CONSUMER ENERGY MANAGEMENT AND ACCESS GUIDE

Prepared By: Kentucky Energy and Environment Cabinet

Date: August 2023

Disclaimer: The information expressed in this guide is for general educational purposes only and does not reflect the endorsement of a specific program or policy. The information contained in this document is up-to-date as of the date of publication and cannot be guaranteed to be complete and accurate following the date of publication. The guide is not a legal document and is no substitute for the advice of a legal professional. The guide provides links to other resources but does not imply endorsement of any particular resource or organization.

Table of Contents

OVERVIEW

This guide presents options for those utility customers who are seeking pathways to access alternative energy through onsite or offsite electricity generation in Kentucky.

Onsite and offsite electricity generation can be broken down into two categories:

1. Power production facilities that utilize a single energy resource or any combination of energy resources for producing power, and
2. Cogeneration facilities that sequentially produces electricity and another form of useful thermal energy (such as heat or steam) in a way that is more efficient than the separate production of both forms of energy. These are also known as combined, heat and power facilities (CHP).

The scale of the electricity generating facilities and how it connects to the electric grid also creates categories by which to categorize these resources.

1. Distributed Energy Resources (DER) can be described as energy resources connected to the distribution system (<69 kV voltage level) that either generate electricity, store electricity, or involve load changes in response to signals. DERs may be utility owned or customer owned resources.
2. By default, utility-scale projects are those projects that are larger in size and connect at high voltage levels.

The configuration of these resources and the role of energy storage is discussed later in the guide.

The Importance of Scope

Each individual, business, or organization must determine:

(1) The objective for accessing alternative energy resources. Reliability, resilience, sustainability, energy security, and grid integration are all factors to consider when identifying objectives;

(2) The parameters for developing or acquiring alternative energy resources and electricity generating technologies such as location or types of preferred resources;

(3) Which electricity generation resources are technically and economically feasible;

(4) The financial resources allocated for acquiring alternative energy resources and electricity generating technologies; and

(5) The measurement, tracking, and reporting metrics.

Even if an alternative energy resource is not technically feasible at a specific location, that does not mean there are no options available as will be addressed in this guide. Taking the time to define the scope as described in items 1-5, will determine which options are available and the ultimate success of any alternative electricity initiative.

Before You Begin

Understanding onsite and offsite electricity generating options available to an individual or business is a key decision point in mapping out how to access any alternative energy resource. Ultimately, an individual or business will determine if an energy resource has the technical, economic and market potential to move forward with a project.

The Kentucky Energy Profile developed by the Kentucky Energy and Environment Cabinet (EEC) provides an overview of energy consumption and production within the Commonwealth, including discussing the energy resource potential and an overview of power production and cogeneration projects.

The National Renewable Energy Laboratory (NREL) has developed technical materials for understanding resource potential and evaluating projects.

Renewable Resources Maps and Data https://www.nrel.gov/renewable_resources/

Renewable Energy Technical Potential https://www.nrel.gov/gis/re-potential.html

Renewable Energy Economic Potential https://www.nrel.gov/gis/re-econ-potential.html

Energy Analysis Data and Tools https://www.nrel.gov/analysis/data-tools.html

The U.S. Department of Energy's "Combined Heat and Power (CHP) Technical Potential in the United States" market analysis report provides data on the technical potential in industrial facilities and commercial buildings. Interested individuals or business can also contact the Kentucky Energy Office for "Kentucky's Action Plan for Combined Heat and Power".

KENTUCKY'S UTILITY LANDSCAPE

Kentucky is home to four investor owned utilities (IOUs), two generation and transmission member cooperatives, one quasi federal government power entity (Tennessee Valley Authority), and thirty municipal electric utilities (see Figure 1).

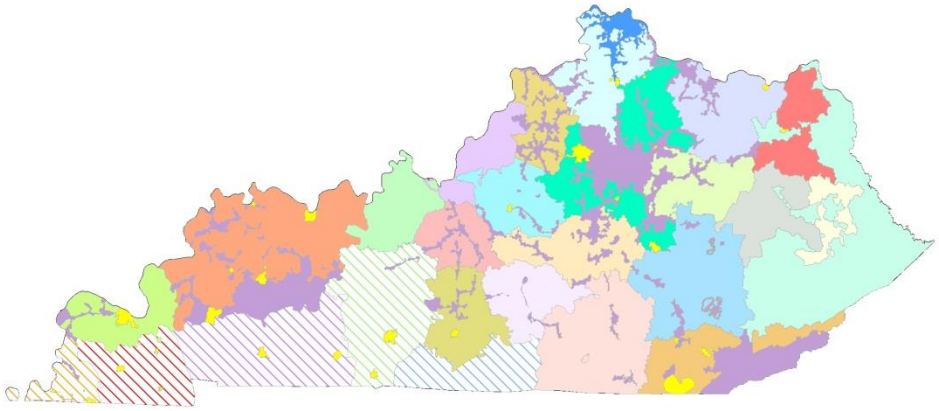


FIGURE 1: ELECTRIC UTILITIES IN KENTUCKY.

In addition, Duke Energy Kentucky, Kentucky Power, East Kentucky Power Cooperative and Big Rivers Electric Cooperative, along with their member-owners, participate in two regional power markets or Regional Transmission Organizations: MISO and PJM (see figure 2). Regional Transmission Organizations are independent, membership-based, non-profit organizations that ensure reliability and optimize supply and demand for wholesale electric power. They operate bulk electric power systems across much of North America and a significant portion of Kentucky.

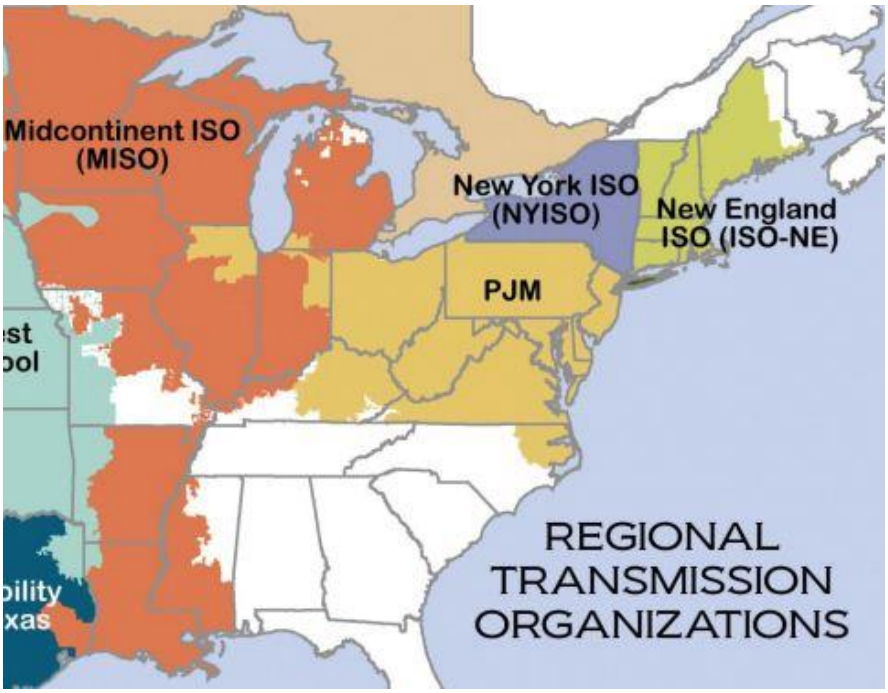


FIGURE 2: REGIONAL TRANSMISSION ORGANIZATIONS IN KENTUCKY.

