

# IGCC/CCS –Federal and State Incentives for Early Commercial Deployment

## State Clean Energy and Environment Technical Forum

### Integrated Gasification Combined Cycle (IGCC) & CO<sub>2</sub> Capture and Storage (CCS)

#### Federal and State Incentives for Early Commercial Deployment

November 9, 2006

## I. BACKGROUND

Over the past twenty years, the U.S. Department of Energy (DOE), state organizations, and industry have supported research and development (R&D) on coal gasification, Integrated Gasification Combined Cycle (IGCC) technology, and associated carbon capture and storage (CCS) methods. As a result of these joint efforts, the application of IGCC and CCS to electric power generation and related energy markets is at the beginning of commercial deployment. Due to technological successes already achieved and unique capabilities relative to competitive technologies, there is currently a very high level of interest in IGCC, CCS, and associated gasification-based technologies. This interest is, in part, a result of evolving Federal and state strategic energy policy goals that encourage the commercial deployment of advanced fossil energy supply technologies to enhance fuel diversity, domestic energy security, environmental footprint and climate change mitigation, while sustaining efficient utilization of domestic resources.

This is the second of two Technical Forum discussions on IGCC/CCS and focuses primarily on the Federal and State incentives offered to encourage technology deployment. Federal energy policy towards IGCC is most recently and clearly established in the *Energy Policy Act of 2005*, which authorizes continued RD&D support and strengthens financial incentives to enhance the competitiveness of early commercial IGCC/CCS projects and encourage use of a broad range of coal types, project locations, and plant designs. State policies supporting IGCC/CCS come in the form of legislation and regulations that provide technology development support, streamlined project siting/permitting, and project financing options for early commercial projects.

## II. ENERGY POLICY GOALS

### A. Federal IGCC/CCS Policy Goals

Federal energy and environmental policy has directly and indirectly supported the development of IGCC power generation technology for more than twenty years. Overall policy goals are defined in a variety of legislation and derivative programs as the need to economically reduce dependence on foreign fuel sources; improve energy conversion efficiency; ameliorate environmental impacts of fuel conversion; and increase the fuel and technology diversity of, particularly but not exclusively, U.S. power generation. The following legislation, initiatives, and programs were instrumental in moving IGCC development towards its current status as ready for early commercial projects.

- **Energy Security Act/US Synthetic Fuels Corporation Act (1980)** – Following the second oil crisis, Congress authorized creation of the Synthetic Fuels Corporation (SFC) to manage \$20 billion in subsidies to promote production of synthetic fuels from coal, tar sands, and shale oil reserves by private industry to reduce America's dependence on foreign oil. *In the mid-80s, the SFC guaranteed product price support for several 1<sup>st</sup> generation IGCC plants – the Texaco Cool Water IGCC Plant that was operated from 1984 to 1988 in California and Dow Chemical's Louisiana Gasification Technology Inc Project that was operated from 1987 to 1995.*
- **Acid Precipitation Act (1980)** – Congress mandated a comprehensive examination of the relationships among fossil fuel combustion, acids and other pollutants formed by power plant emissions, and their effects on the environment and human health. Results of the National Acid Precipitation Assessment Program (NAPAP) culminated in Title IV (Acid Deposition Control) of the **Clean Air Act Amendments of 1990** to further reduce NO<sub>x</sub> and SO<sub>2</sub> emissions. *The overriding policy goal was to develop the means by which the country could continue to use domestic fossil fuel in an environmentally acceptable manner.* This spawned DOE's original **Clean Coal Technology Demonstration Program (CCTDP, 1986 - 1993)**, with added funding provided by the **Energy Policy Act of 1992**, which co-funded the construction and initial operation of Tampa Electric's Polk Power Station<sup>1</sup> (Tampa Electric

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Integrated Gasification Combined-Cycle CCT Project) and PSI Energy’s Wabash River Generating Station<sup>2</sup> (Wabash River Coal Gasification Repowering CCT Project). The follow-on DOE program, the **Clean Coal Power Initiative** (CCPI, 2001 - present), recently awarded cost-share funding to the Orlando Gasification Project (\$235 million), a 285 MW IGCC plant, and the Mesaba Energy Project (\$36 million), a 531 MW IGCC plant.<sup>3</sup>

- **FutureGen Initiative (2003)** — this initiative is a response to President Bush's energy policy directive to develop a hydrogen economy by drawing upon the best scientific research to address the issue of global climate change. The initiative is a government/industry partnership that will employ combined IGCC and CCS technologies to create the world's first zero-emissions fossil fuel plant. The project is scheduled to initiate plant operation by 2012 and is led by the FutureGen Industrial Alliance, Inc., a non-profit industrial consortium representing the coal and power industries. The \$1 billion FutureGen project is expected to create more than 1,000 construction jobs and another 100-plus facility and research positions, provide spin-off research opportunities, and ultimately generate 275 megawatts of electricity. In addition to producing near zero emissions, FutureGen will produce hydrogen for use as a fuel source and will store CO<sub>2</sub> in deep, underground geologic formations.<sup>4</sup>

Current Federal energy policy towards IGCC is most recently and clearly established in the **Energy Policy Act of 2005** (EPACT05), which provides financial incentives to continue RD&D, plus incentives that encourage particular types of early commercial projects, project locations, performance goals, and fuel diversity. The overall policy goals reflected in the Act are to support appropriate projects: 1) *to achieve overall cost reductions in the use of coal to generate useful forms of energy or chemical feedstocks*; 2) *to improve the competitiveness of coal among various forms of energy in order to maintain a diversity of fuel choices in the United States to meet electricity generation requirements*; 3) *to demonstrate methods and equipment that are applicable to 25 percent of the electricity generating facilities, using various types of coal, that use coal as the primary feedstock*; 4) *to promote the deployment and commercialization of GHG intensity-reducing technologies and practices, including capability of adding components which can capture, separate and sequester greenhouse gasses*.

