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KYMEA POWER POST

A Quarterly Publication by KYMEA.

Plan, Execute, Repeat

In September of 2015, after 18 months of study and discussion, ten municipal electric utilities entered into an Interlocal Cooperation Agreement creating the Kentucky Municipal Energy Agency (KYMEA), a joint public agency. An eleventh member joined KYMEA in September of 2016. KYMEA was formed to facilitate effective collaboration among its members to do all things necessary or convenient to serve the current and future electric power and energy requirements of the members.

The planning of the electric power resources is accomplished through the integrated resource planning (IRP) process. When the Agency was formed, in anticipation of the Agency beginning operations on May 1, 2019, a power supply and transmission portfolio was assembled to meet the KYMEA's near-term resource needs. The strategy, goals, analysis, and execution of assembling KYMEA's first portfolio utilized the IRP process to determine the Agency's inaugural resource mix. Upon completion of the IRP, the Agency issued a series of requests for proposals (RFPs) to fulfill the identified needs. The KYMEA Board of Directors (KYMEA Directors), who represent the member communities, then selected which purchase power agreements they preferred to meet their overarching objectives of affordable and stable wholesale rates.

This brings the Agency to its next IRP cycle. In 2022, one of KYMEA's 100 MW coal-based purchase power agreements (PPA) will expire. In its place, the Agency has a 20-year PPA for 54 MW of solar energy, which will supply 9% of KYMEA's energy needs. In addition to solar energy, the KYMEA power supply portfolio has a need for additional capacity and energy in 2022. The resource(s) to meet this need will be identified in the IRP process, at which time the KYMEA Board will have an opportunity to adjust their future power supply mix.

The IRP process is a 20-year plan that is updated every 2 to 3 years, or as we like to say, "Plan, Execute, Repeat."

Least-Regrets Planning

BY DOUG BURESH

Greetings,

An integrated resource plan (IRP) is a utility's plan for meeting forecasted annual peak and energy demand; plus, reserve, operating, and contingency margin(s). A successful resource plan should include consideration of the following elements: a load forecast, reserves and reliability, resource options, fuel prices, market prices, environmental costs and constraints, time frame, uncertainty, valuing and selecting plans, action plan, and documentation.

KYMEA is currently undertaking the rigorous process of identifying its next set of resources through its IRP. Developing an IRP is a painstaking but very important procedure that involves research, stakeholder involvement, and detailed analysis using complex models. But as Abraham Lincoln said, "Give me six hours to chop down a tree and I will spend the first four sharpening the axe."

KYMEA uses least-regret planning when selecting its future resources. The key aspects of least-regrets planning are:

- Key business "unknowns" (i.e., economic growth, game-changing technology, etc.) are identified and used to develop plausible future scenarios of the external business environment
- Critical variables (i.e., load forecast, fuel prices, etc. are forecast within each future business environment scenario
- Candidate resources are identified and analyzed

The least-regrets planning outcome is a portfolio that will perform well under a wide-range of plausible futures while meeting the Agency's objectives of providing reliable and affordable energy services for the communities we serve.

CANDIDATE TECHNOLOGIES

In 2022, one of KYMEA's 100 MW coal-based purchase power agreements (PPA) will expire. In its place, the Agency has a 20-year PPA for 54 MW of the 86 MW Ashwood Solar I project located in Lyon County, Kentucky. This massive solar project, which will be one of the largest solar arrays east of the Rocky Mountains, will provide the Agency with 9% of its energy needs. Coupled with the KYMEA members' entitlement to Southeastern Power Agency (SEPA) hydroelectric power, KYMEA will be 14% carbon-free beginning in 2022.

Over and above the Ashwood solar energy, the KYMEA power supply portfolio has a need for additional capacity and energy in 2022. The IRP will evaluate candidate resources under a wide range of plausible futures, also known as scenarios. The plausible scenarios are not a prediction of what will happen, but rather a plausible future of what might happen.

