



The Solutions Network
Rochester, New York

Electricity Supply Risks -- Emerging Issues

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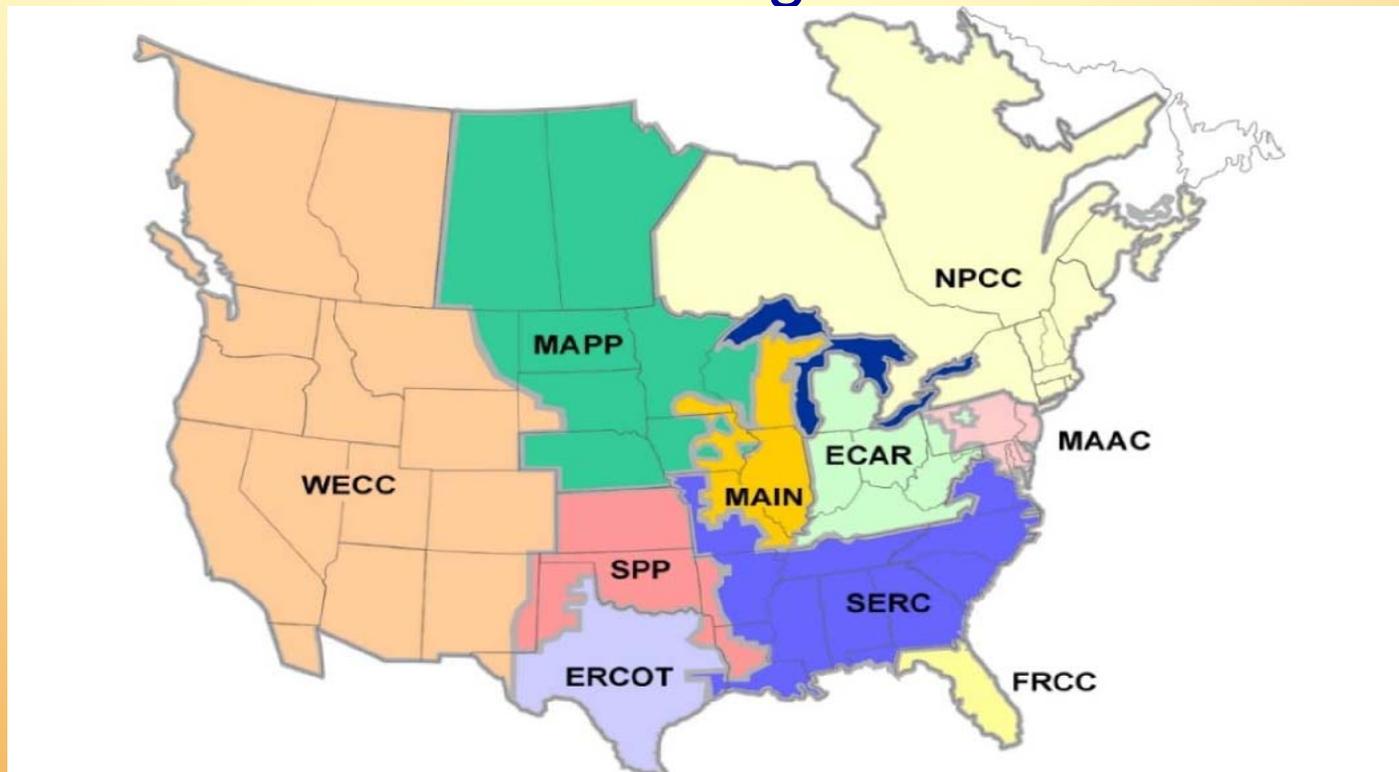
Changing Paradigm



- Traditional industry model:
 - Issue = adequacy of reserve margins
- Emerging issues:
 - Adequacy of natural gas supply
 - Natural gas transportation constraints/ ability to maintain pipeline pressures
 - Adequacy of coal supplies/ transportation availability
 - Hydro availability in West
 - Power quality
 - Transmission constraints in urban areas
- Exposure to severe price spikes = even more pressing problem

- Responsible for Developing Reliability Standards

NERC Regions

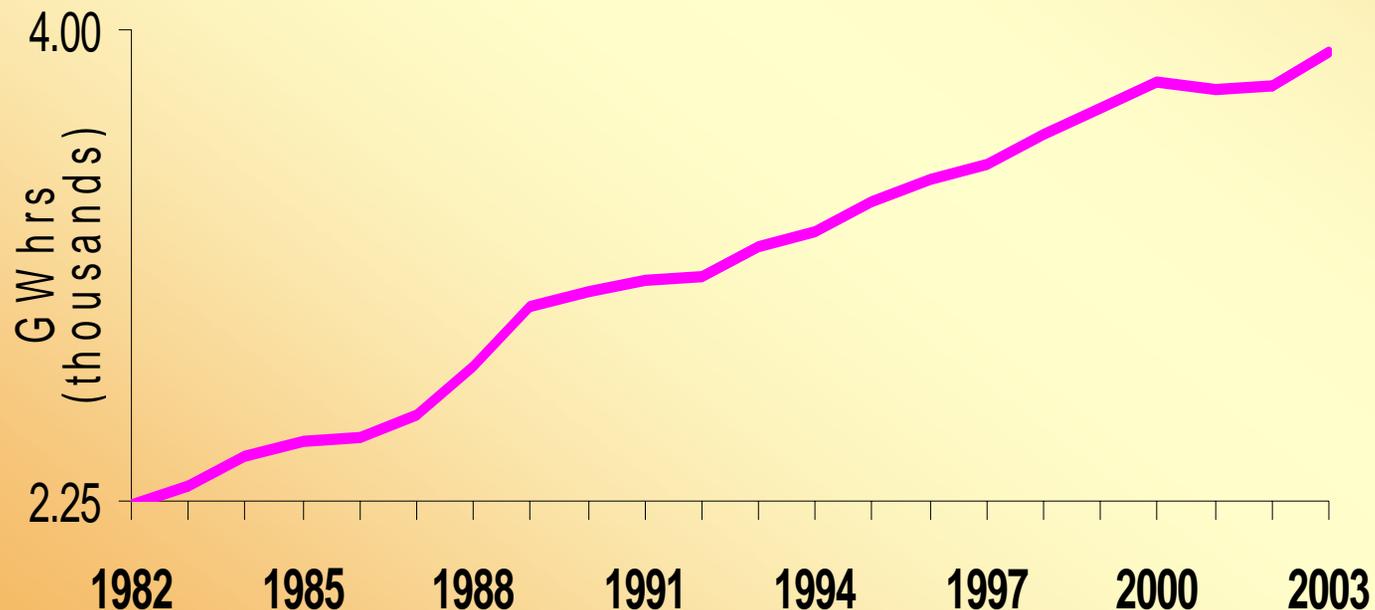


Electricity - Intensive Economy



- Demand grows almost every year
 - More rapid than normal past 12 months

Electricity Consumption Grows Every Year

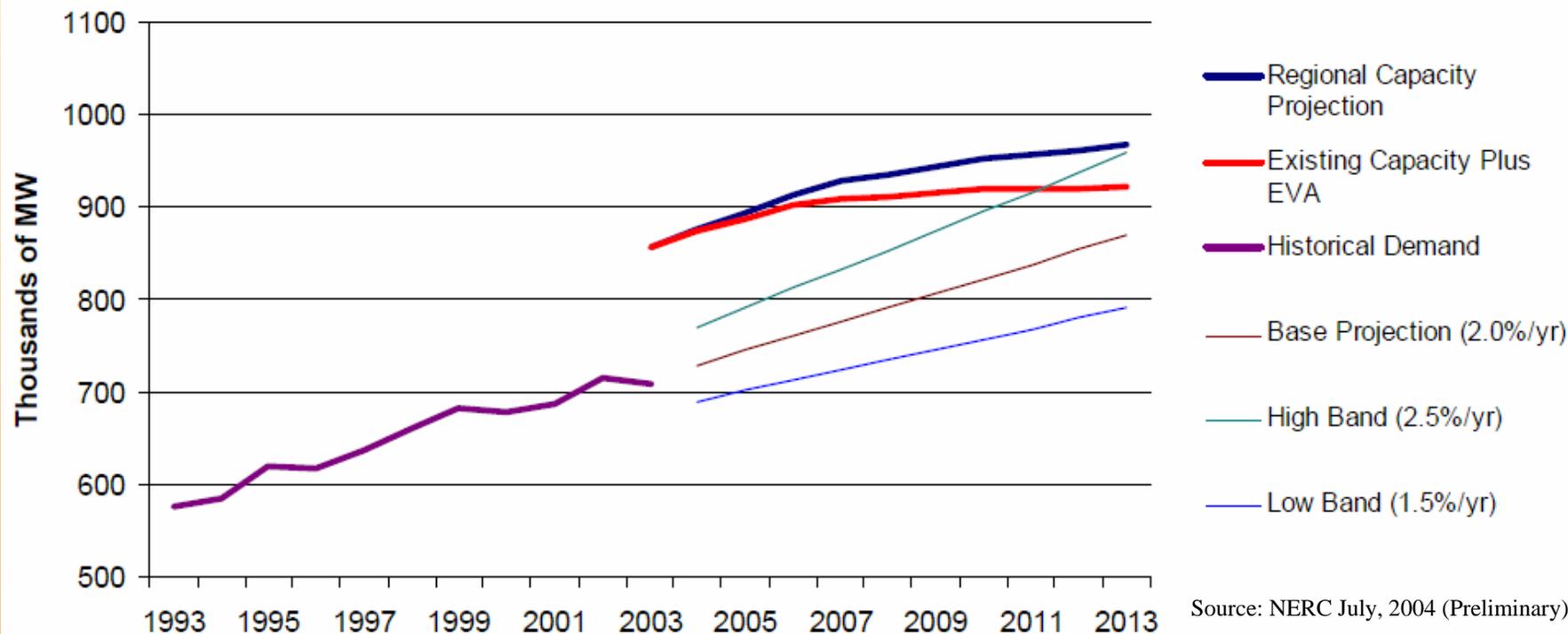


Major Uncertainties Regarding Demand



- Adequacy of supply highly sensitive to growth rate
 - Little cushion to spare

U.S. Capacity vs Demand Growth - Summer



Source: NERC July, 2004 (Preliminary)

