

2016 Indiana Renewables Study & 2015 Forecast

Presented by:

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

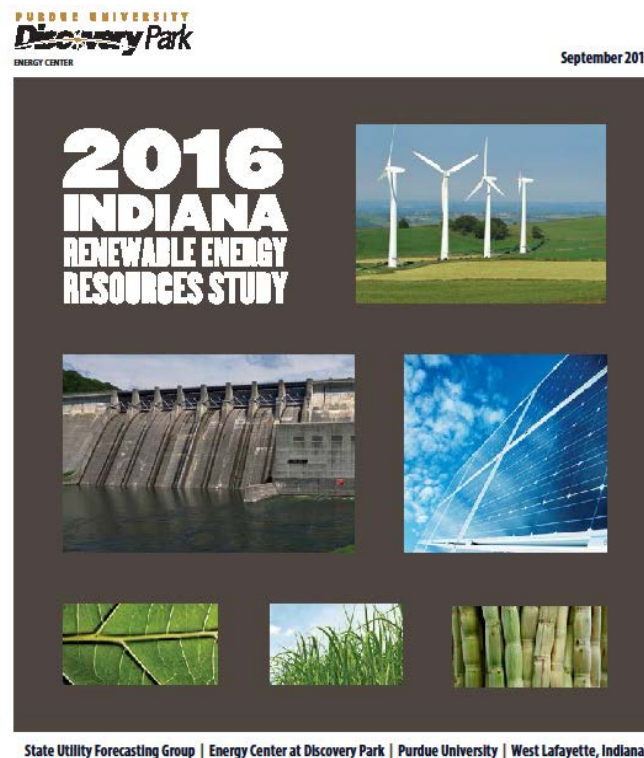
Presented to:

Interim Study Committee on Energy, Utilities, and
Telecommunications
Indiana General Assembly

