# An Innovation Carbon Price: Spurring Clean Energy Innovation while Advancing U.S. Competitiveness

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*A new approach is needed if we are to make progress on energy and climate change in a way that does not negatively impact U.S. industrial competitiveness.*

The United States faces two key energy challenges — improving national security by reducing dependence on foreign oil and mitigating the impacts of climate change by reducing carbon emissions. Closely linked is another challenge – as well as an opportunity – boosting international economic competitiveness by discovering and widely commercializing clean energy technologies. Until now, the predominant approach to these challenges was to raise the cost of carbon, either with a tax or through cap and trade. But this approach has come under strong resistance in part because raising the price of energy hurts U.S. industrial competitiveness. This was one reason for the failure of cap and trade.

However, we believe that it is possible to structure a policy approach that meets all three goals simultaneously — reducing oil consumption and carbon emissions and spur clean energy innovation while at the same time boosting U.S. industrial competitiveness. The way to do that is through a revenue-neutral innovation carbon price policy. ITIF proposes a fifteen year economy-wide carbon tax of $15 per ton with 80 percent of tax revenues recycled back into the economy as growth and innovation inducing business tax incentives. Businesses that invest in the building blocks of innovation and growth — R&D, workforce training, and capital equipment — would receive a much more generous tax incentive than they currently receive. The remaining revenue would fund a Clean Energy Innovation Trust Fund that would support clean energy innovation initiatives. We believe that with this proposal we can have our proverbial cake and eat it too: cut oil imports, reduce carbon emissions, boost U.S. competitiveness and economic growth, expand federal revenues from that growth, and spur the expansion of a domestic clean energy industry.

## THE FAILURE OF CARBON PRICING

In their quest to address the climate change challenge, many policymakers, including those in the Obama administration, favored capping carbon emissions and letting polluters trade their permits to pollute. The cap would decrease each year, decreasing the number of permits issued. As a result, the price of permits would increase over time, in theory spurring companies to reduce emissions. As an alternative, a carbon tax would skip setting a cap and allocating permits altogether and instead directly set a price on carbon that would automatically increase each year.

Neither approach would have made serious progress in reducing carbon emissions and both would have negatively impacted U.S. industrial competitiveness, cap and trade most severely.

The reason the proposals would do little to reduce carbon emissions is that a carbon price is simply not enough to solve the significant energy challenges facing the United States. Due to political constraints, a carbon price would never be high enough to induce the creation of affordable and accessible clean energy technology (and thus reduce $CO_2$ emissions). Policymakers are more likely to opt for a low carbon price to keep down consumer and business energy costs. For example, recent cap and trade proposals set a price annually averaging $15/ton $CO_2$, the equivalent of only a 13-cent increase in the price of a gallon of gasoline. This low carbon price is "insufficient to drive deep and radical innovation; instead, it [a low carbon price] tends to drive incremental technical improvements and marginal cost reductions."[1]

And even if the price were higher, without a viable technology substitute consumers would still not transition away from fossil fuels. If higher carbon prices are really the key to spurring technological change, then we should see clean energy innovation in nations with higher carbon prices. But we don't. In many European nations, the price on $CO_2$ for transportation fuels is over $200 per ton, which is the amount reflected in their overall transportation fuel taxes. Yet, higher fuel prices have not induced Europeans to switch to electric cars. In fact, there are virtually no electric cars in Europe. They might drive less and prefer more fuel-efficient cars but they are still driving internal combustion engine vehicles. The reason is simple: price signals lead to behavior change only when there is a viable substitute. Europeans, like the rest of us, will drive electric cars when there are cheaper and better batteries and the infrastructure to support electric vehicles.

Moreover, both policies would have harmed the competitiveness of American firms in international markets. Exporting industries would face higher costs, putting them at a competitive disadvantage with foreign companies not regulated by similar policies.[2] Exports of traded goods would decrease and imports increase, especially in energy-intensive industries, due to higher prices, resulting in job loss and a higher trade deficit.

This is not to say that setting a carbon price doesn't have a role in energy policy. It does, albeit a less central role than recently discussed by many policymakers. Setting a carbon price can capture some or all of the negative externalities of fossil fuel consumption such as the national security costs related to importing oil and the harmful changes to the climate brought on by greenhouse gases. And setting a carbon price *does* send a helpful price signal to energy markets to recognize these negative externalities by narrowing the gap between the price of fossil fuels and the price of clean energy substitutes.[3]

Many decision makers are certainly cognizant of how energy policy impacts competitiveness, and some proposals reflect this awareness. In fact, some are so cognizant of the impact that they carry the risk of the watering down the effectiveness of the proposals. The Waxman-Markey bill included significant carve-outs for industries thought to be affected economically. But these carve-outs would have reduced the impact on energy and carbon reduction and would not have adequately compensated affected industries for the increased costs. Other proposals sought to provide rebates to consumers affected by higher costs. The Kerry-Lieberman American Power Act (cap and trade) would have provided a direct rebate to consumers to offset higher energy costs. The Cantwell-Collins CLEAR Act (cap and dividend) would have reduced payroll taxes for the same reason. Similar offset proposals have been made for a carbon tax as well.[4] But these alternatives, while a step in the right direction, still would have failed to limit impacts on competitiveness because firms would still have to pay higher costs, even if consumers would not.

*An optimal clean energy policy would reduce carbon emissions and energy imports while spurring economic growth, competitiveness, and innovation.*

In part, as a result of these deficiencies, cap and trade legislation failed in Congress and a simple carbon tax was never seriously considered. It's obvious that a new approach is needed if we are to make progress on energy and climate change in a way that does not negatively impact U.S. industrial competitiveness.

## ITIF PROPOSAL: AN INNOVATION CARBON PRICE

An optimal clean energy policy would reduce carbon emissions and energy imports while spurring economic growth, competitiveness, and innovation. Many assert that these goals are incompatible. We disagree.

By imposing a carbon tax and using most of the revenue to provide innovation-based corporate tax incentives we can reduce, and for some sectors more than eliminate, the impact of increased costs on exports while at the same time spur productivity and innovation. And by allocating a small share of tax revenues to a Clean Energy Innovation Trust Fund, similar to the Highway Trust Fund, we can ensure the development of low-cost clean energy technologies. We call this an *innovation carbon price*.

| POLICY RESULTS | CAP AND TRADE | CARBON TAX | INNOVATION CARBON PRICE |
|---|---|---|---|
| Simple to administer | | √ | √ |
| Reduces impacts on export industry competitiveness | | | √ |
| Supports clean energy innovation | | | √ |
| Spurs economic growth | | | √ |

**Table 1: Characteristics of Proposed Energy Policy Options**

## Carbon Tax Costs and Revenue

We propose that Congress pass legislation establishing a \$15/ton $CO_2$ tax levied economy-wide and on upstream combustible energy sources (e.g. coal, oil, natural gas, etc.). Non-combustible energy sources, such as those sequestered in feedstock, would be exempt.[5] Because the carbon tax is applied upstream, a refund system would be necessary for energy sources that serve a dual purpose of being a fuel as well as a non-combustible energy source. For example, the liquid natural gas product butane is used as both a fuel as well as in producing hydrocarbon feedstock. A similar refund system already exists to administer gasoline tax refunds to eligible consumers, such as public bus companies.[6]

The Energy Information Administration estimates that annual energy-related $CO_2$ emissions were about 6,000 million metric tons before the economic downturn.[7] At this level, the carbon tax would raise roughly \$90 billion annually. Further, EIA forecasts that carbon emissions will increase for the next ten years, if not longer, unless significant policy changes are made. Therefore, we propose that the tax sunset after 15 years so the carbon tax level can be reduced to reflect expected clean energy innovation and carbon emission levels at that time.

