

**NREL****National Renewable Energy Laboratory***Innovation for Our Energy Future*

A national laboratory of the U.S. Department of Energy
Office of Energy Efficiency & Renewable Energy

2006 DOE Tribal Energy Program Review

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TEP Manager
National Renewable Energy Laboratory

October 23-27, 2006



Major DOE National Laboratories



Major NREL Technology Thrusts

Supply Side

Wind Energy

Solar Photovoltaics

Concentrating Solar

Power

Solar Buildings

Biomass Power

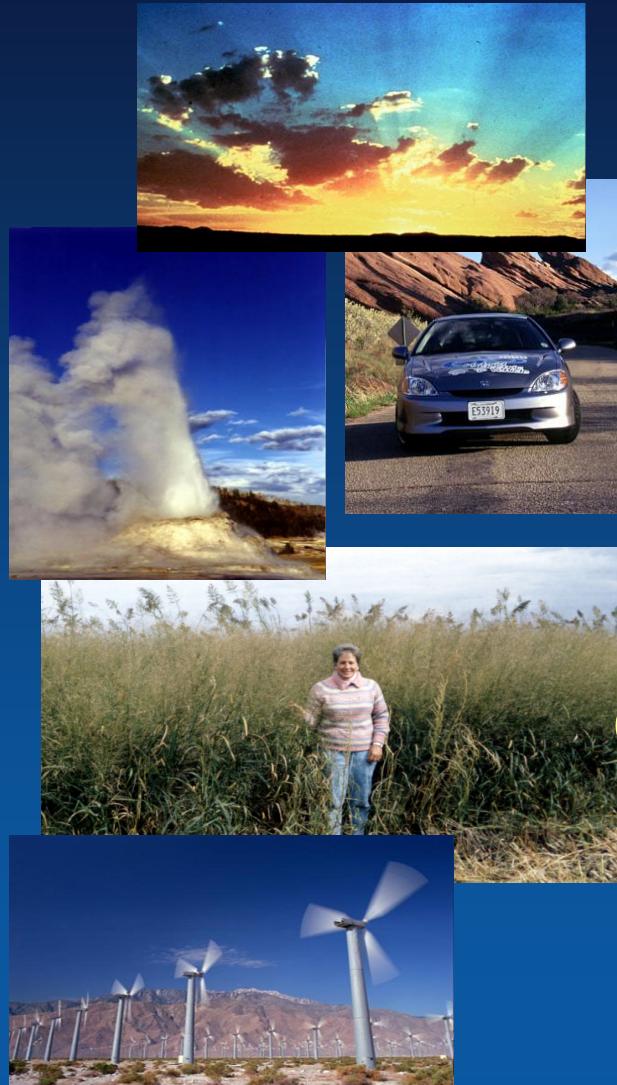
Biofuels

Geothermal Energy

Hydrogen

Superconductivity

Distributed Power



Demand Side

Hybrid Vehicles

Fuels Utilization

Buildings Energy

Technology

Federal Energy
Management

Advanced Industrial
Technologies

Cross Cutting

Basic Energy Science

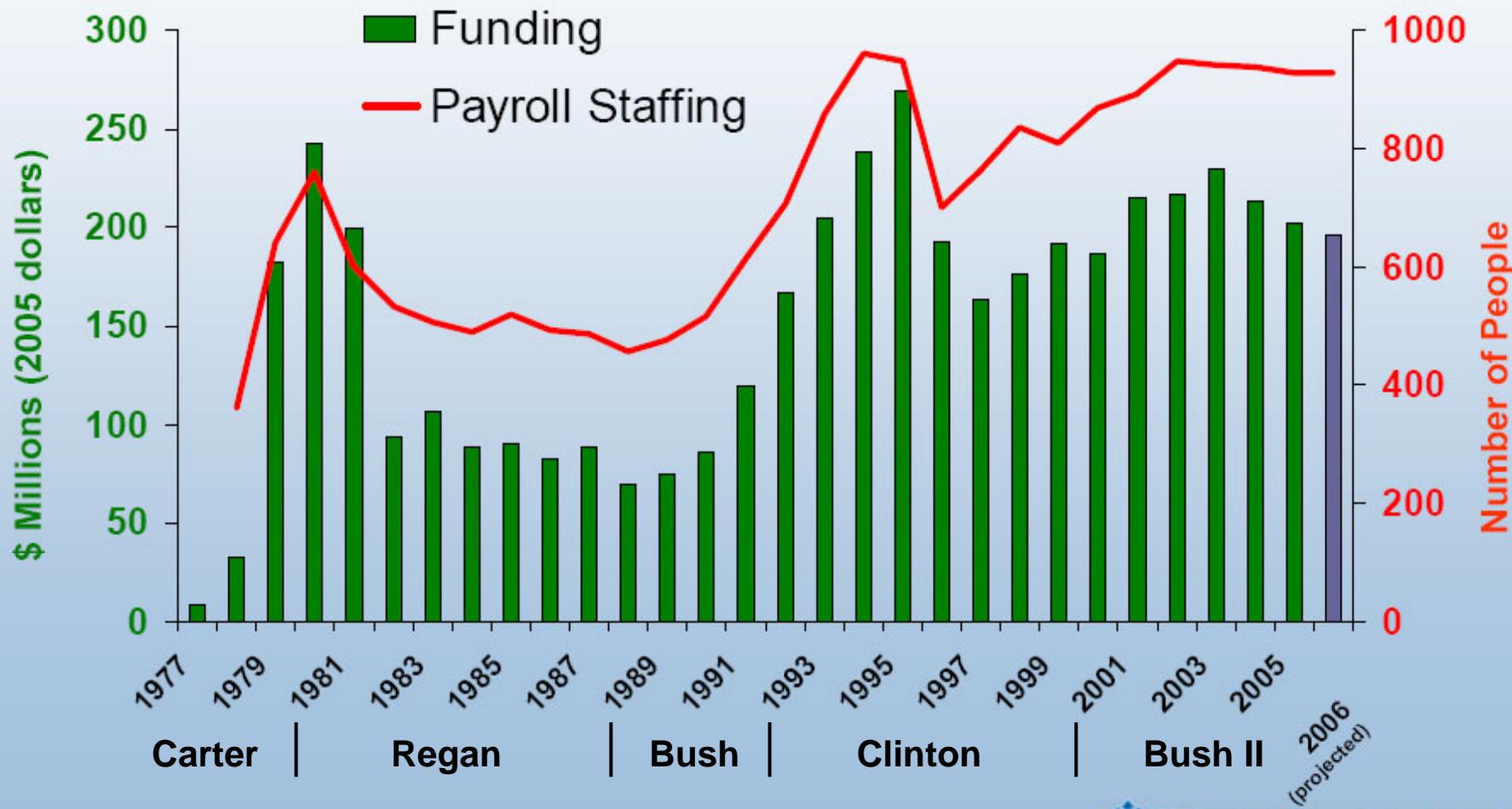
