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UNIVERSITY OF FLORIDA

Graduate Programs in Business
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PURC
"Leadership in Infrastructure Policy"

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Paul M. Sotkiewicz, Ph.D.
Director, Energy Studies

Honorable Pegeen Hanrahan, Mayor
Honorable Warren Neilsen, Commissioner
Honorable Chick Chestnut, Commissioner
Honorable Rick Bryant, Commissioner
Honorable Ed Braddy, Commissioner
Honorable Jack Donovan, Commissioner
Honorable Craig Lowe, Commissioner

Dear Mayor and Commissioners:

Please find enclosed a copy of my comments regarding GDS's Review of ICF's Interim Report as well as supporting attachments. The attachments include two PowerPoint presentations made at the Coal 2020 Conference sponsored by the University of Kentucky, Cinergy, and Eastman Chemical in October 2004.

I will be sending copies of my comments to members of staff at GRU.

Should you have any questions regarding my comments, I can be reached by email, phone, or post at the address in my signature. As always I remain at your service

Sincerely,

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cc: Kurt Lannon

Overall Impressions

The process of reviewing the analysis ICF has provided was a great opportunity to get valuable input from another firm with some expertise in the electricity and energy industries. However, it is most unfortunate that the tone of the report is a mix of sour grapes and bitterness with a disturbing overtone of advocacy for a particular set of interests in the City who have been particularly vocal. As an energy analyst, modeler, and sometimes consultant I am extremely disturbed by the first sentence of the first bullet point of an executive summary to read "*The ICF draft study is what it is.*" Such a flippant and inflammatory statement serves no other purpose than as a juvenile retort toward ICF and provides no substantive analysis of the report.

Moreover, in the executive summary the statement "*The criteria used by ICF may not adequately represent **THE*** (caps and bold provided for emphasis) *stakeholders that have an interest in this important decision for the City"* indicates to me as a reader that there is some sort of advocacy for some interest groups within the City as if there is only one stakeholder group indicated by ***THE***, and only one set of values held by the diversity of citizens in the City of Gainesville. This point is explored further in Section 3 of the Review regarding the weighting of community values. After several pages of faulting ICF for not placing weights on various criteria (cost, environmental effects, health effects, etc.) and for not making statement on which option is best, GDS demurs and refuses to make a decision on weighting and the best option citing among other issues its lack of knowledge with respect to the appropriate weightings. Clearly ICF did not make recommendations for a reason: The decision is the City Commission's to make. Not ICF's and not GDS's. While this discussion has important policy ramifications for the City Commission, it should not be the concern for GDS in its review, and does not add any substantive information regarding ICF's report.

In my opinion such judgmental, inflammatory, and punitive statements as described above have no place in a study review where the review should stick to the facts or debate substantive issues such as assumptions and modeling techniques where reasonable people can disagree.

Inconsistencies and Incomplete Information

It seems that even with two weeks time to prepare a high level report, there are many inconsistencies and instance of incomplete information that jump out at the reader. In most of these cases, it would seem a lack of effort to find the information that is easily available with some web research or phone calls. In other cases, it seems a lack of proofing the Review or general lack of attention to detail. I shall list them below in bullet point format.

- In the Executive Summary on Page 3, the heading reads in part "Alternative Scenarios Analyzed by GDS", yet in Section 2, the first paragraph says no analysis was undertaken by GDS. The City should know which it is, because if no analysis was undertaken, then the numbers GDS present have no basis and should be discounted. The same can be said for the numbers generated as part of Section 4 of the Review on Demand Side Issues. If analysis was undertaken, it would be useful to know how the numbers were generated for DSM adjustments and Demand Response as indicated on Page 3.
- On Page 3 of the Executive Summary, GDS adds up the possible savings from DSM and contract curtailment as if they would be implemented together to arrive at a situation where a new base-load facility could be put off until 2020. This exhibit gives the reader the impression that GDS is recommending in a cumulative fashion, the abrogation of those contracts. Yet, on Page 25 of the Review, GDS reveals Seminole Electric Cooperative is a GDS client and then refuses to make any recommendation on the continuation of these wholesale power contracts. As a reader and energy

analyst, I am deeply disturbed at how the presentation of this information has been handled and cause me to question ever more deeply the information GDS has presented in this review.

- In spite of knowing the RFP called for the analysis of only four options, and with those options being agreed upon in a public process between ICF, the City Commission, GRU, and public input, GDS continues to insist the report examine even more options such as "transmission solutions" as suggested in the executive summary. Moreover, asking ICF to address the possibility of a 20 MW - 30 MW biomass unit with aggressive DSM as suggested on Page 27, would essentially replicate the Max DSM/75 MW Biomass option examined by ICF. Such comments by GDS point at the issues that anybody can raise in evaluating any report, but offer no substantive feedback on what was actually done.
- In Section 4, Page 10, GDS touts Lakeland Electric's solar thermal program, but I fear have not provided all the relevant information. The reason solar thermal is cost-effective for Lakeland is that they charge a different (higher) electricity rate for the equivalent electric power produced by the solar thermal unit. Consequently, they recover all costs of the program through the separate charge, and it is cost-effective under RIM because there is no "lost revenue" from the calculation. I would refer the Citizens and City Commission to Mr. Jeff Curry at Lakeland Electric for further details. I would also refer you to the presentation I gave on the various cost-benefit tests back in April of 2004 which can be found at http://futurepowerneeds.gru.com/ by searching under Author = Sotkiewicz.[1]
- On Page 9 GDS makes the following statement: "*In addition, the City Commission must recognize that if a new 232 MW coal plant is constructed, and the GRU grid has excess capacity, GRU will have little or no incentive to pursue aggressive DSM programs. A decision to build a new 232 MW coal plant will be the "death knell" for aggressive DSM programs.*" This statement makes an unstated assumption that all utility costs are recovered through per kWh charges. **However, with a multi-part tariff rate design where all fixed costs are recovered through a fixed demand charge per month, this statement is false as conservation does not harm the utility's ability to recover its cost.**
- Moreover, on Page 9, GDS cannot seem to get the proposed capacity correct by quoting it as 232 MW as opposed to the 220 MW. They continue with the same mistake on Page 23.
- On Page 26, GDS states that it would like to "…see a scenario where market interaction is turned off…" in order to examine supply option costs without the wholesale market revenue. The omission of this request for DSM Options is curious. This might be worthwhile scenario to examine, however the same must also be done for the DSM and DSM/Biomass options since the "market interaction" also drives the lower costs of these options since wholesale purchases are equally important in these scenarios.
- GDS faults ICF for not examining the possibility of switching to gas water heaters (Page 10), but this is already a part of the baseline as GRU already offers such a program (http://www.gru.com/YourHome/Conservation/Energy/rebates.jsp). On Pages 16-17, GDS also faults ICF for not examining interruptible, time-of-use, and inclining blocks tariffs. Again, these already tariffs already exist and serve as part of the baseline in the analysis.

DSM, Other Load Reduction, and Reliability

With respect to DSM and energy efficiency, GDS faults ICF for not including numerous energy efficiency and load management options. For example, ICF did not include solar-photovoltaic, LED lighting, and agricultural sector efficiency measures. Faulting ICF for not including options that are either not cost-

[1] Information on this program was discovered in a personal conversation with Paul Elwing of Lakeland Electric, February 24, 2006 in Gainesville at the PURC Annual Conference.

effective (such as LED lighting and solar-PV) or not relevant to the footprint (Agricultural sector) seems curious as most energy analysts would agree that the LED and solar PV options are still in the research and development phase and remain extremely expensive options. At http://www.clean-power.com/fsec/ one can see that a solar PV unit in Gainesville after energy savings and and tax incentives still has a net cost of $3/month.[2] A cost-effective program should have net benefits!

