Renewable Energy

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Ohio Valley Environmental Coalition
West Virginia Science Teachers Conference 2019

National Renewable Energy Laboratory

- *More energy from the sun strikes the Earth in an hour than all of humanity uses in a year.*

OVER 130 Companies including Apple, IKEA and Starbucks have committed to become 100% renewable energy
and Google and Microsoft already are!

Solar Facts: Solar is better than coal because…

- JOBS: More people in US work in solar than coal and solar is growing more than 10X faster than US economy
- PRICE: Solar has dropped from $75/watt 35 years ago to $0.75 /watt today and is expected to go as los as $0.25/watt by 2020.
- CAPACITY: Two-thirds of solar capacity has been installed in past two years while 175 coal-fired power plants are scheduled to close in the next five years
- INVESTMENT: More opportunity than coal
- ENVIRONMENTAL IMPACTS

Health and Environmental Impacts from Coal

- **Acid rain (Air pollution)**
- **Coal dust (respiratory problems and black lung)**
- **Coal fires**
- **MTR coal mining destroys ecosystems and streams**
- **HUGE contributor to carbon dioxide and climate change and (methane, particulates, sulfur oxides, mercury and radioactive particles)**
- **Pollutes rivers and streams with coal slurry**

Health and Environmental Effects of Fracking

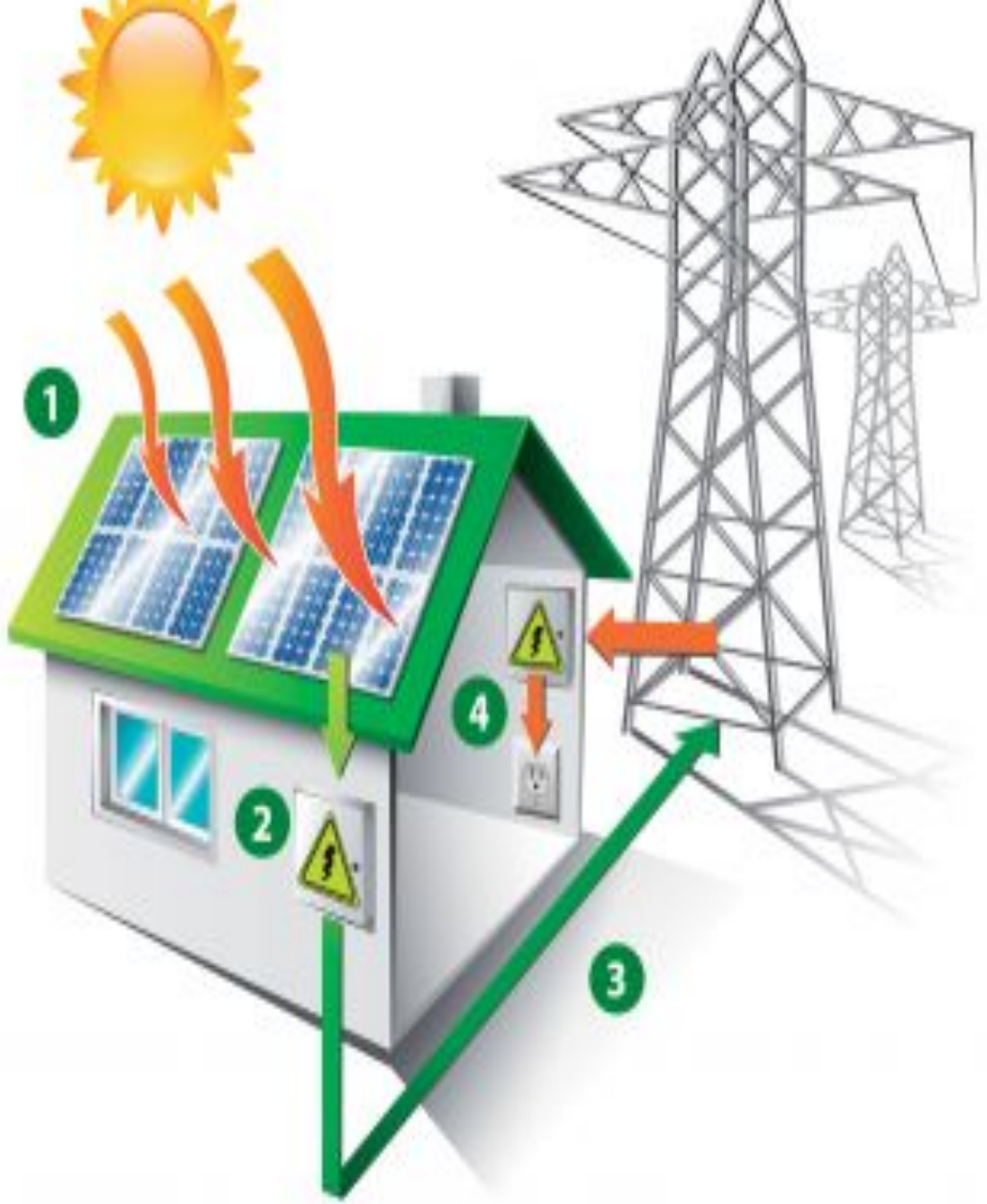
- Withdraw of freshwater (surface and groundwater)
- Sand mining (silicosis)
- Chemicals (proprietary and disclosed)
- Produced water (radionuclides, earthquakes)
- Water contamination
- Methane emissions and transportation (Carbon dioxide)

1. Arrays
2. Solar thermal power plants
3. Home or community installations on roof tops
4. Passive solar during designing new homes

