

Wind and Water Energy

Mr. Skirbst

Wind and Water Energy

- Production of electricity by using the flow of air or water



Wind Energy

- Flow of air resulting from the uneven heating of earth's atmosphere



Windmills

- Until mid 1800's: used to pump water out of ground



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- Late 1800's to mid 1900's: used to generate electricity locally



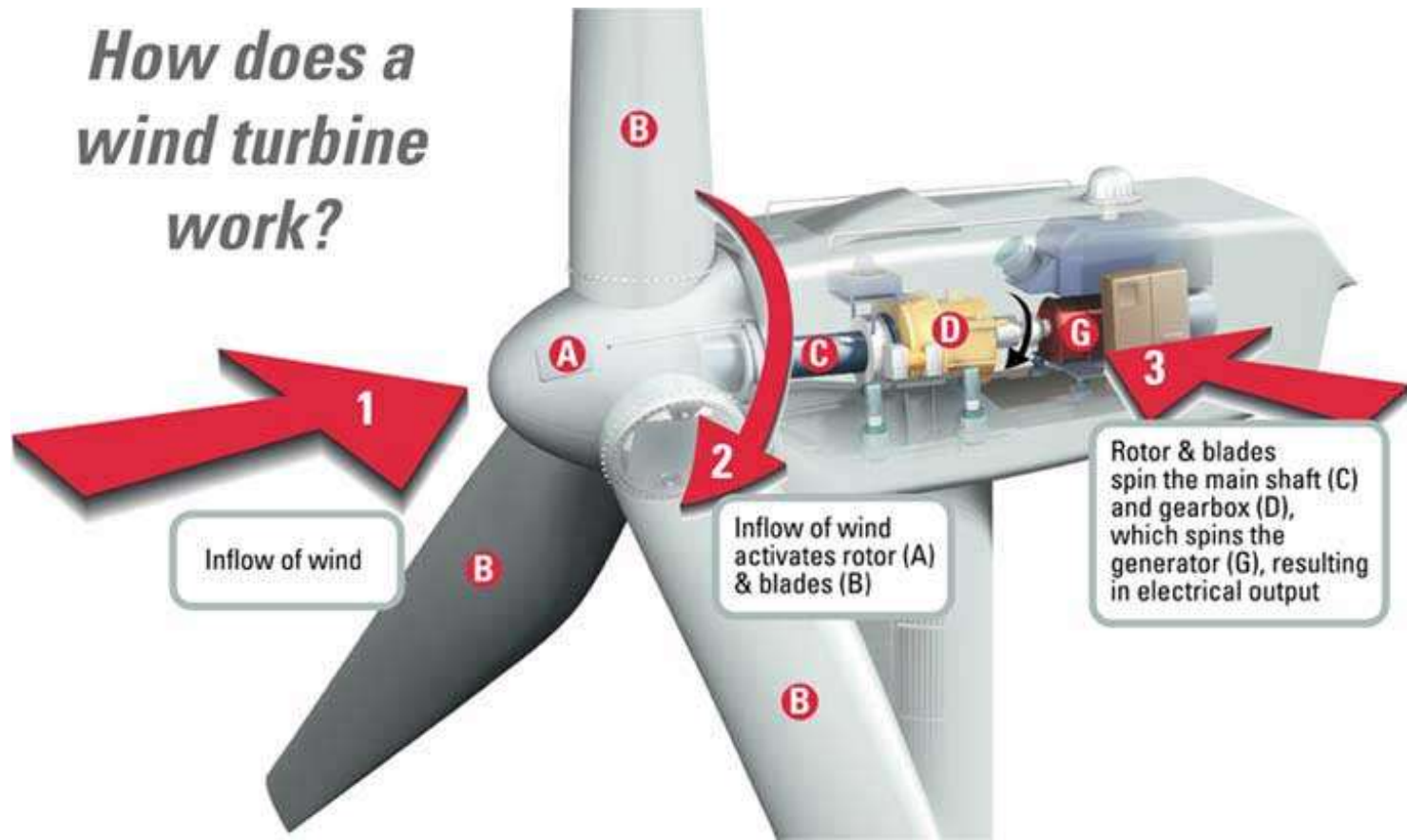
Windmills

- Until mid 1800's: used to pump water out of ground
- Late 1800's to mid 1900's: used to generate electricity locally
- 21st century: used to generate / provide electricity to the grid



