

State
Utility
Forecasting
Group

2006 Indiana Renewable Resources Study & Indiana's Baseload Resource Needs

Presented by:

**Douglas J. Gotham, Director
State Utility Forecasting Group
Purdue University**

Presented to:

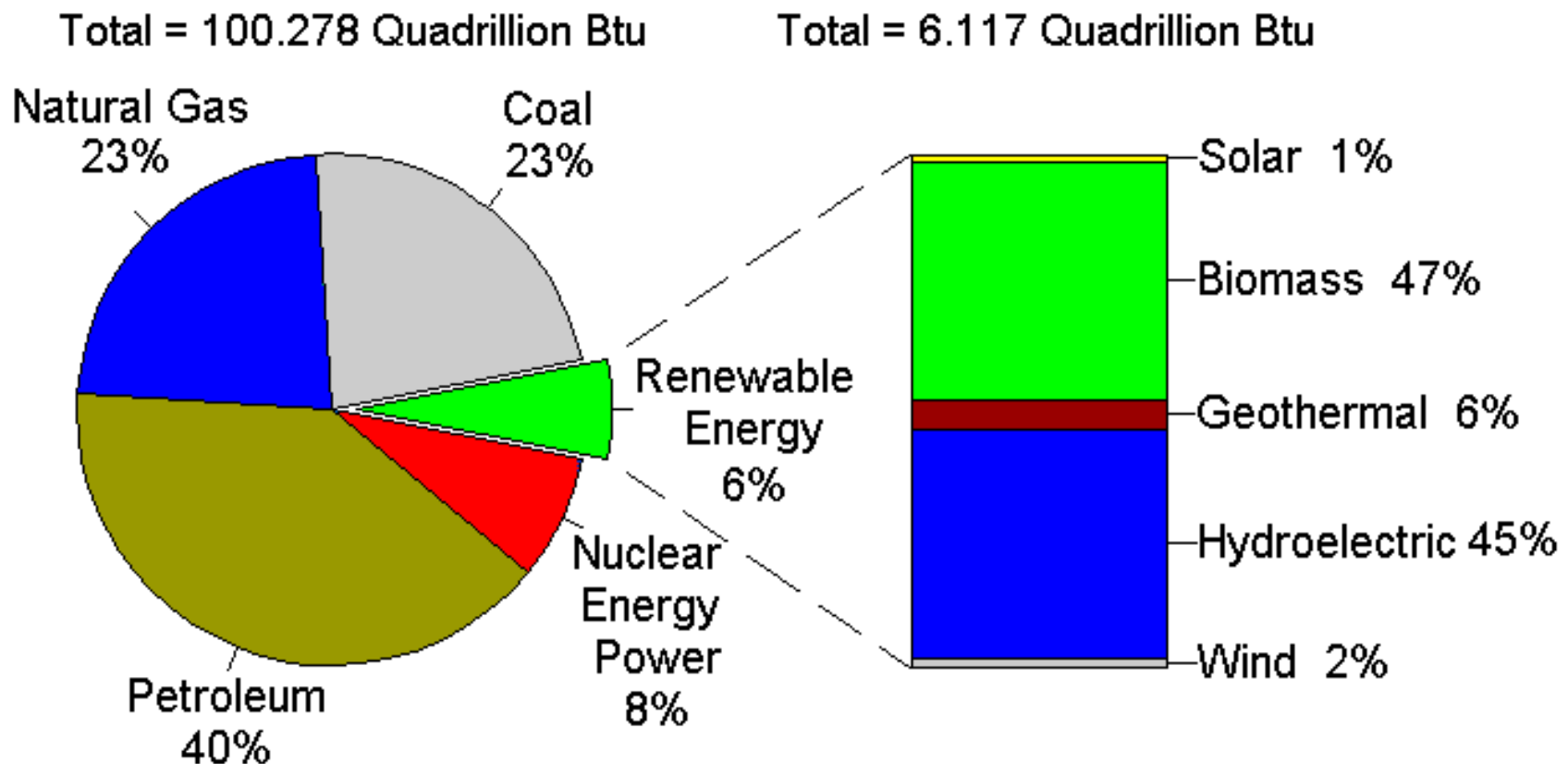
**Regulatory Flexibility Committee
Indiana General Assembly**

