*Abstracts*

# Industrial Transformation towards Sustainability of the Energy System

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## Abstract

Managing the risks of climate change requires a major transformation of the way energy needs are met. Such a transformation includes changes in the production and consumption system and the incentive structure that shapes this system.

Industrial Transformation goes beyond the notion of "green" products and beyond the domain of single sectors. Different sectors are likely to get involved simultaneously. Moreover, Industrial Transformation can not be planned by a single actor, it requires the engagement of society as a whole.

When it comes to Industrial Transformation a number of different approaches can be discerned that can be seen either as competing or as mutually reinforcing paradigms. In a slightly caricatural way the different approaches can be described as the "economist approach", the "technologist approach", and the "behaviour approach".

The economists tend to consider environmental overexploitation as a problem of an inefficient allocation of (common) goods and eco-system services and/or as a matter of imperfect markets in which the prices do not reflect the value of the goods and services provided by nature. The technologists tend to view the environmental problems as a challenge and a trigger for technological innovation. Underutilization of scientific, technological and managerial knowledge and irrational societal perceptions regarding promising technologies are seen as the main reason why environmental problems are not adequately addressed.

Behaviour oriented approaches toward the issue of global environmental change can not be easily captured in a single paradigm. Some approaches focus on individual responsibility and choice and refer to the commons dilemma. "Sufficiency" and the "irrationality of consumerism" are value concepts introduced in the societal debate. More recent approaches focus on the interdependency between producers and consumers and the cultural, institutional and infrastructural setting as determinants for consumer choice.

To explore the ways in which societal energy needs can be met in a way that does not cause serious and/or irreversible environmental degradation it is important to consider

the consumer's perspective, the producer's perspective and the governance perspective (incentives).

a) Consumers perspective.
With growing economic prosperity and increasing access to information, individualism and consumerism have become important characteristics of present day societies in the OECD countries. Economic prosperity has also generated awareness and concern about the environment. Survey results indicate that consumers expect the private sector to produce goods that are inherently safe for the environment (SCP, 1999). We may expect that energy producers, encouraged by governments and NGOs will be responding to these concerns and expectations sooner or later.

b) Producers perspective
A number of energy production companies (including oil companies) have responded to the public concerns about the environment. Their response is not only driven by short-term profit considerations, employers' and customer's satisfaction, and considerations such as "licence to produce" are becoming equally important factors.

A mix of measures including energy efficiency, a switch to natural gas, introduction of renewables, and underground storage of carbon are elements of such response strategies.

c) Governance
The challenge for governments is to develop an institutional framework that helps the producers and consumers to go through such a transformation.

A most promising approach to manage and reduce the flow of carbon to the atmosphere is a global system of tradable CO2 emission permits. This way the environmental resource (air as a sink for CO2) could be introduced in the market system just like other commodities. The challenge, however, is to set up such a pseudo-market and get agreement about the allocation of rights. It is likely to take another 10 to 20 years before agreement about and introduction at a global scale of such a system can be achieved. It is important, however, to start developing such a scheme already now. Trading between countries as envisaged under the Kyoto Protocol could be a start. It is not certain whether a CO2-trading system is the best in all cases. Green taxes as a way to reduce income taxes may also be a promising approach as there are fiscal policy benefits that go beyond CO2 management that may well be attractive. Renewable energy portfolio standards is an effective way to create a market for renewable energy generation. Energy distributors or energy producers could be regulated to bring an over time increasing minimum percentage of energy to the market in the form of renewable energy. Flexibility and efficiency could be introduced by trading. A number of governments in Europe are presently exploring this system.

For some sectors pricing will not have much effect on the efficiency of energy use. Appliances, buildings, cars, trucks, and aeroplanes for example could probably best be made more efficient through the introduction of energy efficiency standards and/or fleet requirements. For some of these products there are only a limited number of producers that operate on a global scale. It may be relatively efficient to reach agreement at a global level by putting pressure on these key producers. A pluralistic approach to

transformation.

The best strategy for transformation is likely to be the introduction of a broad set of options that is mutually reinforcing or at least not mutually exclusive for the long term.

The paper suggests that a pluralistic policy approach including efficiency standards, renewable energy portfolio standards, carbon taxes, and the introduction of a system of tradable emission permits is the most promising approach for a transformation towards a low carbon energy economy.

Keywords: Industrial Transformation, Energy Sector, Climate Change Policies, Carbon Dioxide, Energy Efficiency, Carbon Sequestration, Renewable Energy, Incentive Structure, Production, Consumption.