**Table 1** provides an overview of the federal IGCC policy goals included in EPACT05.

### B. State IGCC/CCS Policy Goals

A group of State energy policy goals, individually and collectively, drives support for fossil power generation in general and commercial use of IGCC/CCS technology in particular. Unique circumstances and conditions in each state result in unique combinations to form an overall policy support strategy. These goals are:

- 1) Promote continued utilization of State-produced fuel and other natural resources (e.g., coal, biomass) – 25 states produce and consume their own indigenous coal;
- 2) Enhance economic activity associated with State fuel and natural resources (e.g., jobs for mining, processing, transport);
- 3) Capitalize on existing use of coal power generation facilities and associated existing infrastructure that currently support coal utilization (e.g., rail, river);
- 4) Capitalize on existing levels of transmission capacity or planned capacity expansion;
- 5) Improve environmental compliance of existing and future fossil power generation plants to maintain attainment status and/or upgrade nonattainment areas;
- 6) Enhance productivity of natural resource utilization (e.g., water) and minimize land-use impacts (e.g., power plant footprint, need and size of landfills);
- 7) Promote fuel diversity to maintain and enhance power supply availability and reliability;
- 8) Minimize the cost of electricity to state businesses and residents to foster economic growth; and
- 9) Mitigate state climate change contribution via improved power generation efficiency and options for CO<sub>2</sub> sequestration, as well as enhance production of oil and natural gas via CO<sub>2</sub> well injection.

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Overall, these state goals look to IGCC to improve socioeconomic benefits for citizens, such as jobs and business growth, while simultaneously sustaining or improving the natural environment in the state. States that are currently promoting the development and commercialization of IGCC/CCS technology are *Illinois, Indiana, Minnesota, Ohio, Pennsylvania, Texas<sup>5</sup>, Wyoming<sup>6</sup>, and Colorado<sup>7</sup>*. All, with the exception of Minnesota, are coal-producing states that adopt most of the above goals. Legislative action is also being proposed *Mississippi, New Mexico, Virginia, and West Virginia<sup>5</sup>, as well as pending in Kansas<sup>8</sup>*. Specific types of incentives being offered are discussed in Section III-B. **Table 2** identifies key resource, economic, and environmental factors in the states identified above that support various policy goals.

### III. IGCC PROJECT FINANCING SUPPORT

#### A. Federal IGCC/CCS Incentives Programs – Energy Policy Act of 2005

DOE-sponsored survey results<sup>a</sup> show a consensus that financial and technical risk factors are the most critical challenges to commercial deployment of IGCC/CCS.<sup>9,10,11</sup> Five Titles in EPACT05 support the development, demonstration, and early commercial use of IGCC/CCS technology, via *loan guarantees, cost sharing, investment tax credit, and production subsidies*. Multiple types of financial incentives are provided because they have varying value depending upon the stage of development of the technology and the type of entity that is proposing a commercial IGCC project. Incentives provided by each Title are summarized in **Table 3**, and the investment tax incentives of **Title XIII** are further defined in **Table 4**.

Some key factors that are relevant in determining the value of particular types of financial incentives to different classes of project sponsors are described below.

- **Federal Loan Guarantees**

This incentive is aimed at encouraging early commercial projects, and it is probably most useful to independent power producers (IPPs), utilities not regulated on a cost-of-service basis, and other unregulated operators.<sup>12</sup> In many cases, IPPs have lower credit ratings than regulated utilities, and therefore this type of incentive is much more valuable to them for securing reasonable financing terms, particularly for individual projects that will be backed by a long-term power purchase contract. This is also particularly true if IPPs initially do not have taxable income (profitability) for which to make use of the investment tax credit. Loan guarantees provide leverage to the Federal government, as well as to companies benefiting from them, because only the credit subsidy amount (which will usually be 1% to 20% of the amount guaranteed) is on-budget. Loan guarantees also can be targeted on specific risks, unlike tax incentives.

Loan guarantees are often not useful to regulated and municipal utilities that usually have good credit ratings and cannot – for regulatory reasons – benefit from highly leveraged IGCC project financing. Municipal utilities tend to have access to capital that is typically cheaper than from the Federal government. Cooperative utilities are also unlikely to benefit from using loan guarantees since they have access to Federal Financing Bank funding through the Rural Utilities Service at interest rates similar to Federal government rates.<sup>12</sup>

- **Cost Sharing**

Cost sharing is most frequently used for RD&D projects. Under a cost-shared arrangement, the U.S. Department of Energy contributes a percentage of the capital cost of commercial demonstration projects. Applicants could be required (but have rarely been) to repay up to 100% of the actual DOE contribution

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<sup>a</sup> A DOE study in 2005 that had funding support from EPA and EPRI (unpublished), the Business Case for IGCC, found that “financial” risk factors are the result of other risks, rather than standing alone. In other words, financial risk is not an independent variable; instead, financial risk increases with higher first cost, lower plant availability, regulatory uncertainty, lack of standard designs, and other factors. This study shows that electricity from IGCC plants is roughly 15% to 20% more costly than electricity from conventional coal plants.

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to the project upon successful commercialization of the technology being demonstrated. All types of project sponsors benefit from this type of incentive because cost sharing is an effective means of reducing upfront capital cost, and it has value even if the technology does not achieve design performance levels. Cost sharing is an expensive way for the Federal government to play, however, because every dollar of outlay is on-budget.

- **Investment Tax Credit**

Under the Internal Revenue Code, an investment tax credit (ITC) provides a taxpaying entity with a credit against regular income tax. Therefore, this incentive applies only to commercial projects and only profitable organizations can effectively make use of the credit; municipal utilities and state power agencies cannot take advantage of them since they are tax exempt. Most cooperative utilities are also tax-exempt and unable to use business credits.<sup>12</sup>

Investment tax credits are particularly useful to regulated utilities and profitable IPPs because they effectively reduce upfront capital cost, but will have less value if the technology does not perform as expected due to lower profitability. ITCs are another expensive tool; every dollar of ITC counts on the budget.

- **Production Subsidy**

A production “incentive payment” (subsidy) provides a plant operator with a direct payment based on the amount of energy actually produced from a facility, up to a specified production limit. Under EPACT05, a 1.8¢/kWh production tax subsidy is available for qualifying advanced power system technology facilities to increase power generation through enhanced operational, economic, and environmental performance.

