American Energy Innovation Council

The Impact of Three Tax-Reform Proposals on the Financial Performance of Energy Plants

By Jason Burwen, Associate Director for Energy Innovation | September 2015

Executive Summary

In recent years, several members of Congress have proposed comprehensive tax reforms: Representative David Camp in February 2014, Senator Max Baucus[i] in December 2013, and Senators Ron Wyden and Dan Coats in 2011. This study quantifies the impact of the Baucus, Camp, and Wyden-Coats proposals on the illustrative project economics of different electricity-generation sources. We at AEIC used a model that estimates the financial performance of electricity-generating facilities to set up an equivalent comparison of the impact of the three tax-reform proposals on three illustrative facilities: a wind-power project, a solar-photovoltaic (PV) project, and a combined-cycle gas turbine (CCGT) power plant. Specifically, we examined the impact of changes to the corporate income-tax rate, depreciation rules, and energy-specific tax credits under the three proposals.

Contents

Summary	2
Introduction	3
Model	4
Method	5
Results	7
Conclusion	11
Technical Appendix	12

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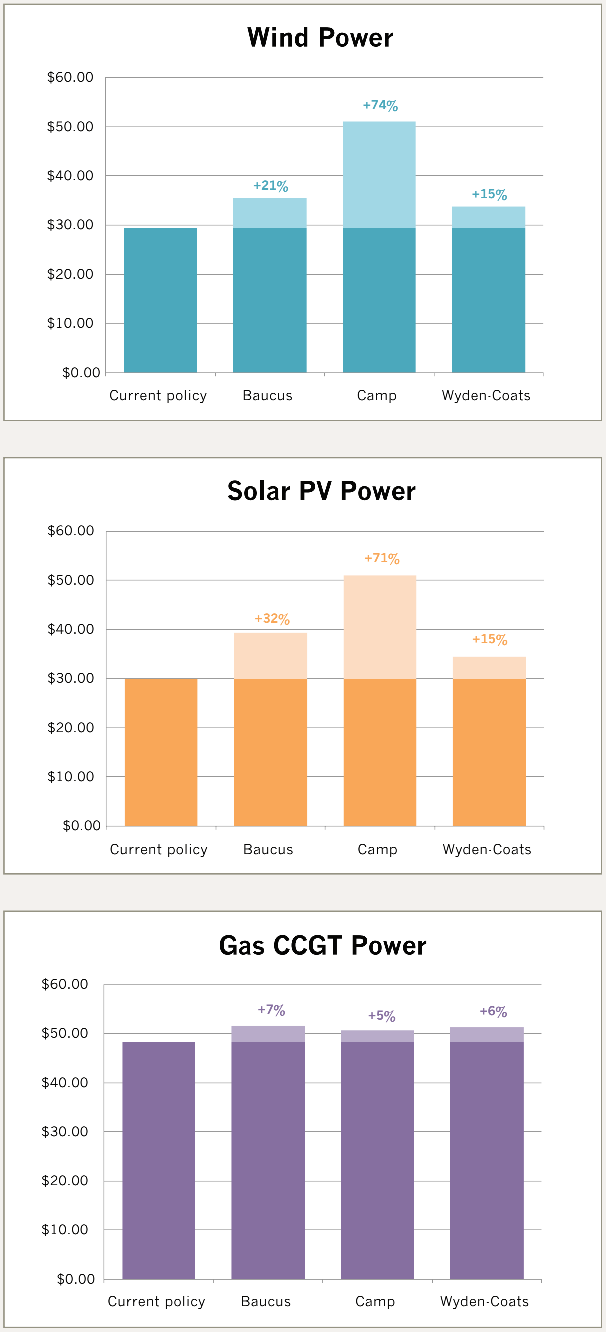
All three tax-reform proposals raise the levelized cost of energy from all three projects, compared with current policy, when project owners fully monetize all tax benefits. (This is illustrated this in Figure 1.) Additionally, changes to depreciation rules affect the cost of wind- and solar-electricity generation more than that of conventional gas-fired electricity generation, as capital costs make up a larger proportion of total energy project costs for renewable energy sources. Changes in depreciation and corporate income tax slightly diminish the effective value of energy investment- and production-based tax credits. Finally, the use of tax equity reduces the cost-effectiveness of energy tax incentives.

"All three tax-reform proposals raise the levelized cost of energy compared to current policy."

Figure 1.

Impact of Depreciation, Corporate Income Taxes, and Energy Tax Credits on Levelized Cost of Energy Under Several Proposals, assuming full tax capacity ($/MWh)



Introduction

The federal tax code, significantly affects the economics of the energy sector, in addition to the broader U.S. economy. According to the Congressional Research Service, tax expenditures—that is, subsidies that reduce the amount of tax owed to the government—for energy accounted for roughly $22 billion in FY 2013 and are estimated to average roughly $16 billion per year through FY 2017 if present trends continue, equivalent to 1 to 2 percent of existing U.S. tax expenditures. These energy-related tax expenditures fall generally into three categories:

1) *Credits and deductions:* the modification of tax liability, either indirectly through reducing taxable income (i.e., deductions) or directly reducing tax payments (i.e., credits);

2) *Cost-recovery mechanisms:* the rules for allocating the business expense associated with an asset over the asset's life; such depreciation (for tangible assets) or amortization (for intangible assets) expenses are then deducted from revenue to calculate a business's taxable income; and

3) *Alternative business structures:* the rules for eligibility and taxation associated with different types of business entities—particularly whether a business entity is subject to corporate income taxation or whether its income is "passed-through" to business owners and subject to individual income taxation.

Most existing energy tax expenditures have been enacted since 1986, when Congress last passed comprehensive tax-reform legislation. All energy sources are directly affected by some part of the tax code, either by provisions specific to a resource, such as the renewable energy production tax credit (PTC) and the percentage depletion allowance for oil and gas, or by general measures, such as corporate income-tax rates and depreciation rules.

In theory, taxes and subsidies are intended either to correct an energy market failure, to correct a distortion introduced by other policies, or to achieve a greater national objective. In practice, U.S. energy tax policy is a product of fiscal objectives and the interests of policymakers, experts, and interest groups. As a result, enacted tax policy embodies compromises between economic and political goals at a particular point in time. As time passes, the policies embodying previous compromises may reach (or prove unable to reach) their goals and can become increasingly dissonant with new economic realities and political goals. (For this and other reasons, in 2013, BPC's Strategic Energy Policy Initiative called for Congress to review all existing tax expenditures associated with energy.)

