

RENEWABLE ENERGY



WHAT IS RENEWABLE ENERGY?

Renewable energy, also known as clean energy, is becoming more accessible across the United States. Renewable energy uses resources that can be regenerated at a faster rate than they are consumed, such as harnessing the wind, the sun, water, or crops. The energy generated from renewable resources powers our homes, schools, and even vehicles. About 20% of the energy generated in 2022 came from a renewable source. The other 80% came from non-renewable sources such as fossil fuels and nuclear energy. When burned, non-renewable energy can cause harmful greenhouse gas emissions. While not all our electricity is currently coming from renewable energy, it is important to see and understand the opportunity for growth.

VOCABULARY

BIODIESEL – biofuel intended for use in diesel engines

BIOFUEL – renewable fuel derived from soybeans and other biomass

BIOMASS – organic matter that can be converted to fuel

ENERGY – a supply or source of power

ETHANOL – renewable fuel made from corn or other plant materials

E-85 – a gasoline blend containing 85% ethanol

GENERATOR – a device that converts mechanical energy into electric power for use in an external circuit

HYDROPOWER – generation of electricity using flowing water

KINETIC ENERGY – the movement energy of an object

SOLAR ENERGY – generation of electricity using light from the sun

TURBINE – a machine for producing continuous power where a wheel or rotor is made to revolve

WIND ENERGY – generation of electricity using wind flow

ILLINOIS



3rd Largest Ethanol Producer



4th Largest Biodiesel producer (3.75 million barrels)



11% of all electricity is produced with renewable energy sources

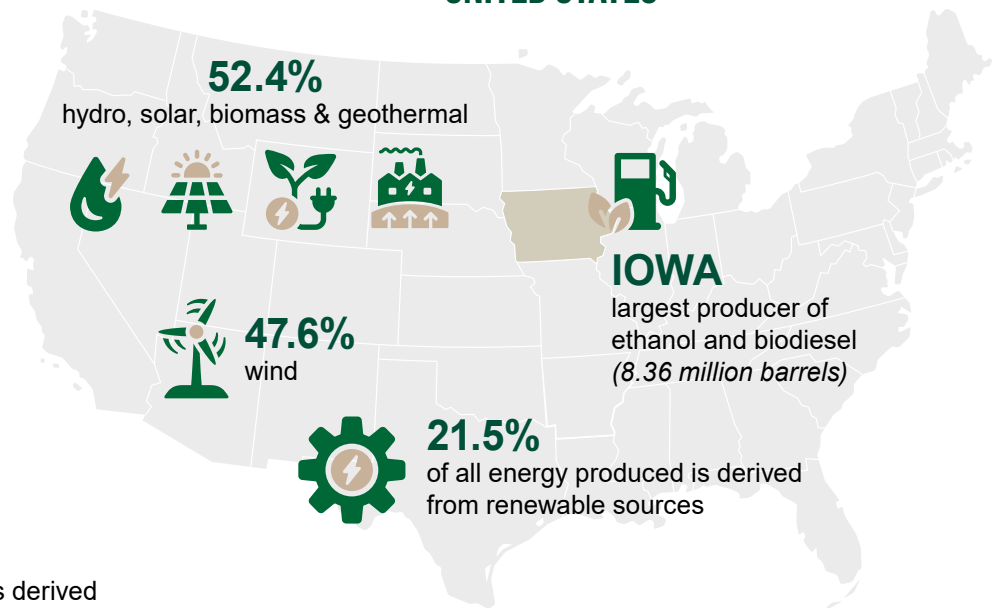


90% of renewable energy is derived from wind



10% of renewable energy is derived from hydro, solar and biomass

UNITED STATES



TYPES OF RENEWABLE ENERGY

BIOFUELS

Biofuels are composed of biomass. Biomass, unlike any other renewable energy source, is organic matter that can be converted directly into fuel. The two most common biofuels used today are ethanol and biodiesel. Ethanol and biodiesel are primarily composed of plant matter and oils, such as those from corn and soybeans.

Ethanol

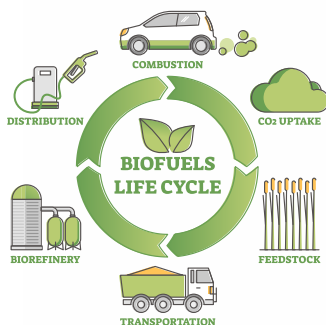
Ethanol is a high-performance fuel made from corn. Illinois farmers plant more than 12 million acres of corn a year, which produces more than 2 billion bushels of corn that can be processed into several different types of products. One of those products is “green fuel” or “homegrown fuel” which is known as ethanol.

