Importance of Modernizing the Grid:

Regional Issues Discussion
Group Introduction

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Missouri Public Service Commission
President of the Organization of MISO States
Columbus, Ohio
November 15, 2006

Need for Modernization of the Grid

In last weekend's USA Today an article on the 'Power crunch'[1] illustrated the *"transmission lines that we have now are overloading."*[2] *"If we are to continue to have a strong economy and continue to meet America's growing demand for electricity, we have got to take proactive measures to ensure our ability to deliver electricity is unimpeded."*[3]

Why does the Transmission Grid Need to Grow & Change?

- *Economic Growth*
- *Increase in use of power consuming technology*
- *Increasing reliance on market transactions for supply*

[1] 'Power crunch could lead to lots more lines, Nov 10, 2006, Paul Davidson.
[2] John Smatlak, Dominion Vice President; [3] Kevin Kolevar, a director for the Energy Dept.

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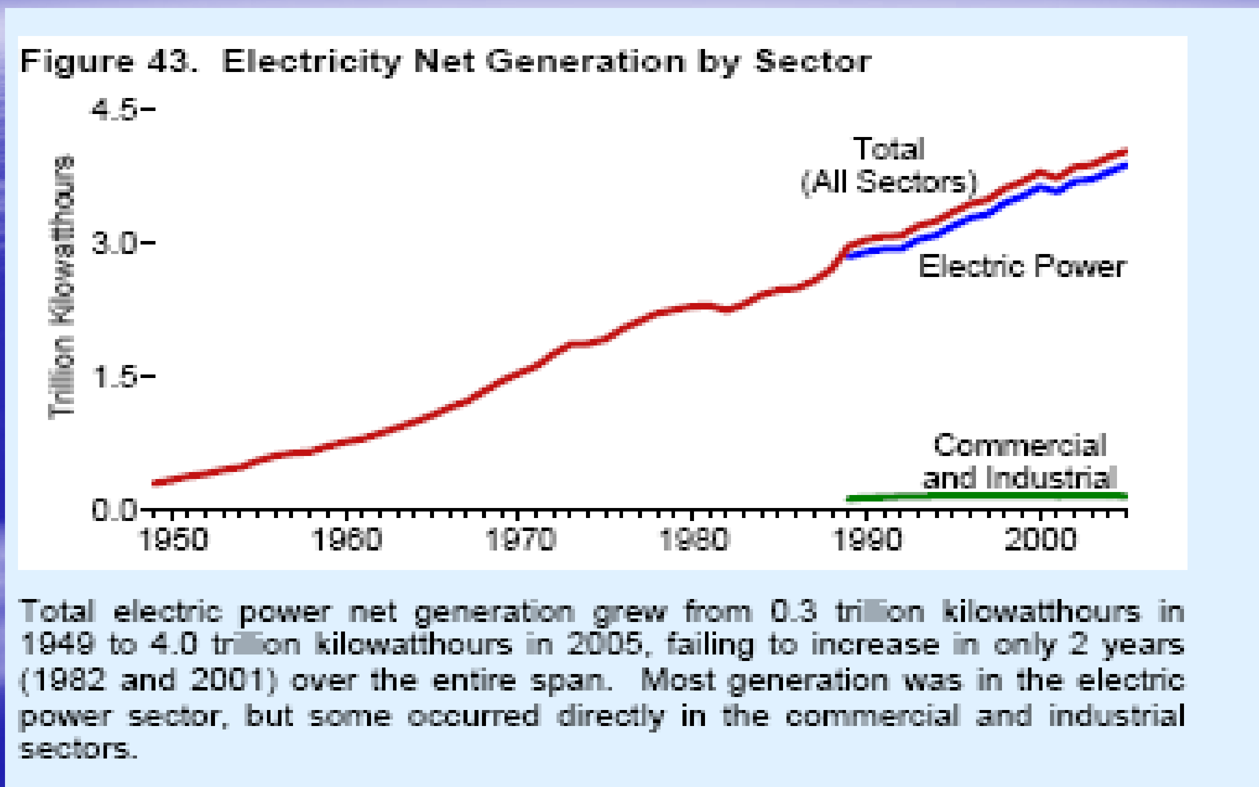
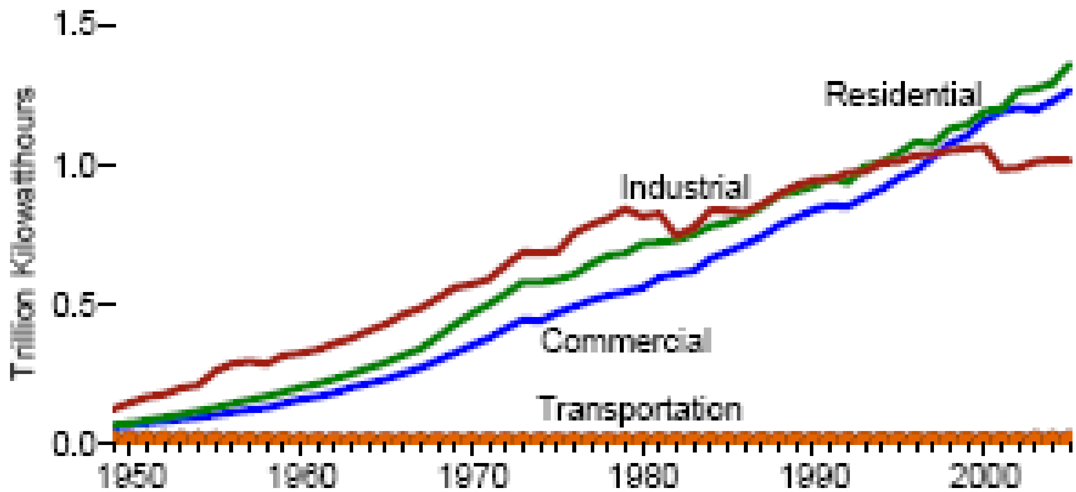
Electricity Net Generation and Useful Thermal Output



EIA / Annual Energy Review 2005: Energy Perspectives

Figure 48. Retail Sales by Sector

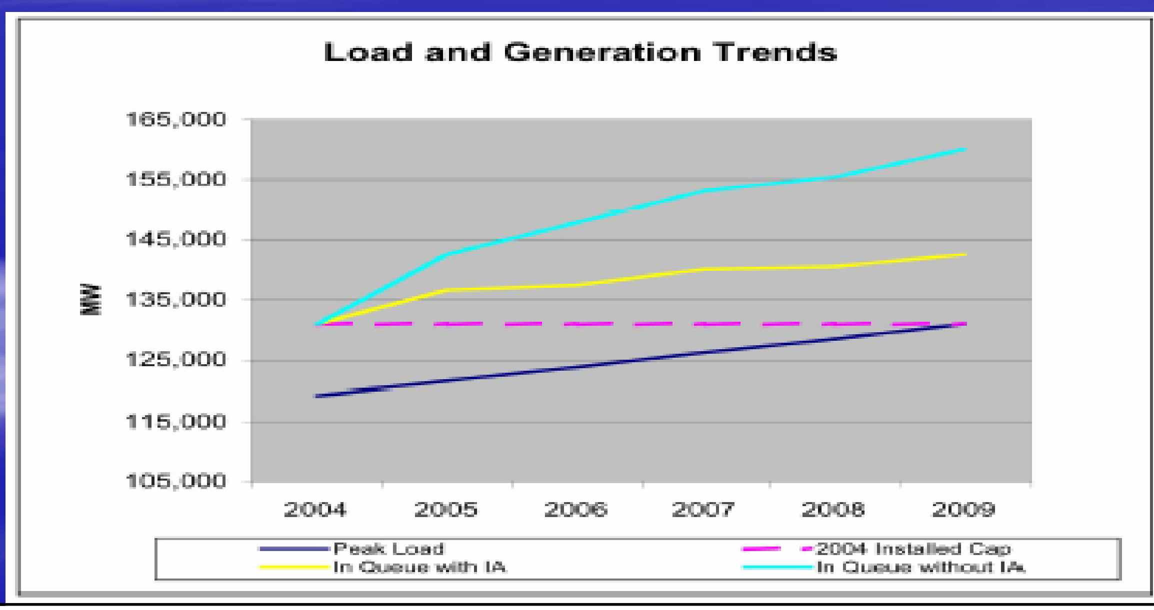


Enormous growth occurred in the amount of electricity sold to the three major sectors—residential, commercial, and industrial. Industrial sector sales showed the greatest volatility. Sales to residences exceeded sales to industrial sites since the early 1990s, and sales to commercial sites surpassed industrial sales since the late 1990s.

Growth in Load

Projected loads show that load will exceed supply anywhere from 2011-2016, depending on how you define the region and whose study you're looking at [sources: MISO, NERC].

