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Renewable Energy: Where to Start?

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We Have Always Used Renewable Energy

- For centuries, shelter and water was heated with wood, dung, peat
- Bees wax, tallow, whale oil was used for light…
- Bio-products!

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Renewable Energy Many Forms

- Solar, Wind, Water Geothermal Generation
- Bio-based Fuels
  - Biodiesel, ethanol, wood pellet
- Waste by-products
  - digester, landfill gas
- Any non-depleting technology or practice

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Industry Before Oil or Electricity:

- Wind pumped water out of the ground through the 1800's
- Worked as long as the wind was blowing
- Electric motors were added to increase reliability

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How Technology Has Changed

1870- present

What if we had developed wind power as aggressively as manned flight?

1903- present

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Renewable Fuels- What are They?

- Natural Energy
- Waste by-products
- Agricultural produce

They are usually more expensive

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Then Why Renewable Energy?

- Mandated for Federal Agencies
- Finite petroleum resource
- Foreign oil dependence by US
- Environmental considerations
- Advance alternative energy technology

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Renewable Energy Mandate

Energy Policy Act (EPACT) of 2005 directs the federal government to increase its renewable energy use:

- ~~3 percent or more in fiscal years 2007 through 2009,~~
- 5 percent or more in fiscal years 2010 through 2012,
- 7.5 percent or more by 2013.

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Finite petroleum resources

- Someday we will run out of oil, gas, coal, time…
- Technologies that are cost prohibitive now will be the only “alternative” later

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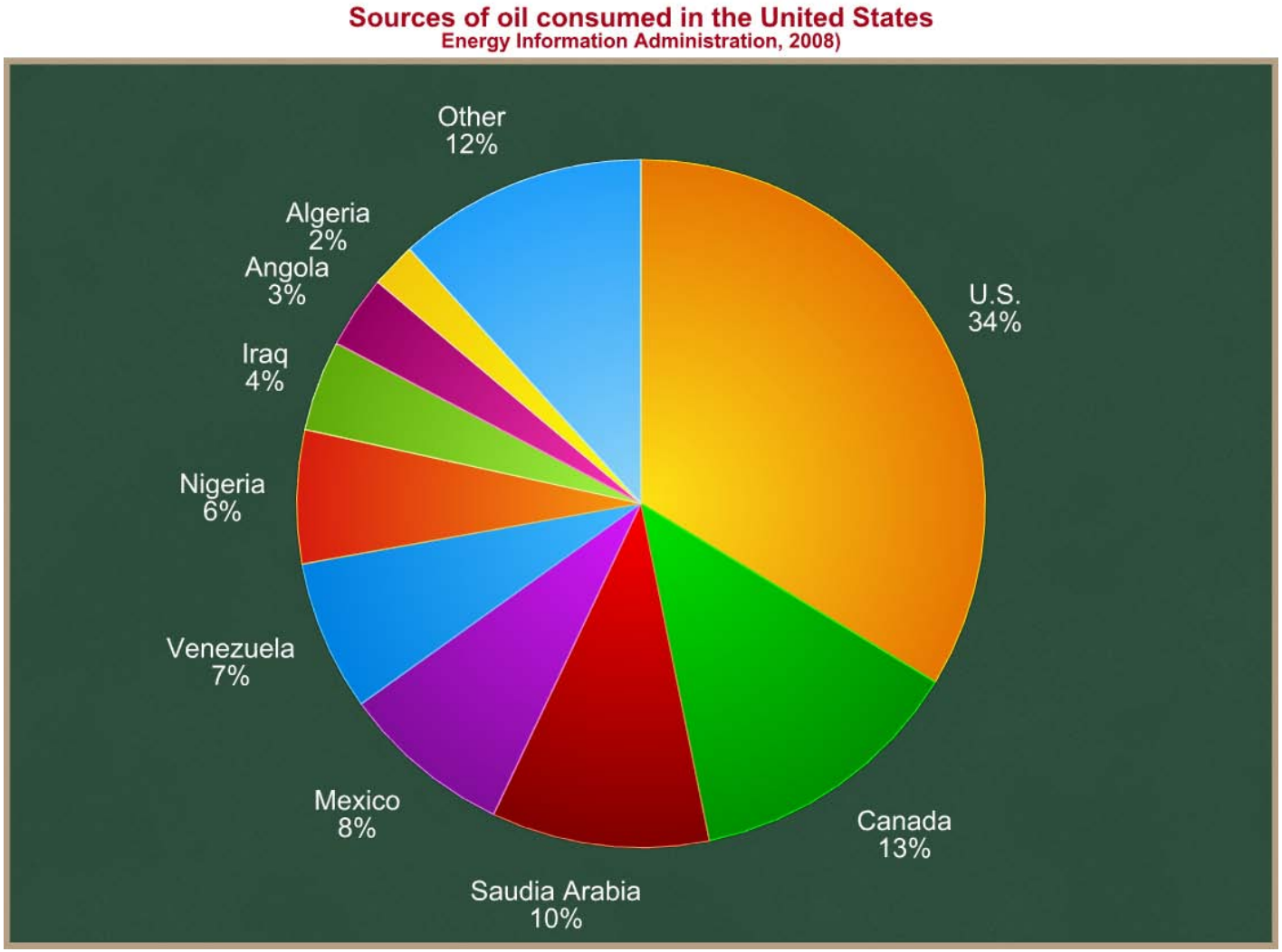
US Foreign Oil Dependence



