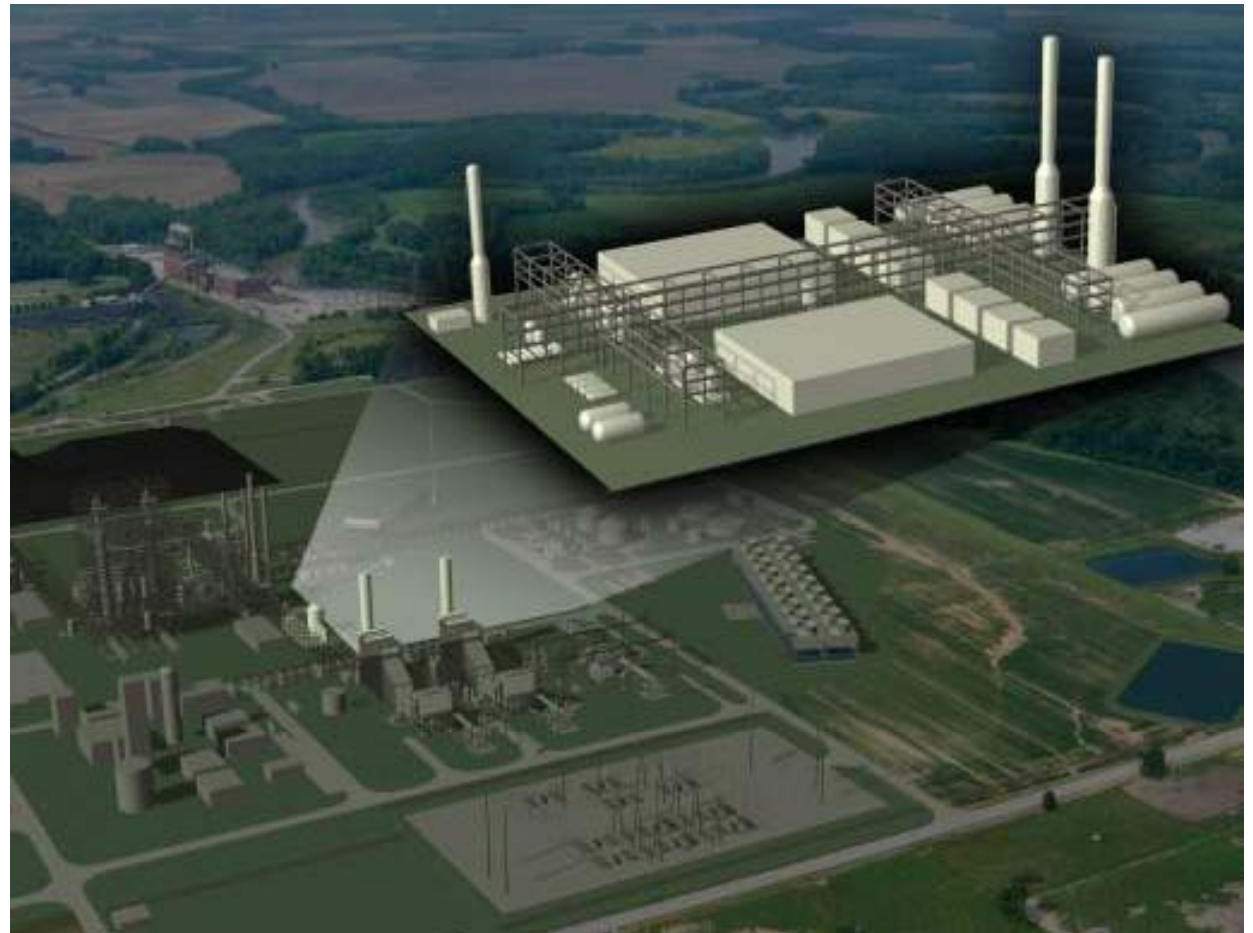


# GE's Carbon Island™

**GTC**  
**October 2008**

**Keith White**  
**GE Energy**



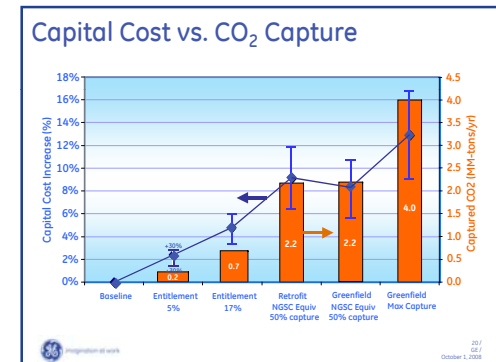
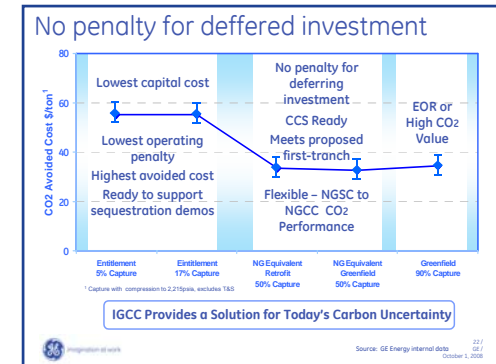
imagination at work

