

Perspectives

A newsletter covering the research, demonstration and education projects of the Iowa Energy Center

Efficiency Helps Homeowners Reach Renewable Dreams

AERLP Profile:

Efficiency was the first and most important step Dan and Kimberly Isbell took when they decided to power their home with renewable energy.

Their 1,600 square foot log home is located near Vinton, Iowa on the banks of the Cedar River. Before they began their three-year renewable energy journey, they were paying \$150 per month for their electric bill. Their home used an average of 1,380 kWh of electricity each month – or 46 kWh daily.

The Isbells realized it was impractical to expect to produce 40 to 50 kWh of their own electricity using small renewable facilities. Therefore, they began to systematically reduce their electricity consumption. Many of the conservation steps they took can easily be done by anyone.

They started with their lights, replacing each of the 45 incandescent lights in their home with compact fluorescent bulbs. Next, they decided to get rid of ghost loads. These are small, but appreciable amounts of electricity wasted when solid state appliances remain continuously “warmed up.” They put plug-in type switches at the wall outlets of their microwave oven, television, VCR, CD player, etc.

When these small appliances are not in use, they are switched completely off. Also, all the clocks in the Isbell home are now battery-powered. Upgrading their lighting and getting rid of the ghost loads saved the Isbells about 350 kWh on their monthly electric bill and they were able to enjoy all their regular conveniences.

The Isbells still needed to make bigger cuts in their electricity consumption so they began to change all of their major heat producing appliances from electric-powered to propane- and solar-powered. Their electric stove was traded in for a propane range. The Isbells purchased a model that has an electronic ignition, but it can also be lit with a match. It also does not have an electric clock, timer or glo-bar (ghost loads).



The electric water heater was replaced with a propane on-demand (tankless) water heater. This style of water heater does not have a storage tank and consequently no standby losses. The water is heated at the point of use. In other words, when the hot water faucet is turned on the water runs through a burner, which heats the water on its way to the faucet. The Isbells added a rooftop solar water heating system that pre-heats the water. It produces approximately 60% to 70% of the hot water, saving them a considerable amount of money in propane costs.

The Isbells discovered their electric clothes dryer used 5,700 watts of electricity to dry one load. Of that amount, only 200 watts was used to tumble the clothes. The remaining 5,500 watts was used to produce heat. Switching to a propane dryer creates the heat needed to dry their clothes and reduced their electric load.

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Letter from the Director

Gasoline prices are up. Diesel fuel prices are up. Natural gas prices are up. Heating oil prices are up. I can't think of a better time in recent years to give serious consideration to energy efficiency and renewable energy.

Energy efficiency is not cutting back on energy use and doing without the services that energy provides. It's not being too hot or too cold in the dark.

Energy efficiency is getting the most value from the energy you use to obtain the services you need. It is using the smallest amount of energy necessary to heat your home, light your office, or drive your car. Energy efficiency is saving money by using just what you need to get the job done.

If the furnace in your house is old, now would be a terrific time to consider a new high efficiency model. If your air source heat pump is old, now would be a good time to consider a new high efficiency model or a ground source heat pump. If the lights in your office are old technology, new equipment can provide better quality lighting with lower operating costs. Replacing the old gas hog with an efficient car will save a lot at the pump. Your investment in efficiency today will have a quick payback as prices rise. And properly selected energy efficiency measures will continue to provide least-cost energy services for years to come, no matter what happens to prices in the future.

Many people think of renewable energy as something for the future, when the cost of renewable energy is closer to the cost of traditional fossil fuel sources. As the costs of fossil fuels rise, the gap be-

tween fossil fuel costs and renewable energy costs closes. It's time to take another look at renewable energy.

In this issue, you will read about a family who has opted to improve the efficiency of their home and power it with a collection of renewable energy sources. Their energy decisions look more cost effective by the day.