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Environmental Downsides

You are here

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Federal Funding of Renewable Energy

- To advance the technology where private ownership is someday affordable
- To develop careers in alternative energy
- Increase acceptance of alternative energy
- Offset the damage done to the environment from fossil fuels
- Promote national energy security

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THE GOOD, THE BAD AND THE UGLY

Solar Photovoltaic (PV) Generation

- Photons transformed into electrons
- Zero Emissions
- Ideal for remote locations

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Solar Photovoltaic (PV) Things You Need to Know

- Site/location is crucial
- Partial shading ≠ partial production
- Output decreases on temperature rise
- Large area required

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DVAMC Solar Electric Farm

- Dallas' 333KW Photovoltaic system is now online and producing enough electricity to power over 100 household clothes dryers

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DVAMC Solar Electric Farm

- 1730 individual panels
- Covers >80Kft²
- Produces electricity when the utility system is heavily loaded

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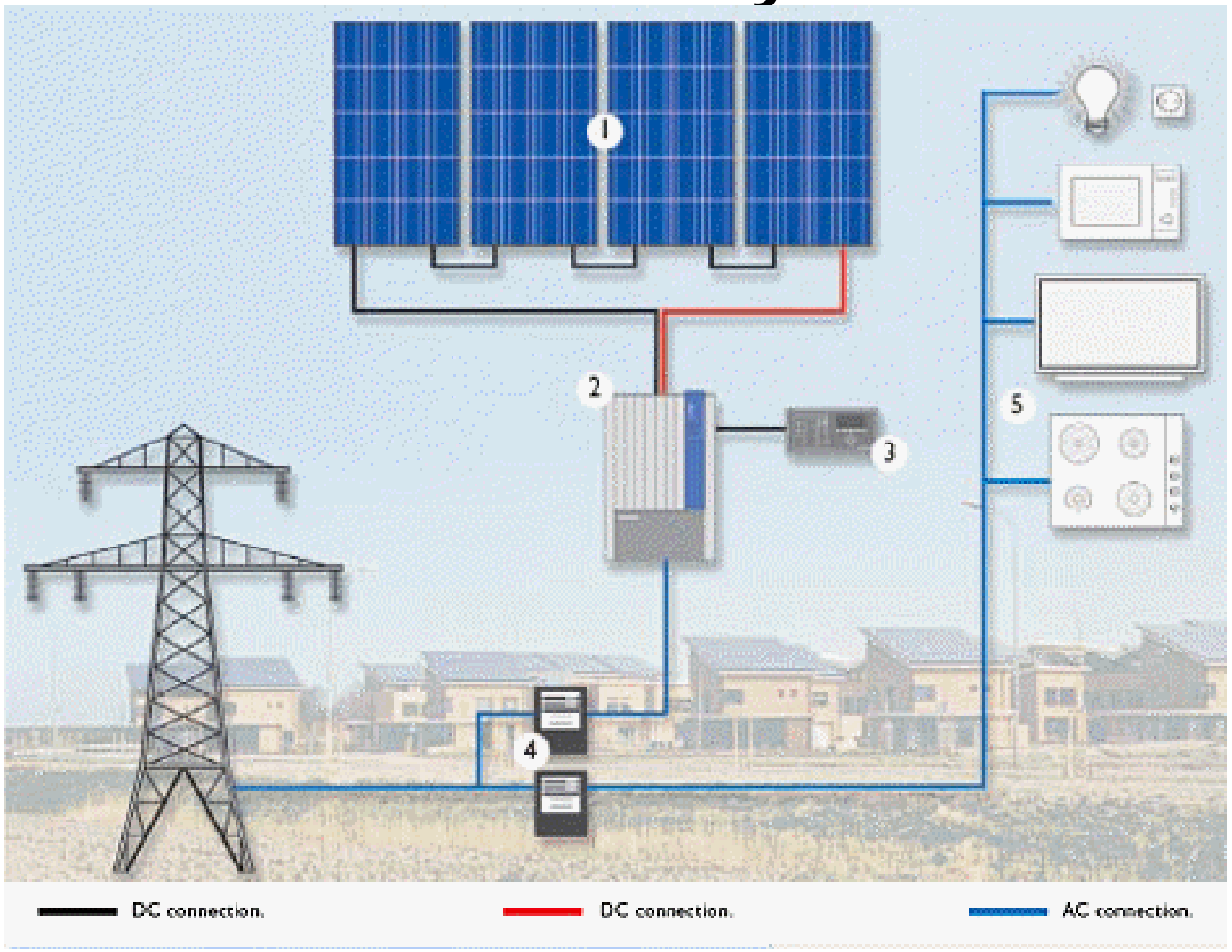
Grid Tied System