# Last year at GTC...

✓ NG equivalency (50-65%) capture has better economics than no shift (18-20%) or max. capture (90+%)

✓ Retrofit capture CAPEX, CoE ≈ Day 1 capture CAPEX, CoE

✓ Need for a total carbon solution



### Schlumberger & GE ... total CCS solution

- Joint marketing ... coordinated but separated offers to customers
- Technology alignment ... optimize IGCC with CO<sub>2</sub> storage facility
- Public policy & advocacy ... position papers/joint white papers
- Site prospecting ... Identify advantage sites for future use (GDSI)

Source: GE Energy Internal data October 1, 2008



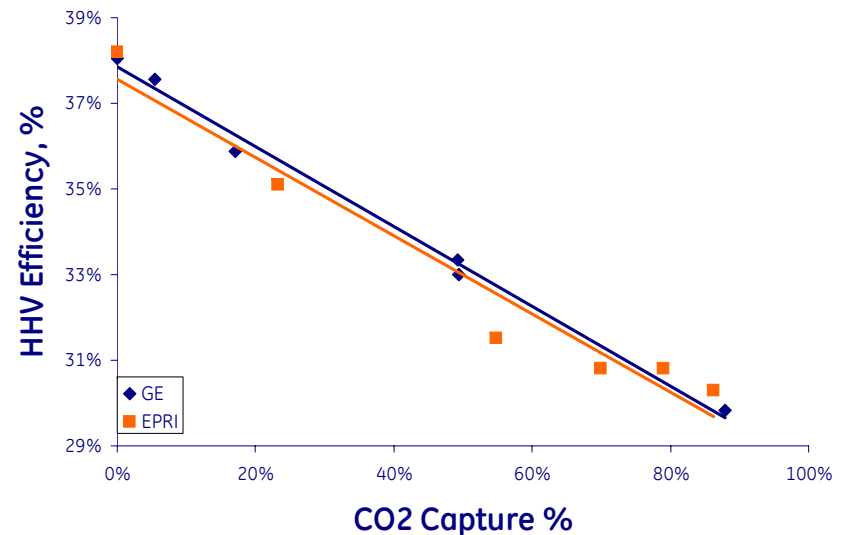
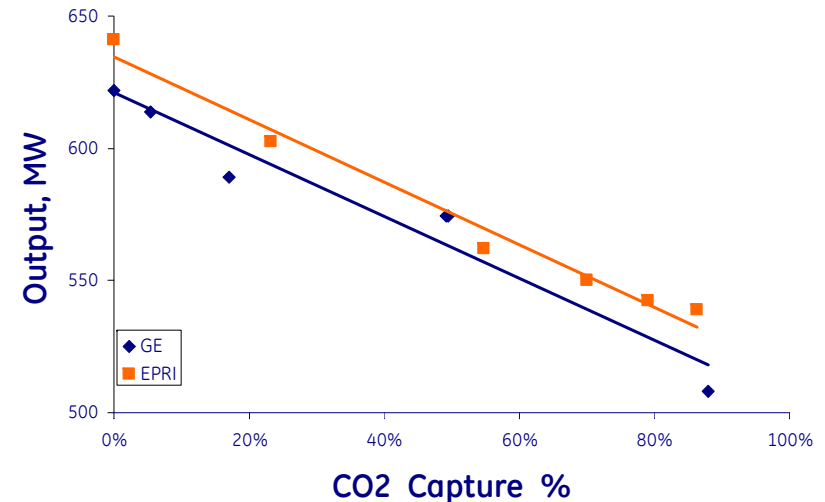
# Independent EPRI CCS study validates trends

Several capture cases:

- Entitlement (18-20%)
- NG Eq. (50-65%)
- Max single shift (70-75%)
- Max capture (80-90%)

Results showed:

- Similar output trend
- Identical efficiency trend
- Same CAPEX trend



Sources: GE Internal Study, 2007 and EPRI IGCC Design Considerations for CO2 Capture: Engineering and Economic Assessment of IGCC Coal Power Plants for near-term Deployment, 2008

# Integrating Capture and Sequestration

GE Energy



## Optimized Cost

- CO<sub>2</sub> quality specification
- Preservation of injectivity & capacity
- Regulations
- Optimum materials, components and features

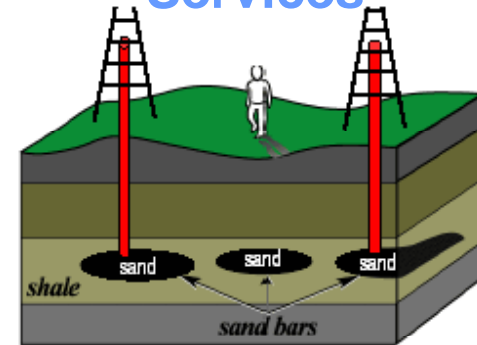
## Interface Control



## Operability and Reliability

- Integrated, consistent mission profiles
- Design for planned & unplanned outages
- Response to upsets
- Safety

