Final Report

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FINAL REPORT

PROFESSIONAL SERVICES CONTRACT EDS#A302-9-PSC-CTR-005

As required in Exhibit A of the subject contract, this final report covers work performed during the duration of the contract (March 1, 2009 – March 1, 2010). This report is due within 30 days of the contract termination date of March 1, 2010.

The report is in two sections. Section 1 describes the work done from March 1, 2009, to September 10, 2009. Deliverables included:

(1) "Estimating the State and Regional Benefits of the Mining and Use of Illinois Basin Coals," Presentation at the Vincennes meeting of the Center for Coal Technology Research Advisory Panel Board, September 10-11, 2009.

(2) "Estimating the State and Regional Benefits of the Mining and Use of Illinois Basin Coals," a report submitted to CCTR September 2009 (included as Section 1 of this report).

Section 2 describes the work done from September 10, 2009, to March 1, 2010. Deliverables included:

(1) "The Impact of Alternative CO_2 Limiting Legislative Designs on Indiana," Presentation at the Indianapolis meeting of the Center for Coal Technology Advisory Panel Board, March 4, 2010.

(2) "The Impact of Alternative CO_2 Limiting Legislative Designs on Indiana," a report submitted to CCTR March 2010 (included as Section 2 of this report).

SECTION 1.

ESTIMATING THE STATE AND REGIONAL BENEFITS OF THE MINING AND USE OF ILLINOIS BASIN COALS

A. MOTIVATION

The coming economic problems for coal caused by the apparently inevitable passage of some form of CO_2 control legislation makes it important for policymakers to have a clear idea of what is at risk in our region when such legislation goes into effect.

As this report makes clear, the economic impact of the mining of Illinois Basin coal alone vastly understates the value to the region of the activity, because much of the region's coal is used within the region to generate electricity. If all the coal mined was simply exported, the value of the mining to the three-state region would be a bit over $7 billion, including the effect of the regional mining multipliers. The value, taking into account the use of that coal within the region to generate electricity, is almost three times that - $18.2 billion, taking into account the electricity multipliers for the coal so used.

This figure does not include the impact on the region of the likely loss of our region's electricity cost advantage relative to other states, as the electricity-intensive industries choose to locate elsewhere. In a previous study, the over-representation of electricity intensive industries in Indiana, certainly due in part to Indiana's lower electricity prices, was estimated to be in the neighborhood of $13 billion [1]. How much of this total would leave with the disappearance of Indiana's electricity cost advantage is unclear, since other factors enter into industry location decisions besides electricity costs.

This does not mean that if regional coal production disappeared, the loss to the three-state economy would permanently be $18.2 billion. Certainly other industries would eventually move in and employ the miners put out of work, and other sources of coal outside the area would be found to replace the local coals at regional power generating stations. What it does represent is the current contribution to the three-state economy of coal and coal use to generate electricity within the region. As such, it can be used by coal advocates as they compete for the attention of government officials interested in the promotion of the region's growth.

To put these numbers in perspective, the average value of the corn produced in the three-state region including the impact of the crop multiplier (see the Methodology section below) for the 2006 and

2007 growing seasons was a bit over $26 billion [2]; the value for soybean production was $13 billion[1] [3].

B. METHODOLOGY - INDIVIDUAL STATE TOTALS

The methodology starts with estimates of coal production in the region in 2007, the base year chosen for the study. All Illinois, Indiana, and Western Kentucky coal production data are taken from EIA 2007 data contained in their table "Domestic Coal Distribution 2007 by Origin State - Total" [5]. The same table presents the tonnage used within the state by utilities, industrial users, and the tonnage exported to other states by state destination.

B.1 THE VALUE OF COAL EXPORTED FROM THE STATE

Each state's exports [6] were multiplied by an estimate of the revenue per ton for that state, taken from EIA 2007 data contained in their table "Average Open Market Price of Coal by State and Coal Rank, 2007" [7]. The open market average was assumed to be representative of the price of coal exports, since 83%, 90%, and near 100% of Illinois, Indiana, and Kentucky coal sales respectively are open market.

These export values were then multiplied by each state's coal mining multiplier value, as contained in BEA RIMS II Multiplier Table 2.5, "Total Multipliers for Output, 2006" [8]. (2007 data were not available at the time of the study.) These multipliers estimate the total economic impact of additional production in a given sector of a regional economy, taking into account that the production of a commodity gives rise to a second round of spending within the region by those receiving income from the production, which in turn gives rise to a third round of spending within the region by those that sell to those whose incomes arise directly from production, and so forth. These multiplier values take into account the additional money spent within the economy only. Thus, if all those associated with coal mining activity in Indiana lived across the river in Kentucky and spent all their incomes there, the Indiana multiplier would be 1.0 - only the initial contribution adds value in Indiana.

In fact, the state multipliers for mining are in the range of 1.9 to 2.1.

[1] These numbers do not reflect the value added by further corn and soybean processing within the states; roughly 50% of Indiana corn production is used within the state - 20% for animal feed, and 30% for further conversion to corn products, such as sweeteners and ethanol; the remainder is exported [4].

B.2 THE VALUE OF COAL USED TO GENERATE ELECTRICITY WITHIN THE STATE

The value of the coal converted to electricity within each state is calculated in a conceptually similar fashion. The calculation has four steps.

First, the amount of electricity generated by the use of such coals is calculated first by converting the coal tonnage used to generate electricity [9] into energy by using the 11,800 btu/lb average energy content for Illinois Basin Coal used by the EIA in their "Coal News and Markets" reports [10].

Second, the btu values so obtained are divided by 10,067 btu/kwh, the average heat rate of pulverized coal units using such coal in Indiana, taken from FERC forms 1 and 767 to obtain the kwh generated from the coals [10]. Thus, Indiana unit heat rates are assumed to be representative of all units in the region burning Illinois Basin Coals, since Illinois Basin coals do not differ that much across state lines with regard to the coal characteristics that influence such heat rates.

Third, the kwh total is multiplied by the average retail price of electricity in each state as reported in the EIA Table "Average Retail Price for Bundled and Unbundled Consumers by Sector, Census Division, and State" for 2007 [11], to obtain the dollar value of the electricity generated from the use of coal mined in the state.

Finally, this total dollar value is multiplied by each state's utility sector multiplier [8] to obtain the contribution of the generation to the state's economy.

B.3 THE VALUE OF COAL USED TO IN THE STATE INDUSTRIAL SECTOR

The overwhelming majority of the coal used in non-utility sectors is used to generate or co-generate electricity, according to Indiana studies. Thus, the same method is used in the Industrial sector to value such coal use [12] as is used in the utility sector, except the retail price is not the average for all sectors, but each state's industrial sector retail price. The logic of this approach is that if the industrial sector did not generate its own electricity, it would have to purchase it from the utilities, and it is this avoided cost that is used as the basis for the analysis. Since a very small amount of coal - about 6% of the total - is used by the Industrial sector, this simplification is appropriate.

C. METHODOLOGY - COMBINED THREE STATE IMPACT

While the approach used is the same as the approach used to calculate the impact of coal on each state individually, the data used differs in two substantial ways.

First, exports from the region are less than the sum of each state's exports because a substantial amount of coal exported by each state is sent to other states within the region. For instance, two-thirds of the coal exported by Indiana goes to Illinois. Fortunately, the EIA data indicate the destination of coal shipments from states, so the correction is an easy one to make.

Second, the regional multipliers are greater than each state's multipliers, since there is less "leakage" from the three states than from any individual state. For instance, the utility multiplier for Indiana is 1.49, while it is 1.63 for the region as a whole.

Otherwise, the calculations are identical, and, as expected, the regional impact is 17% higher than the sum of the three states' individual impact totals.

D. RESULTS OF THE ANALYSIS

D.1 INDIANA ALONE

As Figure 1-1 shows, Indiana mined 34.8 million tons of coal in 2007.

Figure 1-1. Indiana Coal Production

Indiana mined 34.8 million tons of coal in 2007. Of this:

(a) 2.94 million tons were exported at an average price of $28.79/ton, a total export value of $84.8 million. Applying the Indiana coal mining multiplier of 1.959, the total amount of economic activity arising from the mining of this coal was $166 million.

