

A Carbon Positive CO₂ Reduction Technology Offers New Hope for Solving Climate Change

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The 20th Century was The Century of Silicon The 21st Century will be The Century of Carbon

- CO₂ emissions from the burning of fossil fuels are the leading cause of climate change
- The general consensus among experts is that to prevent disastrous environmental impacts, CO₂ emissions must be reduced by 50% or more from current levels by 2050
- Every industry and business will be operationally and financially impacted by the CO₂ emission reduction regulations needed to combat climate change
- CO₂ emissions reduction is a huge new untapped market
 - **It includes research, development and demonstration (RD&D) of a suite of new technologies in an expedited schedule**

RD&D on CO₂ Reduction Technology is a Good Investment (EPRI)

**Avoided Cost to U.S.
Economy**

(2000-2050, present value in 2000 \$)

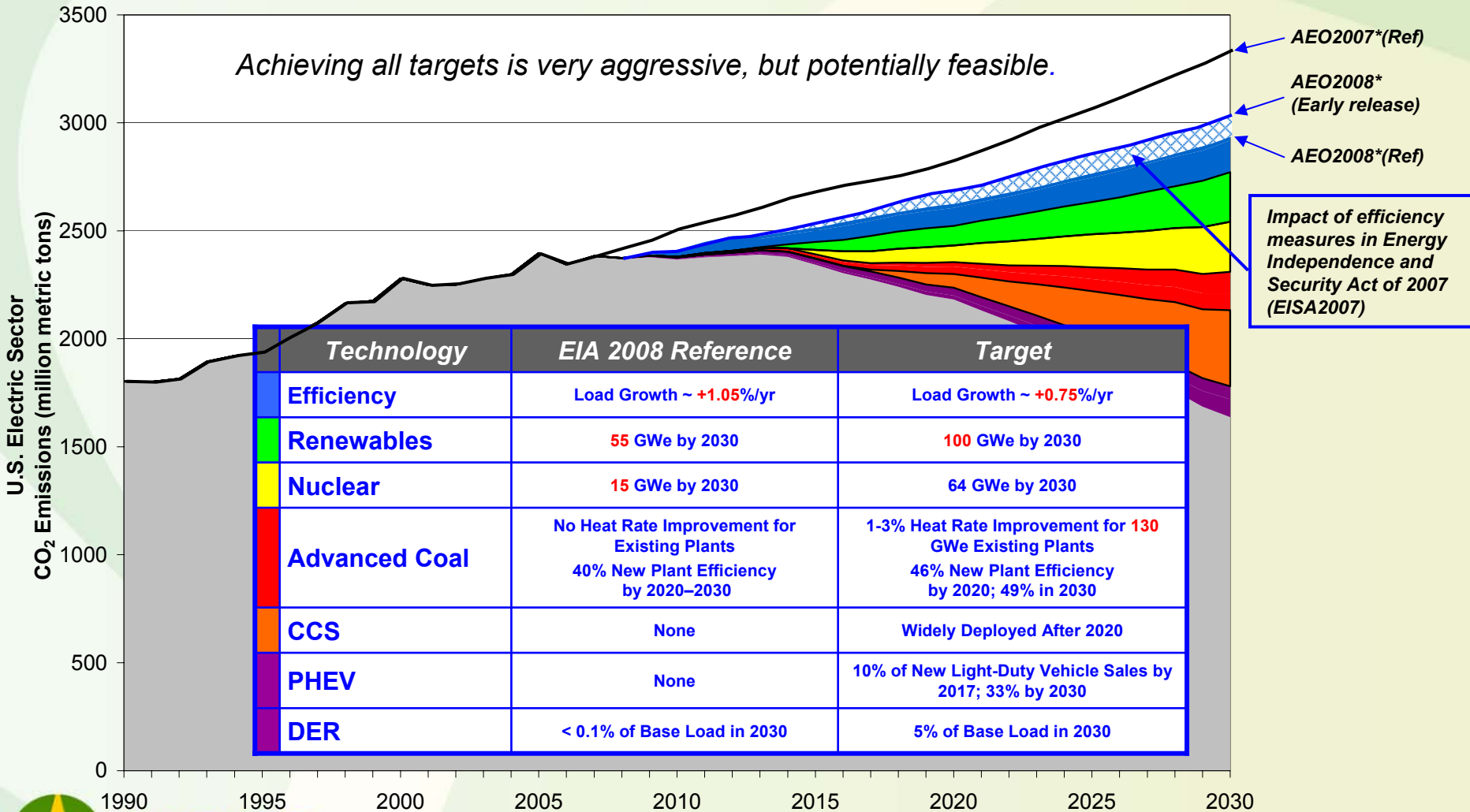
\$1,000B

\$30B

RD&D Investment

(2005-2030, present value in 2000 \$)

2008 Prism... Technical Potential for CO₂ Reductions (EPRI)



Carbon Capture and Storage (CCS)