Biodiesel

Biodiesel is a renewable fuel made from soybeans. It is the fastest growing alternative diesel fuel in the United States. Biodiesel has many benefits, such as reliable engine performance, economical operation, and is an all-weather fuel. It is also helping reduce harmful greenhouse gases. Biodiesel leads to sustainable fleet operation for multiple users like school bus companies.

Illinois Ethanol Numbers:

- 27% of the corn grown in Illinois is used to produce ethanol
- One bushel of corn produces about 2.8 gallons of ethanol
- Illinois can produce enough ethanol to displace 35% of the state’s petroleum usage
- Ethanol makes up 10% of the United States gasoline supply
- Through the production of ethanol in Illinois, more than 4,000 full time jobs have been created



SOLAR ENERGY

Solar energy is created from collecting sunlight on special panels that convert light from the sun into usable energy. The panels used are made with technologies that convert sunlight energy through photovoltaic panels or through mirrors that concentrate solar radiation. These special panels can be placed on rooftops or in wide open areas to collect the sunlight.

Photovoltaic Panels (PV)

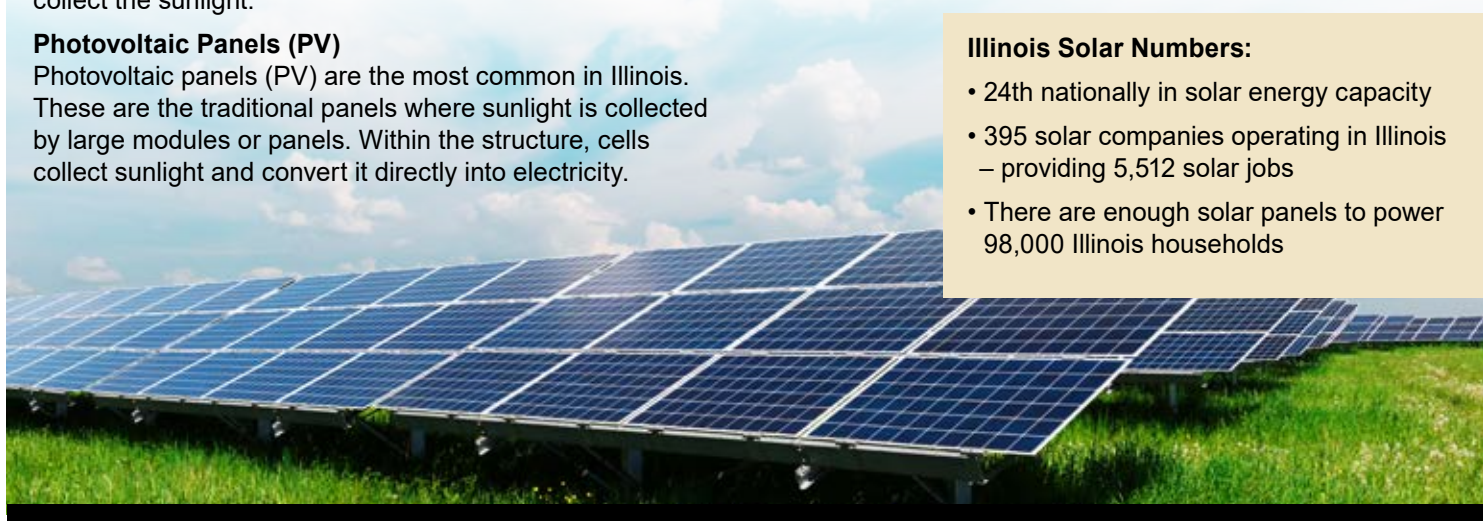
Photovoltaic panels (PV) are the most common in Illinois. These are the traditional panels where sunlight is collected by large modules or panels. Within the structure, cells collect sunlight and convert it directly into electricity.

Concentrating Solar-Thermal Power (CSP)

With concentrating solar-thermal power (CSP) the technologies used are mirrors. CSP uses the mirrors in the receiver to concentrate the sunlight into the system. The energy gathered using the sunlight heats a fluid in the receiver, also known as thermal energy.