In recent years, several members of Congress have proposed comprehensive tax reform. In February 2014, former House Ways and Means Committee Chairman Rep. Dave Camp (R-MI) released his proposal for comprehensive tax reform. Rep. Camp's proposal followed a set of proposals (here and here) issued as part of a staff discussion draft in December 2013 by former Senate Finance Committee Chairman Sen. Max Baucus (D-MT). The previous chairman of the Senate Finance Committee, Sen. Ron Wyden (D-OR), proposed significant changes to the tax code in bipartisan legislation co-sponsored with Sen. Dan Coats (R-IN) in 2011. All three proposals proceed from the premised goal of lowering individual and corporate income-tax rates while broadening the base of taxable activities, generally by removing or limiting deductions, credits, and techniques for recognizing income in low-tax jurisdictions. While supporting documents for each of these proposals make reasoned arguments for changing various tax provisions, they do not attempt to quantify the impact of those changes on energy project economics. Recent studies from the Congressional Research Service and Lawrence Berkeley National Laboratory quantify the impact of changes to the production tax credit and investment tax credit on wind and solar project economics; however, these studies do not model the full impact of the Baucus, Camp, or Wyden-Coats proposals.

The purpose of this study, then, is to quantify the impact of the Baucus, Camp, and Wyden-Coats proposals on the project economics of different electricity-generation types. AEIC uses a financial model developed by Climate Policy Initiative[ii] that estimates the financial performance of electric-generating facilities to set up an equivalent comparison of the impact of the three tax-reform proposals on three illustrative facilities: a wind-power project, a solar-power project, and a gas-fired power plant.

Model

Climate Policy Initiative's financial model uses the technical, policy, and financial characteristics of the illustrative wind-power project, solar-power project, and gas-fired power plant to estimate their key financial-performance metrics, the effect of proposed tax reforms on their costs of electricity, and the cost of those reforms to the government. The model does this using three interconnected modules:

1) *A pro-forma project cash-flow model:* This model uses key project inputs—costs, revenue, financing, and policy parameters—to generate expected tax and cash flows over the development, construction, and operation of the project. In particular, the model estimates cash and tax flows to and from investors, debt providers, ratepayers, and government stakeholders.

2) *A leveled cost of energy (LCOE) model that incorporates tax-equity and debt optimization:* The LCOE model uses the cash and tax flows generated by the pro-forma cash-flow model to solve[iii] for the minimum additional revenues or incentives needed to simultaneously meet the requirements of all project financing sources and maximize the amount of debt. The resulting financial structures and additional revenues or incentives are then used to complete the cash-flow model of the project (and to check that all financial requirements are indeed met).

3) *Scenario and sensitivity analysis:* The scenario analysis worksheet facilitates the analysis of a large number of project cases, along with different policy and financing scenarios, using the pro-forma cash-flow model and/or the LCOE model. This enables AEIC to assess the robustness of our results.

An explanation of model function, key assumptions, parameter values, calculations of key metrics, and other model documentation is contained in the appendix to this paper.

Key Energy Project Financial Terms

Corporate income taxes are levied on the net profits of all business entities classified as corporations.[iv] America's top corporate income-tax rate of 35 percent is the highest nominal rate among Organisation for Economic Co-operation and Development countries. Studies have shown that the impact of corporate income taxes may be borne by business owners through reduced profits, by employees through reduced wages, or by consumers through increased prices.

Depreciation is the method by which costs of a capital asset are allocated over the useful lifetime of that asset. In financial accounting, asset costs are spread out over the life of an asset to account for the fact that the expense associated with the asset accrues benefits over time, rather than all at once. Depreciable assets therefore involve several criteria for calculation: cost, residual value at any point in time, estimated useful life, as well as a method for apportioning cost over that life. For the purposes of taxation, depreciation rules determine how a business makes deductions for a capital-asset expense as part of determining net income for any given tax year.

Tax-equity finance refers to an investment transaction wherein an investor with large tax liabilities (such as a bank) makes an equity investment in another business accruing tax credits (such as an energy project developer); the tax-equity investor's returns come from realizing those tax credits against their tax liabilities. Energy project developers often lack sufficient tax liability to utilize most, if not all, tax credits they accrue; hence, in order to take advantage of those credits they seek investors who will provide capital in exchange for the opportunity to realize those credits. Because only owners of a company can realize tax credits from activities of that company, a tax-equity investor takes ownership of the energy project developer for a specified period of time over which it realizes tax credits. This is a particularly common form of transaction for renewable energy projects, which can accrue tax credits for renewable energy investment or production under certain federal tax provisions. Only a handful of entities serve as tax-equity investors in any given year, and each financing is a complex, customized transaction tailored to specific aspects of each energy project. Also, tax-equity finance makes obtaining project-level debt more difficult, since tax-equity investors typically will require the senior claim on project assets.

Method

To make an equivalent comparison among an illustrative wind project, PV project, and CCGT, we made the three facilities as close to interchangeable as possible by assuming: (1) they meet investors' required rate of return on equity (called the hurdle rate) before taxes; and (2) they have the same LCOE before taxes (which we did by demanding the same equity hurdle rate, assuming optimal debt leverage).[v] The three projects used size, cost, and financing inputs representative of projects found in the United States.[vi] We then modified the wind project's capacity factor and the solar PV project's module costs so that the LCOE from all three projects were economically equivalent in the absence of all taxes.[vii,viii] This means that the revenues required from electricity sales per megawatt-hour (MWh) to meet investors' equity hurdle rates are the same for all projects. From the societal point of view, this also means that the projects would have roughly identical impacts on ratepayer electricity prices. The project parameters are presented in Figure 2.

Figure 2.
Parameters of Illustrative Power Projects

	WIND	SOLAR PV	CCGT
Nameplate Capacity	100 MW	60 MW	620 MW
Capacity Factor	52%[ix]	23.8%	85%
Levelized Cost of Ene Before Taxes ($/MWh)	$50.07	$50.13	$50.09
Weighted Average Cost of Capital (%)	8.4%	8.3%	8.7%

We then applied corporate taxes and depreciation tax benefits under three proposals—Sen. Baucus's December 2013 proposal, Rep. Camp's February 2014 proposal, and Sens. Wyden and Coats's 2011 proposal—and compared that to corporate taxes and depreciation tax benefits under a current-policy scenario. To examine the full impacts of the proposals, we assumed project owners have sufficient tax liabilities to monetize tax benefits fully.[x]

Under current policy, a series of provisions in the tax code, often referred to collectively as "accelerated depreciation," allows businesses to recognize depreciation and amortization expenses much earlier on their tax returns than they can on public financial statements. The primary provision, modified accelerated cost-recovery system (MACRS) depreciation rules, has been in force since 1986 and covers many asset types, including specific provisions for electricity-generating assets, fuel-production facilities, and energy infrastructure.

Rep. Camp's February 2014 proposal would replace MACRS with rules similar to the alternative depreciation system (ADS) currently in use for certain property types. Under the Camp proposal, all tangible property would be assigned to a particular asset class, and each class would be assigned a depreciation life (to be developed by the Treasury Department). All depreciation deductions would then be calculated on a straight-line basis over their assigned asset-class life—that is, as equal increments annually. (In contrast, MACRS currently allows depreciation schedules for physical assets that are frontloaded to early years—and are thus "accelerated.") The Camp proposal also allows further depreciation deductions to account for inflation, using chained consumer-price index. Existing special depreciation provisions, such as bonus depreciation, would be repealed, and other associated cost-recovery provisions in the tax code would be similarly adjusted to better match treatment on financial statements.

