



Get up to speed quickly on the basic concepts and the value proposition of solar and renewable energy.

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## Solar Basics

### **Are solar panels and solar water heating systems a viable renewable energy source for Southern Indiana?**

Absolutely! Indiana gets as many direct sun hours as many parts of Florida, and 50 percent more than Germany, a world leader in solar power. Our region has approximately 4.5 direct sun hours daily on average. This is plenty to provide electricity or hot water for the energy conscious household. The Indianapolis airport has installed 76,000 solar panels on 150 acres, generating 31 million kilowatt hours annually. It is the largest solar farm on any airport in the world.

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### **What are the typical solar renewable energy systems available to a home owner?**

Images of these common solar systems types are displayed in our [Media Gallery](#).

*Grid-tied photovoltaic (PV) systems* use solar panels to generate electricity first for your home with any excess reversing back to the grid. This system is economical because the grid acts as a battery when excess electricity not used during peak season goes back onto the grid and is credited to the homeowner. A grid-tied system automatically disconnects from the electric grid during outages and reconnects after the grid again becomes operational.

*Battery or stand-alone PV systems* are off grid and will provide electricity from batteries or a generator during power outages. Unlike grid-tied systems which are virtually maintenance-free, battery PV systems require considerable maintenance by the owner. See [chart of decreased battery capacity](#) and increased battery life at lower temperatures. Batteries for backup power when grid power is not available should

be in a temperature controlled location, such as an insulated container. The leading edge of the industry is in battery storage for grid-tied systems, such as Tesla's newly introduced **Powerwall** units.

**Hybrid PV systems** are grid-tied with a generator or battery backup for outages.

**Solar hot water heating** is an economical way to heat water from water tanks to pools to radiant heated flooring. Water heating is the second biggest use of energy in most homes after space heating and cooling demands. If your home is all electric, consider a hybrid heat pump water heater using about 1/3 to 1/2 the energy as compared to an electric resistance water heater.

**Solar PV-therm (PVT) systems** combine solar hot water and PV technologies. Solar cells on the front of the panel convert solar to electricity while a closed-loop glycol heat exchanger on the back of the panel draw heat way from the solar cells, improving PV efficiency while heating water.

**Solar air heating** heats air and transfers it into the home with a small fan and thermostat separate from the primary furnace or heat pump. A cost effective heater may be **homemade** or **purchased commercially**.


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## **Where can I install solar panels besides my roof? Will they work on a flat roof?**

Solar photovoltaic (PV) panels, used to produce electricity, may be installed on roofs with south, west, or east facing exposure, in yards as a pole mount or ground mount, or as an architectural feature such as an awning, pergola, or carport. Panels can be installed on a flat roof when supported by racking mounted at an angle and typically grounded with ballast weights to avoid penetrating the roof. Installers can analyze the distribution of ballast weights to satisfy wind ratings and dead weight maximums. See the image Gallery on this site to see some of the ways that local residential, commercial, and institutional solar owners have installed panels.

Solar thermal panels, used to heat water, should be installed directly above the water tank or as close to the tank as possible. Solar air furnaces should be installed on a south-facing wall and vented to an inside room with good air circulation.

On the subject of roofs, people often ask if the age of their shingles matter  probably best to replace shingles before installing solar panel if the shingles are near the end of their life. (Covering shingles less than halfway through their expected life may extend their life.)

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## Where do I start with renewable energy in my home?

First you can try to reduce your electrical use. The biggest and cheapest source of renewable energy is the energy you don't use. The more energy you save, the less you need to generate. Major users of power are electric resistance heaters – in roughly decreasing order of use: the auxiliary setting on a heat pump, clothes dryer, dishwasher drying cycle, oven, toaster, toaster oven, hair dryer – and anything with a compressor, such as refrigerators, freezers, air conditioner, heat pump, and dehumidifier.

See the SIREN energy conservation [tip-sheet](#) for more suggestions. For other creative ways to reduce your use of electricity, see [Green America](#) and [Build it Solar](#), or follow [Monroe County Energy Challenge's](#) task of the month.

