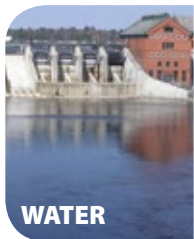


# Waterific!

## What is Consumers Energy?



WATER



SOLAR



WIND



NATURAL GAS



COAL

At Consumers Energy, we make electricity from different sources, including:

- **Water** – It evaporates from lakes and oceans, forms clouds, falls to the ground as rain or snow, and then flows back to the ocean. Hydropower plants use water and gravity to make electricity. Water is a renewable energy source.
- **Solar** – Solar is used for heating water for home use, space heating of buildings, drying agricultural products and generating electrical energy.
- **Wind** – The term given to any natural movement of air in the atmosphere. It's also a renewable source of energy used to turn turbines to generate electricity.
- **Natural Gas** – An odorless, colorless, tasteless, clean-burning fossil fuel. It's a natural resource. Many furnaces, clothes dryers, water heaters and stoves operate using natural gas.
- **Coal** – A fossil fuel formed by the breakdown of plant material trapped underground without access to air.

## FUN FACTS



Consumers Energy  
Company founded:  
1886

People served:  
6.5 million Michigan residents

Counties served: 68 counties in  
Michigan's Lower Peninsula

Types of energy provided:  
Electricity and natural gas

## What Does Consumers Energy Provide?

Energy plays an important role in our society and world. Think about the things you do each day that use energy, whether it's watching TV, playing a video game, turning on a light, using the Internet or swimming in a heated pool.

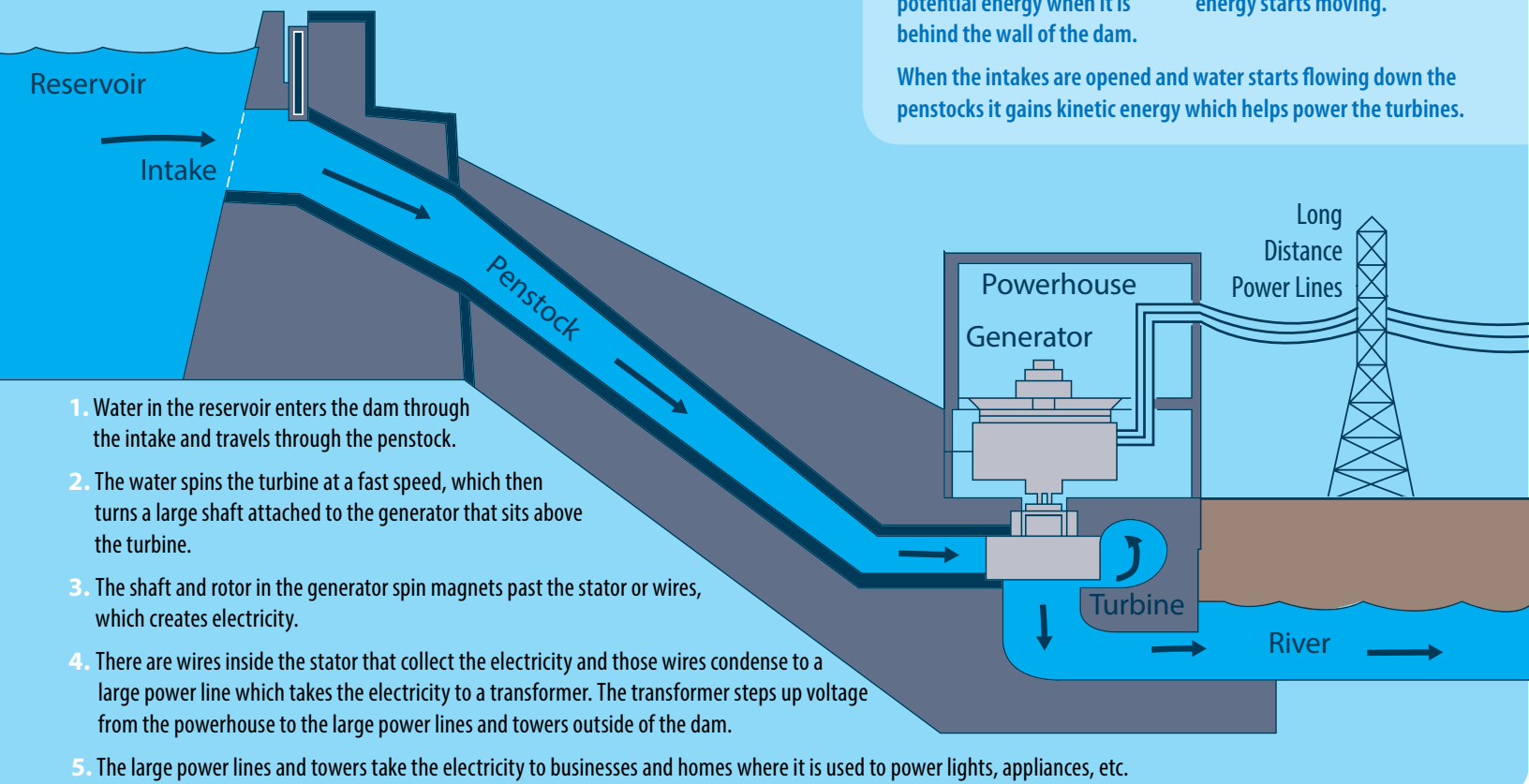
At Consumers Energy, we provide electricity and natural gas to help you do those things each day. The energy we produce helps bring wonderful benefits to millions of residents in Michigan.