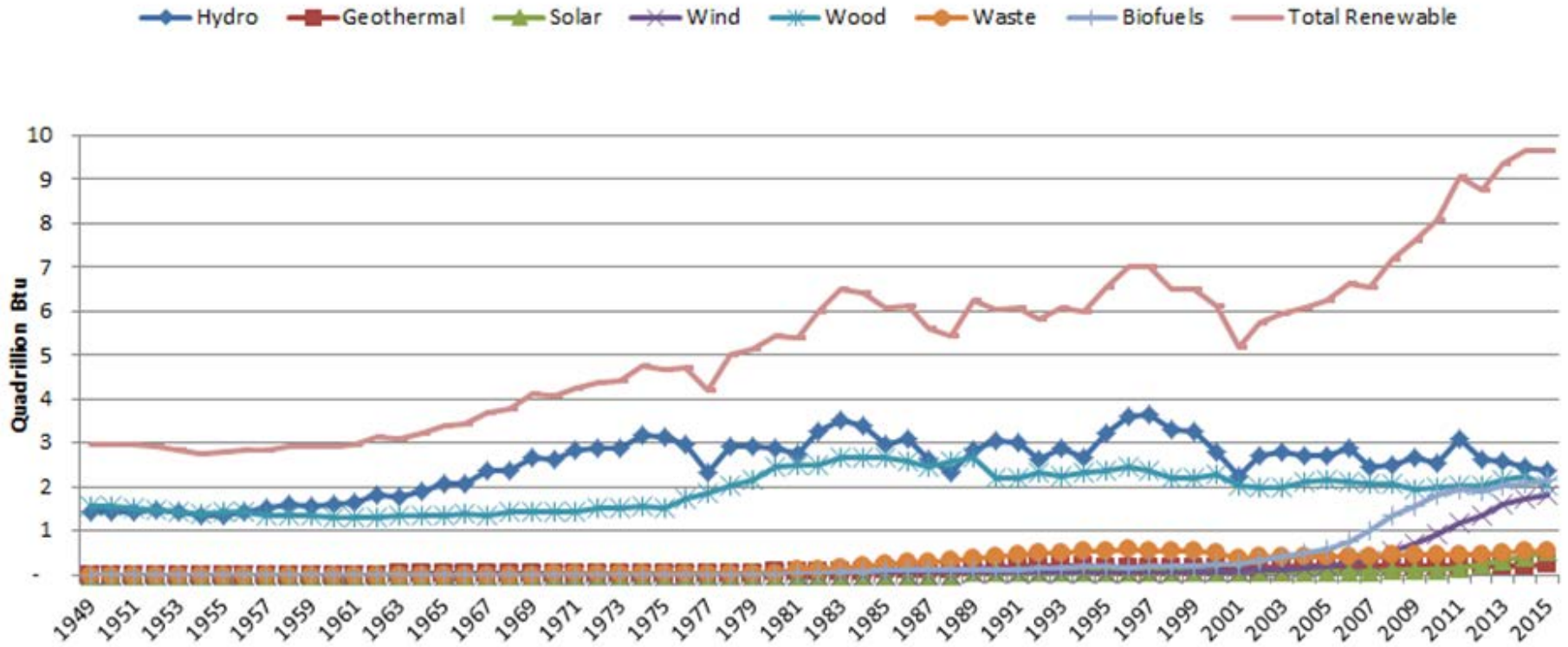
September 29, 2016

2016 Renewable Resources Study

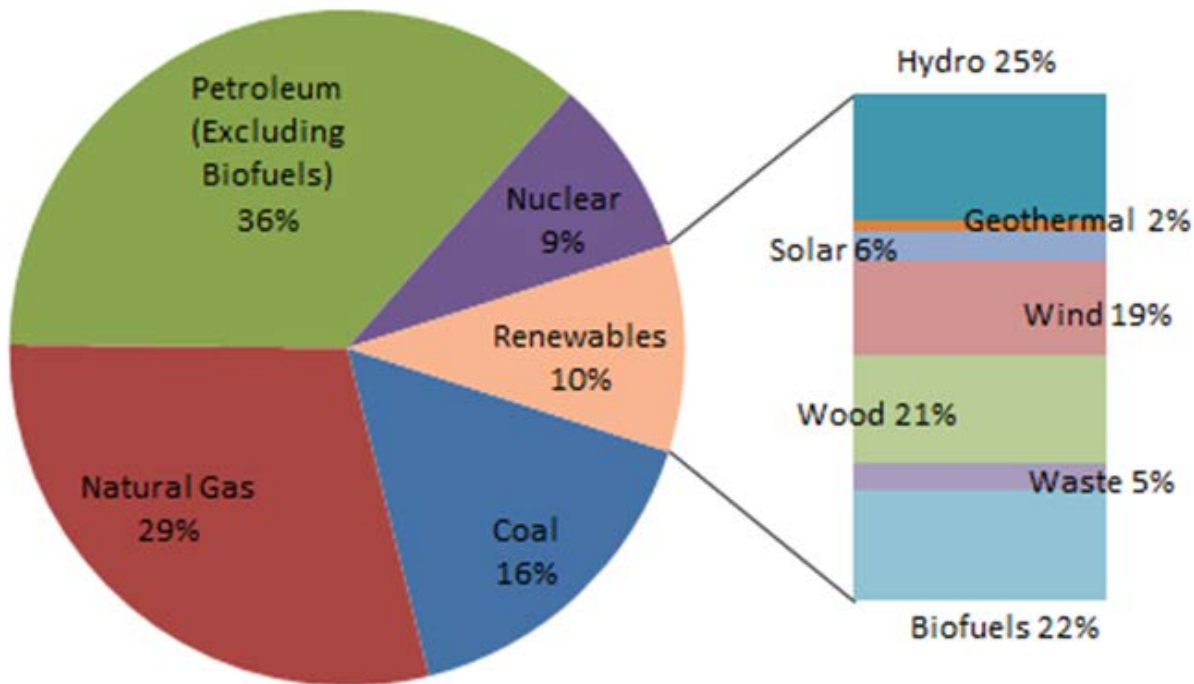
- Renewable energy trends
- Individual renewable resources
 - Wind
 - Energy crops
 - Organic waste
 - Solar/photovoltaics
 - Fuel cells
 - Hydropower
 - Algae



Historical Renewable Energy in the U.S.

