

ENERGY POLICY SOLUTIONS

HOW TO TAKE CONTROL OF AMERICA'S ENERGY FUTURE

America is at an energy and climate crossroads, faced with the challenge of reducing harmful pollution while modernizing our energy system and creating economic growth.

Fortunately, clean energy offers a path to this future, and Energy Innovation's Policy Solutions, based on transparent data and objective analysis, provide a roadmap to get there. "Policy Solutions" is a coherent set of the most cost-effective set of 15 policies—identified from a set of about 50 policy options after analyzing and modeling more than 10,000 policy combinations—to achieve the United States' emissions reductions goals and save hundreds of billions of dollars between 2016 and 2030.

Policy Solutions is an ambitious but realistic set of options designed to bolster our economy and help America own the next generation of energy technologies while expanding energy security and protecting consumers from pollution and economic shocks.

This journey will require political pragmatism, data and objective analysis, and above all else, smart policy. The choice is ours: either we get moving toward a cleaner and more lucrative future, or we delay, and thereby risk dangerous climate change with attendant high costs.

UNSTABLE POLICY HAS PLACED AMERICA IN A PERILOUS POSITION

American energy policy has constantly shifted, with elements often at odds with each other and with very little assessment of how these varying policies affect energy use and production. Since the 1970s, our country has paid a high price for these inconsistent policies through oil imports, volatile energy prices, weakened national security, air pollution, and increasingly through extreme weather intensified by a warming planet.

America has systemically underinvested in new energy technology, starving ourselves of future energy options and forgoing economic opportunities. America's energy policy environment has become increasingly biased against long-term projects, which jeopardizes serious new investments in important technologies. Energy has also become politicized in many cases, even to the extent that Democrats and Republicans axiomatically favor specific technologies.

The net result of this dysfunction is very costly, especially in reducing options—and thus quality of life—for future generations.

SMART POLICY UNLEASHES INVESTMENT AND ECONOMIC DEVELOPMENT

Good policy design is not trivial. It's far easier for policy to inadvertently waste money, slow technology development, or reward incumbent technologies than for it to minimize transaction

costs and spur innovation. Sorting through which policies work, why, and in what circumstances is therefore of paramount importance.

Policymakers can use three types of policies to drive change in the energy realm: Economic signals, performance standards, and support for research and development. Each has different strengths and weaknesses, but all three complement each other—if they are designed well.

Five basic principles should guide policy design:¹

- Set goals and empower market forces to drive the best solutions.
- Reward performance, not investment, being wary of unintended consequences.
- Set a long-term trajectory and require consistent, predictable performance improvements.
- Encourage investments in cleaner and more efficient infrastructure when it is first designed and built, rather than building less-efficient infrastructure requiring subsequent retrofits or replacement at a higher cost.
- Ensure sound incentives for innovation and mechanisms to accelerate uptake of new technologies.

When these policy design principles are followed, they produce dramatic results, ushering in both new technology and new business models.

A HIGHLY COST-EFFECTIVE PACKAGE OF ENERGY POLICIES FOR AMERICA

America's electricity, industry, cars and transportation systems, businesses and homes, and forests and farms are where energy policy is ultimately manifest. Understanding the impacts of policy must therefore include quantitative analysis of how policies affect emissions in each of those sectors.