(b) 29.8 million tons were converted into electricity in Indiana, resulting in the generation of an estimated 70e9 kwh, and sales of $4,541 million. Applying the Indiana utility multiplier of 1.49, the total amount of economic activity arising from the use of coal was $6,766 million.

(c) 2 million tons were used by Indiana industry, the bulk to generate or co-generate electricity. Using the same factors as in (b) above, except using the industrial rate to value the electricity, the total avoided cost was $232 million, and the total including the multiplier was $347 million.

Of this, 2.94 million tons were exported to other states at an average price of $28.79 per ton, assuming the Indiana average price per ton for exports was equal to the state average open market price, a reasonable assumption since 83% of export sales in Indiana were open market sales, according to the EIA. Thus, the estimated value of Indiana exports to other states would be $84.8 million. Using

the BEA mining multiplier of 1.959 for Indiana, this means an estimated $166 million of economic activity in Indiana can be attributed to the mining and export of Indiana coal.

An additional 29.8 million tons were converted to electricity by Indiana utilities. Using the EIA average btu/lb for Illinois Basin Coals of 11,800 btu/lb, this tonnage is equal to a total energy content of 7e14 btu. To calculate the amount of electricity generated by this energy, the total needs to be divided by the average heat rate in btu/kwh for generators burning coal in Indiana, 10,067 btu/kwh, taken from FERC forms 1 and 767. This division results in an estimate of 70e9 kwh generated by Indiana coals in Indiana. Multiplying this by the average retail price/kwh for electricity in Indiana, this corresponds to an estimate of $4,541 million for the sale of electricity in Indiana generated by Indiana coals. Using the BEA utility multiplier of 1.49 for Indiana, this means an estimated $6,766 million of economic activity in Indiana can be attributed to the mining and use of Indiana coals to generate electricity in the state.

Finally, 2 million tons of coal mined in Indiana was used by Indiana industry, the bulk used to generate or co-generate electricity. Coal used for coke production by Indiana's steel industry is brought in from the southeast. Since the tonnage of coal used in this way is relatively minor, the assumption is made that the economic activity represented by this use is equal to that arising if the electricity had been purchased from Indiana utilities, rather than generated internally. Using the same factors as described in the preceding paragraph, except using the industrial, rather than the residential, commercial and industrial sector average price, this means that as estimated $347 million of economic activity can be attributed to the mining and use of Indiana coals in Indiana's industrial sector.

The total estimated amount of economic activity arising from these three uses of Indiana coal in Indiana, including the multiplier effect, is then $7,279 million, or 3% of Indiana Gross State Product [13].

This amount without the multiplier effect is $4,278 million, or 6% of Indiana GSP originating in the manufacturing, utilities, agriculture, and mining sectors [13].[2]

[2] It is not proper to express the value of economic activity including the multiplier as a percent of economic activity originating in the four sectors, since the multiplier reflect activity in sectors other than the four.

D.2 ILLINOIS ALONE

As Figure 1-2 shows, Illinois mined 34 million tons of coal in 2007.

Figure 1-2. Illinois Coal Production

Illinois mined 34 million tons of coal in 2007. Of this:

(a) 26.7 million tons were exported at an average price of $33.60/ton, a total export value of $896 million. Applying the Illinois coal mining multiplier of 2.109, the total amount of economic activity arising from the mining of this coal was $1,890 million.

(b) 4.16 million tons were converted into electricity in Illinois, resulting in the generation of 9.74e9 kwh, and sales of $824 million. Applying the Illinois utility multiplier of 1.57, the total amount of economic activity arising from the use of coal was $1,294 million.

(c) 3.3 million tons were used by Illinois industry, the bulk to generate or co-generate electricity. Using the same factors as in (b) above, except using the industrial rate, rather than the average rate, the electricity avoided cost was $467 million. Using the Illinois multiplier of 1.57, the estimated total economic activity was $733 million.

Of this, 26.7 million tons were exported to other states at an average price of $33.60 per ton, assuming the Illinois average price per ton for exports was equal to the state average open market price, a reasonable assumption since 90% of export sales in Illinois were open market sales, according to the EIA. Thus, the estimated value of Illinois exports to other states would be $896 million. Using the BEA mining multiplier of 2.109 for Illinois, this means an estimated $1,890 million of economic activity in Illinois can be attributed to the mining and export of Illinois coal.

An additional 4.16 million tons were converted to electricity by Illinois utilities. Using the EIA average btu/lb for Illinois Basin Coals of 11,800 btu/lb, this tonnage is equal to a total energy content of 0.98e14 btu. To calculate the amount of electricity generated by this energy, the total needs to be divided by the average heat rate in btu/kwh for generators burning coal in Illinois, taken to be the average for Indiana units burning Illinois Basin coal, 10,067 btu/kwh. This division results in an estimate of 9.75e9 kwh generated by Illinois coals in Illinois. Multiplying this by the average retail price/kwh for electricity in Illinois, this corresponds to an estimate of $824 million for the sale of electricity in Illinois generated by Illinois coals. Using the BEA utility multiplier of 1.57 for Illinois, this means an estimated $1,294 million of economic activity in Illinois can be attributed to the mining and use of Illinois coals to generate electricity in the state.

Finally, 3.3 million tons of coal mined in Illinois was used by Illinois industry, the bulk used to generate or co-generate electricity. Since the tonnage of coal used in this way are relatively minor, the assumption is made that the economic activity represented by this use is equal to that arising if the

electricity had been purchased from Illinois utilities, rather than generated internally. Using the same factors as described in the preceding paragraph, except using the industrial, rather than the residential, commercial and industrial sector average price, this means that as estimated $733 million of economic activity can be attributed to the mining and use of Illinois coals in Illinois's industrial sector.

The total estimated amount of economic activity arising from these three uses of Illinois coal in Illinois, including the multiplier effect, is then $3,917 million, or 0.6% of Illinois Gross State Product [13].[3]

This amount without the multiplier effect is $2,187 million, or 2.1% of Illinois GSP originating in the manufacturing, utilities, agriculture, and mining sectors [13].

D.3 WESTERN KENTUCKY ALONE

As Figure 1-3 shows, Western Kentucky mined 27.9 million tons of Illinois Basin coal in 2007.

Figure 1-3. Western Kentucky Coal Production

Western Kentucky mined 27.9 million tons of coal in 2007. Of this:

(a) 10.9 million tons were exported at an average price of $32.67/ton, an export value of $354 million. Applying the Kentucky coal mining multiplier of 2.095, the total amount of economic activity arising from the mining of this coal was $742 million.

(b) 16.92 million tons were converted into electricity in Kentucky, resulting in the generation of 39.7e9 kwh, and sales of $2,317 million. Applying the Kentucky utility multiplier of 1.56, the total amount of economic activity arising from the use of coal was $3,614 million.

(c) 0.14 million tons were used by Kentucky industry, the bulk to generate or co-generate electricity. Using the same factors as in (b) above, except valuing the electricity at the average industrial rate, the avoided electricity cost was $13.8 million. Applying the multiplier results in a total economic activity amount of $21.5 million.

Of this, 10.9 million tons were exported to other states at an average price of $32.67 per ton, assuming the Western Kentucky average price per ton for exports was equal to the Western Kentucky average open market price, a reasonable assumption since near 100% of these sales were open market sales, according to the EIA. Thus, the estimated value of Western Kentucky exports to other states would be $354 million. Using the BEA mining multiplier of 2.095 for Kentucky, this means an estimated $742 million of economic activity in Kentucky can be attributed to the mining and export of Illinois Basin coal.

[3] The small percentage can be attributed to the size of the Illinois economy - over $600 billion. If Illinois were a country, it would be among the 10th largest in the world in 2000, exceeding both Mexico and India in size.

An additional 16.92 million tons were converted to electricity by Kentucky utilities. Using the EIA average btu/lb for Illinois Basin Coals of 11,800 btu/lb, this tonnage is equal to a total energy content of 4e14 btu. To calculate the amount of electricity generated by this energy, the total needs to be divided by the average heat rate in btu/kwh for generators burning coal in Western Kentucky, taken to be the average heat rate in Indiana for unit burning Illinois Basin Coals. This division results in an estimate of 39.7e9 kwh generated by Western Kentucky coals in Kentucky. Multiplying this by the average retail price/kwh for electricity in Kentucky, this corresponds to an estimate of $2,317 million for the sale of electricity in Kentucky generated by Western Kentucky coals. Using the BEA utility multiplier of 1.56 for Kentucky, this means an estimated $3,614 million of economic activity in Kentucky can be attributed to the mining and use of Western Kentucky coals to generate electricity in the state.

