U.S. DEPARTMENT OF THE TREASURY

The Inflation Reduction Act: Pro-Growth Climate Policy

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The Inflation Reduction Act (IRA) is the largest investment in reducing carbon pollution in U.S. history. But along with the Bipartisan Infrastructure Law (BIL) and the CHIPS and Science Act, the IRA also serves as a key investment in our economic growth.

Some skeptics of government climate policy have claimed that initiatives like the IRA will slow U.S. economic growth.[1] Such concerns have a long history. Since the beginning of serious environmental policy in the 1970s, critics have objected that pollution reductions would come at the expense of economic growth.

But that old objection does not reflect the economic reality that good climate policy can promote growth. That might *sound* like the metaphorical free lunch economists dismiss, but it's not. We describe five ways that climate policies like the IRA can promote growth:

- lessening greenhouse gas emissions which result in costly climate damages;
- adapting to the effects of climate change;
- reducing economic damages from local pollutants often released alongside greenhouse gases;
- supporting innovations that have productivity benefits beyond their direct climate effects; and
- lowering economic reliance on fossil fuels with volatile global market prices.

(1) MITIGATING GREENHOUSE GASES

Reducing greenhouse gases mitigates the costly damages those emissions would have caused--the most direct way that climate policy benefits the economy. Some of those economic costs are obvious, like costs due to more frequent and more powerful hurricanes, floods, and fires.[2]

Others are more subtle but still pernicious. Temperature increases have been found to cause declines in students' academic performance and future incomes, as well as diminish worker productivity, reducing economic potential across the economy.[3]

The U.S. Council of Economic Advisers and Office of Management and Budget summarized twelve recent studies assessing the aggregate cost climate damages will impose on the U.S. economy.[4] Collectively, they suggest climate damages are already reducing U.S. GDP, and that economic damages will accelerate as global average temperatures rise. Cutting back on greenhouse gases will therefore provide economic benefits, especially if the emissions reductions are part of a coordinated international effort like the Paris Climate Agreement.

The United States accounted for 13 percent of global carbon dioxide (CO_2) emissions in 2022, and a quarter of the cumulative global CO_2 emissions from fossil fuels burned since pre-industrial times.[5] That means we cannot solve the climate problem ourselves. While we cannot ensure that all other countries contribute equally by reducing emissions, we can presume they will be less likely to pitch in if the United States, the country responsible for the largest share of cumulative emissions to date, fails to act.[6]

That is one reason why President Biden signed the IRA, the largest-ever U.S. federal effort to reduce greenhouse gas pollution. Nine independent analyses reviewed in the journal *Science* project that the IRA will reduce U.S. emissions in 2035 to an average of 20 percent below what they would be without the IRA.[7]

Even the most ambitious mitigation efforts, however, will be insufficient to avoid damages from the greenhouse gases already causing atmospheric changes. That leads us to a second set of climate policies that also benefit the economy: policies geared towards adaptation.

(2) ADAPTING TO CLIMATE CHANGE

Adaptation policies include building sea walls and reinforcing buildings, designing new forms of insurance and disaster response, and safeguarding critical infrastructure. Although those steps will be costly, *not* making adaptation investments would be even more costly. Adaptation investments help ensure that when climate-related weather disasters do happen, they cause less damage.

Economic research has corroborated the value of adaptation expenses. Globally, Hallegatte et al. (2013) calculate that spending $50 billion per year to build higher bridges and move transportation routes inland for 136 coastal cities around the world would reduce expected

annual losses from climate change in 2050 by nearly $1 trillion.[8] In the United States, Martinich and Crimmins (2019) estimate that proactive adaptation investments in just three areas—coastal properties, roads, and rail—could more than pay for themselves, reducing climate damages by $140 billion per year in 2090 (in 2015 dollars).[9] The magnitudes of these worthwhile investments illustrate how costly it would be *not* to invest in adaptation.

Of course, government policies are not always necessary; many adaptations can be undertaken by individuals. People can reinforce and weatherize their homes and upgrade to new energy-efficient heating and cooling systems. But some families cannot afford those adaptations. That is why the IRA includes tax credits to help homeowners afford better doors and windows and energy-efficient temperature control. The credits reduce homeowners' initial upgrade costs and enable future energy savings.