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Off Grid Application

- Cost is no issue where there no alternatives

Renewable Energy-
Solar Powered Emergency Call Box

- Small items add up
- Remote locations PV is often more economical than standard
  - Monument signs
  - Roadway signs

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Remote Power

Waste Lighting

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Wind

- Oldest renewable technology
- Zero emissions
- Any time of day availability

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Windfalls and Pitfalls

- Mechanically coupled system
- Not all areas are good candidates
- Site selections are dependent on laminar air flow
- Height of tower is crucial to optimum generation

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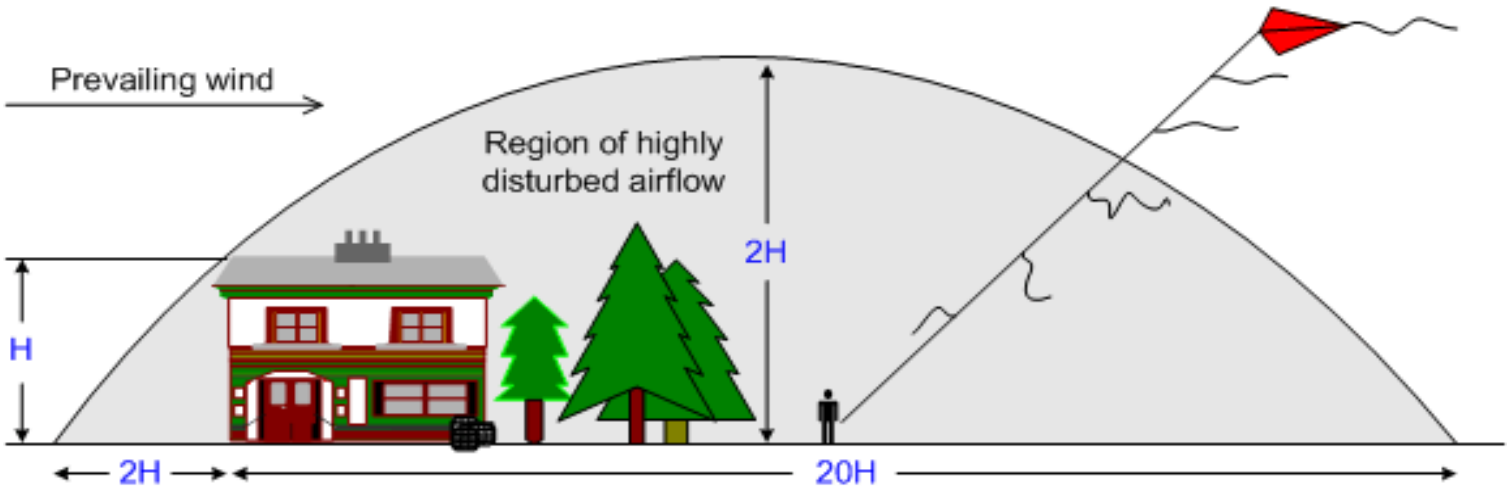
Prevailing Wind