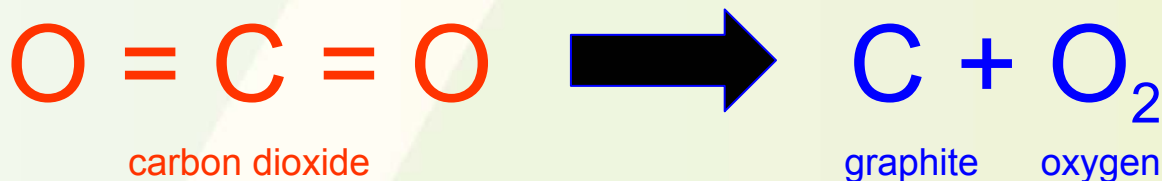
- The International Energy Agency (IEA) has identified Carbon Capture and Storage (CCS) as the key technology in achieving the 2050 CO₂ emission reduction goals
- CCS Involves
 - Capturing CO₂ emissions at the source,
 - Transport by pipeline (some times over great distances), and
 - Injection into underground reservoirs for indefinite storage
- While CCS appears feasible, it faces many technical, political, and business challenges

Challenges of Reducing CO₂ in the Air

- Despite their problems, fossil fuels will continue to be an important energy source in the decades to come
- The bond energy between the atoms in CO₂ is one of the strongest in nature, making the CO₂ molecule very difficult to break or otherwise eliminate
- Many new technologies focus on CO₂ capture and not the destruction of CO₂ molecules
- RD&D of carbon-positive CO₂ reduction technologies is hard to come by and can be very costly

The CCS Alternative – CO₂ Reduction

- IES' CO₂ Reduction Technology breaks the CO₂ bond with only about one-third of the energy in that bond
- In other words, it carbon positively splits the two double bonds between carbon and oxygen in a CO₂ molecule



- Carbon positive: the amount of CO₂ emissions it eliminates exceed those created to supply the technology's energy requirements

Application 1: Convert CO₂ to Graphite and Oxygen

- The technology has performed consistently and successfully in the lab for more than 2 yrs. It is ready for field demonstration
- Instead of capturing and storing CO₂ indefinitely, the technology converts CO₂ into valuable graphite and oxygen → turn a pollutant into income generating byproducts
- High grade graphite can be used in other industrial processes, (e.g. solar panels, hybrid electric cars, semiconductors, batteries...etc)
- Oxygen can be used in boosting boilers' combustion efficiency

Application 2: Reduce Multiple Pollutants in One Process

- Because CO₂ bond energy is higher than many other compounds
 - CO₂, NO_x, SO_x and other gaseous pollutants emitted from a power plant can be simultaneously reduced and destroyed by IES' CO₂ Reduction Technology
- It practically omits the need to separately treat and reduce NO_x and SO_x in the flue gas → A major cost savings in the construction of new power plants

Potential Customers of IES' CO₂ Reduction Technology

1. Fossil fuel burning electric generating plants and other large industrial users of fossil fuels
 - 50% of CO₂ emissions from the industrialized nations comes from the use of fossil fuels for:
 - Electric power generation
 - Other industrial needs
 - Eliminating these CO₂ emissions alone would reach the 2050 goal of 50% reduction in CO₂ emissions
2. New power plants
 - The IEA estimates that each year between 2010 and 2050
 - 35 coal and
 - 20 gas-fired power plantsneed carbon control technology installed
3. CCS sites
4. Small CO₂ emitters that can't access CCS pipelines

Projected Annual Market of Carbon Reduction

(Estimate of Annual CO₂ Emission Reduction Market for North America and Europe)

2004 U.S. Total CO ₂ Emissions (tonnes)	6,049,435,000
2004 European Union Total CO ₂ Emissions (tonnes)	5,010,170,000
2004 Total U.S. and European CO ₂ Emissions (tonnes)	11,059,605,000
Total U.S. and EU CO ₂ Emission Reduction Objectives (50% of Current Levels, tonnes)	5,529,802,500
Emissions Reductions Needed From Power Plants and Industrial Users (Approximately 50% of Reduction Goals, tonnes)	2,764,901,250
Highest Price in \$USD for 2008 CER Futures Traded on ECX in October '08 (€ 23.60 using €1 = \$1.3 USD Exchange Rate)	\$30.68*
Estimated Current Market for CO₂ Emission Reduction	\$84,827,170,350

*The IEA estimates that it may be necessary to spend as much as \$200 / tonne to achieve CO₂ reduction goals

Strategy and Next Steps

1. Work with scientific community, government agencies and news media to publicize IES' CO₂ Reduction Technology
2. Identify logistics of field (level II) demonstrations
3. Raise funds for level II demo activities
4. Select a facility in the U.S. for field demo (level II)
5. Work with state and local regulatory agencies to obtain necessary permits for field demo (level II)
6. Operate system at field demo facility (level II)

Strategy and Next Steps (Cont.)

7. Work with state and local agencies to validate system performance (level II)
8. Document effectiveness and cost savings of the technology (level II)
9. Continue RD&D of different size CO₂ Reduction Systems
10. Continue to pursue additional patent applications
11. Raise capital for full scale operation of the technology (level III)