An Upstream Carbon Pricing Modeling Approach to Establish a Public Benefit Fund for Florida

Zafar Siddiqui – FSU, CEFA
Ted Kury – UF, PURC
Julie Harrington – FSU, CEFA

2011 Florida Energy Systems Consortium Summit
Gainesville, Florida

Institutions

- **Center for Economic Forecasting and Analysis- CEFA, FSU**

  Areas of Specialized Research:

  –Sustainable Energy
  –High Tech Economic Research
  –Environmental/Natural Resources
  –Economic Development
  – Public Policy
  –Economic Impact Analysis
  - Education / Training

- **Public Utility Research Center - PURC, UF**

  - Research

  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)

Concept

- Upstream Carbon Pricing Model to establish a Public Benefit Fund.
- The proposed name is Financing Authority for Clean Energy For Florida: FACE Florida

Outline of Presentation

- Upstream versus Downstream
- FACE – A Policy Innovation for Florida
- Modeling
- Results
- Conclusion

Upstream versus Downstream

- Ambiguity
  - Refineries versus Vehicles

Vs

  - In Electricity Market: Power Plants versus Retailers*

Vs

*(Mansur '10)

Upstream versus Downstream

- Achieving 2050: Carbon Policy for Canada

  - Carbon fuels typically change hands between producers, processors and refiners, distributors, and final consumers who burn them.

  - Producers where fuel first enters the economy

- U.S Center for Clean Air Policy

  - Level of primary fuel producers versus level of fuel users

- Brookings Institution

  - Point of extraction versus combustion

  - Carbon charge should be imposed upstream on fossils at the point of extraction, processing or distribution not at the point of combustion.

Upstream versus Downstream

- Agreement on Benefits

  (i) Transaction Costs

  - Regulating at the earliest node minimizes TCs
  - Earliest Node depends on one's definition

  (ii) Capture Virtually all GHG emissions

  - Downstream would face difficulty in capturing emissions from transport and other small sources.
  - Distortion of market
  - Sifting of GHG to unregulated sector(s)

  (iii) Administrative Feasibility

  - less than 2000 reporting entities in the U.S.

