

Renewable Energy in Indian Country

Roger Taylor
Tribal Energy Program Manager
NREL



Major DOE National Laboratories



National Renewable Energy Laboratory

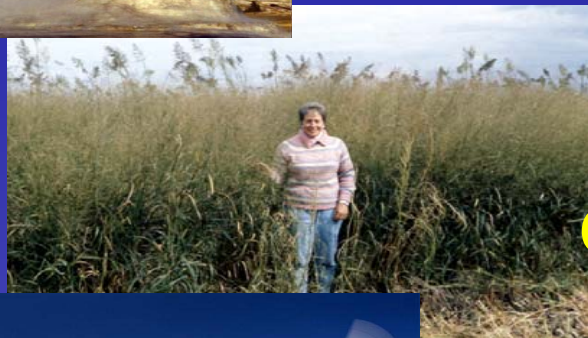
- Only national laboratory *dedicated* to renewable energy and energy efficiency R&D
- Research spans fundamental *science* to *technology* solutions
- *Collaboration* with industry and university partners is a hallmark
- Research programs *linked* to market opportunities



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

Tribal Energy Program

www.eere.energy.gov/tribalenergy/guide/

Tribal Energy Program

Tribal Energy Guide

U.S. Department of Energy
Office of Energy Efficiency and Renewable Energy Bringing you a prosperous future where energy is clean, abundant, reliable, and affordable

Weatherization & Intergovernmental Program
Tribal Energy Program

Search

Tribal Energy Program

Welcome to the Department of Energy's Tribal Energy Program Web site. The Tribal Energy Program, under the Department of Energy's (DOE) Office of Energy Efficiency and Renewable Energy, provides financial and technical assistance to tribes for feasibility studies and shares the cost of implementing sustainable renewable energy installations on tribal lands. This program promotes tribal energy self-sufficiency and fosters employment and economic development on America's tribal lands.

This Web site provides information about Native American renewable energy and energy efficiency projects that have been funded by the Department of Energy. The site includes valuable information such as: business opportunities, including the latest tribal energy solicitation; case studies on renewable energy projects on tribal lands; reports and resources; and links to other relevant sites.

Current Events

Feature

Renewable Energy Development on Tribal Lands brochure (PDF 731 KB)

DOE NEWS
Energy Department to Fund Tribes' 'First Steps' In Developing Clean Energy (PDF 104 KB)

Energy Department Awards Spur Development Of Tribes' Renewable Energy Resources (PDF 93 KB)
[Download Acrobat Reader.](#)

- About the Program
 - TEP Program Background
 - How We're Organized
- Contact Us
- Funding Opportunities
- Projects on Tribal Lands
 - Title XXVI (1994-1995)
 - Remote Applications (1999)
 - Tribal Colleges (2000-01)
 - FY2002 Projects (2002)
 - FY2003 Projects (2003)
 - Other DOE Projects
- Information Resources
 - Tribal Energy Programs
 - DOE Organizations
 - Federal Organizations
 - Tribal Organizations
 - Other Organizations
 - Reports and Additional Information

U.S. Department of Energy
Energy Efficiency and Renewable Energy Bringing you a prosperous future where energy is clean, abundant, reliable, and affordable

EERE Home

A Guide to
Tribal Energy Development

Search

About this Site

The Development Process

- Strategic Planning
- Evaluating Options
- Organizational Development
- Project Development

Resource Library

- Cultural Issues
- Assessing Energy Resources
- Energy Technologies
- The Electrical Grid
- Environmental Considerations
- The Costs
- Risk Factors
- Legal Issues
- Financing Options
- Who To Contact

Case Studies

Publication Index

Glossary

The Rosebud Sioux Indian Reservation located in south-central South Dakota, is now home to a 750-kilowatt wind turbine. Erected near the Rosebud Casino and Convention Center, the new wind turbine is helping to power that facility while earning money by selling excess power to the Basin Electric Power Cooperative.

"Generating our own energy will help our tribe develop a sustainable homeland economy on the reservation in the short term and strengthen our tribal sovereignty in the long term," says Ronald L. Neiss, an enrolled member of the tribe and president of the Rosebud Sioux Tribe Utility Commission. "A tribe is only as sovereign as its economy and finances permit. One of our tribal goals is energy self-sufficiency, and developing our renewable energy resources will help us achieve that goal."

Tribal energy development can serve many goals: economic development, electrification, self-sufficiency, clean air...the list is as long as you wish to make it. With support from the U.S. Department of Energy's [Tribal Energy Program](#), this Web site is intended to give you the information you need to achieve your energy goals. [Learn more about this site, and how to use it.](#)

What's New

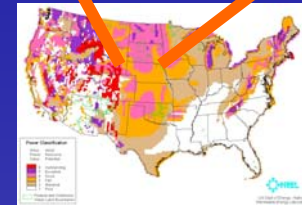
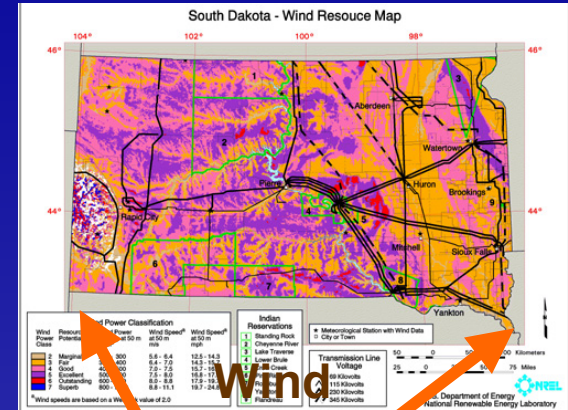
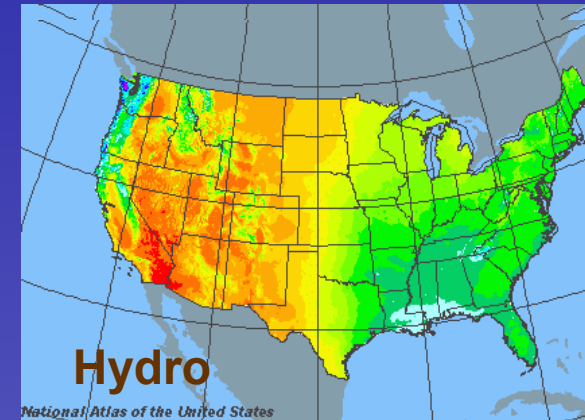
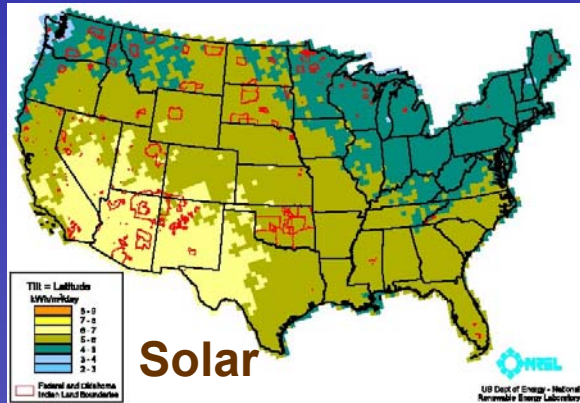
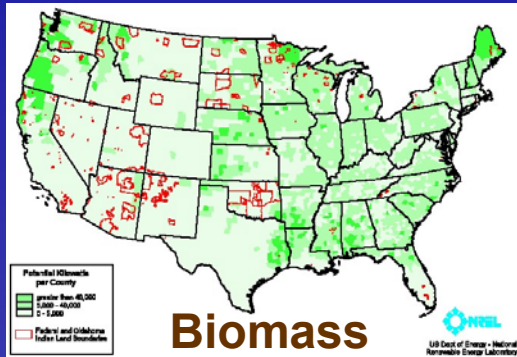
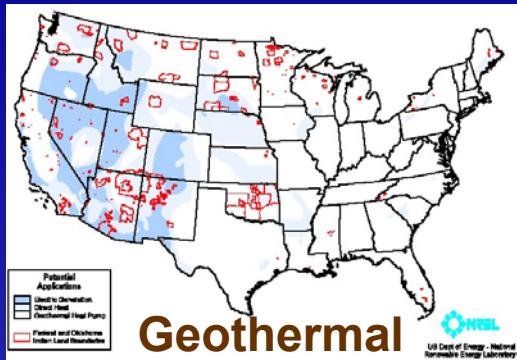
This is a preliminary version of the Tribal Energy Development Web site and is intended for review purposes only. We continue to add content to this site, and we welcome your feedback and suggestions. Please send any comments or suggestions via email by clicking on the Webmaster link, which is located at the bottom of each page, or by sending an email to: tribal_energy_dev@nrel.gov

Tribal College – Teach the Teachers July 12-16, 2004
BIA/DOE/NREL Biomass Energy Workshop Sept 14-16, 2004

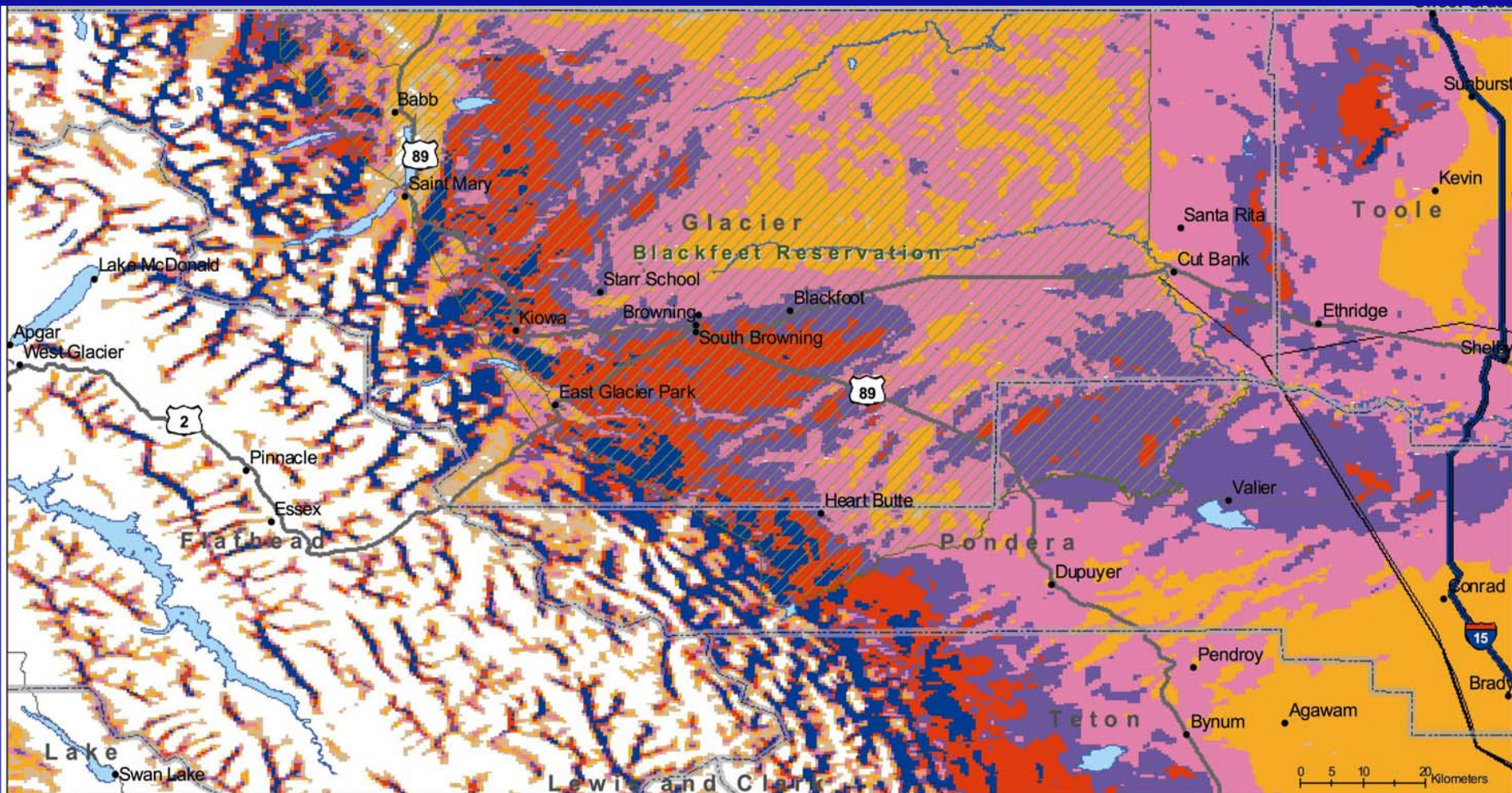
Costs of Electricity with and without External Costs New Generation in ¢/kWh