You could also consider replacing the old clunker with a hybrid electric or flexible fuel vehicle. Both Honda and Toyota have hybrid electric vehicles for sale and E-85 (85% ethanol and 15%) gasoline now costs less at the pump than regular gasoline.

Get the most out of the energy you use. Use it efficiently. Then take a new look at renewable energy. It might now be the right answer to some of your energy needs.

--Floyd Barwig, Director

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The Iowa Energy Center was created by the 1990 Iowa Energy Efficiency Act. Its mission is to help Iowans reduce their reliance on imported fuels and nonrenewable resources and to increase efficiency in all areas of energy use. This is accomplished in part through a competitive grants program which sponsors energy efficiency and renewable energy research and demonstration projects.



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Says Dan, "If you are making your own electricity, this is an appliance where you probably cannot afford to have an electric clothes dryer. The 5,700 watts it takes to dry one load of clothes is nearly twice the amount of all the electricity we use on an average day in our entire house."

Finally, the Isbells replaced their 18 cubic foot refrigerator with a super-efficient DC electric 16 cubic foot model. It uses .56 kWh per day compared to 2.75 to 3.75 their previous model used. When this final change was made, they had cut their electricity use by 1,240 kWh and were using only 100 kWh per month (about 3.5 kWh per day).

At this point in their plan, the local REC noticed the dramatic drop in their electricity use and sent a service person out to replace their home's meter. According to Dan, "They were quite sure our meter must have gone bad and slowed way down. I asked them to test the meter they had removed. It checked out okay, not defective."

Around this time the Isbells were activating their plan to incorporate three types of renewable energy facilities, solar, wind and hydro, into their home. To help them finance their renewable projects, they applied to the Iowa Energy Center's Alternate Energy Revolving Loan Program (AERLP). The AERLP provides loans for the development of renewable energy facilities in Iowa at no interest for half of a project's cost, up to \$250,000. This financial incentive can drastically decrease the cost of a project and make it economically feasible for people like the Isbells to pursue their renewable dreams.

In addition to the a solar water heating system, they installed a solar electric generation unit composed of 10 photovoltaic panels and passive tracking rack. The Isbells say this unit has been their most dependable day-to-day renewable power source, producing an average of 4 kWh per day. The total

cost of the photovoltaic package was approximately \$7,500. Dan, a talented handyman, saved money by doing much of the assembly and installation on the renewable units himself.