Just as with Kentucky's natural resources, the utility landscape is complicated and diverse which presents a host of options available to consumers. Understanding your local utility and how it is regulated is important to determine which options may be available.

Regulated electric utilities in Kentucky are governed by the Kentucky Public Service Commission (PSC). Municipal electric utilities and the Tennessee Valley Authority and their local power companies are not regulated by the PSC. The PSC offers answers to frequently asked questions regarding Kentucky's municipal utilities and interactions with the PSC.

Those utilities in Kentucky that are regulated by the PSC operate under a "regulatory compact". Under the regulatory compact, a utility has a conditional exclusive franchise to provide electricity to a certified territory; protection from direct competition; the ability to recover costs through rates; and the opportunity to earn a reasonable rate of return. In exchange for these provisions, the utility accepts the obligation to provide all paying customers with access to safe, adequate, reliable, convenient, and

nondiscriminatory service on just and reasonable terms. In doing so, the utility assumes certain business and market risks and subjects itself to comprehensive regulatory review and oversight by the PSC.

What this means is that if you are a customer in a regulated utility's territory, the only entity legally allowed to provide you electricity is either yourself or the utility. Independent generators are not authorized to sell electricity directly to the retail customers in a regulated utility's territory.

Remember, customers served by a municipal electric provider or the Tennessee Valley Authority's local power company are not regulated in this way. TVA is deemed to be the regulatory authority for those electric utilities over which it has ratemaking authority.

> *Independent generators cannot legally sell electricity directly to retail customers in a regulated utility's territory.*

Customers served by a municipal electric utilities should consult with that organization for rules, regulations, and policies on onsite or offsite electricity generation. Below are the listed municipal utilities in Kentucky.

Barbourville Utility Commission
Bardstown Municipal Electric
Bardwell City Utilities
Benham City Utilities
Benton Electric & Gas Systems
Berea City Utilities
Bowling Green Municipal
Corbin Utilities Commission
Falmouth City Utilities
Frankfort Electric and Water Plant
Franklin Electric Plant Board
Fulton Electric & Gas Systems
Glasgow Electric Plant Board
Henderson City Utility Commission
Hickman Electric & Gas Systems
Hopkinsville Electric System
Jellico Electric & Water System
Madisonville Municipal Light & Power
Mayfield Electric & Water Systems
Murray Electric and Natural Gas System
Nicholasville Municipal Electric System
Olive Hill Municipal Lighting and Gas
Owensboro Municipal Utilities
Paducah Power System
Paris Combined Utilities
Princeton Electric Plant Board
Providence Electric & Gas Dept.
Russellville Electric Plant Board
Vanceburg Electric & Gas Systems
Williamstown Utility Commission

The Local Power Companies (LPC) that purchase power from the Tennessee Valley Authority (TVA) are regulated by the TVA Act of 1933 and the provisions of the wholesale power contract entered into between TVA and distributors of TVA power. In partnership with local power companies, TVA offers programs to assist customers with energy choices and electrification options. Customers served by TVA

local power companies should contact their electric utility for more information on rules, regulations, and policies for alternative energy options as well as energy solutions. For generation options, TVA local power company customers can review information at "Valley Renewable Energy."

The remainder of this document will focus on those options available to customers of regulated utilities, both investor-owned and electric cooperatives, in Kentucky.

Understanding Your Electricity Bill

For many customers, the first relationship with their utility begins with paying the monthly electricity bill. Before beginning the discussion on alternative energy options, it is important to understand your electricity bill and understand what exactly you are paying for when you pay for electricity.

BILLING SUMMARY

Previous Balance	119.65
Payment(s) Received	-119.65
Balance as of 6/22/16	**$0.00**
Current Electric Charges	158.34
Current Taxes and Fees	11.06
Total Current Charges as of 6/22/16	**$169.40**
Total Amount Due	**$169.40**

For many residential customers, an electricity bill can be broken down into three main categories: a basic service charge, an energy charge, and charges for special programs and taxes.

CURRENT USAGE

ELECTRIC

Meter Reading Information	Meter #
Actual (R) kWh Reading on 6/22/16	8578
Previous (R) kWh Reading on 5/20/16	6910
Current kWh Usage	1668
Meter Multiplier	1
Metered kWh Usage	**1668**

CURRENT CHARGES

ELECTRIC **Rate:** Residential Service

Basic Service Charge	10.75
Energy Charge ($0.0887 x 1,668 kWh)	147.95
Electric DSM ($0.00253 x 1,668 kWh)	4.22
Fuel Adjustment ($-0.00605 x 1,668 kWh)	-10.09
Environmental Surcharge (3.440% x $152.83)	5.26
Home Energy Assistance Fund Charge	0.25
Total Charges	**$158.34**

The bill like the example to the right is a typical two-part rate structure for a residence. You pay for the utility service to your home and for the electricity you use. When a bill is comprised of a basic service charge and an energy charge as described above it is referred to as a two-part rate.

The basic service charge is what is referred to as a fixed charge ($ per month). Traditionally, this would include a portion of those fixed costs borne by the utility to read your meter, meter maintenance, billing and payment processing, service lines, portions of distribution lines and transformers — costs that don't vary with the amount of energy consumed.

While some of the other charges, mainly the energy charge ($/kilowatt-hour), depend on the amount of electricity you use every month, the service charge remains the same regardless of your usage. What this means is that even if you didn't use any electricity for a month, you will still be paying the service charge and any other charge that is not dependent on electricity usage. Any fixed costs not contained in the basic service charge are recovered through other charges on your electricity bill including the energy charge. Taxes on your utility bill should only be charged to those organizations that are not an Internal Revenue Service verified tax exempt organization.

Contrast the residential bill with one that you may see from a commercial or industrial customer. The main difference comes in the form of an additional charge, called a demand charge ($/Kilowatt). Electricity demand is not how much electricity the customer uses, but rather the rate at which the customer uses electricity. It also represents how much equipment a utility must have on-hand to meet its customers' rate of electricity usage. To the utility, demand represents how much generating capacity (power plants) it needs to construct and the amount of wires, poles, transformers, etc. needed to deliver the electricity. Keep in mind that in most cases a rate structure that includes a demand charge is not an additive charge but rather it represents those demand costs that were included in the fixed or energy charge but are now broken out separately. Your monthly bill may be the same under a demand rate structure but your payment is being spread out among three categories instead of two. When a bill is made up of the basic service charge, an energy charge, and a demand charge it is referred to as a three-part rate.

What is a Tariff?

Utilities use tariffs to establish the pricing structure of the electricity, capacity, and services that they provide to their customers. Tariffs outline the service agreements between the customer and the utility, including billing and payment information and the rights and responsibilities of each party in the agreement. Each specific tariff will include but is not limited to the following sections: applicability; the type of service; rates; how the monthly bills are calculated; due dates; late payment charges; and terms and conditions. Regulated utilities in Kentucky file their tariffs with the Kentucky PSC. Those tariffs are reviewed and approved if they are deemed to be fair, just, and reasonable to consumers. The rates used to calculate a customer's electricity bill are directly linked to the specific tariff approved and on file at the Kentucky PSC. Many utilities also will include links to their tariffs on the rates section of their website. Tariffs for a municipal utility are approved by the local authority such as a local board or commission.