CONTINUING GROWTH IN LOAD AND GENERATION:



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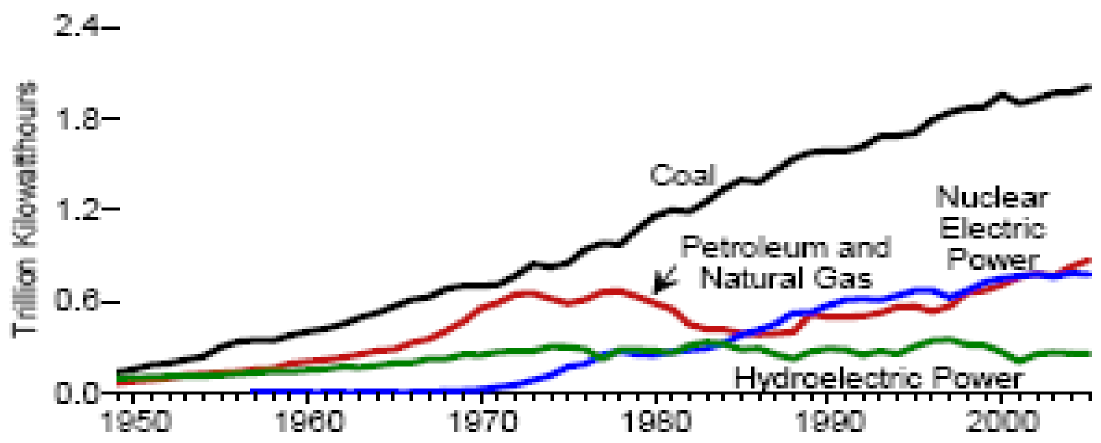
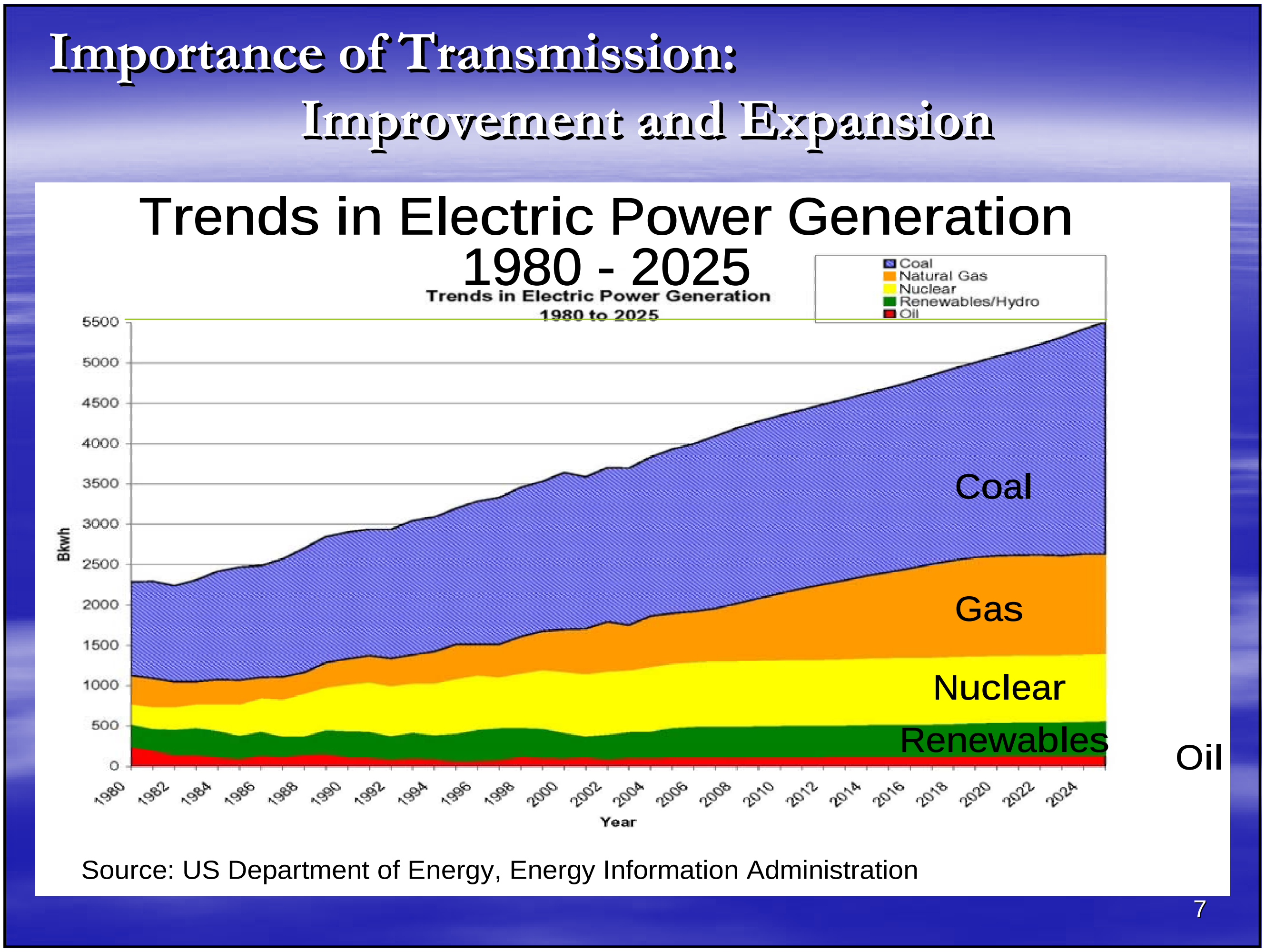
Electricity Net Generation and Useful Thermal Output

Figure 44. Major Sources of Total Electricity Net Generation



Most electricity net generation came from coal. In 2005, fossil fuels (coal, petroleum, and natural gas) accounted for 72 percent of all net generation, while nuclear electric power contributed 19 percent, and renewable energy resources 9 percent. Nearly three-fourths of the net generation from renewable energy resources was derived from conventional hydroelectric power.


Importance of Transmission:
Improvement and Expansion
Trends in Electric Power Generation
1980 - 2025
Trends in Electric Power Generation
1980 to 2025
Coal
Natural Gas
Nuclear
Renewables/Hydro
Oil
Bkwh
Year
Coal
Gas
Nuclear
Renewables
Oil
Source: US Department of Energy, Energy Information Administration
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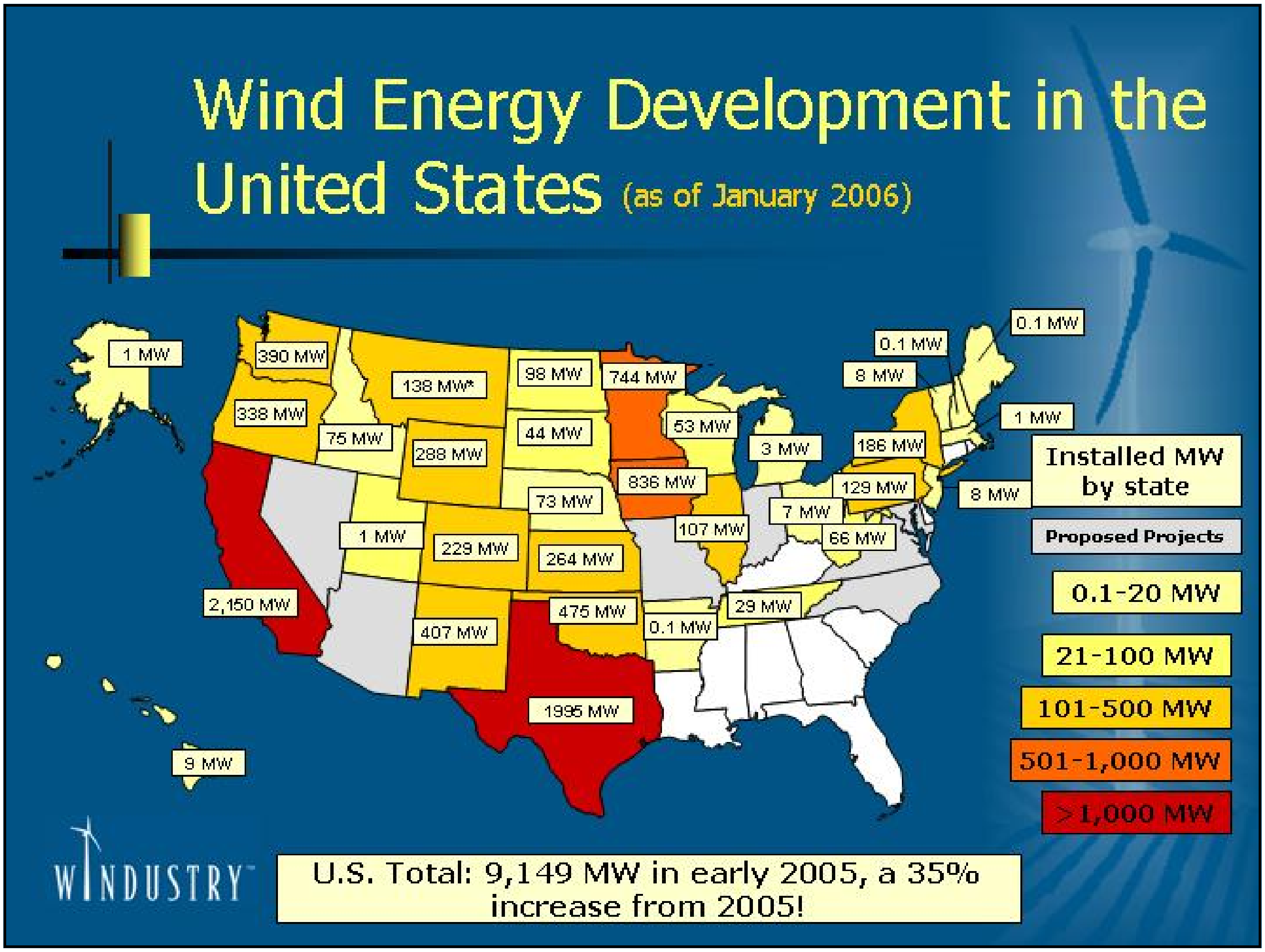
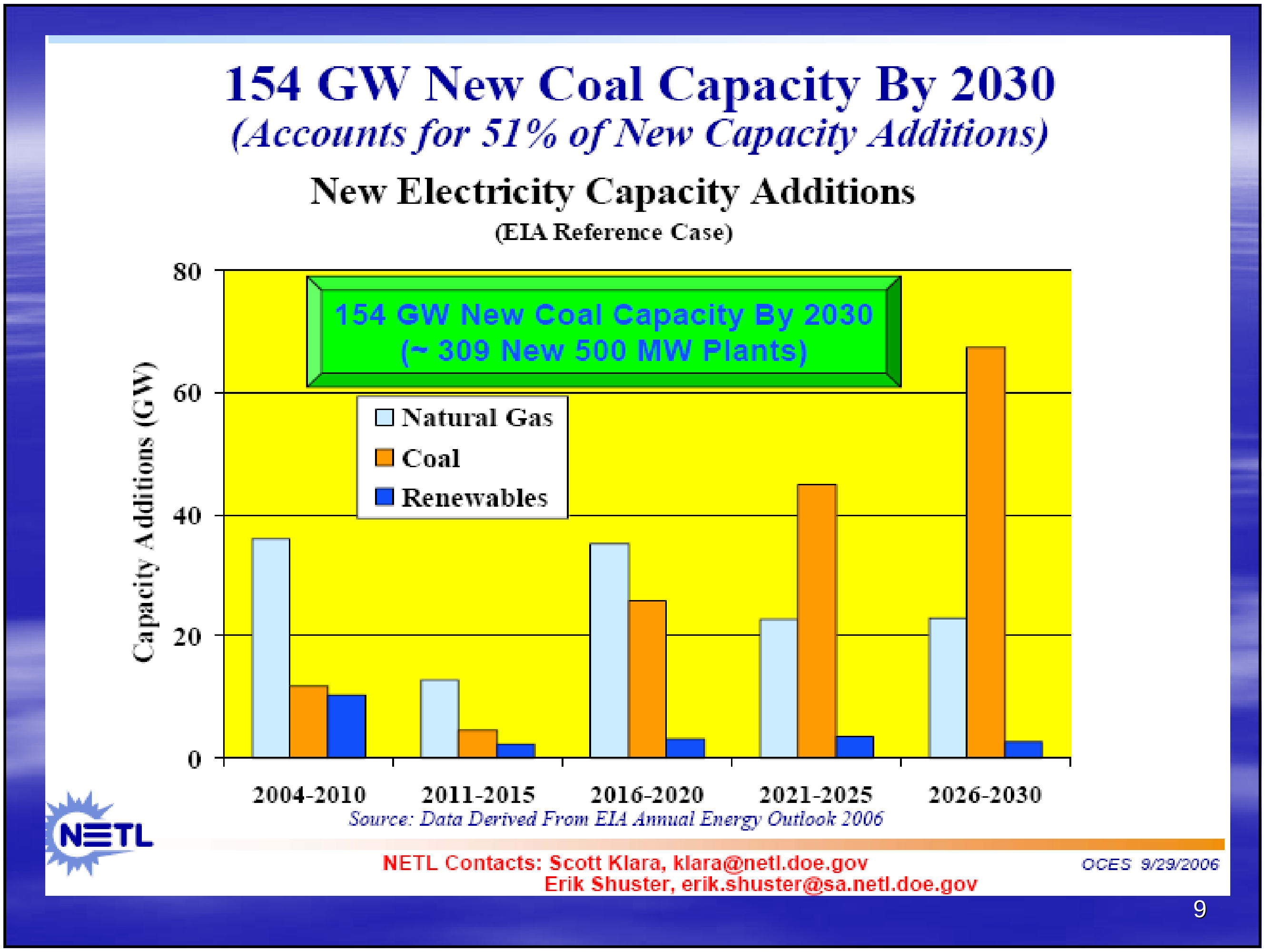

