

# Sustainability Series

## Other Potential Players: Nuclear, Geothermal and More

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# Nuclear Power

This debate is too often too "hi-tech", polarized, politicised and hi-jacked by vested interests. The impacts of this "debate" (nuclear power) will be lived by your children and theirs.

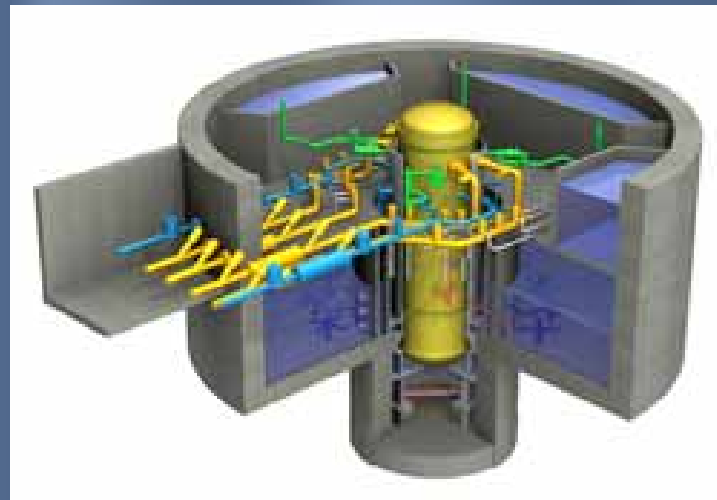
- New Nukes Being Built in 11 Countries notably China, South Korea, Japan and Russia
- 17 Applications Filed with the NRC
- Gen III plants
  - ABWR, Advanced Boiling-Water Reactor
  - AP1000, Advanced Pressurized-Water Reactor
  - ESBWR, Economic Simplified Boiling-Water Reactor
  - EPR, Evolutionary Power Reactor

