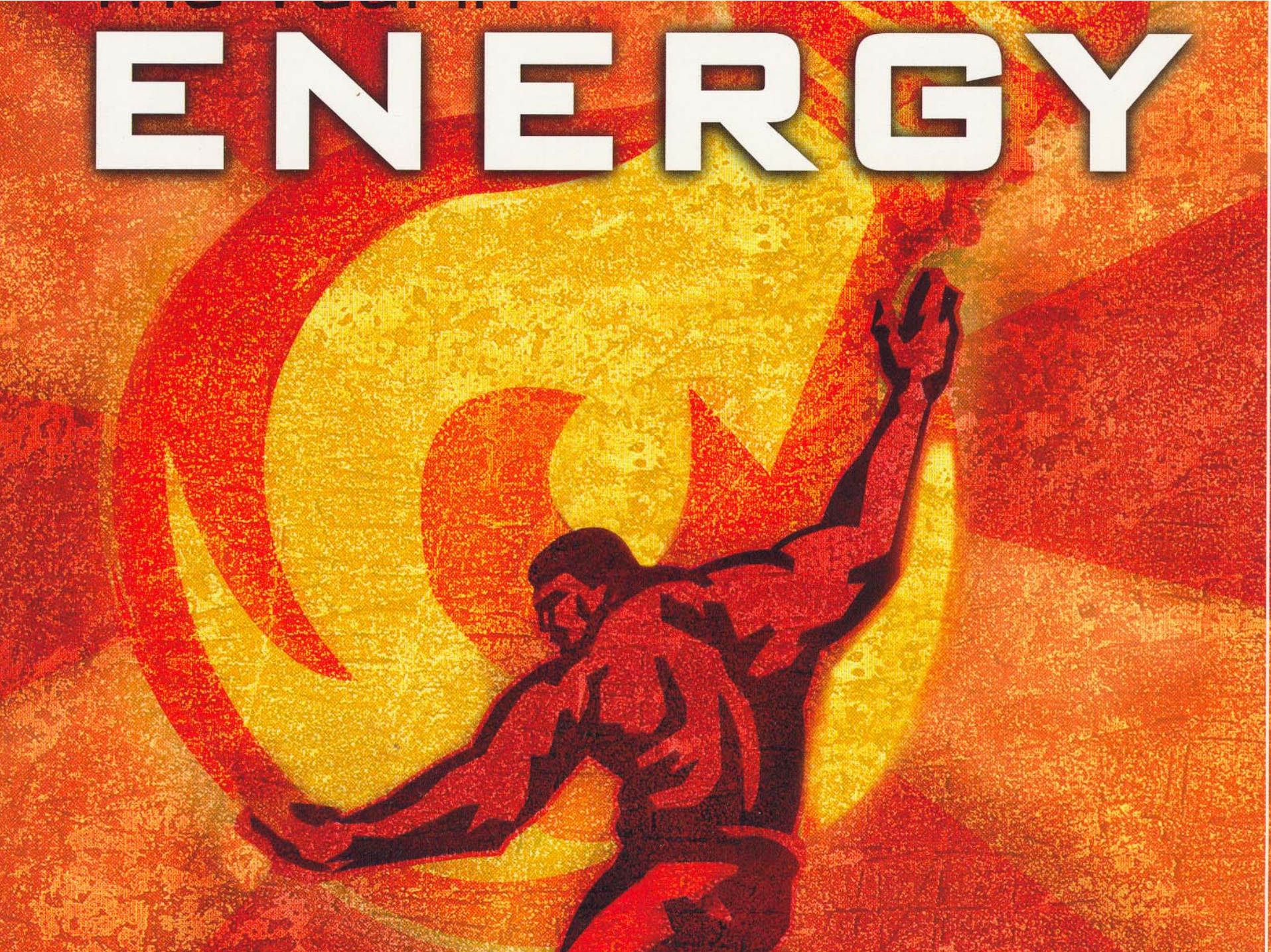
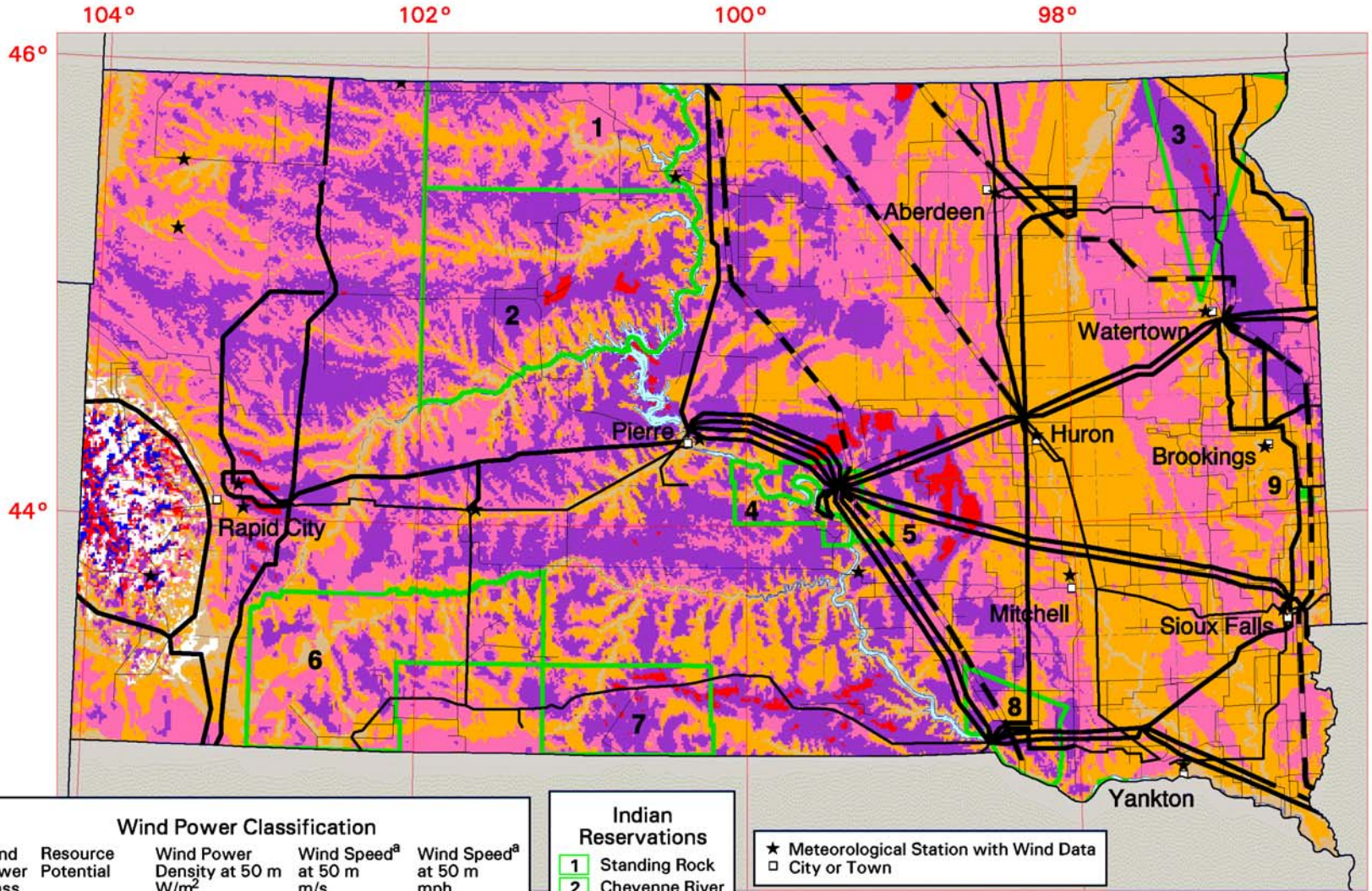
ENERGY



South Dakota - Wind Resource Map



Wind Power Classification

Wind Power Class	Resource Potential	Wind Power Density at 50 m W/m^2	Wind Speed[a] at 50 m m/s	Wind Speed[a] at 50 m mph
2	Marginal	200 - 300	5.6 - 6.4	12.5 - 14.3
3	Fair	300 - 400	6.4 - 7.0	14.3 - 15.7
4	Good	400 - 500	7.0 - 7.5	15.7 - 16.8
5	Excellent	500 - 600	7.5 - 8.0	16.8 - 17.9
6	Outstanding	600 - 800	8.0 - 8.8	17.9 - 19.7
7	Superb	800 - 1600	8.8 - 11.1	19.7 - 24.8

[a] Wind speeds are based on a Weibull k value of 2.0

Indian Reservations

1	Standing Rock
2	Cheyenne River
3	Lake Traverse
4	Lower Brule
5	Crow Creek
6	Pine Ridge
7	Rosebud
8	Yankton
9	Flandreau

★ Meteorological Station with Wind Data
□ City or Town

Transmission Line Voltage

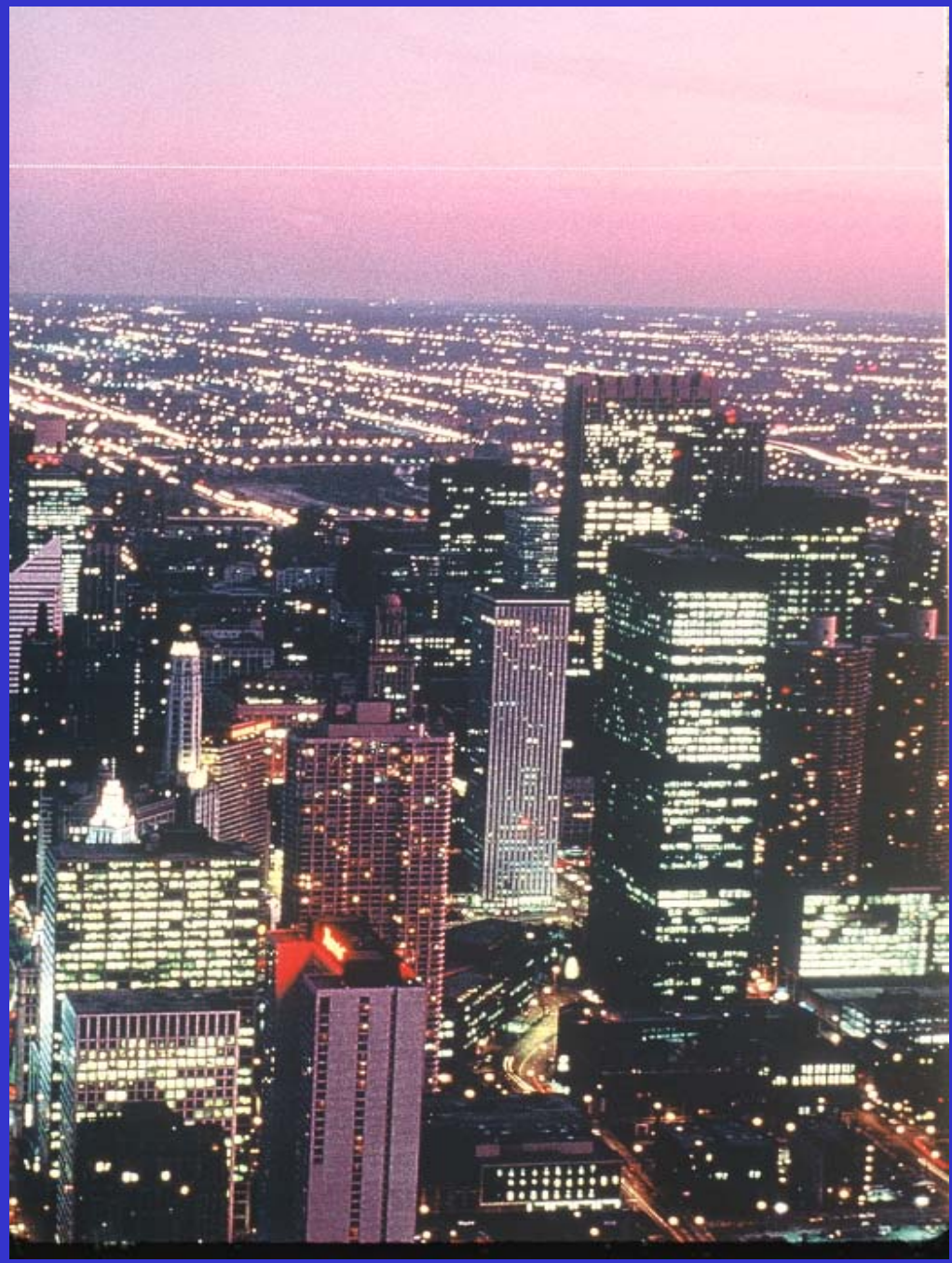
69 Kilovolts
115 Kilovolts
230 Kilovolts
345 Kilovolts