September 26, 2006

2006 Renewable Resources Study

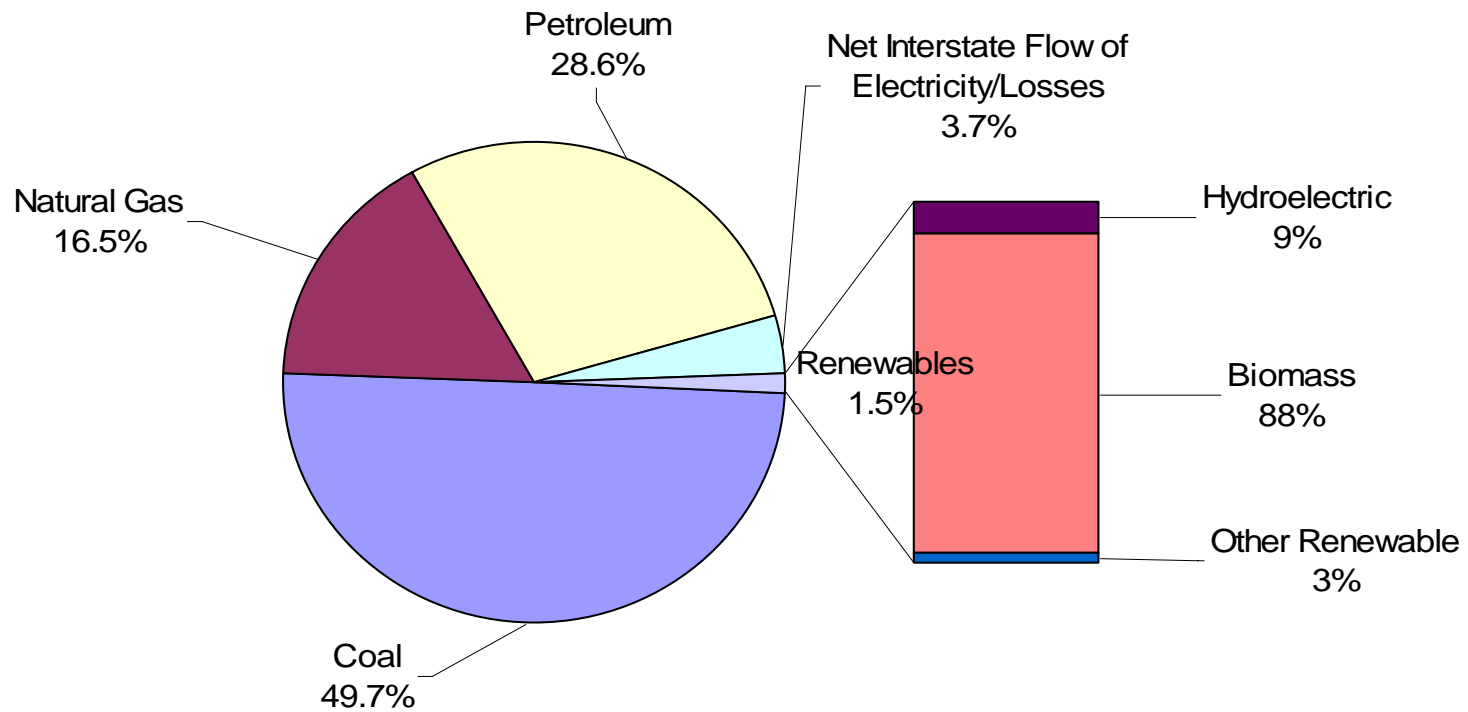
- **Renewable energy trends**
- **Barriers and incentives**
- **Individual renewable resources**
 - **wind**
 - **energy crops**
 - **organic waste**
 - **solar/photovoltaics**
 - **fuel cells**
 - **hydropower**

2004 U.S. Total Energy Consumption by Energy Source



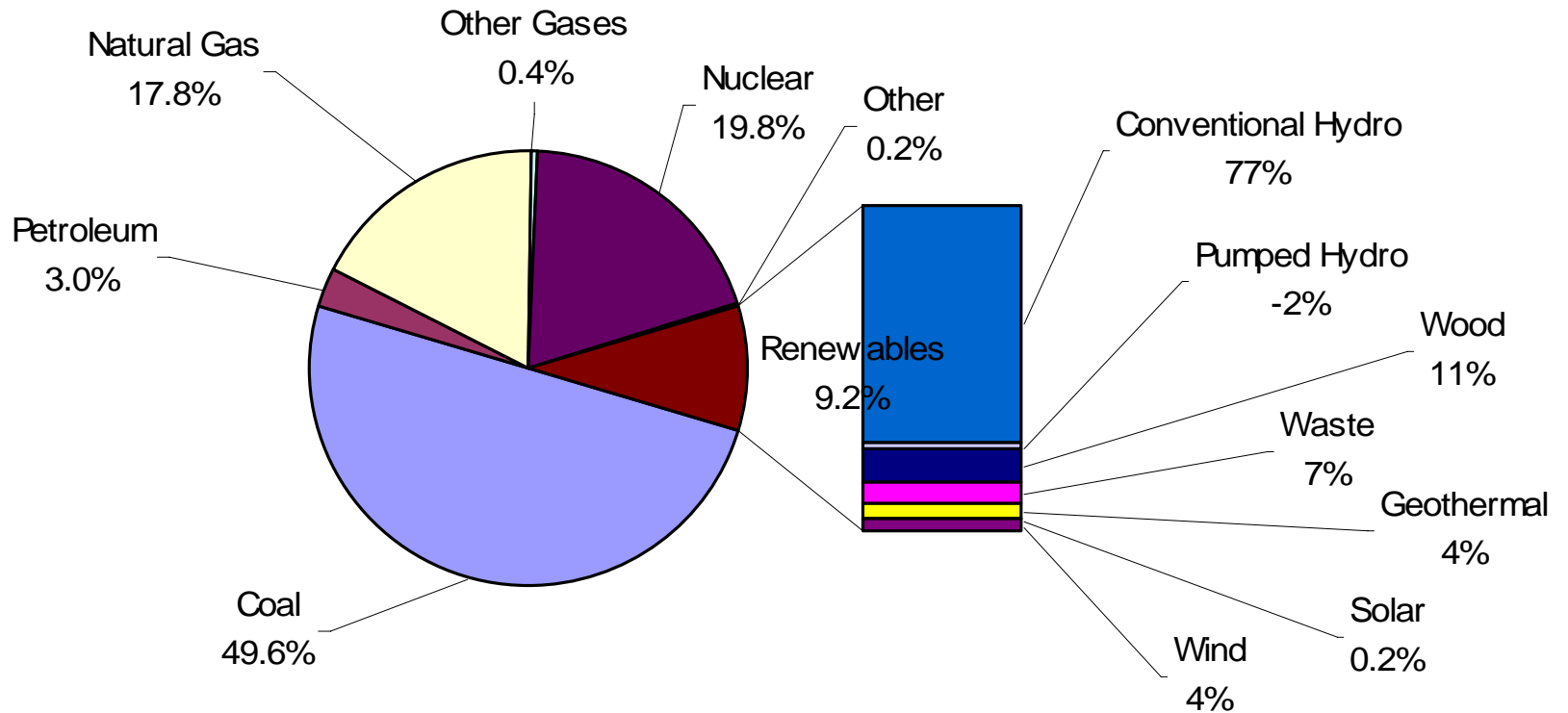
2002 Indiana Total Energy Consumption by Energy Source