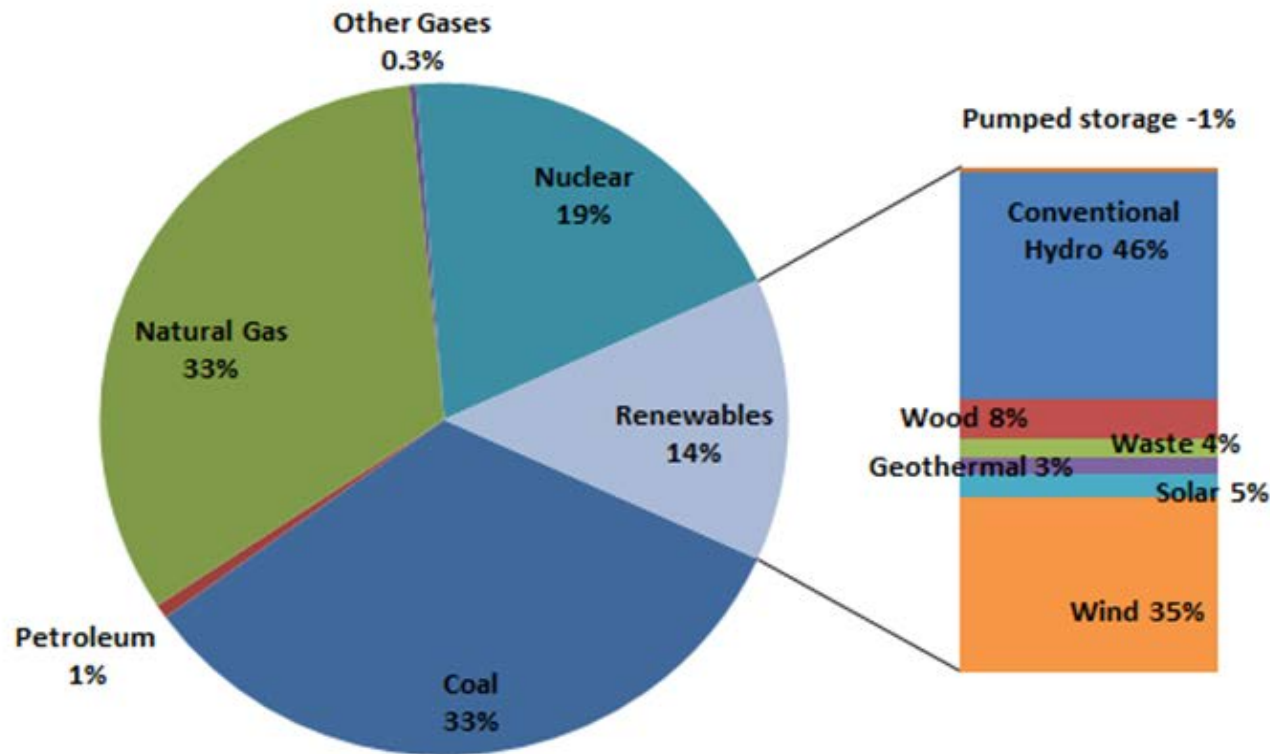


2015 U.S. Energy Consumption by Source



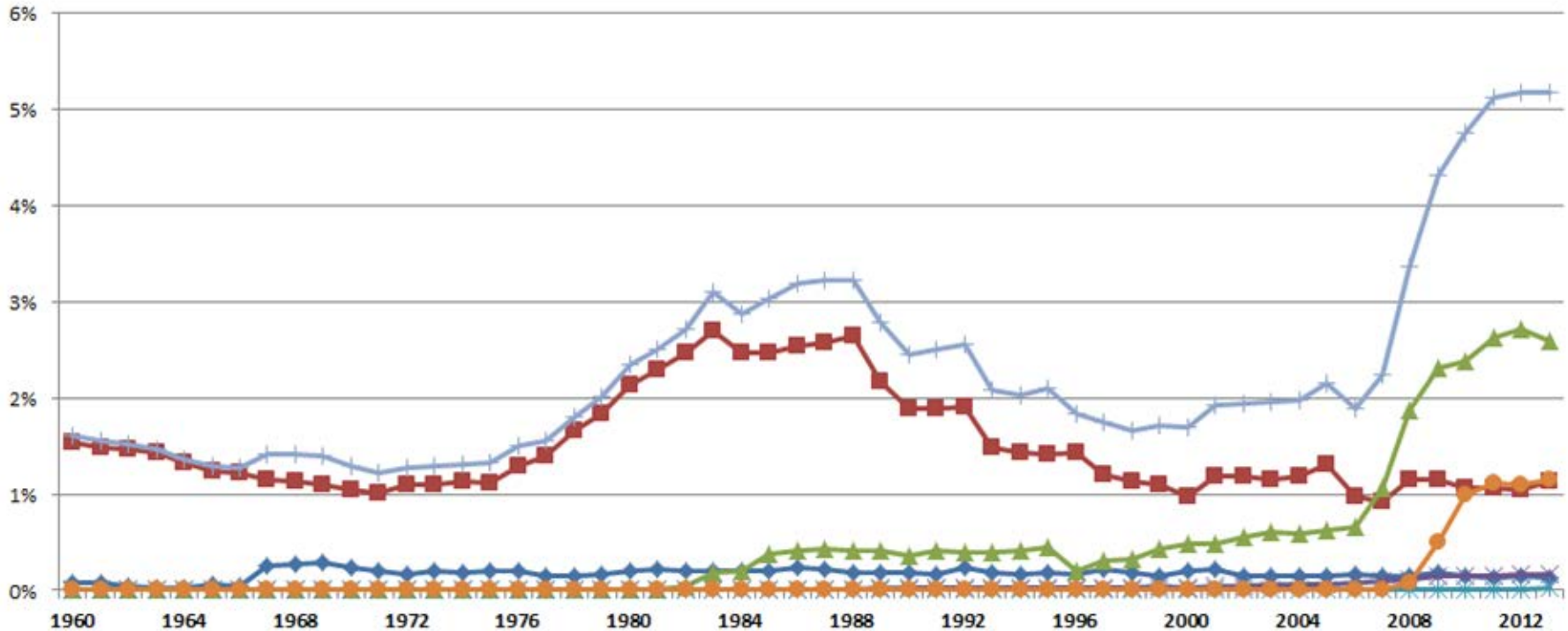
Source: EIA

2015 U.S. Electricity Generation by Energy Source

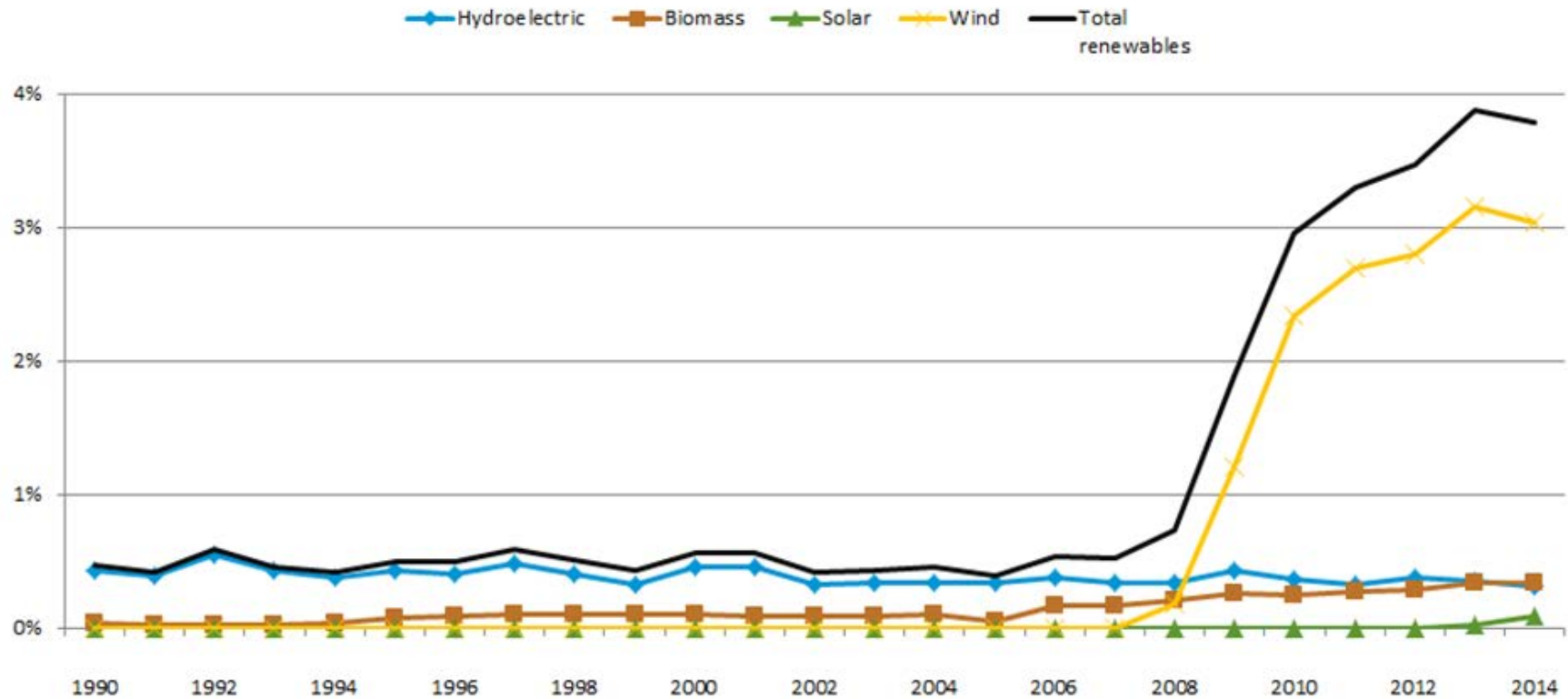