50 0 50 100 Kilometers
25 0 25 50 75 Miles

N

U.S. Department of Energy
National Renewable Energy Laboratory

NASA
Endeavour
USA

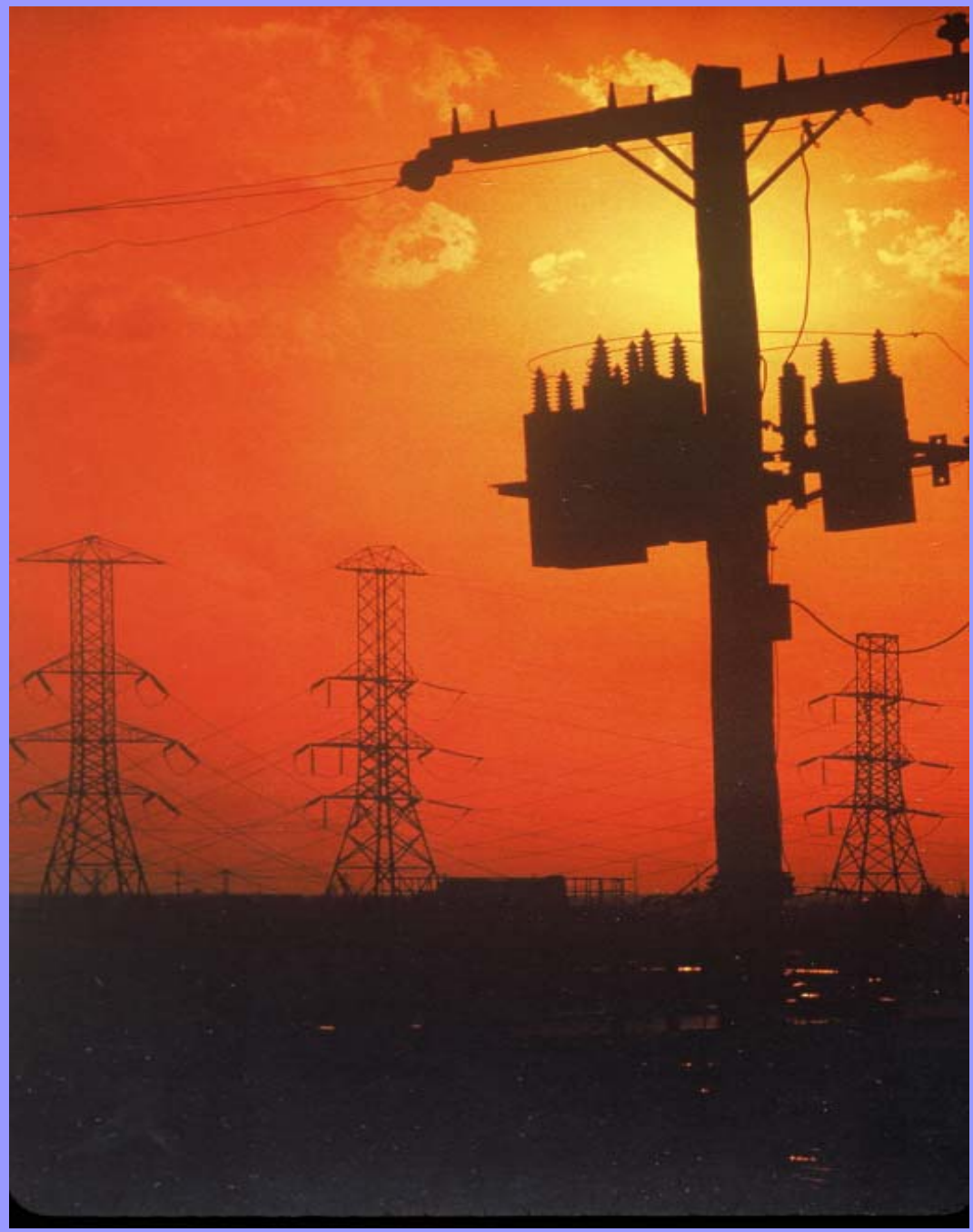


Matthew Simmons: Energy is the Earth's Most Precious Resource

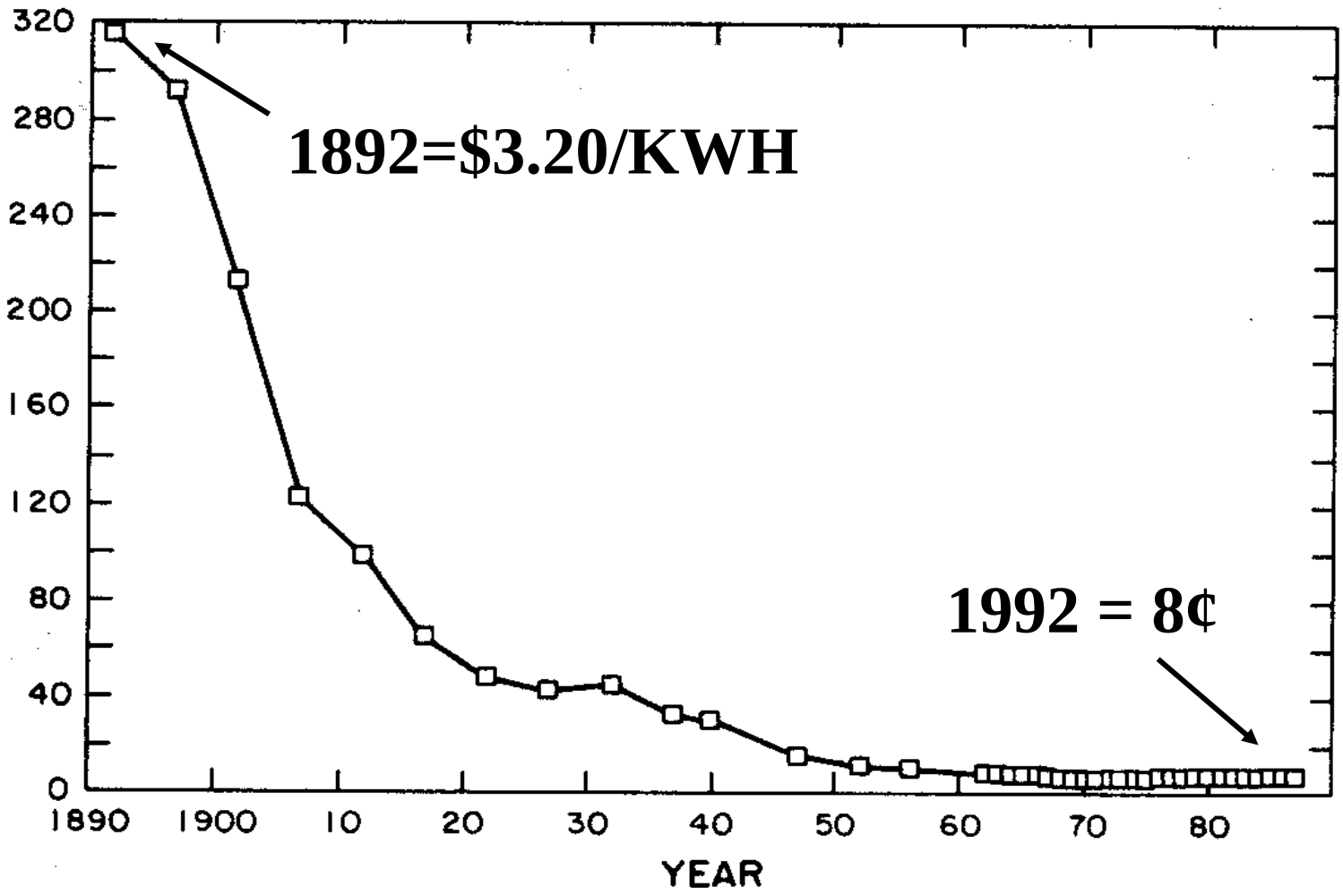
Modern energy was the greatest 20th century innovation. Electricity, Internal Combustion Engine

Technology, telecommunications, advanced agriculture, medical science… without primary energy, none would happen…

Energy invented prosperity



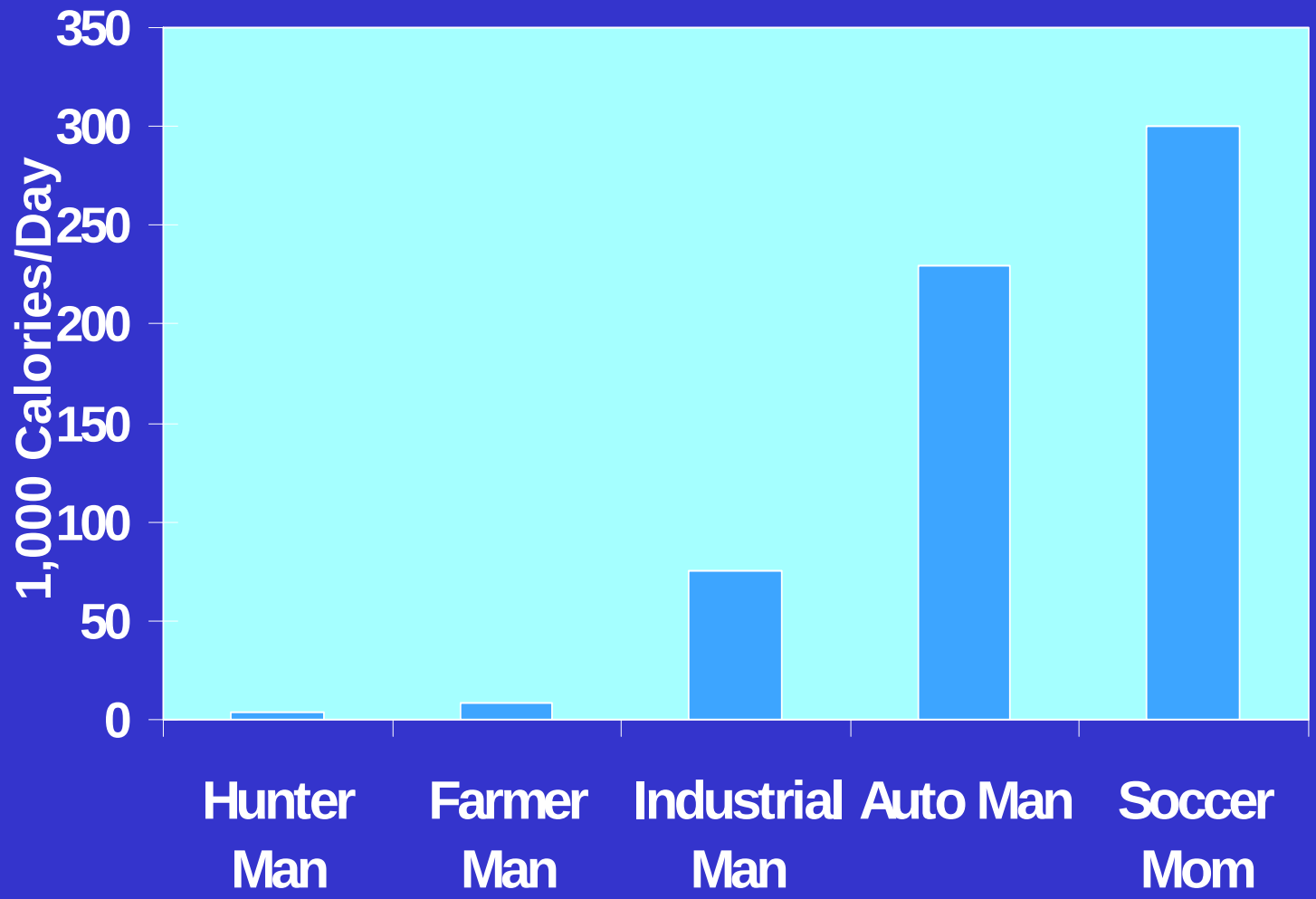
AN *AMAZING* ¢ENTURY



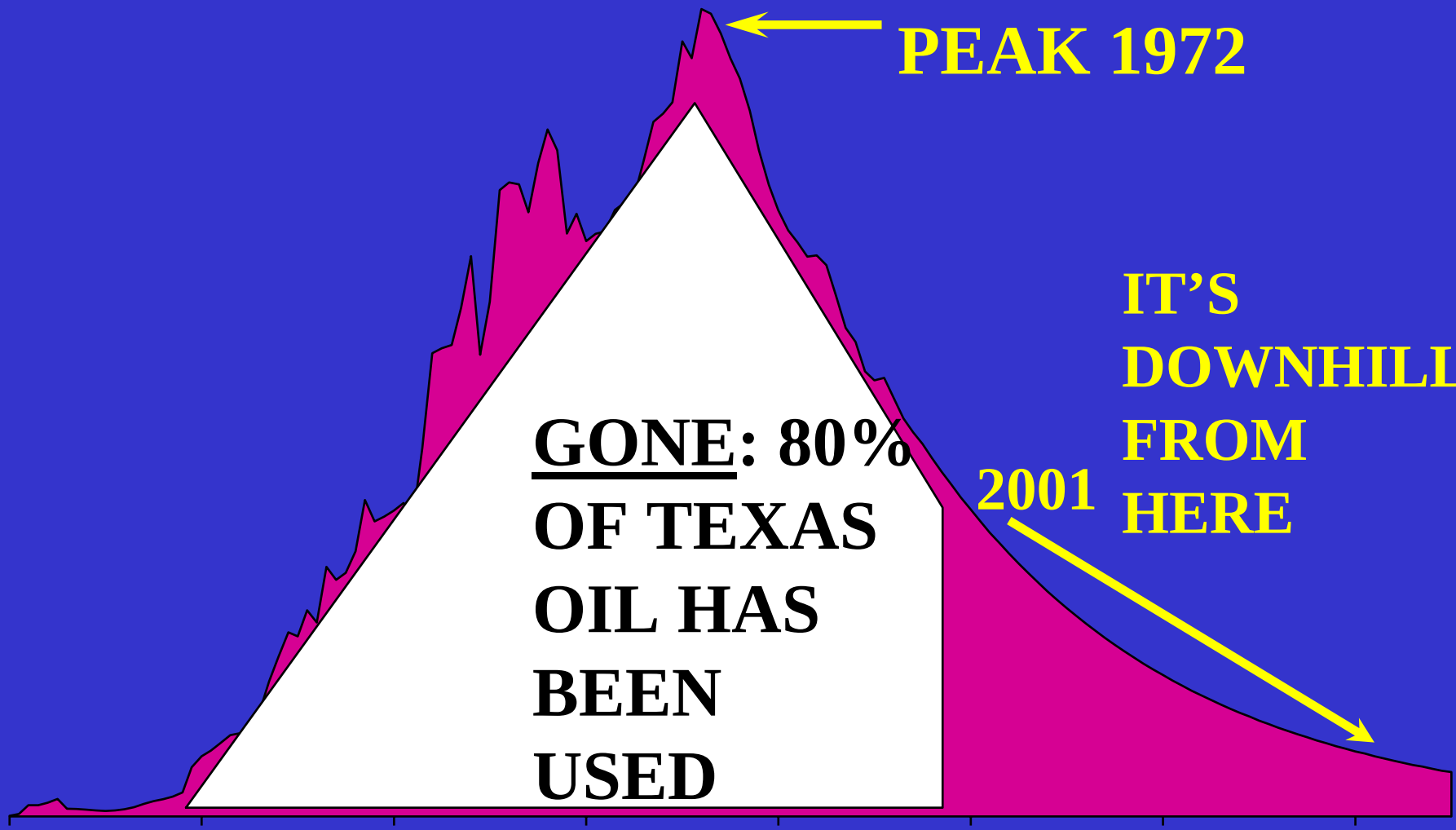
“Lance has a top end of about 600 watts. He can produce 1200 watts for a very short time, less than 20 seconds.

He can maintain 500 watts for 30 minutes going uphill. No one else in the world can do that consistently.”