Schlumberger Carbon Services



## Project Execution

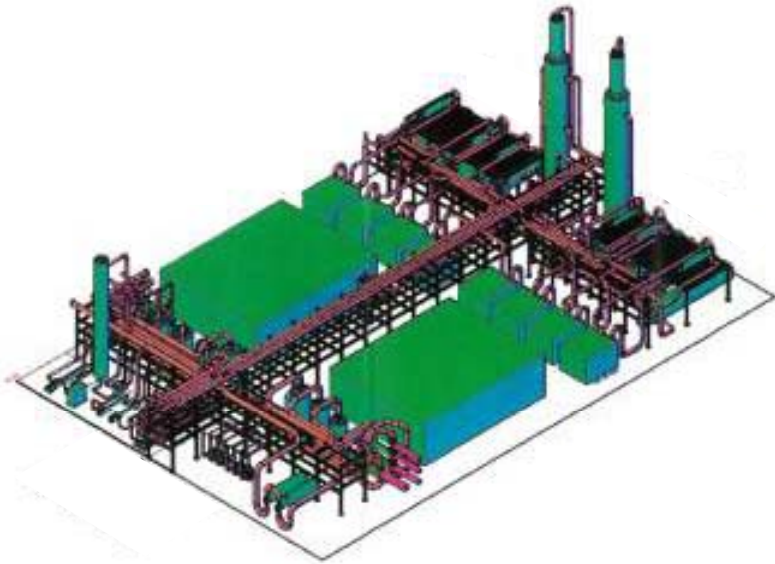
- Coordinated schedules for plant and storage facility
- Permitting
- Commissioning of plant and sequestration facility