Electricity Source	Generating Costs	External Costs	Total Costs
Hydropower	2.4-7.7	0-1	2.4-8.7
Wind	4.0-6.0	0.05-0.25	4.05-6.25
Natural Gas	3.4-5.0	1-4	4.4-9.0
Coal/lignite	4.3-4.8	2-15	6.3-19.9
Biomass	7-9	1-3	8-12
Nuclear	10-14	0.2-0.7	10.2-14.7
Photovoltaics	25-50	0.6	25.6-50.6

New Energy Options



Blackfeet Reservation, MT



- Counties
- Major water
- Indian Reservation
- Cities

- Major Roads**
- Interstate Hwy
 - US Hwy
 - State Hwy

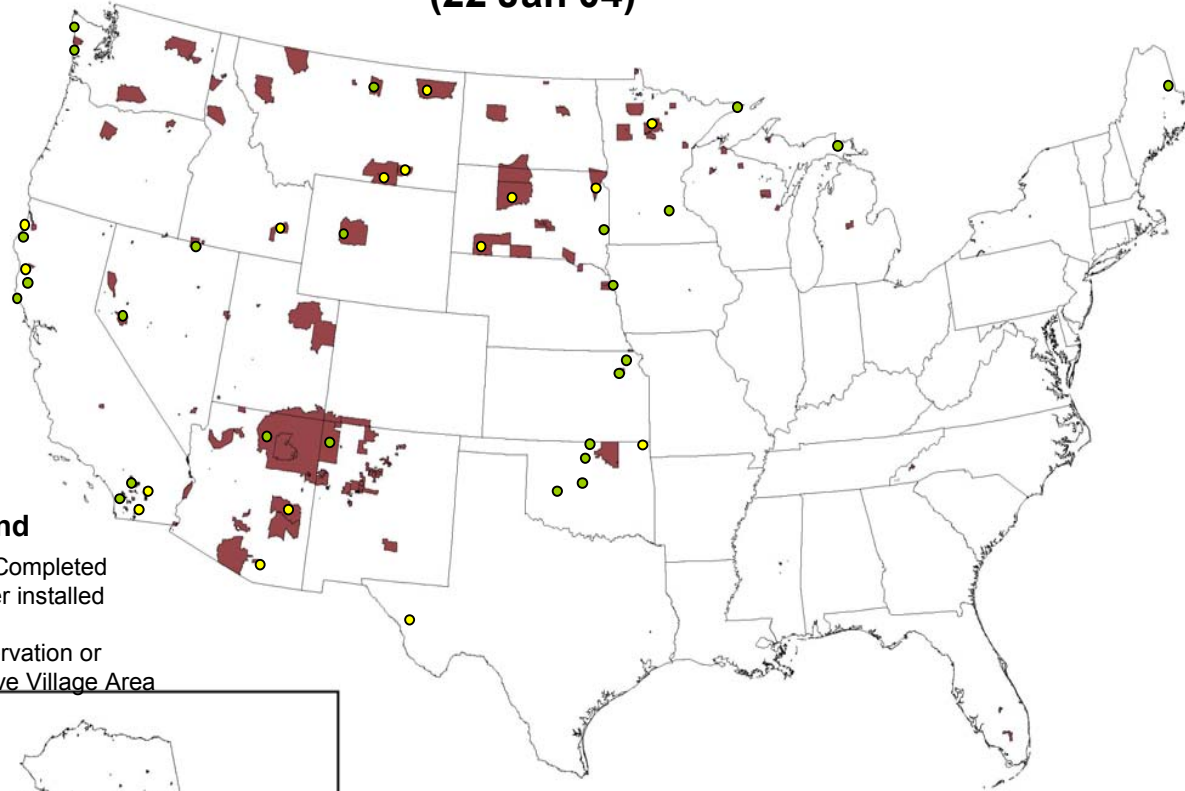
- Transmission Lines ***
- Below 230kV
 - 230kV - 499kV
 - Greater than 500kV

- Wind Power Class and Resource Potential**
- | | | |
|--------------|----------|-----------------|
| 1 - Poor | 3 - Fair | 5 - Excellent |
| 2 - Marginal | 4 - Good | 6 - Outstanding |
| | | 7 - Superb |

* Source: POWERmap, ©2002 Platts, a Division of the McGraw-Hill Companies

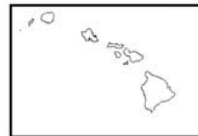
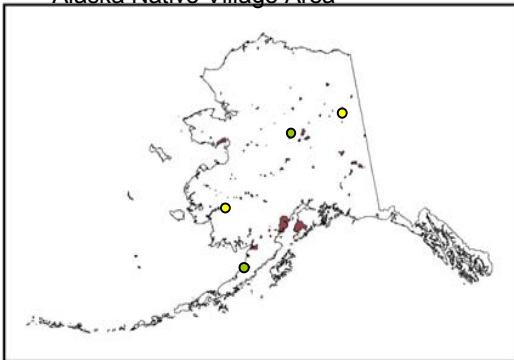


NREL Native American Anemometer Loan Program Installation Sites (22 Jan 04)



Legend

- Monitoring Completed
- Anemometer installed
- Indian Reservation or Alaska Native Village Area



U.S. Department of Energy
National Renewable Energy Laboratory



Installation Year

2000

Bay Mills Indian Community - MI
Hopi - AZ
Rohnerville Rancheria - CA

2001

Houlton Maliseet - ME
Iowa Tribe of Oklahoma - OK
Robinson Rancheria - CA
Shakopee Mdewankan - MN
Shoshone-Bannock - ID
Ugashik Traditional Village - AK
Soboba Band of Luiseno Indians - CA
Tanana Village - AK
Walker River Paiute - NV
Winnebago Tribe of Nebraska - IA
Kaw Nation - OK
Flandreau Sioux - SD
Fort Peck - MT
Fort Yukon - AK
La Jolla - CA
Quinalt - WA
Duck Valley - NV
Pine Ridge - SD
Otoe-Missuria - OK
Fort Belknap - MT
Fort Hall - ID

2002

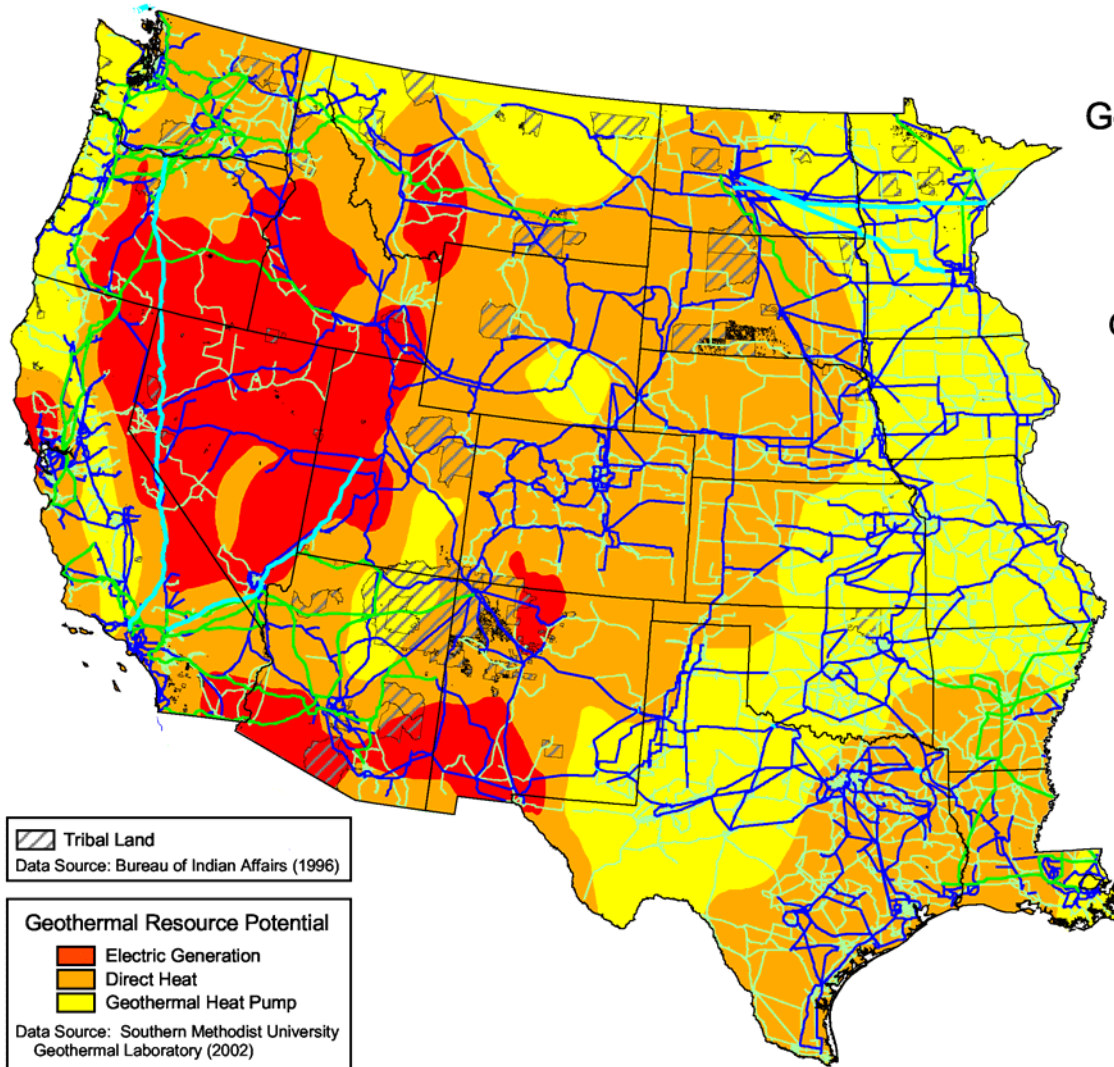
Caddo Nation - OK
Sac & Fox - KS
Navajo - AZ
Sherwood Valley Rancheria - CA
Quileute - WA
Grand Portage - MN
Potawatomi - KS
Crow - MT
Table Bluff Reservation - CA
Stererts Point Rancheria - CA
Sisseton - SD

2003

Northern Cheyenne - MT
Cheyenne River - SD
White Mountain Apache - AZ
Las Coyotes Band of Indians - CA
Ysleta del Sur - TX
Augustine Band of Mission Indians - CA
Pascua Yaqui - AZ
YKHC - AK




Geothermal Resource and Tribal Lands

Western and Great Plains Regions of the United States







 Tribal Land
Data Source: Bureau of Indian Affairs (1996)