Managing Your Electricity Costs

Managing Demand

Fundamentally, demand is the rate at which a consumer will use electricity and depends on how much electricity-consuming equipment a customer runs concurrently. Managing demand requires controlling the amount of equipment consuming electricity along with when consumers use the equipment. All in all, this equals a significant amount of monitoring and control.

Understanding the difference between energy and demand can be difficult. To illustrate the difference, consider a customer who has ten 100-watt light bulbs and all ten are turned on at the same time for two hours. The energy consumed would be 100x10x2=2,000 watt-hours (2 kWh). The demand for the period would be 100x10=1,000 watts (1 kW) because all 10 lights were on at the same time. However, if the customer assured that only 5 of the ten lights were on at any one time during a 2-hour period then the demand would be 100x5=500 watts (0.5 kW), and the energy would be 100x5x2=1,000 watt-hours (1kWh).

Demand charges can account for more than 50% of a customer's monthly electricity bill. Demand charges are generally applied to commercial and industrial customers residing in Kentucky's regulated utility territories. Customers can control demand charges and increase bill savings by:

- Installing energy efficiency equipment that reduces the rate of consumption;
- Right-sizing equipment to fit the job. More is not necessarily better;
- Rescheduling energy-intensive activities at lower load times of the day. Spreading the load around throughout the day rather than at peak times;
- Conducting scheduled startup of high energy-intensive equipment to reduce peak demand, especially at the start of the work day or shift; or
- Looking at energy storage solutions that allow for shifting loads.

Understanding how demand is calculated can help customers determine how their actions affect their facility's electric bill. To calculate demand, the utility measures the average kW required by the customer during each 15-minute or 30-minute clock interval for the billing period (typically a month). The maximum interval recorded for the billing period is then applied to the demand rate ($/kW) to establish the demand charge for the billing period. Demand charges can vary by time of day as well. For billing, the demand a customer is charged for can be based on several methods:

- The maximum demand recorded during the billing period;
- A percentage of the highest measured demand in recent preceding months (demand ratchet);
- Low Power Factor(power factor is the ratio of the real power flowing to the load to the apparent power in the circuit); and/or
- A percentage of the contracted capacity based on the maximum demand expected (or infrastructure installed) at the customer's location.

Demand ratchets are a special area to watch because a one-time event that spikes your demand could set your billing demand to a minimum level for subsequent months regardless of your actual monthly demand.

Different Rates Structures and Contracts

There are several different types of rates beyond the basic rate structures explained above that may present opportunities for savings. Rate structures and options like those below will be detailed in the tariffs approved by the Kentucky PSC for the utility.

- Time of Day or Time of Use Rates can represent energy or demand charges that change based on the time of day. You can schedule tasks or activities to take place when energy or demand charges are low for a certain time of day. Flexibility in scheduling is key here.
- Temporary or Seasonal Rates are applicable to customers who have seasonal operations.
- Curtailment Rates represent a customer's load that can be decreased by the utility or curtailed at a moment's notice. Curtailable rates are typically offered at a discount on the understanding that a utility could reroute that energy to another customer without notice.

- Demand Response (DR) represents a financial opportunity for customers to reduce or shift their electricity usage during peak periods in response to some form of financial incentives. DR programs may not be offered by all utilities.
    - An example of a residential demand response program is one where the utility installs a device to control an air conditioner unit during summer peak demand periods. Customers opt-in to the program and the utility pays the customer for that participation.
    - For commercial or industrial customers, the utility may offer a special contract for voluntary curtailment to incentivize those customers to shed load during peak times and get compensated accordingly. Many Regional Transmission Organizations (RTOs) also offer demand response programs, and Kentucky's participating utilities in those RTOs can assist their customers in participating in these programs through special contracts.

Take Away Points

- If you are a customer in a regulated utility's territory, the only entity legally allowed to provide you electricity is either yourself or the utility.
- Independent generators are not authorized to sell electricity to the retail customers in a regulated utility's territory.
- The TVA and municipal electric providers are not regulated by the Kentucky PSC.
- Making sure you understand your electricity bill and rate options can save you money and is an important first step before looking into alternative energy options.
- The residential energy charge may be made up of both fixed and variable utility costs. Fixed costs are related to generation facilities, poles, wires, and transformers that is required to generate and deliver the energy to a consumer. Variable cost are related to fuel, environmental compliance materials such as limestone, and items that vary with the amount of electricity needed to serve customers.
- Tax exempt organizations such as schools, churches, or other non-profits should check to ensure there are no taxes being assessed to the organization and the proper rate tariff is being utilized.

WHAT YOU CAN DO? ONSITE AND OFFSITE ELECTRICITY OPTIONS

Renewable Energy Certificates (RECs)

A renewable energy certificate (REC) is a market based instrument that represents the property rights to the environmental attributes of renewable electricity generation. RECs are issued when 1 megawatt-hour (MWh) of electricity is generated and delivered to the electricity grid from a renewable energy resource. A key aspect of RECs is that the environmental attribute can be separated from the underlying power and traded, bought, or sold. Once the REC is separated from the underlying power, the actual power that is left over is referred to as null power. RECs operate in two markets: compliance markets and voluntary markets. Compliance markets are created when a policy establishes a requirement that electric utilities must generate a certain percentage of their electricity from renewable sources. RECs are the mechanism by which this is demonstrated. Voluntary markets are formed for those customers such as businesses or households that want renewable electricity due to their own goals and objectives but there is no regulatory requirement to do so where they are located.

Renewable Electricity: How Do You Know You Are Using It? (PDF)

RECs: Making Green Power Possible (Video)

The Legal Basis for RECs (PDF)

RECs are an accepted legal instrument through which renewable electricity generation and use claims are substantiated. In Kentucky, regulated utilities offer renewable energy resource or green power programs to their customers. These programs offer the customer the opportunity to support renewable energy procurement through the utility's purchase of RECs by paying monthly for blocks of RECs. These programs can be found under the tariffs approved by the PSC for the utility. See http://psc.ky.gov/Home/Library?type=Tariffs&folder=Electric

In addition to the standard REC programs offered by utilities, customers may engage a utility via a special contract to purchase RECs and retire them on behalf of the customer for that customer to make a renewable electricity claim. An example of that can be found here between L'Oreal USA, Inc. and Duke Energy Kentucky, Inc.

Outside of a contract with a regulated utility or a utility REC program, a customer may enter into a REC market independently to sell or purchase RECs. For example, PJM (a Regional Transmission Organization) operates the Generation Attribute Tracking System as a tradable platform designed to meet the needs of buyers and sellers of RECs. This includes homeowners, aggregators, states, and other REC market participants. For more information, please visit https://www.pjm-eis.com/getting-started/about-GATS.aspx

On-Site Self-Supply Options

For those customers who want to self-supply their own electricity from an on-site electricity generating system, there are several pathways. Before adding any self-supply systems, customers should ensure that the house or building is as energy efficient as possible, otherwise any renewable electricity generated is wasted and that is wasted savings. Customers should also consider how large to size their generation system, depending on whether they want to generate some, all, or excess energy for their home or facility.