Summer 2005 Supplies



- Current reserve margins generally adequate

Demand and Capacity as Reported by the NERC Regions

Region	Total Internal Demand (MW)	Net Internal Demand (MW)	Projected Capacity Resources (MW)	Reserve Margins (% of Net Internal Demand)	Capacity Margins (% of Capacity)
		Summer – 2005			
ECAR	104,765	102,132	128,943	26.3	20.8
FRCC	43,753	40,926	50,341	23.0	18.7
MAAC	58,056	56,984	68,591	20.4	16.9
MAIN	58,667	55,494	69,817	25.8	20.5
MAPP-U.S.	30,116	29,886	34,308	14.8	12.9
MAPP-Canada	5,717	5,455	8,582	57.3	36.4
NPCC-U.S.	58,624	57,483	72,780	26.6	21.0
NPCC-Canada	48,646	47,793	63,788	33.5	25.1
SERC	161,634	156,079	181,990	16.6	14.2
SPP	40,813	39,812	45,900	15.3	13.3
Eastern Interconnection	610,791	592,044	725,040	22.5	18.3
WECC-U.S.	125,687	123,221	160,998	30.7	23.5
WECC-Canada	15,996	15,877	22,465	41.5	29.3
WECC-Mexico	1,845	1,845	2,634	42.8	30.0
Western Interconnection (a)	143,345	140,759	187,237	33.0	24.8
ERCOT Interconnection	62,906	61,505	78,725	28.0	21.9
U.S.	745,021	723,522	892,393	23.3	18.9

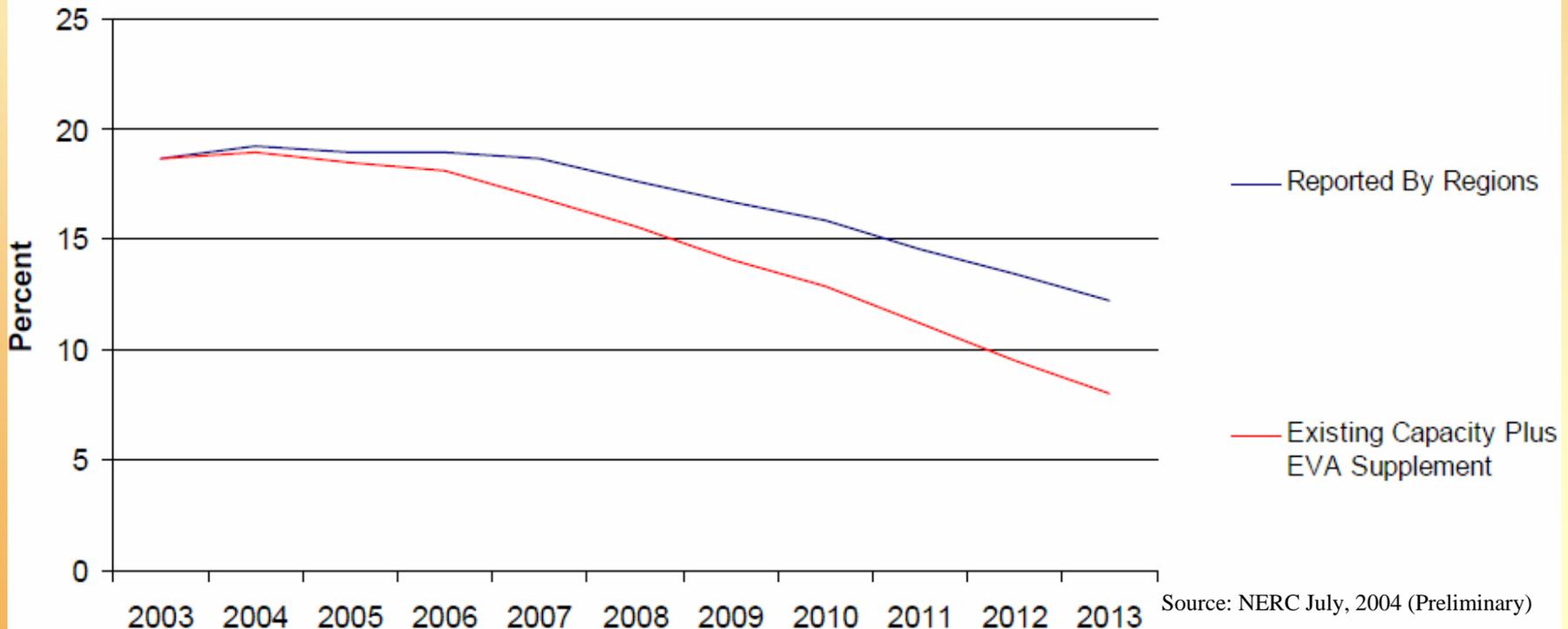
Source: NERC July, 2004 (Preliminary)

Declines Certain to Occur



- Could be rapid

United States Capacity Margins - Summer



Summer 2009 Supplies



- Tighter every year - even with base case growth

Demand and Capacity as Reported by the NERC Regions

Region	Total Internal Demand (MW)	Net Internal Demand (MW)	Projected Capacity Resources (MW)	Reserve Margins (% of Net Demand)	Capacity Margins (% of Capacity Resources)
		Summer – 2009			
ECAR	113,674	111,082	136,630	23.0	18.7
FRCC	47,990	45,214	54,113	19.7	16.4
MAAC	62,276	61,204	68,698	12.2	10.9
MAIN	62,236	59,042	76,446	29.5	22.8
MAPP-U.S.	32,548	32,313	36,527	13.0	11.5
MAPP-Canada	6,065	5,803	8,882	53.1	34.7
NPCC-U.S.	61,376	60,215	78,899	31.0	23.7
NPCC-Canada	52,430	51,570	64,727	25.5	20.3
SERC	175,730	170,598	192,876	13.1	11.6
SPP	43,297	42,271	46,232	9.4	8.6
Eastern Interconnection	657,622	639,312	764,030	19.5	16.3
WECC-U.S.	137,892	135,414	172,376	27.3	21.4
WECC-Canada	17,021	16,902	23,618	39.7	28.4
WECC-Mexico	2,258	2,258	3,096	37.1	27.1
Western Interconnection (a)	157,146	154,549	199,090	28.8	22.4
ERCOT Interconnection	69,166	67,765	79,853	17.8	15.1
U.S.	806,185	785,118	942,650	20.1	16.7

Source: NERC July, 2004 (Preliminary)



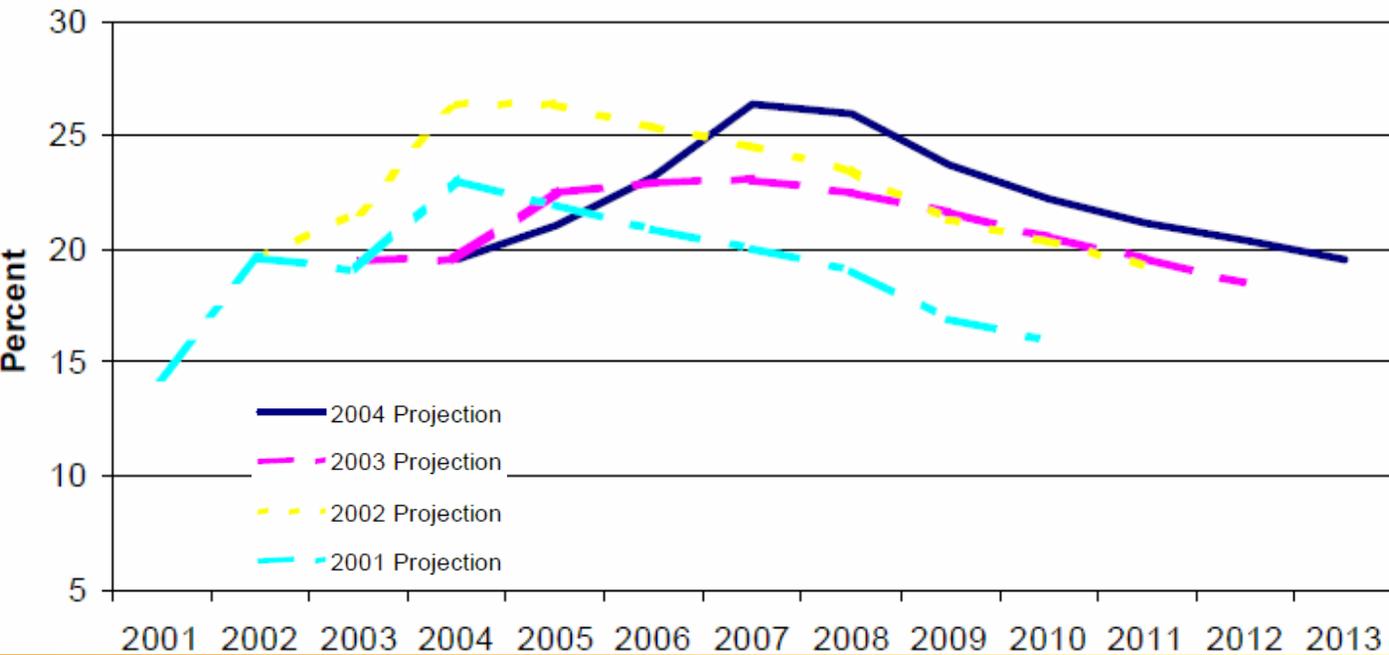
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Regional Breakdown

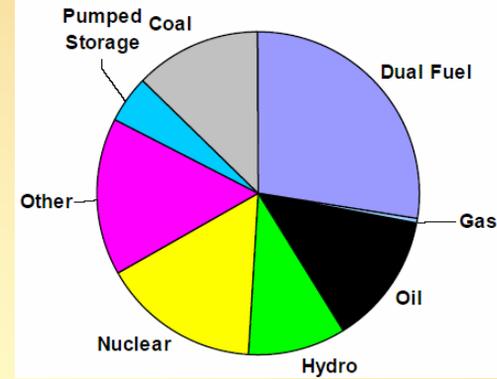
NPCC (New York/ New England)



