Tax Reforms to Advance Energy Efficiency

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Executive Summary

As the 113th Congress convenes and President Obama begins his second term, "tax reform" is becoming one of the key catchphrases. Both Democrats and Republicans are supporting tax reform and actual work on legislation is likely to take place in 2013. Key elements of reform are likely to include simplifying the tax code in some respects and reducing marginal tax rates by eliminating many credits and deductions. Tax reform provides us with an opportunity to remove barriers to efficiency investments imbedded in the current tax code and to use the tax code as a tool to support energy efficiency in the future more than current provisions do.

Discussions about tax reform are just beginning and given the complexities and many political issues involved, it may take a few years before any reform is enacted. To promote energy efficiency as part of this process, we recommend that policymakers consider the following reforms in a revised tax code:

1. **Refine depreciation periods to more accurately reflect the average service lives of equipment.** Under current law, depreciation periods for many types of equipment are written into the law, and some of these depreciation periods bear little relationship to typical service lives in the field. Particularly egregious are the depreciation periods for equipment in commercial buildings, including heating and cooling systems, lighting fixtures and controls, and roofing systems. Currently, this equipment is depreciated over 39 years, the same depreciation period as is used for a new commercial building. However, lighting, cooling and heating equipment and roof systems typically have lives of 15-25 years, not 39 years. The 39-year depreciation period acts as a barrier to energy efficiency as many businesses will choose to repair equipment when it fails so as to avoid having to write off the un-depreciated value. Since equipment has been steadily increasing in efficiency, encouraging equipment replacement will save energy and also create sales and jobs for equipment manufacturers.

   Likewise, in the case of CHP systems, the depreciation period varies as a function of who owns the equipment and how it is used, even though often the same equipment is used by a variety of owners and for a variety of applications. We recommend that a single service life be selected for all owners, perhaps 15 years.

   Our preferred choice is to delegate the choice of depreciation period to the IRS, with instructions to use depreciation periods that match the average service life of equipment. In this way, Congress gets out of the weeds and this also allows for the fact that technology changes much more quickly than the law can change. If this is not possible, we suggest resetting depreciation periods based on the best data on service lives currently available.

2. **Refine existing energy efficiency tax incentives** to focus on using a market transformation approach to promote energy-saving technologies and practices that have a limited market share today, but where temporary federal incentives can advance these technologies and practices to the point where they can prosper without federal incentives. Tax incentives first enacted in 2005 illustrate how a focus on advanced technologies can help to transform markets. For example, high-efficiency appliances, heating and cooling equipment, and new homes now have much higher market shares due in significant part to these tax incentives, and in the case of appliances,

the original qualification levels are now standard practice and qualification levels have been tightened twice. Going forward, limited federal funds should be provided in four areas:

a. Very high-efficiency appliances, heat and cooling equipment, and windows
b. Very-efficient new homes
c. Efficient commercial buildings
d. Comprehensive retrofits to existing homes

We conducted an analysis on the costs to the Treasury of these incentives per unit of energy saved. Overall, the incentives we examined cost the federal government only $0.28 per million British thermal unit (Btu) saved—more than an order of magnitude less than the cost of the energy resources they save.[1] All of the options analyzed had lifetime costs under $2.50 per million Btu.

3. **Promote capital investment in manufacturing** by using low-cost approaches to spur increases in capital investment. Much of the equipment and production processes in America's factories are decades old and not as efficient as modern equipment and processes in use by many of our international competitors. Modernizing these factories will allow them to better compete in world markets by improving product quality and reducing product costs, including through reduced energy use. As we emerge from the Great Recession, many industrial firms have capital to invest, but a nudge from the tax code could spur substantial additional investments here in the U.S. We suggest three possible tax strategies that could spur investment but with low cost to the federal Treasury:

    a. Provide a low tax rate for repatriation of company profits *provided* these repatriated profits are used to increase a company's capital investments relative to their average capital investments in recent years.
    b. Allow accelerated depreciation on increased capital investments in production capacity, allowing companies to reduce their near-term taxes.
    c. Provide repayable tax incentives for increased capital investments. The credit would be taken on taxes in the year the expenses were made, but then the credit would be paid back to the Treasury in subsequent years.

    We recommend that at least two of these approaches be enacted. The first approach would benefit only large multinational firms, while the second and/or third approach should be included in order to benefit firms that primarily serve the domestic market. A firm would only be able to use one of the approaches.

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[1] For example, the Energy Information Administration, in their just-released *2013 Annual Energy Outlook,* estimates that natural gas will average $7.83 per Btu over the 2012-2040 period. See http://www.eia.gov/forecasts/aeo/er/pdf/0383er%282013%29.pdf.

For the commercial sector, a different approach is needed since much of capital investment is for land and buildings and not for energy-consuming systems. We suggest an option to provide accelerated depreciation for purchases of high-efficiency equipment in the commercial sector.

4. **Add a price on emissions.** Our present tax system largely taxes things that result from productive economic activity—wages, non-wage income, and corporate profits. An alternative is to collect some revenue from things that produce negative economic effects, such as cigarettes, alcohol, and (as proposed in this report) pollution. In the economics literature, these are now commonly known as Pigovian taxes. Many prominent economists and politicians have spoken in favor of using Pigovian taxes to regulate pollution. We are not suggesting that all revenues be collected from Pigovian taxes, but instead that an increased portion of the current tax burden comes from these taxes. We recommend working from a proposal examined by the Bipartisan Policy Center Debt Reduction Task Force that would set a fee of $23 per ton of carbon dioxide emissions beginning in 2018, increasing at 5.8% annually. They estimate that such a fee would raise about $1.1 trillion by 2025 while reducing emissions of greenhouse gasses to about 10% of 2005 levels. The revenue raised could pay for simplifying the tax code but with lower tax rates. For example, the Bipartisan Policy Center estimates a 2-tier 15-27% income tax rate would cost the Treasury $1.3 trillion over the 2012-2021 period relative to a modified base forecast that includes extension of the "Bush tax cuts."

5. **Consider ways to remove disincentives to energy efficiency investment from the business tax code.** Under the current tax code, individuals pay taxes on their income, and most expenses are not deductible. Exceptions may include interest on home mortgages and high medical expenses, but not energy expenses. Business taxes work differently. Businesses are taxed on their profits and virtually all expenses are deductible, including energy costs, which create several disincentives to energy efficiency investments. First, since energy bills count as a business expense and are subtracted from the total amount of taxable income, the federal government is effectively "paying" 25% of business energy costs, based on the average effective business tax rate of about 25% and sometimes as much as 35% of a business's energy costs (the maximum business tax rate). Subsidizing energy costs enables higher energy consumption. Second, when businesses do invest in energy efficiency, a portion of the energy savings goes to the federal government in the form of higher taxes (e.g., 25% for a business with the typical effective rate of 25%). When the full value of the savings does not accrue to the firm, the incentive to make investments goes down. This is the flip-side of the first disincentive.

   To address this problem we suggest two alternatives. First, the business tax could be shifted from a tax on profits to a tax on revenues. The tax code would be much simpler, the average tax rate could be reduced to about 3.25% (since revenues are much greater than profits), and energy (as well as other expenses) would no longer be deductible. A credit would be provided for taxes paid by upstream suppliers so that the same expense is not taxed repeatedly. This approach is a radical shift that needs further study. A more limited change would be to exclude energy costs from allowable expenses, except for energy-intensive industries. Just as household medical expenses are no longer deductible except for those with high medical expenses, the same approach could be used for energy. Again, further study is needed.

6. **Eliminate or reduce subsidies that target the fossil fuel industry.** We did not examine these subsidies at length, but several other studies indicate that special treatment for fossil fuel industries cost the federal government around $12-13 billion annually. Broader tax incentives, such as Master Limited Partnerships, are not included in these figures, even though some of these incentives disproportionately benefit the oil and gas industries and other traditional energy supplies. We have not researched this issue in depth, but no discussion of tax reform is complete without at least mentioning that subsidies for traditional energy sources "tilt the playing field" towards increased use of traditional fuels, at the expense of energy efficiency. Most of these subsidies should probably be eliminated or reduced, leaving only subsidies for advanced technologies and practices that could benefit from a temporary federal incentive until they become well established in the market.

These reforms work in synergistic ways. Refining depreciation periods and improving the business tax both remove barriers to efficiency investments in the current tax code. A price on emissions and reducing fossil fuel subsidies help all energy sources to better compete on a level playing field. And tax incentives for advanced energy-saving technologies/practices and for increased capital investment in manufacturing both save energy and help U.S. businesses to be more competitive so they can better compete internationally as well as contribute to a growing domestic economy.

We examined the impacts of three of these provisions (depreciation, energy efficiency incentives, and capital investment) on the federal budget and of the largest provision (energy efficiency tax incentives) on the overall U.S. economy. This first analysis found that these three provisions will actually increase federal tax collections as the extra revenue gained will be about $30 billion more over a 15-year period than the cost of the incentives. This extra revenue is driven by two factors: (a) as energy use is reduced, business profits increase, and a portion of these extra profits are paid in taxes; and (b) a portion of the capital investment provision will be paid out of repatriated profits that would not be available for taxation if these profits remain "parked" overseas.

To estimate the impact of the energy efficiency tax incentives on the overall economy, we used ACEEE's DEEPER input-output model of the U.S. economy. The DEEPER model looks at cash flow in different sectors of the economy and estimates the impact of efficiency investments relative to the investments in conventional energy supplies that are displaced. DEEPER looks both at the investments and the impact of energy savings that are available to be re-spent. Overall, we found that these energy efficiency tax incentives will result in a significant increase in employment—an average of 164,000 jobs over the 2014-2030 period. The job gains start at about 52,000 in 2014 and steadily increase to about 300,000 in the final years. These job gains are driven by both increasing investments in energy-efficient products and services as well as reinvestment of the energy savings. Gross domestic product (GDP) also increases modestly as a result of this provision, with GDP up an average of $8.3 billion annually over the 2014-2030 period. Interestingly, since federal tax revenues are projected to average about 19% of GDP, the macroeconomic impacts of these tax incentives will increase federal revenue by about $1.6 billion per year *in addition* to the direct benefits discussed in the paragraph above.

If enacted, these reforms could reduce barriers to cost-effective energy efficiency investments and contribute toward increase investments in efficiency. With careful attention to details, the tax code can be an enabler to efficiency investments and not a barrier.

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Introduction

As the 113th Congress convenes and President Obama begins his second term, "tax reform" is becoming one of the key catchphrases. Both Democrats and Republicans agree that some kind of reform is needed, and tend to agree that the tax code should be simplified and marginal tax rates reduced by eliminating many credits and deductions. Politicians on both sides of the aisle may disagree on how to implement these key elements and what they might look like in an ideal tax code. The important lesson to take away from all the rhetoric is that some kind of meaningful tax reform is likely to happen in the next few years, with Congress and the Administration beginning the process in 2013.

Cost-effective energy efficiency investments are among the actions we would like to encourage and not discourage. Unfortunately, in some cases the current tax code acts as a barrier to energy efficiency investments. An enormous potential exists for individuals and businesses to reduce energy consumption through currently-available energy efficiency measures, as well as innovative technologies in the future. For example, a January 2012 ACEEE study on long-term efficiency opportunities estimated available energy savings average about 52-69% in the residential sector, 45-62% in the commercial sector, and 36-51% in the industrial sector (Laitner et al. 2012). Realization of these energy savings will help make American businesses more productive; improve their competitive position relative to foreign firms; and reduce the security, cost, and environmental impacts of high energy use.

Tax reform provides us with an opportunity to remove current barriers to efficiency investments and to use the tax code as a tool to support future energy efficiency investments. The challenge is in proposing policies that encourage energy efficiency while still keeping with a key goal of tax reform—simplifying the tax code. We searched available literature and could find very little written on this subject, which motivated us to undertake this research. Much was written around a century ago when the income tax was first begun in the 1890s, refined following approval of the 16th amendment authorizing a federal tax on property in 1913, and then tuned in the 1920s (see Gordon 2011), but we could find surprisingly little written in recent years.