EVOLUTION OF HUMAN ENERGY USE

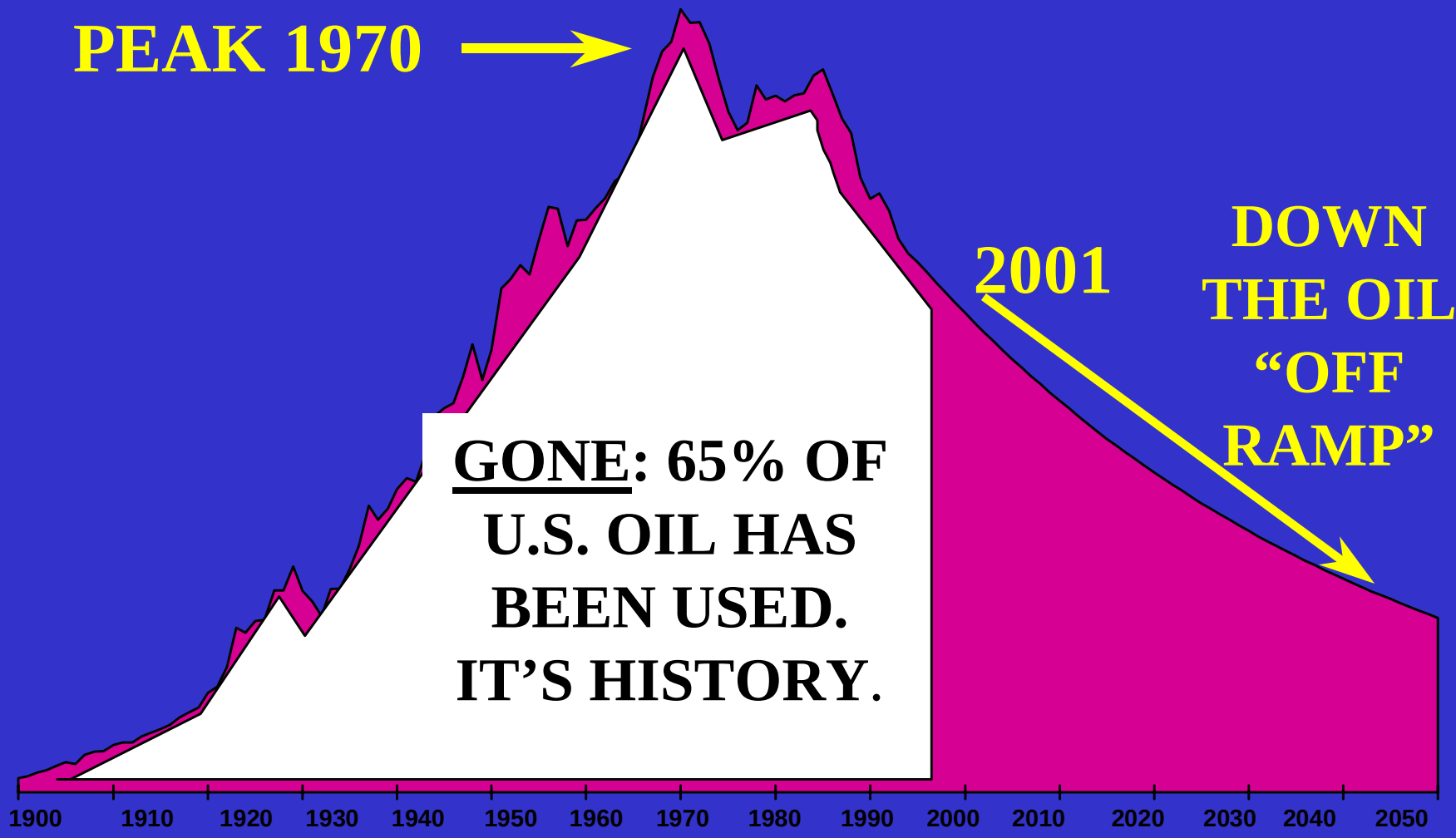


TEXAS OIL PRODUCTION 1900-2050

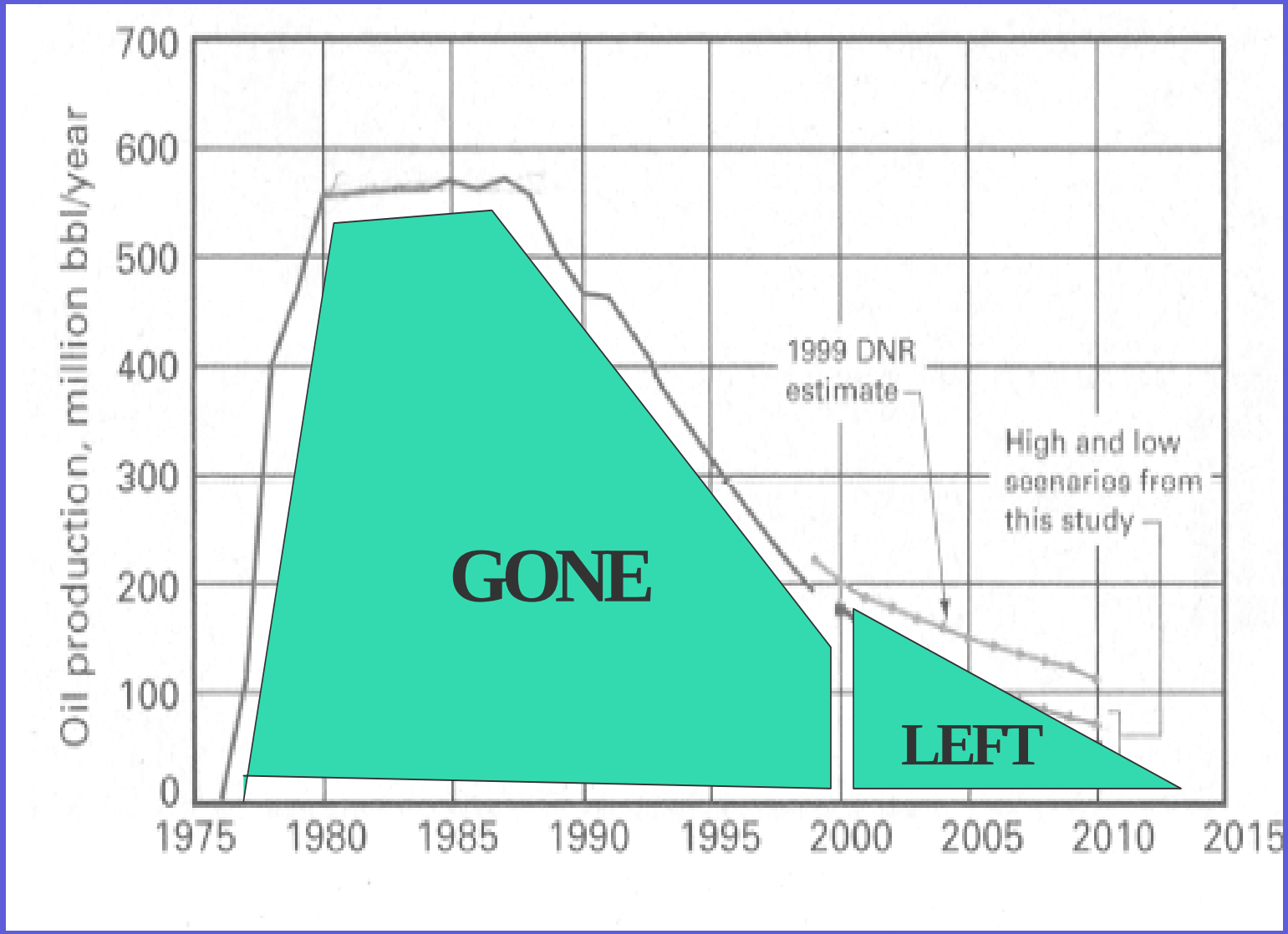



Budweiser
KING OF BEERS
Budweiser
Budweiser
Budweiser
Budweiser

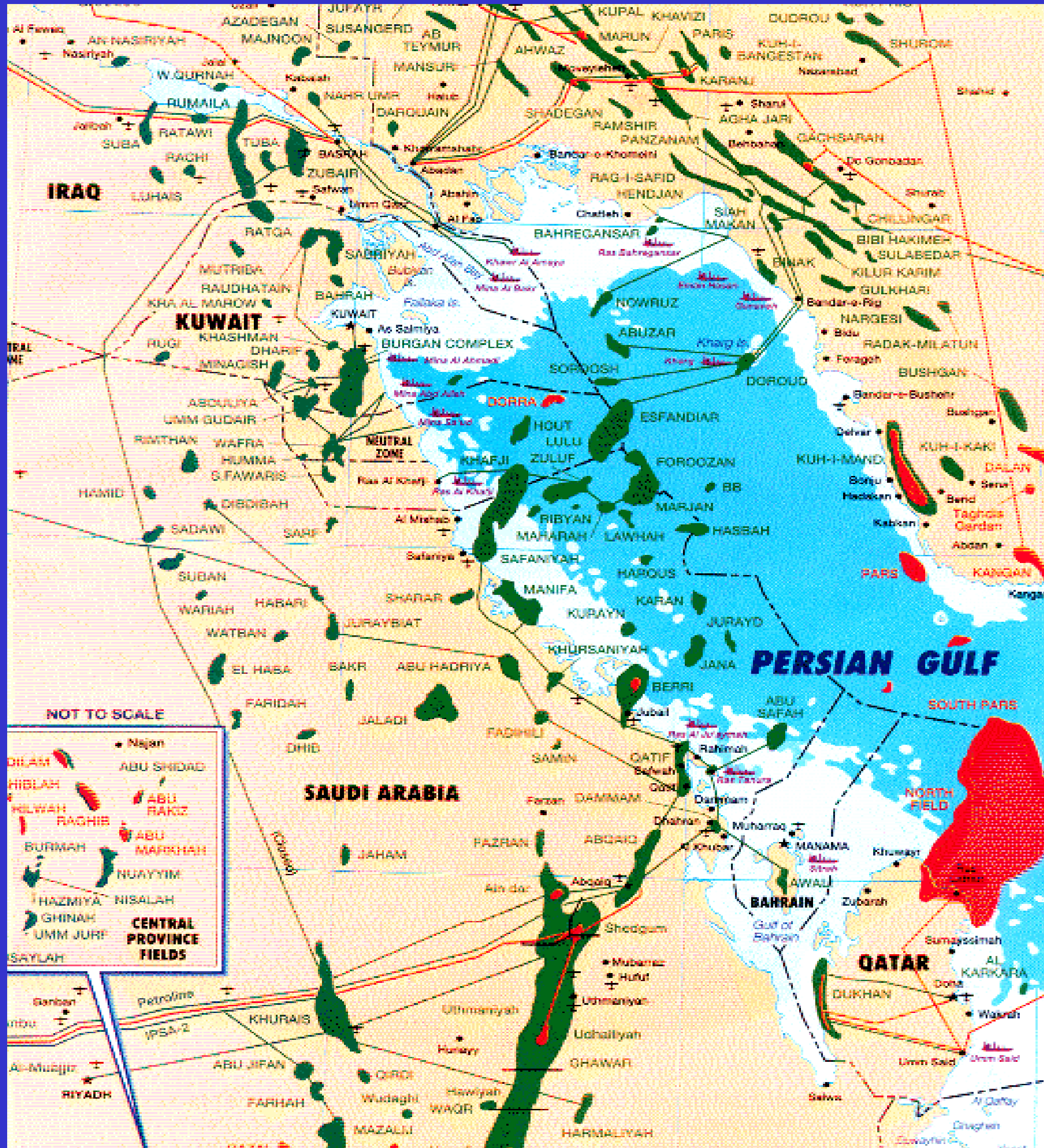
U.S. OIL PRODUCTION 1900 TO 2050



PRUDHOE BAY PRODUCTION

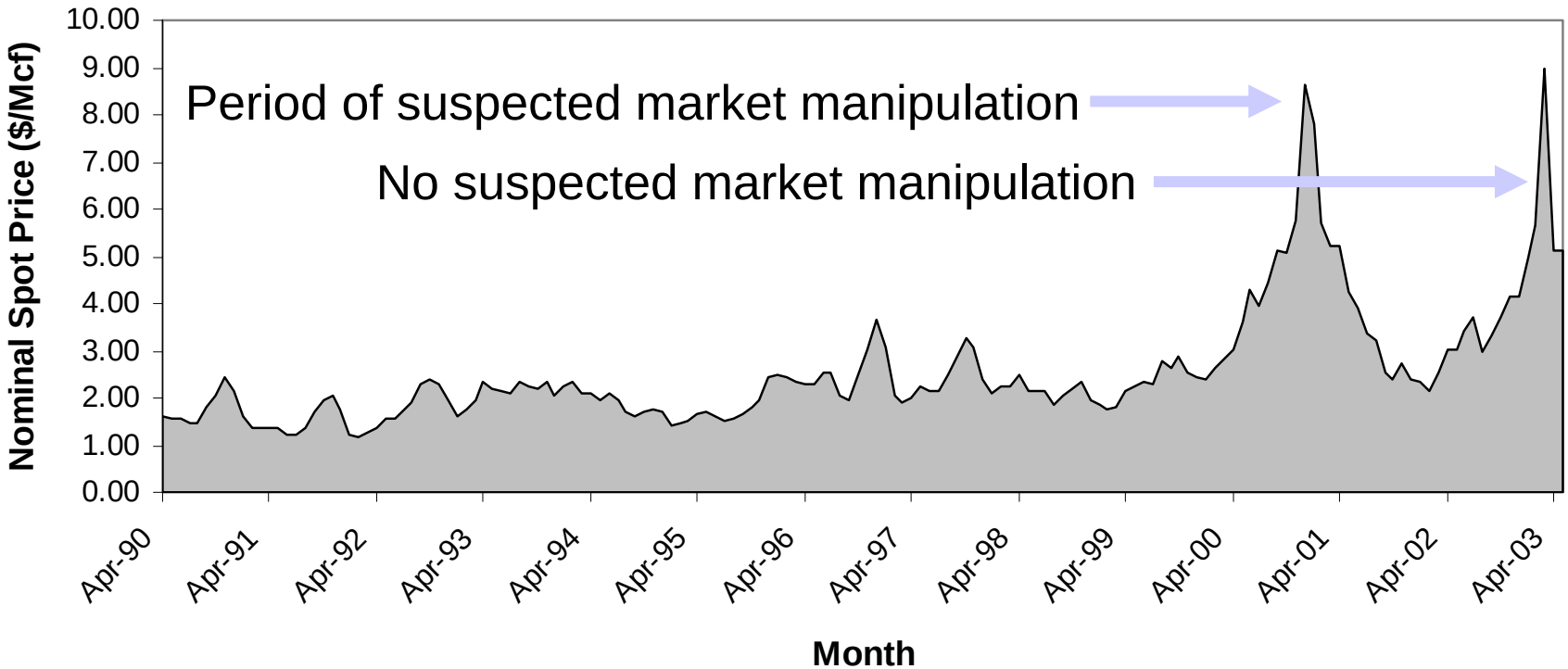



RAVEN
RAVEN


PERSIAN GULF
IRAQ
KUWAIT
SAUDI ARABIA
BAHRAIN
QATAR
NEUTRAL ZONE
NOT TO SCALE
CENTRAL PROVINCE FIELDS
AZADEGAN
MAJNOON
SUSANGERD
AB TEYMUR
MANSURI
AHWAZ
MARUN
KUPAL
KHAVIZI
PARIS
DUDROU
SHUROM
KUH-I-BANGESTAN
KARANJ
AN NASIRIYAH
W.QURNAH
RUMAILA
RATAWI
SUBA
RACHI
TUBA
BASRAH
ZUBAIR
LUHAIS
NAHR UMR
DARQUAIN
SHADEGAN
RAMSHIR
PANZANAM
AGHA JARI
GACHSARAN
RAG-I-SAFID
HENDJAN
SIAH MAKAN
CHILLINGAR
BIBI HAKIMEH
SULABEDAR
KILUR KARIM
GULKHARI
BINAK
NARGESI
RADAK-MILATUN
BUSHGAN
BAHREGANSAR
NOWRUZ
ABUZAR
SOROOSH
DOROUD
ESFANDIAR
FOROOZAN
DORRA
HOUT
LULU
ZULUF
KHAFJI
RIBYAN
MAHARAH
LAWHAH
MARJAN
HASSBAH
SAFANIYAH
HARQUS
KARAN
MANIFA
KURAYN
JURAYD
KHURSANIYAH
JANA
BERRI
ABU SAFAH
SOUTH PARS
NORTH FIELD
PARS
KANGAN
DALAN
KUH-I-KAKI
KUH-I-MAND
RATQA
SABRIYAH
MUTRIBA
RAUDHATAIN
BAHRAH
KHA AL MAHOW
KHASHMAN
DHARIF
RUGI
MINAGISH
BURGAN COMPLEX
ABDULIYA
UMM GUDAIR
RIMTHAN
WAFRA
HUMMA
S.FAWARIS
HAMID
DIBDIBAH
SADAWI
SARF
SUBAN
WARIAH
HABARI
WATBAN
SHARAR
JURAYBIAT
EL HASA
BAKR
ABU HADRIYA
FARIDAH
JALADI
FADHILI
DHIB
SAMIN
QATIF
DAMMAM
ABQAIQ
FAZRAN
JAHAM
KHURAIS
ABU JIFAN
FARHAH
QIRDI
MAZALIJ
GHAWAR
HARMALIYAH
WAQR
GHAZAL
AWALI
DUKHAN
AL KARKARA
MANAMA
KUWAIT
RIYADH
Petroline
IPSA-2
DILAM
HIBLAH
HILWAH
RAGHIB
ABU RAKIZ
ABU MARKHAH
ABU SHIDAD
BURMAH
NUAYYIM
HAZMIYA
NISALAH
GHINAH
UMM JURF
SAYLAH

