# Forest Fuels Reductions and Biomass-to-Energy;

## Parallel Opportunities for Public Benefit

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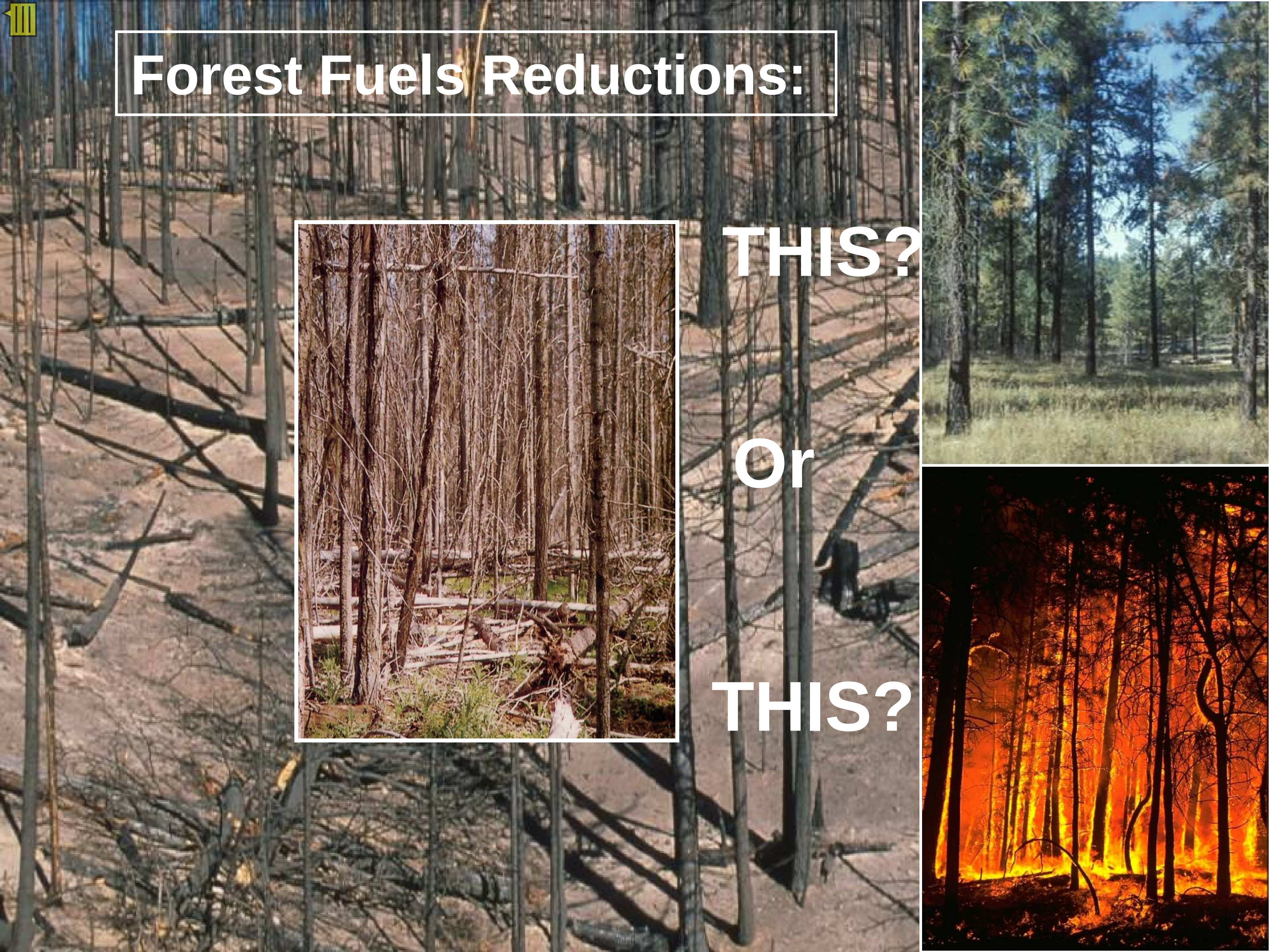
BIO ENERGY
CONFERENCE & EXHIBITION 2008

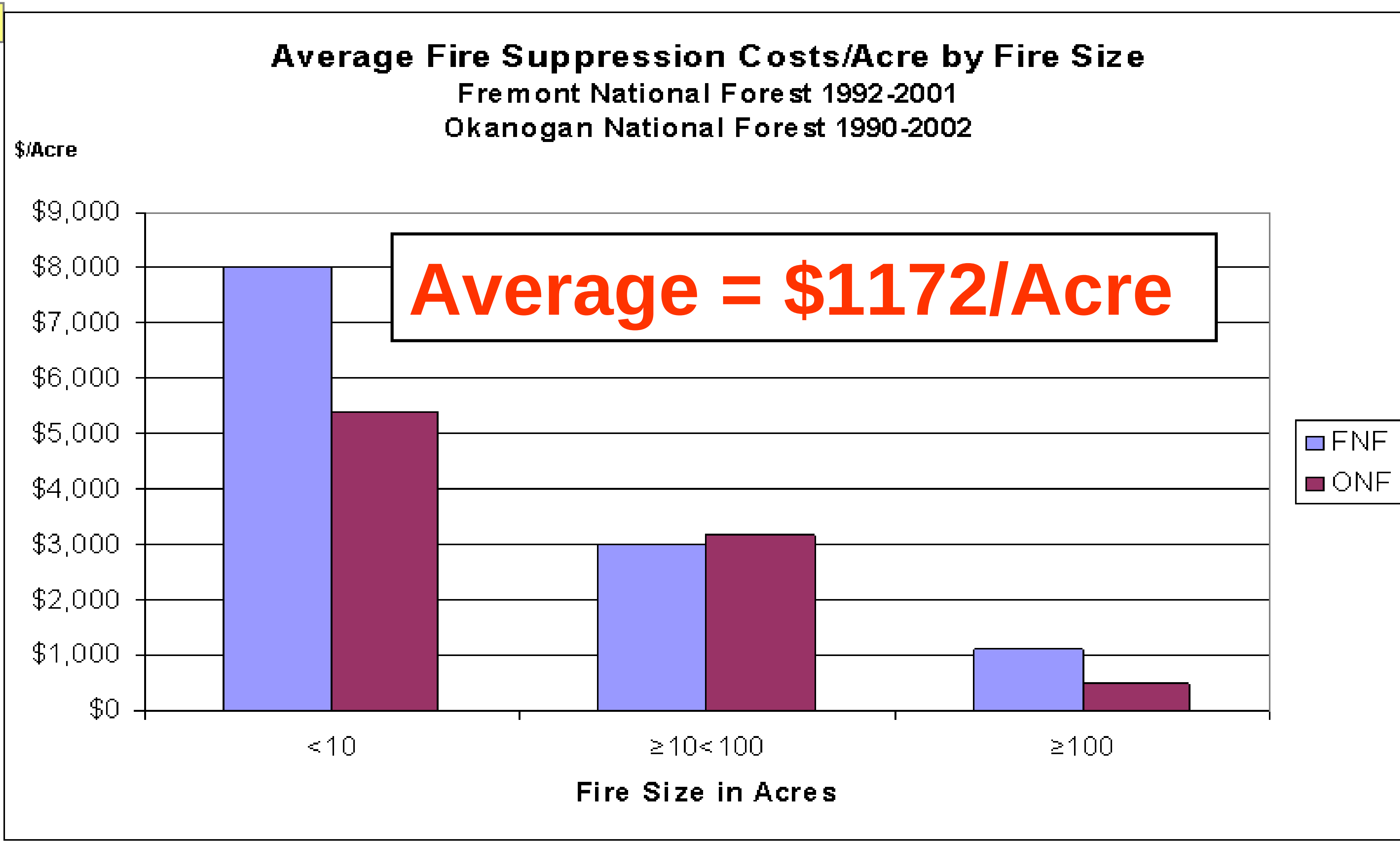

Forest Fuels Reductions:
THIS?
Or
THIS?

# The Rhetorical Problem

**Small Diameter Fuels Removals are costly; the market value of small logs may be less than the harvest and haul charges.**

**However!!**
**There are many values other than net log returns that should be considered…**


**An obvious example is the public cost of fire fighting.**


Average Fire Suppression Costs/Acre by Fire Size
Fremont National Forest 1992-2001
Okanogan National Forest 1990-2002
$/Acre
$9,000
$8,000
$7,000
$6,000
$5,000
$4,000
$3,000
$2,000
$1,000
$0
Average = $1172/Acre
FNF
ONF
<10
≥10<100
≥100
Fire Size in Acres


Fire fighting is expensive and dangerous

# Non-market Valuations

$$V_0 = \frac{V_n}{(1+i)^n}$$

**Where:**

$V_0$ = present value at time 0

$V_n$ = future value after $n$ periods (years)

$i$ = interest rate

$n$ = number of periods (years)

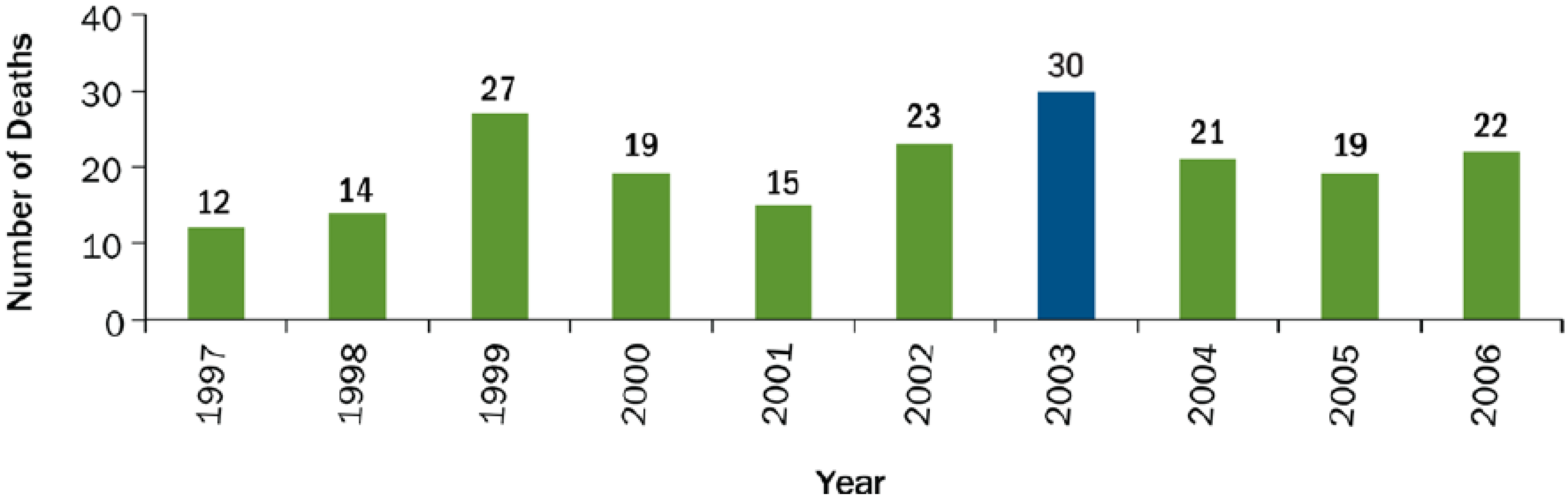
**Parametric Present Value Estimations of Fire Risk Costs with Assumptions of $1000/acre to Fight Fire and 5% as the Discount Rate.**

