



EPRI

ELECTRIC POWER
RESEARCH INSTITUTE

Electricity Technology in a Carbon-Constrained Future

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Context

- Growing scientific findings and public opinion that GHG emissions are contributing to climate change...
- Priority of 110th Congress ...
- U.S. responsible for 1/4 of worldwide CO₂ emissions...
- Electric utilities responsible for 1/3 of U.S. CO₂ emissions...
- Agreement that technology solutions are needed...

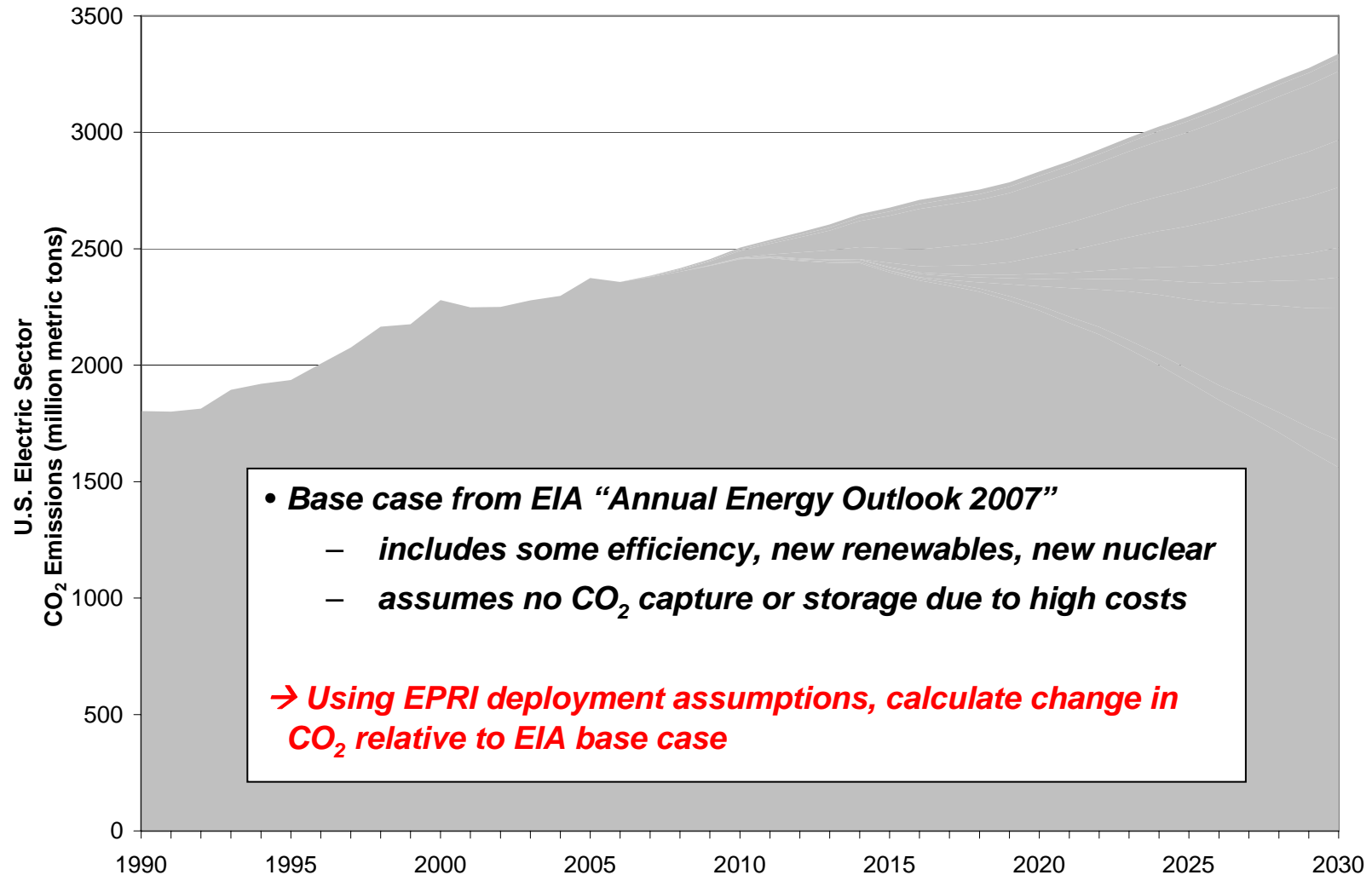


...But What is Feasible???