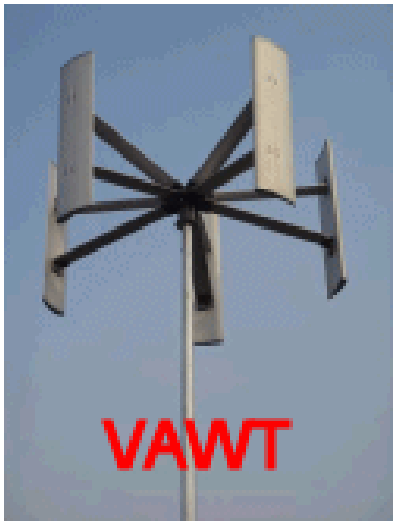
- Turbulence is to be avoided
- Air flow must be uniform across turbine
- Top of a building is not ideal



Wind

- HAWT is the traditional turbine
- VAWT is slightly less susceptible to turbulence
- 50% of the VAWT works against the wind
- Turbulence stresses the mechanics of both

Horizontal Axis Wind Turbine



Vertical Axis Wind Turbine

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Solar Hot Water

- Provides 180ºF water that is mixed to 140ºF
- The most cost effective and practical use of solar power
- Swimming pools are great applications
- Size based on demand

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Solar Hot Water

Section 523 of EISA modifies Section 305(a)(3)(A) of ECPA to require 30 percent of annual hot water demand in new Federal buildings or Federal buildings undergoing major renovations to be met by solar water heaters if life-cycle cost effective.

Solar/ Waste Heat

- Can be combined with heat pump systems
- Waste water heat recovery
- RMI Home Energy Brief #5 is a good basic overview

Geothermal

Heating

- Direct use
- Heat pumps

Power Generation

- Fumaroles
- Hydraulic Fracing

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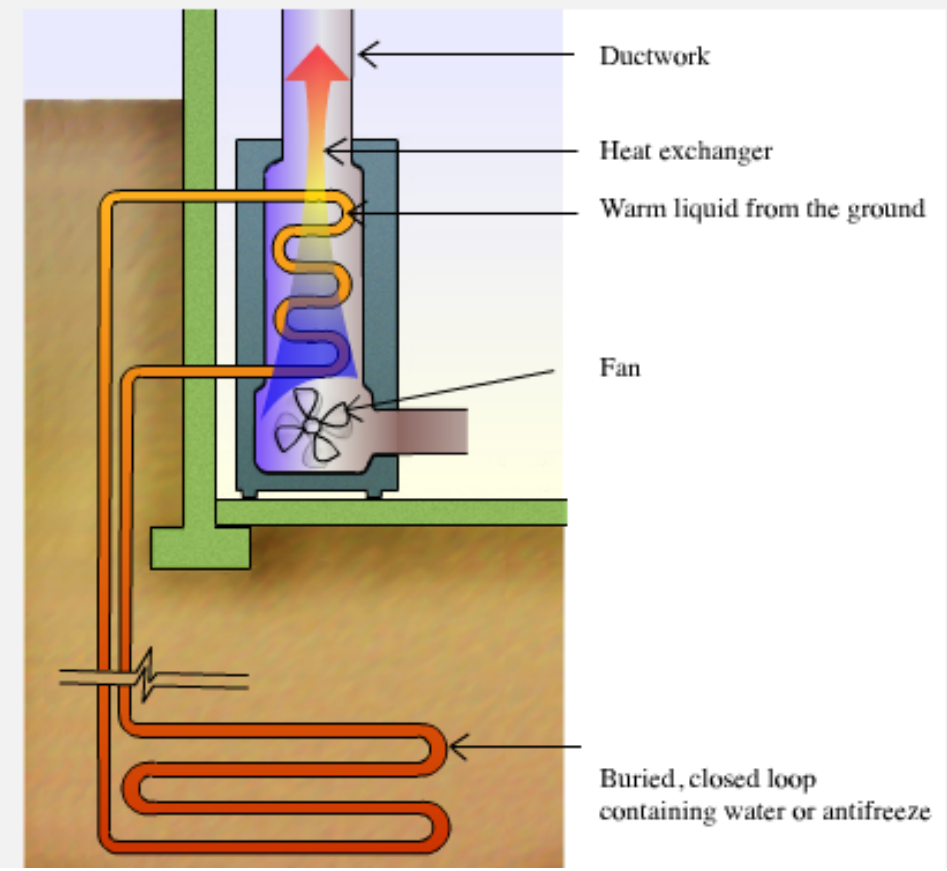
Ground Source Heat Pump