Finally, 0.14 million tons of coal mined in Western Kentucky was used by Kentucky industry, the bulk used to generate or co-generate electricity. Since the tonnage of coal used in this way are relatively minor, the assumption is made that the economic activity represented by this use is equal to that arising if the electricity had been purchased from Indiana utilities, rather than generated internally. Using the same factors as described in the preceding paragraph, except using the industrial, rather than the residential, commercial and industrial sector average price, this means an estimated $21.5 million of economic activity can be attributed to the mining and use of Western Kentucky coals in Kentucky's industrial sector.

The total estimated amount of economic activity arising from these three uses of Western Kentucky coal in Kentucky, including the multiplier effect, is then $4,379 million, or 2.9% of Kentucky Gross State Product [13].

This amount without the multiplier effect is $2,685 million, or 7.2% of Kentucky GSP originating in the manufacturing, utilities, agriculture, and mining sectors [13].[4]

[4] It should be noted that these numbers indicate the economic impact on the Kentucky economy of only the mining and use of Illinois Basin Coals. If the same methodology were also used to estimate the impact of the mining and use of coal in Eastern Kentucky, and the Eastern and Western totals were added together, the total contribution to the Kentucky economy with the multiplier would have been $13.5 billion, 8.9% of Kentucky GSP. The sum without the multipliers would have been $7.4 billion, 19.7% of Kentucky GSP originating in manufacturing, utilities, agriculture, and mining.

D.4 TOTAL THREE STATE PRODUCTION AND USE

As Figure 1-4 shows, the three states mined 96.7 million tons of Illinois Basin coal in 2007.

Figure 1-4. Total Three State Production and Use of Illinois Basin Coals

The three states mined 96.7 million tons of coal in 2007. Of this:

(a) 30.2 million tons were exported outside the three-state region at an average price of $33/ton. Applying the three state coal mining multiplier of 2.30, the total amount of economic activity arising from the mining of this coal was $2,292 million.

(b) 58.7 million tons were converted into electricity in the three states, resulting in the generation of 137.6e9 kwh, and sales of $8,861 million. Applying the three state utility multiplier of 1.63 (4), the total amount of economic activity arising from the use of coal was $14.4 billion.

(c) 6.8 million tons were used by industry in the three states, the bulk to generate or co-generate electricity. Using the same factors as in (b) above, except using industrial electricity prices, the total amount of economic activity was $1,464 million.

Of this, 30.2 million tons were exported outside the three-state region. Note that the tonnage is 25% smaller than the sum of the three states' individual exports, since a significant amount of each state's exports went to the other states in the region. Given the tonnage weighted average price of the three states' exports is $33/ton, the estimated value of the three states' exports to other states would be $996 million. Using the BEA mining multiplier of 2.3 for the three states, this means an estimated $2,292 million of economic activity in the three-state region can be attributed to the mining and export of Illinois Basin coal.

An additional 58.7 million tons were converted to electricity by utilities in the three states. This total is 10% more than the sum of such uses in the three states individually, since much of the individual state exports are used to generate electricity within the three-state region. Using the EIA average btu/lb for Illinois Basin Coals of 11,800 btu/lb, this tonnage is equal to a total energy content of 13.85e14 btu. To calculate the amount of electricity generated by this energy, the total needs to be divided by the average heat rate in btu/kwh for generators burning coal in the region, taken to be the average in Indiana, 10,067 btu/kwh. This division results in an estimate of 137.6e9 kwh generated by the three states utilities burning Illinois Basin coals, Multiplying this by the average retail price/kwh for electricity in the three states, this corresponds to an estimate of $8,861 million for the sale of electricity in the three states generated by burning Illinois Basin coals. Using the BEA utility multiplier of 1.63 for the three states, this means an estimated $14.4 billion of economic activity in the three states can be attributed to the mining and use of Illinois Basin coals to generate electricity in the states.

Finally, 6.8 million tons of coal mined in the three-state region was used by the region's industrial sector, the bulk assumed to be used to generate or co-generate electricity. This is greater than the sum of the three states' uses for reasons discussed. Since the tonnage of coal used in this way is relatively minor, the assumption is made that the economic activity represented by this use is equal to that arising if the electricity had been purchased from the region's utilities, rather than generated internally. Using the same factors as described in the preceding paragraph, except using the industrial, rather than the residential, commercial and industrial sector average price, this means that as estimated $1,464 million of economic activity can be attributed to the mining and use of Illinois Basin coals in the region's industrial sector.

The total estimated amount of economic activity arising from these three uses of Illinois Basin coal in the region, including the multiplier effect, is then $18.2 billion, or 1.85% of the region's Gross State Product [13].

This amount without the multiplier effect is $10.7 billion, or 5.1% of the region's GSP originating in the manufacturing, utilities, agriculture, and mining sectors.

Note that the regional total with the multiplier is 17% higher than the sum of each state's individual totals because of less leakage from the region than the states, which results in higher multipliers, and the fact that within-region shipments to neighboring states' utilities are valued at their electricity value, not their export value.

E. SUMMARY

Figures 1-5 and 1-6 summarize both the production (Figure 1-5) and value of production (Figure 1-6) estimates for the three states individually and as a region.

As Figure 1-5 shows, Illinois Basin coal production was split roughly equally between the three states.

Figure 1-5. Production, Use and Flows – Illinois Basin (millions of tons)

State	Mined	Used in State	Exports	Imports	Reserves at Existing Mines
Indiana	34.8	29.8 elec 2.0 ind	2.9 (2 to IL/KY)	38.8	401
Illinois	34.0	4.1 elec 3.3 ind	26.7 (6 to TN, 4.8 to IN, 3.5 to FL, 2.1 to OH, 1.4 to MO)	54.1	1,286
W. KY	27.9	16.9 elec 0.14 ind	10.9 (6 to FL, 2 to AL, 1 to SC, 0.6 to IL/KY)	NA	513
Combined	96.7	58.7 elec 6.8 ind	30.2	NA	2,200

Both Western Kentucky and Indiana coals were used primarily to produce electricity within their states, such use amounting to 61% and 92% of production, respectively. Illinois exported 78% of its coals, primarily to Tennessee, Indiana and Florida, while Western Kentucky exported 40% of production. This raises the possibility of a "coal by wire" development strategy for both states.

Both Indiana and Illinois satisfied state demand primarily by imports from other states. Imports to Indiana and Illinois represented respectively 55% and 88% of total use within the states. Import statistics were not available for Western Kentucky, only Kentucky as a whole. Clearly, import substitution is a possible economic development strategy for both Indiana and Illinois.

Regarding reserves, Illinois has almost 60% of the proven reserves at existing mines of Illinois Basin coals; Indiana has 18%; and Western Kentucky 22% [14]. The demonstrated reserves are much larger – 104, 9.4, and 19.4 billion tons in Illinois, Indiana, and Western Kentucky, respectively.

Figure 1-6 shows the economic consequences of the tonnage figures.

Figure 1-6. Value of Production and Use – Illinois Basin (millions of dollars)

State	Export w/o mult	Export w/ mult	In-state elec gen w/o mult	In-state gen w/ mult	In-state ind use w/o mult	In-state ind use w/ mult	Total w/ mult
Indiana	$85	$166	$4,541	$6,766	$232	$347	$7,279 (3% of GSP, 7% of Mfg/Util/Ag/Min)
Illinois	$896	1,890	$824	$1,294	$467	$733	$3,917 (0.6% of GSP, 2% of M/U/A/M)
W KY	$354	$742	$2,317	$3,614	$14	$22	$4,379 (2.9% of GSP, 7.2% of M/U/A/M)
Com-bined	$996	2,292	$8,861	$14,443	$898	$1,464	$18,202 (1.8% of GSP, 5.1% of M/U/A/M)

Columns 1 and 2 show the impact on each state individually and collectively of the export of coal to customers outside the state and region both without (Col 1) and with (Col 2) the mining multiplier effect. As noted previously, the combined impact is 18% less than the sum of the three state individual impacts because a substantial part of individual state exports go to the other states within the region.

