Federal Clean Energy Standards

(Should be) A Policy for Low Carbon Technology Deployment*

*A long stale, non-peer reviewed analysis

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A Federal Clean Energy Standard: Understanding Important Policy Elements

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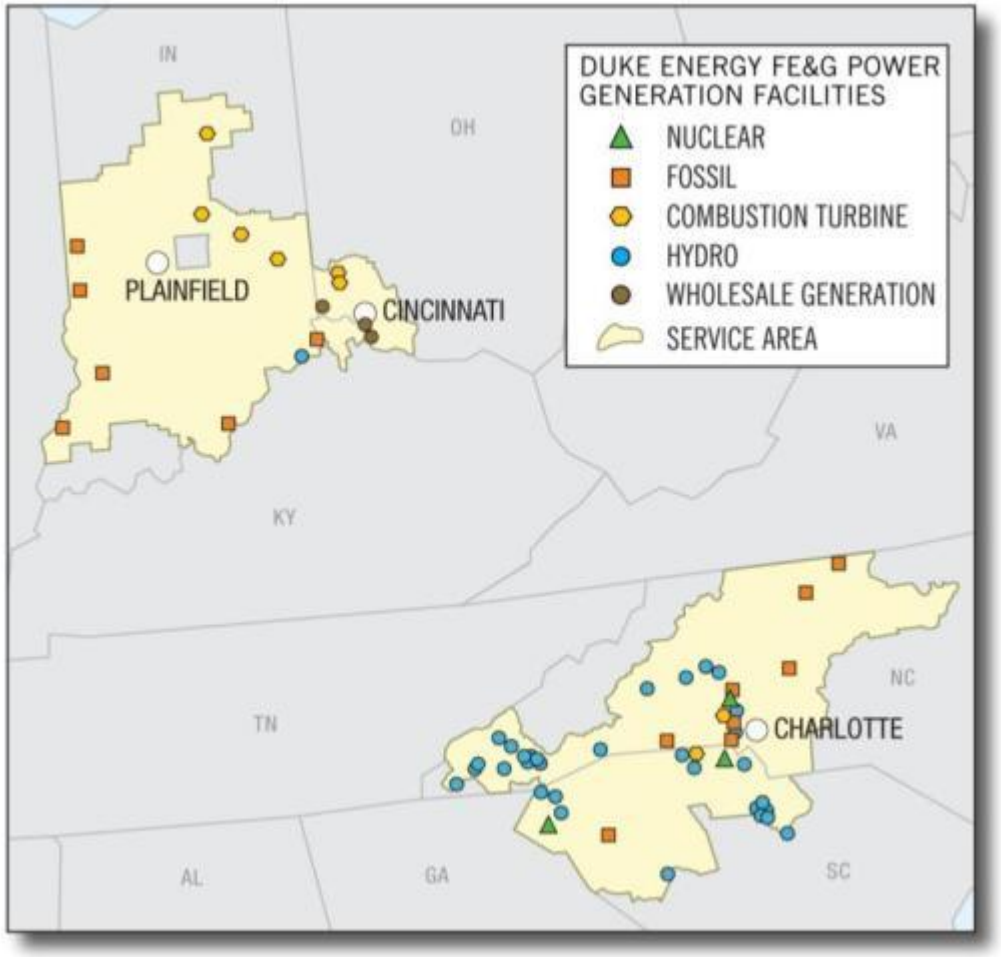
U.S. FRANCHISED ELECTRIC AND GAS

- 5 states: North Carolina, South Carolina, Indiana, Ohio and Kentucky
- 50,000 square miles of service area
- 27,000 MW of regulated generating capacity
- 4.0 million retail electric customers
- 500,000 retail gas customers in the Cincinnati area
- 3rd largest coal consumer & nuclear operator in U.S.

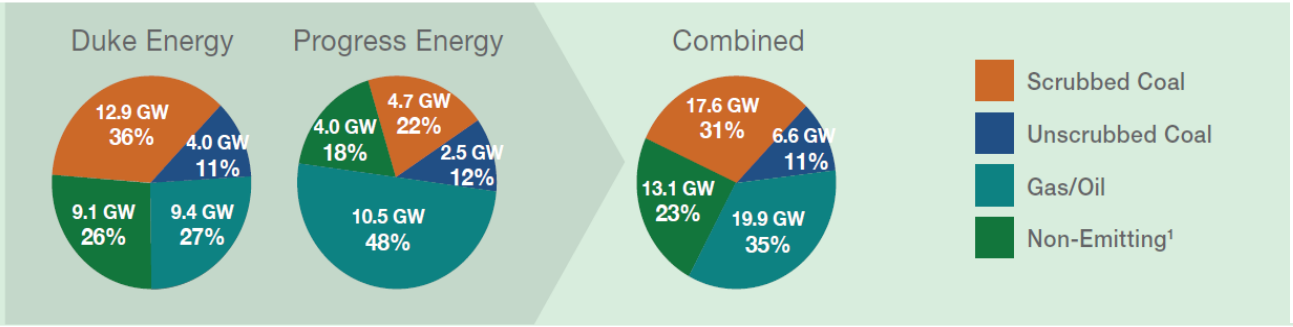


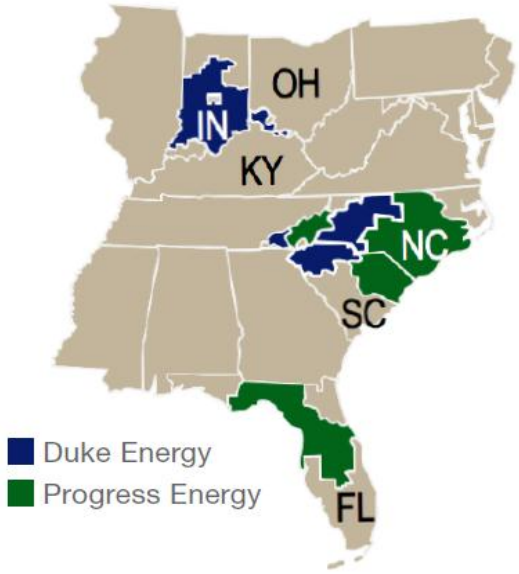
Pending acquisition of Progress Energy will make us largest utility in U.S -- approximately mirror U.S. portfolio

U.S. generation well positioned for pending environmental regulations

Mitigate cost increase and strategic execution risks in era of major change

Generation Capacity by Technology (GW/%)





[1] Duke Energy: Nuclear (15%), Hydro (9%), Renewables (2%); Progress Energy: Nuclear (17%), Hydro (1%); Combined: Nuclear (16%), Hydro (6%), Renewables (1%)
Note: Generation capacity as of 09/30/10 and excludes purchased power and 4.1 GW of Duke Energy International assets.

