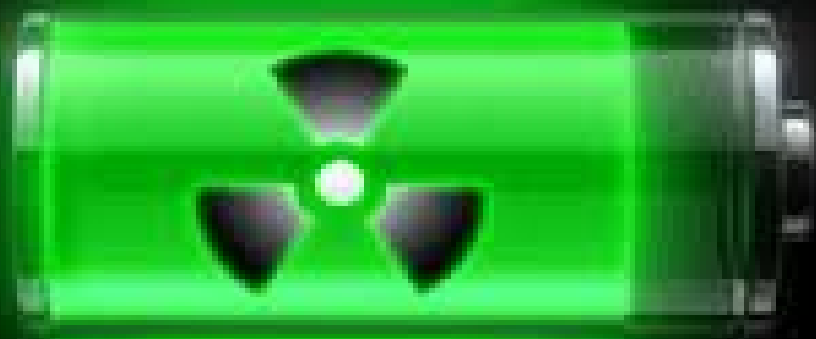


NUCLEAR



What exactly is "Nuclear" energy?

It is the different types of reactions that release energy due to the presence of powerful atomic bonds between particles found within a nucleus.

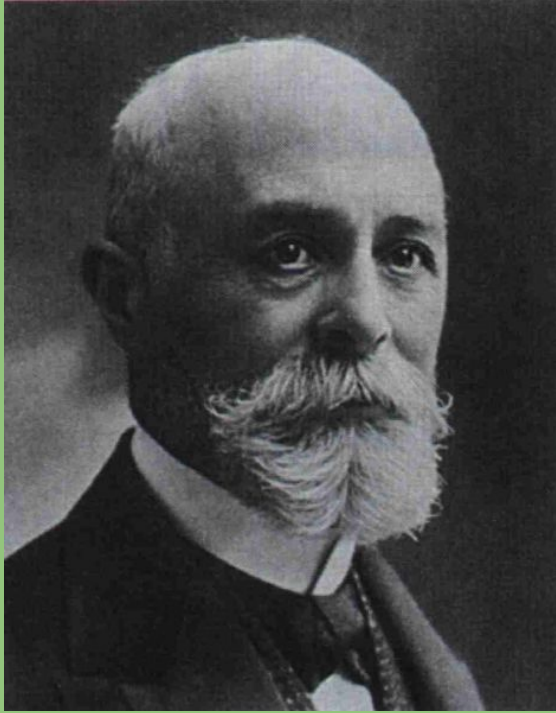


NUCLEAR ENERGY



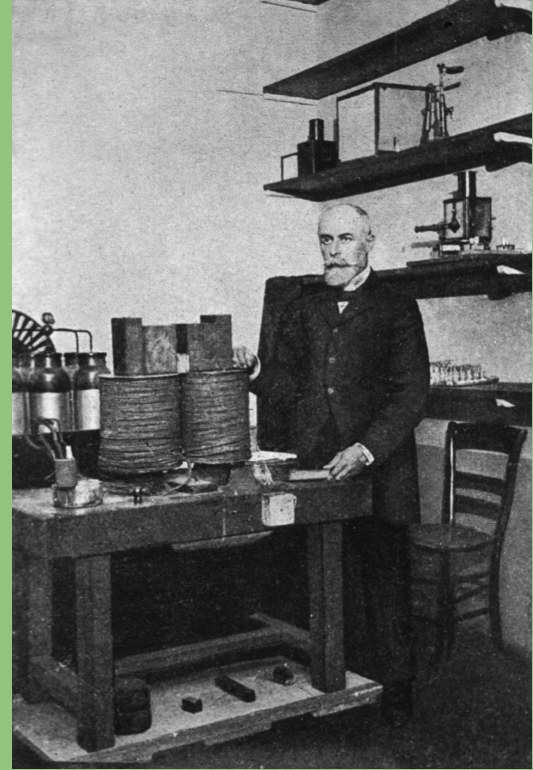
HISTORY

How was Nuclear Energy discovered?



In 1896, Antoine-Henri Becquerel discovered that substances, such as salts of uranium, produce penetrating radiation, called radioactivity

When Becquerel took photographic images, he discovered that the uranium produced radiation without an external source of energy. Thus, Becquerel became the father of nuclear energy.





The Atomic Bomb

President Harry S.
Truman didn't want to
invade Japan because
it would result in
American casualties



Speedy end to world
war 2- started the
cold war



On August 6, 1945, American bomber Enola Gay dropped a 5-ton bomb in the city of Hiroshima, Japan.

3 days later another bomb in the city of Nagasaki.



After 1940

There was lots of excitement for nuclear energy

- would it power plane/car/ homes
- would it replace non reusable
- would it make electricity free



But it did follow through
because...

people didn't want to risk

they were did want to spend their time
on figuring out how

other wanted to stay away from it
because of the that danger



Electricity Use of Nuclear Power

Nuclear power provides over 11% of the world's electricity as continuous, reliable base-load power, without carbon dioxide emissions.



