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Rethinking government subsidies for renewable electricity generation resources

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ABSTRACT

U.S. renewable electricity resource subsidization program design relies on production-based payments that lower electric energy market prices, often below zero, contrary to the objective of increasing market prices when correcting for an environmental externality. An alternative pricing approach, capacity-based subsidy payments, would substantially reduce the likelihood of negative electric market prices. A more thoughtful examination of the impact of subsidization program design on wholesale power markets is long overdue.

1. Background and summary

The construction of renewable electricity generation resources in the U.S. has increased significantly over the last several years in response to incentives created by federal and state subsidies (Barbose, 2016). These subsidy programs take several forms, including production tax credits (PTCs), investment tax credits (ITCs), and renewable portfolio standards (RPS). Proponents of subsidies for renewable resources typically justify these programs by pointing to, among other things, the fact that renewable generation has zero air pollutant and greenhouse gas emissions (as compared to traditional fossil-fuel generation) and that their lower marginal costs will lead to lower electricity prices for consumers. However, these subsidy programs typically appear designed primarily to provide financial support to an evolving industry and to bring investment to local economies, while limiting utility ratepayer financial impacts. Importantly, the details of how subsidy payments under these programs are made have important implications for the functioning of wholesale electricity markets. In many cases, subsidy payment structures can lead to perverse wholesale electricity pricing that has nothing to do with alleviating pollution or ensuring that consumers have access to reliable, yet inexpensive, electricity.

Government subsidy programs to support the development of renewable generation assets will continue and the supply of these assets is expected to grow substantially over the coming decade. In addition, recent programs have been developed to establish zero-emission credits for nuclear resources whose value is based on the avoided cost of carbon dioxide emissions not otherwise captured in electricity prices. This is an opportune time to reexamine how government subsidy programs are structured and whether their design can be improved. From a public policy perspective, the focus of these subsidy programs should be on achieving societal benefits while minimizing unnecessary distortions to the functioning of wholesale power markets. For example, to the extent that the societal benefit of a renewable resource arises from displacing fossil fuel generation (i.e., reducing its dispatch) and thereby reducing carbon emissions, the subsidy to the renewable resource should be based, in part, on the social cost of the carbon emission that would be incurred in its absence. Although accurately estimating the carbon emissions that are displaced may be complex, analytical methods for doing so are readily available.

However, it is important that these subsidies to renewable generation resources not adulterate the incentives these resources face to provide power in wholesale markets at marginal cost. Subsidies that are paid on the basis of how much electricity a generation resource has produced can readily lead to perverse bidding behavior that undermines the functioning of wholesale power markets. Alternatives, such as capacity-based payment mechanisms, avoid distorting the incentives that generation resources face while still encouraging their construction and operation. These capacity-based payment mechanisms would allow governments to continue to direct the market towards a particular resource mixture while fostering a well-functioning wholesale power market. By placing greater attention on how subsidy payments are made, policymakers and regulators can ensure that investments in new renewable generation resources will continue and complement the functioning of wholesale power markets, rather than undermine it.

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2. The economics of existing subsidy programs

Very little social welfare cost-benefit analysis lies behind federal and state RPS programs designed to subsidize renewable electricity resources. Instead, it is typically the case that when state RPS policies are approved they focus on consideration of the cost impacts on retail electricity consumers.[1] For example, it has been recently reported that all states with RPS have cost containment mechanism associated with RPS policies and seek to minimize the impact on consumer costs so it is no more than a small percentage of the monthly bill (Heeter et al., 2014). Moreover, there are several states where meeting the RPS is often found to be a least-cost resource planning approach as the avoided cost of adding a new fossil-fuel-fired resource is greater than the cost of a renewable resource (including the PTC and ITC as appropriate). Importantly the majority of the state analyses of the costs of RPS policies are not evaluating the incremental cost of subsidizing renewable resources and comparing the costs to the benefits (Heeter et al., 2014).

Instead, a recent joint National Renewable Energy Laboratory/Lawrence Berkeley National Laboratory (NREL/LBNL) report finds that state policymakers analyze RPS costs in much greater detail when compared analyses of the benefits that may be attributable to RPS (Heeter et al., 2014). Only a small number of states have estimated the benefits of a RPS policy. In particular, this NREL report examines nine states where there was an effort to carry out some analysis of RPS policy costs and benefits. Depending upon state, these studies sought to estimate the benefits of RPS policies based on avoided air pollutant emissions and health-related benefits, increased local economic investment benefits, and wholesale market price reductions associated with introducing practically zero-marginal-cost renewable resources.