How Solar Works

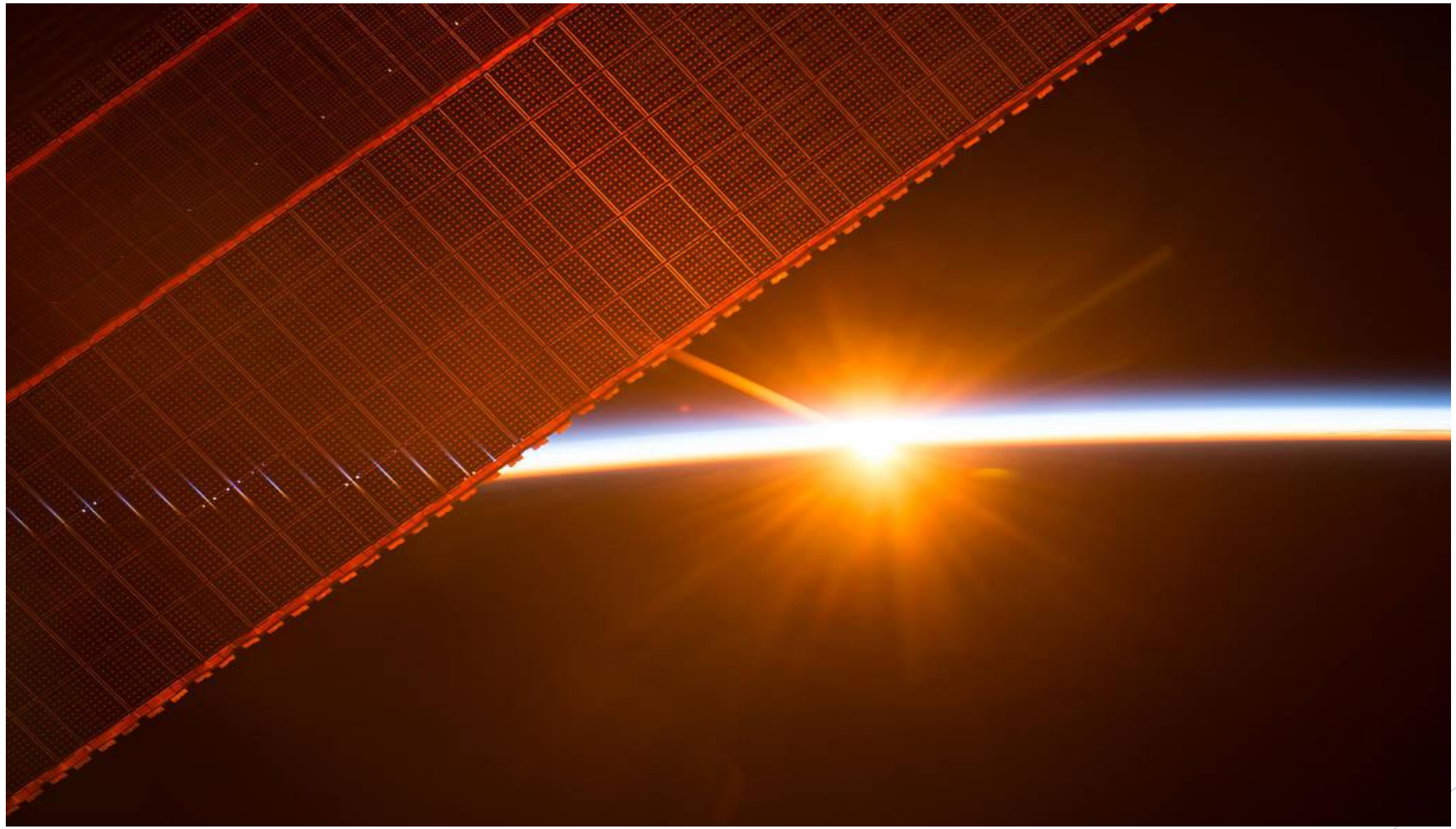
olar electric systems, also called PV systems,
se sunlight to produce electricity. Here's how:

1. Sunlight activates the panels, producing electricity.
2. Electricity passes through an inverter and is converted to usable power.
3. The inverter sends power to your house. Anything you don't use is transferred to the power grid.
4. The meter runs backwards and you save up to 90% on your electric bill.



