



Representing Renewable Financing in NEMS

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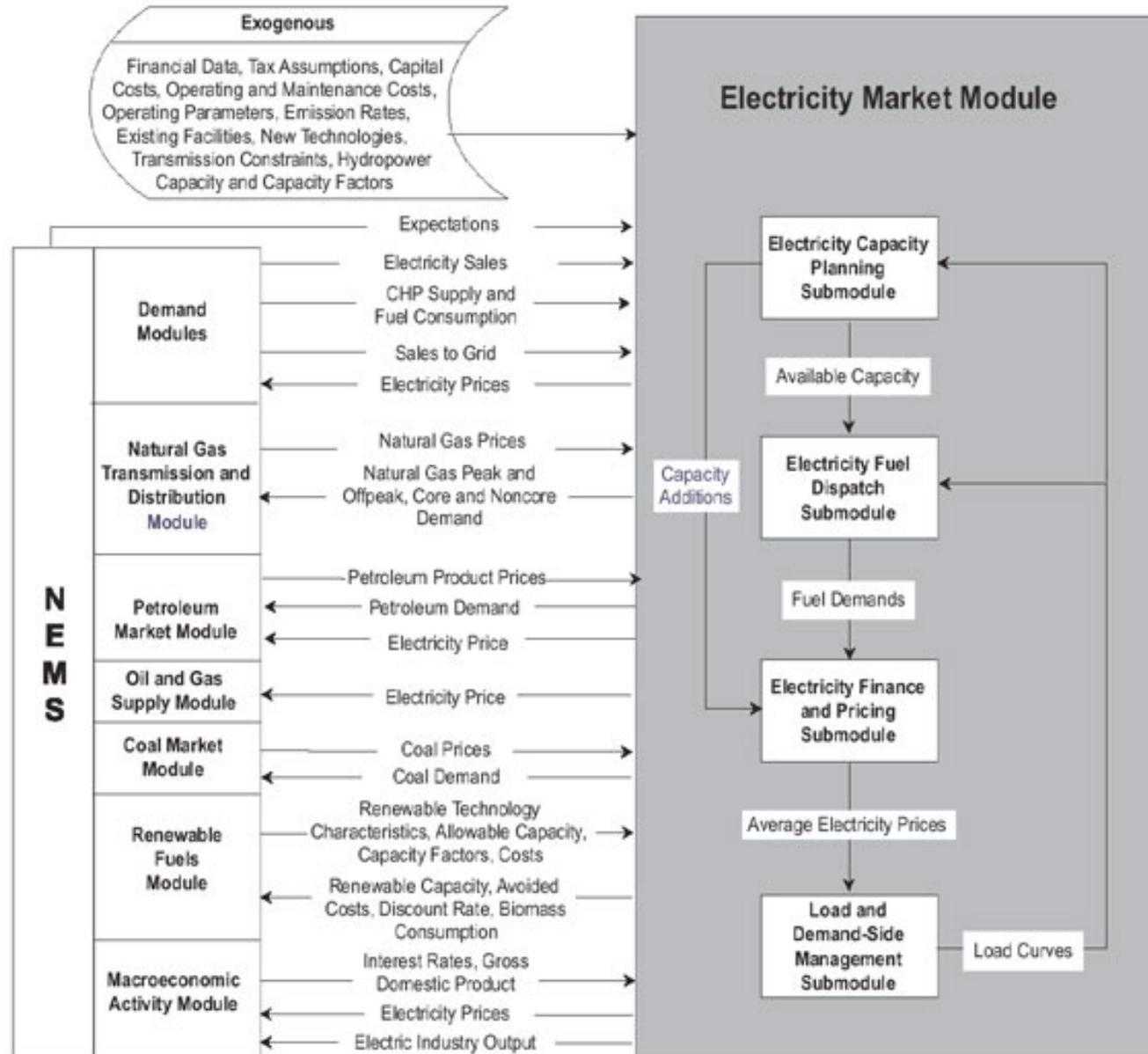
National Energy Modeling System (NEMS)

- Used to develop AEO and policy analysis scenarios
- Integrated U.S. energy sector model with macroeconomic feedback
 - Captures market feedback among different sectors (such as natural gas price response to increased share of renewable generation)
 - Regional, but regions depend on sector
 - Electricity uses 13 regions based on NERC sub-regions
- Updated annually
 - Key assumptions occasionally revisited
 - New modeling techniques added to improve representation
- Adaptable to model new policies or policy detail variations (for example, several different approaches to RPS structures)
- See http://tonto.eia.doe.gov/reports/reports_kindD.asp?type=model%20documentation



