

Innovation for Our Energy Future

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

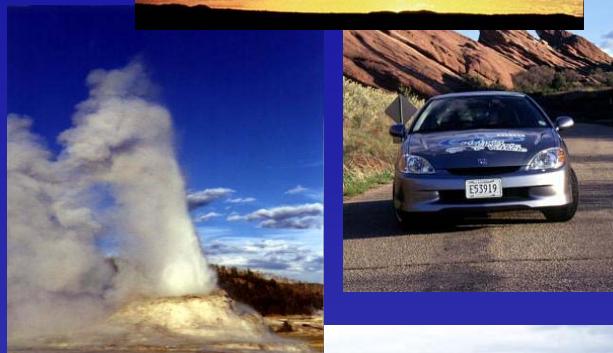
Biofuels

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

 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

About the Program
TEP Program Background
How We're Organized

Contact Us

Funding Opportunities

Projects on Tribal Lands
Title XVI (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

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](#).

Tribal Energy Guide

 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

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

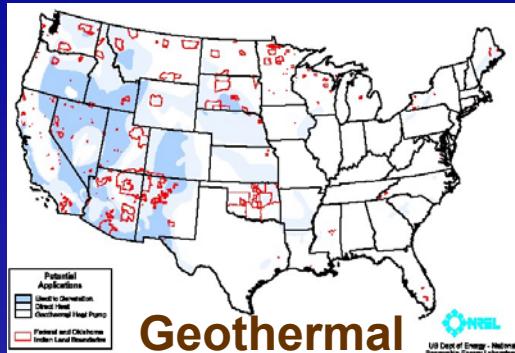
Costs of Electricity with and without External Costs

New Generation in ¢/kWh

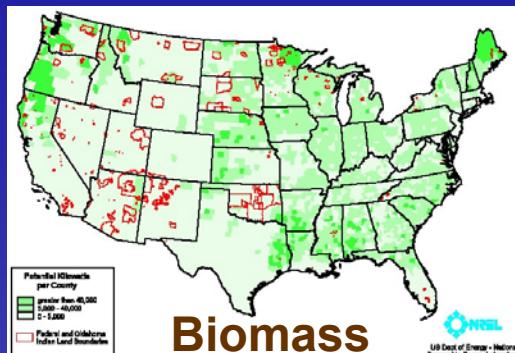
Electricity Source	Generating Costs	External Costs	Total Costs
Hydropower	2.4-7.7	0-1	2.4-8.7
Wind	4.0-6.0	0.05-0.25	4.05-6.25
Natural Gas	3.4-5.0	1-4	4.4-9.0
Coal/lignite	4.3-4.8	2-15	6.3-19.9
Biomass	7-9	1-3	8-12
Nuclear	10-14	0.2-0.7	10.2-14.7
Photovoltaics	25-50	0.6	25.6-50.6

Worldwatch: State of the World 2003

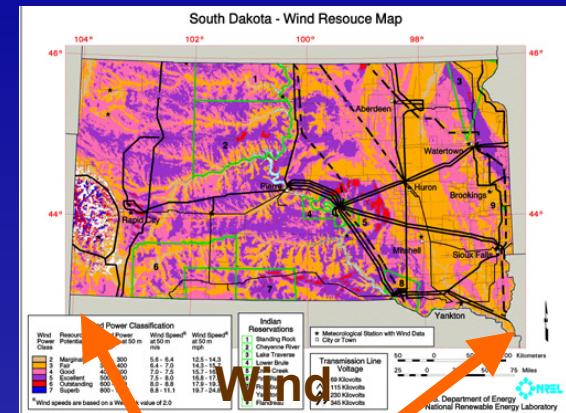
New Energy Options



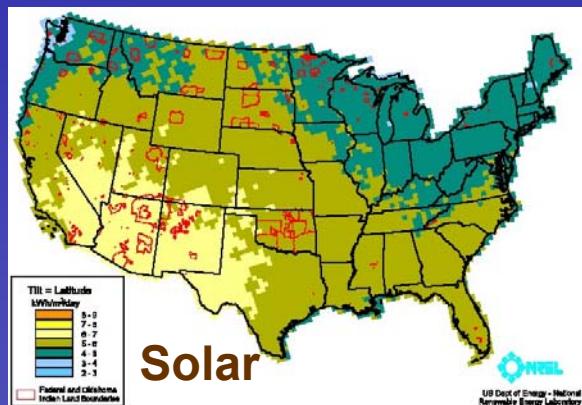
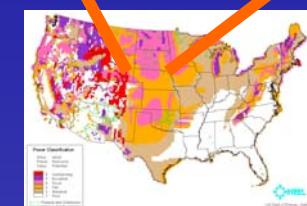
Geothermal