GDS provides a comparison of DSM effectiveness of municipal and all utilities to what GRU has done and to what ICF is reported as possible under the "Maximum DSM" assumptions. The comparison from the EIA 861 database provides a very useful comparison. However, the comparison between utilities is in reality an apples-to-oranges comparison because some utilities "vintage" their DSM in calculating energy savings while other utilities do not. Moreover, utilities across the universe of the EIA 861 database also use different cost-benefit tests.

In the comparison of GRU to the universe of utilities, the reader is left feeling that the ICF estimates for DSM and what GRU has accomplished over time is sub-standard. In my opinion, I find that tone and conclusion to be misleading. While GRU ranks 44th in the US in total kWh savings and 181st in peak load savings, one must compare this to the universe of utilities not just those ahead of GRU. In comparison to the universe of 1,118 utilities, GRU is in the top 5% of utilities in kWh savings and in the top 20% in peak load reduction. It is always good to strive to be the best, but it is also useful to acknowledge how well GRU has done with DSM and to understand the problems with this comparison as explained above.

GDS also offers a comparison of what ICF has determined to be possible for DSM to specific studies that have been done. Again, the comparison is not apples-to-apples in that GRU and ICF "vintage" their DSM programs whereas some utilities (Austin Electric apparently, for example) do not. This biases the estimates of energy saved over time upward. The numbers cited in the GDS study along with the EIA 861 data GDS has presented leads to a troubling conundrum:

> **Why is it that studies repeatedly show large potential savings, yet in practice these savings rarely materialize as shown in the EIA 861?**

Consequently, we know from experience that regardless of the promise of DSM programs, the reality of implementation is often far below expectations. With this being said, GDS's claim that DSM minimizes risk in the context of generating unit failure on Pages 23-24, seems less forceful when one considers the risk of the DSM program not being implemented by consumers, especially when it is needed since it is not under the control of the utility in dispatch or behavior. Additionally, with DSM programs such as interruptible load programs, we know that after numerous interruptions consumers grow weary of interruptions and often leave the interruptible program.

In the Executive Summary and starting on Page 23 and again on Page 34, GDS makes the assertion that a big unit is less reliable than dispersed DSM equipment arguing that dispersed DSM equipment is more reliable as the probability they all fail is less than the probability of a large unit failing. This all sounds good except for two missing pieces of information. First, there is a risk that the DSM resources may not be implemented at all since consumers control this rather than the utility as discussed in the previous paragraph. Second, the risk of unit failure is hedged by a utility being interconnected to other utilities. In fact, the historical reason for interconnection was to share reserves which would save all interconnected utilities money so they would not have to build even greater amounts of excess of capacity for reliability. While GDS on Page 34 acknowledges reserve sharing, it goes on to discuss the 30 MW import constraint in the ICF report, which GDS neglects to inform the reader is for ***firm*** transactions, while any reserve pick-up

[2] Run for zip code 32605 on March 18, 2006 at 5:20pm.

during a contingency would be ***non-firm*** power imports have a 290 MW capacity as indicated in the ICF report, and is clearly important for low-cost wholesale purchases under the Max DSM and Max DSM/Biomass options.

Other Considerations

- GDS argues that the IGCC assumptions about initial cost and capacity factor in the early years and optimistic financing assumptions regarding the financing of IGCC are optimistic. At first blush, I would have to agree with GDS these estimates seem optimistic, but recent estimates from the Electric Power Research Institute (EPRI) and the East Kentucky Power Cooperative (EKPC) are very much in line with ICF's cost estimate if not below it (See attached presentations on Page 7 of the EPRI presentation and Page 8 of the EKPC presentation). Simply eyeballing Page 8 of the EPRI presentation indicates that ICF's conclusion that IGCC would be the least cost choice of new generation is in line with the EPRI conclusions. Moreover, information gathered by Dr. Eric Wachsman at the University of Florida on the cost of gasifiers would indicate the cost of 2 gasifiers (includes spare) would be approximately $260 million plus the $115 million for the combined cycle power island would amount to $375 million dollars with out the additional engineering and infrastructure needed to run the gasifier with the combined cycle unit. Consequently, the $445 million quote for a 220 MW IGCC unit is reasonable, if not above other estimates.[3]
- I, like GDS, agree with ICF on how CO2 policy is handled in the analysis.
- Unlike the ICF results, GDS still believes natural gas fired units will continue to set prices in wholesale markets. I am in agreement with GDS's assumption given current generation plans in the 2005 Ten Year Site Plan and conversations with others in the industry.

Conclusions

The Review of the ICF Report afforded the City a great opportunity to get a sanity check on the reasonableness of the ICF Report. Unfortunately, the report is reads with a tone of advocacy and bitterness in spots. Moreover, GDS spent and inordinate amount of time discussing DSM and relatively little time focusing on the supply-side options and the wholesale market. I believe GDS's assessment of the supply-side options and wholesale market areas are reasonable while there still may be may be areas for disagreement. I have serious concerns with their assessment of DSM and what I believe to be an overall pattern of inconsistencies, incomplete information, and lack of attention to detail in their review especially when the information is so readily available. In short, I believe there is little useful and unbiased information the City Commission can garner from the Review in order to aid its decision on how to view the ICF Report or in what decision to make on the City's future power needs.

[3] We assume no more economies of scale and assumed a cost of $23.4 million for a 40 MW gasifier.

The Future For Coal Fired Generation

Roy Palk, CEO
East Kentucky Power Cooperative

Coal 2020: Burning Questions Conference
October 13, 2004
Panel IV: How Will The Use Of Coal Change?

