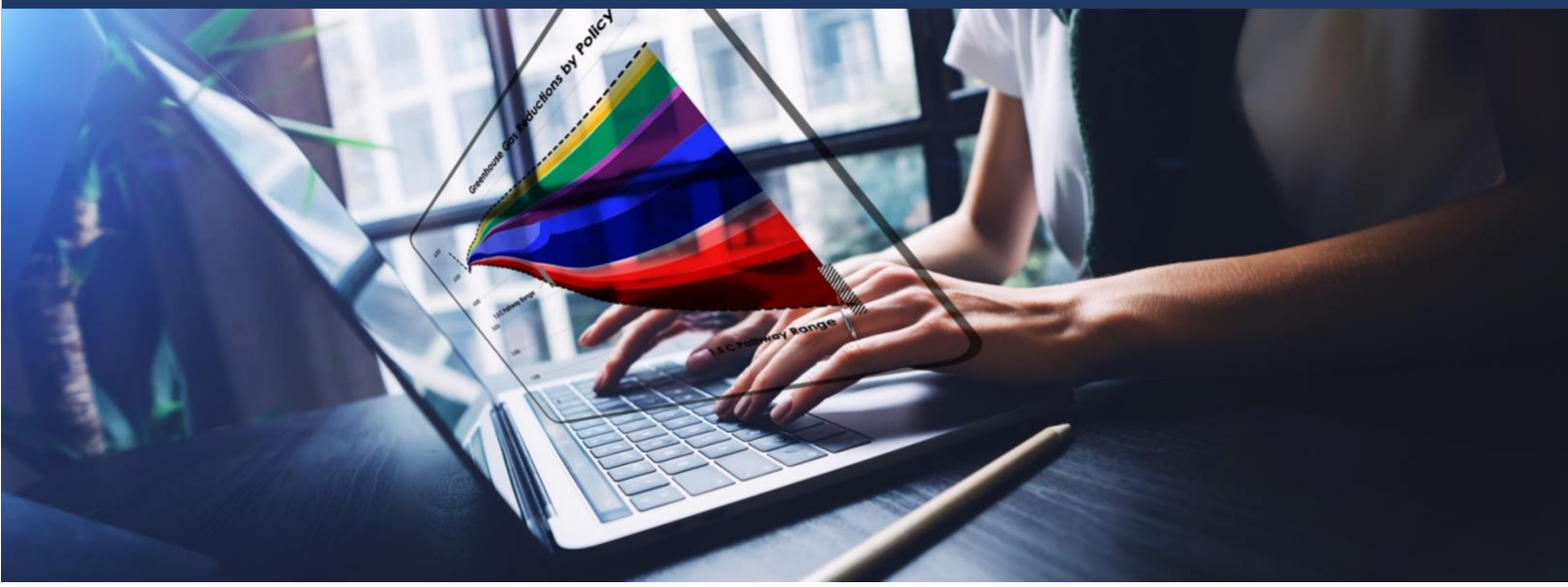

U.S. ENERGY POLICY SIMULATOR VERSION 4.0

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ENERGY INNOVATION
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AN UPDATED U.S. EMISSIONS TRAJECTORY[1]

Energy Innovation is launching an update to the United States Energy Policy Simulator (EPS), our in-house climate and energy policy model. The new model version 4.0 includes exciting new features such as an entirely rebuilt electricity sector with hourly electricity dispatch, seven new power plant types, electricity storage, estimation of wholesale electricity prices, and more. This update also incorporates the impacts of recent U.S. policy developments, including the Inflation Reduction Act (IRA) and the Infrastructure Investment and Jobs Act (IIJA), which enables users to better understand how U.S. emissions are expected to evolve and where emissions will still remain.

