Structuring a Green Recovery: Evaluating Policy Options for an Economic Stimulus Package

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Summary

- A well-designed recovery package can create jobs and stimulate the economy while cutting CO_2 emissions and reducing dependence on foreign sources of energy. Energy savings for businesses, consumers, and the government can play an important role in offsetting the cost of the stimulus package on taxpayers and the economy down the road.
- Investments in building efficiency hold the most promise for both near-term job creation and long-run reductions in energy imports and CO_2 emissions. Spending $10 billion to weatherize homes or retrofit federal buildings would create and sustain up to 100,000 jobs between 2009 and 2011 and save the economy $1.4 to $3.1 billion a year between 2012 and 2020.
- Incentives for renewable energy can yield comparable energy savings and larger emissions reductions, but with more uncertainty. Extending the Production Tax Credit (PTC) would stimulate an additional 16 GW of wind power capacity construction over "business-as-usual" between now and 2014 at a cost to the federal government of $11 billion, assuming that tax credits are made refundable and wind power project developers have adequate access to capital. This would cut CO_2 emissions by 8 million tons per year and reduce energy imports by 9 million barrels of oil equivalent.
- Transportation-sector investments and tax credits have considerable job creation potential (particularly mass transit infrastructure) but more modest energy and environmental benefits, at least in the medium term. Broad-based "smart grid" deployment could yield massive energy savings, though only a small portion can reasonably be achieved as part of a stimulus plan.
- Spending $100 billion on energy and environmental programs over the next 2–3 years is not sufficient to meet long-term US energy security and climate change goals. Policymakers should seek a recovery package that complements forthcoming energy and climate legislation rather than replaces it. This includes understanding how stimulus programs not directly focused on energy (like road, highway, and bridge construction) will impact energy outcomes.

Testimony

Mr. Chairman and members of the Committee, thank you for inviting me to testify on this important and timely topic. My name is Trevor Houser and I am a visiting fellow at the Peterson Institute for International Economics and director of the Energy and Climate Practice at the Rhodium Group (RHG), an economic research firm based in New York. Last year the Peterson Institute, in partnership with the World Resources Institute, launched a multiyear initiative to examine the economic, trade, and financial effects of energy and climate policy. Our first effort under this initiative, *Leveling the Carbon Playing Field*, was published last May and was the first of a series of reports we will be releasing between now and the international climate negotiations in Copenhagen later this year.

As the 111th Congress begins this month, drafting an economic stimulus plan is at the top of the legislative agenda. Both congressional leaders and President-elect Barack Obama have expressed a desire to direct government spending in a way that not only generates short-term economic growth and employment but also addresses long-term policy goals. Energy and environmental objectives including reducing carbon-dioxide emissions and dependence on foreign oil are chief among these and the notion of a "green" stimulus package has gained considerable traction among policymakers as well as attention in the press. Given the speed at which an economic recovery plan is being drafted, there is need for a framework that helps legislators evaluate which policies and programs to include in order to meet both immediate and longer-term policy goals. In a forthcoming report from the Peterson Institute for International Economics, my coauthor, Shashank Mohan, and I assess a range of policy design options currently being considered in terms of their energy and environmental, as well as their economic, impact. In my testimony today I would like to share some of the key findings from our study and am happy to follow up with members of the Committee after the hearing to provide more detail on our work.

Framework: What Makes for a Green Economic Recovery

An economic stimulus package of the scale currently being considered will necessarily include a broad range of elements, from tax cuts for households and assistance to states to direct government investment in infrastructure, education, and healthcare. Our study assesses twelve energy-related programs that could be included in that list, accounting for between $100 and $150 billion in government spending combined. These twelve programs are evaluated in terms of:

- **Speed**: how quickly the program can be implemented at scale;
- **Jobs**: the number of direct, indirect, and induced jobs created;
- **Energy Prices**: the impact on energy demand and prices for the economy as a whole;
- **Climate Change**: the ability to cut greenhouse gas emissions and thus the cost of future climate policy;
- **Energy Security**: reduction in US dependence on imported fossil fuels.