Moreover, some adaptations like seawalls and road reconstruction are public goods that cannot be left to markets. And that is a reason why President Biden signed the Bipartisan Infrastructure Law. Many parts of the $1.2 trillion law are designed to promote both growth and adaptation to climate change. For example, the law provides $16 billion for upgrading electric power grids.[10] That helps reduce power outages—many of which are caused by extreme weather—that already cost the U.S. economy up to $70 billion each year.

(3) REDUCING LOCAL POLLUTION

In addition to improving the economy by mitigating and adapting to climate change, climate policy also benefits the economy by reducing local pollution.

When powerplants burn coal or people drive gasoline-powered cars, that causes greenhouse gas emissions that affect the global climate. Alongside those global pollutants, powerplants and cars also cause local air pollution like sulfur dioxide and particulates. Those local pollutants sicken nearby residents, raise their health care costs, and diminish their productivity, with negative consequences for the whole economy.[11] Government climate policies intended to limit greenhouse gases can thus provide additional economic benefits from reducing local air pollution.

Recent economic research provides abundant examples. Air pollution reduces the productivity of factory workers,[12] results in employees working fewer hours and taking more sick days,[13] impairs adults' cognitive performance on tests,[14] and causes investors to make worse decisions and drivers to have more car accidents.[15] Exposure to pollution during childhood, or even in utero, lowers future college attendance and earnings.[16]

The domestic benefits from reduced local air pollution can be significant. The EPA estimates that its proposed new regulation limiting greenhouse gases from electric power plants will provide global benefits of $5.4 billion in 2030 from mitigated future climate damages.[17] But the agency projects the rule to have even larger domestic air pollution benefits inside the United States, ranging from $6.5 to $14 billion in 2030 alone.[18] Similarly, many of the IRA's climate provisions also have local pollution benefits. One nonpartisan think tank estimated that the IRA will improve local air quality by enough that in 2030 Americans will collectively be losing 350,700 fewer workdays each year to illnesses.[19]

(4) SPURRING INNOVATION AND SPILLOVERS

A fourth way that climate policy can promote growth is by backing innovative research and development (R&D). Without government support, private businesses underinvest in climate-related R&D for two main reasons.[20]

The first is the classic market failure that applies generally to all R&D. Businesses that do invest in new products or production techniques have trouble preventing competitors that do not invest from exploiting their discoveries.[21] As a consequence, many businesses underinvest. But the economy-wide benefits from R&D, including spillovers from researchers to competitors, exceed the returns to individual researchers. The gap between public and private returns is symptomatic of market failures, and a principal justification of government support for R&D of all types, not just climate-related R&D.

The second reason private businesses underinvest in climate-related R&D arises from the fact that the *climate* benefits of mitigating climate change accrue globally, not just to the people or businesses doing the mitigation. In economics jargon, mitigation benefits are a public good. As with any public good, leaving climate R&D to market forces has led to underinvestment.

Because the private sector underinvests, for these two reasons, the economic returns to government funding for climate and energy R&D can be especially large. That return on government investment in R&D motivates President Biden's argument for many aspects of the IRA, as well as the IIJA and especially the CHIPS Act. The policies establish new R&D programs, strengthen existing ones, and advance public-private R&D partnerships, particularly in parts of the country and in academic institutions that have seen underinvestment.

Abundant anecdotes demonstrate the enormous returns on government funding for energy R&D.[22] Decades of funding from the U.S. Department of Energy (DOE) preceded the development of hydraulic fracturing that led to the shale gas revolution and the United States

becoming a net energy exporter. And DOE's Next Generation Lighting program has similarly played a role in the development and spread of LED lights that use less power and last longer than the incandescent bulbs they are replacing, saving energy and reducing greenhouse gases.