- Heat from the Earth is transferred
- Ground temperatures relatively stable
- Ground must be capable of heat transfer

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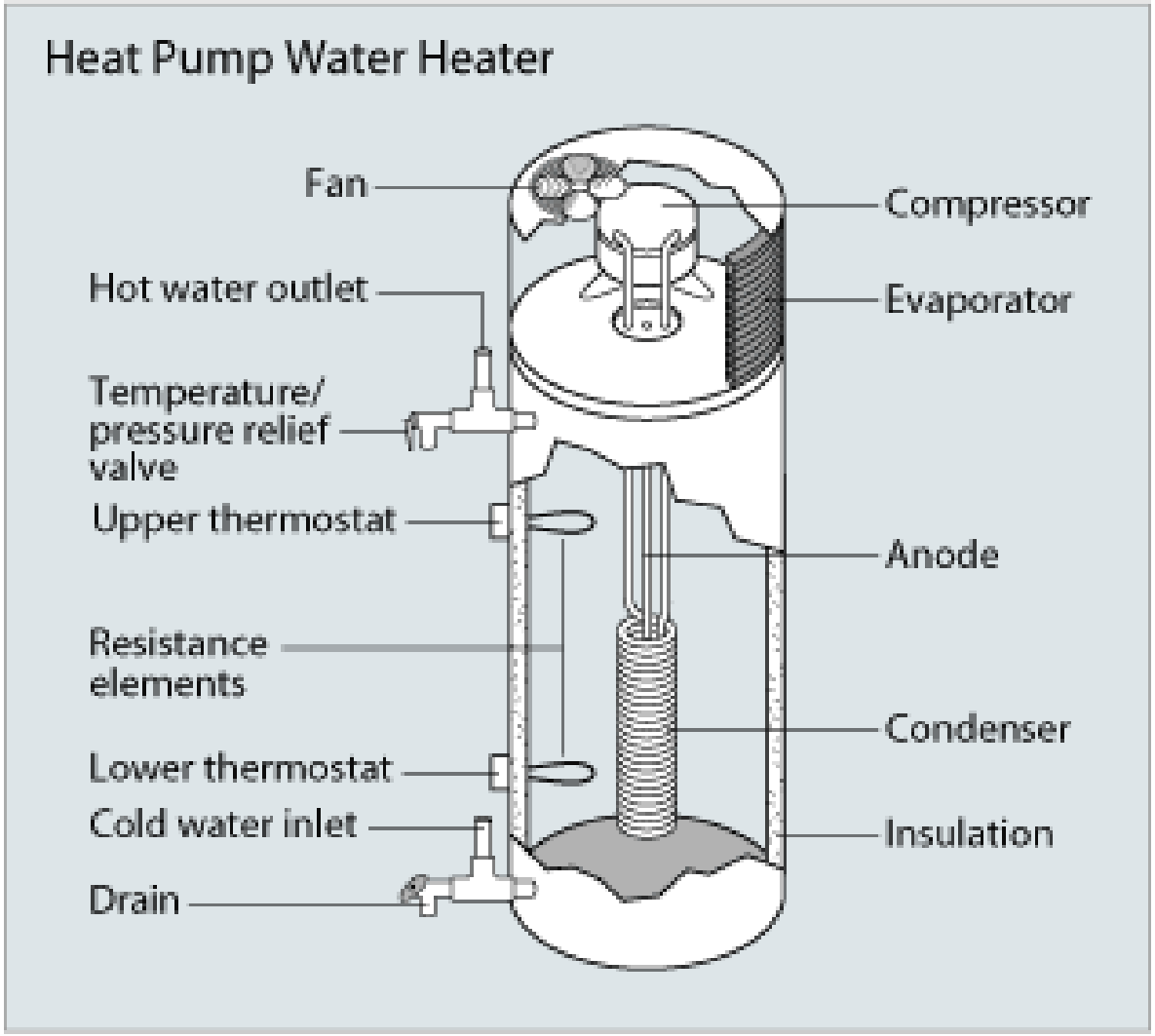
Same Idea