EAST KENTUCKY POWER COOPERATIVE
A Touchstone Energy Cooperative

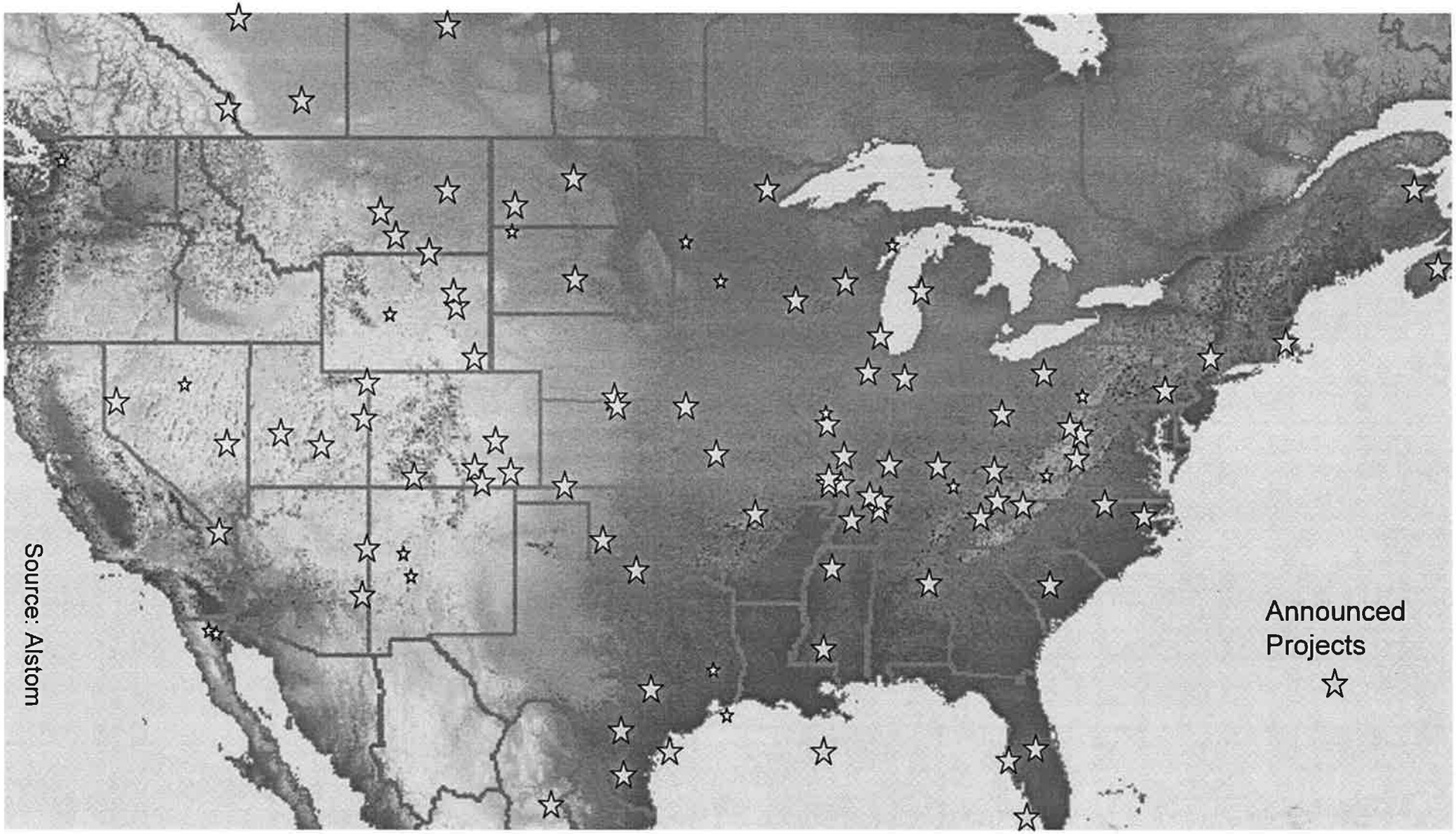
Coal Has A Future But It Must Compete

- The soon to be completed EKPC Gilbert Unit and the recently announced EKPC Spurlock 4 Unit are coal fired but more importantly, they represent a least cost power supply solution.
- Whether you are a regulated utility or a merchant generator, cost matters.

History And Reemergence Of Coal

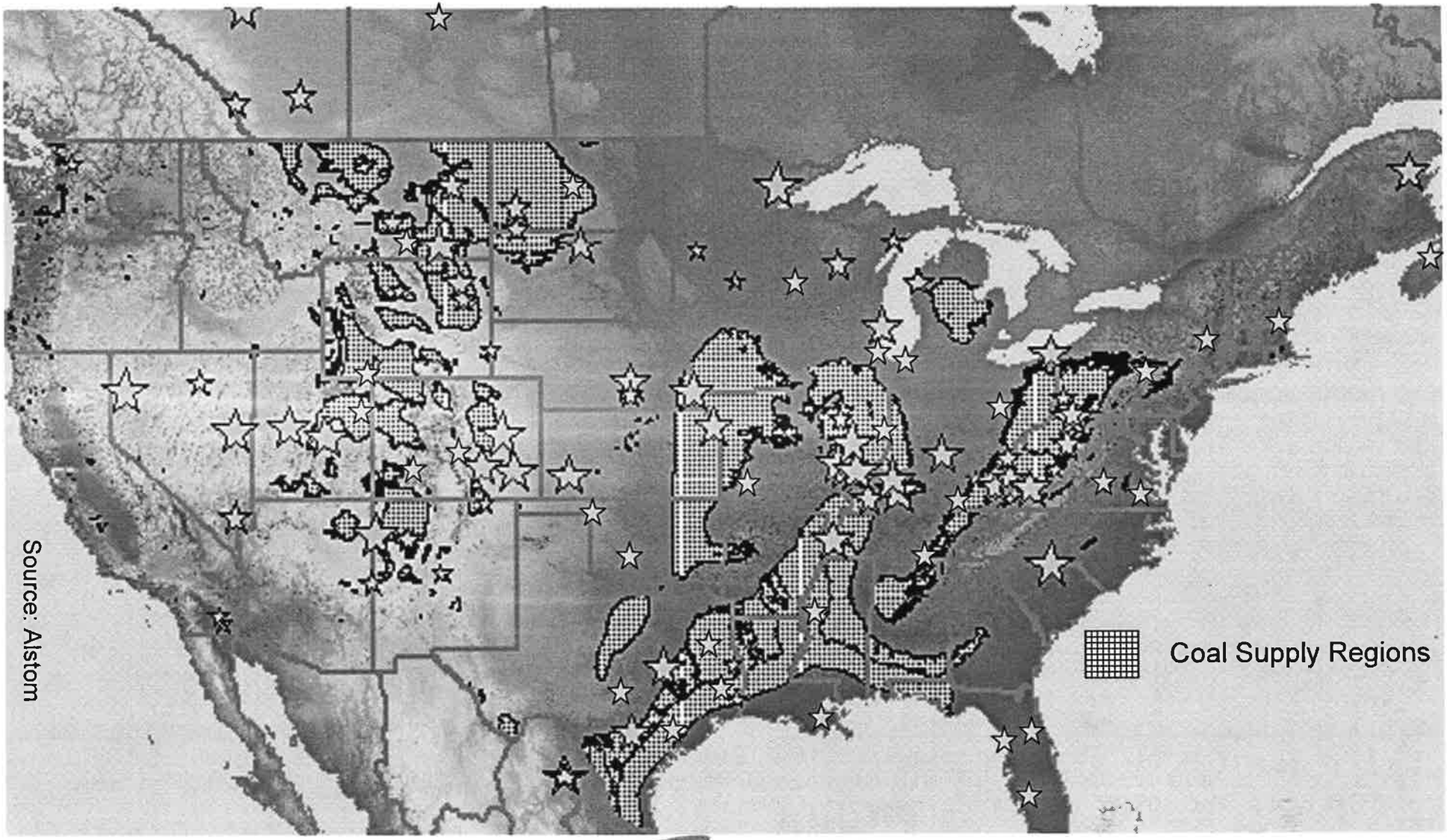
- Coal has been and remains the dominant fuel for electricity.
  - Coal's Share of U.S. net generation
    - 1970 – 46%
    - 1980 – 51%
    - 1990 – 54%
    - 2000 – 53%
- But not without challenges:
  - High efficiency CCs and CTs
  - Uncertain environmental policy, translating into high investment risk
  - Reduced available sites