Installing an on-site electricity generating system may also trigger additional tariffs, which can affect the economic evaluation of the on-site system. Potential tariff changes may include:

- Demand charges or
- Standby or back-up power, if the on-site system provides intermittent or unpredictable generation.

Net Metering

Net metering, in it's original form or Net Metering 1.0, is a policy that allows renewable distributed power systems located at a home or business, that supplies all or part of a customer's energy requirements, to connect to the utility's electrical grid, send any excess power generated to the grid for kilowatt-hour credits, and the owner to use those credits at a later time to offset their power consumption (see Figure 3). Net metering kilowatt-hour credits have a monetary value that is at the prevailing retail rate of electricity.

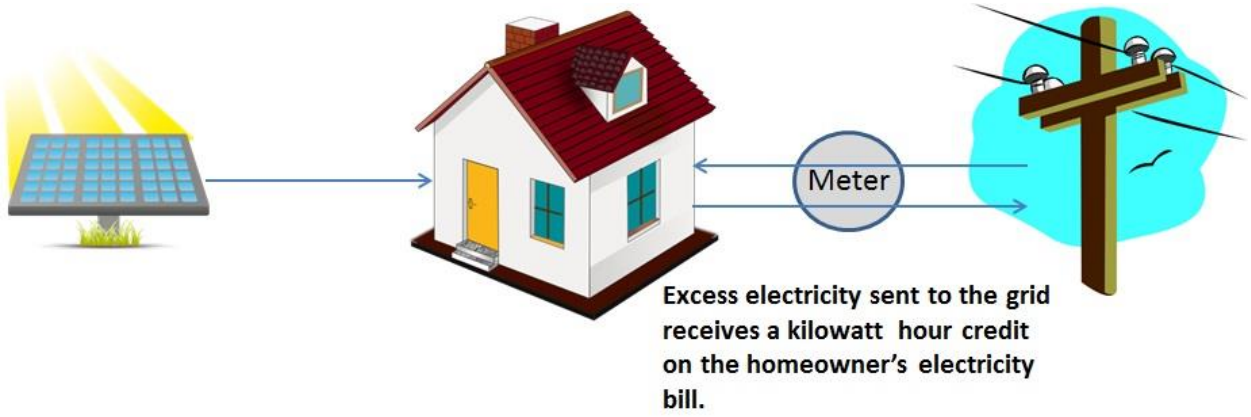


FIGURE 3: NET METERING 1.0

In Kentucky, in 2019, net metering 1.0 was revised to move away from kilowatt-hour credits to monetary credits where the Kentucky PSC determines the monetary value based on a utility filing a request for a new tariff offering. Net Metering version 2.0 (Figure 3.1) is available through Kentucky regulated utilities if they have an approved tariff from the Kentucky PSC. Net metering version 2.0 is established in statute in the Kentucky Revised Statute (KRS) 278.465 to 278.468.

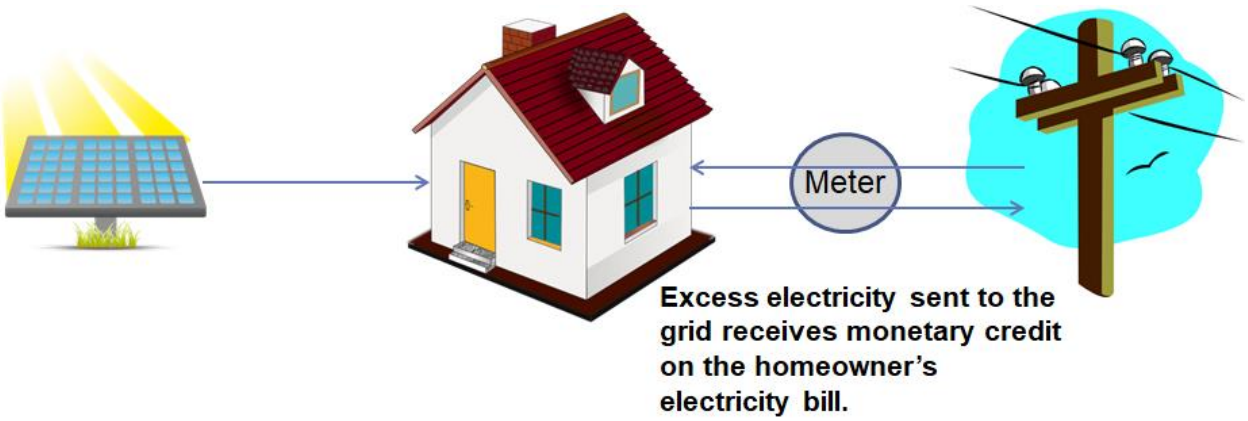


FIGURE 3.1: NET METERING 2.0

A customer must meet the definition of an eligible customer-generator to qualify. In general, the following conditions apply to net metering:

- An eligible electric generating facility is one that generates electricity using solar energy, wind energy, biomass or biogas energy, or hydro energy; and has a rated capacity of not greater than thirty (45) kilowatts;
- Is located on the customer's premises;
- Is owned or operated by the customer;
- Is connected in parallel with the utility's distribution system; and
- Has the primary purpose of supplying all or part of the customer's own electricity requirements.

If the cumulative generating capacity of net metering systems reaches one percent (1%)) of a supplier's single hour peak load during a calendar year, the supplier shall have no further obligation to offer net metering to any new customer-generator at any subsequent time. For Level 1 Net Metering Customers (explained below), interconnecting to a radial distribution circuit, the aggregated generation on the circuit, including the proposed generating facility, will not exceed fifteen percent (15%) of the line section's most recent annual one-hour peak load.

To connect a renewable electricity generating system to the electric utility's grid, the customer must file an application with the electric utility serving that customer. Each utility has a net metering tariff that can be found at http://psc.ky.gov/Home/Library?type=Tariffs&folder=Electric or by visiting the electric utility's website. Keep in mind that net metering information may be found in various places in the utility's website such as under rate options, self-generation, environment, or managing your bill.

Net metering offers standardized interconnection guidelines for all Kentucky's regulated utilities and uniform interconnection processes for customers. Below is a general overview of the interconnection process for those customers considering net metering. **Please note that the Kentucky PSC in Case 2020-0032 is currently reviewing Interconnection and Net Metering guidelines given the 2019 net metering**

law changes. For details, please review your utility's tariff for net metering requirement and those specified by the PSC at the link above.

1. The utility shall provide net metering services, without any cost to the customer for metering equipment, through a standard kilowatt-hour metering system capable of measuring the flow of electricity in two (2) directions.
2. The customer shall submit an Application for Interconnection and Net Metering ("Application") and receive approval from the Utility prior to connecting the generator facility to the utility's system.
3. The customer shall maintain general liability insurance coverage (through a standard homeowner's, commercial, or other policy) for both Level 1 and Level 2 generating facilities.
4. The customer shall retain any and all Renewable Energy Credits (RECs) that may be generated by their generating facility.
5. Applications will be submitted by the customer and reviewed and processed by the Utility according to either Level 1 or Level 2 processes.
    a. A Level 1 Application shall be used if the generating facility is inverter-based and is certified by a nationally recognized testing laboratory to meet the requirements of Underwriters Laboratories Standard 1741 "Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources" (UL 1741).
    b. A Level 2 Application shall be used in the event the generating facility is not inverter based or equipment is not certified to meet UL 1741, or the facility did not meet one or more condition of the Level 1 application.
6. Customers may contact the utility to check on status of an Application or with questions prior to submitting an Application.
7. Each utility shall provide contact information for inquiries regarding the utility's net metering program and application process.
8. Each utility with a website shall provide net metering application forms and information regarding the retail electric provider's net metering program.
9. Utilities shall accept applications by mail or in person. At its sole discretion, the utility may accept applications electronically.
10. Applications will be evaluated on if the generating facility meets the utility's technical interconnection requirements, which are based on IEEE 1547. The utility shall make its technical interconnection requirements available online and upon request.