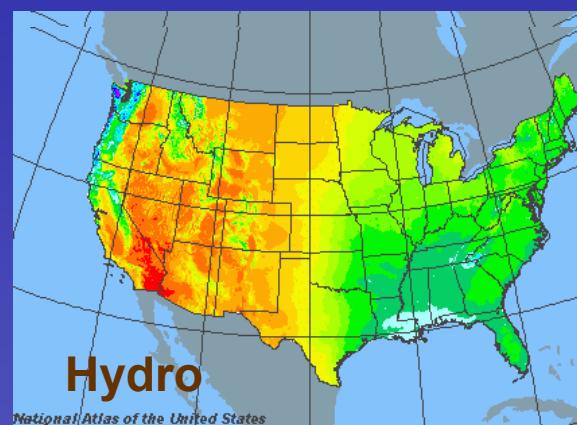
Biomass



Wind

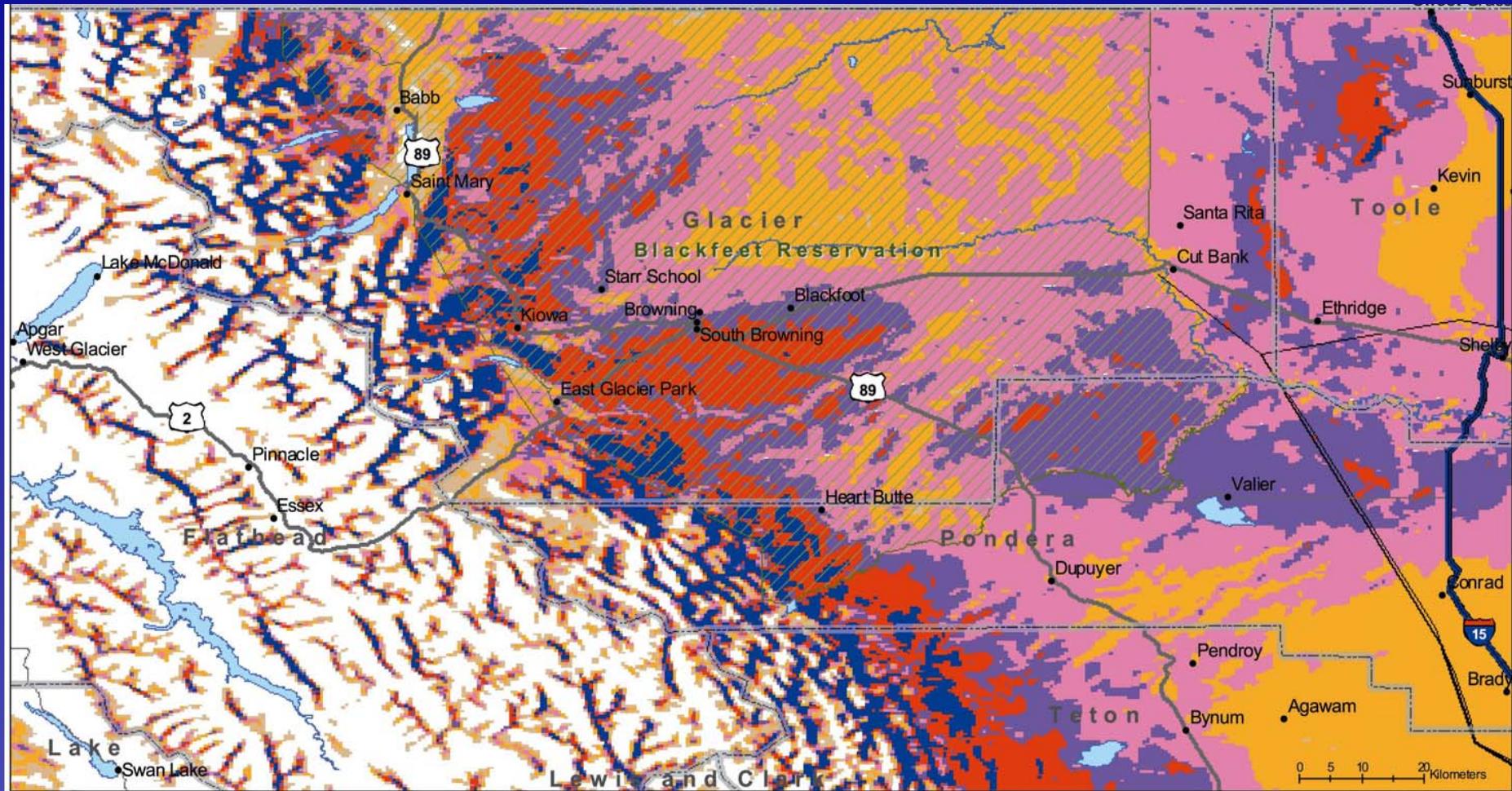


Solar



Hydro

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

2 - Marginal

3 - Fair

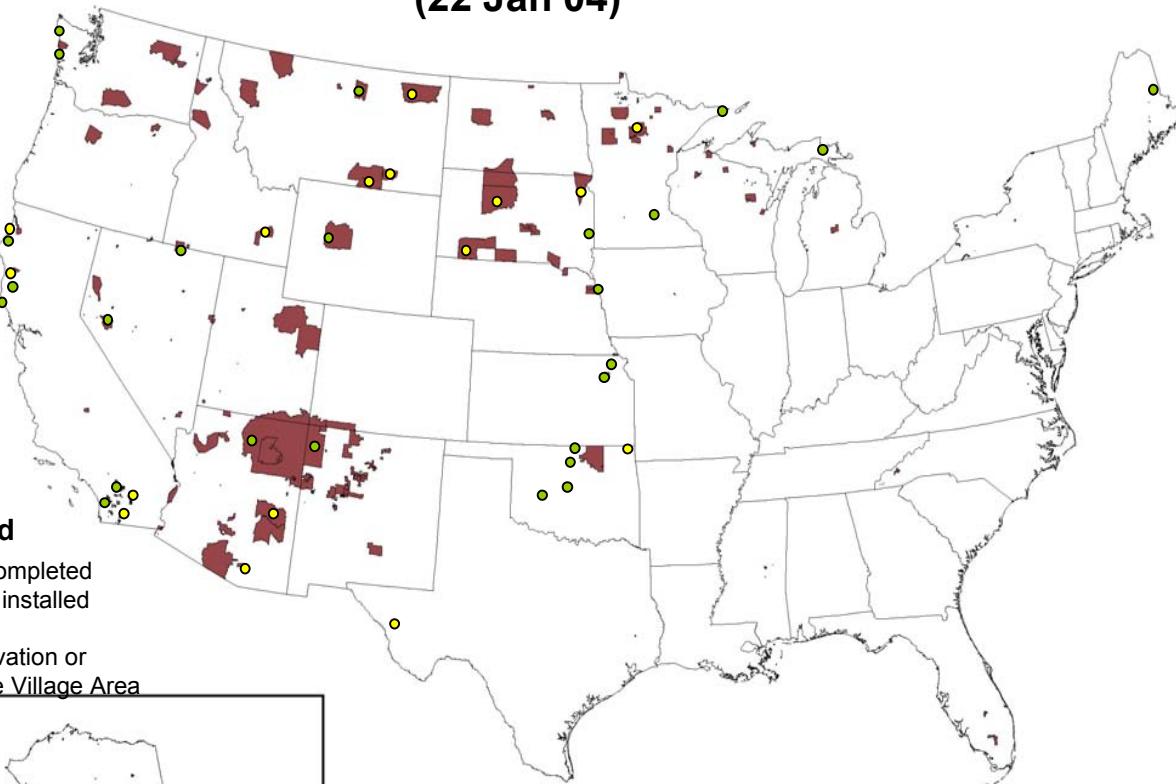
4 - Good

5 - Excellent

6 - Outstanding

7 - Superb

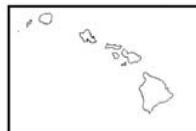
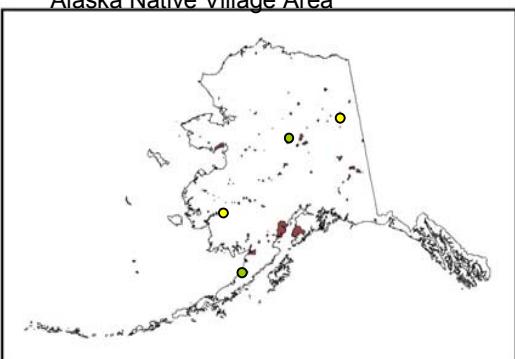
NREL Native American Anemometer Loan Program Installation Sites (22 Jan 04)



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

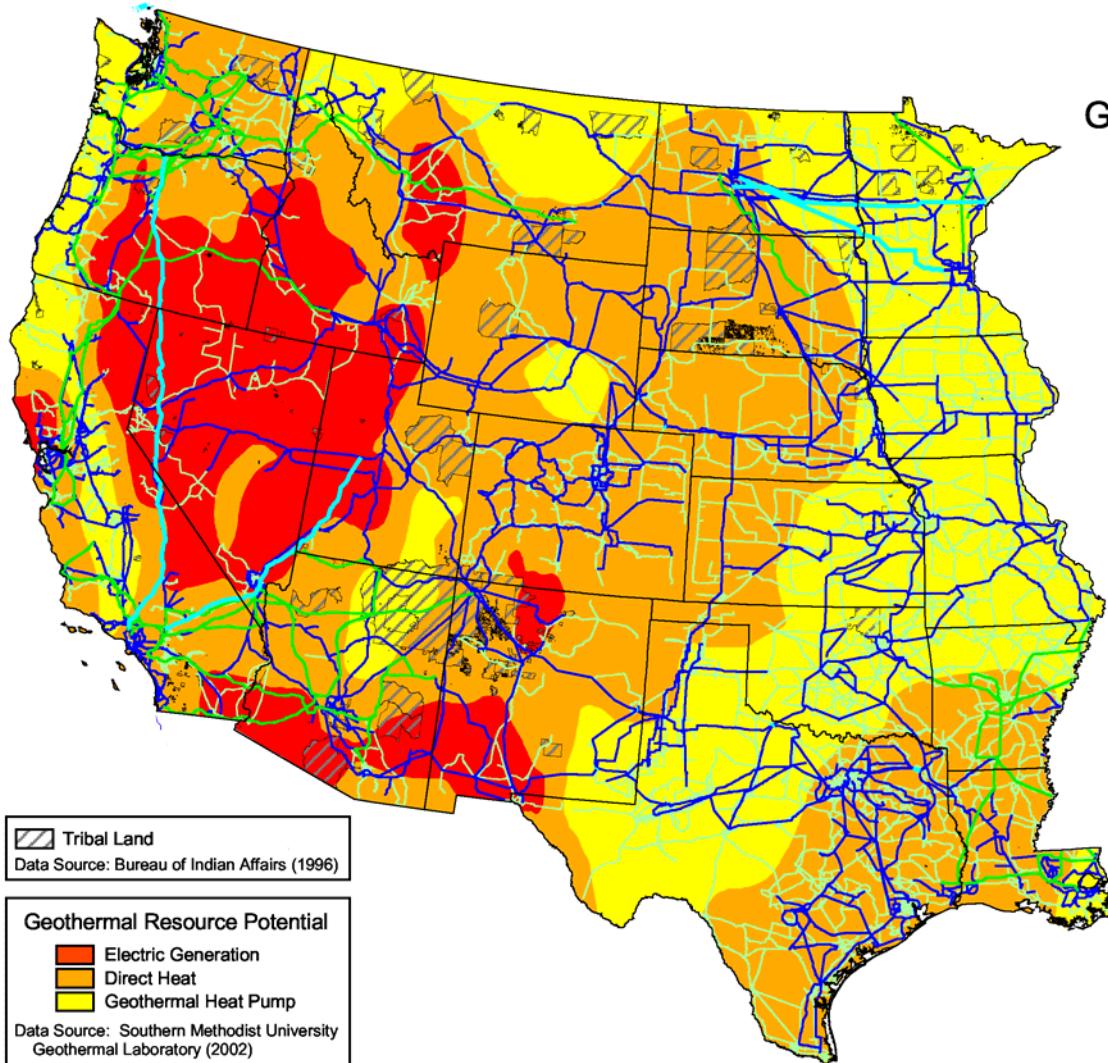
Houlton Maliseet - ME
Iowa Tribe of Oklahoma - OK
Robinson Rancheria - CA
Shakopee Mdewakan - MN
Shoshone-Bannock - ID
Ugashik Traditional Village - AK
Soboba Band of Luiseno Indians - CA
Tanana Village - AK
Walker River Paiute - NV
Winnebago Tribe of Nebraska - IA
Kaw Nation - OK
Flandreau Sioux - SD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

Transmission Line*
Voltage

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

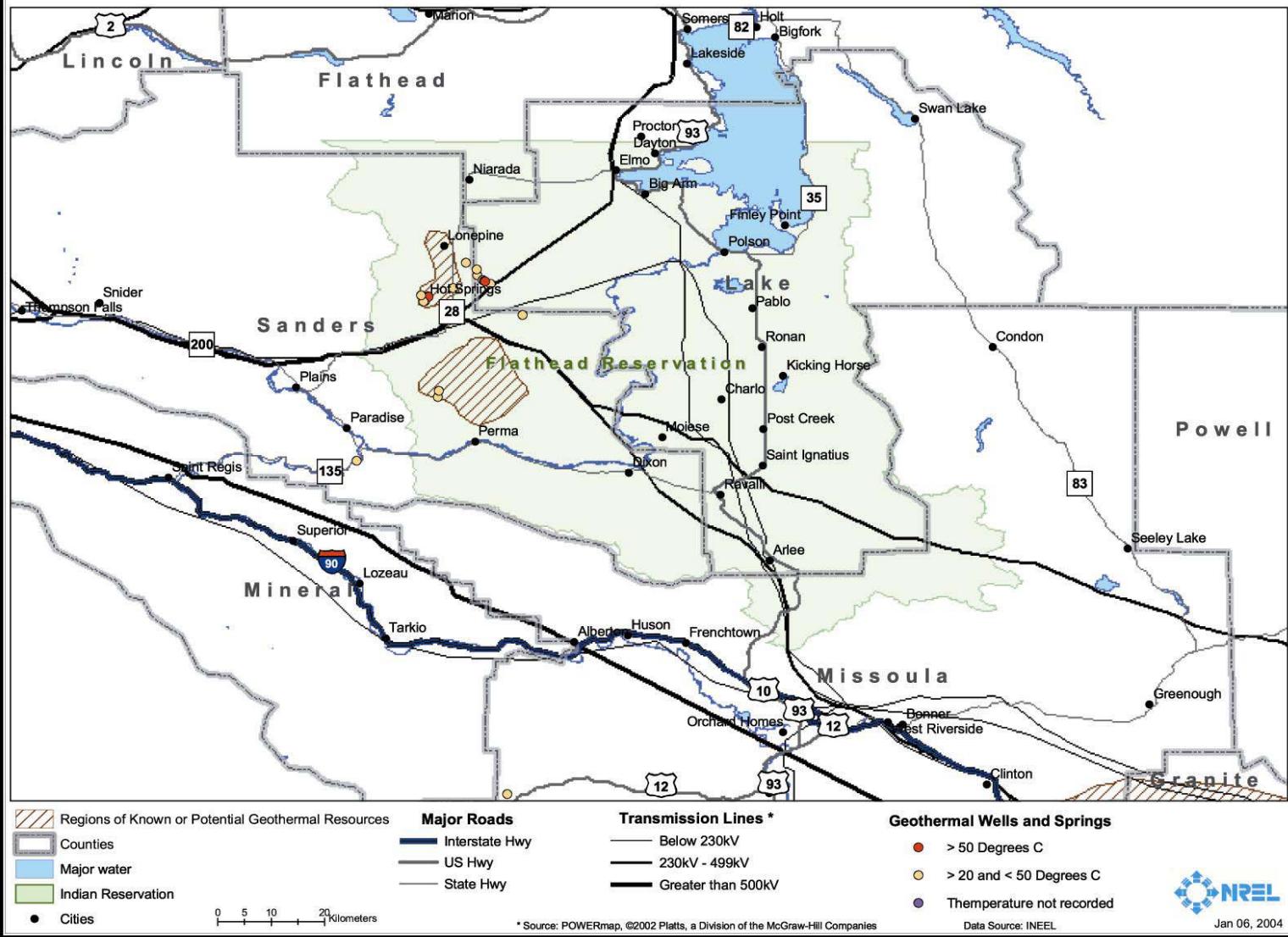
Data Source: PowerMap,
© 2002 Platts, a division
of the McGraw-Hill Cos.