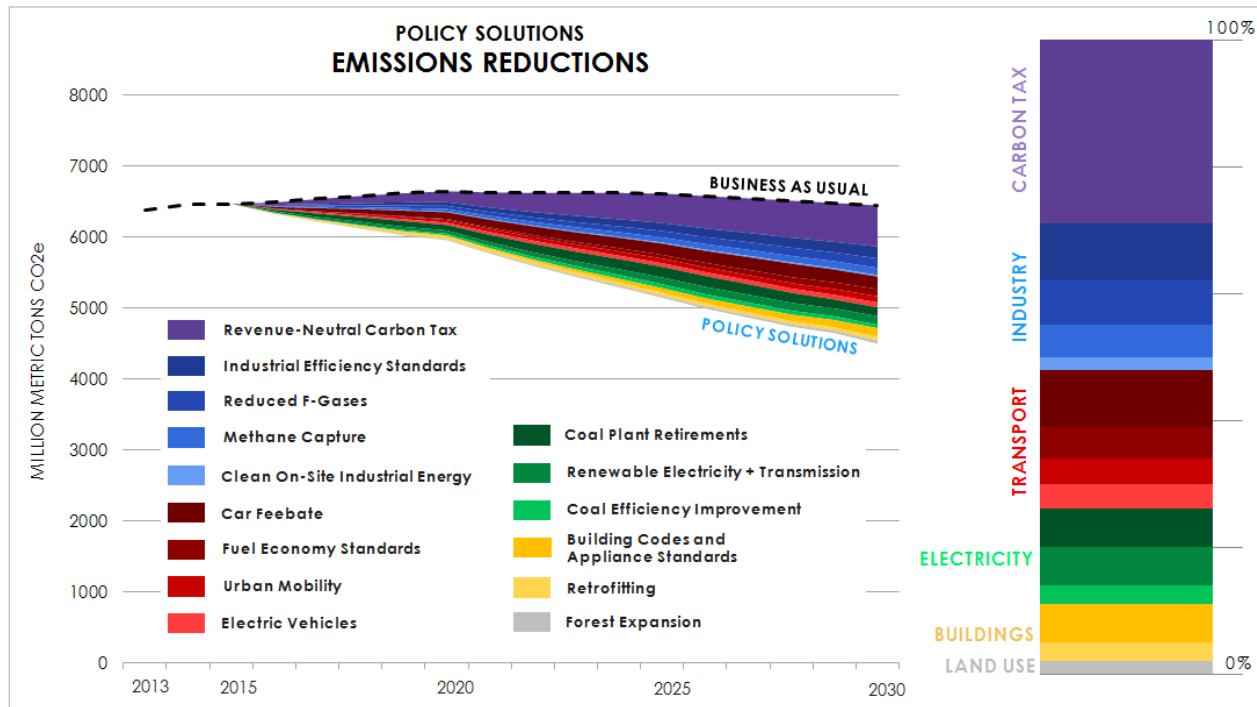
Energy Innovation's *Energy Policy Simulator* has done just that by modeling the combined effects of about 50 policies on each major sector, using real-world data, to demonstrate the effects of each policy and any combination of policies on 12 pollutants, as well as to estimate cash flow among industry, consumers, and government.

The Energy Policy Simulator has been peer-reviewed by experts at two leading U.S. universities (Massachusetts Institute of Technology and Stanford University) and three national laboratories (Argonne National Lab, Lawrence Berkeley National Lab, and the National Renewable Energy Lab). The model is open-source and input data are easily adjustable, so anyone can analyze potential policy implications using their own preferences and insights.

After analyzing thousands of policy combinations through the Energy Policy Simulator, Energy Innovation identified an extremely cost-effective package of 15 policies America can use to reduce domestic emissions.

¹ See http://energyinnovation.org/wp-content/uploads/2014/11/Policies-That-Work_Overview-Report.pdf

If enacted together, these policies **meet the 2025 carbon target set forth by President Obama** and could **save America about \$840 billion dollars between 2016 and 2030**. These Policy Solutions position America to lead global markets in energy technology, reduce oil imports, and insulate consumers from the risks of volatile and rising fuel prices.



In short: America can decarbonize its economy, improve public health, and save money at the same time. But to realize these benefits, we must enact sound policies in each sector. Here are the top 15 energy and emissions policies.

ECONOMY-WIDE EMISSIONS: MODEST, STEADILY RAMPED, REVENUE-NEUTRAL CARBON TAX

Pricing carbon to reflect its true external costs to society is an economically efficient way to drive emissions reductions and send a stable signal for both capital investment and equipment use. In this set of Policy Solutions, America adopts a **revenue-neutral carbon tax** of \$3.33 per ton in 2016, increasing the tax rate by \$3.33 per ton each year until 2030—at which point the tax rate would be \$50/ton, roughly aligned with Environmental Protection Agency’s (EPA) median estimate of the social cost of carbon.² This modest approach, ramped up steadily over 15 years, would create a clear signal for consumers and industry, allowing them to choose more efficient products over time. We do not model different revenue allocations, but presume 100 percent of the revenues would be used to reduce other taxes.

