

# The False Promise of Carbon Capture & Sequestration (CCS) Technology

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# Topics

- Storyline
- Hype vs. Reality
- Volatile Costs of Power from Coal & Gas-fired Power Plants
- Sensible Government Policies

# Storyline

- CCS has emerged as the preferred technology for GHG reduction by:
  - the Governments of the US, EU and Australia
  - World Coal Institute
  - EPRI
  - WWF
- But, for CCS to make a major impact on CO2 emissions, existing coal-fired power plants will need to be retrofitted with advanced CO2 capture systems
- CO2 capture systems are very expensive, inefficient and many are still in the test and demonstration phase
- Heavy reliance on CCS to address the CO2 emission problem will create unacceptably high technical and economic risks for any country.

# Hype vs. Reality

## The Hype

1. Cost of CCS can be defrayed by putting CO<sub>2</sub> to productive use:
  - Enhanced oil recovery (EOR)
  - Producing biomass (microalgae)
  - Making cement
2. New technologies will soon lower CCS costs and improve efficiency of carbon capture process.

## The Reality

1. Markets that reuse CO<sub>2</sub>:
  - are limited in size (EOR)
  - require low or zero cost CO<sub>2</sub>
  - must, at present, rely on immature and unproven technologies (algae & cement).
2. New CCS systems are in either the test or early demo phase.
3. 90% CO<sub>2</sub> capture comes at a very high price:
  - Power plant output and efficiency reduced by ~ 30%
  - Extra capex ranging from \$1319/kW to \$1649/kW
  - LCOE increase of \$.07/kWh (based on 2005 EPC prices)