Net Metering Fees

No application fees or other review, study, or inspection or witness test fees may be charged by the utility for Level 1 Applications.

The utility may require each customer to submit with each Level 2 Application a non-refundable application, inspection and processing fee of up to $100 for Level 2 Applications. If the utility determines an impact study is necessary with respect to a Level 2 Application, the customer shall be responsible for any reasonable costs up to $1,000 for the initial impact study. The utility shall provide documentation of the actual cost of the impact study. Any other studies requested by the customer shall be at the customer's sole expense.

Net Metering Timelines

The utility shall notify the customer within 20 business days whether the Level 1 Application is approved or denied. When approved, the utility will indicate by signing the approval line on the Level 1 Application Form and returning it to the customer. The approval will be subject to successful completion of an initial installation inspection and witness test if required by the utility. The customer shall notify the utility within 3 business days of completion of the generating facility installation and schedule an inspection and witness test with the utility to occur within 10 business days of completion of the generator facility installation or as otherwise agreed to by the utility and the customer. The customer may not operate the generating facility until successful completion of such inspection and witness test (if required).

If the Application is denied, the utility will supply the customer with reasons for denial. The customer may resubmit under Level 2 if appropriate.

The utility will process the Level 2 Application within 30 business days of receipt of a complete Application. Within that time the utility will respond in one of the following ways:

- The Application is approved and the utility will provide the customer with an Interconnection Agreement to sign;
- If construction or other changes to the utility's distribution system are required, the cost will be the responsibility of the customer. The utility will give notice to the customer and offer to meet to discuss estimated costs and construction timeframe. Should the customer agree to pay for costs and proceed, the utility will provide the customer with an Interconnection Agreement to sign within a reasonable time; or
- The Application is denied. The utility will supply the customer with reasons for denial and offer to meet to discuss possible changes that would result in utility approval. Customer may resubmit Application with changes.

The customer may not operate the generating facility until an Interconnection Agreement is signed by the customer and utility and all necessary conditions stipulated in the agreement are met.

Public Utility Regulatory Policies Act of 1978 (PURPA)

In addition to net metering, the Public Utility Regulatory Policies Act of 1978 allows qualifying small and large power production and co-generation facilities to connect to a local utility’s grid. The utilities are obligated to purchase the power produced from these facilities at the utilities’ calculated avoided cost or wholesale cost. There are two ways this could be arranged (See Figures 4 and 5). The figures below show

a solar photovoltaic system as an illustration, but PURPA is not limited to just solar electric generating facilities.

FIGURE 4: PURPA **QUALIFYING FACILITY EXAMPLE SERVING LOAD FIRST AND SELLING EXCESS**

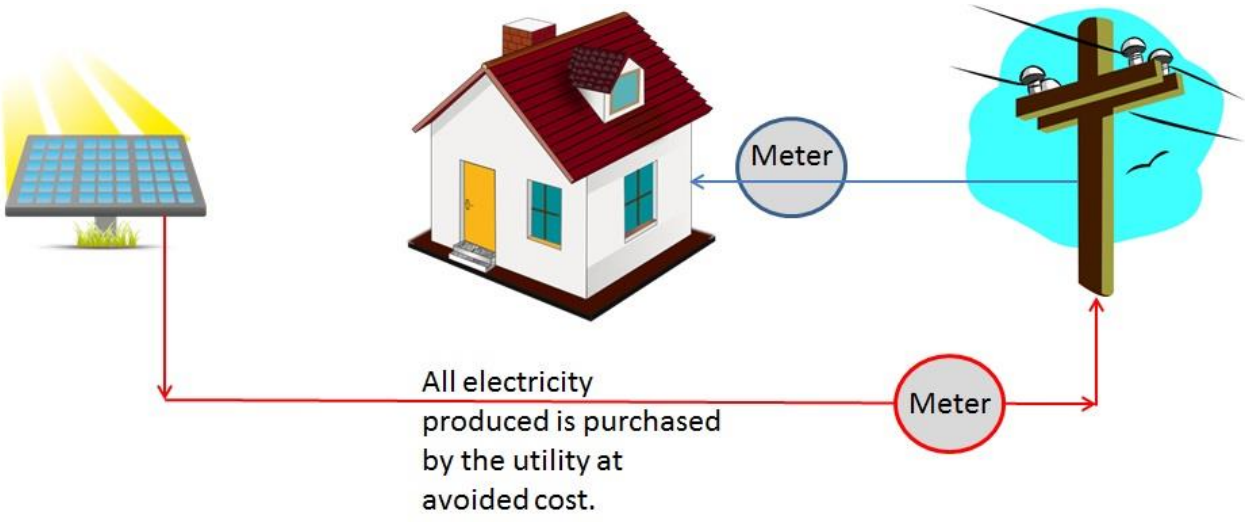


FIGURE 5: PURPA **QUALIFYING FACILITY EXAMPLE OF SELLING ALL RENEWABLE ELECTRICITY GENERATED**

In general, a qualifying facility (QF) is a small power production facility or a cogeneration facility that has been qualified by the Federal Energy Regulatory Commission (FERC). A small power production facility is an arrangement of equipment for the production of electricity with capacity no greater than eighty (80) megawatts that is primarily sourced from biomass, waste, or other renewable resources. A cogeneration facility refers to equipment used to produce electricity and another form of useful energy which is used for industrial purposes or commercial heating or cooling purposes.

For those regulated utilities in Kentucky that participate in a Regional Transmission Organization such as MISO or PJM, PURPA regulations under FERC provide that those utilities may seek an exemption to the obligation to purchase the output from a qualifying facility with capacity greater than 20 megawatts. This means that any qualifying facility greater than 20 megawatts located in a utility's service territory that has received the exemption from FERC would have to sell any output directly to the Regional Transmission Organization.

Federal law confers certain benefits to being a qualifying facility. These benefits generally fall into three categories: (1) the right to sell energy or capacity to a utility, (2) the right to purchase certain services from utilities, and (3) relief from certain regulatory burdens.

PURPA obligates the electric utility to purchase any energy and capacity offered from a small power production facility or a cogeneration facility. PURPA also establishes the terms by which a utility shall purchase the output from a qualifying facility. QFs have the right to purchase supplementary power, back-up power, maintenance power, and interruptible power at rates that are just and reasonable. QFs also have the right to interconnect with a utility by paying a nondiscriminatory interconnection fee approved by a state's public utility regulatory authority.

