology recommended by the Company, in lieu of a control group. This approach would still have a significant margin of error in the estimated load reduction but the costs would be much lower. If the control group were selected from the volunteers for the Program, the total number of actual Program participants could be diluted. If the Program costs were to be held to the budgeted amount, the actual number of Program participants would be decreased by a factor of two or three depending upon the number of control groups utilized.

To increase the accuracy of the load reduction estimates, the Company is exploring the option of using smaller intervals than the 15-minute intervals that are often used in load studies. If load data were collected in 5-minute intervals, then there would be intervals where the air conditioner compressors were completely on or completely off in addition to transition intervals. This increased resolution might enable improved engineering estimates of the load reduction from cycling. However, the feasibility of collecting 5-minute interval data has not yet been established and would certainly increase the costs of the pilot program.

Staff suggests the use a control group with mass memory meters and without Company-supplied programmable thermostats and without the knowledge that they are part of a control group for the pilot program. People who volunteer for the Program may have different behaviors and attributes than customers who qualify but do not volunteer. This issue is known as "self-selection bias." If a control group were selected from a group that is different from the participant group, its loads may not be an accurate representation of what the participants' loads would have been if a cycling event did not occur.

Another concern in establishing this control group is that the Company records do not include information concerning which customers have central air conditioners or which customers do not have programmable thermostats. Selecting a control group without active cooperation from customers would not be impossible but it would be difficult, expensive and delay deployment of the Program.

7. Other Demand Side Management Programs addressing Air Conditioning

Idaho Power, with input from the EEAG, has designed a pilot program to test the feasibility of deploying a dispatchable residential air conditioner cycling program. This Program is designed to address reduction of summer peak demand on Idaho Power's system. The Company's plan is to operate the Program such that the peak load is reduced in a uniform and dispatchable manner. For the Company to measure and evaluate the sizing of AC units, adequate return air flow of residential HVAC systems, proper charging of residential AC equipment, the cleanliness of coils on residential AC equipment, properly sealed ducts in residential HVAC systems, household insulation and sealed building envelopes of residences, as well as, promotion of evaporative coolers instead of residential air conditioners is out of the scope of this pilot program. Programs similar to these have been and are being considered by the Company in consultation with the EEAG, but will require separate program design, evaluation and goals.

8. Customer Incentives and Promotional Costs

Both the Staff and NW Energy Coalition support increasing the customer incentive. When the Company first presented the residential AC Cycling Pilot Program to the EEAG, the Program contained no financial incentive for the participating customers. Other utilities with similar programs use the free programmable thermostat as the only incentive to participate. Austin Energy, for example, offers only the installed free programmable thermostat as a customer incentive and has 24,000 participants.

The members of the EEAG felt strongly that the participants must receive a monetary incentive as well as the installed thermostat. The Company and EEAG both felt that the incentive could be increased in the future but it would be difficult, if not impossible, to decrease the incentive and maintain participation in the future. The Company believes, and the EEAG has concurred, that $5 is an appropriate level to begin the incentive. If the Company finds that it is difficult to enlist participants at this incentive level, the incentive could be increased at a later date.

8. Expanded Program

The NW Energy Coalition noted in their comments that the Company's DSM Rider funds are not fully allocated and, thus, an expanded program should fall within the Company's DSM budget. The Company believes that the monies allocated for the AC cycling program are adequate to test a pilot program. The Company has approached the expenditure of rider funds as a need for a portfolio of programs directed at the different customer classes. The Company has a number of programs in the planning stage and any resources not yet allocated will be used to investigate other DSM options.

CONCLUSIONS

Both the Staff and the NW Energy Coalition have recommended increasing the incentives to customers. The NW Energy Coalition also recommended increasing the size of the Pilot Program. The Company believes that increasing the Program size, incentives, or scope of this pilot program and/or adding multiple control groups would add significant costs to the Program with little or no statistical or analytical benefits. Changing the scope and intentions of this Program could cause delays in its implementation or delays in the research necessary to assess if an ongoing program is effective, practical and economical.

DATED at Boise, Idaho, this 28th day of February, 2003.