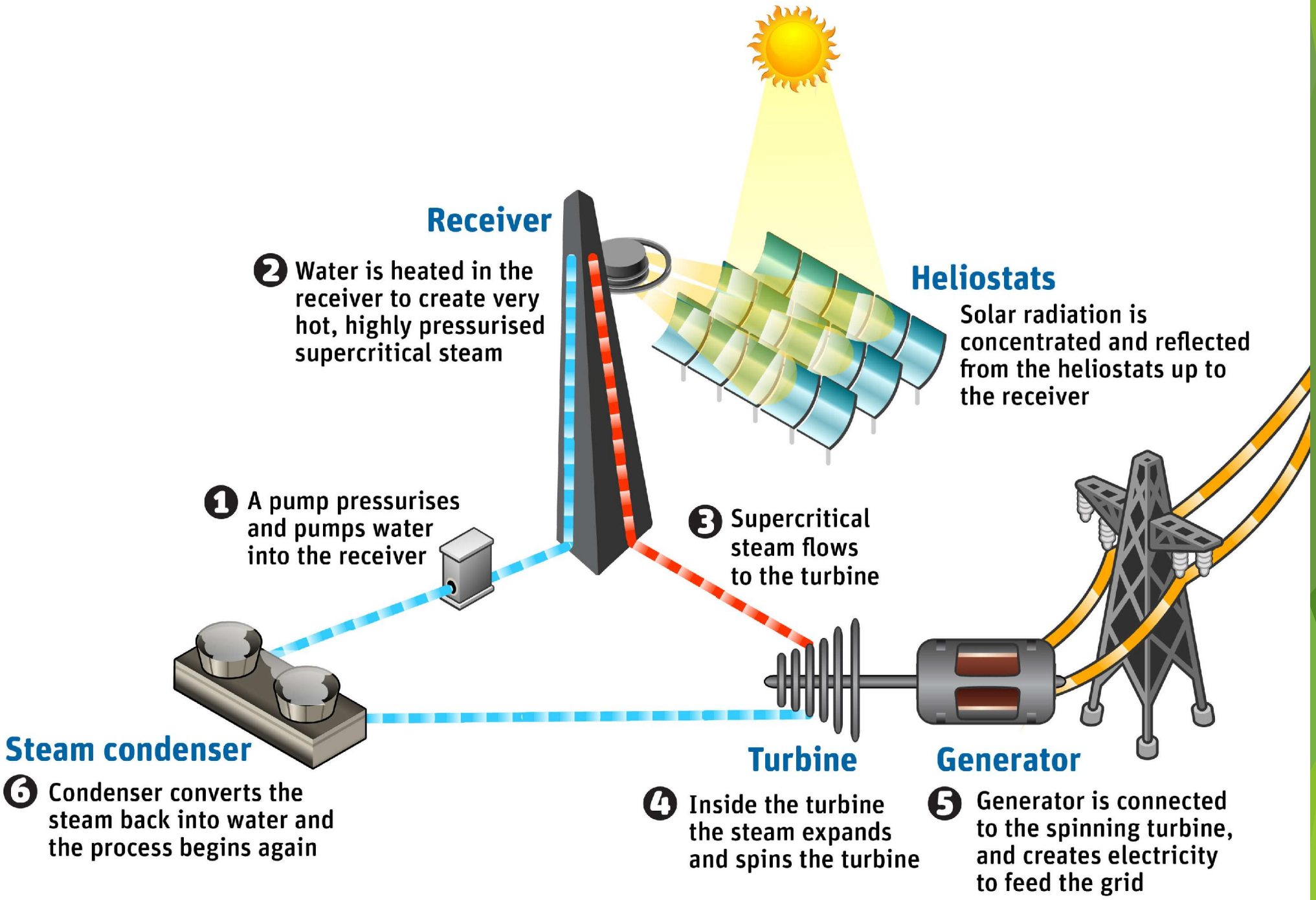
Large Solar Array

Solar Array on Space Station



Small Solar Array in West Virginia

Solar thermal plant


Receiver
2 Water is heated in the receiver to create very hot, highly pressurised supercritical steam
Heliostats
Solar radiation is concentrated and reflected from the heliostats up to the receiver
1 A pump pressurises and pumps water into the receiver
3 Supercritical steam flows to the turbine
Steam condenser
6 Condenser converts the steam back into water and the process begins again
Turbine
4 Inside the turbine the steam expands and spins the turbine
Generator
5 Generator is connected to the spinning turbine, and creates electricity to feed the grid

Residential PV Solar Systems

8.4 kW System in Southeastern Ohio

Pokladnik 8.4 kW Solar System Ohio

Mary and Don built their own energy-efficient, octagonal home on a ridge in a land trust in West Virginia. Don installed their off-grid solar electric system and has helped several other families design different systems. Once an electronics engineer, he now makes a living managing websites. Mary's part is reducing expenses by growing as much as possible of their food, and writes novels and essays. She is currently involved in the battle against fracking and gas infrastructure.