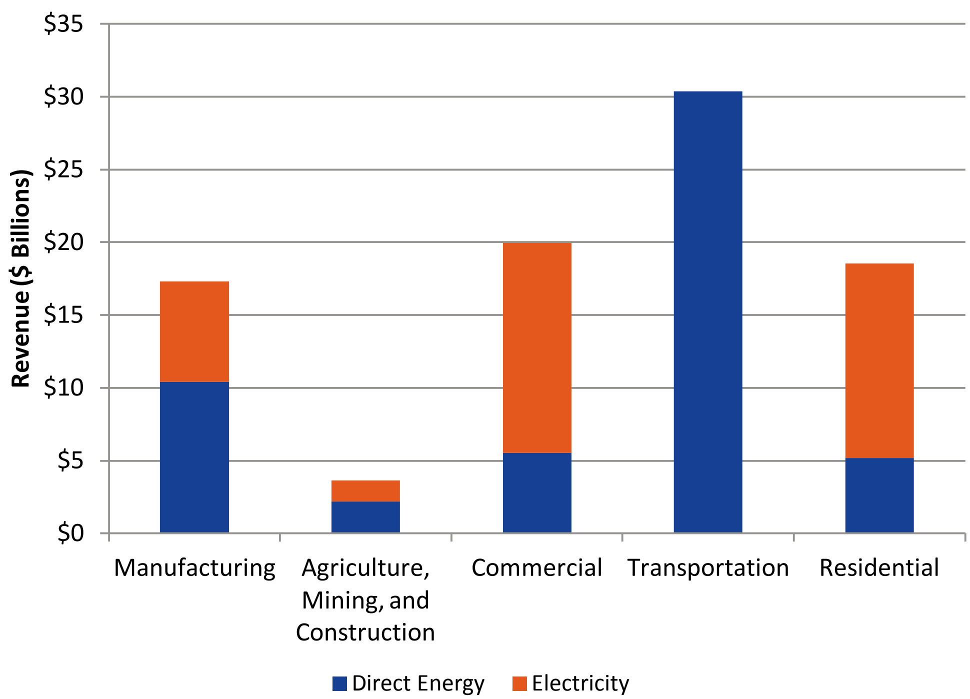


**Figure 1: Estimated costs to sectors of a \$15/ton $CO_2$ carbon tax. Electricity represents the total cost to utilities that are passed through to their customers. Total government emissions are estimated to be 5 percent of total emissions and are included in commercial (building energy use) and transportation sector costs.[8] Values do not account for corporate tax incentives or other pass through.**

Industries would be impacted differently depending on how they use energy — either directly or through electricity consumption. Figure 1 provides a breakdown of the cost impacts of the carbon tax.

Direct energy costs are costs related to the carbon tax on fuel expenditures by households (for example, heating with gas and oil), industrial-process heat generation, and gasoline and diesel for transportation. The transportation sector consumes the most direct energy because nearly all modes of transportation are fueled by gasoline, diesel, jet fuel, or natural gas. Across all sectors, direct energy use accounts for 60 percent of carbon emissions.

Indirect energy costs are the carbon costs passed by electric utilities to residential, commercial, and industrial sectors. The carbon tax would be directly levied on energy producers such as utilities, but we assume that utilities pass the full cost of a carbon tax on to customers in the form of higher electricity prices. Across the economy, electricity consumption accounts for 40 percent of carbon costs.

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## Innovation Tax Incentive Offsets

Higher taxes are not necessarily a cost to the economy, they are a transfer payment, and as such it's not possible to estimate the economic impact of a tax without knowing what the revenues are used for. For example, if one tax is raised while another is lowered, the resulting change can be growth-inducing if the higher-taxed activity has negative externalities and the lower-taxed activity has positive externalities. And this is exactly the case with our proposal. We propose that the lion's share of carbon tax revenues be used to pay corporate tax incentives to induce innovation and spur growth.

We propose that Congress allocate nearly 80 percent of revenue back to businesses as targeted innovation tax incentives; this measure is similar to those in previous carbon tax proposals. For example, the Cantwell-Collins CLEAR Act would have given every U.S. citizen a non-taxable, equal share of 75 percent of revenue from auctioning carbon permits. Other proposals would have used tax revenue to offset a comparable reduction in payroll taxes. But these proposals would not spur clean energy innovation, productivity, or economic growth. Simply giving the money to consumers in the form of a rebate would offset some spending reductions, but notboost investment. Providing a reduction in payroll taxes would do little to create jobs as job creation is almost exclusively a function of macroeconomic demand conditions, not marginal changes in the price of labor.

But more importantly, consumer offsets do not reduce the negative economic impacts on firms competing in global markets. A $15/ton $CO_2$ carbon tax would result in a $54 billion annual tax hike on U.S. businesses (as well as directly impact consumers), putting firms at a competitive disadvantage vis-à-vis foreign companies not under the same carbon pricing policy. As U.S. businesses competing in global markets incurred these higher energy costs they would either lose global market share or be forced to expand or move domestic operations overseas to stay competitive. Either would mean job losses for U.S. workers.

| POLICY | DESCRIPTION | EXPENDITURES | OTHER DETAILS |
|---|---|---|---|
| **Carbon Tax** | \$15/ton $CO_2$ | | Sunset after 15 years; \$90 billion in raised revenue per year |
| **Clean Energy Innovation Trust Fund** | Dedicated to supporting clean energy innovation programs and projects | \$15 billion | |
| **R&D Tax Credit** | Increase Alternative Simplified Credit to 50% | \$8.5 billion | Credit available for all expenses above 75% of the average of three previous years. |
| **Collaborative R&D Tax Credit** | Increase flat credit to 40% | \$3 billion | Expand to include all collaborative research between businesses and federal labs,and universities, as well as research consortia. |
| **Workforce Training Tax Credit** | Expand ASC to include workforce training expenditures | \$12 billion | |
| **Capital Equipment Investment Tax Credit** | 50% credit on machinery, equipment, and software | \$51.5 billion | Credit available for all expenses above 75% of the average of the three previous years. |

**Table 2: ITIF Carbon Tax and Invest Policy Highlights**

*R&D is the principal way industry creates knowledge that can be commercialized into economically valuable products and services and the R&D tax credit is a key way the federal government supports private-sector R&D activities.*

While consumer offsets aren't the right approach, the idea of offsetting carbon costs is. The key is focusing the offsets on businesses, particularly those facing global competition, and to do it in a way that also spurs innovation and productivity. The economics literature demonstrates that investment in new capital equipment, R&D, and workforce training is central to driving innovation and productivity.[9] Targeting offsets at these activities would result in greater economic growth than consumer rebates or payroll tax cuts. And in the long term, Americans would benefit from more jobs, better pay, reduced prices, and new goods and services, even after accounting for the higher carbon prices they would pay.

To realize this vision we propose the following:

### Expand and Increase the R&D Tax Credit

To spur private sector R&D investment, while at the same time reducing the effective corporate tax rate, the R&D tax credit should be expanded. R&D is the principal way industry creates knowledge that can be commercialized into economically valuable products and services, and the R&D tax credit is a key way the federal government supports private-sector R&D activities.[10] The R&D credit is available for qualified expenditures in the United States, which primarily include the wages paid to employees engaging in qualified research activities, 65 percent of the fees paid to external contractors for the performance of qualified research, and supplies used in conducting qualified research (but not equipment used in research).

Almost all scholarly studies conducted in the last twenty years have found that the credit is an effective tool for spurring increased business R&D. The former Congressional Office of Technology Assessment concluded that "for every dollar lost in tax revenue, the R&D tax credit produces a dollar increase in reported R&D spending, on the margin." Other studies have found that it produces even greater additional investment in R&D.[11]

The most widely used R&D tax credit provision is the Alternative Simplified Credit (ASC), which provides a credit of 14 percent on qualified R&D expenses above 50 percent of average research expenses for the preceding three years (described here as the base). But at its current level, the credit is a less important source of competitive advantage than it once was. As nations have sought to compete in the global innovation economy, many have put in place or expanded R&D tax incentives. In 1992, the U.S. had the most generous tax treatment of research expenditures among 30 OECD nations. By 2007, the U.S. had fallen to 17th for large firms (18th for small-medium enterprises), in large part because other nations increased their R&D tax incentives. In some Canadian provinces, for example, firms can obtain a 40 percent credit on all their R&D expenditures.[12] Expanding the R&D tax credit would not only increase the amount of R&D conducted by firms in the United States, it would make America a more competitive location internationally for R&D-based economic activities, boosting exports and in turn creating more high-paying jobs.

We recommend that Congress increase the ASC base from 50 percent to 75 percent while increasing the rate to 50 percent. In other words, companies would receive a credit of 50 percent on all the R&D they perform above 75 percent of their base. We propose raising the base from 50 percent to 75 percent because it enables a higher rate for the same cost in forgone tax revenue, which in turn provides a greater incentive for businesses to increase their R&D investment.

