Energy Stewardship
Using the Smart Grid and Emerging Technologies for Protecting God’s Creation

National Council of Churches
USA Eco-Justice Program
FAITH AND ENERGY

We all use energy in our personal lives, work lives, and faith lives. Yet, our use of energy often comes at a cost to God’s planet and people. Energy use can often impact public health as well as ecosystems and God’s creatures. Air pollution, carbon emissions, and extraction of energy sources can negatively impact God’s Creation. Air pollution contributes to asthma. Mercury emitted from power plants finds its way into local waterways, which in turn finds its way into vulnerable people who consume fish, such as women and children.

As Christians we are called to pursue justice (Deuteronomy 16:20, Matthew 23:23) and to love God and neighbor (Matthew 22:37-39). Protecting God’s Creation is not just about the beauty of God’s natural world; it is also about being just and loving to those around us and to future generations.

As individuals and as a community, we must work to reduce our energy use and to ensure that the energy we do use is derived from clean, renewable, and sustainable sources. These practices are part of being good stewards of God’s Creation and protecting God’s people.

WHY USE LESS ENERGY?

Stewardship

Reducing energy use makes good financial sense; it can help reduce the burden on God’s Creation and help reduce harmful health impacts to God’s people.

God has called people of faith to help protect and restore the integrity of Creation. Every time you switch on a light, a computer, or an air conditioner, you use electricity. Even when you are not using electricity directly, the building you are in is likely using energy. Our society’s use of energy is causing many problems for both the human and non-human parts of Creation.

As God’s people, we have a special responsibility to participate in God’s healing of Creation by using less energy in the places we dedicate to worship and service. Using less energy also saves money, which is why many businesses, homes, and communities of faith have invested in energy efficiency and conservation.

Energy Sources

With the recent increase in gas and electricity prices, many families and communities are starting to wonder where their energy comes from and what their other options are. There are hundreds of different types of energy that are used around the world and in the U.S. to generate our electricity. Of the many different types, the most common forms of energy that fuel our homes, our cars, and bring food to the grocery store are coal, oil, natural gas, nuclear power, and various forms of renewable energy.

The United States is one of the largest energy consumers in the world. The majority of our energy use comes from fossil fuels with the following breakdown:

- 35.3 percent of the nation’s energy comes from petroleum
- 23.4 percent from coal
- 19.7 percent from natural gas
- 16 percent is supplied by nuclear power, hydroelectric dams, and miscellaneous renewable energy sources.

(US Energy Information Administration)
Energy Distribution: How energy gets to our homes, work, and places of worship

Power lines have reached across the United States ever since the Great Depression, when power lines were first strung across rural America. Thomas Edison helped develop our current electric grid structure in 1881 by laying down copper wires inside brick tunnels in lower Manhattan. On September 4, 1882, J.P. Morgan watched as Edison turned on a switch that lit up several office buildings that were part of Edison’s first “grid.” In 1920, electricity accounted for less than 10 percent of U.S. energy use. Today, electricity makes up about 38 percent of our energy use.

Our century-old power grid, according to the Department of Energy, consists of more than one million megawatts of generating capacity and is connected to more than 300,000 miles of transmission lines. The North American electricity transmission system, known as the “grid,” is a complex network of interconnected power lines delivering electricity from more than 950,000 megawatts of generating stations to more than 283 million people. The “grid” contains more than 200,000 miles of transmission lines.

Electricity, unlike other commodities, is difficult to store and must be consumed the moment it is generated. Therefore, peak demand, or the highest demand possible for a particular area during a specified time period, is what drives production capacity. Peak demand is what determines the number and size power plants need to be in order to supply energy in a particular state or region. Since peak demand usually actually occurs during the middle of hot summer days, this means that most of the year there is a lot of idle capacity.

Since 1982, growth in peak demand for electricity—driven by population growth, bigger houses, bigger TVs, more air conditioners, and more computers—has exceeded transmission growth by almost 25 percent every year according to the Department of Energy. This leads to a growing energy supply problem as peak demand increases over the years and pushes utility companies to identify new energy sources, often times in the form of new power plants, which contribute to air pollution. Growing energy needs can also lead to brownouts, which are periods of interrupted power.