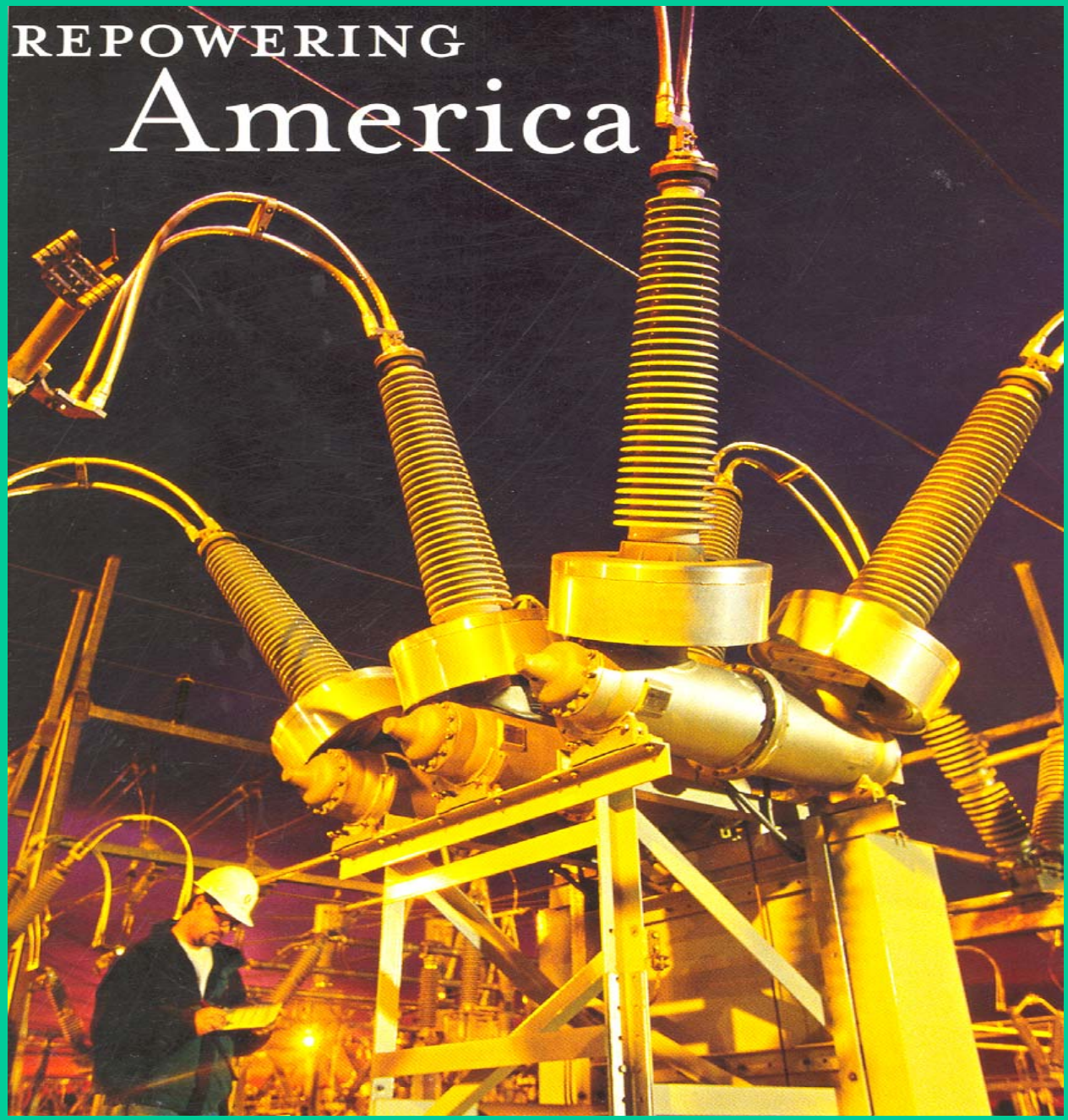
Volatile Natural Gas Prices

(Spot Prices 1990-2003)

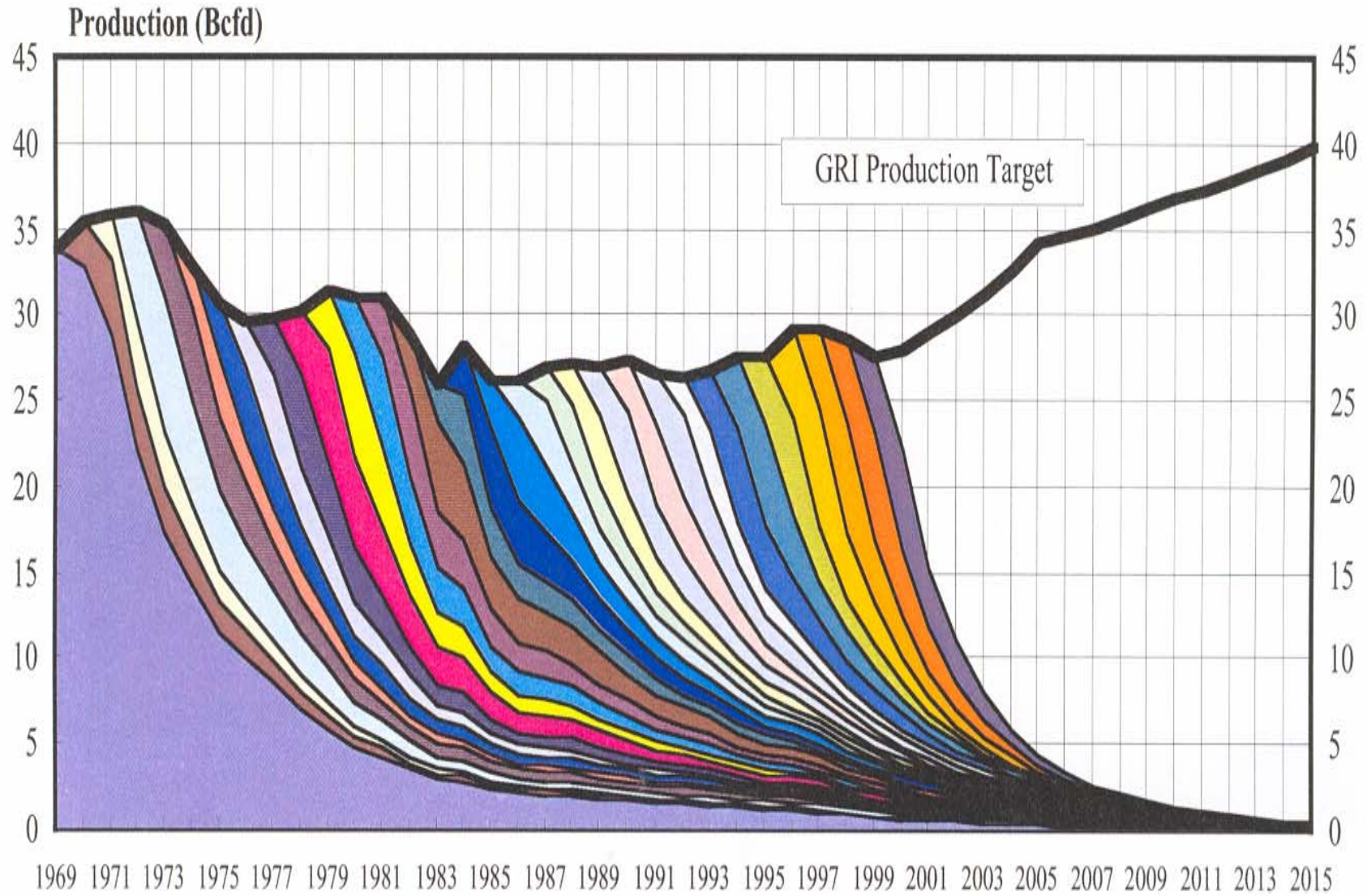


Source: NYMEX; Institute for Energy, Law & Enterprise, 2003

"We will need 10% of all gas produced in North America!"



FORECAST FOR GULF COAST



Methane Madness

“In 1997, 600 rigs kept production flat.

In 2001, 1000 rigs were needed to keep production steady.

In 2002, production fell 3%.

US producers will find it very difficult to reverse these trends.”

Raymond James


L N G
Source: BG

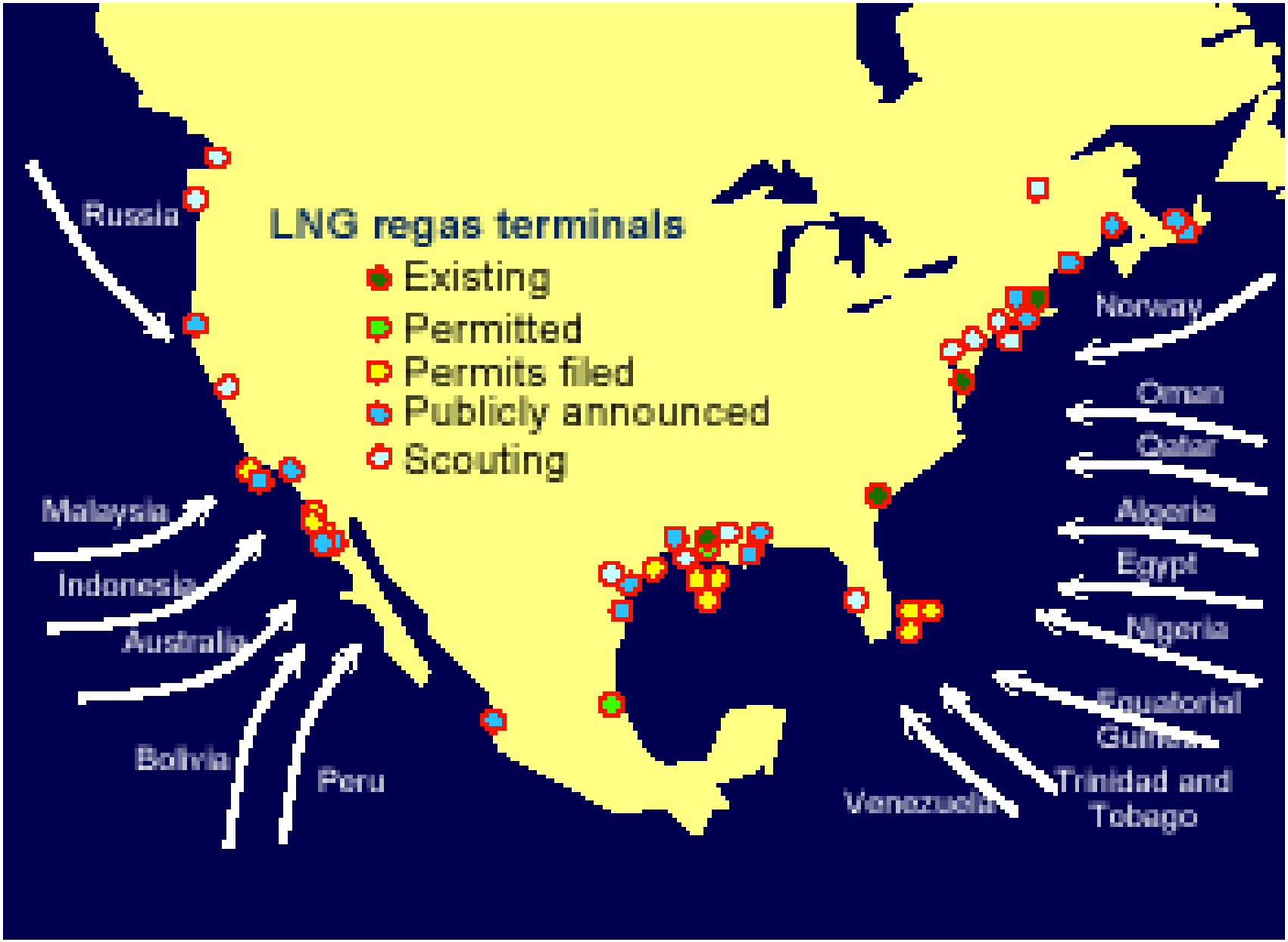
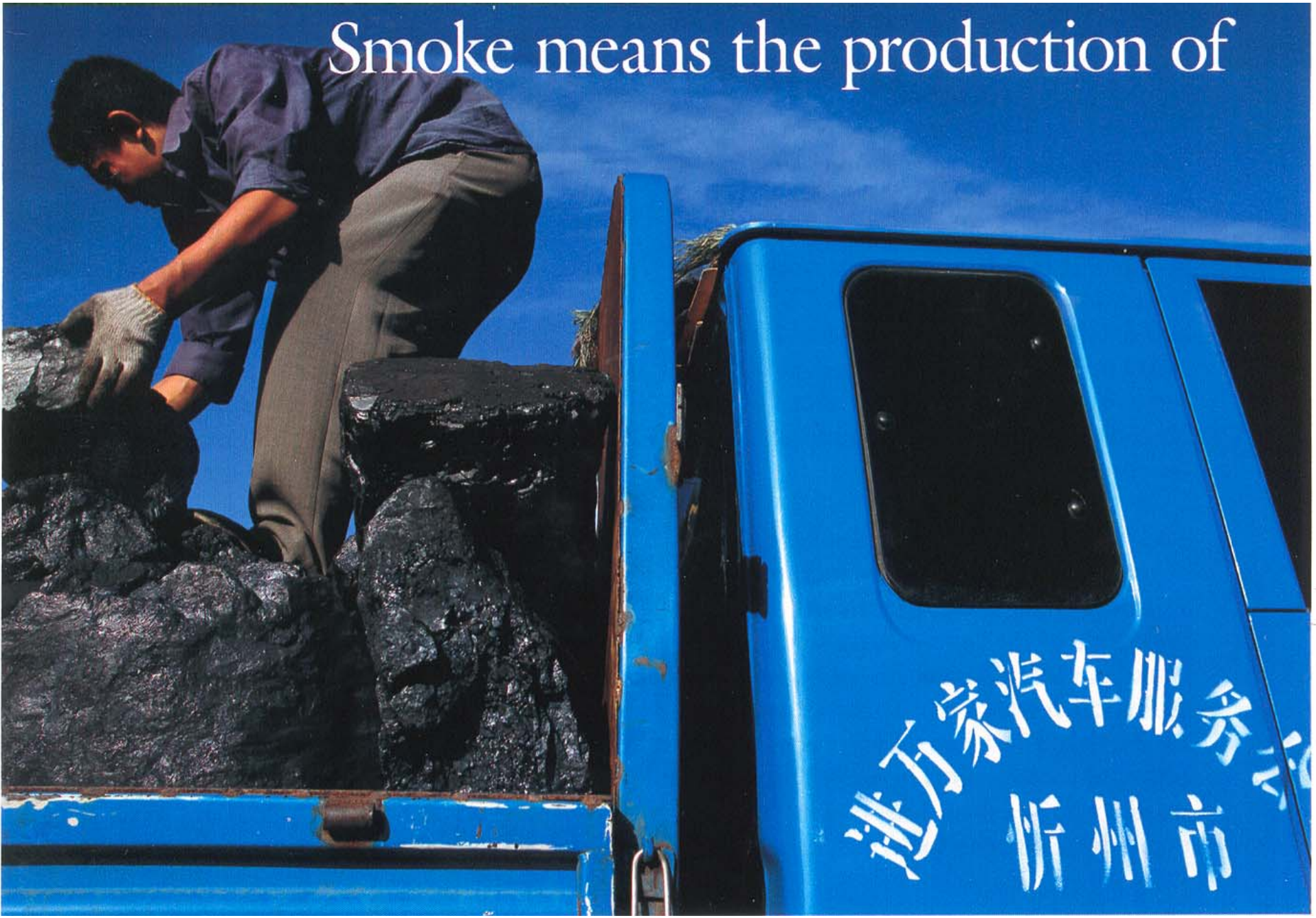
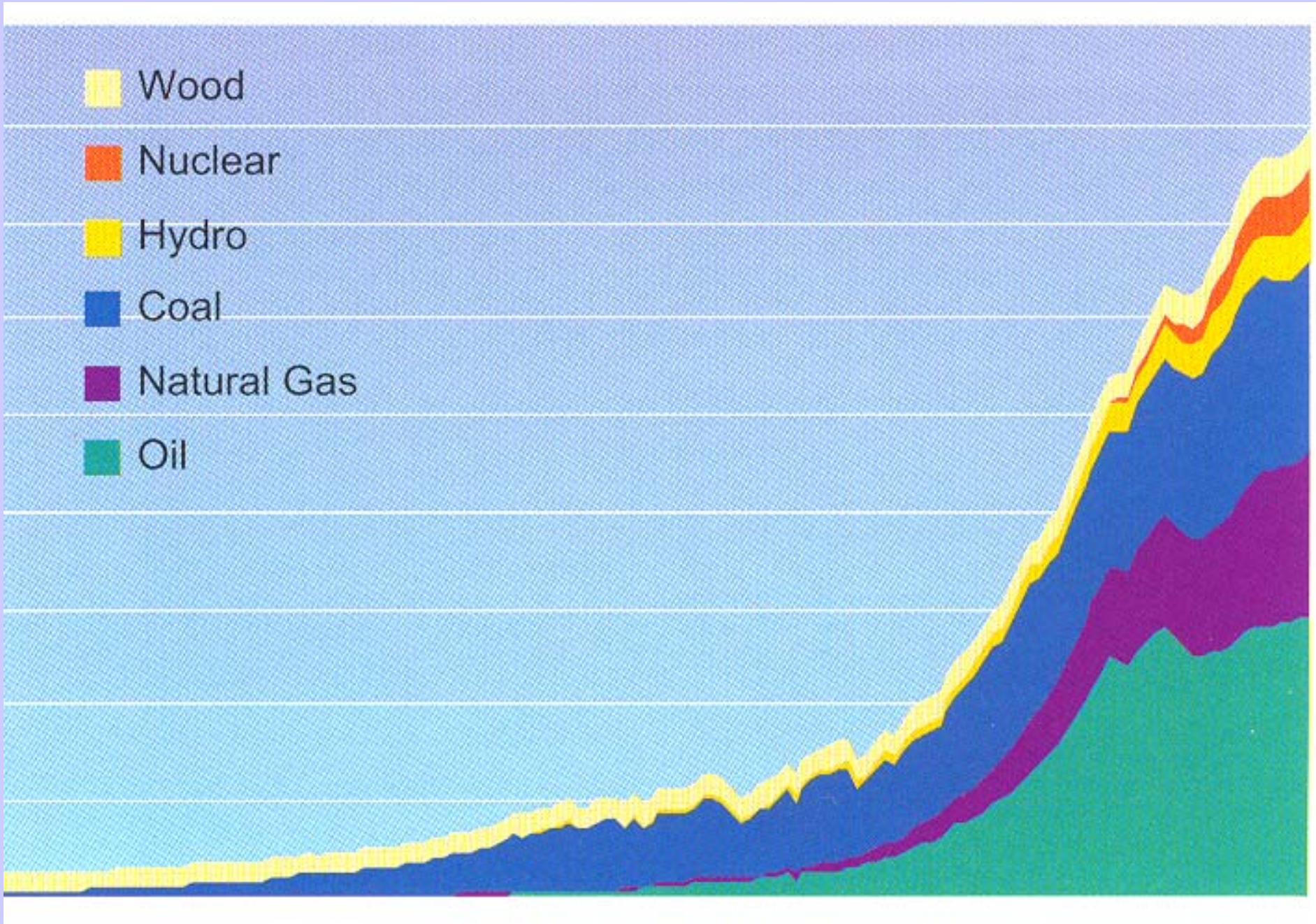
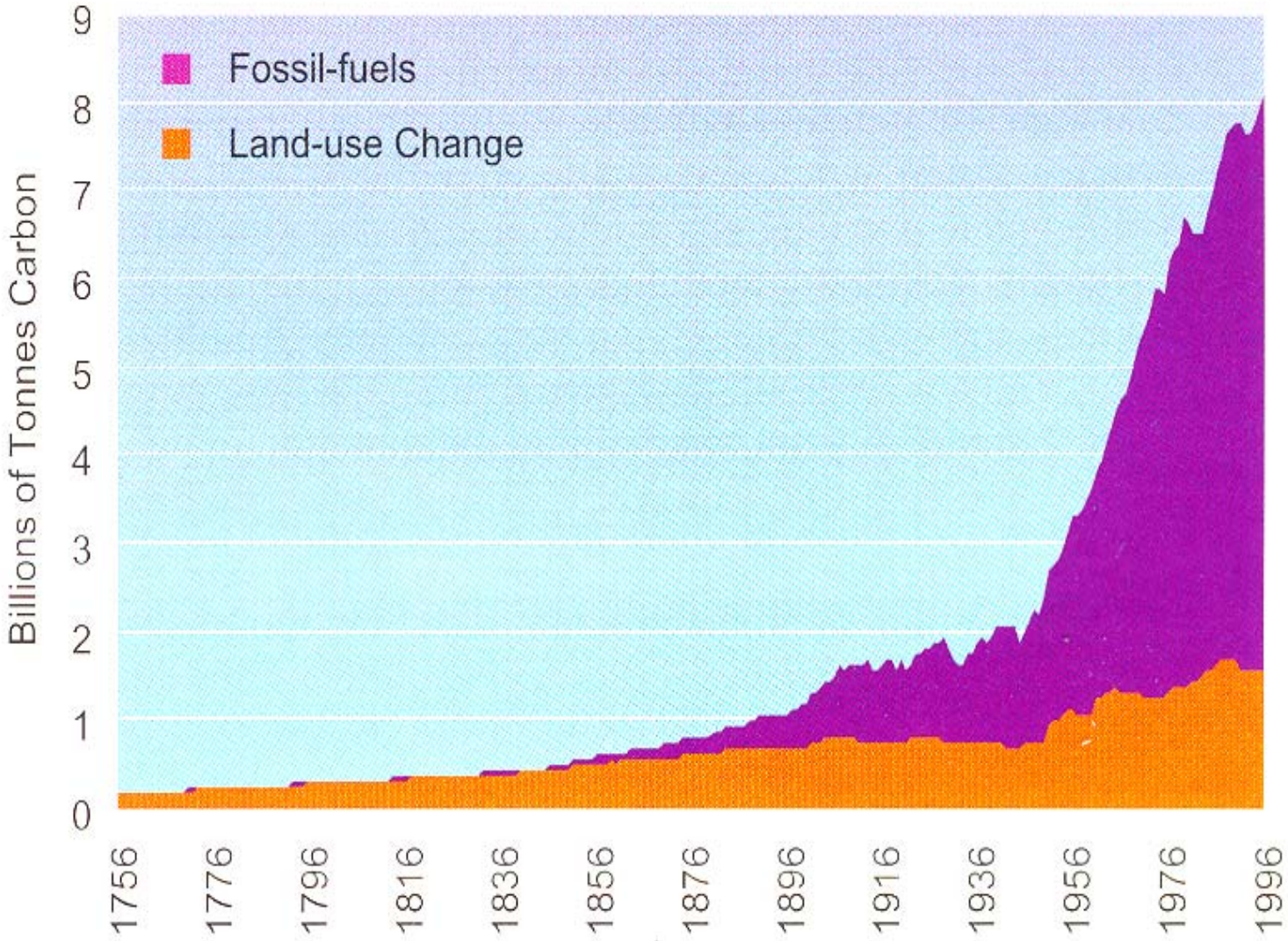


