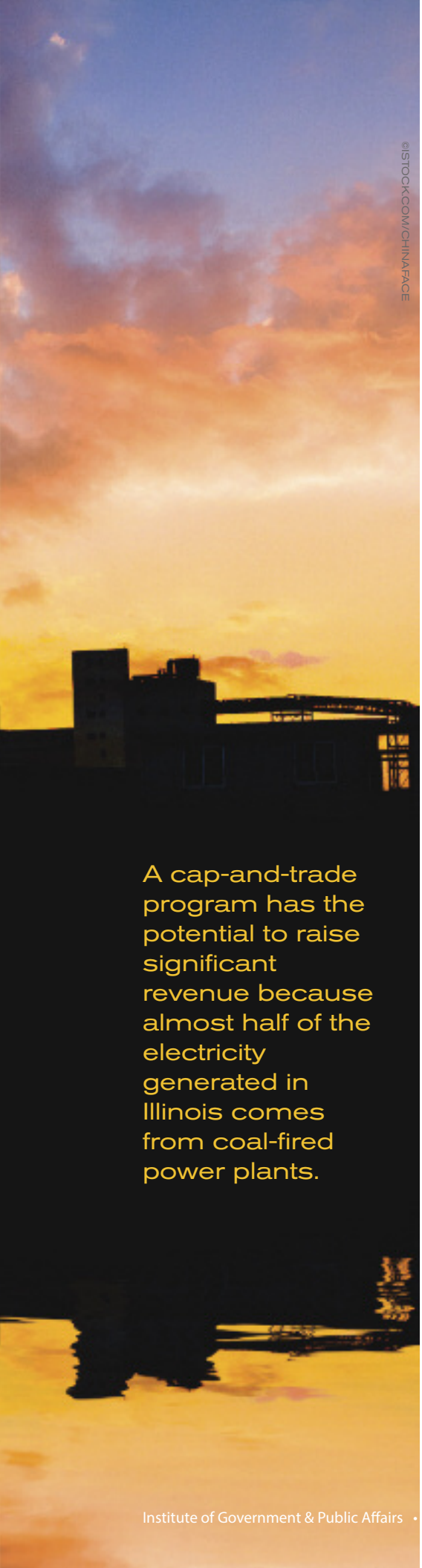
Cap-and-Trade for Illinois?

By Don Fullerton and Daniel H. Karney



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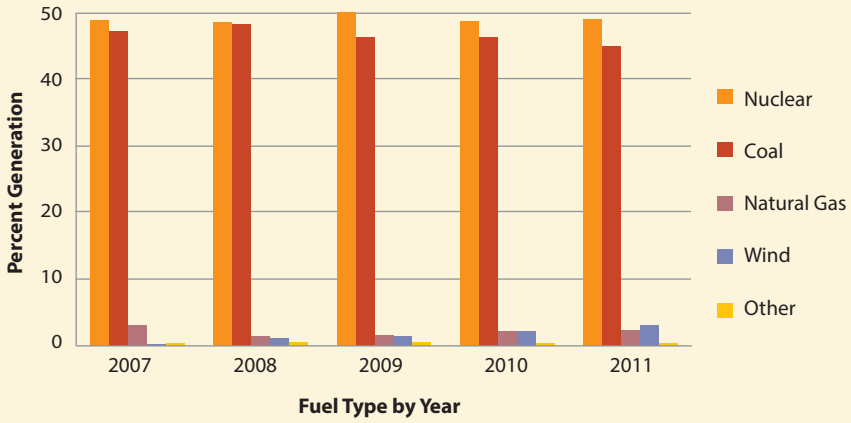
Illinois is faced with seemingly insurmountable fiscal problems. Public pensions are still not out of the woods. Bills aren't getting paid on time. The state's credit rating is in the dungeon. Ideas for curing the state's fiscal illness are many, and nearly every one of them predictably includes the need to raise more money, reduce spending, or a combination of both. One way to raise more money would be to "tax waste, not work" by creating a cap-and-trade policy for greenhouse gases (GHG). We explore that option here.