In this report, we suggest tax policies in six areas that could be used to remove barriers to energy efficiency investments and to encourage energy efficiency investments. These are:

1. Provide targeted but temporary incentives for cutting-edge energy-efficient equipment
2. Rationalize equipment depreciation schedules
3. Promote capital investments, particularly in industry
4. Consider emissions fees
5. Tax business income instead of business profits
6. Reduce or eliminate subsidies for traditional energy sources

Most of these proposals began as a series of ACEEE working papers, for which we solicited review (Nadel 2012; Nadel and Elliott 2012; Nadel and Farley 2012a, 2012b; Sachs et al. 2012). This report is designed to concisely summarize the key recommendations that have emerged from this work. For further details, readers are directed to the earlier working papers. As needed, this summary report addresses the many suggestions and comments that we have received in the past several months since we published the first of the working papers.

Targeted Tax Incentives for Cutting-Edge High-Efficiency Equipment and Practices[2]

The majority of the investment needed to capture available energy efficiency opportunities will come from the private market, since the private market has the most capital and because it is the market, in the form of consumers and businesses, that benefits from energy efficiency savings. Additional investments will be driven by utility energy efficiency incentives and a variety of federal, state, and local policies. But federal tax incentives also have an important role to play that cannot be filled by private capital or other policies. Limited federal incentives can have a catalyzing effect, spurring large energy and cost savings and thereby helping our economy to grow.

We recognize that serious tax reform will include efforts to broaden the base by reducing or eliminating many tax expenditures. However, there are opportunities for Congress to continue to promote energy efficiency improvements in the United States within the confines of a constrained budget for tax expenditures. We believe some tax incentives should be preserved as part of tax reform, but that they should be modest, targeted, and of proven effectiveness, and have scheduled review or sunset dates. The very limited funds available for tax incentives should maximize the "bang per buck" of federal expenditures.

LESSONS FROM PRIOR ENERGY EFFICIENCY TAX INCENTIVES

Tax incentives were enacted during the 1970s to stimulate adoption of both residential and industrial energy efficiency measures. The Energy Tax Act of 1978 included a 15% tax credit up to a maximum of $300 (i.e., a 15% credit on expenditures up to $2,000) for residential conservation and renewable energy investments made between April 1977 and December 1985. Eligible conservation measures included insulation, storm windows and doors, weather stripping, and furnace modifications—standard energy efficiency measures at that time. During 1978–85, there were about 30 million claims for the residential energy conservation and renewable energy credits, amounting to nearly $5 billion in lost revenues for the Treasury.

Early studies of the net benefits of the residential tax credit were deemed inconclusive (OTA 1992) due, in part, to the fact that a variety of policy and market changes occurred simultaneously. However, evidence emerged that the tax credit had relatively little impact on consumer behavior. First, a household survey conducted in 1983 found that 85% of households that implemented energy efficiency retrofits in 1983 did not claim a tax credit; in addition, 88% of the households that claimed a credit that year said they would have made the improvement even if the credit had not been available (EIA 1986). Also, the credits tended to be used by wealthier owner-occupied households. Based on this information as well as the small size of the credit, lack of promotion, and administrative burdens, one review concluded that the credit itself probably did little to motivate retrofitting and that

[2] This section draws heavily from a working paper by Nadel 2012, *Energy Efficiency Tax Incentives in the Context of Tax Reform*. Additional details can be found in this earlier paper.

most recipients were “free riders”—taxpayers who would have made the efficiency investment without the incentive (OTA 1992).

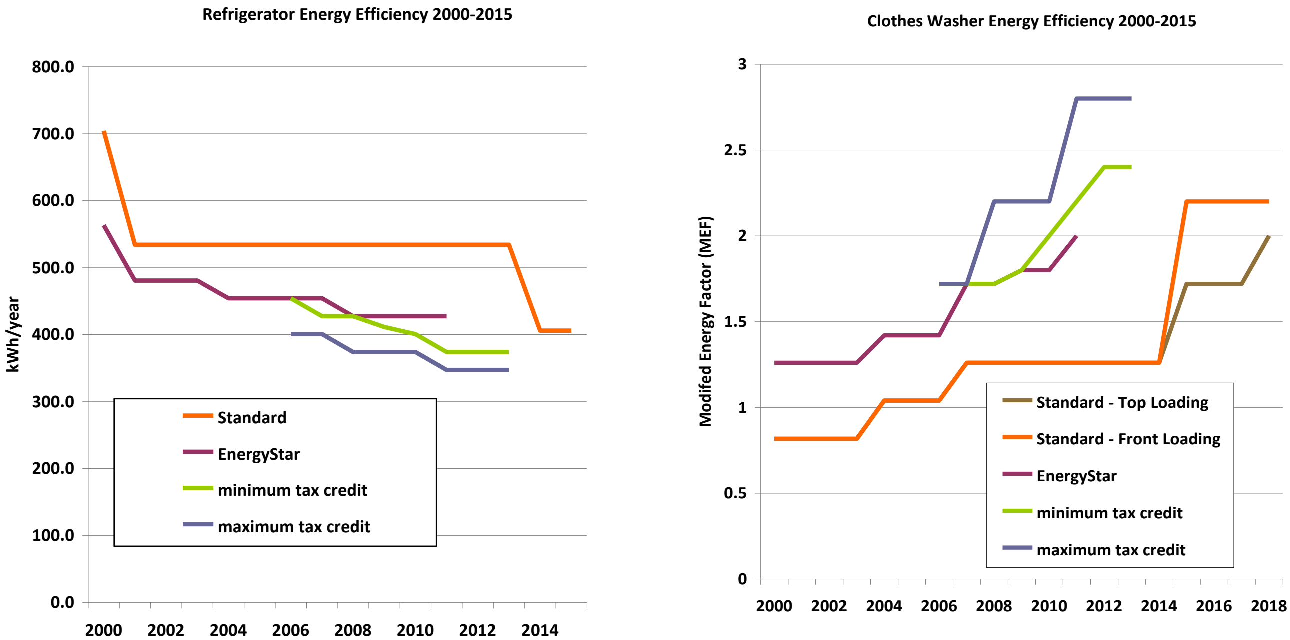
The *Energy Tax Act of 1978* also included a 10% tax credit for specified energy efficiency measures installed by businesses. The measures covered included heat recovery equipment, waste heat boilers, energy control systems, and economizers (GAO 1985). The Act was amended in 1980 to add cogeneration equipment to the list of eligible measures. This credit was in effect during 1978–82 and it also cost the Treasury approximately $5 billion. Surveys and analyses indicated that due primarily to the small magnitude, the credit had little effect on corporate decision-making (ASE 1983; OTA 1983). In other words, most of the measures probably would have been installed without incentives, indicating a high free-rider level. The industrial tax credit also has been criticized for covering a relatively limited list of conventional "add-on" efficiency measures and thereby not supporting technological innovation (ASE 1983). The credits generally did not address opportunities for industrial process improvement, nor were they based on performance.

In summary, it appears that both the residential and industrial tax credits in effect during 1978–85 cost the Treasury a substantial amount of money but had relatively little net impact on fostering energy efficiency improvements. The credits were relatively small in percentage terms while eligibility was limited to widely available and commonly adopted efficiency measures. Consequently, free-rider levels were probably very high.

Tax incentives enacted as part of the *Energy Policy Act of 2005* were more targeted, emphasizing advanced technologies and paying higher incentives. Gold and Nadel (2011) found that the new homes and appliance tax incentives were particularly effective in growing the market share for qualifying homes and appliances.

In the case of appliances, tax credits have contributed to permanently transforming the market, which is the ideal outcome. For example, for refrigerators, clothes washers, and dishwashers, the tax credits spurred manufacturers to develop, introduce, and broadly market new high-efficiency products. As these products gained in market share, the EPA/DOE ENERGY STAR® program adopted the same qualification levels, further growing the market for these products. Ultimately manufacturers agreed to make these levels the basis of new minimum-efficiency standards. At the same time, the energy efficiency levels needed to qualify for these tax incentives have been increased twice, so that the tax incentives only apply to the very highest energy-efficient products available in the market. These trends are illustrated in Figure 1.

Figure 1. Market Transformation of Refrigerators and Clothes Washers, 2000–2015

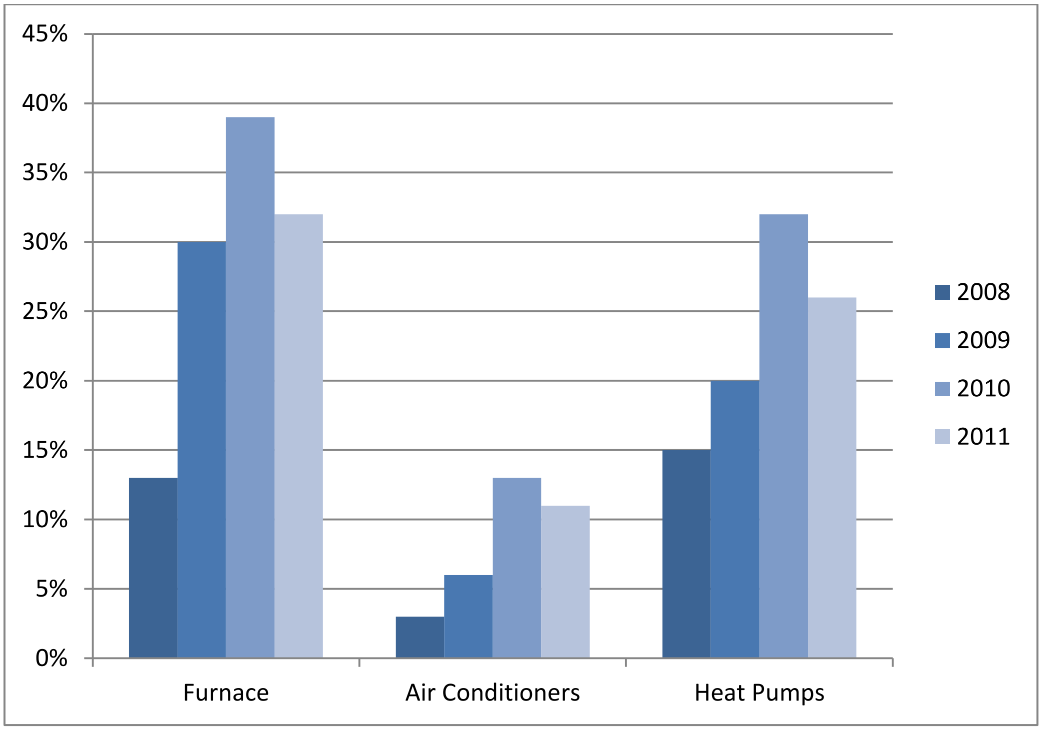


Note: MEF is Modified Energy Factor, a measure of clothes washer efficiency.

In the case of the new homes tax credit, qualifying homes accounted for less than 1% of new homes in 2006, but increased dramatically to about 11% in 2011, spurred by the availability of the credits (RESNET 2012).

Gold and Nadel's review (2011) of the 2005 tax incentives also found that credits for furnaces, air conditioners, and heat pumps have been effective in spurring new product introductions and increased market share, as seen in Figure 2. Likewise, they found that the credit for heavy-duty hybrid vehicles had a significant impact on the products manufacturers brought to market, helping to establish a market for these products. On the other hand, they found that the energy-efficient windows tax credit had too many free-riders, making its cost high and its impact less significant. Some of the other energy efficiency tax credits had low participation rates, resulting in lower-than-hoped-for market impacts, but also low costs.

Figure 2. Percentage of Air Conditioner, Heat Pump, and Furnace Shipments Qualifying for Federal Tax Incentives by Year



Note: Tax incentive was 10% of cost in 2008 and 2011 and 30% of cost in 2009 and 2010. This likely explains lower penetration in 2011.

From this review of past energy efficiency tax incentives, we find that the most effective tax incentive strategy is one that effectively creates a market for more efficient products that can then be leveraged by other policies (such as utility efficiency programs, building codes, and product standards) to expand the savings. Based on these experiences, we recommend that future energy tax incentives:

- Target efficiency levels and new energy sources that currently have a very small market share, which keeps the cost of tax incentives down and minimizes the number of "free riders."
- Provide a substantial incentive to motivate significant additional sales.
- Be in place for long enough so manufacturers and other market players find it worth making investments to develop and market eligible products (e.g., about five years).
- Should either be phased out or eligibility levels increased after that period, starting the transformation cycle again.