It is not clear exactly how much the proposed changes in the Alternative Simplified Credit (ASC) would cost in forgone tax revenues. However, the likely ceiling would be around $13.5 billion annually.[13] This is based on an estimated $245 billion in corporate R&D investments. The ASC credit would apply to 25 percent of this (above 75 percent of the base), or $61.25 billion. However, not all firms eligible for the credit take the ASC.[14] For instance, some firms only take part of the credit because of a lack of taxable income or restrictions associated with the Alternative Minimum Tax. In 2006, businesses claimed $7.3 billion in R&D credits compared to a ceiling of $17.1 billion (a difference of $9.8 billion).[15] We assume that increasing the credit would spur more businesses to take the ASC. As a result, we estimate that increasing the credit would provide $8.5 billion in additional tax credits to companies for research performed in the United States.

### Expand and Increase the Collaborative Research Tax Credit

To spur private-sector collaborative R&D investment, and at the same time reduce the effective corporate tax rate, the existing energy consortia R&D tax credit implemented as part of the Energy Policy Act of 2005 should be expanded to make it a collaborative R&D tax credit that targets all research collaborations, not just energy consortia.

There are several reasons to treat collaborative research more generously. First, participation in research consortia has a positive impact on firms' own R&D expenditures and research productivity.[16] Second, most collaborative research is more basic and exploratory than research conducted by a single company. Moreover, the research results are typically shared, often through scientific publications. As a result, firms are less able to capture the benefits of collaborative research, leading them to under invest in such research relative to socially optimal levels.

As part of the Energy Policy Act of 2005, Congress created an energy consortia tax credit that allowed companies to claim a credit equal to 20 percent of the payments to qualified research consortia of five or more firms, universities, or federal laboratories for energy research.

To bolster the incentive for businesses to conduct collaborative R&D, Congress should make two key changes. First, all collaborative R&D should be eligible for the credit including all collaborations between a business and a federal laboratory, government agency, or university as well as consortia of five or more firms. Collaborative R&D is important for all disciplines. Broadening the credit would spur additional, high impact collaborative R&D in non-energy industries such as IT, computer manufacturing, and transportation manufacturing while also spurring greater private-sector energy R&D.

*Training and on-going education are critical components of robust productivity growth and rising worker incomes.*

Second, the credit should be expanded from 20 percent to 40 percent. (Unlike the ASC, this would be a credit of 40 percent on all collaborative R&D, not just the portion above 75 percent of the base.) Doubling the tax credit would provide a significant incentive for businesses to build valuable research relationships and to partner on projects with outside institutions.

It is not clear exactly how much a collaborative R&D credit would cost in forgone tax revenue. In 2005 (the last year this data was collected), the NSF estimated that businesses invested $6.8 billion in the U.S. on collaborative research. Assuming there has been a slight increase in the amount invested in collaborative R&D since 2005, we estimate that a 40 percent credit would provide roughly $3 billion in tax credits to companies for collaborative research performed in the United States.

### Include Workforce Training Expenditures in the Alternative Simplified Credit

To simultaneously spur greater workforce training and lower the effective corporate tax rate, the Alternative Simplified Credit (ASC), which above we propose to increase from 14 percent to 50 percent (and increasing the base from 50 percent to 75 percent), should be expanded to all companies and include expenditures related to employee training and retraining.

The competitiveness of American industries depends in part on the skills of American workers. Given the rapid increase in education levels abroad, it is clear that the skills of American workers must be strengthened not only pre-market — through better high school curricula and higher college matriculation and completion rates — but also through on-the-job training.[17] Training and on-going education are critical components of robust productivity growth and rising worker incomes. And a key way workers get skills is through training provided on the job by employers.

The need for on-the-job training will only increase in the future as foreign competitors quickly grow in their share in emerging markets. Competition between U.S.-based companies and foreign companies that have access to lower cost labor and less regulated economies increases the need for companies to boost worker productivity and lower costs to stay globally competitive.

The scholarly literature suggests that businesses typically cut costs by under investing in workforce training. Businesses operating in international markets have more high-skilled workers to choose from, resulting in lower demand for less-skilled workers who need to be trained.[18] This becomes more apparent during economic downturns when employers are more able to hire well-skilled, unemployed workers instead of lesser skilled individuals whom they then must train.

Businesses also under invest because of "spillover" effects. Employers want employees to commit to periods of employment. Because workers typically are unwilling to make this commitment, companies assume high turnover and under invest in workforce development.[19] Also, the more general the skills training employees need, the more reluctant companies are to invest in them because they can more easily leave for other jobs, reducing companies' return on investment.[20] But as the U.S. economy continues to expand into more knowledge-based industries requiring higher skilled workers, the gap between what are considered general vs. high skills decreases.

These are likely the major reasons why corporate training expenditures have declined significantly from $180 billion in 1999 to $134 billion in 2008, slipping even more as a share of GDP, from 1.8 percent in 1999 to only 0.9 percent in 2008.[21] The end result is that U.S. workers receive less of the training that increases their productivity, their competitive advantage over foreign workers, and their incomes.

A direct and long-term method of boosting domestic workforce training is to provide a tax incentive that lowers the cost of training employees. A simple way to do this is to expand the eligibility requirements of the ASC to include workforce training costs. This would include staff salaries and costs associated with internal training programs as well as costs associated with hiring external training consultants.

As noted above, in 2008 businesses invested an estimated $134 billion in employee training.[22] The ASC credit would apply to 25 percent of this (above 75 percent of the base), or $33.5 billion. So, the likely ceiling would be around $16.8 billion dollars annually. But the 2008 investment estimate does not strictly apply to U.S. private-sector job training expenses. The American Society for Training and Development (ASTD), which provided this datum, conducts surveys of organizations headquartered in the United States, but many of these U.S. based organizations include foreign workers in their labor force, so it's reasonable to expect that some of the expenditures included in the ASTD estimate are not eligible for the tax credit. Further, the ASTD includes public organizations in its estimate and only private-sector organizations would be eligible for the ASC tax credit. As a result, we estimate that the credit would provide $12 billion in tax credits to companies for investing in job training of U.S. workers.

### Create an Investment Tax Credit for Machinery and Equipment Expenditures

To spur greater investment in capital equipment while at the same time lowering the effective corporate tax rate, an investment tax credit (ITC) of 50 percent, similar to the Alternative Simplified Credit, should be instituted.

A federal ITC has not been place since the U.S. tax code was altered in 1986. In the tax act of that year, Congress eliminated the investment tax credit and reformed depreciation tax write-offs to create the Modified Accelerated Cost Recovery System (MACRS). But since then, twenty states have implemented an average 6 percent ITC to boost capital investment in their economies.[23]

It's easy to see why states have taken it upon themselves to spur additional capital investment within their borders. Traditional depreciation allows a tax-paying entity to deduct a percentage of an asset's cost in the year of purchase and to depreciate the remaining costs over a federally-determined asset lifetime, thus spreading its tax benefits over time.[24] Depreciation increases the initial, after-tax price of capital relative to an ITC.

To spur greater private-sector investment in capital equipment, Congress has occasionally implemented temporary accelerated depreciation, or bonus expensing incentives — most recently in 2011 — to shift more of the tax benefits into the first year instead of leaving them dispersed over the asset's lifetime. For example, 50 percent bonus expensing allows companies to write off 50 percent of an asset's cost in the first year and depreciate the remaining 50 percent over time. Bonus depreciation therefore aims to spur economic growth by decreasing the immediate after tax price of capital, spurring greater investment.

But boosting investment through bonus expensing, especially temporary expensing, has its limitations. Most importantly, bonus expensing is not as effective as it could be. The Treasury Department found that bonus expensing provisions temporarily implemented from 2002 through 2005 were taken for just 50 to 60 percent of eligible capital expenditures.[25] Specific reasons why the "take-up rate" is less than 100 percent are not well established, but three theories seem particularly relevant. First, many states choose not to conform their state tax systems to federal expensing provisions, limiting its impact. Second, many capital-intensive firms carry losses from previous years during the period that temporary bonus expensing provisions are implemented, which limits the total benefit of bonus expensing. Third, some companies choose normal depreciation over bonus expensing to make their asset totals look bigger in future years. If companies choose bonus expensing, then its tax write-offs (therefore its assets) look bigger in the first year and smaller in subsequent years. But if companies choose normal depreciation, then its tax write-offs look bigger in future years, so its book-to-market ratio — a measure used to gauge a company's value — is higher, leading to greater stock market returns (all else being equal).

For these reasons an investment tax credit (ITC) would be a more effective tool to spur capital investment than expensing. The ITC should have four key characteristics.