A cap-and-trade program has the potential to raise significant revenue because almost half of the electricity generated in Illinois comes from coal-fired power plants (see Figure 1). We calculate that permit auctions could raise $1 billion to $4 billion per year, with a reasonable estimate of $2 billion in the initial years. Figure 2 shows that this $2 billion would balance the budget in FY2015, and fill almost half of the projected deficits for fiscal years 2016-2018.[1]

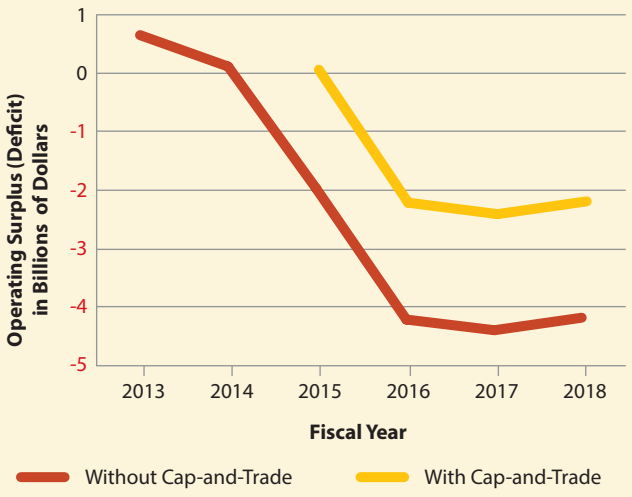
Figure 1
Percent Electricity Generation by Fuel Type in Illinois by Year



Source: Authors' calculations based U.S. Energy Information Agency state-level data on electricity generation by energy source.
Notes: Calculations include generation from independent power producers and electric utilities only.

[1] See the "State of Illinois FY2014 Budget Roadmap," from the Institute for Illinois' Fiscal Sustainability (IIFS), 2013 (available at: http://www.civicfed.org/iifs/publications/IllinoisRoadmapFY2014), or see "Peering Over Illinois' Fiscal Cliff: New Projections from IGPA's Fiscal Futures Model" by Richard Dye, Nancy Hudspeth and David Merriman, The Fiscal Futures Project, 2013 (available at: http://igpa.uillinois.edu/system/files/Fiscal-Futures-Projections-Oct-2013.pdf).

Figure 2
State of Illinois Five-Year Projections: General Funds Operating Surplus (Deficit) with and without Cap-and-Trade Revenue (2013 dollars)



Source: Author's calculations based on data from the Institute for Illinois Fiscal Sustainability. Notes: State of Illinois five-year budget projections from IIFS (2013). Potential cap-and-trade revenue based on $10 per metric ton CO_2 permit price for all fixed-point sources with emissions larger than 25,000 metric tons CO_2 annually and transportation fuels, totaling $2.0 billion annually (starting 2015).

A cap-and-trade policy could position Illinois as a political and technological leader in the fight against climate change. Businesses would gain experience operating under this new framework, ahead of possible future federal limits on GHG emissions. And Illinois could develop patentable technology to be used by other states or countries that adopt GHG emission limits.

We begin by reviewing the basic structure of a cap-and-trade policy, including the key permit auctioning protocol that generates revenue. We use California's cap-and-trade program, known as AB-32, as a model, and we base our revenue projection for Illinois on mimicking California's program. While the electricity generating companies would actually pay the state for the carbon emissions, the true economic burden for such a program would likely be shifted through higher prices, lower wages, or lower rates of return. Conventional wisdom assumes that most of the economic burden of such a program falls on electric utility customers and on workers at industries covered by the cap. In contrast, we argue that most of the economic incidence of an Illinois cap-and-trade policy would fall on out-of-state stockholders of publicly-traded electric utilities (where 62 percent of relevant annual utility emissions come from coal-fired power plants owned by public companies). Therefore, under a cap-and-trade policy such as the one described below, Illinois citizens could benefit with higher state revenue, while people and businesses outside the state might bear most of the cost through effects on their corporate stock prices.

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Program design and implementation

Implementing a cap-and-trade program is usually one part of a comprehensive plan to reduce total GHG emissions. For example, the goal of California's law AB-32 is to return to 1990 levels of greenhouse gas emissions by 2020, and the cap-and-trade element of AB-32 is integral to achieving that goal. Let's examine the basic elements of a cap-and-trade program that Illinois could implement, using California's program as a benchmark, and see how allocating and auctioning permits relates to generating revenue for the state.