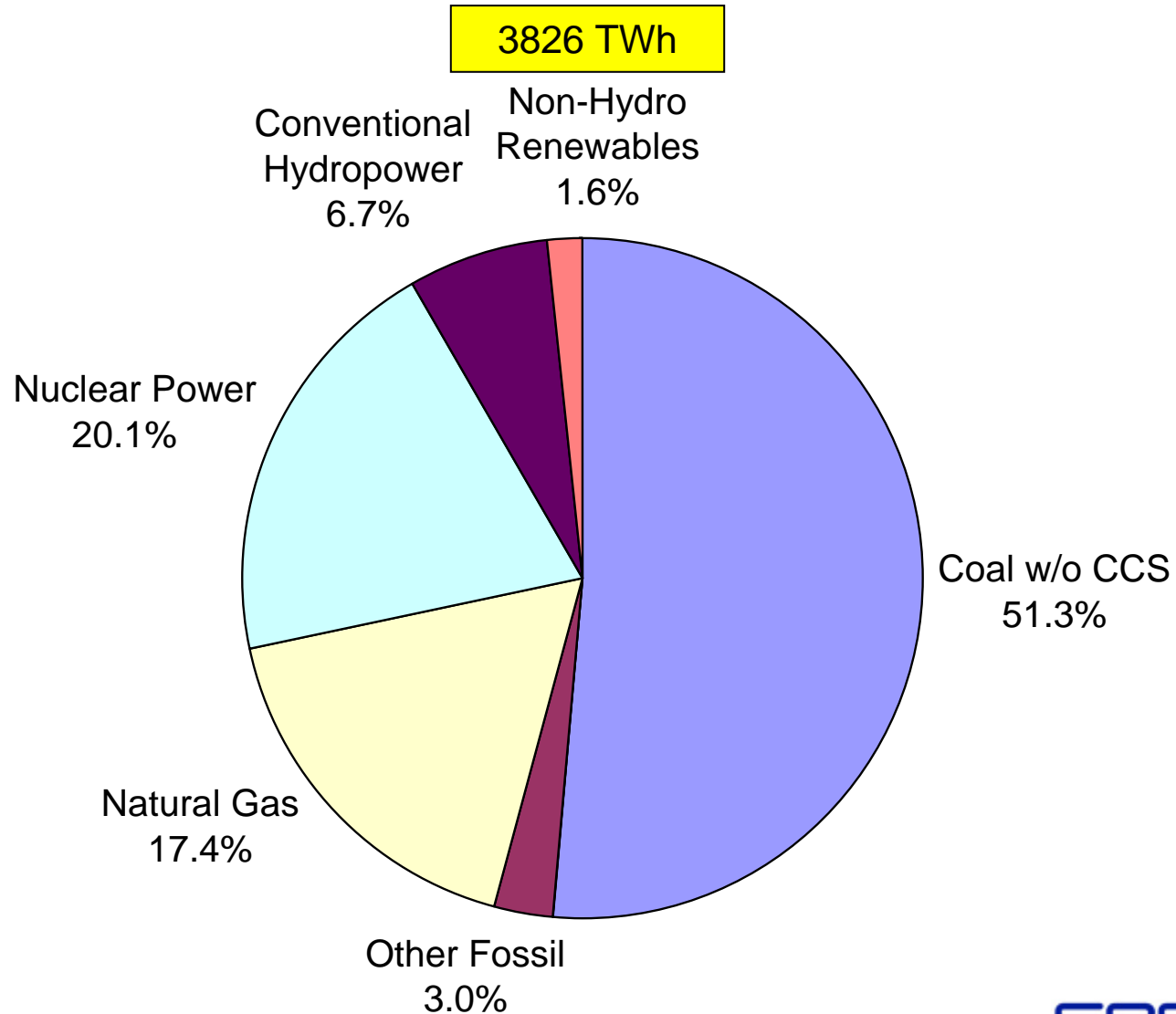
Approach

- EPRI has conducted the technical potential for CO₂ emissions reductions from the U.S. electricity sector.
- EPRI developed 7 aggressive but potentially feasible technology deployment targets and estimated the CO₂ reductions that could result between now and 2030.
 - Potential regulatory and siting constraints were not considered.
 - Economic modeling of these targets is currently being conducted.
- **Conclusions:**
 - The technical potential exists for the U.S. electricity sector to significantly reduce its CO₂ emissions over the coming decades.
 - No one technology will be a silver bullet – a portfolio of technologies will be needed.
 - Much of the needed technology isn't available yet – substantial R&D, demonstration is required.