**For this Exercise Assume all High Risk acres burn in 30 years (15 year midpoint) and all Moderate Risk acres burn in 60 years (30 year midpoint).**

| Year | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Method 1. Present cost/ac of a forest fire at specified future year | $784 | $614 | $481 | $377 | $295 | $231 | $181 | $142 | $111 | $87 | $68 | $54 |

# Fire Fighter Fatalities = 3-5 Persons /Million Acres /Year

Figure 3. Firefighter Fatalities Related to Wildland Firefighting (1997–2006)




Fire Fighter Fatalities in the United States 2006

**Wildfires result in facility losses. Insurance losses average >$300/burned acre.**


Reuters/Fred Greaves & Phil McCarten

# Other important values can easily be estimated

**Timber losses from fire in high and moderate risk areas on the FNF and ONF average $1605/acre.**

| Treatment Benefits | Present Value per acre | |
|---|---|---|
| | High Risk | Moderate Risk |
| **Fire fighting costs avoided** | **$481** | **$231** |
| **Fatalities avoided** | **$ 10** | **$ 5** |
| **Facility losses avoided** | **$150** | **$ 72** |
| **Timber losses avoided** | **$772** | **$371** |
| **Regeneration and rehabilitation costs avoided** | **$120** | **$ 58** |
| **Community value of fire risk reduction** | **$ 63** | **$ 63** |
| **Regional economic benefits** | **$386** | **$386** |
| Total Benefits | **$1,982+** | **$1,186+** |

| | | |
|---|---|---|
| Treatment costs | | |
| **Operational costs** | **($374)** | **($374)** |
| **Forest Service contract preparation costs** | **($206)** | **($206)** |
| Total Costs | **($580)** | **($580)** |

| | | |
|---|---|---|
| Positive Net Benefits from Fuel Removals | $1,402+ | $606+ |

FNF & ONF

1,307,667 acres in High and Mod Risk

Total No-Action Liability ($2,071,000,000+)

Net Savings After Treatment Costs

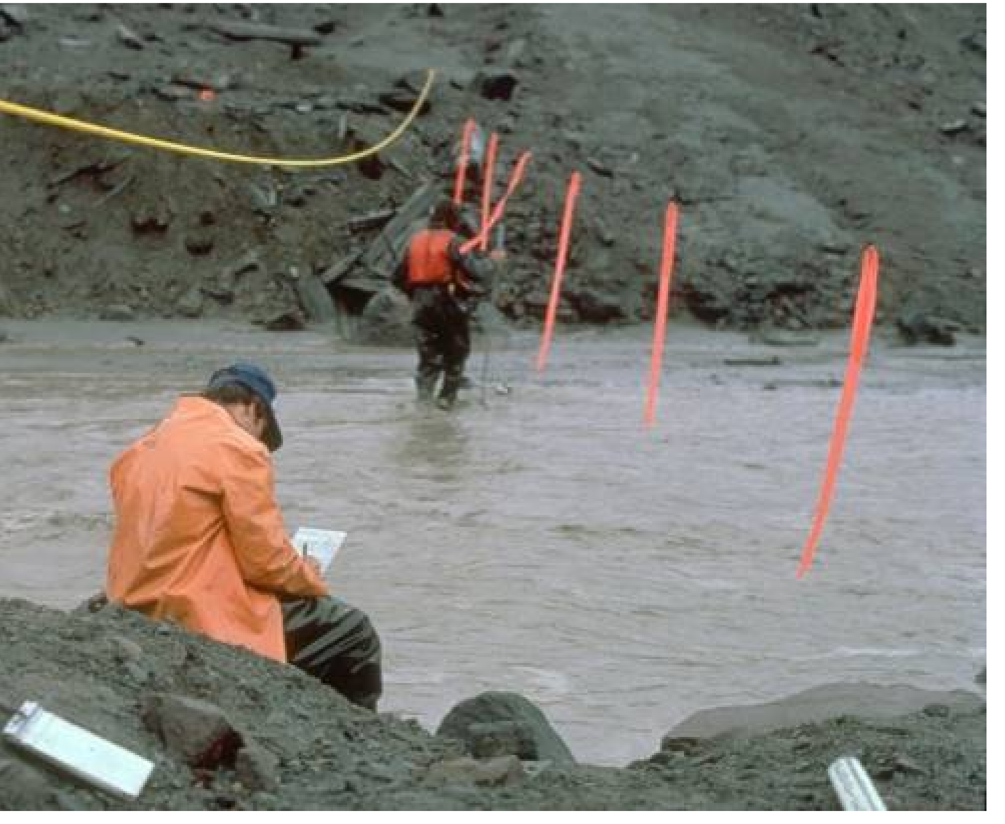
$1,312,677,159

# How do we value habitats lost to forest fires?

# *What value should we place on impacts from Erosion? Sediment? and Debris flows?*


Source: George Ice and Jeff Amoss

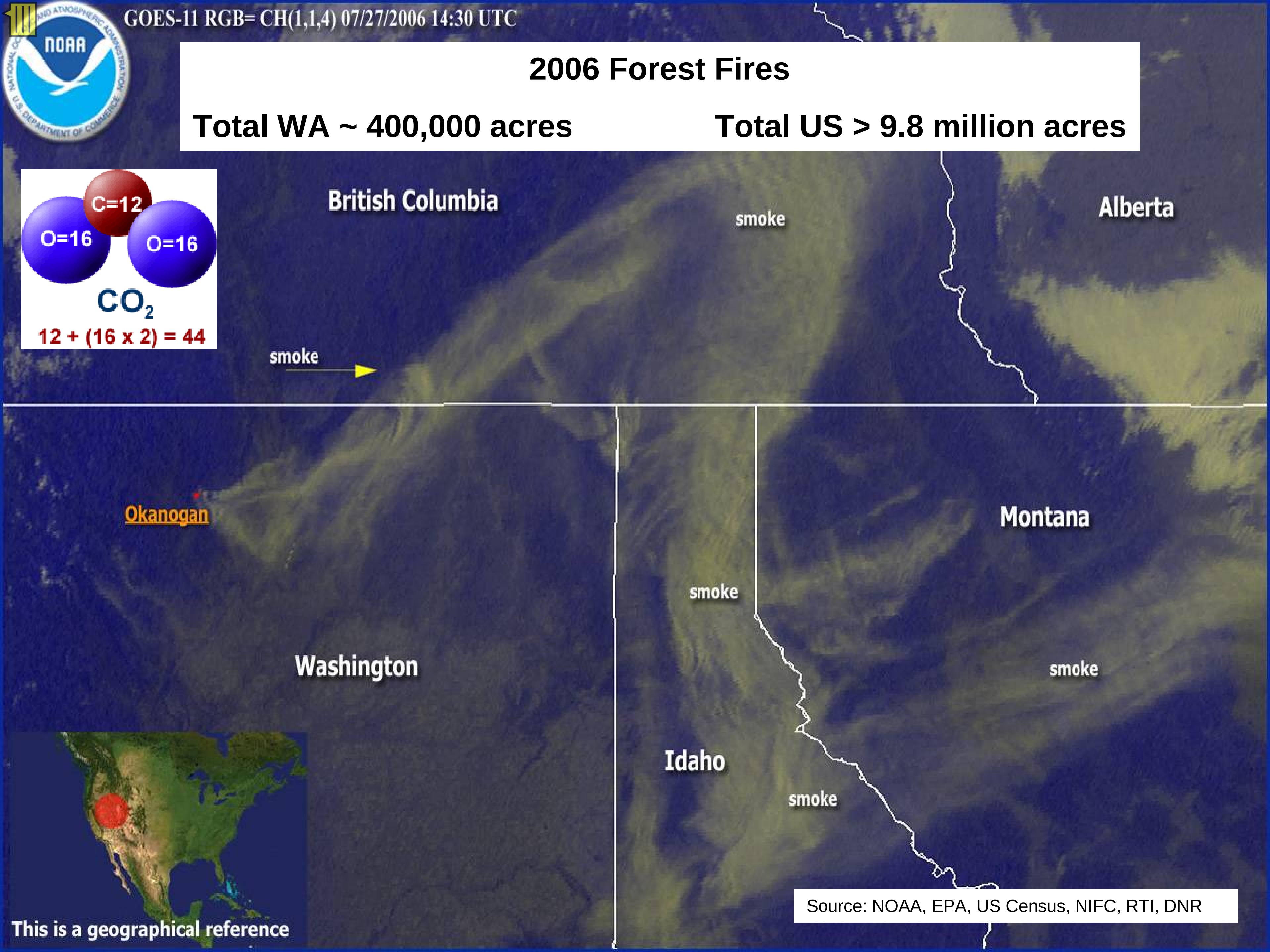

**The most precious and irreplaceable resources at risk are the soil and water.**



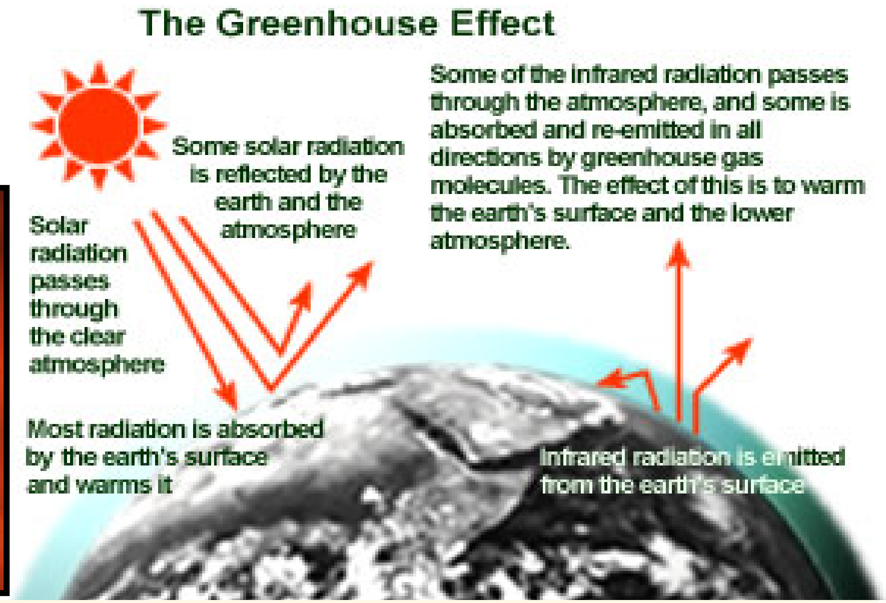
**What are the public costs of carbon and other pollutants released to the atmosphere by forest fires?**