First, ITC eligibility and benefits should not be capped. Under Section 179 of the tax code, businesses can elect to write off up to $2 million in capital equipment expenditures (or up to $500,000 in write-offs in 2011) in the first year. On the other hand, bonus expensing (set at 100 percent for 2011) is rightly not capped. Incentivizing equipment purchasing should not be capped by the size of investment. Therefore all equipment expenditures in a given year should be eligible for the ITC.

Second, the ITC should be permanent. In the past decade, Congress instituted temporary expensing incentives of 30, 50, 50, and 100 percent in 2002, 2003-2004, 2010, and 2011 respectively. In all cases, equipment expenditures with federally-determined lifetimes of 20 years or less were eligible. But because these incentives were temporary, their long-term economic growth impacts were limited. A permanent ITC would alleviate this issue.

Third, the ITC should target investments that have the largest economic returns. Industrial machinery and IT (e.g. computers and software) have significantly higher productivity and growth value than other capital purchases, such as vehicles and buildings. Xavier Sala-i-Martin found that both equipment and non-equipment investment are positively related to growth, but that investment in equipment like industrial machinery has about four times the effect on growth as non-equipment investment (as in buildings).[26] Bartel, Ichiowski, and Shaw found that industrial investments in IT (computers, software, and so forth) improves productivity at all stages of production and creates higher skilled, better paying jobs.[27] And Jorgenson and Stiroh found that investment in IT, above all other types of capital, has been the main driver of U.S. economic and productivity growth since the early 1990s.[28] As such, the ITC should specifically target machinery and equipment (which includes IT equipment and software).

*Our recommended carbon tax is similar to past carbon tax proposals in that while it will help at the margin, it's insufficient for driving significant clean energy innovation by itself.*

The estimated short-term cost in forgone tax revenue of a 50 percent ITC would have a ceiling around $51.5 billion dollars annually. This is based on an estimate of corporate machinery and IT investments of around $685 billion pre recession.[29] The ITC would apply to 25 percent of this (above 75 percent of the base), or $171 billion. A 50 percent credit would provide $85.5 billion in tax credits to companies for machinery and IT investments made in the United States. (It is important to note that the credit would only apply to U.S.-based investment).

Of course, companies that take the ITC would not depreciate the cost of new equipment and machinery over time, reducing government tax expenditures, thus reducing the cost of the ITC. We broadly assume for the sake of this estimate that all businesses take the ITC. We also assume that the average lifetime of new capital equipment and machinery is 7 years, or an annual deductible amount of $98 billion. So, the estimated forgone tax expenditure for the depreciation for equipment and machinery investment is $34 billion, based on a 35 percent corporate tax rate. The difference between the cost of the ITC and increased tax revenue due to businesses forgoing depreciation is $51.5 billion.

### Clean Energy Innovation Trust Fund

Our recommended carbon tax is similar to past carbon tax proposals in that while it will help at the margin, it's insufficient for driving significant clean energy innovation by itself. Our proposal reflects this and explicitly targets clean energy innovation by allocating the remaining $15 billion of carbon tax revenue to a Clean Energy Innovation Trust Fund — similar to the Highway Trust Fund supported by the gas tax — that would support investment in clean energy education, R&D, demonstration, deployment, and manufacturing.

Directly supporting clean energy innovation is central to our proposal because the United States does not have all the clean technologies it needs to reduce fossil fuel consumption.[30] Current clean technologies like solar, wind, and alternative vehicles have only been deployed because of extensive government subsidies that lower their costs relative to fossil fuels. These current clean technologies are incapable of standing on their own in the marketplace, even with a modest carbon tax. For them to be competitive, clean energy innovation is needed. Breakthroughs in battery storage technology would allow electric vehicles to travel more than 40 miles on one charge at a fraction of the batteries current cost. Better materials would greatly increase the energy efficiency of solar cells and drive down costs. Small nuclear reactors that are mass manufactured in modules would significantly decrease the cost of constructing nuclear power plants. The next generation of small modular nuclear reactors (SMRs) could run self sufficiently for decades without refueling. Indeed, innovations not thought possible a decade ago like algae-based energy and ultra capacitor-based batteries hold the possibility of widely accessible, cheap, clean energy. While some of these technologies exist they are far from ready for widespread adoption.

The federal government presently supports advanced clean technologies, but at woefully inadequate levels. The consensus opinion of leading clean energy policy and business experts is that the United States government should be investing between $15 billion and $30 billion annually in clean energy innovation to create the technologies necessary to reduce emissions and ensure leadership and competitiveness in the emerging global clean energy market. Currently, the United States government is investing less than $5 billion.[31] The proposed Clean Energy Innovation Trust Fund would put the level of clean energy investments within the required range.[32]

While it would be up to Congress to determine where the funding from the Trust Fund should go, there are specific programs we feel to be critical.[33] We propose that the eight Department of Energy (DOE) Energy Innovation Hubs should be fully funded to ensure that energy research collaborations are more easily forged. DOE Energy Frontier Research Center (EFRCs) funding should be doubled to ensure that breakthrough basic science in fields like battery storage and solar more rapidly make it to development. Funding should be provided to create a loan program that finances factory retrofits for companies transitioning to clean energy technology. The 48(c) tax credit created by the American Reinvestment and Recovery Act for advanced energy manufacturing should be extended to ten years to support the construction of manufacturing facilities in the United States.[34] Also, the Clean Energy Technology Deployment Act should be implemented and funded to provide low cost financing for high-risk, high-reward clean technology deployment projects that the private sector would normally not support.

The trust fund should also insulate clean energy innovation from annual budget battles. Thus, it should be administered as an independent entity within DOE, with Congress deciding on allocations, but not overall funding levels. Budget and political wrangling in

Congress has resulted in many new clean energy programs having to fight for their survival. For instance, programs created through the stimulus bill, like the high-risk clean energy R&D program ARPA-E, must rely on new budget appropriations in the coming year to continue into the future. This shouldn't be. ARPA-E is vital to spurring the next generation of clean technologies that the private sector deems too risky to support. But it also needs a significant boost in funding as its current appropriations of $300 million is far less than the $3 billion provided to its defense research counterpart, DARPA.[35] The business community rightfully argues that consistency in federal tax and budget policy would allow it to more readily invest. Establishing more permanence in clean energy policy should be a welcome and growth-inducing change.

## ECONOMIC IMPACTS

Implementing this proposal would induce both first-order (short-term) and second-order (long-term) economic impacts.

*At the broadest level, businesses would receive more tax incentives than they would pay in carbon costs.*

First-order impacts are the direct cost or benefit of the carbon tax and innovation incentives on businesses and consumers. We analyze first-order impacts across three economic segments — the industrial sector (including manufacturing industries, agriculture, mining, and construction), the commercial sector, and households. These impacts include direct and indirect carbon costs and immediate tax incentive benefits.

Second-order impacts are the longer term economic benefits of the innovation incentives. These are calculated by estimating the additional investment in R&D, workforce training, and capital equipment spurred by the innovation incentives and the impact on productivity from these additional investments. Finally, we estimate how much of these benefits are passed though to consumers, thereby reducing the cost of the carbon tax.

### Analysis of First Order Impacts

#### Industry

Carbon costs are estimated by calculating total $CO_2$ emissions produced by business sectors. The Energy Information Administration (EIA) provides carbon emission data by economic sector and source (direct energy or electricity consumption).[36] Based on these values, we estimate that the carbon tax would increase manufacturing energy costs by $17.5 billion, agriculture/ construction/ mining by $3.8 billion, and commercial firms by $32.7 billion, for a total carbon tax cost of $54 billion. Business transportation carbon emissions — commercial light trucks and freight transportation — are $11.4 billion and are included in total commercial carbon costs.

Estimating the impact of each tax incentive involves two steps. First, business investment data is collected (R&D, workforce training, and capital equipment). Unfortunately, investment data isn't collected by the same source, in the same format, and is not presented at the same level of detail for each investment category. To ensure continuity across sources, estimates are made for all two-digit NAISC codes and for select three-digit NAISC codes if all investment data is available. We collected 2007 data to assess the maximum, pre-recession impact of the tax incentives on forgone tax revenue and total benefit to industries.[37]

Next, we estimate how much tax credit each industry would take to partially or fully offset the carbon tax costs. Above we estimated the total amount of credit for each tax incentive. And calculating how much credit would be taken at the industry level is similarly limited. So for continuity sake, we apportion tax credits by the amount of investment in capital equipment, R&D, and workforce training each industry made.