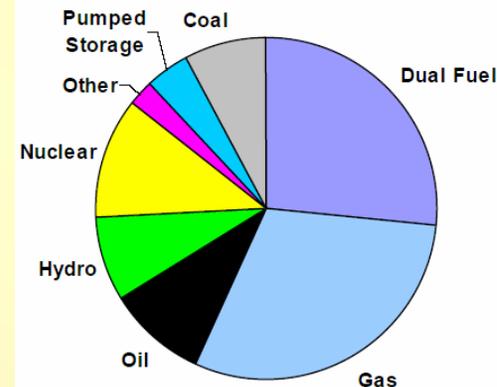
NPCC US Capacity Margins - Summer



NPCC US Capacity Fuel Mix 1999



NPCC US Capacity Fuel Mix 2009

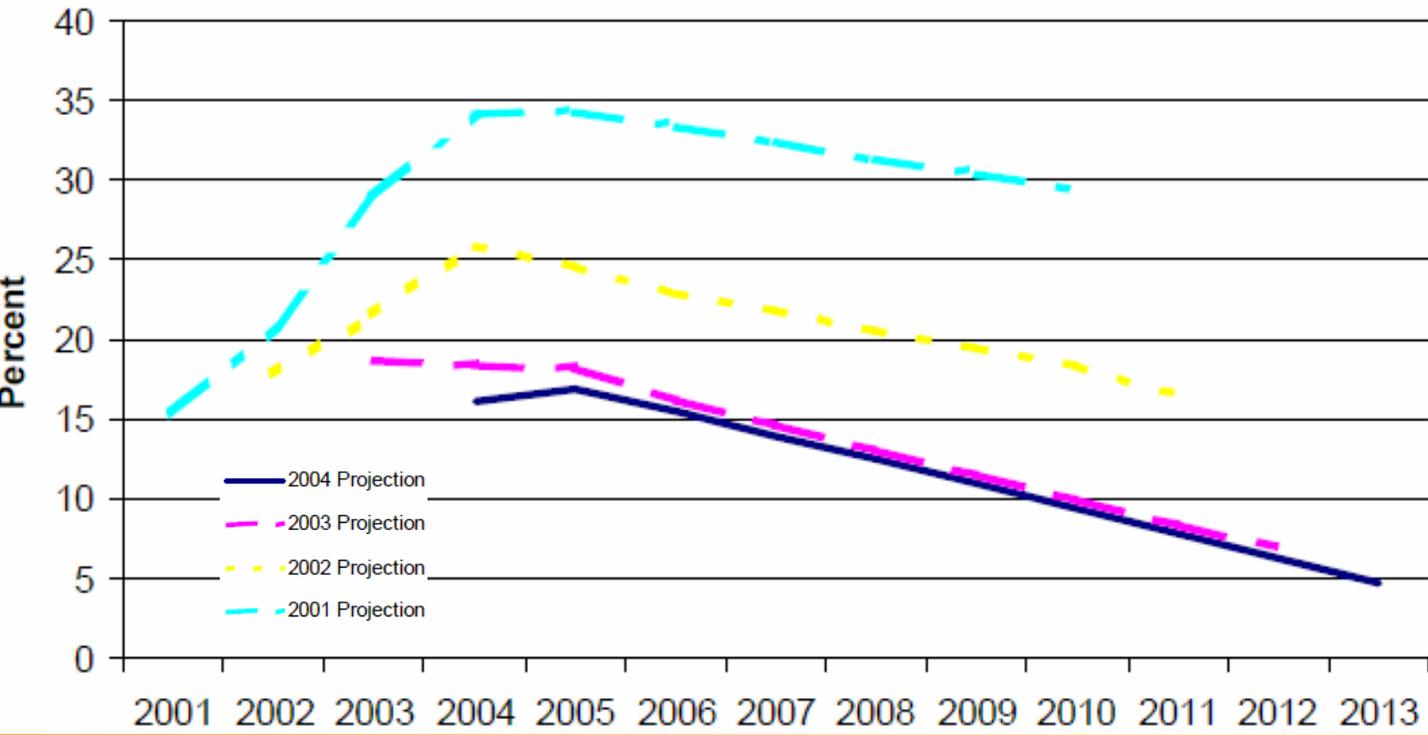


Source: NERC July, 2004 (Preliminary)

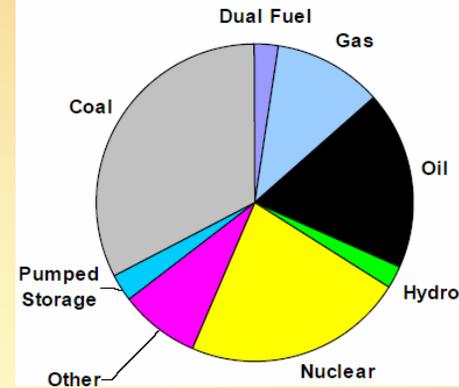
MAAC (Mid-Atlantic)



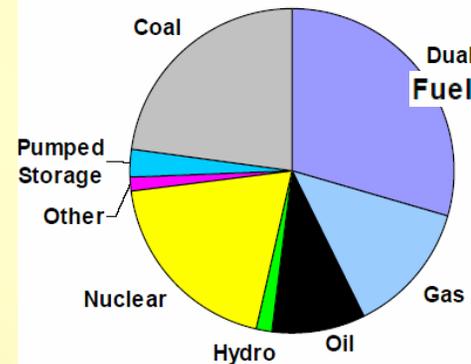
MAAC Capacity Margins - Summer



MAAC Capacity Fuel Mix 1999



MAAC Capacity Fuel Mix 2009

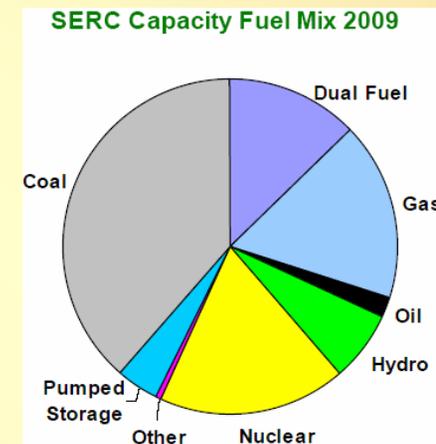
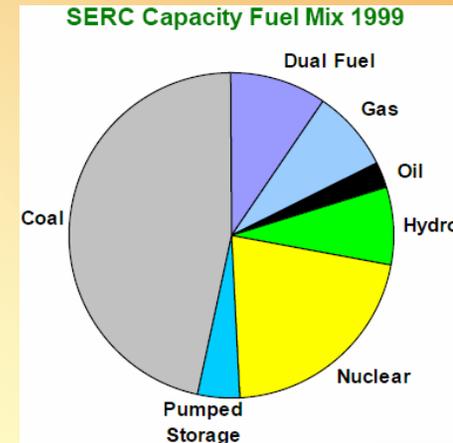
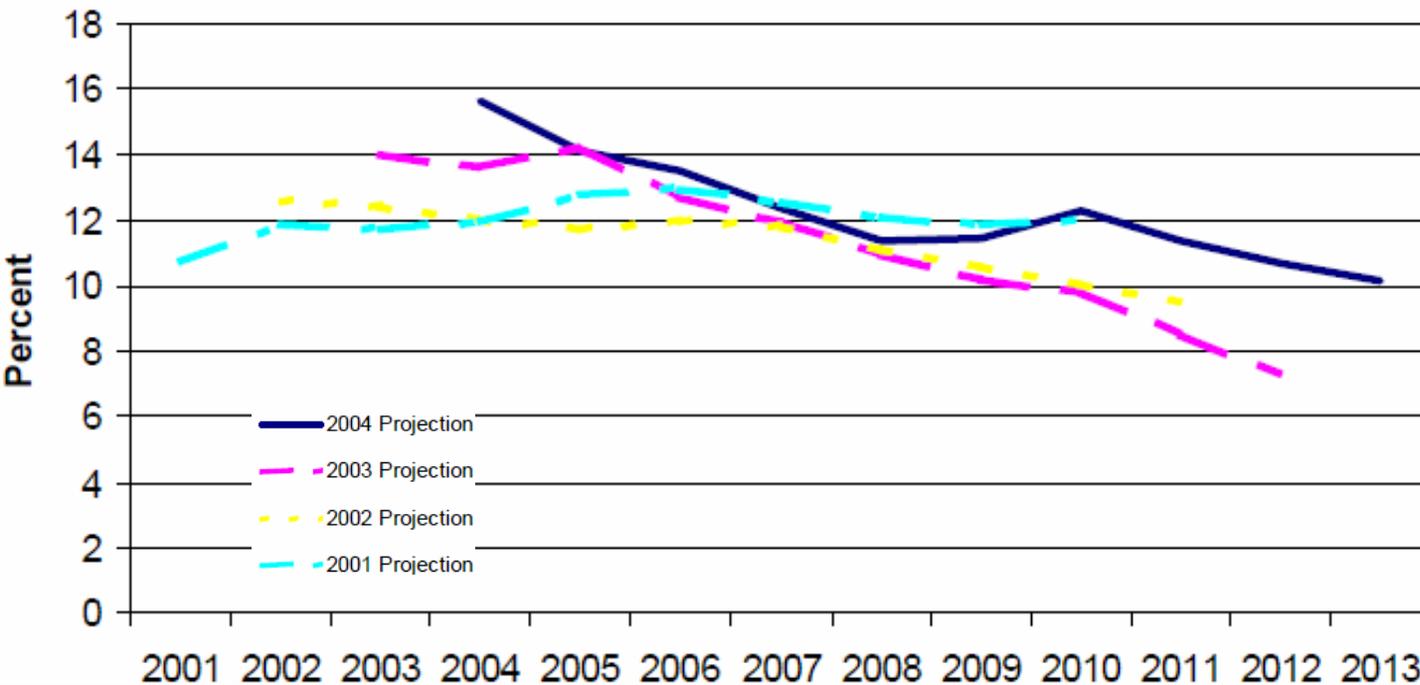


Source: NERC July, 2004 (Preliminary)

SERC (Southeast)