Company Name: Duke Energy Corporation
Corporate Headquarters: Charlotte, N.C.; substantial operations in Raleigh, N.C.
Market Capitalization: $36.5 billion***
Total Assets: $90.6 billion*
Revenues: $22.7 billion**
Customers: 7.1 million electric and 500,000 gas
Generating Capacity: 57,200 megawatts
Service Territory: 104,000 square miles
Executive Chairman: James E. Rogers
President and Chief Executive Officer: William D. Johnson
Board of Directors: The new Duke Energy board will be composed of 18 directors, 11 designated by Duke Energy, including the lead director, and 7 designated by Progress Energy

* As of stock close September 30, 2010
** As of December 31, 2009
*** As of December 31, 2010

Very roughly: 1,000 MW (1 GW) can power 1 million homes

Background

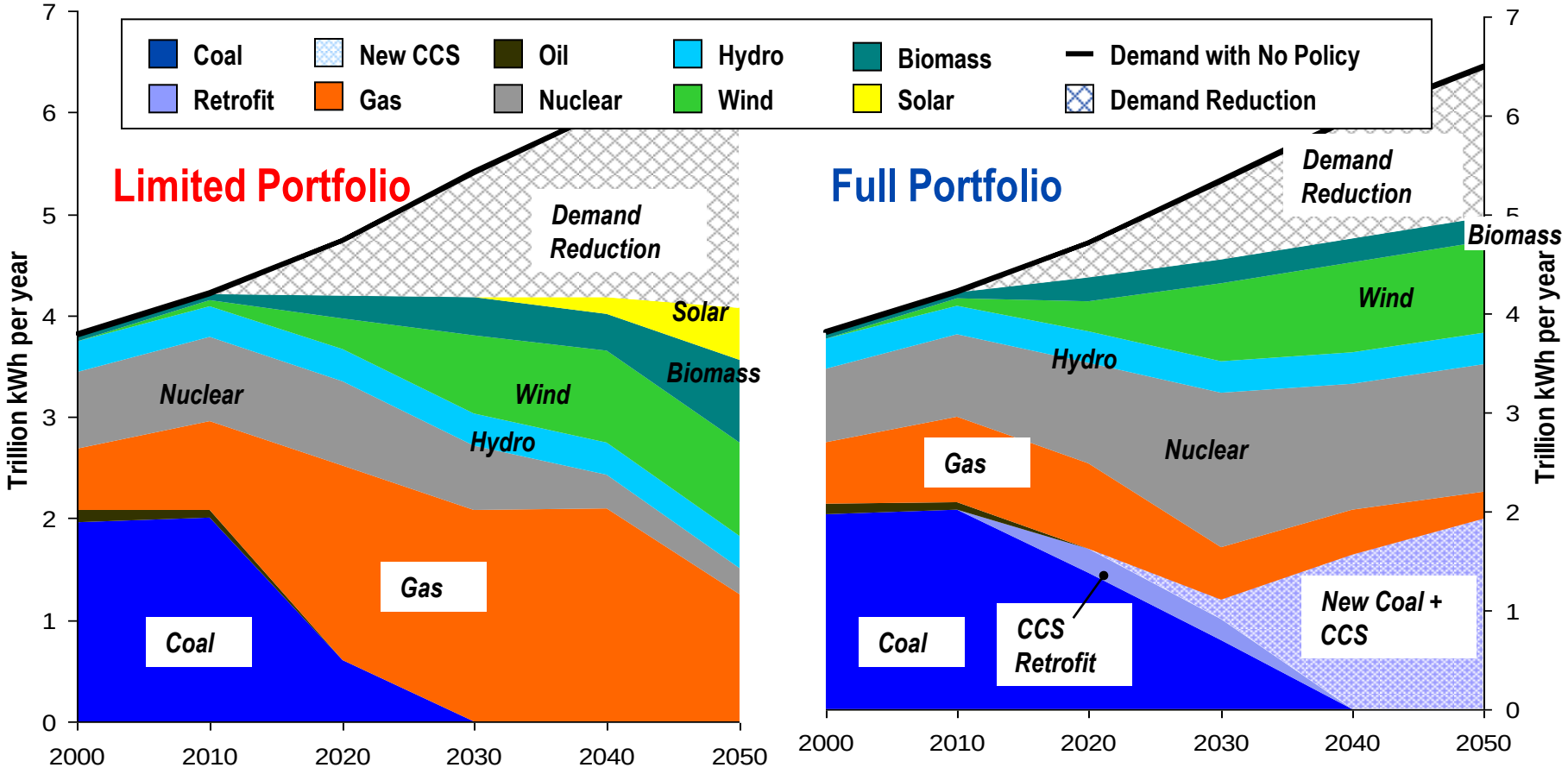
- Our Beliefs
  - Risk of CO2 limits continues to influence the market (no new coal build out)
    - Now a political non-starter
    - Dormant, not dead
    - The direction of EPA CO2 regulation is unclear
  - Low carbon technology development /deployment (especially nuclear & CCS) will stall without a policy driver.
    - Left and Right gloating over AEP's CCS closure

- Possible Policy Initiatives for Low Carbon Technology Development
  - Federal or state loan guarantees
  - Federal or state tax credits
  - Federal or state grants
  - R&D wire charges or fuel surcharges
  - Expanded State renewable portfolio standards to include CCS and nuclear
  - Federal renewable/clean energy standards
  - EPA BACT CO2 Regulation

Policy Framing is Critical -- will impact the speed with which issue can be advanced

- Emissions or technology focused?
- Congress in no mood to deal with GHG emissions
  - Advocates need to convince the public the issue matters – politicians afraid to defend (let alone advance) climate
- Public generally supportive of new clean energy technologies
  - Though Conservative/Libertarian thought leaders attack government support as wasteful support of rent seekers
  - Still easier to support than climate, so more likely to go first
- A carbon policy cloaked in technology won't fool anyone unless pols want to use it as way to discretely support climate (and few do now)
  - Opponents already call any hint of a carbon policy a remake of Waxman Markey

Electricity Sector Was Banking on Nuclear and CCS – 2009 point of view (w/higher nat gas prices)



- Full portfolio was 80% less costly than limited portfolio
- (not shown above) Low natural gas prices give industry more time, but don't change long term tech requirements

2010/11 Senate Proposals

- As an alternative to carbon regulation, Senators Lugar and Graham introduced separate bills that included a Diverse or Clean Energy Standard
  - Included aggressive long-term targets – 50% energy from new low emitting sources by 2050, i.e., renewables, nuclear and CCS
  - Intended as a practical alternative to carbon regulation (Lugar said as much when he introduced it)
  - Duke Energy modeled each proposal using ICF's IPM, later modified to approximate the WH framework