Of all energy consumed to produce electricity, only a portion (approximately 30 percent) reaches consumers in the form of electricity; the remaining is lost in generation, transmission, and distribution. From 1988 to 1998, U.S. electricity demand rose by nearly 30 percent yet the transmission capacity grew by only 15 percent. This has put an increasing strain on the current electricity grid. Peak demand in the summer is expected to increase by almost 20 percent over the next decade.

Without being able to ascertain demand precisely, at a given time, having the “right” supply available to deal with every contingency is problematic at best. This is particularly true during episodes of peak demand, those times of greatest need for electricity.

Without a greater ability to anticipate precisely when demand will peak or how high it will go, grid operators and utilities must have electricity generation assets called peaker plants ready to bring online in order to ensure reliability and meet peak demand. Sometimes older, and always difficult to site, peakers are expensive to operate. But old or not, peakers generate additional greenhouse gases, degrading the region’s air quality. Compounding the inefficiency of this scenario is the fact that peaker plants are power generation assets that typically sit idle for most of the year, costing money to maintain even while they aren’t putting out electricity.

One major drawback of the current electricity grid is that it was not built to handle more sustainable, greener sources of energy. Currently the transmission lines necessary to carry wind and solar power from remote areas where energy is produced to big cities where energy will be consumed aren’t in place.

A Synapse Energy Economics study done in the US found that increasing energy efficiency, renewable energy, and distributed power generation would save an estimated $36 billion annually by 2025.
To more effectively deal with growing and changing electricity demands we must look at ways the power grid can respond quickly and meet the needs of consumers. To make real-time grid response a reality, electricity producers, distributors, and users must communicate to one another and work to reduce use. A smarter electric grid makes it possible to reduce the high cost of meeting peak demand. It gives grid operators far greater visibility into the system with greater detail, enabling them to control electricity loads in a way that minimizes the need for traditional peak capacity. A smarter grid may even eliminate the need to use existing peaker plants or build new ones, enabling consumers and utilities to save money and help protect God’s Creation from increased amounts of power plant pollution.

**Costs of our current structure**

According to the Energy Information Administration (EIA) data, average electricity prices have increased 29 percent since 2000 and consumption of electricity has increased 17 percent. According to the Department of Energy, power outages and interruptions cost at least $150 billion each year—about $500 for every man, woman, and child.

There have been five massive blackouts over the past 40 years, three of which have occurred in the past nine years. More blackouts and brownouts (reductions in electricity available) are occurring because of the slow response times of mechanical switches, a lack of automated analytics, and the lack of information available to grid operators. Blackouts and brownouts impact more than just whether we can turn lights on and off. It impacts everything from food storage to traffic lights to business operations.

A surprisingly substantial portion of your electric bill—between 33—50 percent—is assigned to funding our current electricity infrastructure. This charge is necessary to keep the current grid running. With demand estimated to double by 2050—and more power plants, transmission lines, transformers and substations in neighborhoods needed to meet the rising demand—the costs of this will also show up on your bill in one way or another.

**Smart Grids and Emerging Technologies**

A smart grid is defined as a system that allows for a two-way flow of electricity and information so that power plants, consumer preferences, and individual appliances can be monitored. The smart grid is a system of interconnected technologies that enable two-way communications between different parts of the electric power system, from generation through to the appliances that consume electricity. It includes sensors along the transmission and distribution system to allow grid operators to know the condition of the grid in any given location. Real time information is provided to help balance supply and demand. Smart power grids use computers and sensors to coordinate the distribution of power. Smart grids allow for greater predictability about what is happening on the power grid. The innovation would also help optimize the use of electricity from renewable sources, including solar and wind power.

Smart grids include smart meters (also called “advanced metering infrastructure”) in homes and businesses that can automatically measure and report electricity usage throughout the day. It also will one day include appliances that can respond to signals from grid operators or their owners in response to events on the grid. This system of communication allows grid operators to have a greater awareness of
the condition of the electrical grid at any given location, compared with current, largely analog, one-way systems. It also allows consumers the opportunity to have a better understanding of their own energy use—potentially down to individual appliances’ consumption. Such a two-way communication between electricity consumers and power providers requires new smart meters, communication software and mechanisms, as well as new types of transformers to accommodate these two-way communications.