Active Coal Projects In Development



Source: Alstom

Follow The Fuel



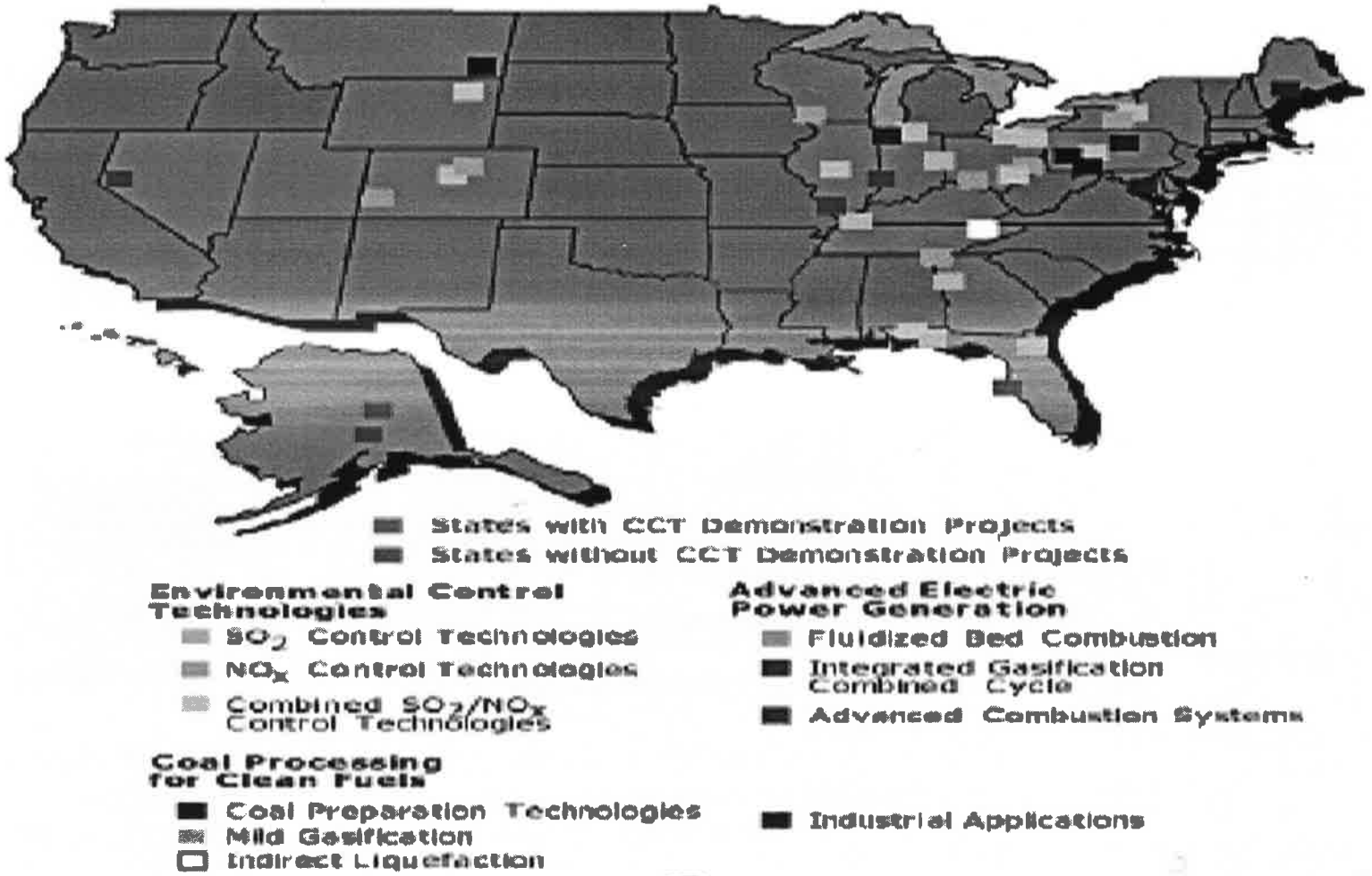
Source: Alstom

Future For Coal Is Bright

- New coal technologies that mitigate or resolve environmental concerns
  - Circulating fluid bed
  - Integrated gas combined cycle
- High prices and limited availability of continental gas
  - LNG will help, but is costly and has risks

Clean Coal Technology Compendium
Clean Coal Projects

Source: www.netl.doe.gov/cctc/factsheets/fs_loc.html



EAST KENTUCKY POWER COOPERATIVE

Coal Plants Can Compete

Technology	Typical Capacity (MW)	Typical Cost Range $ / kW	Typical Heat Rate
Pulverized Coal	600	1,000 – 1,600	9,000 – 10,000
Clean Coal	500	1,000 – 1,700	9,000 – 10,000
IGCC	550	1,200 – 1,800	8,000 - 9,000
Combined Cycle	400	500 – 1,000	7,000 – 8,000
CTs	230	250 – 400	10,000 – 12,000
Nuclear	1,000	1,500 – 2,800	10,000
Wind	50	600 – 1,500	

Source: EKPC Market Research

EAST KENTUCKY POWER COOPERATIVE

Coal Plants Are Flexible

- Coal can participate in most all unbundled wholesale markets
  - Reserve services of regulation spinning and non-spinning reserves, back up
  - ECAR/MISO regional market likely to unbundle into energy and reserve markets

How Will The Use Of Coal Generation Change?

- CO2 cap and trade program is a possibility
- Emission cap likely to tighten over time
- Coal price volatility is likely to remain higher than that of the 90s

Coal 2020 – Burning Questions

Panel: How will the Use of Coal Change?
Combustion Technology, Electric Generation and Coal Utilization through 2020