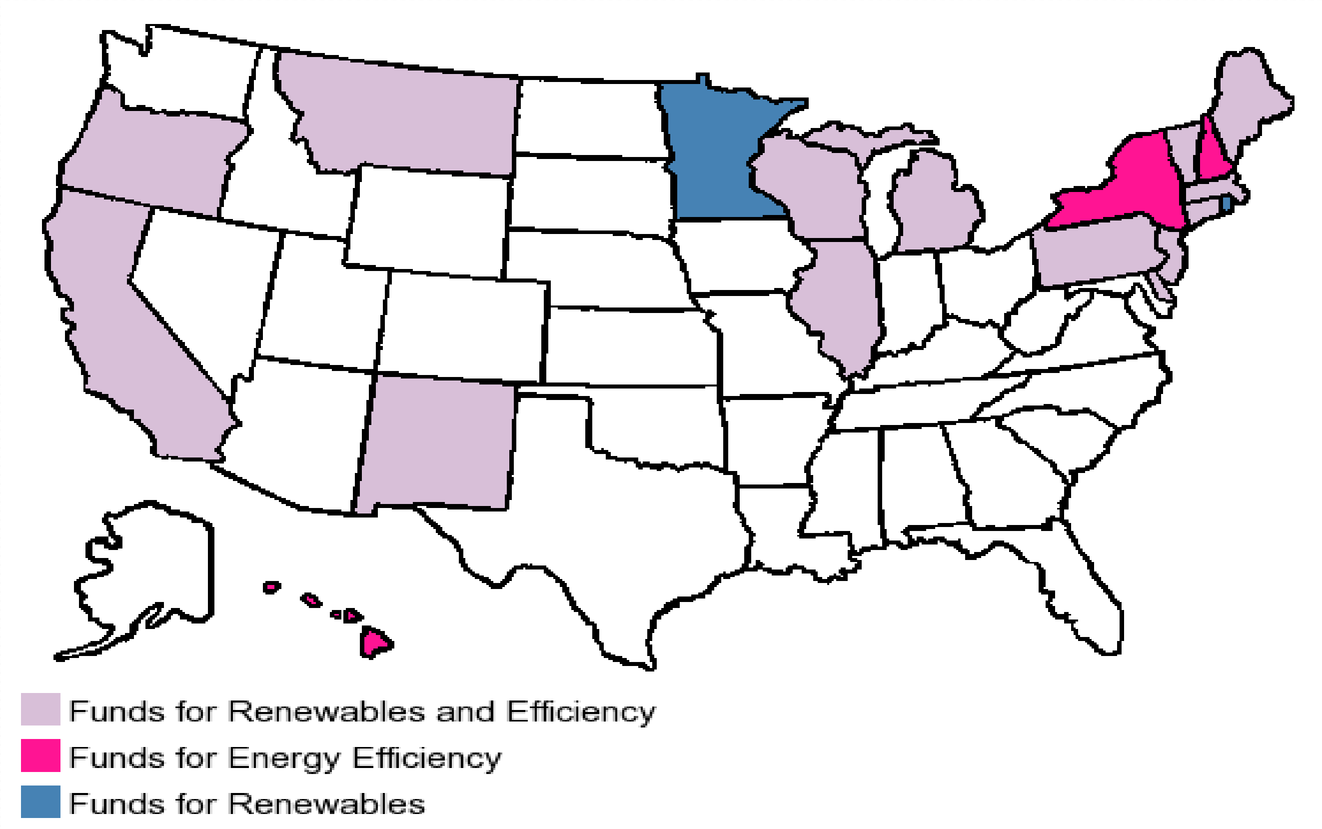
Upstream versus Downstream

- Downside:

  - May not provide as great an incentive for energy saving because fuel users will receive a price signal instead of direct regulation

  - Upstream does not incentivize the employment of end-use emission treatment technologies