In this newsletter, KYMEA describes the technologies that are available to meet its future power supply needs. By combining the various candidate technologies with the existing KYMEA portfolio and then simulating the portfolio against the plausible futures, the robustness of the resource plan is rigorously tested.

New technologies choices such as distributed generation (DG), energy efficiency (EE), demand response (DR), and storage are testing the traditional utility business model of central station generation. Further, new load sources such as the charging of electric cars or homeowner battery storage will likely change the customer's time-of-day usage pattern. As part of the scenario process, KYMEA will include these plausible futures in its analysis.

FUTURE IRPs

The outcome of KYMEA's 2020 IRP will be an action plan to address the Agency's resource needs beginning in 2022. While the IRP covers a 20-year time frame, it is important to acknowledge that many future resource additions in the IRP are merely placeholders that will be reviewed and perhaps replaced in future IRPs. The IRP process is a 20-year plan that is updated every 2 to 3 years. This allows the Agency to incorporate game-changing technologies or address new business environments as they become known.

Important Dates

September

24th KYMEA Board Meeting (Virtual)

October

22nd Compensation Committee Meeting
KYMEA Board Meeting

November

17th Budget Committee Meeting
18th Compensation Committee Meeting
18th KYMEA Board Meeting

Technologies

COAL

COAL-FIRED PLANTS: Coal-fired plants are likely the most familiar generation technology since they have historically been the mainstream electric generation resource in the United States for many decades. While coal continues to prove its reliability, low natural gas prices have been responsible for numerous coal plant retirements, reducing the coal-fired energy mix from 51% in 2005 to 23% in 2019.

Coal is typically mined and transported, place on a conveyor belt, and delivered to a pulverizer where it is finely ground into a powder that can be blown into a boiler's combustion chamber and burned at 2,550°F or greater. The boiler walls are lined with water-filled tubes that create high-pressure steam once heated. As the steam passes through a turbine, it spins the generator whereby generating electricity that is ultimately transmitted to customers.

In order to reduce emissions produced by coal-fired plants, the U.S. requires a process of emission control. The gasses produced during the combustion process are captured and filtered from pollutants before being released back into the atmosphere. Emission control is a dynamic and complicated process requiring significant infrastructure with complex systems that are highly regulated.

NATURAL GAS

SIMPLE CYCLE UNITS: Simple cycle gas plants, also known as combustion turbines, are a type of natural gas power plant which operates by propelling hot gas through a turbine to generate electricity. Simple cycle gas plants can respond to the fluctuating demands for electricity and have great operational flexibility, which means they can be started up quickly to meet these needs. However, this comes at a lower efficiency of 9,725 Btu/kWh (35% efficiency). Since they have relatively lower efficiency, simple cycle power plants are typically not run for many hours in a year.

COMBINED CYCLE UNITS: A combined cycle unit utilizes an electric generating technology in which electricity is produced from otherwise lost waste heat exiting from one or more gas (combustion) turbines. The exiting heat is routed to a conventional boiler or a heat recovery steam generator for utilization by a steam turbine in the production of electricity. The most efficient combined cycle units have a 5,500 Btu/kWh heat rate (62% efficiency). Coupled with low natural gas prices, the combined cycle units are becoming the workhorse for the nation's baseload generation needs displacing nuclear and coal units.

RECIPROCATING ENGINES: Reciprocating internal combustion engines (RICE) are now becoming increasingly popular for larger utility-scale power generation applications, especially in areas with high levels of electricity generation from intermittent sources such as wind and solar. The recent increase in natural gas or dual-fuel capable RICE units has been driven in part by advancements in engine technology that increase operational flexibility. Reciprocating engines tend to be smaller than other types of natural gas-fired electricity generators, which allows for quick operation to deploy a single unit or multiple units to meet the energy needs. The RICE unit efficiency is 8,000 Btu/kWh (43% efficiency), which falls between the combined cycle and simple cycle units.