Electric Industry's Compliance Scenario

- Will be determined by each utility with approval of state utility commission
- Very generally, CES modeling of U.S. electricity system with $50 CEC price indicates:
  - Years 1-5 → significant build of new wind turbines to satisfy near term demand for Clean Energy Certificates -- CECs (due to cost and rapid deployment capability)
  - Years 1-10 → Industry begins building nuclear and CCS units (5,000 MW new nuclear & 3,500 MW CCS by 2020 (nationwide)
  - Consistent with technology deployment industry anticipated with the CO2 limits

- However … If policy inadvertently dilutes demand or inflates supply of CECs, CEC prices will be too low to incentivize robust clean technology deployment and will strand an aggressive base load build-out
  - Example:
    - White House inclusion of natural gas may undermine investment in new technologies by dramatically lowering price of CECs

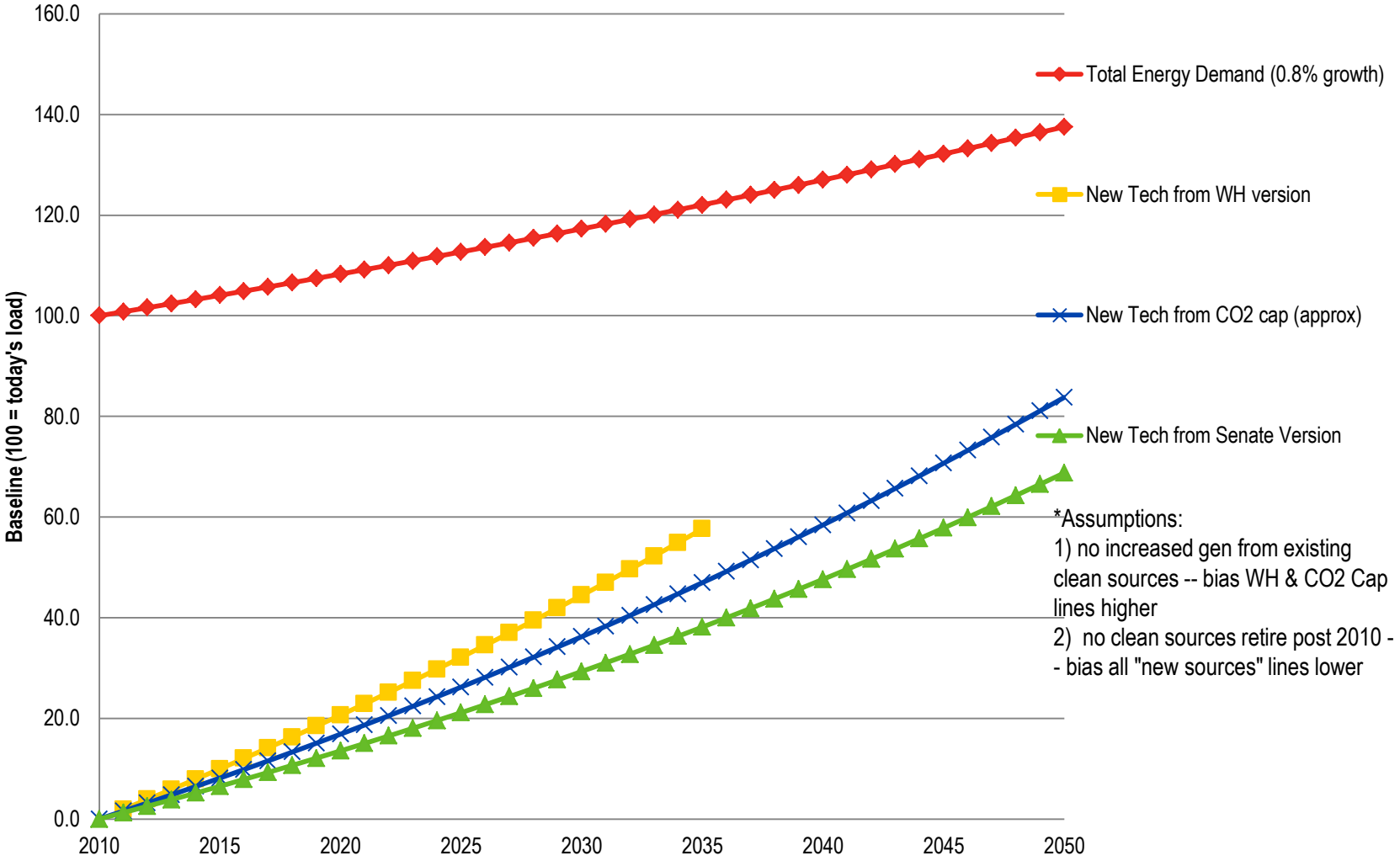
CO2 vs. Tech Standards -- Fundamentally Different

- Senate CES proposals = Technology Focus
  - CES is economically efficient driver of new technologies (technology focus)
  - CES less efficient at reducing emissions – cost/ton reduced is much higher
    - Flattens CO2 growth, little decline at higher equivalent cost/ton
  - Lugar policy good at driving wind, nukes and CCS pre-2030
  - Lugar less ambitious than CO2 policies (WM) post 2030 – 50% 2050 target compared to near complete fleet turnover with CO2 price
  - Can drive same small rate increase across entire country
- Emission focus
  - CO2 price more efficient at reducing CO2 emissions – significantly lower cost/ton and easier to include other sectors
  - CO2 policy *(WM like targets) drives more technology in long run owing to stiffer 2050 targets
  - CO2 price drives greater fuel switching in first decades
  - CO2 legislation would likely have included Clean Air Act Preemption (no NSR problems for CO2) – won't get this with RPS/CES policy
  - Will drive very different rate impacts – regional winners and losers
- Senate CES needed to keep new techs alive but is only a partial CO2 solution