The study finds that well-tailored energy programs as part of a recovery package can create jobs and stimulate the economy while achieving significant energy cost savings for businesses, consumers, and the government. At the same time, it is clear that $100 to $150 billion in energy-related investment today is not sufficient to meet long-term US energy security and climate change goals. Green elements of a recovery package, however, can complement forthcoming energy and climate policy by focusing on:

- **Market Failures**: There are a number of low-cost (or even profitable) opportunities to reduce energy demand and CO_2 emissions through energy efficiency that will likely not respond to price-based energy or climate policies alone. Targeted government spending can address these market failures and complement future policy.
- **Energy Security**: Market-based policies aimed at reducing greenhouse gas (GHG) emissions, such as a cap-and-trade program or a carbon tax, do not necessarily reduce dependence on foreign sources of energy. Tax policy and strategic government investment can be used to ensure that climate policy helps achieve energy security goals as well.
- **Technology Hurdles**: Uncertainty about the availability of critical low-carbon energy technology between 2012 and 2030 creates anxiety about the future cost of climate policy. Policy adopted today can help accelerate technology development and cut the cost of reducing emissions down the road.
- **Infrastructure Bottlenecks**: In addition to reduced cost, the deployment of low-carbon technology depends on the availability of enabling infrastructure. Whether electricity transmission, CO_2 pipelines, or mass transit, the government will necessarily have a role in building and regulating the infrastructure that facilitates a low-carbon economy. Many of those investments can begin today.

While the green programs evaluated in our study would have a direct impact on US energy demand and carbon emissions, other potential elements of an economic recovery package could do so as well. A significant amount of the close to $1 trillion in stimulus being considered will likely go to improving and expanding roads, bridges, and highways. Our study evaluates investments that, while not conceived as energy and environmental programs, would have a meaningful impact on the country's energy and environmental footprint.

Methodology: Modeling Energy, Emissions and Economic Impact

To assess the energy and environmental impact of the twelve green recovery programs included in our study, we used the Energy Information Administration's (EIA) National Energy Modeling System (NEMS). With its extremely detailed model of the energy impacts of US consumer and business behavior both by region of the country and sector of the economy, NEMS is seen as the preeminent tool for forecasting US energy demand and is used to create the Department of Energy's official Annual Energy Outlook (AEO) each year.

We have modified NEMS to simulate each program included in the study.[1] We modeled our policy scenarios using the just-released AEO 2009 version of NEMS to capture recent changes in policy, energy prices, and technology costs.[2] We also modeled each scenario using EIA's modifications to the NEMS model last year to simulate the impact of the Lieberman-Warner Climate Security Act (S.2191).[3] This allows for an assessment of how programs included in a green recovery package would impact the cost and contours of climate policy down the road.

Estimates of the employment impact of each program included in the study were made using the input-output tables from the Department of Commerce's Bureau of Economic Analysis (BEA). This approach allows for an assessment of direct employment effects (jobs created in the industry receiving stimulus spending), indirect employment effects (jobs created in supplier industries), and induced employment effects (jobs created when new direct and indirect hires spend their wages).[4] The use of the NEMS model also allows us to evaluate the employment impact of energy cost savings to households, firms, and the federal government (as well as the corresponding reduction in revenue to the energy industry) resulting from each scenario.

It is important to keep in mind that the NEMS model is a tool for evaluating possible scenarios, not forecasting definitive outcomes. Energy markets are impacted by myriad elements that are volatile in nature. Each year, changes in energy prices, policy, consumer behavior, and technology costs result in significant revisions to previous Annual Energy Outlooks. The same is true with our employment analysis, which is intended to measure potential job creation under normal circumstances with all other variables held constant. Our hope is that this report will help policymakers evaluate the relative merits of prospective economic stimulus programs, rather than serve as a forecasting tool.