Geothermal Resource Potential

-  Electric Generation
-  Direct Heat
-  Geothermal Heat Pump

Data Source: Southern Methodist University Geothermal Laboratory (2002)

Transmission Line*
Voltage

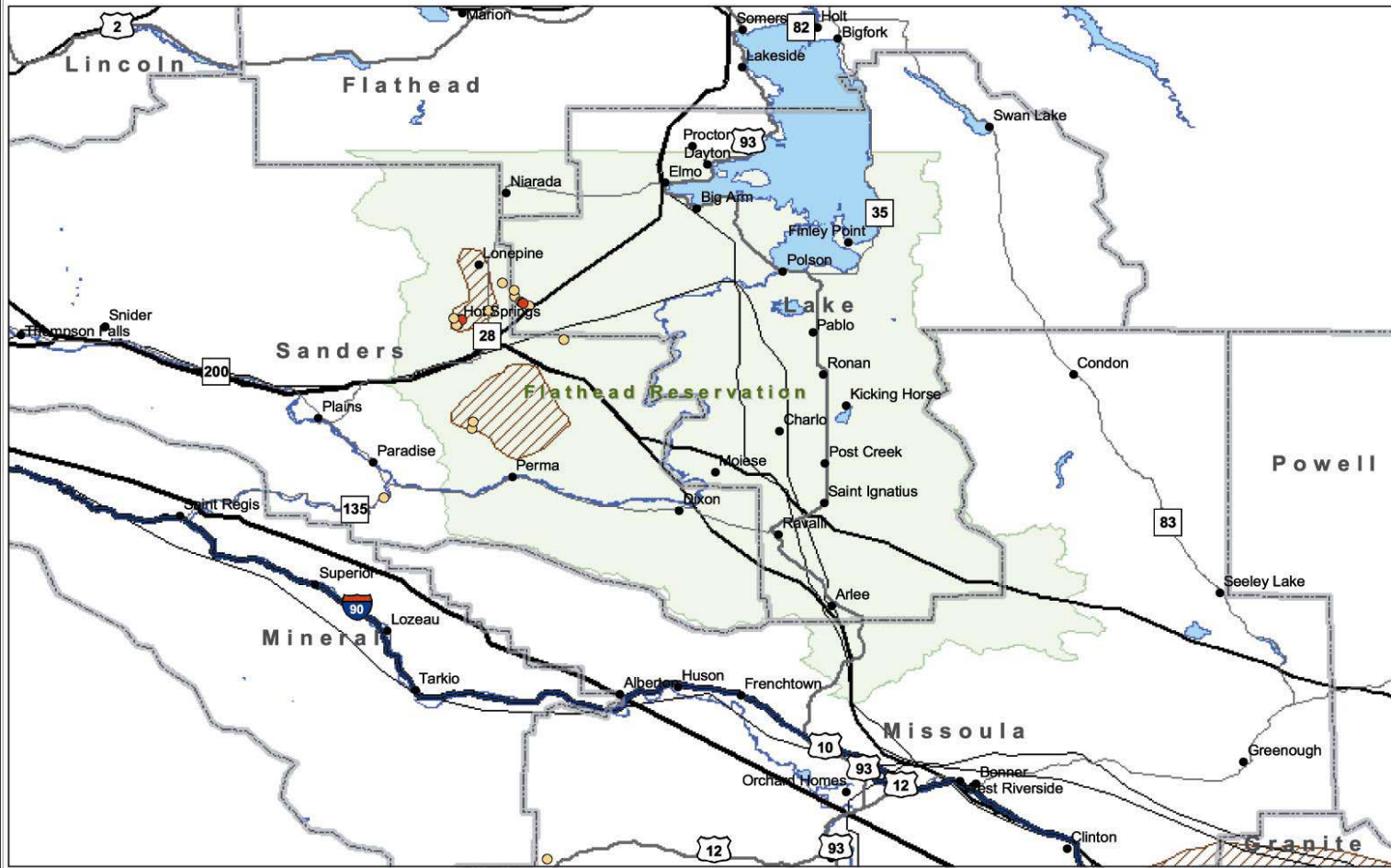
-  DC (1000 kV)
-  500 - 765 kV
-  230 - 400 kV
-  69 - 161 kV

Data Source: PowerMap,
© 2002 Platts, a division
of the McGraw-Hill Cos.

U.S. Department of Energy
National Renewable Energy Laboratory



Flathead Reservation - Montana



- Regions of Known or Potential Geothermal Resources
- Counties
- Major water
- Indian Reservation
- Cities

- Major Roads**
- Interstate Hwy
 - US Hwy
 - State Hwy

- Transmission Lines ***
- Below 230kV
 - 230kV - 499kV
 - Greater than 500kV

- Geothermal Wells and Springs**
- > 50 Degrees C
 - > 20 and < 50 Degrees C
 - Temperature not recorded

0 5 10 20 Kilometers

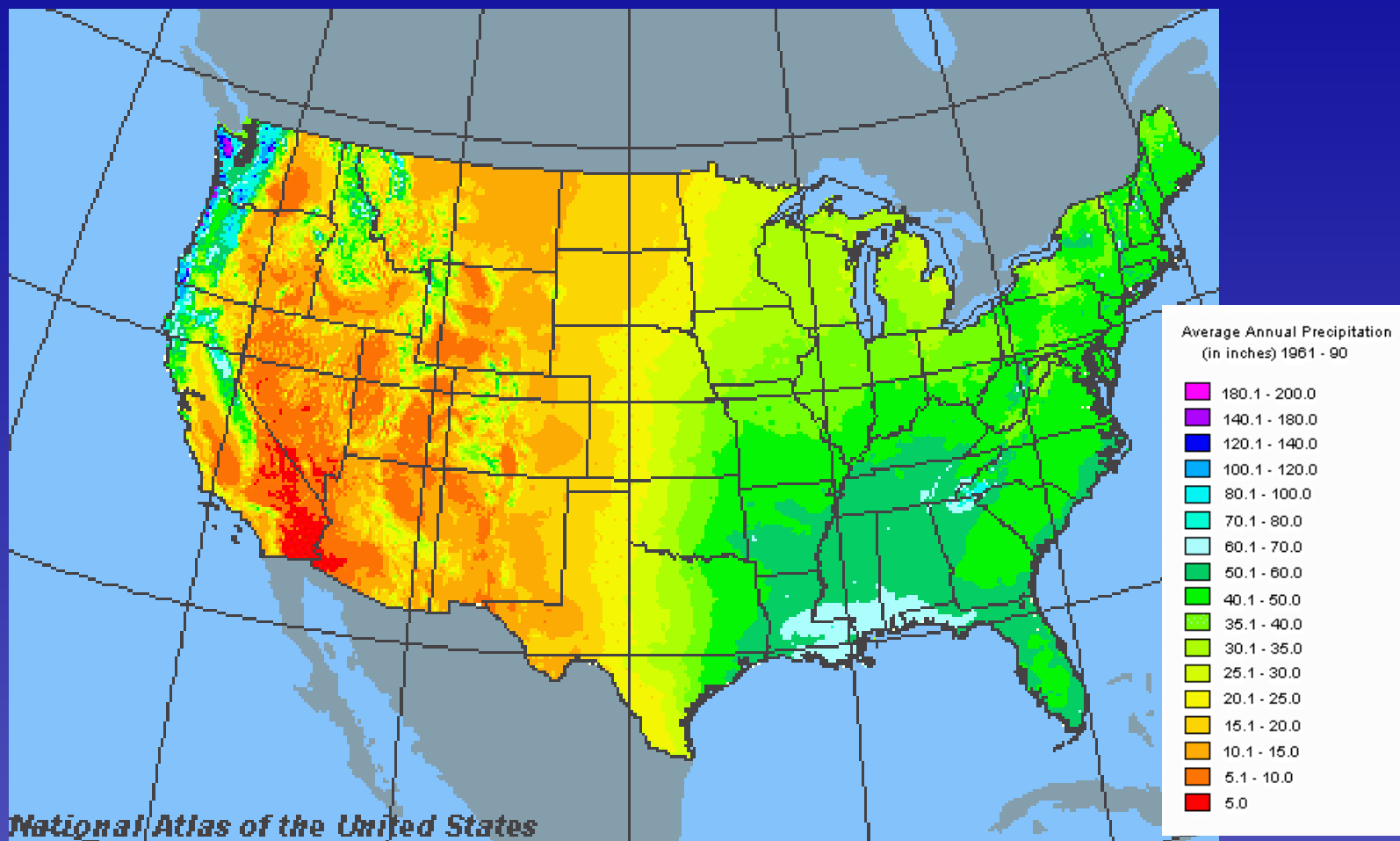
* Source: POWERmap, ©2002 Platts, a Division of the McGraw-Hill Companies