Basic elements

A cap-and-trade program has two basic elements. First, the "cap" sets a limit on the total amount of GHG emissions. Second, the "trade" part of the program allows for the buying and selling of permits, where the fixed number of permits enforces the cap.

Legislative rules specify which emission sources are covered by the cap. For instance, AB-32's cap covers all fixed-point smokestack sources that emit more than 25,000 metric tons of carbon dioxide ($MTCO_2$) equivalents annually. The California law covers approximately 600 fixed-point sources, such as electric utility power plants.[2]

California uses the 25,000 $MTCO_2$ per year threshold because the U.S. EPA already requires fixed-point sources that emit more to report their emission under the Greenhouse Gas Reporting Program. According to 2011 EPA data, Illinois has 216 fixed-point, industrial plants that emit more than 25,000 $MTCO_2$, where the majority of emissions come from electric utilities' power plants.[3]

In addition, AB-32's cap covers transportation fuel distributors. In contrast to industrial sectors, commercial and private-use transportation consists of mobile emission sources such as trucks and cars. Since the cost of technology to measure emissions from the many thousands of mobile sources is prohibitive, the cap instead applies to transportation fuel directly at the distributor level.

In order to enforce the cap, the state issues "permits" so that the bearer of one permit is allowed to emit one metric ton of CO_2. Therefore, the number of permits effectively sets the cap on emissions. In the first year of a cap-and-trade program, the cap is set just below the projected business-as-usual emission level in the absence of the program. The cap then tightens over time, leading to a widening difference between actual emissions and business-as-usual emissions.

The "trade" part of the cap-and-trade program allows for the buying and selling of permits.[4] Supply and demand determine the market price of a permit. The supply of available permits rises when a business can forgo emitting carbon dioxide or other GHGs because they've taken steps to reduce emissions – and that's the point. Abatement could include: (1) capital improvements that increase fuel efficiency, (2) switching from high-carbon to low-carbon fuels, and (3) carbon capture and storage (CCS) technology such as the FutureGen project here in Illinois.

The demand for permits comes from the desire to emit GHGs that coincide with the production of a valuable good or service. For example, burning coal in a power plant generates valuable electricity. Thus, the market price of a permit is the value of emitting one unit of carbon dioxide, and it also reflects the cost of abating one unit of carbon dioxide. The market mechanism ensures that businesses undertake low-cost abatement opportunities in order to sell excess permits. It also means that producers of high-value commodities and services can continue to operate, even if abatement is costly, by instead buying permits.

A carbon tax is another market-based mechanism that can be used to reduce GHG emissions and to raise revenue. With no uncertainty about either the supply or the demand for permits, a carbon tax and cap-and-trade program would yield identical outcomes. However, when supply and demand are uncertain, a cap-and-trade program has the advantage of setting an upper-bound on total amount of GHG emissions.[5] Thus, when the cap is tightened over time, a cap-and-trade program guarantees a reduction in total GHG emissions. Alternatives to market-based approaches can also reduce GHG

[2] The law refers to $MTCO_2$ "equivalents," because carbon dioxide is not the only GHG; however, we drop "equivalents" and refer only to GHGs or CO_2 interchangeably. Each greenhouse gas has a different global warming potential (GWP) index that determines how much heat is trapped per unit of gas during its lifetime in the atmosphere. The six major types of GHGs are carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. The GWP for each gas is relative to the GWP of carbon dioxide. For instance, the GWP of carbon dioxide is 1, while the GWP for methane is 21 (according to the conversion rate in AB-32).

[3] Illinois has a few plants over the emissions threshold in other industrial sectors such as food, chemical, iron and steel, cement, and petroleum.

[4] In general, businesses covered by the cap participate actively in the market for permits, but financial services agencies also buy and sell permits in order to act as brokers and market-makers.

[5] In theory, a permit price can fluctuate from very low to very high, depending on economic conditions and the stringency of the cap. In response, AB-32 and other cap-and-trade programs institute a lower-bound and upper-bound on the permit price, where the state acts as a buyer and seller of last resort. The banking and borrowing of permits is another means of reducing price fluctuations.

emissions. Known as command-and-control (CAC) regimes, these non-market approaches instead mandate where and how abatement must be achieved. Without businesses acting in their own self-interest to maximize profits, however, CAC regimes have a difficult time allocating abatement and production efficiently across many diverse sources. Thus, CAC regimes are inefficient and lead to a higher social cost per unit of GHG reduction. Perhaps more importantly, they do not raise revenue.