What we modeled

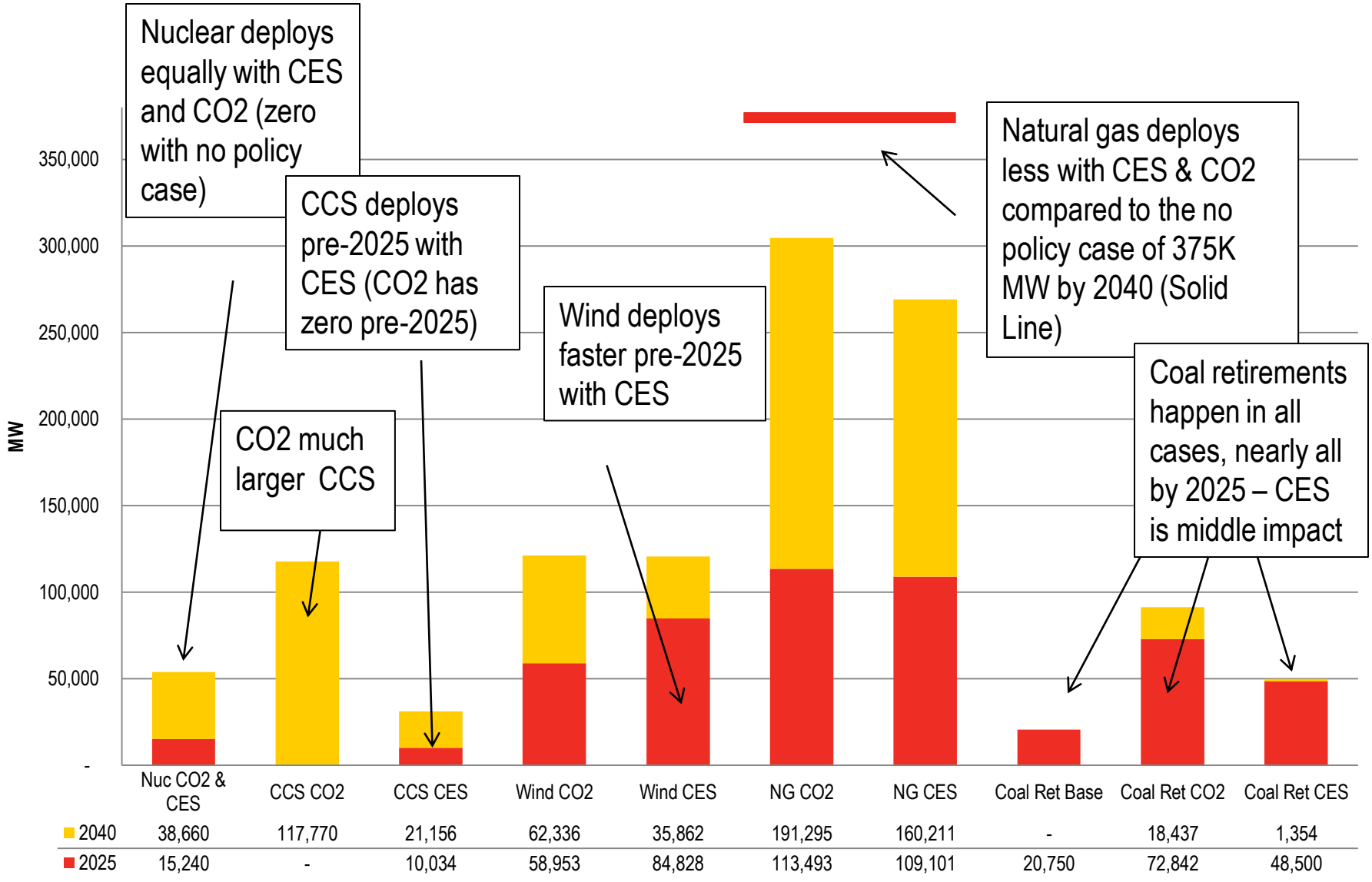
- Lugar – 50% energy from NEW clean sources by 2050 (new plants), $50 ACP, summer 2010 EEI assumptions for criteria pollutants
- Graham – similar targets, exempt small distcos, carve outs for particular techs, $35 ACP, Dec EEI assumptions (harder still)
  - Modified Graham to eliminate exemptions and carve outs to push CEC price higher
- WH framework →Graham targets + ½ CEC for natural gas (no WH details available)
- Graham and Lugar required power from NEW clean energy sources
- WH apparently would include existing clean sources (efficient policy!) with nominally steeper targets – 80% energy from clean by 2030s
- WH – 80% target in ballpark of double today's level – directionally similar to Senate 50% clean target

Very Rough Comparison of Requirements
WH & Senate Frames (spreadsheet)



Implications for the Utility Industry (SAMPLE ONLY – THIS IS FROM LAST FALL's LUGAR ANALYSIS -- $50 ACP)

Total Capacity Build By Technology and Scenario (IPM output)



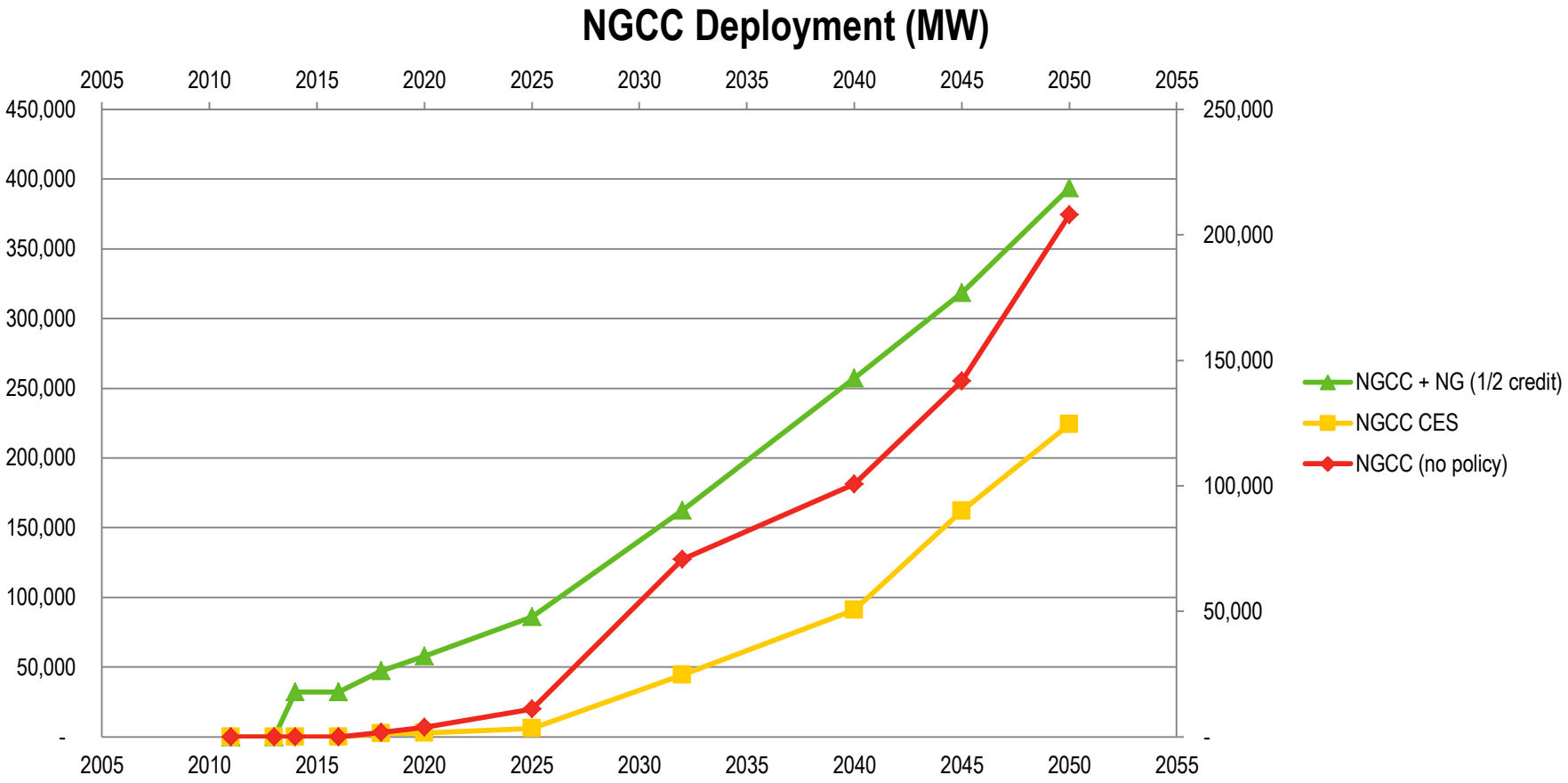
	Nuc CO2 & CES	CCS CO2	CCS CES	Wind CO2	Wind CES	NG CO2	NG CES	Coal Ret Base	Coal Ret CO2	Coal Ret CES
2040	38,660	117,770	21,156	62,336	35,862	191,295	160,211	-	18,437	1,354
2025	15,240	-	10,034	58,953	84,828	113,493	109,101	20,750	72,842	48,500