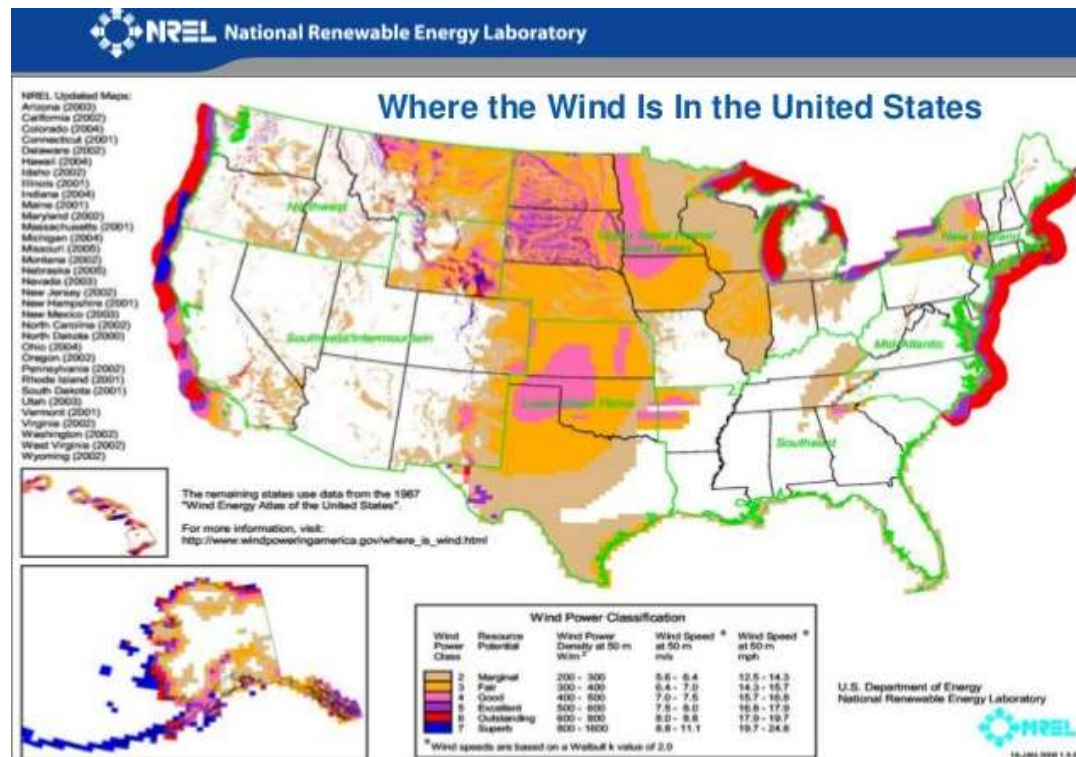
Windmills

- Convert mechanical to electrical energy using generators



Windmill Limitations

- Wind is neither in constant supply nor at a constant velocity



Windmill Limitations

- Wind is neither in constant supply nor at a constant velocity
- Variabilities present energy challenges