Unlike net metering, qualifying facility tariff language, processes, and interconnection requirements vary among Kentucky's regulated utilities. Each regulated utility in Kentucky has a PSC-approved qualifying facility\cogeneration tariff on file at http://psc.ky.gov/Home/Library?type=Tariffs&folder=Electric PURPA regulations in Kentucky can be found in Title 807 of the Kentucky Administrative Regulations Chapter 5:054, small power production and cogeneration.

To become a qualified facility under PURPA, the FERC outlines procedures that can be found here. FERC's Order No. 732 does not require facilities with net capacity of 1 MW or less to make a filing with the Commission to claim QF status, although applicants for such facilities may seek certification if they wish to do so.

Interested customers should contact their local electric utility provider for additional information.

What is a Qualifying Facility? (Website)

PJM (Website)

MISO (Website)

Behind the Meter Systems (No Excess Generation)

In some instances, a customer may choose to self-supply but size the system so that there is no excess generation. The size of the system and the times of generation are designed to meet the minimum electrical needs of the house or building and is never over producing.

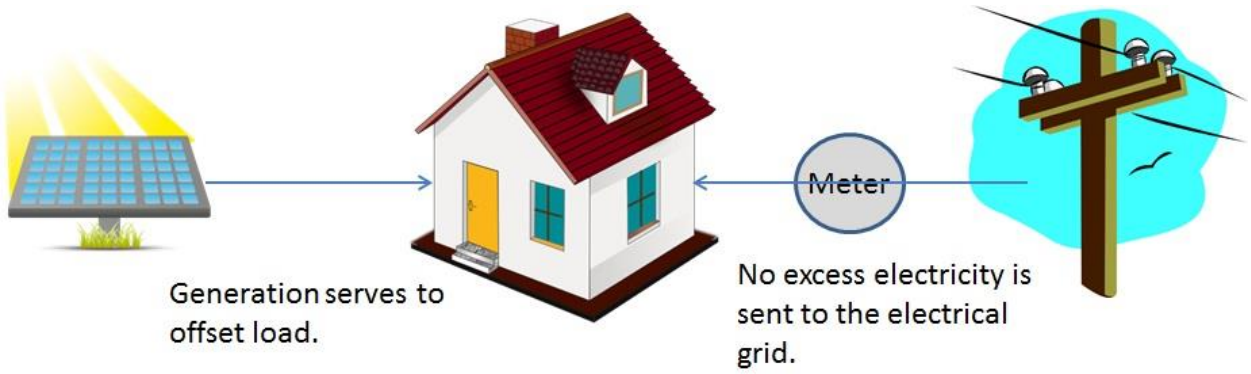


FIGURE 6: AN EXAMPLE OF A BEHIND THE METER SYSTEM WITH NO EXPORT OF EXCESS GENERATION

One thing to keep in mind is these systems operate in parallel with the local electric grid. Parallel operations mean that while the self-supplying system is not physically back-feeding electricity to the electrical grid there is still an electrical connection. These systems must be properly isolated from the electrical grid for safety in the event there is an electrical grid outage to prevent any electricity back-flowing into the electrical grid. Depending on the size of the system, the system owner may have interconnection requirements under Net Metering or PURPA that they must comply with even though they are not providing excess electricity to the electrical grid.

Off-Grid Systems

Off-Grid self-supply systems refer to systems that provide power to a house or building where the house or building is either disconnected from the local electrical grid or because of the location of the house or building, the electrical grid is unavailable. These systems require some type of energy storage or multiple types of generation technology to function and supply power twenty-four hours a day, seven days a week.

FIGURE 7: AN EXAMPLE OF AN OFF-GRID SYSTEM USING ELECTRICAL STORAGE

Customer-Leased Systems

Many times customers may want to lease an electricity generating system for financial reasons or the inability to operate such system. Nonprofits, churches, schools, and government agencies that can't take advantage of tax credits may look to leasing. Many regulations in Kentucky, such as net metering, require systems to be "owned" by the customer. Also, leased systems from a third party that is not a customer's utility may be seen as violating the utility's certified territory, meaning the lease could be interpreted as the customer buying electricity from a third party that is not their utility if the contract is not structured correctly.

However, a customer may lease the equipment that generates electricity where the terms and conditions of the lease agreement do not involve the "selling of electricity" by the third party. In this case the lease is not a power purchase agreement. For example, with a solar lease, you agree to pay a fixed monthly "rent" or lease payment, which is calculated using the estimated amount of electricity the system will produce, in exchange for the right to use the solar energy system. With a solar PPA, instead of paying to "rent" the solar panel system, you agree to purchase the power generated by the system at a set per-kWh price.

For example, a non-profit may lease the equipment for a time period, with the goal of purchasing it with financing gained through energy savings or other funding sources. This model has the potential to work in conjunction with energy savings performance contracting (ESPC), on bill financing, or with local governments that have passed ordinances authorizing Energy Project Assessment Districts (EPAD). There are also private companies that will fund the capital at their expense, and lease the asset back to the customer. This type of business model is known as "Energy as a Service".

Utility-Owned and Built Systems for Specific Customers

Utility-Owned Generation at Customer Location (Asset Not in the Utility Rate Base)

A utility may decide to offer to build a generating facility for a specific customer and **not** include that facility or asset in the utility rate base. The utility rate base consists of the value of property (assets) the utility uses in providing service to all customers. A utility recovers the cost of those assets in the rate base through its general rates that all customers pay.

By not including an asset in the rate base, a utility holds only the one customer responsible for the utility's cost of the asset—in this case, the generating facility at the customer's locations.

An example of a utility-owned and built system is Louisville Gas and Electric Company and Kentucky Utilities Company announced in November 2015 to offer individual private solar facilities for business and industrial customers interested in renewable generation at their location. The company will build, own, and operate the individual solar facilities for interested customers, and each project will be subject to approval by the Kentucky Public Service Commission. The facilities may include ground or rooftop solar arrays.

For customers considering a utility-owned system on their location, they should know that utilities are bound by tax laws to protect customers in the ratemaking process by stabilizing rates. In particular, tax normalization requires state utility regulators to treat tax benefits to customers in the same way that the recovery of the cost of the associated utility property is treated. Essentially, tax normalization spreads the depreciation and tax benefits over the regulatory life of the property.

All of this means that a utility-owned system for a customer will likely cost more than if the customer were to build it themselves or if a third party were to build it and lease the equipment to the company. (Remembering that a third party cannot sell electricity to the customer.) If the customer were to build the facility, the tax incentive is fully available immediately, rather than spread over the life of the system. However, a customer may weigh this increased cost against the benefit of the utility operating the system and the utility taking on the liability and risk of the system for the customer.

Utility-Owned Generation at Customer Location (Asset in the Utility Rate Base)

Should a utility offer to build a generating facility for a customer and place that property or asset into the utility rate base, the utility would be responsible for addressing at a minimum the following:

(1) That the asset is fair, just, and reasonable:
   a. The asset is providing all of the utility's customers a benefit;
   b. The asset is providing a benefit to the Commonwealth or meeting a state requirement; and/or
   c. That the asset fits into the utility's long-term planning.
(2) That the asset is prudent and useful.

Currently, no regulated utility in Kentucky has proposed a customer-sited project that is owned by the utility and put into the utility's rate base.

Take Away Points

- Energy efficiency is the first step to complete before considering any on-site self-generation system.
- Evaluating excess generation and how it will be utilized will determine which self-supply option is best for your needs.
- Every self-supply system must be properly isolated from the local electric grid for safety of customers and utility personnel.