Our updated business-as-usual scenario (BAU) represents our best estimate of energy use and emissions through 2050 given all current policies and expected technology costs. The BAU scenario looks markedly different than in previous versions of the EPS. This is mainly due to the IRA, the landmark federal law passed in August 2022 that earmarks billions in funding for clean energy. We previously released estimates of the IRA's impacts through 2030 using an older, customized version of the model, but our new BAU scenario is built on our improved EPS version 4.0. This update extends the analysis through 2050, incorporates new insights such as recent guidance from the U.S. Department of the Treasury on how tax credits will be implemented, and includes recent policy developments.2 We find that the U.S. is currently on track to reduce its greenhouse gas (GHG) emissions to 36 percent below 2005 emissions in 2030 compared to 2021 emissions, which were only 17 percent below 2005 levels. The updated BAU trajectory is in stark contrast to our pre-IRA scenario, where 2030 emissions reach 23 percent below 2005 levels.

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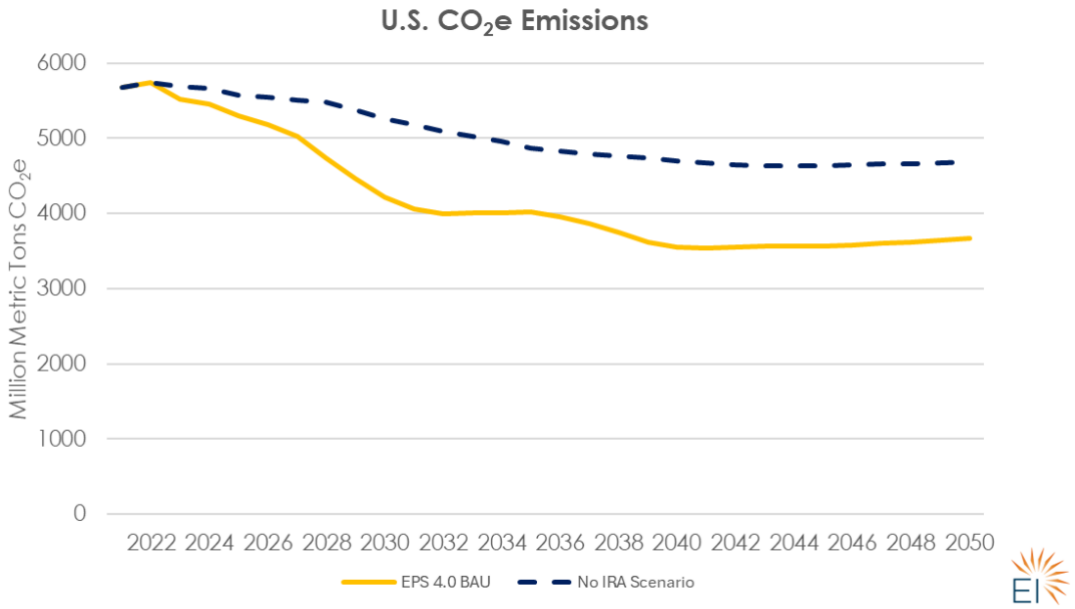
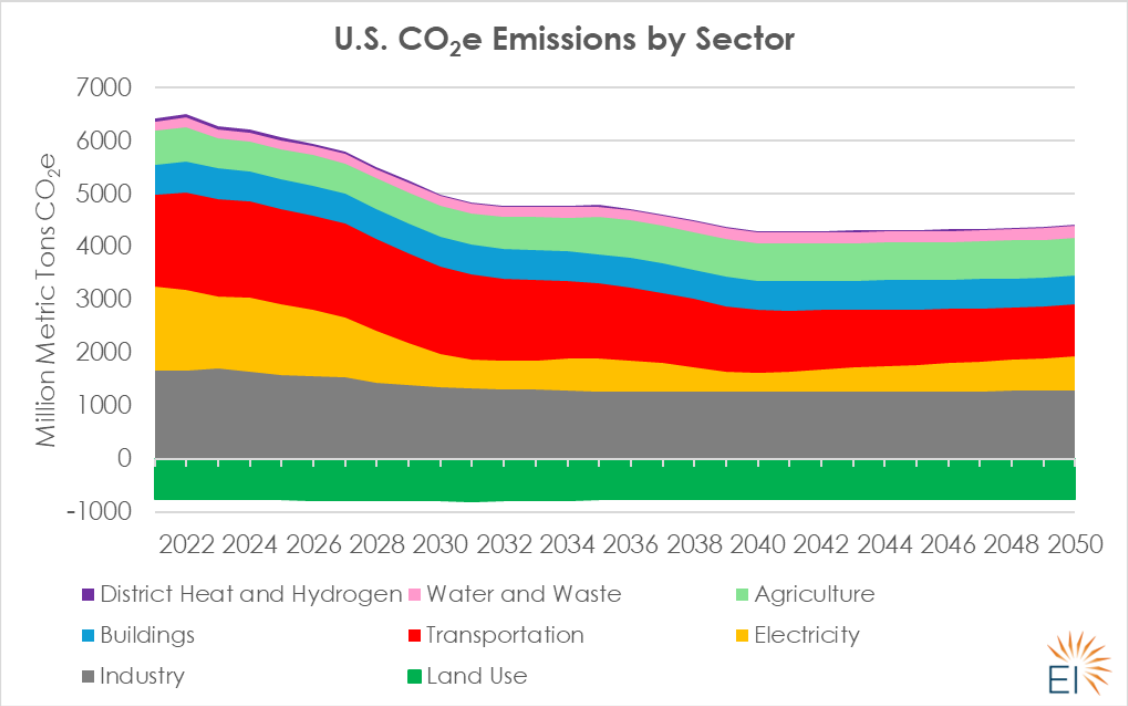
[2] Notably, the December 2023 U.S. Environmental Protection Agency rules for existing oil and gas sources and recent state-level adoption of Advanced Clean Cars II and Advanced Clean Trucks rules.