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## How do I plan for solar on my home?

SIREN frequently offers free Going Solar presentations to community groups. These programs are intended as a public outreach and basic education offerings to community members. Attendees may ask one of the SIREN volunteers at the event about how to arrange for this free service. Additionally, solar site pre-assessments using aerial map views on the internet are available for more distant locations. If you are interested, [contact us](#) with your phone number, address, name of your electric utility company, and how many kilowatt hours (kWh), to the nearest thousand, you use in 12 or 24 months. Also tell us if you have an electric water heater or heat pump, and how much of your electric usage you think you might be able to reduce. We attempt to assess energy demand, solar site potential, and recommend an appropriate size for renewable energy systems.

More comprehensive reports are available from solar contractors and MREA (Midwest Renewable Energy Association) certified site assessors. See the [Solar Contractors](#) listing for more information.

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## Wait, this is confusing. What's the difference between kilowatts and kilowatt hours?

A full explanation is [here](#) but to boil it down, they measure different things. The kilowatt (kW) is a unit of power – 1,000 watts. It measures the rate at which electrical energy is generated or consumed. Solar

panel manufacturers rate the capacity of panels in watts to indicate the output of a panel in full sun. Commonly available panels range from 250 to 300 watts rated capacity. Solar contractors rate a full PV array in watts or kilowatts (number of panels multiplied by number of watts per panel).

On the other hand, the kilowatt hour (kWh) is a unit of energy – 1,000 watts of electricity running for one hour. It is also the billing unit on residential electric bills. You can use it to determine how much you can reduce that bill. On average, an unshaded 250 watt panel produces 300 kWh a year in Indiana.

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### **I am interested in possibly installing my own PV system. Where can I find DIY information, including module ratings and product reviews?**

Some big-box retailers and online solar design firms now sell DIY solar panel kits, including inverters or microinverters. To avoid buying low-quality products, it is wise to do your research up front. [Home Power](#) magazine provides both instruction and product reviews for DIY solar electricity and solar water heating. [Principal Solar Institute](#) and [PHOTON Laboratory](#) both publish test results and ratings of PV modules. PHOTON also tests and rates solar inverters. Homeowners within the community who have completed DIY installations may also be a source of information

It's not only about product. Be aware that some states will not honor the tax rebates if the installation is not done by a certified professional. Also if you take the DIY approach, you will be responsible for all the permitting requests, site inspections, and utility paperwork that a solar contractor usually does. Make sure you know what's required before you start. [Here](#), for example, are Duke Energy's requirements for connecting to the grid. If you plan to install a battery-backed system, check with your local government agencies to see what the electrical code requires.

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### **Is there a public SIREN mailing list? How do I join it?**

Yes, we have a mailing list that anyone can join. It's relatively low volume with ~1-3 emails per week.

To subscribe

1. Send an e-mail to: [list@list.indiana.edu](mailto:list@list.indiana.edu) with the message: **SUBSCRIBE siren-L**
  1. Please note that content needs to be in the body of the message, **NOT** in the subject line.

2. Respond to the confirmation e-mail by clicking the link provided in that e-mail and follow the provided instructions.
3. To communicate with the group, send your email to: [siren-l@list.indiana.edu](mailto:siren-l@list.indiana.edu) (please note that attachments are not allowed).

For the **digest version** with a single daily summary, send an e-mail to: [list@list.indiana.edu](mailto:list@list.indiana.edu) with the message: **SET siren-l DIGEST**

There are lots of other commands that Sympa recognizes. To get a list of them, send an e-mail to: [list@list.indiana.edu](mailto:list@list.indiana.edu) with the message: **INFO siren-l**

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### **How do I register for an event?**

You can **RSVP** online for a SIREN Going Solar presentation. Occasionally our Events calendar contains notices of events offered by other organizations. In such cases, registration contacts are provided in the listing.

