

## **Renewable Energy Markets and Regulation**

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Liberalization of electricity markets has provided consumers with a choice of power suppliers. In turn, this means that power suppliers can differentiate their products to appeal to consumer tastes. While electricity is in some ways a commodity product, one major source of potential differentiation is the method of generating the power. “Green” or renewable sources of power, e.g. wind, solar, biomass, and hydro, cause less pollution and produce less toxic waste than non-green alternatives. Some renewables also clearly generate less carbon dioxide emissions per kWh of energy delivered, and they have the potential therefore to assist in meeting national or regional targets to reduce CO<sub>2</sub> emissions. Renewables also contribute to the diversity and local sourcing of energy and therefore improve the security of domestic and regional energy supply as the 2007 OECD study on energy security showed. Renewable energy sources have been given great impetus by Renewable Portfolio Standards in many US states and in regional agreements such as the EU Directive (2001/77/EC) and the recently concluded 20/2020 agreement, which set various targets on the portion of gross energy in EU countries generated from renewable sources.

In my presentation and accompanying paper, I intend to focus on three issues related to the debate on efficient provision of renewable energy: 1) the general background associated with current trends directed at regulating renewables into existence; 2) finding an appropriate confluence between renewable energy and the broader energy markets in which renewables fit (I will focus principally on electricity markets in this portion of my talk); and 3) some lessons from experience to date and some open questions for discussion.

Concerning the first point, there are obvious tensions that have become especially evident in the last year in terms of the global procurement of renewable energies. These tensions include patently unsustainable practices (e.g., denuding the rain forests in Borneo to harvest palm oil to be used to meet 20/2020 targets in EU power plants). They also include unrealistic projections of availability of renewables (e.g., the implied requirement to remove 50% of arable land in the EU to plant elephant grass or some other dedicated biofuel crop to meet some targets). I intend only to mention these tensions with an example or two, as they are well known by now. What they point to, together, is the

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need for a national renewable energy plan, which has been vetted properly with scientists, policy makers and the public. Failing to do this almost certainly ensures that the resulting policies will not pass some basic common sense tests, with resulting undermining of public confidence.

Concerning the second point, which is the main focus of my presentation, I will discuss the issue of providing incentives for investors to bring new renewable sources on line and having these find a proper confluence with wholesale energy markets. My focus will be on electric power, but some of the same arguments apply to transportation and building design. The thrust of my discussion will be on renewable energy credits or “tradable green certificates” (TGCs) and related approaches to promote the development and deployment of renewable generation technologies. These have taken several forms, including the nature of the technologies covered by these credits (e.g., specifically for biofuels, solar or wind or covering a broader class of renewable energy sources) and in terms of the reporting or payment obligations attached to these credits. There are many differences in national programs to promote renewable energy, either by discouraging non-renewables or encouraging renewables. To highlight the challenges and diversity of approaches currently being pursued, I will provide a brief overview of the structure of specific programs, including the following:

- The generic Renewable Portfolio Standard (RPS) approach applied to generators
- The generic RPS approach applied to suppliers/distributors
- The generic RPS approach applied to consumers
- The generic carbon tax approach
- The generic REFIT approach
- Direct subsidies for renewables implemented through grants or projects
- Mixed or hybrid approaches

I will argue that all of these programs can be complemented efficiently by TGCs. I also argue that if the government wishes to provide subsidies (as opposed to mandating renewables use through one of the RPS approaches), it can do so through participation in the TGC market. The use of TGCs to implement payments per MWh of energy generated by renewables does not preclude the government providing additional per MW-Year subsidies to encourage entry of specific types of renewables (where the MW subsidy could itself be set by a separate market-based mechanism such as auctions per recent work by several authors), but the usual caveats apply to subsidy-based approaches.

I will conclude my presentation with some comments on policy and regulatory issues related to promoting renewables, including the use of TGCs, and some open research questions for discussion.

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