## Hype vs. Reality (cont.)

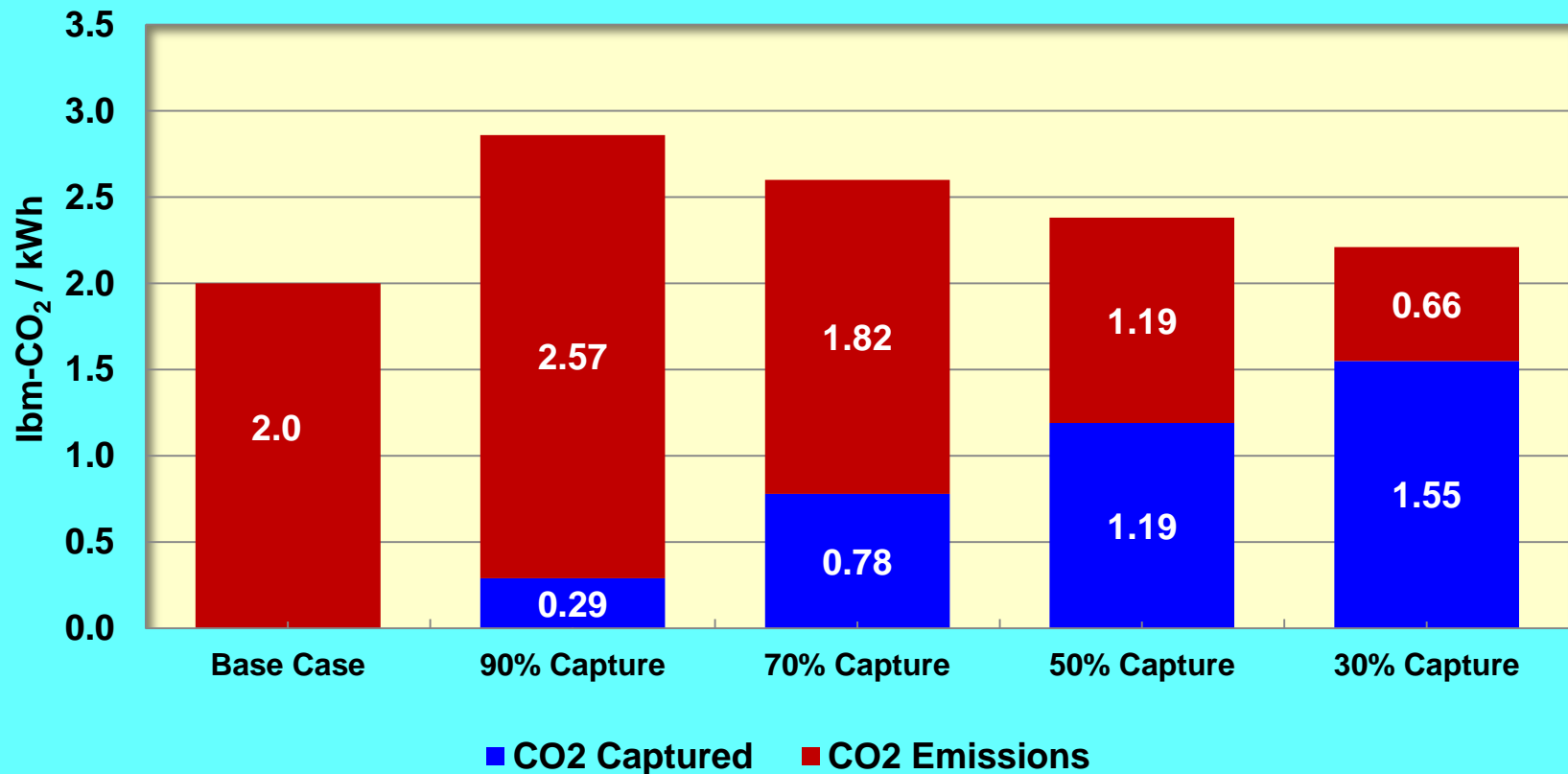
### The Hype

3. CO<sub>2</sub> can be sequestered in saline formations and depleted oil wells
4. Transport & injection technology well-understood and commercial

### The Reality

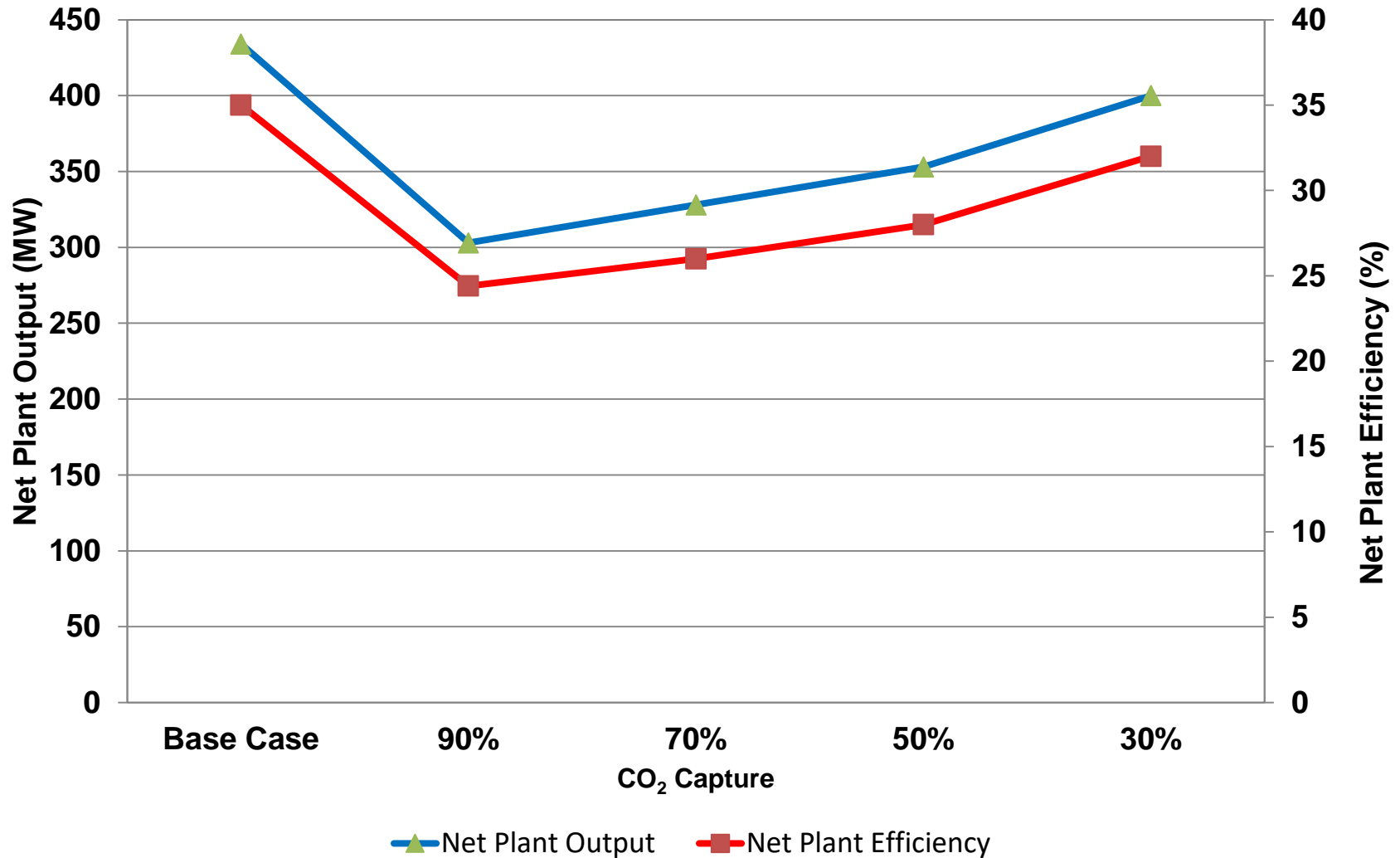
- Distance of such reservoirs from power plant sites will limit applications.
- No definitive exploration studies to confirm capacity of potential reservoirs
- No long term studies to confirm that CO<sub>2</sub> will be permanently sequestered.
- Private companies unlikely to take “long-term sequestration risk” without some form of government-backed indemnity.