Wind Energy Development in the United States (as of January 2006)
1 MW
390 MW
338 MW
138 MW*
75 MW
288 MW
98 MW
744 MW
44 MW
53 MW
0.1 MW
8 MW
0.1 MW
1 MW
3 MW
186 MW
836 MW
73 MW
129 MW
8 MW
7 MW
107 MW
66 MW
1 MW
229 MW
264 MW
2,150 MW
475 MW
0.1 MW
29 MW
407 MW
1995 MW
9 MW
Installed MW by state
Proposed Projects
0.1-20 MW
21-100 MW
101-500 MW
501-1,000 MW
>1,000 MW
WINDUSTRY
U.S. Total: 9,149 MW in early 2005, a 35% increase from 2005!


154 GW New Coal Capacity By 2030
(Accounts for 51% of New Capacity Additions)
New Electricity Capacity Additions
(EIA Reference Case)
154 GW New Coal Capacity By 2030
(~ 309 New 500 MW Plants)
Natural Gas
Coal
Renewables
Capacity Additions (GW)
0
20
40
60
80
2004-2010
2011-2015
2016-2020
2021-2025
2026-2030
Source: Data Derived From EIA Annual Energy Outlook 2006
NETL
NETL Contacts: Scott Klara, klara@netl.doe.gov
Erik Shuster, erik.shuster@sa.netl.doe.gov
OCES 9/29/2006
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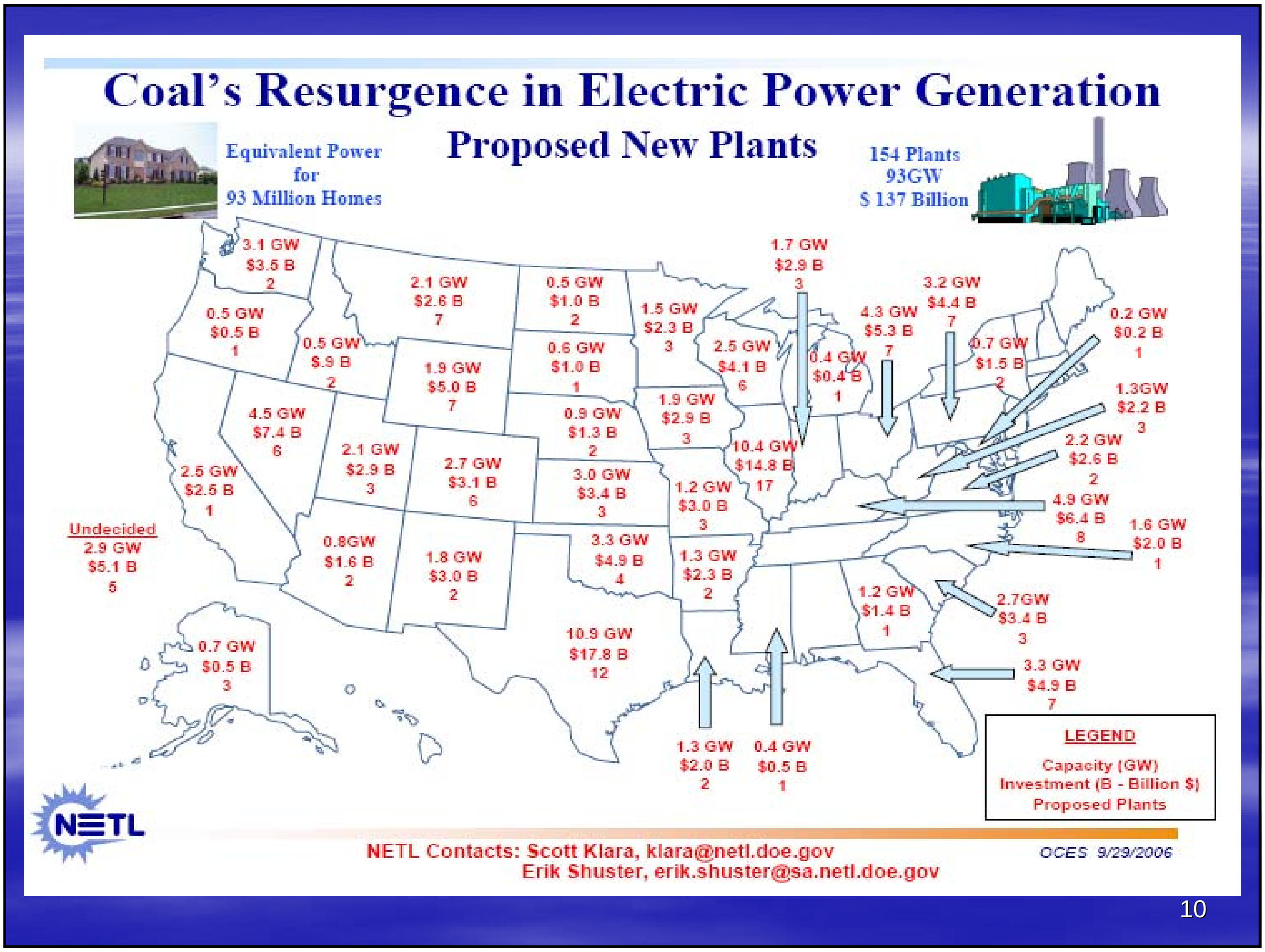
Coal's Resurgence in Electric Power Generation
Proposed New Plants
Equivalent Power for 93 Million Homes
154 Plants
93GW
$ 137 Billion
3.1 GW $3.5 B 2
0.5 GW $0.5 B 1
2.5 GW $2.5 B 1
0.5 GW $.9 B 2
4.5 GW $7.4 B 6
2.1 GW $2.6 B 7
1.9 GW $5.0 B 7
2.1 GW $2.9 B 3
2.7 GW $3.1 B 6
0.8GW $1.6 B 2
1.8 GW $3.0 B 2
0.5 GW $1.0 B 2
0.6 GW $1.0 B 1
0.9 GW $1.3 B 2
3.0 GW $3.4 B 3
3.3 GW $4.9 B 4
10.9 GW $17.8 B 12
1.5 GW $2.3 B 3
1.9 GW $2.9 B 3
1.2 GW $3.0 B 3
1.3 GW $2.3 B 2
2.5 GW $4.1 B 6
10.4 GW $14.8 B 17
1.7 GW $2.9 B 3
0.4 GW $0.4 B 1
4.3 GW $5.3 B 7
3.2 GW $4.4 B 7
0.7 GW $1.5 B 2
0.2 GW $0.2 B 1
1.3GW $2.2 B 3
2.2 GW $2.6 B 2
4.9 GW $6.4 B 8
1.6 GW $2.0 B 1
2.7GW $3.4 B 3
3.3 GW $4.9 B 7
1.2 GW $1.4 B 1
1.3 GW $2.0 B 2
0.4 GW $0.5 B 1
Undecided 2.9 GW $5.1 B 5
0.7 GW $0.5 B 3
LEGEND
Capacity (GW)
Investment (B - Billion $)
Proposed Plants
NETL
NETL Contacts: Scott Klara, klara@netl.doe.gov
Erik Shuster, erik.shuster@sa.netl.doe.gov
OCES 9/29/2006
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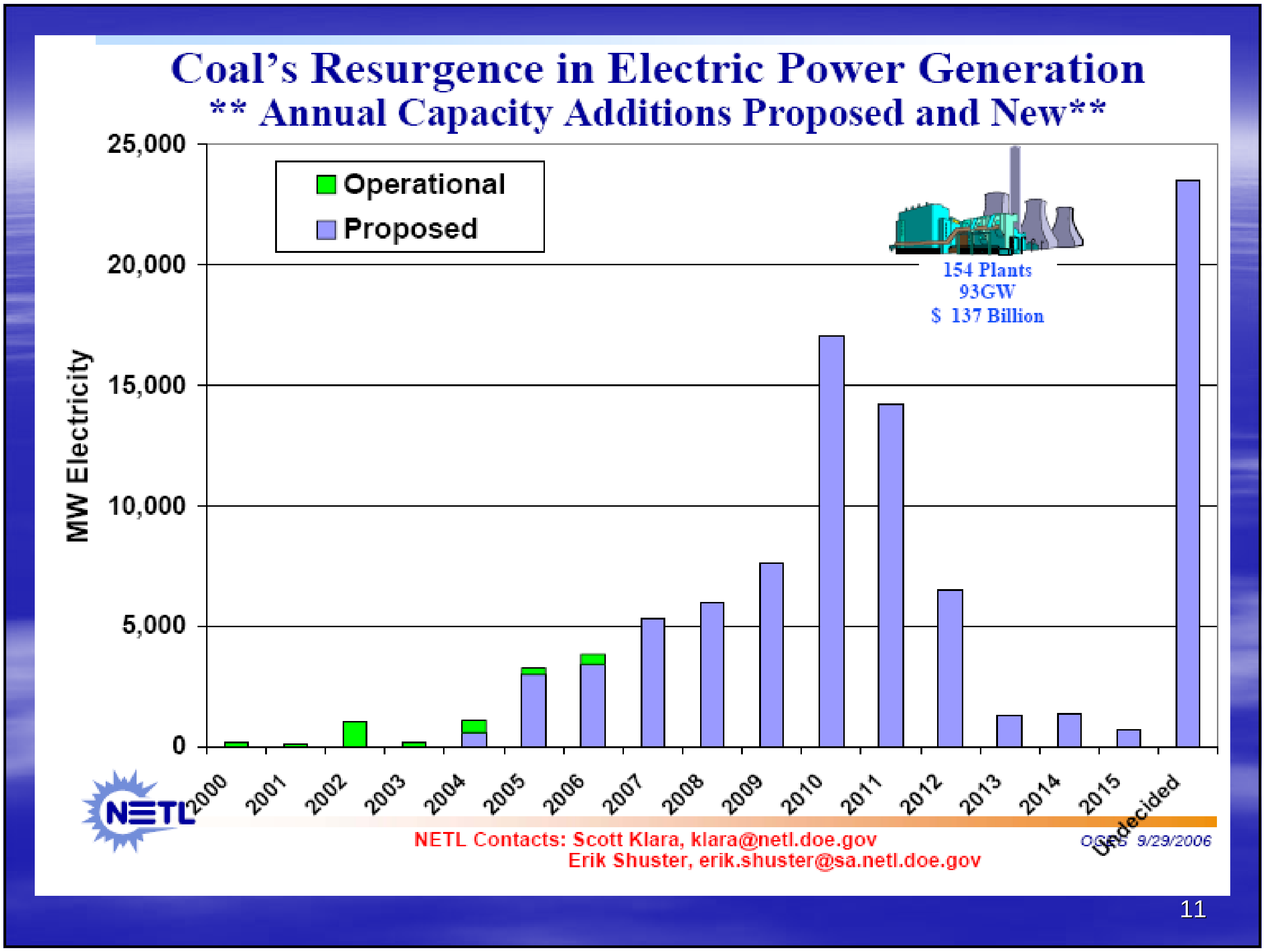

Coal's Resurgence in Electric Power Generation
** Annual Capacity Additions Proposed and New**
Operational
Proposed
154 Plants
93GW
$ 137 Billion
MW Electricity
25,000
20,000
15,000
10,000
5,000
0
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
Undecided
NETL
NETL Contacts: Scott Klara, klara@netl.doe.gov
Erik Shuster, erik.shuster@sa.netl.doe.gov
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Importance of Transmission: Improvement and Expansion

With Continuing Growth in Load There Is a Need To:

Ensure the Reliability of the Bulk Power System

- To prevent blackouts such as occurred in the Summer of 2003.
- To allow reserve generation to meet demands when there are either generation or transmission outages on the power grid.

Provide Deliverability for New Generation

- Access to greater geographic diversity required for competitive supplies of power.
- Environmental and other issues may prevent locating near area in need.
- Renewable resources such as economic wind power are geographically fixed.

Improve the Economics of Wholesale Electricity Markets

- Eliminate transmission congestion that prevents substitution of power from lower-cost generation sources for power from higher-cost generation sources.

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Investment in Transmission

Despite the importance of transmission to reliable and efficient operations of the transmission grid, there has been insufficient investment in Transmission.

The following is a quote from the Notice of Proposed Rulemaking on "Promoting Transmission Investment through Pricing Reform" issued by the Federal Energy Regulatory Commission on November 17, 2005.

"Transmission investment declined in real dollar terms for 23 years, from 1975 to 1998, before increasing again, although investment for the most recent year available, 2003, is still below 1975 levels.[1] Over the same time period, electric load more than doubled, resulting in a significant decrease in transmission capacity relative to load in every North American Electric Reliability Council region.[2] Edison Electric Institute (EEI) estimates that capital spending must increase by 25 percent, from $4 billion annually to $5 billion annually, to assure system reliability and to accommodate wholesale electric markets, and that the 2.5 percent growth rate in transmission mileage since 1999 is insufficient to meet the expected 50 percent growth in consumer demand for electricity over the next two decades.[3]"

[1] EEI Survey of Transmission Investment: Historical and Planned Capital Expenditures (1999-2008) at 3 (2005).

[2] Barriers to Transmission Investment, Presentation by Brendan Kirby (U.S. Department of Energy, Oak Ridge National Laboratory), Transmission Independence and Investment, Docket No. AD05-5-000 (4- 22-2005 Technical Conference).

[3] EPAct of 2005: Hearings before the House Subcommittee on Energy and Commerce, 109th Congress, First Sess. (2005). Thomas R. Kuhn, President of EEI, prepared statement.

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Chairman Joe Kelliher recently listed 5 barriers to new construction:

1. Planning
2. Investment
3. Siting
4. Reliability standards
5. Cost allocation

Major Barriers to Transmission Expansion

1. Siting application and approval processes that differ from state-to-state,
2. FERC Order 888 Policy of the entity requesting new or changed transmission service must pay for all upgrades required to grant that service ("Requestor Pays"),
3. Tension between particular interests of generator owners and improvements in the overall efficiency of the transmission grid,
4. Uncertainty about return of and on an investment in transmission expansion.

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Solution to Barrier 1

Barrier: Siting application and approval processes that differ from state-to-state

Solution: Increased involvement of states in the sub-regional and regional planning process.

- Better understanding of shared sub-regional and regional benefits from transmission upgrades.
- Consistent information across state boundaries.
- Increased consistency in state evaluation of both needs and benefits to end-use customers.