Renewables Share of Indiana Total Energy Consumption

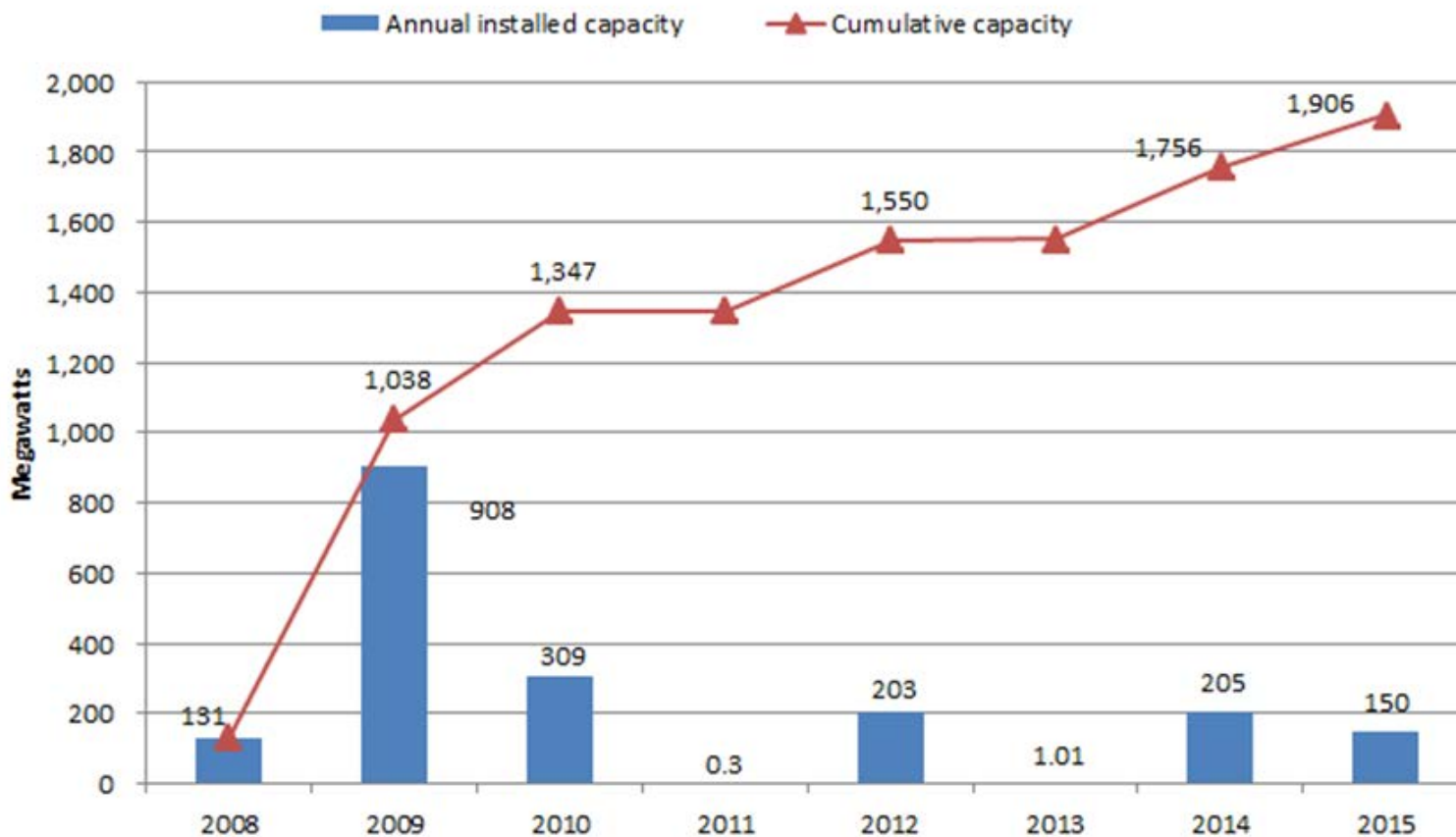
◆ Hydro
 ■ Wood & Waste
 ▲ Fuel Ethanol & Co-products
 ✱ Geothermal
 ✱ Solar
 ● Wind
 — Total Renewables