U.S. Electricity Sector CO₂ Emissions



Total U.S. Electricity Generation: 2005 EIA

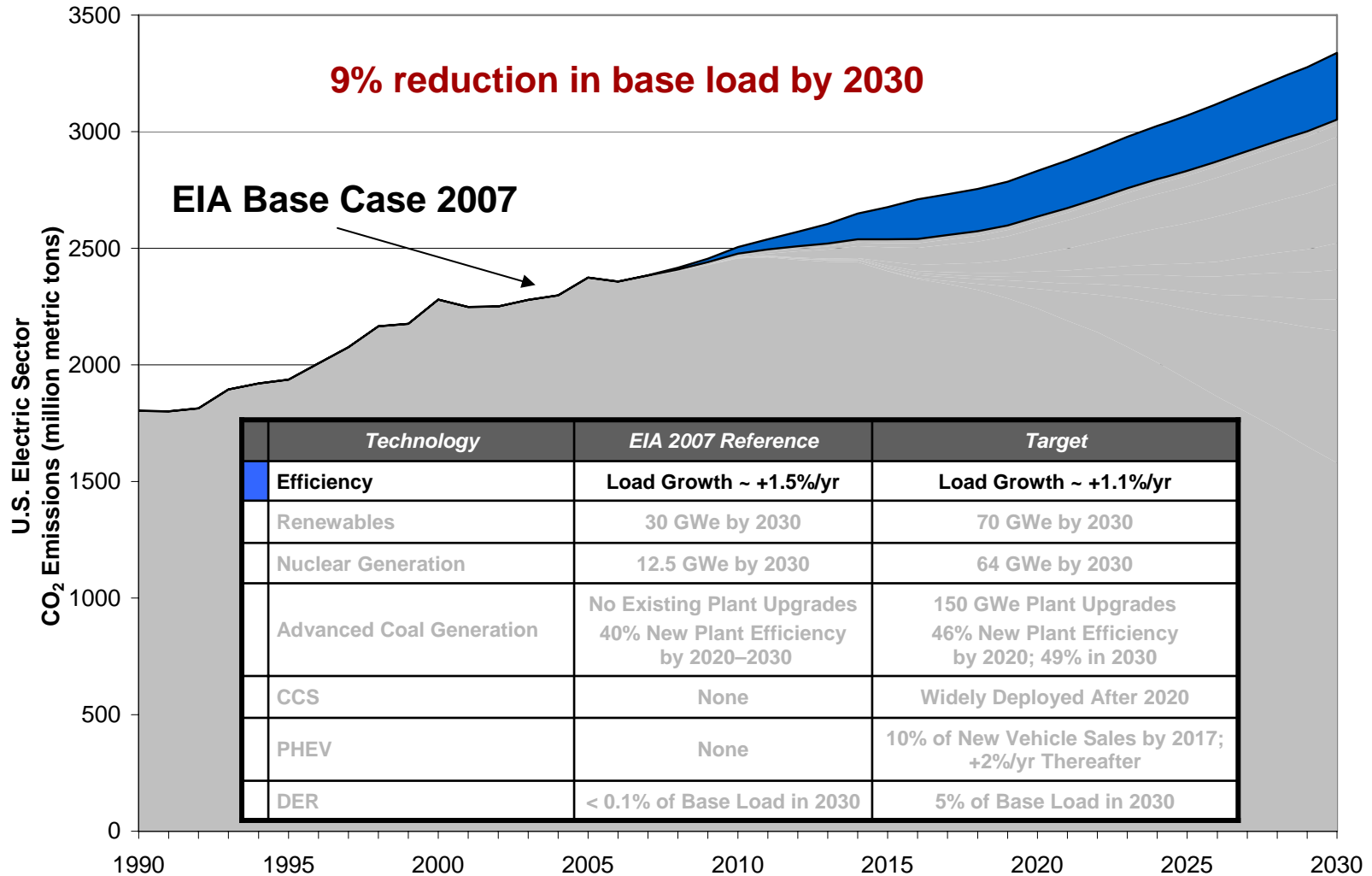


Technology Deployment Targets

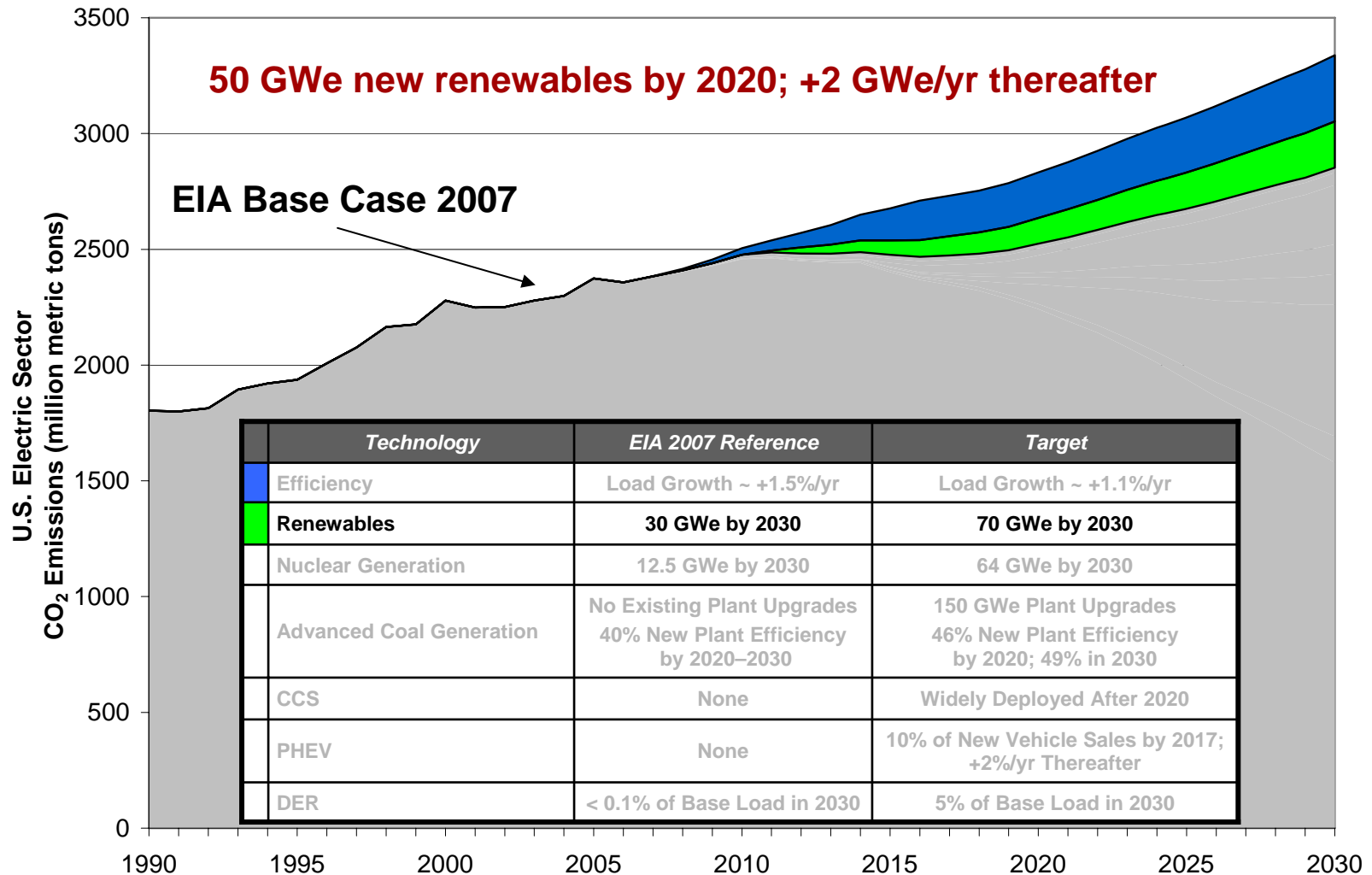
Technology	EIA 2007 Base Case	EPRI Analysis Target*
Efficiency	Load Growth ~ +1.5%/yr	Load Growth ~ +1.1%/yr
Renewables	30 GWe by 2030	70 GWe by 2030
Nuclear Generation	12.5 GWe by 2030	64 GWe by 2030
Advanced Coal Generation	No Existing Plant Upgrades 40% New Plant Efficiency by 2020–2030	150 GWe Plant Upgrades 46% New Plant Efficiency by 2020; 49% in 2030
Carbon Capture and Storage (CCS)	None	Widely Available and Deployed After 2020
Plug-in Hybrid Electric Vehicles (PHEV)	None	10% of New Vehicle Sales by 2017; +2%/yr Thereafter
Distributed Energy Resources (DER) (including distributed solar)	< 0.1% of Base Load in 2030	5% of Base Load in 2030