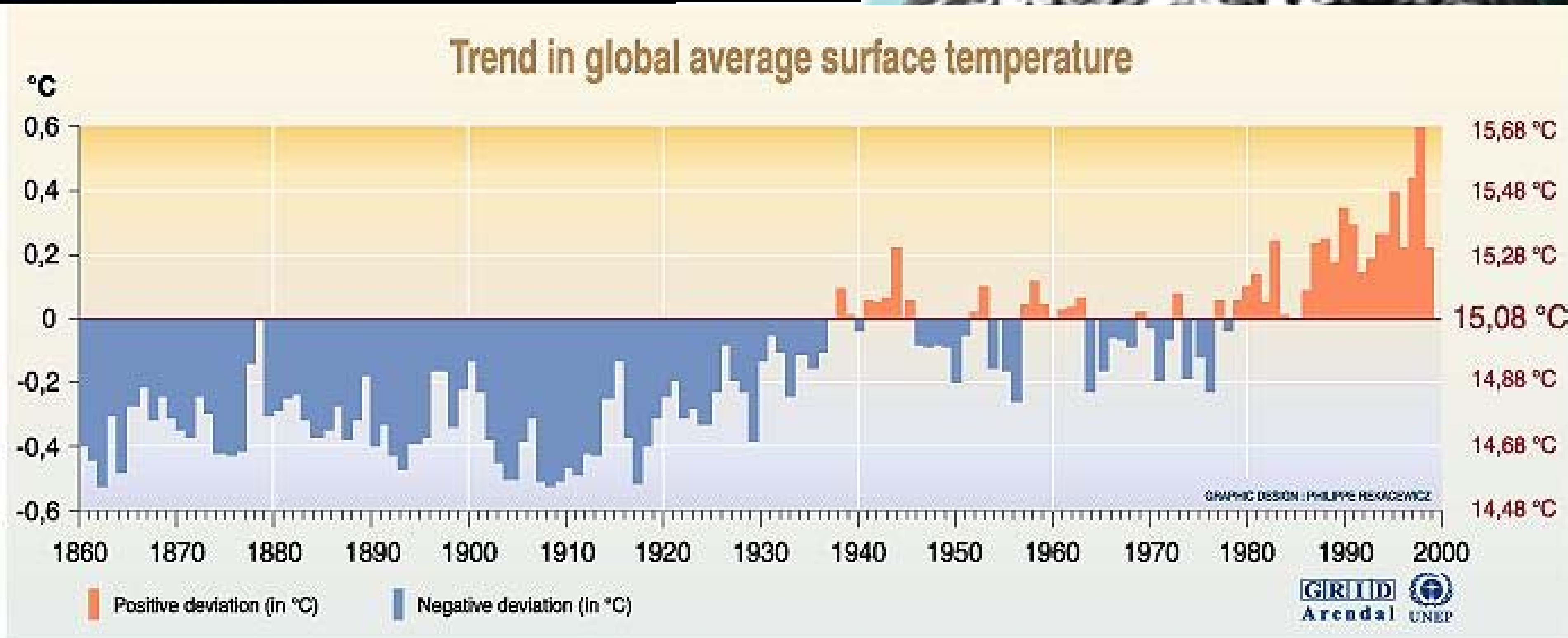
# 2006 Forest Fires

**Total WA ~ 400,000 acres** | **Total US > 9.8 million acres**




Source: NOAA, EPA, US Census, NIFC, RTI, DNR


Source: School of environmental sciences, climatic research unit, university of East Anglia, Norwich, United Kingdom, 1999.

# Managed Forests store carbon several ways

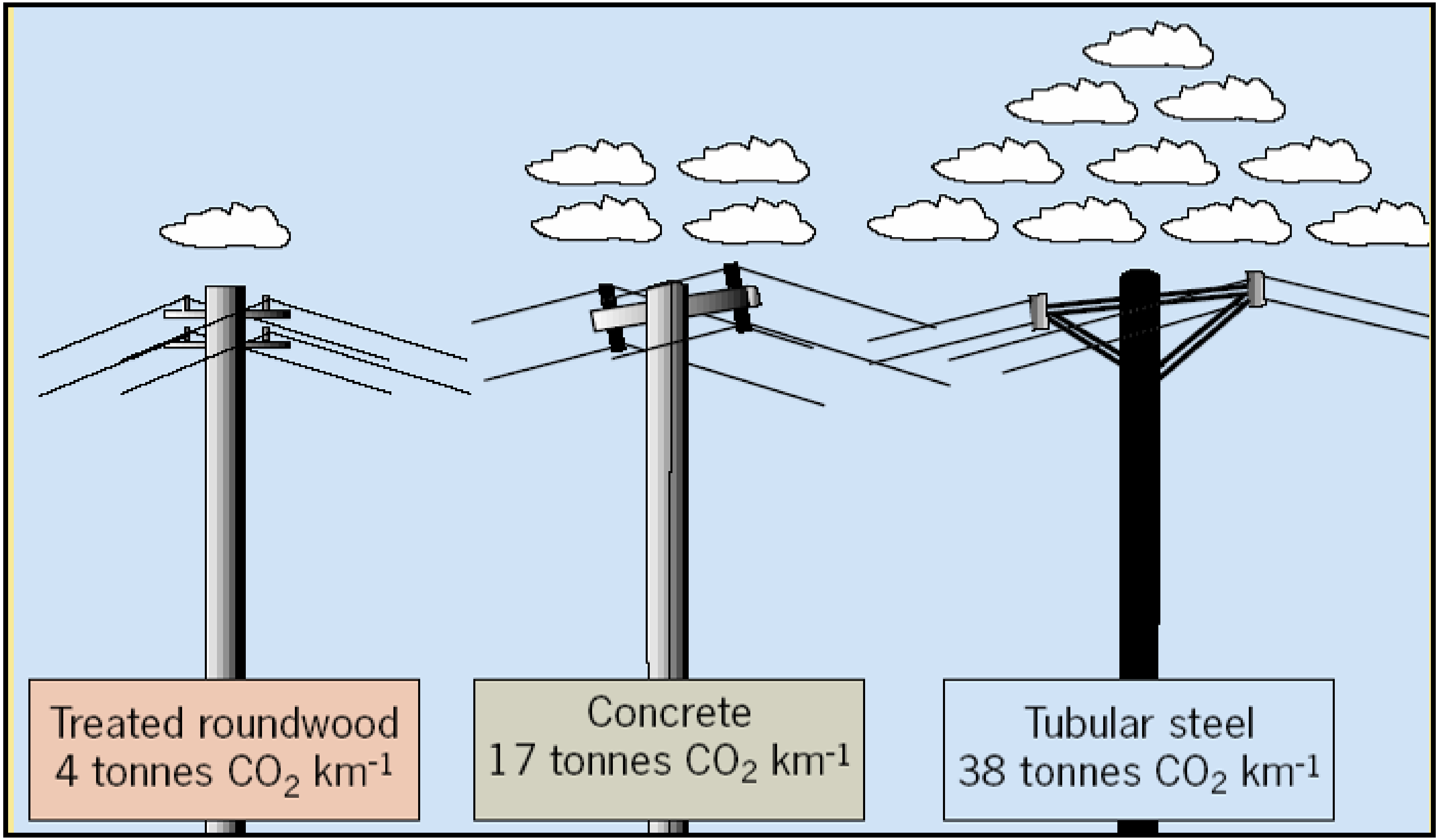
Standing forest

Forest products

Fossil fuel conservation

**Forest Management Can Help Reduce Atmospheric $CO_2$**

# CO2 emissions from product alternatives

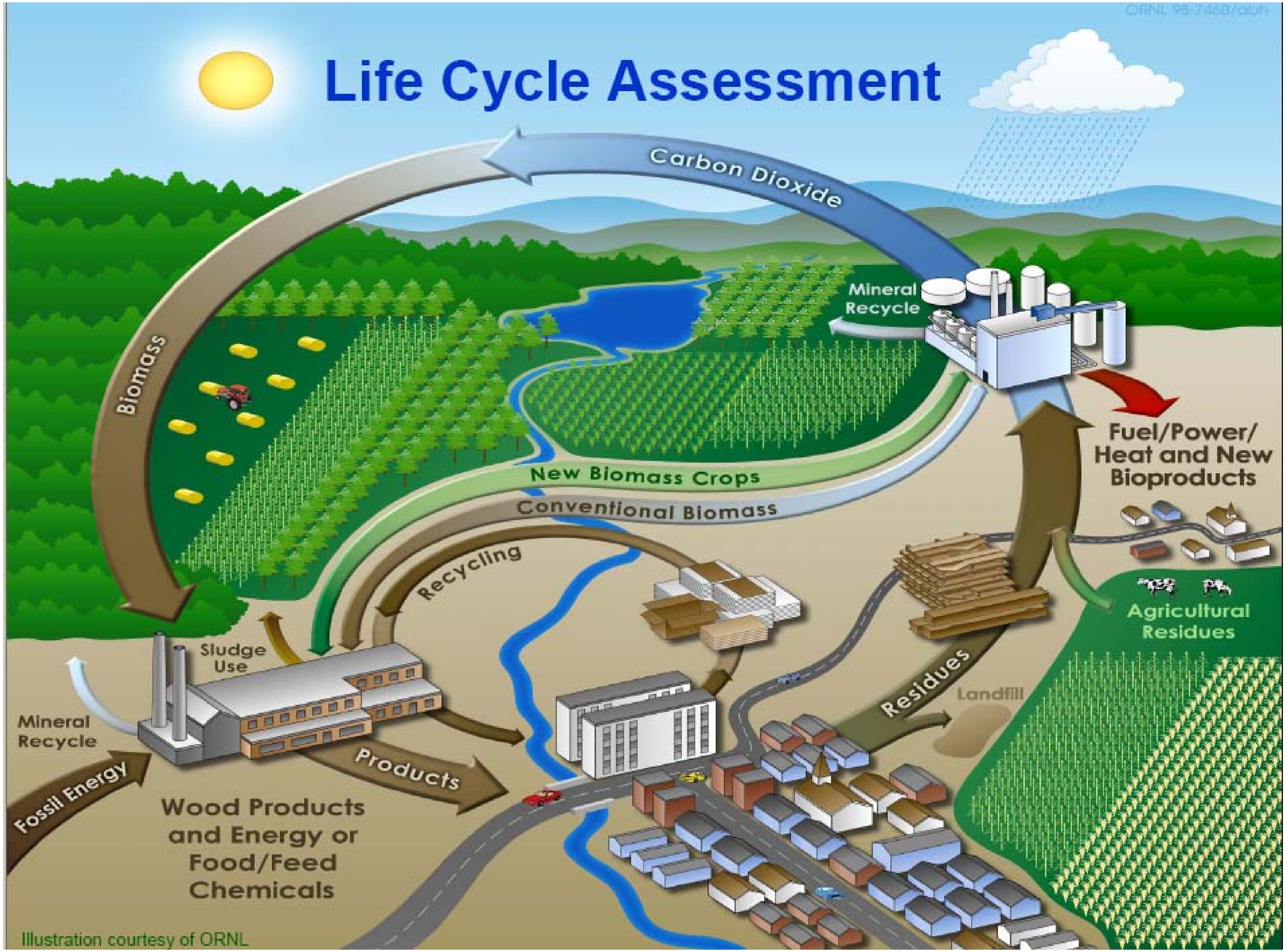



International Energy Agency

# Clean Energy


## Heat, Steam, Electricity, Transportation Fuel

# Biomass is renewable and “carbon neutral”



# Foreign Fossil Fuel Costs Like Pollution, Health Care, Economic Decline, & National Defense Are Not Included In Energy Cost Benefit Analysis.