A key difference between a production tax subsidy and the investment tax credit is that the Federal government assumes none of the technology risks of the project with the production subsidy, since it is allowable only to the extent the facility actually produces electricity. An investment tax credit, by contrast, is available without regard to the level of performance of the facility, so long as it has been placed in service. Production subsidies count on a dollar-for-dollar basis, like other tax instruments, however.

EPACT05 supports technological risk reduction via near-term funding for the DOE Gasification R&D Program and demonstration projects; the intent of continued R&D is to further reduce capital cost while improving efficiency, reliability, and environmental performance. The financial incentives are also a key aspect of EPACT’s goal of mitigating perceived technology risk associated with IGCC and the cost differential between IGCC and PC technologies. In total, over \$6 Billion of financial support is offered by EPACT05 for gasification-based technology development, demonstration, and commercial deployment, and loan guarantees, which project developers must pay for, do not add to the total; **Figure 1** summarizes the level of economic support provided by individual titles.

### **B. State IGCC/CCS Incentives Programs**

Various states, with coal-related interests, are using incentives or planning programs to support IGCC project deployment. States with existing and potential IGCC/CCS incentive policies are identified below as of October 2006, and **Table 5** provides a detailed listing of programs offered by those states with incentives.

- **States with legislated incentives:** Illinois, Indiana, Minnesota, Ohio, Pennsylvania, Texas, Colorado, Wyoming
- **Pending legislation:** Kansas State Legislature (Conference Report Approved May 2006)
- **Emerging Action:** Mississippi, New Mexico, Virginia, West Virginia

Support of strategic goals via promotion of IGCC/CCS typically requires implementing licensing/permitting procedural improvements that streamlines and simplifies the process, providing state funding for various types of project financial incentives (e.g., cost recovery, tax incentives), and indemnifying plants and related

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facilities (e.g., sequestration repositories) against potential damages. Such active support helps mitigate deployment barriers and reduces life cycle costs relative to technologies that have a larger environmental footprint.

### C. Other Incentives and Factors That Reduce Project Risk

While financial incentives are the most critical in reducing business risk to early commercial IGCC projects, a variety of other non-financial incentives and factors can, individually and collectively, help reduce risk. These are commercial projects, so the private sector must address many of the business risks associated with IGCC projects, as they would for projects that employ standard technologies:

- *Effective education* of the public, regulators, environmental organizations, equity investors, and institutional decision-makers regarding the life-cycle benefits and impacts of IGCC technology.
- *Generic and uniform licensing standards* for siting and permitting IGCC in multiple jurisdictions.
- *“Plant Performance wraps/warranties”* – now beginning to be offered by the engineering, procurement, and construction (EPC) firms in conjunction with equipment vendors to certify construction cost, schedule, and plant performance risk and guarantee operating and environmental performance to the IGCC investor.
- *Turnkey IGCC suppliers* – IGCC consortia have been formed in the U.S. via acquisitions and exclusive contractual arrangements between companies. These consortia are cooperating to provide comprehensive offerings for the licensing, development, engineering, procurement, construction and operations and maintenance of IGCC facilities.
- *Reference plant designs* – IGCC consortia are developing reference plants that will be used as the basis for system optimization, performance wraps (system guarantees and warranties based on a single-source offering), reduced front-end engineering design (FEED) effort and cost, equipment supply optimization, and enhanced plant "permitability".<sup>13,14</sup>

In addition, states can helpfully provide:

- *Effective education* of the public, regulators, environmental organizations, equity investors, and institutional decision-makers regarding the life-cycle benefits and impacts of IGCC technology.
- *Generic and uniform licensing standards* for siting and permitting IGCC in multiple jurisdictions.
- Cooperation and coordination among *Federal agencies, state utility rate-setting entities (PUC), and equity investors* to consider national, regional, and state energy and environmental policies.
- Federal or state indemnification for IGCC byproducts (e.g. slag, hydrogen, stored CO<sub>2</sub>).

### D. CCS Risk Reduction

Given considerable uncertainty currently associated with CO<sub>2</sub> sequestration, DOE has formed a nationwide network of regional partnerships to help determine the best approaches for capturing and permanently storing gases that can contribute to global climate change. The regional carbon sequestration partnerships are a government/industry effort tasked with determining the most suitable technologies, regulations, and infrastructure needs for carbon capture, storage, and sequestration in different areas of the country. Characterization Phase activities were conducted from September 2003 through June 2005, and Validation-Phase field tests are currently under way. Geographical differences in fossil fuel use and sequestration sinks across the United States dictate regional approaches to sequestration of carbon dioxide (CO<sub>2</sub>) and other greenhouse gases. The seven partnerships that currently form this network include 300+ state agencies, universities, and private companies, spanning 40 states, three Indian nations, and four Canadian provinces. In addition, agencies from six member countries of the Carbon Sequestration Leadership Forum are participating in the Validation Phase field tests.

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### IV. CONCLUSIONS

IGCC/CCS technology offers the potential for significant economic, environmental, and national security benefits. However, the combination of performance uncertainty and high initial capital cost for early commercial IGCC technology deployment increases regulatory approval uncertainty and magnifies financing risk for project developers. Federal and state policies described in this paper are helping to mitigate this incremental risk by providing funding for ongoing and new RD&D initiatives, as well as instituting various types of project financial incentives as described in the paper. EPACT05, in particular, has initiated a wide range of actions, including the authorization of tax credits and incentives; more than \$6 Billion of financial support is offered by EPACT05 for gasification-based technology development, demonstration, and early commercial deployment, not including loan guarantees.