Data Source: INEEL

Jan 06, 2004



Hydropower Resource



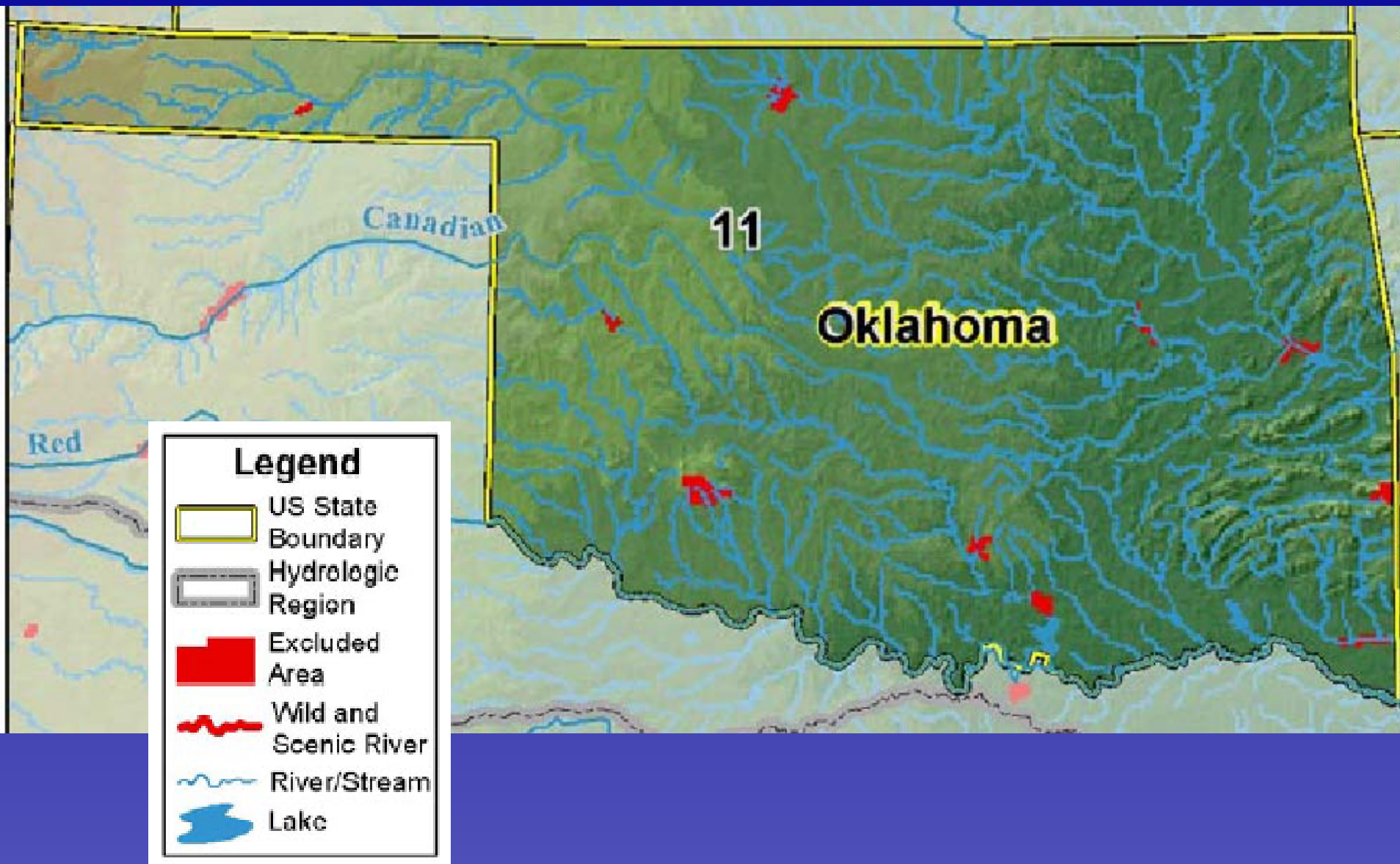
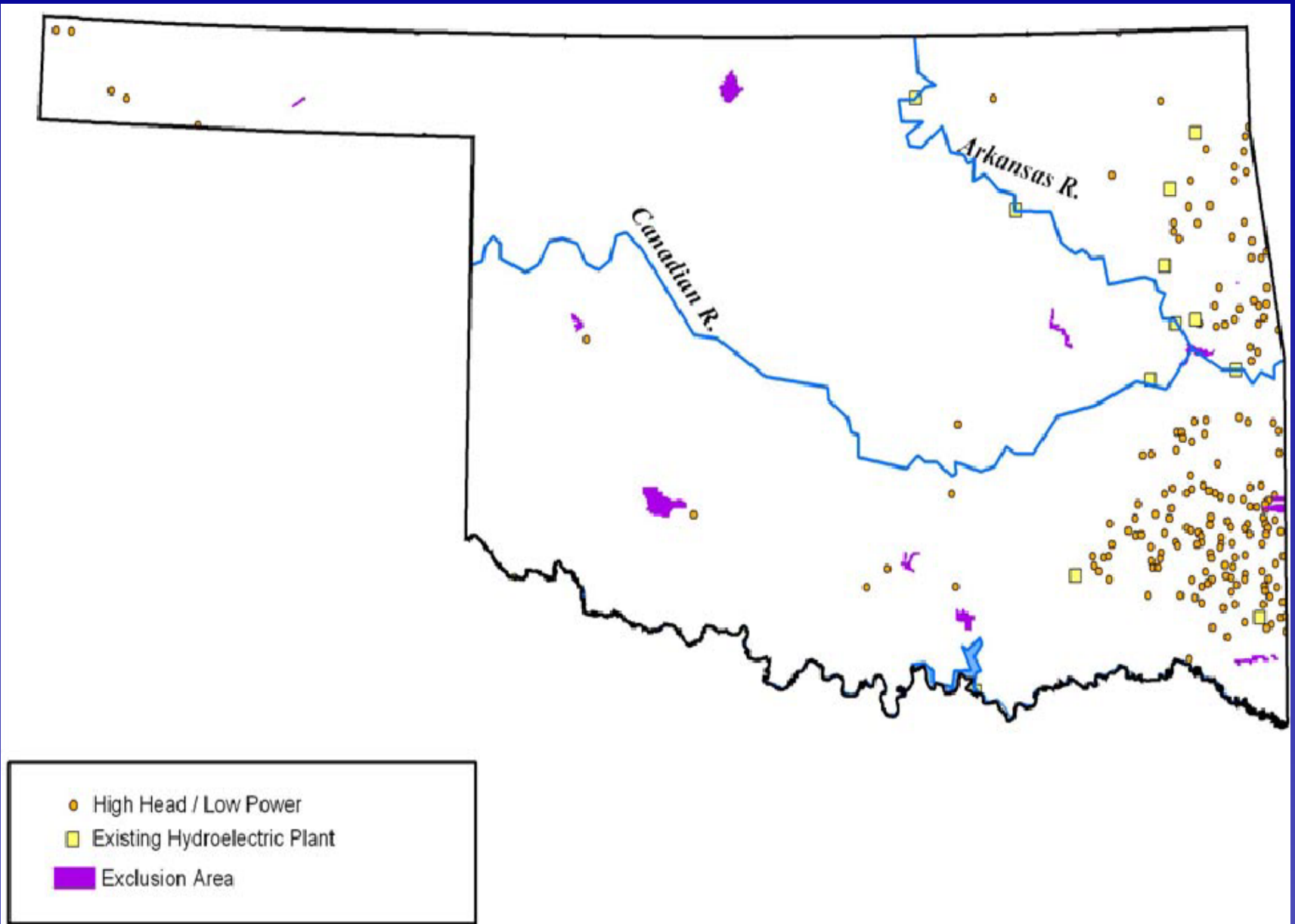
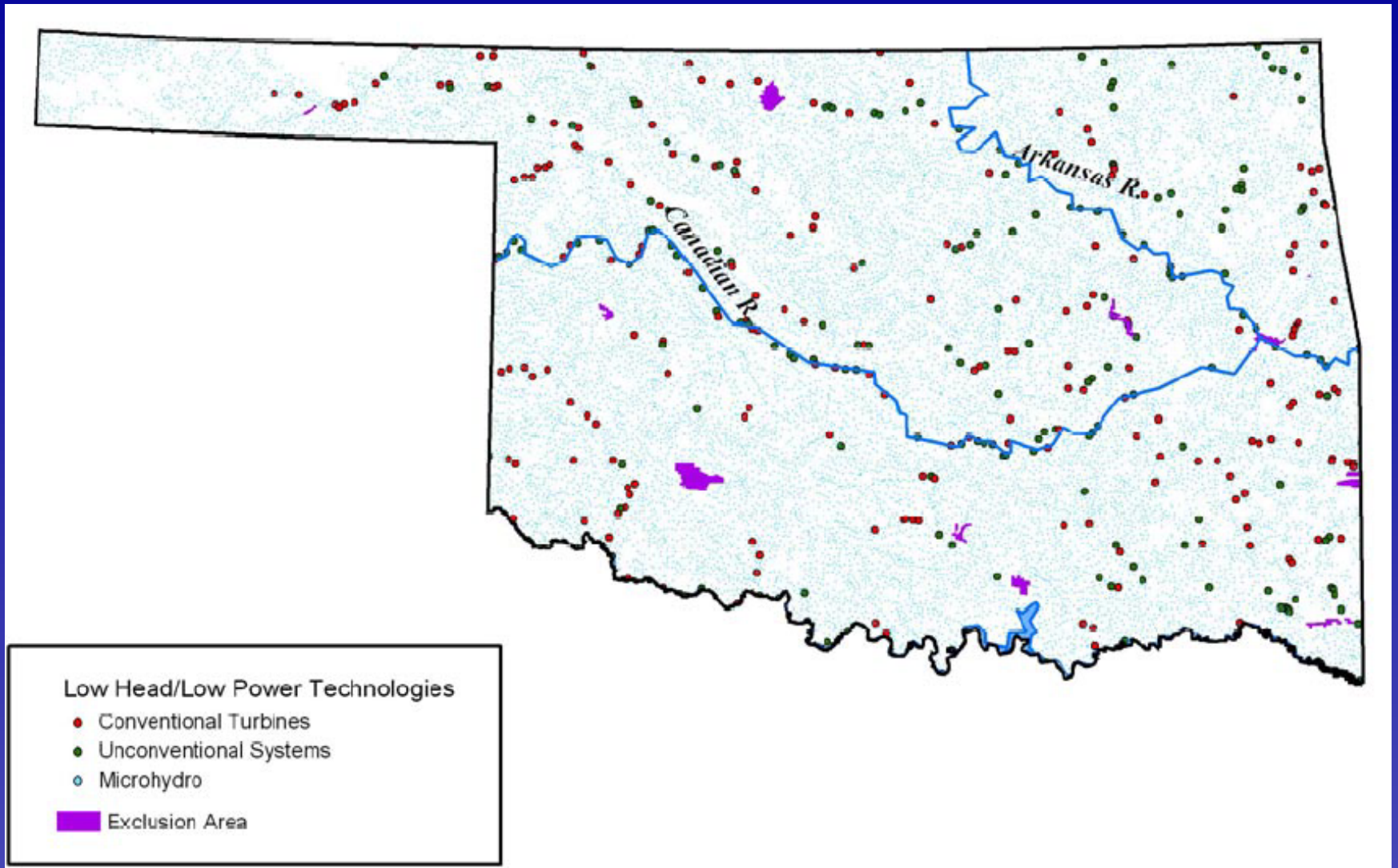


Table B-36. Summary of results of hydropower resource assessment of Oklahoma.

Annual Mean Power (MW)	Total	Developed	Excluded	Available ^a
TOTAL POWER	1,511	239	23	1,249
TOTAL HIGH POWER	725	239	5	481
High Head/High Power	323	239	1	83
Low Head/High Power	402	0	4	398
TOTAL LOW POWER	786	0	18	768
High Head/Low Power	120	0	6	114
Low Head/Low Power	666	0	12	654
Conventional Turbine	286	0	4	282
Unconventional Systems	157	0	5	152
Microhydro	223	0	3	220

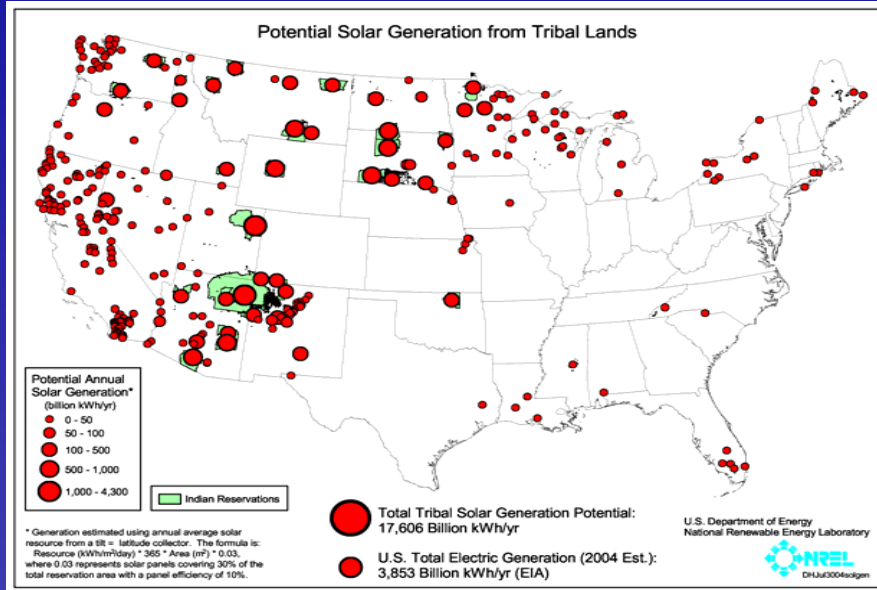
a. No feasibility or availability assessments have been performed. "Available" only indicates net potential after subtracting developed and excluded potentials from total potential.





