The Marginal Effects of the Price for Carbon Dioxide on Rate Design

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"Leadership in Infrastructure Policy"

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Public Utility Research Center

Research

Expanding the body of knowledge in public utility regulation, market reform, and infrastructure operations (e.g. benchmarking studies of Peru, Uganda, Brazil and Central America)

Education

Teaching the principles and practices that support effective utility policy and regulation (e.g. PURC/World Bank International Training Program on Utility Regulation and Strategy offered each January and June)

Service

Engaging in outreach activities that provide ongoing professional development and promote improved regulatory policy and infrastructure management (e.g. in-country training and university collaborations)

The Body of Knowledge on Infrastructure Regulation

Acknowledgements

This presentation is based on material from my papers with Julie Harrington of the Florida State University and Hethie Parmesano of NERA.

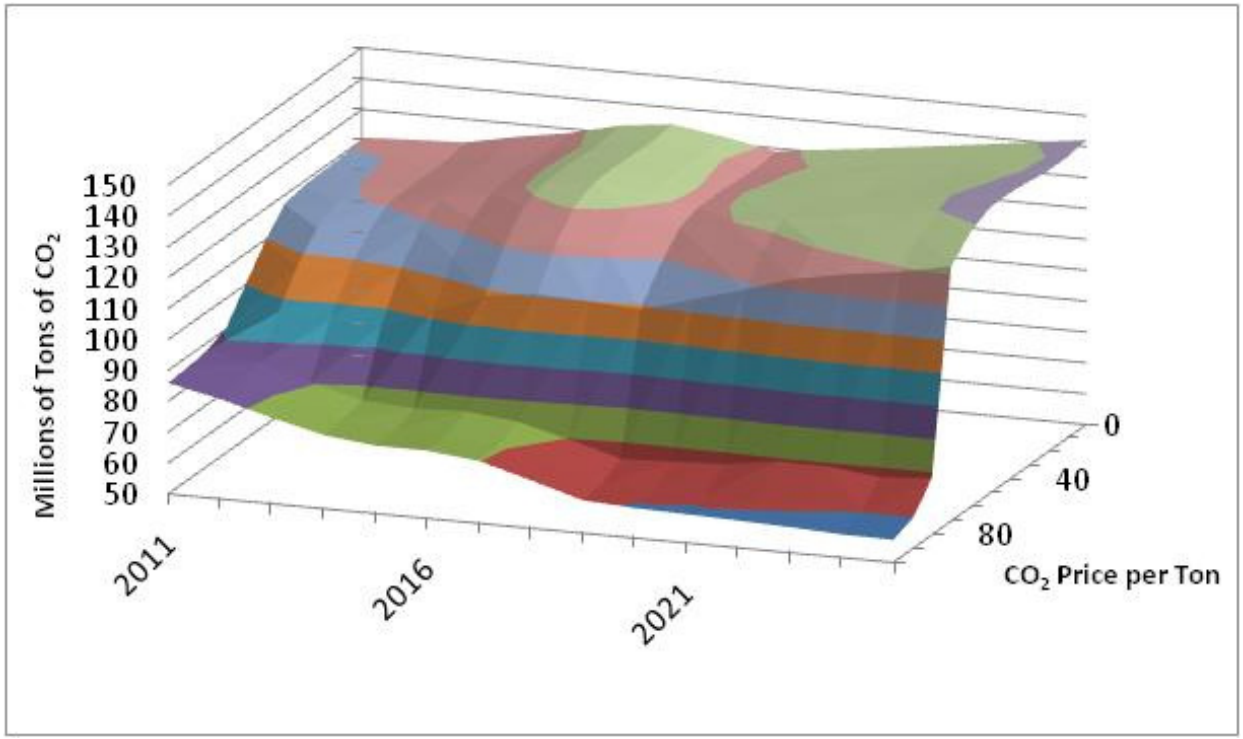
Summary

- Modeling the effects of CO_2 pricing
- Marginal effects of CO_2 pricing on electric generation emissions, costs, and cost structure

Economic Dispatch Model

- Transparent framework and logic
- Quantify the balance between level of the carbon cap and the shadow (or market) price of carbon
- Quantify the impact of RPS, energy efficiency, carbon offsets, and generation additions
- Supply stack dispatch methodology
  - State-wide scope
  - Monthly resolution of hourly load
  - Individual generating units (over 500 in FL, AL, GA)
  - Key operating characteristics for each unit
  - Ability to shape load for growth or DSM