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Regional Planning:

Regional State Committee (RSC)

An example of a Regional State Committee:

- Organization of MISO States (OMS)
  - OMS is the RSC within the MISO footprint. Incorporated in 2003, it was the first RSC formed. OMS provides essential services working with MISO. OMS:
    - Provides guidance in policy decisions of the MISO
    - Established multiple subcommittees to support functional areas
    - Develop regional transmission cost allocation policies to reduce impediments to expansions

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Regional Planning:
Regional State Committees (continued)

The OMS Transmission Planning and Siting Work Group created the OMS Northwest Subgroup comprised of staff from five states: Iowa, Minnesota, North Dakota, South Dakota, and Wisconsin.

The purpose of the OMS Northwest Subgroup is to directly address an impediment to transmission improvement and expansion: siting. The Subgroup works:

- to understand the five states' transmission permitting and siting processes,
- to explore ways the states can work with each other and coordinate activities on transmission line permit applications that cross state lines, and
- to coordinate the planning of a proposed transmission line with all affected states.

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EPAct State Compacts

With EPAct, the Consent of Congress is granted to allow the formation of interstate compacts of 3 or more contiguous states to establish regional transmission siting agencies. Compacts may, at times, be useful in coordinating the various siting requirements across state lines, and could lead the way to states developing consistent requirements across state lines.

Difficulties:

- Congressional Approval
- State Approval
- Withdrawals

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EPAct National Transmission Goals

- DOE to designate selected geographic areas as **"National Interest Electric Transmission Corridors"** (NIETC).
- Applicants for projects proposed within those designated corridors that are not acted upon by state siting authorities within 1 year may request FERC to exercise federal **"backstop"** siting authority.

Solution to Barrier 2

Barrier: FERC Order 888 Policy of the entity requesting new or changed transmission service must pay for all upgrades required to grant that service ("Requestor Pays")

Solution: A regional cost allocation methodology that recognizes:

- Transmission upgrades cannot be sized to exactly fit the request.
- Transmission customers other than the Requestor benefit from transmission upgrades needed to meet the request.

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Regional Benefits from Reliability Upgrades – Basis for Cost Allocations

- Increased deliverability to loads that are growing throughout the region.
- Increased deliverability from generators that are being added throughout the region.
- Improved reliability of the regionally integrated power grid.

What About "Economic" Upgrades

- Economic Upgrades: Upgrades to the transmission system not needed for reliability, but result in reduced power costs for customers.
- Based on Cost-Benefit Analysis: Compare the savings in power costs for end-use customers to the cost of upgrading the transmission system.
- Allocate costs of upgrades fairly and in a manner that encourages investment.

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What Is Being Done to Encourage Economic Upgrades?

The Midwest ISO proposed in a tariff filing with the Federal Energy Regulatory Commission (FERC):

- A **criterion** for including economic upgrades in its approved Midwest ISO Transmission Plan.
- A **method** for allocating the costs of economic upgrades to various transmission zones within the Midwest ISO.

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Solution to Barrier 3

Barrier: The tension between the particular interests of generator owners and improvements in the overall efficiency of the transmission grid.

Solution: An Independent, Regional Transmission Planning Process.

- Provides an independent review of both needs and benefits by an entity that is not economically impacted by the transmission upgrade.
- Includes a stakeholder process that provides input on need and benefits.
- Create a transparency that increases the likelihood of transmission investment and transmission expansion.

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Regional Planning by RTOs

Independent Regional Planning:

- is more efficient and comprehensive planning than on the smaller, control area basis,
- decreases the likelihood of discriminatory decisions on transmission improvements
- can create fairer and more efficient cost allocation that will better assign the costs of expansion to those who benefit,
- sends proper price signals to illustrate the value of transmission upgrades.

1. RTOs are Regional Transmission Organizations with independent boards of directors that have been approved by the Federal Energy Regulatory Commission (FERC), and have as one of their required functions to perform regional transmission planning. For example, the Midwest ISO (MISO) prepares the MSIO Transmission Expansion Plan (MTEP).

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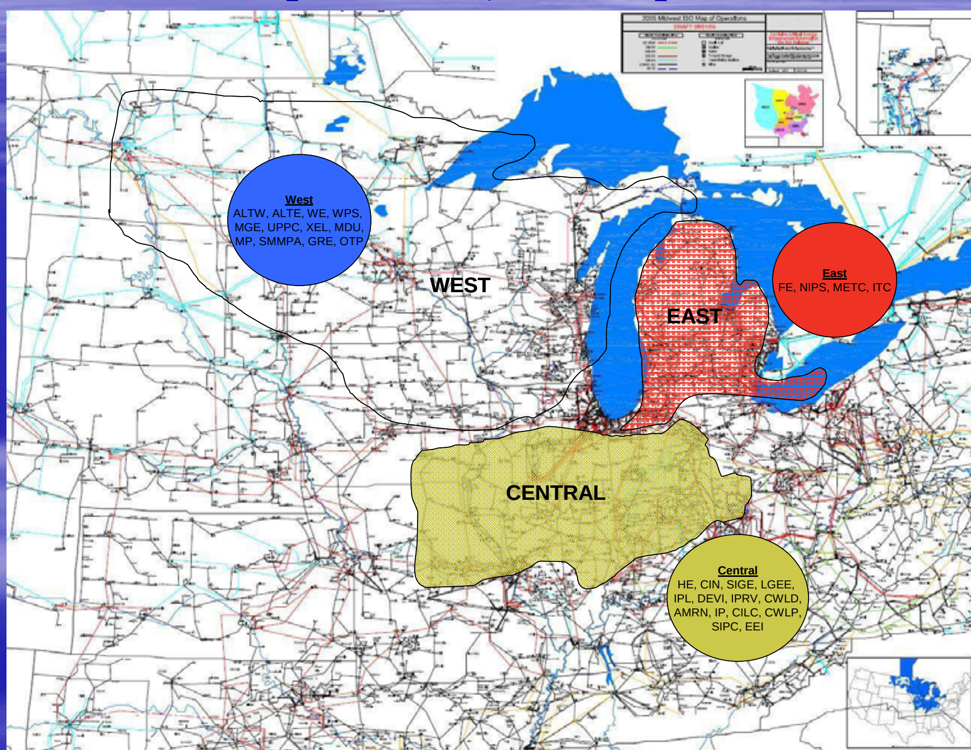
Regional Planning by RTOs

Midwest Independent System Operators (MISO)



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Regional Transmission Planning by MISO

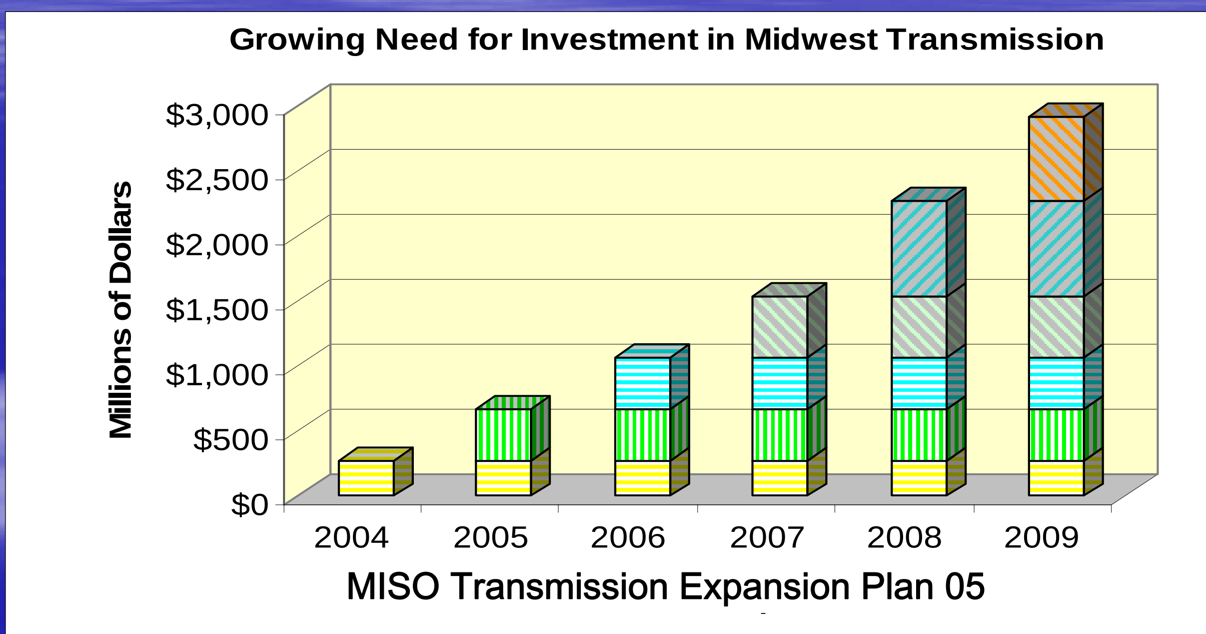
MISO Transmission Expansion Plans have:

- identified over $4.3 billion of transmission projects,
- more than 390 transmission projects primarily for reliability purposes,
- approximately 5,123 miles of transmission line upgrades are projected through 2009 (4.6% of the approximately 112,000 miles of line existing throughout the MISO area),
- over $400 million of these projects were completed by the end of 2004, and
- for 2006, MISO has identified approximately 80 transmission projects. The top ten of those projects will cost approximately $135 million.

MISO Transmission Plans are steadily evolving and the third regional plan is due December 2006.

What kinds of investment will be needed to meet these challenges?

Planned New Transmission Investments in the Midwest



MISO Transmission Expansion Plan 05 estimates.