Scenarios: Potential Green Recovery Programs

The policy scenarios analyzed in the report were drawn from conversations with policymakers, nongovernmental organizations (NGOs), industry groups, and academics in November and December of 2008 about what types of programs are being advocated and considered as part of an economic stimulus package. We opted for a representative set of policy proposals rather than an exhaustive list of possible options. The report does

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[1] Documentation on the NEMS is available on the Energy Information Administration's web site at www.eia.doe.gov/oiaf/aeo/overview/index.html. A full description of how NEMS assumptions were changed to model each stimulus policy scenario is provided in our full report.

[2] Available online from the Energy Information Administration at www.eia.doe.gov/oiaf/aeo/index.html. AEO 2009 includes policy changes in the Emergency Economic Stabilization Act of 2008.

[3] Available online from the Energy Information Administration at www.eia.doe.gov/oiaf/servicerpt/s2191/index.html.

[4] The Bureau of Economic Analysis's RIMS II multipliers are available online at www.bea.gov/bea/regional/rims/. Where predefined BEA industry categories were too aggregated, we made adjustments based on industry surveys. For different forms of power generation, we used estimates from the National Renewable Energy Laboratory's JEDI database, available at www.nrel.gov/analysis/jedi/about_jedi.html.

not recommend any for inclusion in a recovery package but evaluates them against the metrics outlined above. Below is a brief description of each. The cost of each program, as well as the energy, environmental, and economic results of our analysis are described in figure 1 and table 1.

1. **Household Weatherization**: improving the efficiency of 7.5 million homes in New England and the Midwest;
2. **Federal Building Efficiency**: reducing energy demand in federal buildings by 20 percent through retrofits;
3. **Green Schools**: providing funding to ensure all new school construction and major renovation is high efficiency;
4. **Production Tax Credit**: extending the Production Tax Credit (PTC) for renewable energy at the current rate through 2014;
5. **Investment Tax Credit**: increasing the Investment Tax Credit (ITC) for renewable energy (residential, commercial, and utility-scale) to 50 percent (currently 10–30 percent);
6. **CCS Demonstration Projects**: funding ten 500 MW carbon capture and storage (CCS) demonstration projects around the country;
7. **Cash for Clunkers**: providing a $2500 tax credit toward the purchase of a new vehicle when a car 13 years or older is retired between 2009 and 2011;[5]
8. **Hybrid Tax Credit**: providing a $2500 tax credit for the purchase of a hybrid vehicle between 2009 and 2011;
9. **Mass Transit Investment**: providing $10 billion for "shovel ready" mass transit projects—to complement this assessment we have also included the impact of $10 billion and $100 billion in investment in roads and highways;
10. **Battery R&D**: strategic investment in the research, development, and deployment of advanced battery systems aimed at meeting FreedomCAR goals for reducing cost and weight;
11. **Smart Grid**: facilitating an upgrading of electrical grid technology through tax credits, matching funds, and R&D investment;
12. **Transmission**: constructing 12,000 miles of high-voltage transmission lines to allow for greater renewable energy penetration.

The two electrical grid scenarios represent a complex suite of public- and private-sector actions, rather than a targeted policy intervention. As such, we were not able to model them reliably using NEMS. Instead, we provide a more qualitative analysis based on a review of existing research.