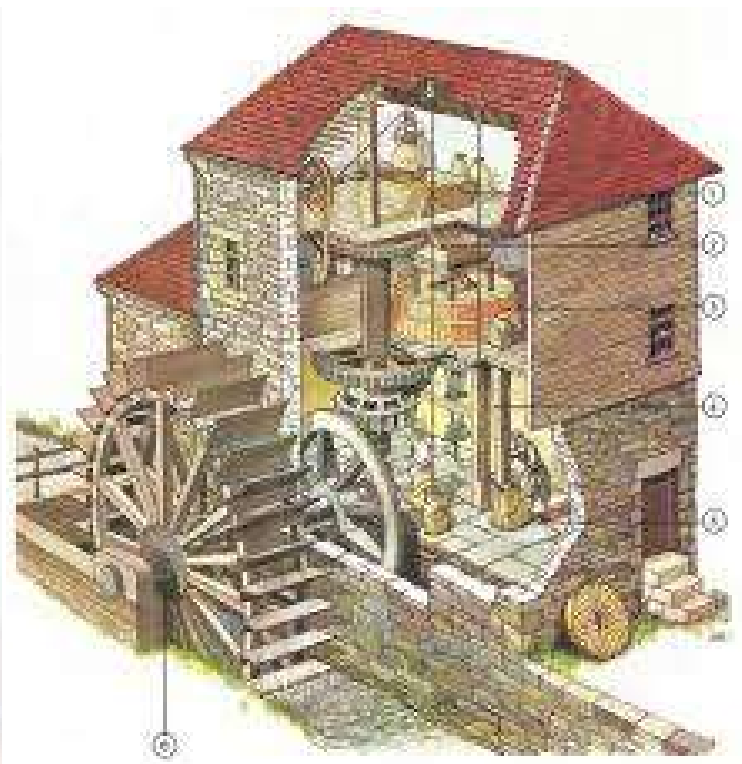
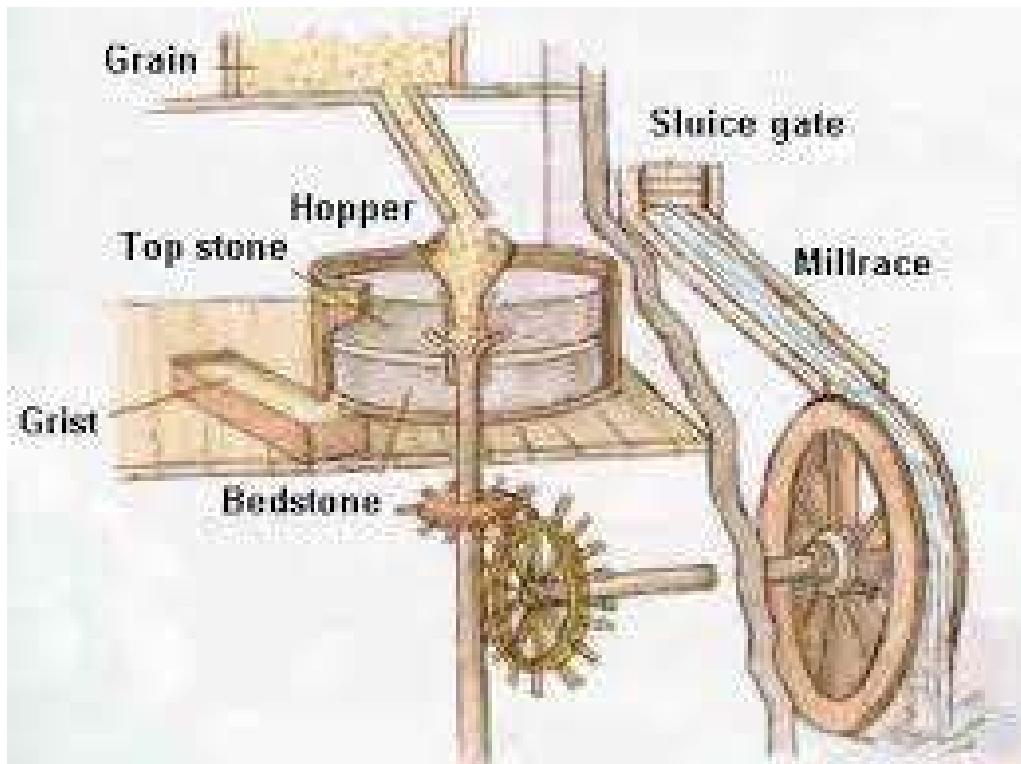
Water Energy