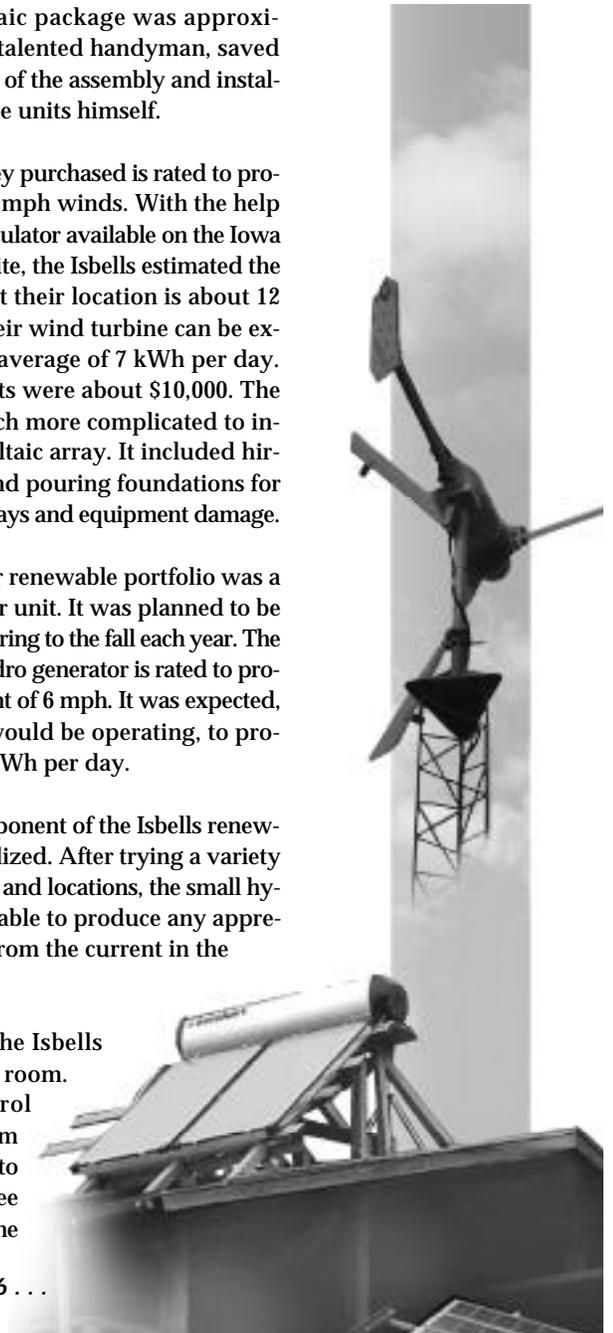
The wind generator they purchased is rated to produce 1,500 watts at 32 mph winds. With the help of the Wind Speed Calculator available on the Iowa Energy Center's web site, the Isbells estimated the average wind speed at their location is about 12 mph. At this speed their wind turbine can be expected to produce an average of 7 kWh per day. The total installed costs were about \$10,000. The wind turbine was much more complicated to install than the photovoltaic array. It included hiring a crane, digging and pouring foundations for the tower, shipping delays and equipment damage.

The third piece in their renewable portfolio was a hydro power generator unit. It was planned to be in operation from the spring to the fall each year. The 24-volt submersible hydro generator is rated to produce 4 amps at a current of 6 mph. It was expected, over the 8 months it would be operating, to produce an average of 2 kWh per day.

The hydro power component of the Isbells renewable plans was not realized. After trying a variety of mounting structures and locations, the small hydro generator has not able to produce any appreciable electric power from the current in the Cedar River.

The final project for the Isbells was to create a power room. This is a central control center and battery room with enough capacity to store DC power for three days. The total cost of the

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Sweetner Made From Ethanol Scraps

A newly developed process can make the costly sweetener xylitol from corn fibers left over from producing ethanol.

Xylitol is a high-value sweetener used in sugarless gum, mouthwash and toothpaste that gives products a minty-cool taste. The process, developed by U.S. Department of Agriculture's Agricultural Research Service (ARS), could greatly improve the economics of ethanol production from corn.

Xylitol has one-third fewer calories than sugar and about the same sweetening power.

Makers of some specialty brand sugarless chewing gums now pay about \$3 per pound for xylitol, according to a press release from the ARS. By comparison, industry now sells the ethanol leftovers as cattle feed for only a few pennies per pound.

Xylitol has one-third fewer calories than sugar and about the same sweetening power. The annual market for xylitol is around \$28 million. Xylitol is currently made in Finland in a chemical process using acid-treated birch wood fibers.

The ARS scientists found that certain strains of the yeast *Pichiaguilliermondii* can excel at making xylitol, but that process can be hindered by glucose, another of the sugars leftover from fermented corn fiber.

The problem, as described by the ARS, is as follows. When *P. guilliermondii* comes into contact with both glucose and xylose in fermenting corn fiber, it prefers —like a child who would rather gorge on ice cream than spinach— to spend its energy gobbling the glucose. This leaves the yeast relatively ineffective for carrying out the xylose-to-xylitol transformation. The solution devised by ARS scientists was to add an initial batch of *P. guilliermondii* to the fermenting fibers to devour

the glucose. Then they mix in more *P. guilliermondii* to tackle the task of transforming the xylose into xylitol.

Biological conversion of xylose should help make xylitol more economical to produce, according to the researchers, because it requires less energy than chemical conversion. This could drive production costs down and the market volume up.

