

EIA's Annual Energy Outlook scenario development process



For

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By

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EIA's Annual Energy Outlook overview

- The Annual Energy Outlook (AEO) uses NEMS, a deterministic model of U.S. energy supply and demand, to create a range of cases reflecting different market and policy assumptions
- EIA approaches these cases as sensitivity analyses to test market response to controlled changes in model inputs, not as aspirational views of a future world
 - The Reference case is a benchmark using current laws, not necessarily “most likely” or “best guess”
- Users may view these sensitivities as revealing the “solution space” of future outcomes (i.e. range and distribution of outcomes)
- Users may also use these sensitivities to reveal important (and not necessarily obvious) relationships among diverse market drivers and outcomes

Agenda

- Purpose and function of the AEO
- Forecasts vs. projections
- Prescriptive planning vs. a Reference case
- Scenarios vs. sensitivities
- Market uncertainties vs. policy uncertainties
- A few examples

Purpose of the AEO

- EIA is a policy-neutral statistical and analysis agency
 - We do not implement, make, or advocate for (against) energy policies, technologies, or market segments
 - While our AEO is an official document of the U.S. government, its results and analysis do not reflect the position, desires, or intentions of Congress or the President (except as codified in law or regulation)
- So what is the AEO?
 - The AEO Reference case is our best assessment of the impact of implementing current laws and (enforceable) policies given our understanding of market structure and economic factors
 - Uses a deterministic model (NEMS) to provide “point” estimates, not probability clouds
 - The AEO includes 8 core “side cases” that examine sensitivity to key market uncertainties
 - EIA also does additional ad hoc side cases to examine other market and policy sensitivities

The AEO is a projection, not a forecast or prediction

- A projection (the AEO) indicates what could happen if the underlying assumptions about the current and future state of key inputs are realized
 - We don't claim that key assumptions will necessarily be realized
 - For example, we know that current laws and policies likely will change over time, but current law is a foundational assumption of the AEO Reference case
 - Uncertainties are resolved by examining alternative assumptions to provide more expansive description of the future solution space (example: if you pass this policy, here's how things could turn out)
- A forecast (not the AEO) provides an unconditional statement about the future state of the world
 - Implicitly (or explicitly) asserts that key assumptions will be realized
 - Resolves uncertainty by placing probabilities on assumptions or outcomes
 - For example, assumes that certain policies will be implemented because...well it just seems like this will or should happen

The AEO Reference case is not a planning scenario

- The Reference case evaluates how the world could evolve if policy-makers, market participants, and others just operate within the framework of current law and projected market conditions
 - Its value is in providing a baseline to evaluate the impact of proposed policies, investments, or other significant market interventions
- The Reference case does not prescribe future market conditions
 - It says “if we enact current laws and policies, we would expect to see X GW of new [combined cycle, wind, solar, etc.] capacity built by 2050”
 - It does not say “we need to build X GW of new [whatever] capacity by 2050 to meet our energy needs”
- The AEO can be used to understand the implications of planning decisions, and how robust those decisions could be under different futures