Then the Yom Kippur War began in 1973, in the middle east that made the oil price increase

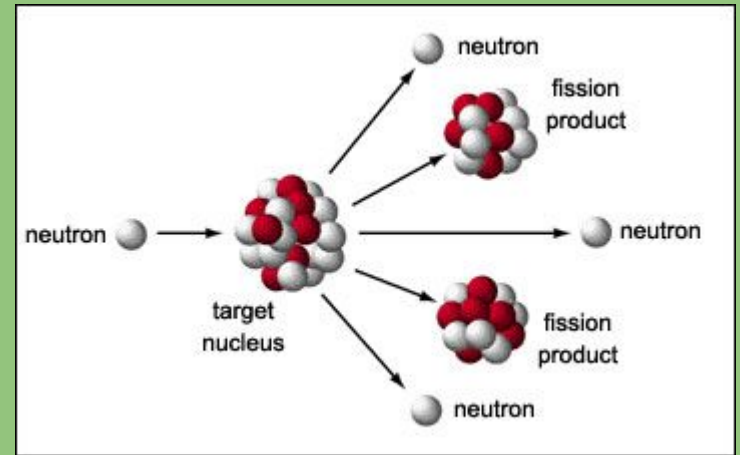
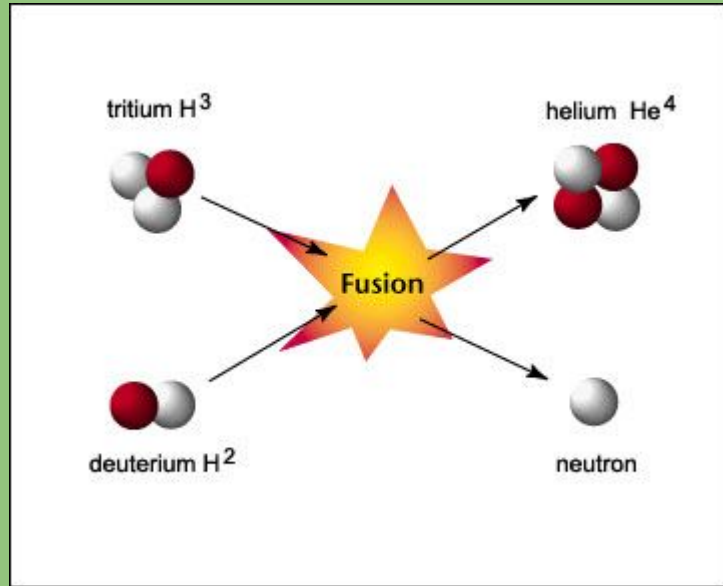
This made the countries look into a cheaper way for energy



The Two Types of Nuclear Energy

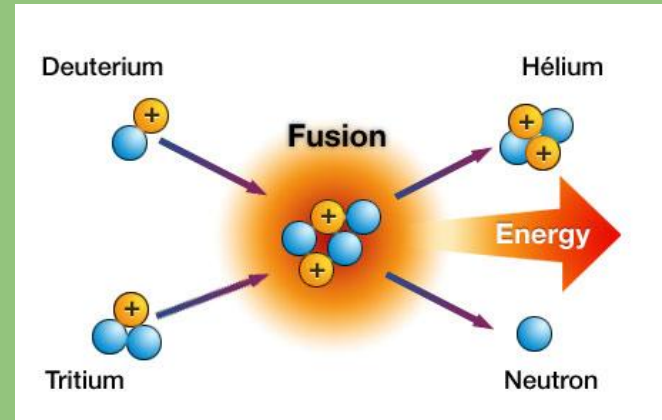
Nuclear Fusion

Nuclear Fission



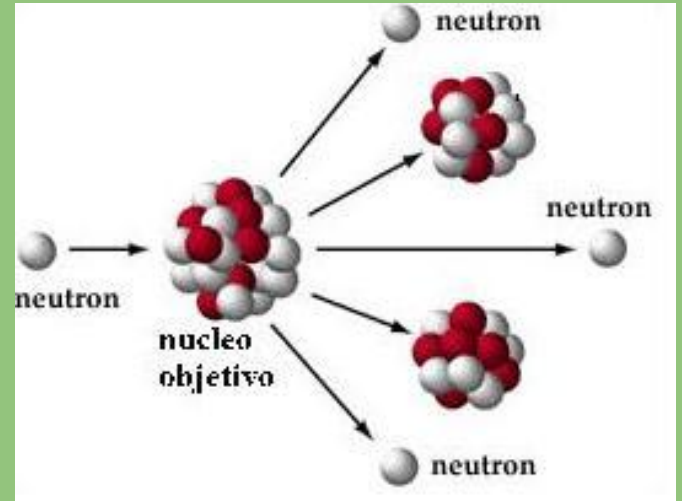
Fusion

Nuclear Fusion is a nuclear reaction in which atomic nuclei of low atomic number fuse to form a heavier nucleus with the release of energy.