An article about the research was published in the July issue of *Agricultural Research* magazine.

New Approach Combines Recycling & Ethanol Production

An innovative waste reduction project that marries biomass conversion and recycling is under construction in Schuylkill, Pennsylvania. This \$275 million project is the first of its kind to combine an ethanol production and a municipal waste recycling program into one facility.

The leaders on this project are Standard Energy Corporation (SEC) and Mayfair Energy Corporation. Using biofuels technologies, the facility will be able to eliminate the need to landfill any of the processed waste. The recycling program will sort and process non-biomass materials like metal, glass and plastics then marketed them as clean saleable recycled products. The remaining organic waste will be processed into ethanol.

Mayfair stated in a press release that, at full production they expect the waste recycling program to process about 6,000 tons of waste and produce 235,000 gallons of ethanol daily. The facility is expected to produce 77 million gallons of ethanol when operating at full capacity.

The Economic Effects of Biomass

Converting biomass into energy, fuels and chemical is an arena under investigation around the world.

For example, recently a research team from the European Commission developed a new economic multiplier that quantifies the economic impact of bio-energy plants in rural communities. This multiplier, called BIOSEM (Biomass Socio-Economic Multiplier), is capable of capturing the income and employment effects that arise from bio-energy plants in rural communities. It can trace both the extent and distribution of income and employment gains, and can assess the merits of differing policy packages, (energy and agricultural) on bio-energy production.

The BIOSEM technique identifies the economic impact of both the biomass production and the plant conversion processes. A range of biomass fuels and conversion processes, as well as the recipient markets, can be modeled. It does this using existing project and regional economic data. First the process assesses whether the bio-energy plant is financially viable, and then it identifies the employment and income benefits from the complete bio-energy chain.

BIOSEM evaluates both the backward (the impact of increased demand in the supply chain) and the forward (the respending of additional regional income) links, before combining these figures to provide a complete analysis of the impact of bio-energy production on a local economy.

For more information or to view case studies of this project visit the BIOSEM web site is www.etsu.com/biosem/.



Biodiesel Gets A+ on Health Effects Tests

Biodiesel, a fuel made from renewable sources such as soybean oil, successfully completed the health effects testing requirements of the Clean Air Act of 1990, according to a statement from the House Energy and Power subcommittee.

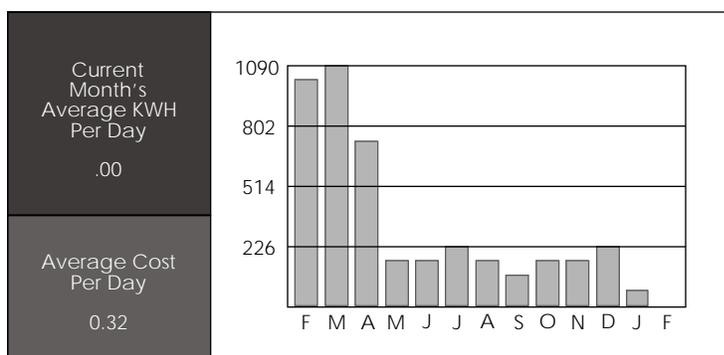
In 1998, the Congressional Budget Office announced the use of biodiesel is the most cost-effective way to meet renewable fuel requirements for government vehicles.

The National Biodiesel Board's strict health effects tests, which cost more than \$2 million, found that biodiesel, "poses no health threats and its use results in a 90% reduction in air toxins." Biodiesel is non-toxic, biodegradable and is used in conventional diesel engines with little or no modifications.

In 1998, the Congressional Budget Office announced the use of biodiesel is the most cost-effective way to meet renewable fuel requirements for government vehicles. Since that time, the use of biodiesel as a cost-effective means for bus and truck fleets to meet renewable fuel standards has grown tremendously.

A complete review of the report can be found on the National Biodiesel Board's web site at www.biodiesel.org.