Columns 3 and 4 show the impact of the use of coal to generate electricity individually and collectively for the three states without (Col 3) and with (Col 4) the multiplier effect.

Note that the combined effect is 19% <u>more</u> than the sum of the three effects, since the combined effect takes into account the impact of coal imported from other states within the region that is used to generate electricity.

Columns 5 and 6 repeat the impact without and with the multiplier effects for the use of coal in the industrial sector of the region.

Column 7 summarizes the economic impact on the states and the region of coal exports, the use of coal to generate electricity, and the industrial use of coal. Note that the combined impact is 17% greater than the sum of the individual impacts for reasons explained previously. Note also that although the mining and use of coal is a substantial part of the Indiana and Illinois economies, it is less so in

Illinois because of the size of the Illinois economy; Illinois' GSP is two times the sum of both the Indiana and Kentucky economies.

Finally, as the last row of the last column shows, the total regional impact of coal mining and use is estimated to be $18.2 billion, 1.8% of regional GSP, and, more importantly, 5.1% of GSP originating in manufacturing, utilities, agriculture, and mining. To put this in perspective, average 2006 and 2007 corn with the crop multiplier contributed an estimated $26 billion to the three-state economy in 2007, and soybeans $13 billion. Thus, the economic value to the region of coal use and production falls somewhere between the crop value of corn and soybeans. To be fair, the corn and soybean figures would be higher, if they included the value added to the corn by further processing within the region, as do the coal use estimates. Nonetheless, the point is that coal mining and within region coal use represents a significant amount of economic activity in the region; regional policymakers should be as alert to developments and challenges in coal markets as they are in our region's agricultural markets.

F. WHAT WOULD HAPPEN IF?

Looking into the future, two developments - one positive and one negative - could dramatically alter these estimated economic impacts of coal on the Illinois Basin region.

First, a possible bad development. While the design of CO_2 control legislation is still being debated, there appears to be a consensus that some form of CO_2 legislation - cap and trade, command and control, whatever - will be passed during the next few sessions. If the legislation is similar to the proposed Lieberman/Warner cap and trade legislation, a 2009 study commissioned by the National Association of Manufacturers and the American Council for Capital Formation estimates that the mining of coal would decrease by 37% (35 million tons) in the three states, while electricity production would decrease from 9% (Illinois) to 15-18% (Kentucky and Indiana) [15]. While many questions can be raised concerning the report and its conclusions (not the least how it is possible to have those coal output declines and yet have a 200 to 300% increase in the cost of coal also forecast by the report), there is a general consensus that Illinois Basin Coal, along with all coal, will be severely impacted by such legislation. Given that coal contains more carbon per unit of energy than other energy sources, it is inevitable that coal will be disproportionally hurt by the imposition of a tax or limit on carbon emissions. Any legislation will set in motion a sequence of events where now cheaper, less carbon-intensive energy alternatives to coal will gradually substitute for coal, and the current electricity cost advantage of states such as Illinois, Indiana and Kentucky which generate electricity from coals will disappear.

There are two responses to this challenge. One is to fight such legislation tooth and nail, characterizing the legislation as a declaration of war against states that produce or consume large amounts of coal. The other is to consider what can be done now in the interim to minimize the impact of the legislation on our region.

The second approach seems the most prudent, given the current mood of the country that such legislation is necessary and inevitable.

Such an approach is perhaps best characterized by those in the utility industry who currently are urging that any new coal plants constructed be easily retrofitted to capture and sequester CO_2, or other actions that will minimize the cost of CO_2 rule compliance.

This brings us to the possible good news for Illinois Basin coal producers and consumers. Is there an opportunity for Basin producers to use the coming revolution in coal production and consumption to expand their regional market share, such that the region ends up with a bigger share of a smaller pie? In particular, will the economic impact of the proposed Clean Air Interstate Rules (CAIR) and CO_2 rules allow the region to recapture at least a portion of the 77 million tons of coal use in the three-state region now imported from the Powder River Basin?

The math is easy: recapture one-half of the regional market lost to Western coals, and that is enough to offset the entire projected decline in Illinois Basin coal use predicted by the ACCF/NAM study.

Is there reason to believe this is possible? The answer is a qualified yes. The reason is that a combination of CAIR and aspects of the proposed CO_2 legislation may favor the use of Illinois Basin coals in the region rather than Western coals.

Utility coal choice is a complex issue; many boilers are designed to burn a particular type of coal, and switching coals can involve some up-front expense. But such switches can happen, particularly in response to environmental legislation. One needs to look no further than the market response to the 1990 Clean Air Act Amendments and the subsequent switch to low sulfur Western coals in the three-state region, rather than install scrubbers and continue to burn high sulfur Basin Coals. Illinois Basin coal production fell from 141 million tons in 1990 to 87 million in 2000 as utilities switched to Powder River Basin coals [16].

Since recent clean air legislation rules under discussion have the effect of requiring installation of scrubbers on boilers that burn even low sulfur Western coals, “the price differential between low and high sulfur coals will diminish as coal heat content becomes the overriding factor in coal quality decisions” [17].

Will impending CO_2 legislation reinforce or counteract this trend? While it has been forecast that the delivered costs of Powder River Basin (PRB) and Illinois Basin (IB) coals will increase [15] substantially, will the forecast increases keep the relative prices of PRB and IB coals the same?

Several factors will determine the answer to this question.

(a) PRB coals have a slightly higher CO_2 production per million btu than IB coals - 212.7 lbs/mmbtu for Wyoming coal versus 203.5 for Illinois coal [18].

(b) Forecast increases in transportation costs caused by the proposed legislation will result in greater price increases in PRB than in IB coals. Transportation costs of Western coal to the Illinois Basin are probably 2/3 of the total cost, since average FOB Western coals are near $10/ton, while delivered coals in the Midwest average around $30/ton.

(c) Forecast increases in energy costs will cause IB mining costs to increase more than PRB costs, since IB coal mining, a mix of surface and underground mining, is more energy intensive than PRB coal mining, which is surface mined.

Estimating the overall impact of these factors is beyond the scope of this study. A rough estimate would be that (a) would produce a 6 -8% cost advantage for IB; (b) given that (i) transportation costs are 2/3 total delivered coal costs, (ii) half of transportation costs are fuel costs, (iii) the ACCF/NAM forecast is for gasoline prices, and by assumption, diesel prices to rise by 20% as a result of CO_2 legislation, (iv) IB coal transportation costs are negligible, then passage of the bill would produce an estimated 6% cost advantage for IB coals. The impact of (c) awaits further analysis.

G. THE IMPACT OF THE PRODUCTION OF SYNTHETIC GYPSUM FOR WALLBOARD MANUFACTURE IN THE ILLINOIS BASIN

Synthetic gypsum produced as a by-product of coal scrubbing is now a major source of gypsum for wallboard manufacturing, particularly here in the Illinois Basin. In 2008, the USGS "Mineral Commodity Summaries" reported that 12.7 million tons of gypsum were mined, while 8 million tons of synthetic gypsum were recovered from scrubbers. According to the American Coal Ash Association, almost all of the synthetic tonnage was used to produce wallboard.

State-by-state data are not reported by the ACCA; nonetheless, the Indiana Geological Survey [19] conducted a phone survey of utilities in 2008 that estimated a total of 1.2 million tons of synthetic gypsum was sold for wallboard use in 2007, or about 1 million tons after calcining. Assuming wallboard

contains 70% by weight of calcined gypsum, the rest being perlite, paper, additives and water [20], this translates into 1.4 million tons of wallboard. Since ½ inch wallboard prices were $176/ton in 2006 according to the 2006 USGS Minerals Yearbook, then the value of Indiana production is estimated to be about $250 million. Applying the BEA non-metallic mineral product manufacturing multiplier of 2.16, this means the estimated total economic value of the recovery and use of synthetic gypsum to manufacture wallboard in Indiana is around $550 million [21].