Renewables Share of Indiana Electricity Generation



Energy from Wind



Sources: IURC, EIA

Wind

- 1,894 MW of utility scale wind in Indiana
- 100 MW under construction
- 317 MW proposed but not started
- Indiana utilities have agreements to purchase 1,111 MW of wind power
 - 697 MW from in-state
 - 414 MW from out-of-state

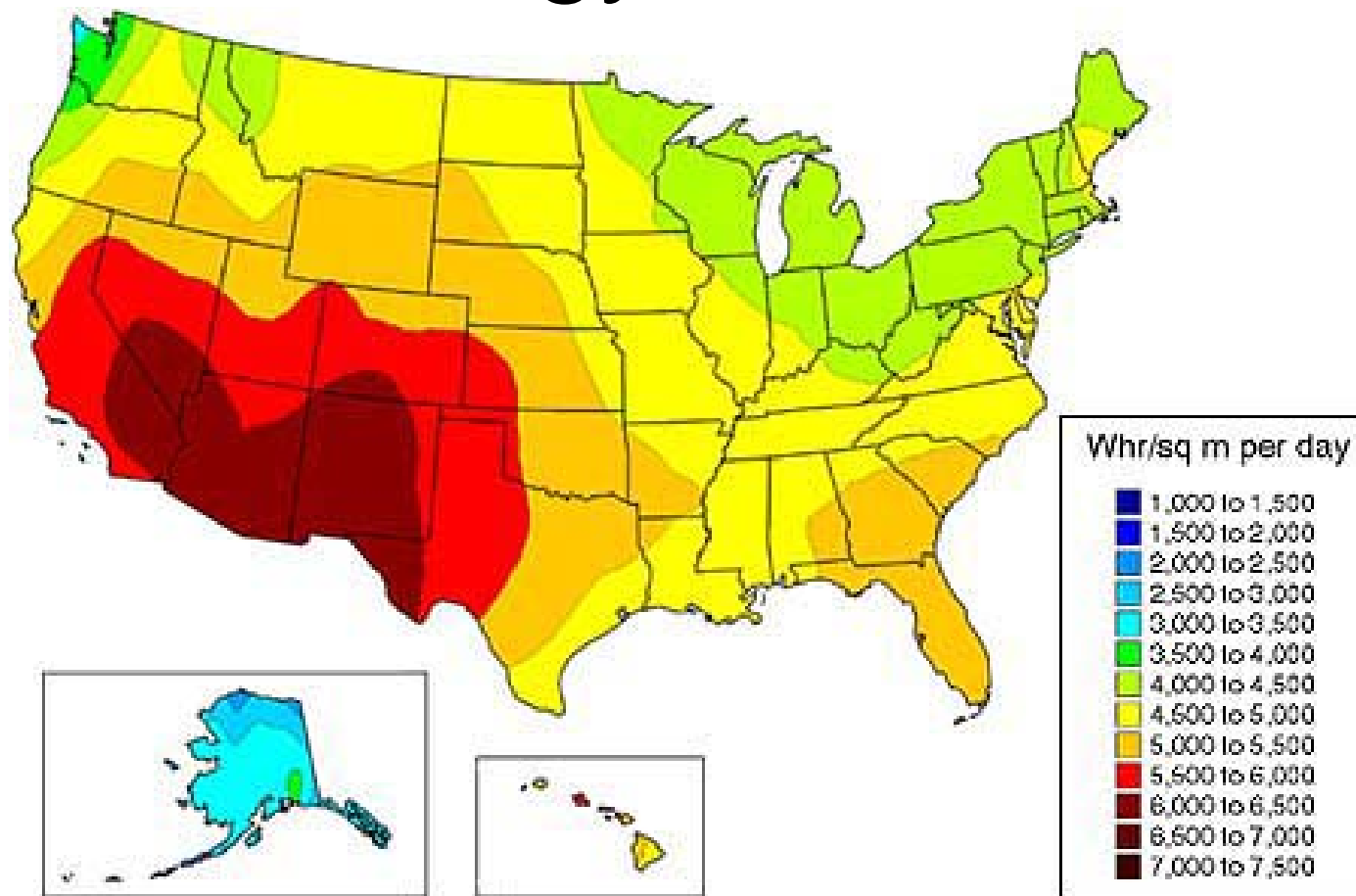
Energy Crops

- Transportation fuels
 - Ethanol
 - Biodiesel
- Other possibilities
 - Fast growing trees (hybrid poplar/southern pine/willow/eucalyptus)
 - Grasses (switchgrass/sugar cane)
- Barriers to be overcome
 - Other high-value uses for the land
 - Harvesting and transportation costs
 - Price of competing fossil fuels