Sen. Baucus's December 2013 proposal also would repeal MACRS and establish a new set of asset classes. In contrast to the Camp proposal, the Baucus proposal would assign most asset classes an annual depreciation rate, rather than asset lifetimes over which to calculate straight-line depreciation.

Sens. Wyden and Coats's 2011 proposal would replace MACRS with the currently existing ADS, which is used for depreciation-deduction calculations for the alternative minimum tax and for assets outside the United States. The ADS assigns specific depreciation lives to classes of capital assets, over which straight-line depreciation is then calculated. While similar to the Camp proposal, the Wyden-Coats proposal would offer varying depreciation lifetimes for various asset classes.

Figure 3 presents the corporate income tax and depreciation parameters for all policy scenarios.

Figure 3.

Corporate Income Tax and Depreciation Parameters for Policy Scenarios

Scenario	Corporate Income Tax	Depreciation Treatment[xi]
Current Policy	35%	WIND: 5-year MACRS SOLAR PV: 5-year MACRS CCGT[xii]: 20-year MACRS
Baucus Proposal	28%	WIND: 5% declining balance SOLAR PV: 5% declining balance CCGT: 43-year straight-line
Camp Proposal	25%	WIND: 20-year straight-line SOLAR PV: 20-year straight-line CCGT: 20-year straight-line
Wyden-Coats Proposal	24%	WIND: 12-year ADS SOLAR PV: 12-year ADS CCGT: 28-year ADS

We followed this analysis with the addition of production-based tax credits and investment-based tax credits as proposed by the Baucus, Camp, and Wyden-Coats plans and compared them with tax credits under a current-policy scenario. Production-based tax credits and investment-based tax credits for renewable electricity generation have a significant impact on the levelized cost of renewable energy and energy project economics; as two of the largest single tax expenditures, they are a central concern in energy tax reform. For the purposes of comparison, we assumed the production tax credit (PTC) for wind and 30 percent investment tax credit (ITC) for solar is available under the current-policy scenario.[xiii] The Wyden-Coats proposal does not discuss changing treatment of either the PTC or the ITC, and thus these measures are assumed to be included as in current policy. The Camp proposal would let the PTC remain expired and repeal the ITC.[xiv] The Baucus proposal includes a production-based tax credit for electric generation that is at least 25 percent lower in greenhouse-gas emissions intensity than the national average for electricity. The amount of the Baucus PTC varies by emissions intensity, and an energy source with no greenhouse-gas emissions, such as wind power, would be awarded a maximum credit of $25/MWh—equivalent to the current-policy PTC value in 2016 adjusted for inflation.[xv]

Figure 4 presents these parameters for the policy scenarios. While we modeled an ITC for solar power under current policy and Wyden-Coats scenarios, we chose to model a PTC for solar power under the Baucus scenario since it has a greater impact on project economics.[xvi] We examined impacts under two different financing scenarios: one in which project owners have sufficient tax liabilities to monetize tax benefits fully, and one in which project owners have only modest tax liabilities and tax-equity investors monetize most tax benefits.[xvii]

Figure 4

Tax-Credit Parameters for Policy Scenarios

Scenario	Tax Credit
Current Policy	WIND: $25/MWh SOLAR: 30% of capex Gas: None
Baucus Proposal	WIND: $25/MWh SOLAR: $25/MWh GAS: None[xviii]
Camp Proposal	WIND: None SOLAR: None GAS: None
Wyden-Coats Proposal	WIND: $25/MWh SOLAR: 30% of capex GAS: None

Results

Impact of Depreciation and Corporate Income Taxes on LCOE Under Different Scenarios

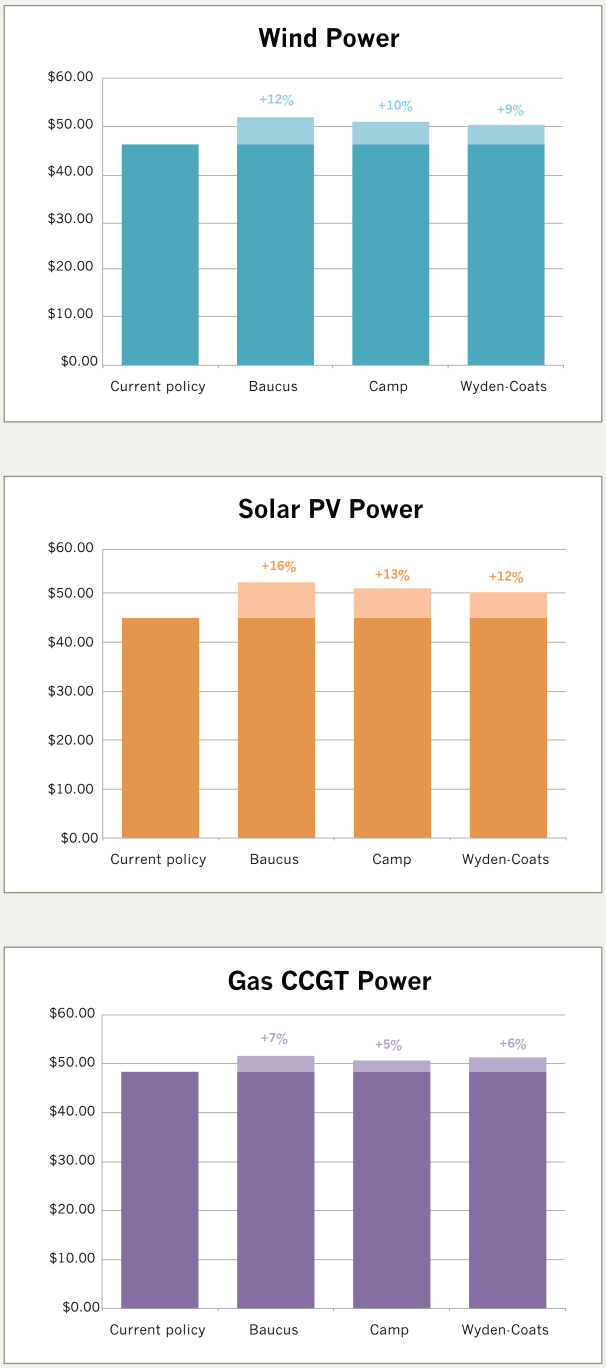
Under the current policy, corporate income tax and depreciation rules reduce the LCOE for the illustrative wind, solar, and gas projects. We found that the application of depreciation and corporate income-tax policies under each of the three tax-reform proposals increases the LCOE for all projects relative to a current-policy scenario. When looking at project LCOEs, the changes to depreciation deductions in each proposal outweigh the accompanying reduction in corporate income-tax rates. Moreover, if projects fully take advantage of all tax benefits, application of depreciation and corporate income-tax policies under the three tax-reform proposals increase the wind and solar projects' LCOE more than the gas plant's LCOE, with wind LCOE rising 9 to 12 percent, solar LCOE rising 12 to 16 percent, and gas LCOE rising 5 to 7 percent (see Figure 5).