EMM Structure

Figure 9. Electricity Market Module Structure





Renewables in the EMM

- NEMS represents several renewable technologies
 - Co-firing
 - Solar PV
 - Biomass IGCC
 - Landfill Gas
 - Solar CSP
 - Hydro
 - Geothermal
 - Wind (onshore/offshore)
 - Dist. PV (in Demand modules)
- In the ECP, renewables compete with other generation resources based on least-cost supply mix
 - Most renewable resources have upwardly sloping supply curves
 - Some have additional constraints based on intermittency or fuel supply issues
- Since most renewables have low variable costs, they operate when their resources are available
 - For both capacity planning (ECP) and fuel dispatch (EFD)
- Renewables have the same financial treatment as all other utility-sector technologies



Cost Characteristics (2006\$)

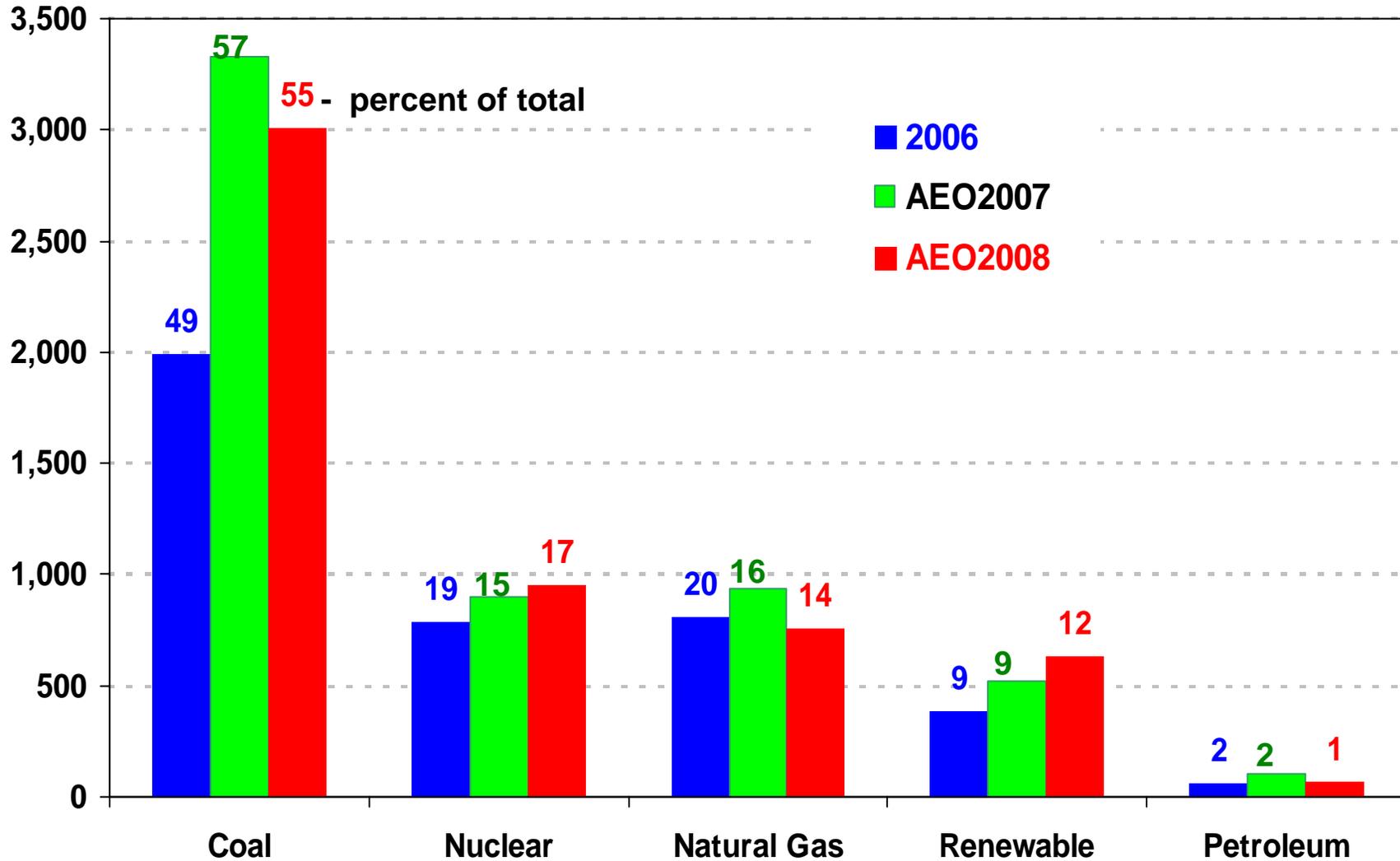
Technology	Var. O&M (mills/kWh)	Fixed O&M (\$/kW)	Capital Cost (\$/kW)
Biomass	6.53	62.70	2,809
Geothermal	0.00	160.18	1,110
Wind	0.00	29.48	1,434
Solar (CSP)	0.00	55.24	3,744

- Source: AEO 2008, Early Release.
- These costs are based on “national average.”
- T&D and financing costs are additional.