Illinois Solar Numbers:

- 24th nationally in solar energy capacity
- 395 solar companies operating in Illinois – providing 5,512 solar jobs
- There are enough solar panels to power 98,000 Illinois households



WIND ENERGY

Wind energy is generated using wind turbines or windmills. Wind energy is harnessed using the kinetic energy of moving air (wind). When the wind turns the propeller-like blades of a turbine it also rotates the rotor. The rotor is often connected to a generator. When the rotor turns, it turns the generator which creates electricity. The energy collected can be used for charging batteries, pumping water, grinding grain, and many more things.

Distributed Wind

Distributed wind energy is when a turbine is connected directly to an energy source. Distributed wind is most used in residential and agricultural spaces. The turbine that harnesses the wind connects to offset the energy usage.

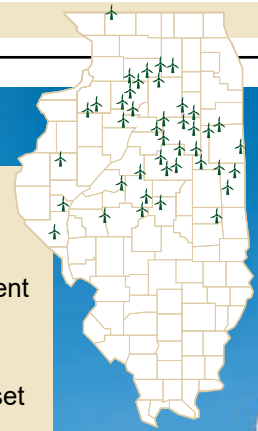
Onshore vs. Offshore

Wind turbines can be onshore, meaning on land, or offshore in the ocean. When they are offshore, the turbines harness the windy conditions of the open ocean. While onshore, they are often placed in groups (wind farms) to collect as much potential energy as possible.



Illinois Wind Numbers:

- 5th in the nation for installed wind capacity
- 4th in the nation in wind industry employment – 7,000+ wind jobs
- It takes less than six months for a wind turbine to make enough energy to help offset the cost of building it



Map of Illinois wind farms



HYDROPOWER

Hydropower uses the flow of moving water to generate electricity. Hydroelectric technologies use elevation differences to generate electricity. This can be through the use of dams or diversions. Hydropower is currently the leading producer of renewable energy in the United States.

Diversion Structures

Diversion structures are 'damless' waterpower plants. These come in a variety of shapes and sizes, from municipal water facilities to irrigation ditches. Most commonly they are run-of-river facilities that channel energy from the rejoining of a river.

