



ENERGY EFFICIENCY: ENHANCING HOME PERFORMANCE  
PROGRAM SIX  
“Advanced and Alternate Energy Technologies”

**INTRO TEASER (MARK MASON):**

Hi, I’m Mark Mason. Are you interested in powering your home with “green” or renewable technologies such as solar or wind power? Then this is the program for you! You’ll learn about the different kinds of green power technologies, find out if they are a cost-effective choice for your home and what they can mean to your energy bills and the environment. We’ll discuss what advanced applications are best suited for your home. And we’ll show you how to get advanced technologies installed by qualified contractors.

**Underwriting**

Funding for “Energy Efficiency: Enhancing Home Performance” is provided by: New York State Energy Research And Development Authority, or NYSERDA, using innovations and technology to solve some of New York State’s most difficult energy and environmental problems in ways that improve the State’s economy.

**MARK MASON:**

In this program, we’ll cover a variety of advanced and alternative energy technologies. Solar electricity, solar heating, and passive solar installations use the power of the sun to produce electricity and heat. In New York State, we have a number of large-scale wind-power farms, as well as some on-site small scale private wind generators. Geothermal heating systems tap into the earth’s hydrothermal water reservoirs to provide heat to houses. Radiant floor heating places heating coils underneath floor boards or tile to provide a uniform temperature from floor to ceiling. On-demand hot water heaters provide hot water when you need it, without the constant heating of a tank. Biomass fuels, like ethanol and biodiesel, are created from plant and plant-derived material.

**GRAPHIC: SOLAR ELECTRIC Power (PHOTOVOLTAIC)**

**MARK MASON:**

Photovoltaic technology converts sunlight directly into electricity when the sun is shining – and even with some cloud cover, allowing you to produce your own electricity with no noise or air pollution. A solar system includes a collection of photovoltaic modules attached as an array on your roof, or set up as freestanding units on the ground. The photovoltaic modules produce direct current, or DC, electricity that the system then converts to alternating current, or AC, electricity, which can then be used to power your lights, appliances, and other home electrical needs.

There are two types of photovoltaic systems: grid-connected solar, and off-grid solar. Grid-connected solar electric systems are connected to the local utility grid. Being connected to the local utility grid provides two benefits: first, when your system doesn't produce enough electricity to power your home – for example, when the sun isn't shining or at night time – you'll automatically receive the additional power you need from the utility. And second, if you produce more electricity than you need, you get a credit on your utility bill that can be used towards future purchases.

**Ben and Regina Budelmann:**

(Regina) “We have solar panels on our barn, which generate electricity that we sell to National Grid. We're what they call 'on the grid.' We sell the electricity we generate to National Grid, and then in turn we purchase electricity from them. The idea is that we don't purchase very much at all, and we don't. We generate most of what we use.” (Ben) “I would say in the good months, which are about nine months out of the year, our electric bill is somewhere around \$25 to \$30 a month, which is great.”

**MARK MASON:**

Today's solar electric systems require little or no maintenance. Depending on the angle of your freestanding unit, you might have to scrape heavy snowfall off of the panels in the winter. However, we don't recommend removing snow off roof panels – it could be very dangerous in the winter. You also may have to prune tree branches. Most solar-electric panels come with 20-25 year warranties.

**Ben and Regina Budelmann:**

(Ben) “They're real sturdy, and there's really no maintenance at all to them.” (Regina) “Great improvements in the technology have been made in recent years, from what I understand. In our case, since the panels are on the barn and the slope is such that snow doesn't collect, we don't have to do anything.”

**Ed Dubinsky:**

“They are set up in such a way that they face the sun and our system has a very interesting tracking mechanism that has rotates from east to west to follow the sun as it comes across during the day. There's a fluid in there, and when the sun comes up it heats the fluid, converts it to gas, and that changes the weight balance so they just turn.”

**MARK MASON:**

When choosing a solar electric system, you must consider your energy needs, the amount of that energy you can generate, and what the system will cost to install. You must also consider the location of the solar panels – are there any obstructions that would prevent the sun from shining on them, such as trees, chimneys, or other buildings?

The larger your system, the more electricity you'll be able to generate, but at a higher up-front cost. While sizes and prices do vary, the average home system is about 4.5 kilowatts, at an average cost of \$8,500 per kilowatt, or \$38,000. The systems are expensive and will take a while to pay for themselves. NYSERDA offers some financial incentives for photovoltaic systems, but

your system must be connected to the local utility, to be eligible for any of those incentives. About 45-50% of a typical system is covered by NYSEDA cash incentives that are available through NYSEDA eligible installers and there are also federal and state tax credits that you may be eligible for.