2002 Total Indiana Energy Consumption = 2.88 quadrillion Btu



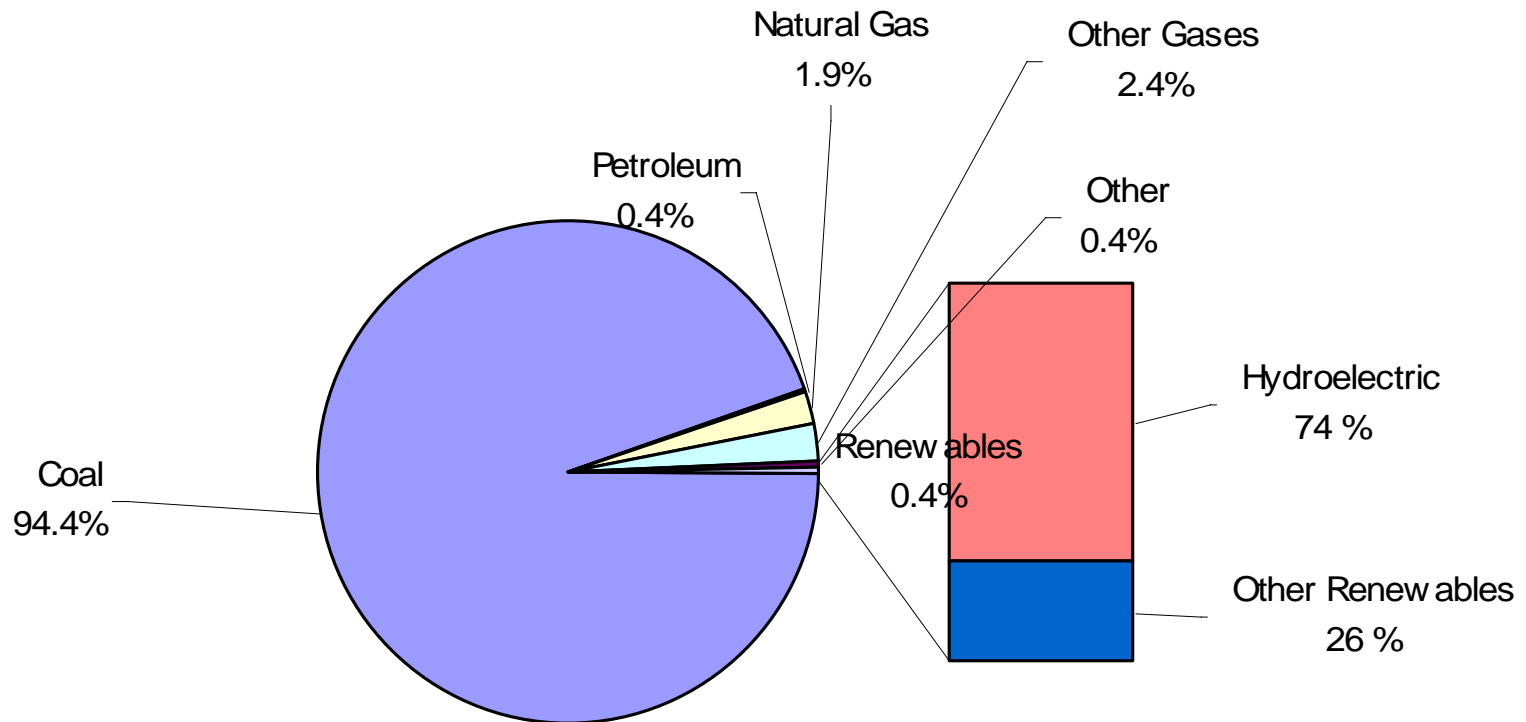
2004 U.S. Electricity Generation by Energy Source

2004 Total U. S. Generation = 3,970,555 GWh



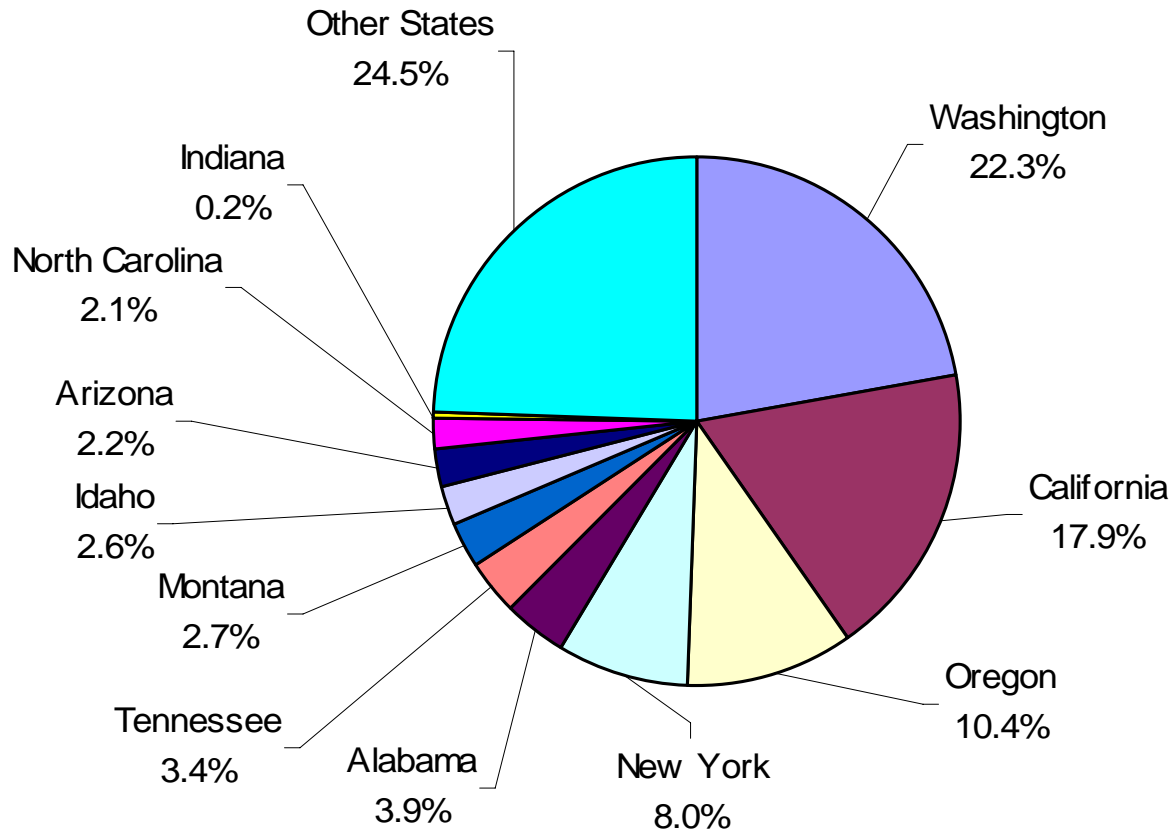
2004 Indiana Electricity Generation by Energy Source