Unfortunately, such production statistics aren't available for Illinois and Kentucky. What is known from the ACCA is that 5 of the 18 plants producing wallboard from synthetic gypsum are located in the Illinois Basin states, two each in Indiana and Kentucky. Assuming the plants are all of the same size and output as Indiana, and using the Indiana calculations as a guide, this means that the value of Kentucky wallboard made from synthetic gypsum is roughly equal to that of Indiana, and Illinois half of that. In total, then, an estimated $1,350 million of economic activity is added to the three states' economies by the recovery and use of synthetic gypsum to manufacture wallboard [22].

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(8) "RIMS II Multipliers (2006), Table 2.5, Total Multipliers for Output…" by Individual State, and by three-state aggregation, BEA, 2009

(9) Ref (5), "Electricity Generation within State"

(10) "Coal News and Markets," EIA, June 8, 2009, the average heat rate of generating units burning Illinois Basin coals in Indiana (FERC Forms 1 and 767)

(11) Estimate obtained by multiplying the kWh from (6) by state average retail price in "Average Retail Price for Bundled and Unbundled Consumers by Sector, Census Division, and State," EIA 2007

(12) Based on Information on the Industrial Use of Indiana Coals in Indiana

(13) "Gross Domestic Product by State-2007", BEA Regional Economic Accounts, Interactive tables, 2007

(14) "Recoverable Coal Reserves and Average Recovery Percentage by State, 2007" EIA

(15) ACCF/NAM study, "Economic Impact of the Lieberman/Warner Legislation," March 13, 2008

(16) "In the 80's and 90's, They Died Like Flies," Energy Biz, Sep/Oct 2005

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(19) Results of a phone survey of Indiana utilities in 2007 cited in Shaffer, N.R. and, Sadowski, R., "Indiana Limestones and Dolomites for Flue Gas Desulfurization," in press, Indiana Geological Survey

(20) "Materials Safety Data Sheet-Wallboard"

(21) Estimate obtained by assuming calcination reduces weight by 85% (assumes ¾ of water driven off during calcining, "Mineral Facts and Problems," U.S. Bureau of Mines, 1985), 70% of the weight of wallboard is calcined gypsum ("Materials Safety Data Sheet-Wallboard,") and the average price of ½ inch wallboard is $176/ton (United States Geological Survey Minerals Yearbook-Gypsum, Table 5, 2006)

(22) Estimate based on ACAA 2007 Coal Combustion Product survey which showed that 8.254 million tons of FGD gypsum were used to produce Gypsum panel Products in the US in 18 plants, 2 each in Indiana and Kentucky, and one in Illinois (Mike McDonald ACAA presentation), and then assuming all plants had the same capacity, which resulted in an estimate of 0.917 million tons produced for Indiana and Kentucky, and 0.458 million tons for Illinois. The 0.917 million ton estimate for Indiana is 20% lower than the survey estimate for Indiana reported in [(16) above

SECTION 2.

THE IMPACT OF ALTERNATIVE CO_2 LEGISLATIVE DESIGN ON INDIANA

A. INTRODUCTION AND MOTIVATION

Despite the statements of many pundits, there appears to be little likelihood that the U.S. push to limit CO_2 emissions into the atmosphere will cease, at least until some form of control legislation is in place. Thus, it is important for Indiana energy policymakers, regardless of their views on the validity or non-validity of the existence of man-made global warming, to participate in discussions regarding the design of possible Cap and Trade or other CO_2 limiting legislation. As one Indiana observer put it, "if you are not at the table, you are on the menu."

Reasonable people can differ as to the existence, and reasonable (and unreasonable) people are differing, as even a cursory look at the news indicates. However, the existence of this debate should not be interpreted as a reason to refuse to enter into the discussion of the design of a response to global warming. Indiana energy policymakers need to take an active role in doing what they can to insure potential legislation is designed to minimize the harmful impact of CO_2 limits on our state.

The purpose of this report is to help such decision-makers identify those aspects of potential CO_2 limiting legislation which are particularly harmful to Indiana, and those that are particularly helpful.

B. ORGANIZING PRINCIPLES FOR INDIANA POLICYMAKERS

B.1 ORGANIZING PRINCIPLE #1

What should be the Indiana policymakers' position regarding global warming? One option is to deny the uniqueness of the current global warming trend (the "global warming denial" strategy), citing the findings of McIntyre et al. and others supporting this view, and oppose any consideration of CO_2 legislation, hoping the whole issue will just go away. A second option is to recognize the inevitability of some form of legislative response to global warming, and to participate in such discussions with the hope of anticipating and preventing inclusion of provisions particularly harmful to our region in the legislation. As one prominent national leader in the debate has put it, it is better to join in the debate about CO_2 legislative design issues now than to deny there is any reason to have the debate.

For all these reasons, it is important for Indiana opinion leaders to enter into the debate about alternative CO_2 legislative designs, to judge which designs particularly help or hurt coal intensive states such as ours, and to act on the public stage accordingly.

Hence, Organizing Principle #1: Indiana policymakers should actively engage in the debate over the design of CO_2 legislation at both the national and regional levels to insure that Indiana perspectives are heard and recognized in the design.

B.2 ORGANIZING PRINCIPLE #2

No matter what the design aspects are to be discussed - allowance allocation, offsets, early action credits, carbon leakage, cap and trade vs. carbon tax, etc., coal use stands to be harmfully impacted; the only issue is how much of a negative impact, and what can be done to minimize the impact in each of the design aspects. This stems from the fact that among the hydrocarbon fuels, coal is by far the most carbon intensive of the hydrocarbons, producing roughly 2 pounds of CO_2 per kWh of electricity produced, compared to 1.3 pounds for natural gas (EIA "Carbon Dioxide Emissions from the Generation of Electric Power…," July 2000, Table 1). Thus, the best those with an interest in preserving the coal option for the US can hope for is to examine the legislative design options in each of the design areas to identify those options which minimize the harmful impact of the legislation on coal and coal producing and using areas.

Hence, Organizing Principle #2: Indiana policymakers should identify the least coal harmful options in each of the design areas, and encourage their adoption.

B.3 ORGANIZING PRINCIPLE #3

No matter what the outcome of the debate over the options, their success or failure at accomplishing their goals will be determined by how well they give incentives to the private sector to adopt less carbon intensive methods of production and use. Such incentives should be a combination of "carrots and sticks." Without such incentives, there will be no effective progress made in reducing CO_2 emissions.

Hence, Organizing Principle #3: Indiana policymakers should focus on cost-effective ways of encouraging private investment in the region to aid in the reduction of CO_2 emissions.

B.4 ORGANIZING PRINCIPLE #4

"Grandfathering" is a perfectly reasonable and fair rule to apply when designing legislation. Further, grandfathering - the exemption from newly-passed legislation for activities undertaken prior to passage, thus preventing retroactive laws - is required by the first article of the Constitution; "No … Ex post facto law shall be passed"; Article One, Section 9 for Congress, Section 10 for the states.

This principle of fairness - those activities undertaken under one set of rules shall not be penalized when the rules change - has a long and contentious history of application and mis-application. Its most familiar application in the utility industry was the requirement that the owners of "stranded investments" - investments made by utilities in anticipation of continued regulation which were put at risk when the industry was deregulated - be compensated as part of the deregulation process. This concept was also the basis for the grandfathering of electric generation plants built prior to passage of the clean air bills regulating SO_x and NO_x emissions, and is equally applicable in the case of CO_2 legislation.

Such grandfathering allows the balancing of private property rights against the rights of the public to regulate in the common interest. In effect, it says "from now on, we will require such and such," thus providing a fair transition from one set of rules to another. The principle is not without its critics in the CO_2 debate; as one representative of a utility which uses no coal put it, "they (the utilities that use coal) should pay for every ton of CO_2 emitted up their stacks."

Once the principle is recognized, the key question is who should be compensated, and how much the compensation should be. One approach in the current CO_2 allowance debate is that the owners of out-of-compliance plants should be given allowances whose value is sufficient to bring the plants into compliance - a reasonable limit on the grandfathering rule.