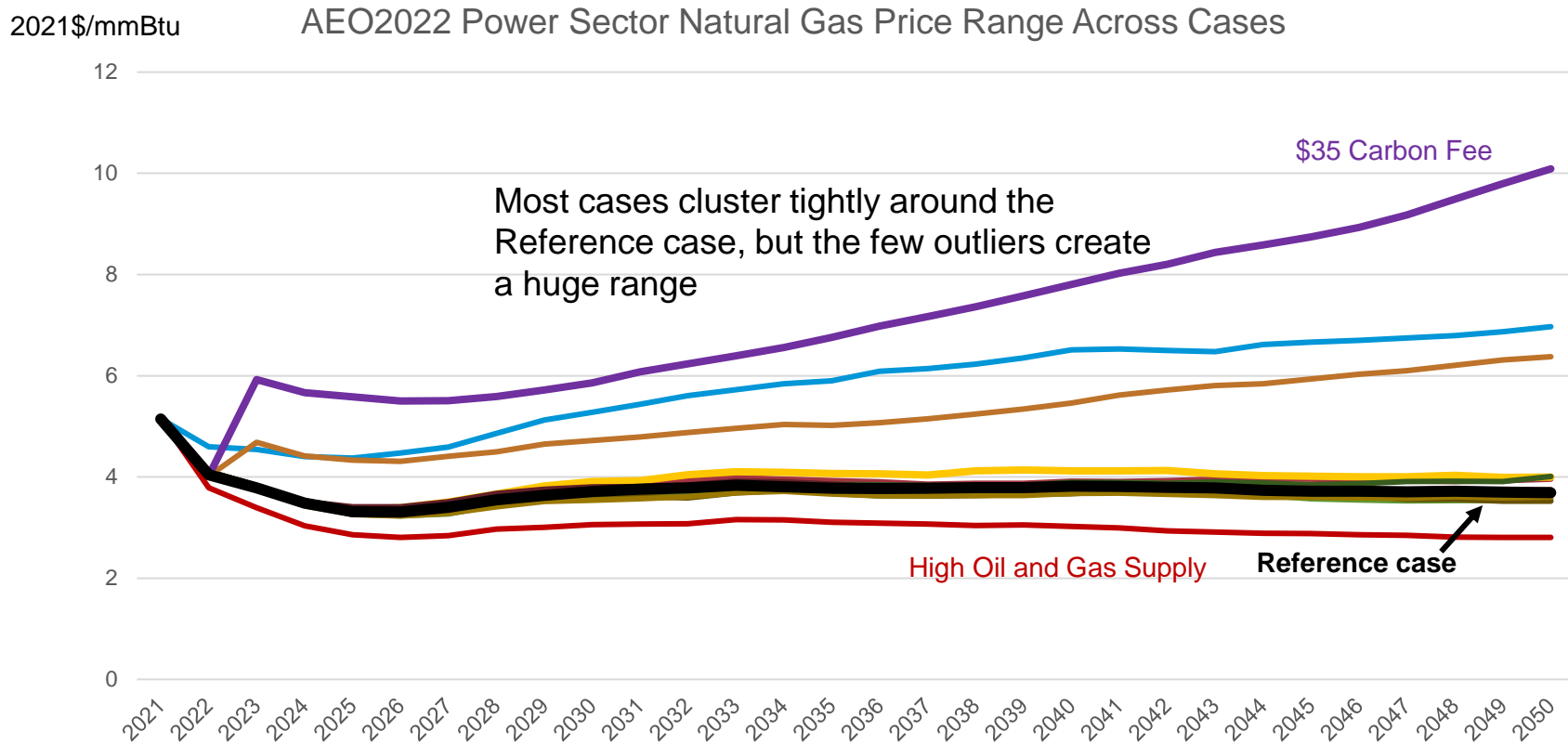
The AEO includes sensitivity analyses

- The AEO side cases examine the sensitivity of model results to limited (and controlled) variations of key model inputs representing both market and policy uncertainties
- The AEO side cases do not start with a known outcome and figure out how we could/should get there
 - We don't advocate for policies, and our models don't "work backward"
- Example of a sensitivity: What would the impact be on carbon emissions, renewable generation, electricity prices, etc. if we imposed a \$35 carbon fee?
- Example of a scenario (not AEO): What would a zero carbon world look like?
 - How we get there matters: Carbon taxes, carbon caps, tax credits, market factors?
 - A scenario starts at the destination, and may miss critical path dependencies