U.S. Department of Energy
National Renewable Energy Laboratory

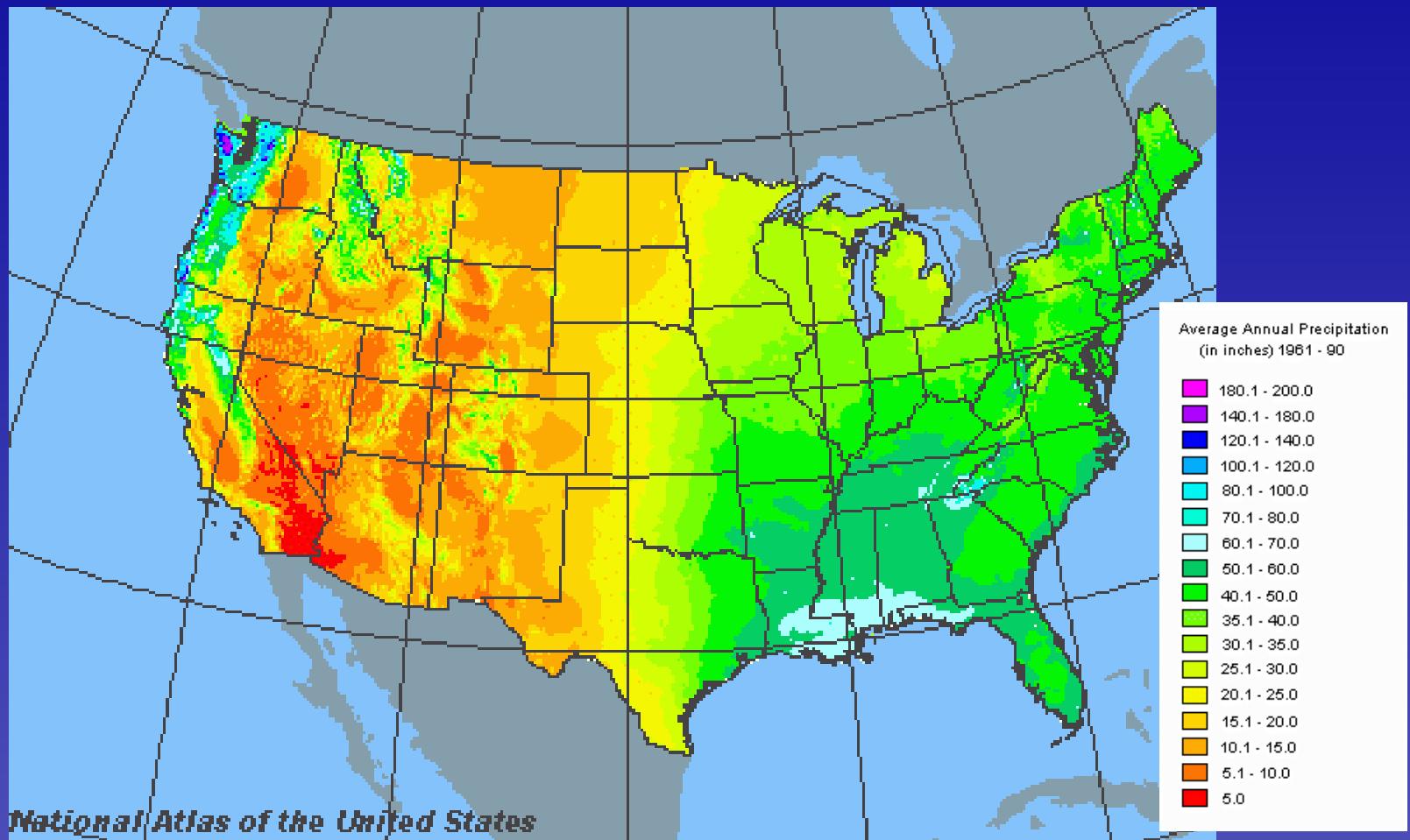


27-OCT-2003 1.1.7

Flathead Reservation - Montana



Hydropower Resource



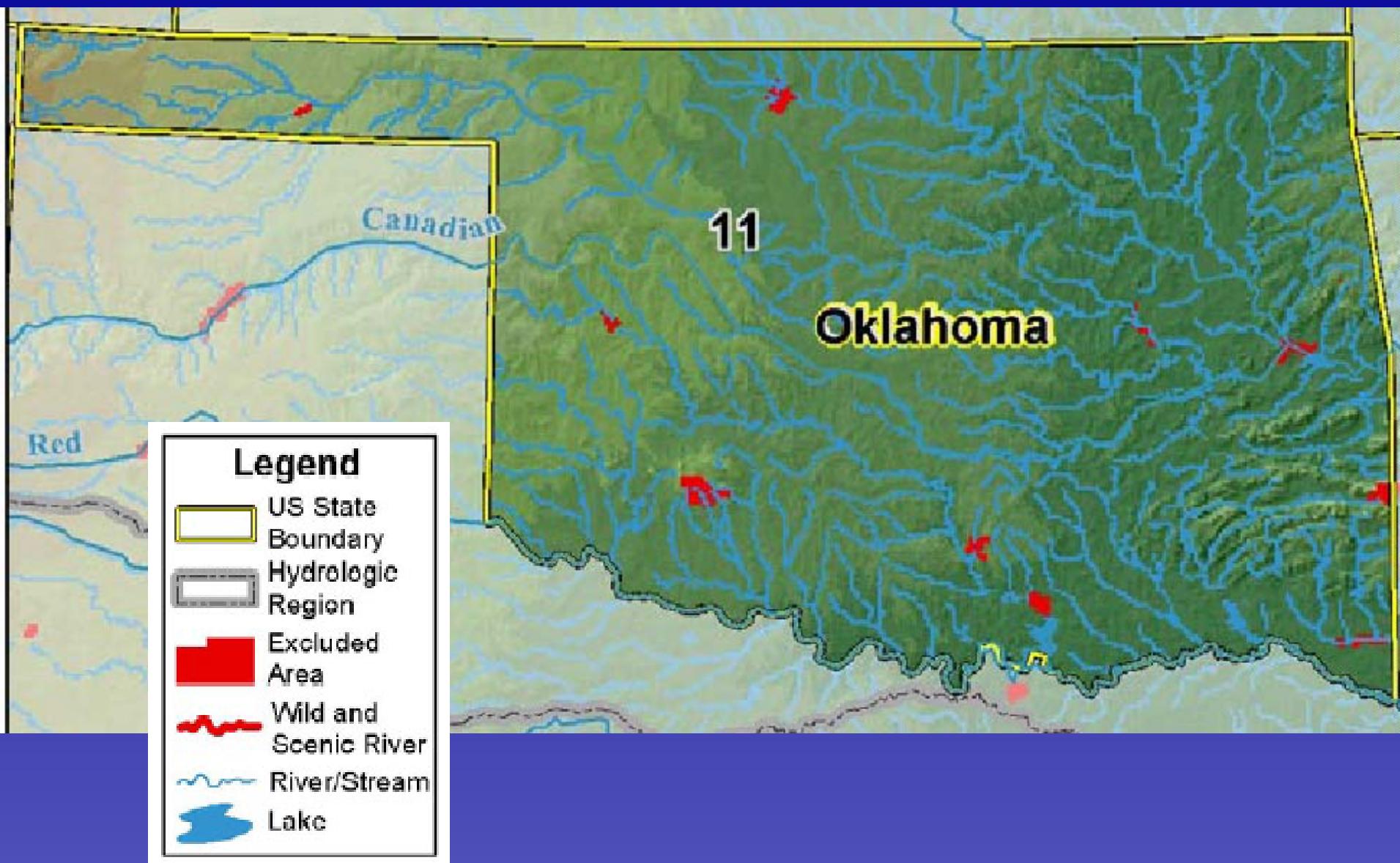
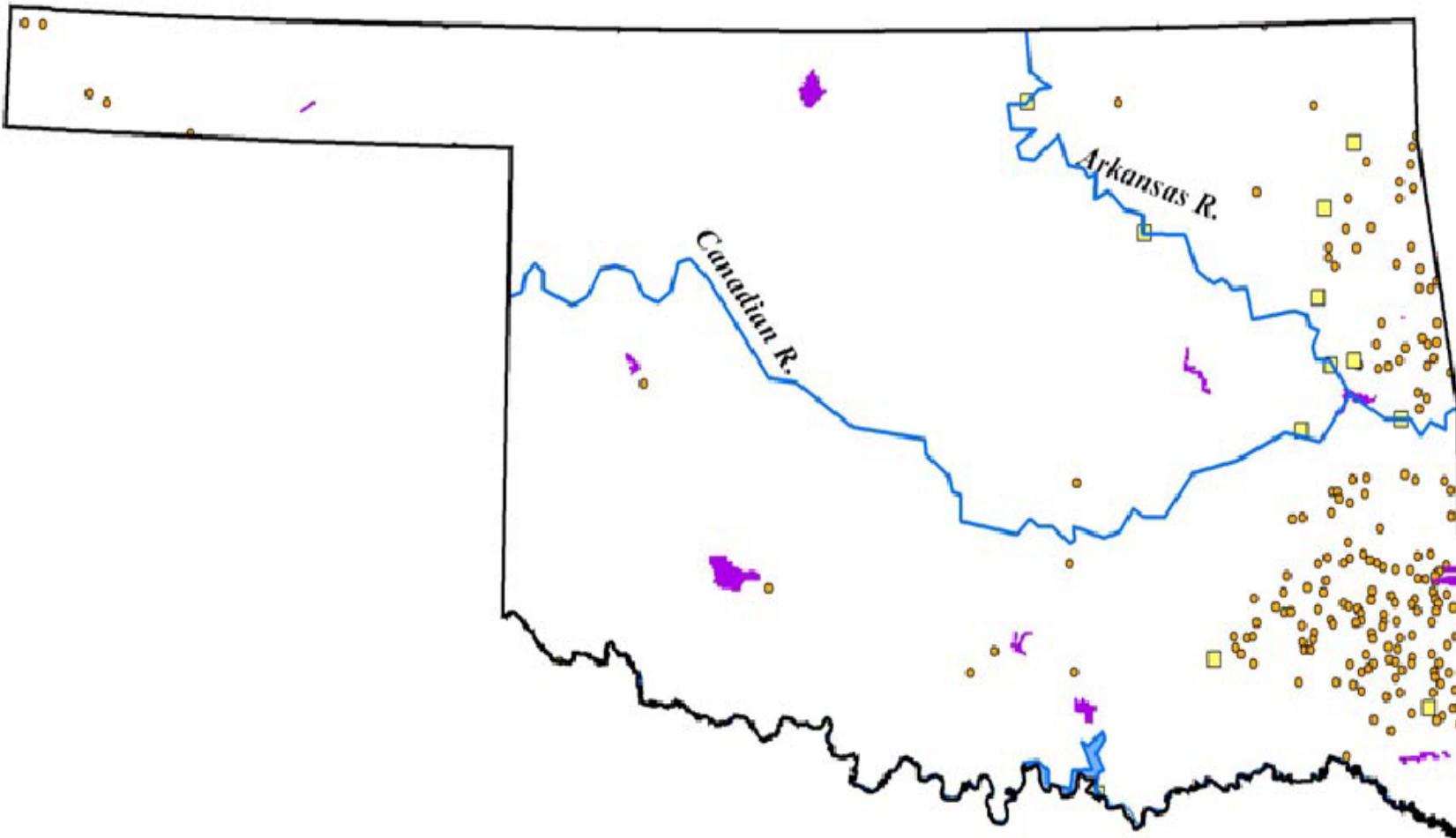