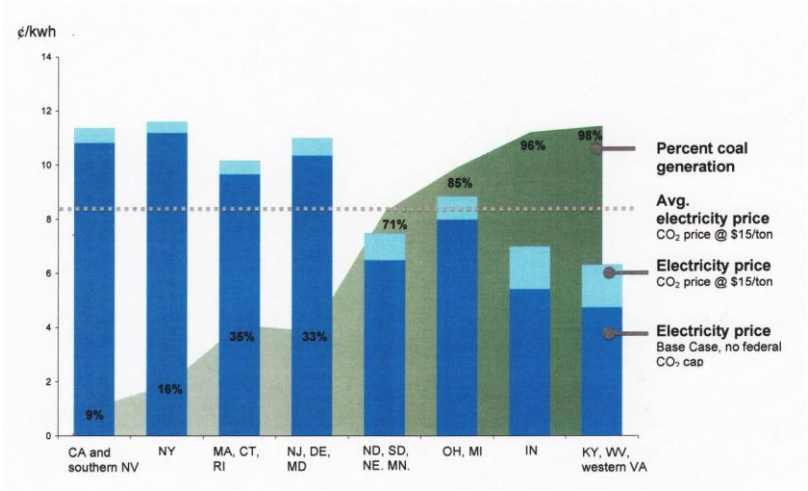
Hence, Organizing Principle #4: Indiana policymakers should urge that those with investments put at risk by any CO_2 legislation be made whole by compensating payments, and suggest equitable ways of calculating what these payments should be.

B.5 ORGANIZING PRINCIPLE #5

Any CO_2 legislation should take into account the higher costs to be imposed by any CO_2 limiting legislation on carbon-intensive regions of the country. Figure 2-1 shows how different regions of the country with varying degrees of dependence on coal to generate electricity would be affected by a $15/ton price on CO_2 emissions.

While there are many advantages to having the same legislation apply equally to all regions of the country, it would be well to recognize that proposed CO_2 legislation will have a disproportionate effect on our region and others similarly dependent upon coal. While less coal dependent regions will argue that they have been cross-subsidizing us for years, and new legislation should not protect the "ill-gotten gains" we have enjoyed, some adjustments should be made, at least during a transition period from the old laws to the new.

Figure 2-1. Distribution of Change in Electricity Prices by Region (2015)



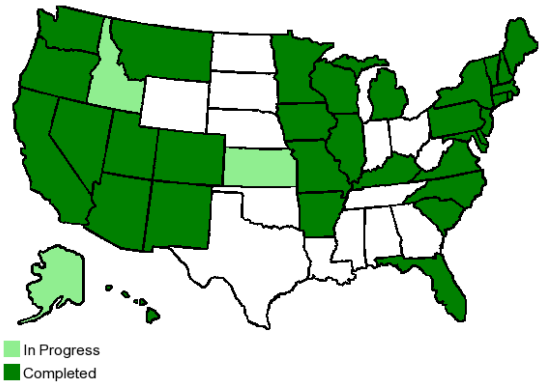
Source: Written Testimony of Dallas Burtraw, January 23, 2008
http://globalwarming.house.gov/tools/assets/files/0326.pdf

Hence, Organizing Principle #5: Indiana policymakers should insure that the special interests of the coal intensive regions in the US are protected as much as possible during the transition period from old to new laws regulating CO_2 emissions.

B.6 ORGANIZING PRINCIPLE #6

As Figure 2-2 indicates, 38 states, in anticipation of some form of CO_2 limiting legislation, have created their own climate action plans to identify cost-effective opportunities to reduce GHG emissions that are relevant to the state.

Figure 2-2. Climate Action Plans by State



Source: Pew Center on Global Climate Change
http://www.pewclimate.org/print/5856

The individual characteristics of each state's economy, resource base, and political structure provide different opportunities for dealing with climate change ("Climate Action Plans," Pew Center for Global Climate Change, Nov 10, 2009). Further, three regions have created regional cap and trade compliance mechanisms to reduce GHG on their own - the Regional Greenhouse Gas Initiative, which includes Connecticut, Delaware, Maine, New Hampshire, New York, New Jersey, Vermont, Rhode Island, and Maryland which started this year; the Western Climate Initiative, which includes Arizona, California, Montana, New Mexico, Oregon, Utah, Washington, and four Canadian provinces which starts in 2012; and the Midwest Greenhouse Gas Reduction Accord (MGGRA), which includes Iowa, Illinois, Kansas, Michigan, Minnesota, Wisconsin, and one Canadian province, which also plans to start in 2012. Indiana is an observer in the MGGRA.

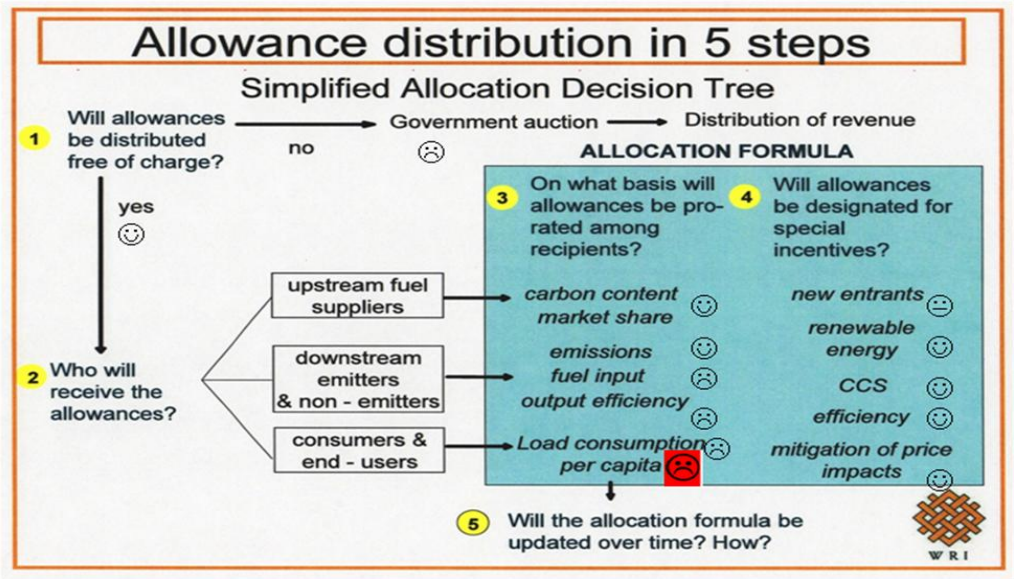
Participation in such Accords has many advantages. In the case of the MGGRA, the group recommends a cap and trade system which recognizes the particular characteristics of our region, which includes: (a) emerging biofuels and renewable electricity industries; (b) vast coal reserves; (c) truly unique experience in building and operating clean coal technologies; (d) significant underground formations for the storage of CO_2; (e) an industrial base that can be tapped for creating new jobs and industries in a carbon constrained world; and (f) strong agricultural and forestry resources that can offer domestic carbon offsets through improved soil and forestry management practices (MGGRA Advisory Group Final Recommendations, June 2009).

Hence, Organizing Principle #6: Indiana policymakers should consider participating fully in the MGGRA, using our political leverage to advance the goals of the organization.

B.7 ORGANIZING PRINCIPLE #7

At the heart of any informed debate regarding the mitigation of the economic impact of CO_2 limiting legislation is the issue of allowance allocation. Figure 2-3 is a modified version of a flowchart for the allocation process prepared for the Wisconsin Governor's Task Force on Global Warming by the World Resources Institute (World Resources Institute presentation before the Wisconsin Global Warming Task Force, May 14, 2008).

Figure 2-3. Impact of Allowance Distribution Methods on Indiana



Source: World Resources Institute, Wisconsin Governor's Task Force on Global Warming
http://dnr.wi.gov/environmentprotect/gtfgw/documents/MgTF20071113.pdf

It provides a flowchart of the major decisions in the process, and an easily understood mechanism for summarizing the likely impact of these decisions on Indiana.

A "happy face" indicates the option would have a favorable impact on Indiana's share of total allowances relative to the most preferred option for our state - allocation based on emissions - the usual meaning of "grandfathering" allowances. (The meaning of the "neutral" and "sad" faces follows.)