- EPRI analysis targets do not reflect potential regulatory and siting constraints. Additional economic modeling in progress

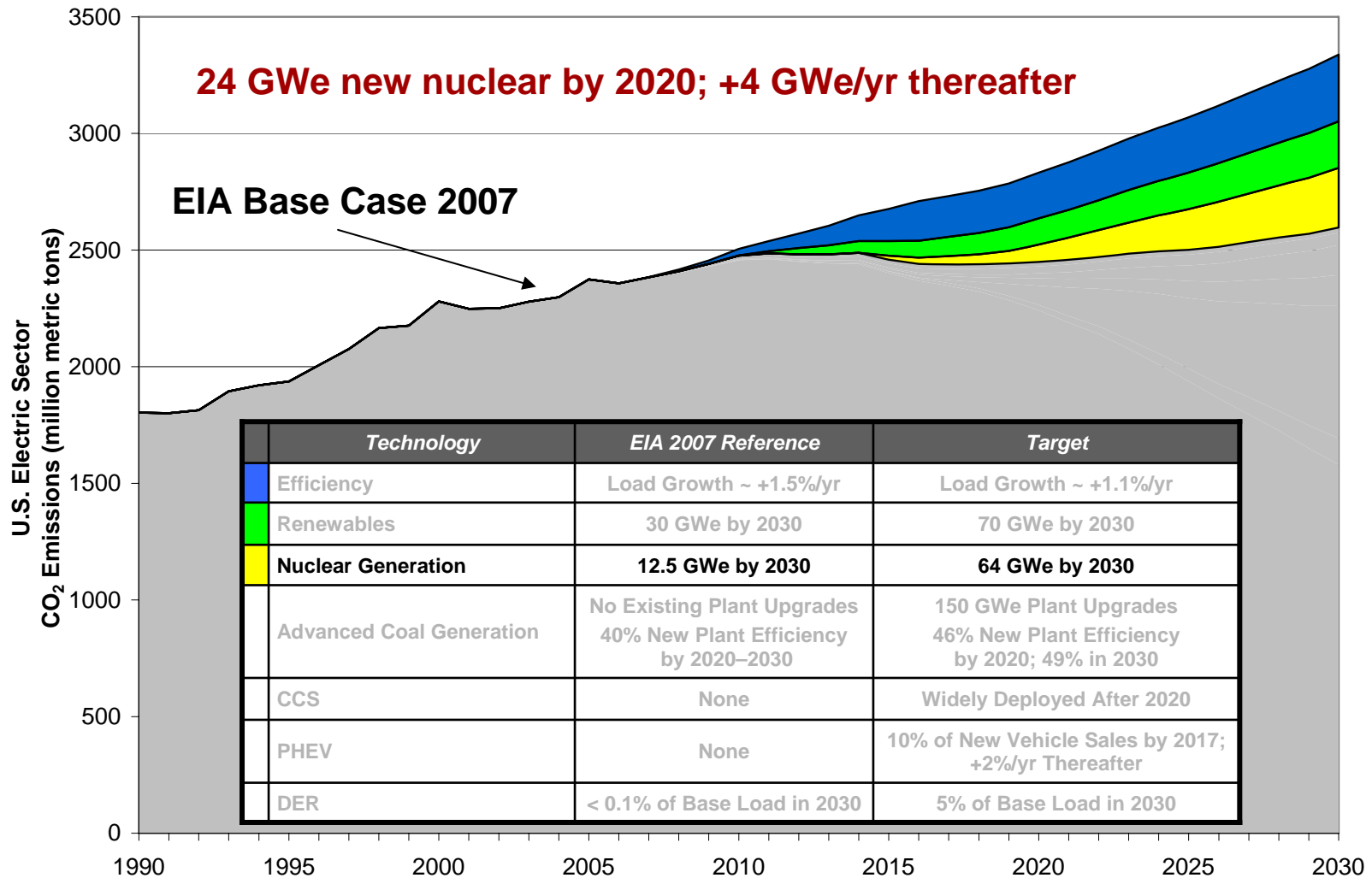
Benefit of Achieving Efficiency Target