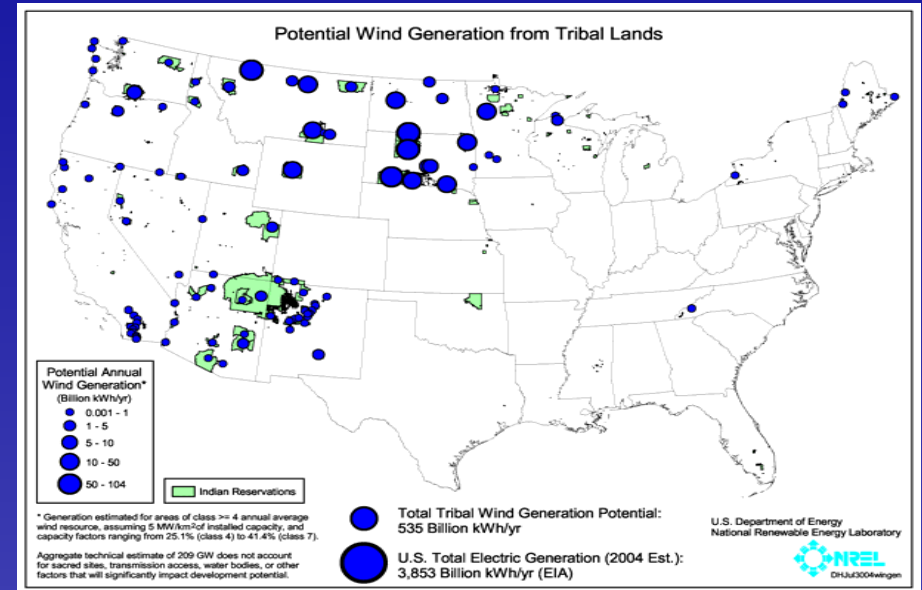
Tribal RE Resources

Solar



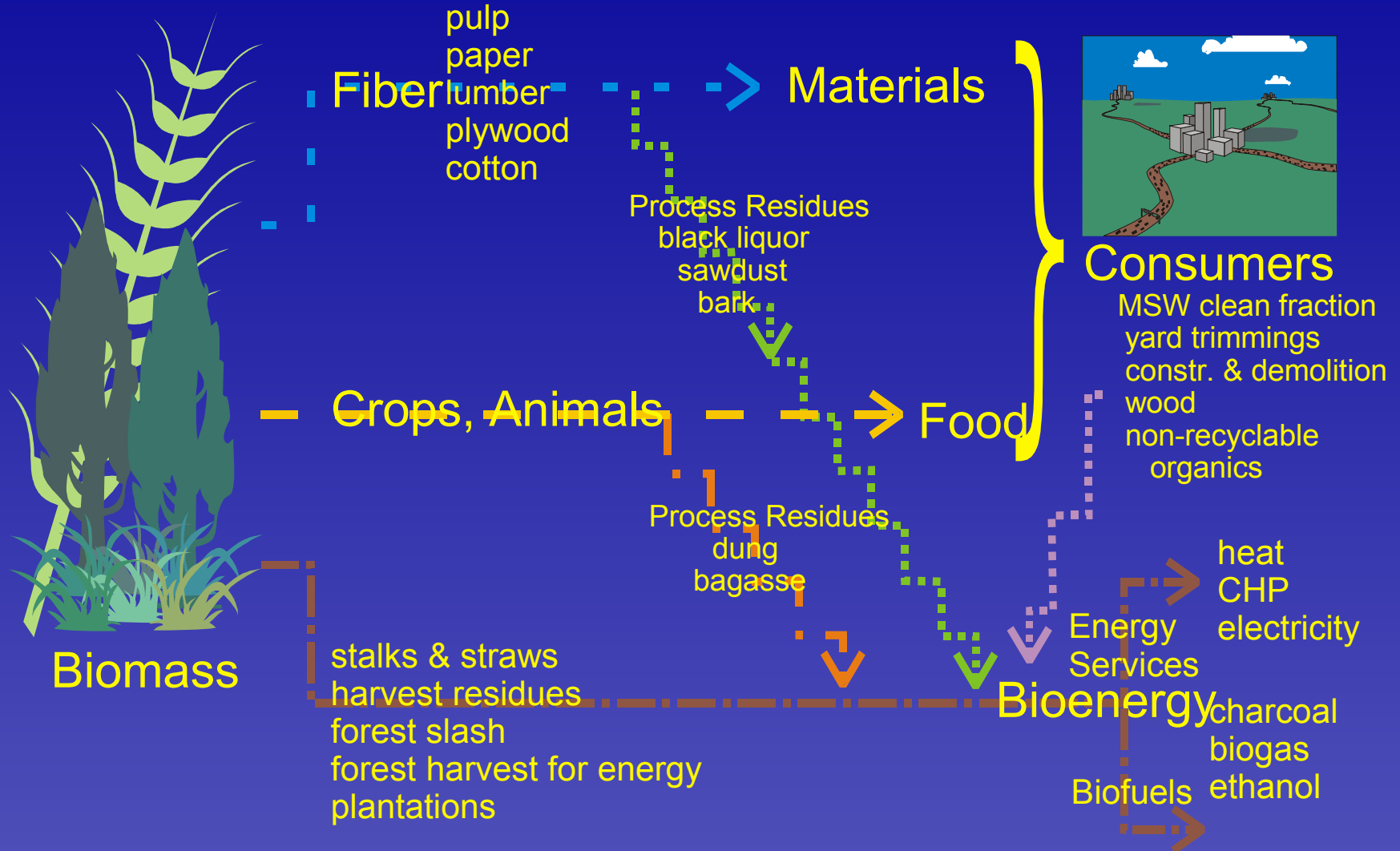
~4.5 times U.S. annual generation

Wind

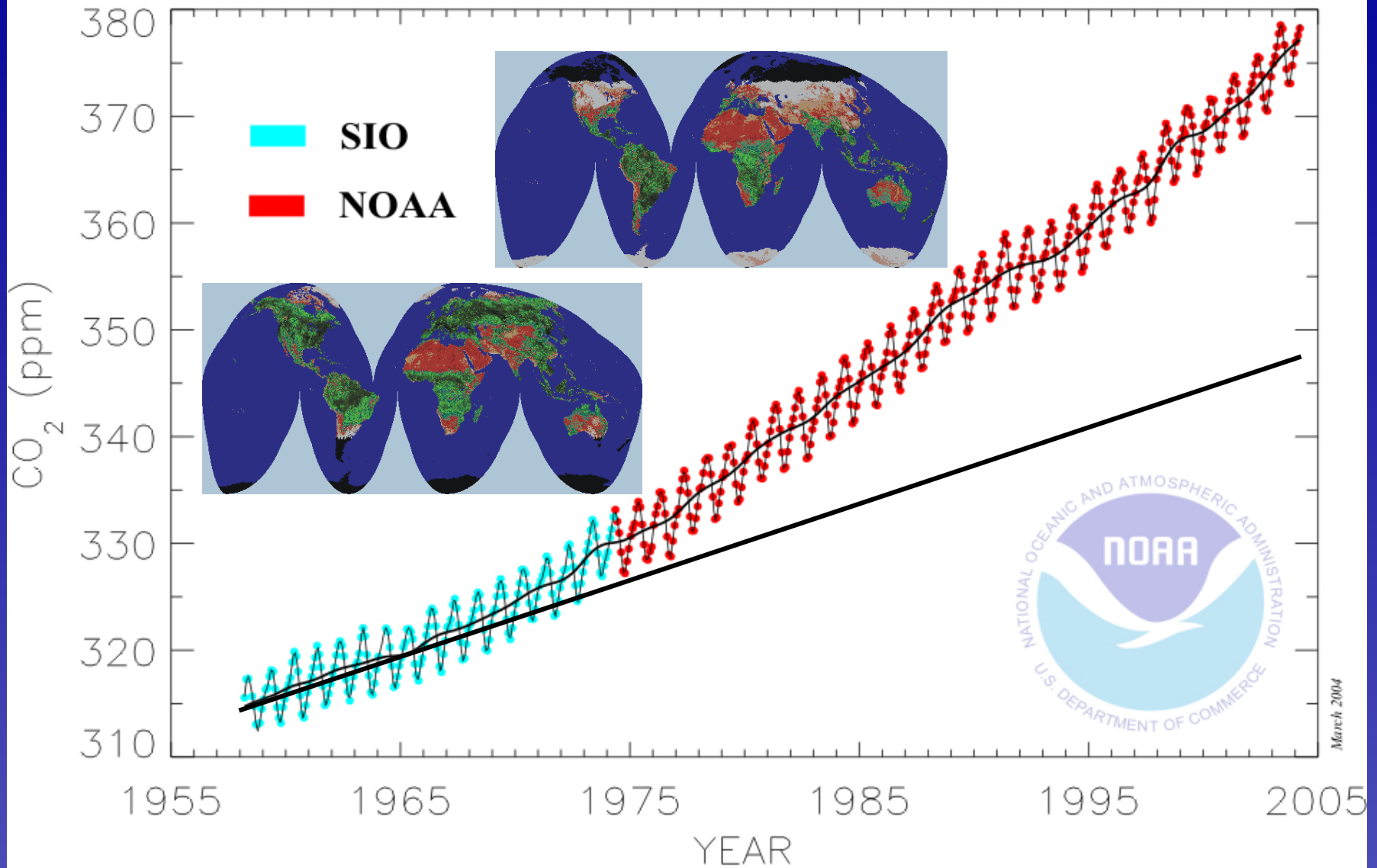


14% of the U.S. annual generation

Biomass & Bioenergy Flows



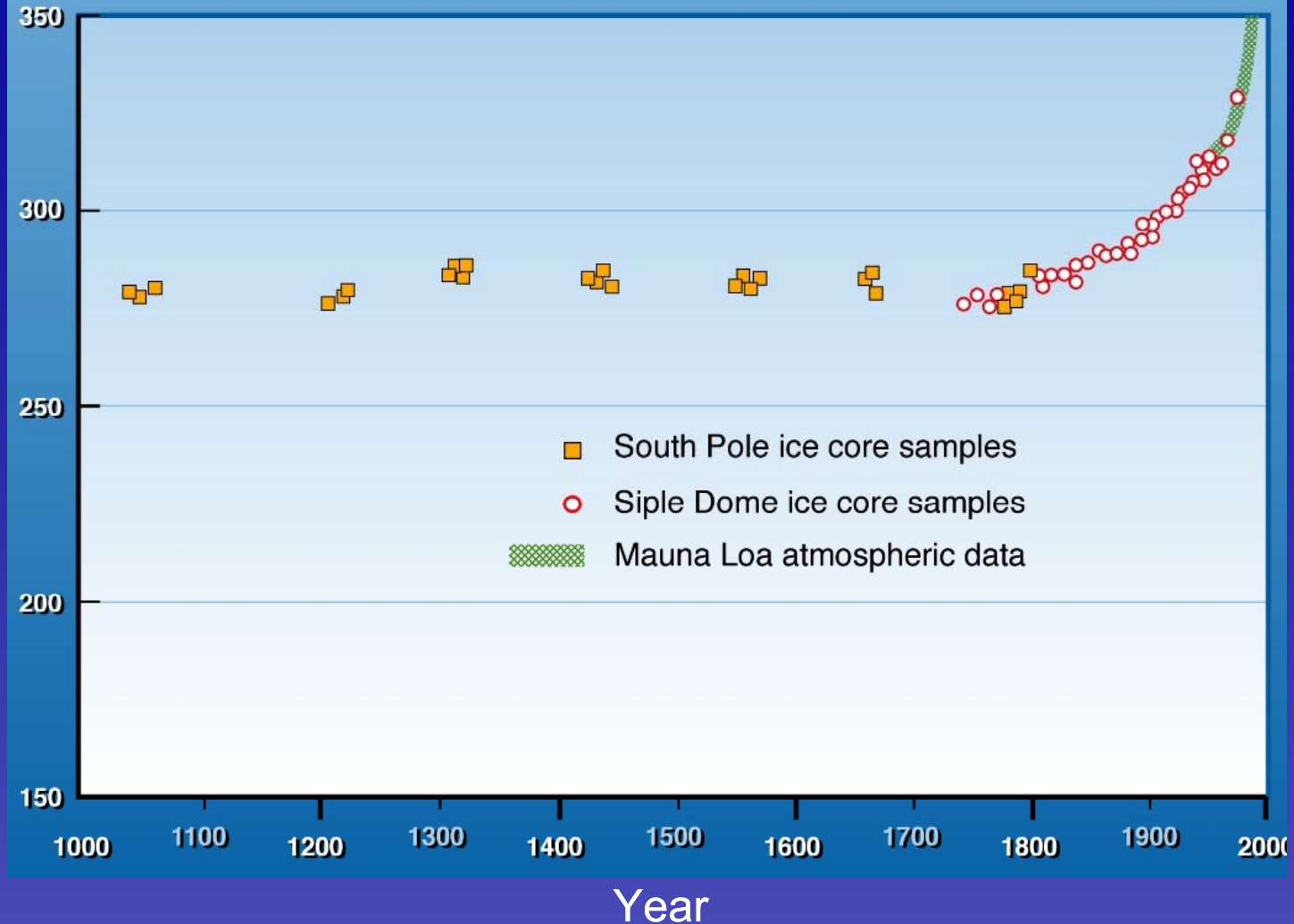
Mauna Loa Monthly Mean Carbon Dioxide



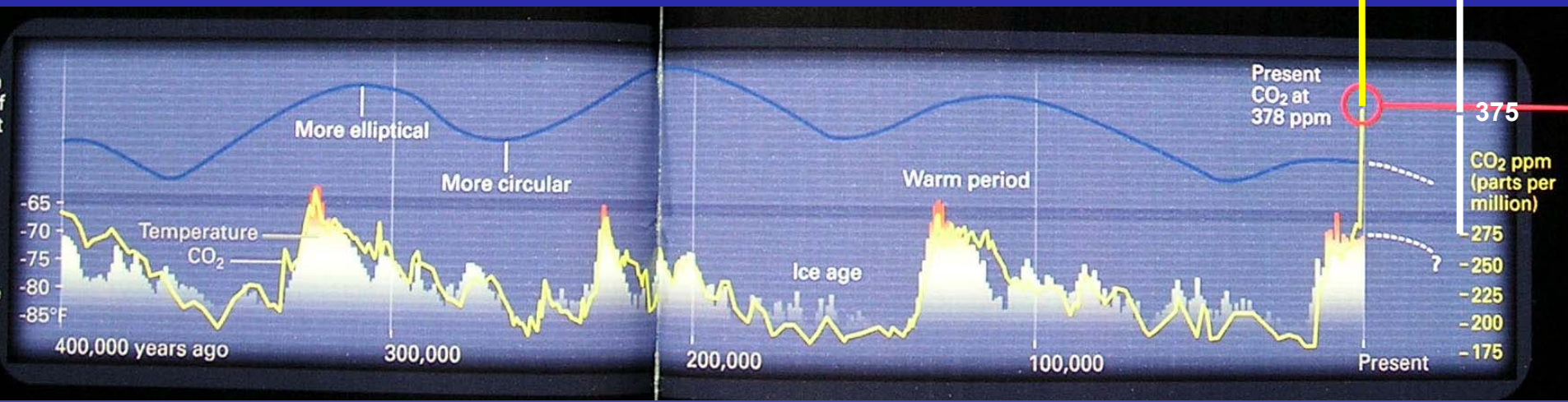
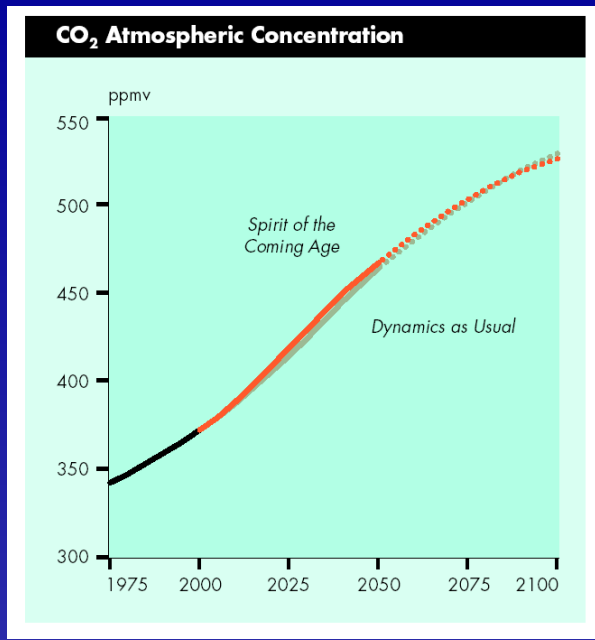