The Market Transformation Approach to Tax Incentives

Building on the success of the appliance and new home tax incentives discussed above, we recommend that the most useful approach to tax incentives is to target long-term structural changes in the market, using temporary federal assistance to build the market so tax incentives can be phased out and the market will continue to grow on its own, supported by other energy efficiency programs and policies. In this way, federal tax incentives can have a large "multiplier effect," helping to leverage future market growth.

While we focus on the market transformation approach to energy efficiency, this approach may apply to other energy incentives as well. An example might be the wind energy production tax credit, which helped to establish a major U.S. wind energy industry. There is general agreement that this credit can now be phased out, although disagreement exists on the period of the phase-out (see, for example, Kaufmann 2013 and Fox News 2013). Similarly, the market transformation approach could be used to support the development of new modular nuclear power plants or new advanced drilling techniques rather than using limited federal funds to support well-established technologies and practices.

Not all technologies and practices lend themselves to a market transformation approach. A market transformation approach makes sense where increased production and market share can lead to economies of scale in product development and production. This approach also applies to markets where a shortage of experienced contractors exists. In this latter case, the tax incentives can encourage additional contractors to get the training and skills needed to enter the market, helping to increase the availability of these skills and inducing more competition in these markets.

Since we assume that money for federal tax incentives will be very limited, we recommend only targeting measures where the market transformation approach can apply, in order to maximize the benefits achieved per federal dollar invested.

The Unique Role Federal Tax Incentives Can Play

Using a market transformation approach, federal tax incentives can play a unique role, helping to complement energy efficiency efforts by states, utilities, and the private marketplace. It will be much harder to transform markets without federal involvement. The federal government brings unique attributes that other players do not have:

- The federal government can provide consistent incentives nationwide, rather than a patchwork where some states have incentives, others do not, and incentive levels vary from place to place.

- The federal government can set uniform national qualifying criteria, providing manufacturers a consistent target for their development efforts and increasing the likelihood that they will devote the necessary resources to develop qualifying products. A variety of utilities and states have set their own criteria, creating a challenging market for manufacturers.

- The federal government has a long-term perspective and can therefore target advanced technologies that will take multiple years to develop. Other market actors (such as utilities and equipment manufacturers) often have a shorter-term perspective, e.g., "what can we do to meet next year's savings or profit goals?" Furthermore, some firms prefer to be "followers" rather than "leaders," learning from the successes and failures of the leaders. But if incentives are provided to the leaders for just a few years, then more firms will be encouraged to lead.

MAXIMIZING BENEFITS PER DOLLAR OF FEDERAL INVESTMENT

Since funds for federal tax incentives are likely to be limited, priorities for tax incentives will need to be set. To aid in setting these priorities, Nadel (2012) analyzed the costs and savings of a five-year federal tax credit for several high-efficiency products and services. The analysis included estimated effects on the market for these products and services over the following decade (e.g., how much long-term "market transformation" is likely to occur). Results of this analysis are summarized in Table 1.

Table 1. Costs, Savings and Federal Cost per Btu of Different Energy Efficiency Tax Incentives

Item	Five-Year Cost to Treasury ($millions)	Electricity Savings 15th Year (GWh)	Electricity Savings Lifetime (GWh)	Fuel Savings 15th Year (TBtu)	Fuel Savings Lifetime (TBtu)	Federal $/ Lifetime mBtu	Rank
Increasing commercial building deduction to $3/sf	$52	2,636	158,139	10	599	$0.02	1
New homes -- extend current credit	1,076	14,608	876,505	96	5,785	0.07	2
Commercial building retrofits (20%+ savings)	843	34,678	520,164	106	1,596	0.12	3
Water heaters -- heat pump and advanced gas	1,308	32,035	416,459	95	1,229	0.24	4
CHP -- remove size cap but limit to 25 MW/system	270	0	0	64	956	0.28	5
A/C & HP SEER 16 installed per ACCA-QI	2,426	35,262	634,707	94	1,698	0.30	6
Residential appliances -- extend and update	1,148	18,371	275,562	41	612	0.34	7
Furnaces (95% AFUE + efficient fan)	901	3,545	63,808	105	1,886	0.36	8
Advanced windows (DOE U .22 spec)	504	2,984	59,674	16	328	0.54	9
New homes -- 50% whole home savings	646	3,488	69,758	21	411	0.58	10
Whole house retrofits (20%+ savings)	1,875	3,808	68,544	40	722	1.33	11
Replace CFC industrial & commercial chillers	236	0	16,646	0	0	1.42	12
Insulation and sealing for homes per 25C	2,022	1,586	31,717	27	549	2.33	13
Totals	$13,300	153,000	3,191,700	720	16,400	$0.28	

Note: "Lifetime" means cumulative energy savings over the 15-year period analyzed.

Two key points emerge from this analysis:

- All of the energy efficiency tax incentives analyzed are highly cost-effective. The average cost to the Treasury of these credits over the 15 years analyzed is only $0.28 per million Btu saved—more than an order of magnitude less than the cost of the energy resources they save.[3] All of the options analyzed had lifetime costs under $2.50 per million Btu.

- The most cost-effective options analyzed include commercial buildings (both energy-efficient new construction and energy-saving retrofits), energy-efficient new homes, heating and cooling equipment, appliances, and combined heat and power systems. Whole-house energy-saving retrofits and replacing old chillers are also very cost-effective.

Based on this analysis, the Gold and Nadel (2011) review of the effectiveness of the current federal tax incentives, and a focus on market transformation, we recommend that as part of tax reform, Congress include several energy efficiency tax incentives as follows:

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[3] For example, the Energy Information Administration, in their just-released *2013 Annual Energy Outlook,* estimates that natural gas will average $7.83 per Btu over the 2012-2040 period (EIA 2012).

1. **Very high-efficiency appliances, heat and cooling equipment, and windows.** This would include continuing the current appliance tax credit and portions of the current credit for windows and heating, cooling, and water heating equipment. However, before any of these credits are extended, the qualification levels need to be updated so only the most efficient products qualify. These credits would spur manufacturers to offer more high-efficiency products, laying the groundwork for future upgrades to ENERGY STAR and equipment efficiency standards. Either a five-year extension could be enacted and then the credit reconsidered by Congress, or, alternatively, a long-term extension could be enacted and a process established to regularly update the qualification levels without an act of Congress. For example, DOE or EPA could be directed to review the qualification levels every two years, and criteria established to guide this review. Another option would be to peg eligibility to the "Most Efficient" criteria established by EPA every year. "Most Efficient" is a subset of ENERGY STAR products that represent approximately the top 5% most efficient products on the market.[4]

2. **Very-efficient new homes.** This could continue the current new home tax incentive, but introduce a new higher savings tier, phasing out the current savings tier in a few years. These credits would help to increase the market share of very high-efficiency homes, increase builder familiarity with the construction techniques involved, and lay the foundation for future upgrades to building codes. The current credit is for homes that use half as much energy for heating, cooling, and water heating as a home that just meets the 2003 International Energy Conservation Code, a national model building code. As discussed above, 11% of new homes now qualify for the credit, so a new higher tier is needed. The two tiers can run in parallel for a few years, with a higher incentive for the new tier, and then the incentive for the old tier can be phased out. For the new tier, we recommend 50% whole home savings (e.g., including lighting and appliances) relative to an average home that just meets the 2006 International Energy Conservation Code.

3. **Efficient commercial buildings.** The current commercial buildings tax deduction should be extended and improved. The current deduction is for $1.80 square foot for buildings that reduce energy use by 50% relative to the requirements in the 2004 version of ASHRAE Standard 90.1.[5] This incentive has not been heavily used as the 50% savings target is achievable only in new buildings, the criteria to qualify for the deduction are complex, and the $1.80 incentive is not enough to drive substantial participation (Gold and Nadel 2011). A bill, the "Commercial Building Modernization Act," has been introduced to address many of these problems (Snowe et al. 2012). This bill increases the deduction for new buildings to $3 per square foot and adds a new deduction for existing buildings for achieving savings of 20%

[4] See http://www.energystar.gov/index.cfm?c=partners.most_efficient_criteria. The criteria are reviewed annually and the criteria changed for some products and left unchanged for others based on this review. If the criteria is changed for a product, perhaps the new criteria could be used to earn a full incentive, but in order to establish a smooth transition, half of the normal incentive could be paid for products that qualified in the prior year but do not meet the new qualification levels.

[5] ASHRAE is the American Society of Heating, Refrigerating and Air-conditioning Engineers. They publish the leading model energy code for commercial buildings.

or more relative to the current consumption of the building, with the amount of the deduction increasing as the savings increase. The new construction portion of the program would familiarize architects and engineers with the techniques for designing high-performance buildings, laying the groundwork for future improvements to building codes. The existing buildings portion of the program would help build a comprehensive building retrofit industry—contractors who could integrate lighting, heating/cooling, and other improvements into a single package.

4. **Comprehensive retrofits for existing homes.** A provision for existing homes should be adopted to complement the provision for new homes discussed above. A bill, the *Cut Energy Bills at Home Act of 2011,* has been introduced that will provide incentives for reducing an existing home's energy use by 20% or more, with the incentive increasing as the savings increase (Snowe et al. 2011). As with the existing commercial buildings program, this provision would help build a comprehensive home retrofit industry.

These recommendations do not include the industrial sector. In the next section, we discuss potential incentives for encouraging capital investments in manufacturing. Additional industrial provisions are contained in the *Expanding Industrial Energy and Water Efficiency Incentives Act of 2012* (Bingaman et al. 2012). For example, this bill includes a modest expansion of the current incentive for combined heat and power systems and a section promoting replacement of old, inefficient chillers that use ozone-depleting refrigerants. Both of these provisions were found to have a low federal cost per Btu saved in the analysis summarized in Table 3.

Impacts of Depreciation on Investments in Energy Efficiency[6]

Many business investment decisions are affected by their anticipated tax consequences. A key component of tax treatment is depreciation. The U.S. Internal Revenue Service defines depreciation as "an income tax deduction that allows a taxpayer to recover the cost or other basis of certain property. It is an annual allowance for the wear and tear, deterioration, or obsolescence of the property" (IRS 2011). In effect, depreciation "spreads" the cost of a durable asset across the years that the asset will be utilized. However, depreciation rules sometimes fail to reflect the actual service lives of such equipment, with consequences for business investment in newer, more efficient assets. Depreciation periods can also vary with who owns the equipment, thereby incentivizing some owners and not others to invest in new assets. As part of tax reform, it is important that depreciation periods be rationalized so that reasonable investments can proceed. In addition, the energy efficiency of many equipment classes has increased greatly in the last two decades. Leaving un-depreciated and inefficient equipment in place affects competitiveness and the environment.

OBSERVATIONS

The fundamental premise of depreciation is to properly "spread" the economic cost recovery of assets over their number of years in operation. While the intent of this concept is straightforward, practical

[6] This section draws heavily from an earlier white paper by Sachs et al. (2012) entitled *Depreciation: Impacts of Tax Policy*. Additional details are available in this earlier paper.

application is not. Evolutionary change and business complexities pose challenges to this fundamental premise.

Long recovery periods assigned to earlier generation assets may delay their replacement in favor of newer, more efficient alternatives. As currently written, the tax code still poses some impractical recovery periods for energy-related assets. For example, overhead lighting, steam boilers, and core heating-ventilating-air conditioning (HVAC) equipment are all assigned a 39-year recovery period.

Technologies may evolve more rapidly that the tax code. Recovery periods established with 1970s technologies in mind do not always reflect the true service life of modern replacements.

Innovations in industrial system design may blur the distinction between structural versus non-structural asset classifications, and accordingly, the manner in which the assets are to be depreciated. In other words, certain components are increasingly flexible in their siting and configuration. Equipment that is a permanent or "structural" asset in one configuration may be perceived as "personal property" in another.

Investors' time horizons for decision-making may be wholly disconnected from the depreciation recovery periods prescribed for their production assets. While some business asset costs are recovered over as many as 39 years, corporate planning horizons are much shorter, often no more than five years. Opportunities for faster cost recovery are highly valued for this reason.

Available data suggests that most HVAC and production equipment wears out and is replaced after periods of time much shorter than 39 years, although the service life expected varies with equipment type. Table 2 provides data on service life for many types of HVAC equipment.