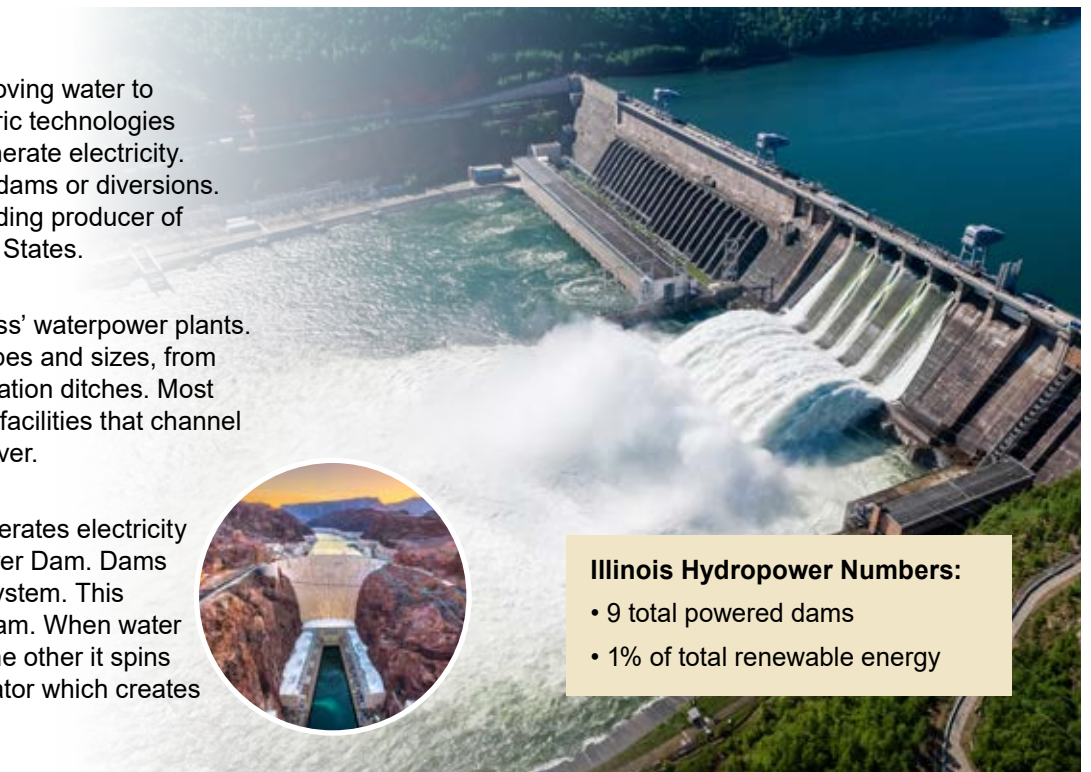
Impoundment and Dams

The most popular dam that generates electricity in the United States is the Hoover Dam. Dams like this use an impoundment system. This places a reservoir behind the dam. When water is generated from one side to the other it spins a turbine connected to a generator which creates electricity.



Illinois Hydropower Numbers:

- 9 total powered dams
- 1% of total renewable energy



RENEWABLE ENERGY HISTORY

- 950 B.C.** The first windmills were used in Persia to grind corn into cornmeal.
- 600 B.C.** Ancient Greeks discovered static electricity.
- 1200s** Windmills were adapted to provide irrigation to farms.
- 1752** Ben Franklin discovered that static electricity and lightning were the same thing.
- 1882** The world's first hydroelectric power station was built in Appleton, Wisconsin.
- 1885** Coal replaced wood as the most important supply of energy to generate power.
- 1902** The first solar power plant in Illinois was built in Olney.
- 1908** Henry Ford produced the Model T car that was designed to run on biodiesel.
- 1935** The average gasoline price was \$0.19 per gallon.
- 1941** Henry Ford built a car made from soybean plastic.
- 1970s** The oil crisis led people to turn to domestic fuel sources.
- 1975** The Illinois Environmental Council was founded by grassroots environmentalists.
- 1979** Illinois Solar Energy Association was founded.
- 1992** Congress passed the Energy Policy Act.
- 1999** Illinois Renewable Energy Association was formed to assist Illinois residents to become aware of the need for renewable energy.
- 2000** The average gasoline price was \$1.51 per gallon.
- 2003** First wind farm in Illinois was installed in Mendota Hills, Lee County.
- 2005** The Energy Policy Act created the Renewable Fuels Standard to ensure all fuel sold in the United States contains set percentages of renewable fuels.
- 2011** The average gasoline price was \$3.53 per gallon.
- 2019** The average E-85 price was \$2.28 per gallon.
- 2022** The average gasoline price was \$4.67 per gallon.

LINKS:

www.eia.gov/state/analysis.php?sid=IL#113
www.un.org/en/climatechange/what-is-renewable-energy
www.ilenviro.org/energy/renewable-energy/
www.energy.gov

CLEAN ENERGY LAWS

Future Energy Jobs Act

The Future Energy Jobs Act (FEJA) helps to make sure that Illinois builds new clean energy resources. It also opens opportunities to people in low-income communities. More than \$750 million has been invested in low-income programs through the FEJA. This law came into effect during the summer of 2017.

Illinois' Renewable Portfolio Standard (RPS)

The Illinois' Renewable Portfolio Standard (RPS) requires specified electric utilities and suppliers to get a certain percentage of electricity from renewable sources. According to this law, renewable sources must make up 25% of overall electric sales by 2025, with wind energy accounting for 75% and solar accounting for 6%.

For more information on RPS visit www.ncsl.org/research/energy/renewableportfolio-standards.aspx.

Solar Rebate Program

The Solar Rebate Program is a self-funded program that provides rebates for solar and wind energy systems that began in 2005. The \$10,000 cash rebate is awarded on a first-come first-serve basis until the program is out of funds. The program is funded through the Renewable Energy Resources and Coal Technology Development Assistance Charge and does not impact the state budget.

CAREERS

Engineer

Engineers solve problems and develop technologies. There are many different branches within engineering. In renewable energy, engineers play a huge role in the implementation of innovative technology. These engineers specialize in mechanical, electrical, and environmental engineering. They design hydroelectric dams, solar cells, and wind turbines.

Environmental Consultant

An environmental consultant works with more than renewable energy. This position affects all aspects of a company's efforts to become environmentally friendly. Companies trying to reduce their environmental impact will hire these consultants to help reduce the damage they are doing to the environment.