2030 Generation By Fuel/Technology

billion kilowatthours



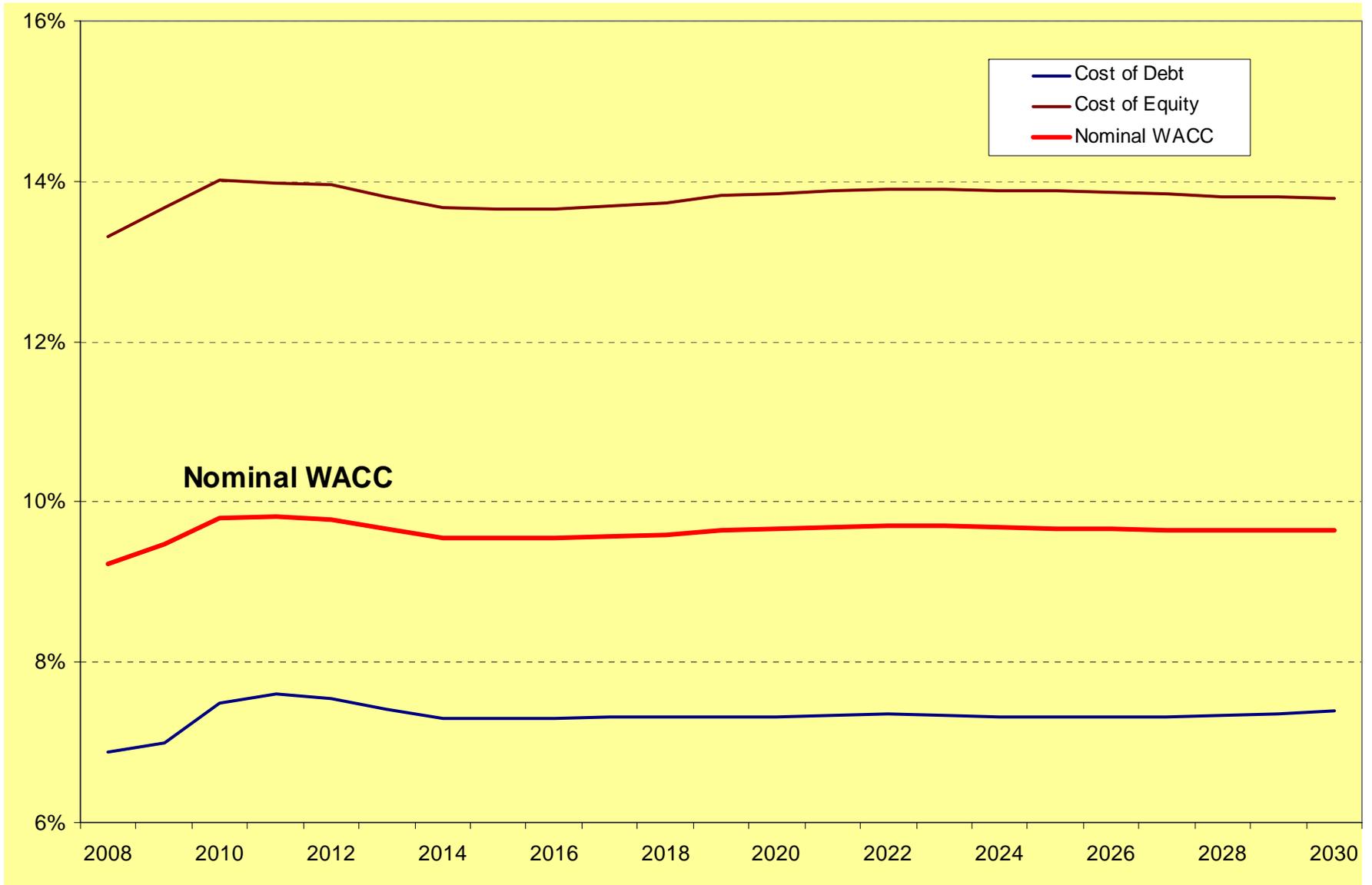


Financial Parameters

1	Project life	20 years	
2	Debt fraction	45%	Constant
3	Equity fraction	55%	Constant
4	Cost of debt	Baa/BBB	Variable
	Average rate	7.3%	
5	Cost of equity	CAPM: SML	
	Risk-free rate	10-year T-note	Variable
	Market risk premium	6.5%	Constant
	Beta	1.3	Constant
	Average rate	13.8%	
6	Tax rate	38%	Constant
7	Nominal WACC	9.63%	Variable
8	Real WACC ($\pi = 1.91\%$)	7.58%	Variable