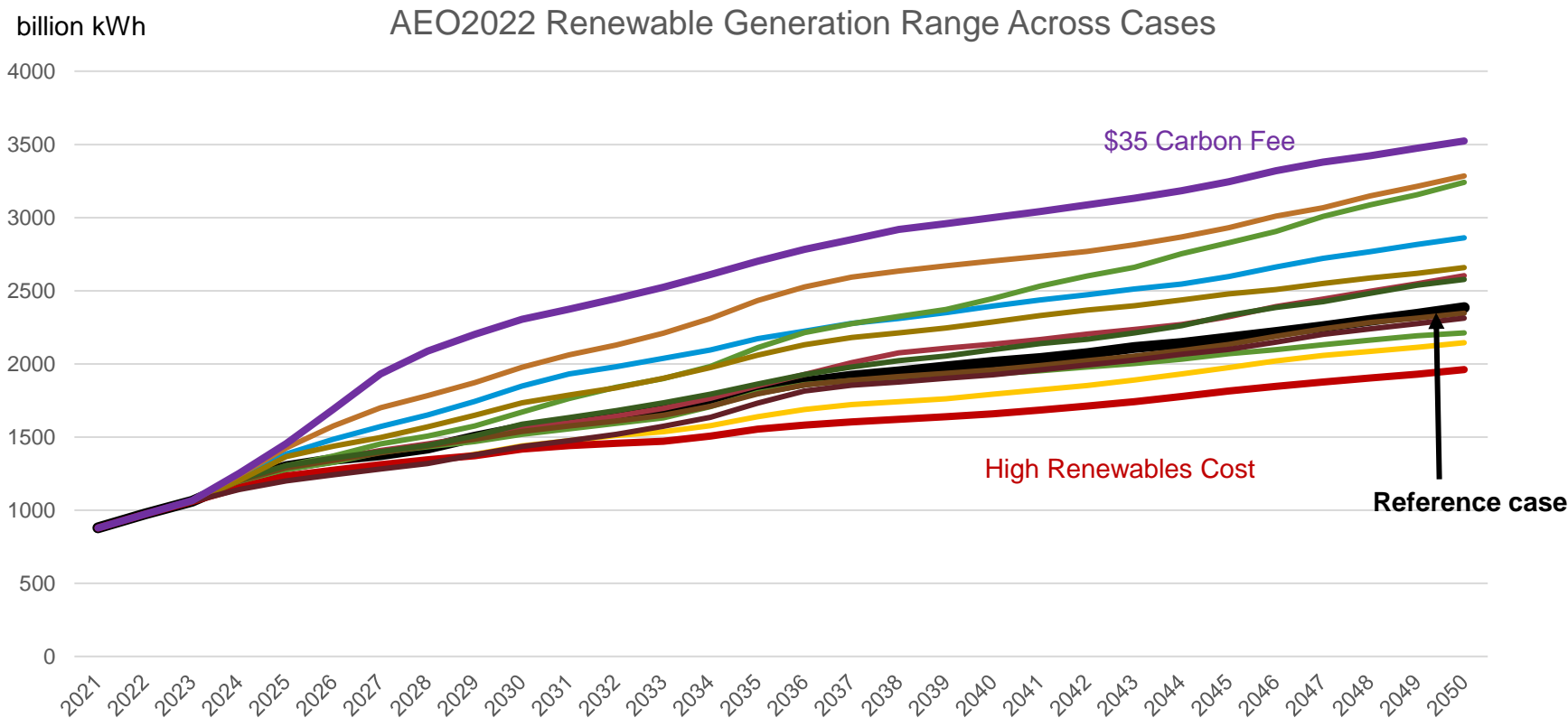
The AEO examines both policy and market sensitivities

- Key market sensitivities (addressed in each AEO)
 - World oil price. High and Low price paths determined by analyst judgement
 - Domestic oil and natural gas supply. Resource and extraction technology improves 50% greater than (High Oil & Gas Supply) or is 50% less than (Low Oil & Gas supply) Reference case
 - Macro economic conditions. High and low growth conditions exogenously determined
 - Renewable technology costs. Renewables costs are 40% lower than Reference case (Low Renewables Cost) or remain unchanged from current cost (High Renewables Cost)
- Policy sensitivities (some examples)
 - What would happen if renewable tax credits were extended rather than expired?
 - What would happen if there was a national carbon tax?
 - What would happen if efficiency standards were extended and strengthened?