- Flow of water resulting from the pull of gravity



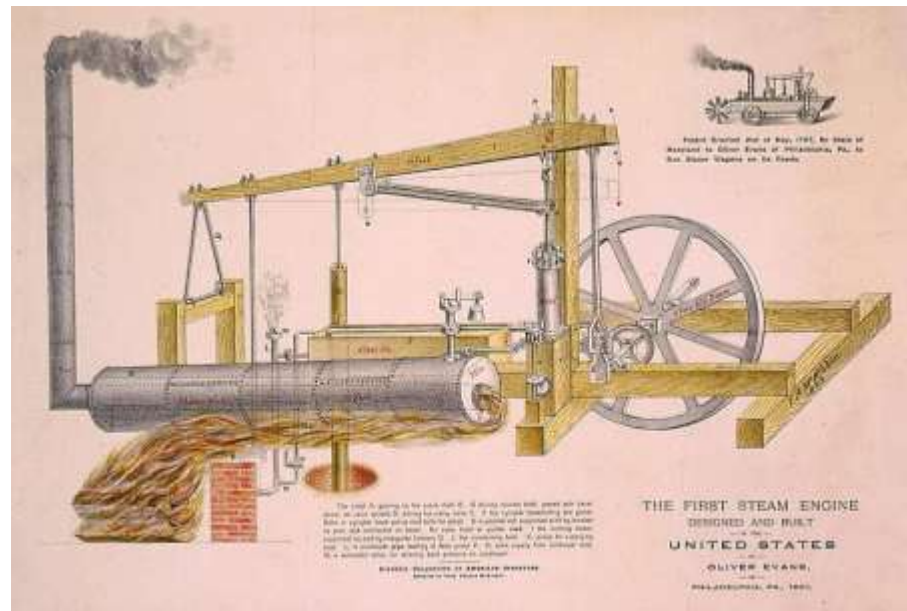
Water Mills

- Until 1800's: used to grind grain (with millstones) or power saws



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Water Mills

- Until 1800's: used to grind grain (with millstones) or power saws
- Late 1800's: replaced by steam
- Late 1800's: Edison's lightbulb causes demand for electricity