More systematic evidence comes from the U.S. National Academies, which found that each patent filed by a DOE grant recipient leads to multiple patent filings by non-recipients.[23] And for clean-energy research in particular, Howell (2017) shows that projects funded by the U.S. Department of Energy over the past 30 years have led to more private financing, more patented innovations, and significantly higher revenue than otherwise similar projects without government backing.[24]

In recent years, the U.S. share of GDP devoted to energy-related R&D has lagged that of many OECD countries.[25] In 2021, U.S. federal funds for energy-related R&D amounted to just 39¢ for every $1,000 of GDP. South Korea spent 42¢, Canada 52¢, Japan 57¢, and Norway $1.15.[26] Policies like the Bipartisan Infrastructure Law will help us catch up, by expanding funds for 12 existing R&D programs at the Department of Energy and standing up 60 new programs.[27]

(5) REDUCING ECONOMIC VULNERABILITY TO INTERNATIONAL PRICE VOLATILITY

Finally, climate policies that promote clean energy may buffer the economy from fluctuations in fossil fuel prices. Just in the past three years, natural gas prices have quadrupled and then fallen by 50 percent,[28] causing significant swings in electricity prices.[29] And oil prices, which account for more than half of the retail price of gasoline,[30] swung from below $40 per barrel to over $130.[31]

At the individual level, those price swings are tough on American businesses and households. Retail natural gas prices rise and fall with spot market prices. Oil accounts for more than half the cost of gasoline at the pump, so when oil prices triple gas prices can easily double.[32] People who use natural gas for heating or cooking saw the prices they pay dip to record lows in 2008 before rising to ten-hear highs in 2022 following Russia's invasion of Ukraine.[33] And drivers of gasoline-powered cars have, in fact, seen gas-station prices double since a low point in 2020 when the pandemic reduced global demand.[34] Businesses must build that price uncertainty into their plans, and households' budgets can be upended by unexpectedly high utility bills or gas prices.

Renewable energy sources like wind and solar are not subject to that type of price uncertainty. Once the solar panels and wind turbines have been installed, the fuel to power them is

effectively costless. Businesses and households that heat or cook with electricity powered by renewable energy will not be vulnerable to large price swings. And drivers of electric cars can rest assured that their transportation costs won't suddenly double.

Economy-wide, international energy price fluctuations have long been blamed for causing or exacerbating recessions.[35] Even temporary recessions cause persistent losses in employment and earnings, especially for young workers just starting out, and those losses are largest for the least advantaged workers, especially nonwhite workers and high school dropouts.[36] Whether recessions in turn reduce aggregate economic growth has been debated, but at least one recent paper estimates that past deep recessions in the United States have resulted in permanent losses in productivity, persistent declines in inputs to production, and lower long-run output.[37] Creating a more stable and resilient energy system may therefore benefit all Americans by making the economy less susceptible to price shocks that can trigger recessions.

CONCLUSION

This post summarizes five mechanisms through which the Inflation Reduction Act and other climate policies can both increase economic output and reduce climate damage. Policies that mitigate greenhouse gases and local pollution, adapt to climate change, spur innovations in energy technologies, and reduce our economic reliance on fuels with internationally set energy prices don't just make sense for the environment and for the future of the planet. They make good economic sense for Americans today and in the future.

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[1] See, for example, the Tax Foundation (Inflation Reduction Act Taxes: Details & Analysis | Tax Foundation), and this editorial in the *Wall Street Journal.*

[2] Deryugina, Tatyana. 2017. "The Fiscal Cost of Hurricanes: Disaster Aid versus Social Insurance." *American Economic Journal: Economic Policy* 9 (3): 168–198.
Boustan, Leah Platt, Matthew E. Kahn, Paul W. Rhode, and Maria Lucia Yanguas. 2020. "The effect of natural disasters on economic activity in US counties: A century of data." *Journal of Urban Economics* 118.

[3] EPA (U.S. Environmental Protection Agency). 2023b. "Climate Change and Children's Health and Well-Being in the United States." Report no. EPA-430-R-23-001. https://www.epa.gov/cira/climate-change-and-childrens-health-report.

Zhang, Xin, Xi Chen, and Xiaobo Zhang. 2023. “Temperature and Low-stakes Cognitive Performance.” *IZA: Institute of Labor Economics*, discussion paper no. 15972.

Zivin, Joshua Graff, Yingquan Song, Qu Tang, and Peng Zhang. 2020. “Temperature and high-stakes cognitive performance: Evidence from the national college entrance examination in China.” *Journal of Environmental Economics and Management* 104: 102365.

[4] CEA and OMB (White House Council of Economic Advisers and Office of Management and Budget). 2023. “Methodologies and Considerations for Integrating the Physical and Transition Risks of Climate Change into Macroeconomic Forecasting for the President’s Budget.” White paper. March 13, 2023. https://www.whitehouse.gov/wp-content/uploads/2023/03/CEA-OMB-White-Paper.pdf .

