

Windpower

Basics

Form of solar energy, winds are created by the differential heating of the Earth

About 2% of solar energy goes into making winds. This is still about 10 times more energy than we currently use on a global scale... **tapping only land surfaces, it is 3 times more energy.**

Problems include reliability and distribution.

Basics

Old form of energy. Windmills, sailing ships, etc. date back thousands of years.

Typical efficiency is about 30%. Maximum theoretical efficiency is thought to be about 60%.

At 30% efficiency, we would have to stop the atmosphere (tap all energy) on land surfaces to use wind as the sole source of power.

Basics

Technology is simple, use wind energy to turn fan blades, which turn the turbine, and you know the rest.

Technology development is in more efficiently capturing wind (blade types) and in making more robust towers that can work in high winds.

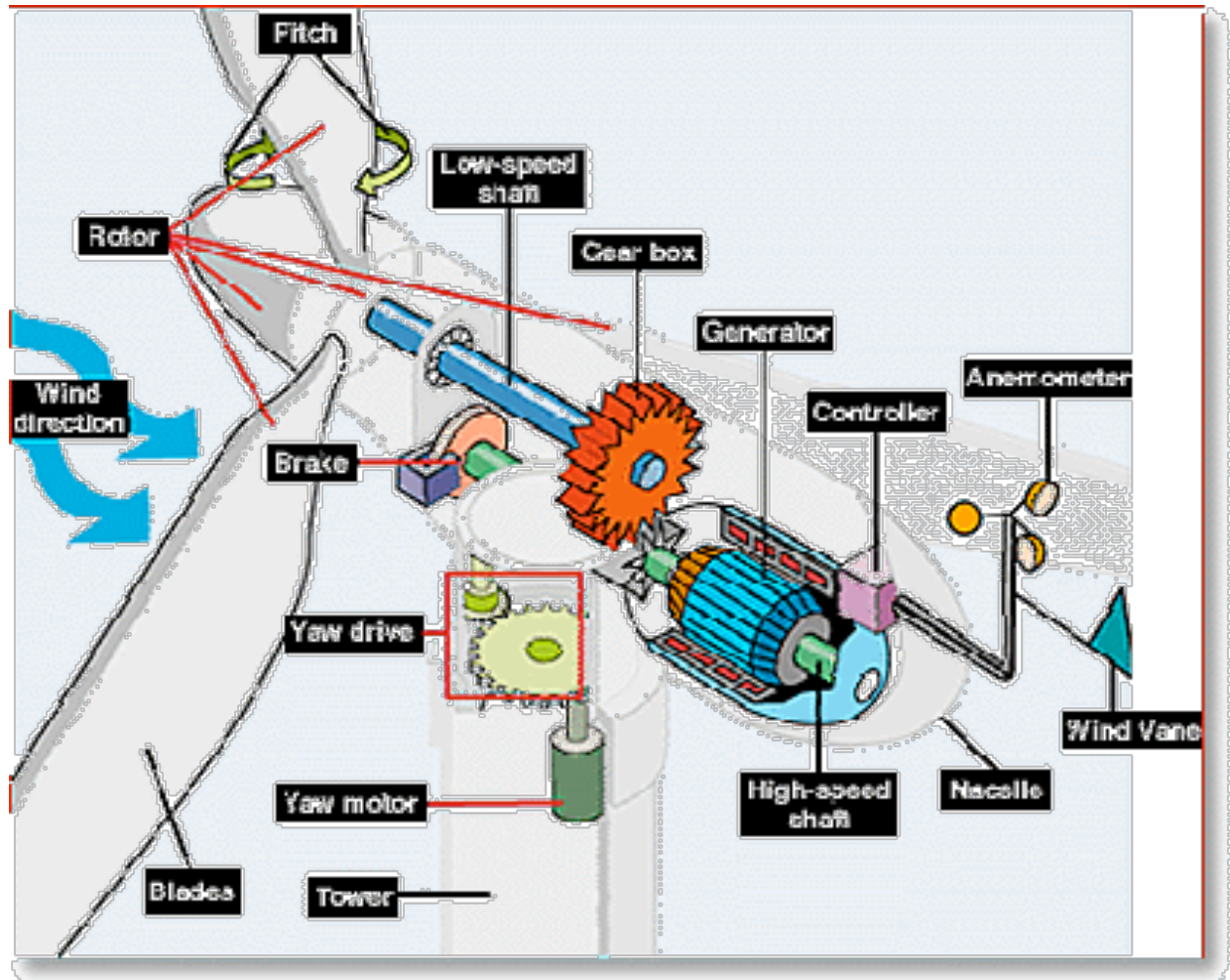
High winds are a problem as they can damage the windmills.