Off-Site Options

Due to location, economies of scale, or limited access to energy resources, some customers may find it difficult to meet their energy goals by building self-supply systems on-site. As noted, RECs can be a tool to utilize to help meet their goals. In addition to RECs, there are other options to consider when on-site electricity generation is not practical or needs to be supplemented.

Utility Special Contracts

On January 22, 2015, the Kentucky Public Service Commission issued a staff opinion regarding the use of special contracts (2015-002). The January 22, 2015 staff opinion stated that:

"Commission Staff believes that a request by an energy intensive customer to purchase renewable energy is a 'reasonable consideration' within the scope of KRS 278.030(3) to justify the use of a special contract for that customer."

This staff opinion reinforced the principle that a customer may enter into a one-on-one contract with the utility for that utility to procure renewable energy specifically for that customer. Each special contract would have to be approved independently by the Kentucky PSC.

Power Purchase Agreements (PPA)

A PPA is a contract between two parties, one that generates electricity (the seller) and one that is looking to purchase electricity (the buyer or the utility). While a customer cannot enter into a PPA with an independent generator in a regulated utility's territory, a utility could theoretically enter into a PPA on behalf of a customer. The seller or developer of the electricity does not have to be in Kentucky, which means a PPA allows a utility to access renewable electricity for customers where renewable electricity generation is most cost effective and economical because it is located where the renewable energy resource potential is high (think of wind turbines in the Midwest).

A PPA is an option for a customer that (1) wants a financial interest in an off-site generation facility with a long-term contract and (2) is not satisfied with REC purchases alone to meet their goals. In Kentucky, regulated utilities do not have much incentive to enter into a PPA because they cannot earn a rate of return on the agreement. Additionally, the customer must pay the full price defined in the PPA, and the regulated utility can only provide a customer with the utility's avoided energy cost from not having to utilize other generation resources and the REC associated with the energy from the off-site generation facility. Currently, the low avoided energy cost of utilities in Kentucky can make it difficult to negotiate a financially attractive PPA. Also, a regulated utility may also find it challenging to design a PPA for an existing customer that does not shift the cost burden of paying for the existing generating resources to other customers.

Virtual Power Purchase Agreements

A virtual PPA is a form of an electricity price hedge. A company enters into a contract to pay a merchant electricity generator an agreed take-off price of the electricity. The merchant generator sells the generated power into the wholesale market on a merchant basis. The merchant pays the company if the

electricity is sold into the market above the agreed contract price, and the company pays the merchant the difference if the electricity falls below the agreed price.

This is a unique option because the developer (merchant generator) is not selling electricity to the customer but rather into the wholesale market, meaning it doesn't violate Kentucky's certified regulated utility territories. The developer of the renewable project (merchant generator) sells the power into the wholesale market when the project is complete. To obtain financing, the merchant enters into a Virtual PPA with the customer who wants renewable electricity. The value proposition to the customer is that through the virtual PPA, the customer can claim credit for bringing renewable energy onto the grid. This is one way that companies can go "100% renewable" without installing on-site renewable generation or directly source energy from renewable power.

Utility Shared Solar Options

There are many types of shared solar designs, however, the example below represents the model chosen by utilities in Kentucky. In this model, an off-site large renewable electricity generating facility is *shared* by multiple customers. There is no direct connection to the generation facility and participants in the shared solar project receive a credit on their monthly electricity bill. One of the first shared solar programs in Kentucky was developed by Berea Municipal Utilities.

Shared solar programs in Kentucky may be suitable for those customers who either do not have the desire to install a system on their rooftop or do not have a rooftop that is either able to accommodate a solar array, or cannot participate in net metering, or is not accessible to the solar resource. A 2008 study by the National Renewable Energy Laboratory (NREL) found that only 22 to 27 percent of residential rooftop area is suitable for hosting an on-site photovoltaic (PV) system. Shared options expand access to solar power for renters, those with shaded roofs, and those who choose not to install a residential system on their home for financial or other reasons.

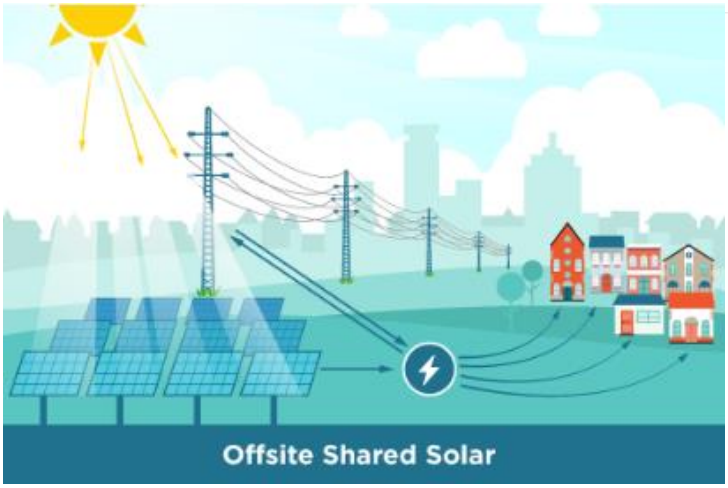


FIGURE 8: EXAMPLE OF A SHARED SOLAR ARRANGEMENT (SOURCE: DEPARTMENT OF ENERGY)

Two regulated utilities in Kentucky offer shared solar programs for customers who cannot install self-supply systems on-site. Each utility structures its program to meet the needs of the utility and the customers. Below are links to the two programs in Kentucky.

- Louisville Gas and Electric\Kentucky Utilities Solar Share Program
- East Kentucky Power Cooperative

Resources for learning more about shared solar programs can be found here.

- DOE COMMUNITY AND SHARED SOLAR (Website)
- NREL A Guide to Community Solar (PDF)
- SEPA Community Solar (Blog)

Green Tariffs

While no regulated utility in Kentucky has yet to offer a "green tariff or rider" they are an option for regulated states to allow customers access to renewable electricity from the marketplace.

Green tariffs allow eligible customers to buy both the energy from a renewable energy project and the RECs. Recently, Kentucky Power was approved for the development of a green tariff. In docket 2017-00179, customers may contract with Kentucky Power to purchase energy and RECs from the renewable energy generator via option B in the Renewable Power Option Rider (RPO). The cost will be determined by an agreement between the customer and Kentucky Power that will reflect a combination of the firm service rates otherwise available to the customer and the cost of the renewable energy resource directly contracted for by the customer.

The value in a green tariff is that it is a PSC-approved tariff which means it is a standing offer from utilities to customers. There are no special contracts between the customer and utility and it eliminates the long process of negotiating terms and conditions. Therefore, green tariffs can save customers time and money when compared to creating a special contract and obtaining approval.

For more information on Green Tariffs, visit "Emerging Green Tariffs in the US Regulated Electricity Market" or the North Carolina Clean Energy Technology Center's "Renewable Energy Tariffs for Large Utility Customers: An Emerging Option to Encourage Greater Solar PV Development".