The early success of the EPACT05 methodology is provided by recent applications for tax credits and loan guarantees. A total of 49 applications have been received from 29 states proposing projects worth \$57.7 billion and \$5 billion in tax credits. Of the 49 applications:<sup>15</sup>

- Twenty-two applications were received under the coal-based program, representing \$27.7 billion in proposed projects and request \$2.3 billion in tax credits. Of these, 18 request credits for integrated gasification combined cycle plants and 4 for advanced coal-based generation plants. Applications include projects using bituminous, subbituminous, and lignite coals to be built in 19 states: Arizona, Connecticut, Delaware, Florida, Illinois, Indiana, Kentucky, Michigan, Minnesota, Missouri, Mississippi, North Carolina, New York, Ohio, Oregon, South Dakota, Utah, West Virginia, and Wyoming.
- Twenty-seven applications were received under the gasification technology program, representing \$30 billion in proposed projects and requesting \$2.7 billion in tax credits. Project are proposed in 17 states: Arizona, California, Florida, Idaho, Illinois, Indiana, Kansas, Kentucky, Louisiana, Maryland, New York, Ohio, Oregon, Pennsylvania, Tennessee, Texas, and Washington.

The IRS expects to make final selection by November 30, with project applicants receiving their notice for eligibility of the tax credit by the IRS shortly thereafter.

In addition to EPACT05, fourteen states have either passed or are considering legislation that provides complimentary RD&D funding, tax incentives and project indemnification to further support early commercialization efforts. The ultimate goal is to enable the nation and state governments to capture projected social benefits from improved IGCC/CCS technologies by encouraging the private sector to provide the bulk of the investment in their development and deployment to advance their future business opportunities.

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**TABLES AND FIGURES**

**TABLE 1. EPACT 2005 IGCC/CCS POLICY GOALS**

POLICY CATEGORIES	EPACT IGCC/CCS POLICY GOALS
<p><b>TYPES OF PROJECTS PROMOTED</b>                      Title IV: Coal – Sections 402, 411, 413, 421                      Title IX: R&amp;D: Fossil Energy – Sections 962                      Title XIII: Energy Policy Tax Incentives – Section 1307; Title XVII: Inc. for Innovative Technologies – Section 1703</p>	<p>Coal-based gasification technologies including <i>gasification combined cycle</i>, <i>gasification fuel cells</i> and <i>turbine combined cycle</i>, <i>gasification co-production</i>, and <i>hybrid gasification</i> capable of producing a concentrated stream of carbon dioxide.</p> <p>Repowering of existing pulverized coal plants</p> <p>Industrial gasification systems</p> <p>Polygeneration of electricity, steam, fuels, hydrogen, chemicals</p>
<p><b>PROJECT SIZE</b>                      Title IV: Coal – Sections 411, 414                      Title XVII: Incentives for Innovative Technologies – Section 1703</p>	<p>&gt;400 MWe for utility-scale IGCC plants</p> <p>&gt;200 MWe for IGCC/Renewable energy plants (Upper Great Plains)</p> <p>&gt;100 MWe for utility-scale IGCC plants in Western U.S.</p>
<p><b>PROJECT LOCATION DIVERSITY</b>                      Title IV: Coal – Sections 412, 413, 414</p>	<p>Healy, Alaska; Western states; Western State at an altitude of greater than 4,000 feet above sea level using coal less than 9,000 Btu/lb; Other locations in deregulated energy generation markets that do not receive subsidies (direct or indirect) from ratepayers; Upper Great Plains - IGCC/Renewable energy plants; nonattainment air quality areas; R&amp;D facilities in Illinois, Indiana, and Kentucky</p>
<p><b>THERMALEFFICIENCY PERFORMANCE</b>                      Title IV: Coal – Section 402                      Title XIII: Energy Policy Tax Incentives – Section 1307</p>	<p><b>New Plants:</b> 50% for coal of more than 9,000 Btu/lb; 48% for coal of 7,000 to 9,000 Btu/lb; and 46% for coal of less than 7,000 Btu.</p> <p><b>Retrofit Projects:</b> 7% for coal of more than 9,000 Btu/lb; 6% for coal of 7,000 to 9,000 Btu/lb; or 4% for coal of less than 7,000 Btu/lb.</p> <p>Thermal efficiency goals are to be adjusted by altitude.</p> <p>Thermal efficiency goals will not apply to projects that separate and capture at least 50% of the potential emissions of CO<sub>2</sub> by a facility.</p>
<p><b>ENVIRONMENTAL PERFORMANCE</b>                      Title IV: Coal – Section 402; Title XVII: Incentives for Innovative Technologies – Section 1703</p>	<p>SO<sub>2</sub> Reduction Level – 2020 Goals: 99%+; NO<sub>x</sub> emissions: &lt; 0.05 lbs NO<sub>x</sub>/million Btu; Mercury Reduction Level: 95%+</p> <p>Minimum Project Goals: SO<sub>2</sub> Emissions Level &lt; 0.05 lb/MMBtu: 99%+; NO<sub>x</sub> emissions: &lt; 0.08 lbs NO<sub>x</sub>/million Btu; Mercury Reduction Level: 90%; Total particulate &lt; 0.08 lbs/MMBtu</p>
<p><b>FUEL DIVERSITY</b>                      Title IV: Coal – Sections 411, 412, 413, 415, 417; Title XIII: Energy Policy Tax Incentives – Section 1307 ; Title XVII: Incentives for Innovative Technologies – Section 1703</p>	<p>All coal types: anthracite, bituminous, subbituminous, lignite</p> <p>All types of Western Coals - (including subbituminous and bituminous coal with an energy content of up to 13,000 Btu/lb.) mined in the western U.S.</p> <p>IGCC using coal of less than 7,000 Btu/lb must be combined with wind or other renewables, minimize and provide the potential to sequester CO<sub>2</sub> emissions, <u>and</u> provide a ready source of hydrogen for near site fuel cell demonstrations.</p> <p>Minimum of five petroleum coke gasification projects</p> <p>Develop Fischer-Tropsch transportation fuels and other transportation fuels from Illinois basin coal</p>
<p><b>CLIMATE CHANGE</b>                      Title IV: Coal – Sections 402, 413                      Title XIII: Energy Policy Tax Incentives – Section 1307; Title XVII: Incentives for Innovative Technologies – Section 1703</p>	<p>High priority given to projects that include CCS capability.</p> <p>Include designs determined to be capable of accommodating the equipment likely to be necessary to capture the carbon dioxide that would otherwise be emitted in flue gas from a plant</p>