Graham & WH frames less potent tech drivers

- CEC prices too low due to:
  - Exemptions for small utilities weaken overall demand
  - Carve outs for select technologies (solar) increase supply
  - Only hit $35 ACP if eliminate both
  - $35 too low to incent nuclear or CCS until later decades
  - Good wind and solar driver
  - CES drives less natural gas deployment than the BAU case (which shows N.G. is the new default technology)
    - CES decreases future share from natural gas

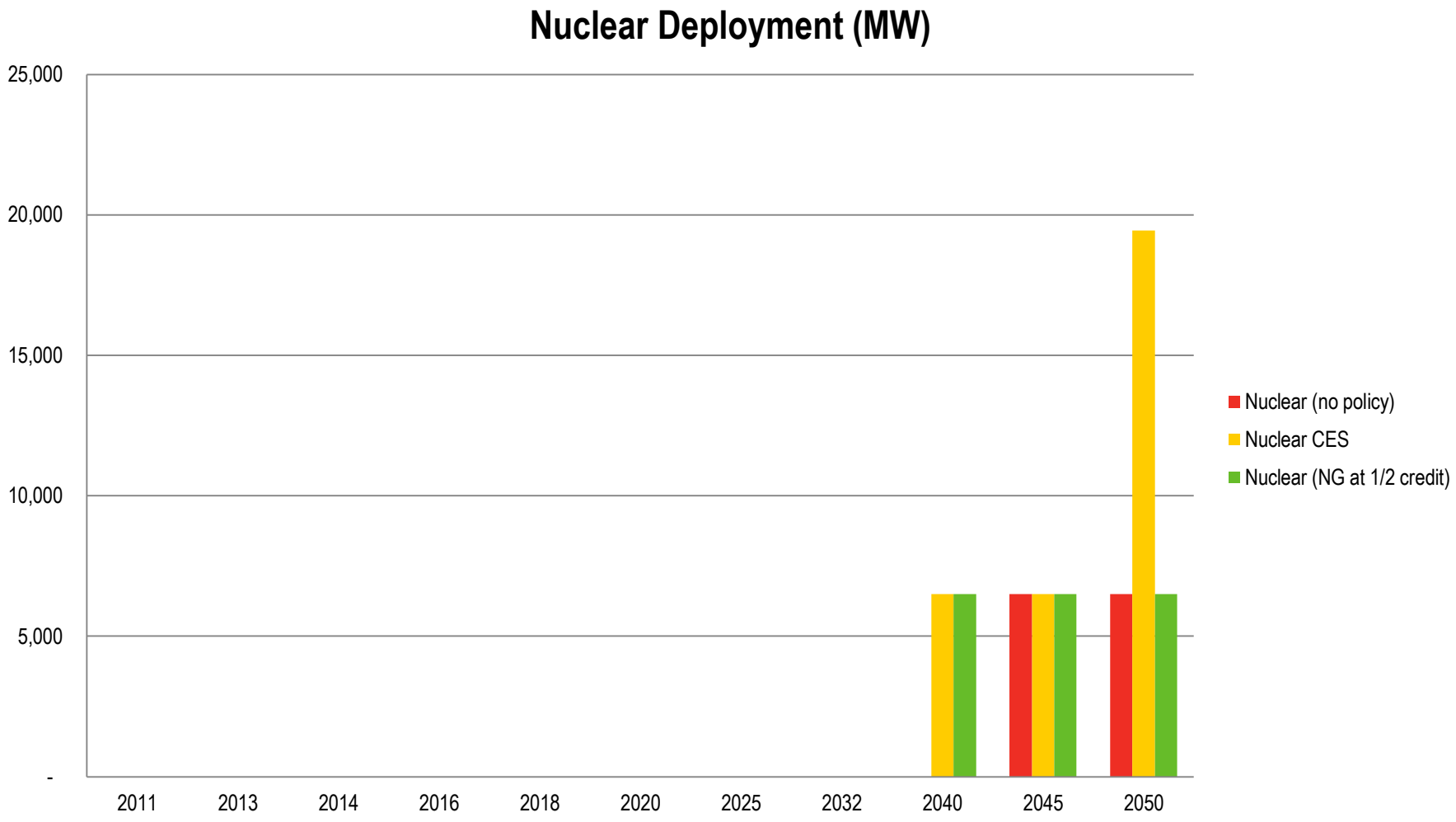
- WH has similar CEC low price problem
  - Amplifies an already strong natural gas deployment
  - Still solid wind and solar deployment
  - No CCS, few nukes beginning 2040