# “America is Addicted to Oil”

President George Bush, State of the Union 2006

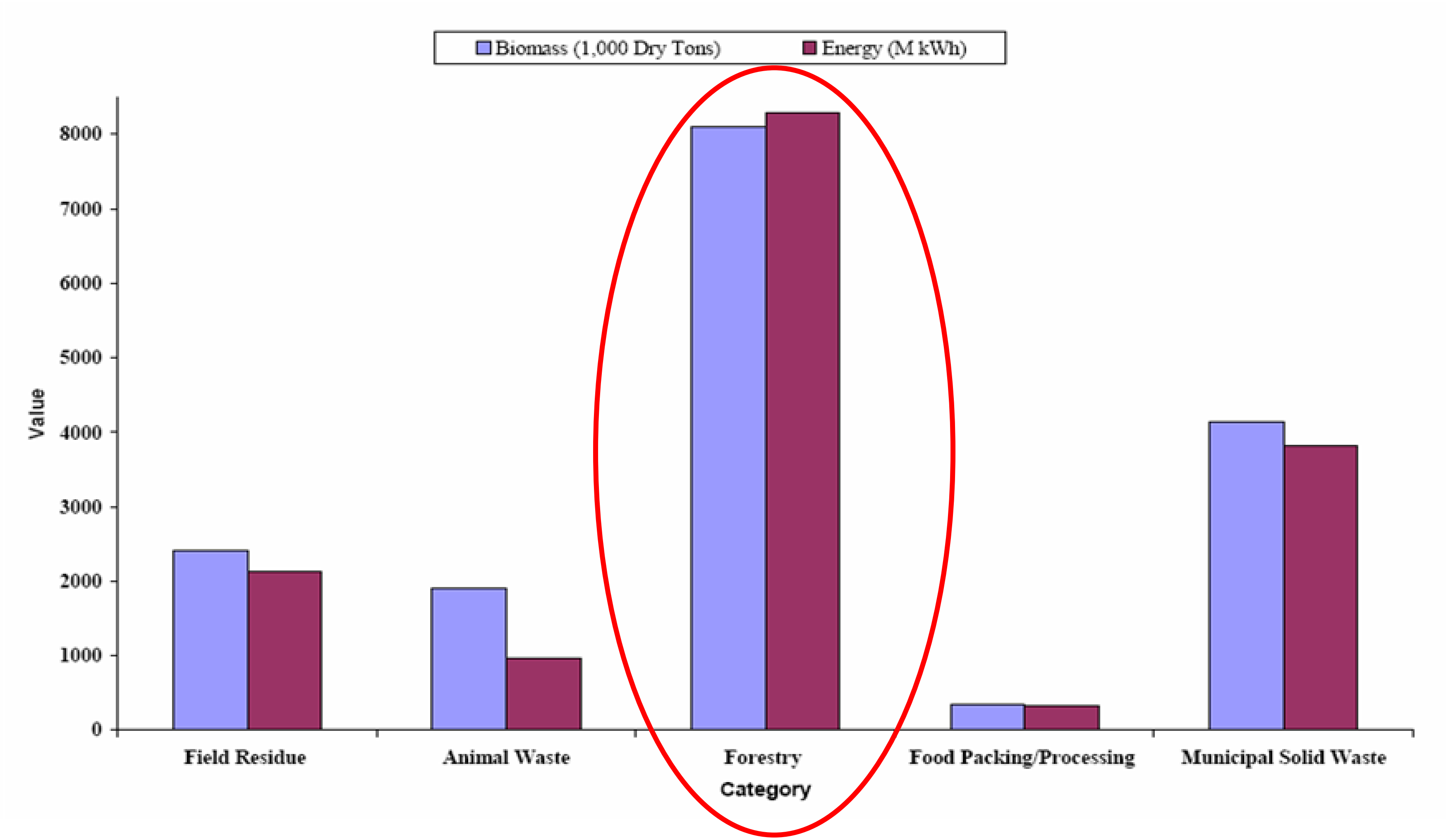
# Clean and Renewable Energy Alternatives Are Needed

# Biomass is a uniquely versatile energy source

# WA Ambitious Energy Objectives

- ✓ I-937 Renewable Portfolio Standard – 15% by 2020
- ✓ Renewable fuels standard – 2% ethanol & biodiesel
- ✓ Cut emissions to 1990 levels by 2020 and to 50% below 1990 levels by 2050

# WA Biomass and Bioenergy Inventory




# Forest Biomass equals all others combined

Source: WSU, WA DOE

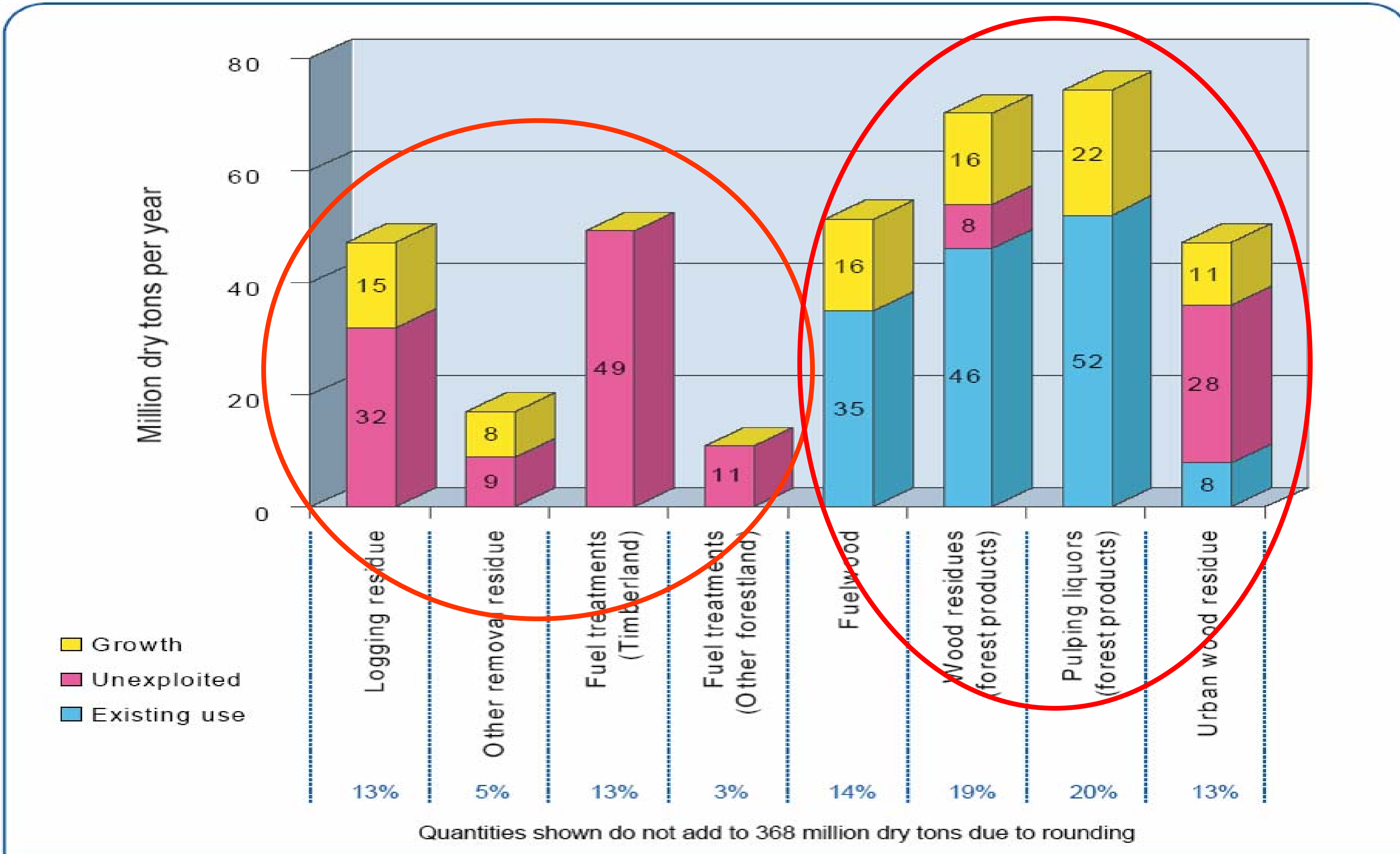


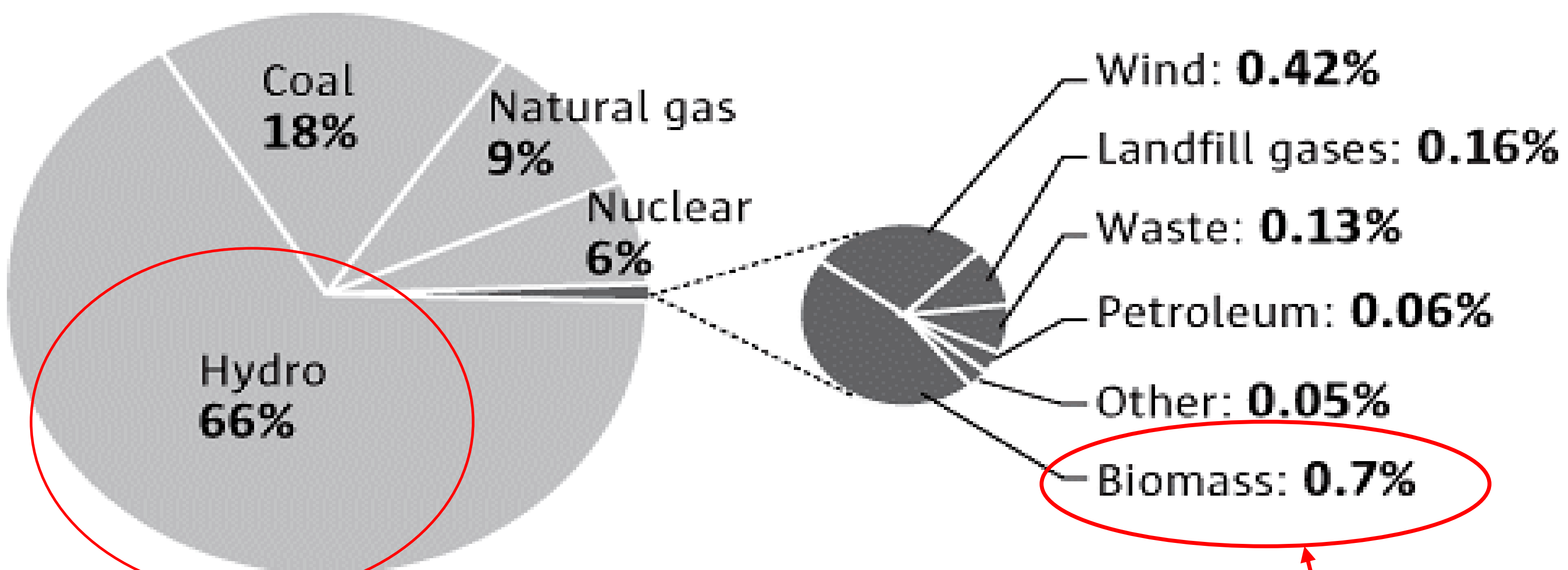

Figure 13: Summary of potentially available forest resources

Source: Biomass as Feedstock for a Bioenergy and Bioproducts Industry: The technical feasibility of a billion-ton annual supply. Perlack et al. 2005.

# WA has clean & cheap electricity

## Where our energy comes from

In 2004, Washington customers got about 66 percent of their electricity needs from hydro and 33 percent from coal, nuclear and natural gas. The rest came from the renewable resources advocated by I-937 supporters, such as wind, solar and biomass.