**Catherine Jahncke:**

“New York State is one of, I don’t know, maybe a half-dozen states that have really good incentives for photovoltaic cells and they’ll pay you a certain amount per kilowatt that you install. And it makes it actually affordable. Also New York is one of the few states that has net metering, which means that um, the electric company is required to buy back what you produce, which is not the case in many states. So, in New York State, um, it makes sense and it certainly makes me feel good. I get very excited, every day I go up and look and see how much electricity we’ve produced.”

**MARK MASON:**

Many homeowners put in solar electric systems not to save money, but because they like the idea of using renewable energy and making as little an impact on the environment as possible. However, before considering photovoltaic systems, it is more cost-effective for the homeowner to take advantage of NYSEDA’s Home Performance with ENERGY STAR Program. This program will make your existing home more efficient, up to 40% more efficient. Once your home is as efficient as possible, advanced technologies, like photovoltaic systems make more sense financially.

**Ed Dubinsky:**

“Certainly it gave me a lot of personal satisfaction to think that a lot of my energy, my electricity, is coming directly from the sun and not um, coming from situations that are not really good for people and the world, the earth.”

**Jan Hutslar:**

“It makes so much sense with using less of the earth’s resources, it’s more self-reliant, it’s more sustainable. So I really feel good having an energy source that’s clean and has less impact on the natural world and on the environment, and on our resources, which are limited.”

**MARK MASON:**

The second type of solar electric system is an off-grid solar system. If you live in a woodland setting, far from a utility grid hookup, or use very little electricity, this option may be for you. Electricity generated from the solar panels is stored in batteries, and then can be converted into AC power. Be aware, however, that with an average-sized off-grid system, you most likely won’t be able to power appliances like big screen TVs, electric clothes dryers, or a whirlpool spa, and doing household tasks like the laundry or baking may require waiting for sunny days. If you choose to install a larger solar system, you might be able to power these appliances, at least one at a time. Of course, the bigger your system, the more batteries you’ll need and the more it will cost.

**Jan Hutslar:**

“I have six 175 watt photovoltaic panels. They’re on a rack outside and um, those are cabled into the house, and then the energy is stored in batteries. I have four deep-cycle batteries. When the power comes in it’s D/C, and I have an inverter which changes it to A/C, so everything, I have has traditional outlets and I can use conventional um, lamps and appliances.”

**MARK MASON:**

To get started, take a look at the list of eligible photovoltaic installers at PowerNaturally.org. These PV installers participate in the NYSEDA incentive program, so they can offer you cash incentives for PV system sales and installation. It is advisable to obtain price quotes from at least three installers. For more information, go to PowerNaturally.org or call 1-877-NY-SMART.

**GRAPHIC: PASSIVE SOLAR**

**MARK MASON:**

Passive Solar is simply orienting your house so that the majority of the windows face south, taking advantage of the heat from the sun to warm your house in the winter. The north side of your house would have fewer windows, most of them small.

**Kathleen Buckley:**

“There are several characteristics of a passive solar home. One is, and first and foremost, that it has a southern exposure. Next are highly insulated windows and double insulated walls. The roofline also becomes an issue in terms of maximizing winter sun and minimizing summer sun. And the final characteristic is the mass of the floor. So the sun’s rays are absorbed and slowly released to warm the house.”

**Ben and Regina Budelmann:**

(Regina) “I thought if we had all these windows, we would be very hot in the summer. And sometimes we are hot, when everybody else is hot. But the truth is the sun is different enough in the summer and the winter, that even though we get direct sun in the middle of the winter in the shortest day, we don’t get that direct sun in the summer because of where the sun is in the sky.”

**Anne Burnham:**

“I have overhangs over most of the windows that are two feet, so in the winter when the sunlight is low, the sun is low, the sun comes in and heats your house. But in the summer, when the sun is higher, it cuts off the sun after it has risen in the morning. So you don’t overheat your house.”

**MARK MASON:**

Larger windows facing east, south, and west also provide what’s called ‘daylighting.’ The windows and the house itself are arranged in such a way as to provide maximum sunlight during the day, eliminating the need to turn on lights.