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### **How do I request a free assessment of the potential for solar on my property?**

SIREN frequently offers free Going Solar presentations to community groups. These programs are intended as a public outreach and basic education offerings to community members. Attendees may ask one of the SIREN volunteers at the event about how to arrange for this free service. Additionally, solar site pre-assessments using aerial map views on the internet are available for more distant locations.

If you are interested, **contact us** with your phone number, address, name of your electric utility company, and how many kilowatt hours (kWh), to the nearest thousand, you use in 12 or 24 months. Also tell us if you have an electric water heater or heat pump, and how much of your electric usage you think you might be able to reduce. We attempt to assess energy demand, solar site potential, and recommend an appropriate size for renewable energy systems.

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### **How can I get a “Powered by the Sun” sign for my yard?**

If you have a solar energy system in your home then all you have to do is ask! A donation is suggested to cover materials and mailing costs, but it is optional. [Contact us](#) with your name and contact information. Use the [Donate button](#) if you are so inclined. Please allow two weeks to receive your sign by mail. If you want it more quickly, please indicate that on the contact form as well and a volunteer will contact you by phone to make other arrangements.



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### **How can I get involved personally in this work?**

Come to a Going Solar presentation and talk with a SIREN volunteer about your interest and aims. We will share what we know about opportunities to participate in renewable energy efforts of various sorts. Networking is a big part of what we do. If you would rather contact us by email, use the Contact form at the bottom of every page of this website.

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Financial Issues

## What does solar cost?

You can get a ballpark estimate sufficient to create a realistic budget and set realistic payback expectations by using online calculators. These calculators enable you to enter your own data (for example, panel size and cost per watt) or to use the default values typical for your location.

The National Renewable Energy Lab (NREL) [PVWatts](#) calculator estimates the amount of energy production and dollar value of energy produced for grid-tied PV systems of specified size and orientation to the sun. The [Solar & Wind Estimator](#) provides a thorough financial analysis for solar water heating, pool or spa heating, and space heating/cooling systems in addition to PV systems. This analysis is based on energy bill savings and net system cost, after tax credits and other incentives are applied. The Solar & Wind Estimator also calculates the impact of loans if you intend to finance your system that way. It displays cash flow and your break-even point in graphical form.

Small changes in energy consumption habits can reduce the cost of renewable energy. For example, reducing household energy use by only 100 kilowatt hours a month has the same effect as buying 3-4 solar panels that produce 1,200 kWh annually, yet it costs nothing. Many PV owners began by replacing half the energy they use from the grid with solar power; then they reduce the other half with energy conservation. PV systems can be installed in stages to spread cost over several years.

Solar PV electricity is an appreciating asset. The value of your system will increase as future electric rates continue to rise. This investment will raise your home's value, reduce peak loading on the grid, and support the local economy. PV prices have fallen by 70% over the last six years due to technological innovation and new financing models so the investment is more affordable than ever.

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## Does a renewable energy system pay for itself?

Yes. The payback period – the length of time it takes for your savings from lower utility bills to equal the initial cost of the system – varies widely, based on the size and type of system you buy, the amount of energy you use or conserve, and how quickly your utility's billing rate increases. Most projected payback periods for residential PV are in the 10-15 year range, based on 2015 prices, which is 10-15 years shorter than the warranty period. Once you get to the break-even point, you will pay nothing and nobody for the electricity your panels generate – and by then, utility rates will be higher than they are now.

The projected payback periods for solar thermal, solar attic fans and other devices are generally shorter, but otherwise the same logic applies.

Here is another way to think about your investment in solar. Residential PV systems cost between \$5,000

and \$10,000 after the federal tax credit. That's less than cost of a used car. A car is a depreciating asset. Most of the value of a car is lost after 10 years, and meanwhile you are buying gas, insurance, license and repairs. Solar PV is an appreciating asset. Solar fuel costs nothing and solar systems require little or no maintenance. In addition, an investment in renewable energy will raise your home's value, reduce peak loading on the grid, and support the local economy.