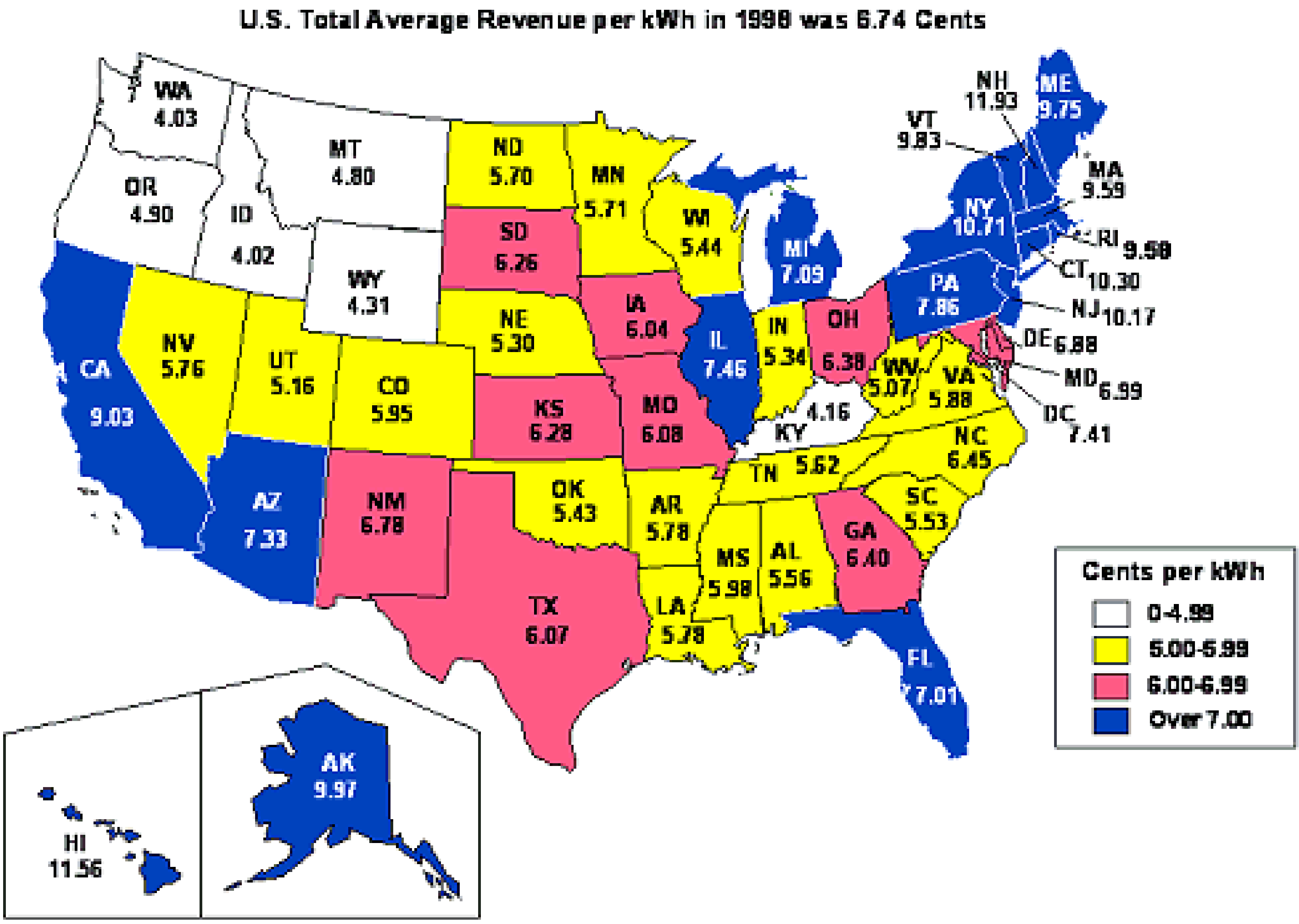

Largest non-hydro renewable

Note: Numbers do not add up to 100 percent because of rounding

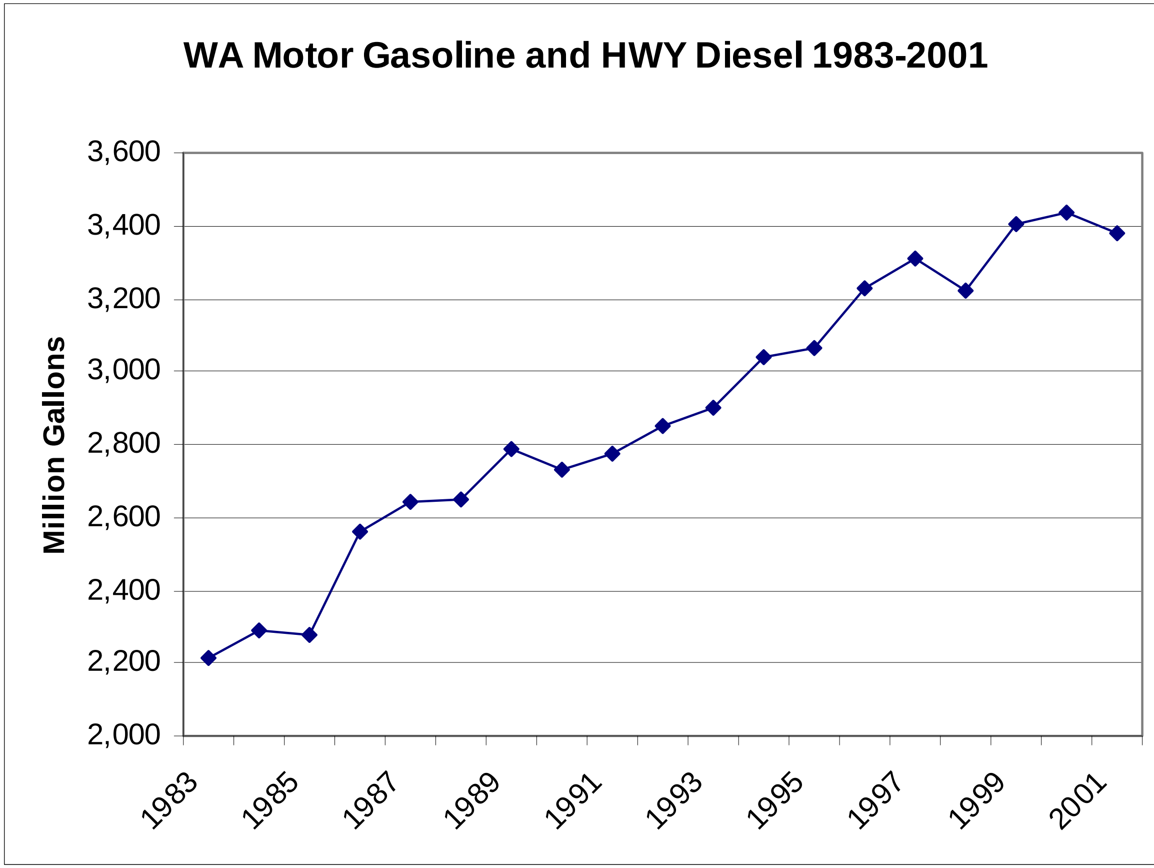
*Source: Washington State Department of Community, Trade and Economic Development*

THE SEATTLE TIMES

# Biomass-to-electricity: Especially challenging in the PNW



# Fossil Fuel Combustion = 99% of WA CO2




**2% Average Increase per Year**
**Total fossil fuel 2001 = 4.3 billion gallons/year**
**3rd highest gas price in the nation**

http://www.ofm.wa.gov/databook/energy/yt06.xls

# $87 Million/year to support research at the National Renewable Energy Laboratory

## President's Biofuels Initiative

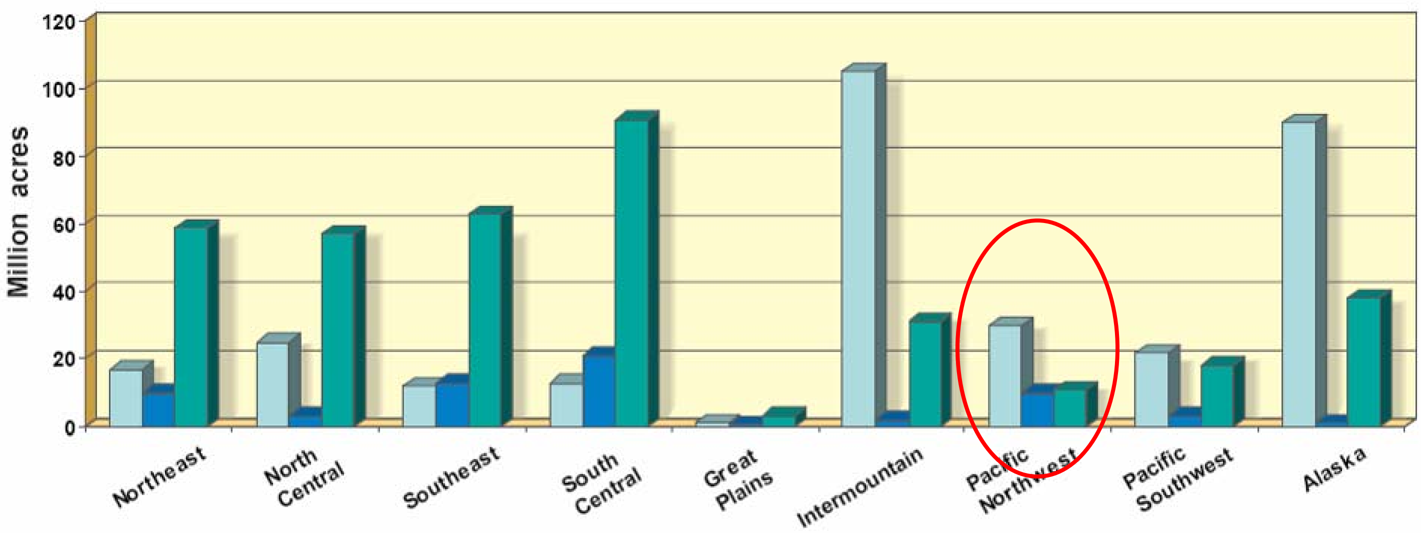
**The President's Goals:**

Replace the equivalent of more than 75 percent of our oil imports from the Middle East by 2030 – 30% of gasoline pool or 60 billion gallons/year

2012 Goal: Fund additional research in cutting-edge methods of producing ethanol, not just from corn, but from wood chips and stalks, or switchgrass. DOE goal is to make cellulosic ethanol practical and cost-competitive ($1.07/gal) within 6 years


National Renewable Energy Laboratory

# Public ownership dominates West forests




- Of the 504 million acres of U.S. timberland, about 29% is publicly owned, 13% is owned by the forest industry, and the remaining 58% is privately owned.
- Timberland ownership varies considerably among regions of the country. The East United States tends to be dominated by private ownership and the West by public land ownership.

Source: Alig et al., 2003

**Figure 4: Ownership break-up of U.S. forestland by region**

Source: Biomass as Feedstock for a Bioenergy and Bioproducts Industry: The technical feasibility of a billion-ton annual supply. Perlack et al. 2005.