We want to position wind turbines in areas of constant wind, yet these areas typically have high winds as well.

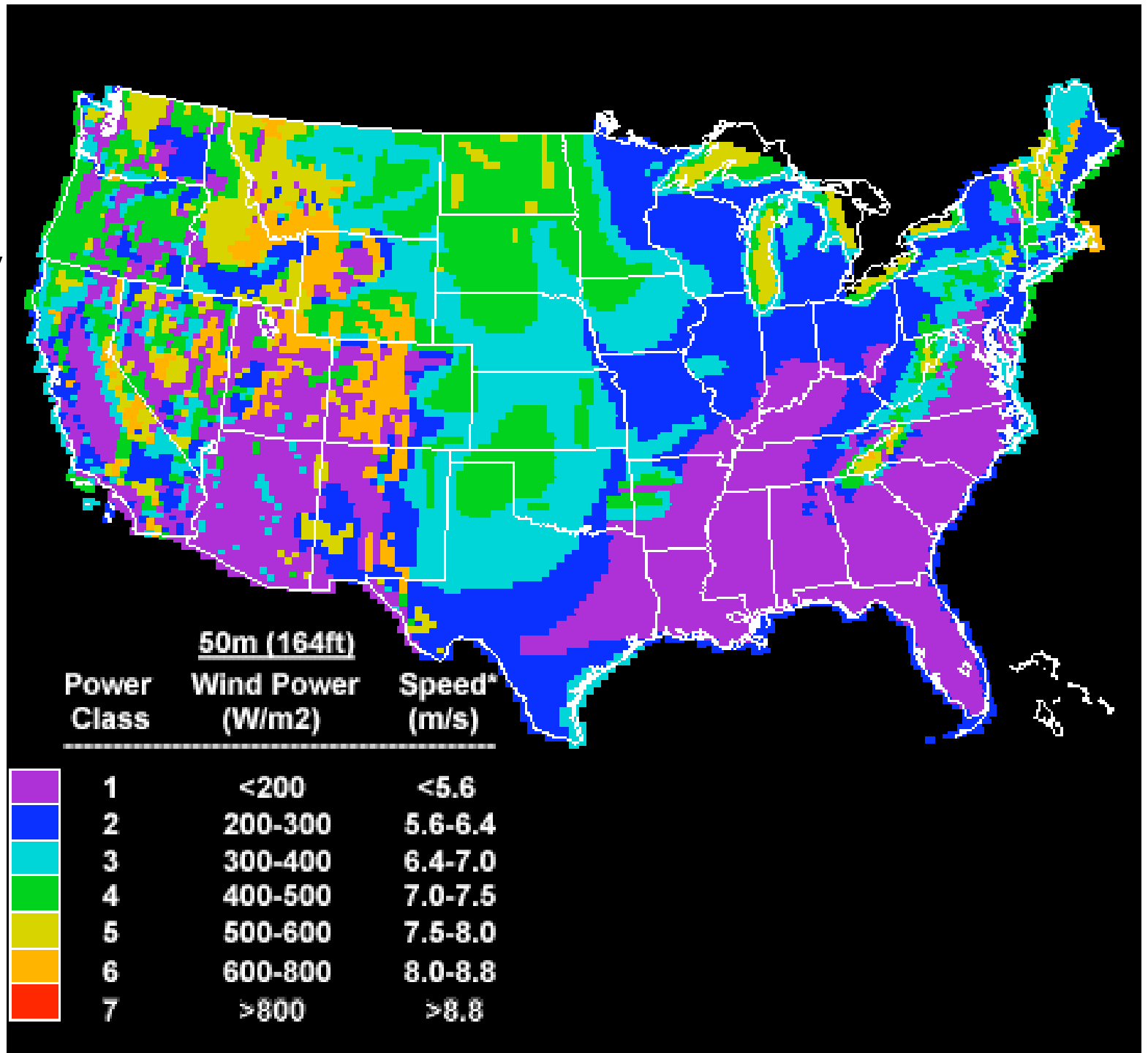
Basics

System is simple...