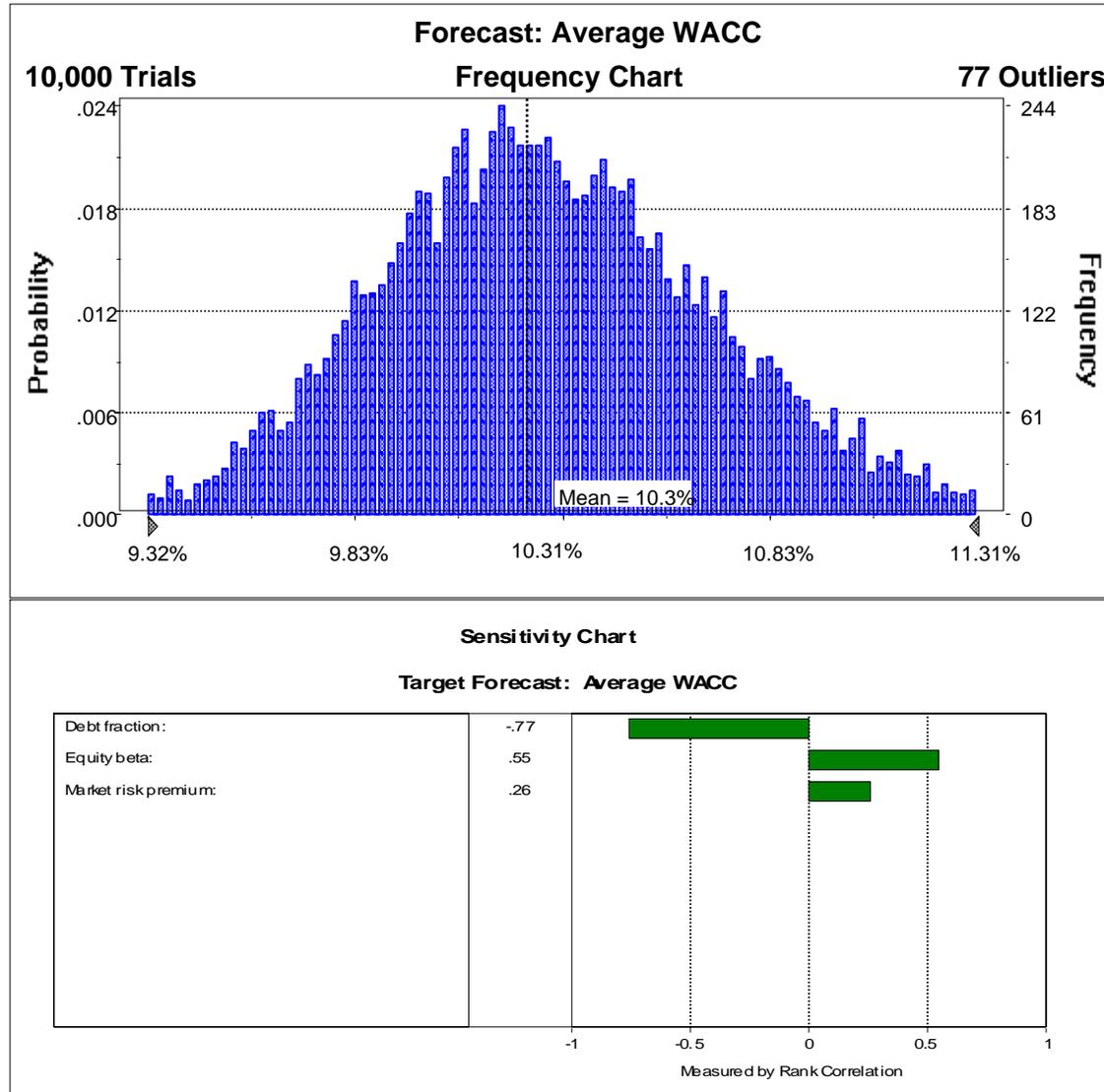


Nominal WACC



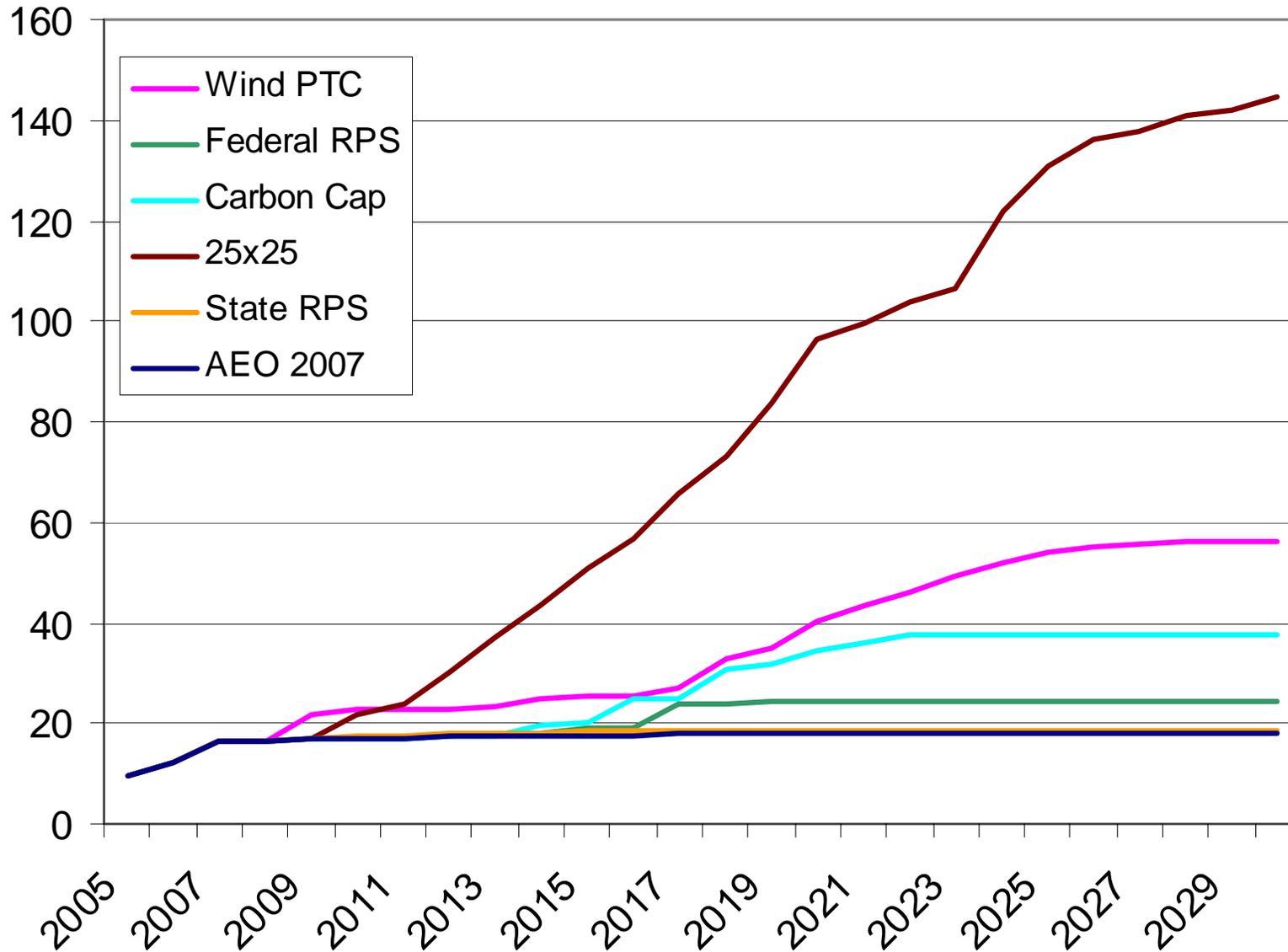