# Washington Unreserved Timberlands

*(thousands of acres)*

| Ownership | Western | Eastern | Total |
|---|---|---|---|
| USDA Forest Service | 2208 | 2494 | 4702 |
| Forest Industry | 3732 | 878 | 4610 |
| Non-Industrial | *1668 | 1292 | 2960 |
| State | 1390 | 647 | 2037 |
| Native American | *310 | 1074 | 1384 |
| County and Municiple | 194 | 7 | 201 |
| Misc. Federal | 78 | 110 | 188 |
| Total | 9580 | 6502 | 16082 |

Washington Farmlands = ~15,318 *thousand acres*

# WA Ambitious Energy Objectives

- ✓ I-937 Renewable Portfolio Standard – 15% by 2020
- ✓ Renewable fuels standard – 2% ethanol & biodiesel
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# WA Emission Reduction Comparisons

From 2001 level to 1990 = (600 million gallons reduction)

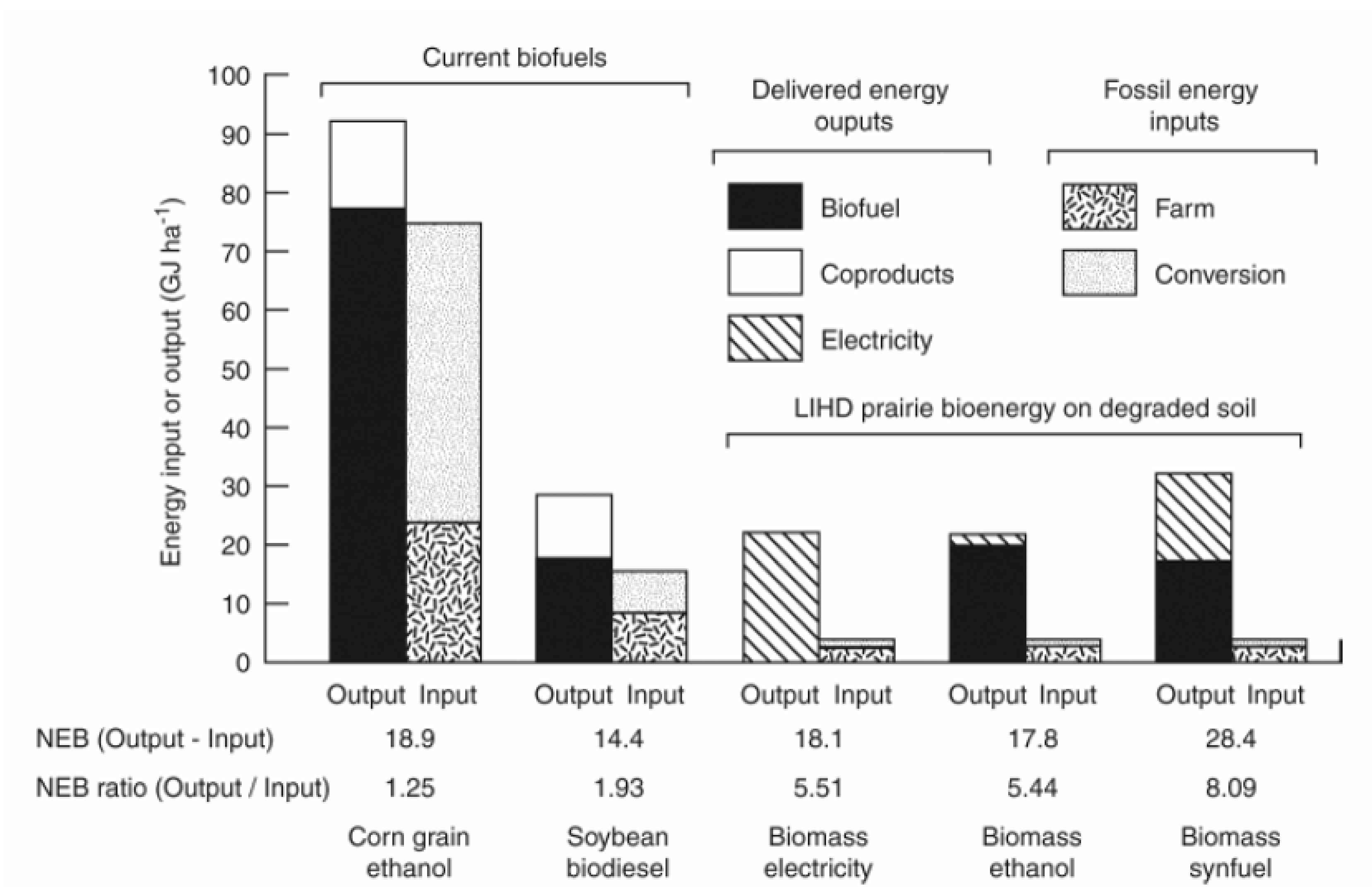
Options:

Bio diesel/ethanol:

Soy = 40 gallons/acre/yr (15 million acres)
Canola = 100 gallons/acre/yr (6 million acres)
Palm = 650 gallons/acre/yr (1 million acres)
Wood = 60 gallons/acre/yr (10 million acres) with 333,000 acres treated each year

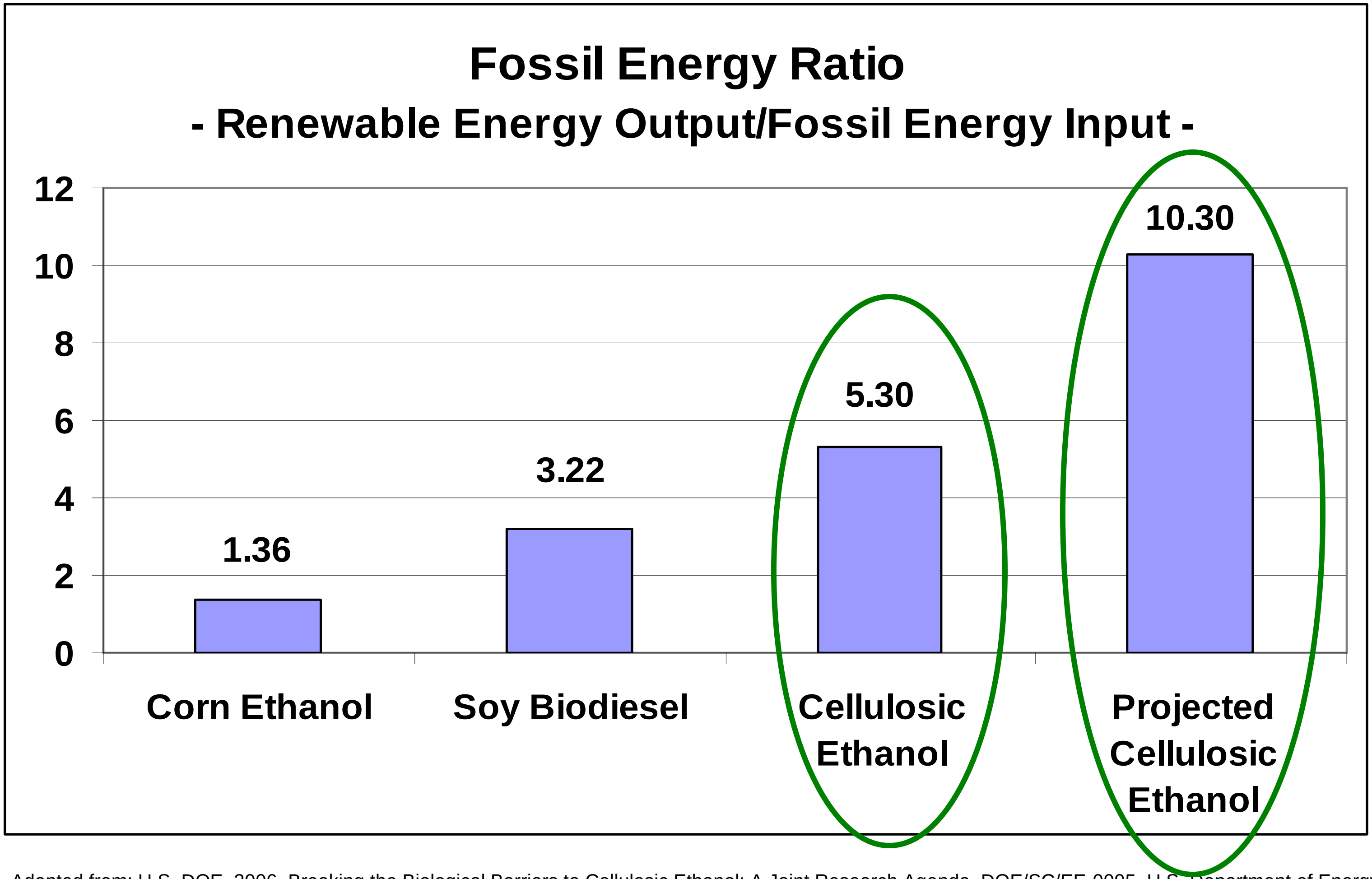
For forest biomass, every acre not burned = ~ 25 tons of $CO_2$ not emitted (2500 gallons gas equivalent emissions @ 20lbs $CO_2$/gal)

# Net Energy Balance Comparisons




Source: Carbon-negative biofuels from low-input high-diversity grassland biomass. Tilman et al. 2006
Environmental, economic, and energetic costs and benefits of biodiesel and ethanol biofuels. Hil et al. 2006

# Biomass to Energy – Gross is not Net




Adapted from: U.S. DOE. 2006. Breaking the Biological Barriers to Cellulosic Ethanol: A Joint Research Agenda, DOE/SC/EE-0095, U.S. Department of Energy Office of Science and Office of Energy Efficiency and Renewable Energy, http://doegenomestolife.org/biofuels/ . Biodiesel data from: Life Cycle Inventory of Biodiesel and Petroleum Diesel for Use in an Urban Bus U.S. NREL/SR-580-24089, Department of Agriculture and U.S. Department of Energy. Cellulose biorefinery data from J. Sheehan & M. Wang (2003).