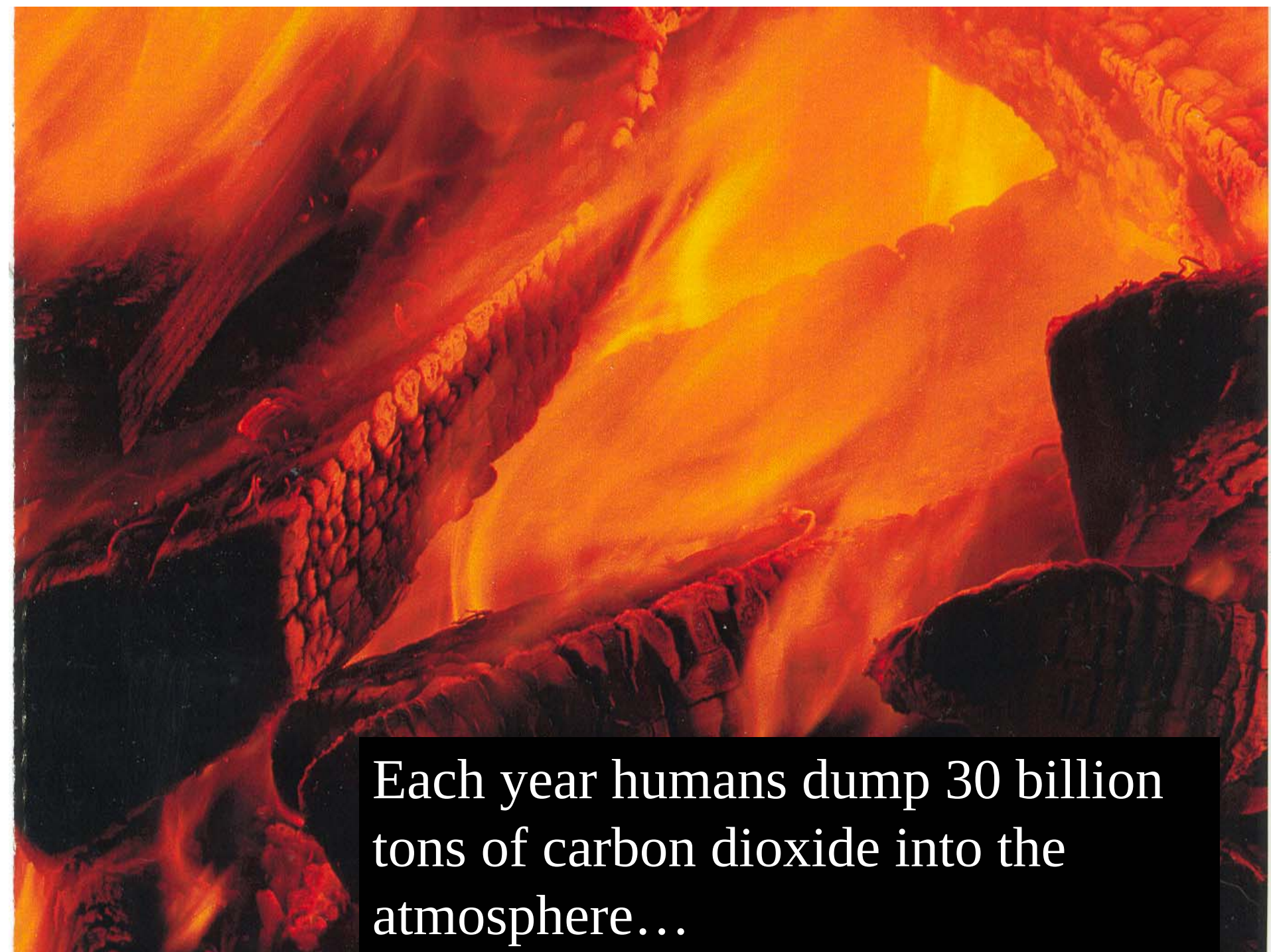
Figure 5: Growth in North American LNH regas projects