Ex: Expected WACC Contingency & Sensitivity



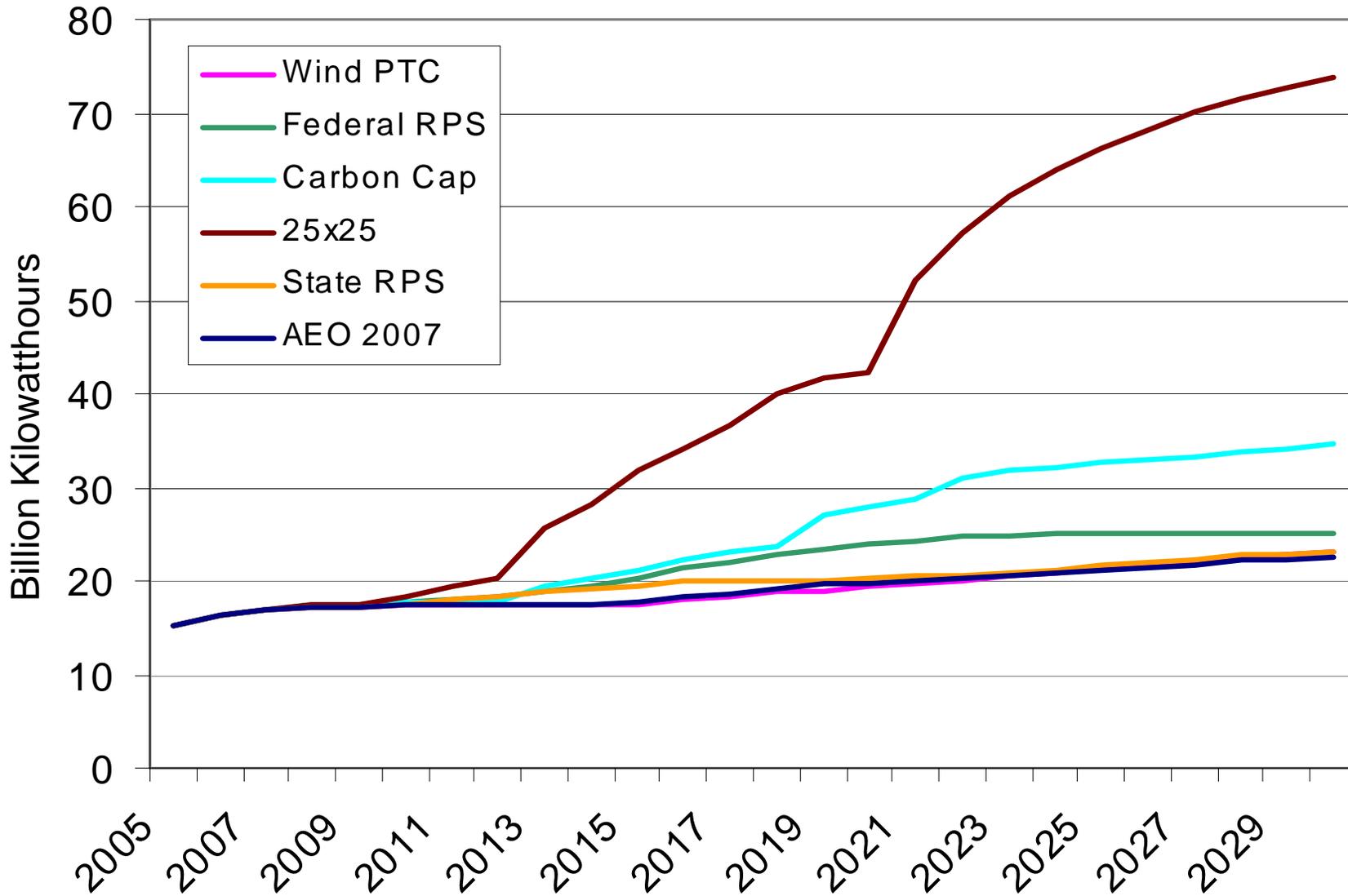


Wind Capacity (GW)