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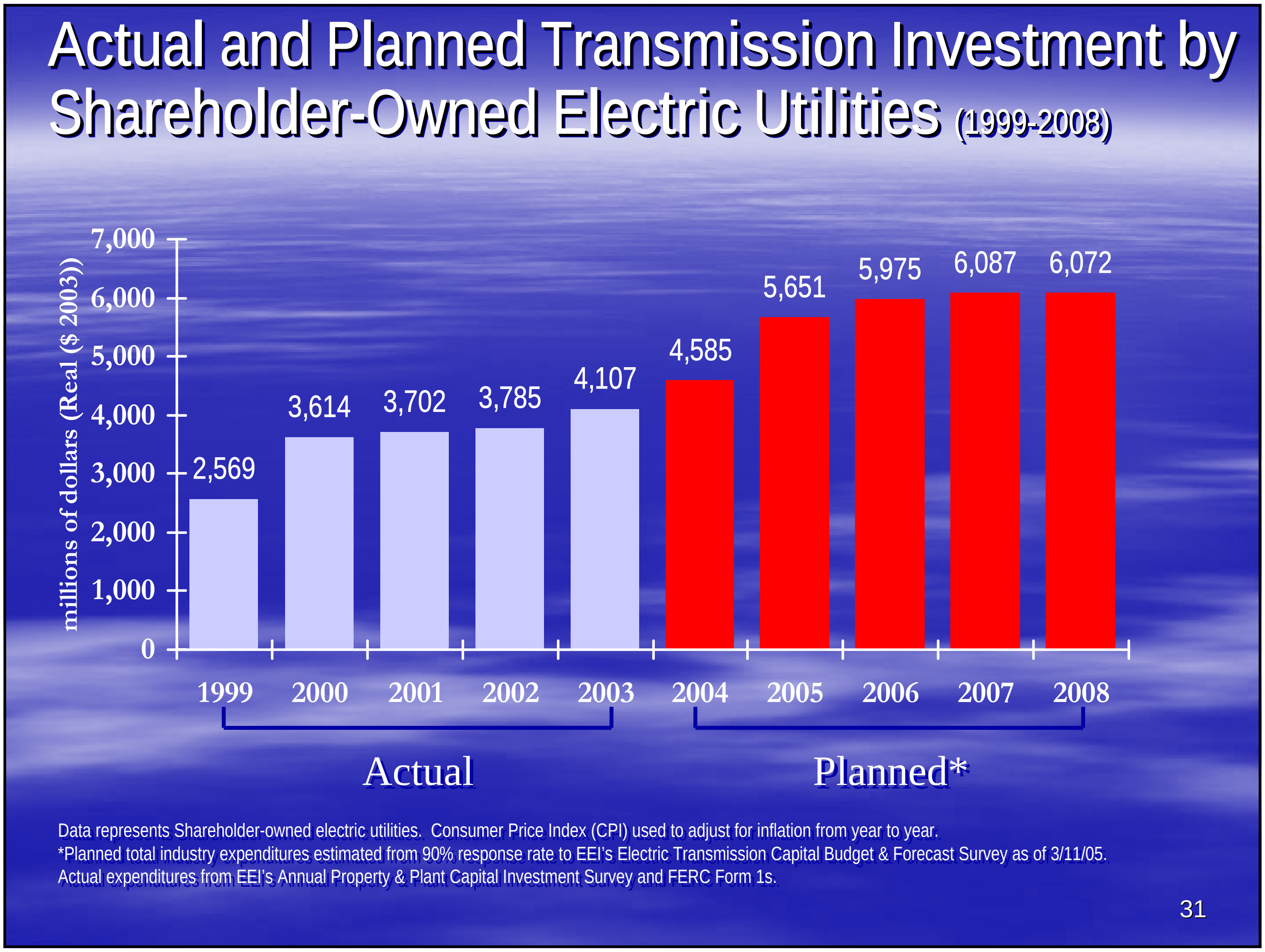
Solutions to Barrier 4

Barrier: Uncertainty about return of and on an investment in transmission expansion.

Solution: All three

- increased state involvement
- cost allocation methods
- independent regional planning authority

provide greater assurance to transmission owners that the upgrades being planned and built will receive a just and reasonable return of and on their investment.


Actual and Planned Transmission Investment by Shareholder-Owned Electric Utilities (1999-2008)
millions of dollars (Real ($ 2003))
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
2,569
3,614
3,702
3,785
4,107
4,585
5,651
5,975
6,087
6,072
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
Actual
Planned*
Data represents Shareholder-owned electric utilities. Consumer Price Index (CPI) used to adjust for inflation from year to year.
*Planned total industry expenditures estimated from 90% response rate to EEI's Electric Transmission Capital Budget & Forecast Survey as of 3/11/05.
Actual expenditures from EEI's Annual Property & Plant Capital Investment Survey and FERC Form 1s.
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Where Do We Go Now?