Monica Moen

MONICA MOEN
Attorney for Idaho Power Company

CERTIFICATE OF SERVICE

I HEREBY CERTIFY that on the 28th day of February, 2003, I served a true and correct copy of the within and foregoing IDAHO POWER COMPANY'S RESPONSE TO COMMENTS upon the following named parties by the method indicated below, and addressed to the following:

Lisa Nordstrom Deputy Attorney General Idaho Public Utilities Commission 472 W. Washington Street P.O. Box 83720 Boise, Idaho 83720-0074	x ____ ____ ____	Hand Delivered U.S. Mail Overnight Mail FAX
William M. Eddie Advocates For the West P.O. Box 1612 Boise, Idaho 83701	____ x ____ ____	Hand Delivered U.S. Mail Overnight Mail FAX

Monica Moen

MONICA MOEN

ATTACHMENT A

1987 GUIDELINE for

(REAFFIRMED 1997)

ENERGY MANAGEMENT SYSTEMS AND LOAD MANAGEMENT THROUGH DUTY CYCLING

AIR-CONDITIONING &
REFRIGERATION
INSTITUTE

Guideline A

4301 NORTH FAIRFAX DRIVE • ARLINGTON, VIRGINIA 22203

IMPORTANT

SAFETY RECOMMENDATIONS

It is strongly recommended that the product be designed, constructed, assembled and installed in accordance with nationally recognized safety requirements appropriate for products covered by this guideline.

ARI, as a manufacturers' trade association, uses its best efforts to develop guidelines employing state-of-the-art and accepted industry practices. However, ARI does not certify or guarantee safety of any products, components or systems designed, tested, rated, installed or operated in accordance with these guidelines or that any tests conducted under its standards will be non-hazardous or free from risk.

Note:

This is a new guideline.
(Reaffirmed 1997)

Price $5.00 (M) $10.00 (NM)
Printed in U.S.A.

ARI

ARI GENERAL GUIDELINES ON ENERGY MANAGEMENT SYSTEMS AND LOAD MANAGEMENT THROUGH DUTY CYCLING

ARI recognizes the desire of many customers, users and other building owners to install some sort of energy management system (EMS) device on heating, ventilating, air conditioning and refrigeration equipment. It is also recognized that some power suppliers feel the need to effect "load management through duty cycling," a program designed to reduce the peak load on a power distribution system and hence delay or eliminate the need for additional generating capacity. ARI offers these guidelines without stipulating that either energy savings, user comfort or equipment performance will be achieved.

The product scope of ARI encompasses a wide variety of products. The availability of various type of EMS devices is very broad and the effect of such devices on equipment warranties may vary product-by-product and manufacturer-to-manufacturer. Therefore, ARI urges that the equipment manufacturer be contacted for specific recommendations concerning that equipment.

The general guidelines are as follows:

1. **Safety**

   Do not alter, disable or bypass any of the safety controls.

2. **Control Circuits**

   Control the unit operation through the control wiring. An auxiliary power supply may be required to carry the load of any additional field supplied controls. Additional load on the equipment transformer can cause voltage drop, chattering contactors, and ultimate failure of motor-compressor or other components.

3. **Fail-Safe Requirement**

   In the event of failure of an add-on control device(s), the normal operation of the equipment being controlled should not be jeopardized.

4. **Cycle Rate**

   Do not short cycle motor controllers, motors, or motor-compressors. The compressor off cycle must be five (5) minutes or longer. If more than four (4) cycles per hour are anticipated, contact the equipment manufacturer for specific recommendations.

5. **Fossil Fuel Heating Equipment**

   Do not short cycle or underfire fossil fuel heating equipment. Adequate burner operating time and temperature is necessary to prevent condensation damage to heat exchanger and/or flue.

In the event of any conflict between the manufacturers' specific instructions and these Guidelines, such instructions should prevail over these Guidelines.

The information in these Guidelines is current as of the date of publication. These Guidelines are only guidelines and should not be referred to or construed as a standard, certification or warranty. The appropriate steps to be taken with respect to duty cycling devices should be done by and under the supervision of qualified and experienced personnel to insure proper installation, and should be properly inspected. However, no changes in these Guidelines (when identified as ARI guidelines) shall be made without the approval of ARI.

Released for publication by the ARI General Standards Committee on June 12, 1985.

Note: Published in the approved ARI Guideline Format in 1987 without change.