Table 2. Service Life Estimates for Some Commercial HVAC Equipment

Equipment Type	Median Service Life, Years
Chillers, air-cooled rotary & screw	23
Cooling tower, metal	17.5
Controls, electronic	18
Boilers, hot-water, steel forced draft	25
Packaged DX unit, air-cooled	22
Split DX system	17
Domestic hot water heater, electric	12
Domestic hot water heater, gas	15

Source: ASHRAE (2012). Data for all units in the database that have already been replaced; may not be representative of equipment purchased recently.

Furthermore, in some cases depreciation periods can vary for the same or similar type of equipment depending on where the equipment is used. It does not make sense to depreciate the same equipment for as little as 5 years in industrial applications while commercial applications of the same or similar equipment are depreciated over 39 years.

REFORMING DEPRECIATION

Businesses function best when able to make decisions independent of tax implications. Depreciation schedules that distort the carrying cost of an asset discourage investment in new, more efficient systems. As the country approaches tax reform, simplifying and rationalizing the treatment of depreciation is in order. This is compatible with the many proposals that call for fewer tax brackets and eliminating tax breaks. Therefore, we present two recommendations for changes to depreciation rules as a part of tax reform:

1. Refine cost recovery periods to reflect the true service life of assets. Recovery periods should approximate service life and certainly should not be longer than average observed service life. Shorter cost recovery periods will discourage the continued operation of obsolete assets and at the same time accelerate the adoption of newer, more efficient assets. With all else being equal, shorter cost recovery periods reduce the tax cost of asset ownership, therefore removing a significant barrier to investment in energy-efficient assets.

2. Reduce the number of asset classes by combining similar categories. There should be fewer asset "lives" or periods over which a given asset is depreciated. This will also reduce the likelihood that the depreciation period will depend on the industry or use of an asset and the amount of effort companies must expend to determine tax liability. For example, CHP equipment should have one depreciation period (perhaps around 15 years) and not the five different periods shown in Table 3.

Table 3. Summary of Current Federal Depreciation Treatment for CHP Assets

Asset Category	Tax Life (years)
Utility	
Steam production or distribution…………………………	20
Steam turbine power plant……………………………….	20
Combined cycle power plant…………………………….	20
Combustion turbine power plant…………………………	15
Industrial	
For power capacity > 500 kW or steam capacity > 12.5 Mlbs/hour:	
Steam production or distribution………………..	15
Power generation……………………………	15
For power capacity < 500 kW or steam capacity < 12.5 Mlbs/hour:	
Steam production or distribution…………..	5–10 years depending on industry classification
Power generation……………………………	5–10 years depending on industry classification
Commercial…………………………………………………	39
Residential…………………………………………………	27.5

Notes: Mlbs = thousand pounds.
Source: Spurr (2001)

These recommendations could be adopted in one of two ways. First, Congress could legislate them. Second, Congress could authorize or direct the Treasury Department to make such changes. The latter approach may be preferable so that future refinements can be made without requiring an act of Congress.

National competitiveness is connected to the ability of U.S. manufacturers to produce products more efficiently than those abroad. Much as was observed in the 1970s and 1980s, U.S. plants with old and outdated systems were eclipsed by manufacturers with newer and more efficient plants in Europe and Asia. A tax code that enables businesses to treat the depreciation of these assets rationally improves their competitiveness. By extension, this collectively results in a reduction in the amount of energy consumed per GDP and propagates environmental and economic benefits throughout society.

Encourage Capital Investments[7]

The energy efficiency of a nation's manufacturing base has been shown to be directly correlated with the vintage of the process equipment. Thus one of the policy strategies to increase the efficiency of the manufacturing sector is to modernize the manufacturing base (Laitner et al. 2012). The United States is poised to enter a period of major modernization that offers the promise of important improvements in the energy efficiency of our manufacturing base (Russell and Young 2012).

This opportunity results from a conjunction of market events that are making the U.S. an attractive global market for manufacturing. Changes in U.S. energy markets, particularly the emergence of bountiful natural gas from non-conventional production, have made our country a low-cost energy manufacturing destination. This attractive energy outlook combines with high levels of labor productivity and a history of innovation to create an attractive environment for investments in manufacturing capacity, both for domestic and export markets (Russell and Young 2012; BCG 2012). As the economy recovers, the existing manufacturing base, which has shrunken as a result of the recent economic downturn, will be stretched to meet expanding demand. This will put greater pressure on manufacturers to invest in additional production capacity. Projections for manufacturing sector investments are in the hundreds of billion dollars, with the potential in the chemical industry alone approaching $100 billion in 91 major projects (Krauss 2012).

Unfortunately there is no assurance that these investments will be made in the U.S. While market fundamentals appear strong, access to capital remains a challenge to many companies as a result of continuing weakness in the U.S. financial sector and uncertainty about the global economic outlook. While some point to the high level of cash holding by many companies, industrial leaders have indicated that they see these reserves as insurance against a return to economic difficulties.

Thus, policies that promote investments in modernization of the industrial capacity would appear timely. Our country faces a once-in-a-generation opportunity to revitalize our manufacturing sector with the employment and economic benefits that would result. Now is the time to consider implementing these policies.

While direct incentives for industrial modernization and other capital investment have been the policy response in the past (e.g., bonus depreciation provisions enacted over the past decade), given the large federal budget deficit, the cost to the federal Treasury of direct incentives has largely taken this option off the table. As a result we need to explore alternative polices that minimize the cost to the Treasury.

Among the policy options to consider for promoting investments in modernization are tapping into non-tax-based sources of capital or involving some form of repayment to the Treasury of the funding so that costs to the Treasury are low. In the following sections we discuss three such options:

[7] This section draws heavily from a working paper by Nadel and Elliott (2012) entitled *Encouraging Modernization of the Industrial Sector and Other Energy-Saving Capital Investments through Tax Reform.*

1. Allowing foreign profits to be repatriated without tax, or with low taxes, if the money is applied to acceptable capital investments;
2. Accelerated depreciation for such capital investments; and
3. Repayable tax incentives.

An example of the first option is to encourage multinational corporations with substantial overseas profits to repatriate these funds to invest in their domestic operations. The second and third options would benefit all companies. We recommend that companies be required to choose only one option—there should be no "double dipping" allowed. Before discussing these options, we first turn to a discussion of "acceptable" capital investments.

ACCEPTABLE CAPITAL INVESTMENTS

Capital investments by U.S. are substantial, with investments by non-farm businesses totaling about $1.1 trillion in 2010. Over the prior decade, annual capital investments ranged from just under $1 trillion to not quite $1.4 trillion (Census 2012). If all capital investments were eligible for special treatment, the first trillion dollars of special treatment would go to investments that would happen anyway—a large cost to the Treasury without any significant benefits. Instead, special treatment should be limited to increases in capital investment relative to some base period. As a starting point for discussions, we suggest a rolling base period based on a firm's average capital investments over the previous three years, adjusted for mergers, acquisitions, and divestitures. Multiple years are needed to reduce sudden changes in the baseline but the baseline period should be short enough to make it easy to calculate and to reduce the impact of the Great Recession as a consideration. New firms would be able to credit all investments in their first year, and increases above their one-year and two-year averages for the next two years. Rules would be needed to handle subsidiaries, in order to discourage formation of new companies just to take advantage of the tax break. For example, subsidiaries should be credited to the firms that own them. Where there are multiple owners, ownership shares can be used to credit the various owners.

There are questions regarding whether all capital investments should receive encouragement, or just certain types of capital investments, or investments in certain sectors, such as industry. We recommend concentrating these incentives on manufacturing[8] because modernizing capital investments in industry has been shown to offer significant energy efficiency benefits, reducing the intensity of manufacturing while making these facilities more globally competitive (Laitner et al. 2012). However, later in this section we do advance a specific, more targeted proposal for the commercial sector. We also recommend limiting special treatment to capital equipment and not real estate; buildings owned by industrial firms should be subject to the same treatment as buildings owned by commercial firms.

Another question is whether, from an energy efficiency point of view, should all capital investments be included or just ones that meet a specific definition of "energy efficient"? In industry, most capital

[8] While the primary focus of this provision is the manufacturing industry, we encourage looking at including other capital-intensive industries such as agriculture, mining, and construction.

investments will be for process equipment. The energy efficiency in processes results from the overall configuration of the process, not in the efficiencies of the individual components alone. When new capital is invested in industry, most of these systems will be more efficient than the systems they replace (due to steady improvements in equipment and system design in recent decades) and thus, at least in industry, allowing all capital investments in process equipment to qualify makes sense. In the commercial sector, while efficient systems design is important, there is also a lot that can be done with more efficient equipment, as we discuss below.

Repatriation of Profits for Increased Capital Investments in Manufacturing

According to a May 2011 JP Morgan Chase study, about $1.4 trillion in foreign profits are held overseas by U.S.-based firms (Hirsch 2011). A 2012 Bloomberg study estimates that about $1.2 trillion is held overseas by about 70 of the very largest firms (Rubin 2012). If these profits were repatriated to the U.S., they would be subject to corporate income taxes, taxes that average about 25% for all U.S. businesses (Markle and Shackelford 2011). The tax rate for large multinationals is probably less since they generally have very sophisticated accounting departments that have figured out many ways to legally reduce their taxes.

These multinational firms and some economists have argued that we should eliminate or reduce taxes on repatriated profits in order to encourage U.S. firms to bring this money home and benefit the U.S. economy. In 2004 there was a one-year special program to allow overseas profits to be repatriated home and be subject to only a 5.25% tax rate. This experience was reviewed in a Congressional Research Service (CRS) report (Marples and Gravelle 2011). Citing a variety of sources, they found that some $312 billion was repatriated to the U.S. under the program. A total of 843 firms claimed the special treatment for repatriations, out of roughly 9,700 eligible corporations. 32% of the repatriations were by the pharmaceutical industry. The top ten firms across all industries accounted for 42% of the repatriations.

Independent studies found small and statistically insignificant impacts on both domestic capital investments and employment. Rather, some empirical evidence suggests that the repatriations were used primarily to return money to shareholders through stock repurchase programs. Under the 2004 program, the repatriated money could be used for nearly any purpose. Marples and Gravelle end their study by noting that an option for future application is to tie any special tax benefits for repatriation to increases in desired activity such as domestic employment, wages, or investment.

Thus, repatriation could provide a source of capital needed for investments in the U.S., but building on the CRS suggestion, guidance should be provided on how the money must be used in order to earn a tax break. We suggest that one way to encourage increased domestic capital investment is to have a reduced tax rate (perhaps the same 5.25% used in 2004) for profits that are invested for increased capital investment in industry, relative to a base period. Such a provision would encourage U.S. firms to increase domestic investments. They will still invest overseas, but with lower tax rates for repatriated profits, they would be encouraged to invest more in the U.S.

Accelerated Depreciation for Increased Capital Investments in Manufacturing

A provision giving special treatment for multinational firms would not provide any benefit for firms that only do business in the U.S.—another provision would be needed to encourage capital investments by these firms. However, as noted above, for any provision to move forward given the current budget situation, the cost to the Treasury needs to be kept very low.

Based on this consideration, we recommend that accelerated depreciation be considered for increases in capital investment relative to a base period. Accelerated depreciation allows firms to increase their depreciation expenses in the initial years after an investment, reducing their taxes. However, if more of an asset is depreciated in the early years after an investment, depreciation will be lower in later years, increasing taxes. Under federal budget scoring rules, the short-term costs and long-term income are added together, allowing accelerated depreciation to have a long-term cost of essentially zero.[9]

From 1981–1986, accelerated depreciation was part of the tax code, with assets assigned to 3-, 5-, 10-, and 15-year recovery periods. However, this system was ended in 1986 as part of the agreement for broadening and simplifying the corporate tax code.

More recently, as part of economic stimulus legislation enacted in 2002 and extended several times, a portion of capital investment can be accelerated into the first year, with the rest depreciated over the normal lifetime. Such *bonus depreciation* originally covered 30% of the investment cost. It was increased to 100% in 2010 and reduced to 50% for 2012. Under current law, bonus depreciation ends Dec. 31, 2012. We could not find any studies on the impacts of accelerated depreciation in the 1980s or any studies on the bonus depreciation provisions that have been in effect for the past eight years. However, the Congressional Research Service reviewed two studies on bonus depreciation from the 2002–2004 period and found that "[t]akeup rates for those allowances were lower than expected and only 10% of firms taking them said that the allowances played a decisive role in their investment decisions." This limited impact is likely due in part to the temporary nature of the incentive and to the fact that only some investments were incented (Guenther 2012). The Tax Policy Center (a joint project of the Urban Institute and the Brookings Institution) elaborate a little on the short-term nature of the incentives, stating: "Businesses may have expected that Congress would extend the provisions, thus blunting their incentive to speed up investment. It takes time for businesses to make major investments, making it hard to fit them into specified time periods. Finally, many businesses may have had too little income to offset with these additional tax benefits, a problem that is especially acute during economic downturns" (Tax Policy Center undated).