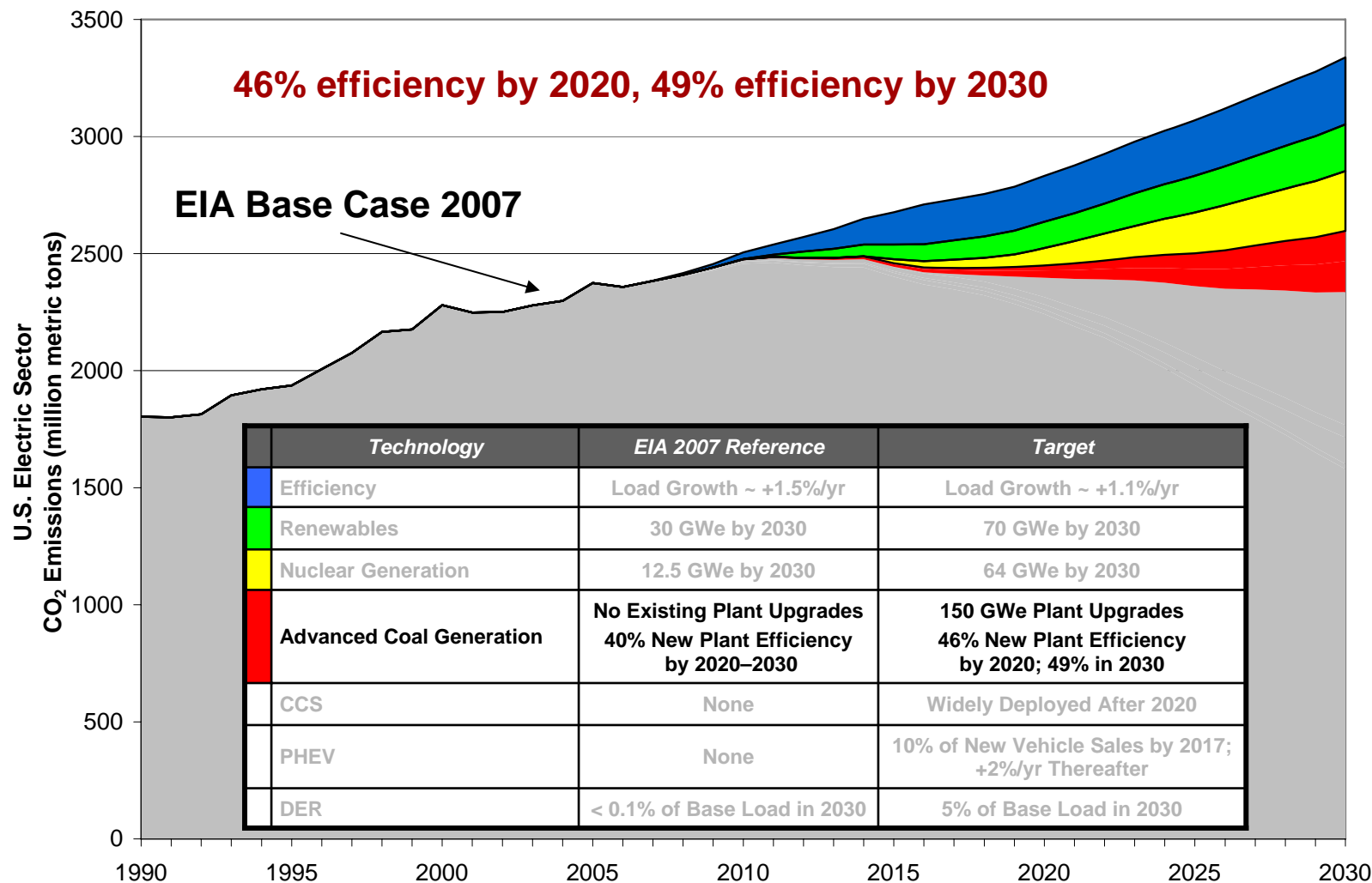
Benefit of Achieving Renewables Target



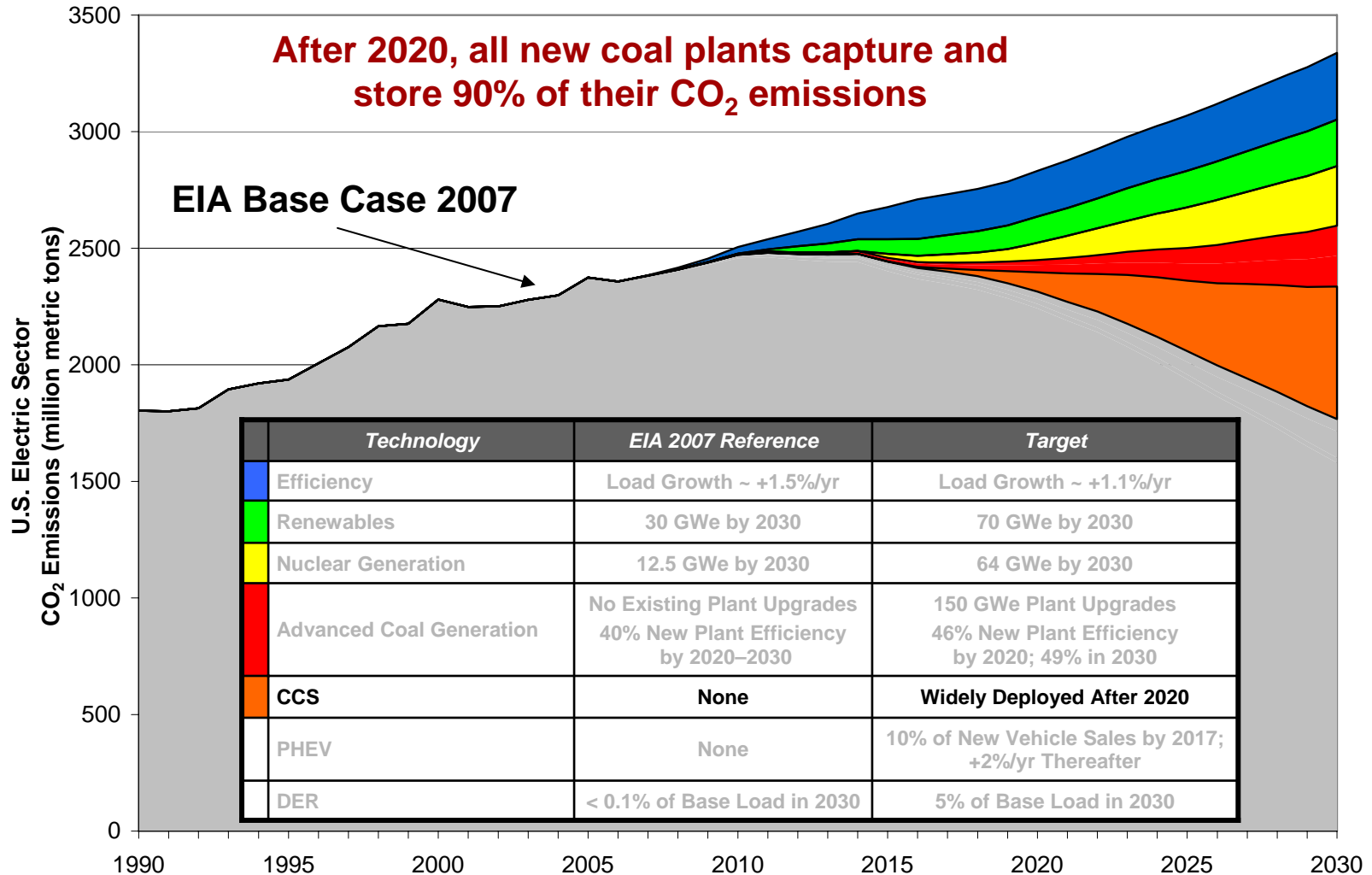
Benefit of Achieving Nuclear Generation Target



