BCA of a Carbon Tax

In this problem you will conduct a BCA of a tax intended to correct a negative externality associated with electricity consumption. It is oversimplified in a number of ways, for example it ignores: i) complexities associated with different production technologies with differing cost structures, ii) differences in types of consumers that pay different prices, and iii) differences in actual and scheduled depreciation which cause regulated prices to differ from marginal long run average production costs. Nevertheless, done correctly, this approximation should give you a reasonable sense of the magnitude of the problem and the potential importance of addressing it.

Suppose the elasticity of demand for electricity is -0.75. The current price per kilowatt hour (KWh) in Florida is $0.12. The price is regulated so that electricity providers make only a normal return. For purposes of this problem, treat the price as approximately equal to the marginal cost of production. Current consumption in Florida is 28 KWh per person per day. Economists estimate that the marginal external cost of carbon emissions is $0.05 per KWh. The METB is 0.25.

Perform a BCA of a carbon tax in Florida equal to the marginal external cost of carbon emissions.

First, draw a figure to illustrate the impacts per Floridian under the assumptions of the problem.

Second, there are about 21.5 million Floridians. What is the annual cost to Florida's electricity consumers? The annual benefit to Florida's taxpayers? The annual benefit of decreased carbon emissions?

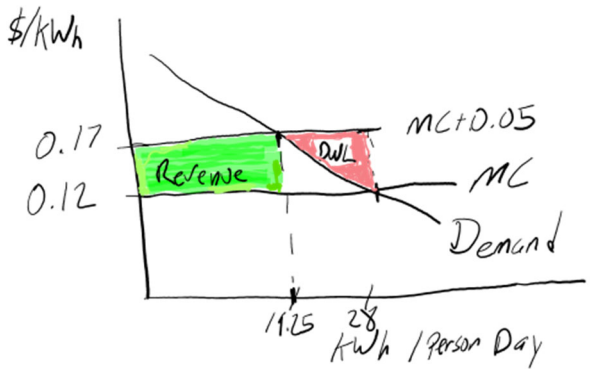
Third, if the benefits of carbon reduction are spread evenly over every resident of the world, and there are about 7.6 billion people in the world, what are the benefits of the carbon reduction to Floridians and the rest of the world, respectively?

Fourth, organize this information on annual costs and benefits by group into a neat table. Is it likely carbon, or any other pollutant, will be effectively addressed by policy on a state or local level? Why or why not? If not, what will it take to address it?

BCA of a Carbon Tax - ANSWER

A corrective tax of $0.05/KWh will raise the price to $0.17, assuming constant unit cost, a 42% increase. Thus the percentage change in quantity demanded is -31%, causing per capita consumption to fall to 19.25 KWh. The impacts per Floridian are as follows:

$\Delta CS=-0.05\times19.25-0.05\times8.75/2=-1.18125$
$\Delta PS=0$
$\Delta GS=0.05\times19.25=0.9625$
$\Delta SS=-1.18125+1.25\times0.9625=0.021875$



Since there are 21.5 million Floridians, and 365 days per year, the gain to taxpayers is about:

1.18125 per Person Day×21.5 Million People ×365 Days/Year=$9.44 Billion / Year.

Similarly, the cost to consumers is about:

1.25×0.9625 per Person Day×21.5 Million People ×365 Days/Year=$9.27 Billion / Year.

The benefits to the world of reduced carbon emissions is about:

0.05 per KWh×8.75 KWh per Person Day×21.5 M People ×365 Days/Year=$3.43B/Year.

The share of the benefits of the reduced emissions captured by Floridians is only 21.5/7600, or, 0.283%, or $9.7M/Year.

All of this is summarized in the table to the right.

Benefit or Cost	**Value ($B)**
Benefits	
Reduced Emissions - Floridians	0.0097
Reduced Emissions – Rest of World	3.4236
To Florida Taxpayers	9.4415
Subtotal	12.8738
Cost to Florida Consumers	9.2699
Net Impact to Floridians	0.1813
Net Impact to the Rest of the World	3.4236
Net Benefit	3.6049

The only reason there is a net gain to Floridians has only to do with the ability to reduce other taxes which have a METB of 0.25 per dollar raised. If the METB were lower, there would be a net cost to Floridians, and the small value of the reduced emissions captured by residents of the state would not make much difference. This, the small value of reduced emissions to Floridians, coupled with political opposition to a tax increase, even if for a good reason, means a state level carbon tax will have very little support. Generally, problems which spill over jurisdictional boundaries require solutions from a higher level, to address the impacts of the spillovers.