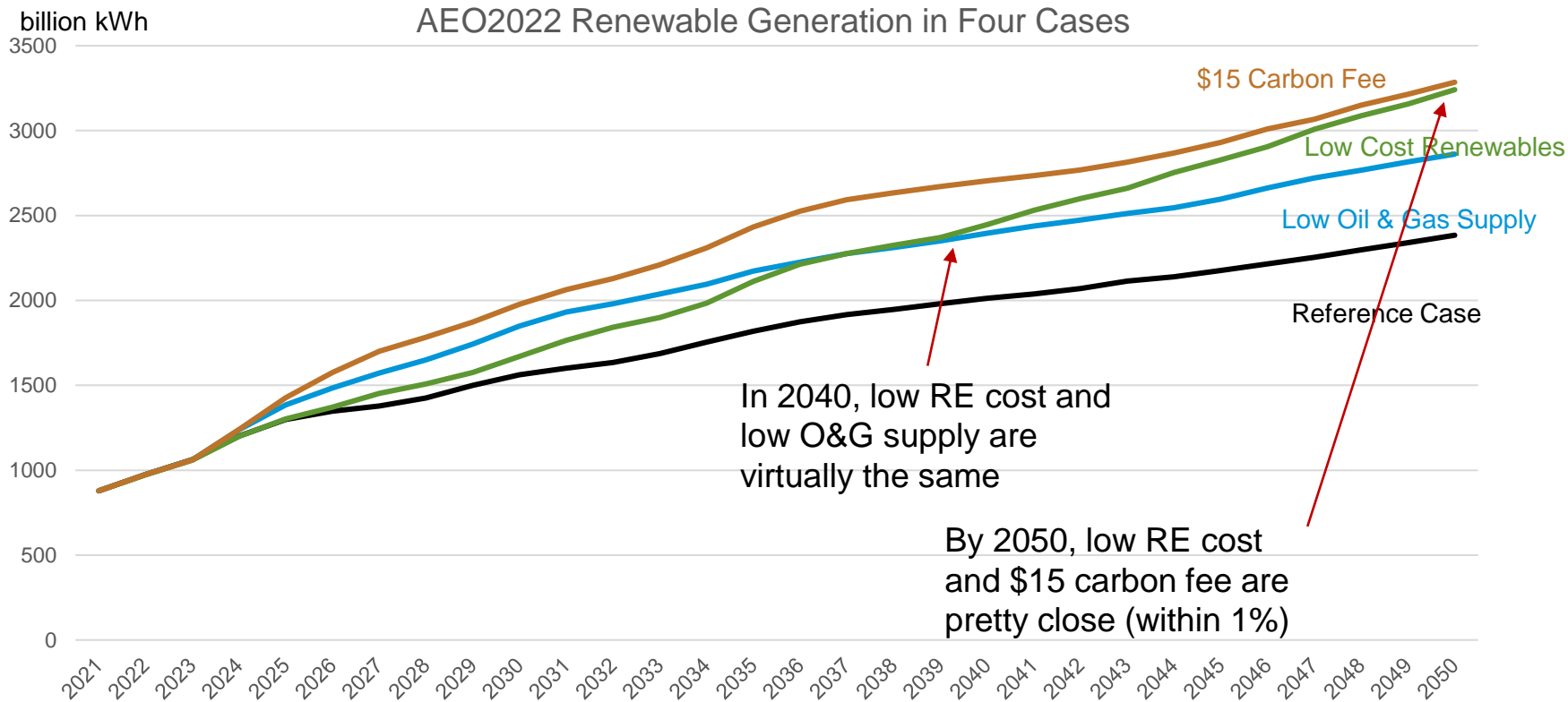
Sensitivities can be used to help think about the range of inputs used within the AEO and in potential planning scenarios