Graham vs. WH – Natural Gas Combined Cycle

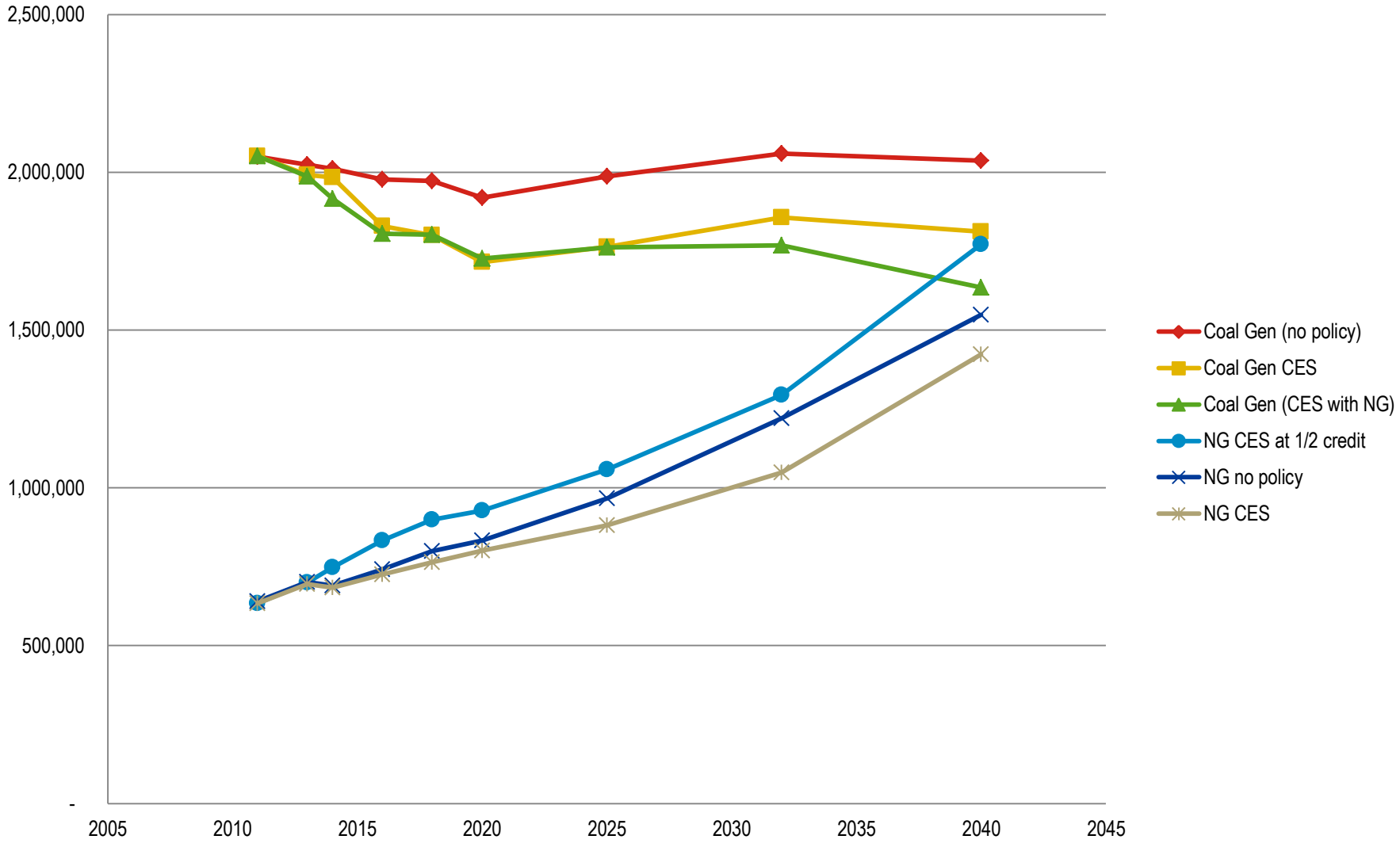


Surprise! Model shows CCS on NG around 2025 for CES (none for WH frame though)

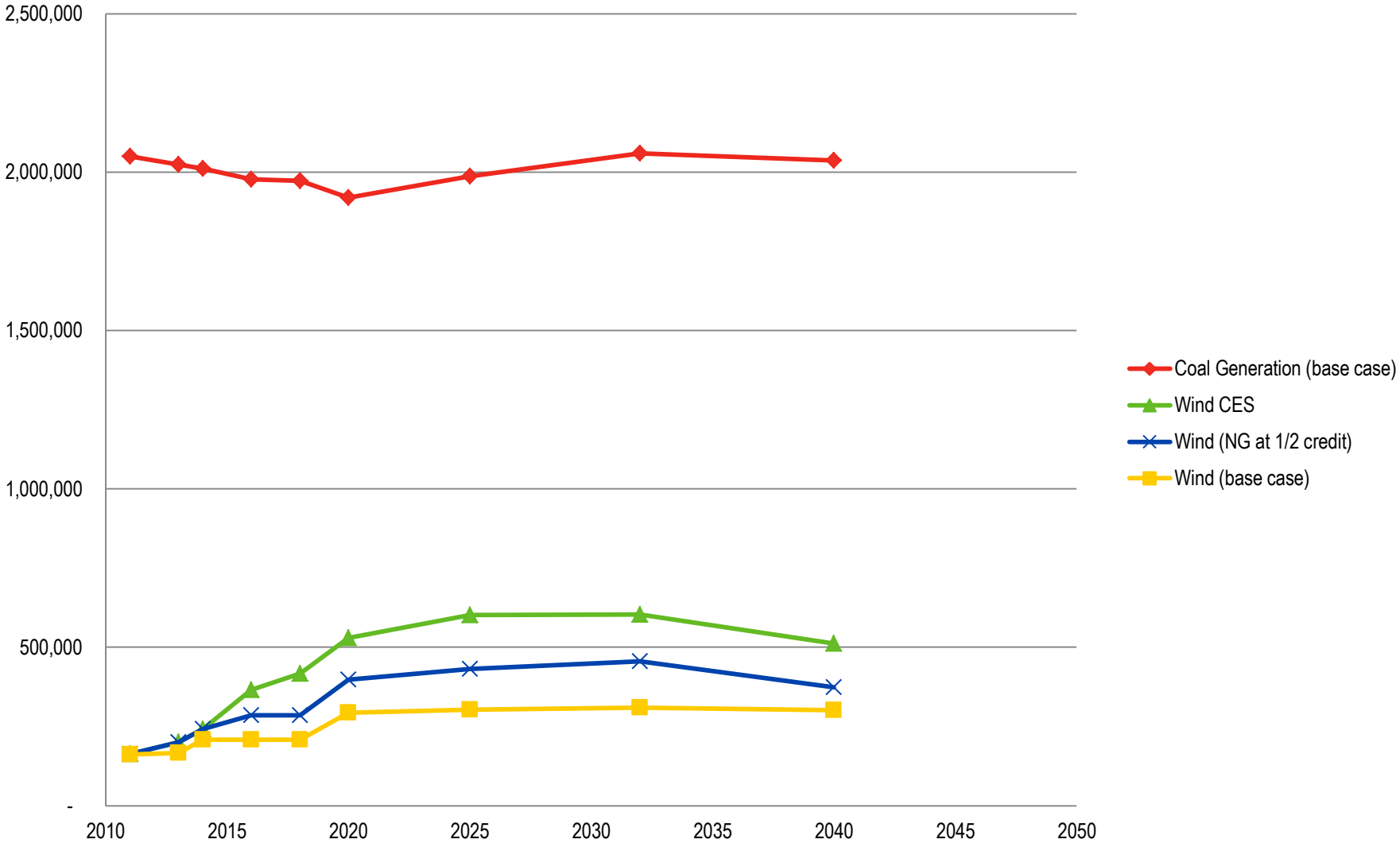
Graham vs. WH – New Nuclear Capacity (No CCS on coal)