SERC Capacity Margins - Summer

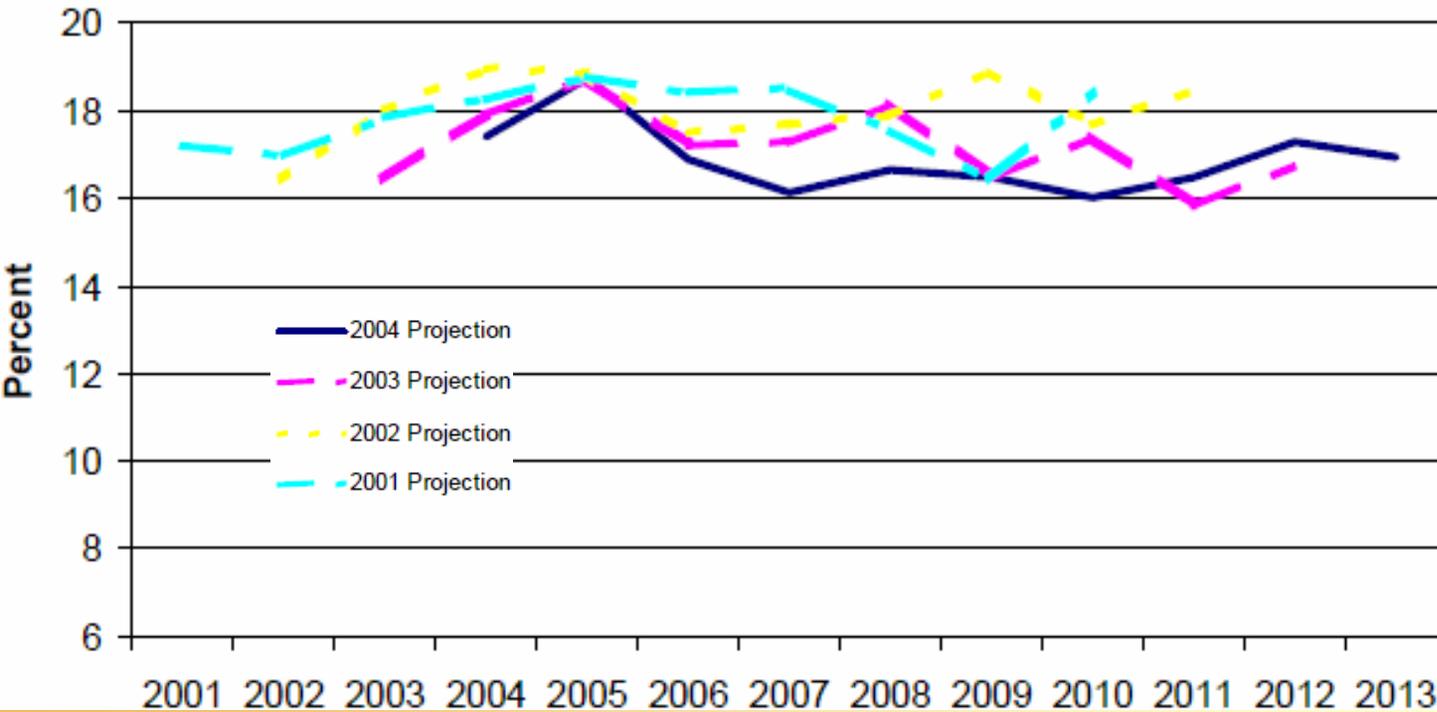


Source: NERC July, 2004 (Preliminary)

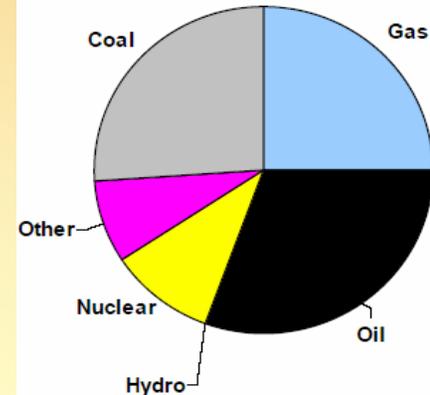
FRCC (Florida)



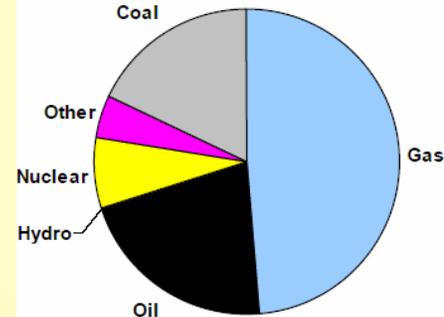
FRCC Capacity Margins - Summer



FRCC Capacity Fuel Mix 1999



FRCC Capacity Fuel Mix 2009

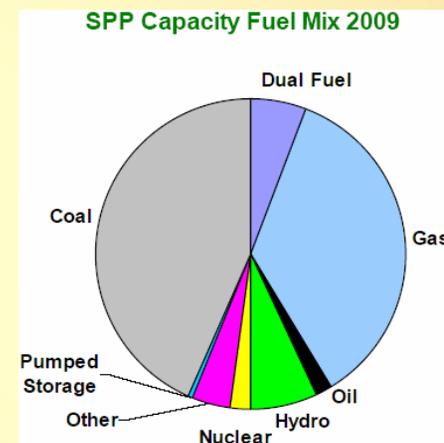
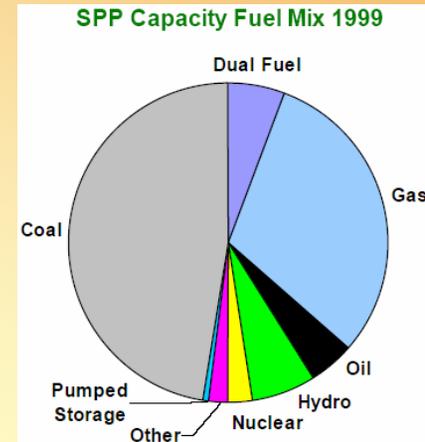
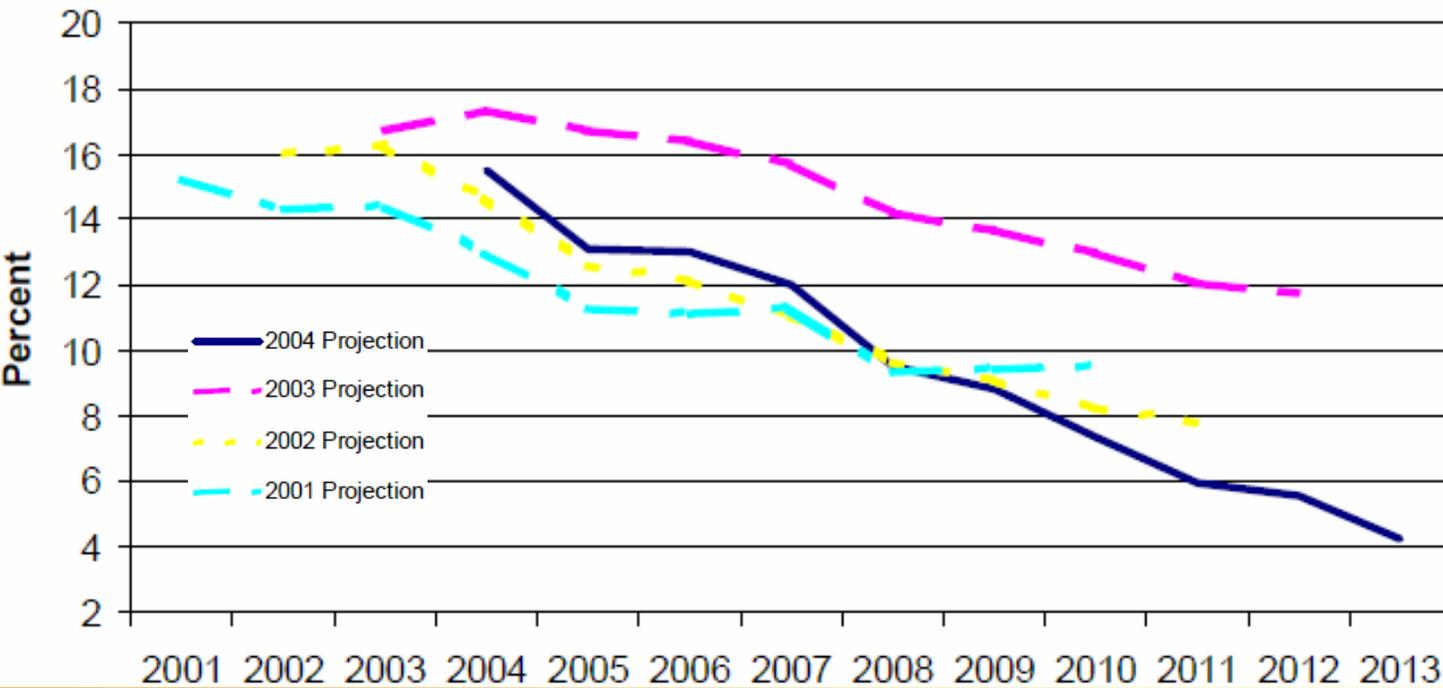


Source: NERC July, 2004 (Preliminary)

SPP (Kansas/Oklahoma)



SPP Capacity Margins - Summer

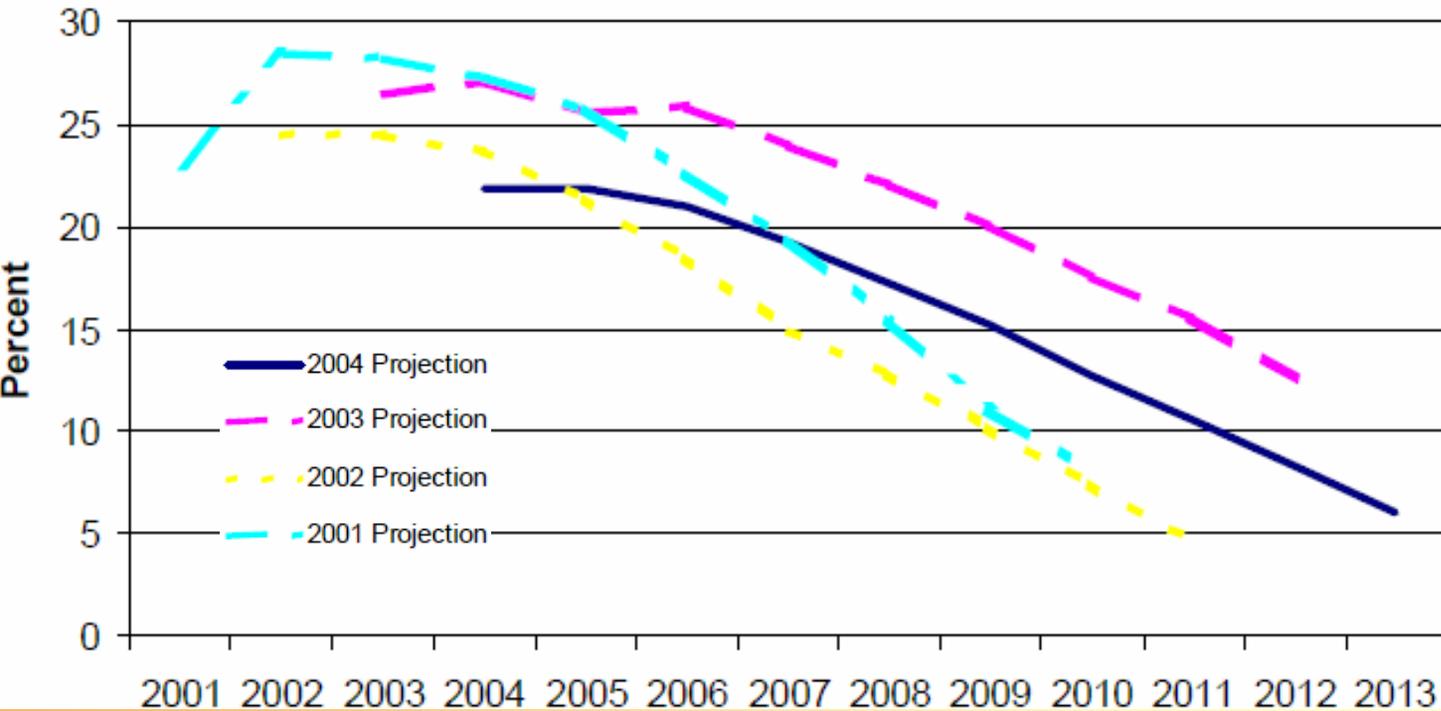


Source: NERC July, 2004 (Preliminary)