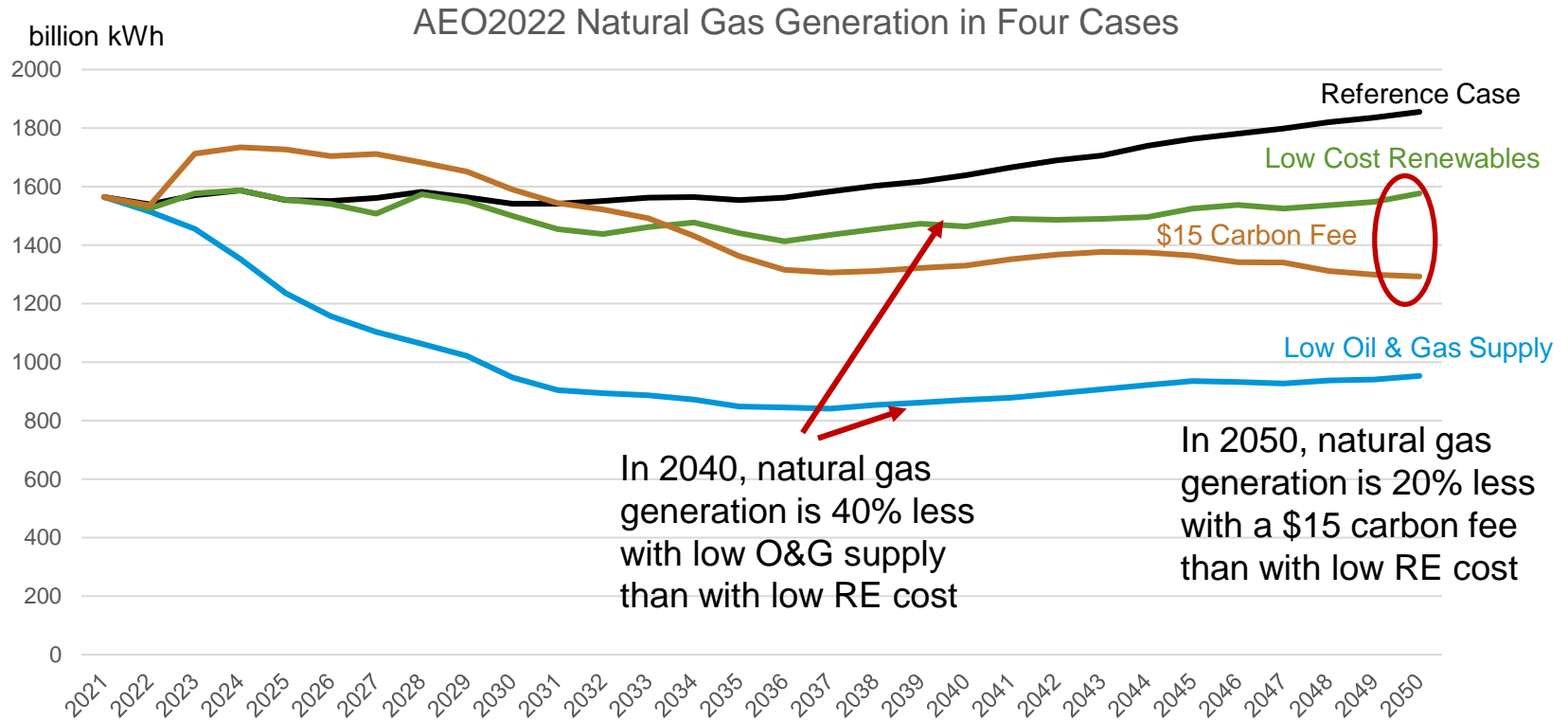
For AEO2022, there is much more “up side” to renewable penetration than “down side”



Sensitivity cases can also better characterize the secondary impacts of uncertainty around a specific result (example for renewable generation)

