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MULTIPLE INSTRUMENTS IN ENERGY AND CLIMATE CHANGE POLICIES

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OVERVIEW

In many countries (e.g. member countries of the EU) policies on climate change and energy focus on three goals: i) reduction of CO2- emission, ii) increase of the share of renewable energy out of total energy use, and iii) reduction of energy use through energy savings and improvements of energy efficiency. In pursuing these goals a number of economic instruments (or mechanisms) have been implemented or proposed, e.g. Pigovian CO2 taxes, CO2 emission permits, green certificates (allowances), feed in tariffs and white certificates. The purpose of this paper is to critically investigate the functioning of such instruments as they act in concert.

Each of these instruments is designed to take care of a specific goal such as those mentioned above. The CO2 taxes and CO2 permits are intended for reducing CO2 emission (Green house gases), green certificates and feed in tariffs are intended for increasing the share of renewable energy, while white certificates are indented for reducing energy use. Furthermore, these instruments cover various areas of energy use e.g. the system of green certificates confines itself to the electricity sector (at least in systems such as the UK system and the Swedish system), while white certificates cover all energy use. Also, the CO2 permit system may only apply for specific sectors of the economy (as in the ETS system of EU), while the sectors not covered by the quota system may be subject to a CO2 tax system.

METHODS

This multitude of instruments and their overlapping areas of coverage give rise to several questions related to how well we may expect the instruments to work and be in line with the specific objectives of the above mentioned goals.

In order to investigate such questions we formulate a simple analytical model of policy goals for electricity and energy generation applying instruments such as CO2 taxes, green certificates and white certificates. This model is further extended to a numerical version that incorporates more realistic model parameters that allow for more detailed analyses.

RESULTS

An important observation from these models is that the effects of the investigated instruments are not independent. Each instrument may affect the attainment of all the above mentioned goals, just as the attainment of one single goal may be affected by all instruments in use. The question then is to what extent the instruments are compatible with each other, i.e. whether their effects are additive, super additive or plain counter productive. Along with this, one may wonder whether the interplay of the various instruments in general promotes efficiency in terms of equalization of marginal cost of say various technologies used for CO2 abatement. A further question is whether one or several instruments may be redundant with respect to achieving the objectives.

The analysis involves investigating the effects of policy adjustments e.g. what will happen to the generation of “green” electricity if the “percentage requirement” of white certificates is

increased when all above instruments are active? In the analytical model the results are typically not clear cut. For this reason we rely on the numerical model to determine net policy effects under reasonable assumptions.

CONCLUSIONS

Important questions relate to the aggregate effects and the compatibility of the various instruments implemented and proposed in energy and climate change policies. It turns out that some instruments in fact function as alternatives and one can therefore not exclude that some of them therefore may be considered redundant. Hence, costs (e.g. system transaction costs) may be avoided by abandoning such systems. Otherwise, great care should be taken to critically investigate how well the various instruments work together and instruments should be designed and amended such that they jointly may attain the various objectives of energy and climate policies at least cost to society.

REFERENCES

1. Amundsen, E. S. and J.B. Mortensen (2001). The Danish green certificate system: Some simple analytical results. *Energy Economics*, Vol. 23, 489-509.
2. Amundsen, E.S., Baldursson. F.M., Mortensen J.B. (2006). Price Volatility and Banking in Green Certificates Market. *Environmental and Resource Economics*, Vol. 35, 259-287
3. Amundsen, E. S. , Nese, G. (2009). Integration of tradable green certificate markets: What can be expected? *Journal of Policy Modeling*, Vol. 31, 903-922.
4. Bye, T. (2003). On the price and volume effects from green certificates in the electricity market. Discussion Paper 351, Statistics Norway.
5. Bye, T., Bruvoll, A. (2008). Multiple Instruments to Change Energy Behaviour: The Emperor's New Clothes? *Energy Efficiency*, Vol. 1, No 4, 373-386
6. Fischer, C. Renewable Portfolio Standards: When do they Lower Energy Prices? *The Energy Journal*, Vol. 31, No. 1, 101-119
7. Nese, G. (2003): "Essays in Liberalized Energy Markets", Doctoral dissertation, Department of Economics, University of Bergen.
8. Traber,T., Kemfert, C. (2009). Impacts of the German Support for Renewable Energy on Electricity Prices, Emissions and Firms. *The Energy Journal*, Vol 30, No.3, 155-178.