Figure 1. U.S. CO2e emission trajectories with and without the IRA



Emissions reductions in the BAU scenario are largely led by the decrease of GHG emissions in the electricity sector, where the share of clean electricity grows from today's value of roughly 40 percent to 72 percent clean in 2030. The rapid growth in clean electricity deployment is due to the IRA's clean electricity tax credits that make low-cost wind and solar resources extremely economically attractive. After 2030, we see some fluctuations in the share of clean electricity as demand grows from additional electrification measures. After the IRA tax credits eventually expire in 2038, we see a modest increase in electricity sector emissions as existing natural gas capacity generates more electricity to keep up with growing demand.

Figure 2. Annual emissions by sector in the BAU scenario



Transportation makes up the second-largest share of emissions reductions in the BAU scenario. We expect emissions from on-road vehicles to fall steadily due to increased uptake of zero-emission vehicles (ZEVs). The IRA includes tax credits for both light- and heavy-duty ZEVs, charging infrastructure, and domestic battery and vehicle manufacturing that together will move the market toward cleaner transportation. State-level adoption of the Advanced Clean Cars II rule also helps increase ZEV adoption. We find that in 2030, ZEVs make up 44 percent of all passenger light-duty vehicle sales and 13 percent of the stock.

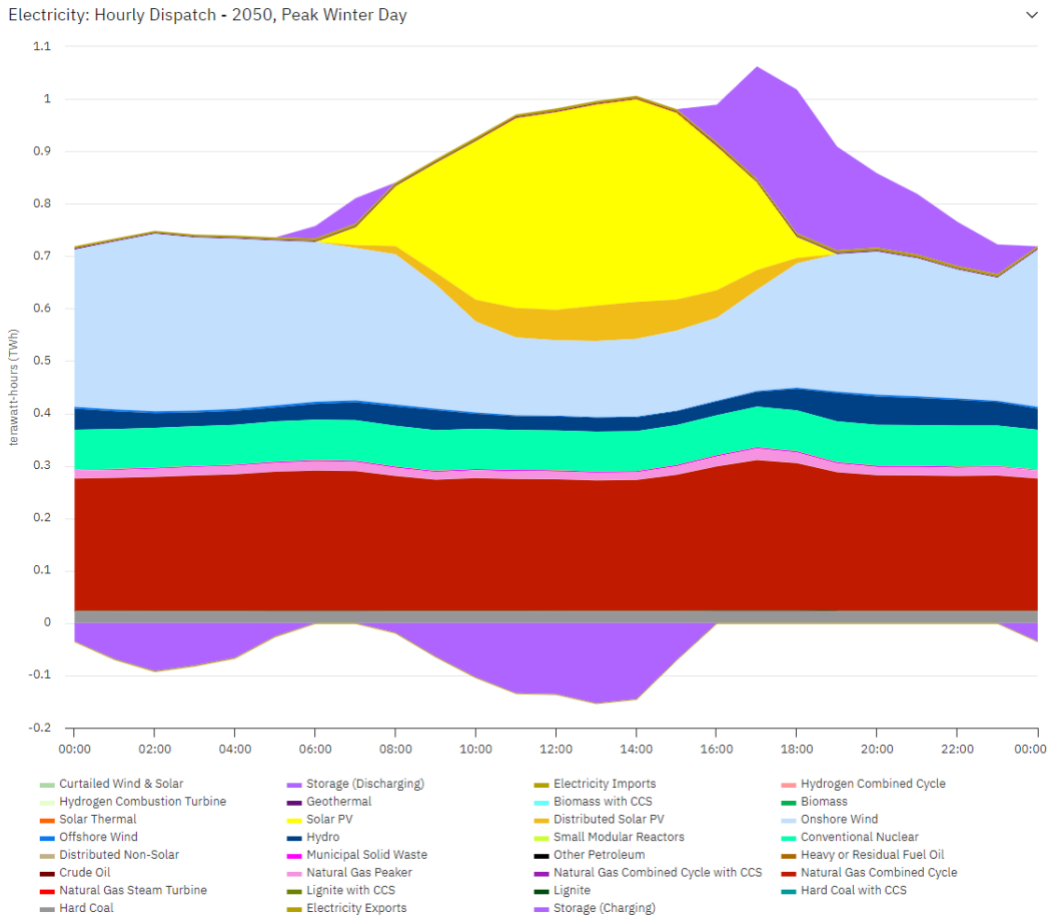
Though the IRA does also include important provisions that address other sectors, the EPS BAU scenario projects that emissions in buildings, industry, and agriculture will hold steady or increase. These sectors represent opportunities for additional policy interventions, which are explored in the nationally determined contribution (NDC) scenario featured on the U.S. EPS website.

NEW CAPABILITIES