² EPA’s 2030 social cost of carbon ranges from \$18-81/ton, with a median value of \$56/ton using a 3% discount rate. See <http://www3.epa.gov/climatechange/EPAactivities/economics/scc.html>

INDUSTRY: METHANE CAPTURE, F-GASES, ENERGY INTENSITY, ON-SITE ENERGY

America has a leaky pipe problem with natural gas—and this is a big deal, as methane, the principal constituent of natural gas, has 25 times the global warming power of carbon dioxide. The EPA has proposed emissions standards for new natural gas and petroleum sites, but plugging many of the leaks in existing sources of methane would also save money for industry. The highlighted set of Policy Solutions assumes almost all of the cost-effective **methane leaks are captured** by 2030, resulting in a 60 percent leak reduction by 2030.³

In addition to methane, industrial use of F-gases for refrigerators and air conditioners contribute substantially to climate change. President Obama and China’s President Xi agreed to phase down emissions of F-gases, and Europe has implemented a phase-down of the gases as well. Policy Solutions assumes **F-gas emissions are halved** by 2030, a level in line with Europe’s existing program.

Policy can also encourage industry to make minor adjustments that reduce emissions in two additional ways. First, Energy Innovation’s Policy Solutions have the U.S. **adopt industrial efficiency standards** for equipment such as pumps and air compressors, and increase standards for industrial motors and boilers, targeting a 10 percent improvement in industrial energy intensity by 2030. Second, the Policy Solutions package **cleans on-site energy supply** by converting 15 percent of coal used in industry to natural gas and pursuing all cost-effective cogeneration and waste heat recovery in industry by 2030.⁴

TRANSPORTATION: FUEL ECONOMY STANDARDS, FEEBATE, URBAN MOBILITY

Fuel economy standards for cars have driven transportation innovations, reduced our dependence on oil imports, and mitigated economic exposure to fluctuating oil prices.⁵ The U.S. has already set a 54.5 mile per gallon (MPG) standard for new cars sold in 2025, up from 35.5 MPG in 2016. Extending that rate of improvement linearly suggests a 65 MPG standard in 2030, but Energy Innovation’s Policy Solutions include a conservative 60 MPG standard in that year.

In addition to the car standard, the Policy Solutions package includes a **heavy-duty vehicle standard** matching the EPA and National Highway Transportation Administration’s Phase 2 standards—achieving a 40 percent fuel economy improvement for new heavy-duty vehicles sold in 2030, phased in linearly, compared to business-as-usual.

A “**feebate**”—or fee on inefficient cars rebated to buyers of more efficient cars—can also induce a substantial reduction in vehicle emissions by supporting customers who choose vehicle manufacturers’ more efficient options. To take advantage of this pricing policy, the Policy

³ See http://www3.epa.gov/climatechange/Downloads/EPAactivities/MAC_Report_2013-Appendixes.pdf. For our analysis, we have assigned specific abatement measures included in this document to methane recovery, which we use to generate a marginal abatement cost curve.

⁴ See http://www.rmi.org/RFGraph-US_industry_energy_saving_potential

⁵ See http://www.theicct.org/sites/default/files/publications/ICCT_ClimateWorks_RegulatoryEngine.pdf

Solutions package includes a rebate or fee of \$1,500 per 0.01 GPM, which is equivalent to a rebate of about \$600 for buying a car 15 MPG more efficient than the average newly sold car in 2025 (54.5 MPG), paid for via a fee on the sale of cars less efficient than the average newly sold car.

Finally, the Policy Solutions package also takes advantage of public transportation options to **shape urban mobility**. The International Energy Agency (IEA) studied the emissions reduction potential of fulfilling mobility needs via bicycles, buses, and trains for people who have those options.⁶ This policy package secures 30 percent of the shifts IEA calculated were possible via support for better citywide public transit and intercity rail.