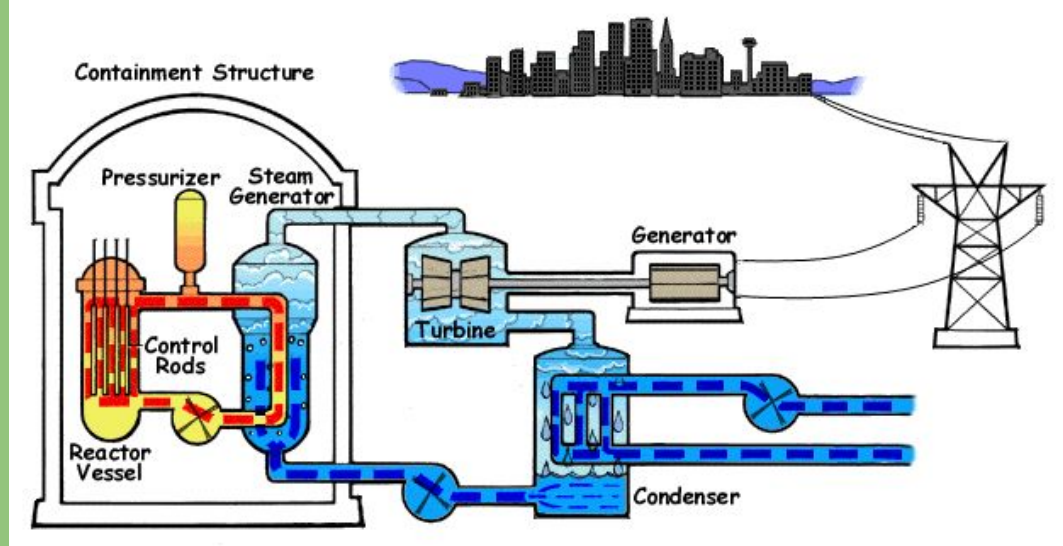


Fission

Nuclear Fission is a nuclear reaction in which a heavy nucleus splits spontaneously or on impact with another particle, with the release of energy.