The Baucus, Camp, and Wyden-Coats proposals all replace MACRS with approaches closer to how depreciation is reported in financial statements—thereby reducing allowable depreciation deductions for capital assets. This change affects the illustrative wind and solar projects more than the illustrative gas project, as wind- and solar-power assets currently enjoy a more advantageous five-year MACRS (versus a 20-year MACRS for CCGT assets). Reducing depreciation deductions for capital assets increases the wind and solar projects' LCOE more than the gas plant's LCOE since the cost of capital assets makes up a larger proportion of wind and solar project LCOE than gas-plant LCOE; since the gas-plant LCOE includes fuel prices and greater operations and maintenance costs, capital costs are only around 20 percent of all project costs, versus roughly 70 percent of wind project costs and 90 percent of solar project costs.

"Energy subsidies reduced government revenue by roughly $22 Billion in FY 2013."

Figure 5.

Impact of Depreciation and Corporate Income Taxes on LCOE under Proposed Scenarios, with full tax capacity ($/MWh)



Impact of Depreciation, Corporate Income Taxes, and Energy Tax Incentives on LCOE Under Different Scenarios

The inclusion of the PTC for wind and the ITC for solar in the current-policy scenario reduces the illustrative project LCOEs by 37 percent and 33 percent, respectively, when projects have tax capacity to fully monetize credits. When projects use tax-equity investment instead, the PTC for wind and the ITC for solar in the current-policy scenarios reduce the illustrative project LCOEs by 33 percent and 15 percent, respectively.

We then applied the PTC or ITC along with depreciation and corporate income-tax policies under each of the three proposals and two tax-capacity scenarios. The Camp plan results in much higher wind and solar project LCOEs than the current-policy scenario, owing to the absence of any PTC or ITC.[xix] The Baucus and Wyden-Coats plans result in moderately higher wind and solar project LCOEs than the current-policy scenario (see Figure 6). The difference is due primarily to the aforementioned changes in depreciation deductions.

If project developers use tax-equity financing, it reduces the effective value of a PTC and an ITC substantially (see Figure 7). Even though the value of a PTC is $25/MWh, it reduces the LCOE for wind power to only $12-$13/MWh. Similarly, the 30 percent ITC for solar, equivalent to a $15/MWh value with full tax appetite under current policy, reduces to only $7/MWh in value when using tax equity under current policy; under the different tax-reform proposals, its value reduces even further.[xx] The costs of capital and transaction costs associated with tax-equity financing substantially reduce the impact and cost-effectiveness of the PTC and ITC.

Interestingly, when a PTC or ITC is combined with changes to depreciation, wind and solar project LCOE increases under the Baucus and Wyden-Coats proposals are greater than with changes to depreciation alone; in other words, proposed changes to depreciation rules slightly reduce the effective value of a PTC or ITC incentive. This is a byproduct of the wind and solar project using tax equity, prompted by the availability of a PTC or ITC. As tax- equity investor returns are more sensitive to the profile of tax benefits than non-tax-equity investors, changes in depreciation profiles have a greater impact on tax-equity investors' ability to meet return requirements, which in turn raises the cost of capital and reduces the effective value of tax credits. Similarly, since the ITC reduces the depreciable basis for a solar project, the accelerated depreciation benefits are similarly reduced. So even though the changes to depreciation have nothing to do with a PTC or ITC, the use of tax-equity financing prompted by the PTC or ITC makes investors more sensitive to changes in depreciation.

The illustrative gas project LCOE does not change, since neither the current-policy scenario nor any of the proposals modeled include a change in tax-credit availability for gas-fired generation.[xxi] As a result, the LCOEs of the illustrative wind and solar projects under the Baucus and Wyden-Coats proposals remain lower than the LCOE of the illustrative gas-fired plant; under the Camp plan, which does not include a PTC or ITC, the LCOEs of the illustrative wind and solar projects are slightly higher (1 to 1.5 percent) than the LCOE of the illustrative gas-fired plant.

Figure 6.

Impact of Depreciation, Corporate Income Taxes, and Energy Tax Incentives on LCOE under Proposed Scenarios, <u>with full tax capacity (i.e., not using tax equity) ($/MWh)</u>

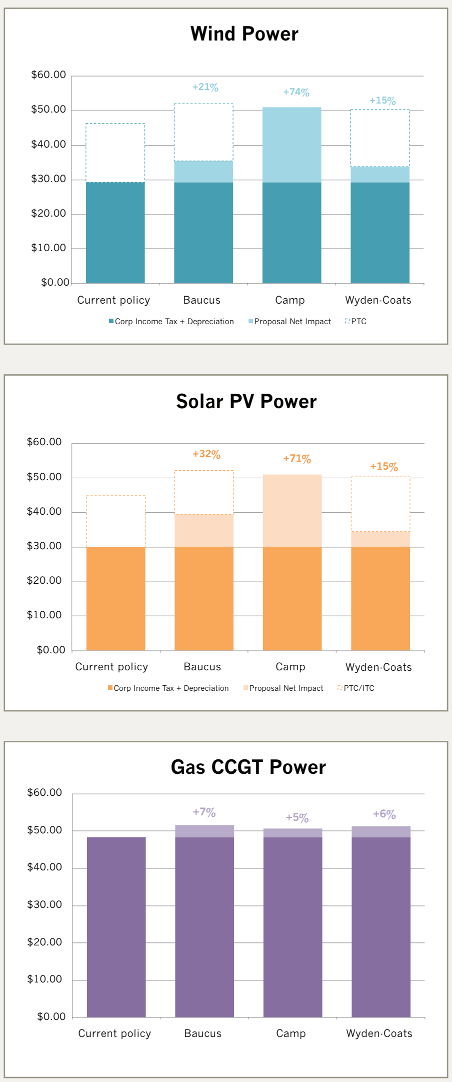


Figure 7.