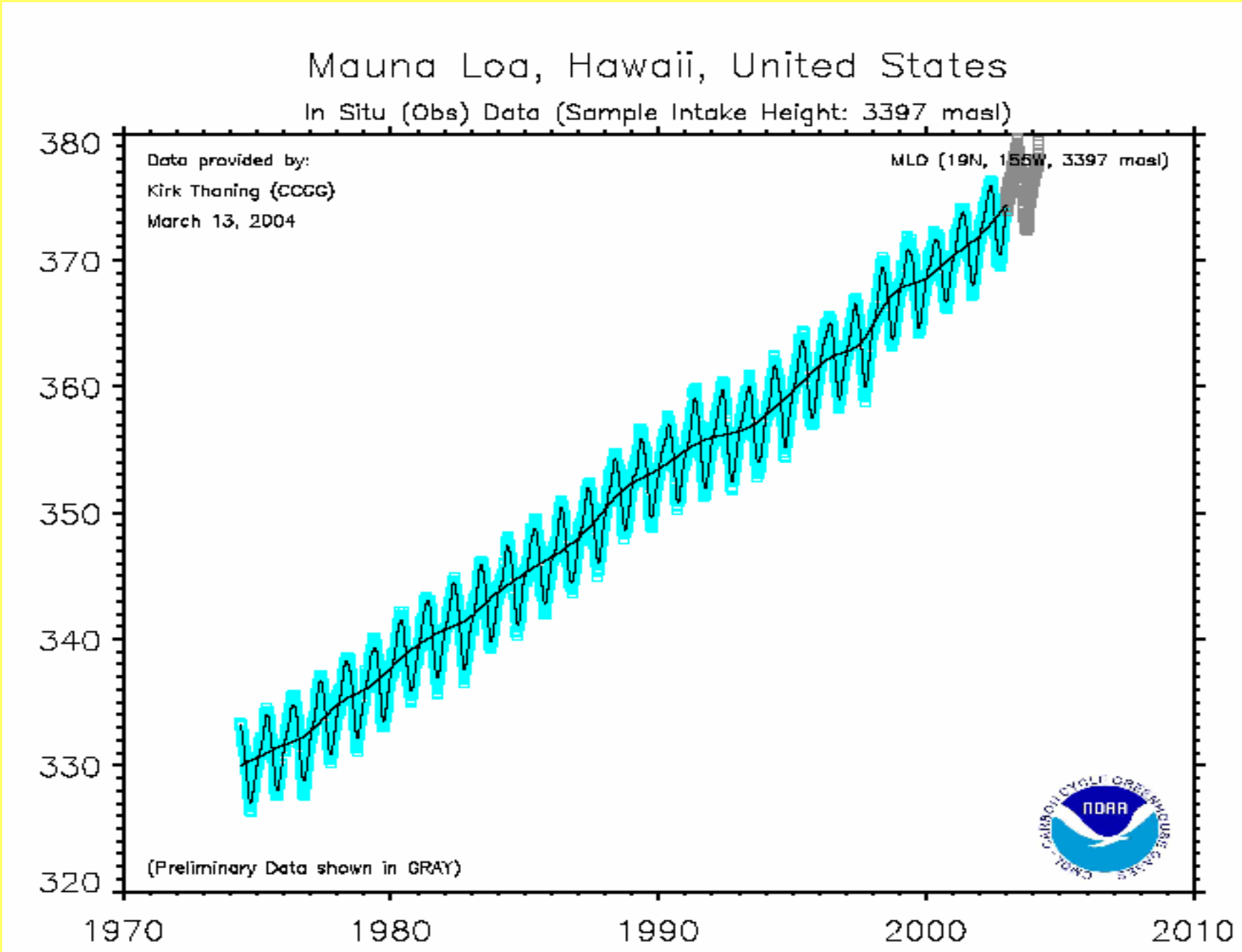

Smoke means the production of


Wood
Nuclear
Hydro
Coal
Natural Gas
Oil

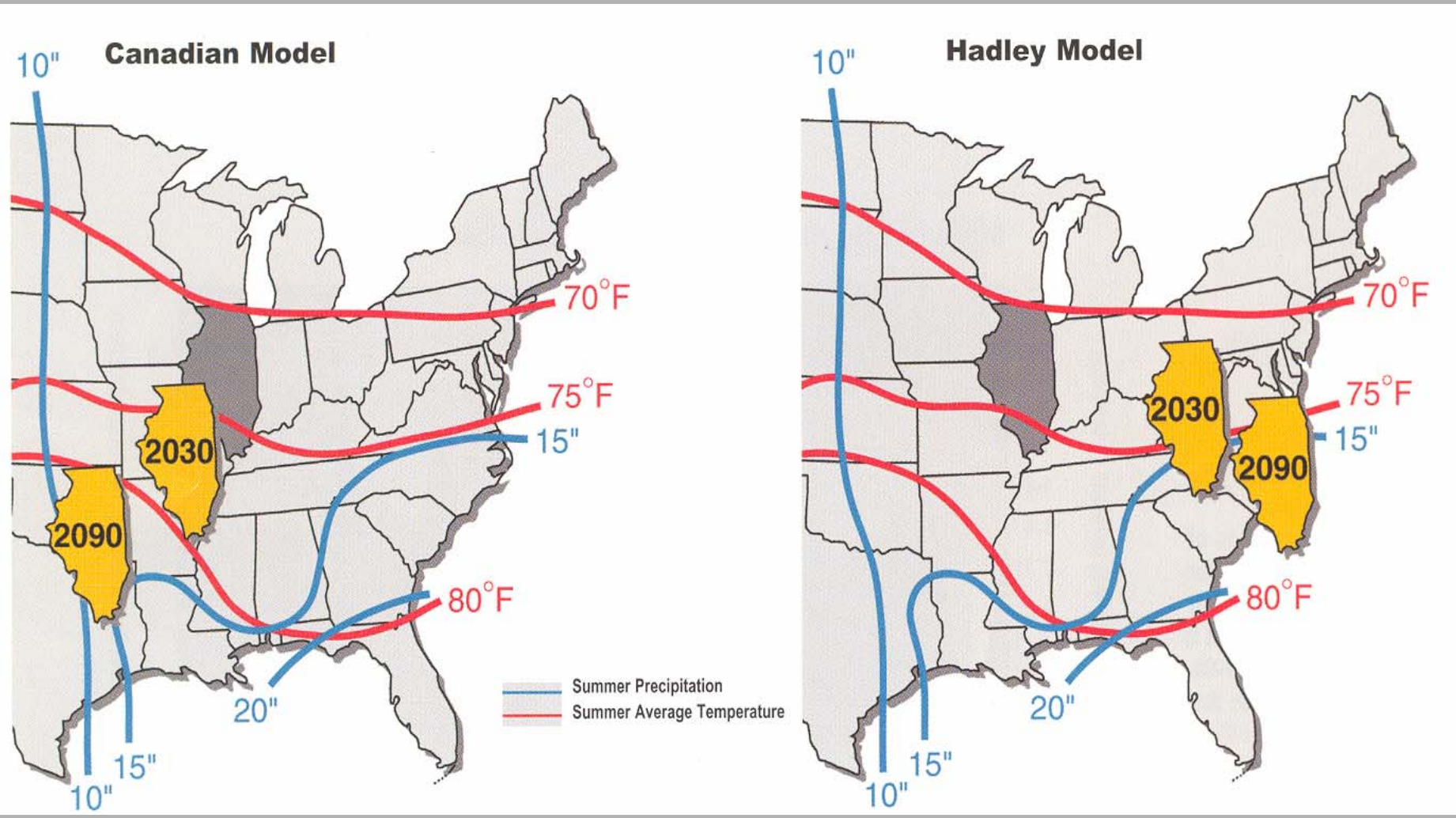
Global Carbon Emissions




Each year humans dump 30 billion tons of carbon dioxide into the atmosphere…


Mauna Loa, Hawaii, United States
In Situ (Obs) Data (Sample Intake Height: 3397 masl)
Data provided by:
Kirk Thoning (CCGG)
March 13, 2004
MLO (19N, 155W, 3397 masl)
(Preliminary Data shown in GRAY)
NOAA
380
370
360
350
340
330
320
1970
1980
1990
2000
2010

“We are not in Kansas anymore…”



THE CLIMATE CHALLENGE

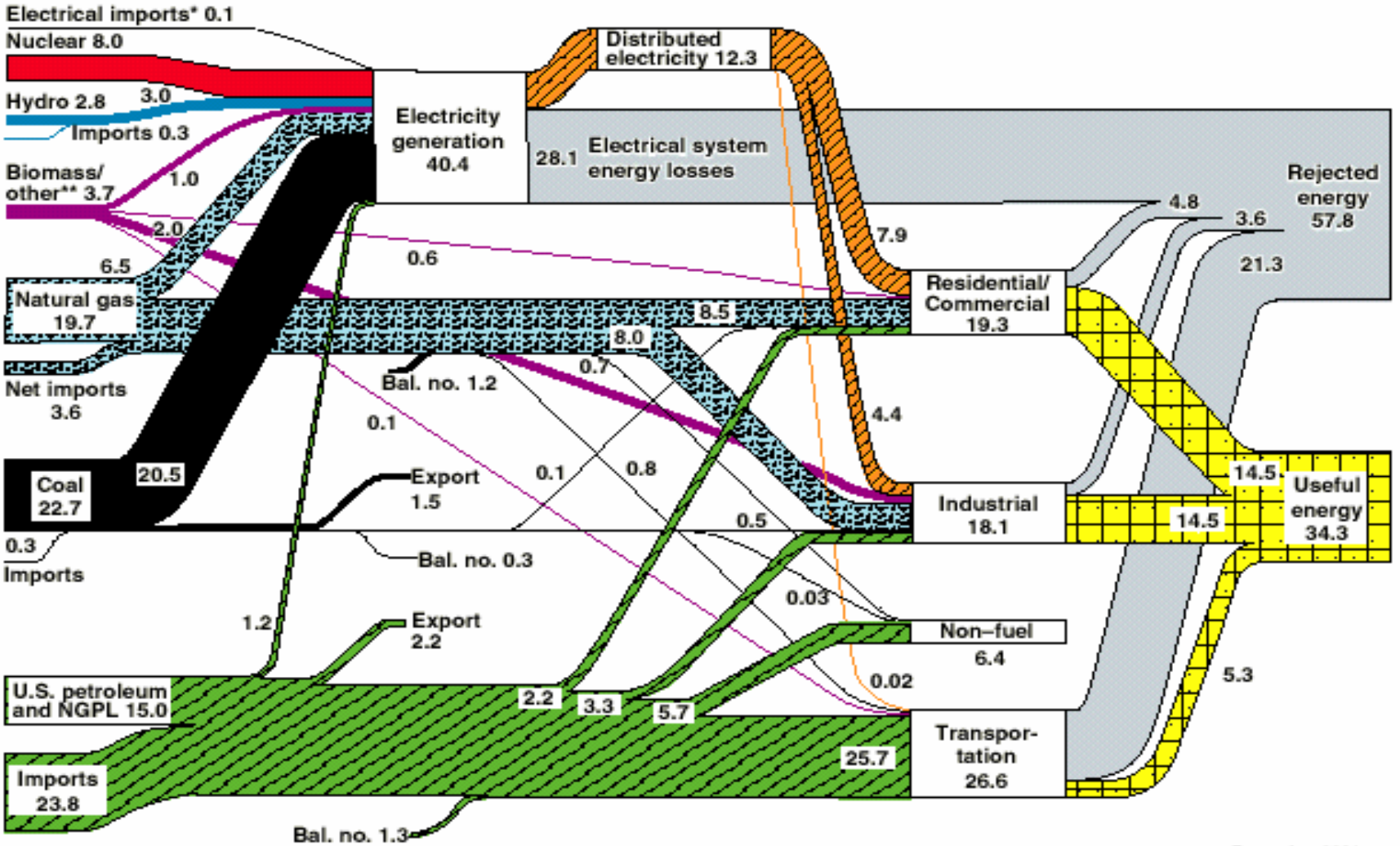
Fossil Fuels are the basis of our prosperity

Burning these fuels produces carbon dioxide, a greenhouse gas. Some of the carbon dioxide produced today will still be in the atmosphere a century from now

To stabilize atmospheric concentrations of CO2, emissions must fall during a century when they would otherwise likely double or triple…

Solution: Efficiency, clean energy, emission limits, electrify the world…

U.S. Energy Flow Trends – 2000
Net Primary Resource Consumption 98.5 Quads



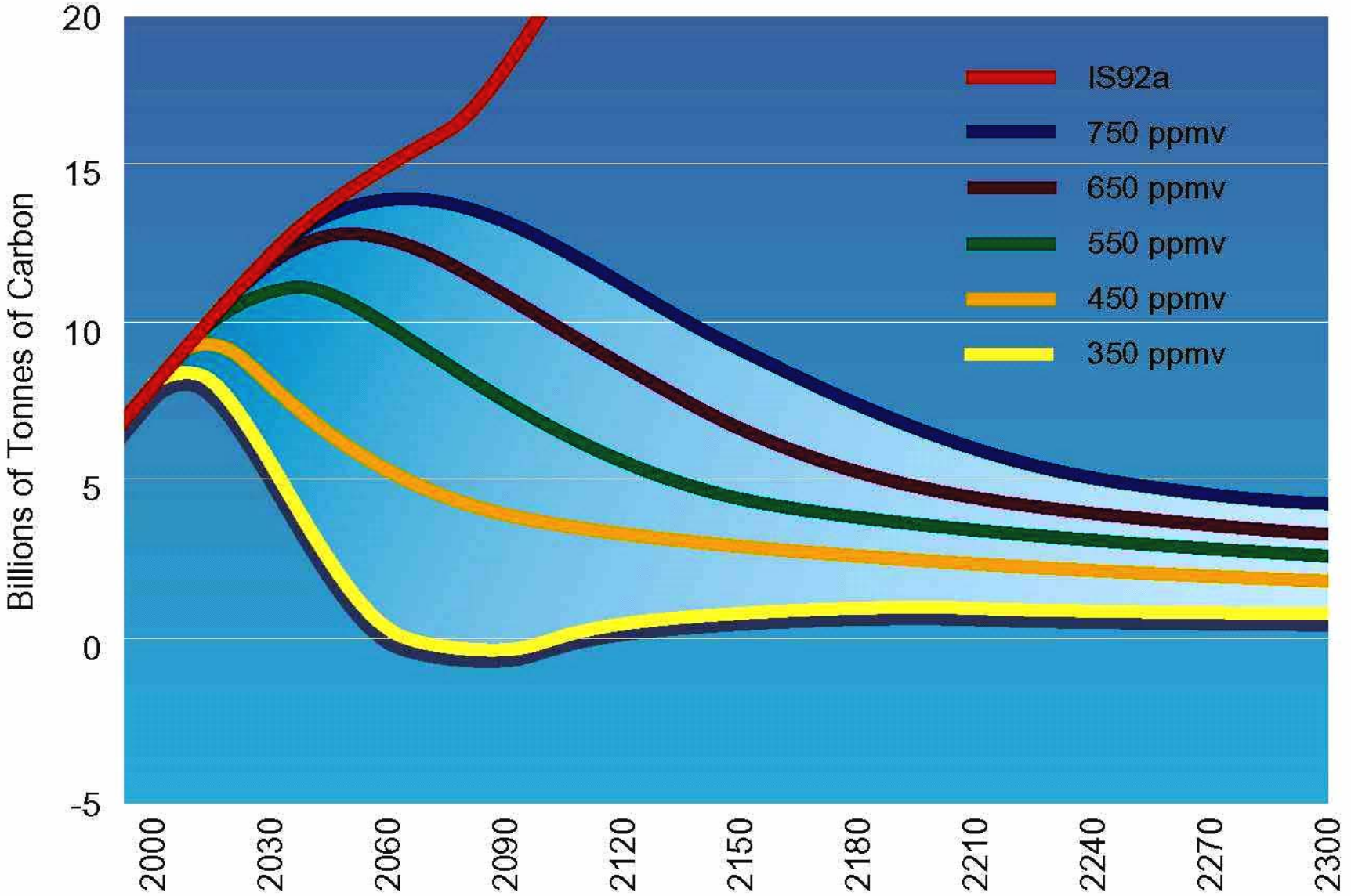
Source: Production and end-use data from Energy Information Administration, *Annual Energy Review 2000*
*Net fossil-fuel electrical imports
**Biomass/other includes wood and waste, geothermal, solar, and wind.

December 2001
Lawrence Livermore
National Laboratory

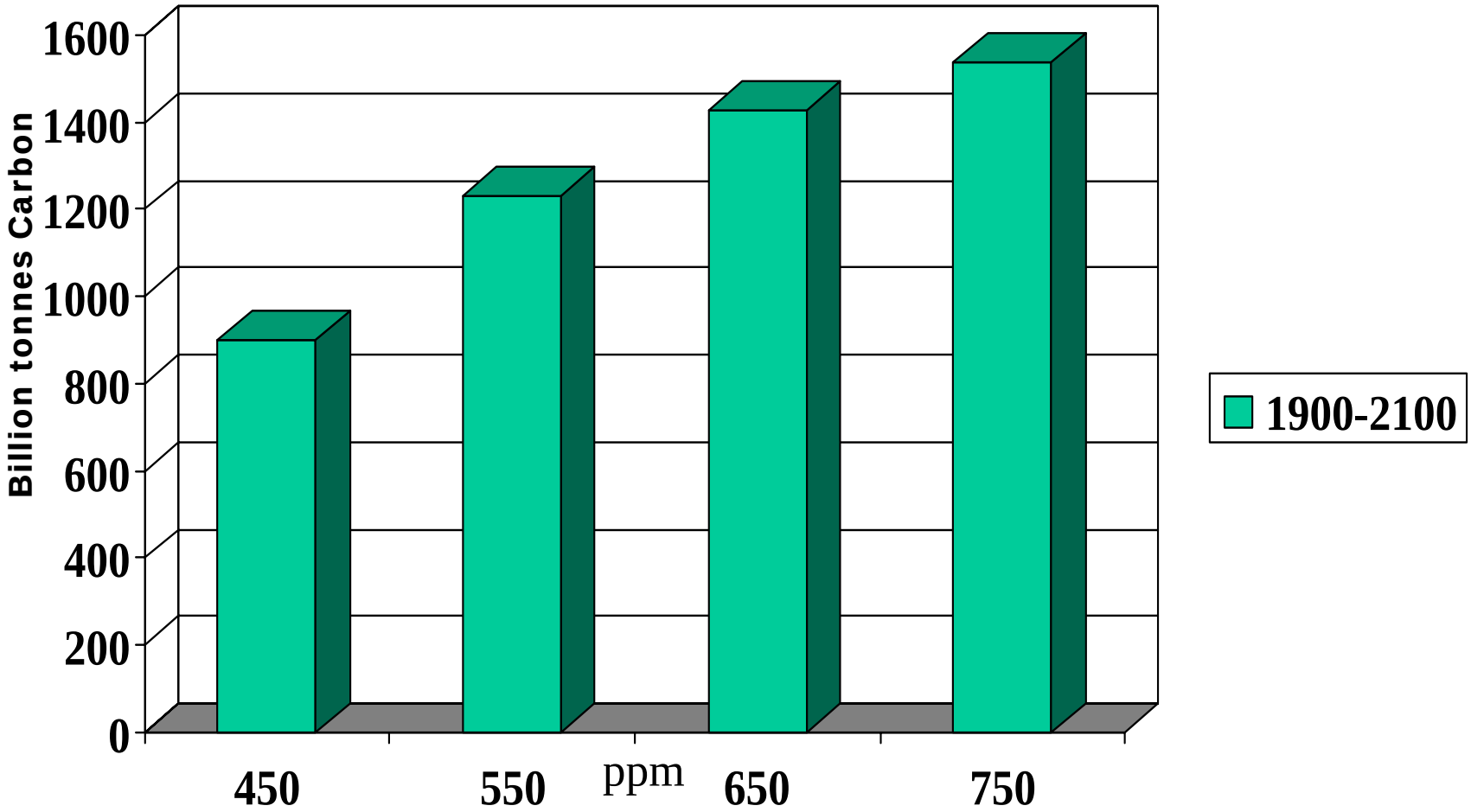
Presenting the remarkable Toyota Prius. Balancing the needs of a driver with the needs of the planet.

www.toyota.com/prius

Emissions Trajectories Consistent With Various Atmospheric CO_2 Concentration Ceilings