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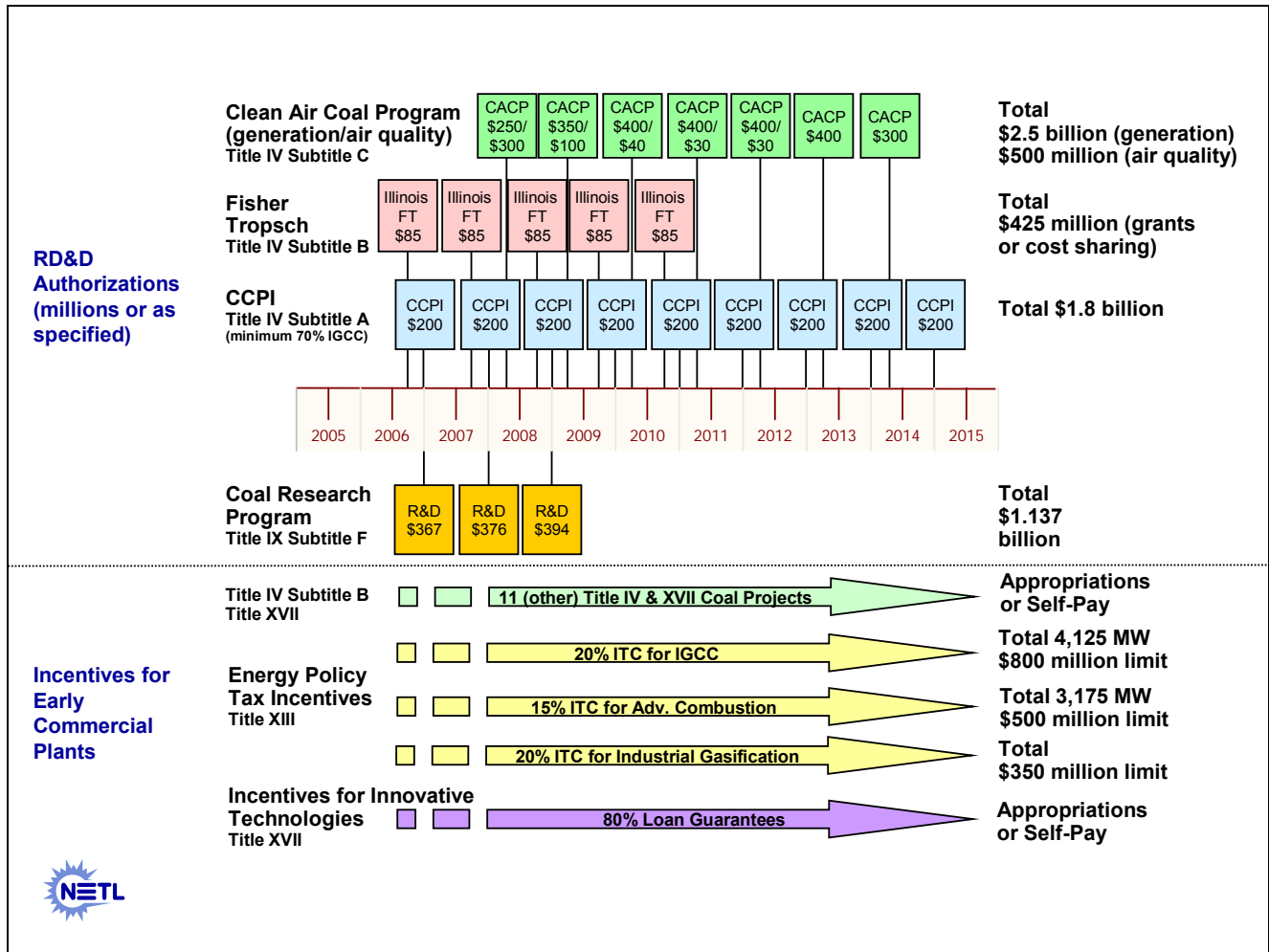
**TABLE 2. UNIQUE STATE FACTORS THAT SUPPORT SPECIFIC ENERGY/ENVIRONMENTAL POLICY GOALS**