We calculated above that a total of $75 billion in tax credits would be taken for investing in R&D, workforce training, and capital equipment. We used business R&D expenditure data from the National Science Foundation to apportion R&D credits by industry.[38] We apportioned tax expenditures for workforce training by total wage level.[39] And we apportioned the ITC expenditures based on the industries' investment in machinery and equipment.

At the broadest level, businesses would receive more tax incentives than they would pay in carbon costs. (Figure 2) Manufacturing would see a net benefit of $3.8 billion, agriculture/mining/construction $3.2 billion, and the commercial sector $14 billion. The business sector would see a combined net benefit (tax incentives minus carbon costs) of $21 billion.

Consumer carbon costs pay for these additional tax benefits. Households incur a net carbon cost of roughly $36 billion. A portion of this ($15 billion) would be invested in the Clean Energy Innovation Trust Fund. The remaining $21 billion would go to the additional tax incentives given to businesses that invest in innovation.

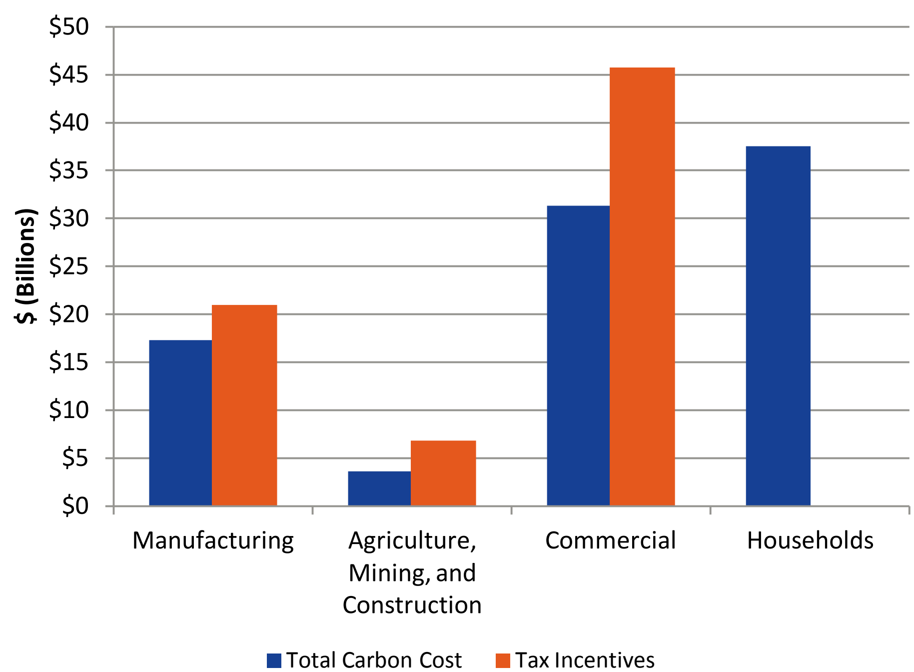



**Figure 2: Total business sector and household carbon tax costs and tax incentive benefits.**

While all major sectors benefit, net impacts vary significantly by industry. Figure 3 provides select comparisons of carbon costs and tax incentive of businesses.

Industries that invest more in R&D, training, and capital equipment receive more tax benefits than those which don't. The construction industry invests heavily in machinery so it would receive tax incentives almost double the cost of the carbon tax. The information sector (including Internet providers, data centers, and the like) would receive tax incentives nearly eight times larger than its carbon tax costs due to significant tax benefits for IT equipment expenditures. The computer equipment industry would gain a R&D tax credit nearly three times the cost of the carbon tax.

*Industries that invest more in R&D, training, and capital equipment receive more tax benefits than those which don't.*

But energy-intensive industries like chemical, cement, and iron and steel manufacturing would pay more than others. These three industries would pay 44 percent of manufacturing carbon tax costs and incur a net cost even with the tax incentives and non-combustible energy use, such as energy used to produce feedstock, exempt from the carbon tax. However, even though their carbon costs are high, the innovation tax incentives reduce their costs by 47 percent compared to instituting a traditional carbon tax with no tax incentives. In fact, the most energy intensive industries would incur net costs 44 percent below those levied by a traditional carbon tax.

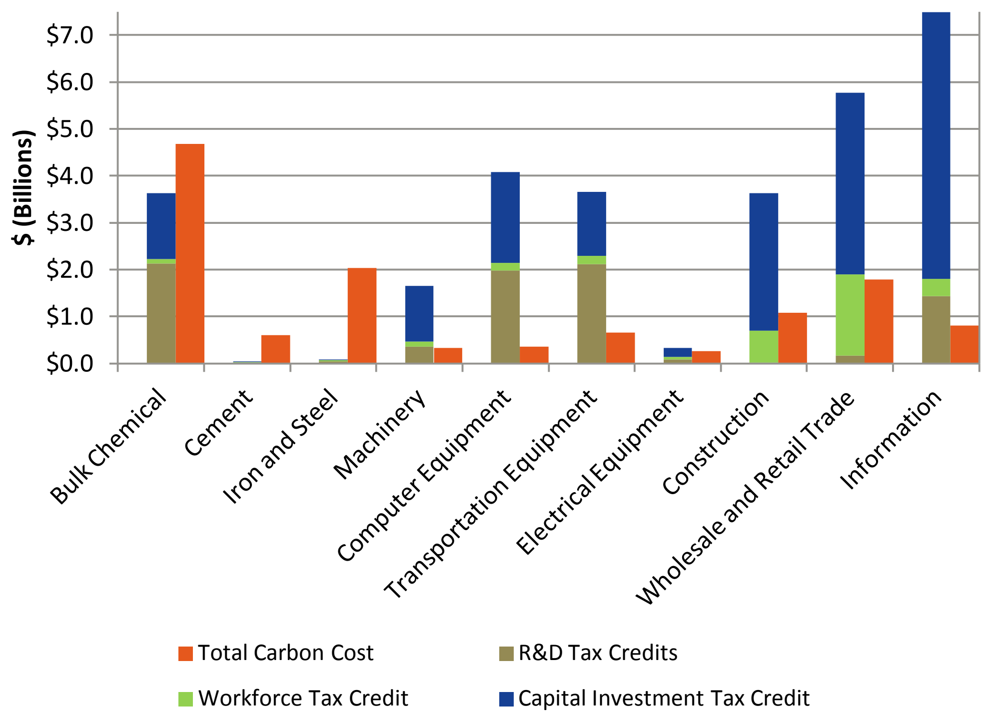
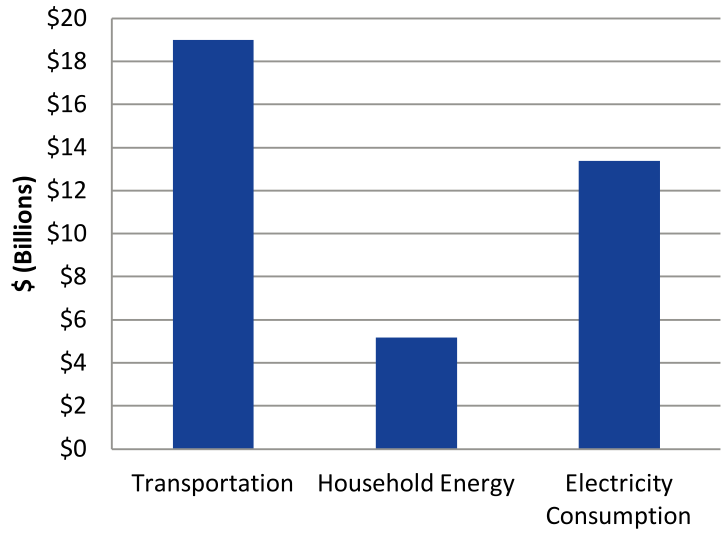



**Figure 3: Total carbon costs and tax incentives for select industries. Tax incentive benefits are the additional benefits gained by businesses if each tax incentive was expanded as described above.**

## Households

Households' total direct carbon tax cost would come from three energy uses: transportation[40], direct energy use in the household (such as burning oil for heat), and electricity.[41] Without pass through of corporate tax incentives to consumers, the carbon tax would cost the average household $326 a year — a total of $36 billion.[42]




*Over time, businesses will pass through most of the net tax benefits (tax incentives less carbon tax costs) to consumers as lower priced goods and services.*

**Figure 4: Cost of carbon tax to consumers by energy consumption category.**

So aren't consumers unfairly burdened by the carbon tax while businesses receive significant tax offsets? The short answer is no. Over time, businesses will pass through most of the net tax benefits (tax incentives less carbon tax costs) to consumers as lower priced goods and services. So while consumer costs do go up $36 billion, little of the $21 billion net tax incentive benefits would stay with companies.