Organic Waste Biomass

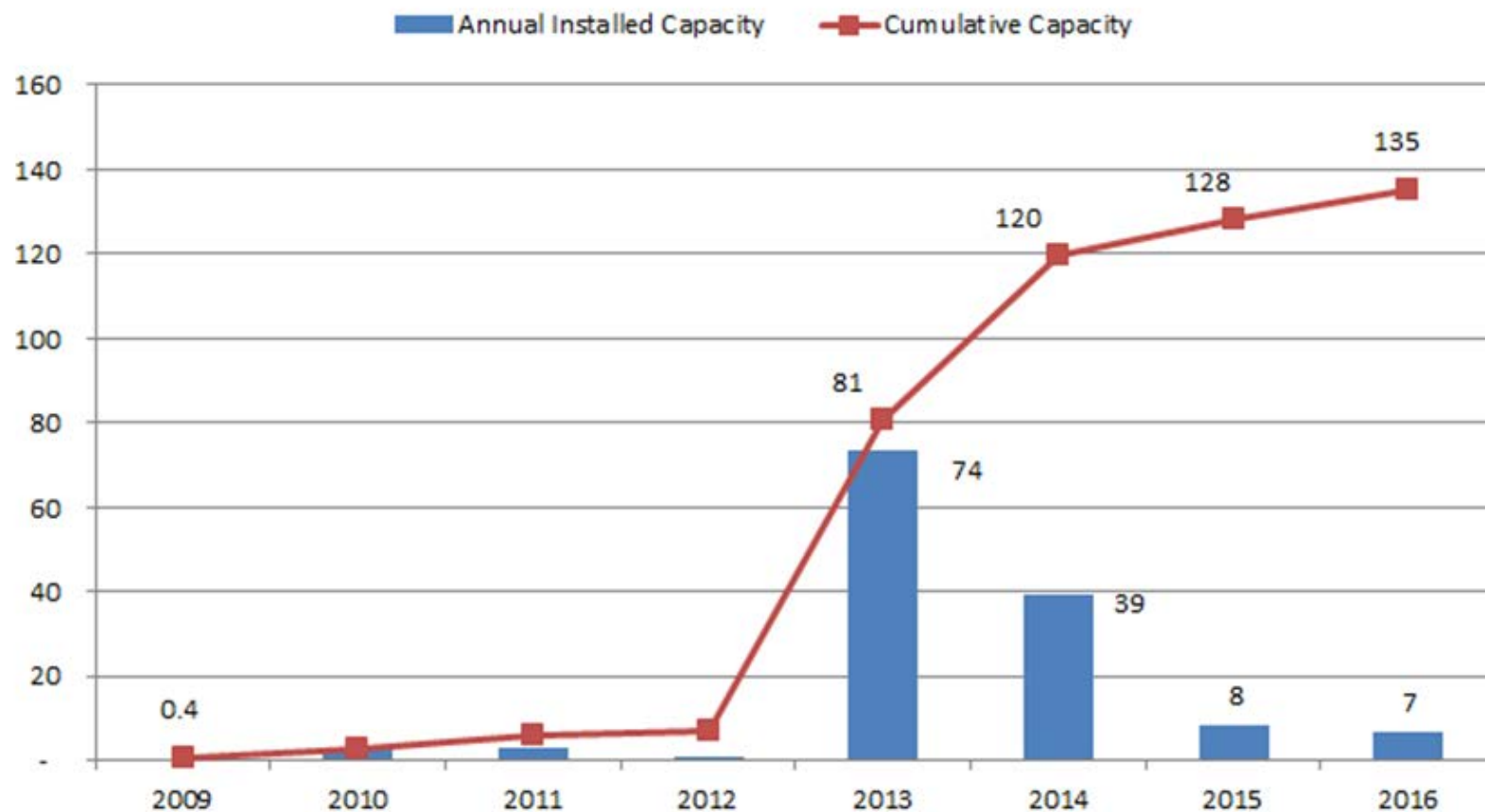
- Until the recent increase in ethanol production, this resource was the largest source of renewable energy in Indiana
 - Primarily due to the use of wood waste
- It is the 2nd largest source of renewable electricity generation in the state
 - Landfill gas (67 MW)
 - Animal waste biogas (16 MW)
 - Wastewater treatment (195 kW)

Solar Energy / Photovoltaics



Solar resource for a flat-plate collector

Photovoltaics



Sources: IURC, NREL

Photovoltaics

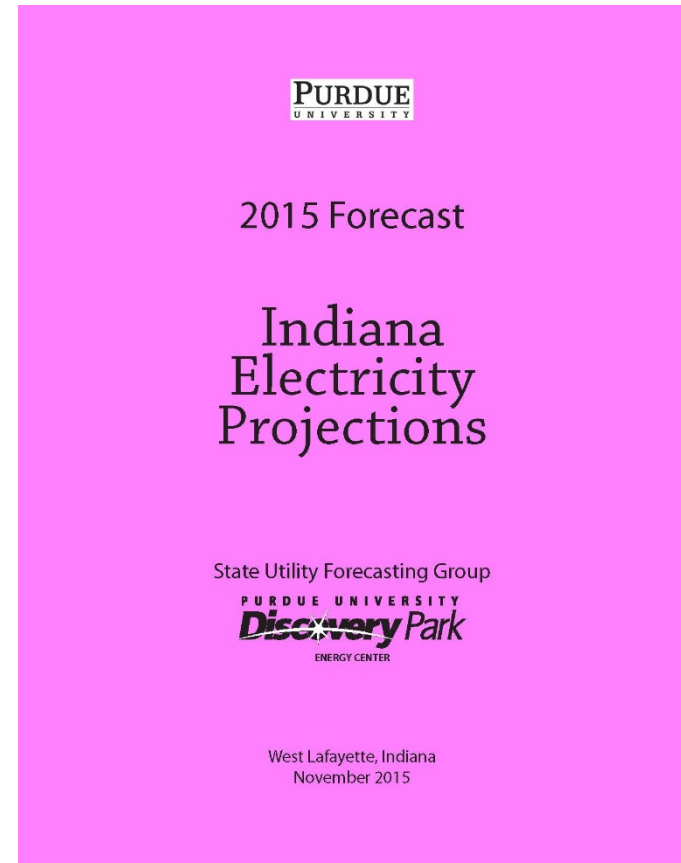
- Continued growth is expected with about 100 MW of planned additions over the next 5 years by Indiana utilities
- Growth has been driven by lowering costs, utility feed-in tariffs, expanded eligibility rules for net metering, and tax incentives