STATE <sup>16,17</sup>	2005 COAL PRODUCTION/ TYPE/ EST. RESERVES (Million Tons)	% POWER FROM COAL	2004 CO2 EMISSIONS (Million Metric Tons)	GEOLOGIC SEQUESTRATION POTENTIAL	CRITERIA POLLUTANT NON ATTAINMENT	STATE POLICIES TOWARD ADVANCED COAL TECHNOLOGIES
<b>IL</b> <sup>18,19,20</sup>	32 High Btu Bituminous 38,000	49	227	Significant reservoirs identified in Illinois Basin deep coal seams; EOR potential	10 counties for ozone, PM2.5	Use of cutting-edge technology deemed desirable by state - actively supports clean coal technology development and implementation to further use of state coal resources & environmental protection Comprehensive long-term energy plan to sets goal of replacing 50% of the state’s energy supply with state fuels by 2017; Launched Global Warming Initiative 10/06 Two Illinois locations have been selected as finalist candidate sites for DOE’s FutureGen plant
<b>TX</b> <sup>21,22</sup>	46 Lignite 9,534	38	656	Gulf Coast has significant deep brine aquifer storage; abundance of depleted oil fields, with significant EOR potential	23 counties for ozone, 1 for PM10, and 1 for CO	Very active in supporting DOE’s FutureGen projects in state Two Texas locations have been selected as finalist candidate sites for FutureGen plant
<b>WY</b>	406 Subbituminous 40,607	97	63	Potential reservoirs in areas underlain by non-surface-minable portions of the Powder River Basin Wyodak–Anderson coal zone	1 county for PM10	Studies ongoing to consider significant increase in transmission capacity to neighboring states Established advisory committee to implement sequestration and CO <sub>2</sub> credit-marketing program
<b>IN</b> <sup>23</sup>	34.5 High Btu Bituminous 4,054	94	230	Significant reservoirs identified in Illinois Basin deep coal seams; EOR potential	27 counties for ozone, 26 for PM2.5	<b>Indiana Strategic Energy Plan</b> – “best way to use our abundant coal reserves and meet the Environmental Protection Agency’s (EPA) clean air mandates is to adopt clean coal technologies” Use of advanced technology deemed desirable by state - actively supports clean coal technology development and implementation to further use of state coal resources & environmental protection Experience with permitting IGCC plants – Wabash IGCC plant in operation
<b>OH</b> <sup>24,25</sup>	24.7 High Btu Bituminous 11,486	86	252	Potential to store about 45 gigatonnes of CO <sub>2</sub> in various subsurface geologic options; EOR and EOG potential	8 counties for ozone; 24 counties (or portions) for PM10	<b>Ohio Energy Policy &amp; Action Plan</b> – “Building on Ohio’s immense coal reserves and leadership in clean coal research and development” Public Utilities Commission of Ohio – “Recognized Attributes to View IGCC Facility Favorably” <sup>26</sup> – Need for investment in new clean coal technology; Value of IGCC for hedging strategy Use of most abundant energy resource while providing option to deal with long-term environmental demands
<b>PA</b> <sup>27, 28</sup>	34.5 High Btu Bituminous 11,754	41	262	Significant potential CO <sub>2</sub> sequestration capacity – estimated at 885 gigatonnes <sup>29</sup>	49 counties for ozone; 17 counties (or portions) for PM2.5	<b>PA Energy Development Plan</b> – Alternative Energy Portfolio Standards Act (AEPS) requires that 18% of retail power must be generated from alternative energy resources by 2020, including IGCC. State is putting in place policies and financial tools designed to promote advanced energy projects. Providing regulatory and financial incentives to shut down older, dirtier, inefficient power plants and re-power with advanced coal gasification technology.
<b>MN</b> <sup>30</sup>	No coal resource base, but large coal consumption for electricity production	49	96	Unknown	None	Energy security and environmental protection are significant issues Supply power needs with in-state plants that protect state’s environment Create IGCC anchor facilities on large industrial sites to attract new industries that can tap IGCC’s polygeneration capabilities
<b>CO</b> <sup>16</sup>	38.5 Subbituminous 9,761	75	39.6	Significant natural reservoirs in Colorado Plateau and Southern Rock Mountains	9 counties for 8-hour ozone	<b>Statute 40-2-123 - New Energy Technologies</b> – Strongly encourages state PUC to consider IGCC projects and use Colorado or other Western coals, and are less than 350 MWe. Financial incentives include early project cost recovery, project assistance from state organizations, and financial assistance for project engineering and development from <b>Clean Energy Development Fund</b>



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FIGURE 1. EPACT 2005 FUNDING OF ADVANCED COAL TECHNOLOGY<sup>31</sup>



**TABLE 3. EPACT05 INCENTIVES FOR IGCC/CCS PROJECTS<sup>32</sup>**

**TITLE IV: COAL**

**Subtitle A - Clean Coal Power Initiative (CCPI), Section 401** authorizes \$200 million per fiscal year FY06-FY14 for clean coal research in coal-based gasification and combustion technologies. At least 70% of the funds must be used to fund projects on coal-based gasification technologies including gasification combined cycle, gasification fuel cells and turbine combined cycle, gasification co-production, hybrid gasification and combustion, and other advanced coal based technologies capable of producing a concentrated stream of CO<sub>2</sub>.

**Subtitle B - Clean Power Projects.**

**Section 411, Integrated Coal/Renewable Energy System, IGCC Technology.** Loan guarantees for IGCC projects that integrate with wind, or other renewables, minimize and provide the potential to sequester CO<sub>2</sub> emissions, and provide a ready source of H<sub>2</sub> for near site fuel cell demonstrations.

**Section 413, Western Integrated Coal Gasification Demonstration Project.** Authorizes financial assistance for a demonstration project to produce energy from coal mined in the Western US and using IGCC that is capable of capturing and sequestering carbon.

**Section 414, Coal Gasification.** Authorizes loan guarantees for a project to produce energy using IGCC technology.

**Section 415, Petroleum Coke Gasification.** Authorizes loan guarantees for petroleum coke gasification projects.

**Subtitle C - Clean Air Program Authorization (Amendment of Title XXXI-- Clean Air Coal Program of the Energy Policy Act of 1992.**

**Sections 3101 and 3102** – Allows Secretary of Energy to carry out a two pronged program to encourage production and generation of coal based power.

**For generation projects authorizes:** \$250 million for 2007; \$350 million for 2008; \$400 million for 2009 thru 2012; \$300 million for 2013. **For air quality enhancement projects authorizes:** \$300 million for 2007; \$100 million for 2008; \$40 million for 2009; \$30 million for 2010 and 2011. Total package is \$3.0 billion.

Funds can be distributed in the form of cost sharing, grants, or loan guarantees. Requires federal cost share of not more than 50 percent.

**TITLE IX: RESEARCH AND DEVELOPMENT**

**Subtitle F – Fossil Energy, Section 962. Coal and Related Technologies Program.** Authorizes funding through FY09 for the Coal R&D program, which includes gasification systems and advanced separation technologies.

**TITLE XII: ELECTRICITY**

**Subtitle B, Section 1224. Advanced Power System Technology Incentive Program.** Provides a COE subsidy of 1.8 ¢/kWh for appropriate projects. The incentive payment applies to, but not more than, the first 10,000,000 kilowatt-hours produced in any fiscal year. Applies to a facility using an advanced fuel cell, turbine, or hybrid power system or power storage system to generate or store electric energy.

**TITLE XIII: ENERGY POLICY TAX INCENTIVES** – Section A - Infrastructure; Section 1307 provides for “Credit for Investment in Clean Coal Facilities.”

**Section 48A** – Qualifying Advanced Coal Project Tax Credit, \$1.3 Billion overall; \$800 million for IGCC projects. The qualifying advanced coal project credit for a taxable year is an amount equal to 20 % of the qualified investment for that taxable year in certified, qualifying advanced coal projects using an IGCC.