Auctioning permits and raising revenue

Before trading can occur, permits must be allocated by the state government to initial recipients. Cap-and-trade programs generally use two different methods for allocating permits. The first "grandfathers" or hands out valuable permits for free to businesses in covered industries, where the number of permits per business is based on historic GHG emissions rates and then prorated so that the total number of grandfathered permits matches the cap. This method generates no revenue, as the state gives permits to businesses. Indeed, polluting businesses effectively receive a lump-sum payment for emitting greenhouse gases in the past.

The second method is to sell the permits at an auction conducted by the state. The revenue from the auction can be used to bolster the state's treasury. California's AB-32 currently uses a mix of grandfathering and auction methods, but over time it will shift mainly to auctioned permits. In the first year alone, California has raised more than $500 million from permit auctions, with a permit price slightly above $10 per $MTCO_2$.[6] Interestingly, although the two methods have different initial permit allocations, permit trading can lead to identical production and abatement outcomes for businesses.[7] The difference comes down to whether the state raises revenue with an auction, or businesses are given valuable permits for free.

How much revenue could a cap-and-trade program raise? Assuming that an Illinois program would be similar to AB-32 and auction all the permits, we expect such a program to generate approximately $2 billion annually in the initial years. AB-32 requires a 2 percent annual emissions reduction in the initial years, and the permit auctions for those years cleared about $10 per permit. We therefore assume that Illinois also could achieve 1 percent emissions reduction for each $5 increment in the permit price: That is, a $10 per metric ton price would yield a 2 percent reduction, while a $20 per metric ton price could result in a 4 percent reduction in GHG emissions. Then the total revenue is calculated by multiplying the permit price by the total emissions under the cap.

How much revenue could a cap-and-trade program raise? Assuming that an Illinois program would be similar to California's, and auction all the permits, we expect such a program to generate approximately $2 billion annually in the initial years.

Table 1 presents three different initial-year estimates of revenue from a cap-and-trade program in Illinois under full permit auctioning. We break the calculation into two parts: fixed-point and mobile-source. To begin, we observe that the 216 industrial plants in Illinois with annual emissions greater than 25,000 $MTCO_2$ emit about 140 million $MTCO_2$ in total per year (using 2011 EPA Greenhouse Gas Reporting Program data).[8] In the first row of Table 1, we apply a 1 percent reduction to these fixed-point emissions and multiply by $5 per permit, so that revenue from auctioning permits to cover fixed-point emissions would be $693 million. Next, we note that the transportation sector in Illinois emits about 67 million $MTCO_2$ from mobile-sources annually (using 2010 U.S. Energy Information Agency (EIA) data).[9] Again, applying the 1 percent reduction to the total mobile-source emissions level and multiplying by $5 per metric ton permit, we calculate that revenue from auctioning permits to cover

Table 1
Initial Year Estimates of Revenue from a Cap-and-Trade Program in Illinois under Full Permit Auctioning (2013 dollars)

Scenario	Permit Price ($/metric ton) [1]	Emissions Reduction (percent) [2]	Fixed-Point Revenue ($ billion) [3]	Mobile-Source Revenue ($ billion) [4]	Total Revenue ($ billion) [5]
1	5	1.0	0.69	0.33	1.02
2	10	2.0	1.37	0.66	2.03
3	20	4.0	2.69	1.29	3.97

Notes: All figures are subject to independent rounding. Assumptions: (a) Baseline fixed-point source emissions are 140 million MTCO2; (b) Baseline mobile-source emissions are 67 million MTCO2; (c) Emission reduction percentages are directly proportional to the permit price, where each $5 of permit price results in a 1.0 percent emission reduction.

mobile-source emissions would accrue $331 million, yielding a total of $1.02 billion. Exact revenue totals depend on many factors, including: the percentage of permits auctioned, the tightness of the cap, and economic growth in covered industries under the business-as-usual scenario.