# Nuclear Power (continued)

## Gen III Reactors

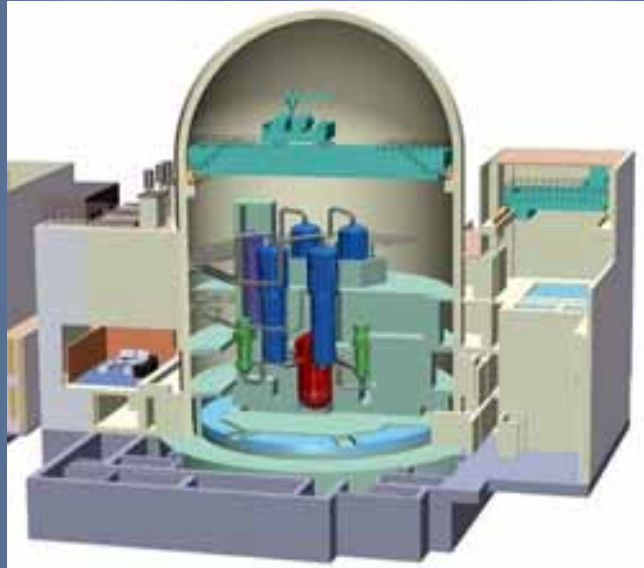


ABWR



ESBWR

# Nuclear (continued)



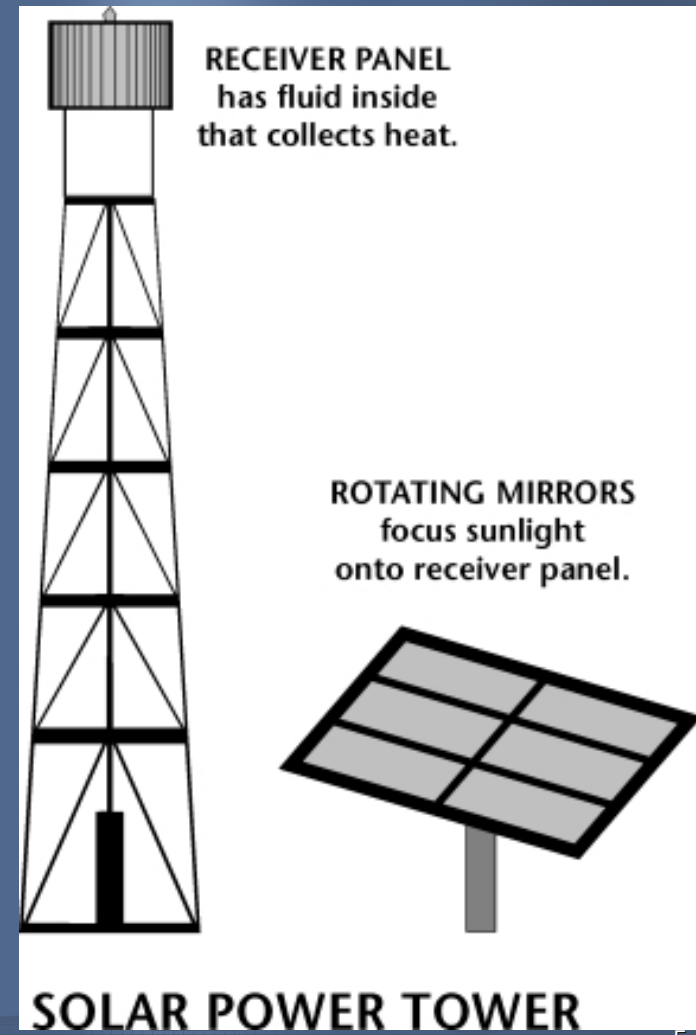
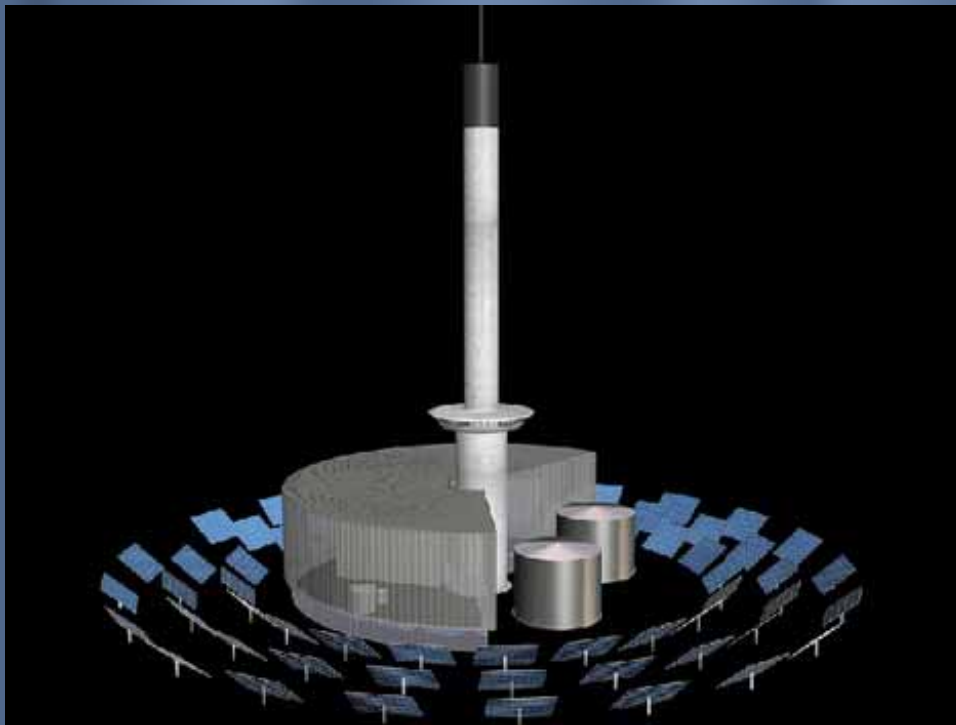
US - APWR



US - EPR

# Solar

- Photovoltaic
- Tower of Power



# Geothermal

Literally heat from the earth. Available anywhere but best at geologically active sites such as “ring of fire” or other hotspots such as Yellowstone.

- District Heating (Direct use)
- Electric Generation

# Geothermal (continued)

## District Heating



Reykjavik Iceland – 95% of homes heated by system

# Geothermal (continued)

The United States generates more geothermal electricity than any other country but the amount of electricity it produces is less than one-half of a percent of electricity produced in United States. Only four states have geothermal power plants: California - has 33 geothermal power plants that produce almost 90 percent of the nation's geothermal electricity.

Nevada - has 14 geothermal power plants.