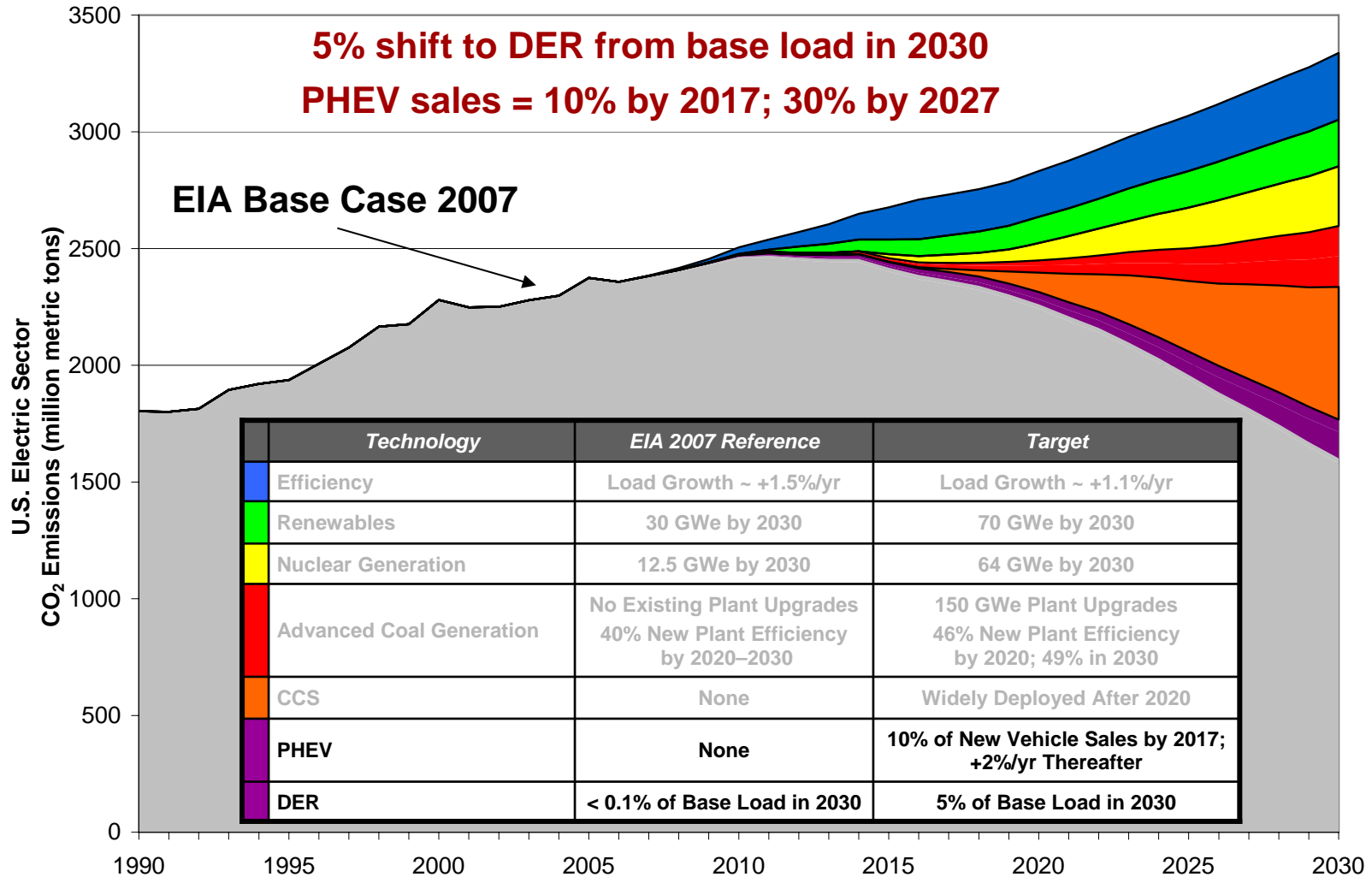
Benefit of Achieving Advanced Coal Generation Target