POWER GENERATION: 30% RENEWABLES, 10% GRID EXPANSION BY 2030

The advent of low-cost natural gas and renewable energy, increased economy-wide energy efficiency, and public demand for cleaner air and reduced greenhouse gas emissions combine to make coal an increasingly undesirable energy source. All these trends, excepting low natural gas prices, are inexorable.

The Policy Solutions package **retires an additional six gigawatts (GW) of coal-fired electricity** per year above business-as-usual retirements. The EPA expects the Clean Power Plan (CPP) and Mercury and Air Toxics Standards (MATS) will induce about 174 GW of retirements on their own by 2030,⁷ and the Policy Solutions package will induce an additional 34 GW of coal retirements. In addition to retiring the most inefficient plants, the highlighted set of Policy Solutions includes a six percent (heat rate) **efficiency improvement** for the remaining coal fleet, to match CPP's coal building block.

To replace the retiring coal, Policy Solutions includes 30 percent **renewable electricity supply** by 2030, along with a 10 percent **increase in nation-wide transmission capacity**. Transmission expansion is particularly important for delivering wind electricity to customers, and this growth by 2030 is in line with projections from the National Association of Regulatory Utility Commissioners.⁸ Texas provides an excellent example of how good transmission planning increases renewable energy and reduces consumer costs.

Getting thirty percent of our electricity from renewables by 2030—up from roughly 10 percent today—is ambitious but feasible. The Energy Policy Simulator uses a least-cost framework to determine the electricity mix under a renewables standard, finding wind is built in the late 2010s at about double the historical rate. Solar deployment rates grow steadily over time as costs

⁶ See IEA's Blue Shift scenario: <https://www.iea.org/publications/freepublications/publication/transport2009.pdf>

⁷ See <http://www3.epa.gov/airquality/cpp/cpp-final-rule-ria.pdf>, Table 3-12, 2030 Mass-Based scenario.

⁸ NARUC estimates 372,340 circuit-miles of transmission in the United States in 2009, with projected growth to 406,730 circuit-miles by 2030. See <http://www.naruc.org/grants/Documents/Silverstein%20NCEP%20T-101%200420111.pdf>

continue to come down, reaching a similar deployment of solar by the late 2020s as China will install this year (2015).

BUILDINGS: CODES, APPLIANCE STANDARDS, RETROFITTING

Building codes efficiently reduce demand for electricity and other fuels, saving inhabitants money. Energy Innovation’s set of Policy Solutions assumes a 20 percent improvement in the average efficiency of residential heating, ventilation, and air conditioning (HVAC) components sold in 2030, compared to business-as-usual efficiencies in 2030. This could be achieved via building codes discouraging sales of the worst performing boilers, furnaces, and air conditioners, and encouraging the use of heat pumps. Performance-based building codes can also encourage efficiency improvements in the building’s envelope, and this package assumes new buildings constructed in 2030 will have 15 percent more efficient envelopes than today’s buildings.

The set of Policy Solutions also includes a 50 percent improvement in the efficiency of new lighting sold in 2030, in line with the Department of Energy’s estimated potential, and achievable via lighting standards.⁹ Energy Innovation’s Policy Solutions include **improved appliance standards** for newly-sold appliances and other building components to ensure the average appliance sold in 2030 will be about 20 percent more efficient than it would be without additional standards.

Using policy to address existing buildings can be difficult, as retrofitting building components often costs money up front, though it saves money for occupants over time. But improving performance of existing buildings is crucial to achieving savings by eliminating waste. Commercial building owners are increasingly examining “retro-commissioning,” the process of evaluating and undertaking efficiency improvements in an existing building. Retro-commissioning and improved financing for building retrofits can help drive efficiency, keeping money in the pockets of building owners and tenants, while increasing the value of commercial properties.

Energy Innovation’s Policy Solutions include **retrofitting commercial building components** (HVAC, lighting, appliances) at twice the current rate—with two percent of existing components replaced each year through 2030.