Technologies Continued

NUCLEAR

CONVENTIONAL NUCLEAR REACTORS: Nuclear reactors are the heart of a nuclear power plant, and their main job is to house and control nuclear fission, a process where atoms split and release energy. Reactors use uranium for fuel, which is processed into ceramic pellets and stacked together into sealed metal tubes (fuel rods). Inside the reactor vessel, the fuel rods are immersed in water, which acts as both a coolant and moderator (light-water reactor) for the neutrons produced by fission. The heat created by fission produces steam which is then used to spin a turbine and ultimately produce electricity.

PROS OF CONVENTIONAL NUCLEAR

- No greenhouse gas emissions
- High capacity factor
- Inexpensive energy

CONS OF CONVENTIONAL NUCLEAR

- Extremely capital intensive to construct
- Nuclear waste
- Public opinion of safety concerns
- Targets for terrorism

PEBBLE-BED NUCLEAR REACTORS: Pebble-bed nuclear reactors (PBR) utilize a different reactor core setup than conventional reactors. Instead of fuel rods being setup into arrays and surrounded by water, PBRs use spherical pebbles. These pebbles are around the size of a tennis ball and contain the nuclear fuel, a fission barrier, and the moderator. The pebbles are held in a vessel, and inert gas, mainly helium, circulates through the spaces and transfers heat to the turbine. A heat exchanger can also be utilized, whereas the gas in the vessel heats another gas or produces steam. As the operating temperatures of PBRs are higher than conventional reactors, the reactor can passively reduce to a safe level during emergency scenarios, thus reducing the expenses associated with safety measures. As the reactor is cooled by an inert gas, absorption of radioactive material is less likely than those cooled by water. PBRs are more economical than conventional reactors and are perceived to be safer. PBRs are also more modular than conventional reactors, thus allowing for the potential of being located near load centers.

Technologies Continued

RENEWABLES

Renewable energy is primarily comprised of biomass, geothermal, hydropower, wind, and solar generation. Renewables represented 17.5% of our nation's electricity generated in 2019. Until the 1990s, the most common forms of renewable energy were hydropower and wood. Since 1990 we have seen progress towards renewable energy sources that include biofuels, geothermal energy, solar energy, and wind energy.

BIO (1.4%) - energy from plants/animals:

Biomass, most simply described, is organic material that is derived from plants and animals. This material is comprised of stored energy from the sun. As photosynthesis occurs, the plants absorb the sun's energy, and as biomass is burned, the chemical energy contained in the biomass is able to be released in the form of heat. Biomass is capable of being burned directly or converted into liquid biofuels or biogas.

GEOTHERMAL (0.4%) - energy from the earth:

Geothermal (geo "earth" plus thermal "heat") reservoirs are naturally occurring areas of hydrothermal resources deep below the earth. Geothermal power plants use hydrothermal resources that have both water and heat. Geothermal power plants require high-temperature (300°F to 700°F) hydrothermal resources that come from either dry steam wells or hot water wells. Power producers use these resources by drilling wells into the earth and then piping steam or hot water to the surface. The hot water or steam powers a turbine that generates electricity.

HYDROPOWER (6.6%) - energy from moving water:

People have been using hydropower for many years by taking advantage of its natural force in flowing streams and rivers to produce mechanical energy. Hydropower is documented as one of the first sources of renewable energy that was used for electricity generation. Hydropower was the largest source of our nation's total annual renewable electricity generation until 2019 when it was surpassed by wind.

Hydropower plants are developed near or on a type of water source. The greater the water flow or volume and the higher the head or elevation, the more electricity a hydropower plant is capable of producing. Water flows through a pipe that turns blades in a turbine and then spins a generator to produce electricity.