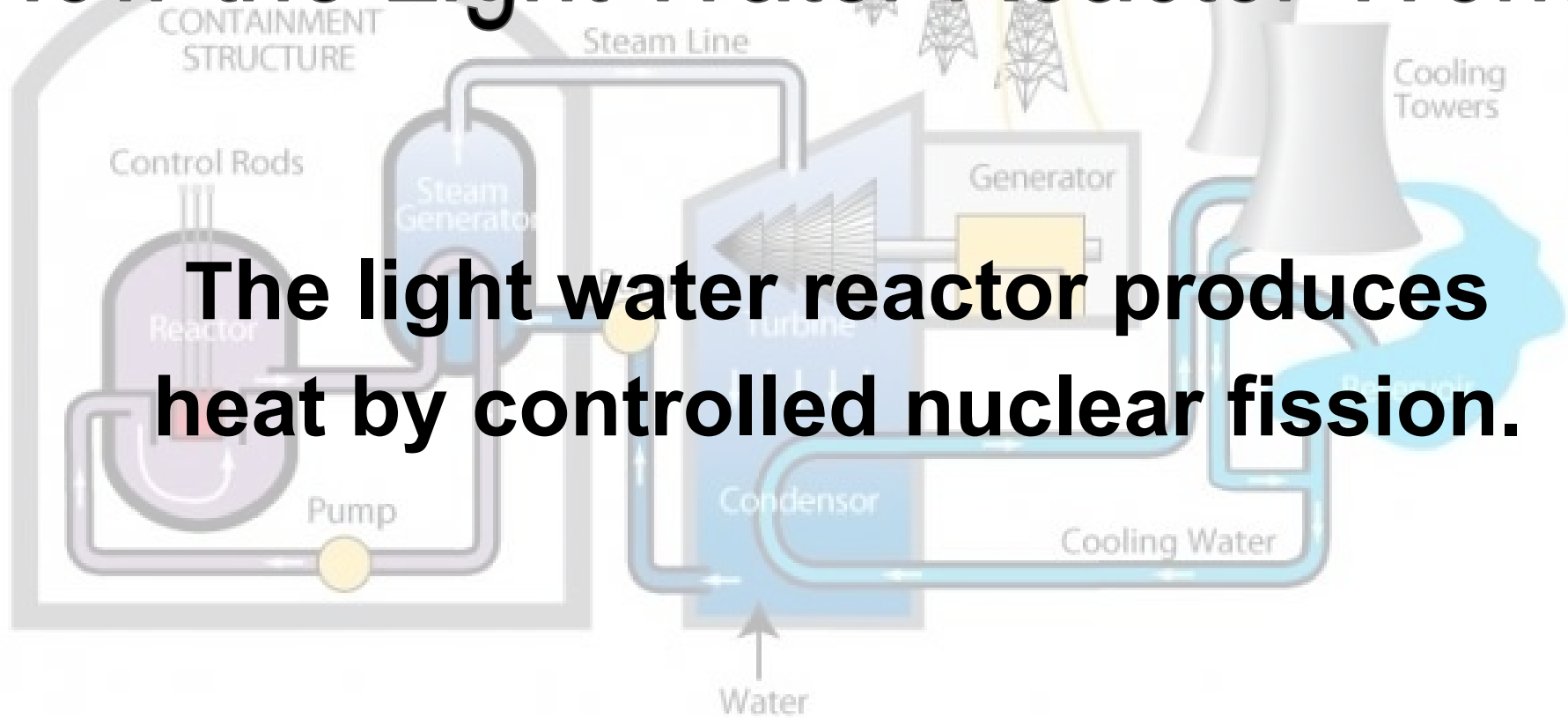


Light Water Reactor



Light water reactors are the nuclear fission reactors used in the United States for electric power production.

How the Light Water Reactor Works

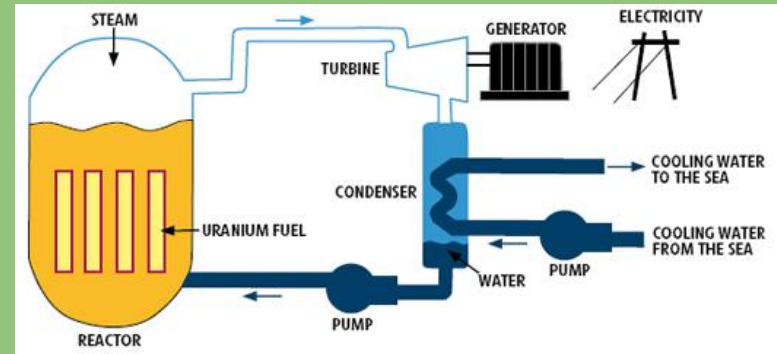


Light Water Reactor Steps...

1. The heat from the fission heats the water which evaporates in the pressure vessel in a boiling water reactor.

Light Water Reactor Steps...

2. In the pressurized water reactor, steam evaporates in a steam generator of a different circuit.



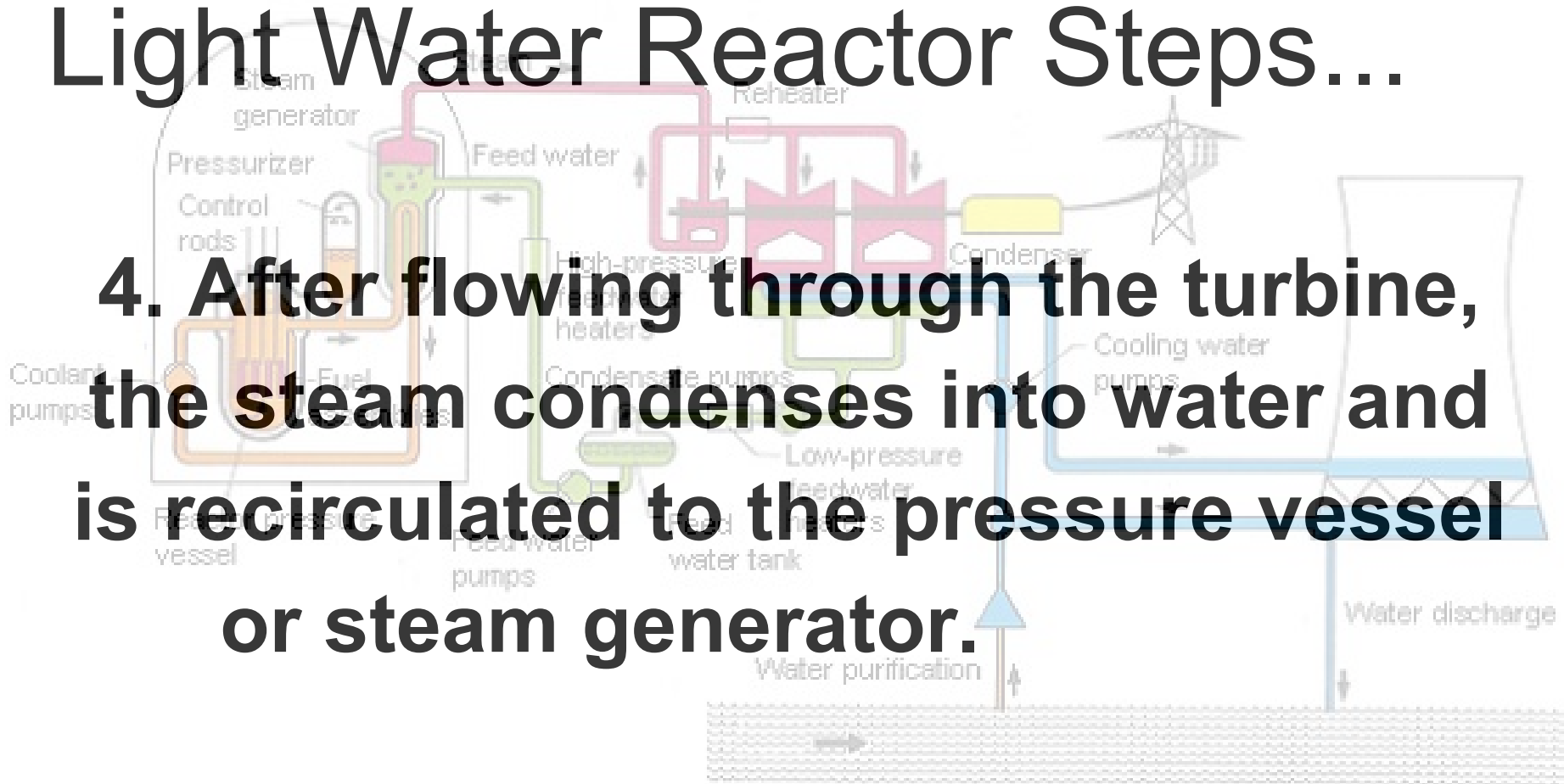
Light Water Reactor Steps...

