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The sun sets upon the Flatirons Campus (FC) of the National Renewable Energy Laboratory, lighting up the 1MW photovoltaic array, the Siemens 2.3MW wind turbine (left), and the Gamesa 2MW wind turbine. (Photo by Werner Slocum / NREL)

Power-Sector Transitions:

Potential Near-Term Impacts of the Inflation Reduction Act and Bipartisan Infrastructure Law

New research finds that the Inflation Reduction Act of 2022 (IRA) and Bipartisan Infrastructure Law of 2021 (BIL)[1] can drive rapid, near-term growth in clean electricity, while reducing costs for consumers, lowering harmful pollutants, mitigating climate change, and creating new economic opportunities.

IRA and BIL represent historic investments in the modernization of the nation's energy system. The two laws are designed to enhance energy security; lower energy costs for consumers; improve human health; and mitigate climate change. The laws also seek to create high-quality jobs and new economic opportunities, including through investments in and incentives for domestic manufacturing. Crucially, the laws address inequities in the nation's energy system, including increasing access to clean energy technologies and reducing the impacts of energy-related pollution on communities that have historically borne the brunt of air pollution impacts.

Recent analysis from the National Renewable Energy Laboratory (NREL)[2] highlights the transformational potential of IRA and BIL on the power sector. The new study builds on the U.S. Department of Energy's (DOE) previous analysis of the economy-wide greenhouse gas impacts of IRA and BIL[3], with additional detail on one key sector of the economy – electricity. It employs an advanced planning model that identifies least-cost power-sector investment portfolios accounting for major provisions of both laws. Provisions evaluated include, among others, tax credits for new clean electricity generation, energy storage, and carbon capture and sequestration, as well as tax credits for existing nuclear plants and a variety of non-tax IRA and BIL provisions.

[1] Formally known as the Infrastructure Investment and Jobs Act, or IIJA.

[2] See: https://www.nrel.gov/docs/fy23osti/85242.pdf

[3] See: https://www.energy.gov/sites/default/files/2022-08/8.18%20InflationReductionAct_Factsheet_Final.pdf

Key findings on the potential near-term impact of IRA and BIL from the NREL study and other related work include:

- **Clean electricity as a percentage of total generation could increase to over 80% in 2030** under mid-case assumptions, with a range of 71% to 90% when considering uncertainties in technology costs, fuel prices, policy impacts, and infrastructure deployment constraints. This is substantially greater than the 41% clean electricity share achieved in 2022. Solar and wind scale rapidly, more than doubling historical maximum rates of annual deployment in many scenarios and leading to 350-750 gigawatts (GW) of new capacity by 2030 depending on future market conditions. This growth is supported by 40-100 GW of new storage and a 11-24% expansion of long-distance transmission by 2030. Fossil generation with carbon capture may also rapidly expand, with a total installed capacity in 2030 of 5 GW to 55 GW across modeled scenarios. Nuclear energy is maintained with supportive IRA and BIL programs, with some demonstration projects using advanced technology assumed to come online by 2030 and the possibility of additional near-term supply due to upgrades to existing plants.
- **Clean electricity growth lowers bulk power costs by $50 to $115 billion through 2030, saving consumers money.** Technological advancement has driven down the cost of clean electricity over the last decades, spurring deployment. The tax incentives in IRA hold the prospect of supercharging this growth and driving overall power-system costs lower. NREL modeling shows a total, net decrease in bulk power costs of $50-115 billion from 2023 to 2030. In 2030, the reduction equates to approximately $3 per MWh (5%) to $6 per MWh (13%). These are reductions in the cost of the bulk power system, so do not directly represent retail electric rates.[4] The reductions also exclude consumer incentives in IRA and BIL for energy efficiency and for electrification of transportation and buildings, thereby understating potential consumer savings. Moreover, BIL and IRA offer significant levels of support for emerging and pre-commercial clean energy technologies. These investments may enable new power-sector options, especially over the medium- to long- term, positioning the nation for continued cost reductions.
- **Power-sector carbon dioxide (CO_2) emissions decline by 84% in 2030 relative to 2005 levels** in the mid case, with a range of 72% to 91%, even with increased generation due to electrification of transportation and other end-uses. Climate change threatens the health, well-being, and livelihoods of Americans through extreme weather, heat-related illnesses and deaths, reduced agricultural productivity, and more. Vulnerable communities are most at risk. NREL's research finds that IRA and BIL's power-sector provisions can avoid 600 to 900 million metric tons of annual CO_2 pollution in 2030. U.S. power sector pollution reductions from 2023 to 2030 result in avoided global climate damages ranging from approximately $670 billion to over $960 billion.
- **Power-sector air pollution reductions can help prevent up to 11,000-18,000 deaths through 2030.** Air pollution—especially sulfur dioxide, but also including nitrogen oxides, direct particulate matter, and more—imposes health burdens, including to disadvantaged communities. By reducing those pollutants, IRA and BIL will enhance the health and productivity of Americans. NREL's research finds that health damages from sulfur dioxide and nitrogen oxides are as much as $120 to $190 billion lower from 2023 to 2030, across all modeled scenarios.