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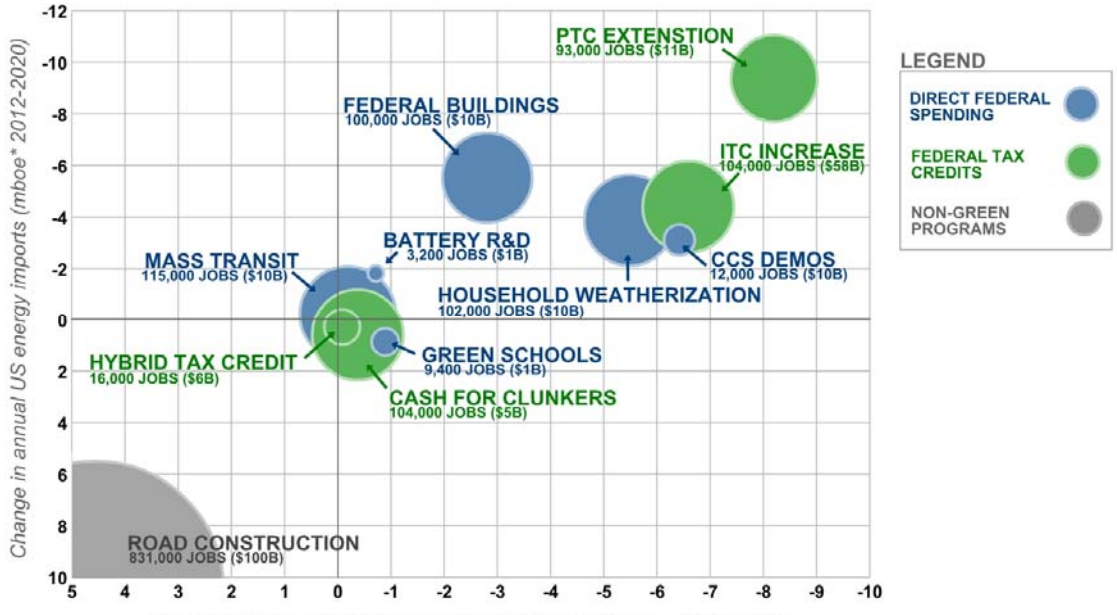
[5] We based our "Cash for Clunkers" scenario on a report by the Center for American Progress, which assumes that a $2500 tax credit for retiring vehicles 13 years and older would result in 2 million passenger vehicles taken off the roads (see Center for American Progress, 2008, *Cash for Clunkers*, Washington, available at www.americanprogressaction.org/issues/2008/cash_for_clunkers.html). We assumed that half of the drivers trading in old cars would have purchased a new vehicle regardless (see J. Dill, 2004, "Estimating Emissions Reductions from Accelerated Vehicle Retirement Programs," *Transportation Research Part D: Transport and Environment* 9 (2): 87–106 for a discussion of consumer response to cash for clunkers programs) and that there was no limitation placed on the type of new vehicle purchased.

Headline Results

The twelve programs listed above vary considerably in implementation time, impact on the economy and employment, cost certainty, and compatibility with future energy and environmental policy. I will focus on a few key findings we think are useful in informing the current policy discussion. The impact of all ten modeled scenarios in terms of employment, energy imports, and CO_2 emissions is depicted in figure 1. The horizontal axis indicates change in average, annual CO_2 emissions between 2012 and 2020 with the right-hand side of the chart corresponding to a net emissions decrease. The vertical axis indicates change in imports of all primary energy products (coal, oil, and gas), measured in million barrels of oil equivalent per year. In our scenarios, most of this reduction comes in the form of natural gas, rather than oil, through a decline in gas consumption either in buildings or power plants. The size of the bubble reflects the number of direct, indirect, and induced jobs created and sustained between 2009 and 2011.

Figure 1: Assessing Green Recovery Policy Options

Impact on CO2 emissions (X-axis), energy imports (Y-axis) and job creation (circle size)*



* Job creation numbers are annual averages between 2009 and 2011 and include direct, indirect and induced jobs adjusted for the change in energy expenditures resulting from the scenario.The dollar figure following jobs estimate is the program cost in USD billions.

** Energy imports include oil, gas and coal measured in million barrels of oil equivalent (mboe)

Building Efficiency

Direct government investment in energy efficiency can have immediate economic and employment impacts, yield significant energy cost savings, and complement future climate policy by addressing market failures. Our Household Weatherization scenario, at a cost of $10 billion in federal expenditures, cuts CO_2 emissions by 5.5 million tons and reduces energy imports by 3.9 million barrels of oil equivalent (mboe) per year. The program would, on net, create 24,000 jobs in the construction industry (direct jobs) and 16,000 jobs in supporting industries (indirect jobs). The 7.5 million households

weatherized receive roughly $700 million per year and the economy as a whole saves an additional $650 million a year in lower energy prices. These cost savings, if spent elsewhere in the economy, would create an additional 44,000 jobs. Add in the 25,000 jobs created when those employed directly and indirectly by the program spend their paychecks (induced jobs) and the scenario could result in up to 102,000 jobs created and sustained between 2009 and 2011. While the construction jobs would fall off after that, the energy savings would continue, extending 35,000 jobs through 2020.[6]