Scenario 2 in the second row of Table 1 presents the case with $10 per permit for a 2 percent reduction in emissions. The permit price is doubled from $5 per metric ton to $10 per metric ton, but the revenue is not quite doubled because the number of tons falls by 2 percent instead of 1 percent. Scenario 3 has a $20 permit price with a 4 percent emissions reduction, so revenue is up from $2 billion to $3.97 billion per year.[10]

As a cap-and-trade program goes on for many decades, revenue in real terms after accounting for inflation can rise or fall depending on (1) changes in the economy toward low-carbon industries, (2) interactions with other federal or state programs to reduce GHG emissions, and (3) technological change (whether induced by the cap-and-trade program or unrelated to it).

Economic incidence and distributional effects

A cap-and-trade program puts the statutory burden on producers that emit greenhouse gases and on distributors of transportation fuels. For example, a coal-fired power plant's operator must purchase a permit for each metric ton of CO_2 that the plant releases from its smokestack. Because of changes in behavior and changes in prices, however, other producers or consumers could bear the

[6] See http://online.wsj.com/news/articles/SB10001424127887323734304578541822111512316, or http://www.arb.ca.gov/cc/capandtrade/auction/auction.htm.

[7] Fullerton, Don (2001), "A Framework to Compare Environmental Policies," *Southern Economic Journal* 68(2): 224–248.

[8] Data retrieved from www.ghgdata.epa.gov (from September 2013).

[9] Data retrieved from http://www.eia.gov/environment/emissions/state/state_emissions.cfm (from September 2013).

[10] The price of $20 per metric ton is approximately the price faced by electricity producers in Europe's Emission Trading System (EU-ETS) from 2005-2011. However, prices fell during 2012 and 2013, so as of late 2013 the carbon price in EU-ETS was slightly less than $10 per metric ton. Meanwhile, $5 per metric ton is slightly higher than the permit price in the Regional Greenhouse Gas Initiative (RGGI) cap-and-trade program that covers the northern portion of the United States.

economic burden (or "incidence"). For instance, while the company that owns the coal-fired power plant must buy the permits, it may be able to pass all of the higher production cost to consumers through higher electricity prices. In that case, consumers may bear the entire economic incidence. Since low-income families spend a relatively large portion of their income on necessities like electricity, a cap-and-trade program that leads to higher electricity prices could have a regressive economic burden. (In contrast, the U.S. graduated income tax is a progressive policy that places a higher proportional burden on high-income families.)

Contrary to the conventional wisdom that carbon pricing would raise prices, we expect a cap-and-trade program in Illinois would not increase local electricity rates significantly.

Distributional effects of a cap-and-trade program include higher prices of carbon-intensive products like electricity, changes in the wage rate at covered industries, and capitalization of higher costs of production into stock prices.[11] For reasons explained below, the last path reflects most of the economic burden, and thus the cost of the program is shifted to stockholders of businesses in covered industries, most of whom live outside Illinois.

Output prices: Electricity

Contrary to the conventional wisdom that carbon pricing would raise prices, we expect a cap-and-trade program in Illinois would not increase local electricity rates significantly. The reason is that wholesale markets determine the electricity price for those customers, using real-time metering, and those rates depend upon the cost of production at the *last* power plant that comes online.[12] In Illinois, the carbon-intensive coal-fired power plants are used earlier in the dispatch order.[13] Instead, the relatively low-carbon natural gas plants are the last ones to come online and effectively set the price. Per unit of electricity, natural gas-fired power plants are approximately 60 percent less carbon-intensive than coal-fired power plants.[14] Then a cap-and-trade program leads to a relatively small cost increase at natural gas plants that set the electricity price. However, if natural gas plants effectively set the price, just breaking even, then the market price of electricity may be too low to cover the higher cost of producing electricity in carbon-intensive coal-fired plants. Seventeen of the 20 coal-fired power plants in Illinois with annual emissions above the 25,000 $MTCO_2$ threshold are owned by publicly-traded companies. Furthermore, these 17 plants account for 62 percent of annual fixed-point emissions from sources above the reporting threshold in Illinois. As a consequence, the nationwide stockholders of those firms may take a loss.[15]

Input prices: Labor

Another concern is the potential effect on the wages and job security of workers in covered industries. Workers at electric utilities and coal mines often get mentioned as potential losers, but we show that the economic burden via this path also is smaller than what most people may think. Power plants are long-term investments that are difficult to replace in the short-run. A cap-and-trade program might encourage a slightly earlier retirement of coal-fired power plants, to be replaced by gas-fired power plants, and workers can gradually move from old to new generation facilities. For coal miners, the effects will be small because Illinois power plants will still demand coal, and power plants in other states without GHG limits will still demand coal. However, Illinois could use some of the permit revenue to create a retraining program for displaced miners (if that specific industry is hit hard by the cap-and-trade program).