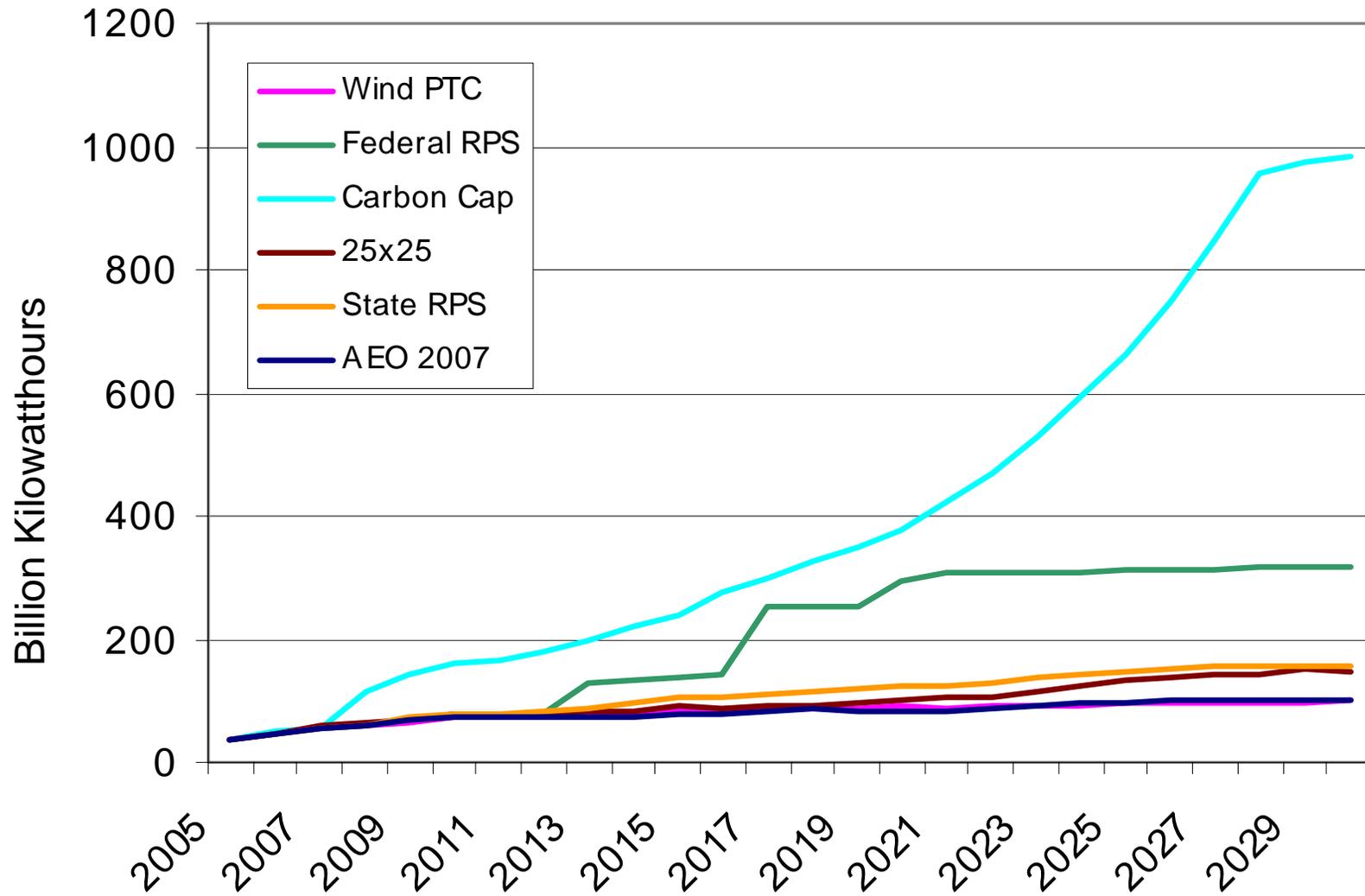


Geothermal Generation





Biomass Generation





Questions?