Impact of Depreciation, Corporate Income Taxes, and Energy Tax Incentives on LCOE under Proposed Scenarios, without tax capacity (i.e., using tax equity) [xxii] ($/MWh)

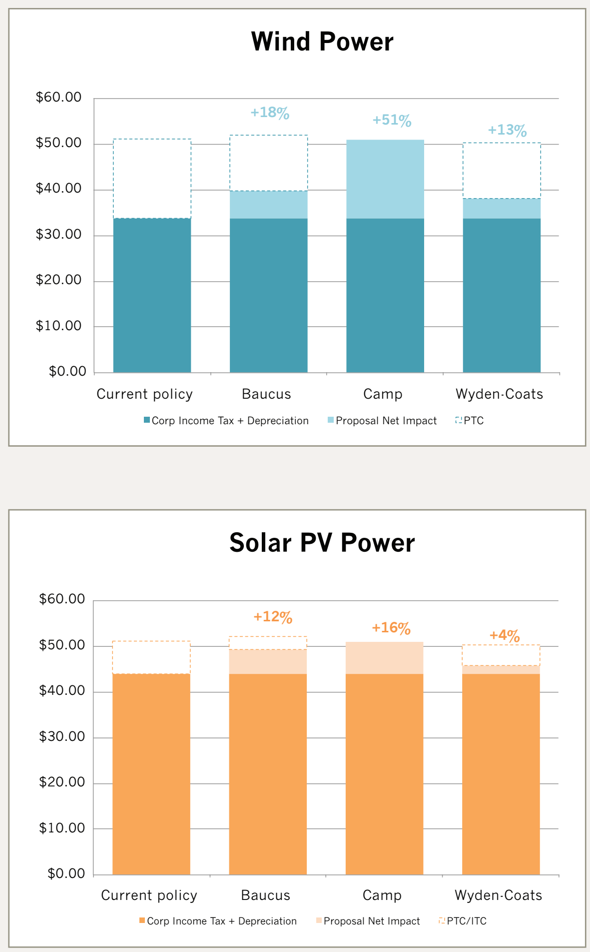
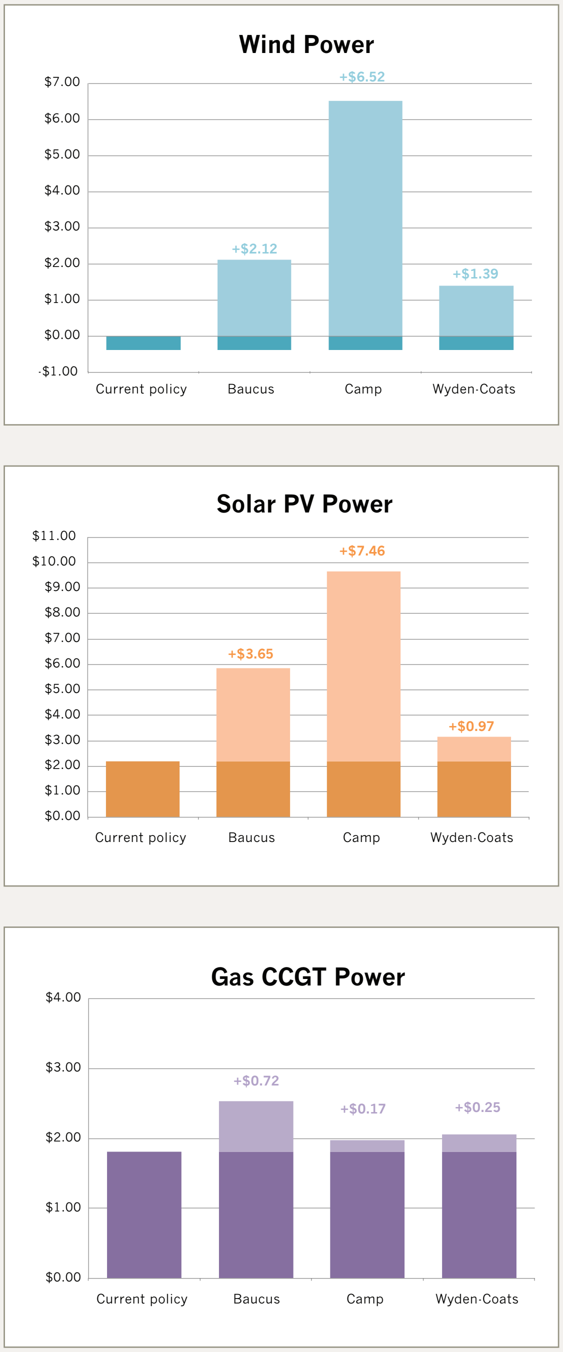


Figure 8.

Impact of Depreciation, Corporate Income Taxes, and Production-Based Tax Credits on Government Revenues under Several Scenarios ($/MWh)



Impact of Depreciation, Corporate Income Taxes, and Production-Based Tax Credits on Government Revenues Under Different Scenarios

In reducing tax expenditures and/or modifying depreciation treatment to be less advantageous, all proposals raise more project-level tax revenue from the illustrative wind project, solar project, and gas-fired plant on a per-MWh basis than under the current-policy scenario.[xxiii] The Camp proposal recovers the most revenue on a per-MWh basis from the illustrative wind and solar projects, primarily by not including any PTC or ITC. The Baucus proposal recovers the most revenue on a per-MWh basis from the illustrative gas-fired plant.

Note that these figures are based on the economics of a single project. Estimating the aggregate revenue impacts of these proposals would require economy-wide modeling of decisions to build new generation capacity, which is beyond the scope of this paper. Nevertheless, we hope that these model outputs can begin to inform such modeling exercises.

Sensitivity Analysis

We conducted sensitivity analyses in order to assess the robustness of our results regarding the relative impact of various tax-reform proposals on illustrative wind, solar, and gas-plant economics. Specifically, we focused on how changing wind-capacity factor, price of natural gas, and cost of tax equity affect these results.

We found that:

1) *Wind-capacity factor does not significantly affect results in the absence of the PTC.* Decreasing the wind-capacity factor doesn't significantly change the relative impacts of various tax-reform proposals on wind cost of electricity in the absence of the PTC. This is likely because wind is very capital-intensive with a high-capacity factor, and changing the capacity factor doesn't change this balance or change the level of distortion associated with income taxation.

2) *With significantly lower wind-capacity factor, the PTC is less valuable, and tax equity isn't viable under the Camp or Baucus*

proposals. When the PTC is retained, a reduction in the capacity factor significantly reduces the value of the PTC—with the practical impact that, at 30 percent capacity factor, the cost of tax equity outweighs the benefits of the PTC under the Baucus proposal.[xxiv]

3) *At higher natural gas prices, gas-fired electricity becomes even more fuel intensive, and the tax system has even less of an impact on its cost of electricity—thereby increasing the distortion relative to wind.* An increasing price of natural gas diminishes the impact of tax provisions on the cost of electricity from CCGT. Increasing the cost of fuel makes the gas facility even less capital-intensive, reducing further the distortionary impact of depreciation-tax provisions. Thus, the distortionary impact of taxation on the illustrative wind project relative to the gas plant becomes greater as natural-gas prices increase.

4) *Under the Baucus and Camp proposals, the cost of wind seems to be more sensitive to tax-equity costs as compared with the current tax system and the Wyden-Coats plan. Also, under the Camp proposal, tax-equity becomes unviable just above the 9 percent tax-equity required rate of return.* In the Baucus and Camp plans, tax-equity investors no longer are able to derive significant early returns from accelerated depreciation schedules; as a result, tax-equity investors instead rely more on greater cash from electricity sales in the earlier part of the project life to meet their required rate of return.