Analytical Studies

International Programs

Tribal Energy Program

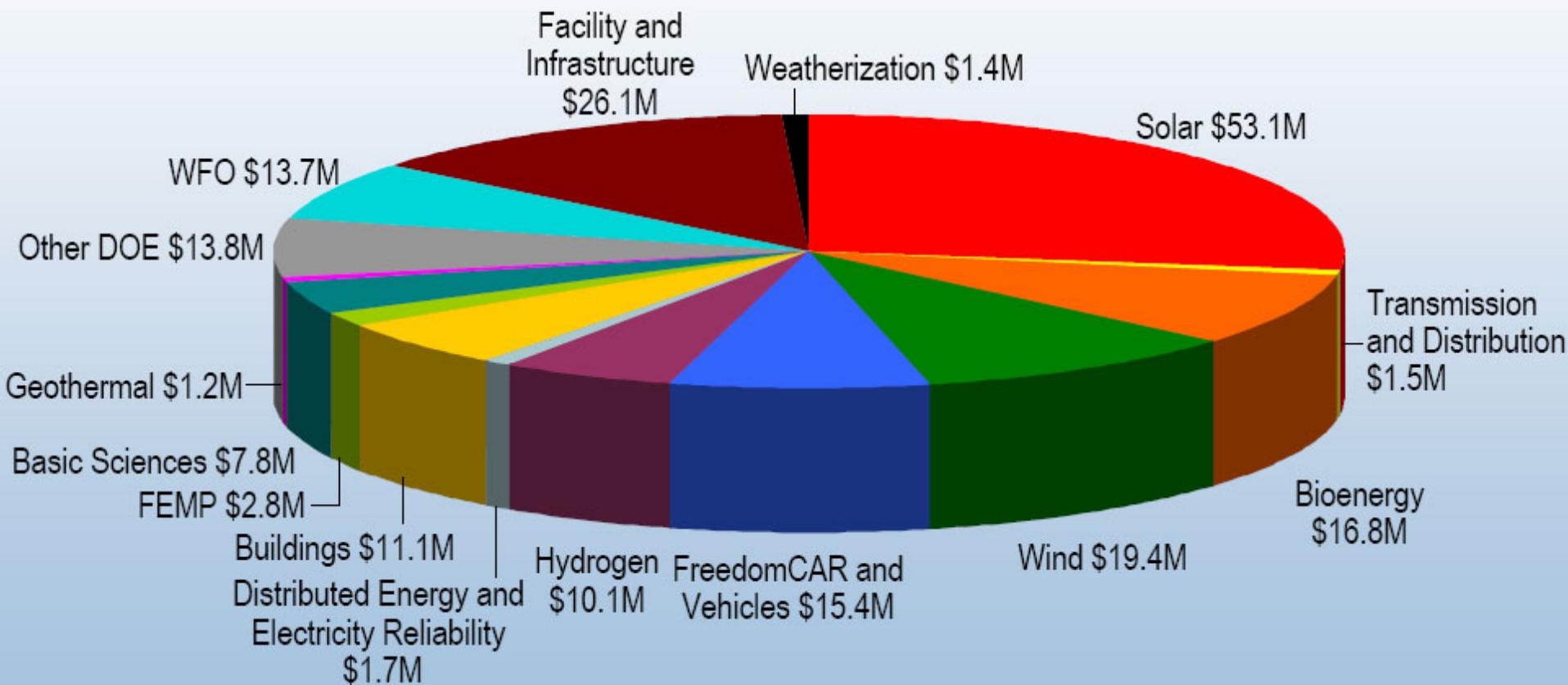
NREL Funding and Staffing

Funding in 2005 Dollars

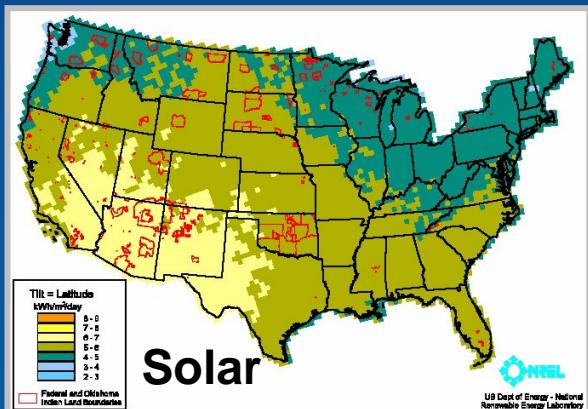
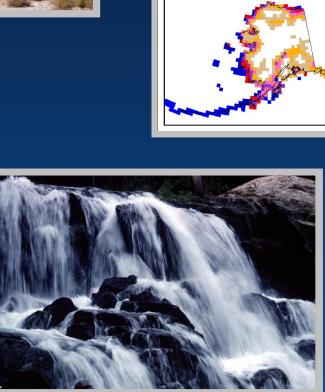
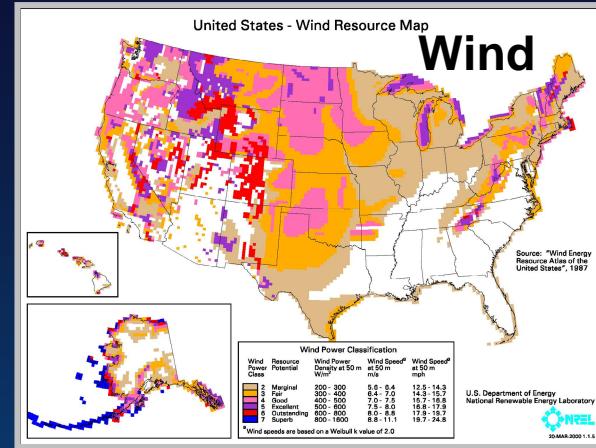
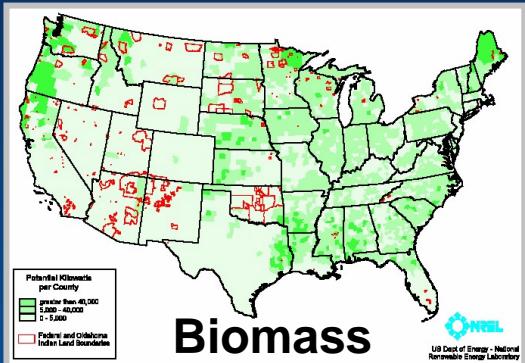
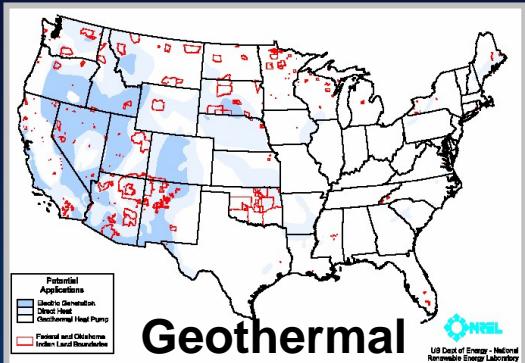


NREL FY 2006 Program Portfolio

Estimated \$195.9 Million

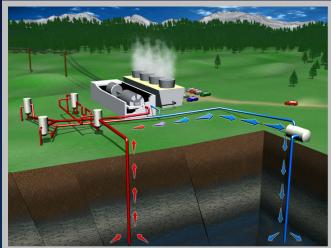


Renewable Resource Options

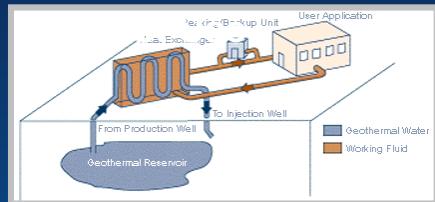


Renewable Technology Options

Power



Direct Use



PV - Remote Homes



Small Modular Power



Diesel Hybrids



Small Wind



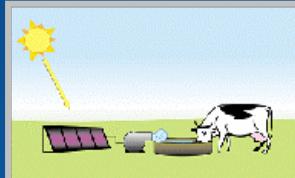
Big Wind



Process Heat



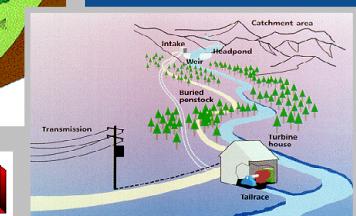
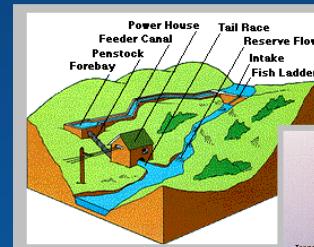
Stock Watering

