The Cost Effectiveness of Renewable Energy Support Schemes in the European Union

By Arjun Mahalingam, David Reiner and David Newbery*

Overview of EU Climate and Energy Policy and Challenges to Decarbonization

The EU Renewables Directive (2009/28/EC) aims to deliver by 2020 a 20% share of renewable energy supply (RES) in gross final energy production, as part of the 2020 climate and energy package. It also includes a binding target of reducing greenhouse gas (GHG) emissions by 20% relative to 1990 along with an energy efficiency target of reducing energy consumption by 20% relative to projected 2020 levels. In January 2014, the European Commission published A Policy Framework for Climate and Energy in the period from 2020 to 2030, which proposed an EU-wide target of a 40% reduction in GHG emissions by 2030 (relative to the 1990 levels) which would be translated into binding national-level GHG targets, complemented by an EU-wide renewable energy target of 27% (European Commission, 2014a).

This GHG target for 2030 is equivalent to a 43% decrease for the sectors covered by the EU Emissions Trading System (ETS) and is likely to require even greater reductions in the electricity sector. The Policy Framework argued that there was no need for country-specific RES targets since the 40% GHG target would likely deliver the proposed 27% EU-wide renewables target. The 2020 RES targets would, however, remain binding. Member States (MSs) are at their liberty to choose their own policy instruments such as green taxes, investment subsidies and feed-in tariffs in order to meet their national targets, provided they accord with the State Aid Guidelines (European Commission, 2014b). The electricity sector offers the greatest potential for switching to RES as it only requires changes to generation and leaves the final product unchanged, thereby requiring the least adaptation by consumers. Many MSs, like the UK, have begun the process of reforming their electricity markets to better support the required share of renewable electricity.

Climate change mitigation is predicated on taking the future seriously, which requires discounting future damage at a rather low discount rate (Stern, 2007). Low-carbon technologies, particularly electricity RES (RES-E), which are highly capital intensive but have low running costs become more attractive at lower discount rates. The key to achieving cost-effective decarbonization is thus to find effective ways of lowering the cost of capital.

Decarbonization was initially facilitated by high CO_2 prices in the ETS, while fuel switching was encouraged by low gas prices. Due to the economic crisis in 2008 and the failure of the 2009 United Nations Climate Change Conference at Copenhagen, the ETS carbon price collapsed. The combination of the trebling of EU gas prices and the shale gas revolution in the U.S., which drove down the world coal prices, put EU decarbonization at risk. Even with an adequate carbon price, less mature renewable technologies would not be commercially viable. Additional RES support can then be justified by the public good they create in the form of induced innovation and reduction in costs from mass deployment. Absent legally binding contractual backing, the cost of financing these highly capital-intensive investments from the private sector becomes excessive and further reduces support for the climate change agenda.

Risk Allocation and Minimizing Costs of Renewable Support

The major cost of supporting RES-E is its high capital cost per MWh. The public sector discounts future social costs and benefits at a lower discount rate than RES-E developers. The cheapest form of support is an up-front capital grant sufficient to lower the cost of the generation investment to the point where it becomes commercially viable selling into the wholesale market. Subsidies could be further reduced through a Feed-in Tariff (FiT) at the expected wholesale price (net of any imbalance costs), thereby transferring the risks of marketing and balancing to their cost minimizing locus with the System Operator.

The cost of risk rises as the square of the income fluctuations, which yields two important implications. First, the total cost of risk decreases proportionally with the number of participants who bear it. Second, the cost of risk depends on its correlation with other risks that the participant bears so uncorrelated risk has much lower cost. Transferring weather forecasting, marketing and balancing actions from large numbers of small wind farm developers to a single large System Operator reduces transaction costs dramatically unless generators are better placed to manage them. As a result, the only cost it is efficient to impose on RES-E is the location cost – the cost of strengthening the transmission

* The authors are with the Energy Policy Research Group, University of Cambridge, with Arjun Mahalingam as the corresponding author. His e-mail address is am2257@cam.ac.uk

grid to deliver the power from its location plus incremental transmission losses. The objective is for all generation to be located and operated to deliver power to final consumers at the least total system cost.