Retrofitting federal buildings yields similar results. At a cost of $10 billion, energy imports are reduced by 5.5 mboe and CO_2 emissions cut by 2.8 million tons per year. The federal government saves around $1.6 billion per year on energy purchases and the economy as a whole cuts costs by and extra $1.5 billion a year. If avoided government spending is passed through to the consumer in the form of lower taxes, 26,000 jobs are sustained between 2012 and 2020. Covering the incremental cost of making all new and renovated schools green is a less ambitious undertaking, costing $1 billion in our scenario, but it could be extended to include retrofits similar to the Federal Building Efficiency program.[7] At a similar level of spending job creation, energy savings, and emission reductions would be in the same range.

Renewable Incentives

Our two renewables scenarios, extending the Production Tax Credit (PTC) and increasing the Investment Tax Credit (ITC), have the potential to result in even larger energy savings and emission reductions, but with more uncertainty. Assuming that tax credits are an effective tool for incentivizing wind power development in the current economic climate, extending the PTC would stimulate an additional 16 GW of wind power capacity construction over "business-as-usual" between now and 2014. Providing a 2.1 cent tax credit for each kilowatt hour produced by this capacity for the first ten years, as well as the 5.9 GW that is projected to be added without an extension, would cost just under $11 billion. Increasing the ITC from 30 to 50 percent would nearly triple the rate of installation of solar panels on homes and businesses, resulting in 24 GW of new capacity between now and when the ITC is schedule to expire in 2017. This capacity expansion would come at a considerably higher price than the PTC. Using EIA's capital cost estimates, increasing the ITC would cost the government $58 billion more than the $20 billion projected under the reference scenario.

Both the ITC and PTC scenarios would create roughly 100,000 direct, indirect, and induced jobs between 2009 and 2011.[8] With the tax credits extending beyond this

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[6] Estimates of the cost and energy savings of weatherizing individual homes are drawn from Oak Ridge National Laboratory assessments of the Department of Energy's Weatherization Assistance Program. These results are then modeled through NEMS to assess economy-wide energy impacts.

[7] Estimates of the cost and energy savings of retrofitting federal buildings are drawn from the Department of Energy's Federal Energy Management Program. These results are then modeled through NEMS to assess economy-wide energy impacts.

[8] Jobs estimates for renewables assume 100 percent local content. While the United States ran fairly balanced trade in solar panels in 2007 (see

window, both would continue to create a considerable number of jobs until they expire. For the ITC scenario, this could be as high as 255,000 jobs between 2012 and 2020 (including jobs created through energy savings).

Transportation

Compared to building efficiency and renewable energy, our transportation scenarios have considerably less impact on energy demand and CO_2 emissions. Neither Cash for Clunkers nor the Hybrid Tax Credit created a noticeable change in the country's energy or environmental trajectory. In the Cash for Clunkers scenario, this is because in the NEMS model old vehicles are not driven as much as new vehicles, so total vehicle-miles-traveled increases as a result of the program. When looking to reduce environmental pollutants like SO_2 and NO_X, this effect is small in comparison to the reduction in emissions achieved by upgrading the vehicle stock. But in terms of fuel economy, and thus CO_2 emissions, the vehicle fleet of 13 years ago does not look much different from the vehicle fleet of today. The effectiveness of a Cash for Clunkers program could be improved by limiting new purchases to high efficiency vehicles, but it would still fall far short of our previous scenarios in terms of energy savings and CO_2 emission reductions.