Accelerated depreciation, including bonus depreciation, can be expensive. We are not proposing accelerated depreciation for all capital investments. Instead, to complement the repatriation

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[9] This statement applies to long-term analyses of federal spending. For some analyses, only spending and savings are considered for ten years and considerations beyond ten years ignored. Under such a short-term window, accelerated depreciation will have costs since a portion of the repayment will be outside of the ten-year "scoring window." However, many of the devices that can be used to decrease long-term deficits have large impacts beyond ten years—for example, raising the retirement age. We expect the ten-year window to be used less in the future than it has in the past.

provision discussed above, we are suggesting that accelerated depreciation cover increases in capital investment relative to the base period. To keep it simple, we suggest that normal depreciation periods be cut in half for such investments. Another option would be to use the 3–15 year depreciation periods that applied in the early 1980s.

Repayable Tax Incentives

Repayable tax incentives represent another strategy to encourage investments while limiting the long-term costs to the Treasury by requiring recipients to repay the tax incentive over time as benefits are realized. The initial credit helps reduce the upfront cost of the investment, and the latter payments reduce the cost to the Treasury. For example, if a business receives an initial tax credit of $100,000 on a combined heat and power (CHP) system the year the system was placed into service, they might repay the federal credit at the rate of $20,000 per year over the next five years. The initial credit encourages the investment, and the subsequent repayments channel the value of some of the energy bill savings back to the federal government, so that the long-term cost to the federal government is very low—just defaults plus interest costs. Essentially this would be a zero-interest loan.

In this context, we suggest that for increases in capital investment over the base period, a business receive an initial 35% investment tax credit. This percentage was chosen to have a value similar to the other provisions (our analysis is presented in the next section). Recipients of this credit would then repay the credit over the following ten years. Businesses already track past investments and depreciation from year to year when compiling their annual taxes. Tracking repayments would be very similar.

This idea has already begun to circulate in Congress. In 2011, Senator Shaheen from New Hampshire circulated a draft bill that would provide a repayable tax incentive for CHP systems. Under the proposal, an incentive would be given to electric utilities that finance CHP systems. The amount of the incentive would then be repaid to the Treasury through an annual installment payment paid by the customer who owns the CHP system equal to the amount of the subsidy divided by an installment period, specified in years. In the draft Shaheen bill, the installment period is 3 years (e.g., the customer repays the subsidy over 3 years) but payments don't begin until the third year after the subsidy is paid (i.e., the customer repays nothing for the first two years, then repays one-third of the subsidy each year for the next three years). However, this particular proposal is complicated by the fact that the electric utility would receive the tax incentive, but the business that hosted the CHP system would make the repayment, resulting in some tricky tax and legal issues. These issues would be much more limited if the same firm received the credit and then made the repayments.

Under current federal procedures for "scoring" the cost of tax expenditures, costs and income are estimated for each year, as well as a simple total, without any discounting. Thus a $100,000 expense followed by five years of $20,000 repayments would be scored as zero over the life of the program. There would, however, be some small cost risk to the Treasury based on the potential for businesses or individuals to go bankrupt before they fully repaid their obligation.

Comparison of the Options for Manufacturing

Each of these approaches attempts to achieve the same goal of increasing investments, but through different mechanisms. Repatriation taps into funds that are a new source of investment. Accelerated depreciation and repayable incentives both provide reductions in taxes for businesses that do not have overseas profits they could repatriate. Accelerated depreciation and repayable incentives are different ways of achieving essentially the same goal and we recommend that only one of these options be enacted to complement repatriation. A business eligible for both repatriation and either accelerated depreciation or a repayable incentive would need to pick just one—"double dipping" should not be allowed. A rough quick comparison of the choices is provided in Table 4, based on simple assumptions. This comparison indicates that the repatriation may be a little more generous than accelerated depreciation or the 35% refundable tax incentive, but all three are similar. However, specific businesses may have reasons to prefer one over the other.

Table 4. Comparison of Repatriation, Accelerated Depreciation, and a Repayable Tax Incentive for an Illustrative Firm and Investment

Investment (millions)		$ 10.00		
Marginal tax rate		20%		
Current depreciation period (years)		10		
Annual discount rate (nominal)		10%		
	Repatriation	Accel. Deprec.	Repay. Incent.	Notes
Avoided taxes (million $)	$ 1.50			Reduce rate from 20% to 5%
PV current deprec		$6.14		
PV halving deprec		$7.58		
Value of halving deprec.		$1.44		PV current minus PV halving
Credit			$ 3.50	35%
PV of repayments			$2.15	PV of repayments over 10 yrs
Net value of credit			$1.35	Credit minus PV of repayments
Note: PV = present value				

Accelerated Depreciation for Purchases of Energy-Efficient Equipment, Primarily in the Commercial Sector

The discussion so far has focused on increasing capital investments in manufacturing. Promoting increased capital investments by industry is likely to improve energy efficiency as new industrial equipment and systems are generally more efficient than existing equipment (Laitner et al. 2012). For the commercial sector, a different approach is needed.

The majority of capital investment in commercial buildings is for "bricks and mortar," where energy efficiency is less of a consideration. As discussed previously, allowing accelerated depreciation or other special treatment for increased capital investments in the commercial sector would promote construction and perhaps real estate speculation, but have only a modest impact on energy efficiency. In order to better target accelerated depreciation for the commercial sector, we recommend that it apply only to energy-efficient equipment, where "energy efficient" is defined as meeting the energy-efficient specifications developed by the Federal Energy Management Program (FEMP) for federal facilities. Accelerated equipment should also be allowed for the same equipment in the industrial sector, even if total capital investment does not increase.

FEMP has been identifying efficient equipment for federal purchasers for more than a decade. They use ENERGY STAR specifications for some equipment, and for other equipment have developed their own specifications. In general, both FEMP and ENERGY STAR aim to identify the roughly top quartile of equipment as energy efficient. As of this writing, FEMP has efficiency specifications for 67 types of equipment. These are listed in Figure 3. We recommend that the same accelerated depreciation periods be used for energy-efficient equipment—half of conventional depreciation periods. By offering more rapid depreciation for efficient equipment relative to standard efficiency equipment, more businesses will be encouraged to purchase efficient equipment when existing equipment needs to be replaced.

Figure 3. FEMP Guidelines for Procuring Energy-Efficient Products

Procuring Energy-Efficient Products

Federal mandates require that Federal agencies purchase energy-efficient products. To help agency buyers meet these requirements, the Federal Energy Management Program (FEMP) maintains a list of FEMP-designated and ENERGY STAR®–qualified product categories found frequently in Federal facilities. Refer to the legend to see which program covers each product category. For more information on these products and requirements, visit *www.femp.energy.gov/coveredproducts*.

Legend of Energy-Efficient Product Programs

- ■ ENERGY STAR
- ▲ FEMP-Designated
- ◆ Low Standby Power
- ● Electronic Product Environmental Assessment Tool (EPEAT)

Heating & Cooling (Space & Water)

Commercial Space Heating and Cooling
- Boilers ▲
- Central Air Conditioners ■
- Chillers
  - Air-Cooled Electric ▲
  - Water-Cooled Electric ▲
- Air Source Heat Pumps ■

Commercial Water Heating
- Gas Water Heaters ▲

Residential Space Heating and Cooling
- Room Air Conditioners ■
- Central Air Conditioners ■
- Boilers ■
- Fans
  - Ceiling ■
  - Ventilation ■
- Gas Furnaces ■
- Heat Pumps
  - Air Source ■
  - Ground-Source ■

Residential Water Heating
- Electric Resistance Storage ▲
- Heat Pump ■
- Gas Condensing ■
- Storage ■
- Whole-Home Tankless (Instantaneous) ■
- Solar ■

IT & Electronics

Information Technology
- Computers
  - Desktops and Workstations ■◆●
  - Notebooks and Integrated Computers ■●
- Displays and Monitors ■●
- Enterprise Servers ■
- Imaging Equipment
  - Copiers ■
  - Digital Duplicators ■
  - Fax/Printer Machines ■◆
  - Mailing Machines ■
  - Multifunction Devices ■
  - Printers ■
  - Scanners ■

Electronics
- Audio/Video ■
- Televisions (TVs) ■
- Battery Chargers ■
- Cordless Phones ■◆
- Set-Top and Cable Boxes ■

Lighting

- Exterior Lighting ▲
- Fluorescent Ballasts ▲
- LED Lighting (Commercial) ■
- Light Bulbs
  - Compact Fluorescent (CFL) ■
  - Light Emitting Diodes (LED) ■
- Luminaires
  - Fluorescent ▲
  - Downlight (Commercial) ▲
  - Industrial (High-Bay) ▲
- Light Fixtures (Residential) ■
- Decorative Light Strings ■

Commercial Food Service Equipment

- Dishwashers (Commercial) ■
- Fryers ■
- Griddles ■
- Hot Food Holding Cabinets ■
- Ice Machines
  - Air-Cooled ■
  - Water Cooled ▲
- Ovens (Commercial) ■
- Refrigerators and Freezers (Commercial) ■
- Steam Cookers ■
- Pre-Rinse Spray Valves ▲
- Beverage Vending Machines ■

Appliances

- Clothes Washers (Commercial) ■
- Clothes Washers (Residential) ■
- Room Dehumidifiers ■
- Dishwashers (Residential) ■
- Refrigerators (Residential) ■
- Freezers (Residential) ■
- Room Air Cleaners and Purifiers ■

Other

Building Envelope
- Cool Roofing Products ■
- Windows, Doors, and Skylights ■

WaterSense Plumbing
- Faucets, Showerheads, Toilets, and Urinals

Miscellaneous
- Water Coolers ■

Additional Guidance
- Centrifugal Pumping Systems
- Lighting Controls

Suspended Categories
- Electric Motors
- Distribution Transformers
- Fluorescent Tube Lamps

Illustrations from iStock/4701623, 9363216, 17534402, 6935827

Source: FEMP (2013)

Emissions Fees[10]

A potential complement to the proposals discussed above is to address energy efficiency on a fundamental level, by creating a strong, economically-efficient disincentive for emissions. Our present tax system largely taxes things that result from productive economic activity—wages, non-wage income, and corporate profits. An alternative is to collect revenue from things that produce negative economic effects, such as cigarettes, alcohol, and as proposed here, pollution. This is not a new suggestion. An added twist is that the revenues generated can be used to reduce taxes on things we want to encourage, such as wages and income. The idea that taxes can be used to discourage activities that produce negative externalities was originally suggested in 1920 by the economist Arthur Pigou, then the head of the economics department at the University of Cambridge in England. In the economics literature, these are now commonly known as Pigovian taxes. Many prominent economists and politicians have spoken in favor of using Pigovian taxes to regulate pollution. As the economist Milton Friedman noted in a 2005 interview: "There is a role for government and the question is what are the means that you use. And the answers of a free market environmentalist is you use market mechanisms. Instead of setting quantitative limits on pollution, you impose a tax" (Friedman 2005).

We are not suggesting that all revenues be collected from Pigovian taxes, but instead that a greater portion of the current tax burden comes from these taxes. We start from a proposal examined by the Bipartisan Policy Center Debt Reduction Task Force (BPC 2010) and look at further details, such as how much tax rates could be lowered, and the impacts of the pollution fees on emissions and investments in low-emissions technologies.

Pollution Fees—The Bipartisan Policy Center Proposal and Related Concepts

The Bipartisan Policy Center convened a Debt Reduction Taskforce chaired by former Senate Budget Committee Chairman Pete Domenici and Dr. Alice Rivlin, a former Director of the Congressional Budget Office and of the Office of Management and Budget as well as Vice Chair of the Federal Reserve Bank. Their final report, released in November, 2010, calls for simplifying the tax system, eliminating or reducing many current tax incentives and establishing a new system with two tax rates—15% and 27%. To help reduce the debt, they call for a "debt reduction sales tax" (DRST). This was ultimately chosen over a carbon tax because it would bring in greater revenue and thereby more effectively reduce the federal debt. However, there was also significant support on the Task Force for a tax on carbon dioxide. This option would have introduced a tax of $23 per ton of CO_2 emissions beginning in 2018, increasing at 5.8% annually. As shown in Figure 4, this option was estimated to raise about $1.1 trillion by 2025 (BPC 2010).