2004 Total Indiana Electricity Generation = 127,770 GWh



2003 Share of Renewable Electricity Generation by State

2003 Total U. S. Renewable Generation = 328,027 GWh



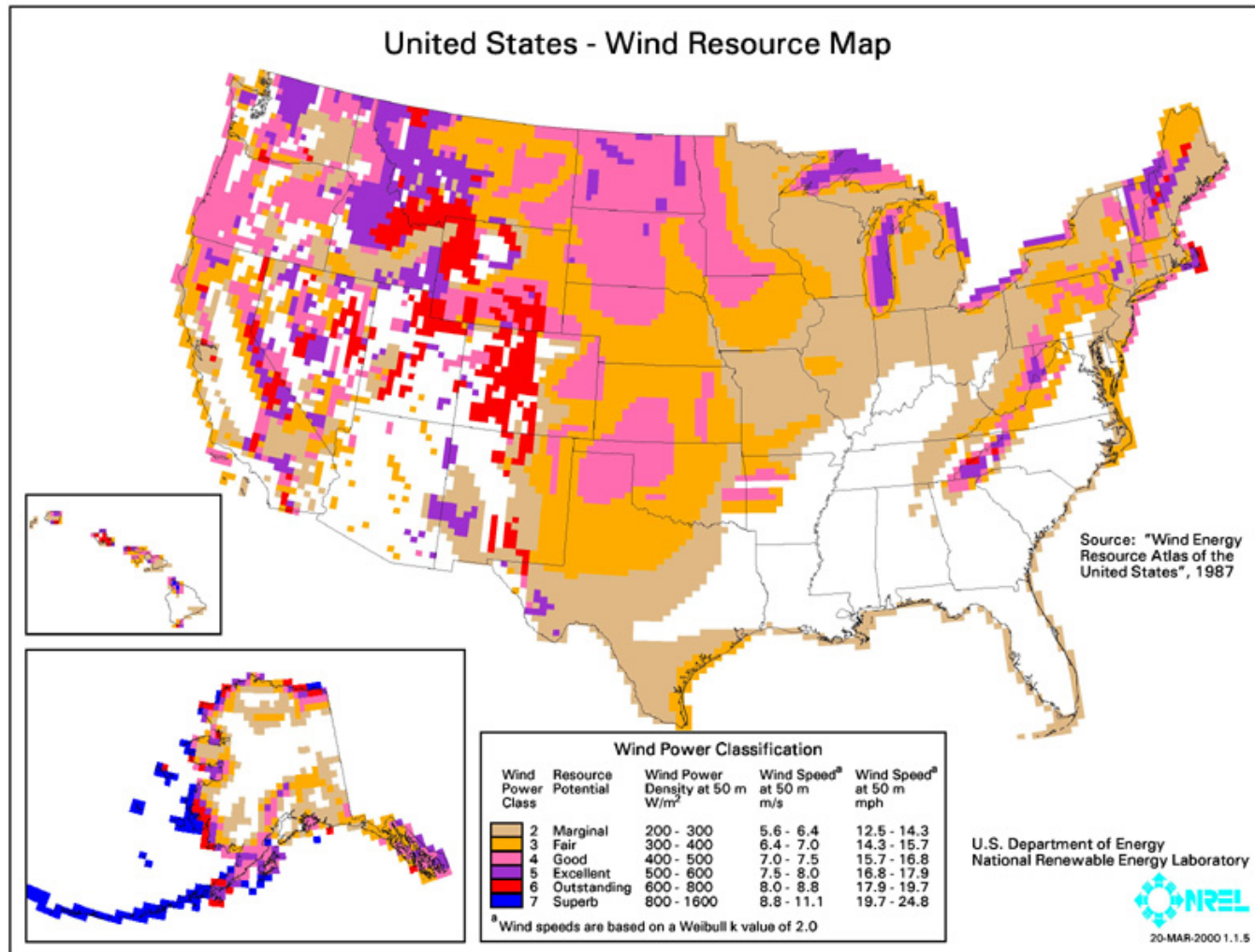
Barriers to Renewables

- **Major barrier is cost**
 - **most renewable technologies have high capital costs**
 - **Indiana had the 5th lowest electricity rates in the country in 2004, according to the Energy Information Administration (5.58 cents/kWh vs. national average 7.47 cents/kWh)**
 - **only ID, KY, WV, WY were lower**
- **Limited resources are also a problem for some technologies**
 - **solar/photovoltaics, hydropower, wind**