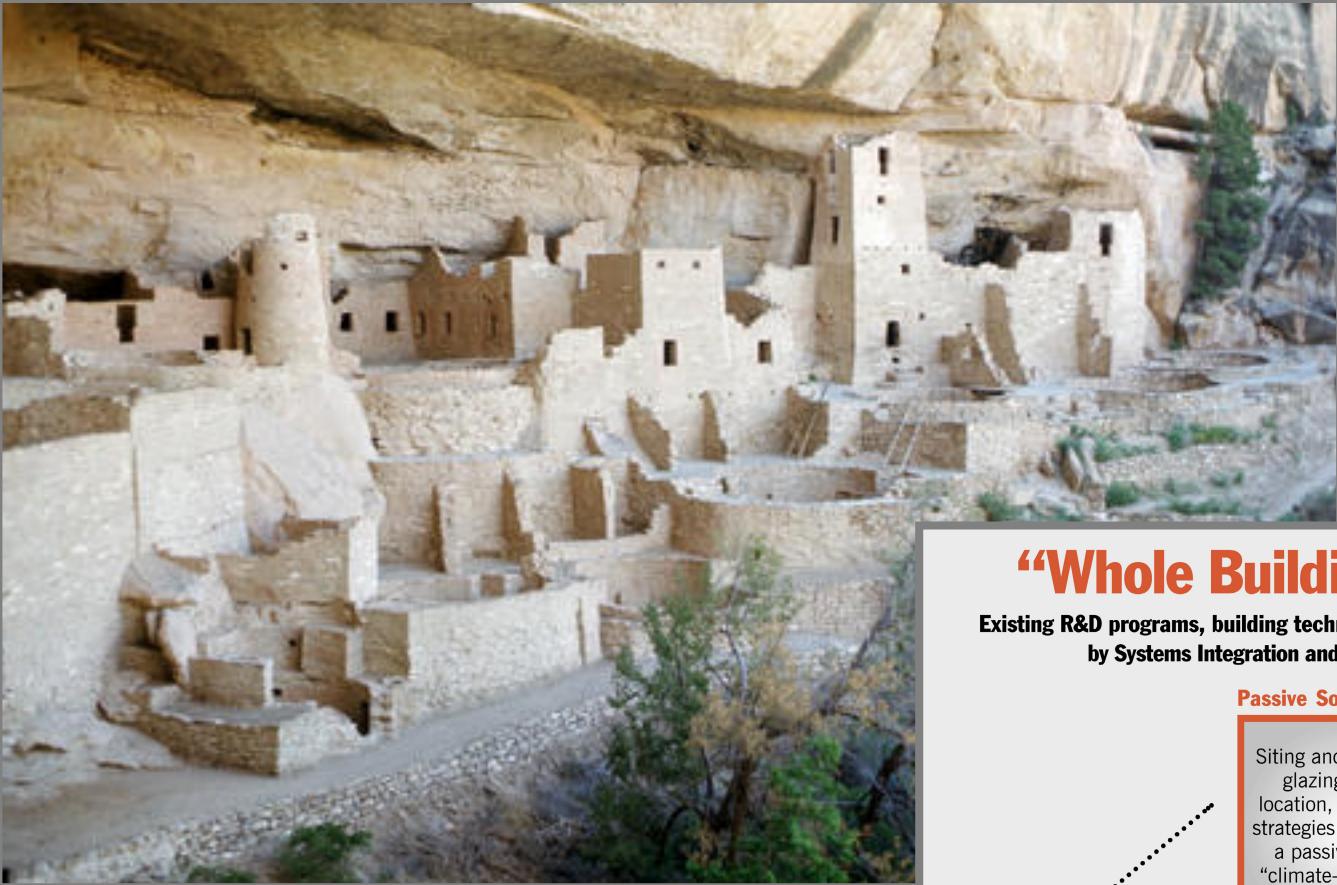


Buildings



Small Hydro





Building Design

“Whole Buildings” Strategy:

Existing R&D programs, building technologies, and components tied together by Systems Integration and Computerized Design Tools.

Passive Solar Strategies

Siting and orientation, glazing size and location, and shading strategies contribute to a passive solar, or “climate-responsive,” building.

Advanced Technologies

Energy-saving appliances, advanced energy controls and thermostats, efficient heating and cooling systems, photovoltaics, and solar water heating systems.

Energy-Efficient Materials

Superior building materials, including high-efficiency windows, insulation, brick, concrete masonry, and interior finish products.



National Renewable Energy Laboratory

Energy Efficiency



Energy Star Appliances

Refrigerators – Half as much energy



Clothes Washers – Save up to \$110 per year



Oil & Gas Boilers – Save up to 10%



Programmable Thermostats – Save up to \$100 per year



Efficient Lighting



If every American changed out 5 lights, we'd save \$6 billion/year and the equivalent of 21 power plants.



Wind Turbine Sizes and Applications



Small (≤ 10 kW)

Homes

Farms

Remote Applications
(e.g. water
pumping, telecom
sites, icemaking)



Intermediate (10-250 kW)

Village Power

Hybrid Systems

Distributed Power

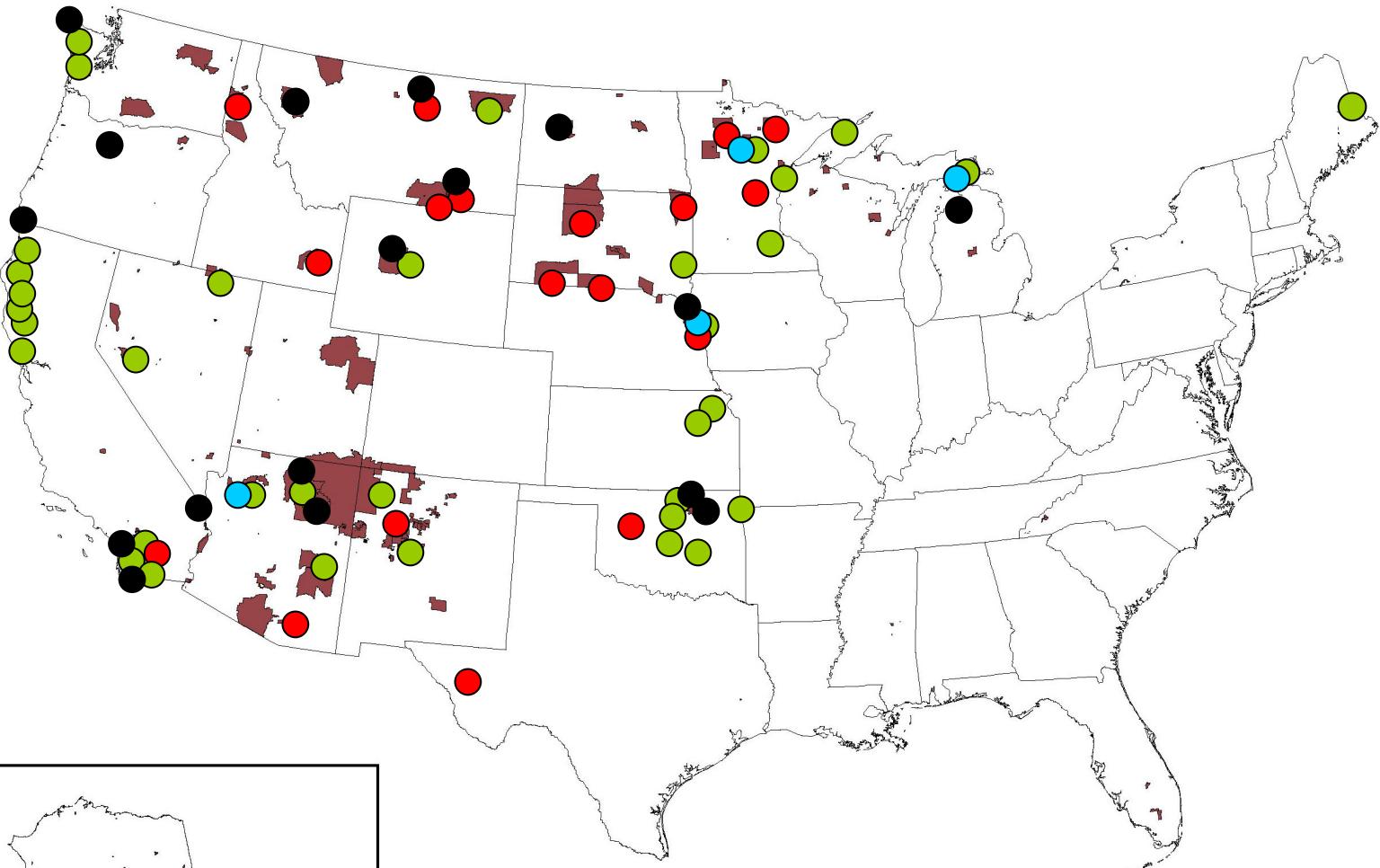


Large (250 kW – 2+ MW)