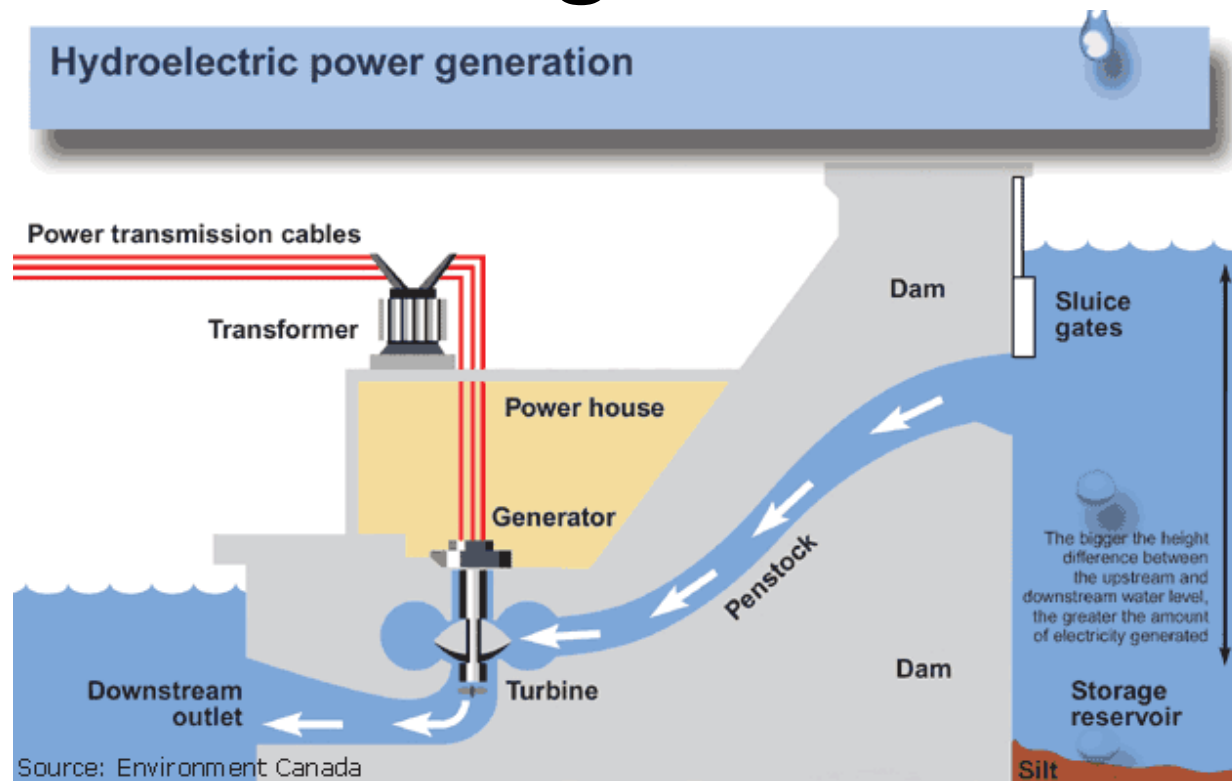
Hydroelectric Power

- Use of falling/running water to generate electricity



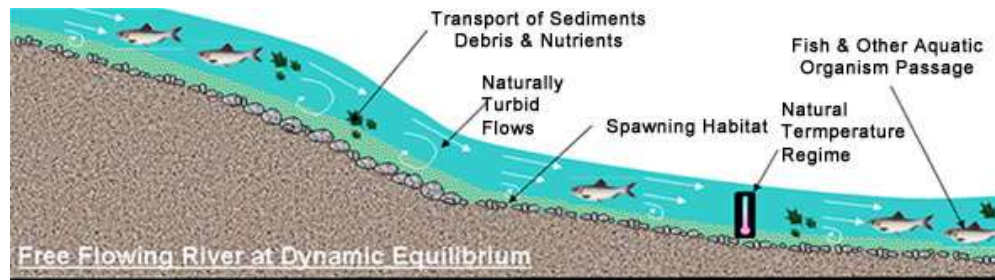
Hydroelectric Power

- Use turbine turned by water to turn a generator



Water Energy Limitations

Environmental impacts: - Sedimentation



UPSTREAM IMPACTS*

Reduced:
Natural Function, Water Quality, Oxygen, Turbid Flow, Circulation, Available Habitat
Rivers ability to adjust horizontally and vertically (reduced resilience to change)

Increased:
Pollutant Accumulation, Stratification, Temperatures, Algae Blooms

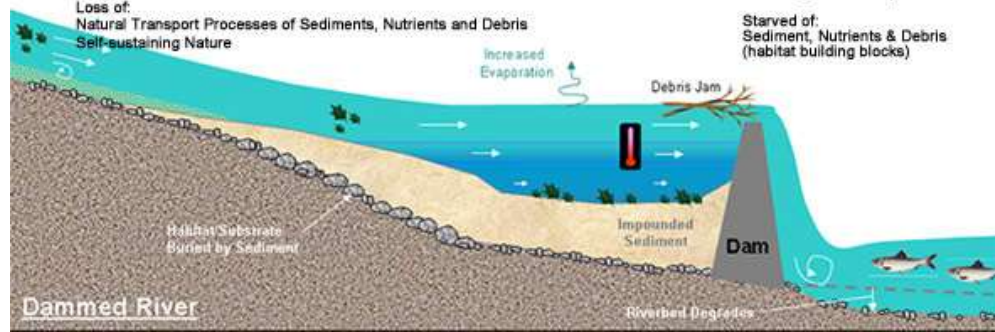
Loss of:
Natural Transport Processes of Sediments, Nutrients and Debris
Self-sustaining Nature

DOWNSTREAM IMPACTS*

Reduced:
Water Quality & Riverbed Elevation

Altered:
Flow Regime & Temperatures

Starved of:
Sediment, Nutrients & Debris
(habitat building blocks)



Water Energy Limitations

Environmental impacts:

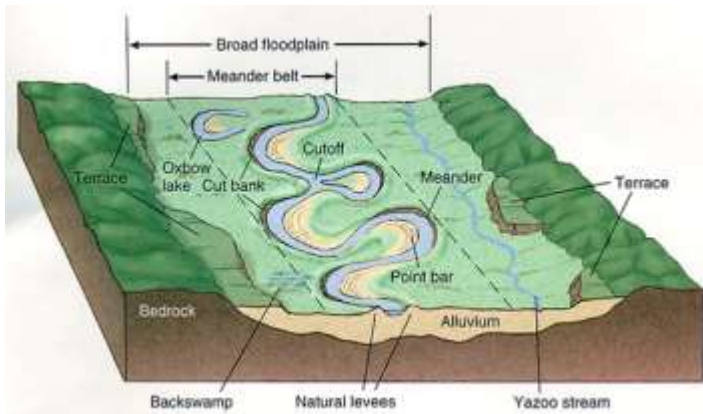
- Sedimentation
- Flooding valleys



Water Energy Limitations

Environmental impacts:

- Sedimentation
- Flooding valleys
- Controlling floods



Water Energy Limitations

Environmental impacts:

- Sedimentation
- Flooding valleys
- Controlling floods
- Preventing spawning



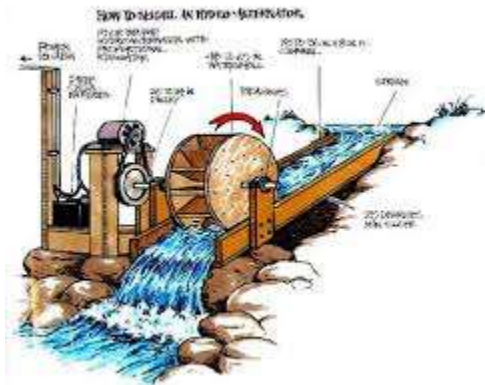
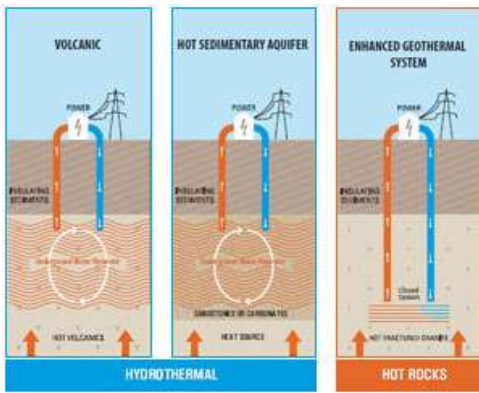
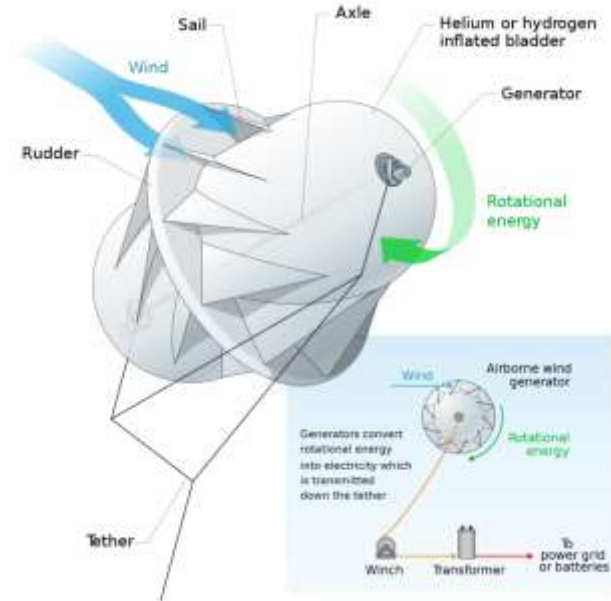
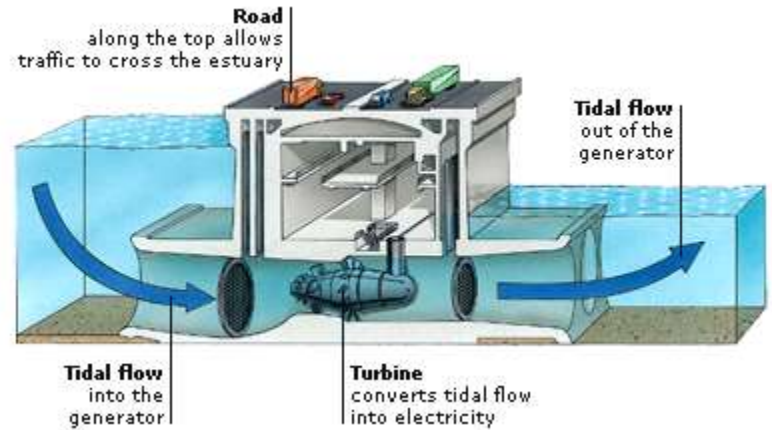
Other Energy Sources