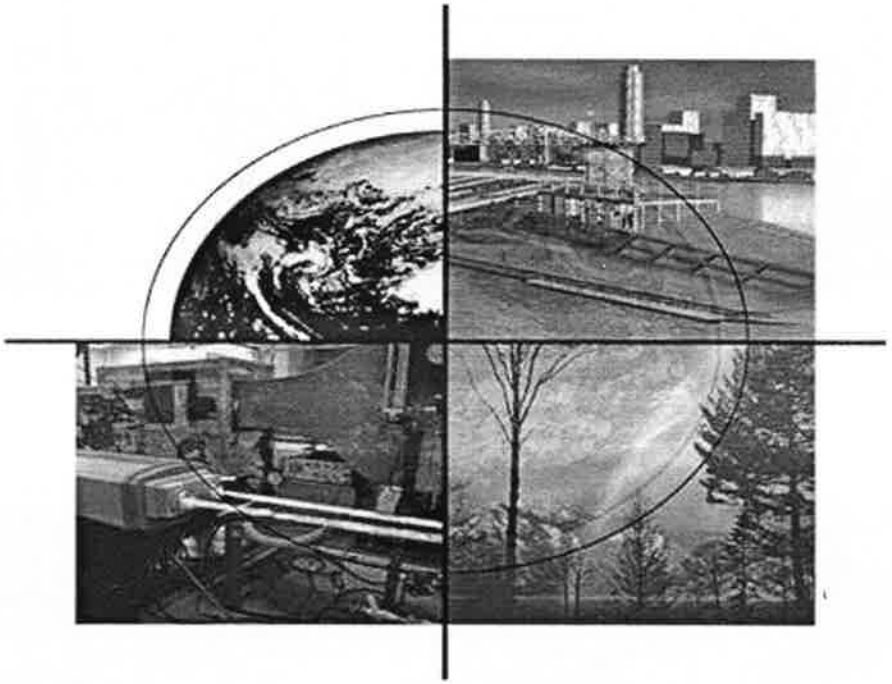
Hank Courtright

Vice President – Power Generation and Distributed Resources

October 13, 2004

EPRI

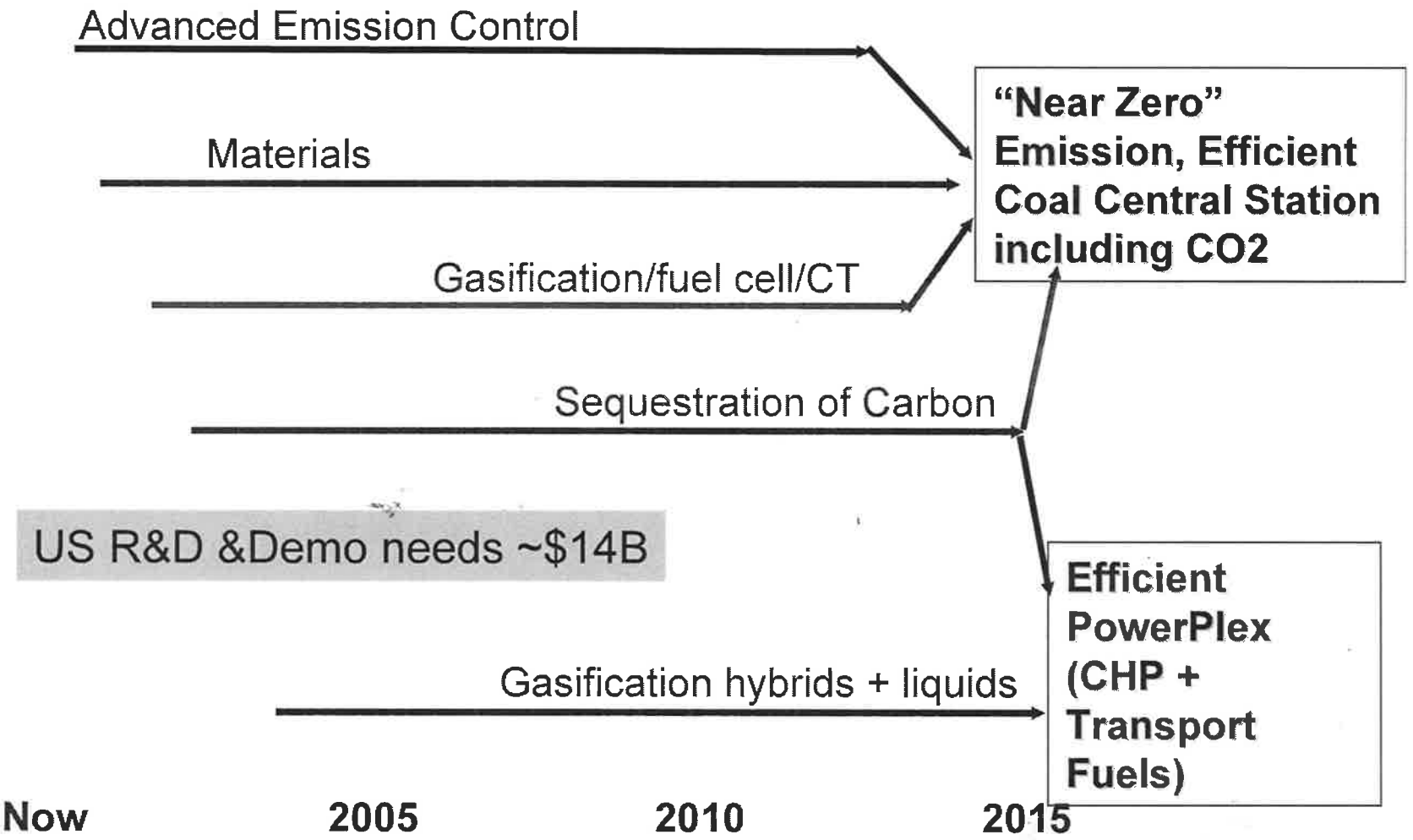
Clean Coal Technology Roadmap
"CURC/DOE/EPRI Consensus Roadmap"



Department of Energy, the Electric Power Research Institute, and the Coal Utilization Research Council

EPRI

Strategic Roadmap for Coal: Two Endpoints



EPRI

Integrated Gasification Combined Cycle

- IGCC may become the coal technology of choice
  - Low emissions
  - High efficiency
  - Best for CO_2 capture on bituminous coal
- Ability to co-produce hydrogen adds potential for:
  - Clean transportation fuel
  - Significant reduction of green house gas emissions

IGCC Environmental Attributes

- Sulfur is removed (99.5-99.99%) from syngas
- NOx emissions are controlled by firing temperature modulation in the gas turbine with SCR possible
- Particulates are removed from the syngas by filters and water wash prior to combustion so emissions are negligible
- Current IGCC design studies plan <3ppmv each of SOx, NOx and CO
- Mercury and other hazardous air pollutants (HAP's) removed from the syngas by absorption on activated carbon bed
- Water use is lower than conventional coal
- Byproduct slag is vitreous and inert and often salable
- CO_2 under pressure takes less energy to remove

Coal IGCC – Status and Issues

- Gasification technology is currently being commercially used in many chemical plants worldwide providing by-products of power, steam and hydrogen.
- Commercial chemical plants with spare gasifiers have achieved >90% availability
- Cost and risk reductions are the probably the biggest barriers to wide-spread adoption for coal-based power generation
- Future advances in air separation, gasification, gas clean up, gas turbine and fuel cell technologies will improve efficiency and lower cost

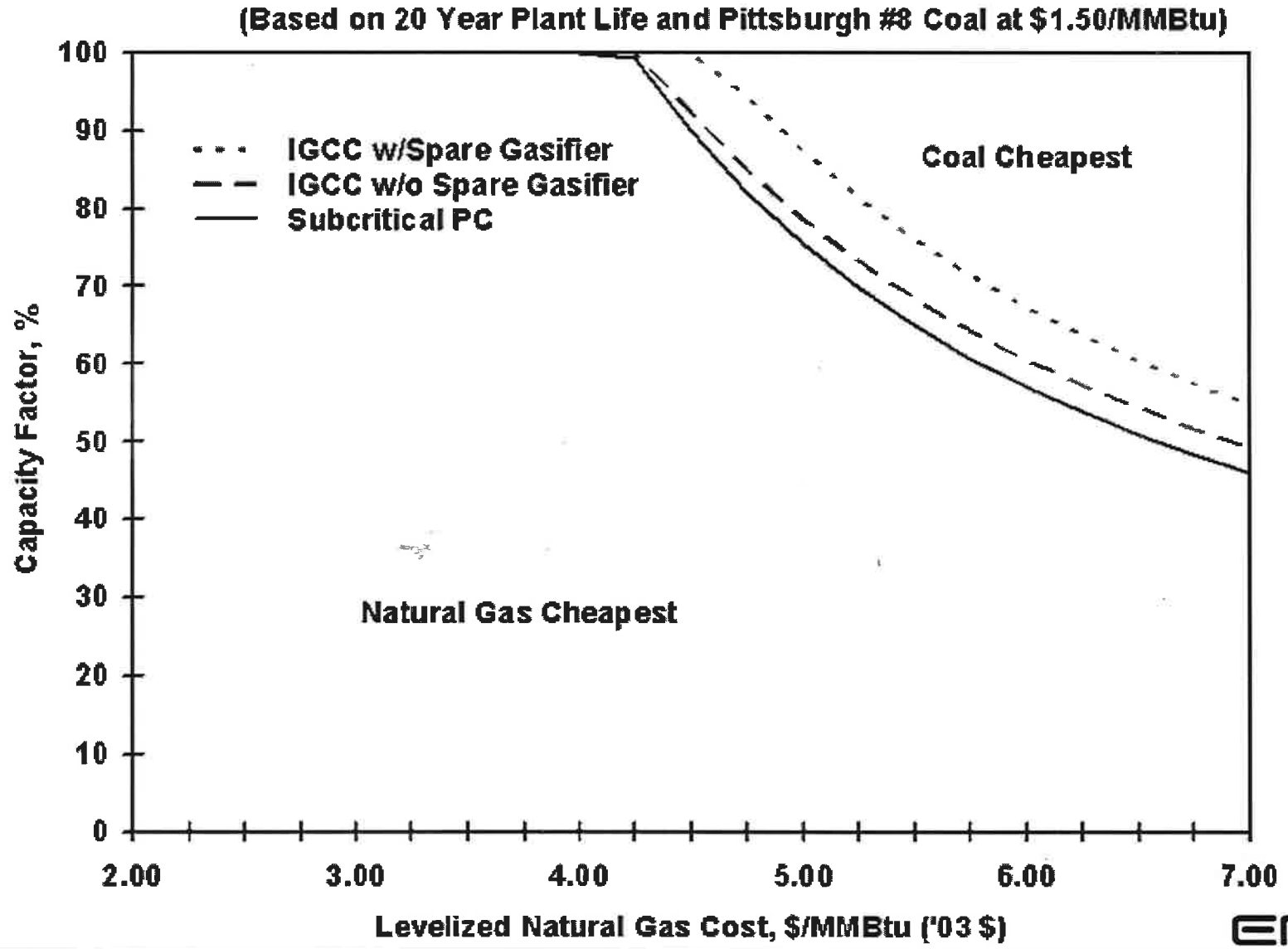
Cost and Performance for 500 MW Power Plant