3. The steam energy is converted into rotary motion of the turbine for the generation of electricity is connected.



Light Water Reactor Steps...

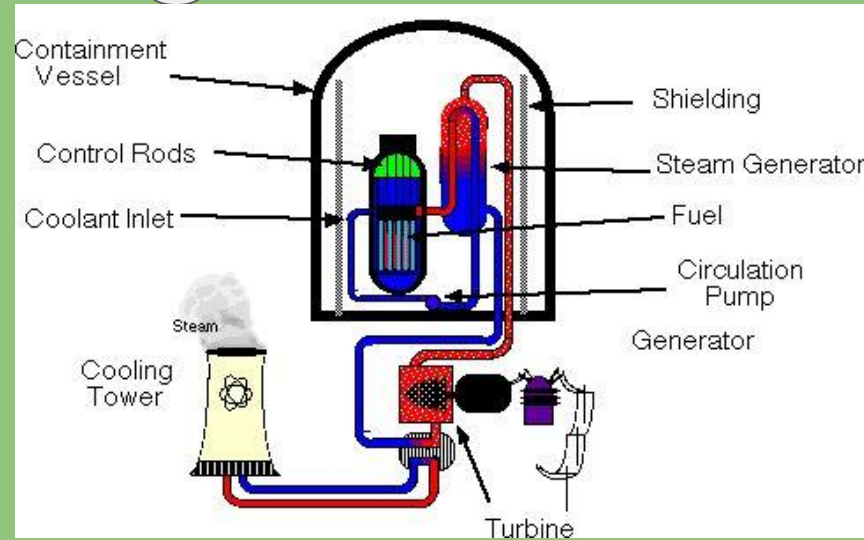
4. After flowing through the turbine, the steam condenses into water and is recirculated to the pressure vessel or steam generator.



Light Water Reactor Steps...

5. The water required to cool the condenser is taken from a river and refeed into the river in warmed condition.

Cost of Light Water Reactors



Light water reactors have lower pressure so it is less expensive. It runs at atmospheric pressure.

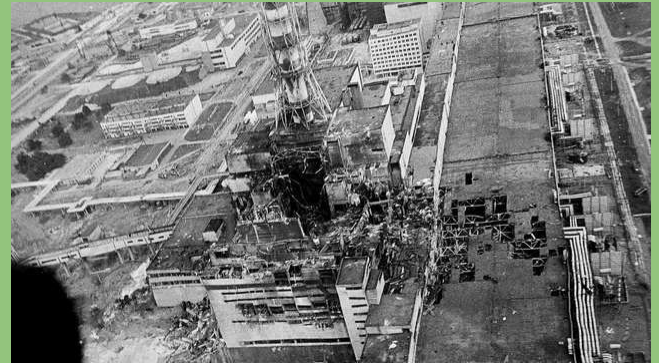
The excitement of nuclear energy
lapsed around ten years because we
had some issues...



For example:

Chernobyl

In 1986, a combination of a flawed reactor design and untrained workers resulted in an explosion that released radioactivity in the atmosphere. Radiation exposure resulted.



San Onofre, San Diego

Had to be shut down because for a 7.0 earthquake, but sits near faults capable of 8.0+ earthquakes



Fukushima-Daiichi

Immediately after the 9.0 earthquake, a >15 meter tsunami flooded the reactors, breaking the seawater pumps, flooding the backup generators and shorting the electricity supply. Most damage was done to reactors 1, 2, and 3.