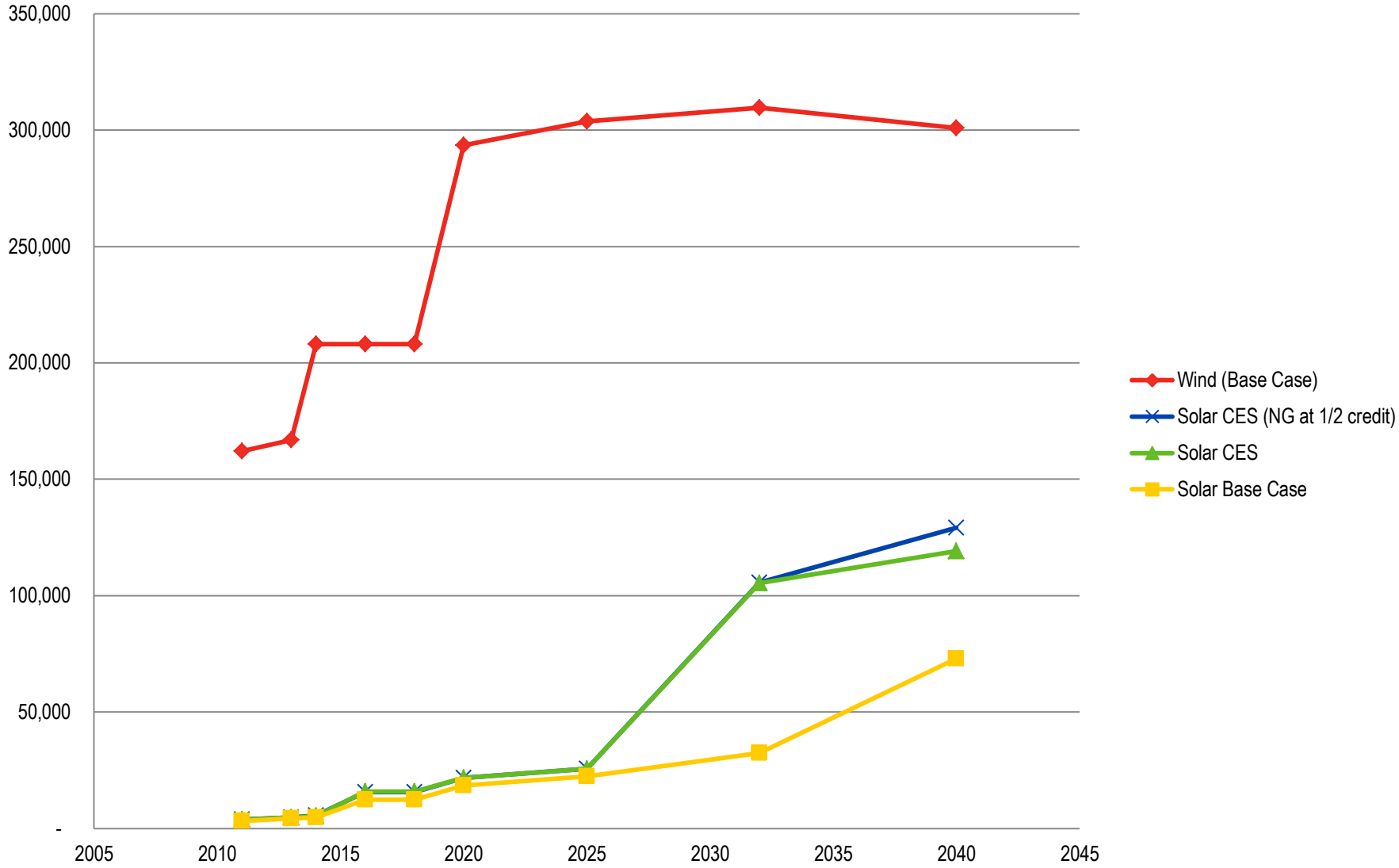
Fossil Generation By Fuel Source (GWh)