Merchant Electricity Generators

In general, a merchant electric generating facility is one that is capable of operating at an aggregate capacity of 10 megawatts (MW) or more and sells the electricity produced into the wholesale market. This does not include most cogeneration facilities at manufacturing plants. A merchant electric generating facility cannot commence construction until it has received a construction certificate from the Kentucky Electric Generation and Transmission Siting Board. In addition, the merchant facility must obtain all necessary state and federal permits and complete any assessments or applications required to sell electricity into the wholesale market.

PSC Electric Generation and Transmission Siting Board

Merchant Electric Generation Statutes

How Merchant Electricity Generators Can Serve Customers in Kentucky

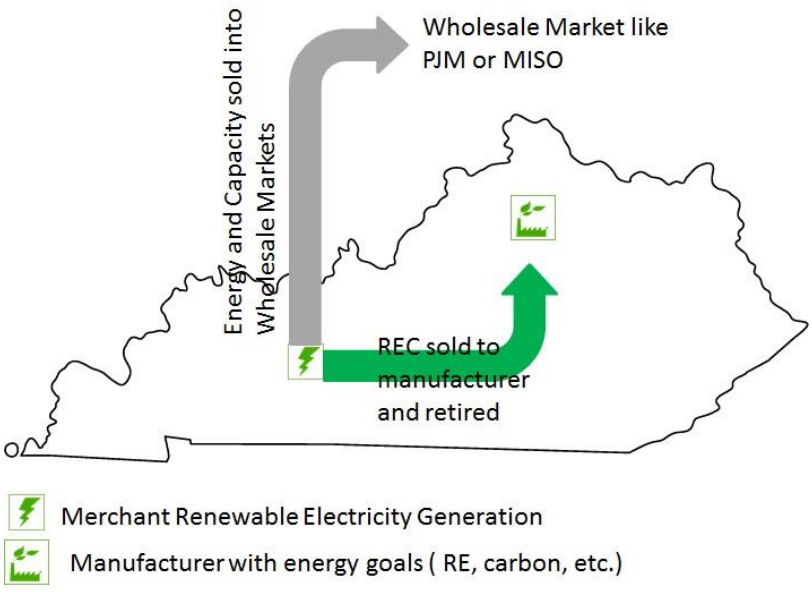
REC Sales

While a merchant electric generating facility sells energy and capacity into the wholesale market, it can also sell the associated RECs from the renewable generating facility into that market. A customer could access those RECs as described earlier or a customer such as a corporate entity could enter into a contract with the merchant generator for the associated RECs directly. A corporate customer may also see advantages to financing part of a merchant generating facility if that is aligned with the customer's goals and objectives.

Sleeved Power Purchase Agreements, Synthetic or Virtual PPAs, or Green Tariff Programs

A customer could also access renewable electricity through a merchant electricity generator that could be a part of a sleeved power purchase agreement with their local utility partner, a utility green tariff offering, or a synthetic power purchase agreement. In short, the utility could procure the renewable electricity for a customer through a merchant electricity generator. If a utility wanted to package the renewable electricity produced by a merchant generating facility for multiple customers to access via a standing tariff arrangement, this would be a green tariff.

FIGURE 9: AN EXAMPLE OF HOW A MERCHANT ELECTRIC GENERATOR COULD SUPPORT A CUSTOMER WITH RENEWABLE ENERGY GOALS VIA REC PURCHASES.



Energy Storage

Many of the options mentioned above may also include energy storage systems. Energy storage systems are resource neutral and are becoming increasingly popular as technologies evolve to provide economically competitive options. Whether electricity is generated from oil, gas, coal, nuclear, wind, solar, geothermal, or other sources, energy storage captures excess electricity for optimal use during outages, peak hours, or whenever effective grid management is a challenge. Energy storage can also be utilized where resilience or energy security is a priority.

Energy Storage can be classified into different categories (Source: Energy Storage Association):

- Solid State Batteries - a range of electrochemical storage solutions, including advanced chemistry batteries and capacitors. Grid-connected electric vehicles also are in this category.
- Flow Batteries - batteries where the energy is stored directly in the electrolyte solution for longer cycle life, and quick response times
- Flywheels - mechanical devices that harness rotational energy to deliver instantaneous electricity
- Compressed Air Energy Storage - utilizing compressed air to create a potent energy reserve
- Thermal - capturing heat and cold to create energy on demand
- Pumped Hydro-Power - creating large-scale reservoirs of energy with water

The DOE Global Energy Storage Database provides free, up-to-date information on grid-connected energy storage projects and relevant state and federal policies. The National Renewable Energy Laboratory's "Identifying Potential Markets for Behind-the-Meter Battery Energy Storage: A Survey of U.S. Demand Charges" identifies where using battery energy storage to manage demand may make sense for commercial customers. Lazard's latest annual Levelized Cost of Storage Analysis illustrates cost trends among commercially deployed storage technologies.

Many regulatory programs or tariffs have yet to include energy storage in terms of eligibility criteria or compensation mechanism. The regulatory treatment of customer energy storage assets is an emerging issue. The Federal Energy Regulatory Commission in Order 841 directs operators of wholesale markets — Regional Transmission Organizations (RTOs) and Independent System Operators (ISOs) — to come up with market rules for energy storage to participate in the wholesale energy, capacity and ancillary services markets that recognize the physical and operational characteristics of the resource.

In 2017, Louisville Gas and Electric Company and Kentucky Utilities Company launched a new Energy Storage Research and Demonstration Site at its E.W. Brown Generating Station near Harrodsburg in Mercer County. The site includes three testing bays for energy storage technologies, each able to house up to one megawatt of storage, resulting in a total hosting capacity of up to three megawatts of energy storage.

Within the commercial sector, Norton Audubon Hospital in Louisville, KY, operates a hybrid energy plant that combines gas air-cooled chillers and a thermal ice storage system that produces cooling capacity for the building.

Microgrids

The U.S. Department of Energy's Microgrid Exchange Group defines a microgrid as ''a group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid. A microgrid can connect and disconnect from the grid to enable it to operate in both grid-connected or island mode."

In Kentucky, Ft. Knox is an example of a microgrid that is grid-connected but can operate in island mode if the electric grid becomes compromised. Forty-four megawatts of new power generation plus existing generation sources on the base use a variety of fuel sources (fossil and renewable). These resources are distributed across five substations and distribution lines and integrated through a central control center to work in conjunction with building automation systems and energy efficiency resources.

Many different tariffs and resources may be deployed within a microgrid architecture. Microgrids have the ability to integrate a variety of distributed energy resources as well as utility resources and may involve a variety of regulatory reviews and oversight. Microgrids are increasingly popular for those entities such as critical facilities (hospitals, wastewater and water treatment plants, etc.) that are concerned with resilience and energy security issues.

Resilience can be thought of as the ability to withstand and or reduce the magnitude and/or duration of disruptive events, which includes our energy infrastructure's ability to anticipate and identify threats, absorb, adapt to, and/or rapidly recover from a potentially disruptive events.

RESOURCES

Mapping How the United States Generates Its Electricity

Levelized Cost of Electricity in the United States: Interactive Map

FEMP Screening Interactive Map: Savings to Investment Ratio, Electricity Rate for SIR =1, and Payback maps

Lazard Levelized Cost of Energy Analysis

Database of State Incentives for Renewables & Efficiency

FERC Qualifying Facility Information

Programs

EPA Green Power Partnership

NREL Voluntary Green Power Procurement

Energy Star

U.S. DOE Better Buildings