**GRAPHIC: WIND POWER:** Utility (large scale) and On-Site (small scale)

**MARK MASON:**

There's nothing new about harnessing the wind for power. We've used wind for centuries to power everything from ships to flour mills and water pumps, but, thanks to new technology, wind energy is becoming a more viable energy source for the homeowner.

Today, large commercial wind sites are becoming more common. The Maple Ridge Wind Farm was recently constructed here on the Tug Hill Plateau of Northern New York. Customers of electric utilities now have the choice of buying "green power," which, in part, uses wind farms as an energy supplier. These modern wind turbines are sophisticated high-tech machines designed to convert the power of the wind into electricity. High tech computer control systems run constantly to ensure that the machines are operating efficiently and safely.

**GARY DAVIDSON, Project Manager, Horizon Wind Energy:**

"Each wind turbine here at the Maple Ridge Wind Farm is capable of producing up to 1.65 megawatts of power, and the American Wind Energy Association or AWEA has conducted studies, and they've concluded that every megawatt of wind is the equivalent of a new square mile of forest in terms of removing carbon dioxide from the atmosphere. And generally, wind farms do that by displacing fossil fuel generation, power that comes from coal, natural gas, or oil."

**MARK MASON:**

Another option is to install a private wind turbine on your property. Smaller wind turbines at residential, industrial, agricultural, and educational sites can be used to supplement or reduce the amount of electricity you purchase from your electric utility.

Wind turbines usually consist of a rotor with two or three blades, a drive shaft, a tail to keep the turbine properly directed, a generator, tower, and foundation, sometimes with guy wires to stabilize the structure.

How do you determine if a wind turbine is right for you? First, you should have an annual average wind speed of at least 10 miles per hour on your property and a location clear of obstructions. Remember that local terrain, buildings, and vegetation can affect the wind speed. Next, you'll need to determine if you have enough space for a turbine. You'll want at least an open acre. But be careful not to place your turbine too close to a neighbor, who may not like the visual impact of the tower. Wind installers can help you determine if your location is suitable for a wind turbine. More importantly, it's necessary to first check with your local municipality about any ordinances or permits necessary for installation of small wind turbines. Your system will need to be connected to the local electric grid in order to reduce your purchase of electricity from your electric supplier. You can visit [www.PowerNaturally.org](http://www.PowerNaturally.org) for a list of installers and more information on small wind.

**ROY BUTLER, Four Winds Renewable Energy, Arkport, NY:**

"Wind is unique because on a lot of the hill tops in New York State, you can generate a lot more energy per installed cost, per kilowatt, than you can for solar. So it has the potential to generate a lot more electricity for your investment. There've been a lot of advances in electronics, the biggest thing, and in air foil design, so they're more efficient, they're quieter, they last longer.

But definitely the homeowner should be aware of the fact that it's man-made, it has moving parts, it will have maintenance.”

**MARK MASON:**

A typical 10 kilowatt grid-connected system on an 80 to 120 foot guyed tower can cost about \$60,000. The New York Energy Research and Development Authority, NYSERDA, is firmly behind the growth of wind power, and offers cash incentives to help New Yorkers install grid-connected wind turbines. The incentives vary based on the size of the system.

Wind is free, renewable and non-polluting. Using wind power helps protect the environment, and increases energy self-sufficiency. PowerNaturally.org has full details on wind power, including incentive programs for the installation of both large and small wind systems. To find out more, go to PowerNaturally.org or call 1-877-NY-SMART.

**GRAPHIC: GEOTHERMAL HEAT SYSTEMS**

**MARK MASON:**

Geothermal heat pump systems tap the constant temperature of the earth to provide efficient heating and cooling. The systems operate by using water-source heat pumps to extract heat energy from the earth and be distributed throughout the home. In the summer the process can be reversed. Unwanted heat is extracted from the home and added to the earth.

Geothermal heat pumps transfer heat between the constant temperature of the earth and the home to maintain a comfortable living environment. Below the surface of the earth throughout New York State, the temperature remains in the low 50 °F range throughout the year. This stable temperature provides a source for heat in the winter and a means to reject excess heat in the summer. With geothermal heat pump systems, water is circulated between the home and the "ground-loop" piping buried several feet below the ground. In the summer, the water picks up heat from the building and moves it to the ground. In the winter the fluid picks up heat from the ground and moves it to the building. Heat pumps make the collection and transfer of this heat to and from the building possible.

