Simulation of Nuclear Power and Alternatives in Wisconsin

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15-year Simulation of a “Wisconsin-Like” Utility:

- Build the power plants providing Wisconsin’s future electrical energy.

- Look at cost, reliability, and emission trade-offs under various scenarios.

- Discuss key considerations and uncertainties.

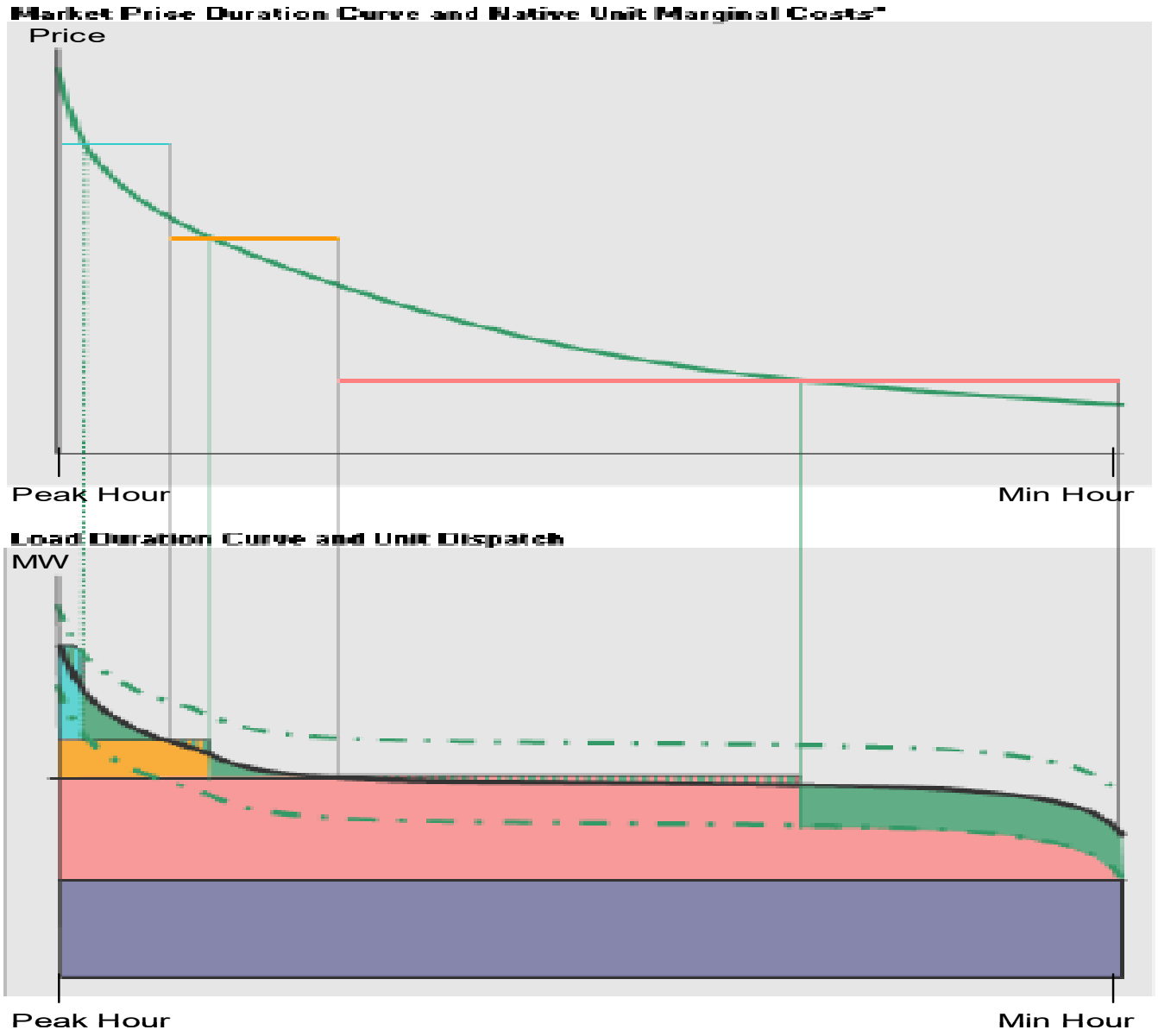
Today's Objective: Facilitate a conversation around the energy/carbon challenge and discuss the role of nuclear power.