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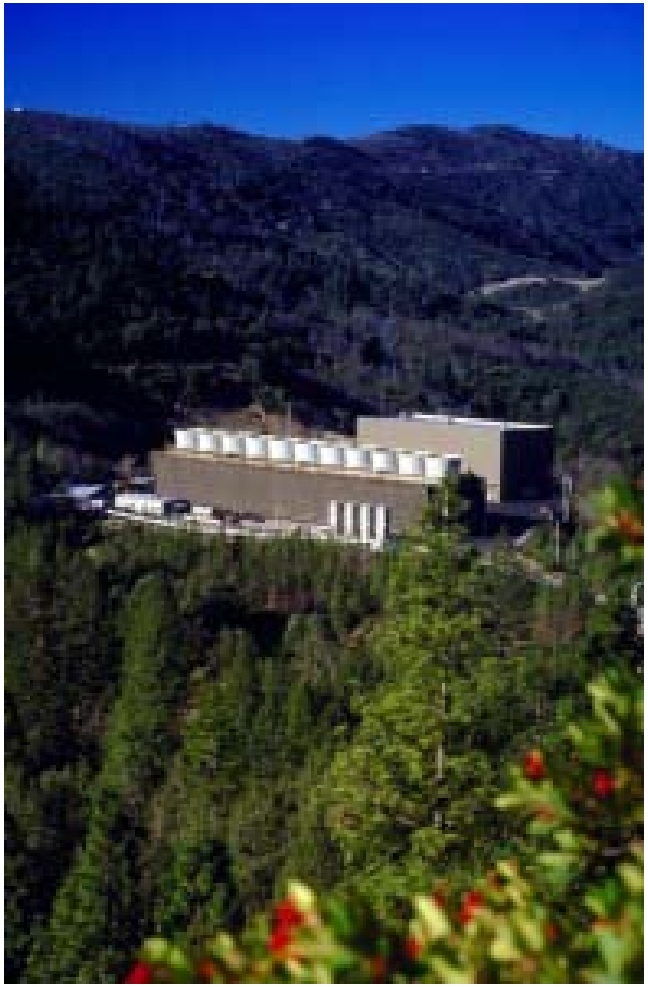
Geothermal Power
The Geysers



- A win-win
- 25% of CA green (non-hydro) energy
- Uses municipal waste water
- Steam generates 200MW of electricity