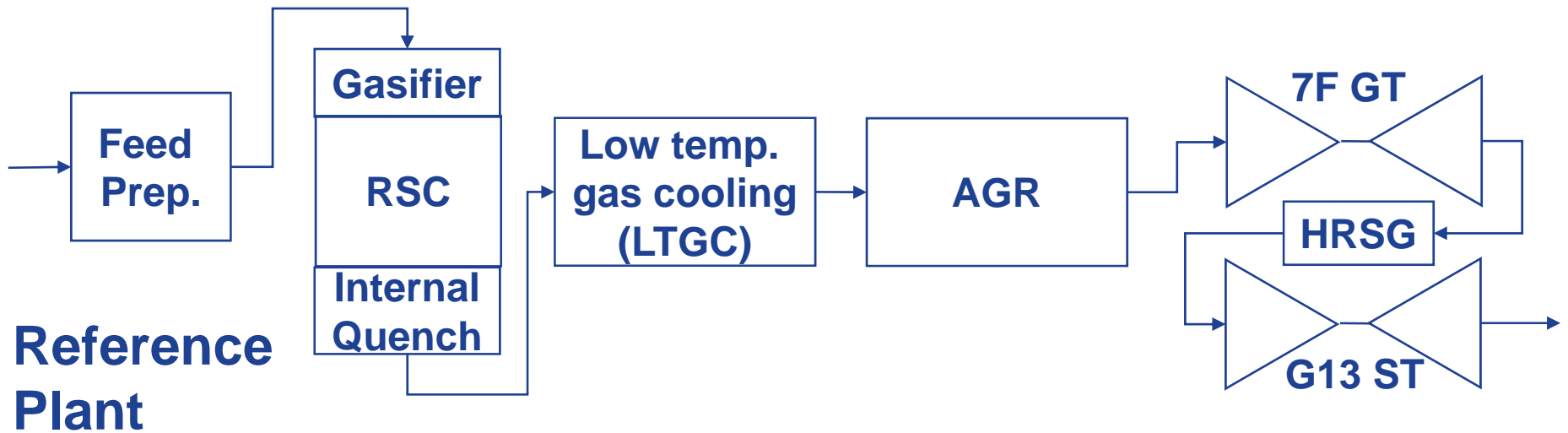
# GE's Carbon Island™

## IGCC retrofit solution

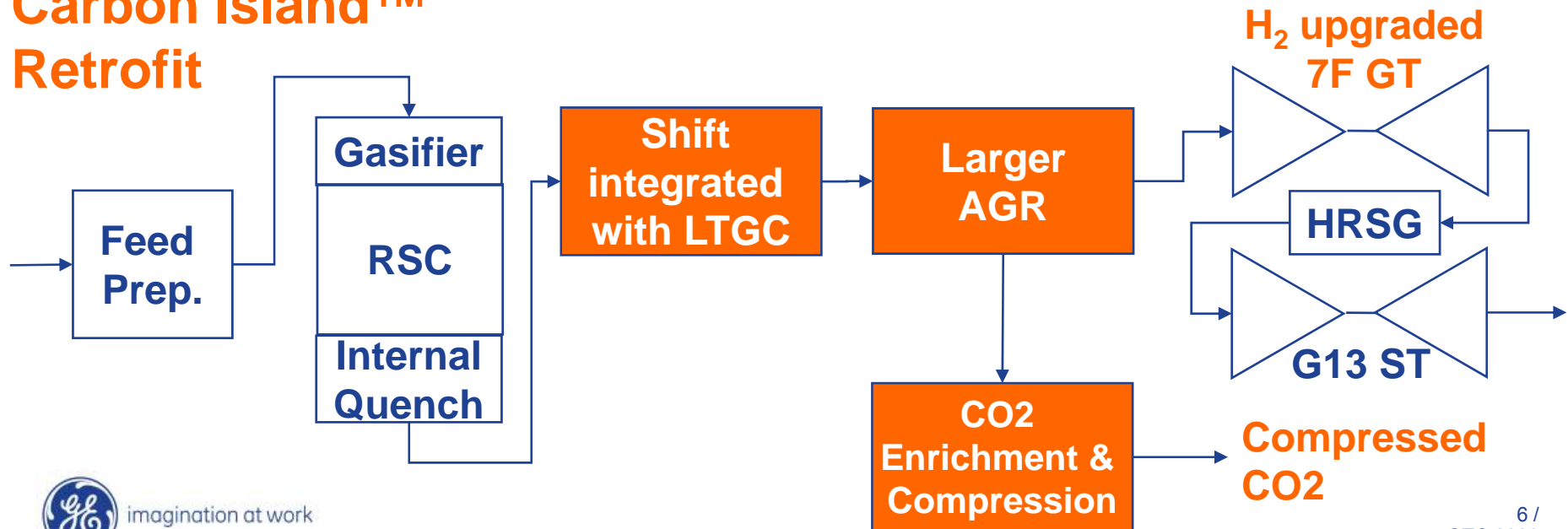
- Option to GE's IGCC plant design
- Fits in allocated plot space
- Integrated with existing AGR
- Commercially proven technologies
  - Shift and low-temp gas cooling
  - Supplementary AGR
  - CO<sub>2</sub> enrichment
  - CO<sub>2</sub> compression
- 50-65% carbon capture
- ➔ NGCC equivalent carbon footprint