The energy consumed by companies that produce food, industrial goods, and services represent almost 29 percent of household carbon emissions.[43] A carbon tax would raise the cost of energy, thus increase the cost of making products, and hence the products' price. But the proposed tax incentives provide significant tax benefits that would offset or exceed the cost of the carbon tax for most businesses. Therefore, the cost of producing goods and services should decrease or stay the same for most businesses.

But there is little consensus as to how much carbon tax costs and innovation incentives would be passed on to consumers. Traditionally, the theory goes like this: a corporate tax would increase the cost of capital, so businesses would invest less domestically in things like factories, machinery, and other equipment. Over time, the supply of goods and services would decrease so prices would rise. Traditional economists therefore believe that increasing business costs through corporate taxation eventually increases the price of goods and services.[44] Other economists believe that costs would be passed on to workers as reduced wages.[45] Also costs would be passed on to foreign customers as higher priced exported goods, affecting competitiveness.[46] But in general, it is accepted that U.S. consumers ultimately incur at least some, if not most, of the cost of corporate taxes.

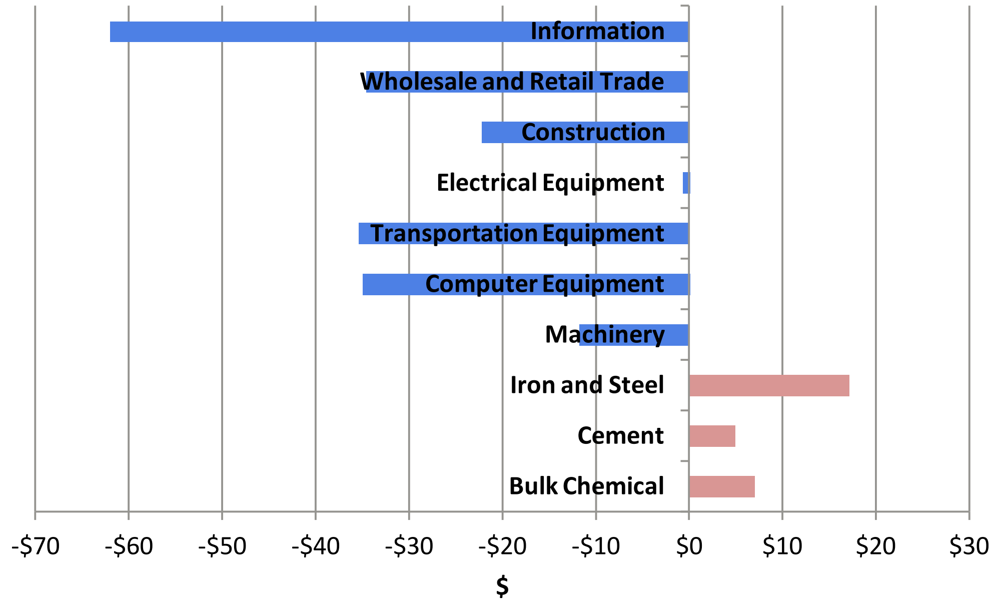



**Figure 5: Average change in the household cost of goods and services sold by specific industries. Assumes industries pass all cost or savings to consumers and assumes no income or expenditure distribution.**

And energy and environmental policy studies typically assume that companies pass through most costs to consumers as higher prices.[47] We agree and assume that over time most tax *benefits* are similarly passed through to consumers in the form of lower prices. Because tax incentives could increase after tax corporate profits, we also assume a small portion of net tax benefits would be passed on to shareholders as dividends.

We estimated above that businesses would incur a total carbon cost of roughly $54 billion. We also calculated that businesses would benefit from $75 billion in tax incentives. Therefore, we estimate that businesses would gain a net benefit of $21 billion (total tax incentives less total carbon costs). Dividend payments represent 5.5 percent of U.S. GDP, so the share of net benefits used for dividend payments totals $1.15 billion.[48] As a result, the remaining $19.9 billion would be passed through to consumers as lower priced goods and services.

But not all industries would see a net benefit, so not all products and services would decrease in price. Prices of products and services from industries with high carbon costs, low innovation investment benefits, or both would increase (for example, chemicals, cement, iron and steel). Prices of products and services from industries with low carbon costs, high innovation investment benefits, or both would decrease (computer manufacturing, information, and construction). Figure 5 provides the annual change in the cost of goods and services per household for select industries to provide an example.[49]

Accounting for business tax benefit pass through in the form of lower priced goods and services households would pay $16.7 billion, or $145 per year. Most of this — $15 billion

— represents the amount that would be invested in the Clean Energy Innovation Trust Fund (Figure 6).[50]

Many believe that households would only be willing to support clean energy innovation, limit climate change impacts, and reduce oil imports if added costs don't exceed a specific threshold, otherwise defined as a consumers' willingness to pay (WTP). There is a wide range of estimates of what this threshold is or, in other words, what is considered "too high" a cost for households to pay. The scholarly literature provides estimates ranging from $22 to $3,624 a year and a majority consensus of these studies fall within $100 to $300 a year.[51] But as Johnson and Nemet point out, each study uses different metrics and procedures to estimate a household's WTP so an apples-to-apples comparison of these studies is difficult.[52]

Instead we use the consensus range to assess whether this proposal would be considered "agreeable" to consumers. The total annual carbon cost to households, $326, does not fall within the consensus range. But with pass through, households would incur in the short-run net costs of $145 per year (nearly all of which includes the $15 billion invested in clean energy innovation). This falls well within the low end of the literatures consensus range and theoretically should reduce citizen opposition towards the proposal.

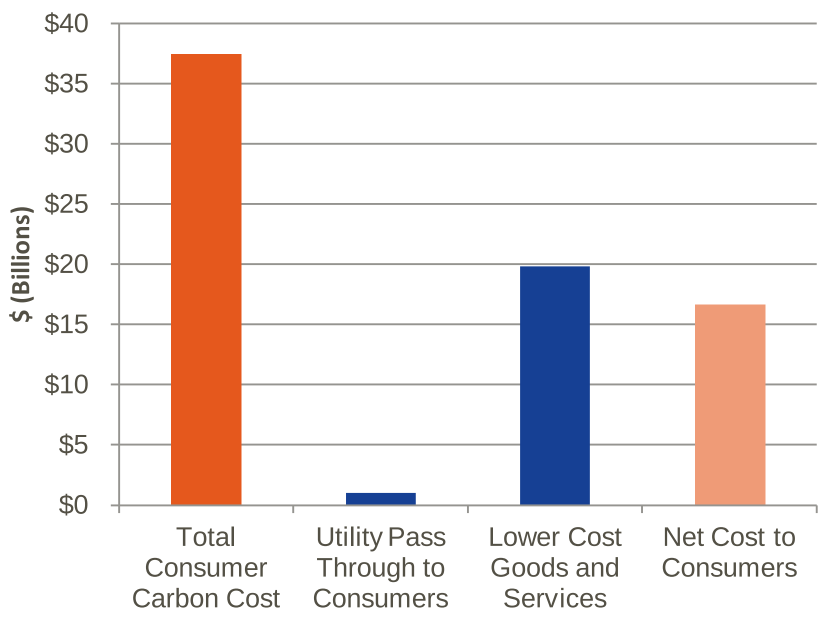



**Figure 6: Net cost of carbon pass through policy to households. Net Cost to Households = Total Carbon Cost - Utility Pass Through - Lower Cost Goods and Services**

But this doesn't mean there won't be real short-term impacts on consumers. Consumers would see small increases in heating, gasoline, and electricity bills. And products linked with energy-intensive industries like cement, steel, and iron, would increase in price as well, while other products and services would decline in price. Our proposal aims to significantly reduce these costs while spurring vital clean energy innovation, increased productivity, and economic growth. In fact, the second-order benefits suggest that this proposal is pro-consumer.

## Analysis of Second Order Impacts

### R&D Tax Credits

The R&D tax credit would spur additional investment in private-sector R&D, which would increase productivity and grow the economy. The first step is to estimate how much private-sector research is likely to be spurred by increasing the ASC from 14 percent to 50 percent (and increasing the base from 50 percent to 75 percent). We estimated above that increasing the credit to 50 percent would provide $8.5 billion in tax credits for private-sector R&D. Estimates of the amount of R&D spurred by the tax credit vary considerably from $1.10 to $2.96 for every $1 of credit given.[53] For this analysis, we conservatively estimate that for every $1 in tax credit, $1.25 in additional R&D would be induced. This suggests that increasing the ASC from 14 percent to 50 percent would spur an additional $10.3 billion in private-sector research in the United States.