This analysis today is educational in nature. I am simulating the resource planning effort using a simplified data set. Utility apacity expansion modeling involves many people gathering and analyzing data over many months using extremely complex modeling applications.

Presentation:

- Brief Modeling Overview
- Simulate 3 Future Scenarios
- Interactive Simulations and Q&A

Modeling Plant Dispatch & Market



3 - 15yr Simulations

Wisconsin-Like Utility
Growth 2% per year (3500 to 4700 MW Peak)

RED PLAN
Similar to Wisconsin's Current and Pending Construction through 2012. Beyond 2012 - No Carbon Constraints

GREEN PLAN
Similar to Wisconsin's Current and Pending Construction through 2012. Beyond 2012 - Carbon Constraints.
New Nuclear Power Excluded.

BLUE PLAN
Similar to Wisconsin's Current and Pending Construction through 2012. Beyond 2012 Carbon Constraints.
New Nuclear Power Option

Take Home Conclusions

- Meeting significant carbon constraints with continued growth in energy consumption requires a major shift toward low carbon emitting technologies.
- Four important alternatives 1) energy efficiency, 2) wind and biomass, 3) IGCC with carbon sequestering, 4) nuclear power.
- Each option includes areas of significant uncertainty, including their total economic resource availability.
- Fundamentally, limiting any option increases both financial risk and environmental risk.

Comparing Costs

Busbar Cost vs Delivered Cost
"Grid-integrated" comparison to other bulk power alternatives.

Conservative Comparison:
Nuclear – higher ROE, No Loan Guar or PTC
IGCC – 12%ROE, No Loan Guar
Wind – No PTC after 2012

Not yet including: Owner's Capital, Admin, Construction Work in Progress

Audience Simulation & Discussion

Plants Included based on National Energy Modeling System Data:

Solar PV
Biomass
Wind
Advanced Nuclear
Super Critical Pulverized Coal
IGCC Coal
IGCC Coal with Carbon Seq.
Advanced CC Gas
Advanced Gas Turbine
Conventional Gas CT

This tool will be online soon at
www.energy.wisc.edu
We are actively pursuing opportunities to deploy this technology.
Please contact me at:
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Cost factors & Financing

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4	Wind-NEMS06	2	50	0	10000	27.6	0	1167	2008	3
9	Advanced Nuclear-NEMS06	3	250	0	10400	61.82	0.5	2014	2013	6
10	Adv CC w/ CS-NEMS06	6	400	6	7493	18.12	2.7	1147	2010	3
11	IGCC-NEMS06	5	550	4	7200	35.21	2.7	1443	2009	4
12	ADV CC - NEMS06	2	400	0	6333	10.65	1.8	575	2008	3
13	Biomass-NEMS06	2	80	0	8911	48.56	3.1	1809	2009	4
14	Conv CT-NEMS06	6	160	0	10450	11.03	3.3	407	2007	2
15	IGCC w/ CS - NEMS06	5	380	5	7920	41.44	4	2065	2010	4
16	Scrubbed Coal - NEMS06	5	600	3	8600	25.07	4.2	1249	2005	4
32	Advanced Nuclear-Hi	3	250	0	10400	61.82	0.5	2014	2013	6
33	Advanced Nuclear-Lo	3	250	0	10400	61.82	0.5	1744	2013	6
34	SCPC Coal DEMO	5	500.00	3.00	9590.00	27.24	1.3	1312.00	2005.00	1.00

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2	RTC	prod tax cre	0	0.4	0.005	0.4	0.06	0.6	0.12	30	30	1.9	10
3	cash		0	0.4	0	1	1	0	0	1	1	0	0
4	15Y-7%		0	0.4	0	1	0.07	0	0	15	15	0	0
5	TFMB 6%		0	0	0.005	1	0.06	0	0	30	30	0	0
6	Nuc Hi		0	0.4	0.005	0.4	0.07	0.6	0.15	30	30	0	0
7	Nuc Lo	prod tax cre	0	0.4	0.005	0.8	0.06	0.2	0.15	30	30	1.8	8
8	IGCC Lo	loan guar	0	0.4	0.005	0.8	0.06	0.2	0.12	30	30	0	0