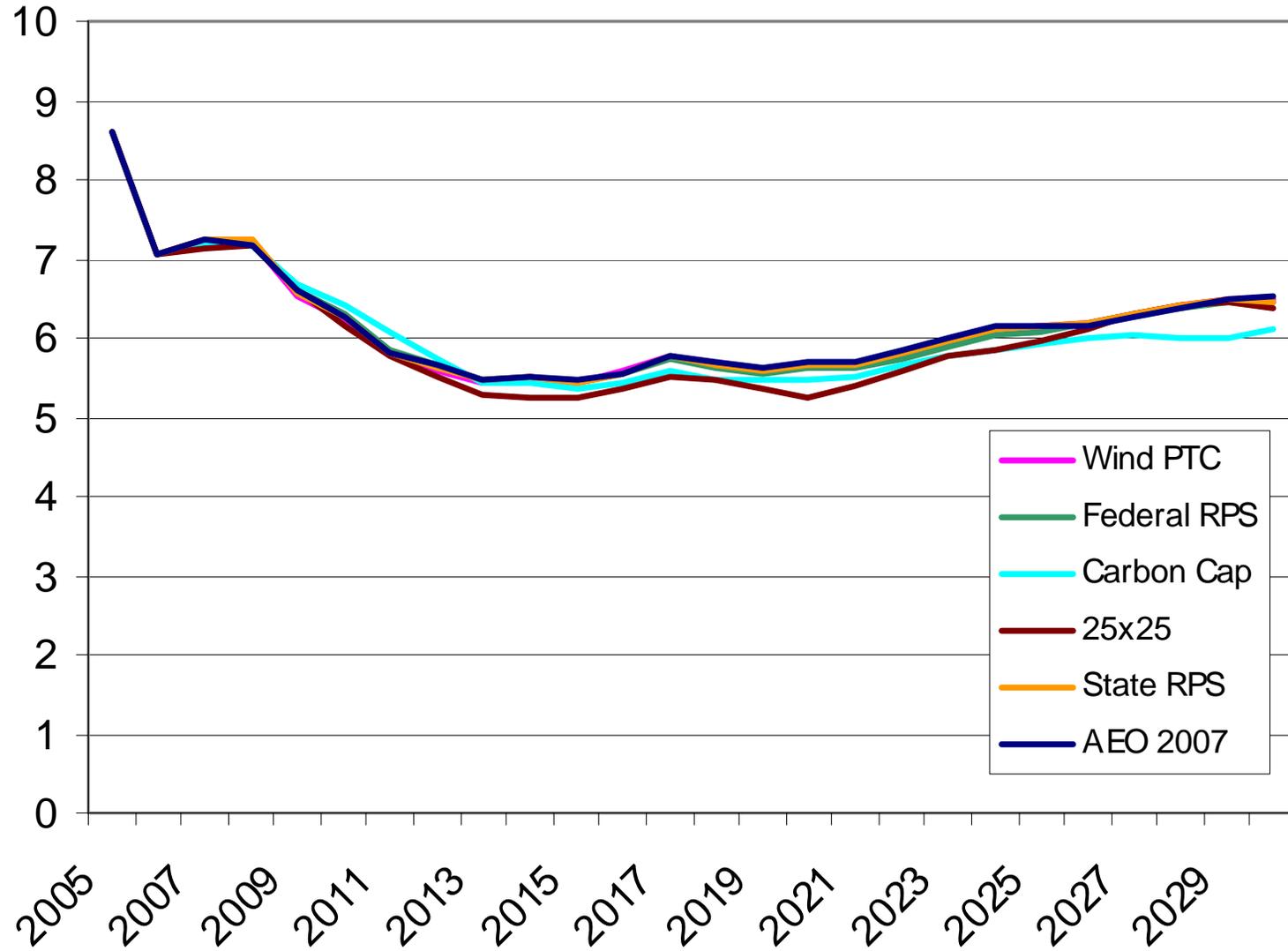
General web site: www.eia.doe.gov

AEO and Congressional Reports:

<http://www.eia.doe.gov/oiaf/forecasting.html>

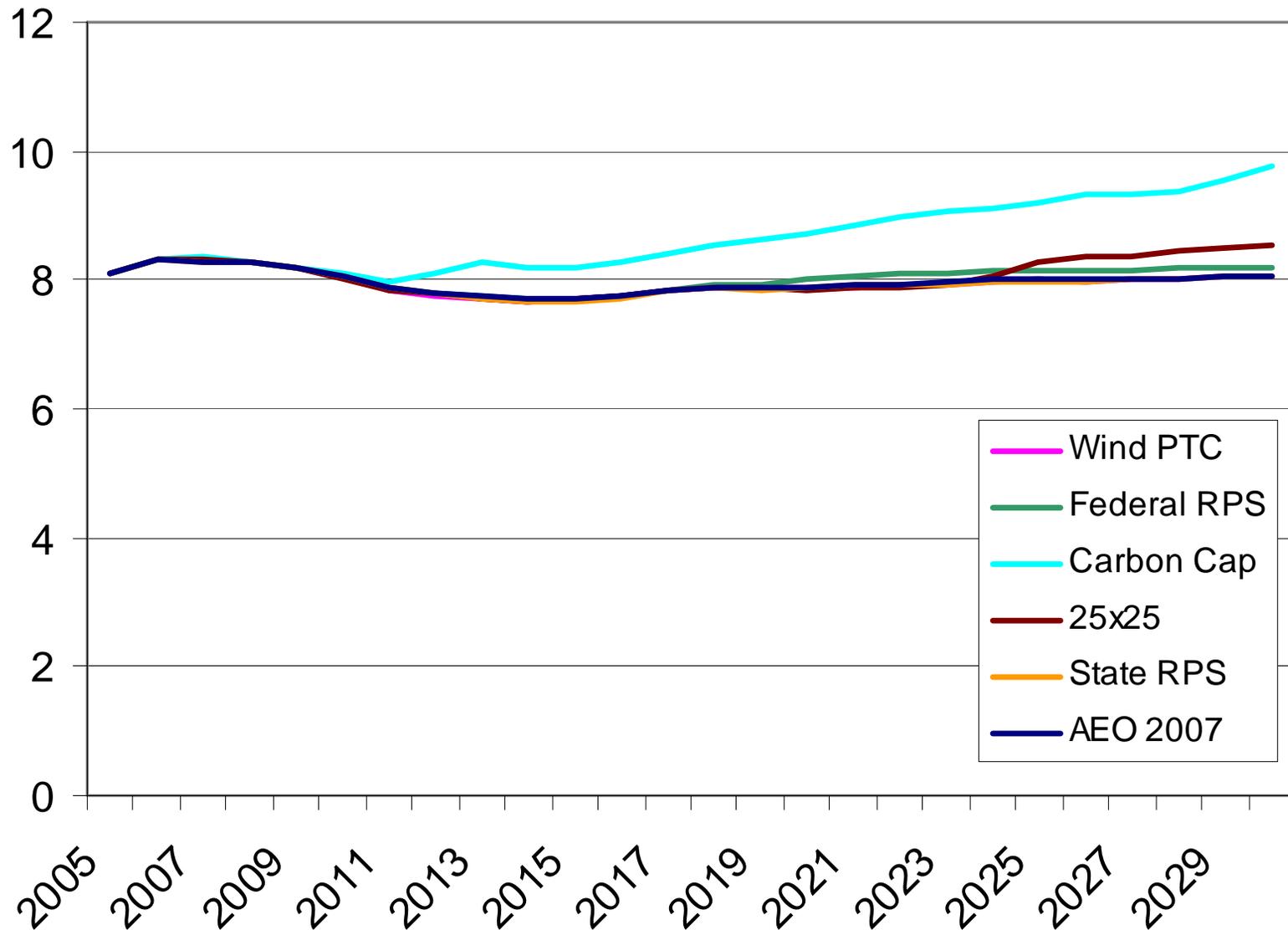


Natural Gas Price (\$/mmBtu, Henry Hub)





Electricity Price (cents/kWh)





Carbon Emissions (mmt CO2)