Increasing R&D investment also boosts productivity. Both Griliches and Kortum estimate that a 1 percent increase in the stock of research would boost productivity 0.3 percent.[54] Coe and Helpman estimate that for every 1 percent increase in the stock of research, productivity would increase 0.23 percent.[55] In this analysis we use the lower number of 0.23 percent and calculate that increasing the ASC from 14 percent to 50 percent would induce an additional $10.3 billion in R&D, increasing the stock of corporate R&D by 0.32 percent. We then estimate that this would lead to a 0.074 percent increase in annual productivity. With an annual GDP of approximately $14 trillion, this equates to a $9.5 billion increase in economic output in the second year, but because of compound growth in GDP, by year 15 the impact is $90.6 billion.[56]

The same methodology is used to calculate second-order benefits of the collaborative R&D tax credit. We estimated above that creating a flat collaborative R&D tax credit of 40 percent would provide $3 billion in tax credits for private-sector collaborative research. We also estimated that for every $1 in tax credit $1.25 in additional collaborative R&D would be induced. As a result, we calculate the credit would spur an additional $3.7 billion in research.

This additional research would increase the stock of corporate R&D by 0.115 percent. We estimate that this would lead to a 0.027 percent increase in annual productivity, which equates to a $3.5 billion increase in economic output in the second year. By year 15, the impact on GDP would be $30.9 billion.

### Workforce Training Tax Credit

Investing more in on-the-job training would also boost productivity and spur economic growth. The first step is to estimate how much job training is likely to be spurred by the tax credit. We estimated above that expanding the ASC (to 50 percent) to include job training expenditures would provide a $12 billion tax credit to businesses. But we are not aware of studies exploring the relationship between the cost of job training and additional investment in job training. So we use studies on the relationship of general business capital costs to investment as a proxy. Hassett and Hubbard found that lowering the after-tax cost of business capital would lead to 0.5 to 1 percent increase in business capital investment.[57] Cabellero also found that a 1 percent decrease in capital cost would result in a 1 percent increase in investment.[58] For the purpose of this analysis, we will assume that a 1 percent reduction in the cost of job training would spur an additional 0.5 percent in training expenditures. This suggests that expanding the ASC (to 50 percent) to include workforce training expenditures would spur an additional $6 billion in private-sector job training in the United States.

There are a wide range of economic studies on the effect of increasing workforce training on productivity. Using German business survey data, Zwiek found that increasing the stock of a trained workforce 1 percent boosts productivity 0.3 to 0.7 percent.[59] Using British employment data, Dearden, Reed, and Van Reenen (2005) found that for every 1 percent increase in the stock of trained employees productivity would increase by 0.6 percent.[60] Conti calculated an increase of 0.4 percent using employer survey data from Italy.[61] But these findings are limited and don't account for the loss of productivity from training during working hours. Almeida and Carneiro recently found that on-the-job training reduced productivity by as much as 25 percent during the training period, though training still increased net productivity in the long term.[62] Given the limitations found in the literature, we go with the low estimate and assume that a 1 percent increase in the stock of workforce training boosts productivity 0.3 percent.

Calculating the stock of U.S. workforce training is an uncertain task. Studies differ on the methodology for doing so and we are unaware of any publically available estimates. For the purpose of this analysis we estimate workforce training stock using recent ASTD estimates of U.S. workforce training expenditures, and calculate that training investments have grown annually by roughly 1.5 percent. We assume that workforce training depreciates at the same rate as R&D or 5 percent annually. As a result, we calculate a workforce training stock of $1.8 trillion.[63] Therefore, an additional $6 billion in workforce training investment would increase the stock of workforce training by 0.33 percent. We estimate that this would lead to a 0.098 percent increase in productivity (0.3 multiplied by 0.33), which equates to a $12.7 billion increase in economic output in the second year. By year 15, the impact on GDP would be $114 billion.

### Capital Equipment Investment Tax Credit

Reducing the after-tax cost of capital equipment would induce businesses to invest more, which boosts productivity and thus economic growth. The first step is to estimate how much machinery and IT equipment purchases would likely be spurred by a 50 percent investment tax credit (with a base of 75 percent). We estimated above that the investment tax credit in replacement of expensing would provide a $51.5 billion in tax benefit to businesses; however, the amount of additional capital equipment expenditures spurred by a tax credit or reduction in cost varies. Chirinko, Fazzari, and Meyer found that reducing the cost of capital by 1 percent increased capital investment by 0.25 percent.[64] Caballero, Engel, and Haltiwanger found a larger elasticity range of 1 percent to 2 percent in the manufacturing sector.[65] Bond and Xing found that a 1 percent cost reduction in capital equipment would spur a 1 percent in equipment purchases.[66] And the Federal Reserve's Coulibay and Millar concurred, finding capital equipment investment would increase by 0.8 percent to 1 percent.[67]

For this analysis, we estimate that a 1 percent reduction in the after-tax cost of capital equipment due to the ITC would induce a 1 percent increase in capital equipment investment. As a result, a 50 percent ITC would reduce the cost of capital equipment investment by 7.5 percent (given an annual investment of $690 billion). This suggests the tax credit would induce an additional $51.5 billion in equipment investment.

Investing more in capital equipment boosts productivity, but by how much depends on the type of capital equipment. Wilson found that increasing the stock of computers increased productivity by 0.54 percent, compared to 0.70 percent for communication equipment, and 0.81 percent for software.[68] DeLong estimated that a 1 percent increase in the stock of industrial machinery would induce a 0.33 percent increase in productivity.[69] In recognition of these differences, we calculate productivity gains individually for each type of equipment investment.

*In total, the tax incentives would induce $77.5 billion in additional investment annually in R&D, workforce training, and capital equipment.*

Using Bureau of Economic Analysis data we estimated machinery and IT stock to be $5.739 trillion.[70] We calculate that a 30 percent ITC would induce an additional $51.5 billion in equipment purchases. Using the same data used to calculate total capital equipment investment, we can reasonably estimate how much investment in each equipment type would be induced by the ITC.[71] Using the values for productivity elasticity associated with each type of equipment, we estimate that total productivity would increase by 0.519 percent (Table 3). With an annual GDP of approximately $14 trillion, this equates to a $65.5 billion increase in economic output in the second year, but because of compound growth in GDP, by year 15 the impact is $487 billion.

| EQUIPMENT TYPE | PRODUCTIVITY ELASTICITY | SHARE OF ADDITIONAL INVESTMENT | INCREASE IN CAPITAL EQUIPMENT STOCK | PRODUCTIVITY INCREASE |
|---|---|---|---|---|
| Computers and related equipment | 0.54% | $6.1 billion | 0.108% | 0.0585% |
| Software | 0.81% | $18.6 billion | 0.325% | 0.2634% |
| Communication Equipment | 0.7% | $6.4 billion | 0.114% | 0.0797% |
| Industrial Machinery | 0.33% | $20.4 billion | 0.356% | 0.1175% |
| Total | | $51.5 billion | | 0.519% |

**Table 3: Additional investment and productivity gains per eligible equipment type in response to ITC**

## Long Term Impact on Consumers and Tax Revenues

The tax incentives would spur significant, cumulative economic benefits that would lead to significant net benefits to U.S. consumers (and workers) in the long term. In total, the tax incentives would induce $77.5 billion in additional investment annually in R&D, workforce training, and capital equipment. This additional investment would boost productivity by a combined 0.718 percent and grow the economy by $722.5 billion in added GDP by year 15 (Table 4).

A significant share of this would be passed on to consumers. The Bureau of Economic Analysis calculated that consumer spending represents roughly 70 percent of GDP.[72] This means that 70 percent or $506 billion in economic output spurred by the tax incentives would impact households. Given 115 million U.S. households, this represents roughly $4,400 in additional household income, well over annual household carbon tax costs.