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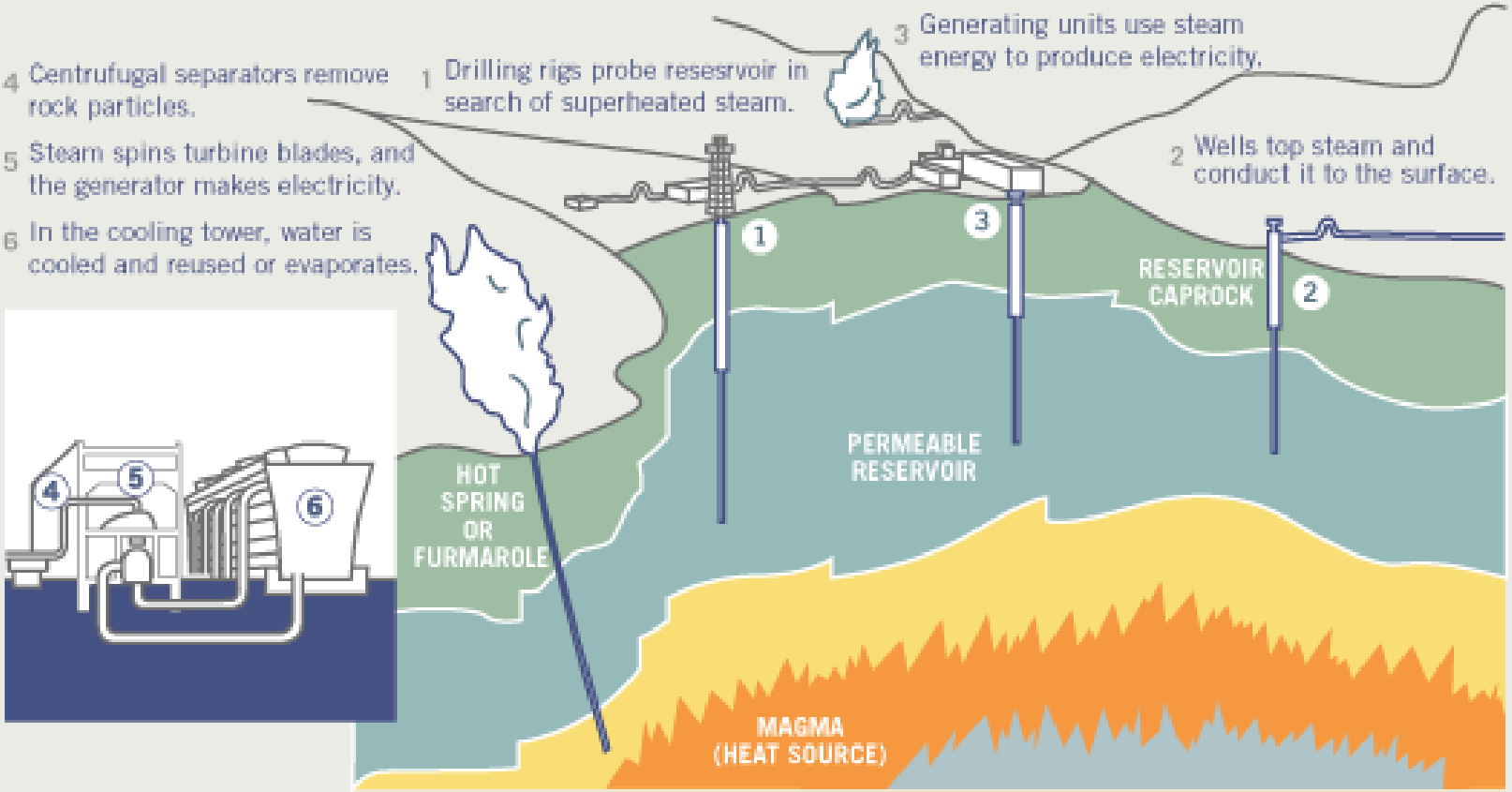

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Renewable Fuels

- Made from corn, sugar cane or grass
- Some disagreement over small engines
- 10% of unleaded gasoline currently sold in US is Ethanol

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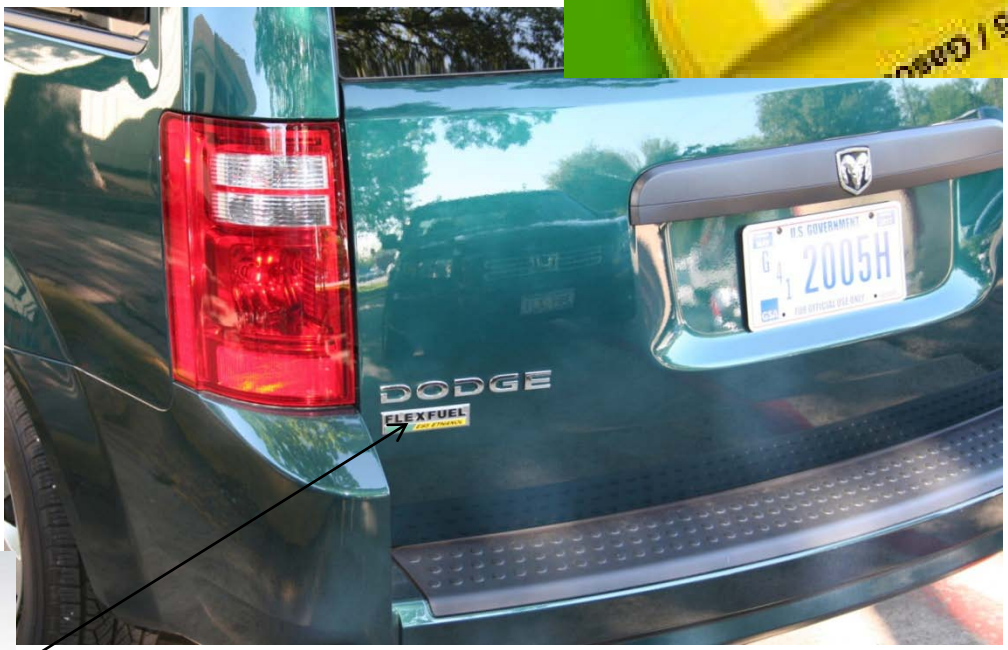
Renewable Fuels- E85