Hawaii and Utah - each have one geothermal plant



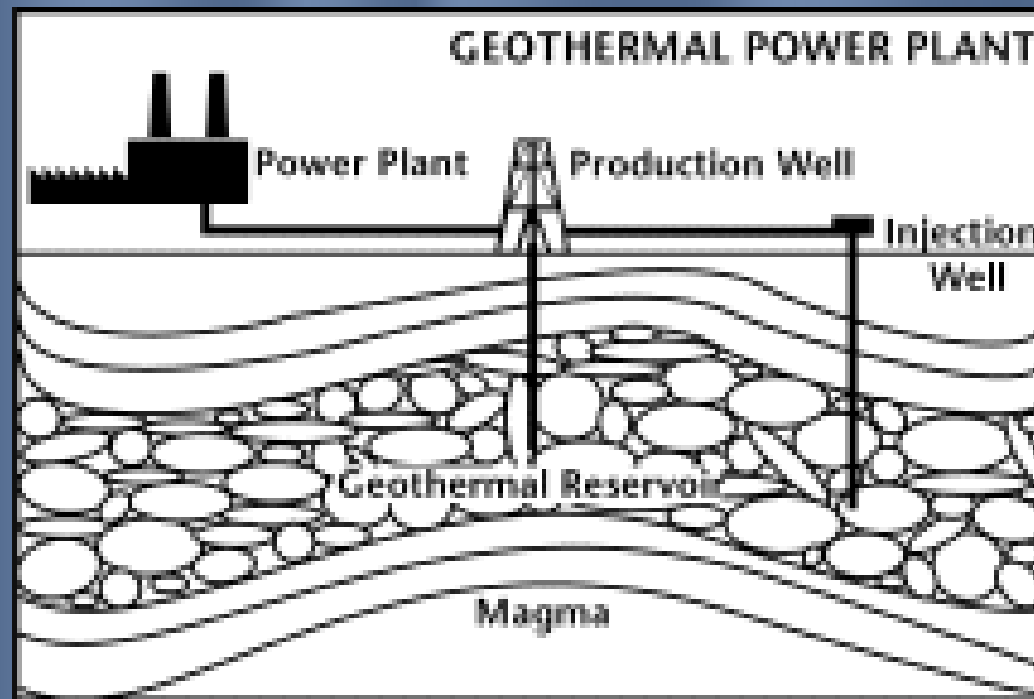
# Geothermal (continued)

There are three basic types of geothermal power plants:  
Dry steam plants - use steam piped directly from a geothermal reservoir to turn the generator turbines.

Flash steam plants - take high-pressure hot water from deep inside the earth and convert it to steam to drive the generator turbines. When the steam cools, it condenses to water and is injected back into the ground to be used over and over again. Most geothermal power plants are flash plants.

Binary power plants - transfer the heat from geothermal hot water to another liquid. The heat causes the second liquid to turn to steam which is used to drive a generator turbine.

# Geothermal (continued)



# Hydo

- Dams
- Tidal – Currents/River Flow
  - Bay of Fundy –Rances  
Areas of extreme tides (estuaries) use both incoming and outgoing tides with a conventional turbine.
  - Strangford Narrows in Northern Ireland  
1.2 MW When fully operational the tidal system's 16m diameter, twin rotors will operate for up to 18-20 hours per day to produce enough clean, green electricity, equivalent to that used by a 1000 homes. (Resembles a wind turbine).

# Hydo (continued)

- Tidal (continued)

Little wind turbines on steroids: Water's greater density means fewer and smaller turbines are needed to produce the same amount of electricity as wind turbines. In the last four years, the federal commission has approved nearly a dozen permits to study tidal sites. Applications for about 40 others, all filed in 2006, are under review. The site that is furthest along in testing lies in New York's East River.