Central Station Wind Farms

Distributed Power

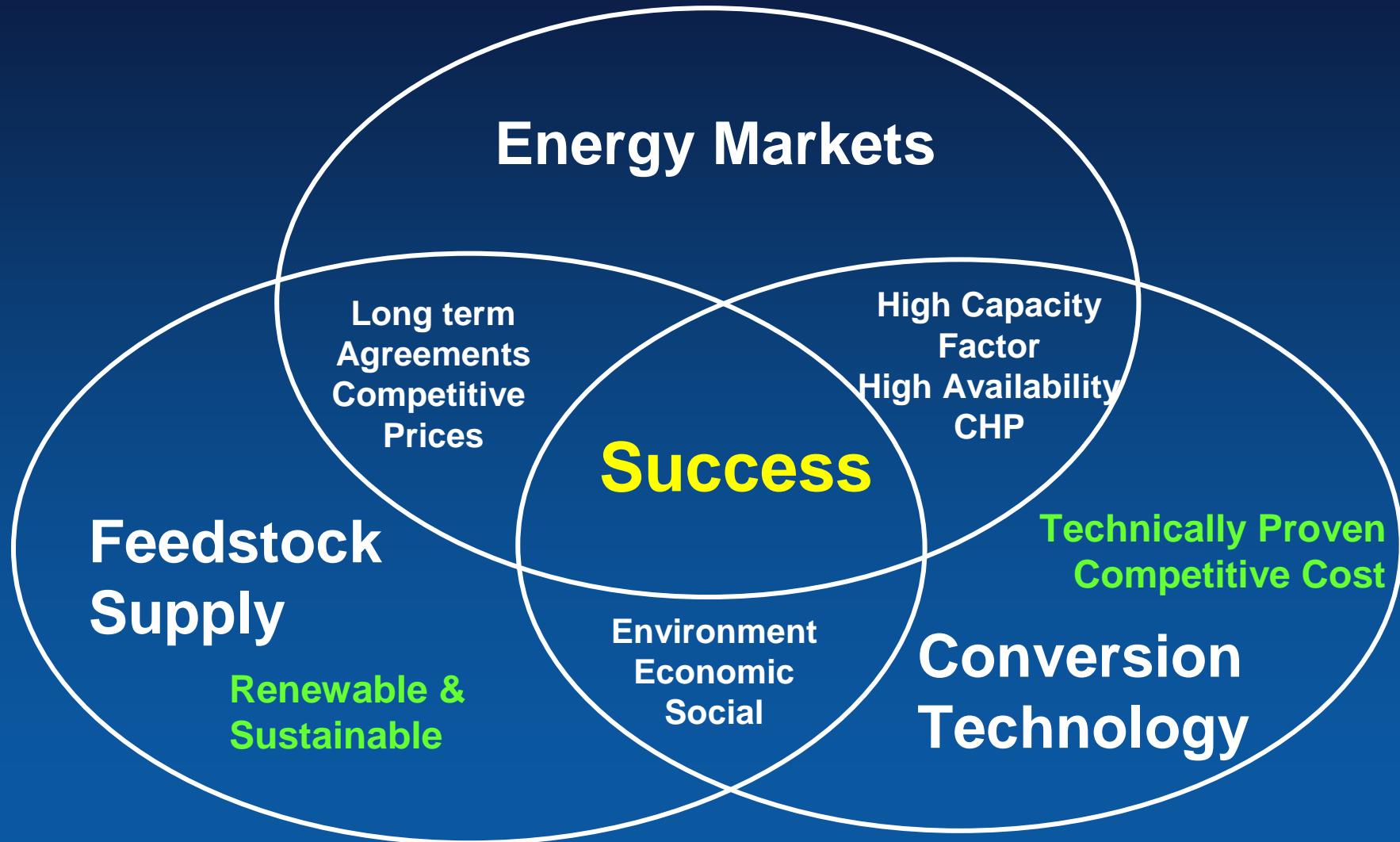
Tribal Wind Monitoring Sites



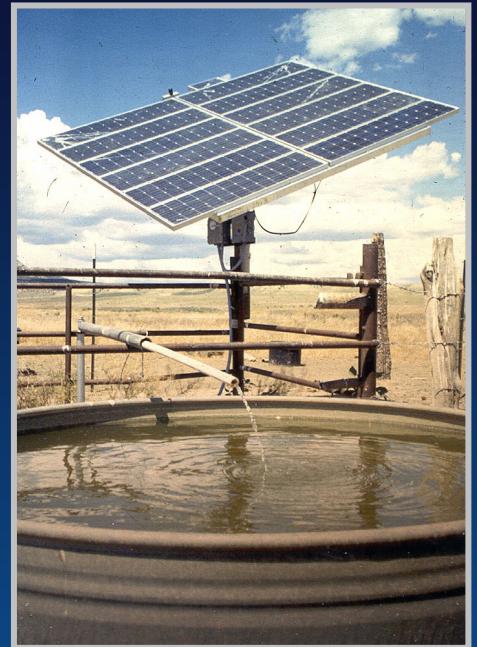
- 20m WPA Monitoring Completed
- 20m WPA Anemometer
- 50m WPA Anemometer
- 50m TEP Anemometer

Bioenergy

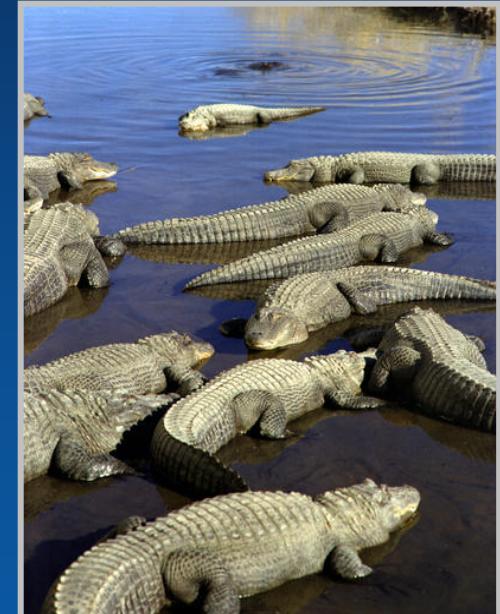
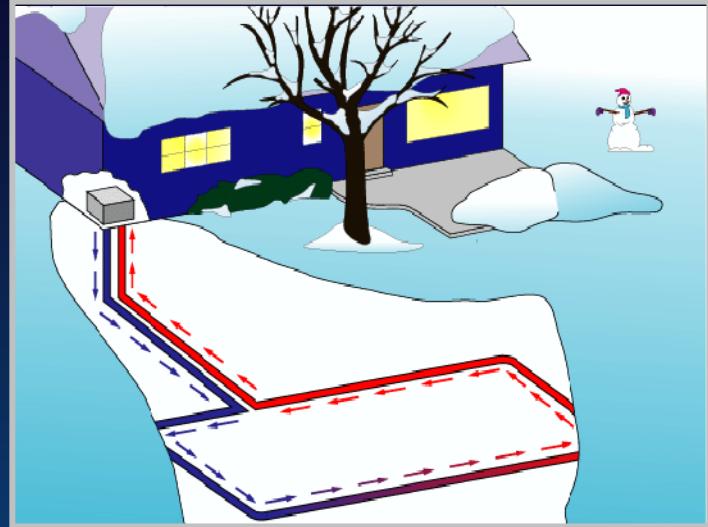
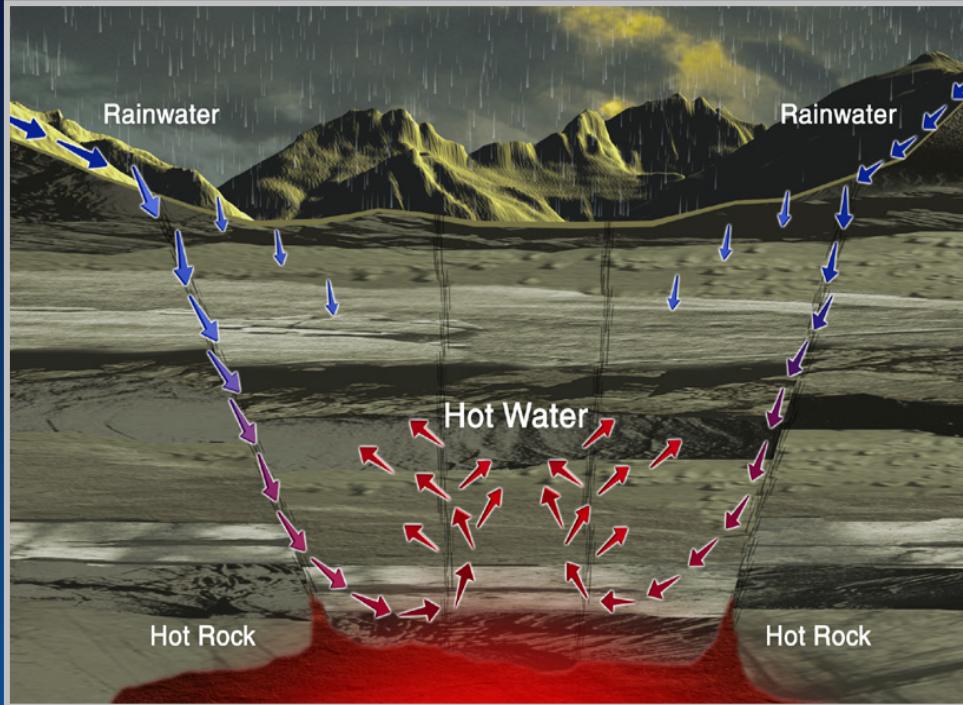
Criteria for Success



Solar Options



Geothermal Options



Small Hydro Power

INL Idaho National Laboratory

Home > Renewable Energy > Hydropower > Virtual Hydropower Prospector >

Virtual Hydropower Prospector

Region Selector

Click on a region to access the VHP desktop

The map shows the continental United States and Alaska. Each state and region is assigned a number from 1 to 20. The numbers are: 1 (New England), 2 (Pennsylvania), 3 (Florida), 4 (Michigan), 5 (Ohio), 6 (Georgia), 7 (Illinois), 8 (Mississippi), 9 (North Dakota), 10 (South Dakota), 11 (Oklahoma), 12 (Louisiana), 13 (Texas), 14 (Colorado), 15 (Arizona), 16 (Utah), 17 (Wyoming), 18 (Idaho), 19 (Alaska), and 20 (Hawaii).