Incentives for Renewables

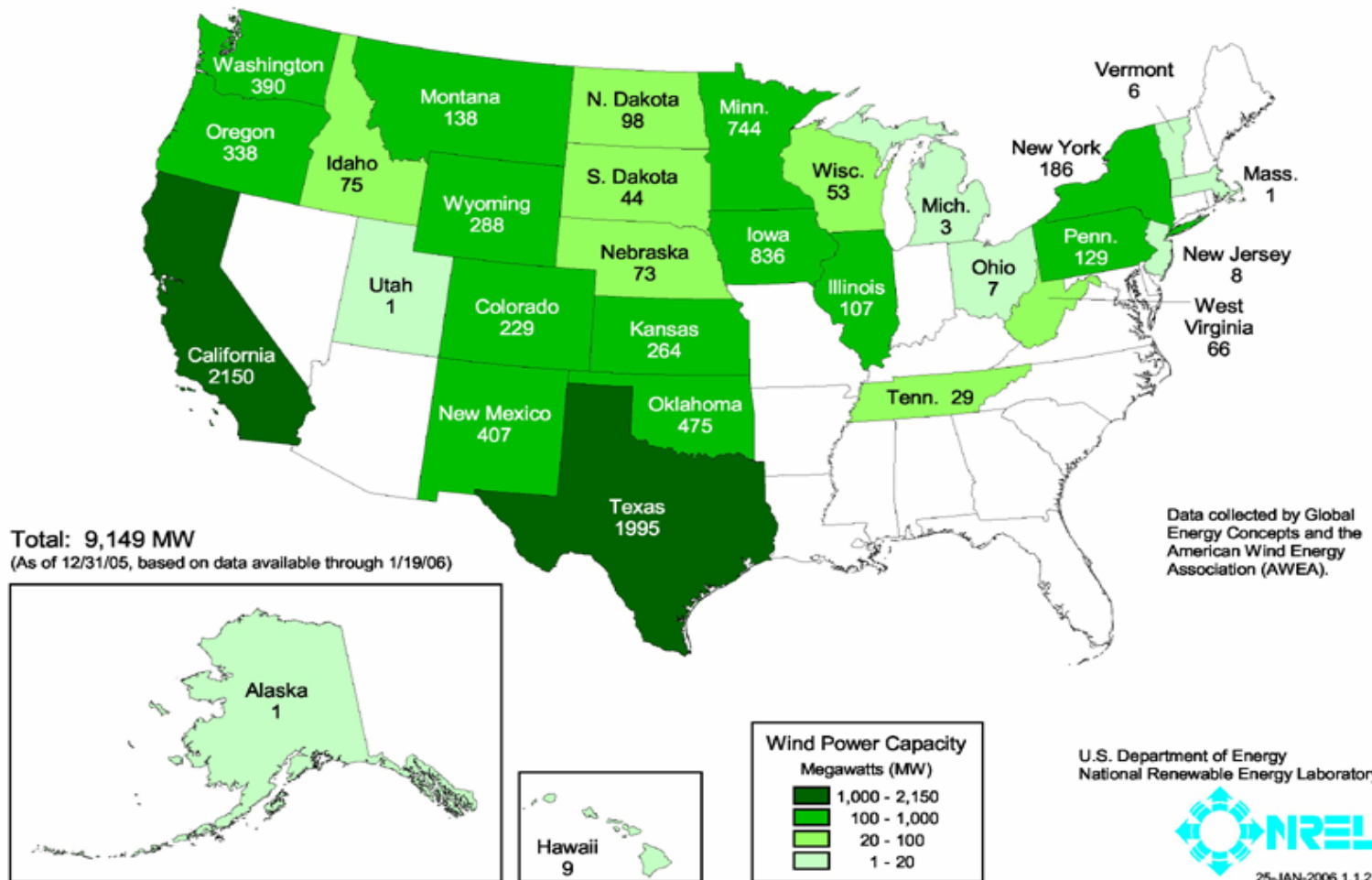
- **Federal**
 - tax credits and exemptions (production tax credit)
 - grant programs
- **State**
 - net metering rule
 - grant programs
 - tax credits
 - emissions credits
- **Utilities**
 - green pricing programs

Wind Resources



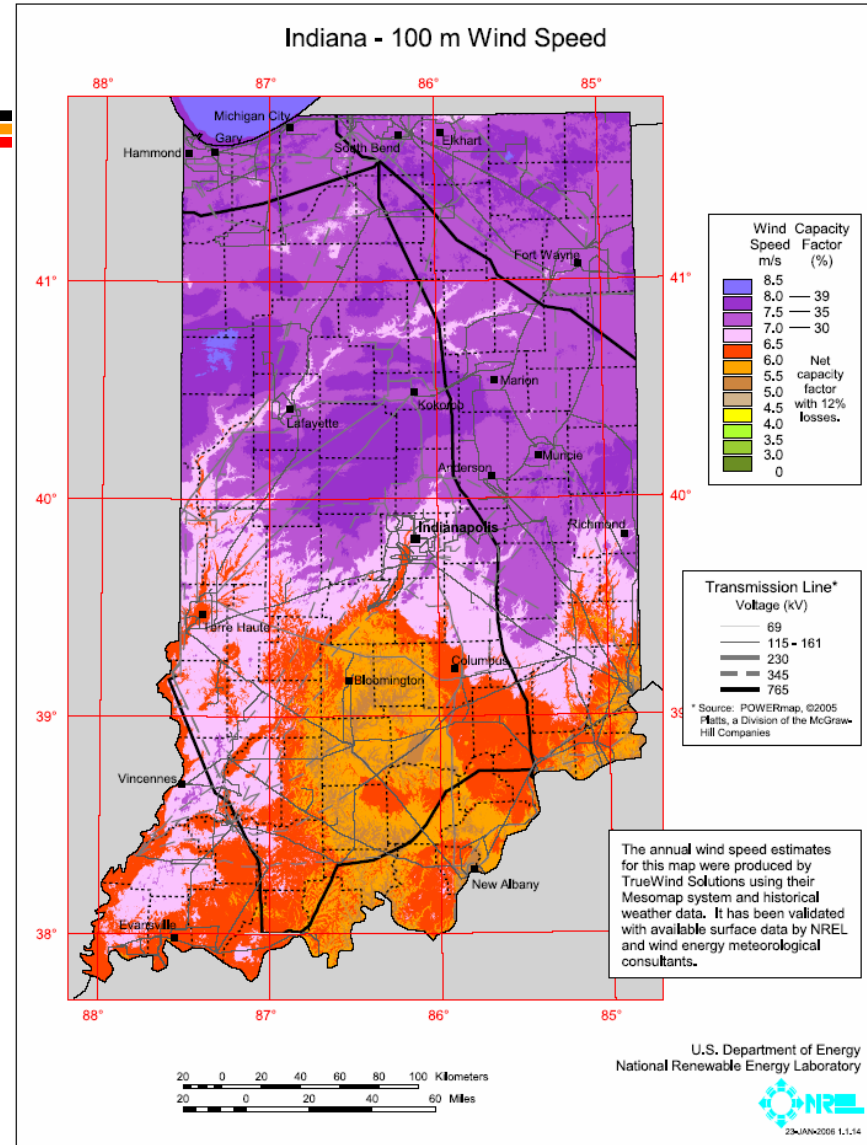
Wind Power Capacity

United States - 2005 Year End Wind Power Capacity (MW)