- \$267 million total for bituminous projects, maximum \$133.5 million per project
- \$267 million total for sub-bituminous projects, maximum \$133.5 million per project
- \$266 million total for lignite projects, maximum \$133 million per project

**Section 48B** – Advanced Gasification Program Tax Credit; 350 \$million for specific gasification project attributes (CCS, renewable fuels, experienced and successful gasification teams); Eligible for 20% ITC

**TITLE XVII: INCENTIVES FOR INNOVATIVE TECHNOLOGIES**

**Section 1703** – provides for Advanced Fossil Energy Technology Loan Guarantees, not to exceed 80% of project valuation.

**TABLE 4. IGCC/CCS PROJECTS ENTITLED TO TITLE XIII TAX INCENTIVES<sup>32</sup>**

**Section 48A –**

- **Within 2 years of certification applicant must**
  - Obtain all Federal and State environmental reviews to commence construction
  - Enter a binding contract (except for re-powering) to purchase main steam turbine(s)
- **Applicant must place project in service in 5 years following certification**
- **Project can be new construction or re-powering**
- **Fuel input at least 75% coal**
- **Electric generation at least 400 MW**
- **Evidence that output can be utilized or acquired**
- **Evidence of site ownership (site in U.S.)**
- **Priority assigned to projects**
  - Greenhouse gas capture capability
    - Capable of adding components which can capture, separate...and sequester greenhouse gasses
  - Increased by-product utilization
- **Performance characteristics**
  - SO<sub>2</sub> , 99% removal
  - NO<sub>x</sub> , 0.07 lbs/MMBtu emissions
  - PM , 0.015 lbs/MMBtu emissions
  - Hg , 90% removal

**Section 48B –**

- **Priority for**
  - Projects with carbon capture capability
    - Reflect reasonable consideration for and be capable of accommodating equipment likely to be necessary to capture carbon dioxide for later use or sequestration
  - Projects that use renewable fuel
  - Project with teams that demonstrate successful gasification technology operations
- **Applicant has 7 years to place project in service**
- **Project employs gasification technology**
  - Process which converts a solid or liquid product from coal, petroleum residue, biomass or other material and into a synthesis gas composed primarily of carbon monoxide and hydrogen for direct use or subsequent chemical or physical conversion
- **Application is related to**
  - Chemicals, fertilizers, glass, steel, petroleum residues, forest products, agriculture including feedlots & dairy
- **Applicant financially viable without other federal funding**
- **Market exists for products – written contracts or statements of intent from potential customers**
- **Fuels identified with gasification technology comprise 90% of fuels required by project for production of chemical feedstocks, liquid transportation fuels, or co-production of electricity**

**TABLE 5. STATE IGCC/CCS INCENTIVE PROGRAMS**

**ILLINOIS<sup>5,33</sup>**

- **Illinois Finance Authority Authorization/Financial assistance to energy generation facilities (ILCS 605/605-332):** Up to \$300 million in bond funds for *new gasification facilities* funded through Federal grant, >400 MW, uses coal gasification or IGCC, supports creation of Illinois coal mining jobs
- **Coal Demonstration Program:** 183 million bond authorization to demonstrate and deploy innovative technologies; \$1 to \$30 million grants; Use high sulfur Illinois coal; locate project in Illinois; meet all Federal and state environmental regulations
- **Illinois Coal Revival Program:** Grant based on State Retail Occupation Taxes paid on Illinois coal purchases for new electric plants. Qualifying facilities may be eligible for grants roughly based on the present value of future sales taxes paid on Illinois-mined coal over a 25-year period, up to a maximum amount of \$100 million
- **High Impact Business Designation (20 ILCS 655/5.5):** Designated businesses qualify for tax credits and exemptions associated with various Illinois revenue-generating laws; specifically includes businesses seeking to build power generation plants using IGCC/gasification technologies and other gasification facilities
- Senate Bill 90, permits gas utilities to enter into long-term supply contracts with any plant that uses IGCC to produce natural gas from Illinois coal.<sup>34</sup> Sets the price for IGCC-produced gas 18 to 30 percent lower than that of conventional natural gas.
- **Southern Illinois University/Clean Coal Review Board:** \$25 million program to support clean coal projects and programs
  - Southern Illinois Clean Energy Center, \$2.5 million grant, 545 MW IGCC with SNG production
  - Taylorville Energy Center IGCC Feasibility Analysis, 750k grant, IGCC and chemicals coproduction
  - Close Coupled Gasification Microgeneration Powerplant, \$2.5 million grant, modular gasifier-combustor

**TEXAS<sup>5,35</sup>**

- **2005: Legislature funded site screening process for potential FutureGen plant**
  - Approved \$22 million in grants and incentives for low-emission projects
  - Expedited permitting for FutureGen-type projects
- **2006: Legislation establishes ownership of CO<sub>2</sub> captured by FutureGen clean coal project**
  - State will provide indemnification for the CO<sub>2</sub> permanently stored in deep underground formations
  - State also retains the right to sell CO<sub>2</sub> for enhanced oil recovery if not injected

**WYOMING<sup>5,36</sup>**

- **Wyoming Code, Title 39 - Taxation and Revenue, Chapter 15 - Sales Tax, Article 1 State Sales Tax, § 39-15-105 - Exemptions**
  - Exempts sales tax on equipment purchased to build new gasification or liquefaction plants
  - Limited to the acquisition of equipment used in a project to make it operational. Does not apply to tools and other equipment used in construction of a new facility, contracted services required for construction and routine maintenance activities nor to equipment utilized or acquired after the facility is operational.