As the figure indicates, the first step in the allocation decision process is the decision to either auction the allowances, or distribute them free. As the faces indicate, as a practical matter, Indiana's share of total allowances would be higher with free allocations than with government auctions. In theory, allocating the revenues from allocation auctions could lead to exactly the same result as

allocating the allocations themselves for use or resale. In practice, the temptation to allocate revenues to worthy causes un-related to reducing global warming has proven irresistible. This is evidenced by the revenue allocation rules proposed in various designs, which allocate revenues from everything from household tax relief to per capita dividends to everybody. Such allocation rules will harm Indiana more than the allocation of free allowances, where such redistributions unrelated to compliance costs are much more difficult to achieve.

If the decision is made to auction off the allowances, or some portion of the allowances, then those in most need to them will get them - a point in favor of auction mechanisms.

If the decision is made to allocate free allowances, the issue becomes step two in the flowchart -- who will receive the allowances - the companies that sell the fuel to emitters, the emitters themselves, or the consumers of the end use energy-electricity, gasoline, etc.

Recently, little consideration has been given to the first option in the flowchart - giving the allowances to the coal mining companies and others who first exploit the resource. Outside of HR5049, the Keep America Competitive Global Warming Policy Act introduced in 2006 by Rep Tom Udall, the major CO_2 control bills have concentrated on downstream emitters or end-users. The logic for allocations to fuel suppliers is based on the fact that those who first extract the fossil fuels can either eat the tax or pass it on - there is no upstream to shift the burden to - only downstream. The assumption is that fuel suppliers will pass on to emitters the cost of having to purchase allowances either initially, if the allowances are initially auctioned off, or eventually, as the emission levels are reduced. The approach's final impact is similar to giving/charging downstream emitters the allowances except there are fewer fuel producers than emitters, an advantage when policing compliance. Economists tell us the incidence of the tax depends completely on the supply and demand elasticities, not who initially pays the tax, ignoring income effects - a big ignore.

Once the decision has been made as to who should receive the allowances, the issue becomes what rules will be used to allocate the allowances within the groups - step three in the flowchart. In terms of the impact on Indiana, the decision to allocate on the basis of carbon content would be best for Indiana, in the sense that it will result in a higher fraction of the allowances going to Indiana, while a decision to allocate on the basis of btu market share would not so good for Indiana, as it penalizes coal. Hence, the smiley face for carbon content, the sad face for market share.

Moving back to step 2, by far the majority of allocation plans involve allocation either to emitters or end use consumers. Here again, the impact on Indiana is determined by what rules are to be used to allocate the allowances within the groups.

If the allocations go to emitters, the impact on Indiana will depend on which of the allocation options are chosen. If the allocation is made on the basis of emissions (grandfathering), then Indiana's share of total allowances will be higher than any other option on the flow-chart; hence, the smiley face. If the allocation is made of the basis of all fuel inputs - that is, if your units used "X" million Btu to generate power, you are allocated the percent of total national Btu use represented by "X." This is not so good for Indiana, since non-coal units get the same fraction of allowances as coal units of equal size. The same is true for allocation rules based on output shares, that is, the unit's share of total kWh generation; hence, both fuel input and output efficiency have sad faces.

If allocations go to consumers and end-users, Indiana stands to suffer if the allocations are based on kWh use, or, worse yet, given out on the basis of population. Since we are a state with above-average kWh use per person, Indiana would be better off if the allocation were made on the basis of kWh than a per capita basis, but in both cases, Indiana will be disadvantaged, since neither take into account the higher than average carbon intensity of our state.

The issue in step four is whether or not some allowances will be designated for special purposes. In general, such diversions will hurt Indiana compared to allocating 100% of the allowances on the basis of emissions. However, if the special allocations were to go to activities expected to be particularly beneficial to our state, such as carbon capture and storage, mitigation of price impacts, or set-asides for state energy-using industries, Indiana might be better off with such set-asides. However, set-asides for renewable resources, or energy conservation and end use efficiency improvements would likely reduce Indiana's share of total allowances.

The question of the justification for special allowances for coal-based merchant plants (5% in the current versions of the bills) – those coal-burning plants which sell electricity in competitive wholesale markets - is a topic of much debate. Nor is the debate academic - all merchant plants provide over 50% of the power nationally, and 43% in our region, the latter primarily due to Illinois deregulation. The issue hinges on the ability of such plants to pass on CO_2 regulation induced cost increases to customers in their markets - something their still-regulated counterparts can easily do either through the fuel adjustment clause or by rate basing CO_2 reducing investments under the supervision of state regulatory commissions. Regulated utilities and regulators argue that such set-asides will result in windfall profits

for merchant plants that are under no obligation to do anything with revenues from the sale of such allowances. Further, they say, since competitive market prices are set by the highest cost supplier meeting demand, market clearing prices in the markets in which they sell will increase to cover compliance costs, leaving merchant plants with the windfall. Hence, argue the regulated portion of the business, all allowances allocated to the power sector should go to local electricity distribution companies who, under the watchful eye of their Commissions, will shield their customers from sharp price increases during the transition period.

What appears to be the answer in our region?

It appears that regional merchant plant gas-fired combustion turbines and combined cycle units in our region will recover at least the incremental costs of compliance, and in some cases more, while coal-fired merchant plants will not be able to recover the full compliance costs.

This is because the wholesale market is an hourly market, where each hour's market clearing price is set by the most expensive offer to sell accepted by the market during that particular hour. During the off-peak hours, the price in our region will likely increase by the full amount of the cost of purchasing CO_2 allowances for coal plants, since in the Midwest, the most expensive offer accepted during off-peak hours will likely be base load coal-fired plants, whose bid should reflect the full cost of the CO_2 allowance purchase for coal plants. In this case, low CO_2 emissions base load plants (combined cycle, nuclear) will see their profits rise, since product prices increase with no (nuclear) or a smaller (combined cycle) increase in costs.

During the peak hours, when the generating costs of Midwestern gas-fired combustion turbines are likely to determine the market clearing price, the market price should increase only enough to cover the cost of CO_2 allowances for the gas-fired plants, which at most will be roughly 50% of the cost increase for the base load coal plants operating during peak hours. In this case, the profits of the coal-fired base load plants will decrease, since costs go up by the full amount of the CO_2 purchases necessary for coal plants, while revenues go up only by the smaller amount necessary to cover the cost increases for gas-fired peaking plants. Combined cycle merchant plants should see their profits increase, since their lower heat rate compared to combustion turbines should increase their revenues more than their costs of purchasing CO_2 allowances.

During the intermediate hours, the answer is a mixed bag depending on what units set the price during those hours. If combined cycle plant costs determine the intermediate hour price, then base load

and intermediate coal-fired unit profits will decrease; if older coal-fired units determine the price, their profits will be unaffected, and cycling combined cycle unit profits will increase.

From this discussion, it can be concluded that coal-fired merchant plants will not be able to pass on compliance costs as easily as their regulated counterparts. At best, they can recover their costs during the hours when they are marginal, price setting units. However, when gas-fired units are the marginal fuel, as is likely the case during peak and intermediate hours, they will be able to recover only the incremental costs of compliance for gas-fired units, usually about one-half that of coal units.

So - some allocation to coal-fired plants appears to be justified to make them whole; how much is justified depends on the particulars of the wholesale markets. If, for instance, merchant plant companies own a portfolio of coal and gas-fired units, it is quite possible for the increases in profits for the gas units when coal units are the marginal units could more than offset the profit decreases for the coal units when the gas units are the marginal units.