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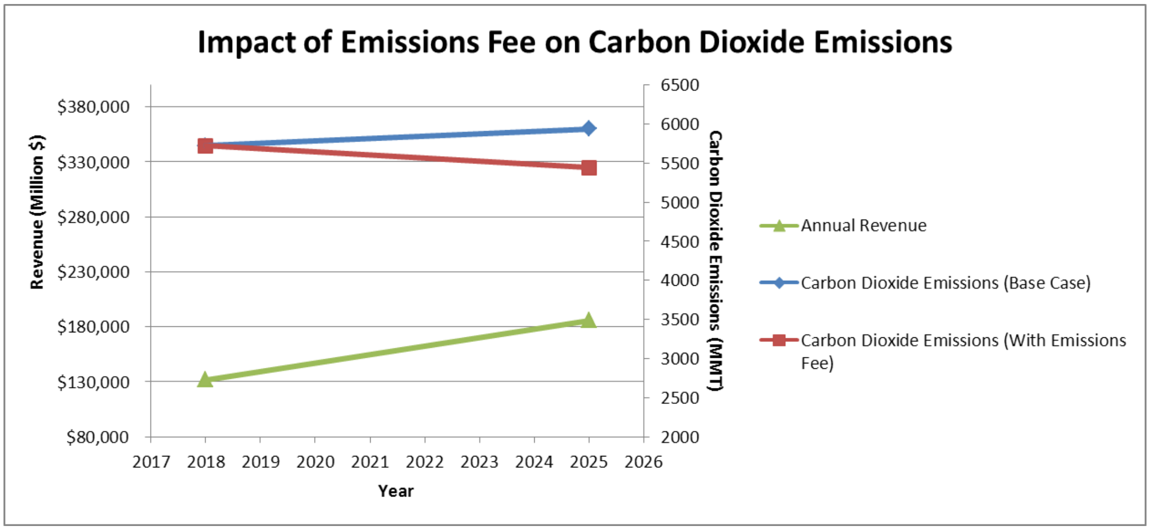
[10] This section draws heavily from a working paper by Nadel and Farley (2012) entitled *Should the U.S. Consider a Modest Emissions Fee as Part of a Strategy to Lower Marginal Tax Rates?* Further details can be found in that paper.

Figure 4. An Emissions Fee Reduces Carbon Dioxide while Raising Revenue that Could Be Used to Address the Federal Debt



A fee on CO_2 emissions has a number of desirable attributes. Unlike taxes on income, payroll, or consumption, which penalize work effort by reducing real wages without any corresponding economic benefit (other than the revenue raised), a carbon dioxide fee could actually increase economic efficiency. By establishing a price for CO_2 emissions—which have a social cost—the tax would shift production and consumption toward less carbon-intensive goods, reducing carbon dioxide emissions in the process. In addition, by providing certainty regarding the cost of CO_2 emissions going forward, the tax would relieve the uncertainty that has delayed necessary capital investments in the energy sector, while also encouraging research and development in cleaner energy technologies. An emissions fee would increase energy prices, however, raising concerns about impacts on energy intensive industries and regressive impacts on households. While the Task Force plan did not include a fee on carbon dioxide emissions, many members believed it warrants further consideration as the nation works to address America's long-term debt.

A somewhat similar proposal was introduced in the 111th Congress by Representatives Inglis (R-SC), Lipinski (D-IL), and Flake (R-AZ) as the *Raise Wages, Cut Carbon Act of 2009* (H.R. 2380).[11] Under this bill, the fee for carbon dioxide emissions from fossil fuels would start at $15 per ton and gradually rise to $100 per ton in 2040, with any revenue matched dollar for dollar with a reduction in the social security tax on wages. In addition, a border adjustment fee would be placed on imported goods, so foreign manufacturers pay the same fee per ton of carbon dioxide as domestic manufacturers (Inglis 2009).

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[11] See http://www.gpo.gov/fdsys/pkg/BILLS-111hr2380ih/pdf/BILLS-111hr2380ih.pdf. .

LOWERING TAX RATES

The Bipartisan Policy Center estimated that its CO2 tax proposal would collect about $1.1 trillion in revenue cumulatively over the 2018-2025 period. A 2011 analysis by the Congressional Budget Office of a similar proposal covering the 2012-2021 period was estimated to raise $1.2 trillion (CBO 2011). This income could be used to reduce taxes on wages (e.g., the social security tax), as Rep. Inglis, Lipinski, and Flake proposed, or it could be used to reduce income taxes. $1.2 trillion would be about enough to do simplify the tax code but with lower tax rates. For example, the Bipartisan Policy Center (BPC 2010) estimates a 2-tier 15-27% income tax rate would cost the Treasury $1.3 trillion over the 2012-2021 period relative to a modified base forecast that includes extension of the "Bush tax cuts."

Treatment of Expenses in Business Taxes[12]

Another area to consider as part of tax reform is to look at business taxes, and in particular on how businesses account for energy costs when computing their taxes. Commercial and industrial facilities consume about half of primary energy in the U.S., as well as a portion of transportation energy (EIA 2010).

THE CURRENT TAX CODE

Under the current tax code, individuals pay taxes on their income, and most expenses are not deductible. Exceptions may include interest on home mortgages and high medical expenses, but not energy expenses. Business taxes work differently. Businesses are taxed on their profits and virtually all expenses are deductible, including energy costs. Capital expenses must be depreciated, meaning they are recovered over the a multiyear period—as much as 39 years in the case of commercial buildings and equipment installed in these buildings. As a result, the current tax code creates three disincentives to energy efficiency investments:

1. Since energy bills count as a business expense, and are subtracted from the total amount of taxable income, effectively, the federal government is effectively "paying" 25% of business energy costs (based on the average effective business tax rate of about 25%—Markle and Shackelford 2011) and sometimes as much as 35% of a business's energy costs (the maximum business tax rate). Subsidizing energy costs enables higher energy consumption.

2. When businesses do invest in energy efficiency, a portion of the energy savings go to the federal government in the form of higher taxes (e.g., 25% for a business with the typical effective rate of 25%). When the full value of the savings does not accrue to the firm, the incentive to make investments goes down. This is the flip-side of the first disincentive.

[12] This section draws heavily from a working paper by Nadel and Farley (2012) entitled *Modifying How Energy Costs Are Treated for Business Tax Purposes in Order to Decrease Subsidies and Increase Energy Efficiency.* Further details can be found in this earlier paper.

3. When a firm makes capital investments, the values of the new assets are depreciated over time, and therefore the positive impact on earnings by decreasing taxable income is spread out over time. Long depreciation periods can reduce the incentive to make investments.

These three disincentives are illustrated in Table 5, showing the after tax profits and cash flow of the hypothetical widget manufacturer, Acme Corporation[13]:

Table 5. Effects of Energy Costs and Energy Efficiency Investments on Acme Corporation Taxes Under Current Tax Code

		Efficiency Investment	
	Baseline	Before Depreciation	With Depreciation
Annual Sales	$10,000,000	$10,000,000	$10,000,000
Investment in Energy Efficiency	—	$120,000	$120,000
Energy Expenses	$200,000	$160,000	$160,000
Other Expenses	$8,800,000	$8,800,000	$8,800,000
Depreciation of Energy Efficiency	-	$0	$8,000
Profit for Tax Purposes	$1,000,000	$1,040,000	$1,032,000
Federal Tax Rate	25%	25%	25%
Federal Taxes	$250,000	$260,000	$258,000
Profits after Taxes	$750,000	$780,000	$774,000
Net Cash Flow	$750,000	$660,000	$662,000

Notes: Energy efficiency investment saves 20%, has a 3-year simple payback, and is depreciated over 15 years. Net cash flow is profits minus taxes and investments. In this and subsequent tables we use average tax rates since data on average marginal tax rates is hard to come by. Business tax rates range from 15-35%, but due to many tax incentives, marginal tax rates for most businesses are significantly less than 35%.

ALTERNATIVES

We propose two possible new ways to treat business energy costs in the tax code. One is simple, but radical –shift business taxes to focus on revenue, not expenses, so that it more closely resembles the individual income tax. The second is more surgical in that it would just apply to energy costs and

[13] With apologies to Road Runner, Wile E. Coyote, and any real company named Acme.

would reduce incentives for energy waste. At this point we are not advocating for either of these options, but instead propose that they be subject to serious examination and discussion.

We note that potential tax changes need to be reviewed from the perspective of the average firm, but also from the perspective of firms with high energy costs, particularly those that need to compete internationally. These latter firms might need special attention so that we don't undercut American firms in international competition. A good discussion of some of these issues can be found in a 2009 Interagency report (Interagency Report 2009) and articles by Resources for the Future (Morgenstern 2010).

A Radical Idea. It is a matter of significant debate among historians as to why policy makers in the 1890s and 1910s set up two separate tax systems—one for corporations, one for individuals—with the former based on profits and the latter based on income. As a consequence, according to Gordon (2011), "there has since been a sort of evolutionary arms race, as tax lawyers and accountants came up with ever new ways to game the system ('playing the two systems against each other'), and Congress endlessly added to the tax code to forbid or regulate the new strategies." Switching the corporate tax to be based on revenue instead of profits could reduce this gaming, simplify the tax code, dramatically reduce marginal tax rates, and remove the current distortions with regards to energy efficiency investments.

A business tax that was based on only revenue would be far simpler, as the many pages of law and regulations related to expenses and how to account for them would no longer be needed. It could allow marginal tax rates to be decreased to as low as 2.3% as it would increase the tax base by about an order of magnitude.[14] Such an approach would provide incentives to reduce all costs, not just energy costs, improving economic efficiency.

As with any change to the tax code, there would be winners and losers. Most obviously, this approach would reduce taxes on firms with above-average profit margins while increasing taxes on firms with low profit margins. The government would no longer share in gains or losses. Firms with very-low profit margins (e.g., grocery stores) might raise prices to pay for the higher taxes. On the other hand, lower taxes on high-profit firms could reduce the prices they charge.

A tax on just revenues could benefit integrated firms that produce parts as well as final products. They would pay taxes on just their selling price. Firms that buy parts from others would have taxes included in the price of the parts they purchase. To address this, the amount of taxes included in the cost of goods purchased could be credited against a firm's tax bill. Many other developed countries have value-added taxes that only tax the incremental value added, showing how such costs and taxes could be tracked. As a rough estimate, as shown in Table 6, if such a credit were provided, the marginal tax rate might increase to 3.25%.

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[14] Markle and Shackelford (2011) provide data that indicate that corporate profits average about 9.2% of income and effective corporate tax rates average about 25%. If income is taxed and expenses ignored, the tax base would increase 10.9 times (1/.092), allowing the tax rate to decrease to approximately 2.3% (25% current rate divided by 10.9) and still collect the same revenues.

From an energy efficiency point of view, such an approach would eliminate many of the disincentives for energy efficiency investments discussed above. Taxes would not change as energy use goes up or down and taxes would not change with energy efficiency investments. After tax profits with efficiency investments go up relative to the example in Table 5. Net cash flow goes down due to the energy efficiency investment, but not as much as in the example in Table 5. These trends are illustrated in Table 6, which uses all of the same assumptions as in Table 5, except for the tax treatment. Acme's Federal taxes are identical in Tables 5 and 6, but now they have simpler taxes and more incentive to reduce energy (and other) expenses.

Table 6. Effects of Energy Costs and Energy Efficiency Investments on Acme Corporation Taxes Under a Tax System Where No Costs Are Deductible

	Baseline	Efficiency Investment
Annual Sales	$10,000,000	$10,000,000
Investment in Energy Efficiency	-	$120,000
Energy Expenses	$200,000	$160,000
Other Expenses	$8,800,000	$8,800,000
Depreciation of Energy Efficiency	NA	NA
Profit for Tax Purposes*	$10,000,000	$10,000,000
Federal Tax Rate	3.25%	3.25%
Gross Federal Taxes	$325,000	$325,000
Credit for taxes in purchased goods and services	$75,000	$75,000
Net Federal Taxes	$250,000	$250,000
Profits After Taxes	$750,000	$790,000
Net Cashflow	$750,000	$670,000

*Nothing is deductible

Note: To prevent cascading of taxes, we provide a credit for prior taxes included in goods and services purchased by the firm. The 3.25% tax rate is designed to for simplicity and to permit comparison with Table 1 and is based on a rough guess that 30% of an average firm's costs might be from goods and services subject to a prior federal tax.