Legend

- Water Energy Resource Sites
- Hydrography
- Power System
- Transportation
- Areas & Places
- Land Use

Detailed map of the Western United States showing hydroelectric power systems. The map includes state boundaries and major rivers. A legend on the left identifies symbols for water energy resource sites, hydrography, power system, transportation, areas & places, and land use. A sidebar on the right contains various map tools and options.

<http://hydropower.inl.gov/prospector/>

Refresh Map

Legend

Water Energy Resource Sites

Feature Active
Select Feature

High Head High Power

Low Head High Power

High Head Low Power

Low Power Conventional

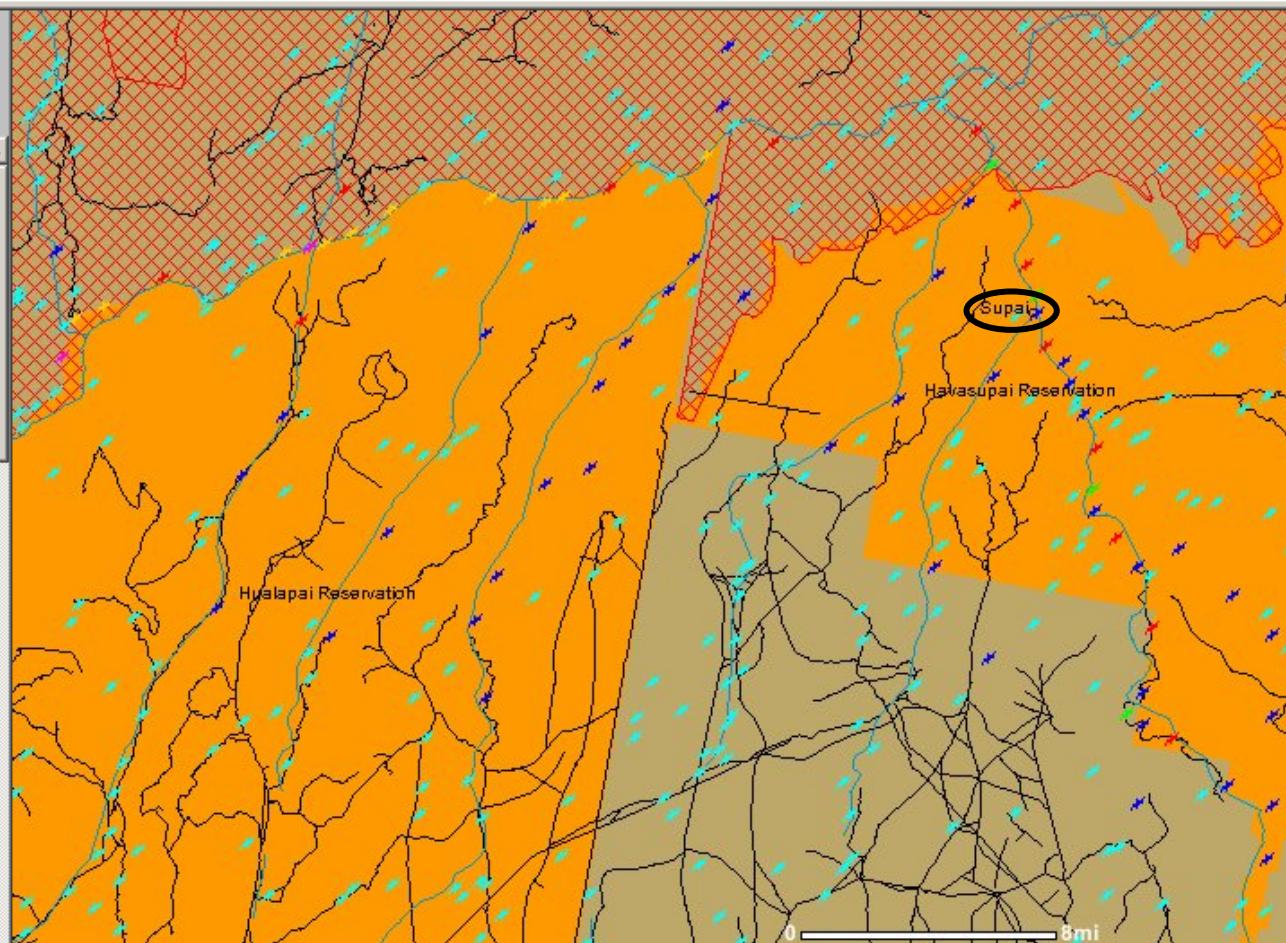
Low Power Unconventional

Microhydro

Hydrography

Power System