Wind turns blade,
gears used to
increase speed of
generator



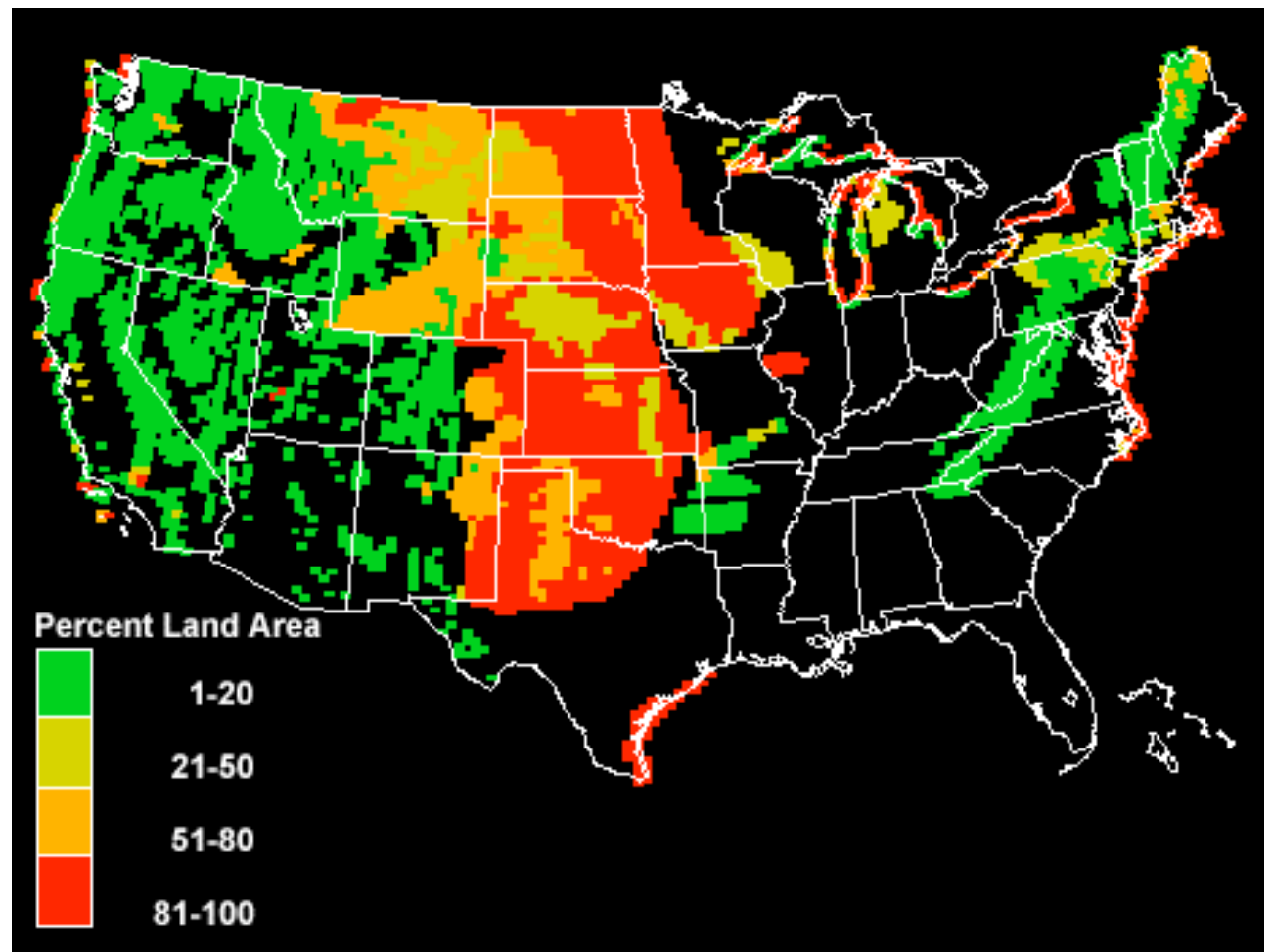
Wind energy



Useful winds

Useful energy is mostly above 300 watts per square meter.