Shortcomings of Nuclear Energy

1. radioactive waste
2. Nuclear plants have a limited life.
3. Nuclear power plants are objectives of terrorist organizations.



Solutions

Radioactive waste: Placing the waste in a deep and stable geological setting that have remained virtually unchanged for millions of years.



No solutions to other issues.

Production & Reactors



Electricity Use of Nuclear Power

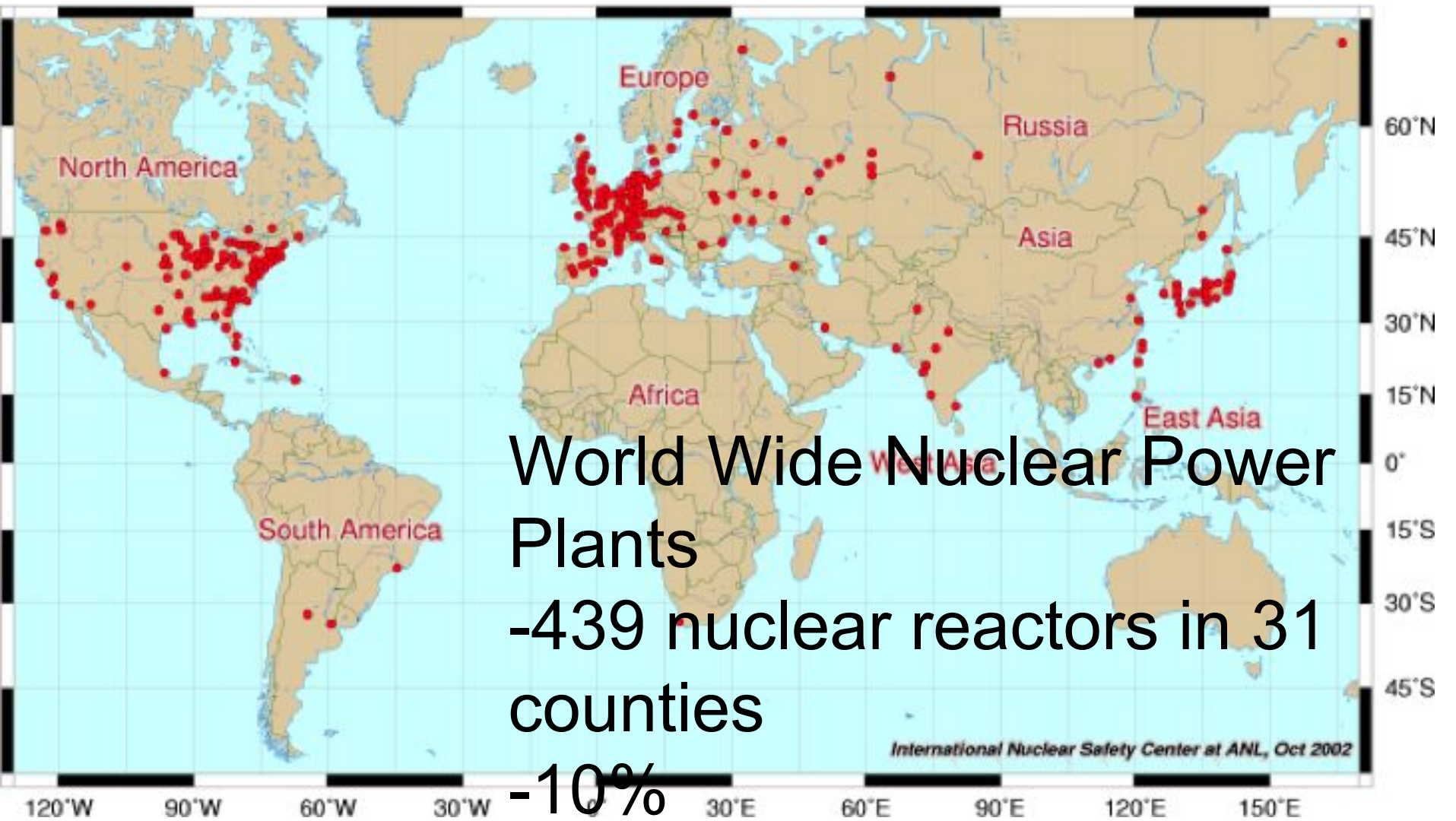
56 countries operate a total of about 240 research reactors and a further 180 nuclear reactors power some 140 ships and submarines.