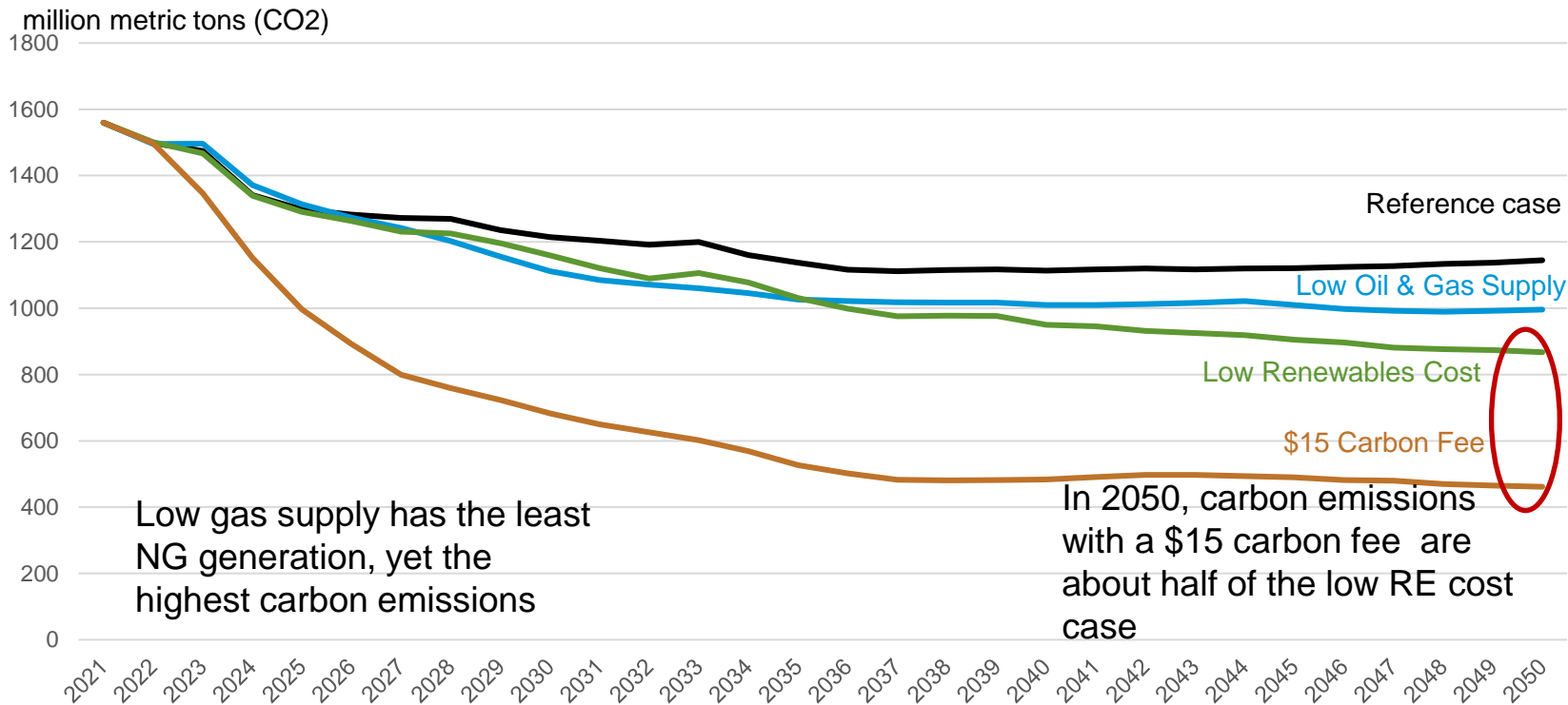


Renewable generation is not necessarily well correlated with natural gas generation across the same set of cases