Smart Grid vs. Smart Meters?

Smart grids and smart meters are not the same thing. Smart meters are electronic monitoring devices that continuously measure the electricity output from each household and business. They communicate on a regular basis back to the utility. The goal is to enable power companies to better understand patterns of power consumption throughout the day and adjust power generation accordingly. The meters, through new software and devises, provide real-time information that can allow consumers to see what electricity costs at different times of day and adjust their energy use accordingly. Energy will be the most expensive at peak hours. When consumers are given a price difference based on time of day, they can choose to use less of the expensive electricity and more of the cheap kind. They can run clothes dryers and dishwashers at night, for instance. Even if the dishwasher still uses the same amount of energy by running it at off peak hours the consumer can save money, and help eliminate the inefficiency of having all of those extra peaker power plants provide the extra energy needed on the hottest days of the summer.

The way electricity is priced now, customers are not aware of the price differences during the day for energy. Advanced metering (smart meters) is a way to help utilities meet growing demand for electricity and help consumers manage increasing costs. A Time of Use program allows utility companies to charge consumers different prices for electricity on the basis of the time of day the electricity is used. This can encourage consumers to shift energy use away from peak hours of consumption. By shifting use away from peak hours, this can reduce the need for electricity generation during these time periods. Smart meters are integral in the development of a “smart grid” that can provide electricity customers pricing options, help system operators pinpoint outages more quickly and improve reliability and efficiency of the grid.

For a smarter grid to benefit society, it must reduce utilities’ capital and/or operating expenses today or reduce costs in the future. A smart grid should help us become aware of how much we’re consuming and save the utilities and consumers money while also reducing pollution through efficiency. It is estimated that smart grid enhancements, including the use of smart metering, will ease congestion and increase utilization (of full capacity), sending more electricity through existing energy corridors.

While smart grid upgrades can’t completely displace the need to build new energy infrastructure, a smart grid will enable new, more persistent forms of demand response that will succeed in deferring or avoiding some of it. A smarter grid would help prevent blackouts in two ways. Faster, more detailed feedback on the status of the grid would help operators stay ahead of a failure cascade. Supply and demand would also be easier to balance, because controllers would be able to tinker with both.

Smart meters are planned to be deployed in the following states CA, OR, ID, NV, NM, TX, OK, AL, GA, SC, FL, WV, WI, MI, PA, ME, and MD.

Potential bill savings using a smart grid depend on a number of factors, but generally speaking, a study done by the University of Oxford suggests that consumers would save 10–15 percent before accounting for additional costs to pay for new smart grid technologies.
The understanding that the Earth is the Lord’s is a foundation of our faith. From the psalmist praising the Lord for the beauty and wonder of Creation, to the tortured theology of the book of Job, we are reminded that God is creator and sustainer of the Earth. But the realization that God is sovereign over the Creation does not just stop with worship and theology; it has a practical implication in how we as individuals and communities approach our lives. Leviticus 25 is the most complicated set of laws and regulations that we have from ancient Israel, and the foundation of this section of legal code is the affirmation that the land is the Lord’s. The ancient Israelites did not even have the right to sell their land in perpetuity. How does the knowledge, as people of faith, that Creation belongs to God impact our decisions and action? How do we relate to God’s good Earth if we claim that ownership belongs to the Lord? How do we structure our lifestyles so that we honor God’s gift of Earth’s abundance in the way that we use energy?

Genesis 1 seems to have been written to remind us that the Earth is good. As if to drive home the point, the first chapter of Genesis says seven times, “And God saw that it was good.” The basic goodness of Creation contrasts with the brokenness of the fall, in which human beings attempt to take what God has made and make use of it for their own gain. When the Lord’s hand opens up to us we are filled with good things. And yet we often live with our own hands closed, holding on to as much as we can. It is perhaps fitting that one of the punishments described for failing to live by God’s rule is to toil to bring forth food from the earth (Genesis 3:17-18). This is the consequence of our misuse of the Earth’s bounty that God has provided. When we use fossil fuels at rates far above what the Earth can replenish and in a way that poisons God’s air and water, we are actively creating a future in which we will have to work even harder to bring forth the bounty from the Earth. When we fail to conserve what God has given us so that there will be enough for others, we are denying the goodness of God’s Creation and failing to meet the demands of justice. Being smarter about our energy use affirms the goodness of God’s Creation and allows us to live well off of the abundance that God has provided.
Call to Worship
Our help is in the name of the Lord, Creator of heaven and earth!
Praise be to Jesus Christ!
Who is the image of the invisible God, the firstborn of all Creation.
In Christ all things in heaven and on earth were created. All things have been created through him and for him. In Christ the fullness of God was pleased to dwell. Through Christ God was pleased to reconcile all things, things on Earth and things in heaven, making peace through the blood of the cross.
—from Colossians 1:15-20