FACE- Policy Innovation for Florida

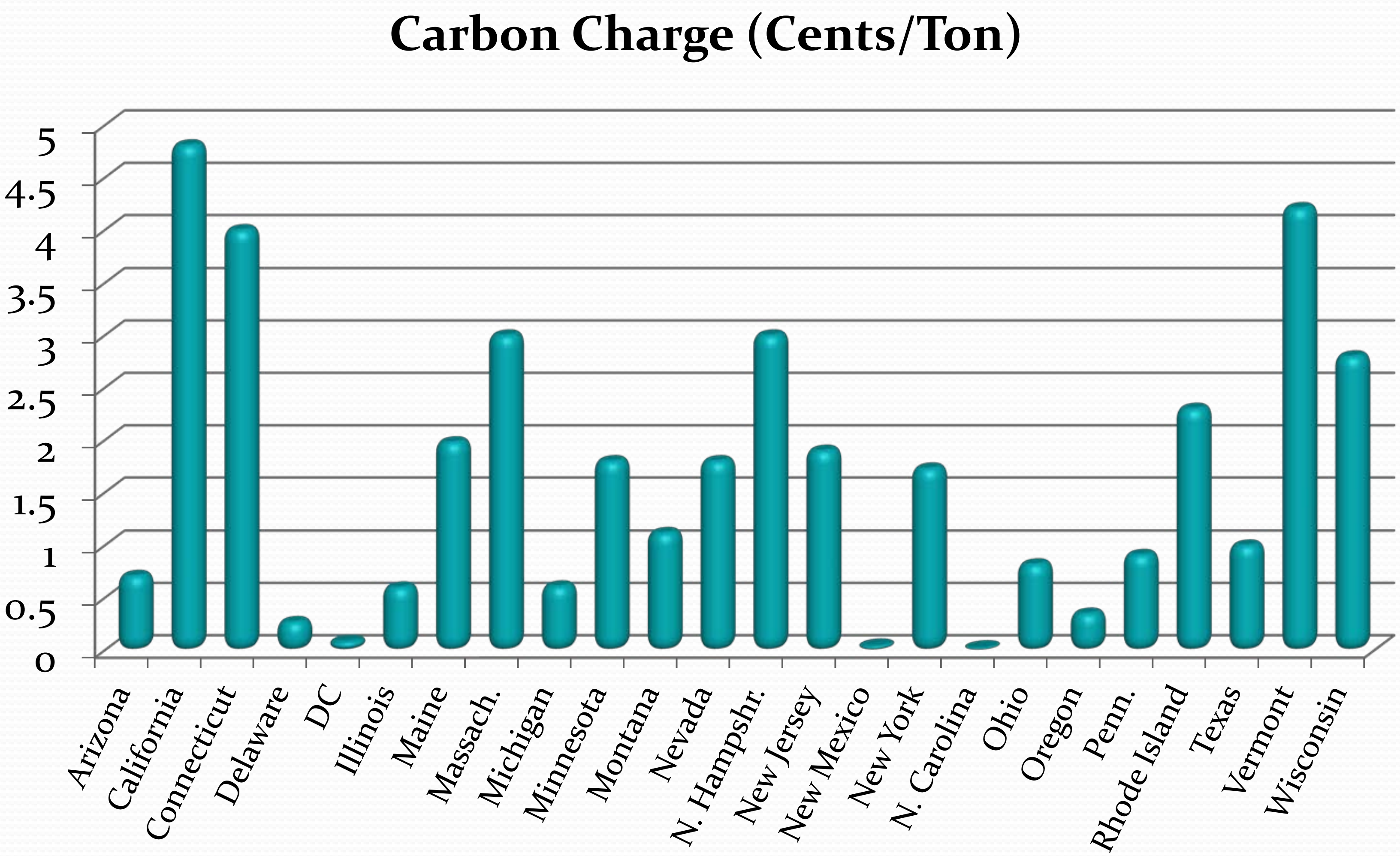


* **Courtesy PEW Center**

FACE- Policy Innovation for Florida

- The purpose is to create funding sources for energy efficiency and renewable energy projects
- Different states already have these funds ranging from $1 M to $300M (EPA).
- Florida has an arrangement under PSC, but innovation of having a legal authority can be done by learning from successful pilots of other states

FACE- Policy Innovation for Florida



FACE- Policy Innovation for Florida

- Why FACE ?
  - Cohesive strategy
  - Conversion from fossils to cleantech
  - Grants can be utilized to retrofit large energy intensive manufacturing plants
  - Opposition from industry and long term benefit
  - Utilities -peak load control

Modeling

- Modeling for upstream carbon pricing includes interaction of two models:
  - Dispatch Model
  - Upstream Carbon Pricing Model

Modeling-The Dispatch Model

- The unit of analysis is an ‘electricity generating unit’.
- The objective of least-cost economic dispatch of a group of electric generating units is to minimize the aggregate costs required to provide the amount of electricity demanded by end-users in each hour
- The costs to produce this electricity will be driven by the type of generating unit, its operating efficiency, the variable costs required to operate and maintain the unit, and the price of its fuel
- Once a price to emit carbon dioxide is introduced, the cost of emissions is added to the dispatch decision as well

Modeling-The Dispatch Model

- ‘Dirty’ fuels – coal & petroleum coke and ‘clean’ fuels - natural gas
- Hourly cost is calculated for each unit
- Units are stacked from lowest to highest cost
- Lowest cost units are dispatched till the demand of that hour of electricity is met.
- The output variable like the energy production, units of fuel burned, total dispatch costs, and the carbon emissions can be aggregated by utility, type of plant and/or fuel type

Modeling-The UCP Model

- An economic model designed to generate policy options by using Visual Basic on Excel platform.
- Utilizing aggregate data from Dispatch model, the UCP model works bidirectional depending on set of inputs and choice of main decision variable between carbon price or FACE.