The Hybrid Tax Credit doubles projected hybrid sales to 2.5 million between 2009 and 2011. But in the NEMS model, many of these hybrid purchases come at the expense of ethanol-powered flex-fuel vehicles, diminishing much of the energy and emissions benefit. Both Cash for Clunkers and the Hybrid Tax Credit scenarios assume traditional consumer response to tax incentives, which may not be applicable in the current economic environment. The Battery R&D scenario, on the other hand, is direct government investment in research and development. Reducing battery cost and weight holds the promise of making plug-in hybrids competitive with conventional vehicles and significantly altering the energy profile of the transportation sector over the long term.[9] We assume that $1 billion in research investment would enable the Department of Energy (DOE), in conjunction with private-sector partners, to meet the FreedomCAR battery cost targets by 2015. In the model, this causes plug-in hybrid sales to jump to 390,000 a year by 2020, 170,000 more than in the reference case. This modest start toward broad-based plug-in hybrid penetration reduces oil imports by 2 million barrels a year.[10]

Investing $10 billion in mass transit yields relatively modest energy and environmental improvements but significant job creation. In our scenario, the transit investment is

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www.eia.doe.gov/cneaf/solar.renewables/page/solarreport/table3_12.html and www.eia.doe.gov/cneaf/solar.renewables/page/solarreport/table3_14.html) this may not be the case in the years ahead.

[9] See Electric Power Research Institute and Natural Resources Defense Council, 2007, *Environmental Assessment of Plug-In Hybrid Electric Vehicles*.

[10] The AEO 2009 is the first version of NEMS model to include a detailed model of battery and plug-in hybrid (PHEV) costs. The approach adopted by EIA has yet to receive rigorous review, as the AEO 2009 is still in early release. Therefore we adjusted our scenario based on findings in recent PHEV reports from the Electric Power Research Institute, Pacific Northwest National Laboratories, and the American Council for an Energy-Efficient Economy.

distributed proportionally to bus, light rail, and heavy rail, and yields average levels of energy efficiency. Under this assumption, the energy demand increase from greater mass transit usage offsets about half the gains from lower vehicle miles traveled in passenger cars. The energy and environmental "bang for the buck" of mass transit spending increases if systems are designed to maximize energy efficiency.

Grid

"Smart grid" refers to a whole suite of technologies and applications that increase awareness of energy costs and improve the efficiency of transmission and distribution. While we were unable to model such a suite in NEMS, recent studies suggest that a smart grid broadly deployed can have major energy and environmental benefits. We took the estimates of what could be done independent of other policies in one such study and updated them using the AEO 2009.[11] We find that an aggressive program of smart grid deployment nation wide could reduce energy costs by $12 billion to $35 billion and cut CO_2 emissions by between 23 and 66 million tons a year between 2012 and 2020. Smart grid deployment is still in trial stages around the country and there are no reliable estimates available for what a comprehensive program would cost. A well-planned smart grid roll-out would take time, but selected elements could be tackled during the 2009–2011 window. Construction crews could, for example, install new metering systems while performing household weatherization.

The cost of upgrading the transmission system to accommodate wide-spread deployment of renewables is better understood. DOE's National Renewables Energy Laboratory, for example, estimates that the 12,000 miles of new transmission lines needed to increase wind power penetration to 20 percent would cost $20 billion.[12] They calculate that this would decrease CO_2 emissions by 84 million tons per year and reduce natural gas demand by 11 percent. New transmission lines could also potentially enable concentrated solar power in the Southwest to displace coal-fired power for base-load generation. Government action will be required to get these transmission lines planned, approved, and sited, and the country's transmission needs will change over time as the nature of the power sector evolves. Given uncertainty about the future generation mix, there is little in the way of "shovel-ready" transmission projects waiting for stimulus funding. Policymakers should incorporate a longer time-horizon for grid investment and look to options like a national infrastructure bank.

Roads

Stacked up against our twelve green stimulus options is the potential for massive investment in the construction and repair of roads, bridges, and highways. Our study finds that $100 billion in road investment would increase energy imports by 10.5 mboe

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[11] See O. Siddiqui, 2008, *The Green Grid: Energy Savings and Carbon Emissions Reductions Enabled by a Smart Grid*, Electric Power Research Institute.

[12] See National Renewable Energy Laboratory, 2008, *20% Wind Energy by 2030: Increasing Wind Energy's Contribution to U.S. Electricity Supply*. Estimates are based on the AEO 2007.

and CO_2 emissions by 4.6 million tons per year between 2012 and 2020.[13] This would cancel out the impact of the nongrid green scenarios by 42 percent and 14 percent, respectively. The road investment scenario would create over 300,000 jobs directly in construction and 177,000 jobs in supporting industries. Energy expenditures increase by $4.3 billion, which results in a loss of 10,000 jobs between 2009 and 2011 and 5,000 jobs between 2012 and 2020 (though this may well be offset by increased productivity resulting from the infrastructure improvement).