Solar on a West Virginia Home

Solar panels on a home in West Virginia Note tilt of panels in Summer

Battery Back up for OFF-Grid system

Battery Bank

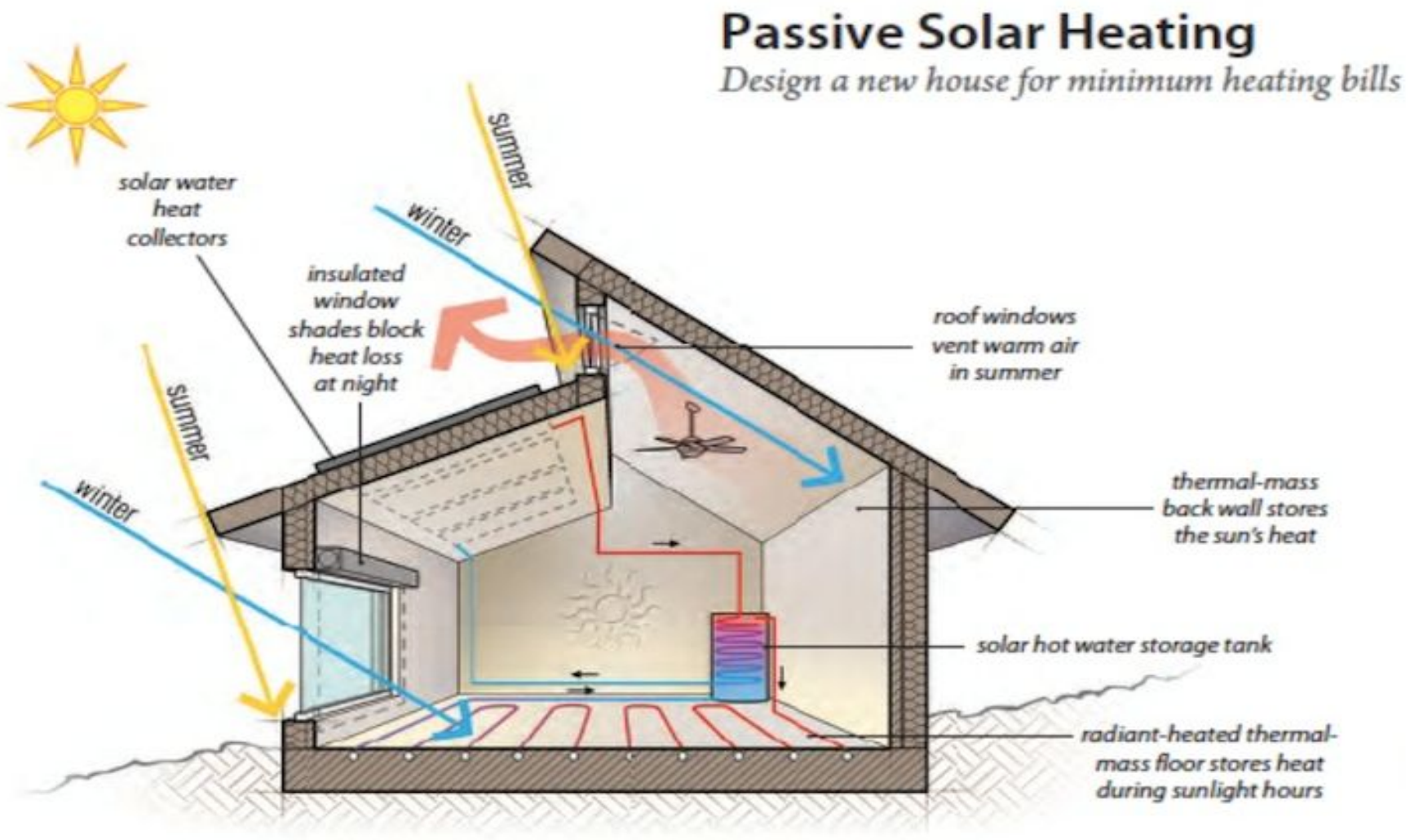
Control for West Virginia System

Solar homes can be passive or active

Passive by using designs to get most energy from sun

Active