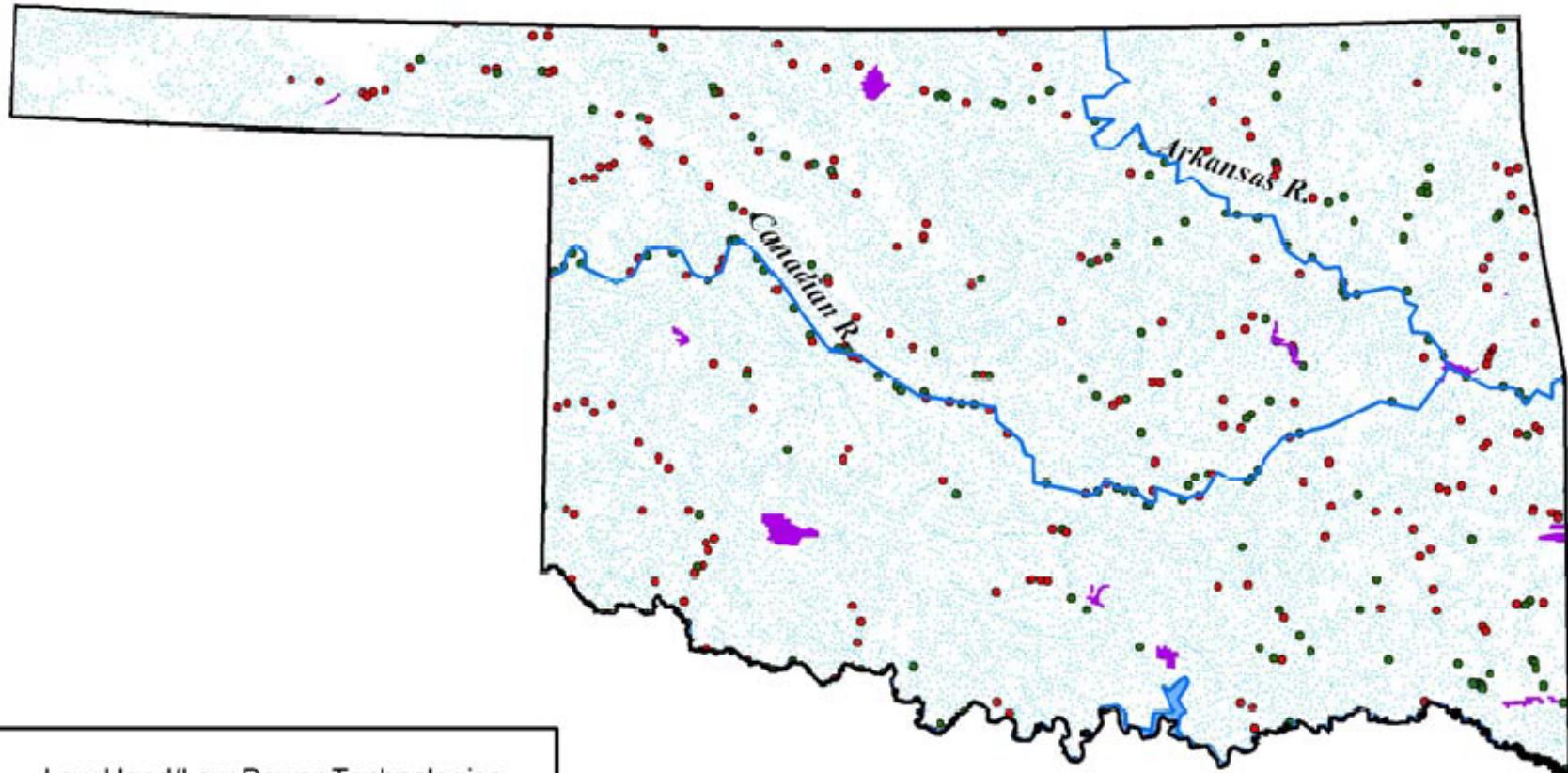
Table B-36. Summary of results of hydropower resource assessment of Oklahoma.

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.