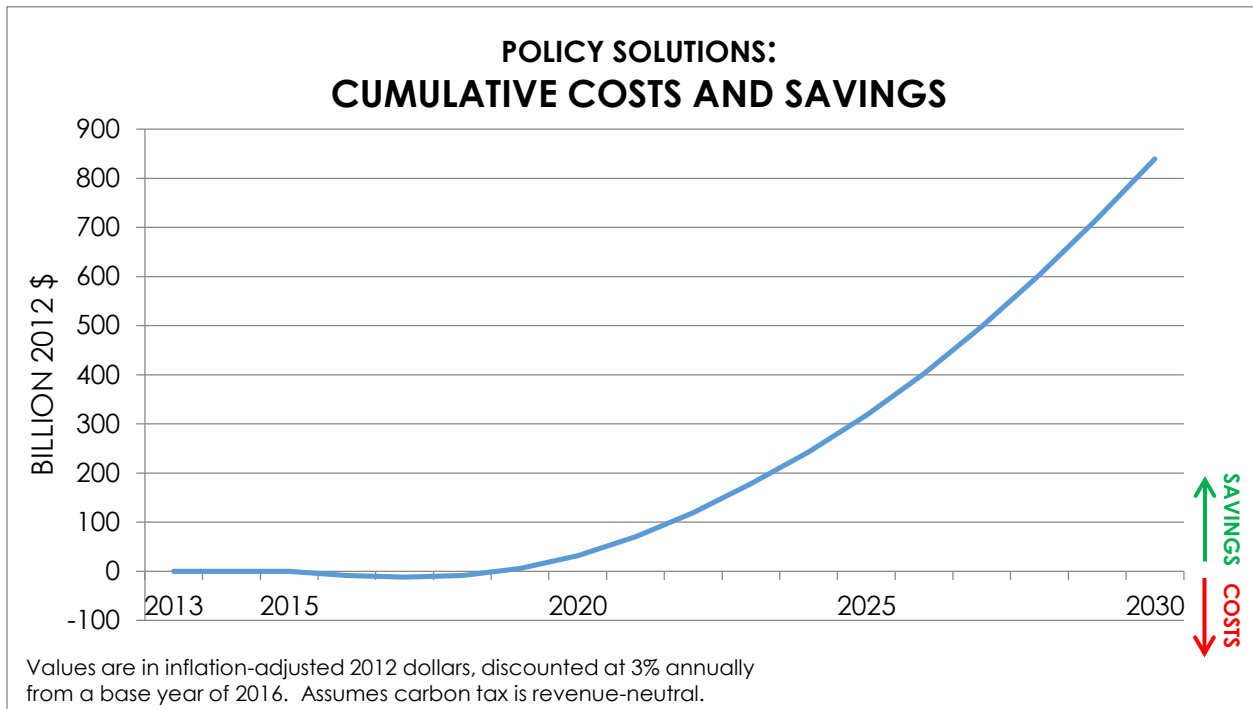
LAND USE: FOREST EXPANSION

The way land is used has an important effect on overall emissions. The highlighted set of Policy Solutions includes an **increase in America’s forested lands** by 1.5 percent from today’s levels by 2030. This means an average of 756,000 acres of reforested or newly forested land each year.

⁹ See http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/ssl_energy-savings-report_jan-2012.pdf

ACTING NOW WILL SAVE MONEY

The 15 policies in Energy Innovation’s Policy Solutions package may seem like a long list, but it is actually a trim and focused set, considering that energy is embedded in every facet of the economy. With these policies, America can control its energy future, rather than leave it to overseas political whim. These policies enable America to secure a more robust economy, better public health, reduced exposure to national security threats, and overall *cost savings*. Good policy can create these kinds of enduring benefits across the board.



From a political perspective, this approach requires a disciplined focus on results, a keen eye to accelerating innovation, and the ability to think for the long term.

To realize these benefits, American policymakers must act promptly. This will create more options and lower costs for American consumers, dramatically cut pollution, and put our country back in front of the energy technology race.

To use the *Energy Policy Simulator* yourself, visit <http://energypolicy.solutions>.

For more information, contact policy@energyinnovation.org.