Fuel Mass to Energy Output

1 tonne of Thorium(estimated to)= 200
tonnes of Uranium=3500000 tonnes of
coal





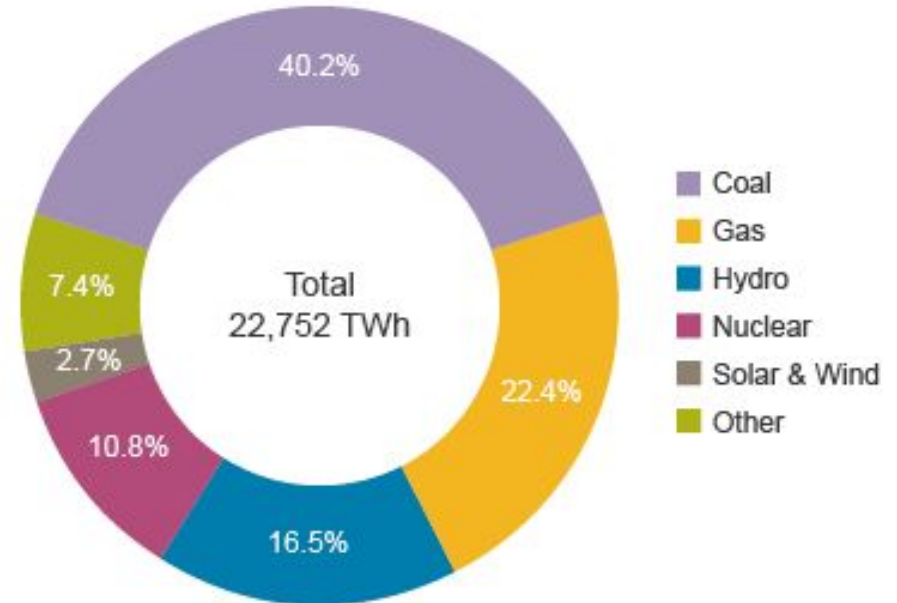
Global Production

Nuclear Electricity Production by Countries and Regions in Gigawatts (World Total 350 Gigawatts) and percent of electricity

US	97	Trend: declining
<i>North America Region</i>	109	
France	63	Increasing
Germany	21	Being phased out
U. K.	12	
<i>Western Europe Region</i>	126	
Japan	44	Increasing
<i>Asia Region</i>	66	Increasing
<i>Eastern Europe Region</i>	11	
<i>Former Soviet U. Region</i>	34	