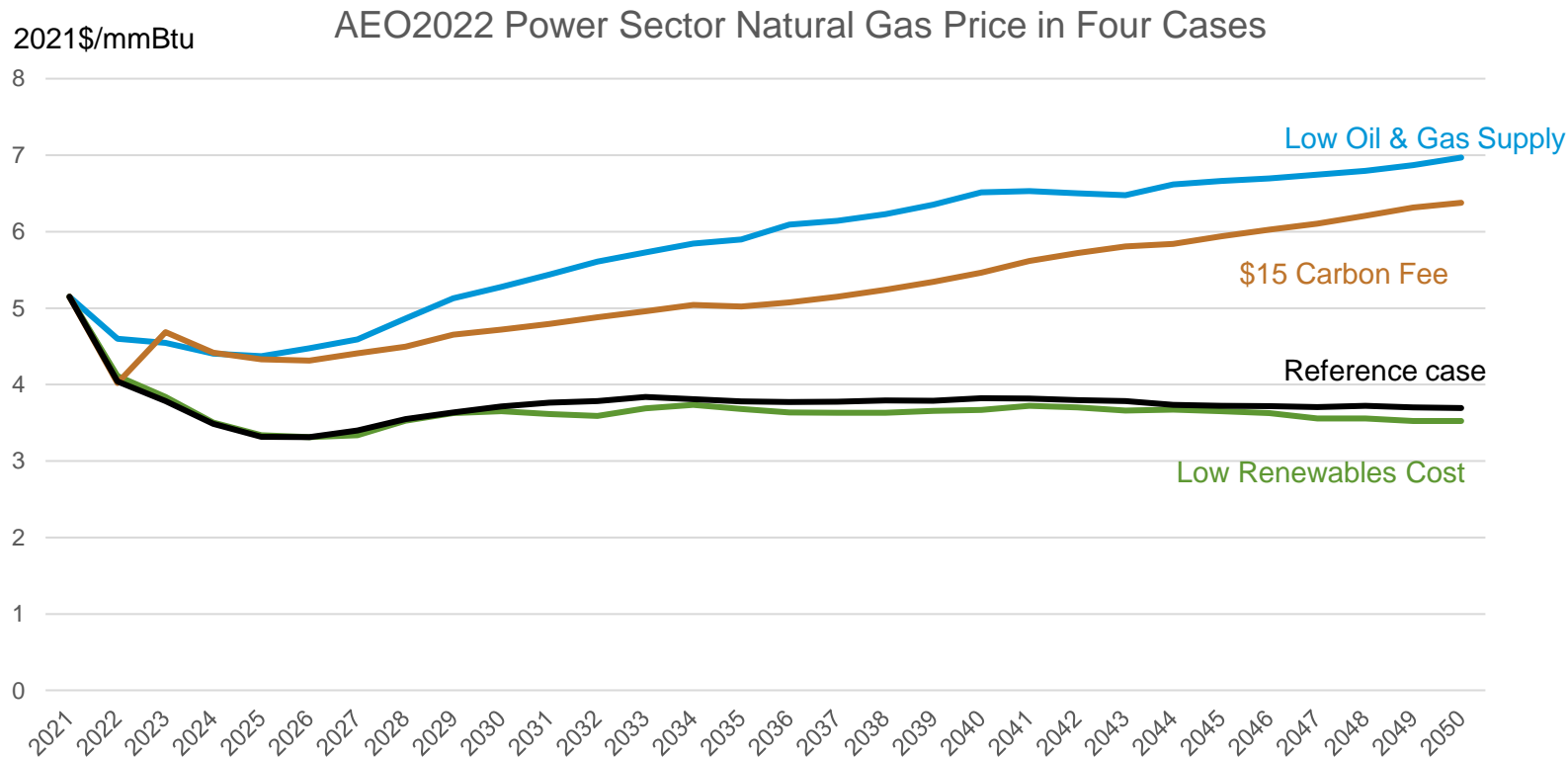


High levels of renewable generation helps to reduce carbon emissions, but it clearly isn't the only factor in play