- Government vehicles are often Flex-Fuel capable
- Do NOT put E85 in an engine unless it is clearly labeled for use



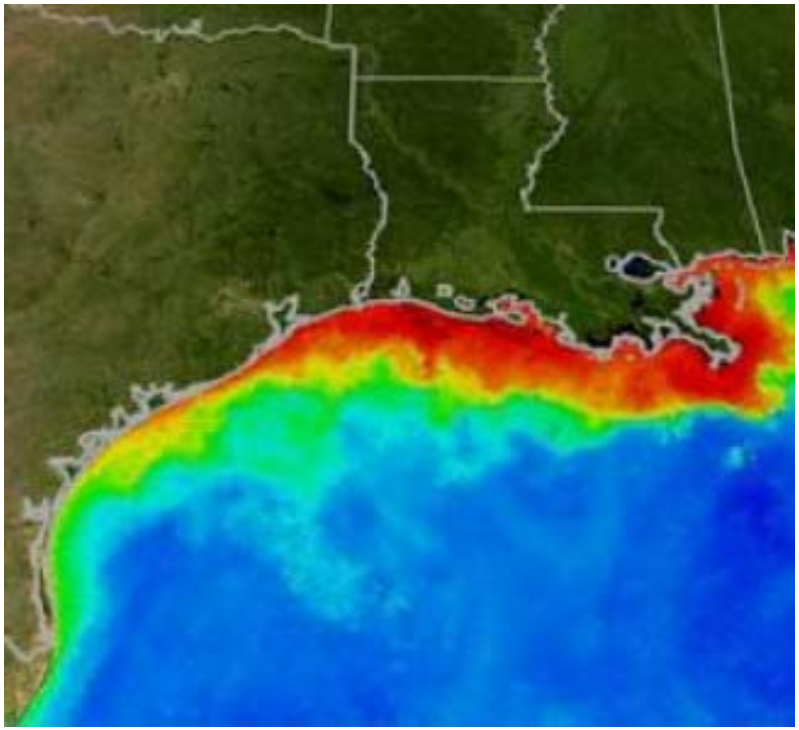
FLEXFUEL
E85 ETHANOL

Renewable Fuels- Biodiesel

- Since 2001 the VANTHCS bus fleet, shuttle bus and equipment have been powered by B20
- 20% less sulfur dioxide emissions
- Must have turnover of product

Renewable Fuels Downsides

- Less energy content
- Nitrogen, phosphorus from agricultural runoff seasonally deplete O_2 in the Gulf of Mexico
  - Hypoxia



http://oceanservice.noaa.gov/products/pubs_hypox.html

Renewable Utility Purchasing

- Electricity can be purchased with up to 100% renewable content
  - Essential and ongoing purchase
  - Cost is spread over time
  - No capital investment

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Wrapping Up

- Renewable Energy may be more expensive than traditional energy
- That will change as the price of traditional fuels rise and Green energy becomes competitive
- Look for ways to match the condition with a technology

Wrapping Up

- Be clear about what the goal is concerning Renewable Energy
- Best practice is to link Renewable Energy into an existing need

QUESTIONS

Why are we doing this?
What problem are we solving?
Is this actually useful?
Are we adding value?
Will this change behavior?
Is there an easier way?
What's the opportunity cost?
Is it really worth it?

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