Indiana Wind Power

- Most recent wind map shows some potential areas in the northern half of the state
- In 2003 enXco proposed a 100 MW wind farm in Benton County, with little progress to date
- In June 2006, Orion Energy proposed a 130 MW wind farm, also for Benton County



Energy Crops

- **Transportation fuels**
 - ethanol
 - soy diesel
- **Other possibilities**
 - fast growing hardwood trees (hybrid poplar/willow)
 - grasses (switchgrass)
- **Barriers to be overcome**
 - other high-value uses for the land
 - harvesting and transportation costs
 - price of competing fossil fuels

Ethanol in Indiana

- **One operating plant (New Energy)**
 - 102 million gallons per year (1980)
- **Four plants under construction**
 - 295 million gallons per year
- **Another fourteen plants announced (ten of them in 2006)**
 - 1,200 million gallons per year

Organic Waste Biomass

- **This resource is the single largest source of renewable energy in Indiana**
 - primarily due to the use of wood waste
- **It is the second largest source of renewable electricity generation in the state**
 - landfill gas
 - municipal solid waste
 - animal waste biogas
 - wastewater treatment

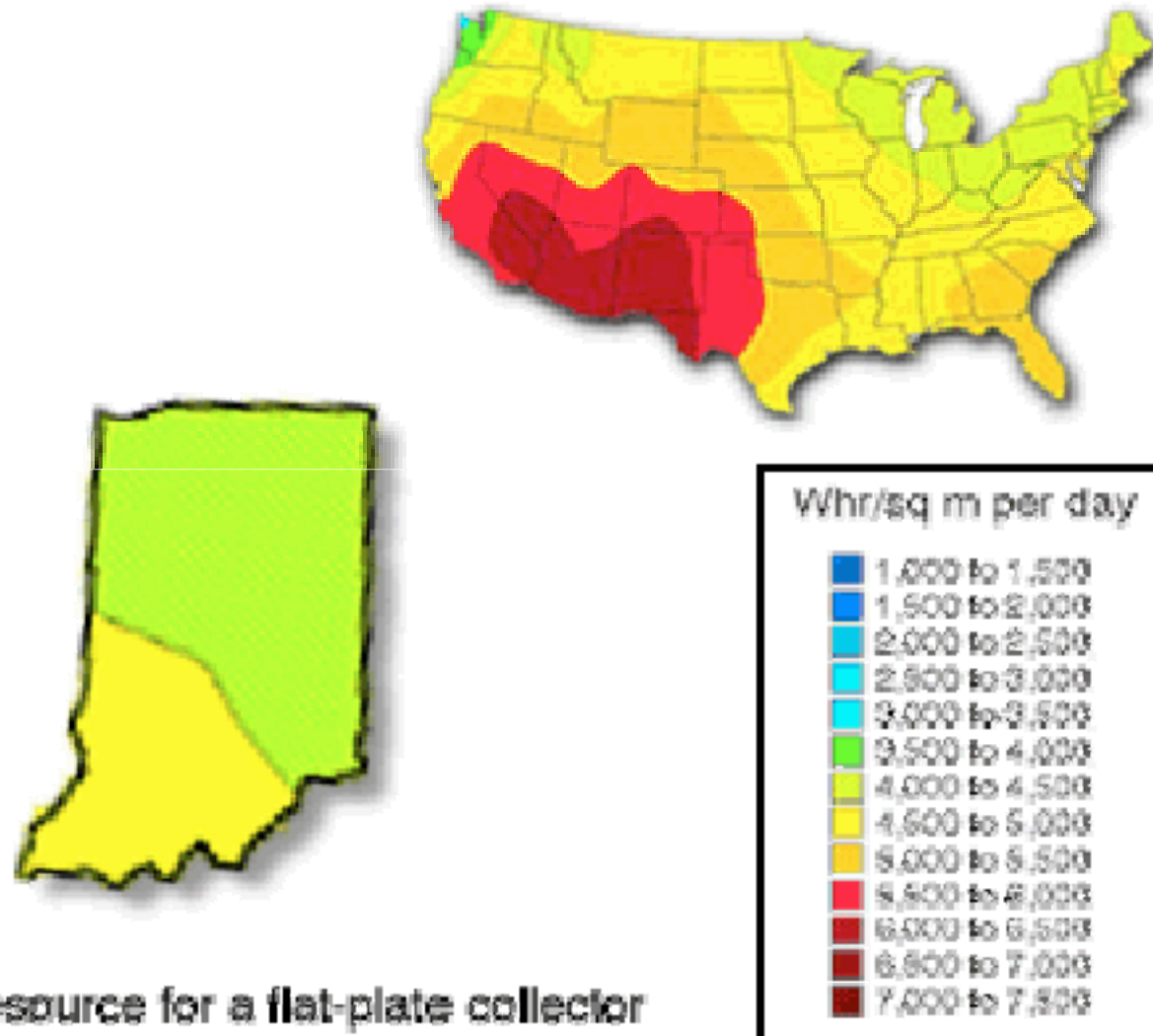
Landfill Gas

- **11 landfills in Indiana generate electricity**
 - **approximately 33 MW of generating capacity**
- **Another 5 landfills use landfill gas for other processes (greenhouses, boilers, leachate evaporation)**
- **The EPA has identified another 16 landfills as candidates for landfill energy projects in the following counties:**
 - **Allen, Boone, Clark, Elkhart, Fulton, Greene, Henry, Jackson, Pike, Ripley, Shelby, Vigo, Wabash, Wayne**

Animal Waste Biogas

- **Animal waste can be collected and used to produce methane using an anaerobic digester**
- **It is not economically feasible to collect the waste from every cow, pig, and chicken. According to the EPA, biogas recovery may be economical for confined operations with**
 - **>500 head (dairy)**
 - **>2000 head (swine)**
- **While it is possible to collect the waste from multiple smaller farms, transfer of pathogens is a concern**

