The Shadow Price of CO_2 for Nebraska Electricity Plants

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Introduction

Federal regulation of greenhouse gas (GHG) emissions in the United States is imminent. Under any of the legislative or regulatory alternatives currently being considered, power plants would have to pay, directly or indirectly, a price for their GHG discharges.

This fact is particularly relevant for Nebraska plants, as most of them rely heavily on fossil fuels for power generation. Although this is widely recognized, there is little quantitative appreciation of the potential cost that Nebraska fossil fueled power plants would have to bear to reduce their GHG emissions.

The main purpose of this research is to estimate those costs.

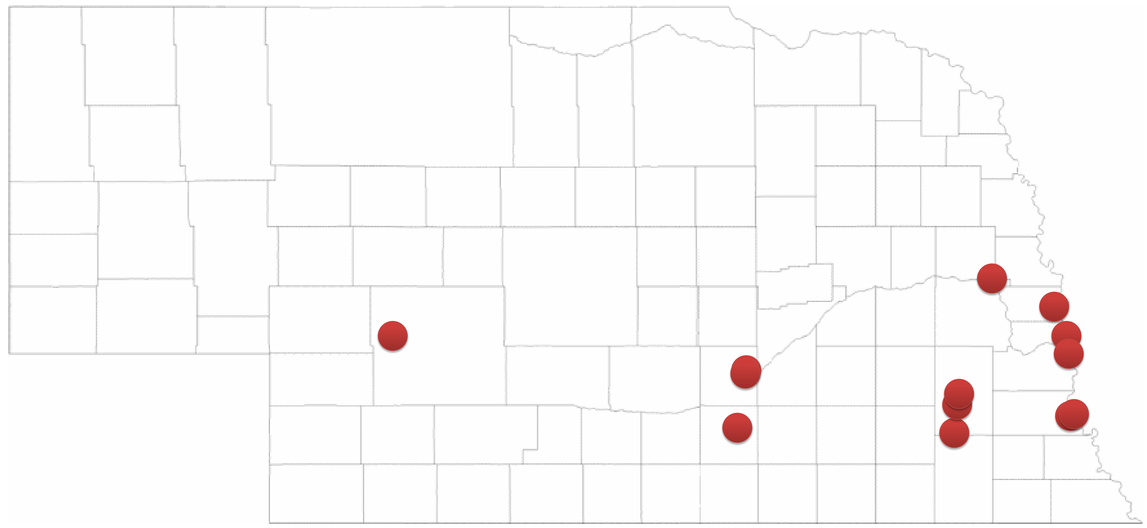
As a first step towards this goal we analyze the cost saving opportunities of Nebraska fossil fueled power plants from substitution among fossil fuels.

Method

We use Data Envelopment Analysis (DEA) to develop a model of technically efficient production.

This technique allows the simultaneous estimation of frontier technologies and individual firm efficiency measurement relative to the firms on the frontier.

A "graph measure of technical efficiency" [1] was used to measure relative technical efficiency of plants and to obtain for each a measure of output loss due to weak disposability of CO_2 emissions.



Data

Data on inputs and outputs for 13 fossil fueled power plants were obtained. These plants were responsible for 96% of total electricity generation from fossil fuels in the state of Nebraska in 2010. They are: *Gerald Gentleman, Nebraska City, North Omaha, Sheldon, Platte, Lon Wright, Whelan Energy Center, Sarpy County, Cass County, Rokeby, Archer Daniels Midland Lincoln, C W Burdick and Nebraska City # 1.*

- Inputs :
  - Plant nameplate capacity (MW). [2]
  - Quantity consumed in physical units of fuel (coal, natural gas and oil). [3]
- Outputs [4] :
  - Plant annual net generation (MWh).
  - Plant annual CO2 equivalent emissions (tons).

Results and Conclusions

Under three assumptions of returns to scale it as found that power plants are environmentally efficient (in relative terms).

In this case this implies that they can not reduce their CO_2 emissions through substitution among fossil fuels.

To do it they could consider technology options such as retrofitting existing pulverized coal plants, either through add-ons to existing plants, the rebuilding and upgrading of existing boilers to facilitate carbon capture, or increasing the thermal efficiency of existing boilers . Alternatively, they could consider repowering existing boilers with alternative fuels such as biomass or natural gas, and rebuilding existing plants with more efficient technologies.

References

1. Fare, Grosskopf and Lovell (1994). *Production Frontiers.* Cambridge University Press.

2. Source: eGRID2010, Environmental Protection Agency, http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html

3. U.S. Energy Administration Information, Form 923 http://www.eia.doe.gov/cneaf/electricity/page/eia906_920.html

4. Source: eGRID2010, Environmental Protection Agency, http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html

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