Modeling-The UCP Model

- Policy Options with FACE as main decision variable:

- Price on the carbon content in the fossil fuel generated in units of $/MT

- % adder to the existing base sales tax in Florida for comparison purpose

- Electricity price charge in the units of mills per kWh

Modeling-The UCP Model

- Policy Options with Carbon price as main decision variable:
  - the amount of FACE generated in $(M)
  - % adder to the existing base sales tax in Florida for comparison purpose
  - change in Electricity price charge (mills/kWh) as a result of carbon price

Modeling-The UCP Model

- Fixed input variables:

  - Fuel growth rate projections by the U.S. EIA
  - Demand elasticities for different fuels across different sectors in Florida
  - Heat content of different fuels
  - CO_2 emission factors for stationary combustion
  - Energy use in Florida in BBTUs (1960-2008)
  - Florida expenditure data in $(M) 1970-2008

Model Results

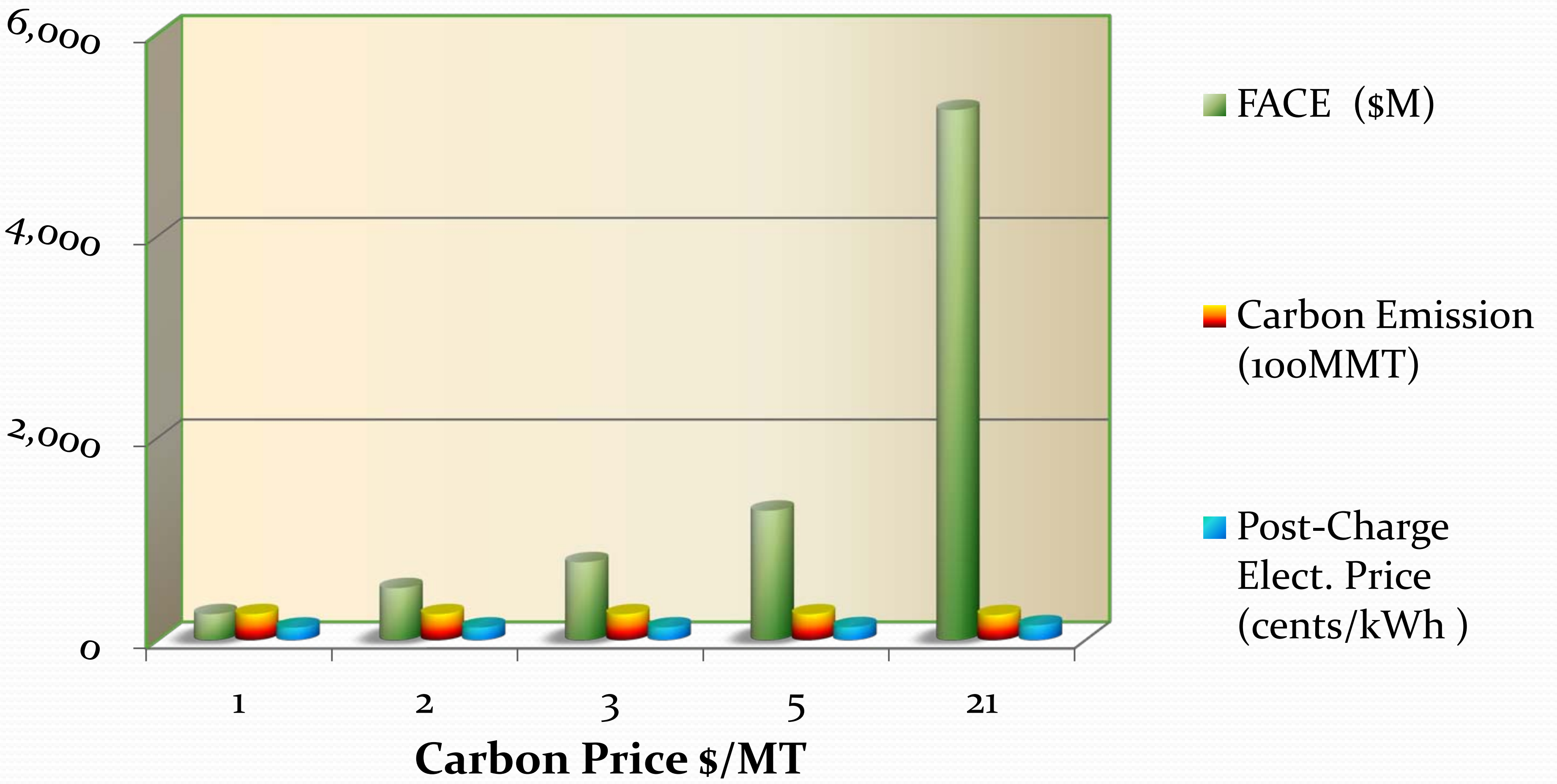
- The model was tested with different scenarios of carbon price and FACE Fund-some are presented here:
  - FACE fund of $100M
  - FACE fund of $150M
  - FACE fund of $500M
  - FACE fund of $1.00B
  - Carbon Prices ranging from $1 to $21 per MT