Proposed System for TransAmerica Grid

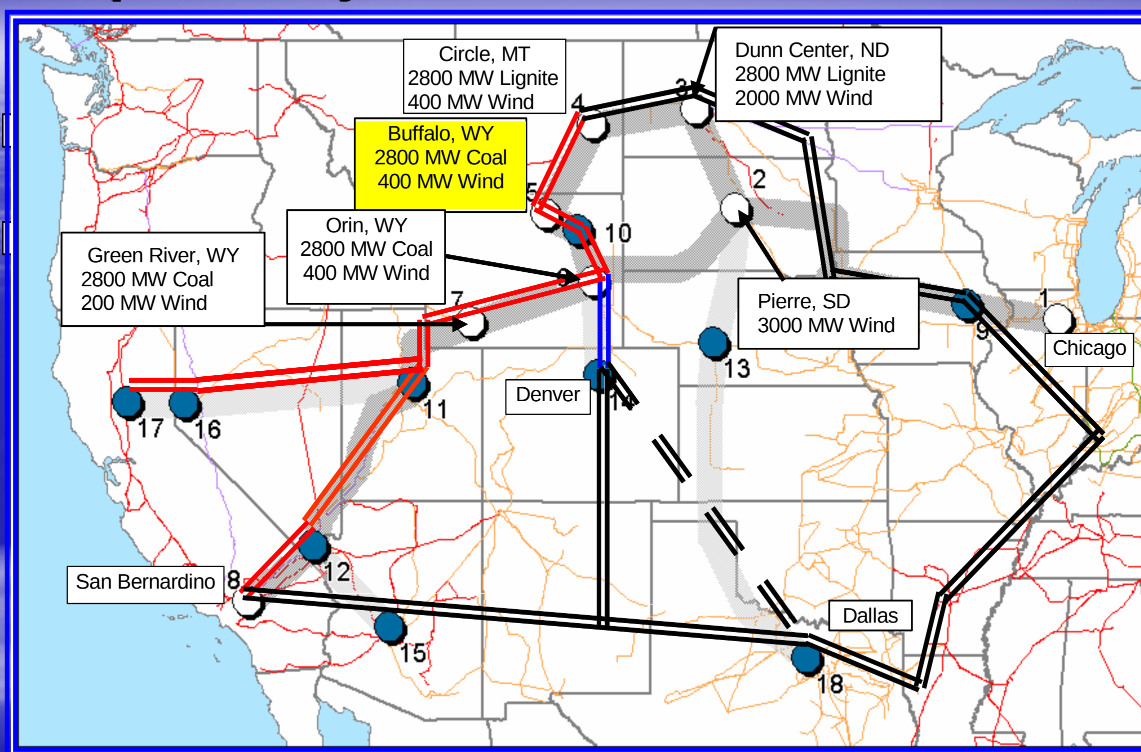


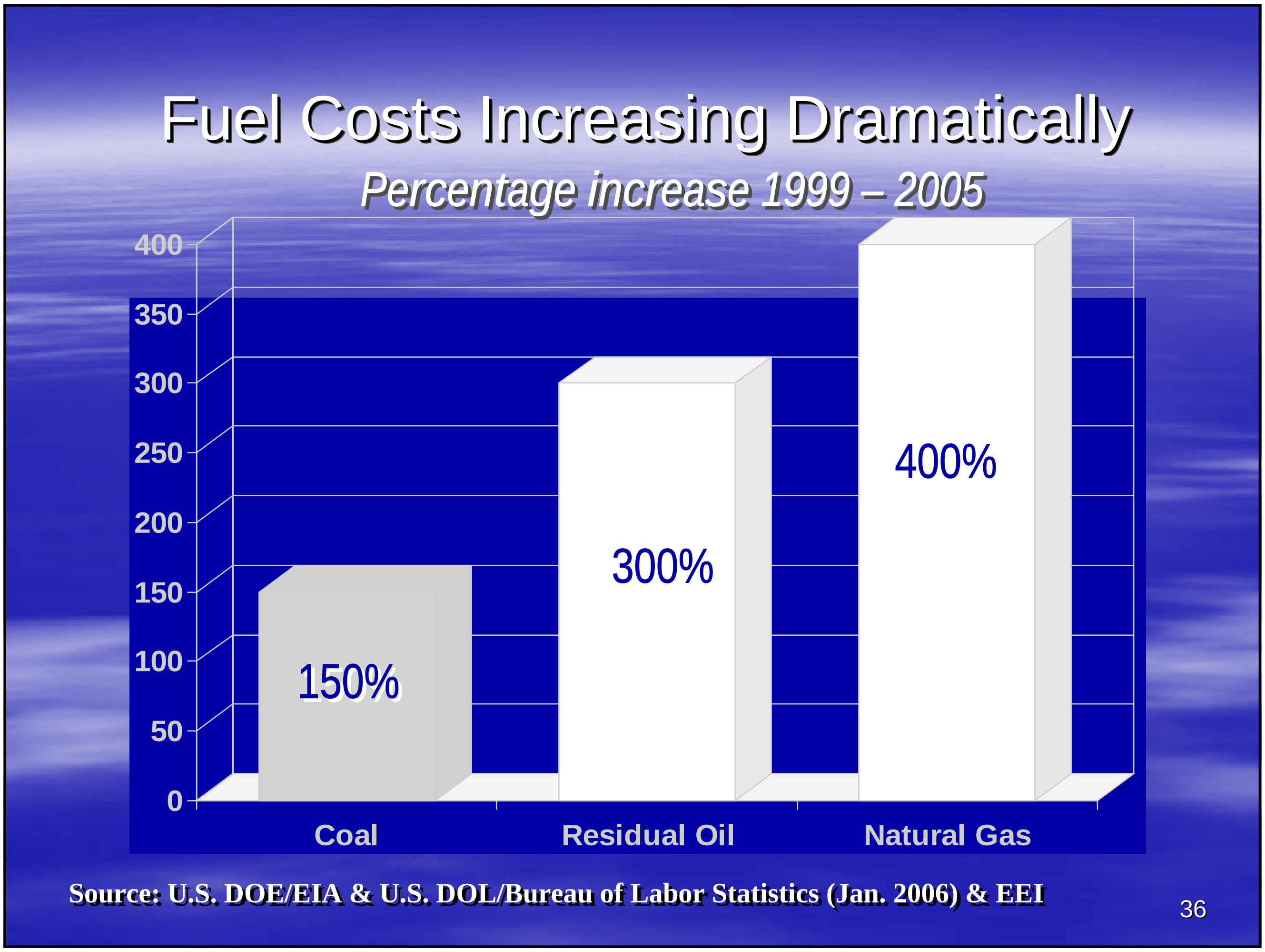
Figure 1: Layout of Proposed TAGG Project Master Plan
(The dashed line represents an alternative route.)

Proposed System for TransAmerica Grid

1. Approximately 7800 Miles
2. Two Corridors separated by 10 Miles
3. One Set of Towers in Each Corridor
4. Three Conductor Bundles on Each Tower
5. 9000 MW Capacity
6. 500 or 765 kV AC – Subject to Study
7. HVDC May be Part of Project – Subject to Study

Proposed System (cont.)

8. Access to up to
   - a. 14,000 MW of New Coal/Lignite Generation (Possibly IGCC)
   - b. 10,000 MW of Wind Generation
9. Price Tag: $11 Billion AC Only
10. Price Tag: $17 Billion With DC Converter Stations


Fuel Costs Increasing Dramatically
Percentage increase 1999 – 2005
400
350
300
250
200
150
100
50
0
150%
300%
400%
Coal
Residual Oil
Natural Gas
Source: U.S. DOE/EIA & U.S. DOL/Bureau of Labor Statistics (Jan. 2006) & EEI
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Optimal Transmission Investment

Key Component:

There is a trade-off between Generation, Transmission, and Load (i.e., Supply, Delivery, and Demand).

- Any “shortage” in the power grid can be corrected by either:
  - Expanding Generation capability
  - Expanding Transmission capability
  - Reducing demand for electricity during shortages

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USA Today: "*Power crunch could lead to lots more lines. Planned tower-building spree worries environmentalists*"

- Do not assume that construction will occur merely due to need—Political Atmosphere driven by citizens may bar necessary growth.
- New Technology can decrease construction needs (i.e., wire stringing),
- Demand Response is 1 of 3 factors in the equation with Generation and Transmission.

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Demand Response

Demand Response and energy efficiency efforts will have an impact on necessary generation and transmission.

- Demand response and energy efficiency efforts can:
  1. Slow the increase in need for additional generation, and
  2. Reduce grid congestion.
- Understanding how demand response fits into the equation for Modernization of the grid will be important.