Solar Energy / Photovoltaics



Solar resource for a flat-plate collector

Fuel Cells

- **Currently available fuel cells cost about \$3000/kW**
- **This is roughly twice the cost of a large coal plant and about 10 times the cost of a natural gas-fired combustion turbine**
- **There is a large amount of research being performed to solve some of the problems**
 - **cost**
 - **efficiency**
 - **hydrogen production**
 - **hydrogen storage**

Hydroelectric Power

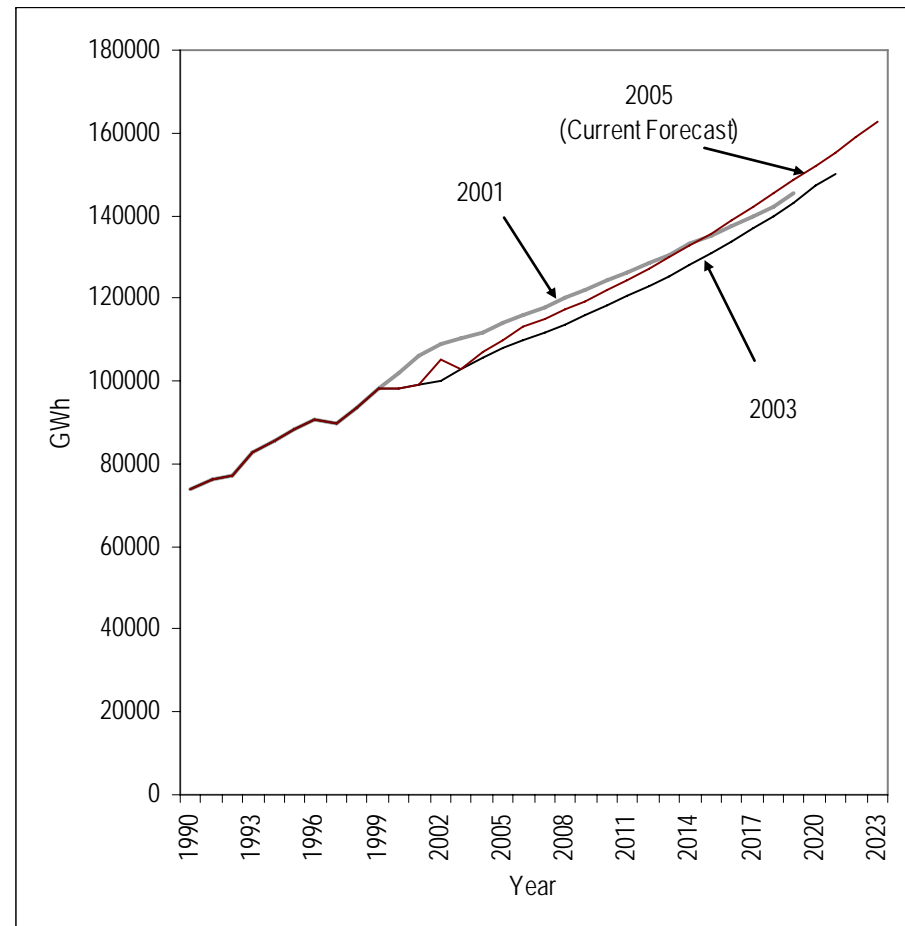
- **Indiana has about 60 MW of hydroelectric generating capacity.**
 - **mostly run-of-the-river (no dam)**
 - **largest source of renewable electricity**
- **The U.S. Department of Energy identified another 66 MW of potential hydropower at existing dams**
 - **Only about 42 MW was considered viable (spread out over 27 sites)**

Indiana's Baseload Resource Needs

- **Current SUFG Forecast (December 2005)**
 - **Indiana electricity requirements**
 - **Indiana peak demand projections**
 - **Indiana resource requirements**
 - **Alternative scenarios**

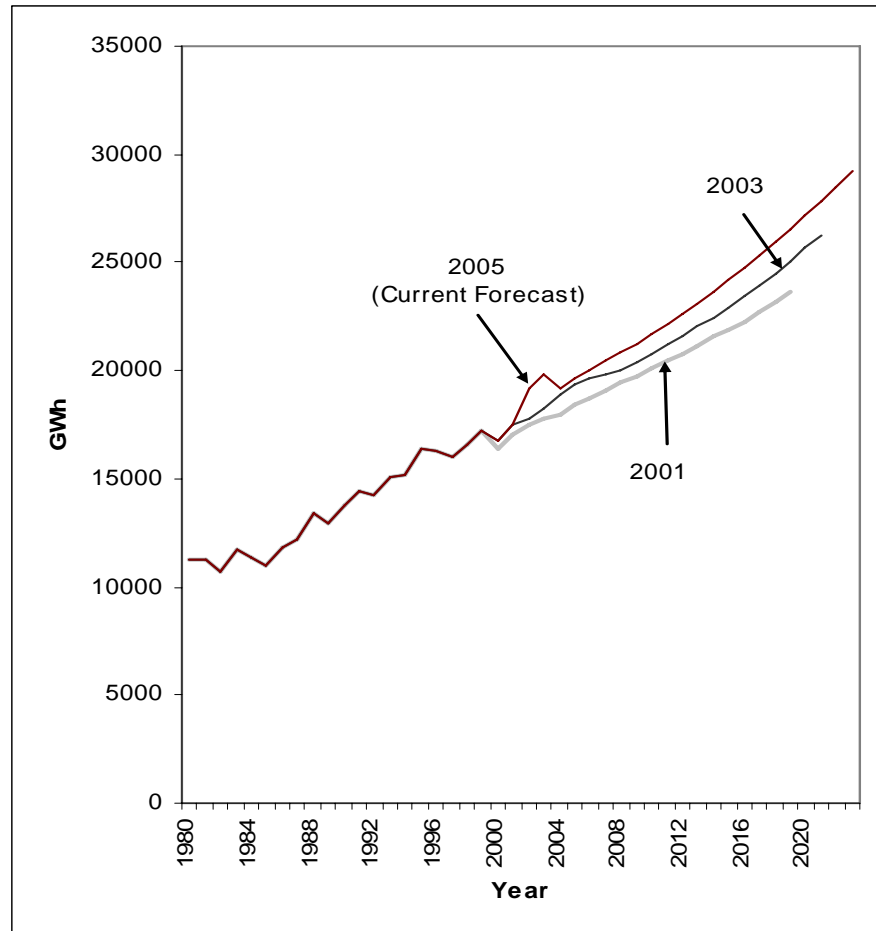
Indiana Electricity Requirements

- **Retail sales by investor owned and not for profit utilities**
- **Includes estimated transmission and distribution losses**
- **Growth rates**
 - **2005 forecast: 2.22%**
 - **2003 forecast: 2.16%**