# Plant modifications for retrofit

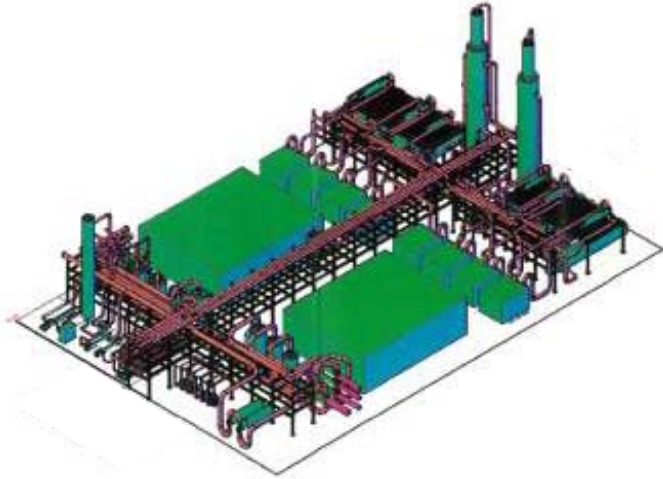


## Carbon Island™ Retrofit





# Carbon Island™ performance



## NG Eq. CO<sub>2</sub> Footprint

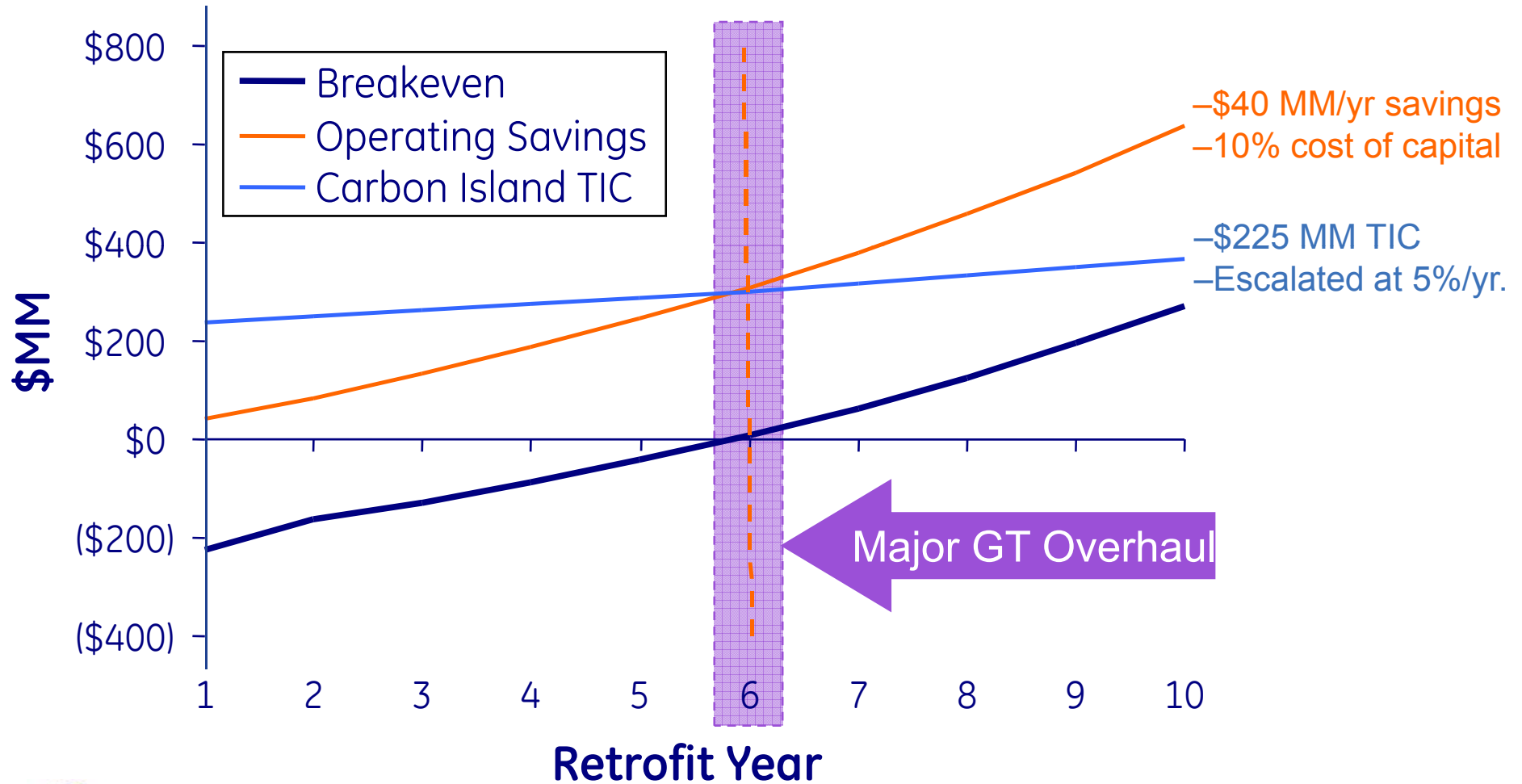
- Simple Cycle:  
50% carbon capture  
(~1,100 lb/MWh)
- Combined Cycle:  
65% carbon capture  
(~770 lb/MWh)

- \$225MM total installed cost
  - 585 MW output  
(from 630 MW)
  - 33% efficient  
(from 38.5%)
  - Tie-ins matched GT outages  
(Minimum plant downtime)
- Output/  
Efficiency Drop ~  
(\$40 MM/yr)**

*Note: Illinois Basin Coal on ISO site with proven technology...Performance and CAPEX are coal-dependant*