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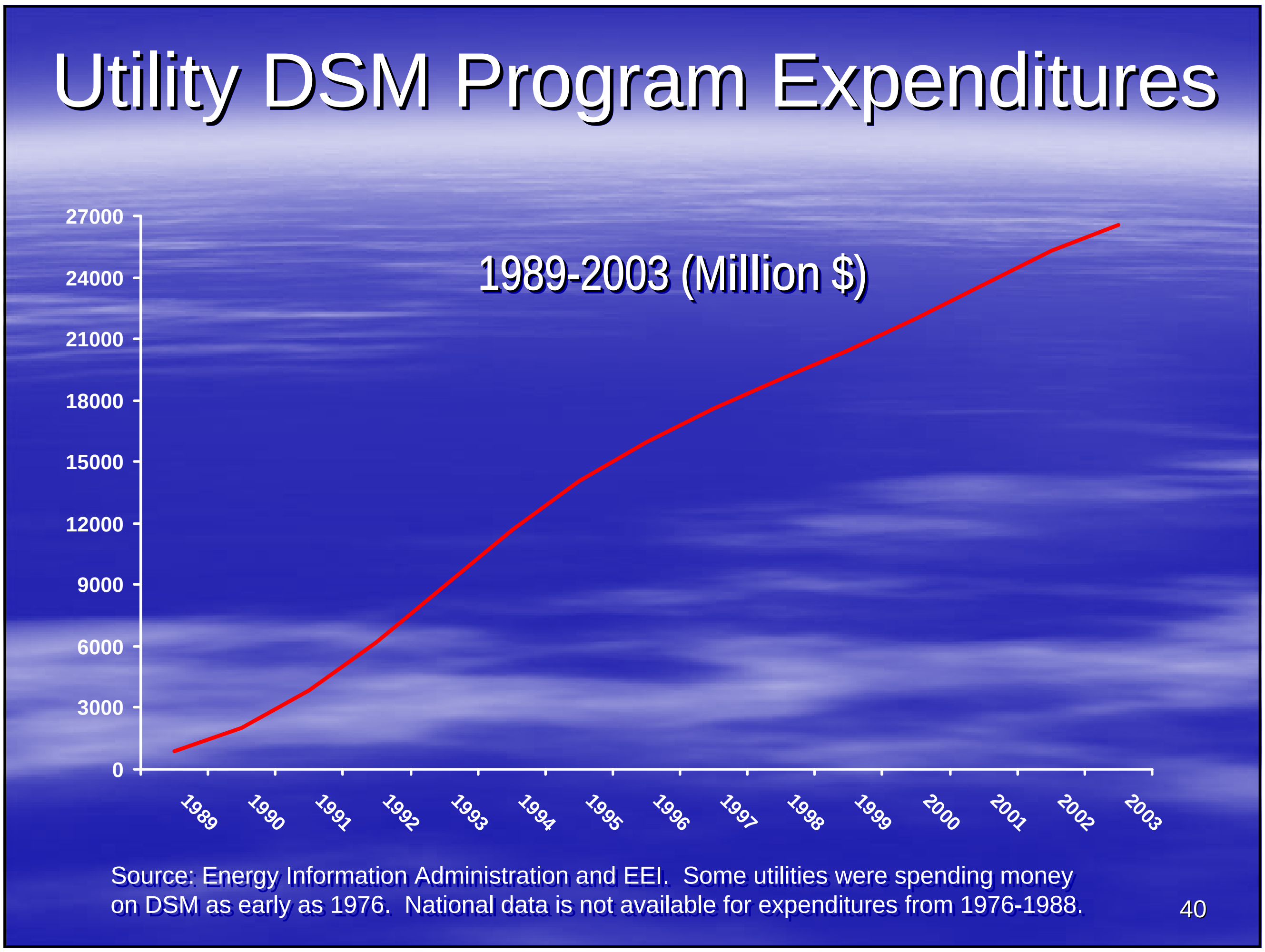
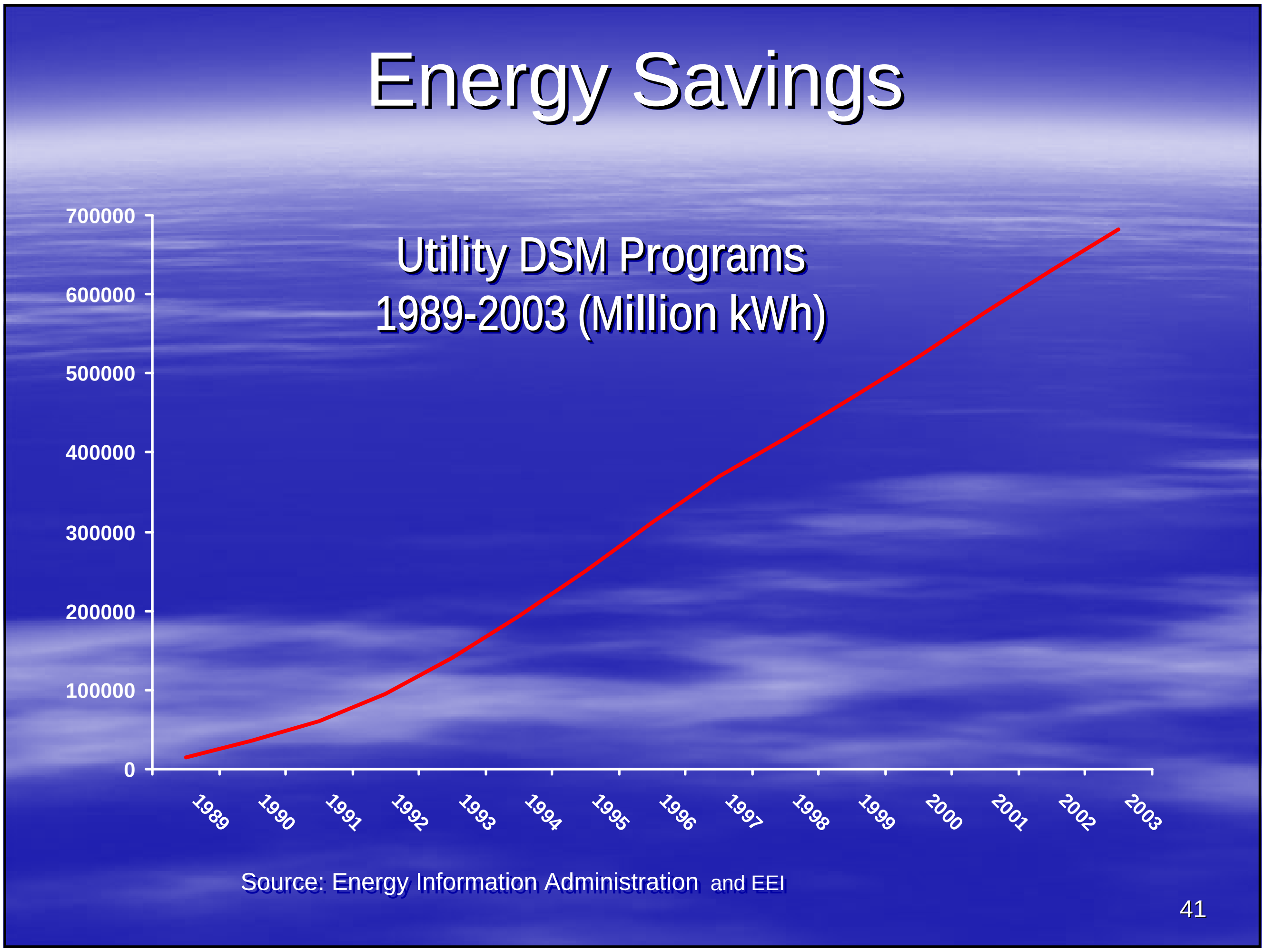
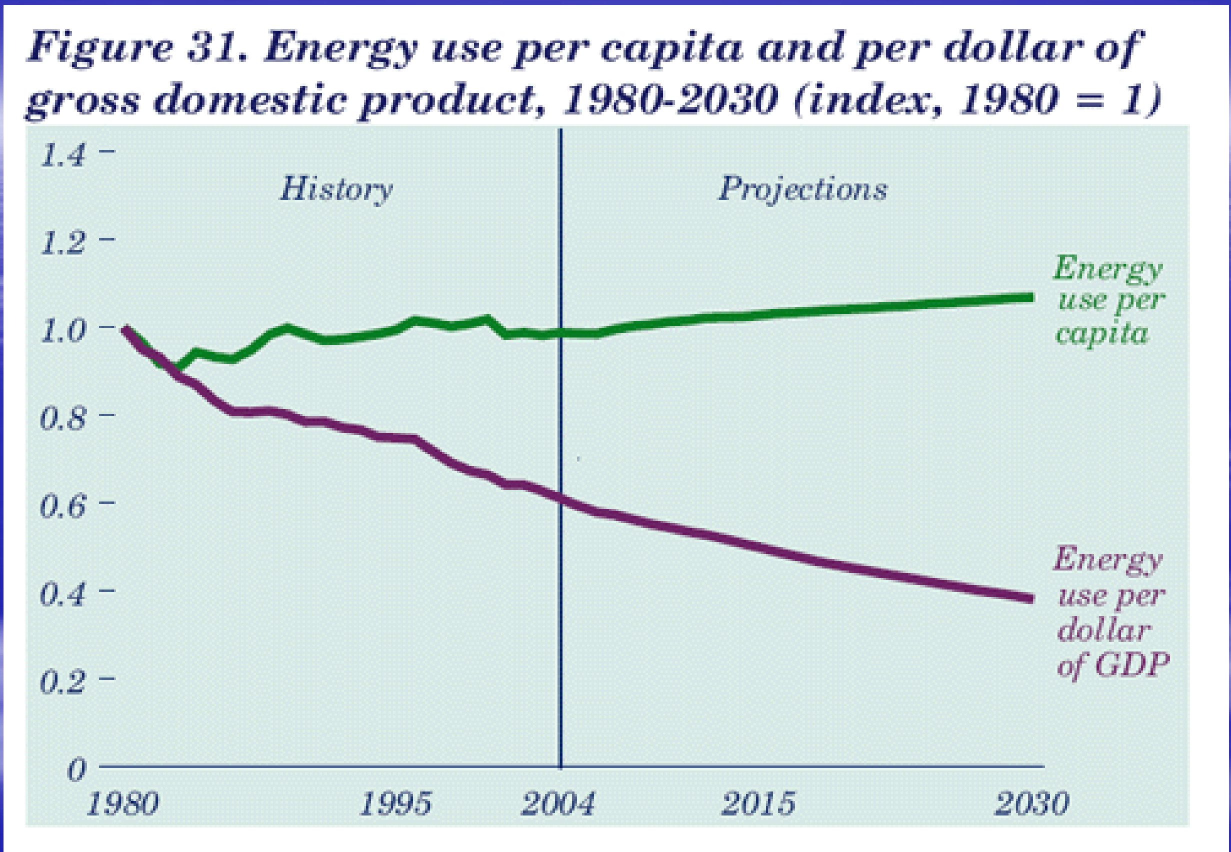

Utility DSM Program Expenditures
1989-2003 (Million $)
27000
24000
21000
18000
15000
12000
9000
6000
3000
0
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Source: Energy Information Administration and EEI. Some utilities were spending money on DSM as early as 1976. National data is not available for expenditures from 1976-1988.
40


Energy Savings
Utility DSM Programs
1989-2003 (Million kWh)
700000
600000
500000
400000
300000
200000
100000
0
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Source: Energy Information Administration and EEI