ATTACHMENT B

DOE/GO-10099-379
FS 206
June 1999

ENERGY EFFICIENCY AND RENEWABLE ENERGY CLEARINGHOUSE

Energy-Efficient Air Conditioning

Are you considering buying a new air conditioner? Or, are you dissatisfied with the operation of your current air conditioner? Are you unsure whether to fix or replace it? Are you concerned about high summer utility bills? If you answered yes to any of these questions, this publication can help. With it, you can learn about various types of air conditioning systems and how to maintain your air conditioner, hire professional air conditioning services, select a new air conditioner, and ensure that your new air conditioner is properly installed.

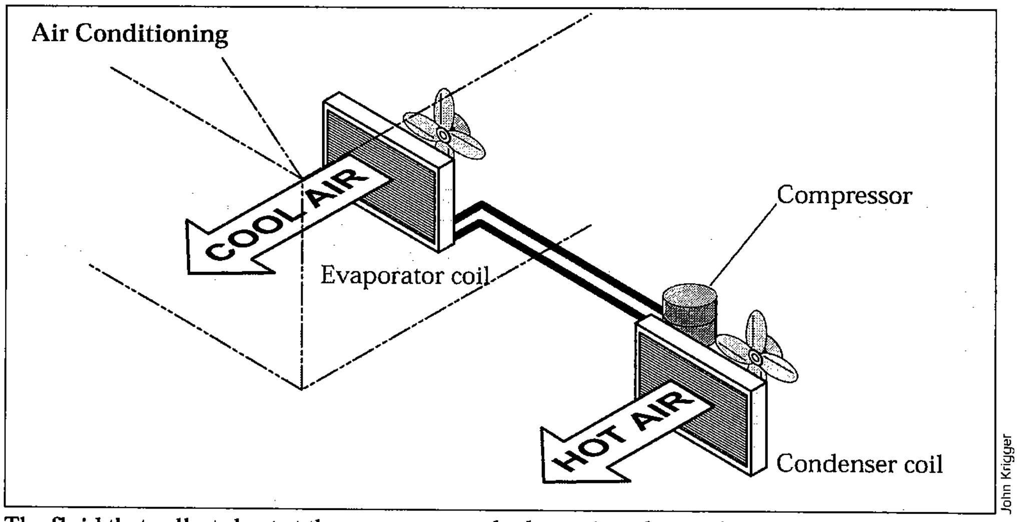
Understanding Air Conditioners

Many people buy or use air conditioners without understanding their designs, components, and operating principles. Proper sizing, selection, installation, maintenance, and correct use are keys to cost-effective operation and lower overall costs.

This publication discusses both central and room air conditioners. Heat pumps, which provide both home cooling and heating, are not covered in this publication. Contact the Energy Efficiency and Renewable Energy Clearinghouse (EREC–see *Source List* below) for more information about heat pumps of all kinds.

How Air Conditioners Work

Air conditioners employ the same operating principles and basic components as your home refrigerator. An air conditioner cools your home with a cold indoor coil called the evaporator. The condenser, a hot outdoor coil, releases the collected heat outside. The evaporator and condenser coils are serpentine tubing surrounded by aluminum fins. This tubing is usually made of copper. A pump, called the compressor, moves a heat transfer fluid (or refrigerant) between the evaporator and the condenser. The pump forces the



The fluid that collects heat at the evaporator and releases it at the condenser is called refrigerant. A pump, called the compressor, forces the refrigerant through the circuit of tubing and fins in the coils. Air moves through the tiny spaces between the fins and is cooled by the refrigerant in the coils.

This document was produced for the U.S. Department of Energy (DOE) by the National Renewable Energy Laboratory (NREL), a DOE national laboratory. The document was produced by the Information Services Program, under the DOE Office of Energy Efficiency and Renewable Energy. The Energy Efficiency and Renewable Energy Clearinghouse (EREC) is operated by NCI Information Systems, Inc., for NREL / DOE. The statements contained herein are based on information known to EREC and NREL at the time of printing. No recommendation or endorsement of any product or service is implied if mentioned by EREC.

Printed with a renewable-source ink on paper containing at least 50% wastepaper, including 20% postconsumer waste

refrigerant through the circuit of tubing and fins in the coils. The liquid refrigerant evaporates in the indoor evaporator coil, pulling heat out of indoor air and thereby cooling the home. The hot refrigerant gas is pumped outdoors into the condenser where it reverts back to a liquid giving up its heat to the air flowing over the condenser's metal tubing and fins.