Conclusion

The purpose of this study is to illustrate the differential impacts of several recent tax-reform proposals—Sen. Baucus, Rep. Camp, and Sens. Wyden and Coats—on the economics of different sources of electric generation. The projects themselves are illustrative, and the numbers that result in the study should be interpreted as such. In actuality, the diversity of energy project types, sizes, and locations ensures that a single change in tax code is likely to have heterogeneous impacts on the economics of electric generation from a particular technology. Nevertheless, from the results of the comparison exercise, several takeaways emerge:

1) Tax provisions not specific to energy can affect energy project economics on a magnitude comparable to energy-specific tax provisions. For example, given the capital-intensive nature of electricity generation, changes to the depreciation treatment of capital assets can have a significant impact on energy project economics. Accelerated depreciation provisions help fix the distortion introduced by income taxes on capital-investment decisions. In our illustrative wind, solar, and gas cases, simplification of depreciation provisions reintroduces the income-tax distortion.[xxv]

2) On a related note, the same technology-neutral tax provision can have differential impacts on different energy project types. As this study demonstrates, changes to depreciation rules may affect the cost of wind- and solar-powered electricity generation more than that of conventional gas-fired electricity generation since capital costs can make up a larger proportion of total energy project costs for non-fueled sources than for fuel-based sources.

3) Tax provisions can interact such that their combined effect differs from the sum of their individual effects in isolation. This study demonstrates that the same investment- or production-based tax credit for renewable electric generation can have different effective values depending on the impact of other unrelated tax provisions. The use of tax-equity investment effectively links depreciation and production tax credits, the combination of which creates much of the returns to tax-equity investors. Eliminating accelerated depreciation provisions lowers the ability of investors to meet required internal rates of return and is counteracted by relying on a higher electricity sales price.

4) Tax-equity financing reduces the effective value of tax credits substantially. Only half of the value of production- and investment-based tax credits is realized in the LCOE from wind and solar power. This result is in line with previous analyses by the Lawrence Berkeley National Laboratory and the Climate Policy Initiative.

On a final note, this study only examines how tax-reform proposals affect project economics. How they affect project financing is a separate and equally important consideration. While it is beyond the scope of this study to fully examine investor behavior, we suggested how tax-reform proposals might reduce the pool of tax-equity financing for projects by reducing cost-effectiveness at higher internal rates of return. Other critical factors, such as lengths of viable tenors for debt investment, will likely affected by tax reform and could significantly impact capital availability.

Ultimately, while energy-specific tax provisions lend themselves to a focused conversation on energy policy, broad tax provisions that affect energy project economics, such as depreciation rules, are likely to be discussed as part of a larger tax-reform conversation that focuses on non-energy goals, such as broadening the tax base. The concerns of energy-sector participants are one of many voices in the discussion of these broader provisions, and while they will not drive the greater conversation, electric-sector participants can inform the parameters of broader provisions to promote market competition among sources and further innovation in electric-generation technology.

In the future, we hope to expand our work not only to assess the impacts of other tax-reform proposals on energy project economics but also to incorporate a wider set of electric-generation technologies in that analysis.

Technical Appendix

Key Modeling Assumptions

The cash-flow model uses several assumptions about cash flows. These assumptions can be broadly categorized as: (1) project finance, (2) the "waterfall" of cash flows, (3) tax and depreciation treatment, and (4) capitalization vs. expensing of costs.

Project finance: The cash-flow model assumes that the project is structured as a stand-alone business entity (a pass-through entity that is not subject to the corporate tax (e.g., an LLC), which is financed using a non-recourse project-finance structure. We assumed that all investors are taxable corporations. While many projects are financed using corporate on-balance-sheet financing, a project-finance model is nevertheless often employed to inform investment decision-making. As such, the model captures the viability of the project as a stand-alone business decision, but it cannot capture how the project's risks, costs, and benefits might fit into an investor's broader portfolio of investments or business operations. The only exception to this is that we did include an option to assume that any given equity investor either does or does not have tax liabilities sufficient to realize any tax benefits as they are generated over the life of the project.

"Proposed changes to depreciation rules may increase the cost of wind- and solar-powered electricity generation more than gas-fired electricity generation."

Waterfall assumptions: The priority of various claims on the cash flows of a project is often referred to as the "waterfall" of project cash flows. The model assumes that project cash flows are first used to cover operating expenses, then to service senior debt, followed by subordinate debt, with the remaining cash flows split proportionally between outside and developer-equity investors with respect to their contributions (or in a predetermined fashion as is sometimes the case with tax-equity arrangements in the United States).

Tax and depreciation treatment: This model assumes that capitalized costs, including interest paid during construction, lenders fees, and sales tax or value-added tax on development and construction expenditures, are depreciated over a specified schedule. Costs associated with creating reserve accounts are excluded from the depreciable basis of the project, and the option is available to reduce the depreciable basis using investment-based incentives. Depreciation expenses, as well as interest expenses during operation, are deducted from the project's taxable income, which in some cases yields net tax benefits. These net tax benefits (along with any tax benefits associated with tax incentives) or liabilities are passed through to investors. Investors can be modeled either to have enough outside tax liabilities to use the tax benefits as they are generated, or have no outside tax liabilities beyond those arising from the project itself. In the latter case, the model assumes that any net tax liabilities passed through to the investor must be carried forward to offset future tax liabilities arising from the project itself.

Capitalization vs. expensing of costs: This model also assumes that costs incurred during development and construction of the project can be capitalized, thereby affecting the investment required by the project, as well as the amount that can be depreciated for tax purposes. In addition to hard development and construction expenditures, capitalized costs include interest paid during construction, lenders' fees, and sales tax or value-added tax on development and construction expenditures. Costs that occur during project operation are counted as expenses against project revenues. These costs include property taxes, annual, fixed, and variable O&M costs, and fuel costs (if applicable).

Key Parameter Values

We assumed a 7 percent cost of debt, with senior debt issued on a 20-year term and requiring a debt-service coverage ratio of 1.3.

We assumed an 11 percent developer internal rate of return (IRR) and an 8 percent tax-equity IRR, based on the midpoint of the range of IRRs from several sources (see Mintz Levin and Chadbourne and Parke).[xxvi]

In scenarios where projects lacked tax capacity, we assumed tax-equity financing covered 60 percent of financing needs for solar projects and 70 percent of financing needs for wind projects. The value for wind is somewhat higher than observed in recent years, due to the high capacity factor of the projects studied, which resulted in a greater fraction of their value delivered via tax benefits.

We placed a cap on leverage for gas projects at roughly 80 percent, based on conversations with ratings agencies and investors regarding achievable leverage in the United States.

Future electricity prices were based on reference-case projections in the Energy Information Administration's 2013 Annual Energy Outlook, and treasury yields were calculated based on an average over the last two years for the appropriate duration instrument; this yield is only used as an input at the time of financing closure, assumed to be mid-2015. Inflation is assumed to be 2 percent annually.

Calculations

Weighted Average Cost of Capital

The weighted average cost of capital (WACC) is most often used in the context of corporate finance and is a function of the firm's cost of equity, leverage (the fraction of financing from debt), tax rate, and the cost of debt:

WACC= (1-Leverage.) x Cost of Equity + Leverage x Cost of Debt x (1-Corporate Tax Rate)

This WACC calculation does not account for the fact that the financial structure will not be consistent over the entire lifetime of the project. This is because debt and equity fractions change over time, and tax equity complicates things even further. As a result, we elected to instead use a "lifetime WACC" (i.e., the internal rate of return of all financing activities). We believe that this metric is a better reflection of the true cost of capital than the traditional WACC metric.