**Carbon capture technology can capture 90% of CO<sub>2</sub> emissions but will only achieve an 85% reduction in “Base Case” CO<sub>2</sub> emissions**

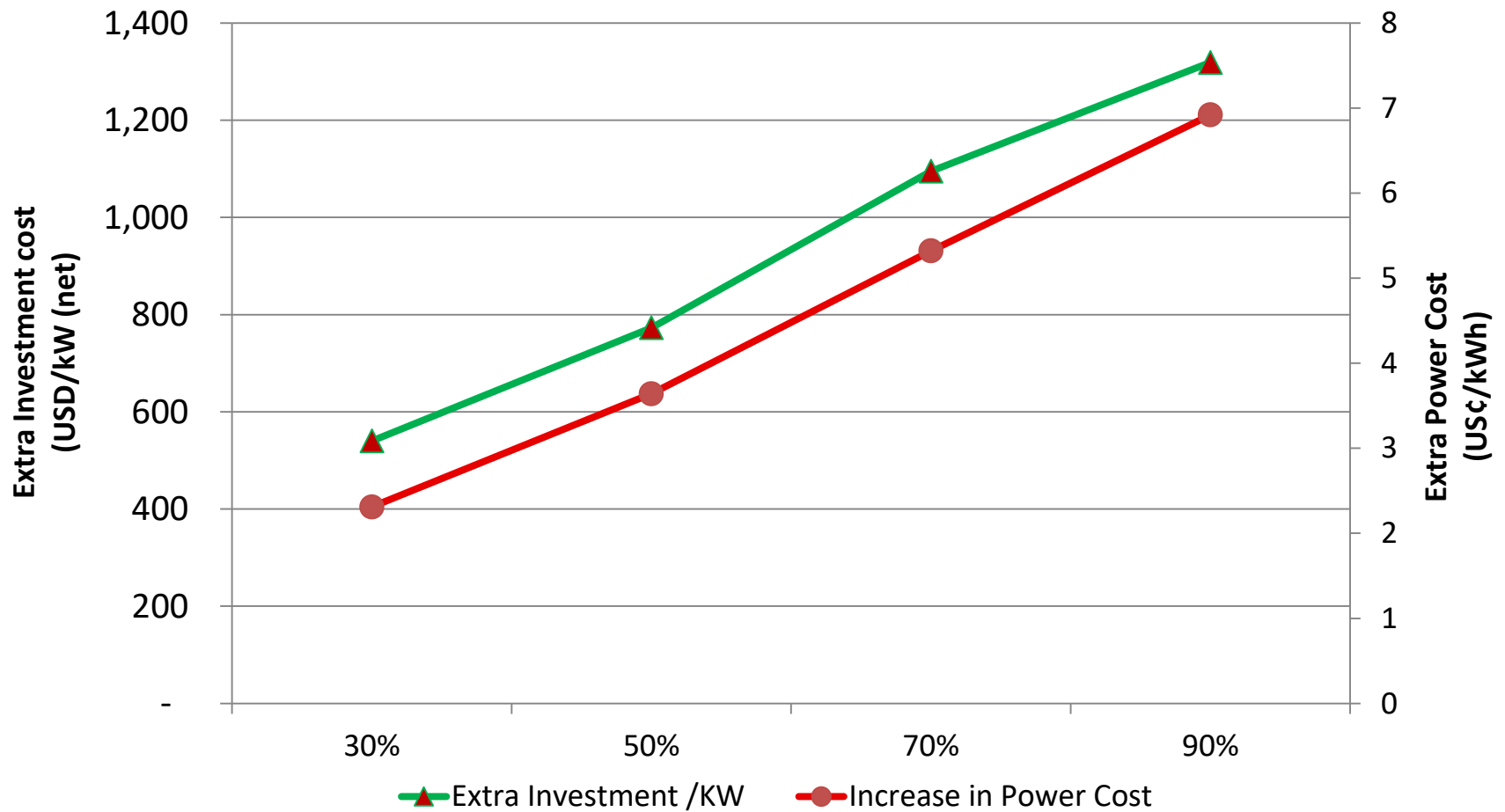


Source: NETL “Carbon Dioxide Capture from Existing Coal-fired Power Plants: Final Report” Nov 2007

# 90% CO<sub>2</sub> capture will lead to a 30% loss in plant output & efficiency



... and will require additional capex of \$1300 - \$1650 per kW and for power cost to double





# Impact of MEA Carbon Capture System w/ 90% CO<sub>2</sub> Capture on cost and technical performance of an existing Coal-fired Power Plant<sup>2)</sup>

Performance Parameter	2001 Technology	2006 Technology	Future Technology
Solvent Regeneration Energy (Btu/lbm-CO <sub>2</sub> )	2350	1550	1200
Net Plant Output (MW)	303	303	303
Net Plant Efficiency (%)	20.2	24.4	25.7
Incremental Capex (\$/kW)	\$2,748 - \$3,435	\$1,319 – 1,649	\$1,279 - \$1,600
Increase in LCOE due to CCS <sup>1</sup> (¢/kWh)	12.54	6.92	6.32
<b>Cost of CO<sub>2</sub> Mitigation</b>	<b>\$127</b>	<b>\$89</b>	<b>\$85</b>
Cost of CO <sub>2</sub> Capture	\$ 84	\$59	\$56

1. New coal fired power plant assumed to have LCOE of 6.4¢/kWh
2. AEP Conesville #5 Unit used as case study, 434 MW capacity and 35% plant efficiency

Source: NETL “Carbon Dioxide Capture from Existing Coal-fired Power Plants: Final Report” Nov 2007

# Sensible government policies should be based on reality, not hype

- Underlying premises:
  - There are no silver “technology” bullets
  - Promising technologies remain “unfulfilled promises” until commercialized
  - A lot of low hanging fruit can be collected by following a portfolio approach -rather than an “all eggs in one basket” approach – to GHG reduction
- Governments should try to avoid a sense of panic over climate change and only implement policies and new regulations that are supported by good research and commercial-scale demonstration projects.
- Hopefully, a sense of deliberate but systematic purpose will guide policies over the next few years.

# Examples of policy options worthy of serious consideration

- Require all new coal plants to be “CCS ready”
- Incentivize investors to implement open raceway algae ponds at:
  - coal-fired power plant sites
  - sewage treatment plants
  - ethanol plants
  - agro-processing centers
- Cost share on initial CCS demonstration projects to create comfort among power plant owners that technology works as expected.
- Provide ample research funds for development of commercial-scale closed photobioreactors for microalgae production
- Impose a CO<sub>2</sub> emission limit on coal-fired power plants that will bring CO<sub>2</sub> emissions in line with those of gas-fired CCGT plants