A More Surgical Approach Addressing Just Energy Costs. One more limited way to address the fact that all taxpayers share in high business energy costs is to reduce the amount of energy costs that can be deducted. For example, the tax code could be amended to not allow businesses to deduct energy costs from revenues except the portion of energy costs that exceed 4% of revenues, and even then, to only deduct 80% of energy costs. The 4% threshold misses most businesses, which would have to include energy expenditures as a part of taxable income. However, it allows energy intensive industries to receive some deduction. Energy intensive industries include trucking, chemicals, primary metal manufacturing, electric utilities, mining and many types of agriculture. This is similar to how health care costs can only be deducted on personal income taxes when they exceed 7.5% of adjusted gross income (rising to 10% in Jan. 1, 2013). The 80% figure is based on a typical U.S. corporate effective tax rate of about 25% (Markle and Shackelford 2011) minus the roughly 5% reduction in the tax rate that this proposal would allow. By allowing only 80% of energy costs to be deducted, we allow for the fact that the other 20% is effectively subsidized through the tax code. However, while this approach makes energy efficiency investments more attractive, it does not simplify the tax code.

Scaling back deductions for business energy costs would increase corporate tax receipts unless other adjustments were made. Most likely corporate tax rates would be lowered—an example is provided below. A second option would be to use at least some of the revenue to fund popular tax credits such as the credit for Research and Development (R&D) investments that Congress keeps extending each year and/or improvements in depreciation schedules for energy-consuming equipment as discussed earlier in this report.

Table 7 illustrates how this change might affect the Acme Corporation. Acme has modest energy costs so the reduction in the tax rate to 20% more than compensates for the fact that energy costs are not deductible. Furthermore, unlike with the present system, reductions in energy costs fully flow through to Acme's bottom line and their federal taxes do not go up with the energy efficiency investment. The efficiency investment increases their after-tax profits relative to the current system (see Table 5). On the other hand, since depreciation rules remain in place, their taxes go down slightly when depreciation is included but their net cashflow, while moderately improved relative to Table 5, is still affected by the capital investment in energy efficiency investments.

Table 7. Effects of Energy Costs and Energy Efficiency Investments on Acme Corporation Taxes Under a Tax System Where Energy Costs Are Not Deductible

	Current	New	Efficiency Investment	
	Baseline	*Base Case*	*Before Depreciation*	*With Depreciation*
Annual Sales	$10,000,000	$10,000,000	$10,000,000	$10,000,000
Investment in EE	—	—	$120,000	$120,000
Energy expenses	$200,000	$200,000	$160,000	$160,000
Other expenses	$8,800,000	$8,800,000	$8,800,000	$8,800,000
Depreciation of EE	—	—	0	$8,000
Profit for tax purposes	$1,000,000	$1,200,000	$1,200,000	$1,192,000
Federal Tax Rate	25%	20%	20%	20%
Federal Taxes	$250,000	$240,000	$240,000	$238,400
Profits After Taxes	$750,000	$760,000	$800,000	$801,600
Net Cashflow	$750,000	$760,000	$680,000	$681,000

An example for an energy-intensive industry is also useful. Consider Intensive Chemical, a small chemical firm with the same annual revenues and profit margin as the Acme Corporation, but paying 7% of revenues for energy and 83% for other expenses. Their situation is illustrated in Table 4. For Intensive Chemical, because they have high energy costs that are only partially deductible, their taxes go up $42,000 per year. Essentially, if taxes go down for average companies such as Acme Corporation, then the lost revenue is made up elsewhere—in this case by energy-intensive firms. Taxes also go up with an investment in energy efficiency since we've retained a deduction for high energy costs. On the other hand, with the efficiency investment, profits after taxes are up since the large reduction in energy costs flows through to their bottom line. Net cash flow with the efficiency investment is down in year one due to the high capital investment. However, beginning in year 2, cash flow will improve substantially due to the large energy savings.

Table 8. Effects of Energy Costs and Energy Efficiency Investments on Intensive Chemical Taxes Under a Tax System Where Energy Costs are Only Partially Deductible

	Current	New	Efficiency Investment	
	Baseline	*Base Case*	*Before Depreciation*	*With Depreciation*
Annual Sales	$10,000,000	$10,000,000	$10,000,000	$10,000,000
Investment in EE	—	—	$420,000	$420,000
Energy expenses	$700,000	$700,000	$560,000	$560,000
Deductible energy (80% of costs above 4% of revenues)	$700,000	$240,000	$128,000	$128,000
Other expenses	$8,300,000	$8,300,000	$8,300,000	$8,300,000
Depreciation of EE	—	—	0	$28,000
Profit for tax purposes	$1,000,000	$1,460,000	$1,572,000	$1,544,000
Federal Tax Rate	25%	20%	20%	20%
Federal Taxes	$250,000	$292,000	$314,400	$308,800
Profits after Taxes	$750,000	$708,000	$825,600	$831,200
Net Cashflow	$750,000	$708,000	$405,600	$411,200

Of course these are simple examples meant to illustrate concepts. While they are based on typical data, individual taxpayers will vary.

Reduce Subsidies for Traditional Energy Sources

An additional way to advance energy efficiency is to reduce subsidies for competing traditional energy sources such as fossil fuels and nuclear power. As shown by a 2011 study by the Organization for Economic Cooperation and Development (OECD), fossil fuel subsidies have averaged about $13 billion annually over the 2008-2010 period (OECD 2011). The biggest subsidies include the Low-Income Home Energy Assistance Program [LIHEAP] (average of $2.8 billion per year), fossil fuel research and development ($1.9 billion), the Strategic Petroleum Reserve ($1.3 billion), expensing of exploration and development costs ($1.2 billion), severance tax exemptions ($1.2 billion), fuel tax exemptions for farmers ($1 billion), depletion allowances ($0.8 billion), and temporary expensing of equipment for refining ($0.6 billion). Similar findings come from a report by the Environmental Law Institute (ELI 2009) which estimates total fossil fuel subsidies of about $72 million over the 2002-2008 period, an average of about $12 billion per year. Broader tax incentives, such as Master Limited Partnerships, do not appear to be included in these figures, even though some of these incentives disproportionately benefit the oil and gas industries and other traditional energy supplies.

ACEEE has not researched this issue in depth, but no discussion of tax reform is complete without at least mentioning that subsidies for traditional energy sources "tilt the playing field" towards increased use of traditional fuels, at the expense of energy efficiency. For example, the $13 billion identified by OECD is about 1.3% of consumer expenditures on fossil fuels in 2010 (EIA 2011). While we are not advocating for ending the LIHEAP program, ending the other subsidies might make sense.

Impact of These Tax Changes on Federal Budget and the U.S. Economy

Each of the changes discussed in this report will have an impact on both the federal budget and the U.S. economy overall. Doing a full analysis on these impacts is beyond the scope of this report. However, we performed a "first order" analysis of the impacts of several of these provisions on the federal budget, as well as the impact of one of these provisions on the overall U.S. economy. Specifically, we looked at the impact of the first three provisions (depreciation, tax incentives and capital investment) on receipts under the corporate income tax, and looked at the impact of the tax incentives on the overall economy.

The business tax changes affect tax receipts in two ways. First, each of these changes provides incentives for investment, which reduces tax receipts. Second, as discussed earlier, when businesses save energy, their energy expenses go down which increases their profits. As profits go up, taxes on these profits also go up.

In the case of energy efficiency tax incentives, as shown in Table 9, we estimate that these tax incentives will have a direct cost to the federal Treasury of $13.3 billion over five years, an average of $2.66 billion per year. However, approximately half of these incentives go to businesses, and businesses are effectively taxed on their energy savings. Using the energy savings shown in Table 3 for only the provisions that affect businesses, estimated national average energy prices (EIA 2012), and an assumed average business tax rate of 20%,[15] we estimate that the energy savings achieved under this provision will increase direct federal tax receipts by $42 billion over the analysis period.[16] In other words, this provision will increase federal tax receipts by a total of about $29 billion

Likewise, we approximated the costs and energy savings of the depreciation and capital investment provisions. The analysis is summarized in Table 9, with further details found in Appendix A.

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[15] As discussed above, current business taxes average about 25% of profits but we assume that this will decline to 20% after tax reform.

[16] The analysis period is 15 years and includes the impact of the tax incentives on the long-term market. The costs and energy-saving benefits both assume that the tax incentives run for five years and then end. If the tax incentives are extended, then both the costs and benefits will increase.

In the case of depreciation, we examined the impact of reducing depreciation periods on commercial heating, ventilating and air conditioning (HVAC) and lighting equipment from 39 years to 20 years, assuming the change affects tax receipts on all equipment purchases, and influences 20% of purchasers to reduce their energy use by 15% (for the other purchasers, we assume they would have made the same purchase decision as under current law). Overall, we found that the extra revenue generated from the energy savings offsets nearly half of the cost.

For the capital investment provision, we looked at the impact of capital investments in the manufacturing sector, assuming that special treatment for increases in capital investment increase such investment by 10%. We assume that half of this increased investment if from repatriated profits and half is due to accelerated depreciation. Overall, the revenue over 15 years (about $7 billion) is significantly greater than the costs (about $4 billion).

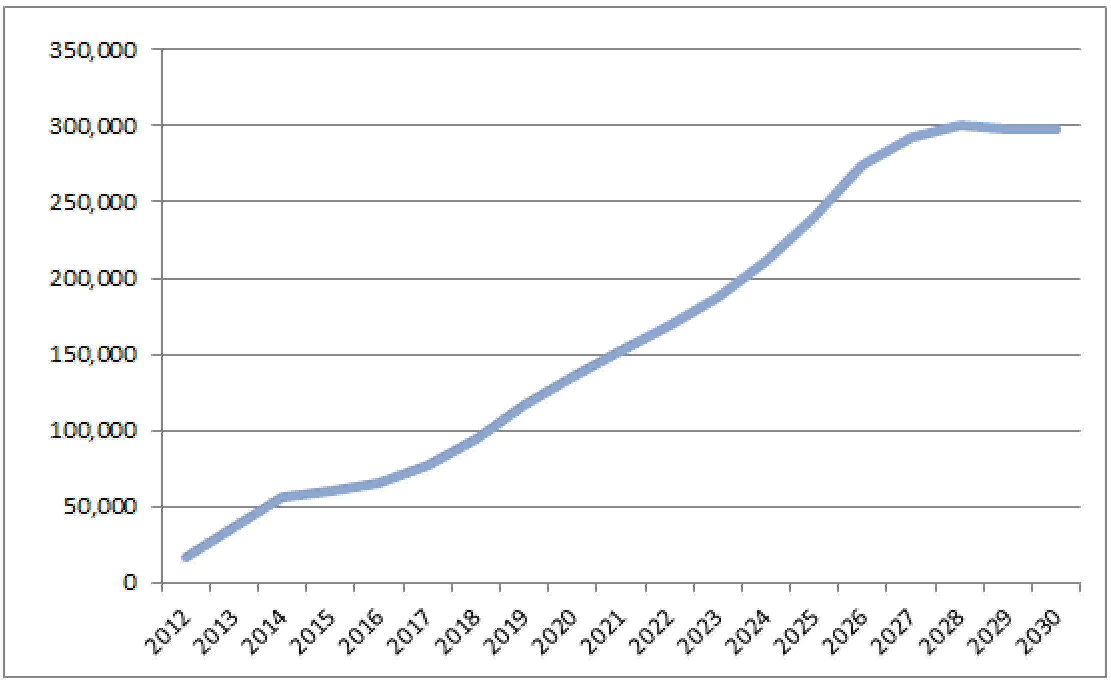
In total, for all three provisions, we estimate that over 15 years the impact on the federal budget will be a surplus of about $30 billion, with most of this "profit" coming from the energy efficiency tax incentives.