Isbell's kWh Usage History



By applying energy efficient measures the Isbells reduced their home's electricity consumption to just 100 kWh per month.

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power room was just over \$10,000. The Isbells chose to purchase industrial quality absorbed glass mat sealed batteries because they located their power room inside their home. They did not want the smell and danger of battery fumes associated with the less expensive liquid lead-acid batteries. The power room was completed December 29, 1999 and the Isbells were renewably powered to ring in the new millennium.

With the average power produced from the combination of wind and photovoltaics, the Isbells have a good deal more electric power available than they are able to use. Says Dan, "Our life style hasn't changed any, and we haven't given up any conveniences we formerly had. Really, the most surprising thing about all these changes we made was how easy it was to drastically reduce our electric demand when we converted to energy efficiency."

For more information on the Alternate Energy Revolving Loan Program visit the Center's web site at www.energy.iastate.edu/about/grantloan/AERLP/index.htm.

Governor's Iowa Environmental Excellence Awards

Applications are now being accepted for the Governor's Iowa Environmental Excellence Awards. These awards are designed to recognize environmental leadership and innovation in Iowa.

Awards will be given for overall environmental excellence, along with special project awards in water quality, waste management and energy efficiency/renewable energy.

Categories for the awards include:

- Large businesses and industries (more than 200 employees);
- Small business and industries (up to 200 employees);
- Local governments;
- Public sector facilities (hospitals, schools, colleges, etc.);
- Agriculture (farm or other ag-related businesses or organizations);
- Service/civic/nonprofit organizations (Kiwanis, Lions Club, Pheasants Forever, etc.);
- Youth organizations (4-H chapters, boy/girl Scout troops, FFA chapters, etc.).

Additionally, a special leadership award for individuals who have provided exemplary leadership in natural resource conservation has been established.

The application deadline is September 29, 2000. To obtain an application contact Julie Tack at the Department of Natural Resources via email Julie.Tack@dnr.state.ia.us or phone (515) 281-8665. Awards information is also available at www.state.ia.us/dnr/energy/awards.

Up and Coming . . .

Carbon: Exploring Benefits to Farmers and Society

When & Where: August 29-31, Des Moines, IA
Hosted By: Chariton Valley Resource Conservation and Development Council; Iowa Heartland Resource Conservation and Development Council; Iowa Valley Resource Conservation and Development Council; Iowa Chapter of the Soil and Water Conservation Society, Natural Resources Conservation Service

Focus: The event will explore the agricultural perspective on emerging policies and technologies involving carbon management and sequestration and other greenhouse gases.

For More Information: Paul Miller at 515-323-2241 or www.cvrkd.org

Next Generation of Commercial Buildings Teleconference

When & Where: September 12, 1 - 3 pm, IEC's Energy Resource Station, Ankeny, Iowa

Hosted By: Iowa Energy Center and Iowa Chapter of American Society of Heating Refrigeration and Air conditioning Engineers

Focus: This teleconference will feature national leaders in commercial building standards. They will discuss changes in the national standards regarding building envelopes, HVAC and lighting.

For More Information: Space is limited and pre-registration required. Call Denise Junod at 515-965-7055 or djunod@energy.iastate.edu

UPEx2000: The 5th Annual UPVG Photovoltaic Experience Conference & Exhibition

When & Where: October 2-5, Baltimore, Maryland
Hosted By: Utility PhotoVoltaic Group

Focus: This event focuses on the issues and opportunities facing energy service providers, manufacturers, communities, builders and designers

and governments in expanding the market for photovoltaic power. The program covers market trends, business innovations, product development, building with solar, public policy, customer service and the role of energy service providers in bringing solar power into widespread use.

For More Information: 202-857-0898 or upvg@ttcorp.com

WEEC 2000: GEOEXCHANGE Conference and Expo

When & Where: October 25-27, Atlanta, Georgia

Hosted By: Association of Energy Engineers

Focus: The event is designed for end users, consultants, equipment specifiers, energy engineers and managers who are searching for answers to diverse strategic questions and equipment purchasing options.