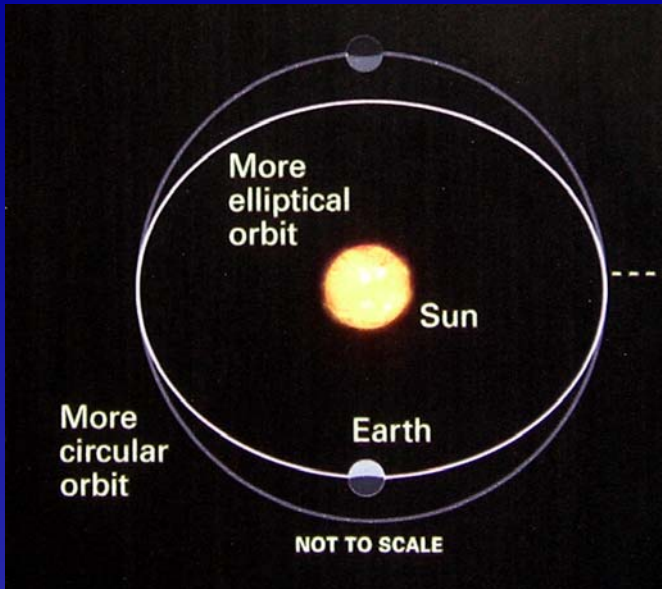
March 2004

CO₂ over the Past 1000 Years

Atmospheric CO₂ Concentration (PPMV)



Source: Adapted from W.M. Post, T.H. Peng, W.R. Emanuel, A.W. King, V.H. Dale, and D. DeAngelis. *American Scientist*, 1990. "The Global Carbon Cycle."

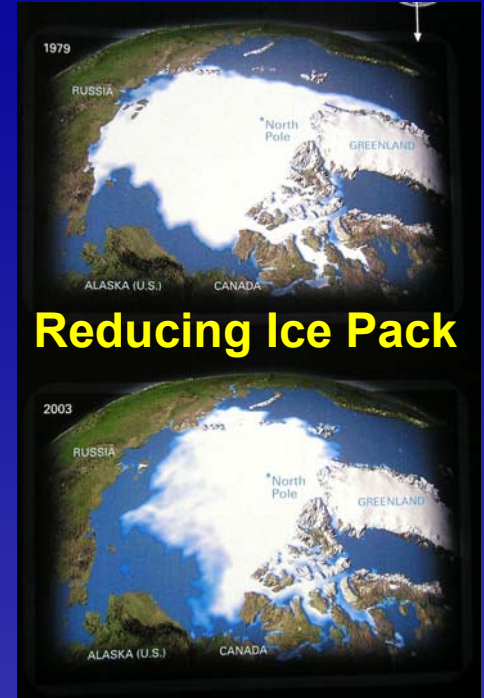
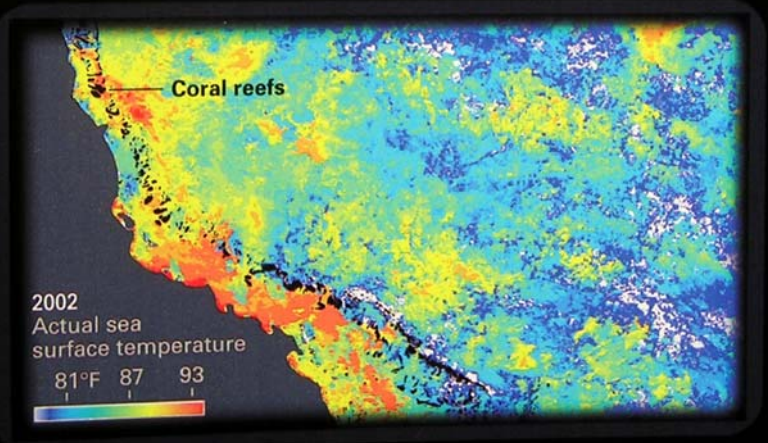
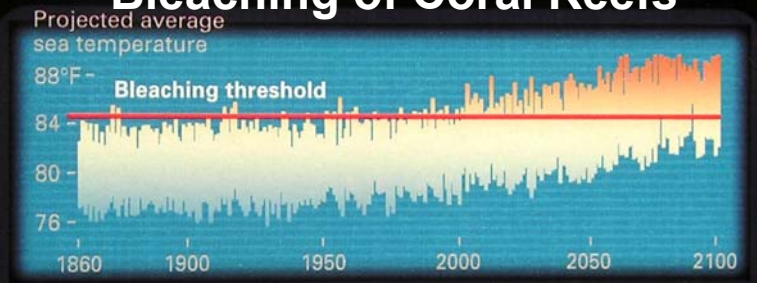