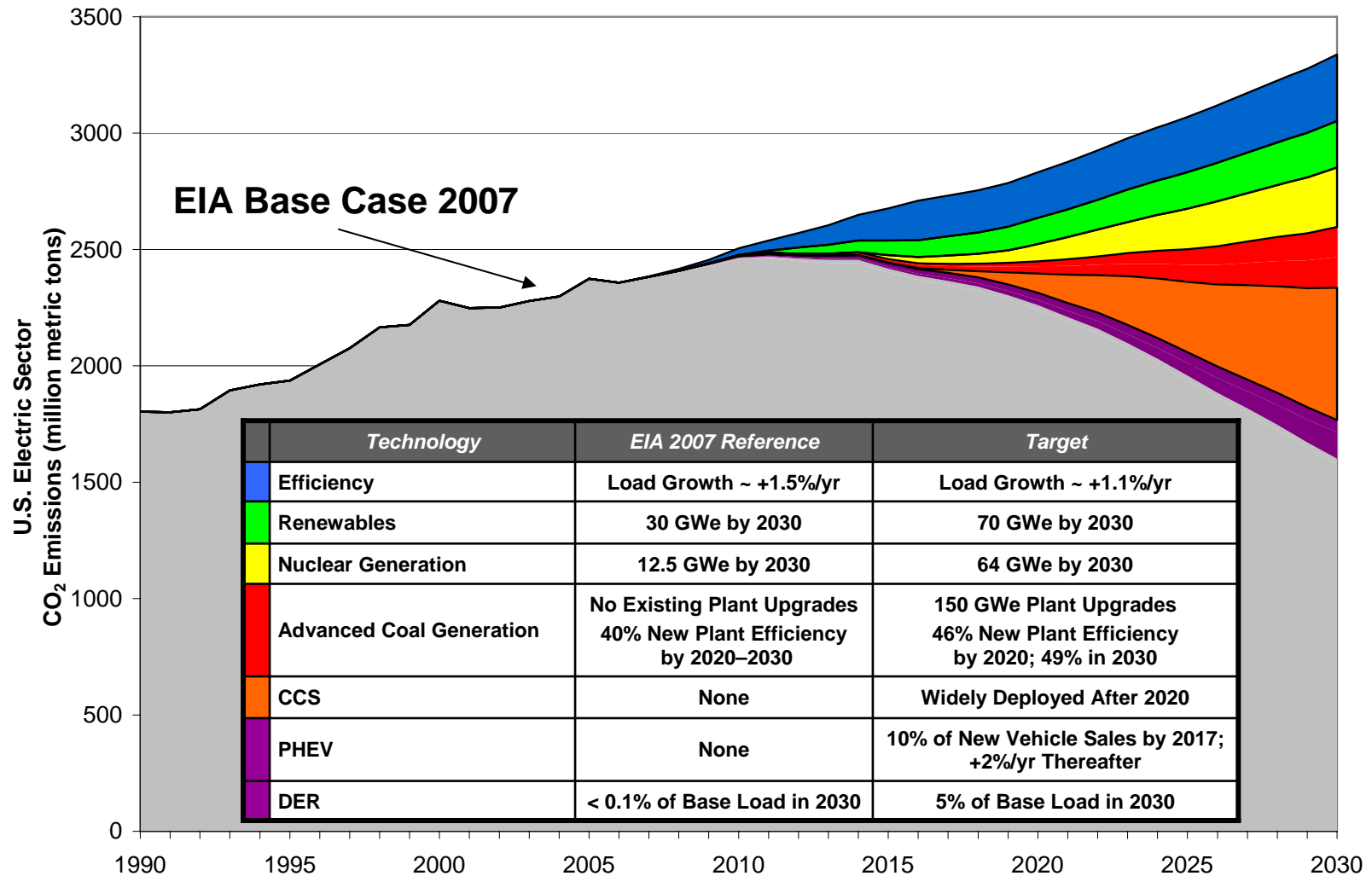
Benefit of Achieving the CCS Target



Benefit of Achieving PHEV and DER Targets

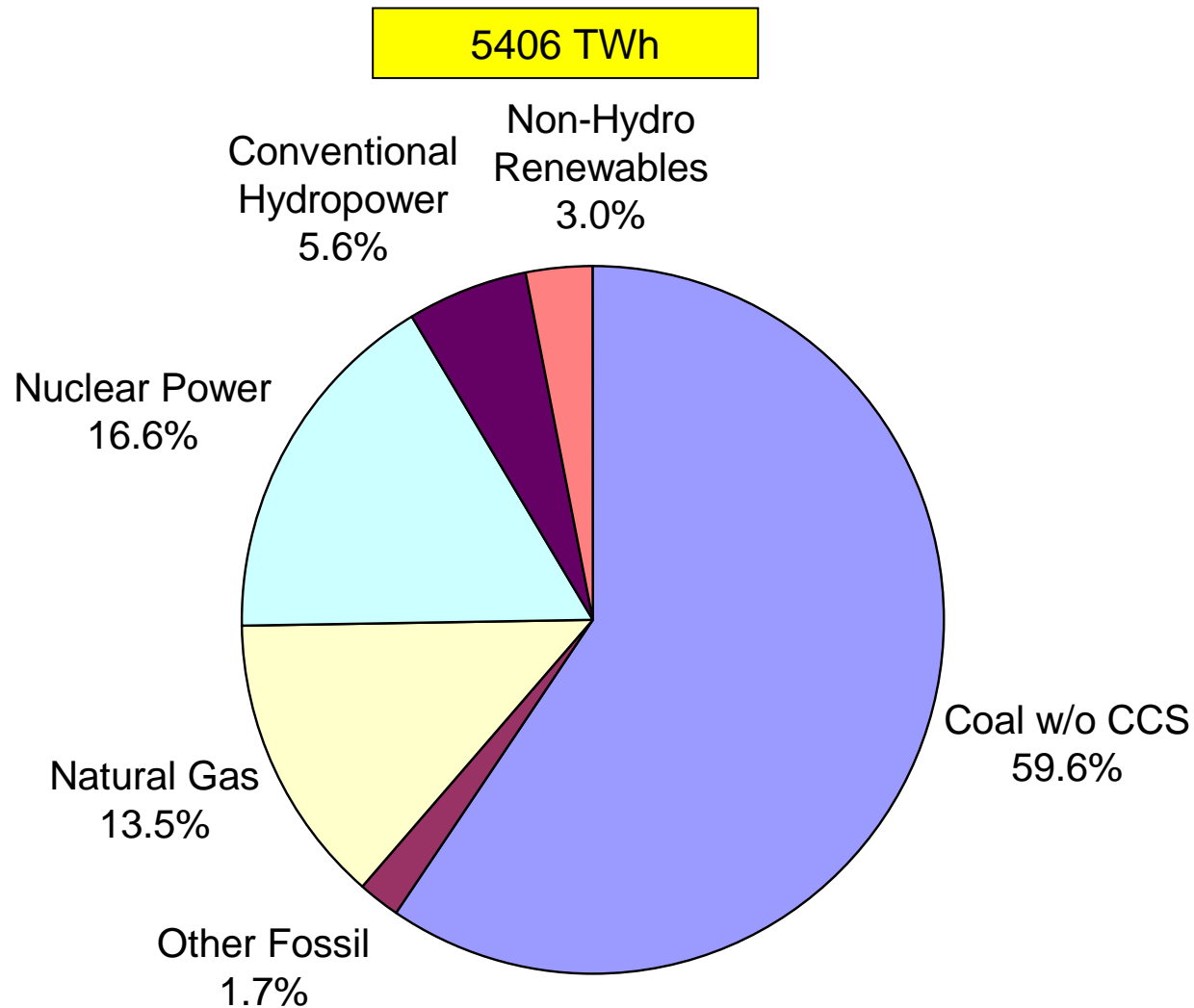


CO₂ Reductions ... Technical Potential*

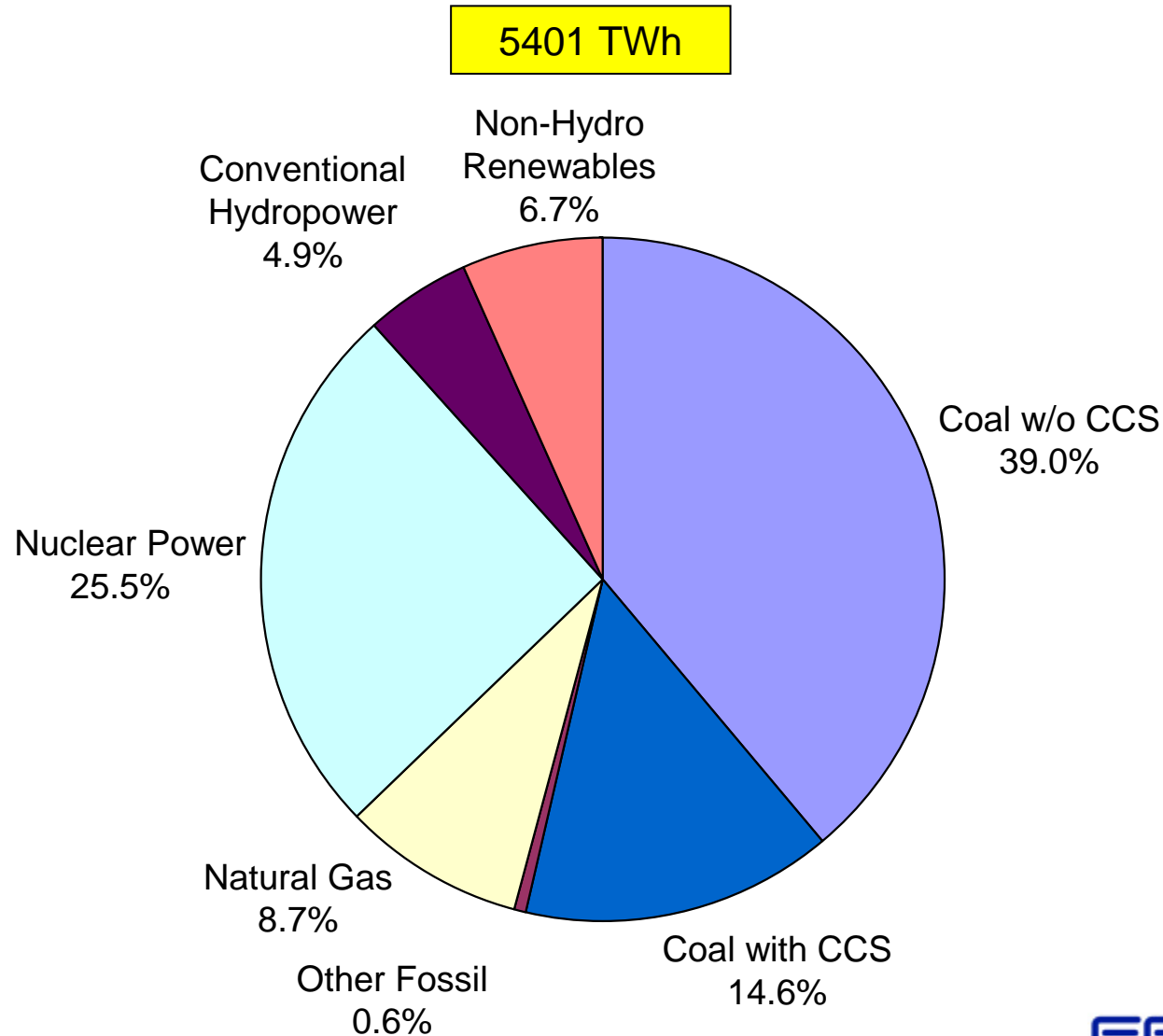


* Achieving all targets is very aggressive, but potentially feasible.

Total U.S. Electricity Generation: 2030 EIA Base Case



Total U.S. Electricity Generation: 2030 Advanced Technology Targets



Key Technology Challenges

The U.S. electricity sector will need ALL of the following technology advancements to significantly reduce CO₂ emissions over the coming decades:

1. Smart grids and communications infrastructures to enable end-use efficiency and demand response, distributed generation, and PHEVs.
2. A grid infrastructure with the capacity and reliability to operate with 20-30% intermittent renewables in specific regions.
3. Significant expansion of nuclear energy enabled by continued safe and economic operation of existing nuclear fleet; and a viable strategy for managing spent fuel.
4. Commercial-scale coal-based generation units operating with 90+% CO₂ capture and storage in a variety of geologies.