- High Head / Low Power
- Existing Hydroelectric Plant
- Exclusion Area



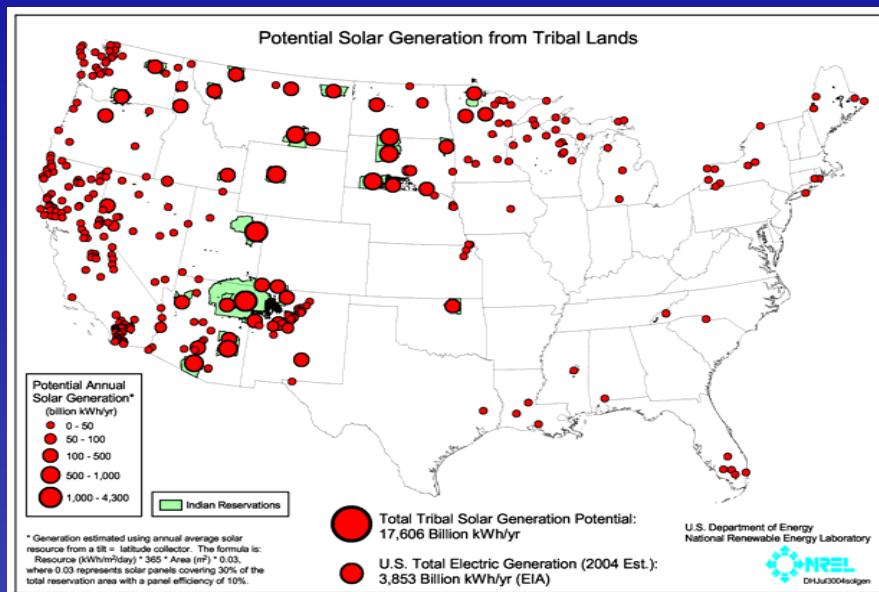
Low Head/Low Power Technologies

- Conventional Turbines
- Unconventional Systems
- Microhydro

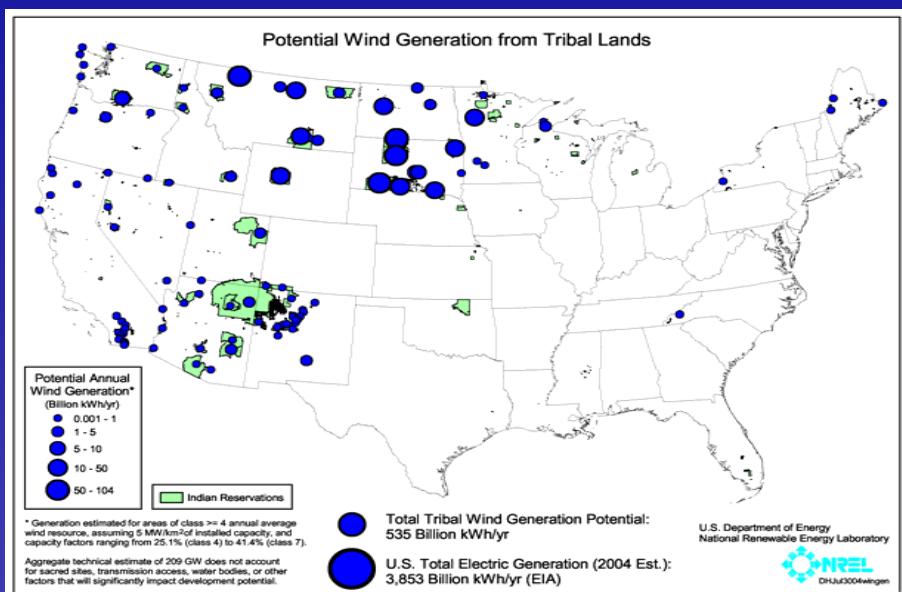
 Exclusion Area

Tribal RE Resources

Solar



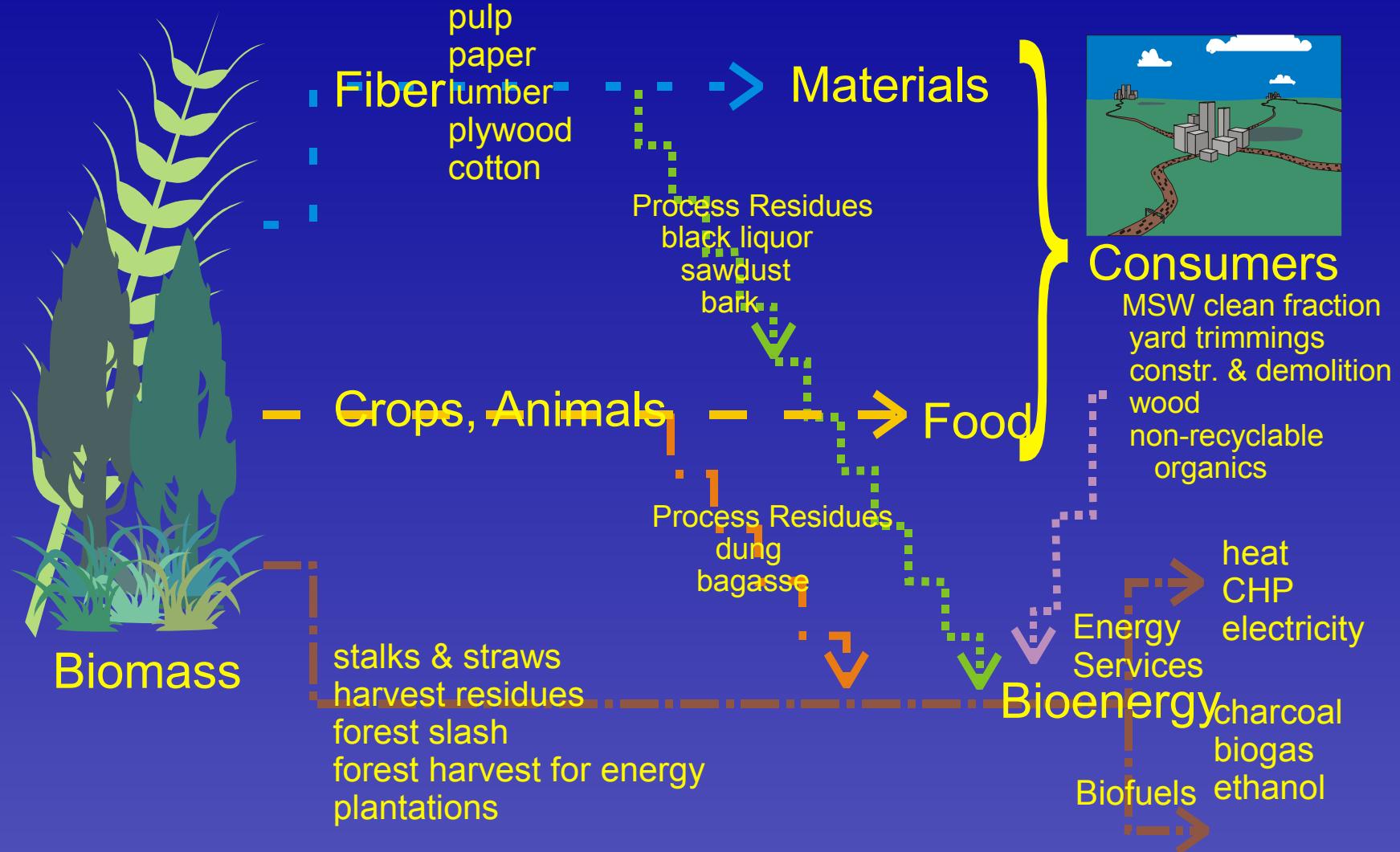
Wind



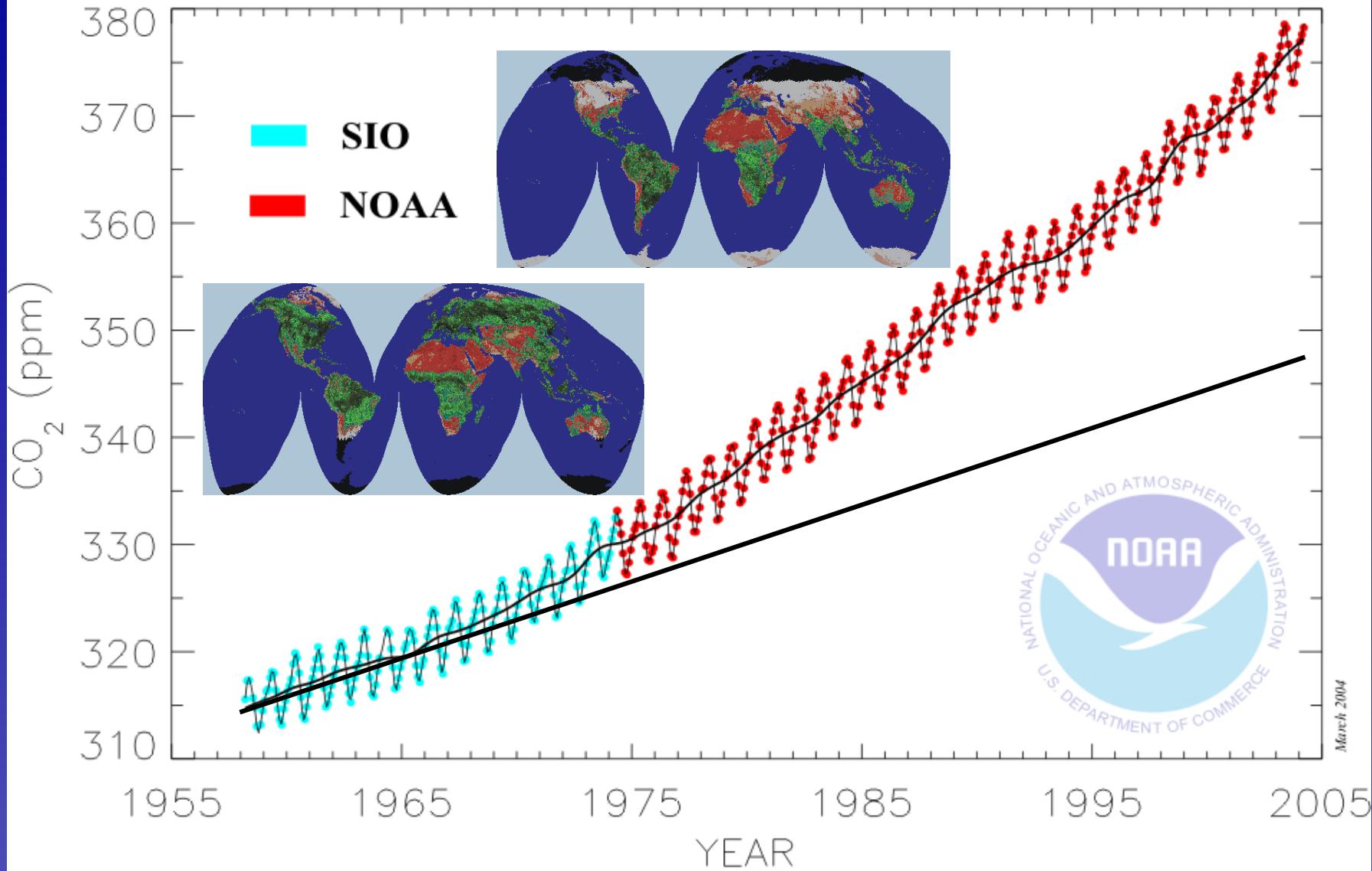
~4.5 times U.S. annual generation

14% of the U.S. annual generation

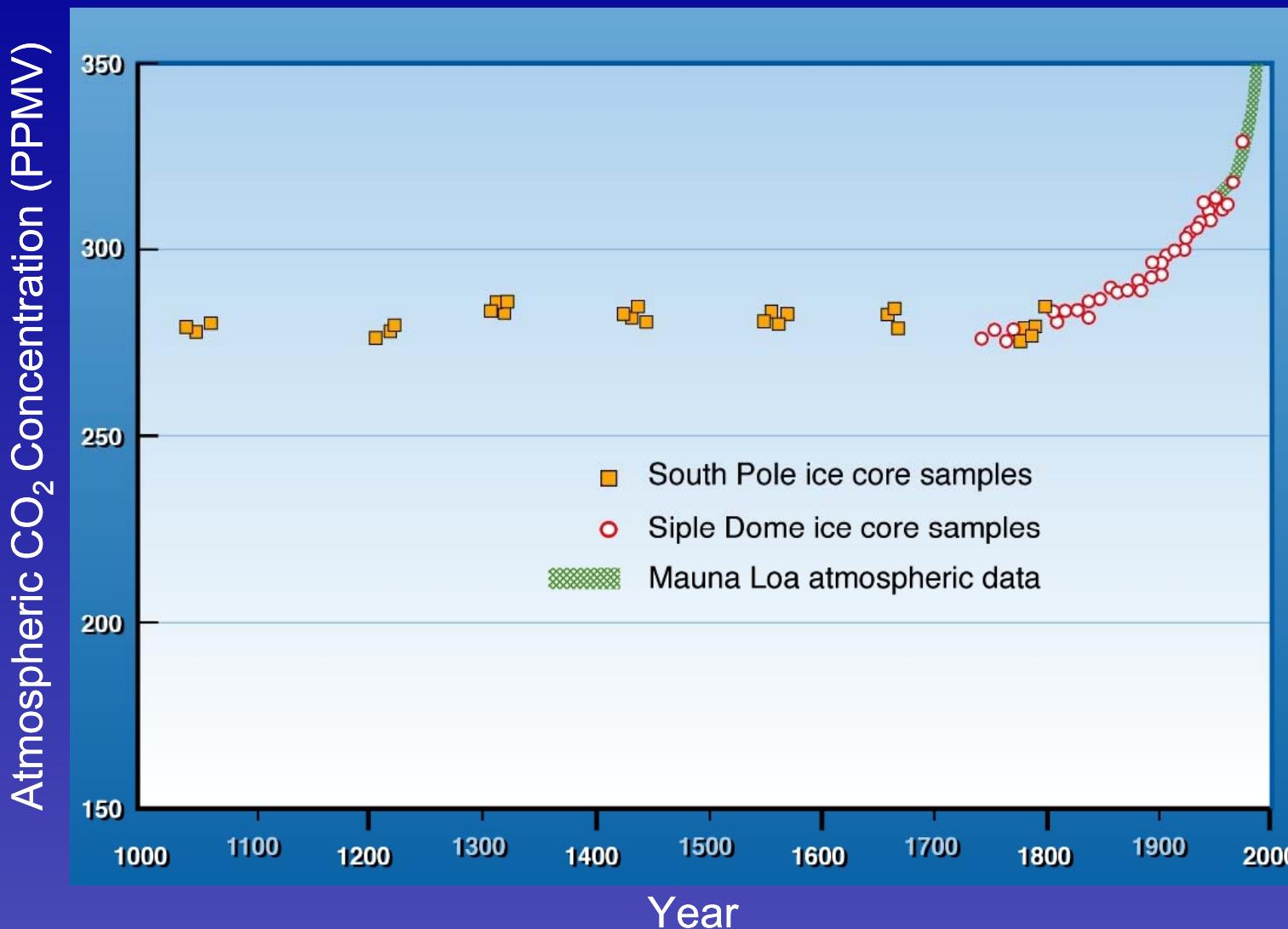
Biomass & Bioenergy Flows



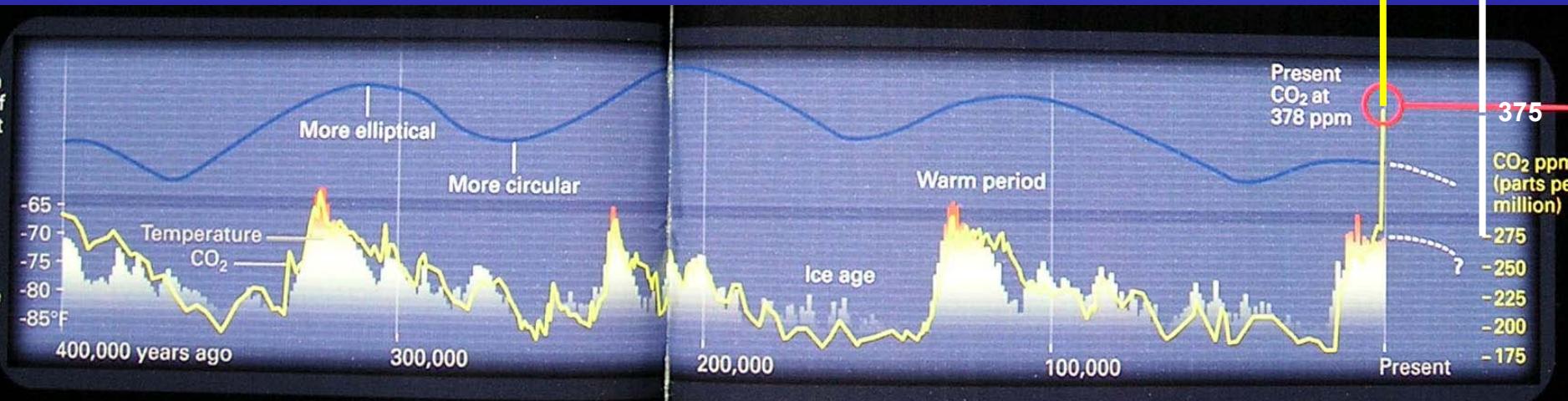
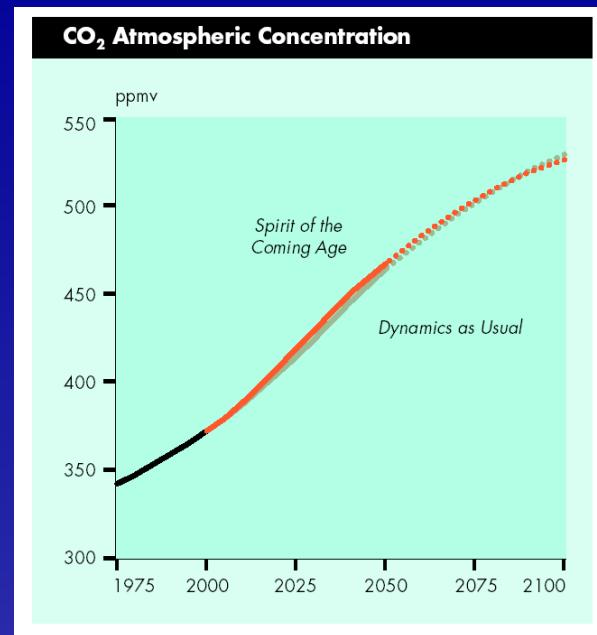
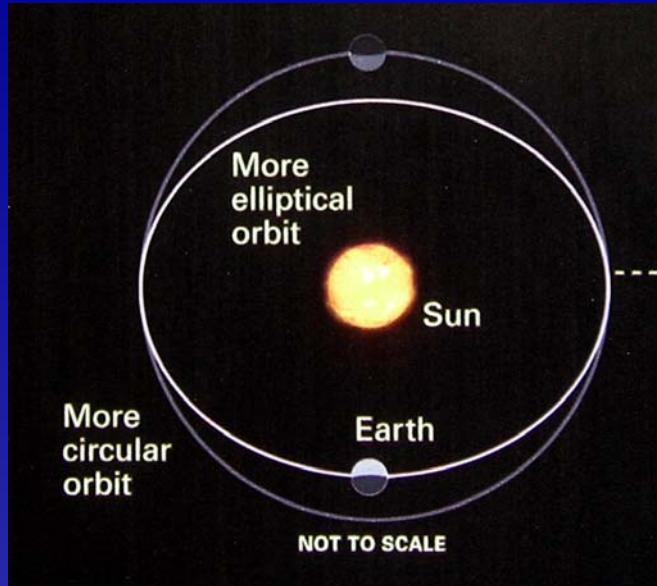
Mauna Loa Monthly Mean Carbon Dioxide