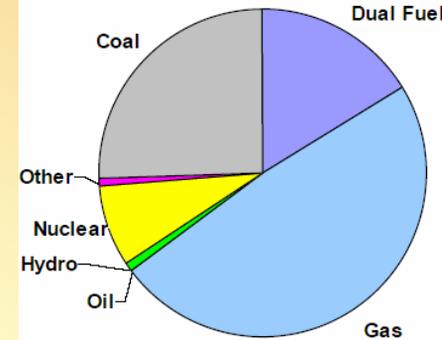
ERCOT (Texas)



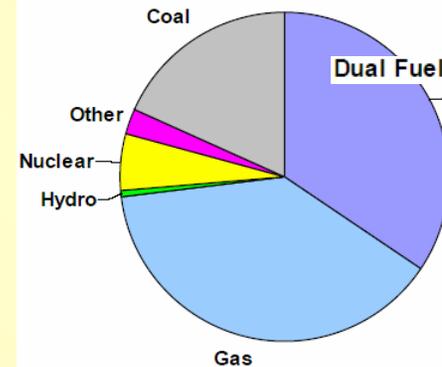
ERCOT Capacity Margins - Summer



ERCOT Capacity Fuel Mix 1999



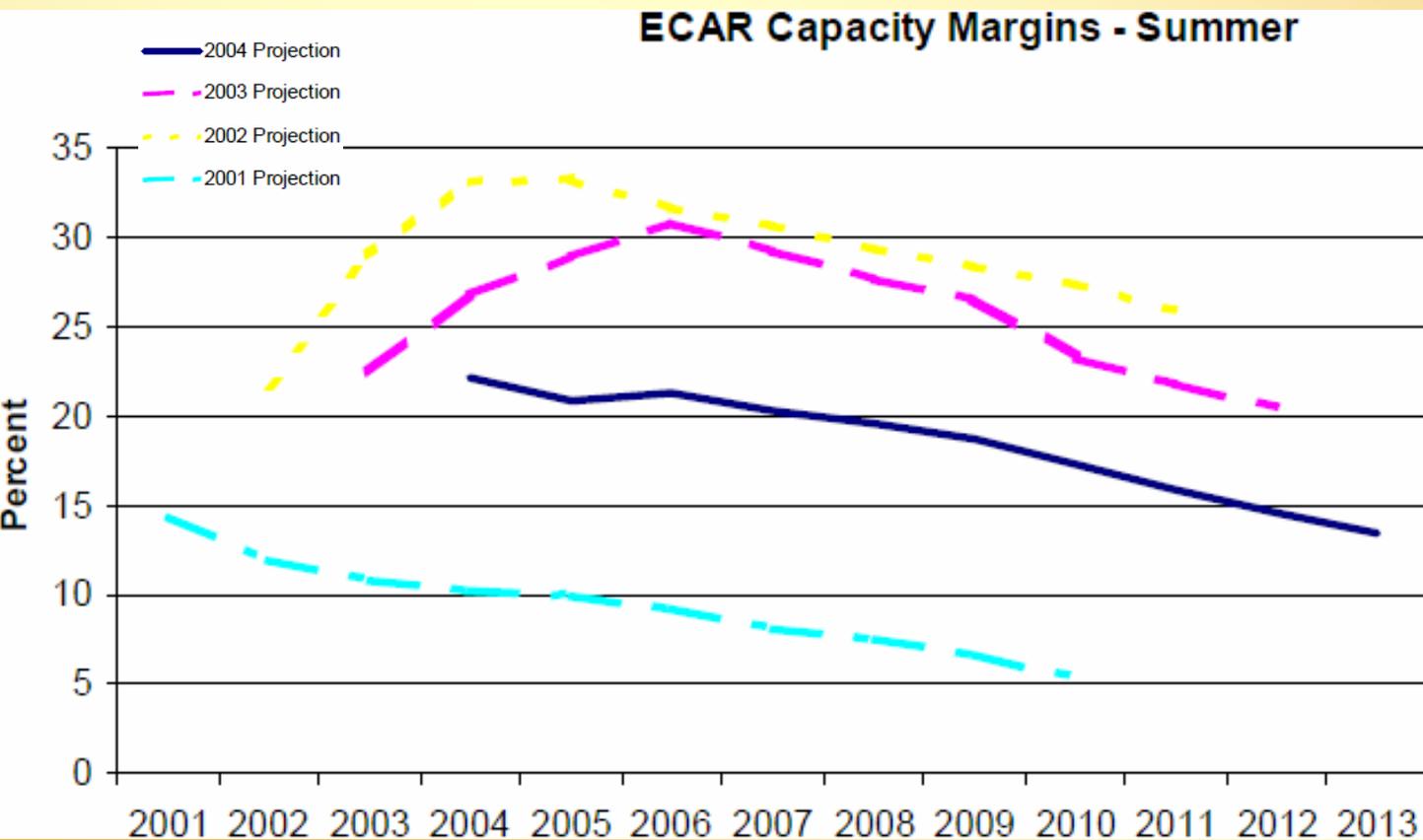
ERCOT Capacity Fuel Mix 2009



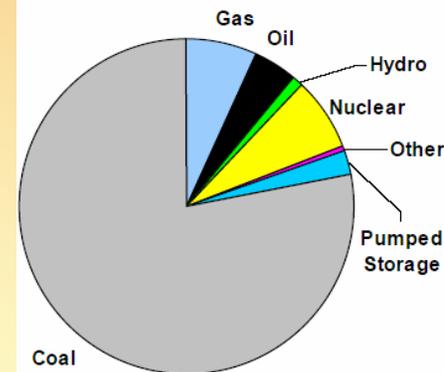
Source: NERC July, 2004 (Preliminary)

ECAR

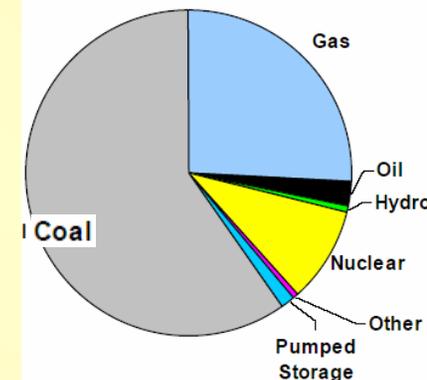
(Ohio, Indiana, Michigan, W. Virginia, Kentucky)



ECAR Capacity Fuel Mix 1999



ECAR Capacity Fuel Mix 2009



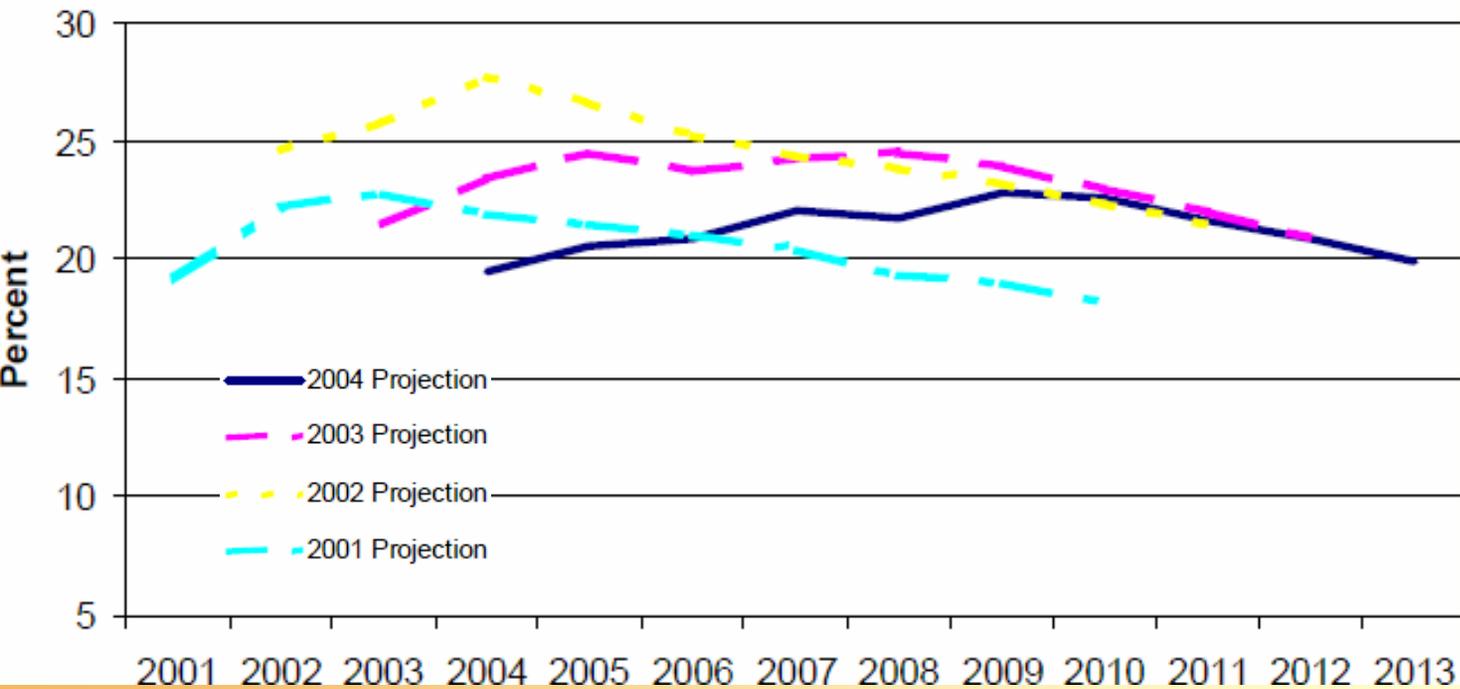
Source: NERC July, 2004 (Preliminary)