We've been producing energy since 1886, when our founder, W.A. Foote, helped brighten downtown Jackson with city streetlights. More than 127 years later, we continue to make Michigan a better place to live, work and grow.

**Consumers Energy**

*Count on Us*

# How Does it Work? Hydroelectric Generator



Consumers Energy hydroelectric plants use two different types of energy to create electricity:

**Potential Energy:**

A form of stored energy that is not moving. Water turns into potential energy when it is behind the wall of the dam.

**Kinetic Energy:**

A form of moving energy that exists once stored potential energy starts moving.

When the intakes are opened and water starts flowing down the penstocks it gains kinetic energy which helps power the turbines.



# The Big Battery

One of our hydros, Ludington Pumped Storage, is unique because it relies on pumped storage rather than the natural movement of water in a river. Known as Consumers

Energy's "big battery," Ludington Pumped Storage plays an increasingly important role as a storage facility for renewable energy produced during off-peak hours.

## Ludington Pumped Storage By the Numbers

Volume of Reservoir:  
**27 Billion Gallons**

Enough water to fill: **217,741,935 bath tubs**

or

Enough water to fill: **2 million swimming pools**

Enough water for everyone in the country to: **flush a toilet over 53 times**

## Here is how it works:

- 1** At night, when electric demand is low and the cost of electricity is cheaper, Ludington's reversible turbines pump water from Lake Michigan through the penstocks 363 feet uphill to the intake building and into the reservoir.
- 2** During the day, when electric demand is high and the cost of electricity is more expensive, the pumps are reversed and when the water enters through the intake in the reservoir, the water travels back down the penstock.
- 3** The water spins the turbine at a fast speed, which then turns a large shaft attached to the generator that sits above the turbine.
- 4** The shaft and rotor in the generator spin magnets past the stator or wires, which creates electricity.
- 5** There are wires inside the stator that collect the electricity. Those wires condense to a larger power line which takes the electricity to a transformer that steps up voltage from the powerhouse to the larger power lines and towers.
- 6** The large power lines and towers take the electricity to businesses and homes where it is used to power lights and appliances.
- 7** Ludington Pumped Storage produces up to 1,872 megawatts, enough to power a city of nearly 1.4 million people. By comparison, the Hardy Hydro dam — which has the highest generating capacity of the 13 river hydros — produces about 30 megawatts.

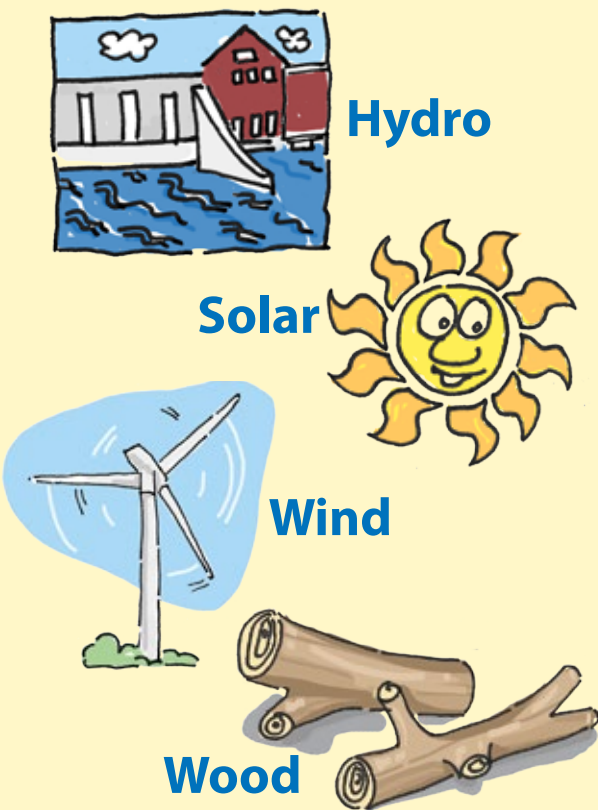
# What is Renewable Energy?