Hydroelectric Power

- Until expansion of wind energy beginning in 2008, hydro was the largest source of renewable electricity in Indiana
 - 73 MW, mostly run-of-the-river (no dam)
 - Now 3rd largest source of renewable electricity
- The 88 MW project at the Cannelton Locks on the Ohio River is expected to be fully commissioned in 2016
 - Most of the output will go to utilities outside Indiana

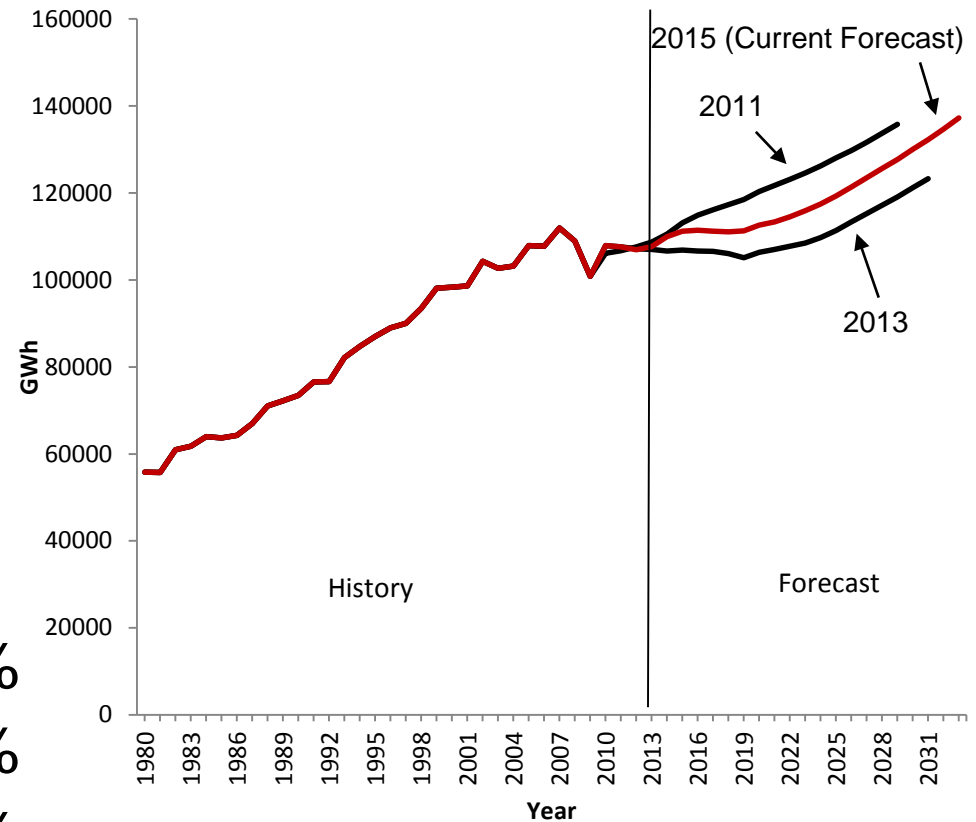
Indiana Electricity Projections: The 2015 Forecast

- The 2015 forecast shows little growth through 2020 and stronger growth thereafter
- Real (inflation-adjusted) prices increase in the first few years before leveling off