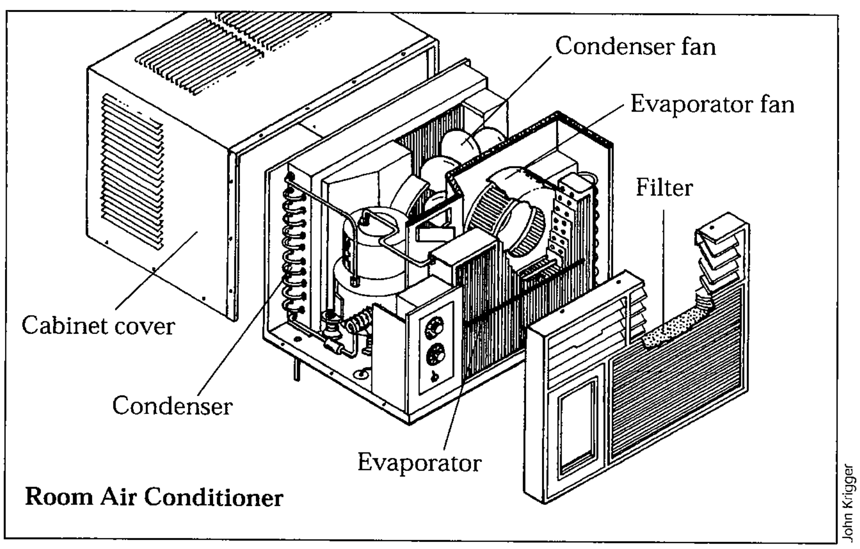
Types of Air Conditioners

The basic types of air conditioners are room air conditioners, split-system central air conditioners, and packaged central air conditioners.

Room Air Conditioners

Room air conditioners cool rooms rather than the entire home. If they provide cooling only where they're needed, room air conditioners are less expensive to operate than central units, even though their efficiency is generally lower than that of central air conditioners.

Smaller room air conditioners (i.e., those drawing less than 7.5 amps of electricity) can be plugged into any 15- or 20-amp, 115-volt household circuit that is not shared with any other major appliances. Larger room air conditioners (i.e., those drawing more than 7.5 amps) need their own dedicated 115-volt circuit. The largest models require a dedicated 230-volt circuit.



Room air conditioners are installed directly in windows or walls, which means they have no ductwork. The evaporator's fan faces indoors, while the condenser's fan faces outdoors.

Central Air Conditioners

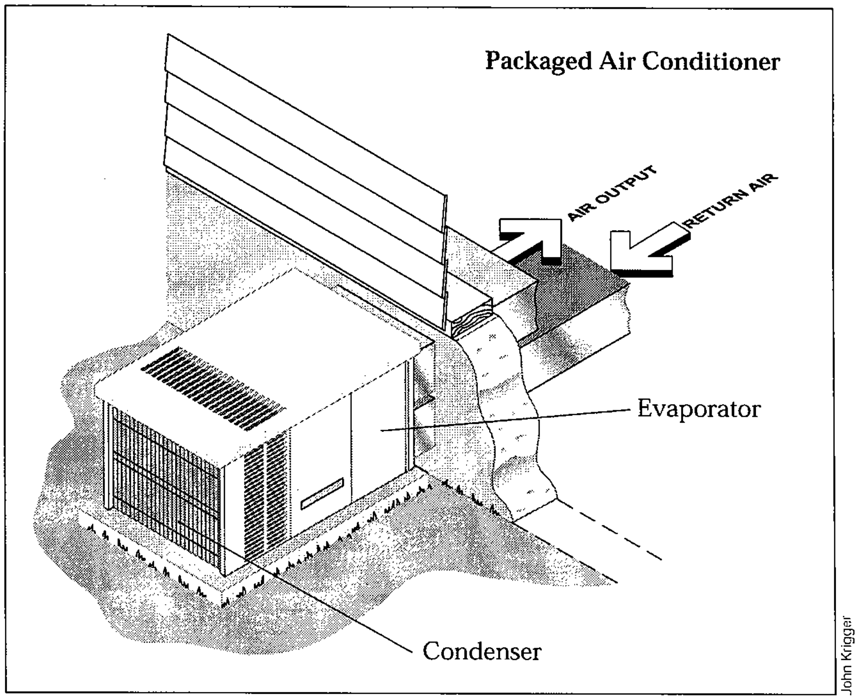
Central air conditioners circulate cool air through a system of supply and return ducts. Supply ducts and registers (i.e., openings in the walls, floors, or ceilings covered by grills) carry cooled air from the air conditioner to the home. This cooled air becomes warmer as it circulates through the home; then it flows back to the central air conditioner through return ducts and registers. A central air conditioner is either a split-system unit or a packaged unit.