Capitalization: Stock prices

If higher production costs cannot be passed on to consumers via higher electricity prices, or to workers via lower wages, then the result is reduced profits in the covered industries. Reduced profitability lowers the value of a business, and a publicly-

traded company's stock price would probably fall. Large companies have many stockholders around the world, and they may have well-paid lobbyists operating in Illinois, but only a small fraction of their owners live in Illinois. In terms of magnitude, for a $10 permit price, the publicly-traded company that owns the greatest share of coal-fired power plants in Illinois would incur a 2.5 percent burden relative to annual revenue.[16]

An option to consider

Illinois has a significant fiscal crisis, with projections for multi-billion dollar budget deficits. Yet, a reasonable cap-and-trade program to reduce greenhouse gas emissions could significantly reduce future deficits. Specifically, under a program similar to California's AB-32, a full auction protocol could raise $2 billion annually in the initial years of a cap-and-trade program. Most of the economic burden of the program would fall on stockholders of the covered industries, and most of those stockholders live outside Illinois. In addition, Illinois businesses could gain experience operating in a GHG-limited environment ahead of possible future federal limits. Illinois researchers could invent patentable technologies that other states and countries would want in their later efforts to reduce GHGs. Implementing a revenue-raising cap-and-trade program mitigates the need to revoke the sunset provisions on the income and corporate tax rates or to increase the state's sales tax.

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[11] Fullerton, Don (2011), "Six Distributional Effects of Environmental Policy," *Risk Analysis* 31(6): 923–929.

[12] The wholesale markets are the JPM Interconnect (northeast Illinois) and the Midwest ISO (remainder of the state). For customers without real-time metering, the Illinois Power Agency procures electricity for Ameren and ComEd customers and thus determines a fixed per unit electric price.

[13] Nuclear plants have the lowest marginal cost and are first in the order, while coal and gas-fired plants come later in the dispatch order. It might be a concern that a cap-and-trade program would change the order so that coal-fired plants would be the last ones to come online. However, technological constraints make it difficult for coal-fired plants to turn on and off quickly (i.e. cycle). The plant is either operating all the time or not at all, so it is never just sitting ready to be next in the dispatch order.

[14] The U.S EIA estimates that the average coal-fired steam generator has a fuel efficiency rate slightly above 10,000 Btu per kilowatt-hour (noting a higher number means lower efficiency). In contrast, it estimates that the average natural gas-fired combined cycle has a fuel efficiency rate of slightly above 7,500 Btu per kilowatt-hour; that is, the gas-fired plant is approximately 25 percent more fuel efficient. In addition, natural gas is just less half as carbon intensive as coal per unit of energy. The U.S. EIA reports that when combusted natural gas produces 117 pounds of CO_2 emitted per million Btu, while coal produces 205.7 to 228.6 pounds of CO_2 emitted per million Btu depending on coal type (e.g. bituminous). Multiplying fuel efficiency times the fuel's CO_2 content yields CO_2 per unit of electricity.

[15] If the remaining small electricity price increase is still deemed too onerous, then Illinois can institute a rebate program to assist low-income families in order to mitigate the burden. In addition, the price of gasoline would also increase under a cap-and-trade program. However, many of the lowest-income families do not own cars, thus mitigating concerns about regressivity via gasoline prices. Instead, local public transit systems may require a transfer from the state to cover higher fuel costs.

[16] Midwest Generation EME LCC is a subsidiary of Edison International (NYSE:EIX), which has annual revenue of nearly $13 billion. Their seven coal-fired power plants in Illinois emit approximately 30 million metric tons of CO_2 annually, so a $10 per metric ton price means $300 million dollars, or 2.5 percent of revenue. Other smaller companies may incur higher burdens as a share of revenue.