Feature Active



Map On/Off

Zoom In

Zoom Out

Pan

Zoom to Previous

Full Extent

Identify

Find

Select By Rectangle

Select By Distance

Buffer

Query

Clear Pins

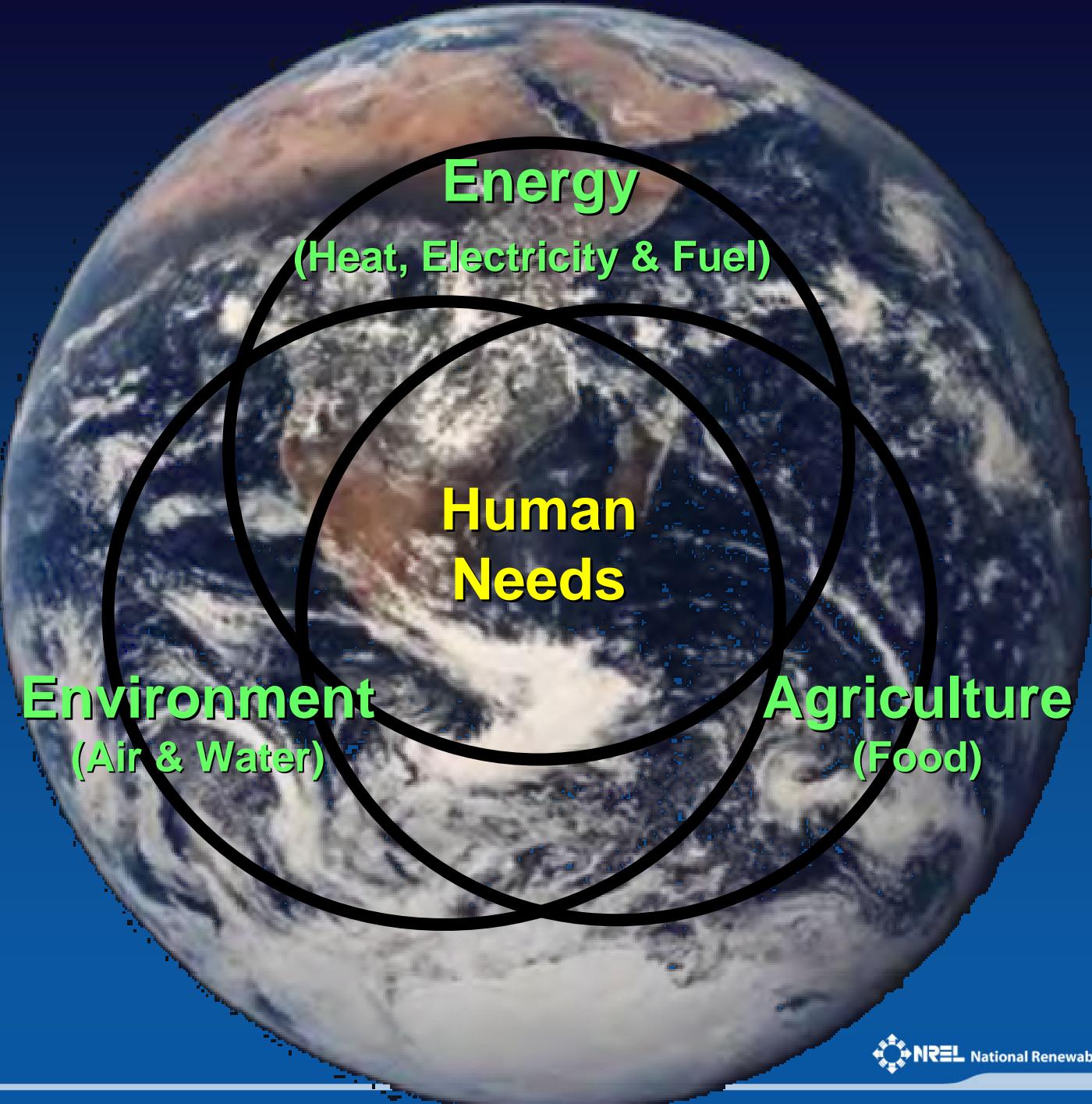
Clear Select

Measure

Print

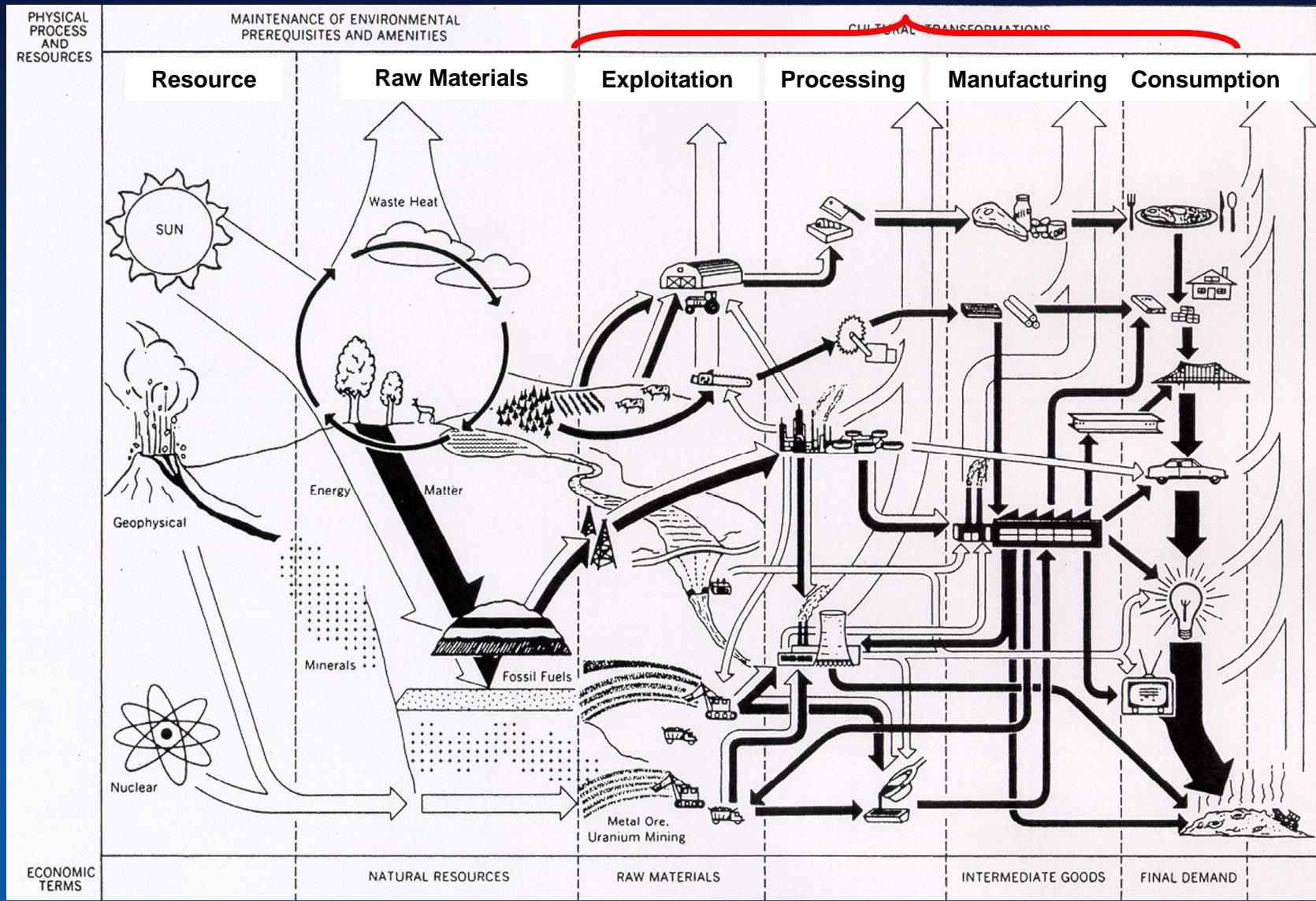
Active Layer - High Head/Low Power

Rec	Power Class	Power Potential (MW)	Hydraulic Head (ft)	Flow Rate (cfs)	Federally Excluded	Environmentally Excluded	Nearest Rd. (mi)	Nearest RR (mi.)	Nearest Population (mi)	Nearest Powerline (mi)	Nearest Substation (mi)	Nearest Power (mi)
1	High Head/Low Power	0.463	34.91	156.44	N	N	1.611	999999	0.073	999999	999999	999999



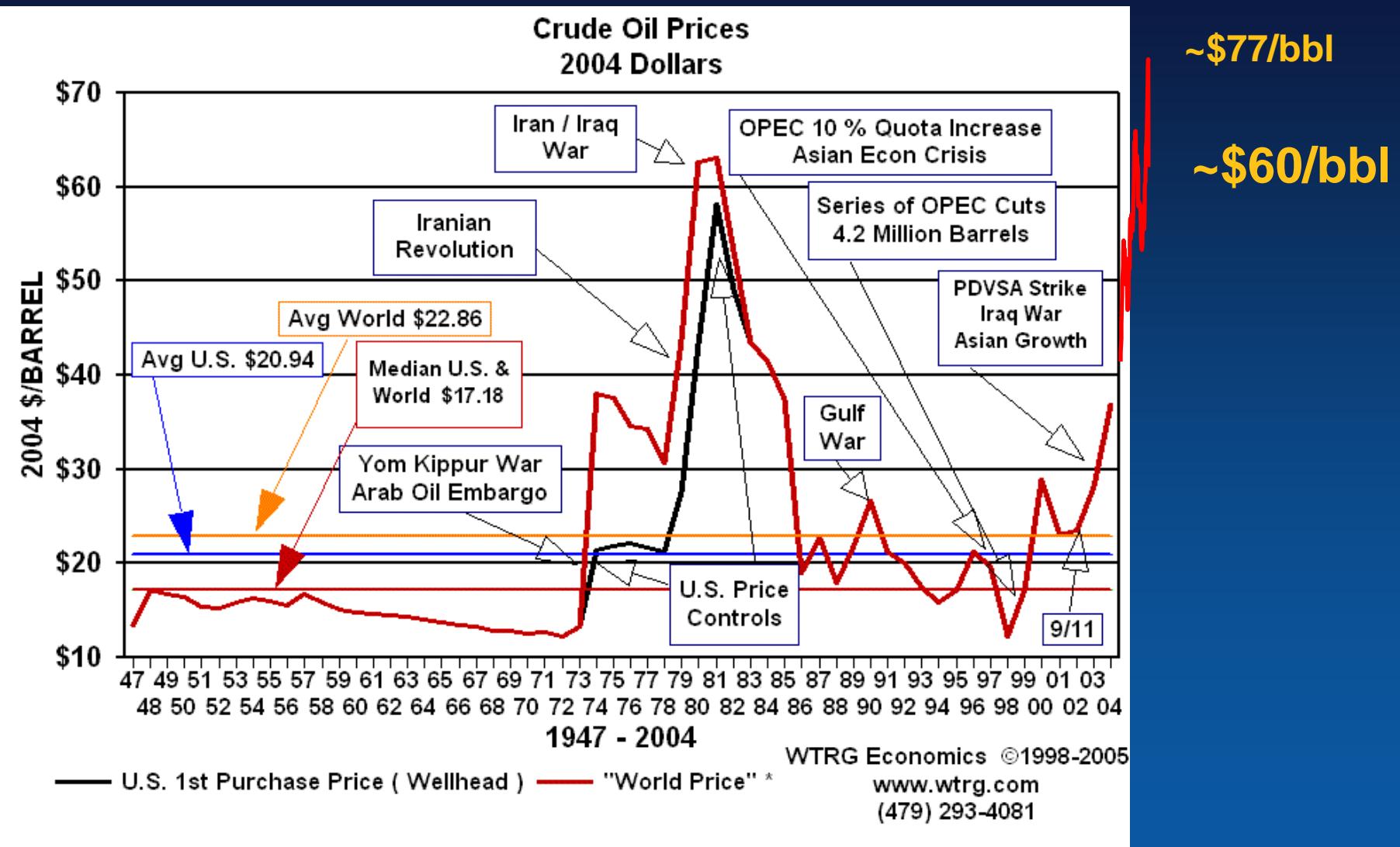
The global economy is very complex

And it's, almost entirely, dependent on cheap oil.