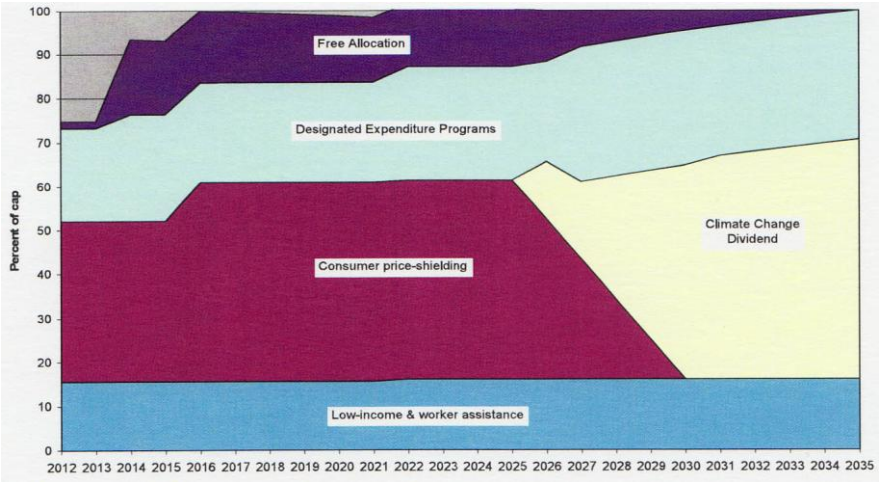
If some allocations are made to coal merchant plants to make them whole, this means consumer prices will be higher than would be the case if all allocations were given to LDCs. The fairness of the action to make the coal merchant plants whole is not altered by this fact. It simply shows that in such markets, efforts to make sellers whole will result in higher consumer prices. To make the point that this is a "rob Peter to pay Paul" situation, consumer prices would be even lower if URCs decided not to allow regulated utilities to pass on all the compliance costs, and forced them to eat part of the compliance costs in the form of lower profits.

All this, and more, is discussed in a study funded by NARUC and others by Synapse ("Productive and Unproductive Costs of CO_2 Cap and Trade…" , Synapse Energy Economics, July 16, 2009) which shows that giving approximately 10% of allowances to coal merchant plants would substantially increase Indiana consumer prices, compared to giving all the allowances to LDCs (Figure 6, p-14), since the merchant plants view the value of the allocations as their compensation for lost revenue, and feel no moral or other obligation to pass on these values to their customers.

Set-asides for the refinery, iron, steel, cement, and paper industries are also considered in the legislation, on the basis that the ability of these industries to pass on compliance costs is limited by foreign unregulated competition. Such set-asides would be particularly important and beneficial for Indiana, given the substantial presence of the refinery, iron and steel, and cement industries in our state.

Finally, since all such allocation rules require that the total tonnage of CO_2 emissions allowed decrease over time, the question is how the allocations will be reallocated over time as the total decreases. The time pattern of allowance value for the Waxman-Markey bill (American Clean Energy and Security Act of 2009) is illustrated in Figure 2-4, taken from "Allocation in Air Emissions Markets," Danny Ellerman, Nov 2009, Center for Environmental Policy and Research, MIT.

Figure 2-4. Waxman-Markey Allocation by Broad Use



Source: "Allocation in Air Emissions Markets," Danny Ellerman, Center for Energy and Environmental Policy Research, MIT, Report 09-016, November 2009, p. 17

http://web.mit.edu/ceepr/www/publications/workingpapers/2009-016.pdf

As Ellerman notes, "the most striking feature of this proposal is the extent to which direct compensation to consumers" (the lower three areas of the figure) "has replaced free allocation to incumbents…." Such a substitution is likely being justified by the fact that the limit on grandfathering should be the amount of allowance value necessary to allow the owners of existing facilities to be made whole; when this limit is reached, grandfathering should cease.

The result of all this is Organizing Principle #7: Indiana policymakers should consider carefully the rules proposed for the allocation of allowances or revenues from the sale of these allowances, since the Indiana impact of any CO_2 limiting legislation will to a large extent depend on such rules.

C. DESIGN FEATURES THAT WILL PARTICULARLY HELP INDIANA

In summary form, the following features incorporated into CO_2 limiting legislation will help Indiana adjust to a carbon constrained economy. Indiana would be helped by provisions which

(a) Discourages a rapid "dash to gas" by utilities by grandfathering, and a phased-in plan to auction CO_2 allowances;

(b) Stimulates clean coal investments by allowing such projects to qualify for carbon offsets and similar measures;

(c) Stimulates CO_2 sequestering in underground formations and soils;

(d) Distributes allowances in a way that recognizes the extra burdens to be placed on coal producing and using states such as ours; in particular, base allowance distributions at least in part on current CO_2 emissions, not on population or electricity consumption;

(e) Allows for the protection of Indiana's carbon intensive export industries (steel, refineries, cement, in particular) by means of boarder taxes or allowances;

(f) Gives early mover credits to utilities and industries (again, steel in particular) which have already taken steps to reduce their carbon emissions;

(g) Recognizes that Indiana electric utilities are still regulated, which allows our Regulatory Commission's expertise and authority to be utilized to help insure the transition period is managed so as to minimize the harmful impact of a carbon constrained economy on our states ratepayers and stockholders.

D. DESIGN FEATURES THAT WILL PARTICULARY HARM INDIANA

Again in summary form, Indiana would be particularly harmed by provisions which

(a) Require the immediate auction of all CO_2 allowances as some all gas utilities have proposed. As one spokesman said; "I think they (the coal-fired utilities) should pay for every ton of carbon that goes up the sack";

(b) Prohibit distribution of allowances or offsets designed to encourage carbon capture and storage and integrated gasification and combined cycle electricity generation;

(c) Would require distribution of allowances or revenues from their auction based on population or electricity consumption;

(d) Require uniform regulations for all geographic areas regardless of the impact of any CO_2 limiting legislation. Perhaps the best outcome for Indiana would be a set of connected regional CO_2 limiting plans, each tailored for each region's peculiarities. Individual state initiatives to create climate change centers should be encouraged;

(e) Allocation of a portion of the allowances to coal-fueled merchant electricity generation plants, rather than to local electrical distribution companies, since merchant plants in Indiana are primarily gas fueled. Such a diversion is questionable anyway, since most observers agree that market clearing prices in the markets in which they sell will rise to cover the cost of purchasing such allowances, which means the burden of the tax will be on the purchasers of merchant power - the local distribution companies.

E. DESIGN FEATURES THAT ARE GOOD NO MATTER WHERE YOU LIVE

(a) Allowing the banking and borrowing of allowances between time periods to reduce allowance price volatility;

(b) The inclusion of price ceilings, which trigger the flow of additional allowances onto the market, and price floors, which trigger the purchase of allowances, which also reduce allowance price volatility, making it easier for investors to plan their CO_2 reducing investments;

(c) Mandatory, rather than voluntary CO_2 reducing plans. Voluntary plans result in "dinosaur" plants - plants with very high cost CO_2 reduction options - not participating in any CO_2 reduction campaigns - only best-practice plants with modest costs would chose to participate ("Voluntary versus Mandatory Approaches to Climate Change Legislation," T.P. Lyon, Resources for the Future, February 2003);

(d) Attention to defensible methods of calculating the economic losses arising from "stranded investments" which arise from any CO_2 legislation. Such calculations should provide limits on the amount of allowances allocated or revenues from the auction of such allowances.

F. DESIGN FEATURES THAT ARE BAD NO MATTER WHERE YOU LIVE

(a) The inclusion in any CO_2 offset plans of projects which are hard to monitor over their lifetime. The experience of the Common Market Clean Development Mechanism programs are instructive in identifying what not to include in such offset programs. One option is to set a maximum percentage of such offsets which can be beyond easy monitoring;

(b) Inadequate protection against "carbon leakage" - the migration of production to regions which have no, or little, regulation of CO_2 emissions;

(c) Revenue sharing between states, with high carbon emission states transferring income to lower carbon emission states.

G. SUMMARY AND RECOMMENDATIONS

What emerges from this survey is a clear message. There is a cost to any state or region simply stonewalling the climate change debate in the hope it will go away with no harm to their state or region. The recent controversy over the voracity of some of the supporters of immediate action to reduce CO_2 emissions has bought some time for a thoughtful debate over what could, if left unattended, turn into a real economic disaster for coal-producing and consuming states such as Indiana.

In the time we have been given, we should carefully consider the option of using our political and other influence to design a CO_2 program which is as 'Indiana friendly" as can be made.

More specifically, we should

(a) Consider joining the Midwest Greenhouse Gas Reduction Alliance as a full partner, adding our political clout and skills to the design and implementation of a CO_2 program responsive to our regions particular needs and situation;

(b) Capitalize on our state's head-start in Integrated Gasification Combined Cycle Technology and Carbon Capture and Storage opportunity identification.

(c) Involve Indiana Utility Regulatory Commission experts early on in the design of a workable CO_2 allowance allocation plan. This would allow the state to utilize the IURC's extensive knowledge of the value of utility assets to develop a workable, transparent, and equitable resolution to the distribution of allowances within the state.