Results

- **Carbon Price Scenarios: Year-2012**

Carbon Price ($/MT)	FACE ($M)	Current Electricity Price- Florida Avg. ($/kWh)	Electricity Price Charge (Mils/kWh)	Post-Charge Electricity Price- Florida Avg. ($/kWh)	Sales Tax Adder (%-Addition)	Carbon Emission (MMT)
1	258.94	0.1239	1.1039	0.1250	0.0813	258.94
2	516.95	0.1239	2.2129	0.1261	0.1623	258.48
3	774.04	0.1239	3.3270	0.1272	0.2431	258.01
5	1,285.50	0.1239	5.5708	0.1295	0.4039	257.10
21	5,248.27	0.1239	24.2899	0.1482	1.6530	249.92

Carbon Price Scenarios



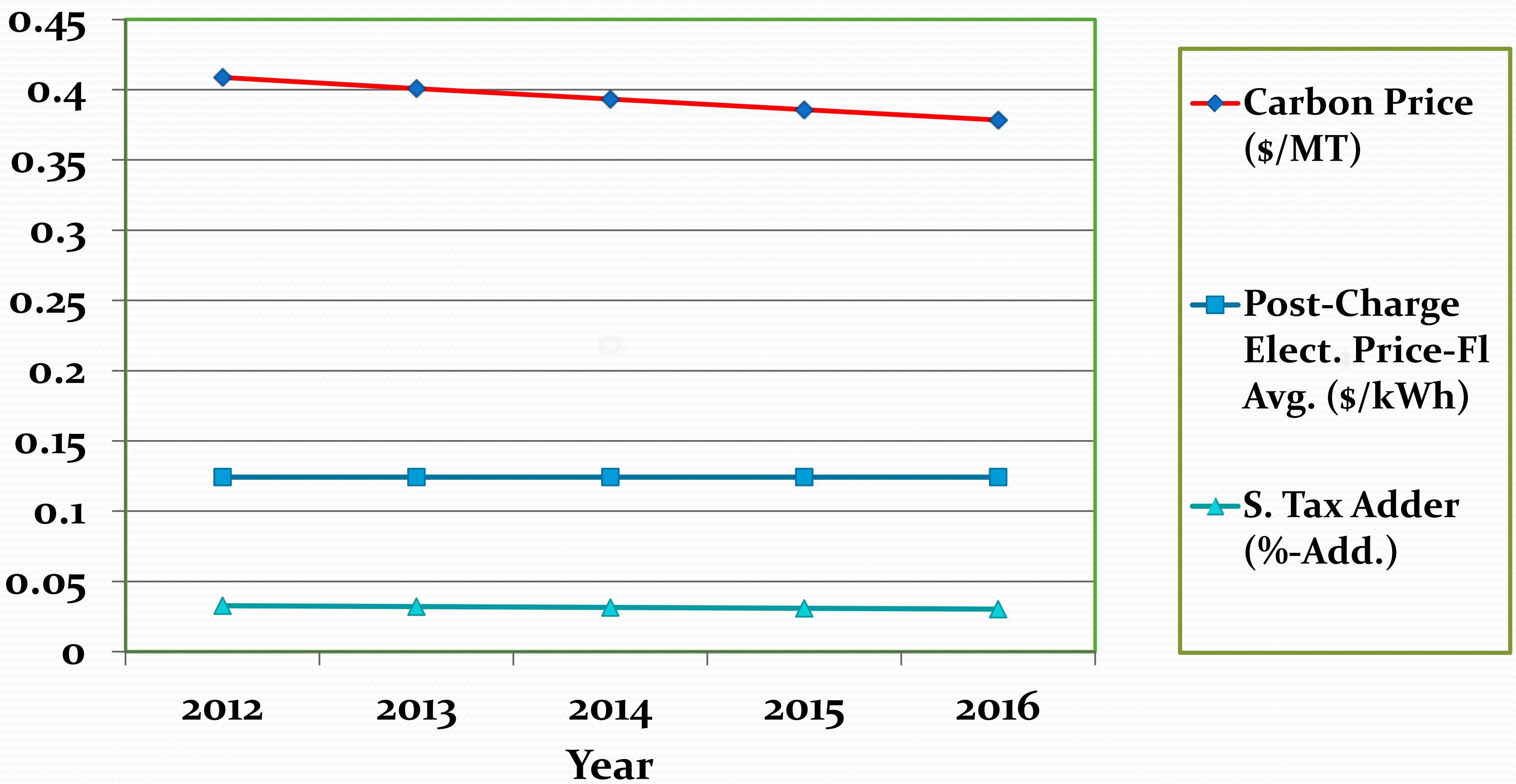
Model Results

- **FACE Fund of scenarios of $100M**