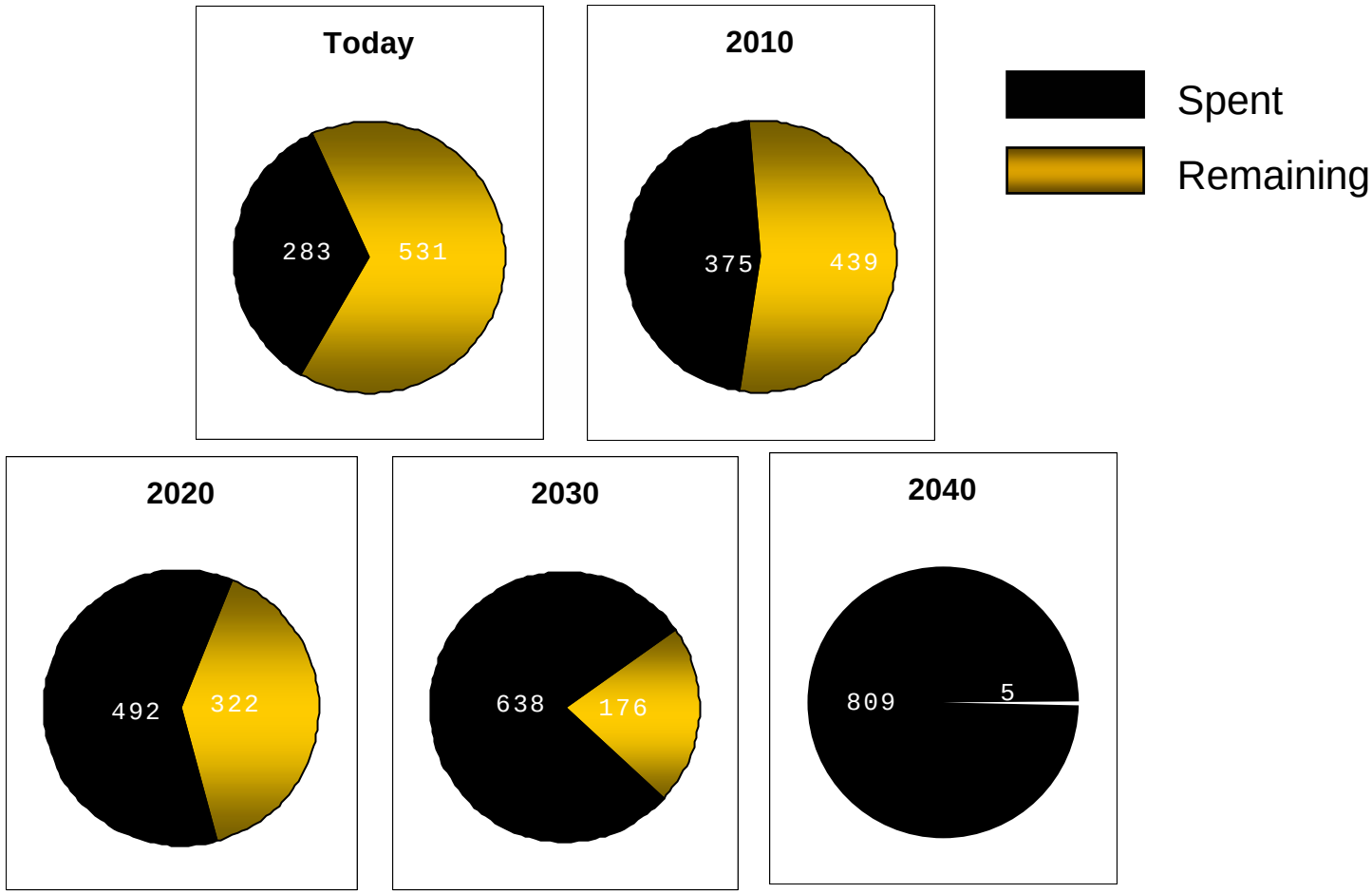


Stabilization Implies a "Carbon Budget"



The Budget is Disappearing

Cumulative carbon emissions 1900-2100 (GtC)



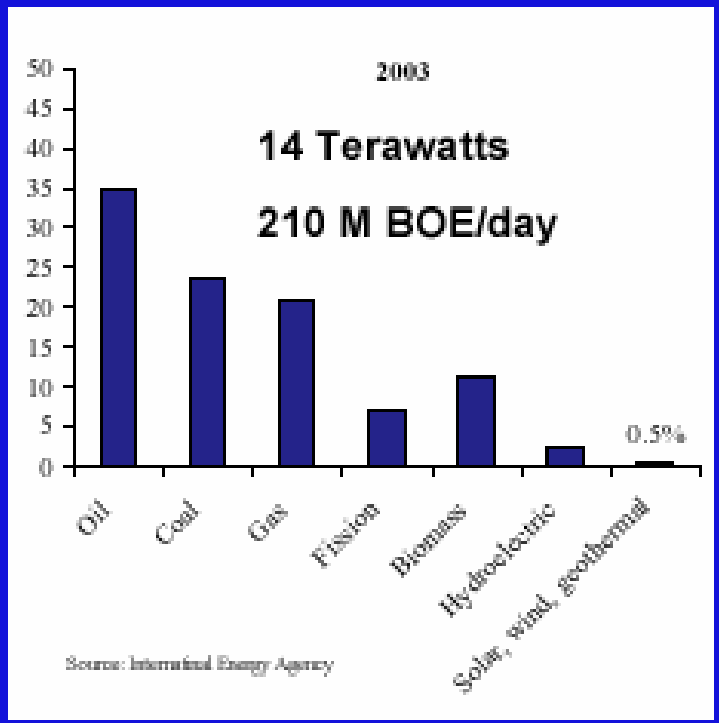
Budget for 450 ppm Stabilization

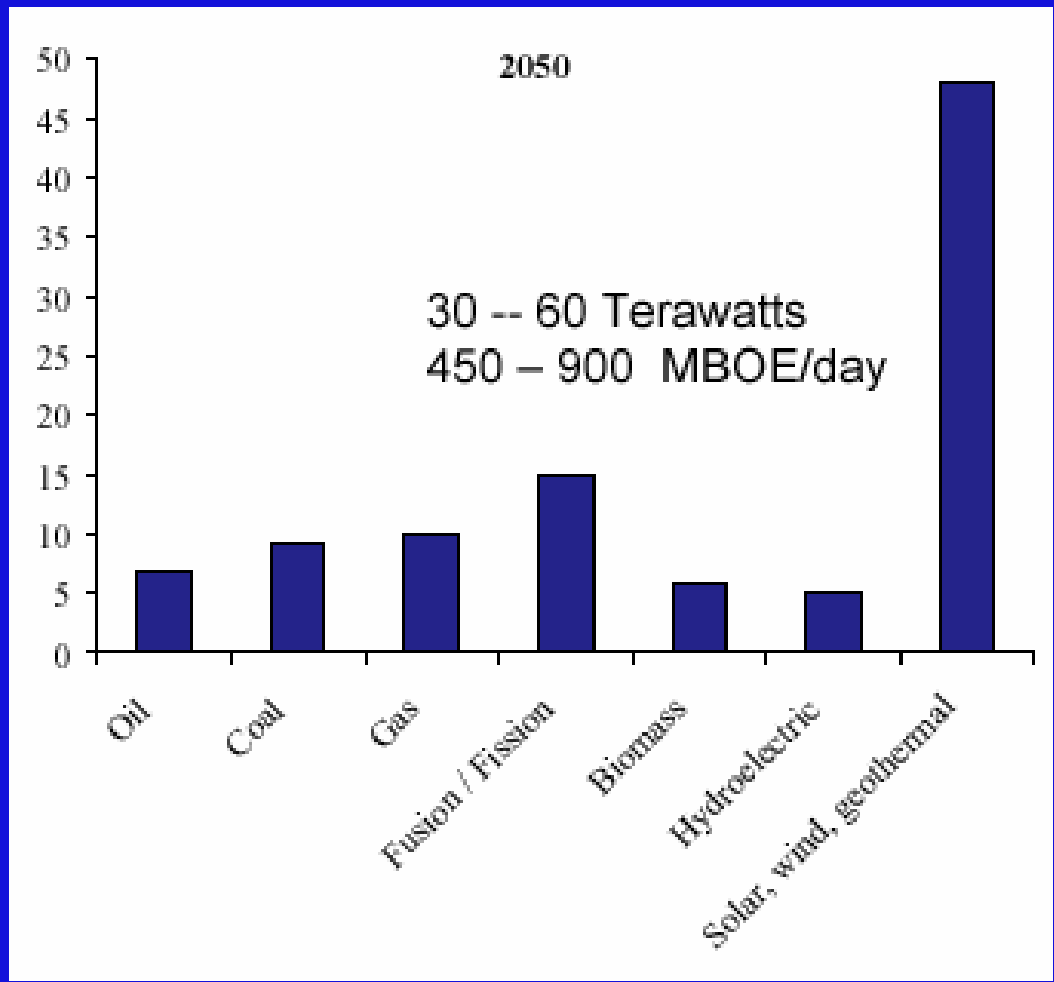
Humanity's Top Ten Problems for next 50 years

1. **ENERGY**
2. WATER
3. FOOD
4. ENVIRONMENT
5. POVERTY
6. TERRORISM & WAR
7. DISEASE
8. EDUCATION
9. DEMOCRACY
10. POPULATION

2003	6.3	Billion People
2050	9-10	Billion People

The ENERGY REVOLUTION (The Terawatt Challenge)





The Basis of Prosperity

20st Century = OIL

21st Century = ??

14 Enabling Nanotech Revolutions

1. Photovoltaics -- a revolution to drop cost by 10 to100 fold.
2. H_2 storage -- a revolution in light weight materials for pressure tanks , and/or a new light weight, easily reversible hydrogen chemisorption system
3. Fuel cells -- a revolution to drop the cost by nearly 10 to 100 fold
4. Batteries and supercapacitors -- revolution to improve by 10-100x for automotive and distributed generation applications.
5. Photocatalytic reduction of CO_2 to produce a liquid fuel such as methanol.
6. Direct photoconversion of light + water to produce H_2
7. Super-strong, light weight materials to drop cost to LEO, GEO, and later the moon by > 100 x, to enable huge but low cost light harvesting structures in space; and to improve efficiency of cars, planes, etc.
8. Nanoelectronics to revolutionize computers, sensors and devices.

14 Enabling Nanotech Revolutions

9. High current cables (superconductors, or quantum conductors) with which to rewire the electrical transmission grid, and enable continental, and even worldwide electrical energy transport; and also to replace aluminum and copper wires essentially everywhere -- particularly in the windings of electric motors (especially good if we can eliminate eddy current losses).

10. Thermochemical catalysts to generate H_2 from water that work efficiently at temperatures lower than 900 C.

11. CO_2 mineralization schemes that can work on a vast scale, hopefully starting from basalt and having no waste streams.

12. Nanoelectronics based Robotics with AI to enable construction maintenance of solar structures in space and on the moon; and to enable nuclear reactor maintenance and fuel reprocessing.

13. NanoMaterials/ coatings that will enable vastly lower the cost of deep drilling, to enable HDR (hot dry rock) geothermal heat mining.

14. Nanotech lighting to replace incandescent and fluorescent lights

EPRI CONCLUDES:

Better technology alone is not enough, also need emission limits

CARBON DIOXIDE WILL GET A VALUE

$3 TO $10 PER TON, RISING OVER TIME

$10/MWH FOR COAL, $6 FOR GAS

INTRIGUING QUESTION #1

How Badly Will the United States Need Agricultural Energy Crops?

Ethanol, biodiesel, wind power…

INTRIGUING QUESTION 2

Could Wind and Wind-Generated Hydrogen

Someday Be South Dakota's

Largest Export?

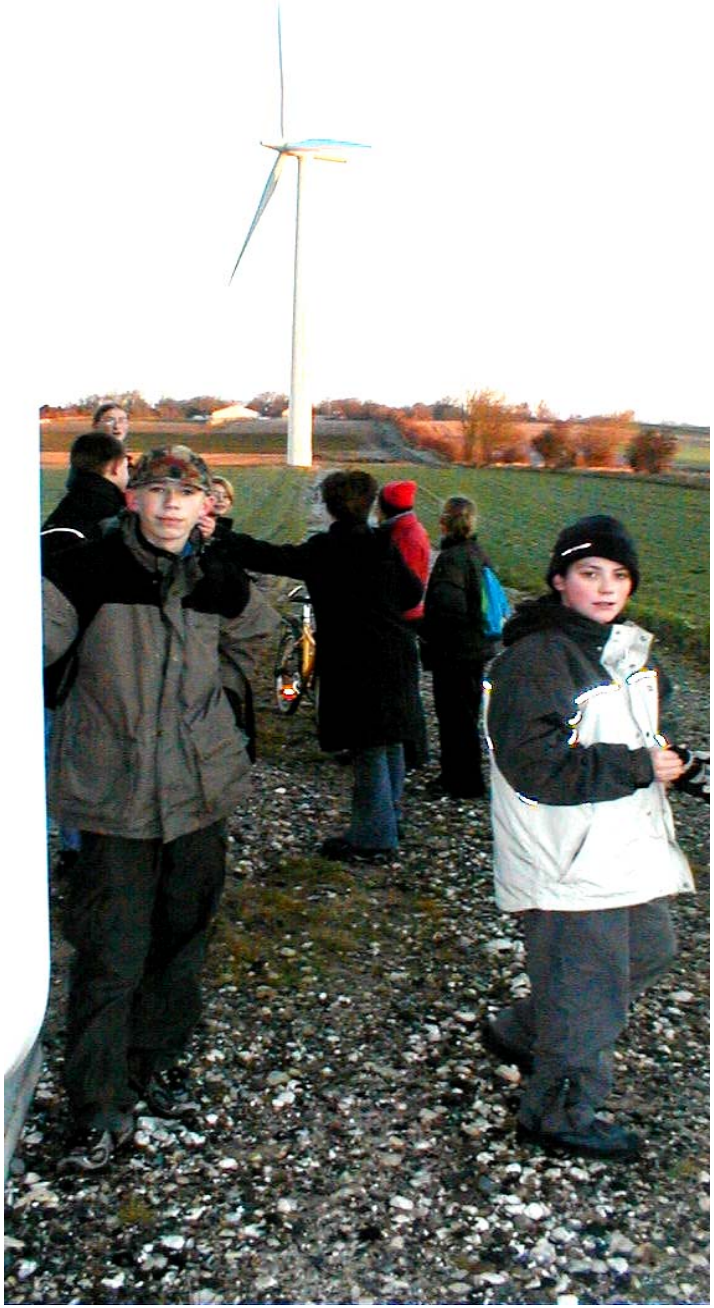
Worth $1 Billion/year

INTRIGUING QUESTION 3

Could South Dakota be a test platform for carbon capture at coal plants…or

For renewable hydrogen… or

For carbon sequestration in agricultural soils?



Danish Renewable Energy Island…

Selected in nation wide contest…

Denmark: 18% electricity from wind…

5% own shares of utility scale wind turbines..