Passive Solar



Passive Solar on West Virginia Home: Lower Windows

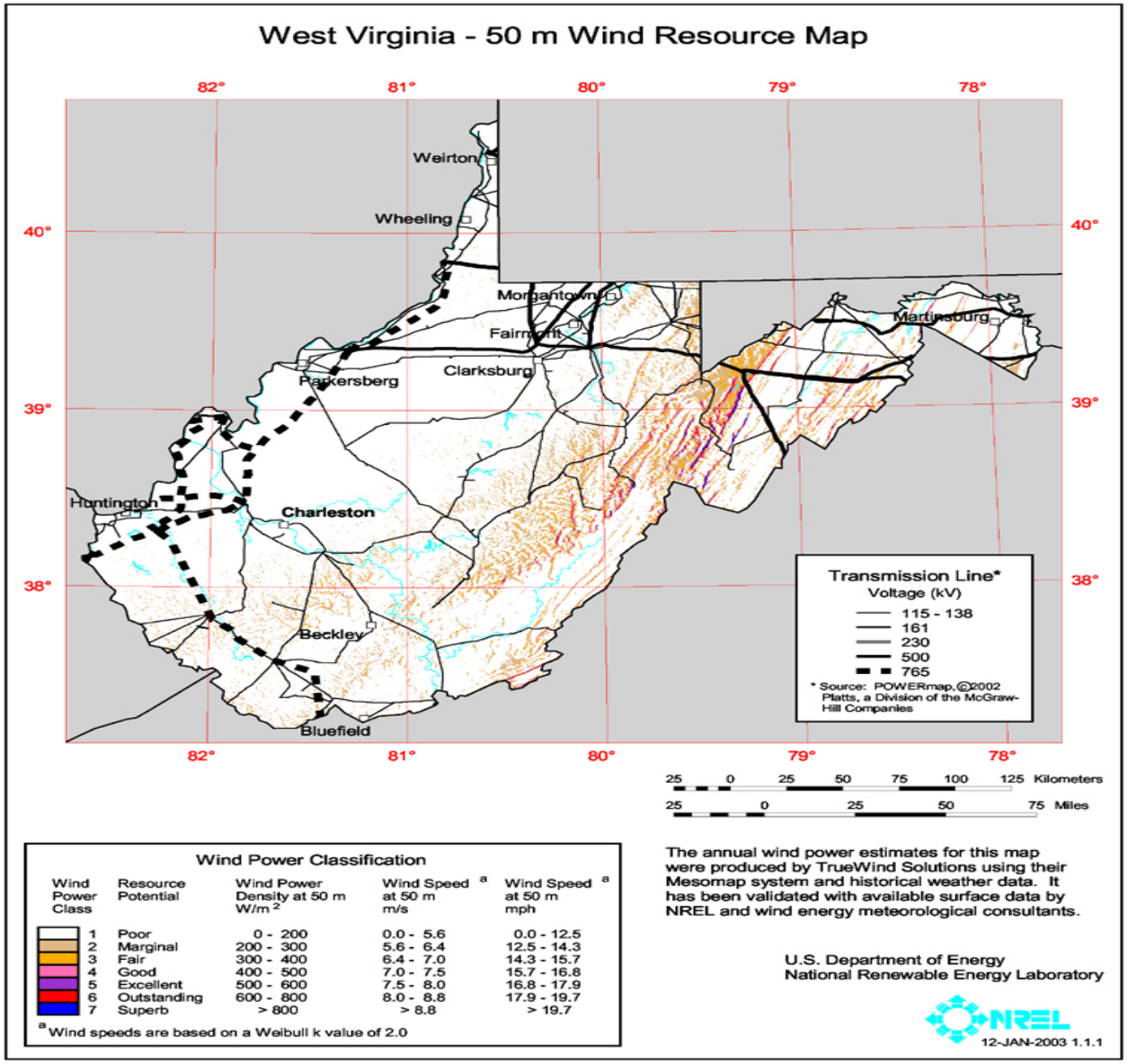
Solar Greenhouse : Part of Passive

Jobs in Solar

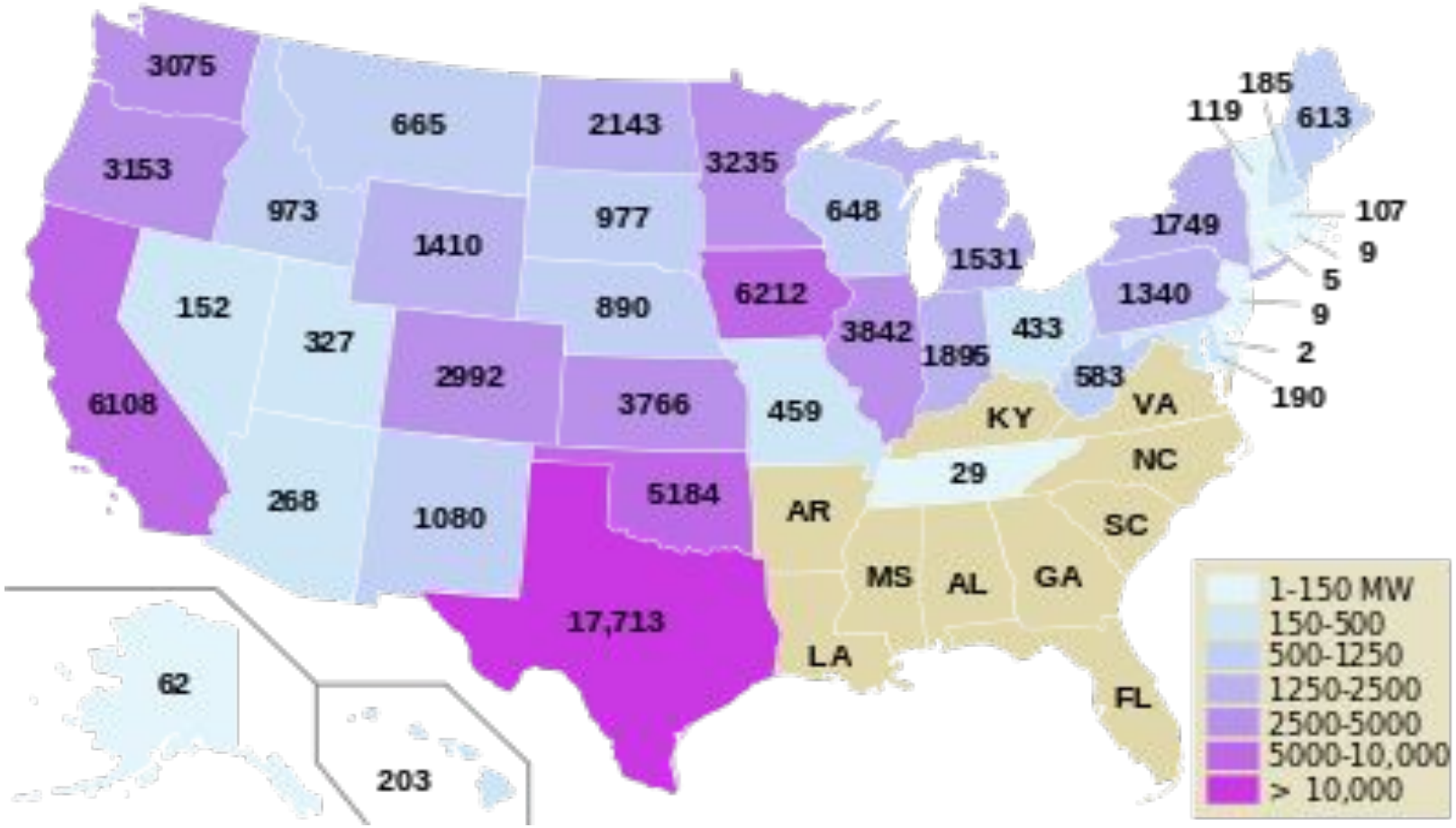
- Fastest Growing jib sector in energy jobs in USA
- Installation salary $39K Site Assessor $73K Project Supervisor $95K