# Pulp and paper mills are currently struggling

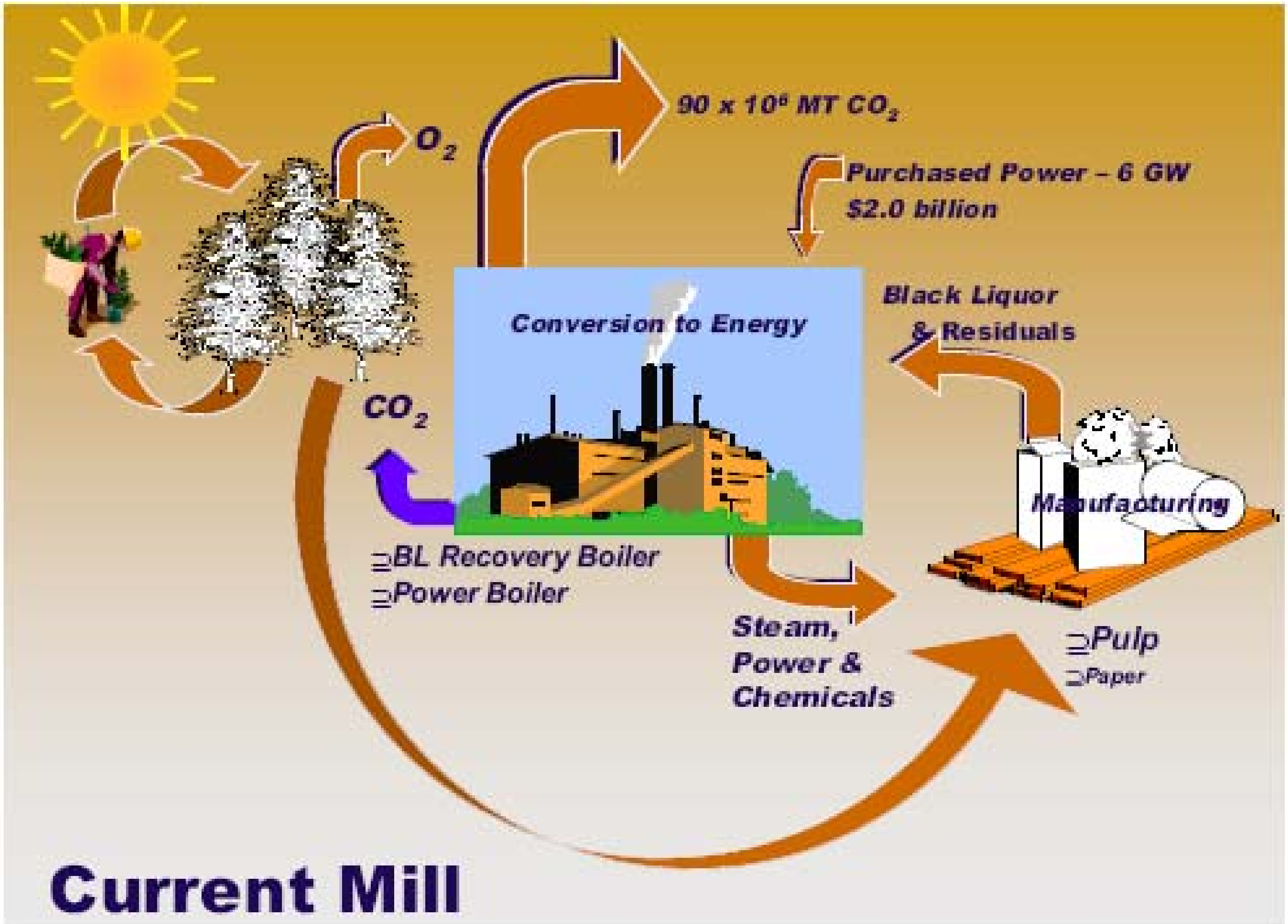



Figure 5. Typical pulp mill today using conventional technology

PaperAge.Oct.2004

# These mills could become forest biorefineries

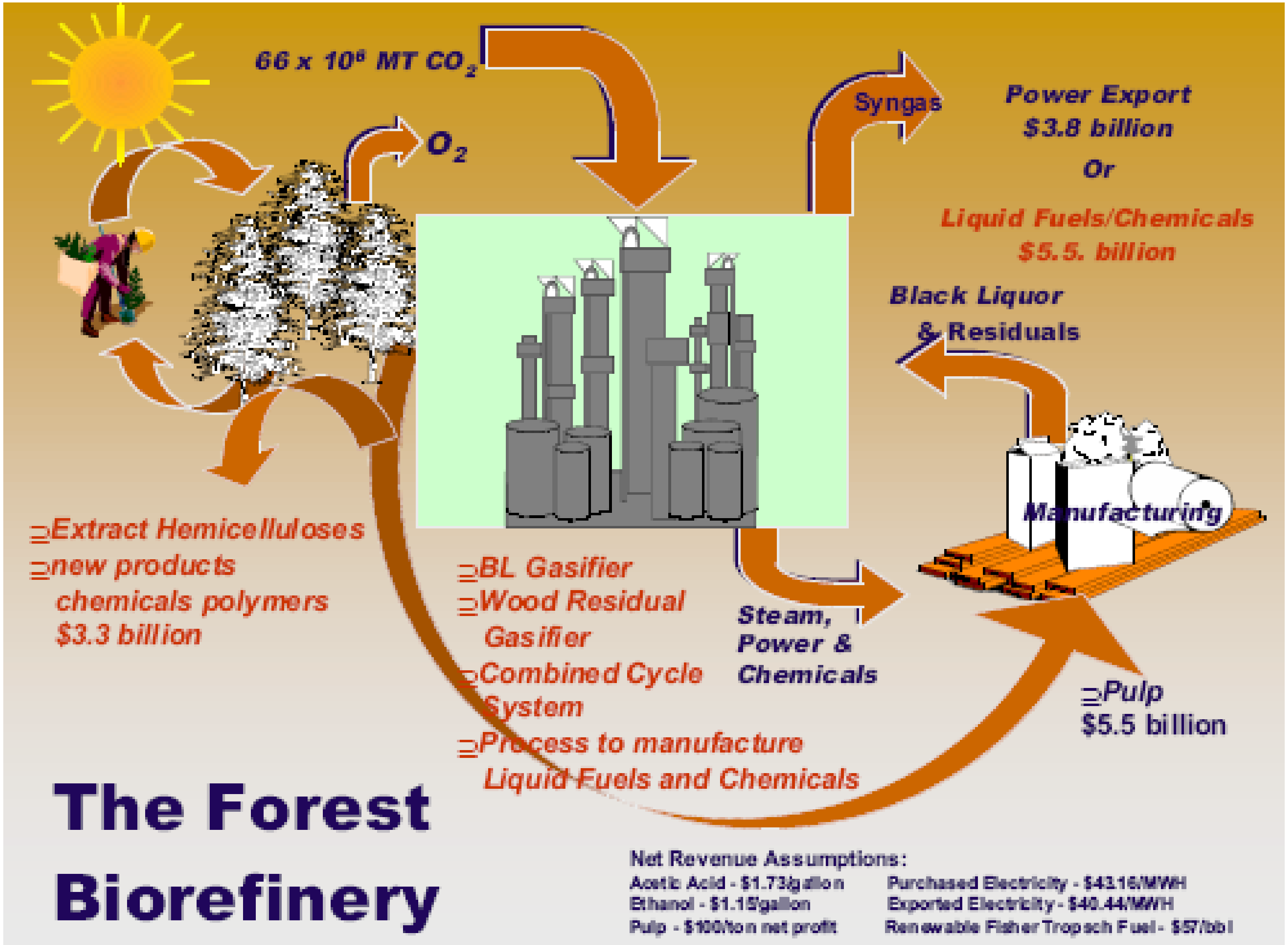
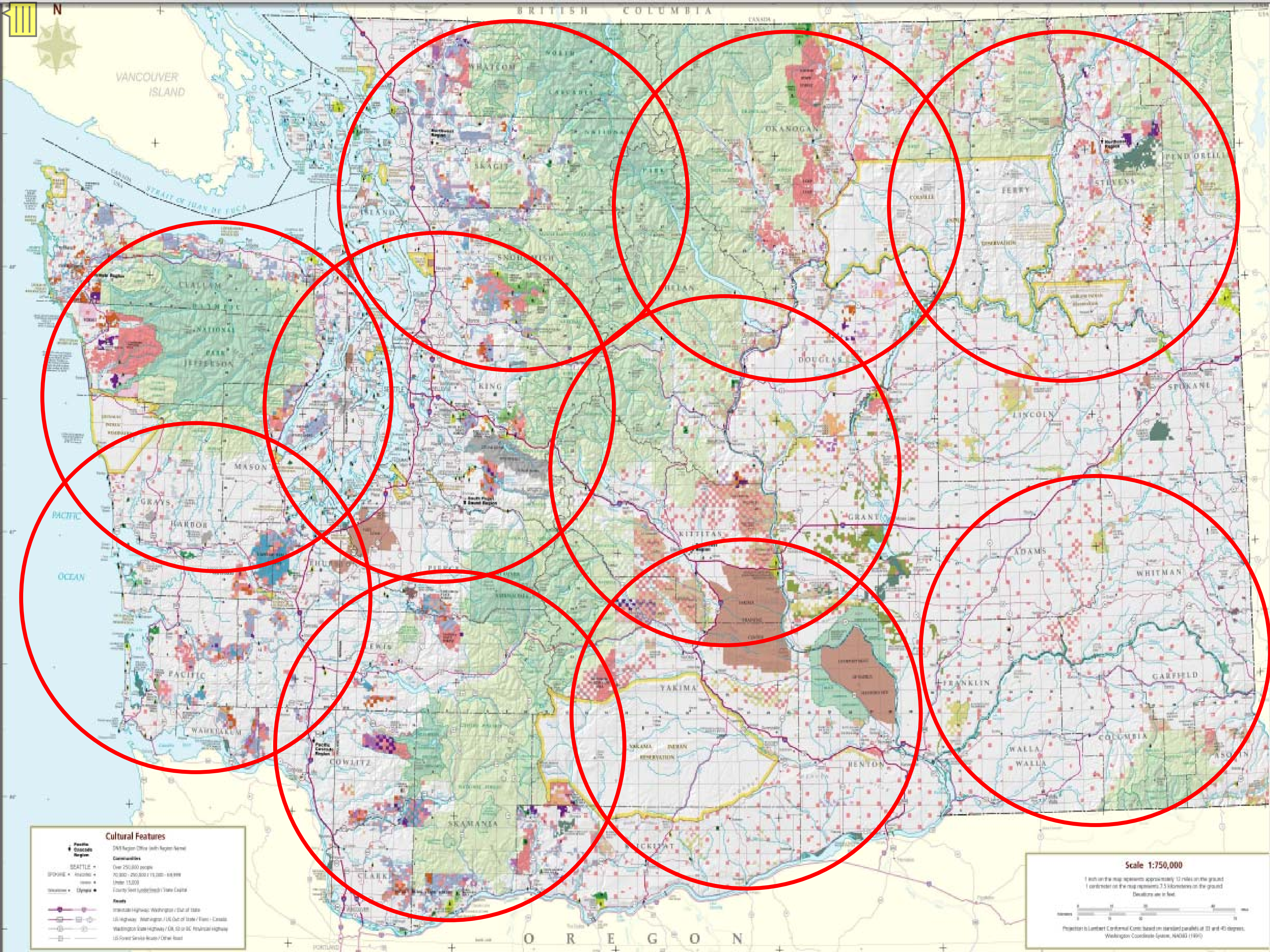