Percent land area with useful windpower potential

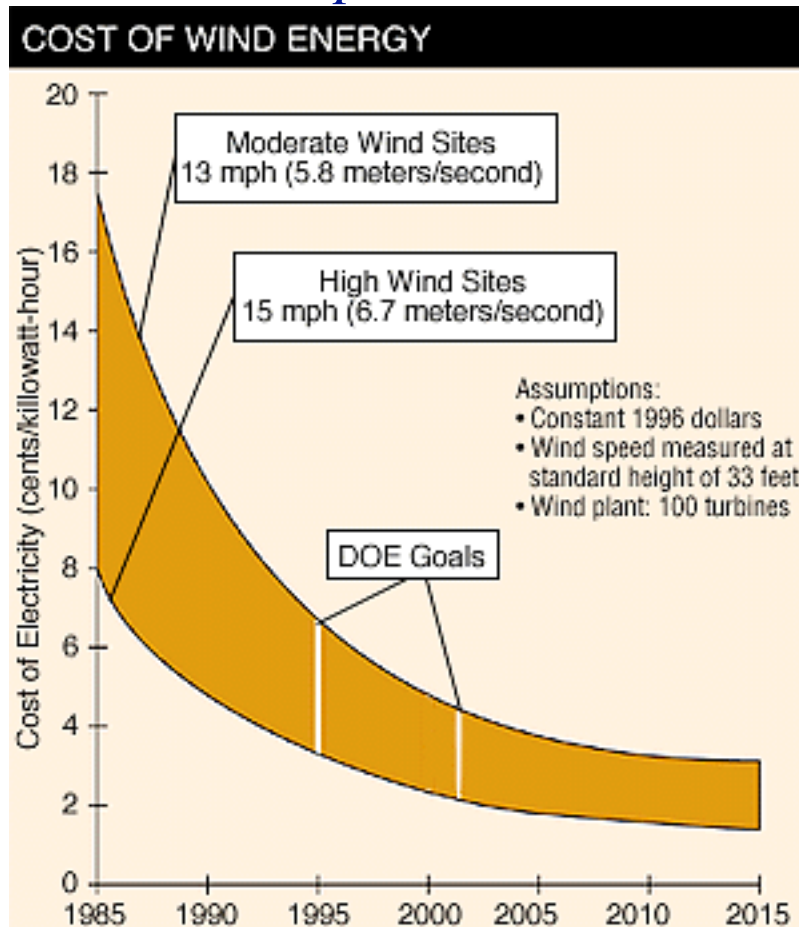


Midwest has the greatest potential

Montana, Wyoming, Colorado, New Mexico, North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, Texas, Iowa and Minnesota have more than 90% of US potential.

Pros

Cost is very competitive, production costs are *currently about 5 cents per kilowatt-hour.*



This is down from 7 to 10 cents per kilowatt-hour in 1995 and 15 cents per kilowatt-hour in the 1980's.

This is another example of subsidies creating a viable market.

Pros

It is estimated that the costs could be lowered to 3-4 cents per kilowatt-hour as wind technology improves.

Improvements in technology may also open less windy areas up for economically useful and viable wind power.

Potential

Overall potential is 20% of **current** US needs, with caveats for reliability and storage...

This is if we blanket the areas with useful wind energy with windmills, about 50 million windmills, or one every 10 square kilometers (spacing to avoid interference with each other).

Probably 5 to 10% of total energy, or 20% to 40% of electricity is a more reasonable estimate for future potential.

Keep in mind that electricity needs are only about 1/5th of our total current energy needs.

Cons

Reliability is a key issue, as the wind does not always blow. *Requires a storage mechanism that compensates for reliability.*

Recently, *aesthetics* has become a significant issue.

Killing of birds.