Pittsburgh #8 Bituminous Coal –for National Coal Council Report

	Pulv. Coal Subcritical	Pulv. Coal Supercritical	IGCC with Spare	NGCC
Total Capital Requirement, $/kW	1,430	1,490	1,610	475
Ave. Heat Rate, Btu/kWh (HHV)	9,300	8,690	8,630	7,200
Capacity Factor, %	80	80	80	80/40
Levelized Fuel Cost, $/MBtu	1.50	1.50	1.50	5.00
Levelized COE, $/MWh (2003$)	*46.5*	*46.6*	*49.9*	*47.3/56.5*

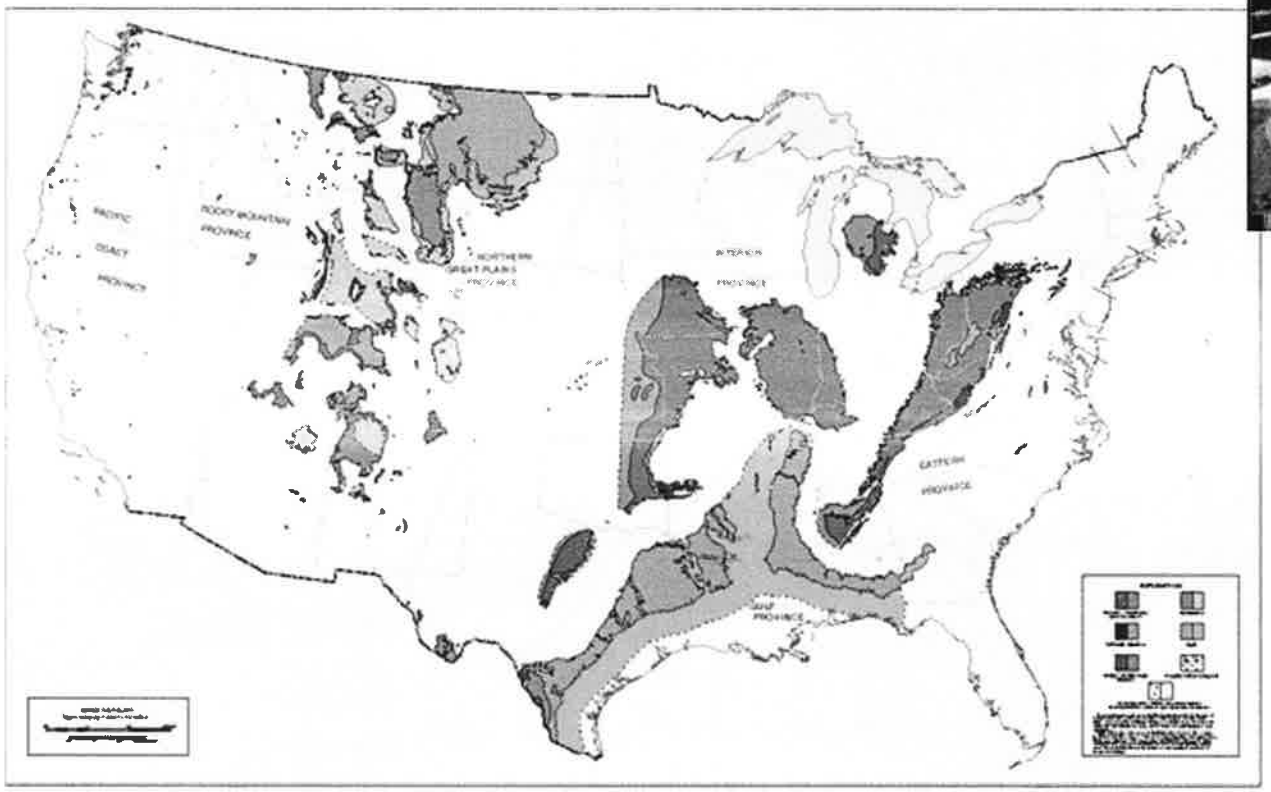
EPRI

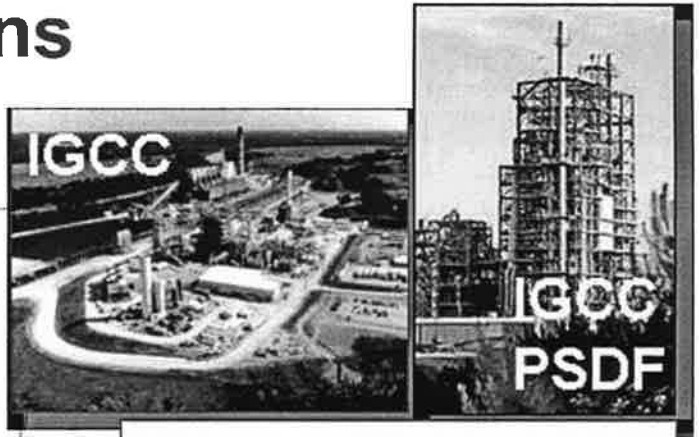
Breakeven Capacity Factor and Fuel Cost for Natural Gas vs Coal