The EPS version 4.0 features a completely redesigned electricity module. Whereas previous versions of the EPS only captured the electricity sector at annual time resolution (with a simplified representation of annual peak demand), version 4.0 includes hourly electricity demand and dispatch for six different time slices, including average seasonal days and peak winter and summer days. This more detailed representation allowed us to build in new features for both profitability- and reliability-based capacity expansion mechanisms; endogenous cost-driven retirements and

retrofits; endogenous deployment, charging, and discharging of electricity storage; and a new bottom-up calculation of electricity rates. Figure 3 below is an example of a new EPS graph available on the web app demonstrating hourly dispatch by plant type for a selected time slice.

Figure 3. Example hourly dispatch graph



These enhancements were necessary to properly represent the impact of the generous clean electricity tax credits included in the IRA as well as to ensure the EPS can adequately represent the reliability impacts of clean electricity deployment and electrification.

The electricity sector updates also add seven new power plant types, including four different types of plants equipped with carbon capture and sequestration (CCS), two types of hydrogen power plants, and small modular reactors. The model now allows power plants to economically retrofit with CCS, if it is cost-effective to do so.

Other notable additions made to represent policies included in the IRA are better tracking of ZEV costs and vehicle battery manufacturing incentives, more detailed representation of industrial CCS costs, and new pathways for producing hydrogen, including electrolysis through designated new clean electricity.

CONCLUSION

The U.S. energy and emissions landscape has undergone profound changes in the past few years due to the IRA and IIJA. Against this backdrop, emissions are now poised to fall to a record low of 36 percent below 2005 levels by 2030, led by significant gains in the share of electricity generated by clean sources. The updates to the U.S. EPS 4.0 capture these changing dynamics and allow for more accurate and fine-grained analysis than ever before. Model users can explore all of the changes and additional climate and energy policies in our open-source online simulator.