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### **What's the deal with the tax credit?**

A **30 percent federal renewable energy investment tax credit** is available until December 31, 2016 to individual taxpayers who install solar PV, solar hot water, fuel cells, geothermal and small wind systems on property they own and use as a residence. For example, a \$10,000 system would cost \$7,000 after the tax credit.

In describing the **residential tax credit**, "Expenditures include labor costs for on-site preparation, assembly or original system installation, and for piping or wiring to interconnect a system to the home. If the federal tax credit exceeds tax liability, the excess amount may be carried forward to the succeeding taxable year. The excess credit may be carried forward until 2016, but it is unclear whether the unused tax credit can be carried forward after then." See [Energy.gov](#) for all relevant terms and conditions.

The **corporate tax credit** for taxpayers is somewhat different. Installations of solar PV and hot water, fuel cells, small wind systems and PTC-eligible technologies on business property are eligible for a 30 percent tax credit and installations of geothermal, micro-turbines and Combined Heat and Power (CHP) systems are eligible for a 10 percent tax credit. The deadline is the same: December 31, 2016. These purchases can also be depreciated like any other equipment acquired for business use, following standard Modified Accelerated Cost Recovery System (MACRS) accounting rules. Both the tax credit and a substantial portion of the depreciation allowance can be taken in the first year, making renewable technologies very affordable.

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### **What are Solar Renewable Energy Credits (SRECs)?**

You can get paid for the renewable attributes of your grid-tied PV energy source by registering with a



broker such as [SRECTrade](#) or [Sol Systems](#). Participating utility companies purchase renewable energy credits to meet state required renewable portfolio quotas. Solar owners receive a check for market value solar production. Midwestern market values range \$30-50 per 1,000 kWh of solar energy produced (one SREC). A home producing 12,000 kWh per year with solar PV would earn \$360 each year at \$30/SREC.

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## **Can I get a grant or other funding to help pay for a solar or other renewable energy system?**

For both individuals and organizations, the best place to start is [DSIRE \(Database of State Incentives for Renewables and Efficiency\)](#). It is the most comprehensive source of information on this topic in the United States. It includes financial incentives including loans, grants, tax breaks and utility rebate programs.

Noteworthy non-residential programs that work with specific groups include:

- The Indiana Office of Energy Development offers grants under the [Community Conservation Challenge](#) to community organizations and government entities, including schools.
- [Hoosier Interfaith Power & Light \(H-IPL\)](#) offers free advisory services and occasional grants to faith communities.
- Solar Uniting Neighbors (SUN) grant program awards grants to diverse group of businesses and organizations in northern Indiana, made available through the Indiana Association for Community Economic Development .
- The USDA's [Rural Energy for America Program \(REAP\)](#) provides financial assistance, including grants, to agricultural producers and rural small businesses.
- The [S. Department of Energy](#) supports a number of grant, loan and financing programs for businesses and for state, local and tribal governments.

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## **Can I finance a solar energy system?**

Many people finance with a bank home equity line of credit. The minimum monthly interest payment can be less than your savings from electric bills. Talk your local credit union or bank for financing options.

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## Can I lease a PV system?

Leasing is an option for homeowners in many states but not currently in Indiana. The closest thing to it is the community solar option available from [Tipmont REMC](#), Indiana's first community, remote solar program. The REMC owns and operates an array of 240 panels on its land. Customers can purchase electricity generated from one or more panels and receive a monthly credit on their bill.

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## How does solar PV or other renewable technologies affect my property tax and property value?

Indiana offers a [property tax exemption](#) for the assessed value of most renewable energy systems, typically based on the actual cost of components and labor. Effectively this means that you can increase the value of your home without paying tax on the increased value. Commercial and industrial property owners may also claim this exemption.

The few home sales to date that have involved rooftop solar in Indiana do show it to be an advantage, not only in commanding a higher price but also resulting in less time on the market. A [national study](#) found that home buyers are willing to pay more for houses with rooftop solar systems. Data on properties with other renewable technologies is scattered, but suggestive of the same advantage.

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## What does it cost to charge an electric plug-in vehicle with solar energy?