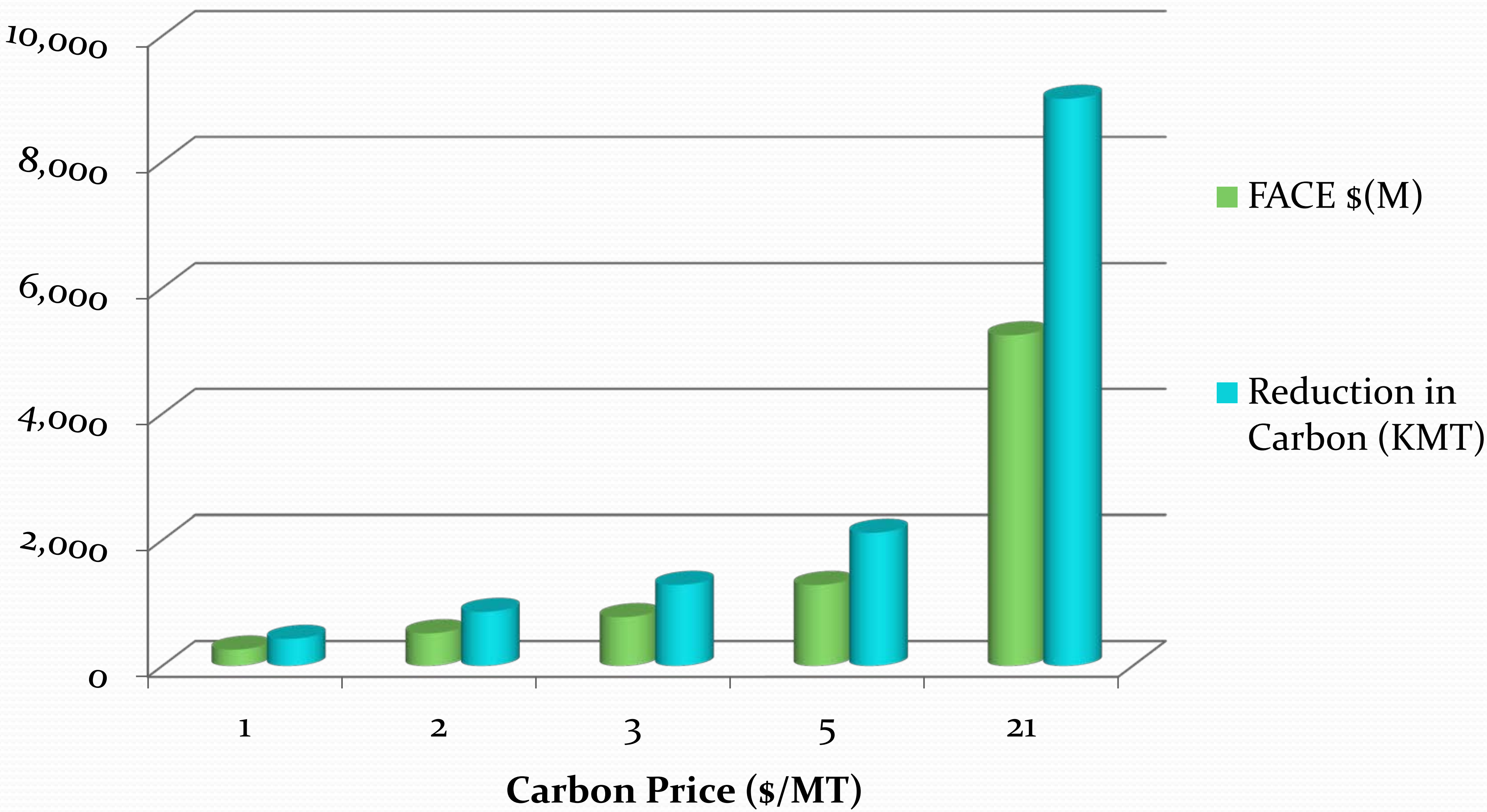
Year	Carbon Price ($/Metric ton)	Current Electricity Price-Florida Avg. ($/kWh)	Electricity Price Charge (mils/kWh)	Post-Charge Electricity Price-Florida Avg. ($/kWh)	Sales Tax Adder (%-Addition)	Carbon Emissions (MMT)	Fuel Consumption (Bbtu)
2012	0.4087	0.1239	0.4425	0.1243	0.0327	244.70	3,443,241
2013	0.4009	0.1239	0.4338	0.1243	0.0320	249.45	3,509,305
2014	0.3933	0.1239	0.4253	0.1243	0.0314	254.29	3,576,691
2015	0.3858	0.1239	0.4170	0.1243	0.0308	259.23	3,645,424
2016	0.3784	0.1239	0.4088	0.1243	0.0302	264.26	3,715,532

Model Results

- **FACE Fund of scenarios of $100M**



Model Results (2012)



FACE-Proposed Uses

- Investment opportunities
- Energy efficiency research & development
- Financing mechanism for projects
- Off-shore wind/solar/biomass
- Grants to retrofit inefficient plants
- Grants for green buildings
- Projects for sustainable development
- Grants to affected businesses and industry

Conclusions

- Carbon Price on fossil fuel at the stage of importation-Upstream Pricing
- Negligible variation in electricity generation price
- Establishment of FACE-Florida
- Reduction in Carbon emission over BAU level

Contact: Zaf (Zafar) Siddiqui
Email: zrs07@fsu.edu
Phone: (850) 320-3693