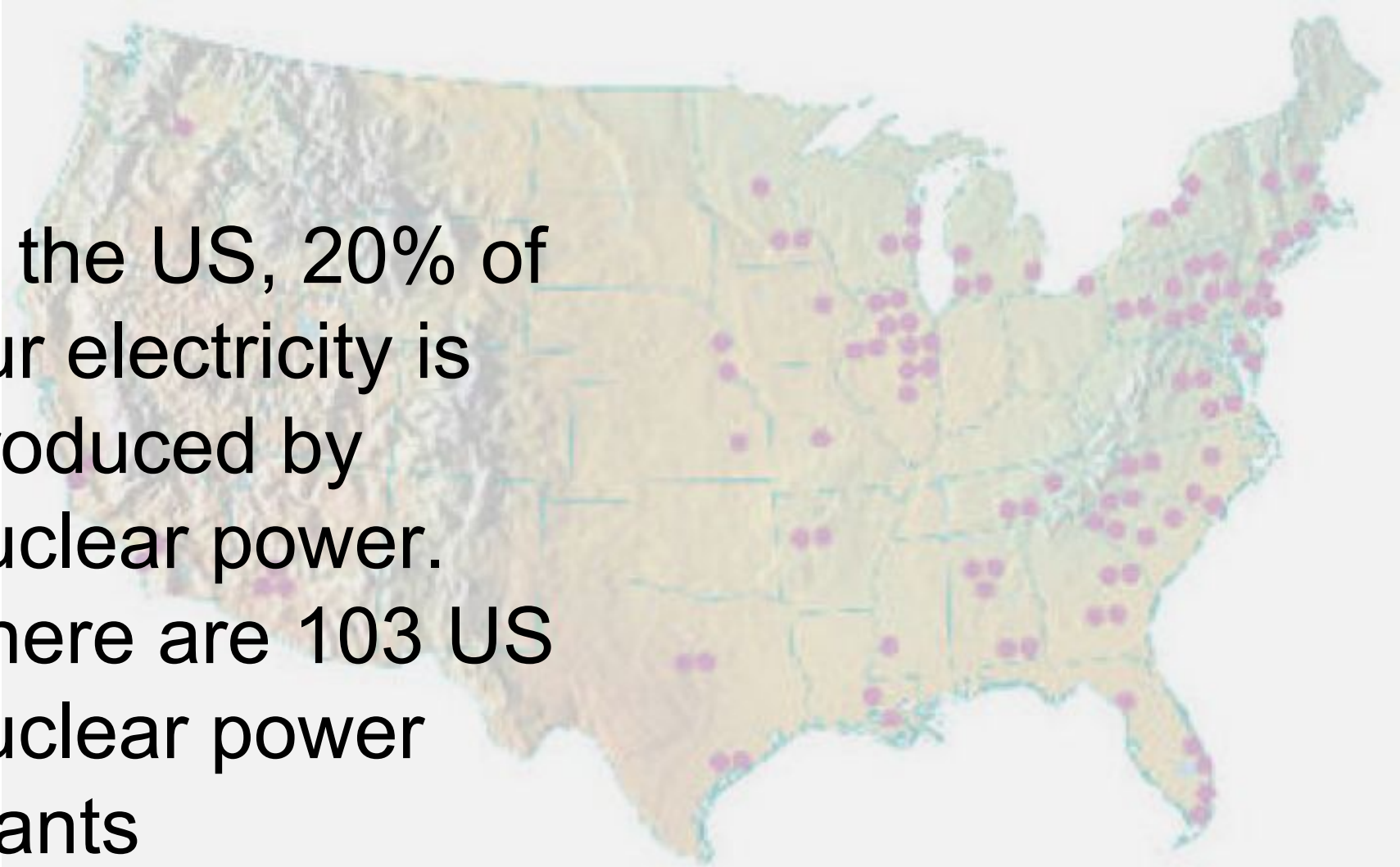
WORLD NUCLEAR ASSOCIATION

World Electricity Production 2012



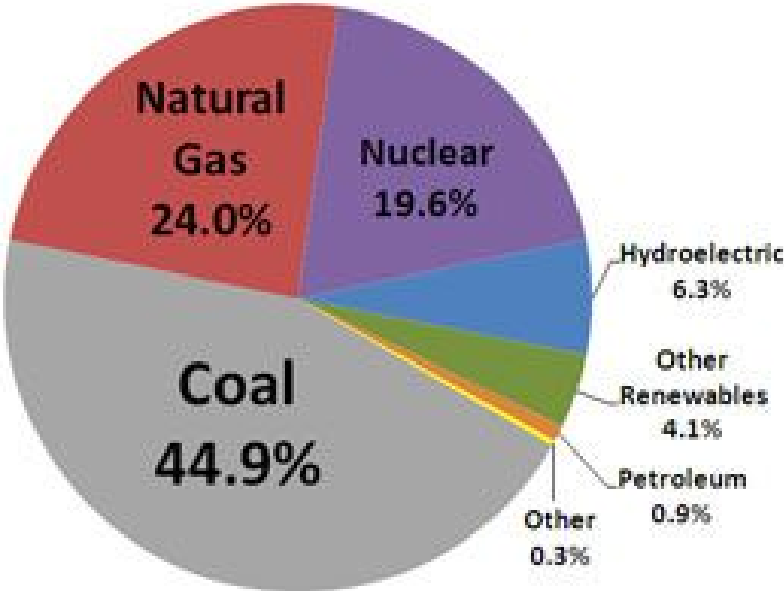
Source: IEA Electricity Information 2014

In the US, 20% of
our electricity is
produced by
nuclear power.
There are 103 US
nuclear power
plants



National Production

U.S. Electricity Generation (2010)



Source: U.S. Energy Information Administration, 2012.

California related reactors

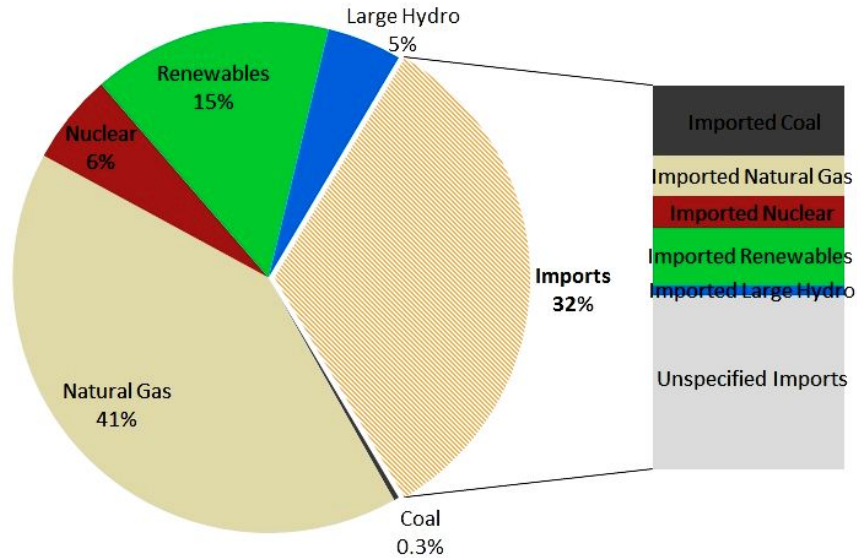
A map of California is shown on the left side of the slide. Two black arrows originate from the text on the right and point to specific locations on the map. The first arrow points to the central-eastern part of the state, corresponding to the Diablo Canyon location. The second arrow points to the central-southern part of the state, corresponding to the San Onofre location.

Diablo Canyon,
two reactors

San Onofre, two
reactors

Southern California Usage

Figure 2. California's Total Electricity Supply (2014)





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