In a **split-system central air conditioner**, an outdoor metal cabinet contains the condenser and compressor, and an indoor cabinet contains the evaporator. In many split-system air conditioners, this indoor cabinet also contains a furnace or the indoor part of a heat pump. The air conditioner's evaporator coil is installed in the cabinet or main supply duct of this furnace or heat pump. If your home already has a furnace but no air conditioner, a split-system is the most economical central air conditioner to install.

In a **packaged central air conditioner,** the evaporator, condenser, and compressor are all located in one cabinet, which usually is placed on a roof or on a concrete slab next to the house's foundation. This type of air conditioner also is used in small commercial buildings. Air supply and return ducts come from indoors through the home's exterior wall or roof to connect with the packaged air conditioner, which is usually located outdoors. Packaged air conditioners often include electric heating coils or a natural gas furnace. This combination of air conditioner and central heater eliminates the need for a separate furnace indoors.

Maintaining Existing Air Conditioners

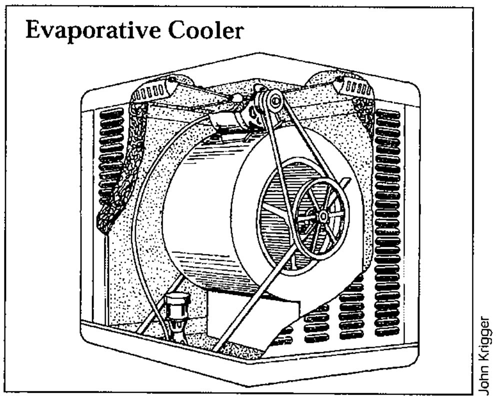
Older air conditioners may still be able to offer years of relatively efficient use. However, making your older air conditioner last requires you to perform proper operation and maintenance.



A packaged air conditioner sits outside the house next to the foundation or on the roof. Its cabinet contains the evaporator, condenser, compressor, and all other parts of the air conditioner. Supply and return ducts connect to this outdoor cabinet.

Evaporative Coolers

An evaporative cooler (also called a "swamp cooler") is a completely different type of air conditioner that works well in hot, dry climates.



Evaporative coolers cost about half as much as central air conditioners and use about 25% less energy.

These units cool outdoor air by evaporation and blow it inside the building, causing a cooling effect much like the process when evaporating perspiration cools your body on a hot (but not overly humid) day. When operating an evaporative cooler, windows are opened part way to allow warm indoor air to escape as it is replaced by cooled air.

Evaporative coolers cost about one-half as much to install as central air conditioners and use about one-quarter as much energy. However, they require more frequent maintenance than refrigerated air conditioners and they're suitable only for areas with low humidity.

Air Conditioning Problems

One of the most common air conditioning problems is improper operation. If your air conditioner is on, be sure to close your home's windows and outside doors.

Other common problems with existing air conditioners result from faulty installation, poor service procedures, and inadequate maintenance. Improper installation of your air conditioner can result in leaky ducts and low air flow. Many times, the refrigerant charge (the amount of refrigerant in the system) does not match the manufacturer's specifications. If proper refrigerant charging is not performed during installation, the performance and efficiency of the unit is impaired. Service technicians often fail to find refrigerant charging problems or even worsen existing problems by adding refrigerant to a system that is already full. Air conditioner manufacturers generally make rugged, high quality products. If your air conditioner fails, it is usually for one of the common reasons listed below:

- ***refrigerant leaks.*** If your air conditioner is low on refrigerant, either it was undercharged at installation, or it leaks. If it leaks, simply adding refrigerant is not a solution. A trained technician should fix any leak, test the repair, and then charge the system with the correct amount of refrigerant. Remember that the performance and efficiency of your air conditioner is greatest when the refrigerant charge exactly matches the manufacturer's specification, and is neither undercharged nor overcharged.
- ***inadequate maintenance.*** If you allow filters and air conditioning coils to become dirty, the air conditioner will not work properly, and the compressor or fans are likely to fail prematurely.
- ***electric control failure.*** The compressor and fan controls can wear out, especially when the air conditioner turns on and off frequently, as is common when a system is oversized. Because corrosion of wire and terminals is also a problem in many systems, electrical connections and contacts should be checked during a professional service call.