Levelized Cost of Energy

In order to capture the impact of policy on project financing, we needed to measure or model how different policies would impact the finances of the same project (keeping its non-financial cost and performance characteristics fixed). The key metric that captures this effect is the levelized cost of energy (LCOE), the revenue per unit of electricity generated over the life of the project needed to meet investors' financial requirements. Differences in the LCOE for the same project under different policy regimes reflect the impact of policy through changes in financing costs, which must ultimately be borne by ratepayers.

However, the conventional calculation of LCOE is not well suited for assessing the influence of policy on project-financing structures that include tax-equity financing and/or project-level debt. The conventional calculation represents investors' financial requirements by discounting project costs and revenues using a single aggregate financing cost for the project—the WACC.

$$\text{Discounted Revenues} = \sum_{t=1}^{\text{Project life}} \frac{\text{LCOE x Electricity generated in year t}}{(1+\text{WACC})^{t-1}}$$

$$\text{Discounted Costs} = \sum_{t=1}^{\text{Project life}} \frac{\text{Project costs in year t}}{(1+\text{WACC})^{t-1}}$$

There are two key drawbacks to using this definition of LCOE based on a WACC in our analyses:

1) **It doesn't guarantee that all financing requirements are actually met at lowest cost.** The LCOE calculated to achieve a particular WACC may or may not be sufficient or necessary to guarantee that the individual requirements of different equity investors (such as tax-equity investors and developers) are separately met. It also does not guarantee that key debt requirements (such as a minimum debt-service coverage ratio) can be achieved under the revenues provided by the LCOE. More specifically, the traditional LCOE calculation only assumes an average level of generation over the lifetime of the project ("P50"). Financiers are more concerned with a higher exceedance probability ("P90"), which conventional LCOE calculation ignores.

2) **The leverage depends on policy supports as well as project costs and revenues.** For project financing, the leverage achievable depends on the project's costs and revenues along with the terms, conditions, and costs of debt and tax-equity financing. Moreover, it varies significantly with the policy regime and the financing structure used—and, given the low cost of debt relative to equity in most developed nations, represents the key driver of cost differences among policy regimes. As such, the leverage should really be a function of the LCOE and the policy supports provided—that is, it should be an output of the LCOE calculation model, rather than an input.

To address these issues, we derived expressions for a variant of LCOE that is more appropriate for project financing and implemented a model to solve for it. It calculates the minimum revenue needed to meet the equity return requirements of both the developer and a potential tax-equity investor separately. It does this while adjusting certain tax-equity financing parameters and optimizing the leverage to meet a required minimum debt-service coverage ratio. In greater detail:

1) **Meet all investor return requirements.** This is determined by the requirement that the cash and tax flows for each equity or tax-equity investor reach their investment return requirements at all appropriate times while optimizing the tax-equity financing arrangement (within the constraints of IRS rules) to minimize the cost of electricity.[xxvii] Note that the returns calculated are after tax.

2) **Maximize debt volume.** This is determined by the requirement that the cash flow available to pay debt in each period exceeds the required payment by a certain debt-service coverage ratio. More specifically, the Climate Policy Initiative's model incorporates the P90 level of generation, which allows for, in combination with a stipulated debt-service coverage ratio, the calculation of the maximum annual debt service a project can provide to the financier. The incorporation of both P50 and P90 values allows the Climate Policy Initiative's model to sculpt the amount of debt a project has throughout its entire lifetime, thereby ensuring all financing requirements are met and thereby calculating an LCOE more realistic than via traditional means. However, the end LCOE value of the Climate Policy Initiative's calculation may be higher or lower than that of the traditional calculation depending on how much risk the project assumes over time.

The combination of these constraints uniquely determines the LCOE. Thus, the model calculates the LCOE as a function of required equity return, debt-service coverage ratio, and certain tax equity and debt costs and fees rather than equity return and leverage. We provide a detailed description of this variant of LCOE in a technical appendix to this document.

We note here three other key features of this model:

1) **Treatment of taxes and project debt.** As we assumed that the project was structured as a pass-through entity that is not subject to corporate tax at the project level, all modeled tax benefits and liabilities are actually generated or incurred by taxable investors, rather than at the project level. This means that neither tax benefits nor liabilities are considered when assessing the cash flows at the project level, which are available for the purposes of debt repayment and the calculation of debt-service coverage ratios.

2) **Tax-equity structure optimization.** In the case where tax incentives are employed, the pro-forma model includes options to model the tax-equity project-financing structures used by project developers to bring in outside tax investors to help them monetize the tax benefits provided by federal incentives. These options are the parameters and conditions describing the allocation of tax and cash benefits among tax-equity investors and sponsors over the life of the project, and they are constrained by IRS rules as well as industry practice.[xxviii] The LCOE calculation includes options to adjust the tax-equity structure to minimize the revenue required to simultaneously meet the return requirements of both tax-equity investors and sponsors while maximizing the leverage.

3) **Policy supports as additional revenues.** In order to compare the cost to government of different incentives that deliver the same cost of electricity to ratepayers, we also included options to allow the revenues needed to meet financial requirements to arise (at least in part) from specific policy sources, such as investment or production tax credits.

Cost to Government

We calculated the cost to all levels of government (either in the form of direct payments or foregone tax revenues) of policy supports utilized by the project, such as grants, tax credits, accelerated depreciation, or deductions of interest expenses. The cost is equal to the present value of all flows to government, discounted using zero-coupon treasury security yields of the appropriate security.[xxix] That is, we assumed that any impact on government cash flows is marginal and therefore must be financed through a government debt transaction—either through the purchase or sale of a treasury security. Note that since we computed costs to all levels of government, we implicitly assumed that transfers from the federal government enabled marginal shifts in state-government finances.[xxx]

The full cost to government incurred due to the provision of an incentive is not captured by the direct cash flows associated with, for example, foregone tax revenues due to the tax incentive. The choice of incentive may affect the extent to which the project utilizes other tax provisions, such as accelerated depreciation or business interest-deduction tax benefits. For example:

1) **The use of an investment tax credit** reduces the depreciable basis of the facility by 50 percent of the value of the investment tax credit, thereby reducing the cost to government of the accelerated depreciation benefit.

2) **A production-based cash incentive** provides additional project cash flow that may allow the project to take on a larger loan than it would have without the incentive. As the interest on the larger loan is tax deductible, this increases the cost of the interest deduction to government.