[5] Current emissions from IEA (2023a), and cumulative emissions based on Hefner et al. (2022). IEA (International Energy Agency). 2023a. “CO2 Emissions in 2022.” https://www.iea.org/reports/co2-emissions-in-2022; Hefner, M., G. Marland, T. Boden, and R. Andres. 2022. Global, Regional, and National Fossil-Fuel CO_2 Emissions: 1751-2019 CDIAC-FF, National CO_2 emissions from fossil fuels and cement manufacture. Retrieved from Research Institute for Environment, Energy, and Economics, Appalachian State University. Accessed July 12, 2023. https://energy.appstate.edu/cdiac-appstate/data-products.

[6] Barrett, Scott. 2011. “Avoiding disastrous climate change is possible but not inevitable.” *PNAS* 108 (29): 11733-11734.

[7] Bistline, John, Geoffrey Blanford, Maxwell Brown, Dallas Burtraw, Maya Domeshek, Jamil Farbes, Allen Fawcett, et al. 2023. “Emissions and energy impacts of the Inflation Reduction Act.” *Science* 380 (6652): 1324-1327.

[8] Hallegatte, Stéphane, Colin Green, Robert Nicholls, and Jan Corfee-Morlot. 2013. “Future flood losses in major coastal cities.” *Nature Climate Change* 3: 802-806.

[9] Martinich, Jeremy, and Allison Crimmins. 2019. “Climate damages and adaptation potential across diverse sectors of the United States.” *Nature Climate Change* 9: 397-404. See Table 2.

[10] whitehouse.gov/briefing-room/statements-releases/2021/11/06/fact-sheet-the-bipartisan-infrastructure-deal/

[11] Aguilar-Gomez, Sandra, Holt Dwyer, Joshua Graff Zivin, and Matthew Neidell. 2022. “This Is Air: The “Nonhealth” Effects of Air Pollution.” *Annual Review of Resource Economics* 14: 403-425.

[12] Chang, Tom, Joshua Graff Zivin, Tal Gross, and Matthew Neidell. 2016. “Particulate Pollution and the Productivity of Pear Packers.” *American Economic Journal: Economic Policy* 8 (3): 141-169.
He, Jiaxiu, Haoming Liu, and Alberto Salvo. 2019. “Severe Air Pollution and Labor Productivity: Evidence from Industrial Towns in China.” *American Economic Journal: Applied Economics* 11 (1): 173-201.

[13] Aragón, Fernando, Juan Jose Miranda, and Paulina Oliva. 2017. “Particulate matter and labor supply: The role of caregiving and non-linearities.” *Journal of Environmental Economics and Management* 86: 295-309; Holub, Felix, Laura Hospido, Ulrich J. Wagner. 2021. “Urban air pollution and sick leaves: evidence from social security data.” *Social Science Research Network*, August 21, 2021.

[14] Zhang, Chen, and Zhang (2023); Roth, Sefi J. 2018. “The effect of indoor air pollution on cognitive performance: Evidence from the UK.” Working paper. Accessed August 11, 2023. https://personal.lse.ac.uk/roths/JMP.pdf .

[15] Huang, Jiekun, Nianhang Xu, and Honghai Yu. 2020. “Pollution and Performance: Do Investors Make Worse Trades on Hazy Days?” *Management Science* 66 (10): 4359-4949; Sager, Lutz. 2019. “Estimating the effect of air pollution on road safety using atmospheric temperature inversions.” *Journal of Environmental Economics and Management* 98: 102-250.

[16] Isen, Adam, Maya Rossin-Slater, and W. Reed Walker. 2017. “Every breath you take—every dollar you’ll make: The long-term consequences of the Clean Air Act of 1970.” *Journal of Political Economy* 125 (3): 848-902.
Voorheis, John. 2017. “Air quality, human capital formation and the long-term effects of environmental inequality at birth.” *Center for Administrative Records Research and Applications, U.S. Census Bureau*, working paper 2017-05.

[17]This is the central estimate valued using the February 2021 social cost of carbon from the U.S. Interagency Working Group on Social Cost of Greenhouse Gases (2021), following Executive Order 13990. The newer version of the social cost of greenhouse gases, proposed by the EPA (2022) in September 2022, would more than triple those benefits. Climate benefits are in Table 4-3. Particulate and ozone benefits are in Table 4-19.