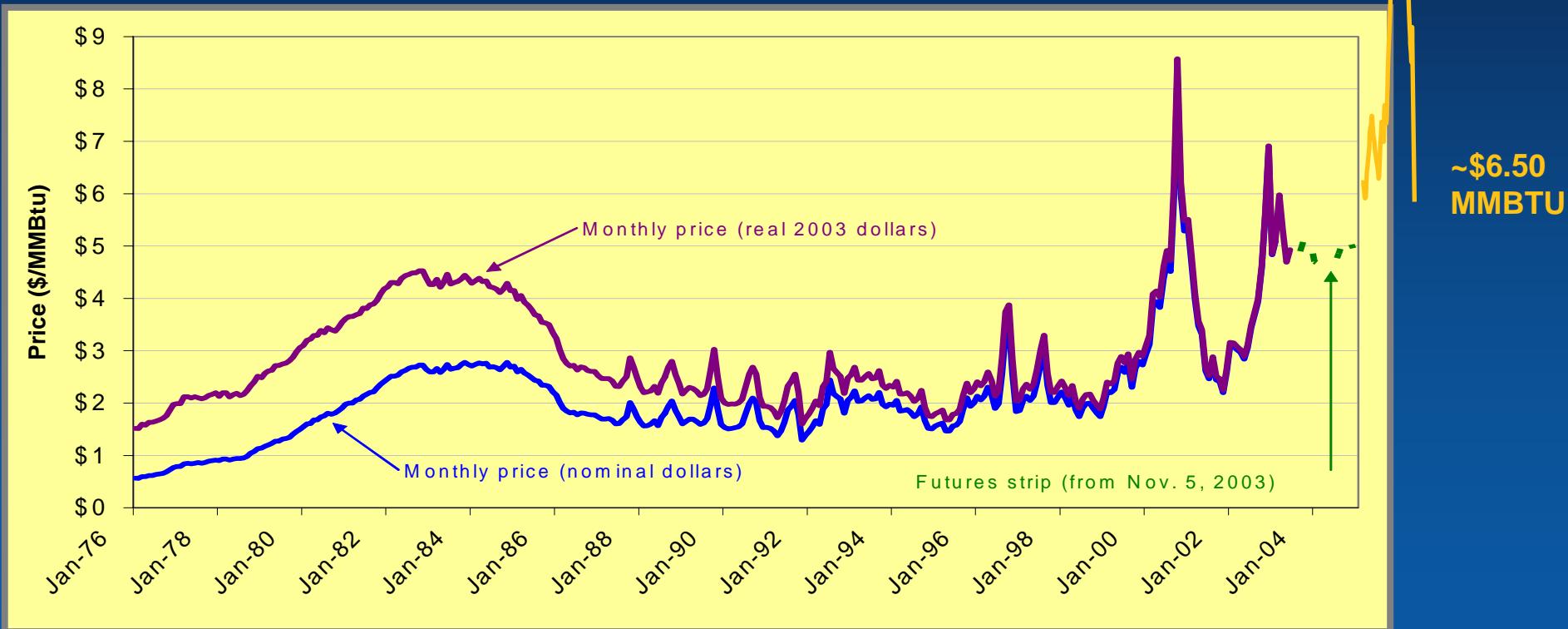


After: Charles Hall, SUNY Syracuse, 2005

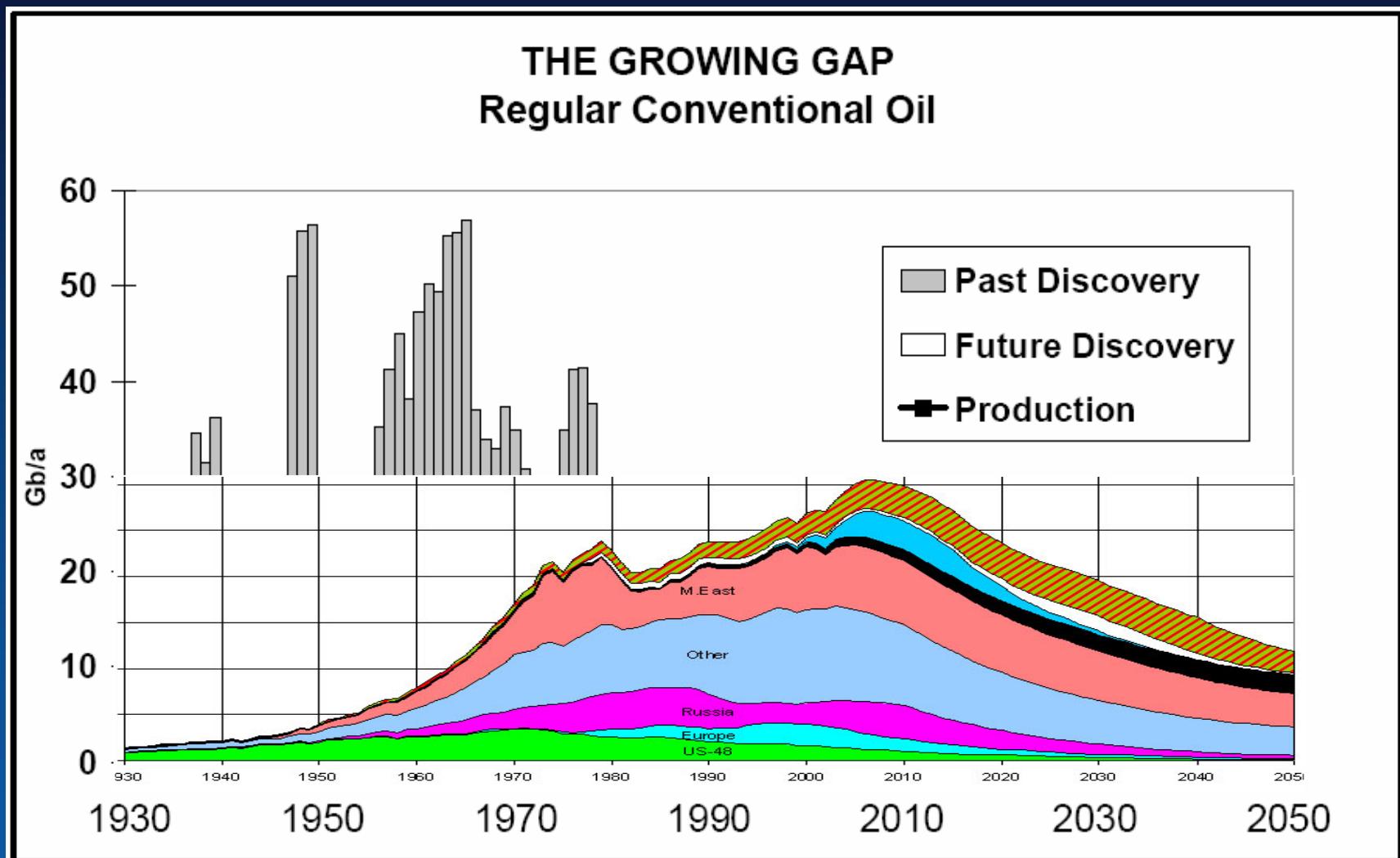
Increasingly volatile, increasingly upward



After a decade of low prices, natural gas prices are now more volatile at a higher level.