However, accelerated depreciation and interest-deduction tax benefits are broadly provided across industries in order to correct for the distortion of economic activity associated with corporate income taxation. Furthermore, as such an incentive very likely redirects investment that may have occurred anyway, it is not generally clear if the full social cost of correcting for the distortion is actually significantly affected by the presence of the incentive. So, we separately provided metrics for the incentive cost—the cost to state and federal government that results directly from the incentive alone and is relevant to scoring—and the change to the cost of accelerated depreciation and interest-deduction tax expenditures resulting from the interaction. The sum of these two costs is the total cost to state and local governments of providing the incentive at a project level.

Endnotes

i Sen. Baucus released a staff discussion draft in December 2013; Baucus proposed no actual legislation.

ii This study utilizes the Climate Policy Initiative's Renewable Energy Project Financial Model, current version as of June 11, 2014. Climate Policy Initiative staff Uday Varadarajan, Donovan Escalante, and David Wang contributed to the modeling and analysis in this study.

iii Since the additional revenues or incentives and the optimization of financing structure affect the cash flows, a solution is often only possible through iteration.

iv Corporate income tax is not assessed on S-corporations or on "pass-through entities," such as partnerships, where the business owners treat income from the partnership as part of their individual tax returns.

v A perfect equivalence is not possible. The wind and solar facilities have better environmental performance and lower operating risks, while the gas facility can provide greater flexibility and predictability to the grid. We chose not to incorporate these characteristics into the model for the sake of simplicity.

vi We adjusted capacity factor for wind because it is improving in new wind projects, and we adjusted capital cost for solar because it is improving in new solar projects. We assumed these projects would begin service in 2016, to account for the lag time between policy changes and necessary construction and other pre-operational activities.

vii The initial no-tax scenario assumes 20-year straight-line depreciation for all capital assets, roughly equivalent to their treatment in financial accounting.

viii The LCOE is well within the range observed in actual operational wind and solar projects in recent years. For data on wind and solar project power purchase-agreement prices, see the Lawrence Berkeley National Laboratory's annual wind-technology report and solar-technology report.

ix The capacity factor of the illustrative wind project is similar to the best-in-class projects in the windier sites of Oklahoma and Texas.

x We modeled full tax capacity for projects to more clearly illustrate the impacts of the different tax proposals. In actuality, most wind and solar project developers lack tax liabilities to monetize tax benefits to any significant degree on their own. Yet, in a scenario in which the only tax benefit is accelerated depreciation, the value of the benefit in a wind or solar project is smaller than the cost of the tax-equity investment to monetize it; thus, we did not model tax-equity investment in wind and solar power for depreciation tax benefits alone. In a case of limited tax capacity, project developers would only partly monetize accelerated depreciation benefits—having a nominal impact on project economics (between -2 percent and +2 percent on all projects' LCOEs).

xi MACRS = modified accelerated cost recovery system; ADS = alternative depreciation system.

xii Under current policy, while simple-cycle gas-turbine plants are allowed 15-year MACRS, CCGT plants are only allowed 20-year MACRS.

xiii Under current law, the ITC for utility-scale solar power will decline to 10 percent of capital costs for projects placed in service starting in 2017. For the purposes of this study, we used the existing ITC level of 30 percent of solar project capital costs.

xiv Additionally, the Camp proposal would repeal the inflation adjustment of the existing PTC for electricity sold after 2014, reducing its value to $15/MWh, and repeal the credit for electricity produced after 2024.

xv The Baucus proposal also allows projects to elect a 20 percent ITC in lieu of a PTC. There are reasons why this ITC may be preferable for some project developers; modeling those scenarios is beyond the scope of our analysis.

xvi This is only the case for the solar PV project as modeled; projects with greater per-kW capital costs would likely elect to use an ITC once its value exceeds the PTC. Also, there are reasons why an ITC may remain preferable for some project developers, particularly for distributed generation; modeling that tradeoff is beyond the scope of our analysis.

xvii We modeled multiple financing scenarios to capture the impacts of the proposals under realistic financing situations. The impact of tax benefits relies on the extent to which they can be monetized. As mentioned previously, most wind and solar project developers lack tax liabilities to monetize tax benefits to any significant degree on their own and bring in tax-equity investors to fully monetize the tax benefits. Therefore, in addition to modeling scenarios in which wind and solar projects have full tax capacity to monetize benefits, we also modeled scenarios in which wind and solar projects lacked tax capacity and used tax-equity investment. Gas-fired power plants generally have annual tax liabilities from sale of electricity to fully utilize their depreciation deductions as they are generated.

xviii Note that gas-fired generation could theoretically receive tax credits under the Baucus plan, so long as the gas plant maintains an emissions intensity of more than 25 percent below the national average for electricity. For the purposes of this analysis, we did not assume this.

xix Wind and solar projects are assumed to have no tax equity under the Camp proposal, due to the absence of a PTC or ITC. We noted, furthermore, that even at the retroactively applied level of $15/MWh for the wind PTC proposed in the Camp plan, the cost of utilizing tax equity is greater than the benefits derived, and so no tax-equity financing would occur even at this level.

xx The ITC is a tax benefit that accrues more quickly than the PTC. As a result, tax-equity investment to monetize an ITC leaves projects with higher tax liability and less upfront benefits than monetizing a PTC. Similarly, the shortened stream of benefits from an ITC makes lower competition for the incentive than for a PTC—which increases tax-equity internal rates of return.

xxi As mentioned previously, the Baucus proposal would make a production-based tax credit available for gas under circumstances in which the installation had a low-emissions profile; that scenario is not included in our analysis.

xxii As previously mentioned, the gas-fired power plant is assumed to have full tax capacity to utilize depreciation deductions as they are generated, much as is observed in actual projects.

xxiii We examined government revenues under the financing scenario, in which projects have tax capacity to fully utilize tax benefits, since it illustrated the maximal impact on government revenues. Under tax-equity scenarios, government revenue per-MWh is greater, as projects use less debt leverage and thus cannot take advantage of interest deductions.

xxiv The Camp proposal, by excluding a PTC, does not use tax-equity financing regardless of changes to capacity factor or cost of capital.

xxv The complexity of the current depreciation system reflects cumulated political compromises over time and is not necessarily an ideal correction to income-tax distortions; nevertheless, simplification of depreciation provisions can reintroduce the income-tax distortion.

xxvi The model assumes the same equity internal rate of return across all wind and gas projects for the purposes of comparability of tax proposals. In reality, gas investors and wind investors face a variety of different risk factors that may alter their financial characteristics.

xxvii We did not model capital adequacy requirements.

xxviii We relied heavily on the recent work of Mark Bolinger and collaborators at the Lawrence Berkeley National Laboratory and the National Renewable Energy Laboratory regarding the specific tax-equity structures used.

xxix These are bills, notes, or bonds depending on the maturity—we referred to them just as treasuries.

xxx The focus on combined cost to all levels of government arises from a modeling limitation—our model used a blended state and federal tax rate for calculations. Another consequence of this is that we did not separately distinguish state and federal tax benefit carry-forward. This could, therefore, underestimate the cost to government of carrying forward federal tax credits (but not deductions). However, as all the financial structures we considered in policy scenarios with tax credits involved the use of tax equity, this issue did not affect our current analysis.

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