[18] EPA (U.S. Environmental Protection Agency). 2023c. “Regulatory Impact Analysis for the Proposed New Source Performance Standards for Greenhouse Gas Emissions from New, Modified, and Reconstructed Fossil Fuel-Fired Electric Generating Units; Emission Guidelines for

Greenhouse Gas Emissions from Existing Fossil Fuel-Fired Electric Generating Units; and Repeal of the Affordable Clean Energy Rule" Report no. EPA-452/R-23-006. https://www.epa.gov/system/files/documents/2023-05/utilities_ria_proposal_2023-05.pdf .

[19] Mahajan, Megan, Olivia Ashmoore, Jeffrey Rissman, Robbie Orvis, and Anand Gopal. 2022. "Updated Inflation Reduction Act Modeling Using the Energy Policy Simulator." *Energy Innovation*, August 23, 2022. https://energyinnovation.org/publication/updated-inflation-reduction-act-modeling-using-the-energy-policy-simulator/.

[20] Armitage, Sarah, Noël Bakhtian, and Adam Jaffe. 2023. "Innovation Market Failures and the Design of New Climate Policy." In *Environmental and Energy Policy and the Economy, Vol. 5*, edited by Matthew J. Kotchen, Tatyana Deryugina, and Catherine D. Wolfram. Chicago: University of Chicago Press.

[21] Bloom, Nicholas, John Van Reenen, and Heidi Williams. 2019. "A Toolkit of Policies to Promote Innovation." *Journal of Economic Perspectives* 33 (3): 163-84.

[22] Singer, Peter. 2014. "Federally Supported Innovations: 22 Examples of Major Technology Advances that Stem from Federal Research Support" The Information Technology and Innovation Foundation.

[23] National Academies of Sciences, Engineering, and Medicine. 2020. *Review of the SBIR and STTR Programs at the Department of Energy*. Washington, DC: The National Academies Press.

[24] Howell, Sabrina T. 2017. "Financing Innovation: Evidence from R&D Grants." *American Economic Review* 107 (4): 1136-1164.

[25] Hausman, Catherine. 2023. "Principles for Public Investment in Climate-Responsible Energy Innovation." *The Hamilton Project, Brookings Institution*, April 27, 2023.

[26]Sources: Energy RD&D from <a href=">Total public energy RD&D budgets by country for 2021 or latest available year – Charts – Data & Statistics - IEA. GDP numbers from World Economic Outlook (April 2023) - GDP, current prices (imf.org).

[27] energy.gov/infrastructure/clean-energy-infrastructure-homepage.

[28] Source: U.S. Energy Information Administration. https://www.eia.gov/dnav/ng/ng_pri_sum_dcu_nus_m.htm

[29] U.S. Energy Information Administration - EIA - Independent Statistics and Analysis

[30] Factors affecting gasoline prices - U.S. Energy Information Administration (EIA).

[31] U.S. Energy Administration, Brent. https://www.eia.gov/dnav/pet/pet_pri_spt_s1_d.htm

[32] U.S. Energy Information Administration. Gasoline and Diesel Fuel Update - U.S. Energy Information Administration (EIA) (accessed 11/7/2023).

[33] U.S. Energy Information Administration - EIA - Independent Statistics and Analysis (Accessed 11/7/2023).

[34] U.S. Energy Information Administration. U.S. All Grades All Formulations Retail Gasoline Prices (Dollars per Gallon) (eia.gov) (accessed 11/7/2023).

[35] Kilian, Lutz. 2008. "The Economic Effects of Energy Price Shocks" *Journal of Economic Literature* 46(4):871-909.

[36] Schwandt, Hannes and Till von Wachter. 2019. "Unlucky Cohorts: Estimating the Long-Term Effects of Entering the Labor Market in a Recession in Large Cross-Sectional Data Sets" *Journal of Labor Economics* 37(S1):S161-S198.

[37] Furceri, Davide, Sinem Kilic Celik, Joao Tovar Jalles, Ksenia Koloskova. 2021. "Recessions and total factor productivity: Evidence from sectoral data" *Economic Modelling* 94:130-138.