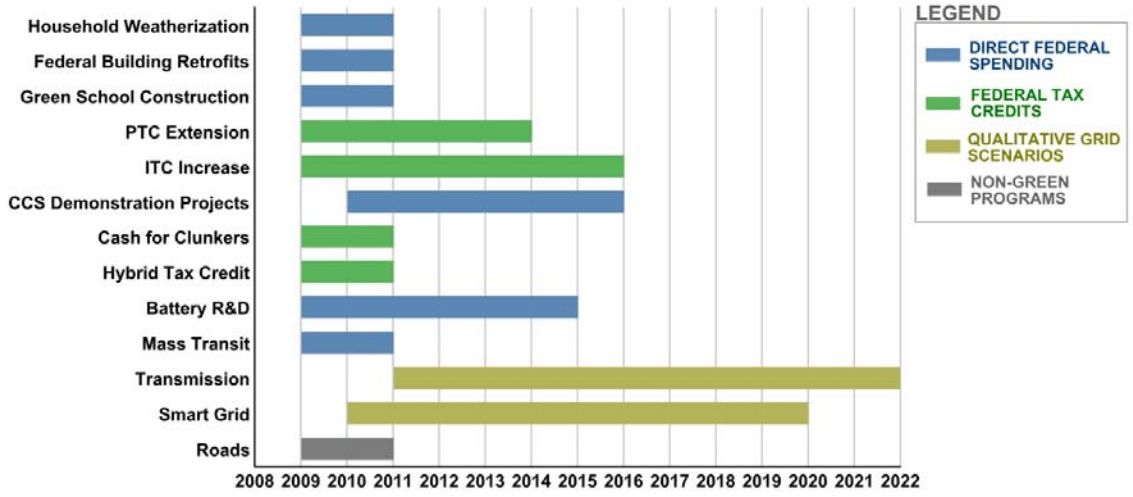
Table 1: Comparing green recovery options (change over AEO 2009 reference case, preliminary results)

	Cost	Energy savings**	Employment***			
Green Programs	Total cost in billion USD	Billion USD/year 2012–2020	Direct 2009-–2011	Indirect 2009–2011	Wage induced 2009–2011	Efficiency induced 2009–2011
Household Weatherization	$10	$1.37	24,000	15,000	20,000	44,000
Federal Building Retrofits	$10	$3.10	25,000	16,000	25,000	35,000
Green School Construction	$1	$0.07	2,700	1,700	3,000	2,100
PTC Extension	$11*	$2.93	20,000	17,000	32,000	24,000
ITC Increase	$10*	$5.04	26,000	24,000	44,000	9,000
CCS Demonstration Projects	$10	$1.66	3,800	1,300	6,800	-
Cash for Clunkers	$5*	-	19,000	25,000	53,000	-
Hybrid Tax Credit	$6*	-	2,900	5,600	8,300	-
Battery R&D	$1	-	1,600	-1,200	2,700	-
Mass Transit	$10	-	41,000	24,000	49,000	-
Transmission	$20	NA	NA	NA	NA	NA
Smart Grid	NA	$12-$35	NA	NA	NA	NA
Other Programs						
Road Investment	*$100*	*-$4.26*	*303,000*	*177,000*	*362,000*	*-10,000*

* These programs are open-ended tax credits so the exact cost is unknown. Estimates here are based either on model results from AEO 2009 or assumptions from existing literature.
** Indicates savings in energy expenditures for the economy as a whole. These have only been listed for scenarios where the finding was statistically significant.
*** Employment numbers are measured as the average number of jobs created and sustained between 2009 and 2011. This includes jobs lost in the energy sector as the result of improved efficiency but not the jobs lost as a result of higher tax rates to recoup the fiscal cost of green stimulus programs. Efficiency-induced jobs have only been listed for those programs where the change was considered statistically significant. Job estimates for changes in electricity generation capacity assume 100 percent domestic content for materials and technology.