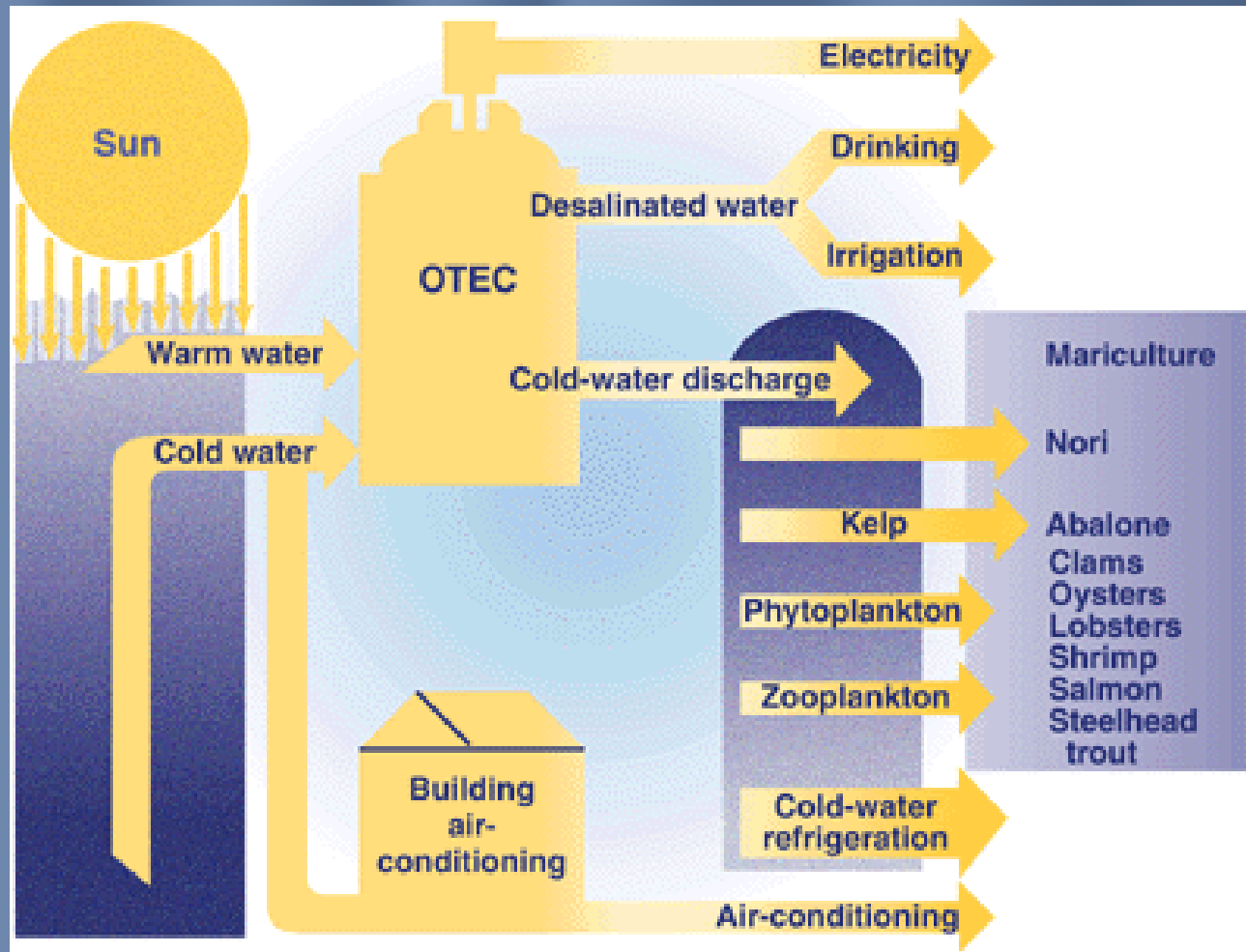
- Ocean Energy

Ocean energy covers a series of emerging technologies that use the power of waves, ocean currents, tides, ocean thermal energy gradient and salinity gradient to generate energy.

# Hydro (continued)

- Ocean thermal energy conversion (OTEC)
  - These systems have many applications or uses. OTEC can be used to generate electricity, desalinate water, support deep-water mariculture, and provide refrigeration and air-conditioning as well as aid in crop growth and mineral extraction. These complementary products make OTEC systems attractive to industry and island communities even if the price of oil remains low.
  - OTEC can also be used to produce methanol, ammonia, hydrogen, aluminum, chlorine, and other chemicals. Floating OTEC processing plants that produce these products would not require a power cable, and station-keeping costs would be reduced.

# Hydro (continued)



# Hydro (continued)



SeaGen 1.2 MW Ireland

# Hydrogen

- Fuel Cells

- A fuel cell is an electrochemical energy conversion device. A fuel cell converts the chemicals hydrogen and oxygen into water, and in the process it produces electricity. The electricity can be used to power homes or businesses directly or power a electric vehicle

- Vehicle Fuel

- Fuel for a modified internal combustion engine