# Deferring CCS retrofit cost neutral

Operating savings = Retrofit cost in 6 years

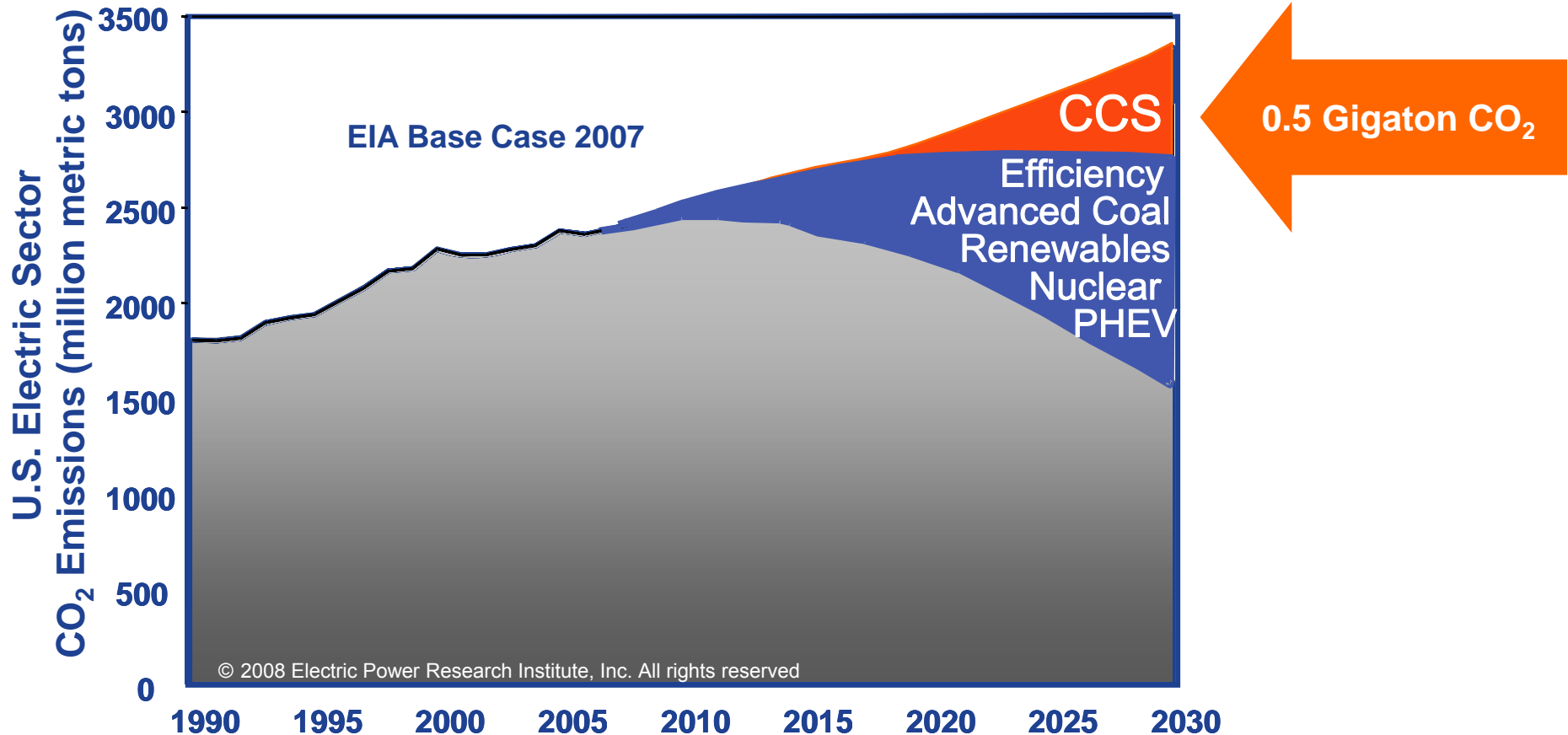


# Carbon capture ready criteria

All processes and components are in commercial application today	<i>Inventions and those in early technology development do not qualify.</i>
Components should be at, or within accepted engineering limits of scale-up	<i>Technology still requiring pilot scale-up for validation do not qualify.</i>
Incremental investment is needed only for addition of components and process steps.	<i>No significant modification, underutilization or scrapping of existing major equipment</i>
Site utilities – e.g. once-through and makeup water – are sufficient for operation with CC	<i>Post combustion capture likely to require significantly more water with CC</i>
Plant space is reserved and adequate for specific process components and layout.	<i>Supported by engineering analysis with heat and mass balances for component sizing.</i>
Potential life-of-plant sequestration resources and access identified	<i>Candidate primary sequestration sinks as well as back-up sites screened.</i>
CO2 quality must be suitable for sequestration.	<i>Compatible with reservoir geochemistry, well life, maintenance of injectivity and capacity.</i>
Deferring retrofit will incur <10% economic penalty in avoided cost of carbon.	<i>Incentive for adding CC when carbon price or regulatory requirements justify doing so.</i>

# Carbon Island™ is a part of the Total CO<sub>2</sub> Solution

EPRI Prism Analysis



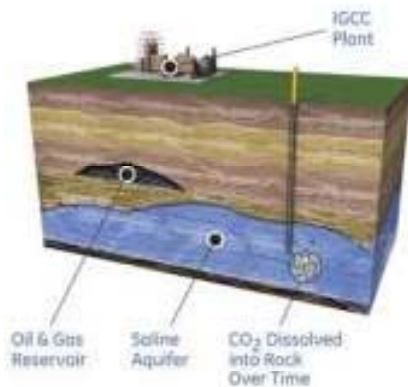
# US Roadmap for new coal plants

CO2 policy established

CO2 value mature market

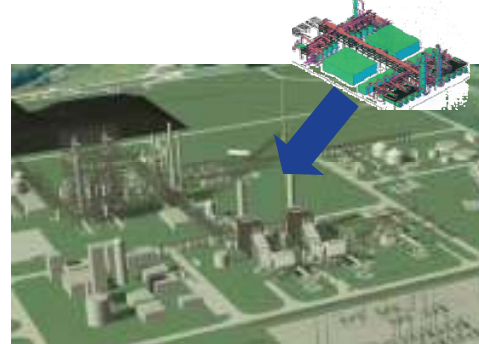
## Phase I (Now-2015)

- Build IGCC CC-Ready
- Build IGCC CCS demos
- Validate CO2 storage



## Phase II (2015-2020)

- Retrofit installed base to NG Eq. CO<sub>2</sub> footprint
- Commission commercial CCS