Figure 6. Same mill converted to a forest biorefinery operation



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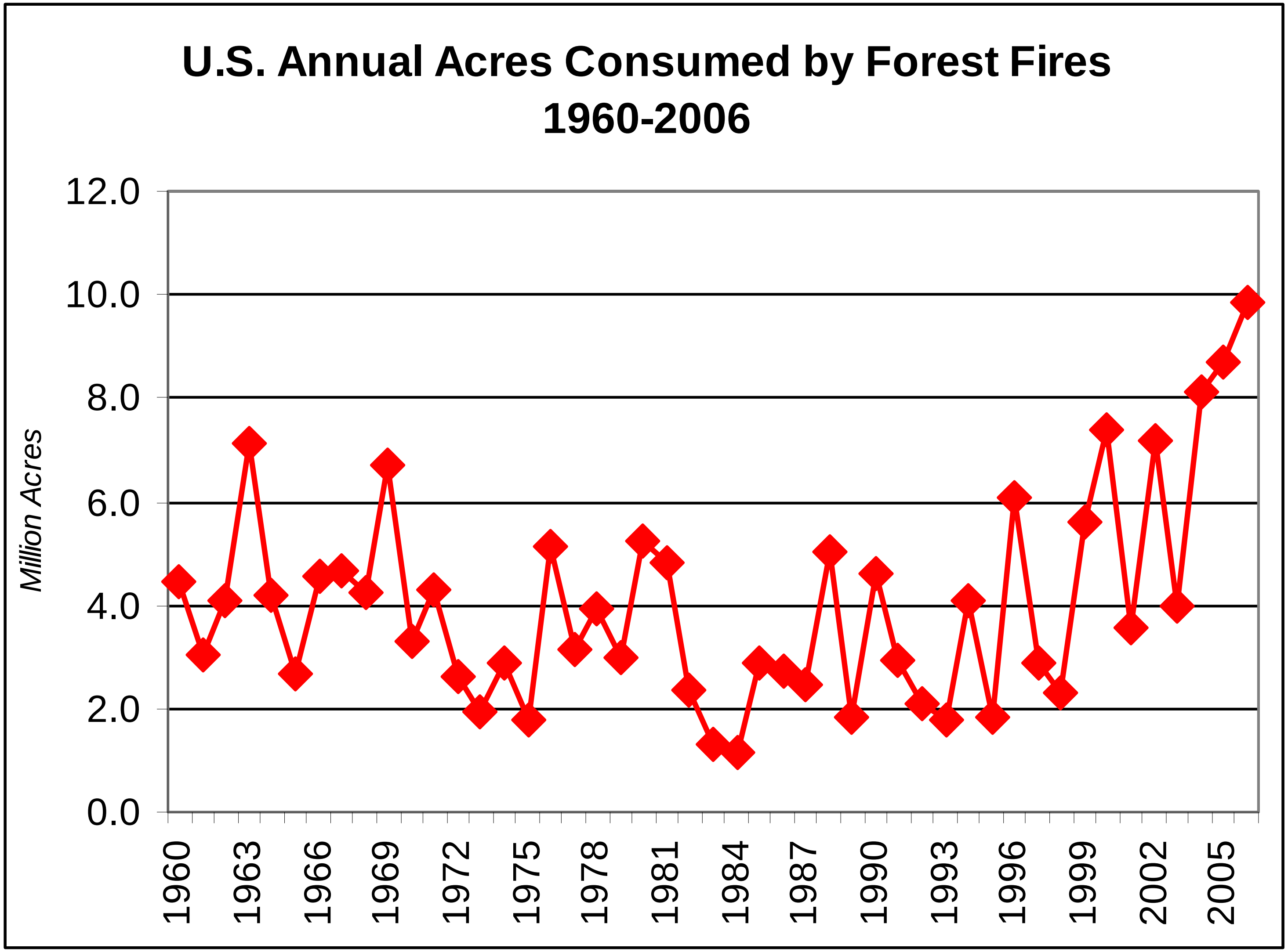
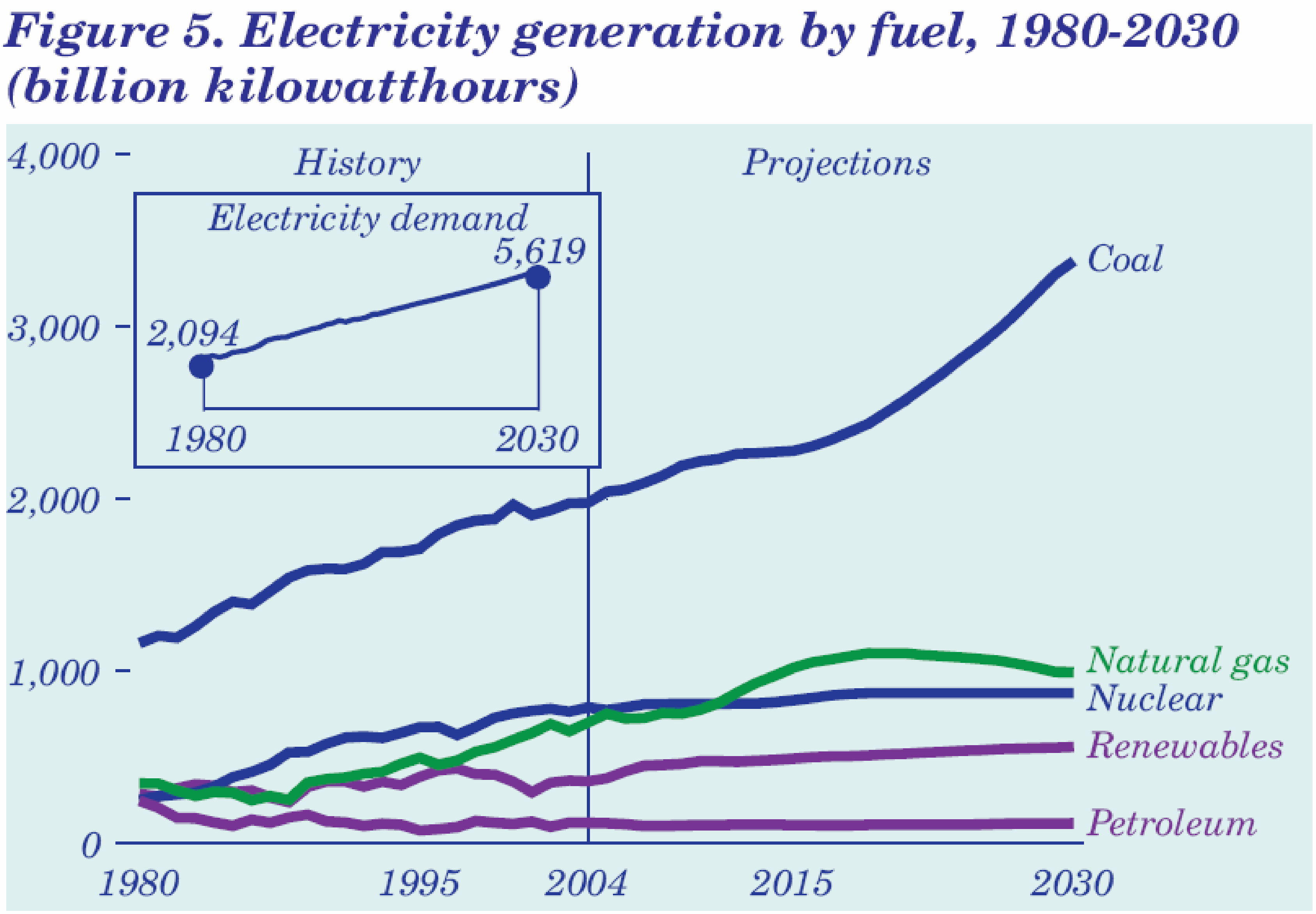
BRITISH COLUMBIA
CANADA
VANCOUVER ISLAND
STRAIT OF JUAN DE FUCA
PACIFIC
OCEAN
WHATCOM
NORTH
CASCADES
NATIONAL
SKAGIT
ISLAND
SNOHOMISH
OKANOGAN
FERRY
STEVENS
PEND OREILLE
COLVILLE
INDIAN
RESERVATION
CLALLAM
OLYMPIC
NATIONAL
PARK
JEFFERSON
CHELAN
DOUGLAS
SPOKANE
LINCOLN
KING
MASON
GRAYS
HARBOR
KITTITAS
GRANT
ADAMS
WHITMAN
PIERCE
LEWIS
PACIFIC
WAHKIAKUM
COWLITZ
SKAMANIA
CLARK
YAKIMA
YAKAMA INDIAN RESERVATION
BENTON
FRANKLIN
GARFIELD
COLUMBIA
WALLA
WALLA
ASOTIN
KLICKITAT
OREGON
Cultural Features
Communities
SEATTLE
Over 250,000 people
Under 15,000
Olympia
Roads
Scale 1:750,000
Elevations are in feet.

# The Current Trend – Forest Fires



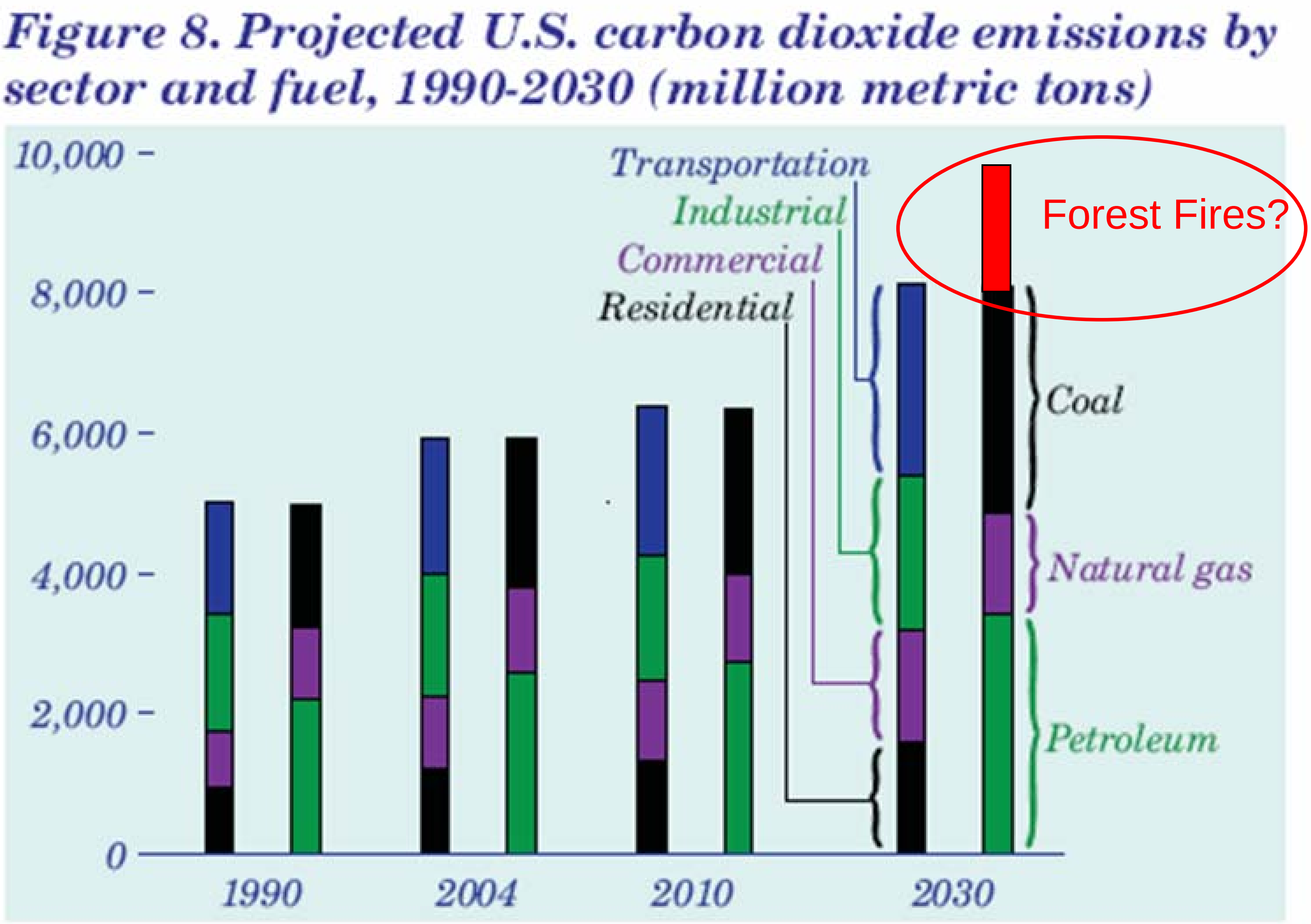

National Interagency Fire Center

# The Current Trend – Energy




Energy Information Administration/Annual Energy Outlook 2006

# CO2 Emissions increase 37% from 2004 to 2030




Energy Information Administration/Annual Energy Outlook 2006


THIS? or THIS?
The choice seems remarkably simple…

# Questions?