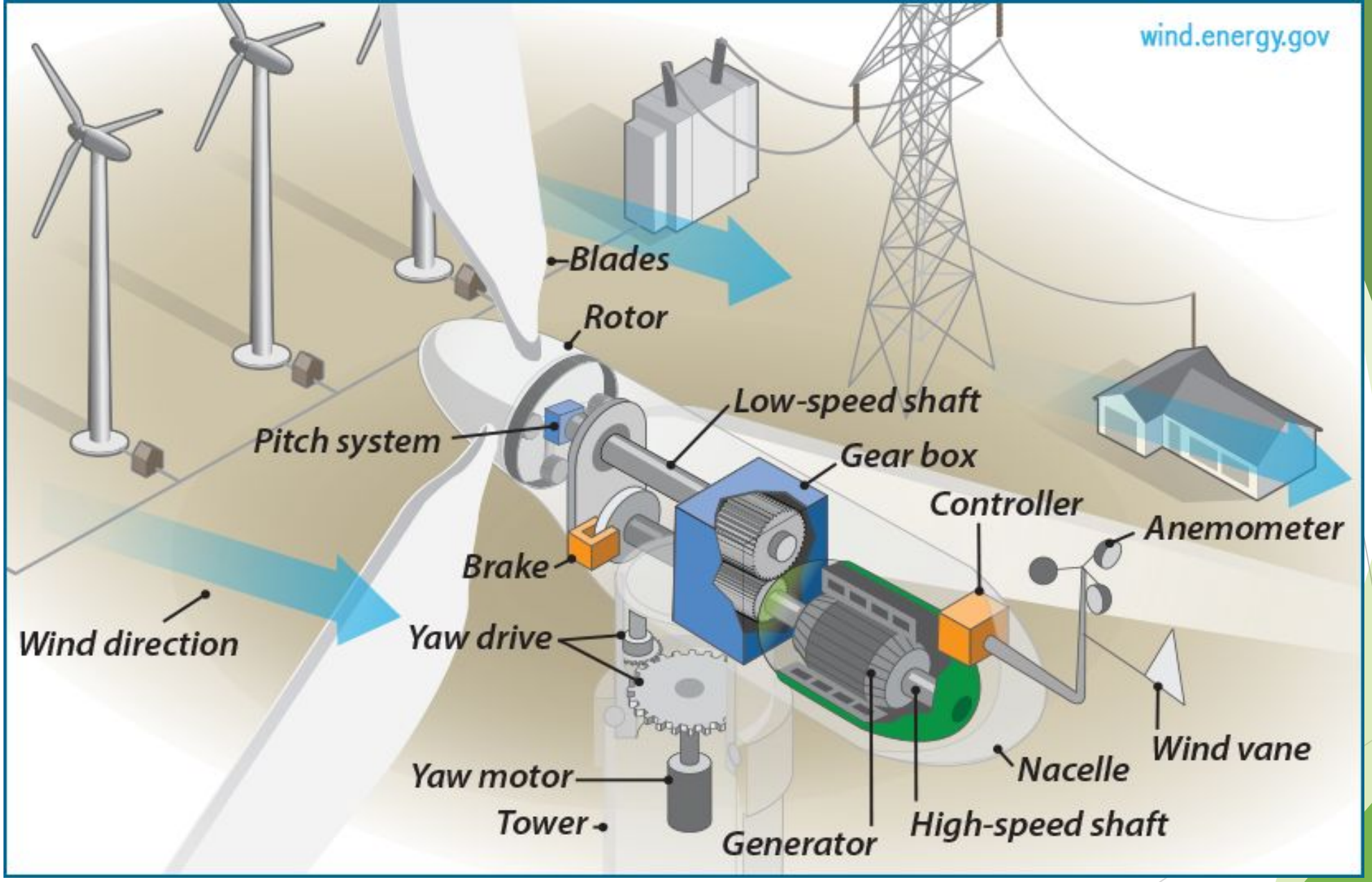
WIND ENERGY

Wind Possibilities in West Virginia

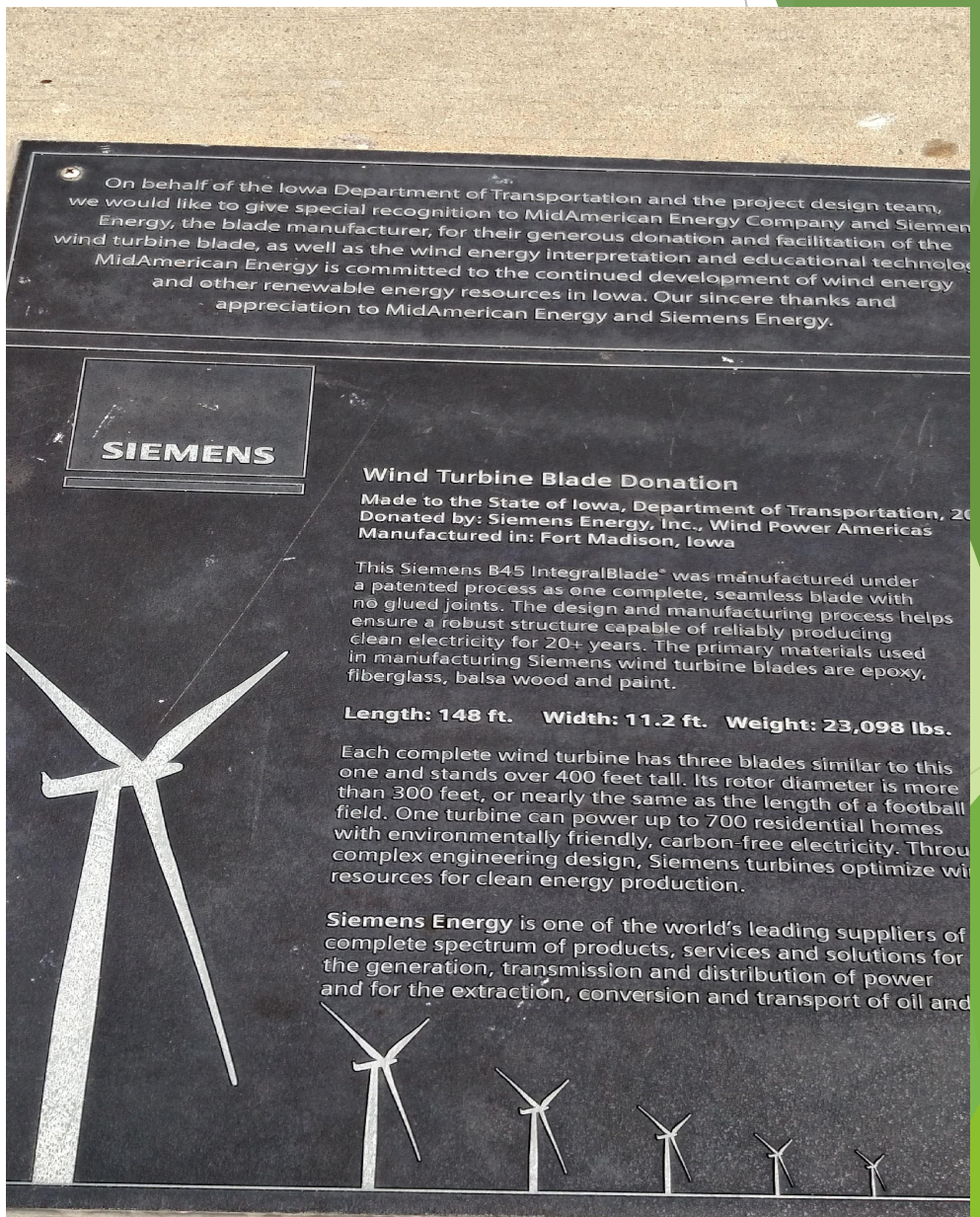


Big Wind States: Texas, Iowa and California




wind.energy.gov
Blades
Rotor
Low-speed shaft
Pitch system
Gear box
Controller
Anemometer
Brake
Wind direction
Yaw drive
Wind vane
Nacelle
Yaw motor
Tower
Generator
High-speed shaft