CO₂ over the Past 1000 Years

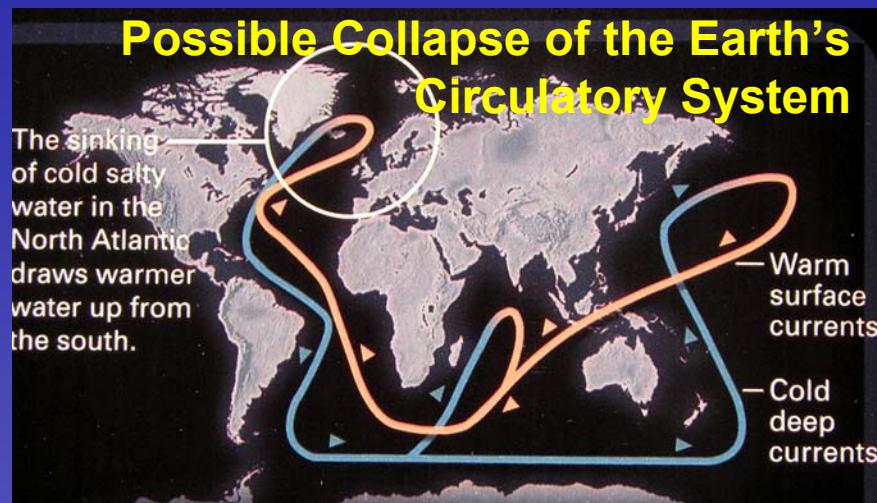
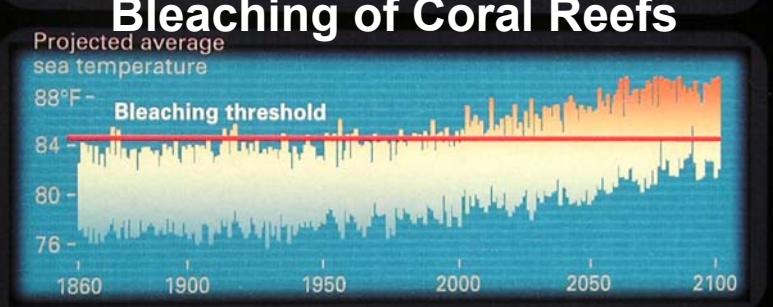
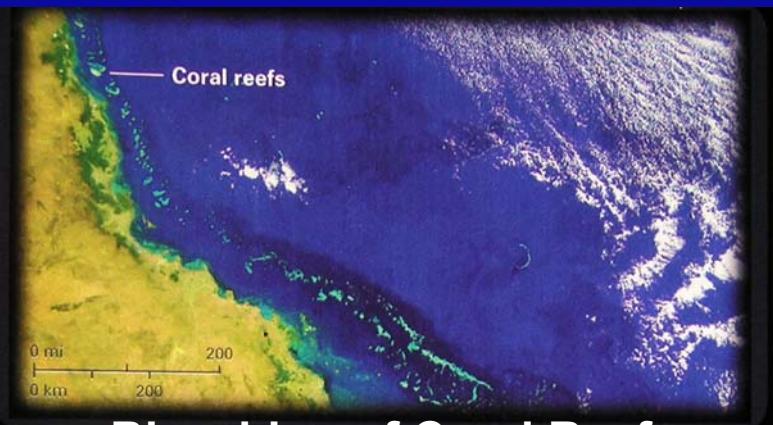


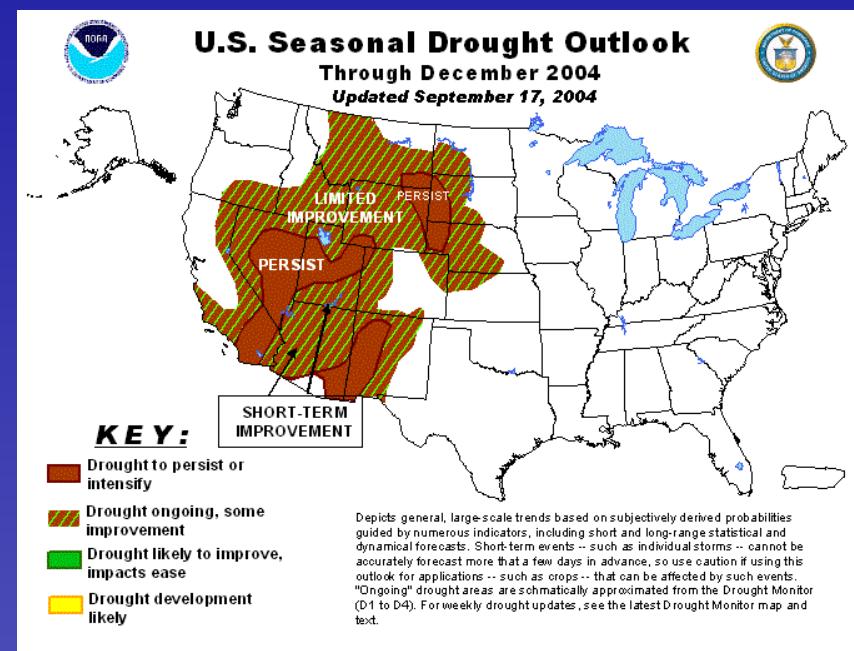
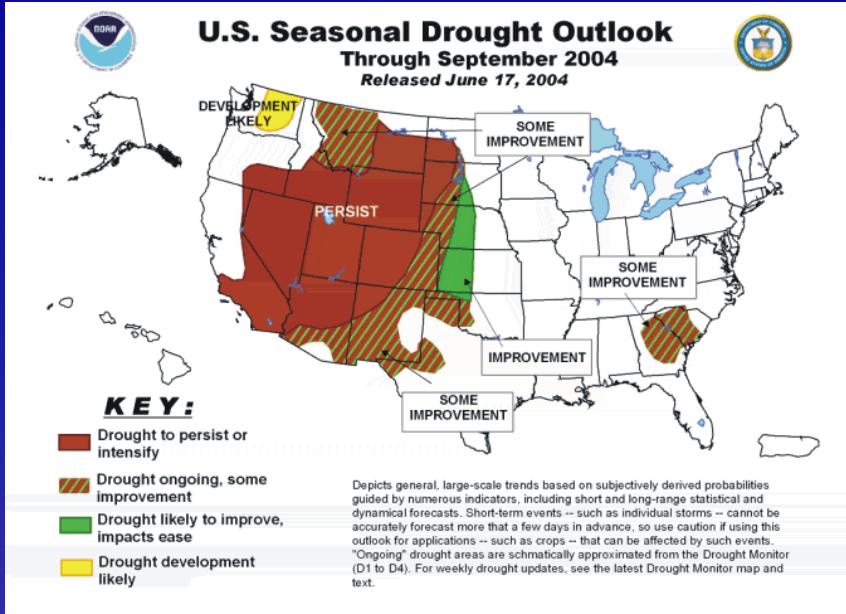
Source: Adapted from W.M. Post, T.H. Peng, W.R. Emanuel, A.W. King, V.H. Dale, and D. DeAngelis. *American Scientist*, 1990. "The Global Carbon Cycle."