## Phase III (2020-2030)

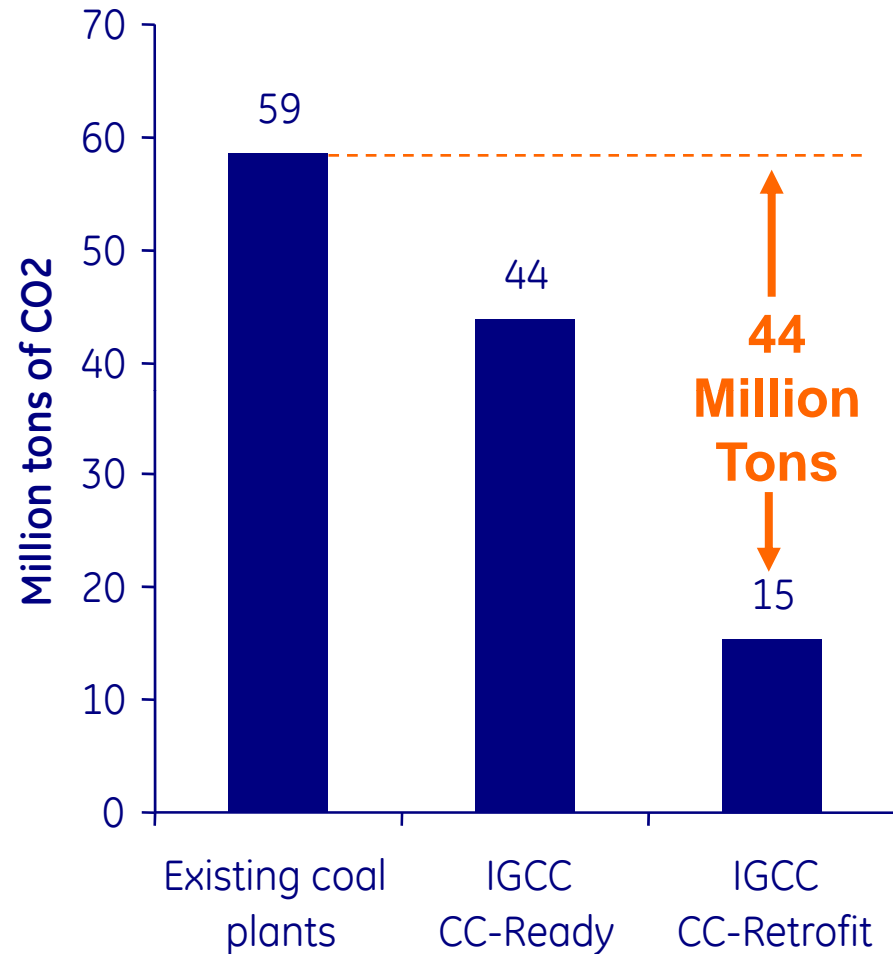
- Greenfield N G CO<sub>2</sub> footprint coal build



# CO<sub>2</sub> footprint impact on existing coal

## Plant characteristics

- Plant size > 100 MW
- Capacity factor < 40%
- Plant age > 20 years
- Currently operating



Source: GE Internal data, 2008

# Build IGCC now. Retrofit Carbon Island™ later.

## Proven

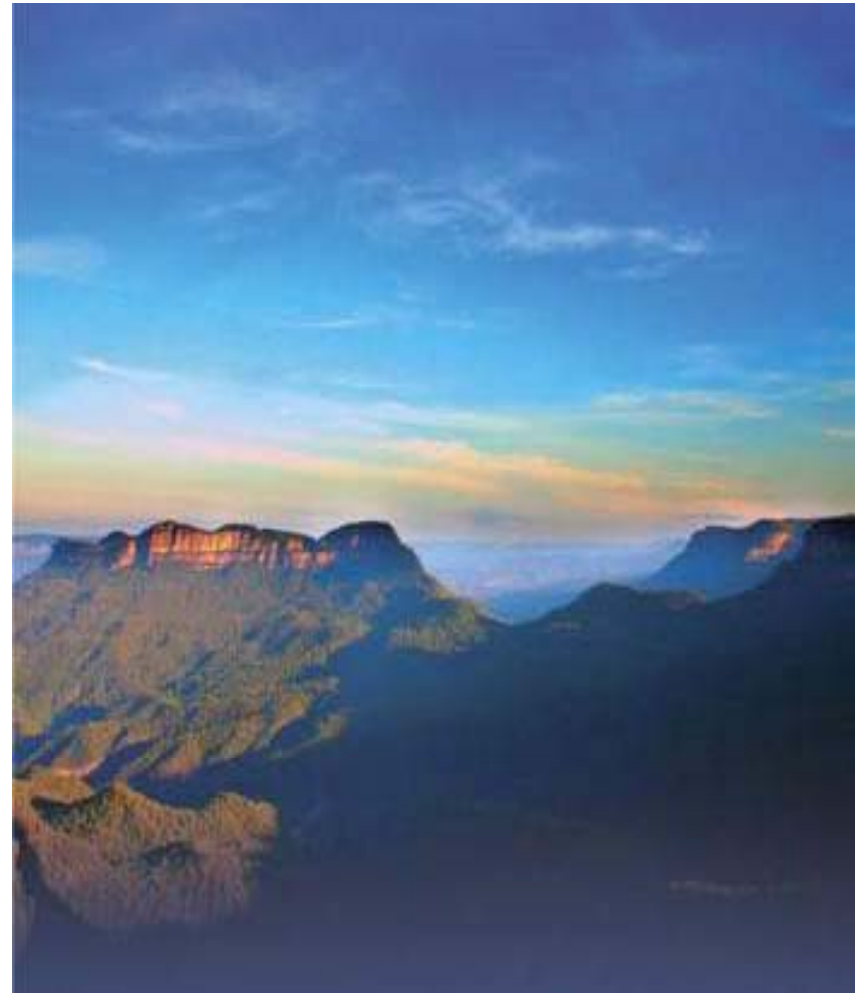
- Commercially demonstrated
- Available today