[4] "Bulk system costs" refer to all costs associated with investment, operations, and maintenance of utility-scale generation, transmission, and storage, and includes the value (negative cost) of the PTC, ITC, and 45Q tax credits. It does not include other costs that influence retail electric rates and bills, including costs associated with distribution infrastructure or end-use distributed energy investment.

- **IRA and BIL are driving supply-chain expansion, creating new jobs, and addressing energy inequities**. Though not estimated in the NREL analysis, other studies and emerging evidence demonstrate that IRA and BIL are already beginning to have wide-ranging impacts. Research has found that a power-sector transformation of the type expected under IRA and BIL could yield more-than 500,000 more jobs.[5] A recent study has tallied 100,000 planned clean energy jobs already, as companies throughout the supply chain announce intentions to invest in American factories.[6] IRA's targeted support for disadvantaged communities, energy communities, and lower-income households include, among many other provisions, $3 billion for Environmental and Climate Justice Block Grants, $27 billion for the Greenhouse Gas Reduction Fund, and $4 billion under the Advanced Energy Project Credit directed to industrial or manufacturing facilities located in communities historically reliant on fossil fuels.

Fully realizing these benefits requires breaking down deployment barriers and continued technology advancement. IRA and BIL have the potential to drive transformative change. The speed of change will be impacted by infrastructure deployment constraints such as the ability to build-out transmission infrastructure as well as the pace of technology advancement.
The NREL study finds that scenarios with deployment constraints or limited cost reductions may still yield ~70% clean electricity shares by 2030, but those shares are more-than 10 percentage points lower than in the mid case. This indicates that continued research and development to drive advancements in clean electricity technologies coupled with actions to mitigate barriers to clean energy and infrastructure deployment will be crucial to fully realizing the potential benefits of IRA and BIL. DOE and other federal agencies have been hard at work, implementing IRA and BIL, spurring continual technological advancement and addressing deployment barriers. State, local, and tribal governments, civil society and the private sector also have important roles to play, to take advantage of the opportunities afforded by IRA and BIL. An all-of-government and all-of-society approach will help maximize the positive returns from these historic new laws.

For more information, see the full report from the National Renewable Energy Laboratory: https://www.nrel.gov/docs/fy23osti/85242.pdf

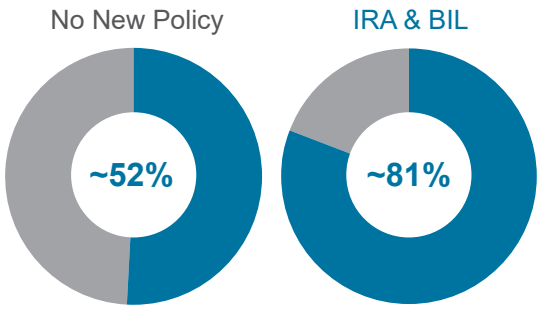
Scott Bartos, Regional Energy Advisor, USAID/RDMA, tours the hydrogen facilities at NREL's Energy Systems Integration Facility (ESIF). (Photo by Dennis Schroeder / NREL)

[5] Estimate only reflects jobs related to the power sector. See: https://www.2035report.com/, and https://peri.umass.edu/publication/item/1633-job-creation-estimates-through-proposed-inflation-reduction-act

[6] See: https://climatepower.us/wp-content/uploads/sites/23/2023/02/Clean-Energy-Boom-100K-Report.pdf

Potential Power-Sector Impacts of IRA and BIL

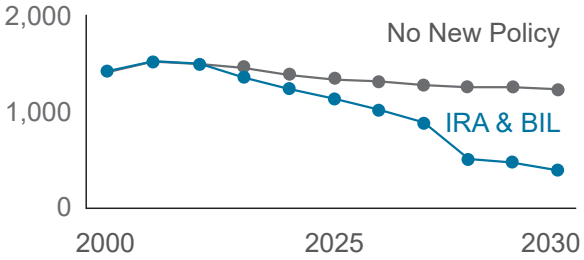
2030 Clean Electricity Share



2022 clean share = 41%

Carbon Dioxide Emissions

Million metric tons per year



IRA & BIL in 2030 = 84% lower than 2005

Renewables
~580 GW of new capacity by 2030

Carbon Capture
~40 GW of new capacity by 2030

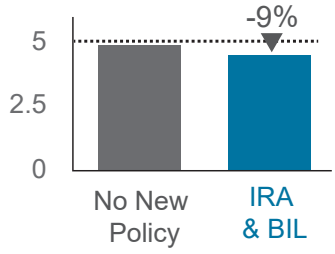
Nuclear
~16% of supply in 2030

Storage
~80 GW of new capacity by 2030

Transmission
~16% expansion by 2030

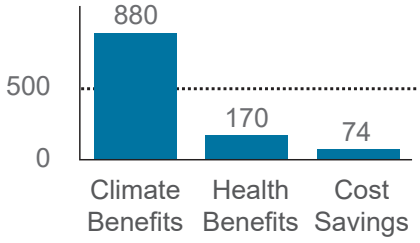
Bulk System Cost

(cents/kWh, in 2030)



Cumulative Benefits

(billion $, 2023-2030)



▲ +500,000

Average additional jobs in 2020s in and induced by power sector.*

**Estimates derive from other analyses, not NREL*

Note: Results presented here are for unconstrained mid-case scenario; see report for scenario and sensitivity analysis.

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