Table 9. Summary of Costs and Revenues Over 15 Years from Three Energy Efficiency Provisions

Provision	Cost to Treasury ($billion)	Revenues to Treasury ($billion)	Net Cost ($billion)	Notes
Rationalize depreciation in the commercial sector	$1.0	$0.4	-$0.6	Only examined HVAC and lighting equipment in the commercial sector
Energy efficiency tax incentives	13.3	42	29	Costs include costs of residential provisions, revenues only from the commercial provisions
Encourage capital investment	4.4	8.3	3.9	Analysis looks at manufacturing provisions.
Total	$19	$51	$32	

To estimate the impact of the energy efficiency tax incentives on the overall economy, we used our DEEPER input-output model of the U.S. economy (ACEEE 2011). The DEEPER model looks at cashflow in different sectors of the economy and estimates the impact of efficiency investments relative to the investments in conventional energy supplies that are displaced. DEEPER looks both at the investments as well as the impact of energy savings that are available to be re-spent. We used the costs and benefits summarized in Table 3 to develop our inputs. Half of the energy efficiency investments are assumed to be financed out of cashflow in the year the investments are made and the other half with a ten-year loan at a 5% real interest rate (which is roughly an 8% nominal interest rate if inflation is 3% per year). Our DEEPER analysis of the energy efficiency tax incentives is summarized in Appendix B. Overall, we found that these energy efficiency tax incentives will result in a significant increase in employment—an average of 164,000 jobs over the 2014-2030 period. The job gains start at about 52,000 in 2014 and steadily increasing to about 300,000 in the final years (see Figure 5). The job increases are driven by both increasing investments in energy-efficient products and services as well as reinvestment of the energy savings. GDP also increases modestly as a result of this provision—with GDP up an average of $8.3 billion over the 2014-2030 period. Interestingly, since federal tax revenues are projected to average about 19% of GDP (Tax Policy Center 2012), the macroeconomic impacts of these tax incentives will increase federal revenue by about $1.6 billion per year *in addition* to the direct benefits discussed above.

Figure 5. Estimate of Net Job Impacts of Energy Efficiency Tax Incentives



Further Work

Some of the ideas discussed in this report are fairly well understood and can be considered for policy adoption in 2013. These include changes to depreciation schedules to better match average service lives, refinement of existing energy efficiency tax incentives, and use of repatriated profits and other mechanisms to promote capital investments. While further analysis of the costs and benefits would be useful, the analysis available is similar to analyses that were used to support many policies that are now law. Regarding depreciation, further work is needed to assemble data on equipment lives in the field and synthesize these into a workable number of depreciation categories with associated definitions. Likewise, a variety of analyses have been conducted on emissions fees and subsidies for traditional energy sources. Decisions on whether to proceed with these items will be primarily in the political and not the analytical realm.

On the other hand, much more work is needed to develop the business tax schemes explored in this paper. For example, for the radical change which would focus on taxing revenues, not profits, additional work is needed to decide how to handle taxes incorporated in the cost of purchased materials and to consider an investment tax credit. Likewise, further work is needed to clarify repayable tax credits and refine how to handle and track needed repayments. All of these ideas involve substantial changes in the tax code, which will have both winners and losers. Losers will tend to fight hard to retain the current system and hence substantial political effort will be needed to enact any significant reform.

Summary and Conclusions

Discussions about tax reform are just beginning, and given the complexities and the many political issues involved, it may well take a few years before any reform is enacted. We recommend that policymakers consider the following reforms in a revised tax code:

- Refine depreciation periods to more accurately reflect the average service lives of equipment, particularly in the commercial sector.
- Refine existing energy efficiency tax incentives to focus on using a market transformation approach to promote energy-saving technologies and practices with limited market share today, but where temporary federal incentives can advance these technologies and practices to the point where they can prosper without federal incentives.
- Promote capital investment in manufacturing by using low-cost approaches to spur increases in capital investment. Such approaches might include reduced tax rates for repatriated foreign profits, accelerated depreciation, and repayable tax incentives.
- Add a price on emissions.
- Consider ways to remove disincentives to energy efficiency investment from the business tax code.
- Eliminate or reduce subsidies that target the fossil fuel industry.

These reforms work in synergistic ways. Refining depreciation periods and improving the business tax remove barriers to efficiency investments in the current tax code. A price on emissions and reducing fossil fuel subsidies help all energy sources to better compete on a level playing field. And tax incentives for advanced energy saving technologies and for increased capital investment in manufacturing both save energy and help U.S. businesses to be more competitive so they can better compete internationally as well as contribute to a growing domestic economy.

The tax code is a powerful tool for influencing investment decisions and accomplishing policy goals. The reforms described here could reduce barriers to cost-effective energy efficiency investments and contribute toward increase investments in efficiency. Furthermore, these reforms will help create jobs, improve the productivity of American firms, help reduce dependence on foreign fuel, and reduce pollution in the environment. With careful attention to details, the tax code can be an enabler to efficiency investments and not a barrier.

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Appendix A: Calculations of the Impact of Depreciation and Capital Investment Provisions on Federal Tax Receipt

Depreciation		
Annual impacts		
Value of shipments to manufacturers ($B)		
Commercial unitary HVAC	1.7	Census CIR for 2010
Chilllers	1.1	From Buildings Energy Databook http://buildingsdatabook.eren.doe.gov/TableView.aspx?table=5.3.1
C&I lighting fixtures	4.2	Census CIR for 2000
Total wholesale cost	7	
Rough est. of retail cost	14	Wholesale X 2
Annual tax cost, 39 years	0.359	Total retail cost / 39 years
Annual tax cost, 20 years	0.700	Total retail cost / 20 years
Annual increase in cost	0.341	Difference between above two rows
Effect on federal tax receipts ($B)	0.068	20% average tax rate
Annual energy savings		
Commercial HVAC use (primary quads)	5.48	For 2020 from AEO 2013 Early Release
Commercial lighting use (primary quads)	2.68	From AEO 2013 Early Release
Total	8.16	
Average primary energy price	11.4	For 2020 from AEO 2013 Early Release in $/mBtu
Value of energy savings ($B)	0.140	Assuming 5% of equipment replaced each year (20 year avg. life), new equipment saves 15%, and change in depreciation affects 20% of equipment purchases
Federal taxes on savings	0.028	20% average tax rate
15 year analysis		
Cost to Treasury	1.023	Effect on federal tax receipts (annual) X 15 years
Revenue to Treasury	0.419	Federal taxes on savings (annual) X 15 years
Net impact on federal tax receipts ($B)	-0.604	
Capital Investments in Manufacturing		
Annual impacts		
Historic investments ($B)	174	Average for manufacturing over 2001-2010 period from U.S. Census Annual Capital Expenditures Survey
Growth in investments due to policy	17.4	10% of above
Increased depreciation expenses	0.87	If 1/2 of these investments qualify for accelerated depreciation with depreciation now 5 years instead of 10 years
Cost to federal Treasury	0.2	20% average tax rate
Average primary energy price	8.47	For 2020 from AEO 2013 ER in $/mBtu
Energy bill savings	0.295	Assume investment has 5-year simple payback,
Federal taxes on savings	0.059	20% average tax rate
Federal taxes on repatriation	0.457	Based on 5.25% tax rate
Total federal revenue	0.516	Sum of above two rows
15 year analysis		
Cost to Treasury	4.350	Five years of increased depreciation expenses. After this, the cost of depreciation for new investments is offset by the reduction in depreciation for investments more than 5 years ago.
Revenue to Treasury	7.736	15 years of savings
Net impact on federal taxes	3.386	

Appendix B: DEEPER Estimate of the Macroeconomic Impacts of Energy Efficiency Tax Incentives

Spending Patterns (in Millions of 2009 dollars)	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Program Cost (Other than Incentives)			0.0	0.0	1.0	1.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Federal Government Spending			0.0	0.0	2,660.0	2,660.0	2,660.0	2,660.0	2,660.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Productive Investment from Private Sector and/or Households			0.0	0.0	3,990.0	3,990.0	3,990.0	3,990.0	3,990.0	6,650.0	8,312.5	9,975.0	11,637.5	13,300.0	14,962.5	16,625.0	19,950.0	23,275.0	26,600.0	26,600.0	26,600.0
Total Productive Investment			0.0	0.0	6,650.0	6,650.0	6,650.0	6,650.0	6,650.0	6,650.0	8,312.5	9,975.0	11,637.5	13,300.0	14,962.5	16,625.0	19,950.0	23,275.0	26,600.0	26,600.0	26,600.0
Consumer Out of Pocket Payments			0.0	0.0	1,995.0	1,995.0	1,995.0	1,995.0	1,995.0	3,325.0	4,156.3	4,987.5	5,818.8	6,650.0	7,481.3	8,312.5	9,975.0	11,637.5	13,300.0	13,300.0	13,300.0
Consumer Amortized Payments			0.0	0.0	258.4	516.7	775.1	1,033.4	1,291.8	1,722.4	2,260.7	2,906.6	3,660.1	4,521.3	5,231.8	5,791.6	6,308.3	6,782.0	7,212.6	7,212.6	6,674.3
Annual Interest Payments			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Change in Electricity Demand			0.0	0.0	735.0	1,460.7	2,232.2	3,002.8	3,876.1	5,118.5	6,388.7	7,648.4	8,972.6	10,388.3	11,843.5	13,357.0	14,949.1	16,565.5	18,271.9	17,949.7	17,675.9
Change in Natural Gas Demand			0.0	0.0	207.0	419.9	681.1	956.1	1,268.3	1,741.5	2,233.3	2,766.9	3,369.6	4,015.0	4,660.7	5,305.5	6,036.3	6,745.7	7,547.5	7,587.3	7,612.3
Key Impact Coefficients (Total Jobs/$MM; Value-added/$)	**Jobs**	**GDP**																			
Construction	19.64	1.49																			
Elec	6.42	1.24																			
Nat Gas	6.64	0.99																			
Finance	12.40	1.52																			
Other	16.89	1.43																			
Annual Rate of Labor Productivity (from AEO 2011)	1.97%																				
Implied Change in Final Demand (Millions of 2009 Dollars)	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Construction			0.0	0.0	6,650.0	6,650.0	6,650.0	6,650.0	6,650.0	6,650.0	8,312.5	9,975.0	11,637.5	13,300.0	14,962.5	16,625.0	19,950.0	23,275.0	26,600.0	26,600.0	26,600.0
Elec			0.0	0.0	-735.0	-1,460.7	-2,232.2	-3,002.8	-3,876.1	-5,118.5	-6,388.7	-7,648.4	-8,972.6	-10,388.3	-11,843.5	-13,357.0	-14,949.1	-16,565.5	-18,271.9	-17,949.7	-17,675.9
Nat Gas			0.0	0.0	-207.0	-419.9	-681.1	-956.1	-1,268.3	-1,741.5	-2,233.3	-2,766.9	-3,369.6	-4,015.0	-4,660.7	-5,305.5	-6,036.3	-6,745.7	-7,547.5	-7,587.3	-7,612.3
Finance			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other			0.0	0.0	-3,972.4	-3,292.1	-2,517.8	-1,730.5	-803.4	1,812.6	2,205.1	2,521.2	2,863.3	3,231.9	3,791.1	4,558.4	4,702.0	4,891.6	5,306.8	5,024.5	5,313.9
Suggested Macroeconomic Impacts	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Jobs (actual)			0	0	52,100	55,900	60,400	64,800	70,200	96,100	116,700	135,300	152,800	169,300	187,300	206,800	240,600	273,500	306,900	299,000	297,500
GDP (Million 2009 Dollars)			0	0	3,110	2,970	2,870	2,760	2,700	4,430	5,410	6,240	6,970	7,580	8,420	9,470	11,940	14,460	17,090	17,050	17,780
			17,367	36,000	56,133	60,367	65,133	77,033	94,333	116,033	134,933	152,467	169,800	187,800	211,567	240,300	273,667	293,133	301,133	298,250	297,500

Source:

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Notes:
(1) This analytical framework is intended only to provide a working estimate of first order impacts likely to result from a productive investment in energy-efficient technologies.
(2) This working model does not imply a valid set of input assumptions; and a change in spending patterns may require additional changes in rows and/or impact coefficients than what are presented here.
(3) The impact coefficients are drawn from the 2010 IMPLAN economic accounts for the United States. See, http://www.implan.com .
(4) This framework does not include positive impacts likely to result from stabilized or reduced energy prices and from other, non-energy productivity benefits likely to emerge from such investments.