WIND (7.3%) - energy generated from wind:

Over the past 30 years, wind generation in the United States has significantly grown. The tremendous influx of wind technology, as well as government incentives in the U.S., have caused a decrease in the cost of production and encouraged continued growth. Wind turbines generate electricity by utilizing massive blades to collect the wind's kinetic energy. The wind blows across the blades, which creates a lift that is comparable to its effect on airplane wings. This effect causes the blades to spin a drive shaft that rotates an electric generator producing electricity.

SOLAR (1.8%) - energy generated from the sun:

The sun has provided energy for the earth since the beginning of time and is ultimately the source of all energy we use today. In modern times, technologies have been developed to collect energy from the sun and convert it into electricity for many purposes. Early examples include a solar oven that absorbed sunlight and was used in the 1830s by British astronomer John Herschel to cook food during an expedition to Africa. Currently, we use solar thermal energy systems to heat water for use in homes, buildings, or swimming pools. Solar thermal energy is also used to heat fluids to high temperatures in solar thermal power plants.

Solar cells are called solar photovoltaic (PV) devices and convert sunlight directly into electricity. Small PV cells are used to power calculators, watches, and other small electronic devices. When multiple of these solar cells are arranged in PV panels they can produce electricity for an entire house. PV panels can also be configured into very large arrays covering thousands of acres to produce utility-scale energy that powers thousands of homes.