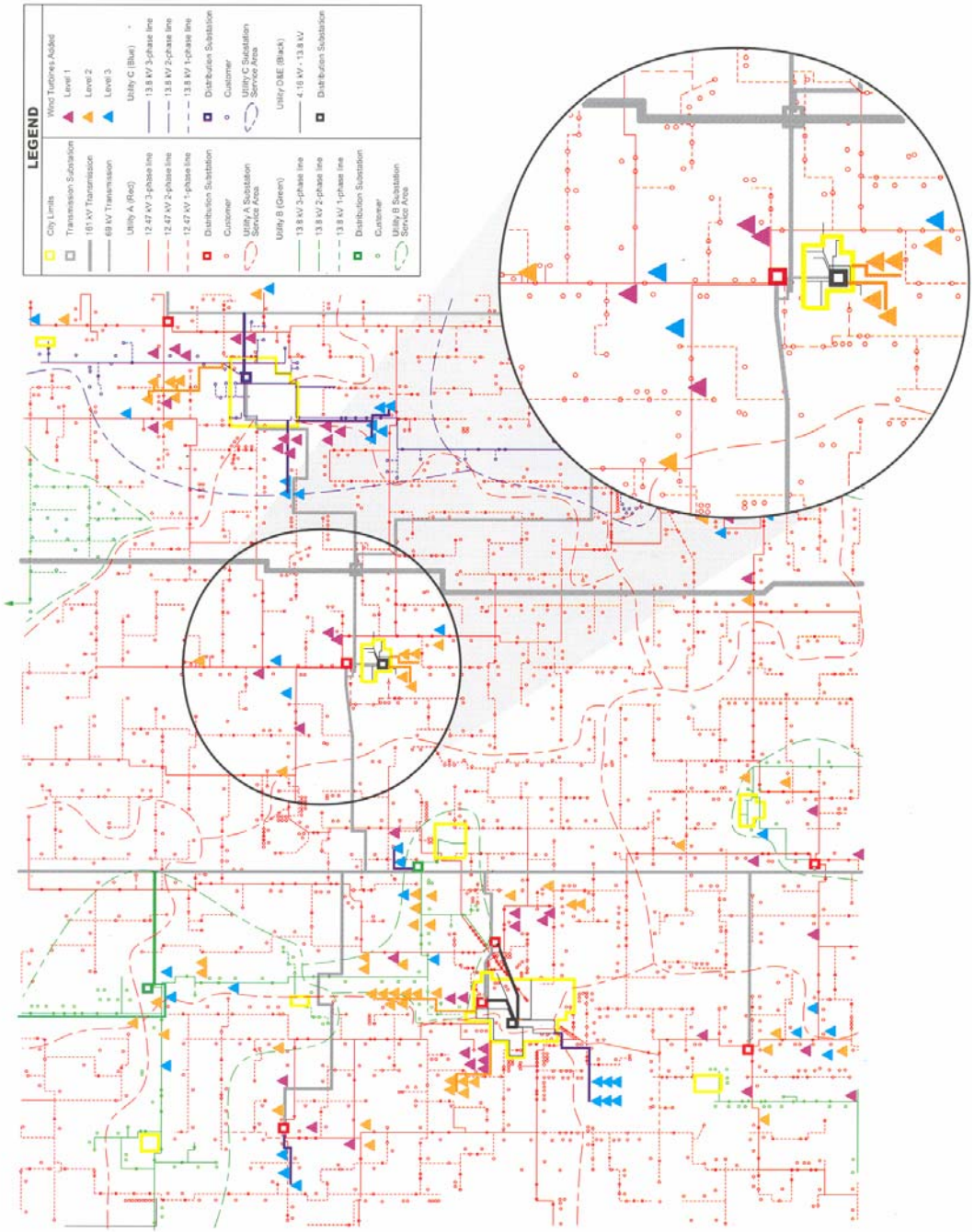


Figure 3.7 Electrical lines, customers, and wind turbine placement in Iowa Case Study area.


Carpe
Ventem?

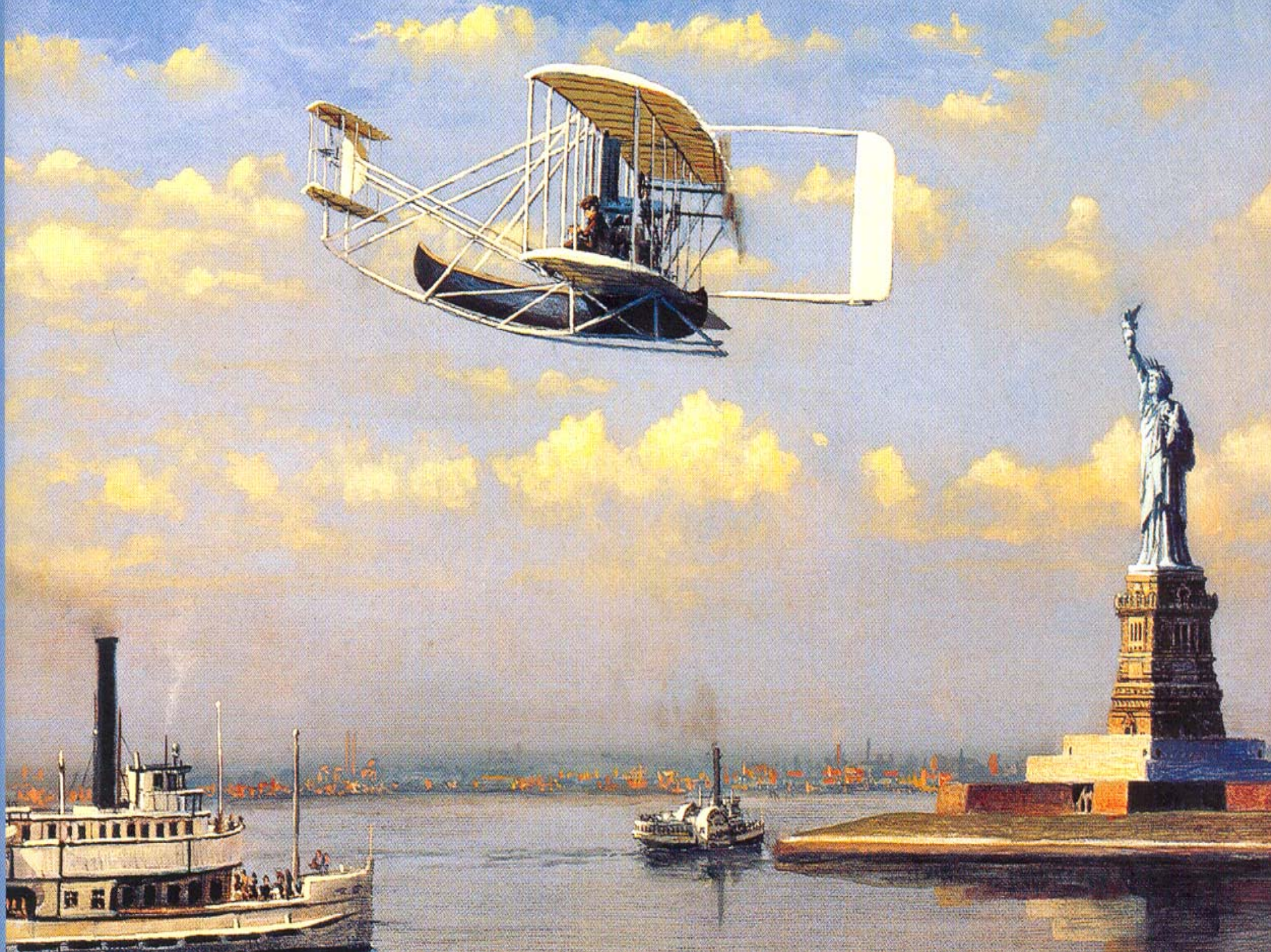
www.aspencore.org

Thanks!

Rudall@aol.com

www.aspencore.org


NEW YORKER

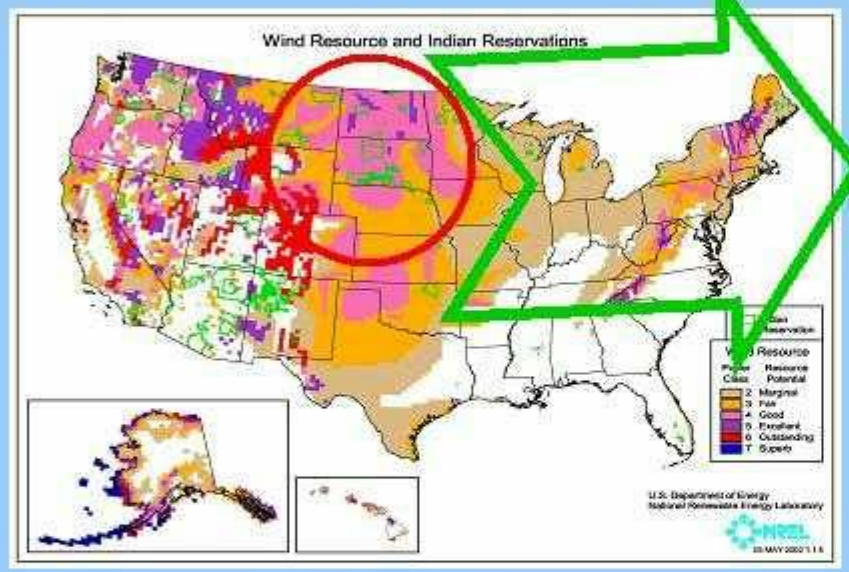


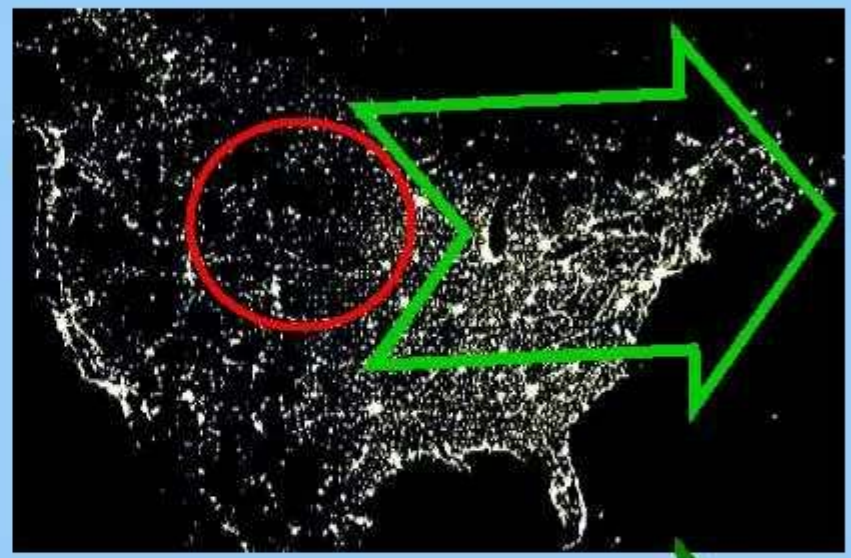

NEW YORKER

Learning We Live In A WINDSHED !

The Richest Wind Energy Regime in the World is Just Upwind from the Region of Greatest Energy Consumption and Acid Rain Impacts in North America!!

UpWind Generation ⇨ DownWind Benefits





Sustainable Homeland Economic Development based on Tribal Wind Energy Generation

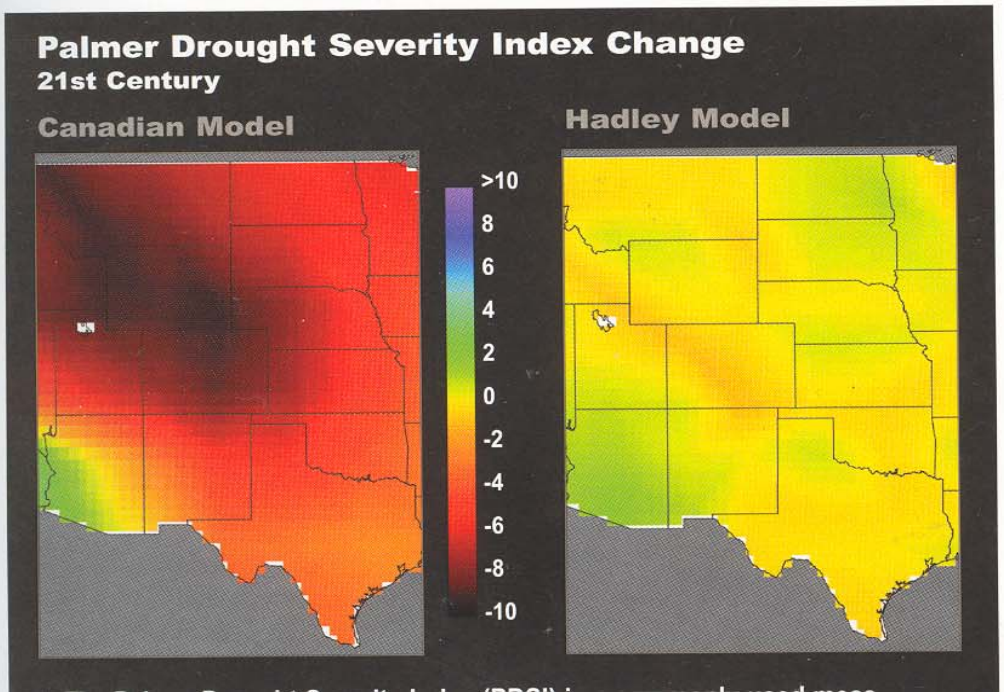
Downwind Communities can Support Tribal Wind and Benefit from Clean Energy and Cleaner Air

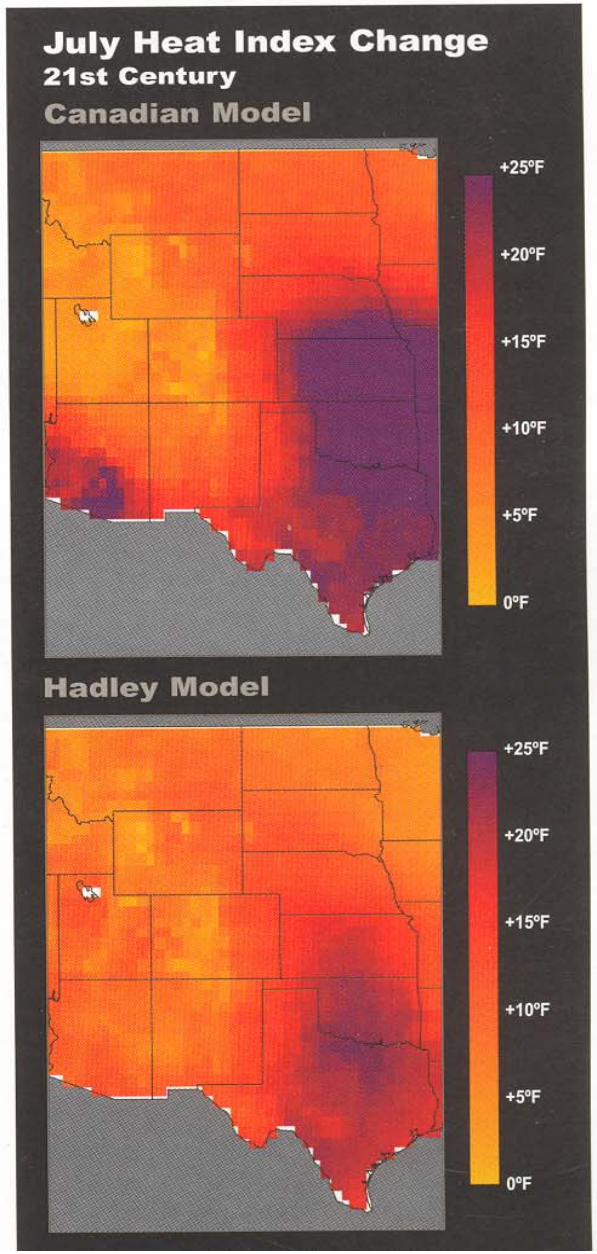
www.EnergyIndependenceDay.org

Intertribal Council On Utility Policy

There is some chance that the projected increase in drought tendency in the Sand Hills of the Great Plains will result in expansion or shifting of sand dunes if vegetation cover is not maintained. The potential for new patterns in climate extremes raises questions about the ability of current coping strategies to deal with future impacts.

Adaptations: Better access to more accurate and timely information about near-term weather including extreme events, and longer-term forecasts could help reduce risk and uncertainty in decision making. For example, heat stress events are projected to occur more often in the central and southern Great Plains in the future. This information can help intensive-livestock operators weigh strategic decisions about investments in cooling systems. Real-time weather information can prepare them to implement an immediate response to cool their animals.





Carpe Ventem?