Of these nine state studies, only six estimate potential carbon dioxide emission reductions resulting from the RPS.[2] Notably, considerably more effort is undertaken in these six studies to analyze local economic investment benefits and estimate potential reductions in wholesale market prices resulting from the additional of zero marginal cost renewable resources. For example, Table 1 compiles benefits estimates from these six states' studies. Table 1 shows that only three of the six studies placed a value on the benefits of avoiding carbon emissions. Of particular interest is the variation in the estimated avoided emissions of carbon dioxide per megawatt-hour of electricity production. The geographic location of renewable resources substantially affects the expected carbon dioxide emission benefits with the Northeast and New York estimating lower values than the Midwest, and with no value estimated by states in the Mid-Atlantic. Surprisingly, as of 2014, the benefit of reducing carbon dioxide emissions has only been estimated and reported on a limited basis for the 29 states with RPS (Heeter et al., 2014).[3]

Table 1 also shows that state studies of potential benefits associated with RPS focus more on estimating the local economic impact associated with the addition of renewable resources and the potential wholesale power market price reductions. A comparison of the findings shown in Table 1 demonstrates that the substantial source of estimated benefits arising from the subsidization of renewable resources is local economic impacts and wholesale power market price suppression.

Because subsidization in favor of preferred renewable power resources affects wholesale power market pricing, it is important to estimate the benefits of subsidization using a defensible analytical framework. Of those analyses conducted by states to assess RPS benefits, the majority undervalue the benefits due to carbon reduction, and account for benefits that are based on estimates of isolated impacts on a state's local economy and wholesale power price suppression.[4] These latter benefits are not appropriately counted when using an analytical framework that evaluates the change in overall social welfare.[5] Not surprisingly these benefits focus on individual state economic impacts associated with supporting investment in one particular state and do not account for economic interactions with other states. Moreover, while some states see wholesale price suppression as a benefit of renewable resource additions, it is not a direct measure of increase in social welfare. Instead, holding consumer demand constant as is typical in these analyses, it is a transfer of wealth from producers to consumers.[6] However, one of the most important benefits to consumers of subsidizing low-carbon-emitting resources is avoiding the future costs to society of carbon emissions (and other avoided air pollutants). Given that these resources are typically cited as important for reducing future greenhouse gas emissions, it clearly makes sense to evaluate their cost-effectiveness based on the benefits that they provide to society.

More recent analysis focused on estimating the benefits of RPS policies reinforces the importance of focusing on the avoided costs associated with reduction of pollution from fossil-fuel electric generation units. For example, a 2016 NREL/LBNL report seeks to supplement the results of the various state level studies shown in Table 1 in an effort to provide a nationwide estimate of benefits attributable to RPS policies (Wiser et al., 2016). In this recent study the emphasis is appropriately on the societal benefits that result from a reduction in greenhouse gas and other air pollutants, as well as reduced use and reliance on water.[7] And while the report evaluates other financial impacts of RPS policies, it correctly notes that environmental benefits are those expected to accrue to society and increase welfare (Wiser et al., 2016).

In addition, the measurement of the social welfare impact of policy proposals that increase renewable resource penetration was also the subject of comprehensive studies of the cost-effectiveness of different policies for reducing carbon dioxide emissions. For example, Resources for the Future and the National Energy Policy Institute (RFF/NEPI) conducted a detailed analysis of the welfare impact of various policies to reduce carbon dioxide emissions (Krupnick et al., 2010). Although the RFF/NEPI report compared the welfare costs of different policies to reduce carbon dioxide emissions, it evaluated a how a federal RPS policy would compare to other policies and expressed the findings using a consistent analytical framework which does not consider localized economic impacts as a source of increased welfare.

Finally, an analysis of the impact on dynamic efficiency is often overlooked when evaluating the impact of these subsidy policies on social welfare. The implementation of these policies results in the levy of an implicit tax on unsubsidized zero- emission resources due to costs that are no longer recovered from power markets as a result of reduced prices. However, analysis of dynamic efficiency can show that alleged price reduction benefits are likely to be lost, in part, due

[1] The focus herein is on state subsidization programs. For federal subsidization programs, the stated objectives are to provide financial support to new technologies and create jobs (U.S. Public Law 111-5 2009).

[2] The other three states' studies examined local economic investment impacts and/or wholesale power market price reductions.

[3] There are a number of independent studies that estimate renewable resource benefits, including carbon dioxide emissions reduction estimates, which are often developed in association with regulatory proceedings evaluating resource siting and/or power sales contract approvals. However, these studies rarely focus on an analysis of change in social welfare.

[4] The importance of recognizing that wholesale electric energy price suppression is not itself a measure of benefits of subsidization has been explained previously. See, for example, Felder, 2011.

[5] A modeling framework that examines the benefits to society of a particular renewable resource development policy on power markets should focus on measuring the change in power system production costs resulting from the policy as this change represents a measurement of those resources that are saved by society due to the addition of zero marginal cost resources. To the extent that the analysis of a proposed policy accounts for price elasticity of demand associated with a given shift in the supply curve due to the addition of renewable resources, there will be an increase in efficiency that must also be estimated.

[6] A standard societal cost- benefit analysis appropriately nets out transfers of economic rents and surplus between producers and consumers which result from changes in wholesale power market prices associated with a renewable resource policy.

[7] Note that the study relies on a mixture of methodologies to estimate the potential benefits resulting from the addition of renewable resources in the year 2013.