Prayer of Confession
Merciful God, in your gracious presence we confess our sin and the sin of this world. Although Christ is among us as our peace, we are a people divided against ourselves as we cling to the values of a broken world. We pursue cheap energy at the cost of clean air and water. The fears and jealousies we harbor set neighbor against neighbor and nation against nation. We abuse your good gifts of imagination and freedom, of intellect and reason, and we have turned them into bonds of oppression. Lord, have mercy on us; heal and forgive us. Set us free to serve you in the world as agents of your reconciling love in Jesus Christ.
—adapted from the Book of Common Worship (PCUSA)
The prayer will continue in silence

Litany for Creation
Leader: Creator God, breathing your own life into our being. You gave us the gift of life. You place us on this Earth with its minerals and waters, flowers and fruits, and living creatures of grace and beauty. You gave us the care of the Earth. Today you call us to care for the Earth. Today you ask us: “Where are you; what have you done?”

Silent prayer for Creation.
Leader: We hide in utter shame, for we are naked. We violate the Earth and plunder it. We refuse to share the Earth’s bounty. We seek to own what is not ours, but yours.

People: Forgive us, Creator God, and reconcile us to your Creation.

Leader: O God of love, you gave us the gift of peoples—of cultures, races and colors—To love, to care for, to share our lives with. Today you ask us: “Where is your brother, your sister?”

Silent prayer for others
Leader: We hide ourselves in shame and fear. Poverty, hunger, hatred, and war rule the Earth. The refugees, the oppressed, and the voiceless cry out to you. Forgive us, O God of Love, and reconcile us to yourself and to one another.

People: Teach us, O Creator God of Love, that the Earth and all its fullness is yours, the world and those who dwell in it. Call us yet again to safeguard the gift of life. Amen.
—Sixth Assembly of the World Council of Churches

Sending Forth
Leader: People of God: the Creation waits with eager longing for the revealing of the children of God.

All: Such is the love God has given us, that we should be called children of God.

Leader: People of God: the day is coming when Creation itself will be set free from its bondage to decay and will obtain the freedom of the glory of the children of God.

All: We are God’s children now; what will be is yet to be revealed.

Leader: People of God: In Christ, God was reconciling the world, and entrusting the message of reconciliation to us.

All: We are ambassadors for Christ, with God making his appeal through us.

Leader: Go forth, therefore, as signs of the new Creation
All: We go in the Spirit of Christ, who calls us to bring justice to those who are poor; to make peace among the people; to tend and keep the gifts of Creation.
—from Romans 8, I John 3, II Corinthians 5
Smart Grids, Smart Meters, and Low-Income Communities
Use of advanced or smart metering can benefit electric customers across a broad range of incomes but may benefit higher income consumers to a greater extent because they use more electricity than lower income consumers and they may be in a better position to shift use. Not all consumers are able to reduce their energy use during peak times. Pilot studies that have been conducted are split as to whether lower income consumers can reduce their electricity as much as higher income consumers. Low-income consumers are more likely to rely on older, less energy efficient appliances which consume more energy and could be more expensive to use during peak demand, high priced periods. Another concern is that elderly consumers may need to avoid temperature extremes for health reasons; if they are forced, because of pricing, to reduce energy use during peak times, they may suffer adverse health consequences as a result. It is important that efforts to implement smart grid.smart meter technology be structured in a way that helps lower income consumers realize the benefits and savings that can come from the use of smart metering.

For additional educational and worship resources on energy stewardship and smart grids, visit: www.nccecojustice.org or contact info@nccecojustice.org