Globally Unprecedented Levels of CO₂

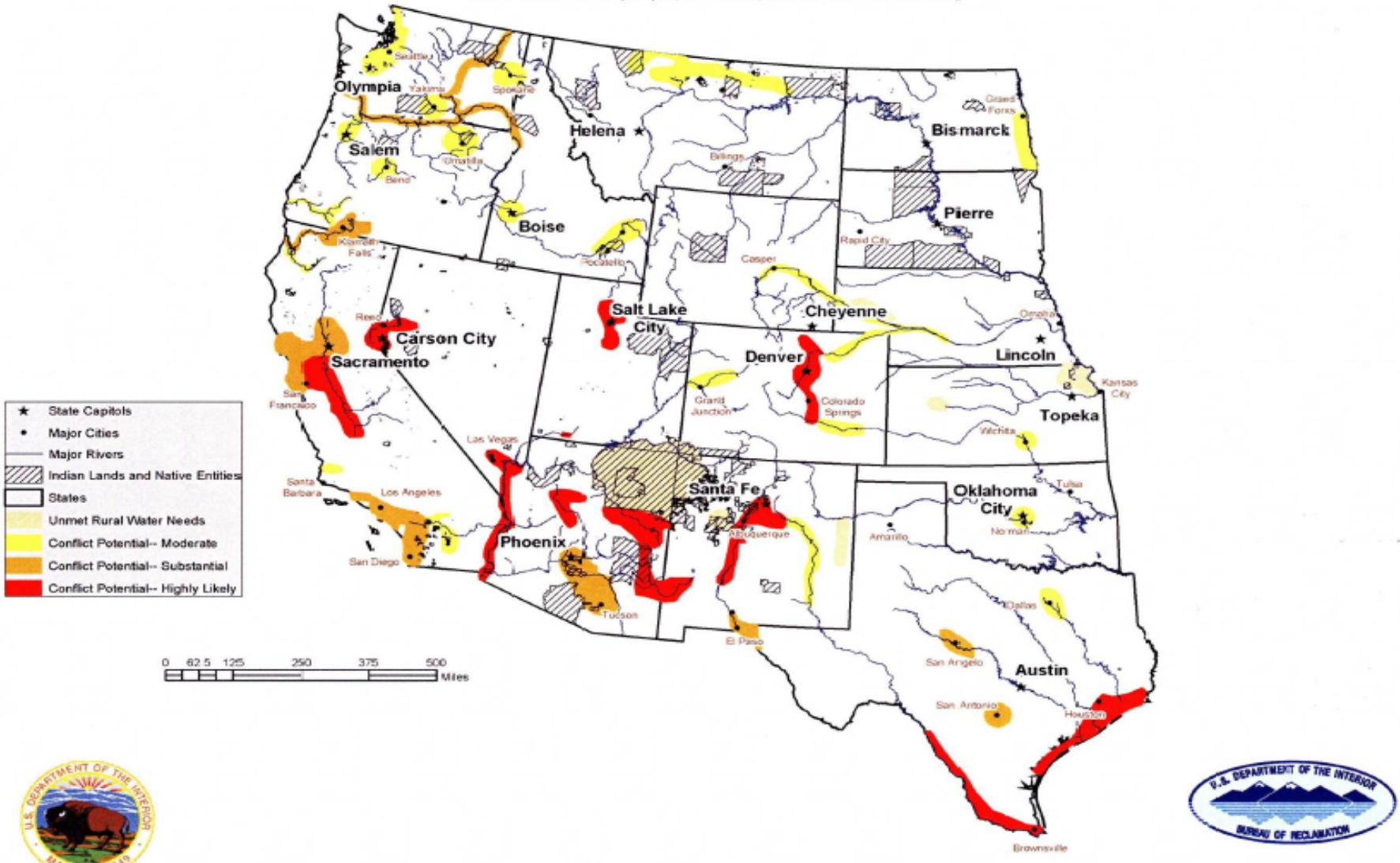
Warming Temperatures





Potential Water Supply Crises by 2025

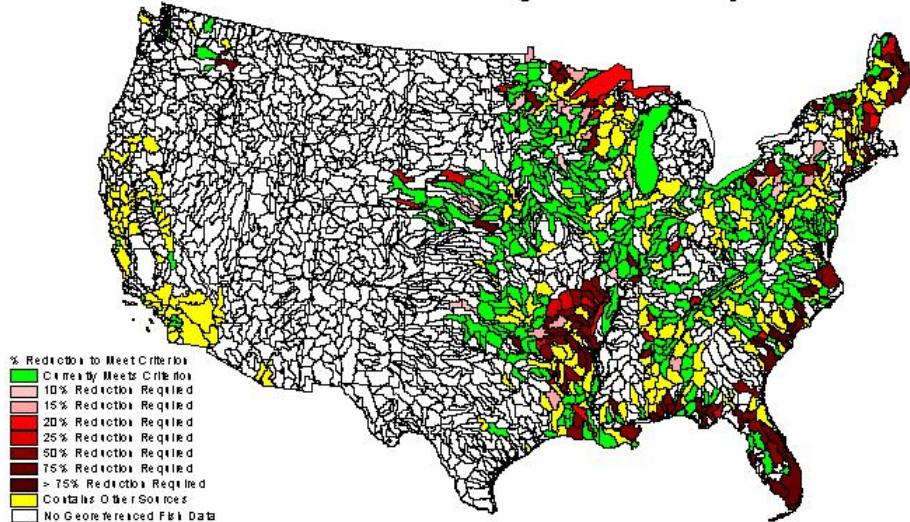
(Areas where existing supplies are not adequate to meet water demands for people, for farms, and for the environment)



Electric Power Research Institute Electricity Technology Roadmap

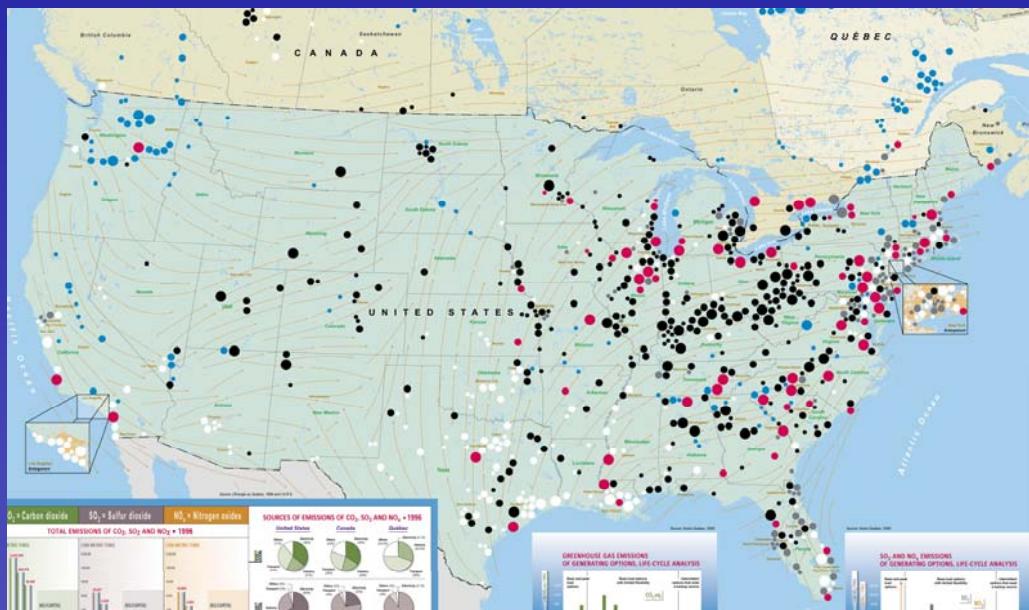
Stabilizing atmospheric concentrations of CO₂ at 550 ppm (twice the pre-industrial concentration level) would require that 75% of electricity be generated from zero-emitting sources by 2100, and that carbon intensity (Carbon/\$GDP) be no more than 10% of today's value.