At first the value of reducing gasoline cost seems high because of the return on investment (ROI) for charging an electric plug-in vehicle with solar energy. However, this analysis only applies to an off-grid solar array where the only electricity available is from the sun or storage batteries. For example, the Chevrolet Volt uses about 1,200 kWh to drive 3,400 miles (85 trips of up to 40 miles in all electric mode). The avoided cost of gasoline is \$340 (assuming 10 cents per mile with 30 mpg and \$3 per gallon gas cost). If the cost of a one kilowatt solar array (to generate 1,200 kWh annually) is \$2,400 after the federal tax credit, then the ROI will be 14 percent (\$340 savings vs. \$2,400 cost). The ROI becomes 15 percent after including SREC income of \$30 per megawatt hour generated. When gas costs \$2.10 per gallon the ROI is 11 percent, at 7 cents per mile with 30 mpg.

A similar analysis is less favorable for someone with grid-tied net metering who can charge a Volt from the electric grid at night and on cloudy days. In this case the comparison is between grid power and gasoline. The cost of 1,200 kWh from the grid could be \$120, or 10 cents per kWh, to drive 3,400 miles. Now the ROI for purchase of the car is calculated as \$220 savings (\$340 avoided cost of gas, minus \$120 cost of electricity) for each 3,400 miles. If you drive 10,200 miles in a year, your savings would be \$660.

Adding solar to the grid-tied analysis changes to a comparison of grid power and solar power. You can add \$30 SREC income to the \$120 avoided cost of grid power. Therefore the value of solar energy for charging an electric car could be \$150 for 3,400 miles or \$450 for 10,200 miles. However, the accuracy of any analysis depends on its assumptions. Your actual cost of grid power may be between 8 cents and 20 cents per kWh. The incremental cost of electricity depends on your rate, utility company and how many kWh you are using.

New cars are expensive but a pre-owned Volt with less than 30,000 miles can be purchased in 2015 for under \$20,000.

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### **What are the benefits to the owner of installing a solar PV system?**

The greatest benefit for the owner is creating a clean, renewable form of energy right at home. Eighty percent of Indiana's electricity is generated from central coal-fired plants, which results in double the carbon emissions of a typical Indiana household compared to their natural gas or automobile use. The main financial benefit comes from locking in the cost of electricity for the next several decades and removing uncertainty about future rate increases. Locally, annual rate increases are forecast to be about three percent a year.

Solar systems produce electricity long after they've paid for themselves. **Solar panels manufactured in the 1970s still provide power.** Solar assets appreciate in value if electric rates rise by more than one percent annually – the maximum rate at which cells in the panels degrade. Most PV panels carry a warranty guaranteeing that in year 25, the system will still generate at least 80 percent of what it did in the first year. The zero cost of fuel from the sun remains constant.

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### **What are the support levels of tax-deductible donation to SIREN?**

As a volunteer-run organization, SIREN is supported via tax-deductible contributions made by individuals and businesses in our community. If you are interested in supporting our work, you can [donate](#) at a level of support that fits you best.

- **Individual** \$25/year
- **Family** \$50/year
- **Sustainer** \$100/year
- **Business** \$250/year. Benefactors receive a SIREN certificate which can be proudly displayed in your place of business. They can also choose to be listed as a supporter on SIREN's website.
- **Benefactor membership** – \$500/year. Benefactors can also choose to be listed as a supporter on SIREN's website.

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## Utility Customers

### **What is net metering?**

According to the [Solar Energy Industries Association](#) , “Net metering is a billing mechanism that credits solar energy system owners for the electricity they add to the grid. For example, if a residential customer has a PV system on the home’s rooftop, it may generate more electricity than the home uses during daylight hours. If the home is net-metered, the electricity meter will run backwards to provide a credit against what electricity is consumed at night or other periods where the home’s electricity use exceeds the system’s output. Customers are only billed for their “net” energy use. On average, only 20-40 percent of a solar energy system’s output ever goes into the grid. Exported solar electricity serves nearby customers’ loads.”

