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Challenges for Designing Renewable Energy Development Policies

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In recent years, with the growing concern for environmental protection and the enactment of the Kyoto Protocol, the development of renewable energy has increasingly become a major focal point of energy policy in many countries. Many policy-makers are eager to develop various new kinds of renewable energy, such as solar energy, wind energy, biomass energy including crop-based ethanol and bio-diesel, and hydro-energy, by setting up various policy instruments such as fixed production targets and various subsidy schemes. Their enthusiasm in this regard is mainly due to a frequently heard claim that renewable energy is inexhaustible and that its supply is unlimited. In addition, it is also claimed that renewable energy has many inherent advantages such as energy price stability, cleaner air, the protection of global climates, the protection of landscapes and watersheds, as well as the safeguarding of jobs and the economy.

Could this be a “win-win” solution for energy supply and the environment? Hardly. The apparent free lunch of renewable energy, especially crop-based ethanol and bio-diesel, cannot satisfy our appetite for energy resources, and such energy will not be free, nor will it be environmentally friendly.

We all know that there is no such thing as a free lunch. Although renewable energy comes from natural flows of sunlight, wind, or water around the Earth, in order to capture some of this energy and put it to use in our homes, businesses and transportation, many inputs, including human resources, man-made capital, water, land, the environment, and fossil fuels, are needed. In addition, the quality of most kinds of renewable energy is low because these natural flows of sunlight, wind, or water are mostly unstable and have low energy content.

Three policy implications can be drawn from these simple facts regarding renewable energy. First, more investment in research and development in regard to renewable energy technology and policy analysis is warranted before it can be fully developed. Second, it is imperative to make sure that the new technology of renewable energy production can meet the tests of energy analysis and benefit-cost analysis before it is fully developed. However, in the design of many renewable energy development policies, the neglect or misapplication of energy analysis and cost-benefit analysis is often apparent. Energy analysis is used to determine whether the gross renewable energy output is greater than the energy invested in its whole life cycle of production. The term gross energy output refers to the total energy returned, while the term net energy output represents the energy surplus after deducting the energy invested for its production. If the net energy output as the result of producing a renewable energy is less than zero, then such energy should not be used as a primary source of energy. The literature indicates that the net energy yields of most renewable energies are low, and some may even have negative net energy yields. Apart from energy analysis, other production factors should be included as well in the analysis, and environmental issues such as agricultural chemicals and water pollution, soil and water conservation, air pollution, food security and biodiversity are also important. A comprehensive social cost-benefit analysis which takes all outputs, inputs, and impacts into consideration is required to derive a good development policy. Specifically, the criteria for the adoption of a development policy should include the following: (1) a positive net energy; (2) fossil fuel displaced >0; and (3) GHG displacement >0. For the social cost-benefit analysis criteria, the requirements are (1) a positive net benefit; (2) a positive maximum ratio of benefit/fossil fuel displaced; and (3) a positive maximum ratio of benefit/GHG displacement. Renewable energy development policies should meet the above criteria before they are adopted for implementation.

Third, the policy instruments used to promote renewable energy production, for example, price support, should base themselves on net energy output instead of on gross energy output. Since the production cost of renewable energy is generally higher than the corresponding costs of fossil fuels, we cannot depend on the power of the free market to promote the development of renewables. Policy instruments are therefore necessary to facilitate the introduction of renewable energy. The task of designing a good policy instrument for renewable energy development is today’s challenge. It is found that all of the policy instruments used by governments today are based on gross energy output. If gross energy output is used as the base of subsidy, then a subsidized higher price will draw inefficient energy providers whose net energy output is negative into the market, thereby wasting energy, time and money. The correct base for a price or quantity policy instrument is therefore not gross energy output but rather net energy output. If the government regards promoting the total output of renewable energy as a policy goal at this moment, it may cause inefficient technology to be used and this may in turn accelerate the exhaustion of natural resources and the degradation of the environment.

Actually, changing the base for price support from gross energy output to net energy output is still the second-best policy choice. The first-best policy for the development of renewable energy in particular, energy in general, is to place a higher tax on non-renewable energy without any subsidy for renewables. This is a shift from the supply-side policy to the demand-side policy. With an energy tax which reflects mainly the intergenerational externality (user cost), those renewables with higher energy efficiency will enter the market naturally without any subsidy. In addition to energy diversification, total energy demand will be kept from rapid growth. In this case, there will be no waste of energy, time and money.