From the sun's warm rays, to a fast-moving river, to fossilized remains of plants and animals, our planet offers many sources of power.

As the world's engineers and scientists discover more ways to make electricity, the 7 billion people on Earth are using more power than ever before. There are many concerns as to whether or not the planet has the resources to keep up with this growing demand for more energy.

Some fuels used to make electricity are renewable or easily replenished. These include wind, solar, water and wood. Other fuels such as coal, natural gas and oil have been formed over many millions of years and aren't available again once they are used. Each fuel offers different benefits and impacts to our environment.

Knowing these facts, we have important choices to make. We can use less energy and conserve.



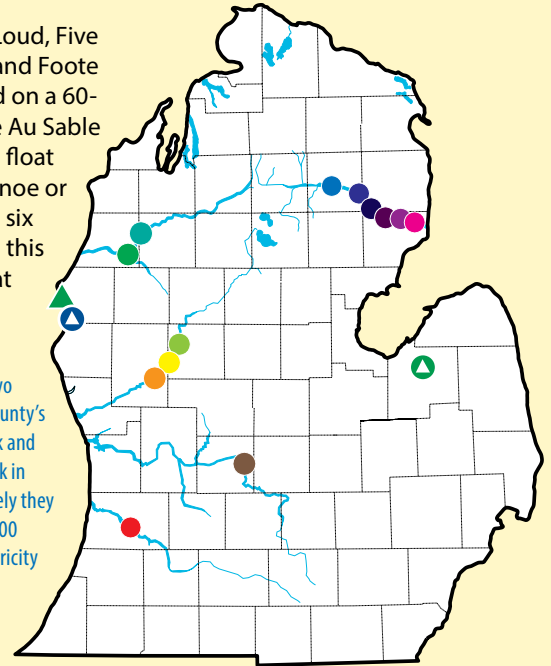
# Escape to Nature



If one paddles down the Grand, Muskegon, Kalamazoo, Manistee or Au Sable Rivers, they may come upon one of the 13 hydroelectric plants owned by Consumers Energy.

Our Mio, Alcona, Loud, Five Channels, Cooke and Foote hydros are located on a 60-mile stretch of the Au Sable where visitors can float down the river, canoe or paddlewheel. The six hydros located on this river provide great wildlife viewing.

Consumers Energy has two wind farms — Mason County's Lake Winds™ Energy Park and Cross Winds™ Energy Park in Tuscola County. Collectively they will produce more than 200 megawatts of clean electricity for our customers.



## Question 1

The flowing water of a river is stopped by a dam. Since it is not moving, it has stored potential energy. **Where does more potential energy exist, at 20 ft. above the penstock, or 40 ft.**

A: Potential energy is dependent on the height of the object, thus, water at 40 ft. has more potential energy than water at 20 ft.

## Question 2

When Consumers Energy wants to produce electricity, the penstock is opened and water begins to flow. The water is moving and creating kinetic energy that turns the turbines. **Which produces more energy, water moving at 3 miles per hour (mph) or water moving at 6 mph?**

A: Velocity of the object determines the amount of kinetic energy, thus, assuming the same amount of water is passing through the turbine, the water moving at 6 mph has more kinetic energy.

## Question 3

The 13 hydroelectric plants in Michigan produce a total of 130 megawatts every year. **If a TV is on for 6 hours every day of the year, how many TVs can the hydroelectric plants power?** (A TV uses 130 watts of electricity)

### Step 1

Figure out watts per year for 1 TV  
**TV wattage X hours per day X days in the week X weeks in the year**

A:  $130 \times 6 \times 7 \times 52 = 283,920$  Watts/year for one single television

### Step 2

Convert hydroelectric power output from megawatts to watts:  
**130 megawatts X 100,000**

Note: 1 megawatt = 100,000 watts

A:  $13,000,000$  watts/year for all 13 hydroelectric plants

### Step 3

**Answer from Step 2 ÷ Answer from Step 1**

A: Thirteen hydroelectric plants can power 45.8 televisions that are on for six hours every day of the year



Find fun activities, games and more by visiting:  
[www.ConsumersEnergy.com/kids](http://www.ConsumersEnergy.com/kids)