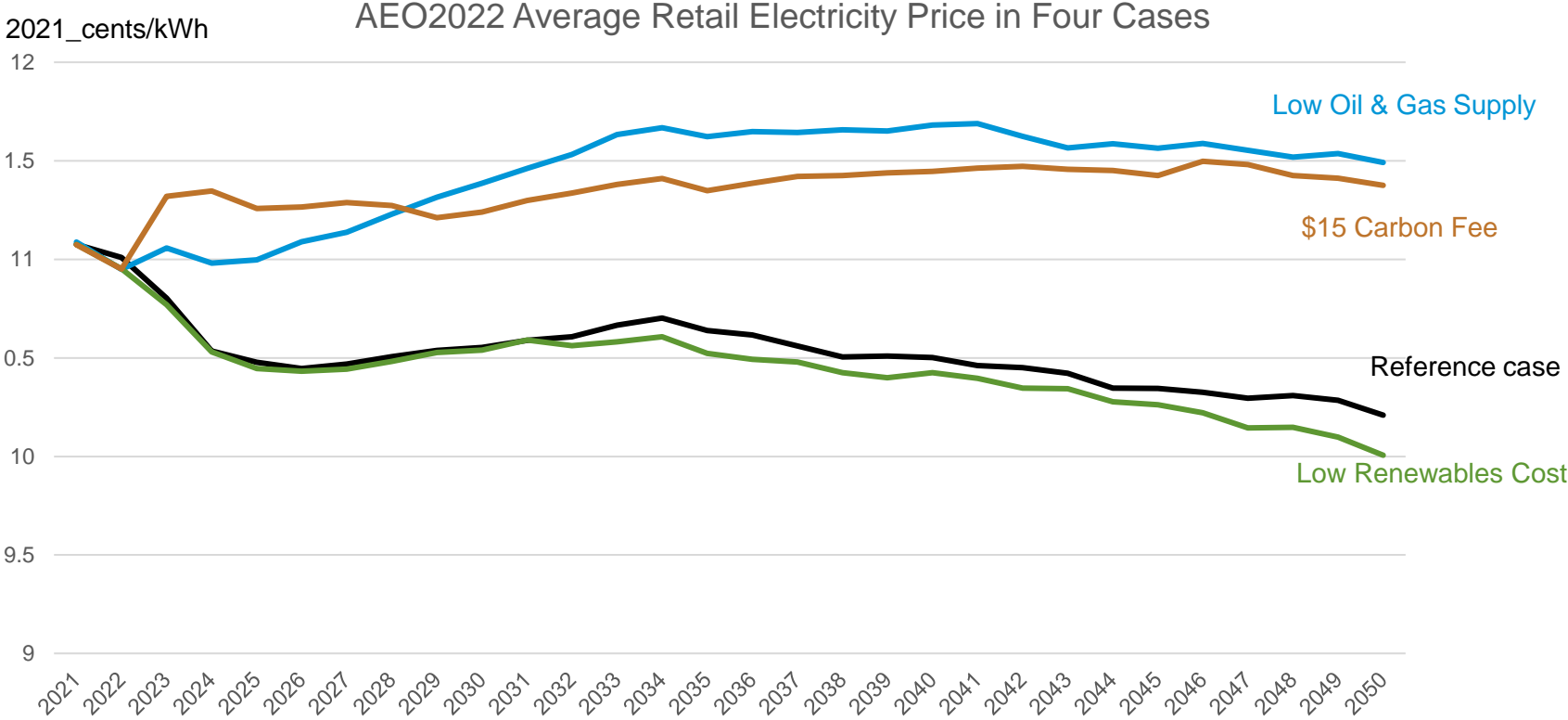
AEO 2022 Power Sector Carbon Dioxide Emissions in Four Cases



High natural gas prices result in high renewables growth, but high renewables growth doesn't always imply high gas price



Electricity prices correlate well with natural gas prices, not with renewables growth



Comparing results of cases with similar “key” outcomes can better frame implications of market and policy uncertainty

- Three different scenarios (Low Oil & Gas Supply, Low Renewables Cost, and \$15 Carbon Fee) get approx. same renewables build out
 - Vastly different NG generation and residual gen mix
 - Very different prices, different emissions
 - So not sufficient to have a “high renewable penetration scenario”. It matters how you get there!
- When picking bounding cases, keep in mind that the case details matter

Conclusions

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