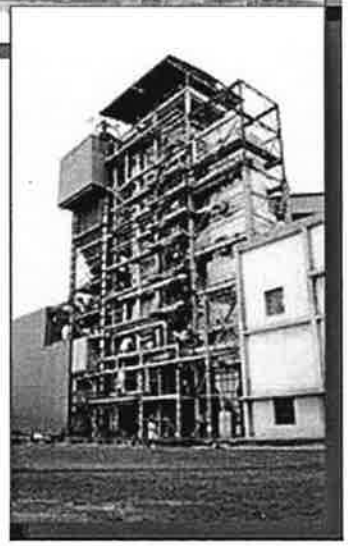


EPRI

Regional Coal Differences Compel Multiple Advanced Coal Options

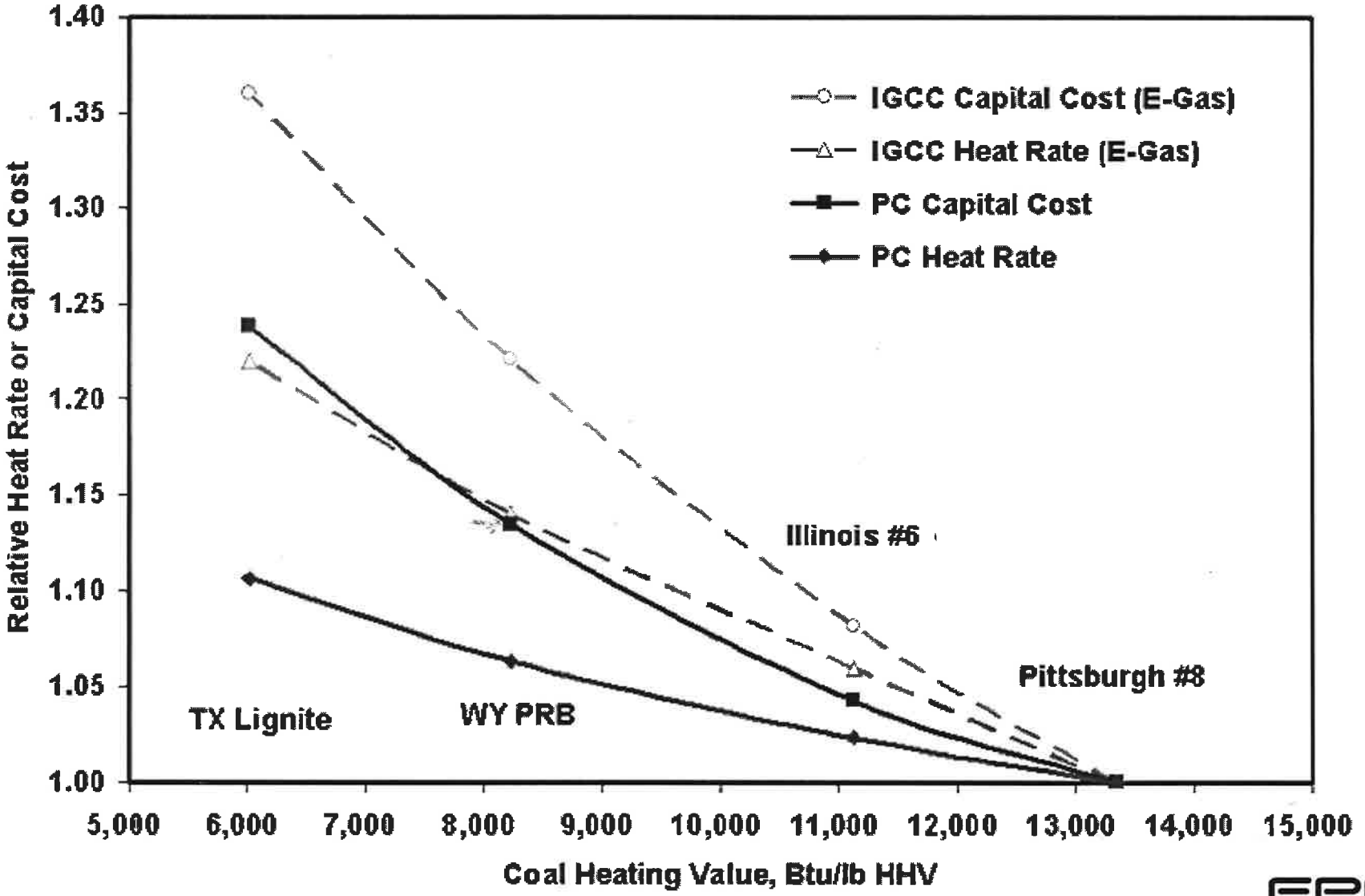






EPRI

Effect of Coal Quality on PC and IGCC Plant Heat Rates and Capital Cost



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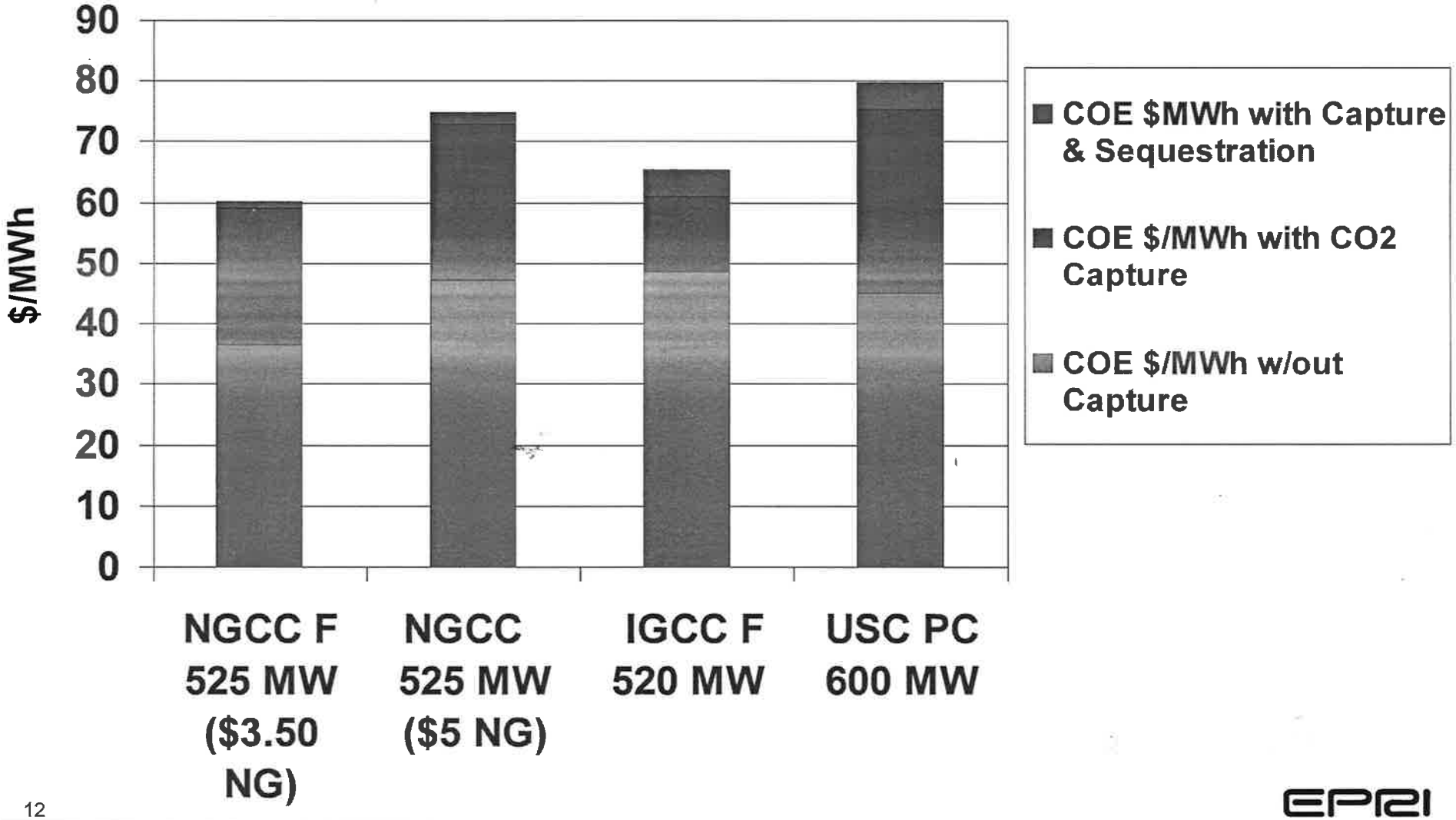
CO_2 Capture and Sequestration (CCS)

- At current State-of-the Art (SOA) there is no "Single Bullet" technology for CCS. Technology selection depends on the location, coal and application
- Sequestration is the key technical issue - location and geology dependent
- CO_2 capture adds considerably to Cost of Electricity(COE)
  - IGCC w/ CO2 least cost for bituminous coals
  - IGCC plant w/ CO2 capture and Pulverized Coal (PC) plant with Amine scrubbing for CO2 capture have very similar costs with high moisture Sub-bituminous Coals
  - PC with Amine scrubbing least cost for Lignites
- CFBC can handle high ash coals and other low value fuels
- Oxyfuel (O_2/CO_2 Combustion technology at early developmental stage

Costs of Electricity from New Fossil Fuel Power Plants



EPRI

Economics of IGCC and USC PC with CO_2 Capture. (Gasification Technologies are not all alike!)