Finally, the favoured system of financing RES-E support by imposing the costs on electricity consumers is fiscally illiterate (as well as being regressive). Given that such support is justified by the public good of driving down costs so as to benefit all future users of RES-E and thereby the environment, these funds should come from general taxation and should neither be inefficiently loaded on to the production sector nor by raising the tax on one specific final good, electricity.

The State Aid Guidelines requires that interventions or support must be "compatible with the internal market within the meaning of Article 107(3)(c) of the Treaty" so that they do not "affect trading conditions to an extent contrary to the common interest." (§3 (23)), as well as other requirements to ensure that markets are not needlessly distorted. In doing so, the Guidelines advocate auctions to establish the least cost means of supporting RES-E. If suitable sites with planning and environmental permission and grid connections could be secured, then each site could be auctioned off for the least cost of support and allow the site rent to be transferred from developers and/or land-owners to consumers. As different developers may have different financial and construction costs, it may be desirable to run a multi-dimensional auction (Che, 1993). Bidders submit possibly several bids, each of which specifies aspects they consider cost-relevant. They could offer a required up-front subsidy per MW capacity, or a fixed price per MWh for 10 years, a lower fixed price for 15 years, and a discount if balancing is provided, etc. The auctioneer chooses the option that has least public cost.

One way of reforming deployment subsidies is to comprehensively reform RES Research, Development, Demonstration and Deployment (RDD&D) support. The EU's aspirations for the Strategic Energy Technologies (SET) Plan of trebling energy R&D lacks adequate financial support but offers only modest additional EU funds. RES deployment targets could be replaced with a roughly equivalent financial target. MSs could work out a burden sharing arrangement for national-level financial targets similar to that for the RES or climate targets. Credit for MS support actions could be benchmarked, so that for supporting, say, advanced solar PV, the MS would be credited with an annual value per kWp based on the extra annual revenue needed to justify installation in a reference sunny location (such as southern Spain) compared to a CCGT there.

The method for financing renewables would be determined by technology readiness. For immature technologies, EU-wide competitions are probably best; this logic has been applied, for example, in the NER300 competition to support carbon capture and storage (CCS) and 'innovative' renewable technologies. For demonstration plant and for near-market technologies, tender auctions for feed-in tariffs per MW of available capacity would likely be preferable.

Conclusions

The main cost in decarbonizing electricity is the cost of financing the capital-intensive investment required. Transmission investments are regulated and benefit from a low Weighted Average Costs of Capital. Most low-carbon technologies such as renewable electricity, nuclear power and CCS are costly to finance in liberalized markets subject to uncertainty over future carbon prices and policy risks unless they are provided with credible contracts that allocate risks to those best placed to manage and bear them. Given the intermittency of RES-E, that means the System Operator who, with necessary regulatory and/or Government support, can offer a fixed payment per MW or MWh, ideally with the lowest transfer of rent to developers. Carefully designed multi-dimensional auctions that are consistent with the new State Aid Guidelines are probably the best way to reveal the least cost solution. Finally, there seems to be a growing mismatch between the large subsidies provided to RES-E support and underinvestment in low-carbon RDD&D that has been exacerbated by privatization and liberalization.

References

Che, Y.K. (1993). 'Design Competition Through Multidimensional Auctions,' RAND Journal of Economics, 24, 668-680.

European Commission (2014a) A policy framework for climate and energy in the period from 2020 to 2030 COM/2014/015 final, Brussels.

European Commission (2014b). Guidelines on State aid for environmental protection and energy 2014-2020. Brussels at http://ec.europa.eu/competition/sectors/energy/eeag_en.pdf

Stern, N. (2007). The Economics of Climate Change: The Stern Review. Cambridge and New York: Cambridge University Press