Tidal power

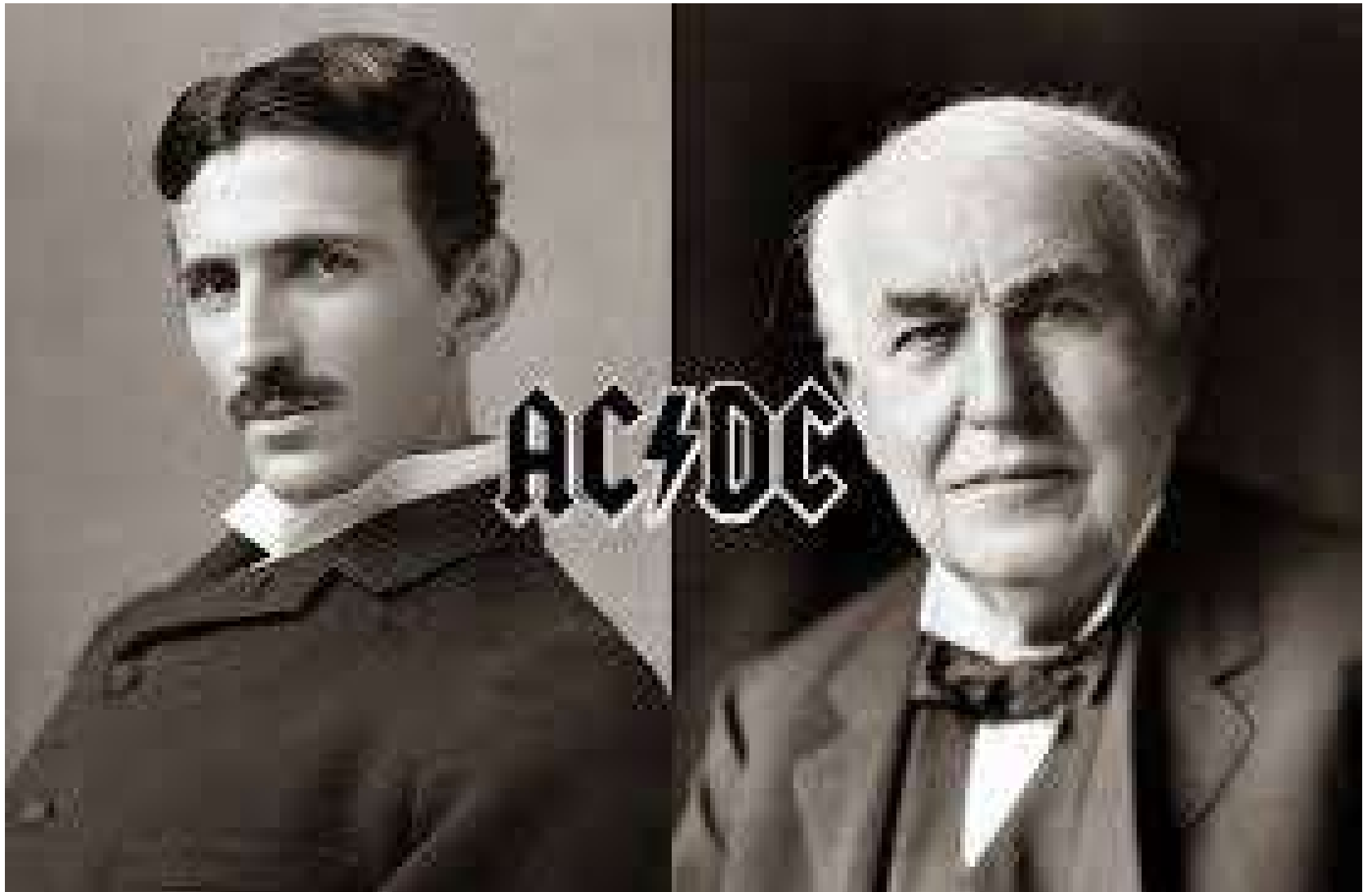
Airborne turbine

Micro-generators

Geothermal



Power Transmission



Power Transmission

DC – Direct Current (like batteries)

Power Transmission

DC – Direct Current (like batteries)

AC – Alternating Current (houses)

Power Transmission

THE CURRENT WAR THE TALE OF AN EARLY TECH RIVALRY

DC

DIRECT CURRENT

The flow of electricity is in one direction only. The system operates at the same voltage level throughout and is not as efficient for high-voltage long distance transmission.