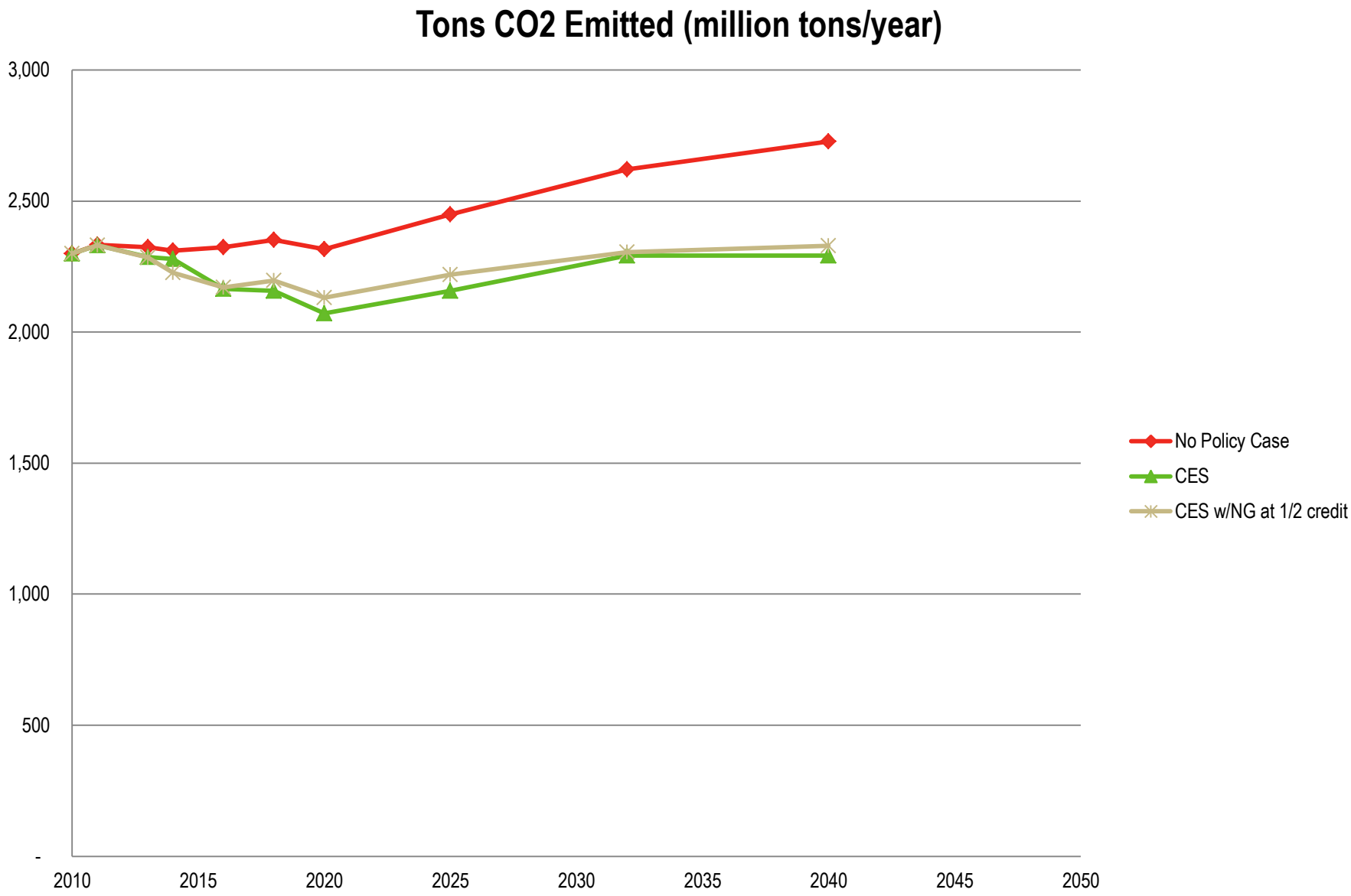


Wind Generation (GWh) with Coal Comparison

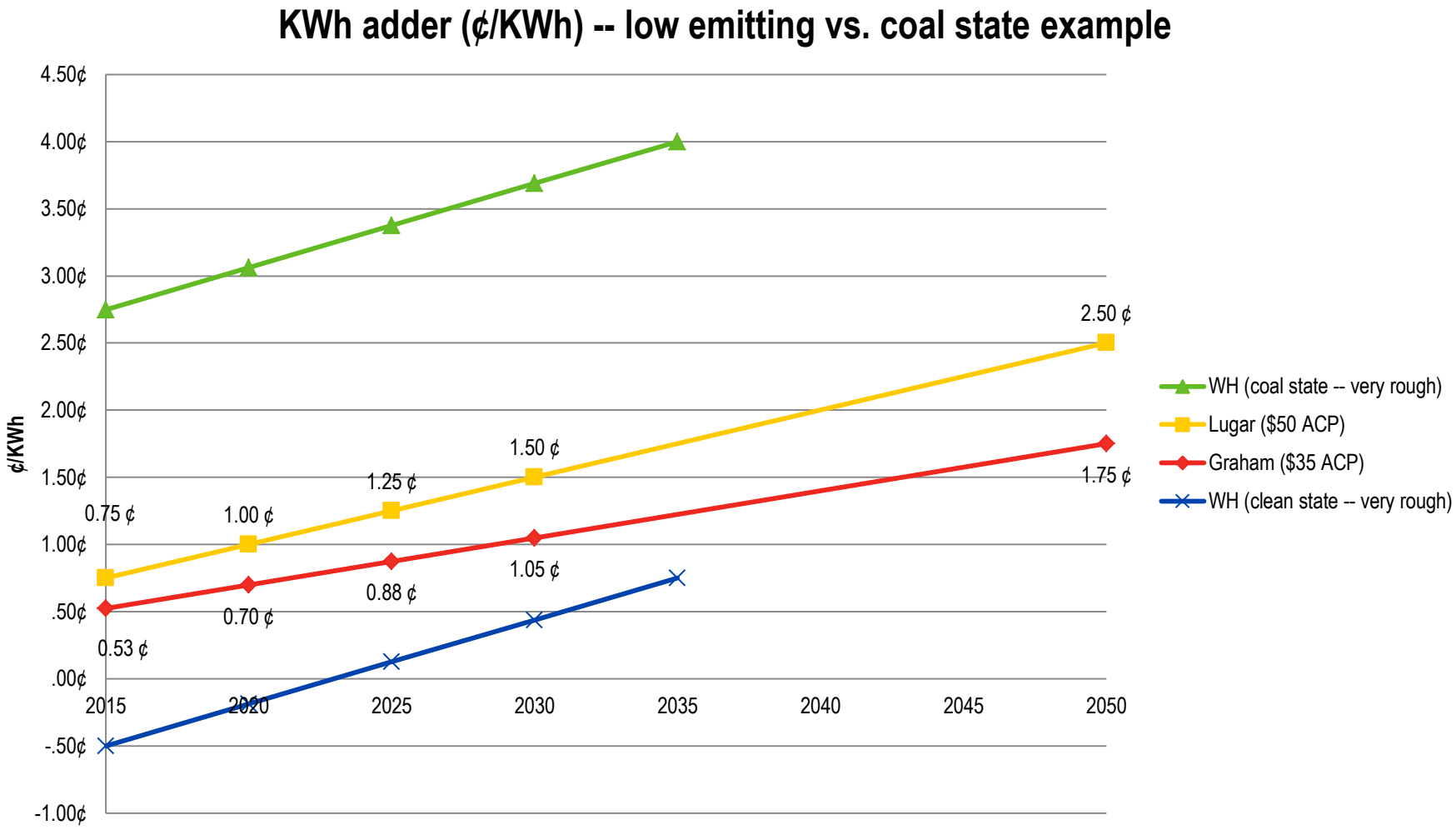


Solar Generation (GWh) compared to Wind Base Case




Tons CO2 Emitted (million tons/year)
3,000
2,500
2,000
1,500
1,000
500
-
2010
2015
2020
2025
2030
2035
2040
2045
2050
No Policy Case
CES
CES w/NG at 1/2 credit

Scale of Consumer Impacts of Different Frames (rough spreadsheet analysis)



Q: Is CES all that's needed? A: Probably not

- Big multi-billion dollar projects with innovative techs still have experience curves – costs decline/performance improves with each additional copy – this is typically a barrier to first movers
  - Nuclear: Strong, long term federal financing support is required for initial projects
    - Cost over-run protection
    - Timely recovery – Federal incentives to encourage states to approve CWIP
    - New federal financing source, with reduced political risks (remove from federal budget process)
    - Streamline NRC permitting/licensing
    - Several of these components were in last year's Kerry/Graham/Lieberman draft legislation
  - Clean Coal/CCS
    - Sustained funding for first 5 to 10 projects to fully develop the technology (brine sequestration is key)
    - Liability protection, streamlined permitting under SDWA, pore space policy with components from last year's Rockefeller-Voinovich proposal
- Transmission
  - Coordination of planning, development and citing
- Energy Efficiency
  - Federal incentives to encourage states to advance/approve utility based EE programs
- Transportation Sector Incentives (EV, CNG) – Lugar contained transport section in his draft bill

Above list is not all inclusive – other ideas may emerge