The most important maintenance task that will ensure the efficiency of your air conditioner is to routinely replace or clean its filters.

Regular Maintenance

An air conditioner's filters, coils, and fins require regular maintenance for the unit to function effectively and efficiently throughout its years of service. Neglecting necessary maintenance ensures a steady decline in air conditioning performance while energy use steadily increases.

Air Conditioner Filters

The most important maintenance task that will ensure the efficiency of your air conditioner is to routinely replace or clean its filters. Clogged, dirty filters block normal air flow and reduce a system's efficiency significantly. With normal air flow obstructed, air that bypasses the filter may carry dirt directly into the evaporator coil and impair the coil's heat-absorbing capacity. Filters are located somewhere along the return duct's length. Common filter locations are in walls, ceilings, furnaces, or in the air conditioner itself.

Some types of filters are reusable; others must be replaced. They are available in a variety of types and efficiencies. Clean or replace your air conditioning system's filter or filters every month or two during the cooling season. Filters may need more frequent attention if the air conditioner is in constant use, is subjected to dusty conditions, or you have fur-bearing pets in the house.

Air Conditioner Coils

The air conditioner's evaporator coil and condenser coil collect dirt over their months and years of service. A clean filter prevents the evaporator coil from soiling quickly. In time, however, the evaporator coil will still collect dirt. This dirt reduces air flow and insulates the coil which reduces its ability to absorb heat. Therefore, your evaporator coil should be checked every year and cleaned as necessary.

Outdoor condenser coils can also become very dirty if the outdoor environment is dusty or if there is foliage nearby. You can easily see the condenser coil and notice if dirt is collecting on its fins.

You should minimize dirt and debris near the condenser unit. Your dryer vents, falling leaves, and lawn mower are all potential sources of dirt and debris. Cleaning the area around the coil, removing any debris, and trimming foliage back at least 2 feet (0.6 meters) allow for adequate air flow around the condenser.

Coil Fins

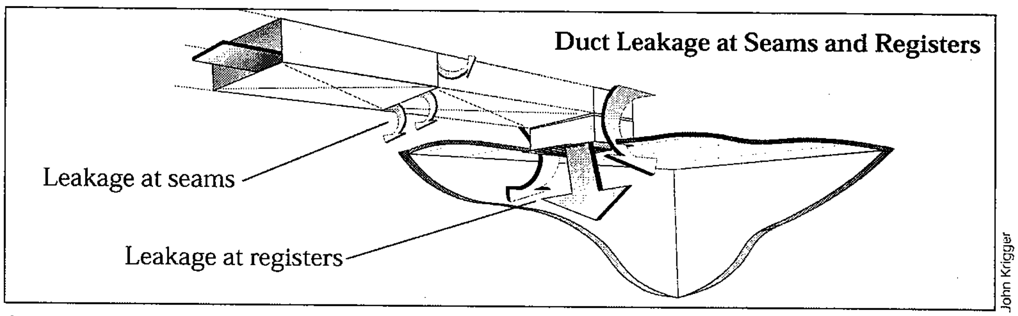
The aluminum fins on evaporator and condenser coils are easily bent and can block air flow through the coil. Air conditioning wholesalers sell a tool called a "fin comb" that will comb these fins back into nearly original condition.

Sealing and Insulating Air Ducts

An enormous waste of energy occurs when cooled air escapes from supply ducts or when hot attic air leaks into return ducts. Recent studies indicate that 10% to 30% of the conditioned air in an average central air conditioning system escapes from the ducts.

For central air conditioning to be efficient, ducts must be airtight. Hiring a competent professional service technician to detect and correct duct leaks is a good investment, since leaky ducts may be difficult to find without experience and test equipment.

Duct Leakage at Seams and Registers



Air from hot attics can leak into the home around registers of the duct system. Air in the ducts can leak out through holes and seams.