Direct current runs through



Battery-Powered Devices Fuel and Solar Cells Light Emitting Diodes

"[TESLA'S] IDEAS ARE SPLENDID, BUT THEY ARE UTTERLY IMPRACTICAL."

- THOMAS EDISON

AC

ALTERNATING CURRENT

Electric charge periodically reverses direction and is transmitted to customers by a transformer that could handle much higher voltages.

Alternating current runs through



Car Motors Radio Signals Appliances

"IF EDISON HAD A NEEDLE TO FIND IN A HAYSTACK, HE WOULD PROCEED AT ONCE... UNTIL HE FOUND THE OBJECT OF HIS SEARCH. I WAS A SORRY WITNESS OF SUCH DOINGS, KNOWING THAT A LITTLE THEORY AND CALCULATION WOULD HAVE SAVED HIM 90 PERCENT OF HIS LABOR."

- NIKOLA TESLA



THOMAS EDISON



NIKOLA TESLA

VS.

You would have never found two geniuses so spiteful of each other beyond turn-of-the-century inventors Nikola Tesla and Thomas Edison. They worked together—and hated each other. Let's compare their life, achievements, and bitter battles.



FALLING OUT

Edison promised Tesla a generous reward if he could smooth out his direct current system. The young engineer took on the assignment and ended up saving Edison more than \$100,000 (millions of dollars by today's standards). When Tesla asked for his rightful compensation, Edison declined to pay him. Tesla resigned shortly after, and the older inventor spent the rest of his life campaigning to discredit his counterpart.



EDISON FRIES AN ELEPHANT

In order to prove the dangers of Tesla's alternating current, Thomas Edison staged a highly publicized electrocution of the three-ton elephant known as "Topsy". She died instantly after being shocked with a 6,600-volt AC charge.



LATE BLOOMER

Thomas Edison, the youngest in the family, didn't learn to talk until he was almost 4 years old.

1847 BORN 1858

Milan, Ohio BIRTHPLACE Smiljan, Croatia

Wizard of Menlo Park NICKNAME Wizard of the West

Home-schooled and self-taught EDUCATION Studied math, physics, and mechanics at The Polytechnic Institute of Graz

Mass communication and business. FORTE Electromagnetism and electromechanical engineering

Wild and erratic. METHOD Getting inspired and seeing the invention in his mind in detail before fully constructing it

DC (Direct Current) WAR OF CURRENTS: ELECTRICAL TRANSMISSION IDEA AC (Alternating Current)

NOTABLE INVENTIONS

Incandescent light bulb, phonograph, sound-making technology, motion picture camera, DC motors and electric power

Tesla coil, resonant transformer circuit, radio transmitter, fluorescent light, AC motors and electric power generation system

1,093 NUMBER OF US PATENTS 112

0 NUMBER OF NOBEL PRIZES WON 0

0 NUMBER OF ELEPHANTS ELECTROCUTED 0

1931—Passed away peacefully in his New Jersey home, surrounded by friends and family

DEATH

1943—Died lonely and in debt in Room 3327 at the New Yorker Hotel



WAR OF CURRENTS OFFICIALLY SETTLED

In 2007, Cam Edison ended 125 years of direct current electricity service that began when Thomas Edison opened his power station in 1882. It changed to only provide alternating current.

NOBEL PRIZE CONTROVERSY



In 1915, both Edison and Tesla were to receive Nobel Prizes for their strides in physics, but ultimately, neither won. It is rumored to have been caused by their animosity towards each other and refusal to share the coveted award.