Nominal 450 MW net Plants Pittsburgh #8 Bituminous Coal, All IGCC with spare gasifiers

Technology	IGCC Texaco Quench	IGCC Texaco Radiant SGC	IGCC E-Gas	IGCC Shell	PC Ultra Supercritical
MW no capture	512	550	520	530	600
TPC $/KW no capture	1300	1550	1350	1650	1235
COE $/MWh no capture	50.1	55.7	50.2	57.2	45.0
MW with capture	455	485	440	465	460
TPC $/kW with capture	1650	1950	1900	2200	2150
COE $/MWh with capture	62.7	69.6	68.9	75.1	76.2

Current Situation for Advanced Coal

- High perceived risk given limited commercial history
  - Costs and reliability less predictable
  - Extent/timing of new environmental regulations uncertain
  - New cost/risk sharing incentives required
- Advanced coal versus conventional coal
  - >40 GW of U.S. planned additions have been announced; at present, nearly all conventional coal
  - At ~$1000/kW, this represents >$40 billion in new investment in coal technology
  - Advanced technologies not being selected
    - OEM, A/E, O&M, and regulatory infrastructure not robust
    - Technology selection and design guidance needed

"CoalFleet for Tomorrow"

An Initiative to Accelerate the Deployment of Advanced Coal-based Power Generation

- Industry collaborative program:
  - Leadership by major coal-based generation owners focused on accelerating deployment of new full-scale plants
- Involve other key stakeholders (e.g., equipment manufacturers, A/Es, constructors, DOE) to ensure commercial viability of advanced coal plants
- Support the development of standardized plant designs to reduce technology, performance, and financial risks
- Accelerate and augment RD&D for advanced coal technology components, CO_2 capture/sequestration and human performance (e.g. training simulators)

"CoalFleet for Tomorrow" Program Elements

1. Assess Technology Trade-Offs, Licensing, Permitting and Incentives

Assess the costs, benefits, and risks of CO_2-ready advanced coal plants, evaluate environmental permitting and determine incentive structures to accelerate deployment

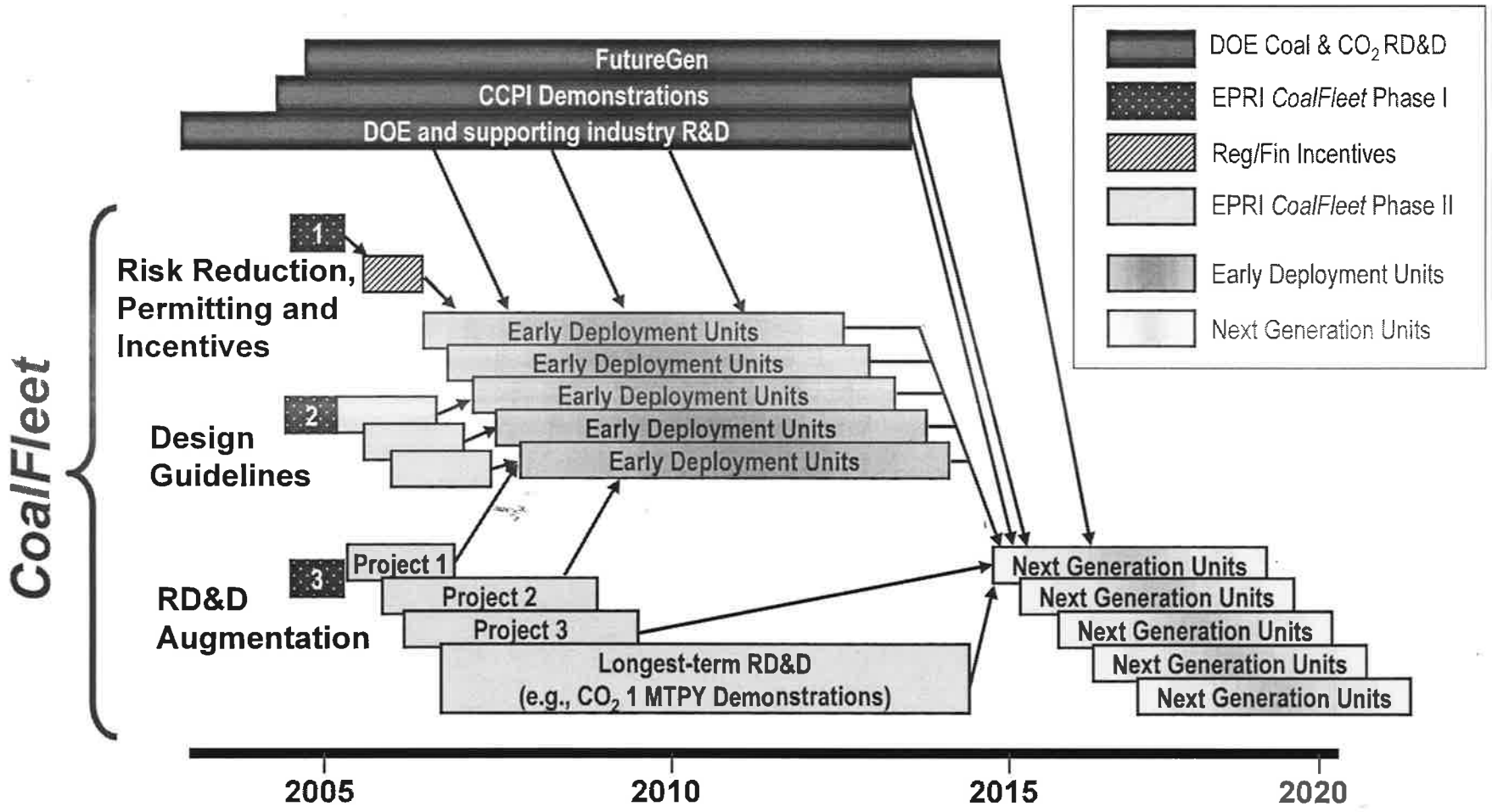
2. Develop and Implement Generic Design Guidelines for Standardized Plants

Minimize time, costs, and risks in the design, permitting, construction, and operation phases

3. Accelerate and Augment RD&D

Complement existing programs (e.g., FutureGen) with industry funding and support to accelerate deployment

"CoalFleet for Tomorrow"
CoalFleet Supports Deployment



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Summary

- The drivers for keeping coal "in the mix" are low fuel cost, fuel diversity and fuel source security
- IGCC is currently more expensive than conventional coal firing, however the environmental advantages of IGCC are clear and costs should come down as new plants are built and improved designs become standard
- Advanced coal options are needed for lower-rank coals such as PRB and lignite
- CO2 capture and sequestration may add considerably to the cost of electricity unless R&D can reduce the impact
- The development of performance "wraps" for the advanced coal power plants will provide improved choices for plant owners
- An industry collaborative will contribute to getting early plants "on the ground" with satisfactory costs and performance