MAIN

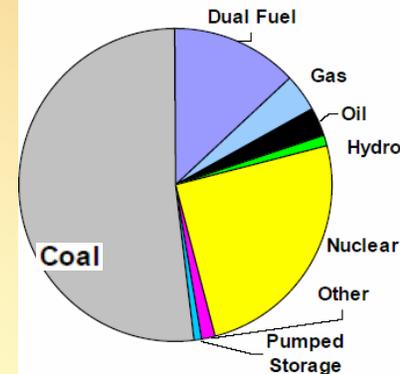
(Illinois Wisconsin, Missouri)



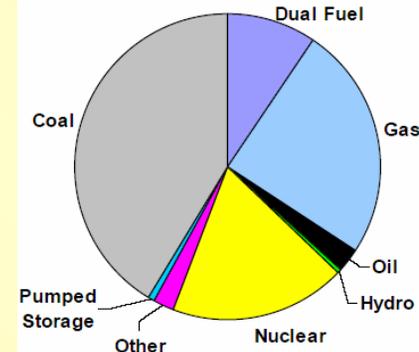
MAIN Capacity Margins - Summer



MAIN Capacity Fuel Mix 1999



MAIN Capacity Fuel Mix 2009



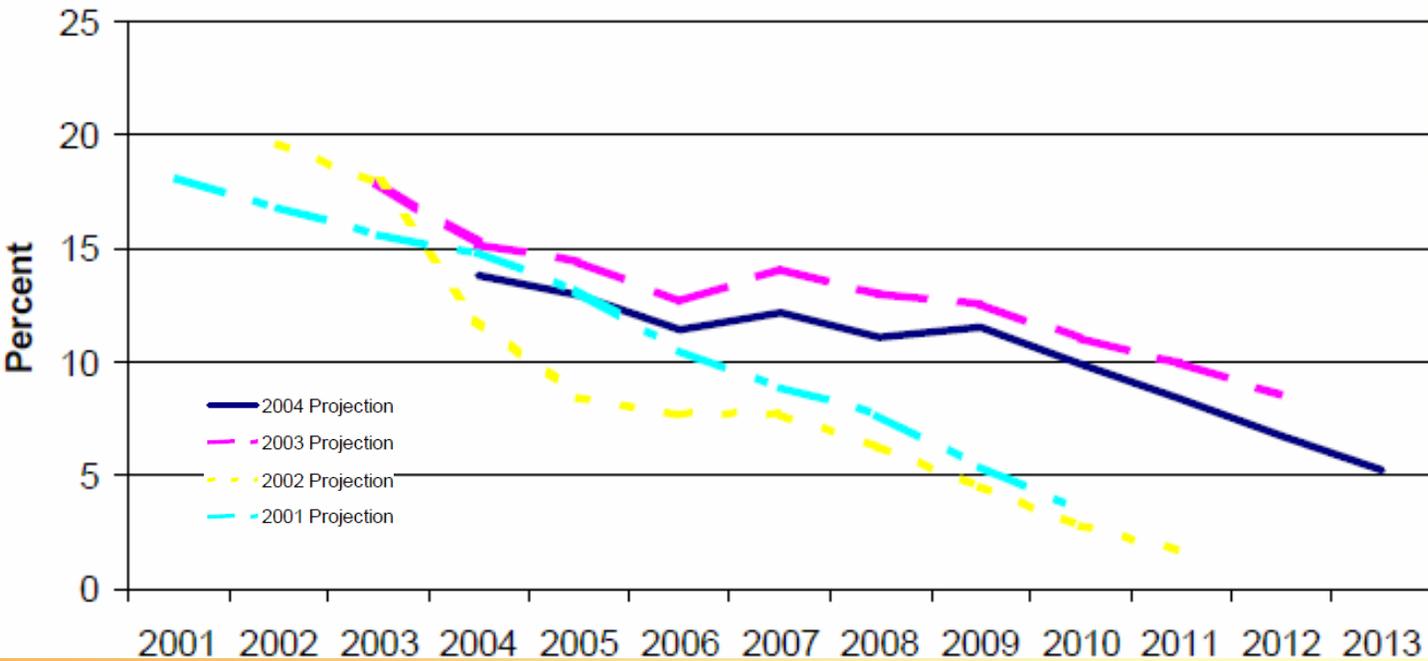
Source: NERC July, 2004 (Preliminary)

MAPP

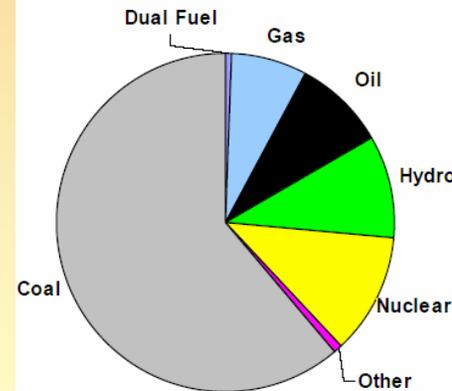
(Upper Midwest/Plains States)



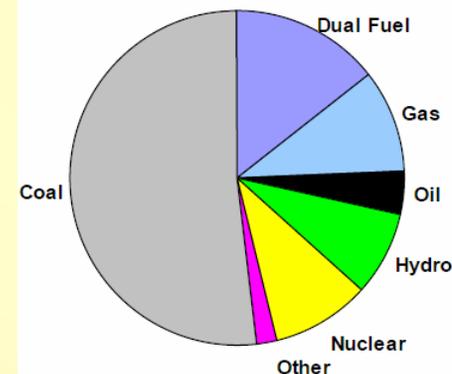
MAPP US Capacity Margins - Summer



MAPP US Capacity Fuel Mix 1999



MAPP US Capacity Fuel Mix 2009

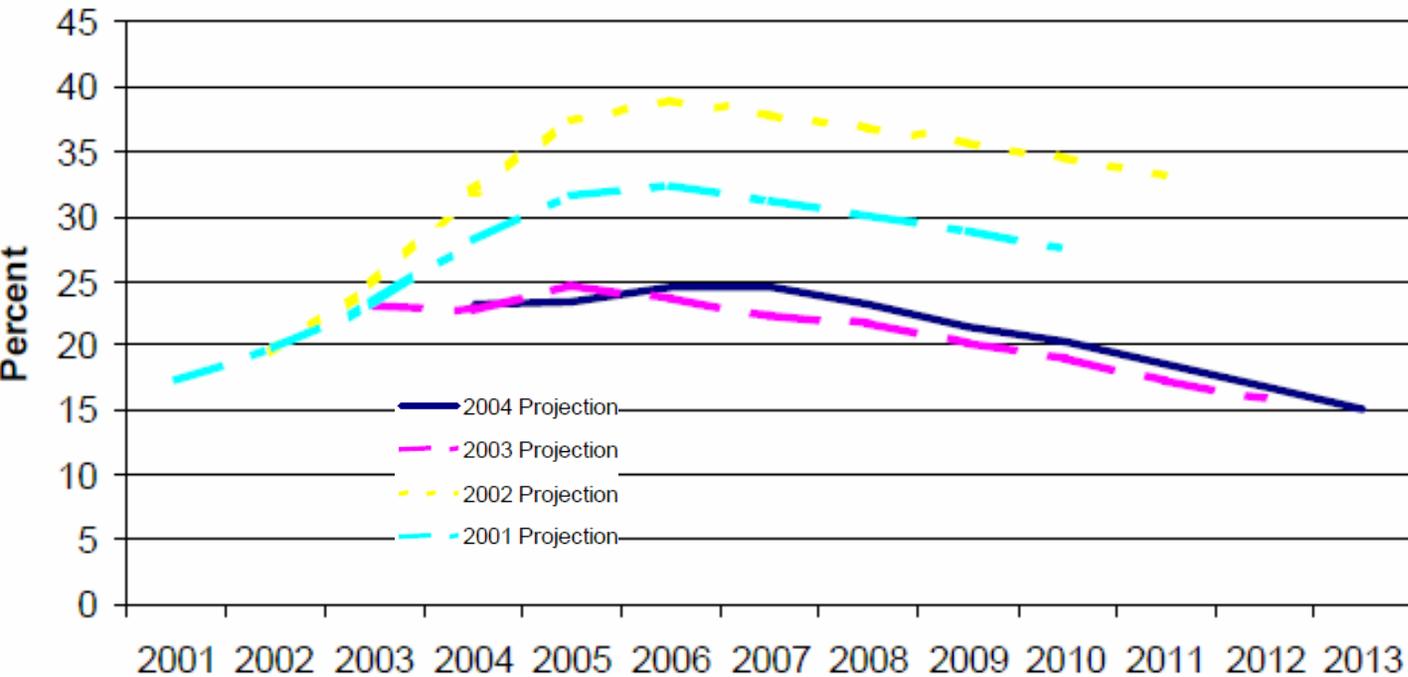


Source: NERC July, 2004 (Preliminary)

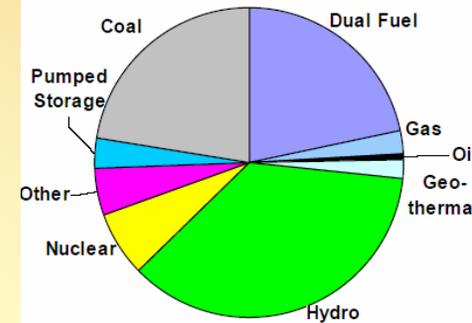
WECC (Western U.S.)