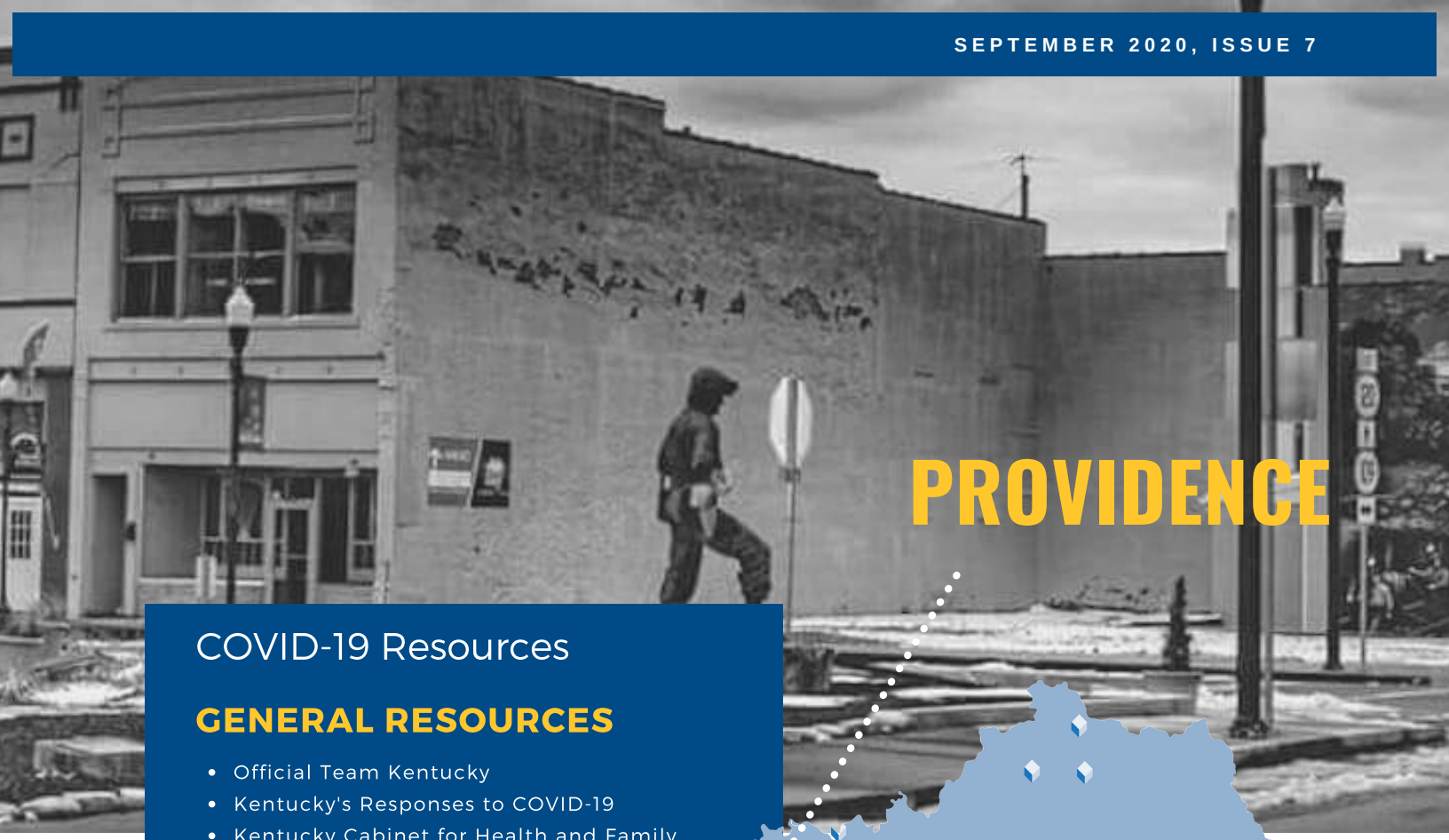
Technologies Continued

DISTRIBUTED GENERATION

Distributed generation is often referred to as a wide variety of technologies that can generate electricity at a location close to where it will be consumed. An example could be rooftop solar panels or combined heat and power, and it may also provide power to a single home or business. Distributed generation may include microgrids that can be tied into a larger grid or delivery system. Distributed generation is a creative way to deliver clean and reliable power while also reducing electricity losses during transmission.

Distributed generation units are versatile and can be used in commercial and residential applications. These types of technologies include small wind turbines, natural-gas-fired fuel cells, biomass combustion, municipal solid waste incineration, hydropower, emergency backup generators or, reciprocating combustion engines. As the use of renewable technologies increases, distributed generation will become more cost-effective. Distributed generation systems can be used to provide greater reliability during power outages or peak service hours, particularly combined heat and power systems.

Distributed generation is a great way to help the environment by also reducing the amount of generation needed at a centralized power plant. There is still some concern because they are unsightly and will take up valuable space closer to communities. Microgrids may also have some carbon footprint if they too are required to burn fossil fuels, and may require water for steam generation or cooling; such as waste incineration, biomass combustion, and combined heat and power.



PROVIDENCE

COVID-19 Resources

GENERAL RESOURCES

- Official Team Kentucky
- Kentucky's Responses to COVID-19
- Kentucky Cabinet for Health and Family Services
- State by State Policy Tracker

BUSINESS RESOURCES

- KY Chamber Resources for Small Businesses
- Kentucky SBA District Office
- US Chamber of Commerce Guidance for Employers
- Identifying Critical Infrastructure During COVID-19
- CDC Resources for Business/Employers
- American Public Power COVID-19 Resources
- Electricity Subsector Coordinating Council Resources
- Cybersecurity & Infrastructure Security Agency (CISA) Resources
- U.S. Environmental Protection Agency Memorandum
- Federal Energy Regulatory Commission (FERC) Policy Statement

More resources are available at https://www.kymea.org/kentucky-covid-19-resources/

DID YOU KNOW?

- Providence is located in Webster County. It was founded in 1820 and was originally called Savageville until the first post office was established and it was renamed "Providence".
- Providence's location was in the heart of the Black-Patch tobacco-region and at one-time was known as the nations third largest stemming market.
- In 1888 Providence began its historical commercial coal mining and continued until its last coal train made its final pass through the town on September 12, 2019.
- The City of Providence Utilities was established in 1924 and now serves approximately 1,335 residential and commercial customers.

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DISCOVER THE POWER OF ENERGY OPTIONS

#PUBLICPOWERFORKENTUCKY

If you have ideas for the next Power Post, please email Michelle Hixon at mhixon@kymea.org.