## Favorable Economics

- Lowest cost of avoided CO<sub>2</sub>
- Deferring retrofit pays for itself in 6 yrs.

## Path to 2020 CCS Industry

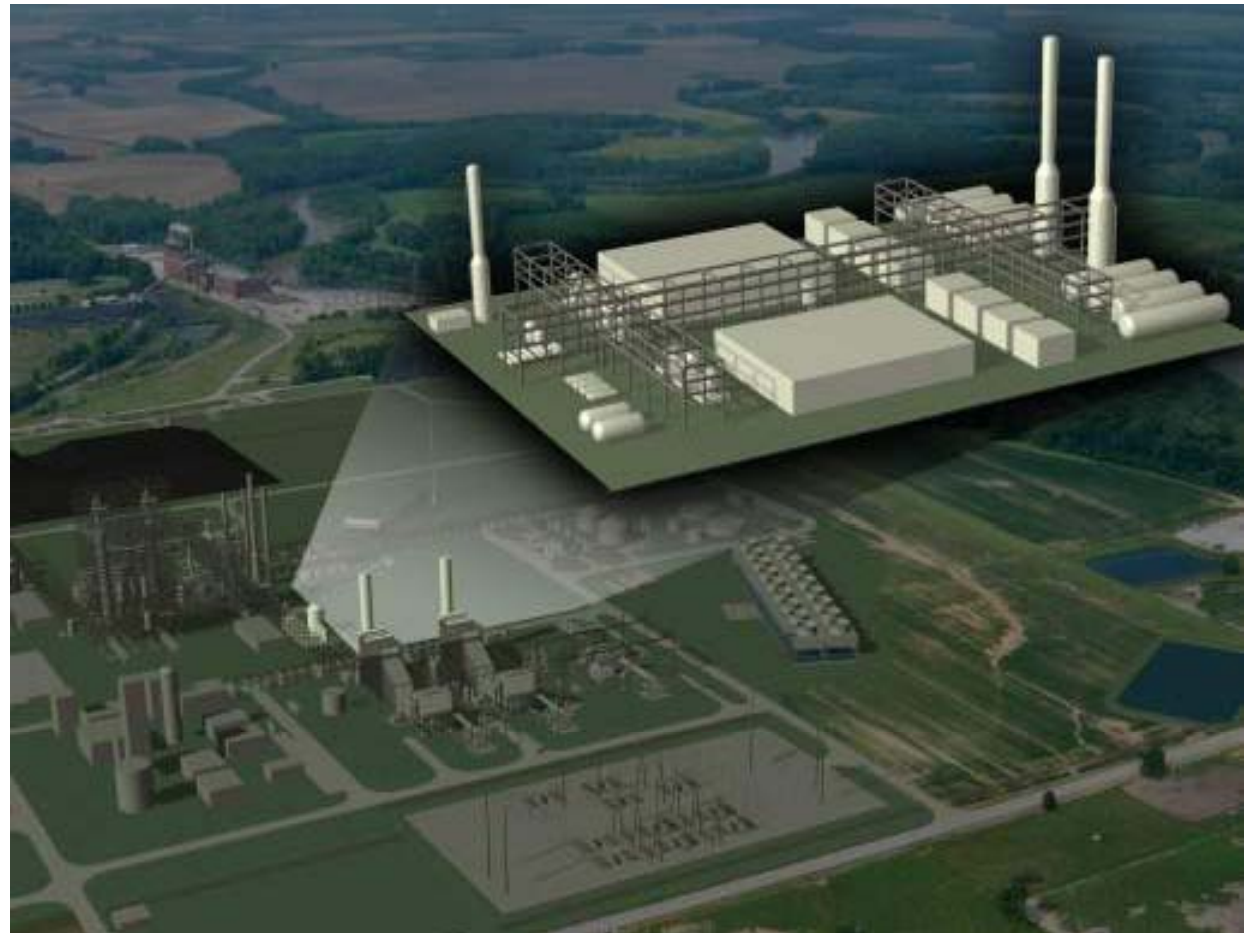
- Path to 2020
- Enabler for CCS demonstrations



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