41



Source: EIA Annual Energy Outlook with Projections 2006 to 2030, http://www.eia.doe.gov/oiaf/aeo/figure_31.html

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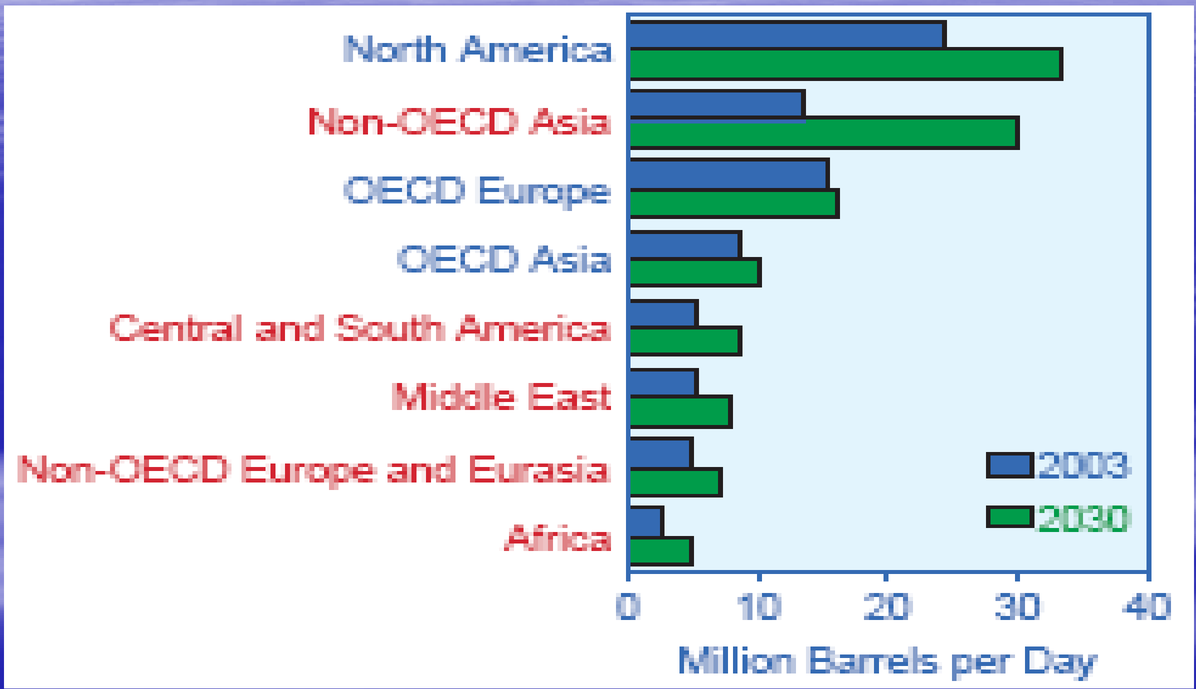
World Oil Consumption by Region and Country Group, 2003 and 2030



Sources: 2003: Energy Information Administration (EIA), *International Energy Annual 2003* (May-July 2005), web site www.eia.doe.gov/iea/. 2030: EIA, System for the Analysis of Global Energy Markets (2006).

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THANK YOU

Steve Gaw, Commissioner

Missouri Public Service Commission and

President of the Organization of MISO States

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