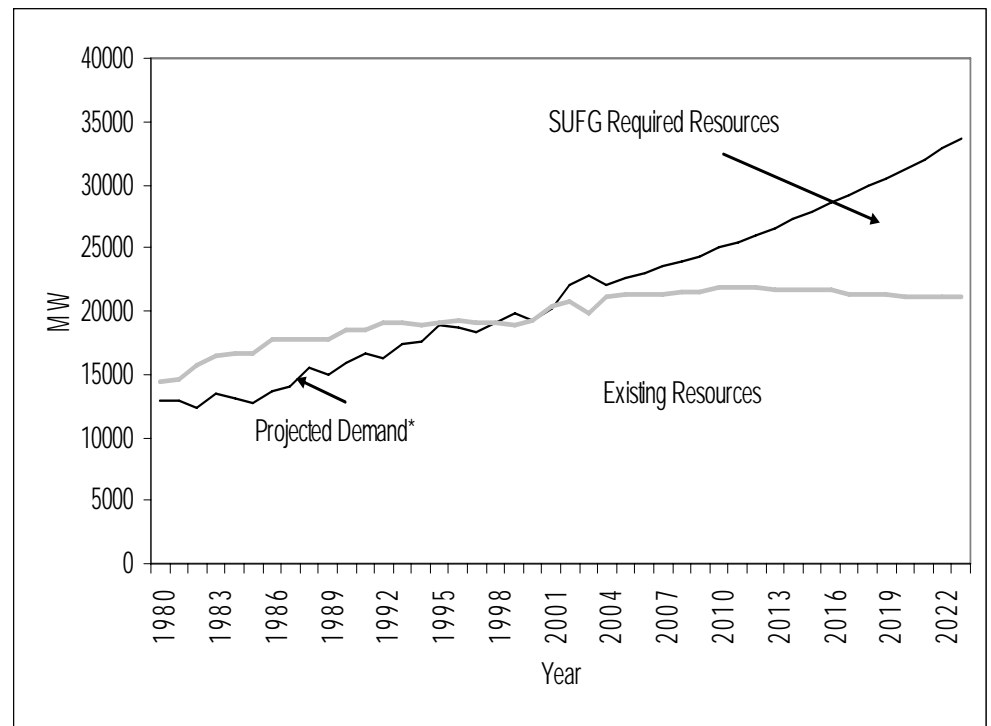
Indiana Peak Demand Projections

- **Peak demand is net of DSM and interruptible loads**
- **Growth rates**
 - **2005 forecast: 2.24%**
 - **2003 forecast: 2.07%**



Indiana Resource Requirements

- Resources may be provided by conservation measures, contractual purchases, purchases of existing assets, or new construction
- This forecast identifies a relatively balanced need for the three types of resources (peaking, cycling and baseload) in the short term



* Projected Demand includes 15% Reserve margin

Indiana Resource Requirements

	Uncontrolled Peak Demand	Interruptible	Net Peak Demand	Existing/ Approved Capacity	Incremental Change in Capacity	Projected Additional Resource Requirements				Total Resources	Reserve Margin
						Peaking	Cycling	Baseload	Total		
2003				19839							
2004	19917	750	19167	21058	1219	240	410	320	970	22028	15
2005	20361	761	19599	21355	296	410	470	450	1330	22685	16
2006	20833	781	20052	21345	-10	490	670	600	1760	23105	15
2007	21278	792	20486	21278	-67	620	860	750	2230	23508	15
2008	21624	804	20820	21493	215	760	930	670	2360	23853	15
2009	22018	817	21201	21493	0	890	1050	880	2820	24313	15
2010	22541	829	21712	21934	441	860	1170	940	2970	24904	15
2011	23006	839	22167	21869	-65	930	1190	1420	3540	25409	15
2012	23474	853	22620	21804	-65	1060	1250	1810	4120	25924	15
2013	23984	863	23121	21704	-100	1300	1340	2140	4780	26484	15
2014	24543	876	23666	21704	0	1460	1430	2490	5380	27084	15
2015	25096	890	24206	21601	-103	1730	1520	2840	6090	27691	15
2016	25694	903	24790	21601	0	1910	1610	3220	6740	28341	15
2017	26276	913	25362	21260	-341	2150	1960	3600	7710	28970	15
2018	26882	928	25954	21260	0	2330	2030	4030	8390	29650	15
2019	27512	938	26574	21260	0	2430	2110	4520	9060	30320	15
2020	28163	952	27211	21097	-163	2730	2180	5030	9940	31037	15
2021	28819	963	27855	21097	0	2860	2250	5540	10650	31747	15
2022	29503	977	28526	21044	-53	3090	2340	6030	11460	32504	15
2023	30185	989	29196	21044	0	3240	2420	6560	12220	33264	15

- 1 Uncontrolled peak demand is the peak demand without any interruptible loads being called upon.
- 2 Net peak demand is the peak demand after interruptible loads are taken into account.
- 3 Existing/approved capacity includes installed capacity plus approved new capacity plus firm purchases minus firm sales.
- 4 Incremental change in capacity is the change in existing/approved capacity from the previous year. The change is due to new, approved capacity becoming operational, retirements of existing capacity, and changes in firm purchases and sales.
- 5 Projected additional resource requirements is the cumulative amount of additional resources needed to meet future requirements.
- 6 Total resource requirements are the total statewide resources required including existing/approved capacity and projected additional resource requirements.

Alternative Scenarios

- **Any forecast contains uncertainty**
- **CEMR provides alternative low and high growth econometric forecasts**
- **Low and high growth scenarios are intended to give a plausible bound to uncertainty**