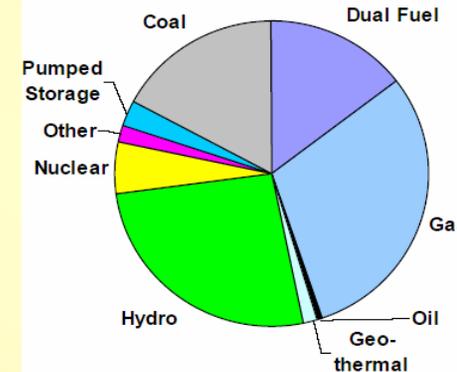
WECC US Capacity Margins - Summer



WECC US Capacity Fuel Mix 1999



WECC US Capacity Fuel Mix 2009



Source: NERC July, 2004 (Preliminary)



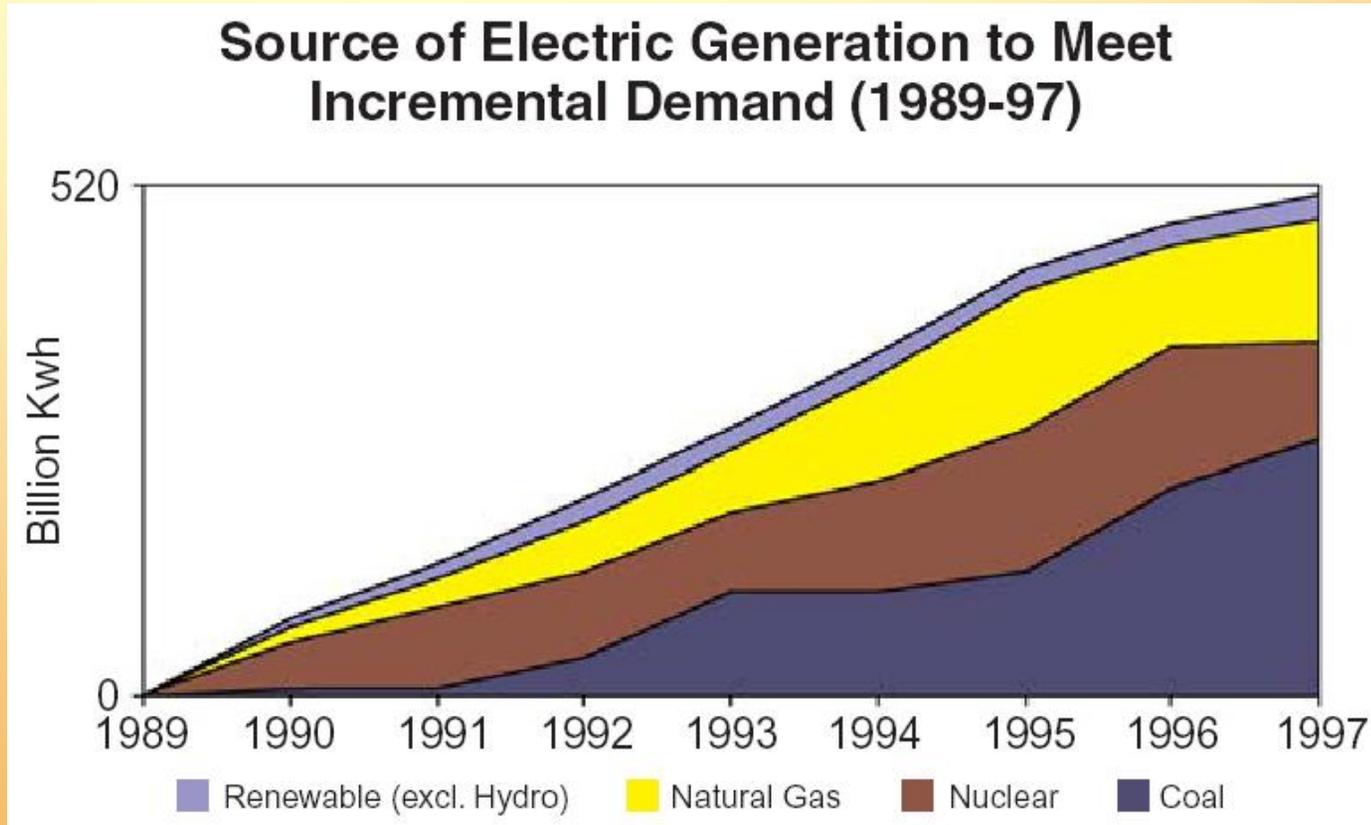
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Fuel Supply Crisis

Major Turning Point



- Prior to late '90's, possible to meet incremental electricity needs of U.S. economy primarily thru increased utilization of existing coal and nuclear units:



Need for New Capacity



- By late 1990's, new capacity needed in every region of U.S.
- Industry in midst of far-reaching change
 - De-regulation of wholesale markets by FERC + statewide restructuring in states representing 2/3rd's of total U.S. load
 - Explosive growth of Independent Power Producer industry & power marketers
 - Darlings of Wall Street with 40:1 P/E ratios
- Developers strongly favored gas-fired capacity over coal
 - Shorter lead time and much lower (apparent) capital cost
 - Much lower permitting risk/perceived as “environmentally-friendly” choice
 - Widely believed supplies plentiful and prices would remain low

Choices Necessary



- Result = abrupt shift in U.S. energy strategy
 - \$ 100 billion investment in new gas-fired plants

Gas-Fired Generating Capacity Added Since 1999

Year	Additions	Total Gas-Fired Generation	% of Total US Capacity
1999	22,641 MW	201,979 MW	25.4%
2000	25,527 MW	227,506 MW	27.7%
2001	41,372 MW	268,892 MW	31.0%
2002	54,701 MW	323,593 MW	34.7%
2003*	60,488 MW	384,081 MW	39.0%
2004*	10,404 MW	394,485 MW	40.0%

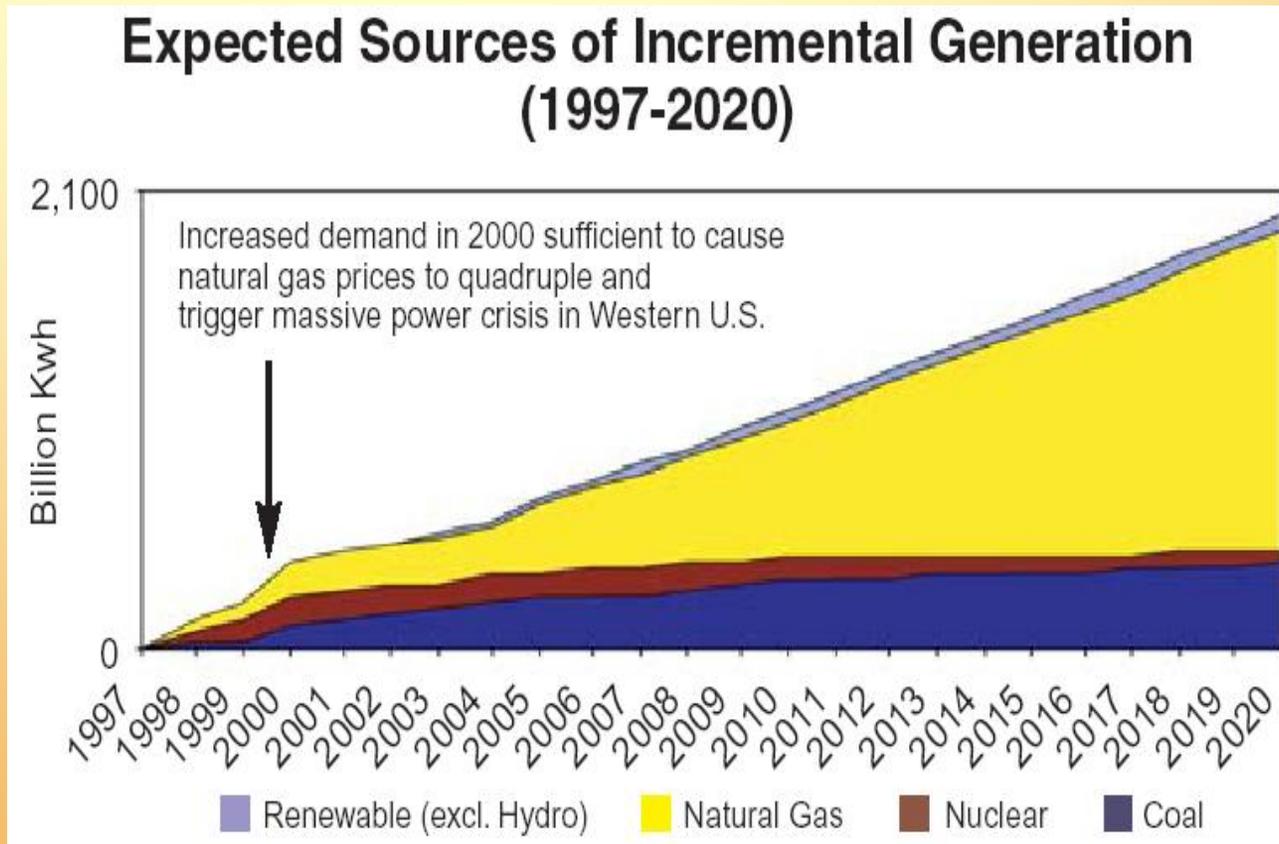
Total Additions 215,133 MW

* Includes plants currently under construction but excludes all planned additions that have not yet broken ground

Massive Increase



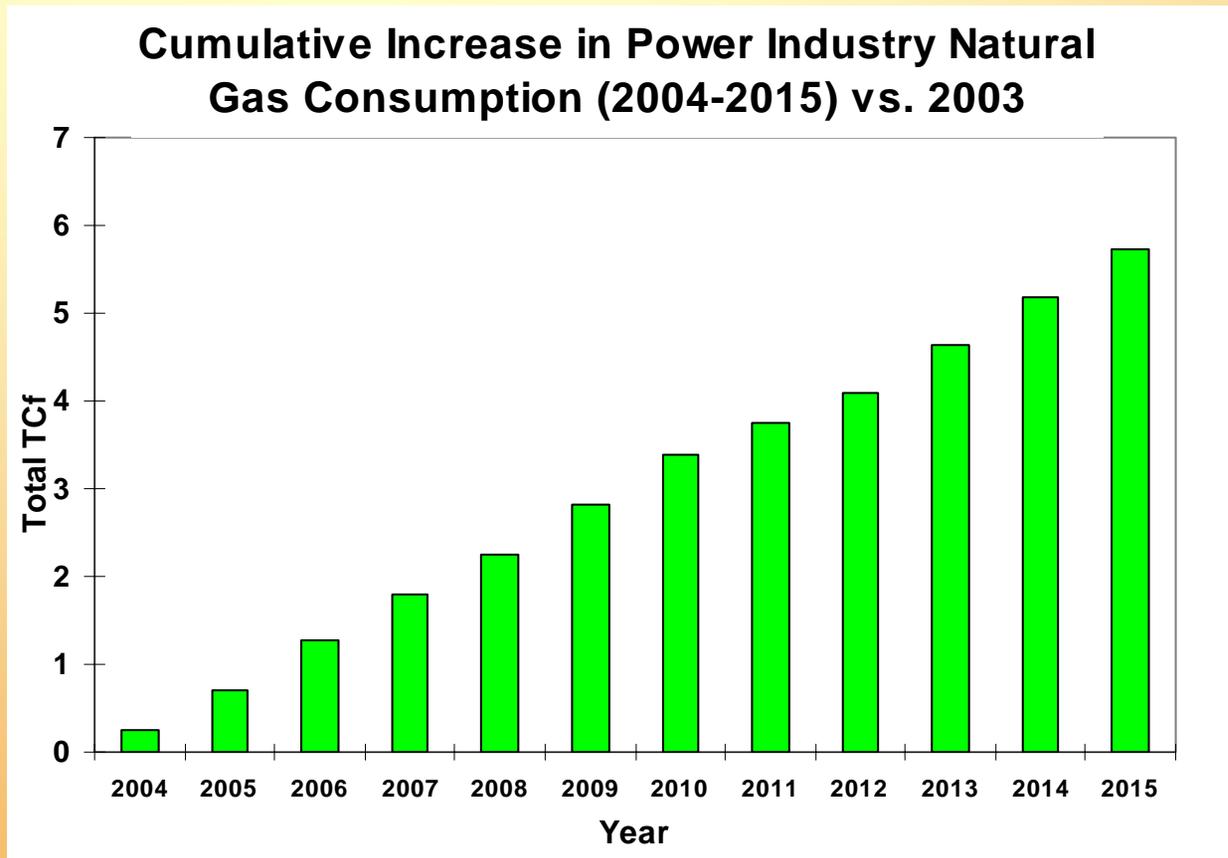
- U.S. now dependent upon increased utilization of gas-fired units to meet virtually all of its incremental electricity needs