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

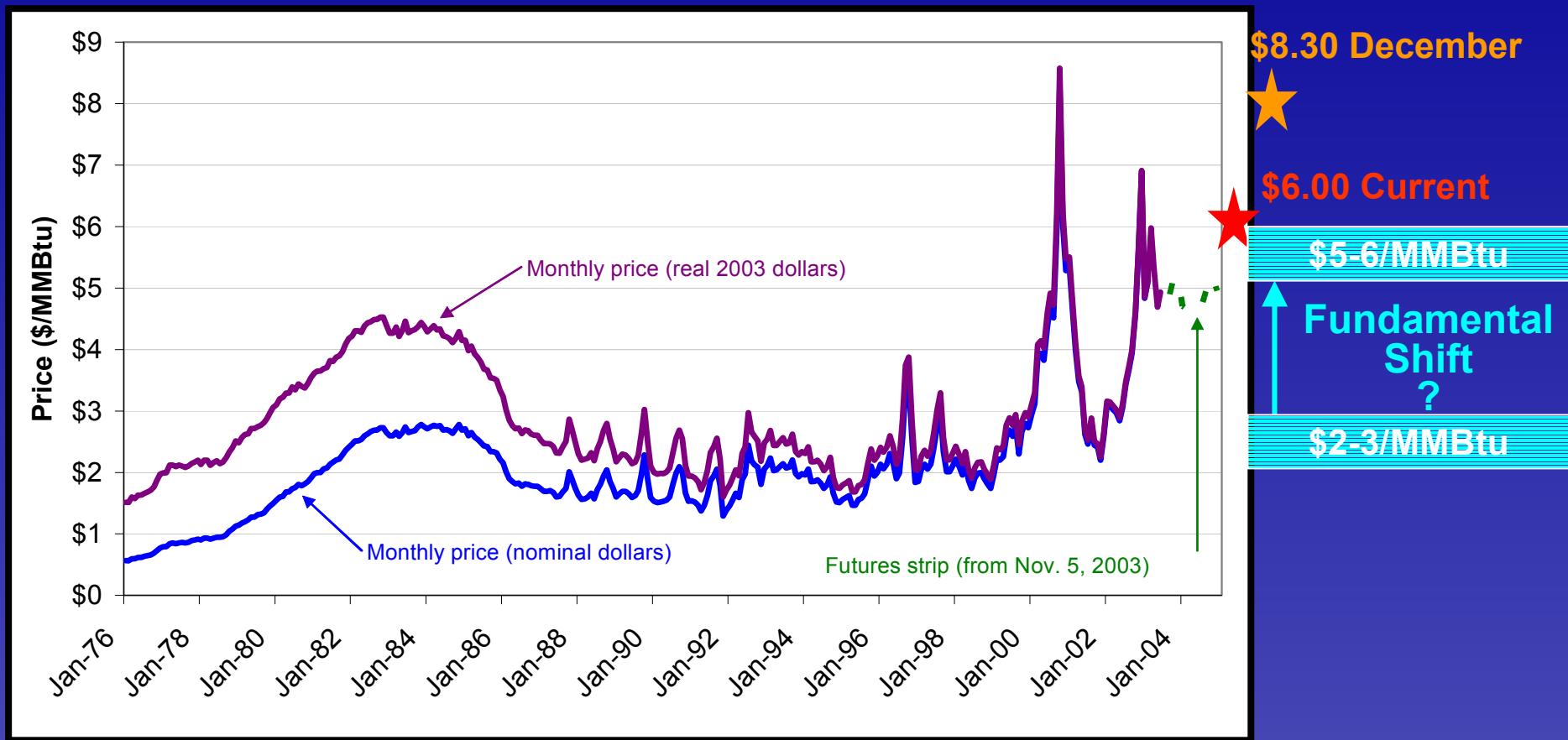


Mercury Contamination of Fish

Closely correlated with Power Plant Emissions



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



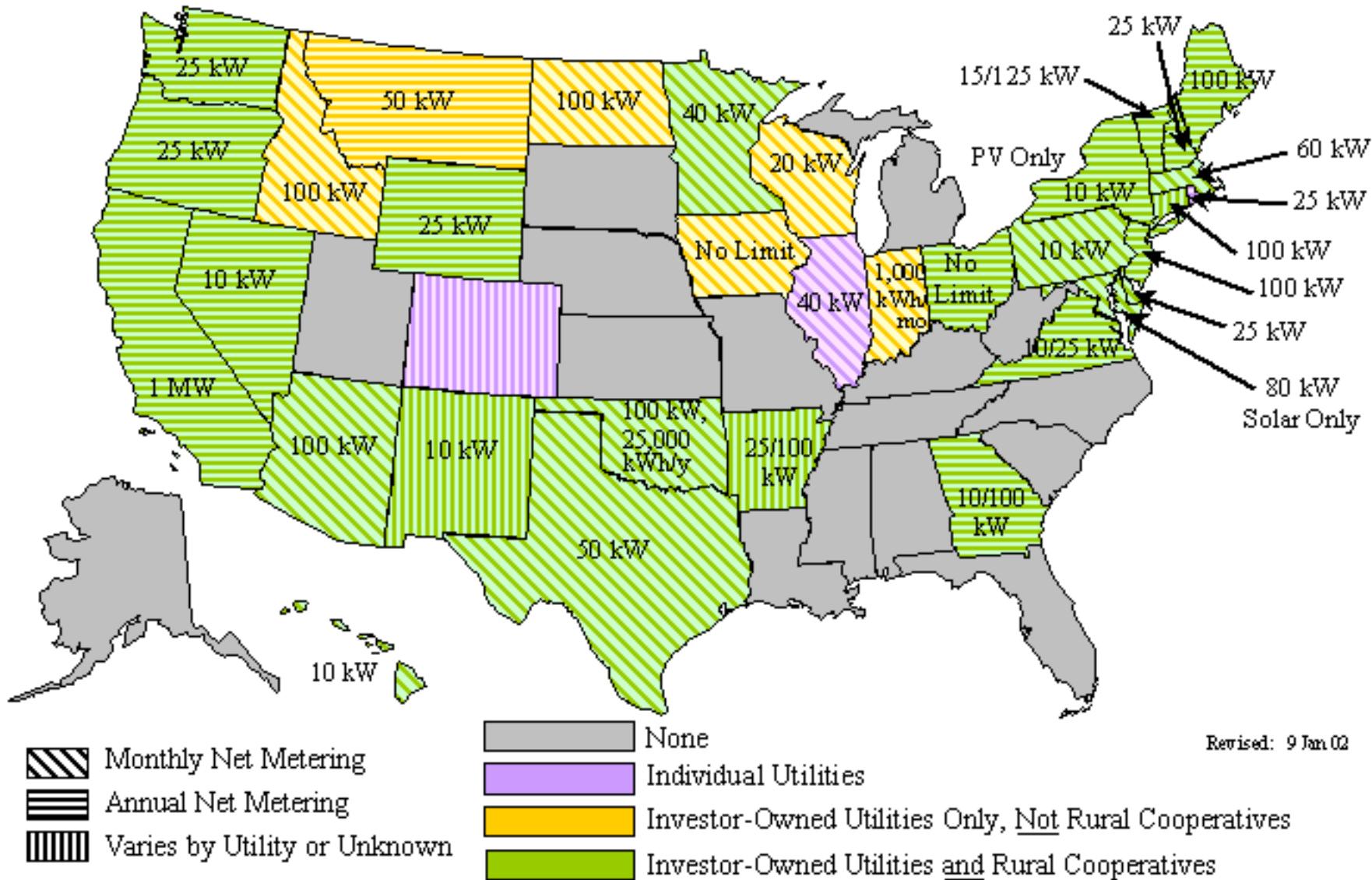
Sources: Nymex, EIA and Bureau of Labor Statistics. Data current through May 2003.

Crude Oil Spot WTI Cushing



WTRG Economics ©2004
www.wtrg.com
(479) 293-4081

Net Metering By State



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

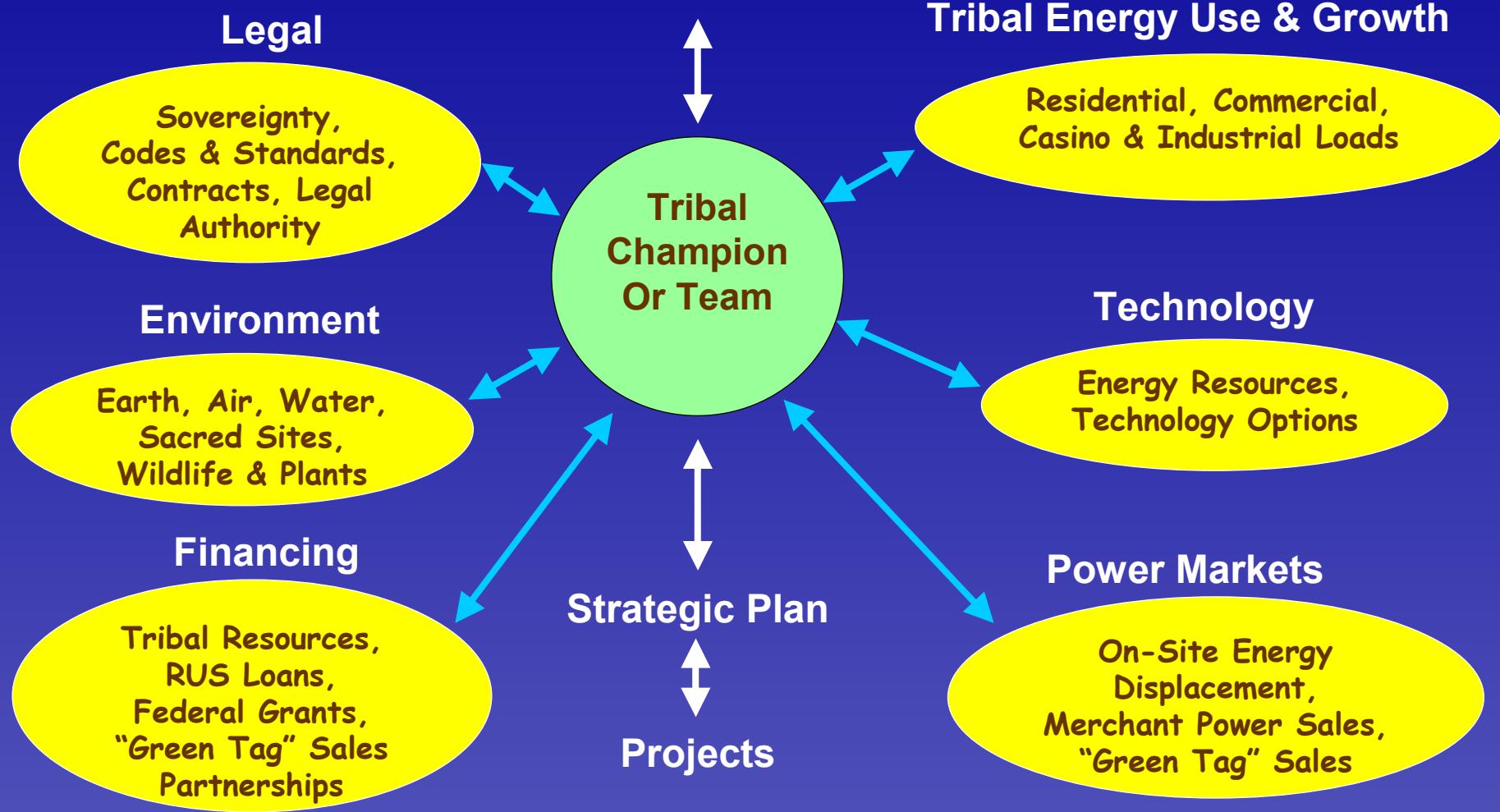
Local Community
Food (Earth)
Air
Energy (Fire)
Water

Community of Cooperation

“Share and share alike.”

The Tribal Energy Development Challenge

Tribal Council



Progressive Partnerships

For Rural Economic Development and Local Self Sufficiency

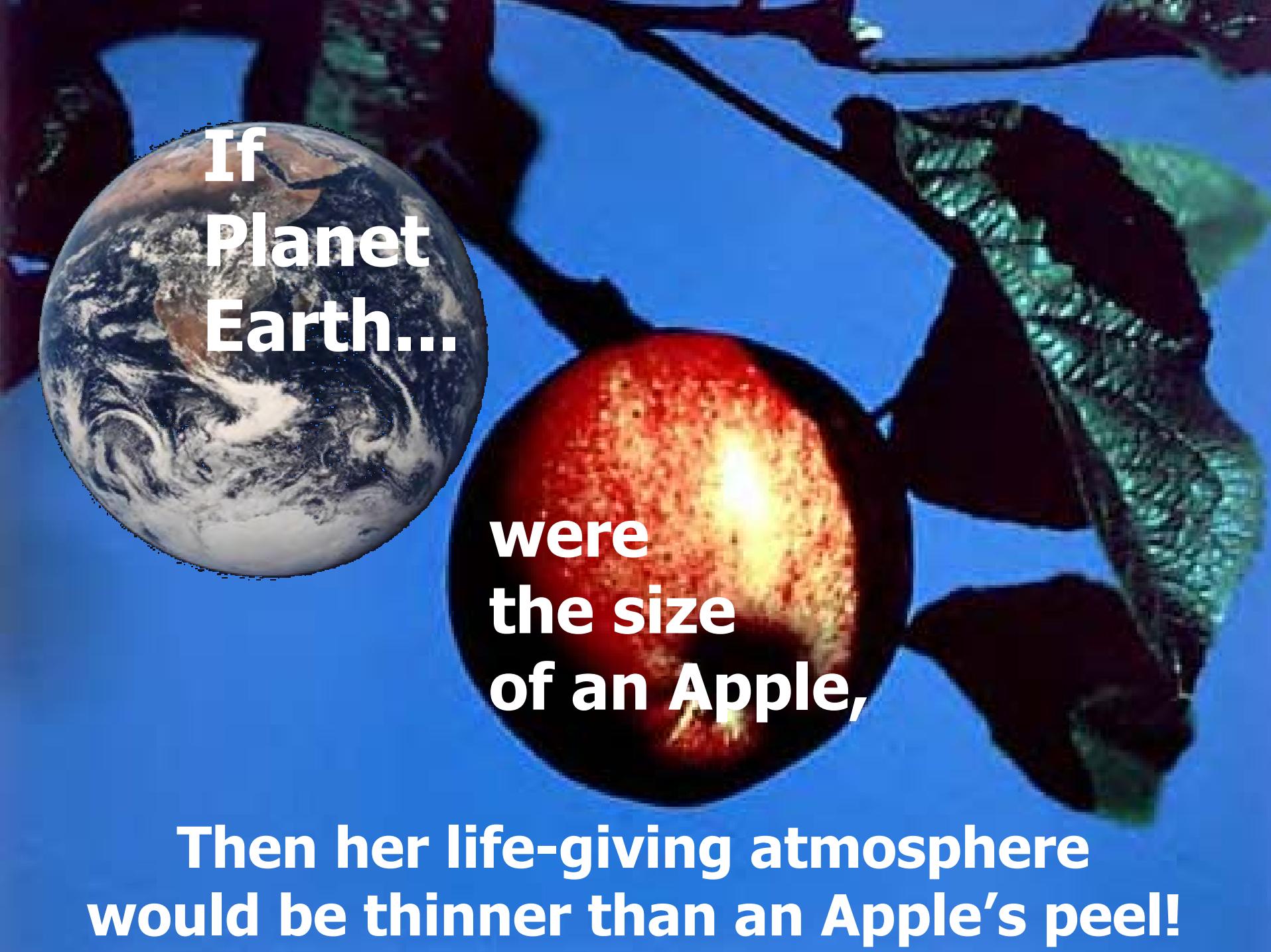
Interdependence

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



Independence

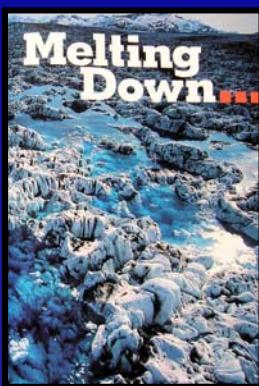
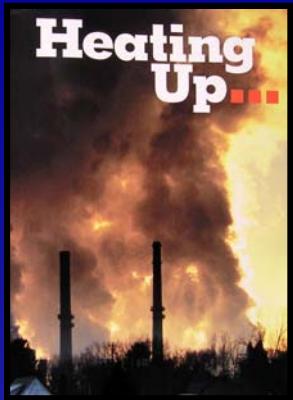
Tribal Capacity Building
On-site Production
Local Cultural Integration
Local Quality of Life
Local Pride



If
Planet
Earth...

were
the size
of an Apple,

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



Interdependence



Independence