[13] Estimates of the impact of road investment on vehicle-miles traveled are drawn from the Federal Highway Administration's (FHWA) Highway Economic Requirements System (HERS).

Figure 2: Green Recovery Program Timelines
Start, stop and duration of policy scenarios included in the study



Conclusions and Policy Design Considerations

In seeking to implement any of the above programs as part of an economic recovery package, considerations should be made for how the current economic climate has impacted the utility of traditional policy tools. Tax credits are only useful if firms have a tax burden to reduce. The PTC and ITC scenarios will likely be less effective in changing firm behavior over the next two years than under normal circumstances. This can potentially be addressed by making the credits refundable. Even if firms are profitable, and thus have an appetite for tax credits, they may have trouble gaining access to finance. A federal lending facility for renewable projects could be an important complement to tax incentives. On the consumer side, current retrenchment may not be undone simply by offering a $2500 credit toward the purchase of a new car. Estimates of the scale of impact of the Cash for Clunkers and Hybrid Tax Credit scenarios assume a normal environment and may need to be adjusted downward. Likewise, wages and energy cost savings to households may be saved at a greater rate than normal, which would reduce the induced job estimates in this study. I have broken out the employment effects by type in table 1 so you can apply your own assumptions about consumers' current propensity to save.

I would also urge the Committee to keep future climate legislation in mind when evaluating policy options for the current stimulus package. While the impact of the programs listed above on CO_2 emissions are certainly meaningful in absolute terms, they fall far short of medium- and long-term emission reduction targets. The ten scenarios we modeled would cut emissions by 32 million tons per year on average between 2012 and 2020, a 0.5 percent reduction in the US total. In contrast, EIA estimates that the Lieberman-Warner Climate Security Act would reduce emissions by 484 million tons during the same period. Green components of a stimulus package should be seen as a segue into, not a replacement for, a cap-and-trade system or a carbon tax.

Given that the programs assessed in our study are no substitute for climate policy, Congress should consider how proposed stimulus programs will interact with future climate regimes. Some of our scenarios, like the PTC extension, cost more and have less value if a price for carbon is introduced. Under the EIA's model of the Lieberman-Warner Climate Security Act, a PTC extension only increases wind capacity in 2020 by 12 GW (from 87 GW to 99 GW), but costs the government $41 billion, or four times the cost of the reference case scenario for an equivalent increase in generation capacity.[14] Other scenarios are enhanced by the imposition of carbon controls. CCS demonstration projects have a modest emissions benefit in and of themselves but are primarily a means of facilitating broader diffusion under a carbon-constrained future. Likewise, the extent to which greater plug-in hybrid penetration can reduce CO_2 emissions depends on the ability of climate policy to move the power sector in a less carbon-intensive direction.

The same considerations hold for energy security. All together, our ten modeled scenarios decrease annual energy imports by 27 mboe, roughly 0.5 percent of the US total. And most of that reduction is in natural gas. A serious attempt to curtail dependency on foreign oil will require more comprehensive and aggressive policy. While a stimulus package can make an important start on both this and emission reduction goals, Congress should be careful to include only those programs that will have a meaningful short-term economic impact and do not conflict with long-term energy and environmental policy down the road.

Finally, when considering medium-term employment implications of a prospective stimulus package, it is important to keep in mind that money borrowed to pay for stimulus programs will need to be repaid down the road, either through increased taxes or a cut in government services. The debt obligations incurred over the next 24 months will cost the economy jobs in the years that follow (though hopefully from a considerably higher base than there would have been without the stimulus effort). The energy cost savings created through green components of a stimulus package have the potential to offset a considerable amount of this by redirecting consumer spending to more labor-intensive and locally produced goods and services over the long run.

Thank you for the opportunity to share our research with you and I look forward to your questions.

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[14] The EIA model of Lieberman-Warner based on AEO 2008 data was updated to reflect current wind power capacity additions through the beginning of 2009.