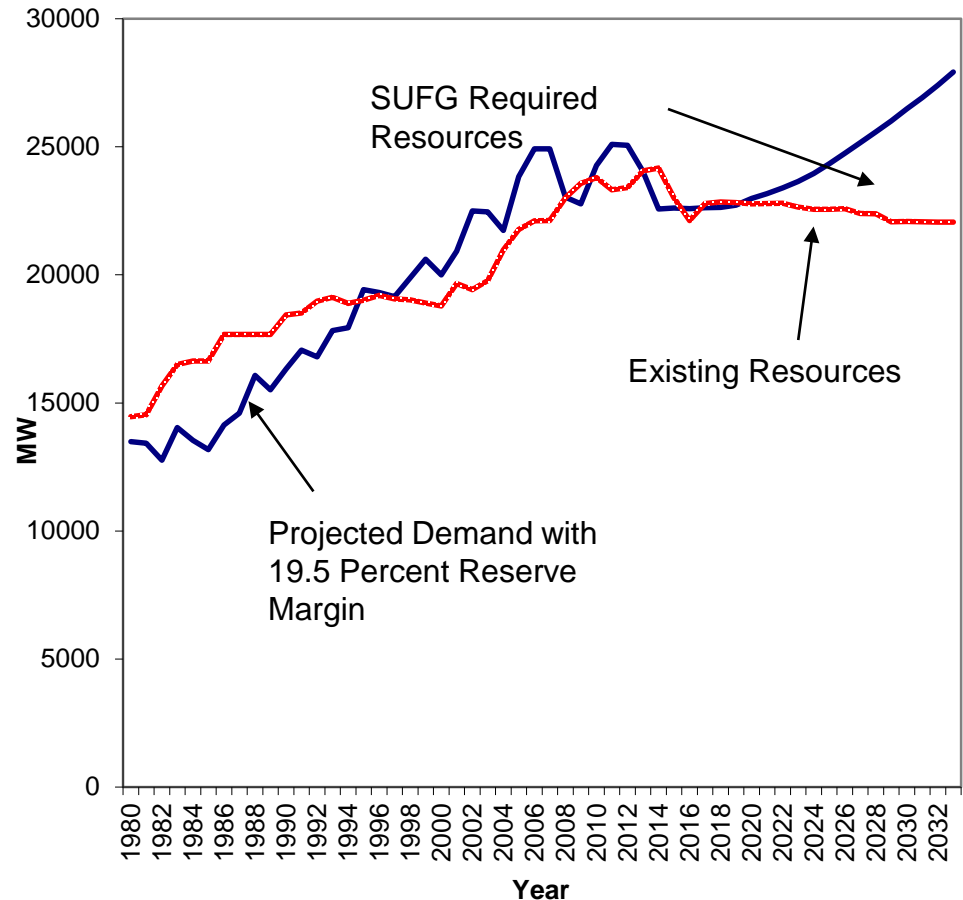
Indiana Electricity Requirements

- Retail sales by investor owned and not-for-profit utilities
- Includes estimated transmission and distribution losses
- Growth rates
 - 2015 forecast: 1.17%
 - 2013 forecast: 0.74%
 - 2011 forecast: 1.30%



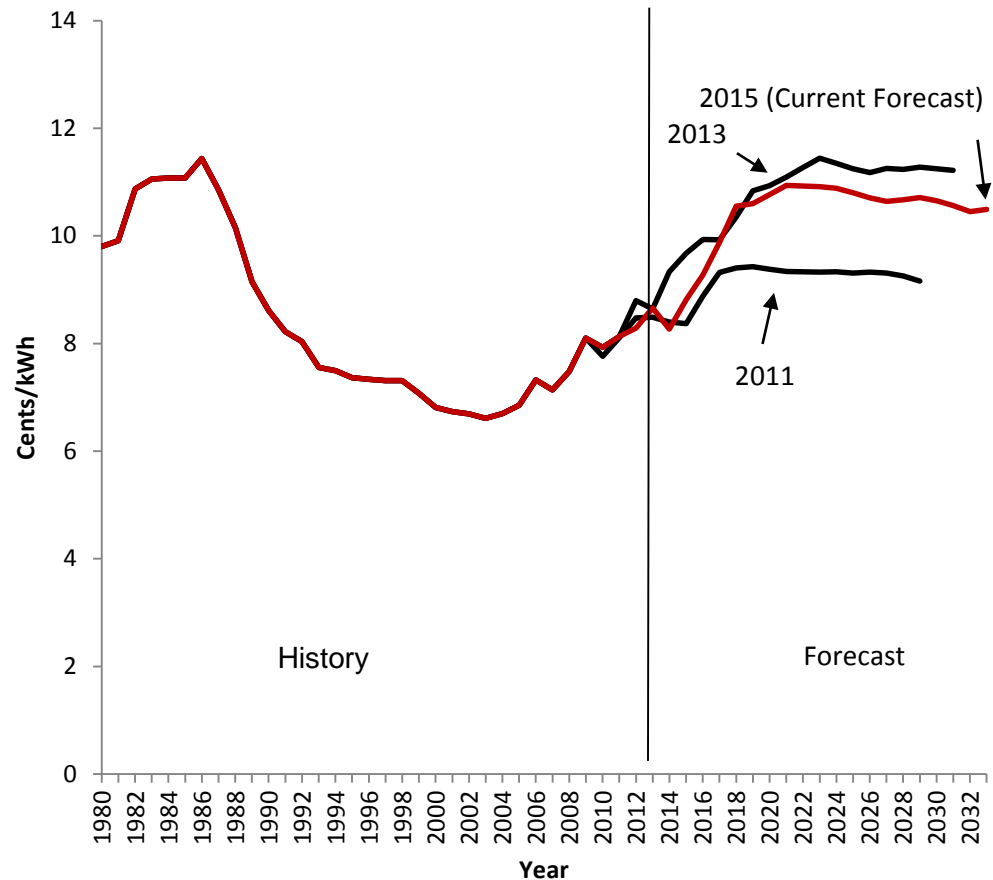
Indiana Resource Requirements

- Resources may be provided by conservation measures, contractual purchases, purchases of existing assets, or new construction
- Existing resources are adjusted into the future for retirements, contract expirations, and IURC approved new resources



Indiana Real Price Projections (2013 \$)

- Effect of inflation removed
- Includes the cost of new resources
- Due to timing of the release of the final version of the EPA Clean Power Plan, it is not included
- Other finalized rules (e.g., MATS) are included



Further Information

State Utility Forecasting Group

765-494-4223

www.purdue.edu/discoverypark/energy/SUGF/

Douglas Gotham

765-494-0851

gotham@purdue.edu