Different utilities have different net metering policies. Here is what [Duke Energy Indiana](#) says about [renewable generating options](#) and [net metering](#) in its territory. Indiana Electric Cooperatives (IEC) represents Indiana’s 38 [REMCs](#), each with its own net metering or similar policies. Drill down on the [REMC](#) map to see their websites for more information.

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### **How do the Duke Energy charges for base rate and riders affect net metering customers?**

Grid-tied solar owners will pay Duke the monthly minimum connection fee, regardless of surplus

production. The Duke rate tariff schedule charges less per unit as your electricity usage increases. The first 300 kWh monthly is the most expensive. Your monthly bill is reduced by power produced with renewable energy. For example, if you used 900 kWh and produced 500 kWh with solar PV, the net bill would be for 400 kWh from the grid. The first 300 kWh would cost about \$44 and the next 100 kWh would cost about \$11 for a net metering bill of approximately \$65 including the \$9.40 connection fee.

Your electricity usage is seasonal with the lowest bills in spring and fall when heating and cooling are not needed. Solar energy peak production is from March to October. A solar PV system sized to offset most or all of your power in April and September will have the greatest benefit by reducing your monthly kWh below 300.

#### DUKE ENERGY RATE ANALYSIS FOR INDIANA RESIDENTIAL (May 2014)

Monthly energy kWh usage	Under 300	301 – 1000	over 1,000
Base rate per kWh	0.092945	0.054178	0.037794
Rider adjustment charges	0.045177	0.045177	0.045177
Electric charges total	\$0.138122	\$0.099355	\$0.082971
Sales tax 7%	\$0.008652	\$0.005938	\$0.005258
<b>Cost per kWh</b>	<b>0.147</b>	<b>0.105</b>	<b>0.088</b>

Cost per kilowatt hour (kWh), including Indiana sales tax, is near 15 cents, 11 cents and 9 cents for each residential kWh rate tier, including base rate and riders.

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#### What are the rates for other Indiana utility companies?

Here are the rates as of 2014. Rates are set by the [IURC](#) for set periods; utility companies have to request rate changes. We will try to track rates changes and update the rate information on this page to the best our abilities.

#### I&M:

Service Charge: \$7.30 per month, Energy Charge: 8.634¢ per kWh

**IPL:**

Customer Charge for bills of 0-325 kWh per month: \$ 6.70 per month; for bills over 325 kWh per month: \$11.00 per month

Energy Charge: any part of the first 500 kWh per month: 6.70¢ net per kWh; over 500 kWh per month 4.40¢ net per kWh

With electric heating and/or water heating, over 1000 kWh per month: 3.18¢ net per kWh

**NIPSCO:**

Customer Charge: \$11.00 per month

Energy Charge: \$0.097836 per kWh

Adjustment for customers with electric space heating: \$0.077836 per kilowatt hour for all use in excess of 700 kilowatt hours during any billing period more than half of which is within any calendar month from October to April

**VECTREN:**

Customer Facilities Charge: \$11.00 per month

Energy Charge:

- Standard Customers \$0.09771 per kWh for all kWh used per month;
- Transitional Customers
  - \$0.07656 per kWh for the first 1,000 kWh used per month
  - \$0.05266 per kWh for all over 1,000 kWh used during the months of June through Sept
  - \$0.03899 per kWh for all over 1,000 kWh used during the months of October through May

**REMCs and municipally owned utilities:**

Indiana has 38 **REMCs**, each with its own net metering or similar policies, rate structures and tariffs. In addition, Indiana has 60 **municipally owned utility** companies throughout the state. If you receive your electricity from one of these utilities, please consult the company for information on renewable energy options.

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## **What are the benefits of rooftop solar to the utility company?**

Private rooftop systems also benefit the utility. They are most productive at the same time that demand for electricity is greatest – on summer afternoons, often referred to as ‘peak load times.’ This means that solar owners supply their own needs and put any surplus energy they generate back out on the grid where it is used by their nearest neighbors. Solar owners relieve the peak load on the utility and do not incur line losses when electricity travels through the distribution system from the utility’s power plant.

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