Globally Unprecedented Levels of CO₂

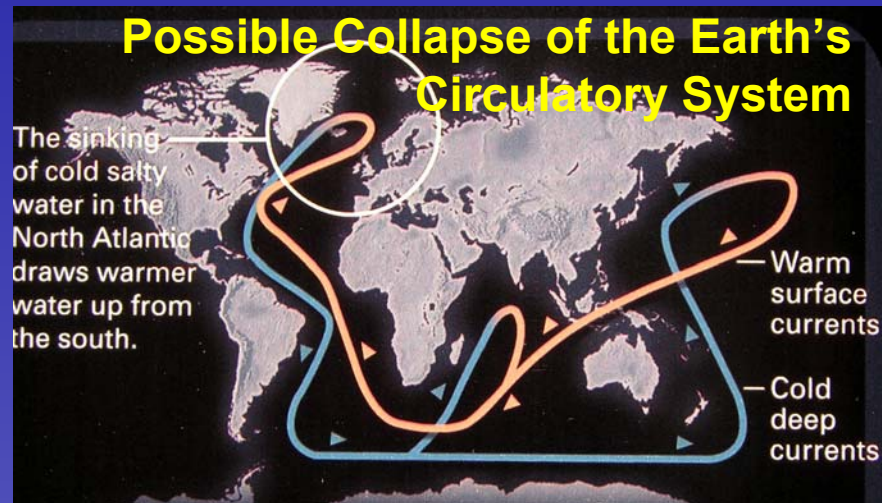
Warming Temperatures

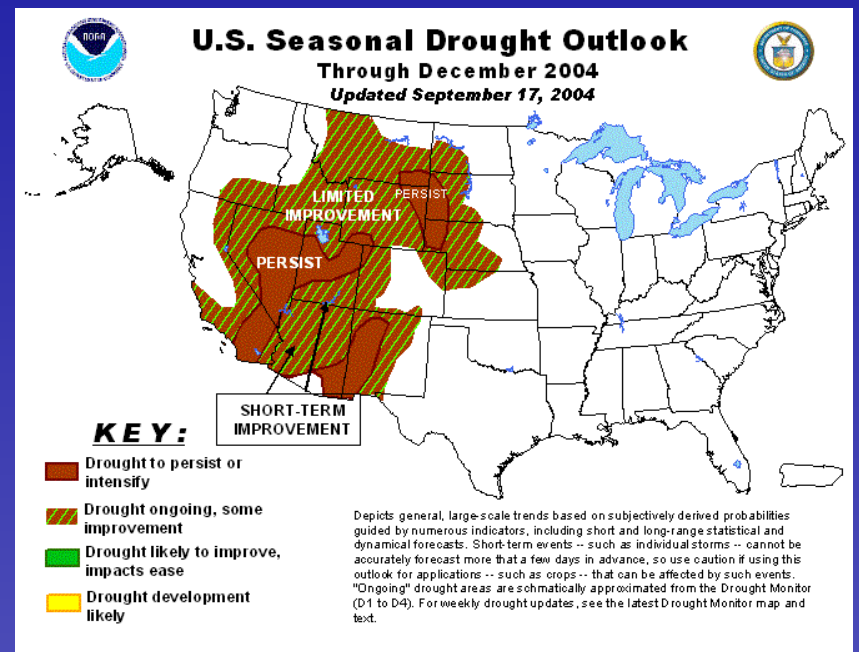
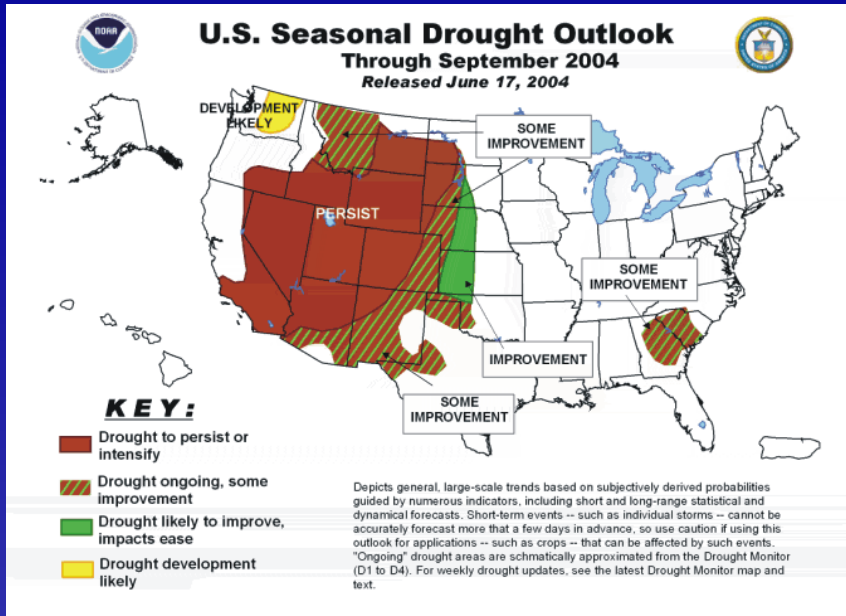


Bleaching of Coral Reefs



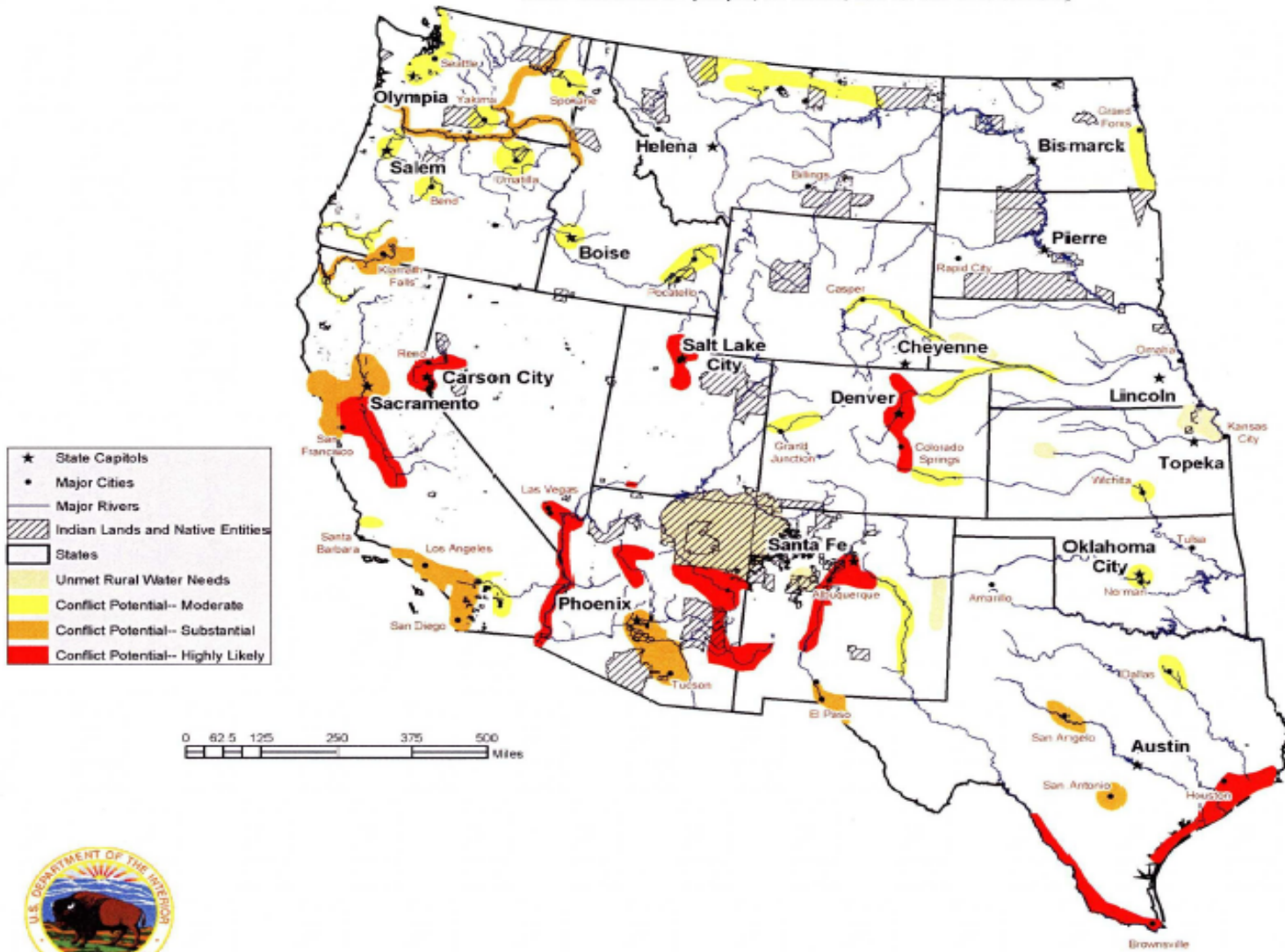
Reducing Ice Pack





Potential Water Supply Crises by 2025

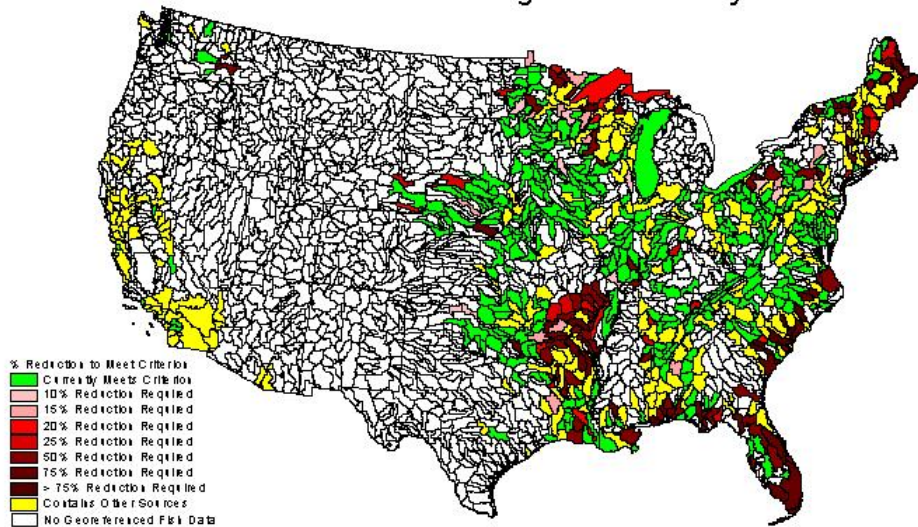
(Areas where existing supplies are not adequate to meet water demands for people, for farms, and for the environment)



Electric Power Research Institute Electricity Technology Roadmap

Stabilizing atmospheric concentrations of CO₂ at 550 ppm (twice the pre-industrial concentration level) would require that 75% of electricity be generated from zero-emitting sources by 2100, and that carbon intensity (Carbon/\$GDP) be no more than 10% of today's value.

Estimated Percent Reductions in Air Deposition Load
Necessary to Meet New Methylmercury Criterion
In Watersheds with No Other Significant Mercury Sources

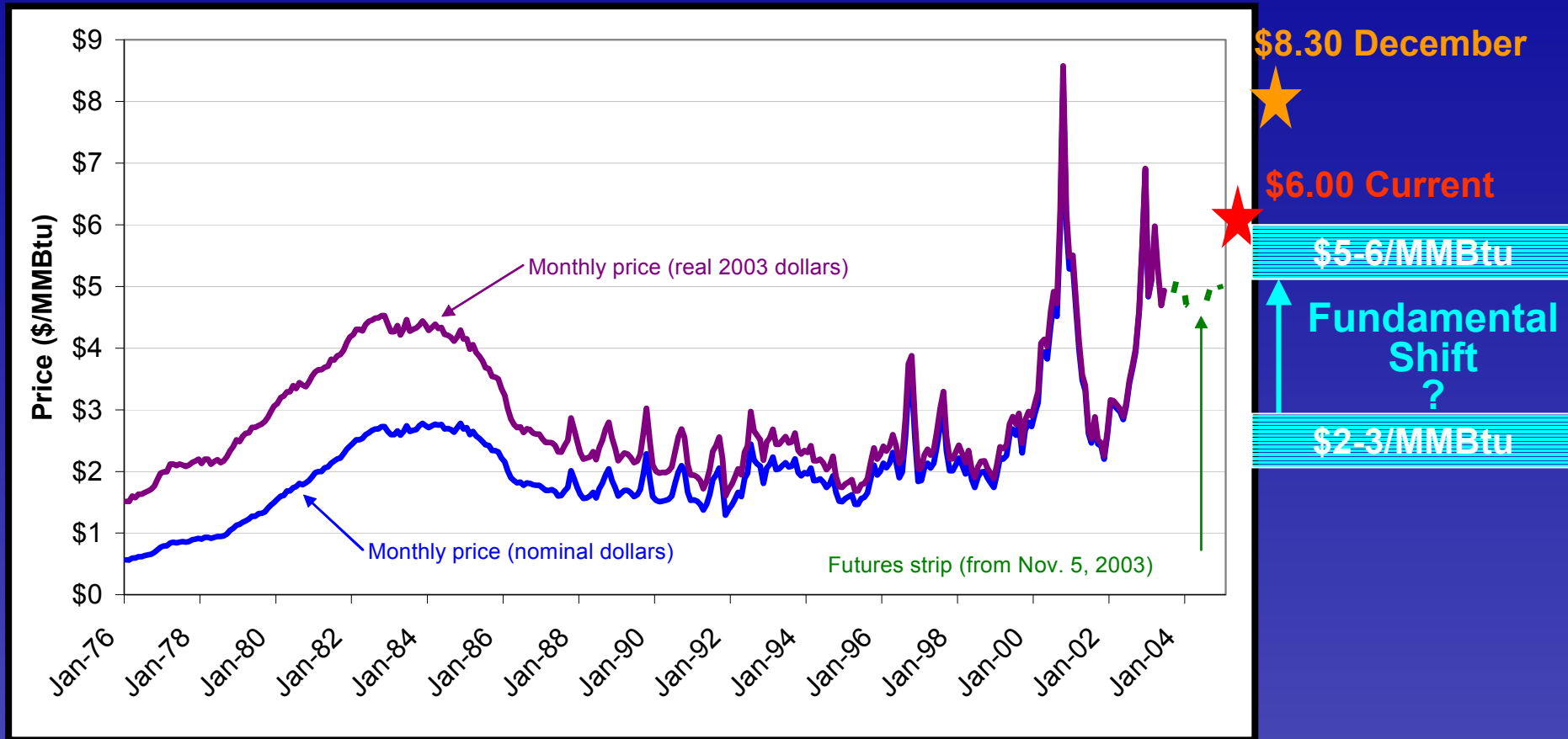


Mercury Contamination of Fish

**Closely correlated with
Power Plant Emissions**



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



Sources: Nymex, EIA and Bureau of Labor Statistics. Data current through May 2003.