For More Information: <http://www.aeecenter.org/Shows/>

EEBA's Building for Peak Performance Conference 2000

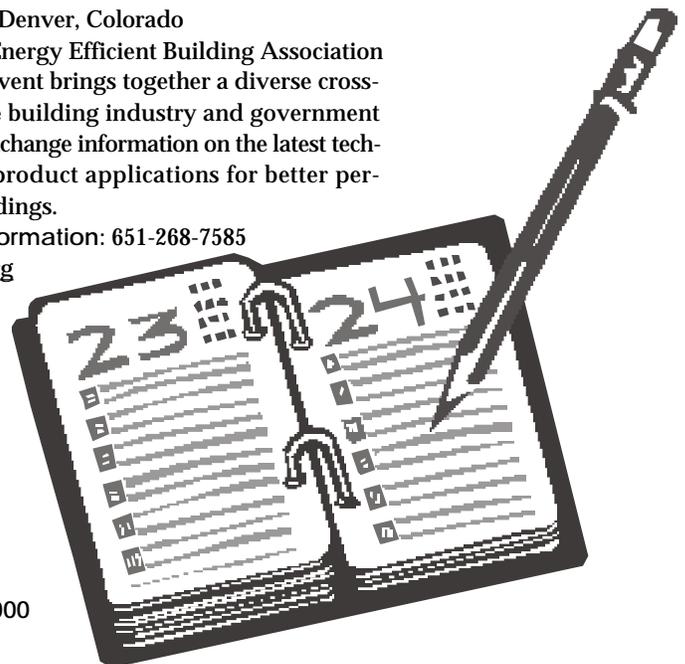
When & Where: October 25-28, Denver Marriott Tech Center, Denver, Colorado

Hosted By: Energy Efficient Building Association

Focus: The event brings together a diverse cross-section of the building industry and government agencies to exchange information on the latest technology and product applications for better performing buildings.

For More Information: 651-268-7585

www.eeba.org



Home Audio Equipment Wastes Energy

The adage, “little things add up,” couldn’t be more true when it come to the energy use of clock radios, portable stereos, compact stereos and other home audio equipment. In fact, these products use about 223 Trillion Btu annually, or roughly as much electricity used by all the households in the state of Maryland each year.

There are approximately 318 million of these home audio systems in the U.S. and each household consumes on average, about 200 kWh a year to operate them. A high percentage of this use is related to the surprisingly large number of stereo systems coupled to televisions to enhance the audio quality.

These surprising energy use findings came to light as part of a study done by Lawrence Berkeley National Laboratory (LBNL) for the U.S. Department of Energy’s Office of Building Technology, State and Community Programs. The focus of the study was to track the energy use characteristics of home audio products. To construct the national esti-

mates, LBNL measured the power draw of about 200 components (in each mode of operation) and obtained recent consumer survey data on home audio products including: hours of use, shipments, saturation and equipment lifetimes.

The report found that for this group of products, the portion of total consumption in idle mode and stand-by mode was 33% and 34% respectively. Stand-by power draw for some products was in the 10 to 25 watt range.

Researchers found they could save up to 50% of the energy used in audio products by reducing the standby power requirements and idle modes used in low-power audio products, and by using more efficient amplifier technology in the designs for high-power audio products.

The full report, *Energy Use of Home Audio Products in the U.S.*, is available as a PDF file on the Internet at www.eren.doe.gov/buildings/documents.

If you have an energy-related event you would like to have included in *Perspectives*, please send the information at least two months in advance to: *Perspectives*, Iowa Energy Center, 2521 Elwood Drive, Suite 124, Ames, Iowa 50010-8263, fax the information to 515-294-9912 or e-mail iec@energy.iastate.edu.

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