Moreover, the cumulative additional federal tax revenues would increase to $1.211 trillion in year fifteen, providing a net surplus of $143.5 billion in tax revenue (Table 5).[73] In other words, in real net present value terms the tax incentives collectively produce net revenue gains over time. As such, implementing tax incentives targeting the building blocks of innovation not only spurs economic growth, but ultimately creates more revenue for the federal government than they cost.

| TAX INCENTIVE | ANNUAL FORGONE TAX REVENUE | ANNUAL INDUCED INVESTMENT | ANNUAL PRODUCTIVITY GAIN | LONG TERM ECONOMIC BENEFIT |
|---|---|---|---|---|
| 50% R&D Tax Credit (ASC) | $8.5 billion | $10.3 billion | 0.074% | $90.6 billion in added GDP |
| 40% Collaborative R&D Tax Credit | $3 billion | $3.7 billion | 0.027% | $30.9 billion in added GDP |
| 50% Workforce Training Tax Credit | $12 billion | $12 billion | 0.098% | $114 billion in added GDP |
| 50% Capital Equipment Investment Tax Credit | $51.5 billion | $51.5 billion | 0.519% | $487 billion in added GDP |
| Total | $75 billion | $77.5 billion | 0.718% | $722.5 billion |

**Table 4: Estimated costs and benefits of tax incentives over 15 years**

Notwithstanding that this is a pro-growth package, some will argue that this proposal smacks of “industrial policy” whereby government inappropriately picks winners and losers. But government already does this when it lets companies emit carbon without charging them the full cost. High emitters are being picked as de-facto winners. The carbon tax actually gets government out of the business of picking winners.

With regard to the tax incentives, some, particularly conventional neoclassical economists will argue that the tax code should not favor particular activities over others. As Congressional Research Service tax economist Jane Gravelle argues, “Conventional economic analysis of capital income taxation suggests that providing subsidies for particular types of investment is inefficient. Economic analysis suggests that capital is allocated efficiently and the economy is more productive, absent some market failure or other existing distortion, if all capital income is taxed at the same rate."[74] This is why many conventional neoclassical economists oppose incentives for capital investment, arguing that the foregone revenues would be better spent on deficit reduction. For example, Gravelle argues that "the most serious problem with an investment tax credit is that it absorbs tax revenues that could probably be used in ways that would be more successful in achieving the goals of an efficient economy."[75]

But the definition of efficient is a tautology: something is efficient if the market invests in it and the market only invests in things that are efficient. But if the externalities from investing in capital equipment are higher than investing in, say, subprime mortgages, then society is better off if the tax code encourages more investment in capital equipment, even if that means that effective tax rate on income from subprime mortgages is marginally higher. And this is exactly the case with all three activities targeted: R&D, capital equipment expenditures and workforce training. All three have significant externalities, meaning that the market, left to itself, will under invest in them, resulting in lower levels of overall economic growth.[76]

*Notwithstanding that this is a pro-growth package, some will argue that this proposal smacks of "industrial policy" whereby government inappropriately picks winners and losers. But government already does this when it lets companies emit carbon without charging them the full cost.*

| TAX INCENTIVE | ADDITIONAL CUMULATIVE TAX REVENUE IN NPV | CUMULATIVE TAX CREDIT COST TO TREASURY | NET COST/SURPLUS |
|---|---|---|---|
| 50% R&D Tax Credit (ASC) | $120 billion | $127.5 billion | -$7.5 billion |
| 40% Collaborative R&D Tax Credit | $45 billion | $45 billion | $0 billion |
| 50% Workforce Training Tax Credit | $161 billion | $90 billion | $71 billion |
| 30% Capital Equipment Investment Tax Credit | $853 billion | $773 billion | $80 billion |
| Total | $1.211 trillion | $1.063 trillion | $143.5 billion |

**Table 5: Net cost/benefit of tax incentives over 15 years**

At the end of the day, this opposition is largely ideological, rather than empirical. Even when neoclassical economists show that the incentives spur growth, they oppose them. We saw this with the seminal 1979 article by Larry Summers and Alan Auerbach, who modeled the impact of instituting an investment tax credit (ITC). Not surprisingly, they found that a 12 percent ITC would increase the stock of equipment by 18 percent while boosting GDP.[77] But even with this, they opposed the policy, for their model also showed that the tax credit would lead to slightly higher interest rates and crowding out of other "investment sectors." What exactly were these sectors? Housing. As a result, they opposed an investment tax credit that would grow the economy and boost manufacturing competitiveness because it would distort allocation efficiency by leading to more investment in manufacturing and less in housing. As a result, since 1986 the presumption has been, incorrectly, against investment incentives.

*A carbon tax is a simple and straightforward method for raising revenue to invest in what we want more of — affordable clean energy, jobs, productivity, innovation, and economic growth — and to reduce what we want less of — fossil fuel consumption.*

## CONCLUSION

The U.S. is at risk of losing its ability to lead the emerging clean energy economy while failing to reduce oil imports and mitigate climate change. Climate and energy proposals have been unsuccessful, offering complex policies that would significantly increase energy costs, harm global competitiveness, and fail to spur innovation. This proposal offers an alternative. By focusing on the fundamental building blocks of innovation — investment in R&D, capital equipment, and job training — U.S. workers, households, and most businesses would be better off in the long term.

But proposing a carbon tax is not politically popular. A carbon tax is a simple and straightforward method for raising revenue to invest in what we want more of — affordable clean energy, jobs, productivity, innovation, and economic growth — and to reduce what we want less of — fossil fuel consumption. Other methods of funding could be used and by no means is a carbon tax the sole solution. But the purpose of this proposal is not necessarily to prove the efficacy of a carbon tax, but to show that clean energy innovation, improving U.S. competitiveness, and boosting economic growth are not mutually exclusive.

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6. In fact, the number of industrial process energy uses that emit CO2 is relatively small and relegated to only a handful of industries. See IPCC industrial process greenhouse gas guidelines for a detailed discussion on these energy uses at: http://www.ipcc-nggip.iges.or.jp/public/gl/guidelin/ch2ref1.pdf.
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36. U.S. $CO_2$ emission forecasts and data can be found in the EIA Annual Energy Outlook at http://www.eia.doe.gov/oiaf/forecasting.html. For the purposes of this analysis, the 2010 Outlook data was used.
37. Using Bureau of Economic Analysis data (All Fixed Assets Table 3.7E), we calculated what type of equipment expenditures were made per industry and only counted industrial machinery and IT related purchases.
38. Federal R&D tax credit claims data was collected from the NSF 2010 Science and Engineering Indicators Table 4-25. For example, the Information Sector (NAISC code 51), represented 11.8% of total business R&D credit, so they were assumed to take 11.8% of the total R&D credit.
39. Industry wage level was determined by multiplying the average hourly earnings per industry by the total number of workers per industry. Average hourly earnings data were collected from the Bureau of Labor

Statistics Occupational Employment Statistics dataset (see: http://www.bls.gov/oes/current/naics2_11.htm).

40. The full cost of domestic rail and air travel is assumed to be passed on completely to consumers.
41. For perspective, a $15/ton CO2 tax would increase the cost of a gallon of gasoline by 13 cents and coal powered electricity by 1 cent per kWh. Currently, EPA estimates that gasoline equals 19.4 pounds of CO2/gallon. Coal based electricity equals 2.095 pounds of CO2/kWh. The conversion value of pounds to metric tons CO2 is 2204.62 pounds/mT CO2.
42. Assuming 115 million households and not accounting for income variations.
43. To calculate, we used average per capita carbon emission per expenditure data from Table 4 of Boyce and Riddle (2007).
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48. We used Bureau of Economic Analysis data on corporate net dividend payments (National products and Accounts Table 6.20D, see http://www.bea.gov/national/nipaweb/SelectTable.asp) totaling $798 billion. Assuming U.S. GDP of $14.3 trillion, the dividend-to-GDP ratio is 5.5%.
49. We simply assume that the total cost or benefit to an industry is passed through equally to all households, set at 115 million.
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71. We used the same Bureau of Economic Analysis data (All Fixed Assets Table 3.7E) used to calculate total equipment (machinery and IT) expenditures. We then grouped equipment type data into four categories – computers and related equipment, software, communication equipment, and machinery. To calculate the share of total expenditures for each eligible equipment category, we divided the category total by total equipment expenditure ($711 billion). As a result, computers and related equipment is 12% of investments, software is 36%, communication equipment is 12.6%, and machinery is 39.4%.
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## ACKNOWLEDGEMENTS

The authors wish to thank the following individuals for providing well thought out input to this report: Matthew Hourihan, ITIF; Alex Kragie, Coalition for Green Capital; Bill Bonvillian, MIT; Steve Norton, ITIF; Luke Stewart, ITIF and Kathryn Angstadt and Sue Wunder for expert editorial assistance. Any errors or omissions are the authors' alone.


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