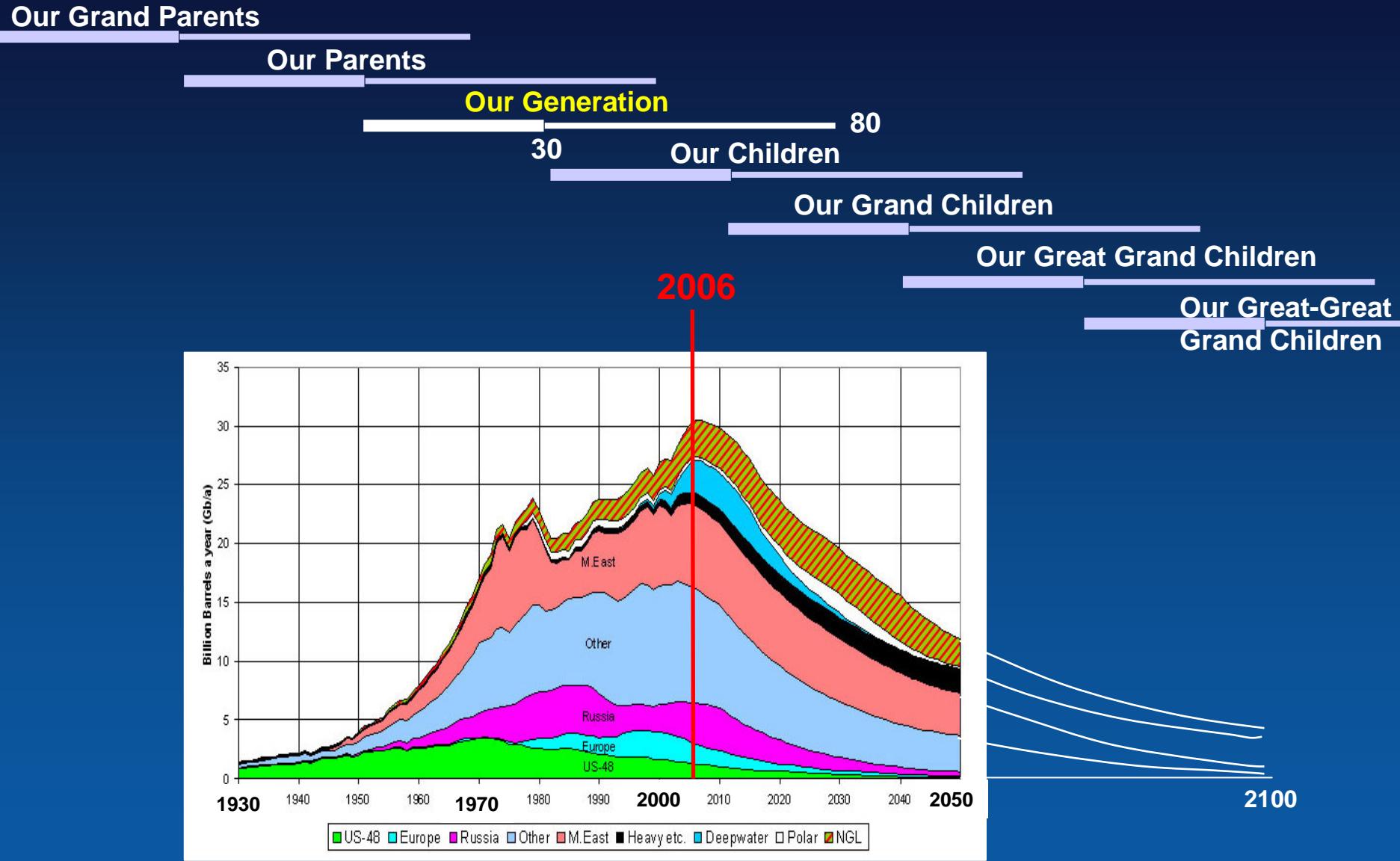


Worldwide Discovery Trend



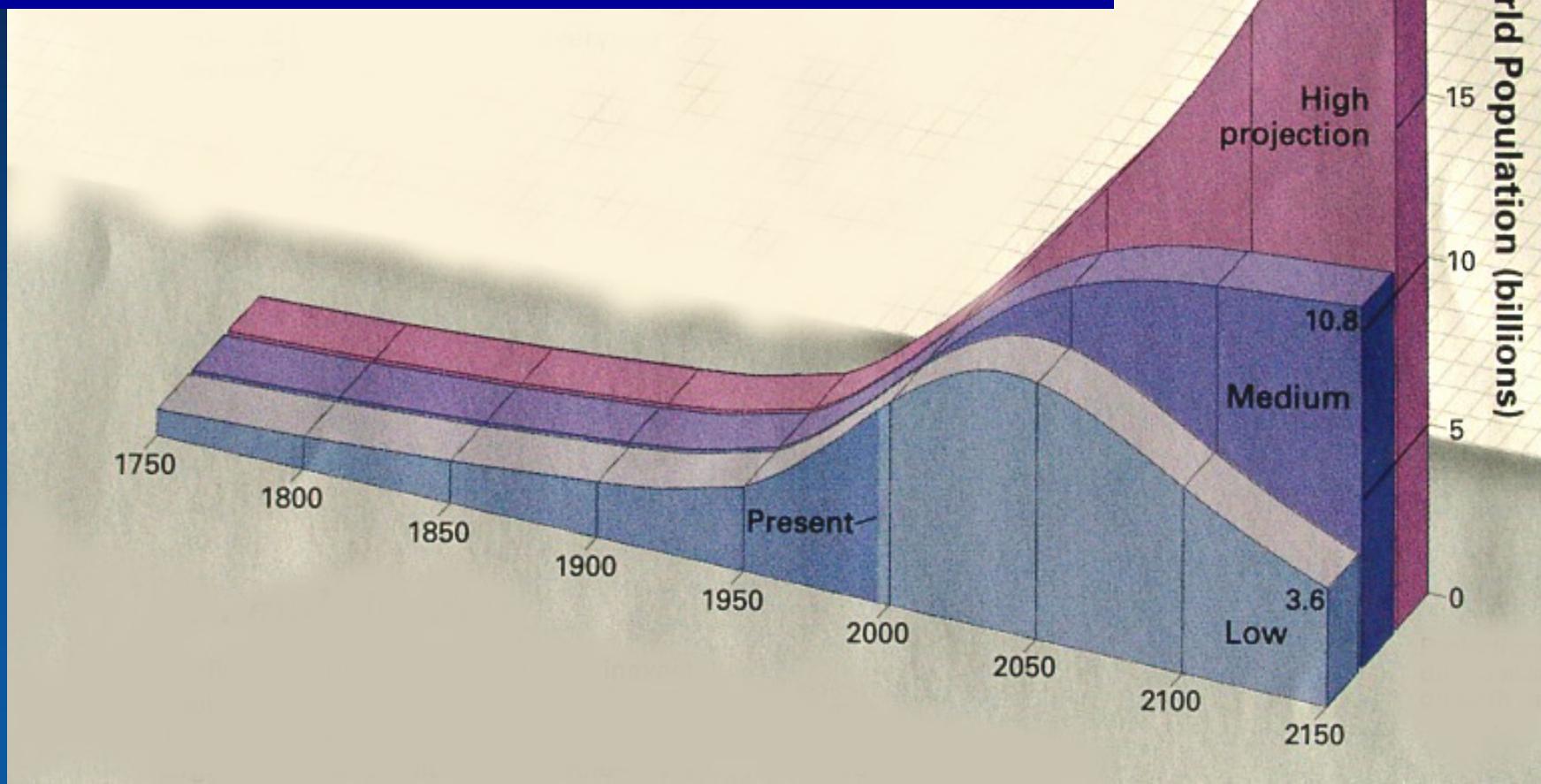
Source: Campbell, September 2006

7 Generations Span The Age of Oil



Peak Oil Graph from: ASPO.com - Colin Campbell 2004

Population growth and energy growth have gone hand-in-hand. What happens if energy supply declines?



National Geographic, 1998

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Are we already exceeding the carrying-capacity of the planet?

Tribal Energy Security & Sovereignty Through Local Self-Sufficiency

Economic Dependence

- Oil Imports
- Fuel at the Pump
- National Grid
- Coal-based Power
- Water Transport
- Foreign Manufacturing
- Agro-Industry

“He who has the gold,
makes the rules.”



Community Independence

- Self sufficiency
- Food
- Energy
- Water

- Skill Rebuilding
- Local Production
- Regional Sourcing

- Sufficiency & Enoughness
- Human Satisfaction

“Community of Cooperation”

The Community Energy Development Challenge