Geothermal pump systems exchange thermal energy between a building and the ground. When the home needs heating, the system extracts heat energy from the ground, and pumps it into the house where it is boosted by the heat pump to a comfortably warm temperature. Conversely, when the building needs cooling, the heat from the building is collected by the heat pumps and sent into the ground, much as a refrigerator's compressor transfers heat from inside the refrigerator to the outside. The geothermal heat pump system moves thermal energy between the ground and the building using heat pump technology.

The two most common geothermal systems in NYS are closed loop and open loop systems. **Closed loop** systems are most common. This uses continuous loop of plastic pipe where water is circulated from the heat pump to ground and back again. Closed loop systems can be designed where the piping is installed underground either vertically or horizontally, depending on the site. If the site has an adequate body of water, a **Pond or Lake Closed-Loop System** may be the

lower-cost option. A supply line pipe is run underground from the building to the water and coiled into circles at least eight feet under the surface to prevent freezing. **Open loops** use ground water. Water is pumped from a well to the heat pump and injected back to the well, or discharged to the surface water.

Which type of loop you choose depends on site conditions and needs. What makes this a green technology on the heating side is that BTUs or thermal energy is not released through combustion. Rather, the electrically-driven heat pump simply pulls existing BTUs from the ground to heat the home.

## **SAVINGS**

### **MARK MASON:**

Each site is different and it depends on what you pay for electric, gas or oil, but in broad general terms costs savings range from 10-40% on the heating side and 30-60% on the cooling side. As with any energy efficiency measure, the more you use it, the more you save.

The cost can vary significantly based on the type of system, complexity of the project, and site conditions. On average, a residential system will cost about \$15 to \$25 per square foot to install. This means a geothermal system for a 2,000 square foot home will cost anywhere between \$30 to \$50,000 dollars. Despite the initial cost of the system, there are many benefits to geothermal energy, including:

- Low Operating Cost
- No Required Exposed Outdoor Equipment
- No On-Site Combustion
- Long Life Expectancy
- Low-Cost Integrated Water Heating
- Low Maintenance
- No Supplemental Heat Required and
- Low Environmental Impact

### **PATRICK FORD, Energy Smart Ground Works:**

“... the advantages outweigh what the disadvantages are as far as cost, because its so inexpensive and there are no fossil fuels required. You get your payback very quickly. And you don't have to rely on the oil companies.”

### **MARK MASON:**

Through its New York Energy Smart Loan Fund, NYSERDA can help provide low-interest financing for geothermal projects. For more information about geothermal heating systems and installers, visit [www.NYSERDA.org](http://www.NYSERDA.org).

## **GRAPHIC: RADIANT FLOOR HEATING**

**MARK MASON:**

Radiant heat is a growing trend that started in Europe and is now becoming popular in North America. Instead of warming air and then circulating it throughout your home using ducts and vents, radiant heat is embedded under your floor and uses the entire floor to evenly distribute heat. Radiant heat warms objects rather than air to create a more even heat throughout the home.

**Catherine Jahncke:**

The heat is a very comfortable heat. The heat is in the floor, which is where you are, rather than up at the ceiling, which is particularly nice in my house which has lots of big, open spaces and we don't have all the blowing around of dusty air, because it's not forced air heat.

**MARK MASON:**

Radiant heat panels consisting of PEX tubing are laid across a bare floor, then covered with the flooring material of choice – usually concrete, tile or hardwood. PEX tubing is used to distribute heat via water in Radiant Heat and Hydronic Heating Systems. Most radiant heat systems require PEX Tubing with an oxygen barrier. A boiler system heats hot water, and the water is circulated through the PEX tubing throughout the floor. The hot water warms the floor, and the heat radiates from the floor into the living space. The heat is by your feet, and naturally rises to warm the room. Since there are no furnaces or blowers, noise and dust are reduced to make the home cleaner and quieter. The result? A room with radiant in-floor heating will have a very uniform temperature from ceiling to floor with high comfort levels, and will eliminate cold floors in the cold weather.

Comment [rjn1]: What is PEX?

Another benefit of radiant floor heating, is that the water temperature being delivered does not have to be heated to the typical temperatures required for conventional hydronic baseboard heating. A well designed system with minimum manifold surface areas, can utilize water temperatures between 90 - 120 deg F. This represents a significant savings in the boiler water temperature being required, and actually lends itself better to energy sources such as ground source heat pumps, which operate best at lower temperatures.

In addition, it's vital that a home be properly insulated, especially the shell of the home, to ensure heat is properly maintained throughout the house.