Primary Driver



- Power sector consumption of natural gas nearly certain to increase every year



Cumulative Increases *Huge*



- Increase likely to be > 3.4 TCf by 2010, > 5.7 TCf by 2015
 - No other current source of supply to meet incremental electricity needs of U.S. economy

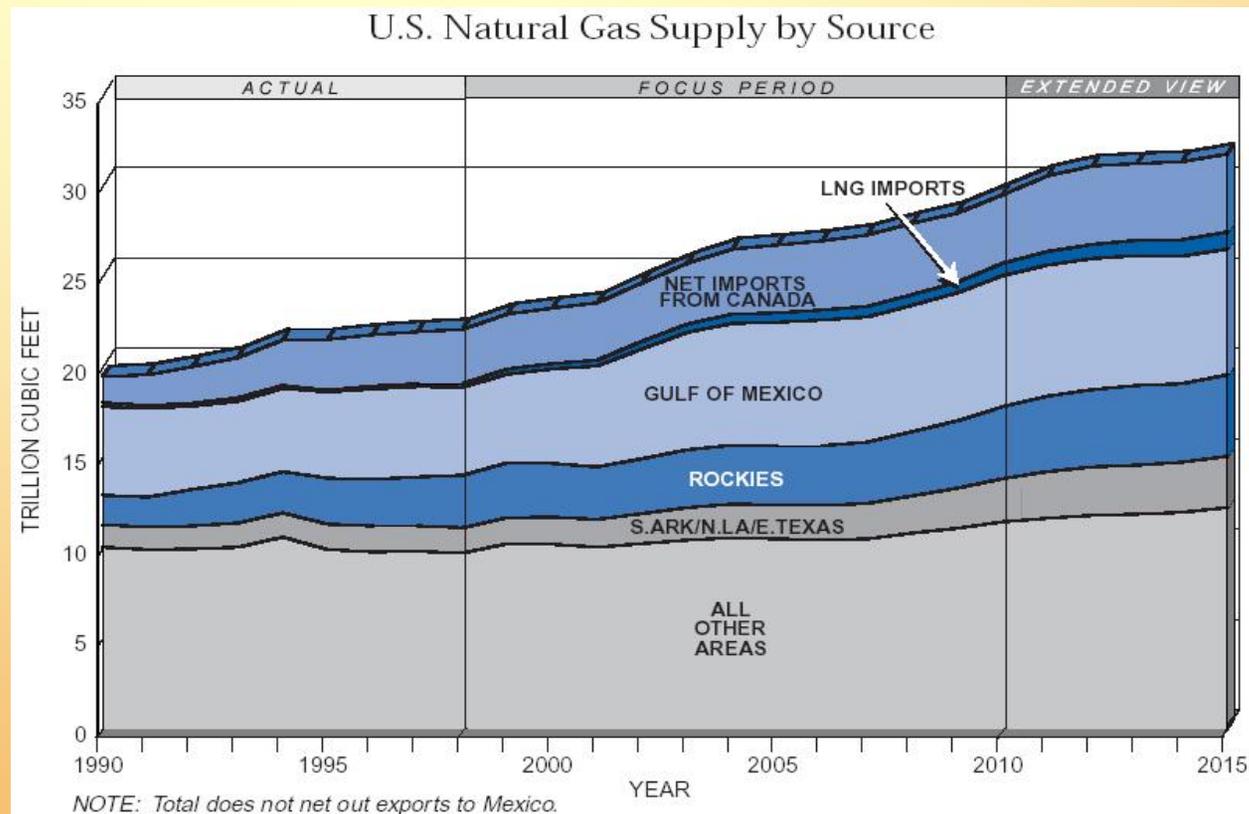
Projected Increase in Power Sector Natural Gas Consumption

<u>Year</u>	<u>Increase</u>	<u>Increase vs. 2003</u>	<u>Total</u>
2004	0.275 TCf	0.250 TCf	5.486 TCf
2005	0.462 TCf	0.712 TCf	5.948 TCf
2006	0.563 TCf	1.275 TCf	6.511 TCf
2007	0.522 TCf	1.797 TCf	7.033 TCf
2008	0.460 TCf	2.257 TCf	7.493 TCf
2009	0.568 TCf	2.825 TCf	8.061 TCf
2010	0.568 TCf	3.393 TCf	8.629 TCf
2011	0.353 TCf	3.746 TCf	8.892 TCf
2012	0.353 TCf	4.099 TCf	9.335 TCf
2013	0.546 TCf	4.645 TCf	9.881 TCf
2014	0.546 TCf	5.191 TCf	10.427 TCf
2015	0.546 TCf	5.737 TCf	10.975 TCf

Until Recently, Natural Gas Supplies Perceived as Plentiful



- December 1999 National Petroleum Council (NPC) Study forecast North American production increasing to 33.5 TCF by 2015 with little or no increase in price - Principally from lower 48 States



Disastrous Coincidence in Timing



- Production from major sources in U.S. and Canada began to hit a wall in 2000-2001 time frame
 - Major turning point after 20 – 30 years of development of many fields
 - *Not* physically possible to reverse
- Massive ramp-up in drilling in late 2000/first three quarters of 2001 further depleted remaining inventory of attractive targets
- U.S. supply crisis further exacerbated by:
 1. Sudden, unexpected decline in imports from Canada
 - Due largely to same underlying causes as in U.S.
 2. Sudden, largely unexpected (and in all likelihood also continuing) rapid increase in exports to Mexico
- Net effect is to significantly exacerbate deficit

NPC Study

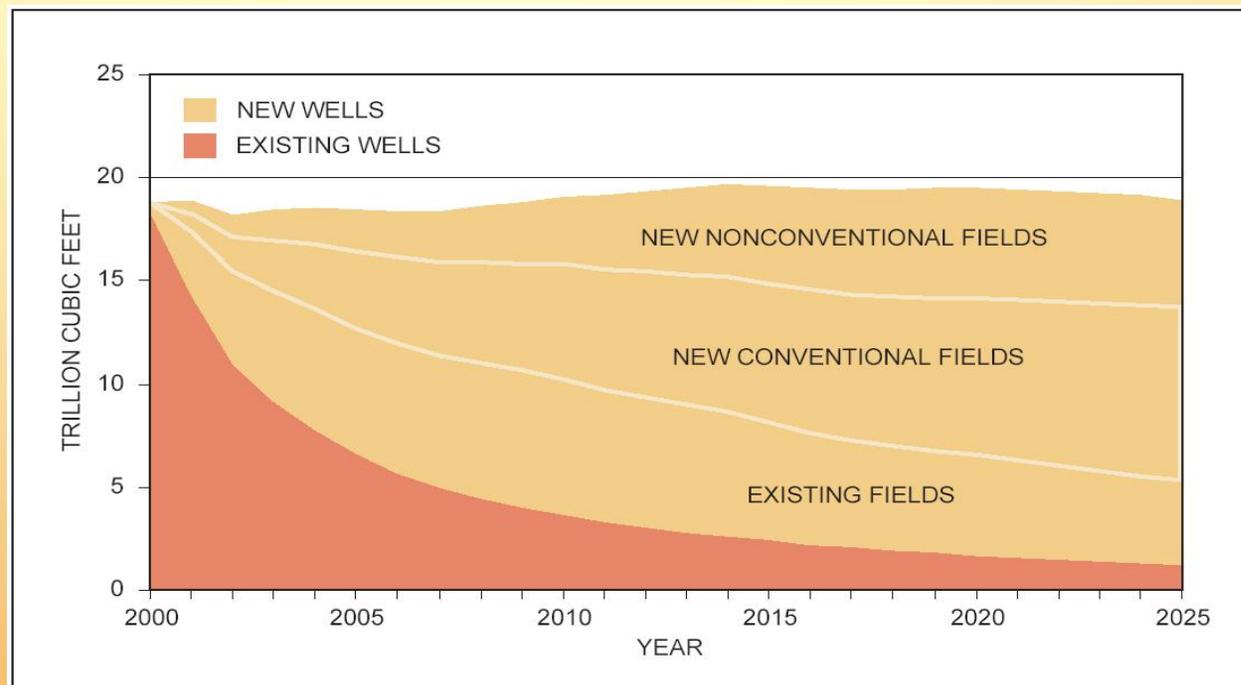


- New National Petroleum Council Study prepared for Secretary of Energy Spencer Abraham = landmark event
 - *Summary of Findings and Recommendations* and Draft of *Integrated Report* available at www.npc.org
- Most comprehensive assessment of North American supply and demand undertaken in many years
- Primary conclusions:
 - Findings of Council's earlier, December 1999 Study are ***no longer valid***
 - Major fields in U.S. and Canada aging far more rapidly than expected just four years ago
 - No longer realistic to expect ***any*** significant increase in supply from "traditional" North American sources (i.e., sources south of the Arctic Circle)

Huge Void



- New NPC Study finds conclusively that traditional sources of supply **cannot** meet this demand
 - Estimate of production for lower 48 States alone reduced by a stagger 16 BCf/day (i.e., just under 6.0 TCf/year)



Lower-48 Production, Existing and Future Wells

Implications



- Creates huge potential supply gap
- Other major potential risks include:
 1. Coal Shortages
 2. Limited hydro availability in the west
 3. Uncertainties regarding nuclear
 4. Potential natural gas pipeline constraints
 5. Transmission constraints
 6. Reliability issues from overloading grid
 7. Power supply quality



The Solutions Network

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Thank You

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