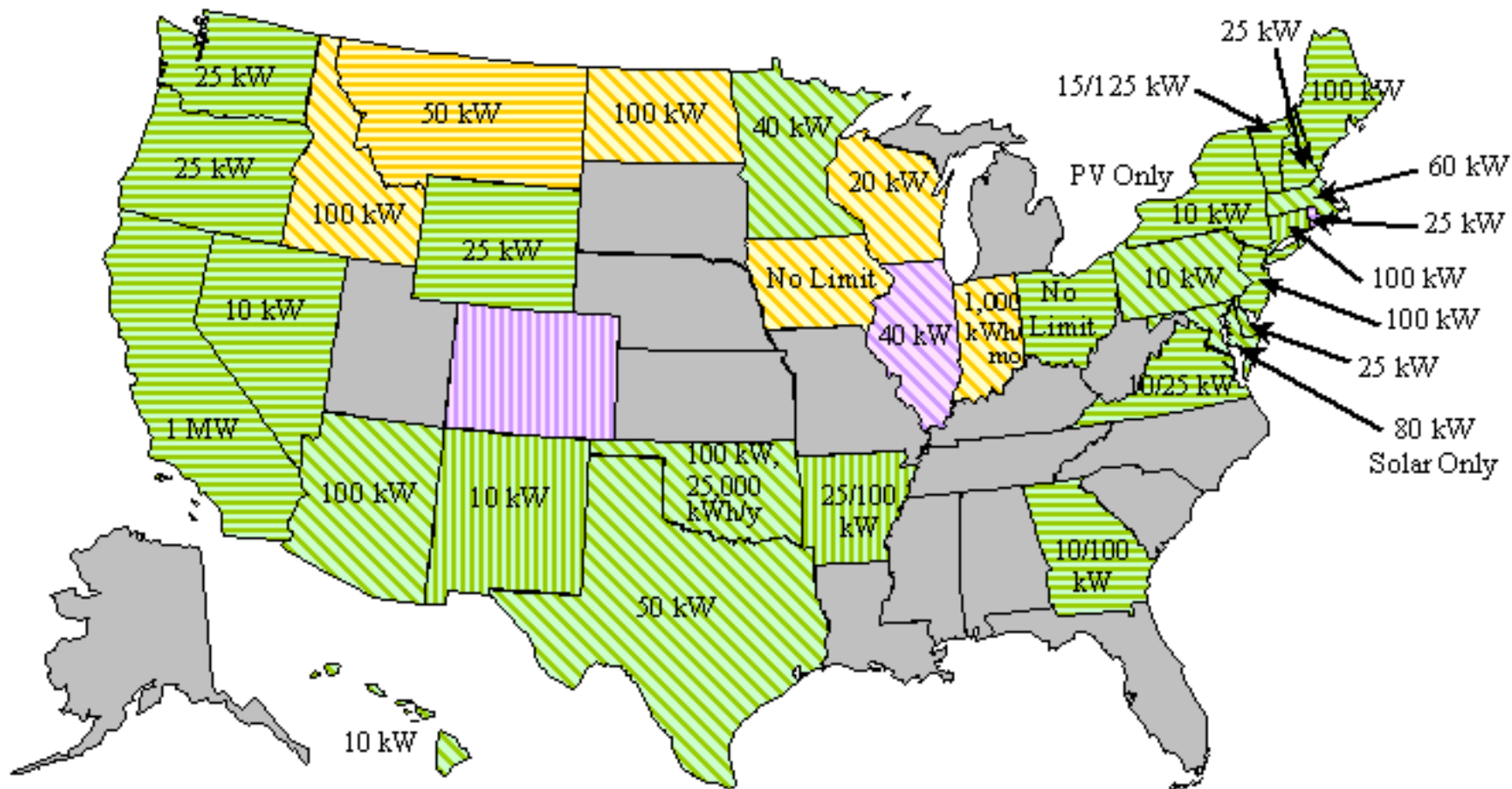
Crude Oil Spot WTI Cushing










— Close

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www.wtrg.com
(479) 293-4081

Net Metering By State



-  Monthly Net Metering
-  Annual Net Metering
-  Varies by Utility or Unknown

-  None
-  Individual Utilities
-  Investor-Owned Utilities Only, Not Rural Cooperatives
-  Investor-Owned Utilities and Rural Cooperatives

Revised: 9 Jan 02

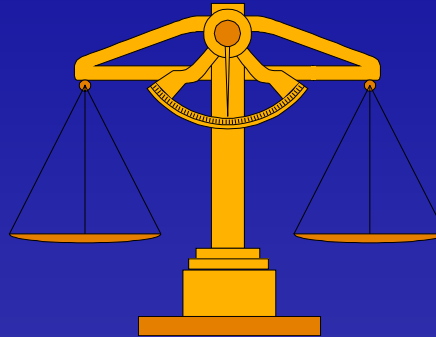
Energy Security & Sovereignty Through Local Self-Sufficiency

Interdependence

“We’re all in this together.”

National Grid
Oil Imports
Air Pollution
Water Contamination
Shrinking Planet
Agro-Industry

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



Independence

Self sufficiency

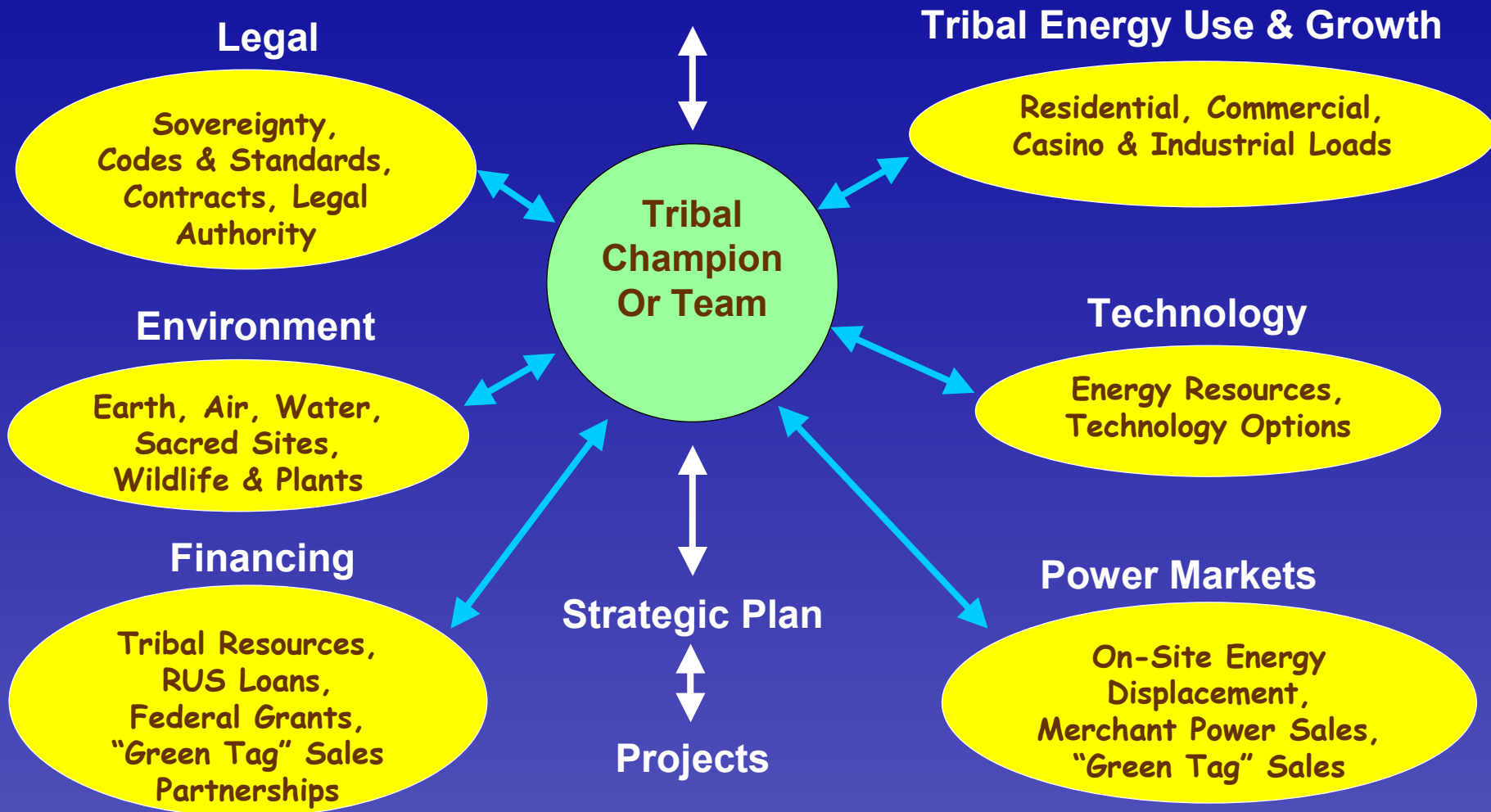
Local Community
Food (Earth)
Air
Energy (Fire)
Water

Community of Cooperation

“Share and share alike.”

The Tribal Energy Development Challenge

Tribal Council



Progressive Partnerships

For Rural Economic Development and Local Self Sufficiency

Interdependence

Information Sharing
Business Development
Economic & Financial Equity
Quality of Life for All
Survival of the Planet



Independence

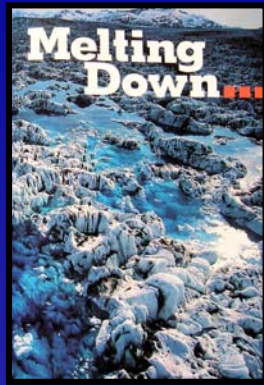
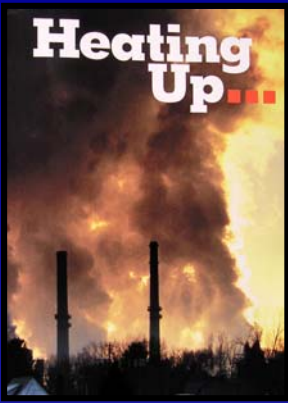
Tribal Capacity Building
On-site Production
Local Cultural Integration
Local Quality of Life
Local Pride



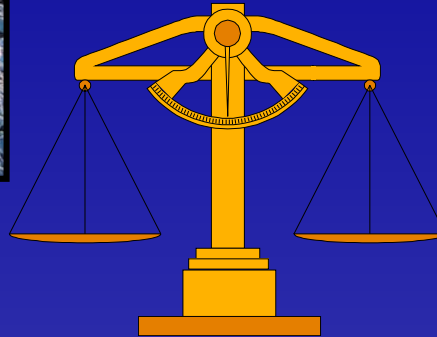
**If
Planet
Earth...**

**were
the size
of an Apple,**

**Then her life-giving atmosphere
would be thinner than an Apple's peel!**



Interdependence



Independence