**INDIANA<sup>5,37</sup>**

- **2002 Utility Generation and Clean Coal Technology (IC 8-1-8.8) Legislation – PART 1: Financial incentives for “clean coal and energy projects” using Illinois Basin coal or gas:**
  - *Clean coal technology at new or existing facilities*
  - *Advanced technologies that reduce regulated air emissions from existing generating facilities*

Financial incentives for “clean coal and energy projects” include:

  - *Cost recovery* - during construction and operation of projects at new or existing generating facilities
  - Up to 3% on the *return on shareholder equity* that would otherwise be allowed
  - *Cost recovery and 3% return* on shareholder equity for purchase of synfuels from gasification facility
  - *Other financial incentives the IURC considers appropriate*
- **2002 Utility Generation and Clean Coal Technology (IC 8-1-8.8) Legislation – PART 2: Financial incentives for “new energy generating facilities.”**
  - New or expanded energy generating facilities using coal or gases from the Illinois Basin
  - Use of clean coal technologies is acceptable, but not necessary

Financial incentives for new energy generating facilities include:

  - Cost recovery for construction, repowering, expansion, operation or maintenance

**IGCC/CCS –Federal and State Incentives for Early Commercial Deployment**

**TABLE 5. STATE IGCC/CCS INCENTIVE PROGRAMS**

- Pollution control equipment added to utility's rate base
- **2005 Coal Gasification Investment Tax Credit P.L. 191-2005 (IC 6-3.1-29)**
  - Allows state tax liability credit for a qualified investment in an IGCC power plant when placed in service
  - ITC = 10% of Project Cost for the First \$500 million and 5% of the Remaining Cost Above \$500 million
  - 100% Indiana coal required (2006 Amendment)
- **2006 Legislation (P.L. 122-2006)**
  - Amended existing pipeline safety statute to apply to the pipeline transportation of hazardous liquid or carbon dioxide fluid in addition to gas
  - Provided for confidentiality of certain information concerning pipelines for purposes of the law concerning access to public records
- 10 year real and personal property tax abatement and a 45% tax increment finance district was approved by the Knox County Council on April 11, 2006

- OHIO<sup>5</sup>**
- Ohio Air Quality Development Agency and Ohio Coal Development Office offer:
    - Conduit financing
    - Loan, loan guarantees, grants
    - Tax incentives
    - Funding for demonstration projects

- PENNSYLVANIA<sup>5,38,39</sup>**
- Alternative Energy Portfolio Standards Act of 2004 (73 P.S. s 1647.2, SB 1030)
    - Load-serving entities must provide 18% of their electricity using alternative sources by the year 2020, including IGCC; level of alternative energy gradually increases according to 15 year schedule
  - Energy Deployment for a Growing Economy (“EDGE”)
    - Priority funding through the PA Economic Development Financing Authority (PEDFA) and the PA Energy Development Authority (PEDA) for advanced coal gasification plants.
    - Low interest loans for IGCC
    - Permits long-term power purchase contracts to assist with financing
    - Permitting synthetic gas producers to operate without the burden of utility regulation when they serve and sell to limited purchasers such as chemical, manufacturing or industrial facilities.

- MINNESOTA<sup>5,40</sup>**
- 2003 statute (216B.1694) provides incentives for proposed 531 MW Mesaba Energy IGCC Project
  - Entitles project developer, Excelsior Energy, to sign 450 MW power purchase agreement with Xcel
  - Exempted from certificate of need for all initial and future generation and transmission
  - Grant of \$2,000,000/year for 5 years for development, engineering from renewable development account
  - Job Opportunity Building Zone designation, which provides a 12-year holiday on State taxes

- COLORADO**
- **Colorado Revised Statutes – Title 40: Utilities, 40-2-123: New energy technologies - Consideration By Commission - Incentives - Demonstration Projects**
    - Requires the PUC to give “fullest possible consideration” to IGCC facilities upon a showing of feasibility, environmental benefits, and cost-effectiveness
    - Project must use Colorado or other Western coal, be located in Colorado, be less than 350 MW, and demonstrate CCS technology
    - Includes methods and procedures to monitor the fate of the carbon dioxide captured and sequestered from the facilities
    - PUC can approve current cost recovery by a utility through the rate adjustment clause of the utility's weighted average cost of capital, including its most recently authorized rate of return on equity, for expenditures on an IGCC project during the project’s construction, startup, and implementation phases.
    - The department of public health and environment, the Governor's Office of Economic Development, and the Governor's Office of Energy Management and Conservation may provide public utilities with reasonable assistance in seeking and obtaining financial and other support and sponsorship for a project from the U.S. congress, U.S. DOE, and other appropriate federal and state agencies and institutions.

**IGCC/CCS –Federal and State Incentives for Early Commercial Deployment**

<b>TABLE 5. STATE IGCC/CCS INCENTIVE PROGRAMS</b>
<ul style="list-style-type: none"> <li>- Financial support for the study, engineering, and development of an IGCC facility shall be appropriated from the <b>Clean Energy Development Fund</b> created in section 24-22-118, C.R.S.</li> <li>- To facilitate financing of an IGCC project, one or more public utilities may develop, construct, or own an IGCC facility through a special purpose entity or other affiliated partnership or corporation. If such an ownership structure is employed, the utility or utilities may apply to the PUC for a waiver of the rules requiring competitive resource acquisition.</li> </ul>
<p><b>KANSAS (Pending Legislation)</b></p> <ul style="list-style-type: none"> <li>• <b>SB 303/HB 2904 would enact the Kansas Energy Development Act – Conference Committee Report On House Substitute for Senate Bill NO. 303 Agreed To May 9, 2006, Final Legislation Pending</b> <ul style="list-style-type: none"> <li>- Provides 12-year (beginning with purchase or the start of construction or installation) property tax exemption for any new or expanded (by at least 10 %) ICGPP (Integrated Coal Gasification Power Plant) property, except transmission equipment located at the plant.</li> <li>- Provides 12-year (beginning with purchase or the start of construction or installation) property tax exemption for property purchased for or constructed or installed at an ICGPP to comply with federal or state air emission standards</li> <li>- Income tax credit for projects are 10 % of the first \$250 million investment and 5 % of the amount in excess of \$250 million</li> </ul> </li> </ul>
<p><b>MISSISSIPPI (Emerging Action)</b></p> <ul style="list-style-type: none"> <li>• Bond Issuance for Gasification</li> </ul>
<p><b>NEW MEXICO (Emerging Action)</b></p> <ul style="list-style-type: none"> <li>• Tax credit for IGCC, Fuel Cells, and Renewables</li> </ul>
<p><b>VIRGINIA (Emerging Action)</b></p> <ul style="list-style-type: none"> <li>• Promotes gasification research in current state energy plan</li> </ul>
<p><b>WEST VIRGINIA (Emerging Action)</b></p> <ul style="list-style-type: none"> <li>• Promotes gasification research in current state energy plan</li> </ul>

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