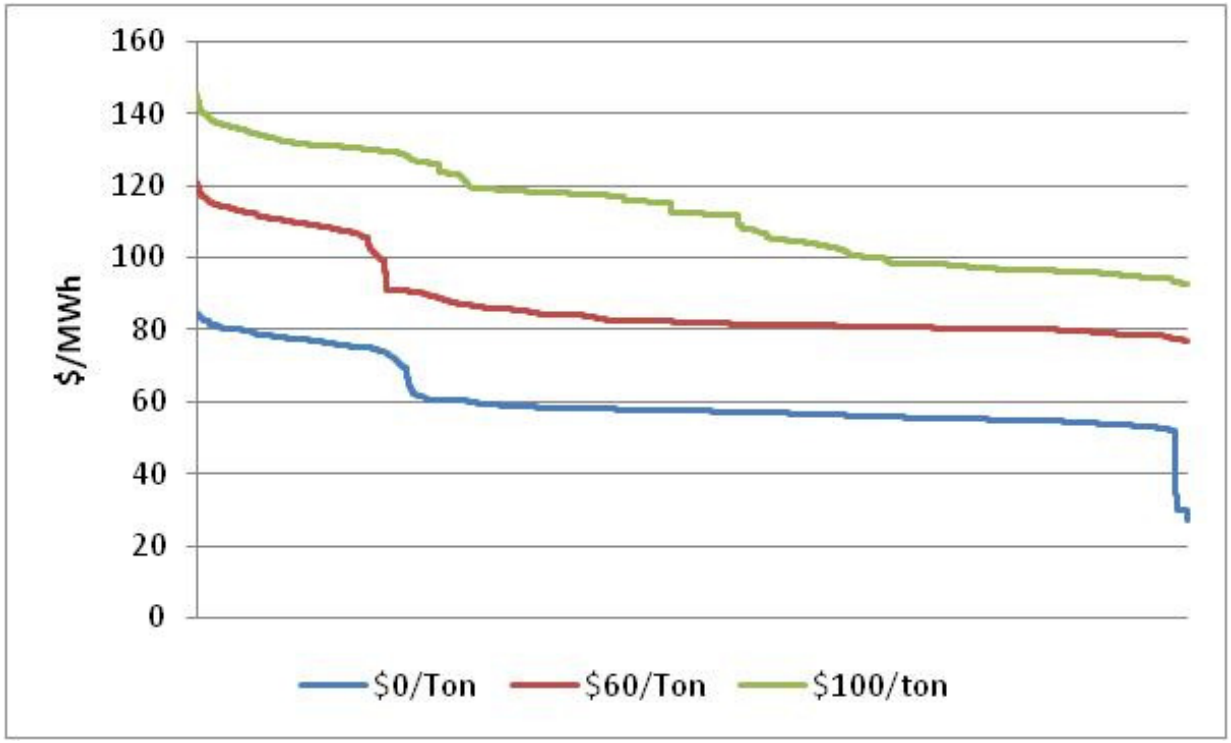
Marginal Effects of CO_2 Price



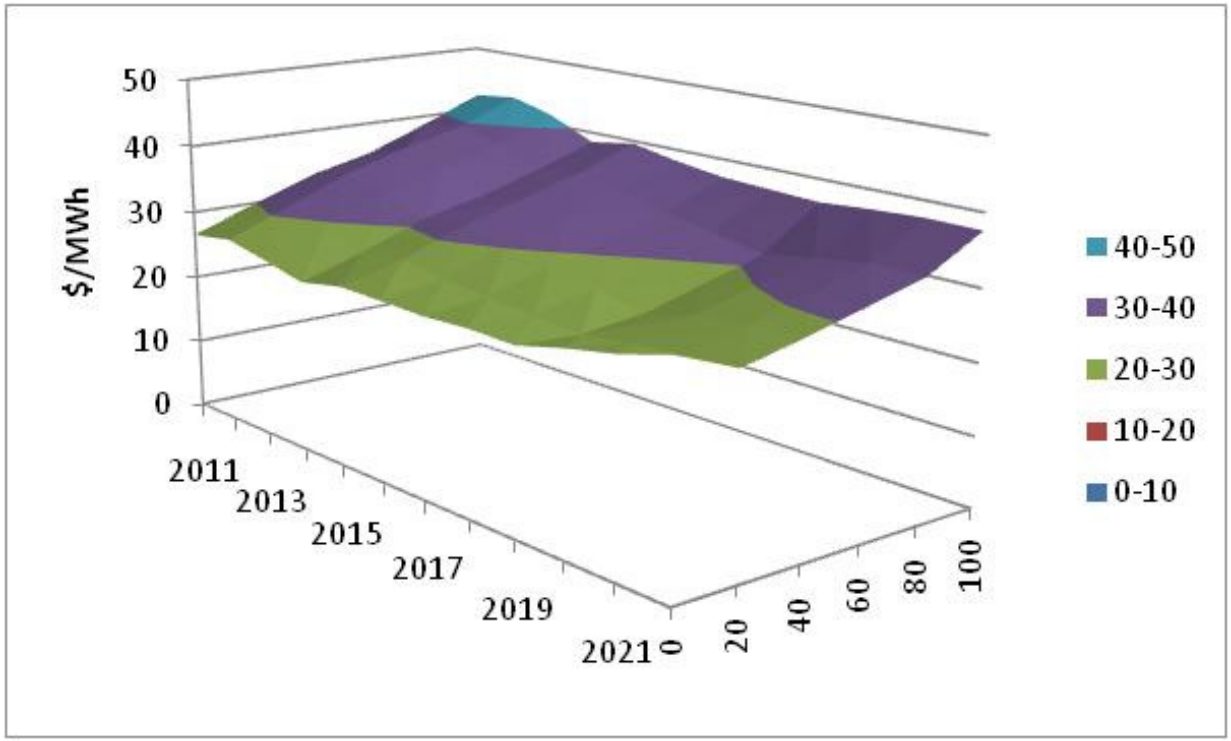
Economic Benefits of Shifting Load

- Many technologies rely on the difference between on peak pricing and off peak pricing to derive economic benefit
  - Appliances that can delay their operating time
  - PHEVs that function as load or storage during the day and charge at night
- Because emissions prices affect certain types of generation more than others, emissions prices can alter this relationship

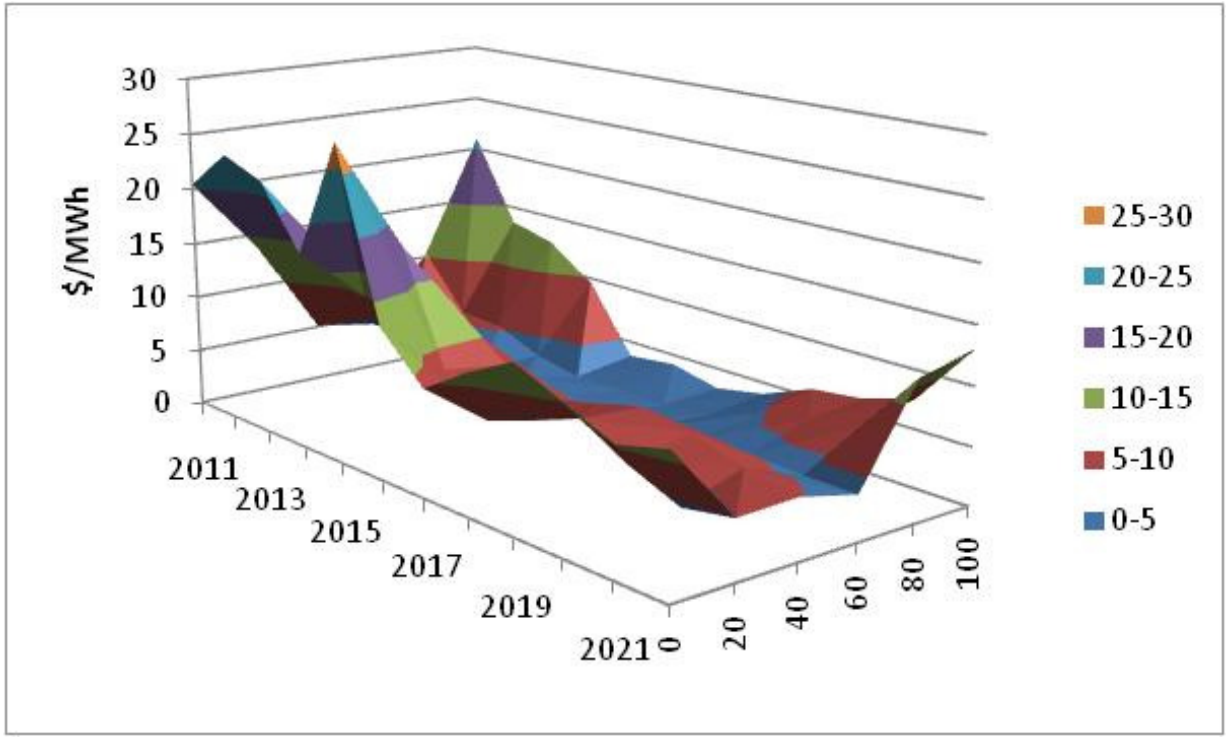
2011 Marginal Cost Duration Curves



July Peak/Off Peak Differential



January Peak/Off Peak Differential



Peak Differentials

- Emissions prices may tend to flatten out marginal cost duration curves
- The presence of peak differentials drives the economic benefits of technology that shifts load from one period to another
- The effect of emissions prices may be to decrease this differential, and thus decrease the economic benefit of these technologies
- Regardless, the behavior of these differentials will change over time and across emissions prices

Conclusions

- Marginal effects of CO_2 pricing are dynamic
  - Vary across years
  - Vary depending on price
  - Vary depending on generation mix
- CO_2 pricing can alter the relationship between on peak and off peak pricing and thus the economic benefits of technology that exploits this relationship
- Modeling needs to address these marginal effects

References

- Kury, Theodore J. and Julie Harrington, "The Marginal Effects of the Price for Carbon Dioxide: Quantifying the Effects on the Market for Electric Generation in Florida", *The Electricity Journal* May 2010
- Parmesano, Hethie and Theodore J. Kury, "Implications of Carbon Cap-and-Trade for Electricity Rate Design, with Examples from Florida", *forthcoming in The Electricity Journal*

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