

# The Shadow Price of CO<sub>2</sub> Emissions for Nebraska Fossil-Fuel Electricity Plants

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## Introduction

The electricity sector is responsible for roughly 40 percent of U.S. carbon dioxide (CO<sub>2</sub>) emissions, and a shift away from conventional coal-fired generation is an important component of the U.S. strategy to reduce greenhouse gas (GHG) emissions.

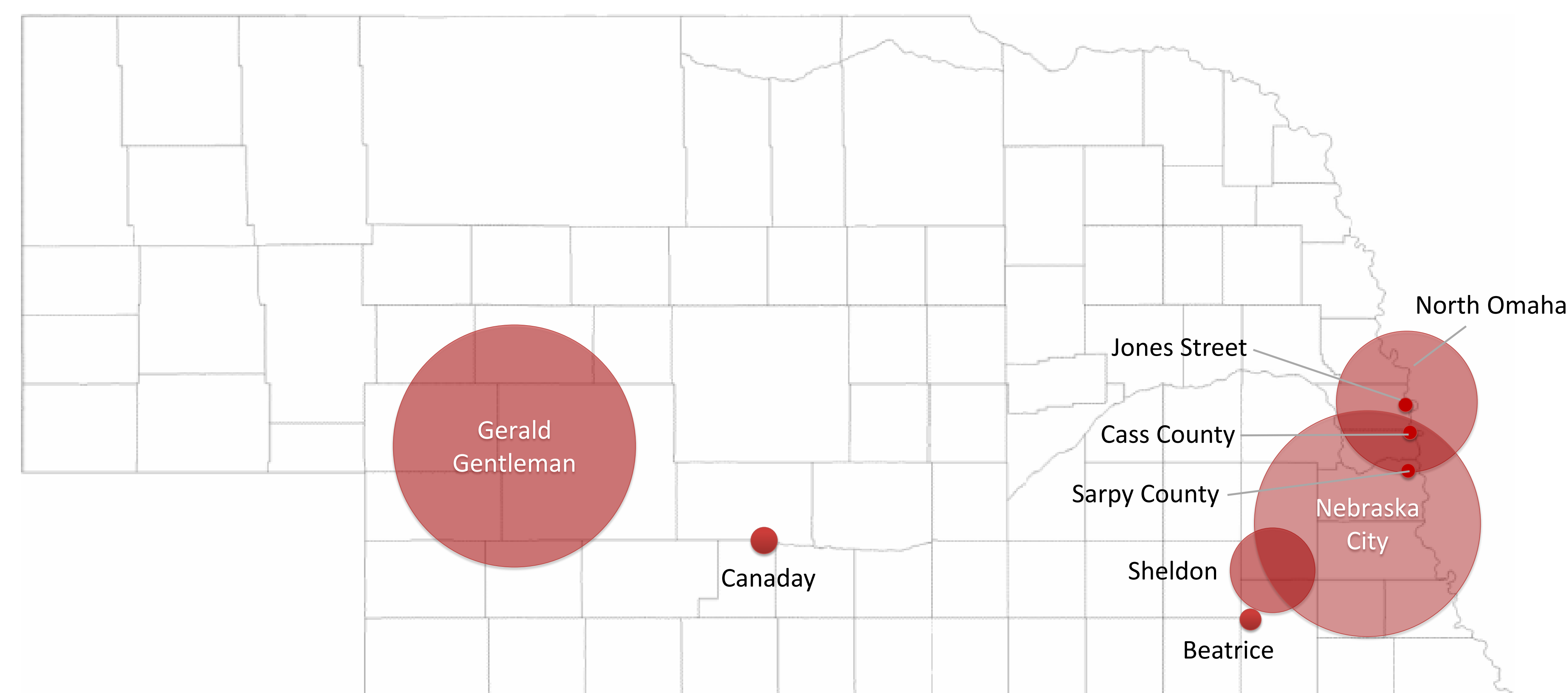
Currently, the U.S. Environmental Protection Agency (EPA) is *required* to regulate GHG emissions.

The imminent advent of GHG emissions regulations is particularly relevant for the state of Nebraska, as it's the only wholly public power state in the nation and as 67% percent of its total electricity generation is produced from either coal, oil or natural gas.

In this context it becomes imperative for Nebraska fossil-fuel power stations to determine the shadow cost of GHG emissions abatement for these plants, i.e., the per-ton cost of reducing GHG emissions. This research answers that question.

## Method

The method employed is data envelopment analysis (DEA). DEA is a non-parametric methodology that allows the simultaneous estimation of a frontier technology (a "best practice" frontier) and individual firm efficiency measurement relative to it (Färe et al., 1994; Coelli et al., 2007)<sup>1, 2</sup>.



## Data

Data on inputs quantities and prices and outputs quantities for 9 fossil fueled power plants were obtained.

These plants were responsible for 92% of total electricity generation from fossil fuels in the state of Nebraska in 2010.

They are: *Beatrice, Canaday, Cass County, Gerald Gentleman, Jones Street, Nebraska City, North Omaha, Sarpy County and Sheldon*.

- Inputs :
  - Fossil fuels quantities, expenditures on fuels, on labor, number of workers, utility plant in service at cost and accumulated depreciation.<sup>3</sup>
- Outputs :
  - Annual net generation of electricity and CO<sub>2</sub> equivalent emissions in tons<sup>4</sup>.

## Results

The shadow cost of GHG emissions abatement for these plants, i.e., the per-ton cost of reducing GHG emissions ranges from \$7 to \$43, with an average of \$21.

## References

1. Fare, Grosskopf and Lovell (1994). *Production Frontiers*. Cambridge University Press.
2. Coelli, T.J., Lauwers, L., Van Huylenbroeck, G. (2007). *Environmental efficiency measurement and the materials balance condition*. Journal of Productivity Analysis 28, 3–12.
3. Sources: U.S. Energy Administration Information, Form 923  
[http://www.eia.doe.gov/cneaf/electricity/page/eia906\\_920.html](http://www.eia.doe.gov/cneaf/electricity/page/eia906_920.html) and direct communication with NPPD and OPPD.
4. Source: EPA Clean Air Markets.  
<http://www.epa.gov/airmarkets/>

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