Radiant heat is ideal for bathrooms, kitchens, basements, bedrooms – basically, anywhere in your home. Radiant heating can be installed in new construction or under existing floors.

**GRAPHIC: ON-DEMAND HOT WATER**

**MARK MASON:**

The boiler in your radiant floor heating system can also be combined with an on-demand hot water system.

**Anne Burnham:**

“The hot water is demand hot water, that means it's not heated up till you turn the faucet on. And you have to wait a minute for it to heat up but other than that, it's fine. And it's plenty. I just had my son and his family visiting and it was, nobody ran out of water ever. My heater and



hot water system didn't cost any more than a regular furnace. So it wasn't any more expensive. To just put in an electric hot water heater is cheap. It's also really expensive to run. So how cheap is it?"

**MARK MASON:**

You can also combine on-demand hot water heaters with other heating systems – such as geothermal or a boiler. Or you can install the system as a separate entity fired by gas, oil, or electric. An on-demand hot water heater starts generating hot water almost immediately when you open the hot water faucet. The cold water enters the tankless water heater and triggers the heating elements to turn on. The water is then heated as it flows through the heating elements or the heat exchanger. The unit turns itself off when the faucet is closed. The water is heated only while it's needed for the time that the hot water faucet is turned on.

There is no hot water tank to heat. Since there is no storage of hot water and no constant heating and re-heating of water as in standard water heaters, you're not wasting energy when you don't need it. You'll get an endless supply of hot water if you size the unit properly. The units are designed to last for twenty plus years and can be mounted to a wall to save space. An on-demand hot water heater is easier on the environment and can save you money. The typical energy savings of an on-demand hot water heater are approximately 30% of your energy bill. On-demand hot water heaters are eligible improvements for incentives under the Home Performance with ENERGY STAR Program or if you're building a New York ENERGY STAR Labeled Home, an on-demand hot water system is also a viable option to save on energy use.

**GRAPHIC: BIOMASS RESOURCES**

**MARK MASON:**

"Biomass" includes all plant and plant-derived material, essentially all energy originally captured by photosynthesis. Biomass energy is a fully renewable resource that essentially generates little to no net greenhouse gases. Biomass has surpassed hydroelectric power as the largest domestic source of renewable energy. Biomass currently supplies over three percent of the U.S. total electric consumption. According to the North East Regional Biomass Program, biomass refers to living and recently dead biological material that can be used as fuel or for industrial production. Most commonly, biomass refers to plant matter grown for use as biofuel, but it also includes plant or animal matter used for production of fibers, chemicals, or heat. Biomass may also include biodegradable wastes that can be burned as fuel.

Two biomass fuels that you may have heard of are ethanol and biodiesel.

Ethanol, also known as grain alcohol, can be used either as an alternative fuel or as an octane-boosting, pollution-reducing additive to gasoline. Though it's commonly thought that ethanol is derived from corn, in truth corn and other starches and sugars are only a small fraction of biomass that can be used to make ethanol. Advanced ethanol technology turns ordinary low-value plant materials such as corn stalks, sawdust, or waste paper into ethanol fuel.

Biodiesel is a renewable alternative to conventional diesel. It does not contain petroleum, but it can be blended at any level with petroleum diesel to reduce emissions and improve lubricity. The main feedstocks for biodiesel are agricultural commodities like soybeans and rapeseed, also known as virgin oils, or refined cooking oils and unwanted animal fats, or non-virgin oils. Biodiesel can be used as a full replacement of diesel fuel, or B-100, but it is most commonly found mixed at a ratio of 20% biodiesel to 80% normal diesel, or B-20. The fuel can be used in existing diesel engines.

Biomass fuels can not only be used to power motorized vehicles, but also for electrical power generation. Among NYSERDA's many programs related to biomass, NYSERDA is currently working towards low-cost ways to incorporate biomass projects into farms and develop an infrastructure to make biomass fuels a feasible option in New York State, further reducing our dependence on foreign oil.

For more information on the State's effort in biomass and alternative fuels, visit [www.nyserda.org](http://www.nyserda.org).

**MARK MASON (OUTRO):**

With higher energy prices, advanced technologies are gaining appeal fast. In today's program, we've shown you how to weigh the cost against the benefits. It's important to do your homework first. Research who installs this kind of equipment, get different quotes, and make sure it's right for your home. Thanks for watching today and to learn more about ways to save energy, visit [getenergysmart.org](http://getenergysmart.org) or call 1-877-NY-Smart.

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**Special Thanks To**

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