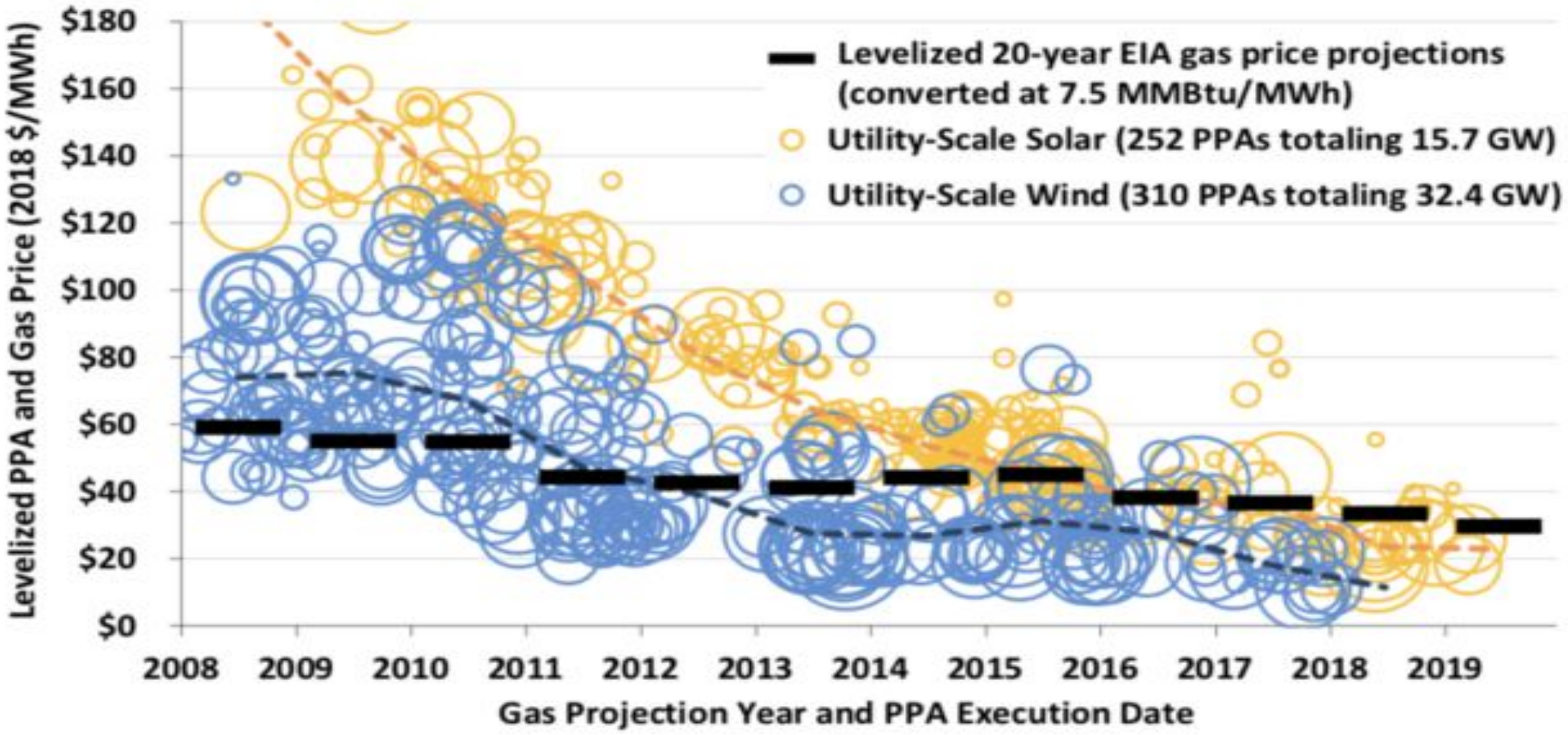
Wind Turbines: Made in Iowa of metal, fiberglass and balsa wood



Vertical Wind Turbine

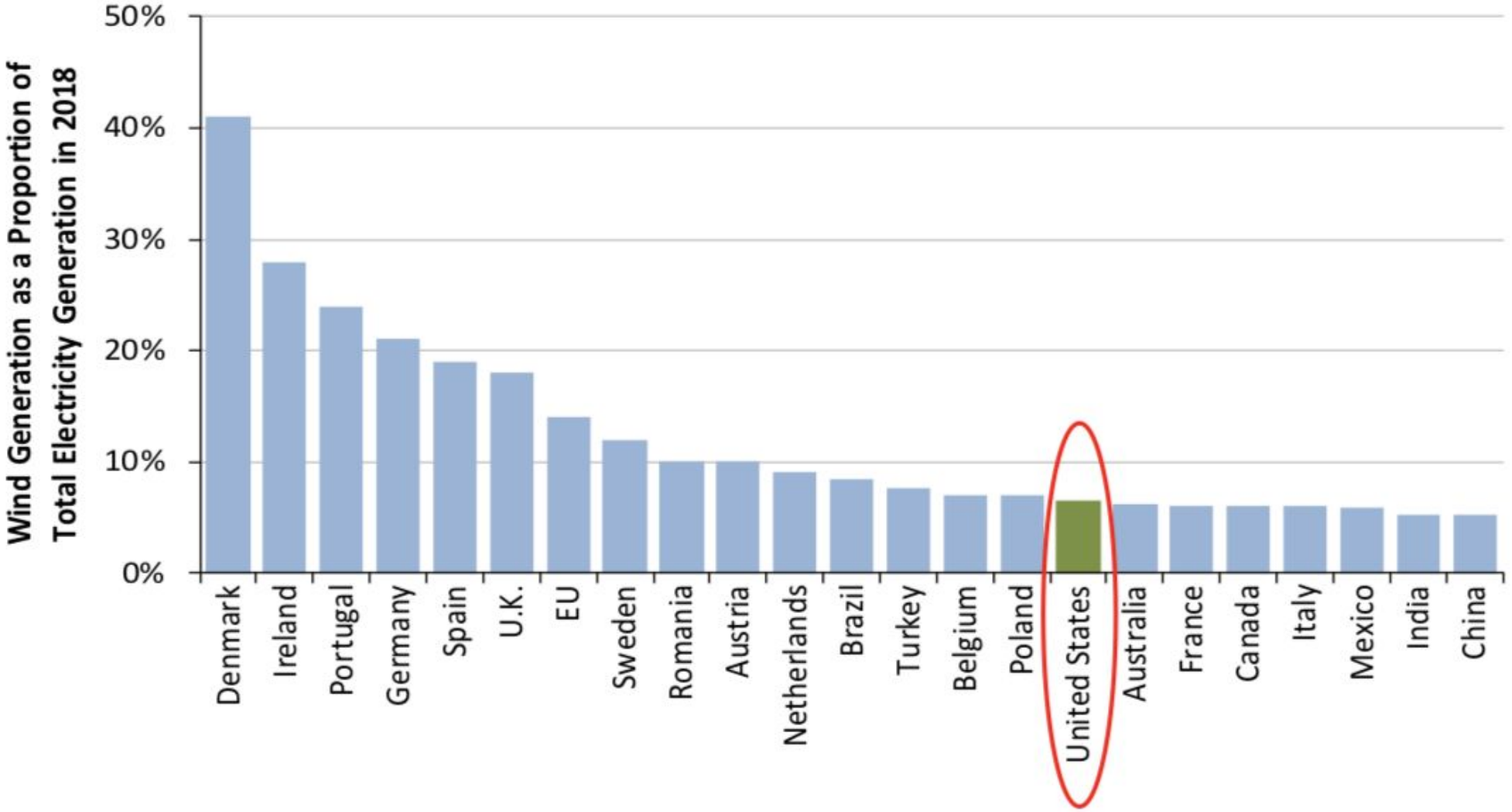
Wind Turbine Georgetown Winery, Cambridge Ohio 10kW ($15,000)

It is now cheaper to build wind power in Central USA than build a gas powerplant
$20 MW/hour

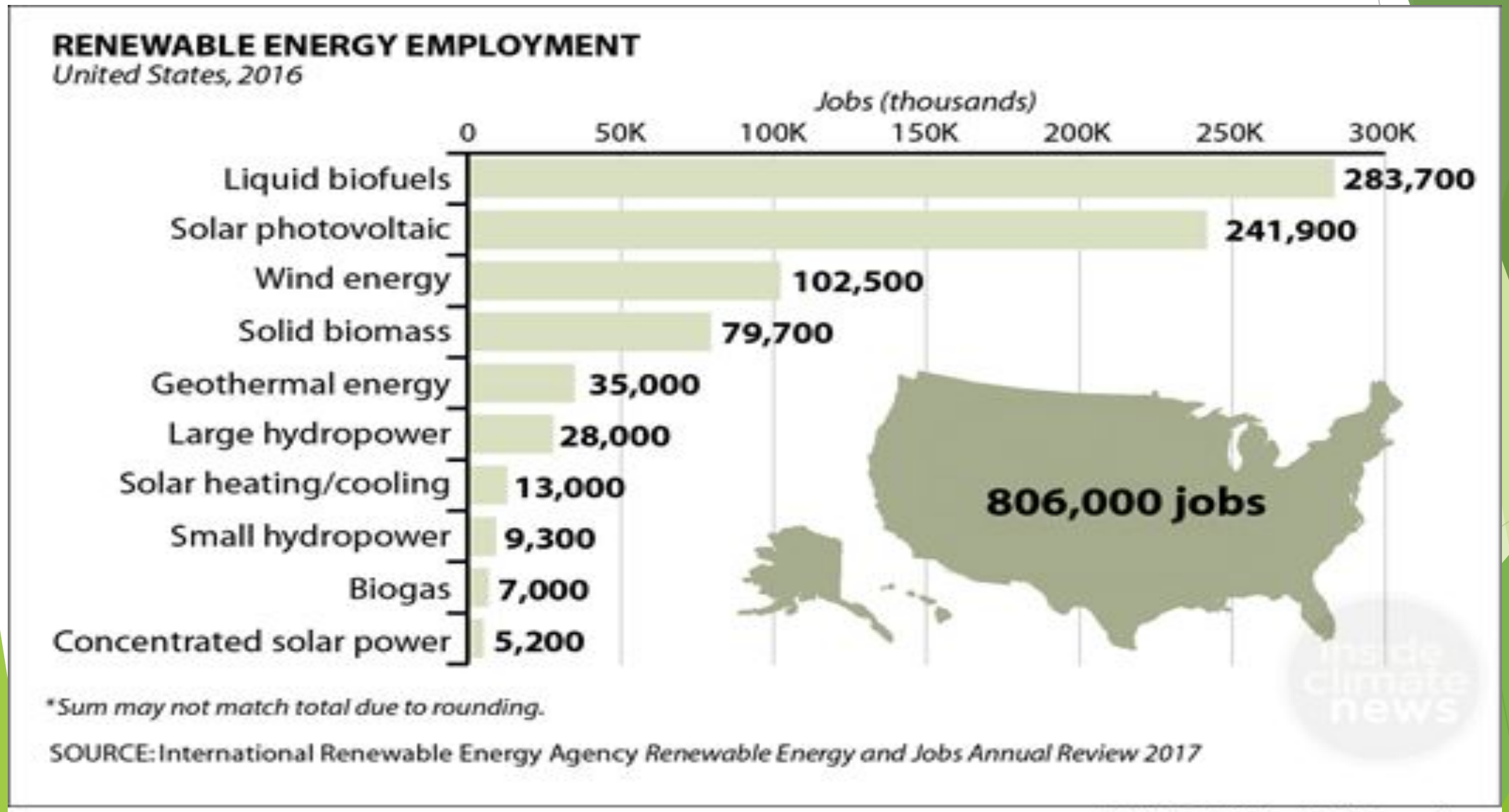


- The average wind turbine installed in 2014 generates about 17 times more electricity than one from 1990.**
- The share of America's total electricity production generated by wind energy tripled between 2008 and 2013—from 1.5 percent to 4.5 percent. By 2030, that share could rise to 20 percent. And by 2050, it could grow to as much as 35 percent.***
- America already has almost 900 large-scale wind projects in operation throughout 39 states. And more than 550 wind-related manufacturing facilities also offer good job opportunities to people in 44 states.**
- Based on just the amount of wind-suitable land in America, wind energy alone has the potential to one day provide more than 10 times the amount of electricity needed for the whole country.**

Percent of Wind Energy for Total Electricity



Jobs in Renewable Energy



Environmental/Health Concerns for Wind

- Land Use- The turbine has a quarter acre footprint but wide spaces are needed for winds
- Birds: Care must be taken for placing the farms out of migration paths
- Bats: Turbines are turned off when low wind speeds occur to help prevent bats from being killed
- Noise: Use of insulation on blades and friction free surfaces cuts down on noise (health studies show no evidence of impacts to human health)
- There are multi-uses for the land around turbine (farming, wildlands, parks, even can be placed on brownfields areas

JOBS IN WIND

- In 2018, the average yearly pay of a wind turbine technician in America was $58,000. And the highest earners in the wind energy trade made over $83,560.
- The training programs take from 18-24 months
- Increase in community college programs in Midwestern States

Wind Farm Iowa 2019