

## Indirect demand-side policies for green innovation

### Green regulation

Regulation, the implementation of rules by public authorities and governmental bodies to influence the behaviour of private actors in the economy, has been identified as an important mechanism in terms of diffusion and adoption of green technologies. Regulation influences innovation indirectly, since it affects the framework conditions for firms and involves no direct outlay of public funds (Geroski, 1990). For example, energy efficiency or environmental pollution regulations are used in the absence of market mechanisms to influence agents' behaviour and to achieve certain social or economic objectives. Germany's Promotion of Renewable Energies Heat Act (2009) encourages the diffusion of green innovations because it obliges owners of new buildings to use renewable energies.

However, the effects of economic regulation on innovation are far from straightforward. Some of the literature suggests in fact that regulation can both inhibit and stimulate innovation. The impacts of regulation on innovation are also likely to be highly technology and industry-specific. OECD analysis shows that anticipation of regulatory change has induced innovation in some sectors (OECD, 2011a). To assess the appropriateness of regulatory policy targeting a specific sector, analysts also need to explore whether the market would introduce appropriate technology in the absence of regulation. Regulations interact with market-based incentives and it can be relatively difficult to isolate the specific effects of regulation. This is due to the complex ways in which regulation may shape innovation, the possibility of long lead times between a regulatory stimulus and an industry response, the simultaneous impacts of an array of supply-side factors, as well as the inherent uncertainties in the dynamics of innovation (including exhaustion of the research frontier).

In the context of green technologies, policy makers have made significant use of environmental regulation in recent years and the effects on innovation have been extensively analysed. The evidence shows that environmental regulation has had positive impacts on green innovation and its adoption (Blind, 2012; OECD, 2011a). Conventional approaches to regulating the environment are often referred to as "command-and-control" (i.e. performance and technology-based) as opposed to market-based environmental regulations and standards. In general, market-based policies provide incentives for constant incremental improvements, whereas "command-and-control policies" punish polluting firms that do not meet the standard, but they also do not reward those that perform better than mandated (Popp et al., 2009, Stavins, 2003). Environmental policy design has thus been used more to reduce environmental externalities than to make targeted use of regulation for innovation purposes.

### Standards

At their root, standards are documents based on various degrees of consensus which lay out rules, practices, metrics or conventions used in technology, trade and society at large (OECD, 2010a). Standards can be categorised in many ways and the driving forces include network effects, switching costs, government policy and intellectual property regimes, as well as other environmental factors (Blind, 2004; see Narayanan and Chen, 2012, for an overview). Even if they are developed for a single purpose they often serve several.

Standard-setting activities and organisations need to be understood and monitored by policy makers. The setting of standards is mainly the responsibility of different types of organisations: industry bodies (private), governmental (public) and non-profit technical bodies (hybrid) (Funk and Methe, 2001). Governments can act as facilitators and co-ordinators while industry bodies must be supported by firms as well as by governments. Firms commonly use standards strategically by steering and facilitating the adoption of de facto technology standards (Narayanan and Chen, 2012).

Standards may be developed by technical experts working in government agencies but in most cases they adopt standards developed by industry bodies for reasons of expediency and because of a lack of technical expertise (e.g. California Air Resources Board). Depending on the nature of the standards, in particular for environmental standards, some are enacted through legislation and are mandatory, whereas others are voluntary but are adopted by entire sectors (e.g. EU emission performance regulation) (Contreras, 2011).

A limit on the role of government in standards setting is the fact that for many technologies, standards are set openly at the international level. Efforts to impose national standards through public procurement, for example, are risky and costly as it is difficult to determine in advance what will become the dominant standard in a rapidly evolving area such as green innovation and may lead to technology lock-in. Procedures in standards bodies can also be slow and bureaucratic and may be influenced by large players.

The economic benefit of standards has become clearer to policy makers in recent years. Standards can affect incentives for diffusing green innovation in several ways. They provide information that facilitates the diffusion of innovation and economies of scale and they remove bottlenecks. Technical standards facilitate the organisation of network industries (e.g. by promoting interoperability or facilitating the substitution of old technologies or their co-existence with new ones) and value chains. It is sometimes argued that standardisation acts as much to enable as to constrain diffusion.

Technical standards are likely to play an increasingly prominent role in the development, adoption and regulation of green technologies. Most environmental policy and public procurement relies on standards. In the environmental area, performance-based environmental regulation and procurement promote minimum levels of performance for innovators and foster confidence among consumers. The UK government decided to support standardisation in biometrics, with technical standards that support interchangeability and interoperability. A 2009 review of standardisation and innovation programmes in the United Kingdom found that this had facilitated the diffusion of technology in the marketplace, made procurement more cost-effective and eased SMEs' access to the procurement market (OECD, 2010a).

## **Consumer policies**

As consumers and users become catalysts for innovation, by creating demand and facilitating the diffusion of innovation, consumer policy takes on growing importance. Consumer policy regimes and consumer education play a role in promoting innovation in key innovative markets and can help ensure that confident consumers make informed choices. Potential private adopters of green technologies may be uncertain about the technology's quality and performance. It is therefore necessary, for example, to address behavioural biases to foster "greener" consumer choices and to enhance the quality and reliability of information on green goods and services, for example through green labelling. The potential savings to be achieved through resource-efficient technologies depend on scenarios which are uncertain and rely on many assumptions. This may lead firms and consumers to postpone the purchase of the technology.

Consumer policy can be used to counter inertia and scepticism towards new goods and services and help improve the flow of information between users and developers. One way to lower information barriers and to reduce information asymmetries is to improve the quality of claims made by firms that have expanded the use of self-declared "green claims" as a corporate marketing tool. To improve the value and effectiveness of such claims, some governments have prepared guides to help business develop and/or use green claims. The US Federal Trade Commission's Green Guides are a case in point. Finland and Norway have developed sector-specific guidance on the use of terms such as "carbonneutral" and "energy-efficient" (OECD, 2010b).

## **Adoption and deployment policies**

OECD governments provide a wide range of financial or price support mechanisms to business and/or consumers to encourage the adoption of green products and services. These measures are intended to help stimulate adoption and diffusion by reducing the price of the technology being adopted or by affecting behaviour (OECD, 2012a):

- Fiscal and financial incentives to reduce prices can be direct subsidies such as feed-in tariffs, consumer grants or financial transfer payments or tax incentives such as tax reliefs or tax credits.
- Fiscal and financial disincentives (environmental taxes and charges) are designed to influence the behaviour of producers and/or consumers while raising government revenue and covering the costs of environmental services (e.g. petrol tax, congestion charges).

In addition, several governments have used tax measures and subsidies to support growth and exports to new markets abroad. As world demand increasingly values green technologies, governments speculate that this could lead to future benefits, more internationally competitive sectors and more innovation.

OECD governments also provide support for large-scale demonstration projects or pilot plans to overcome the “valley of death”, with its high technological and financial risk. The aim is to gain first-hand information about operation, maintenance and opportunities for incremental innovation and to create social acceptance. As part of its Economic Action Plan, Canada’s Clean Energy Fund is investing in large-scale carbon capture and storage (CCS) demonstration projects and smaller-scale demonstration projects on renewable and alternative energy technologies. A key example is the federal government’s CAD 120 million investment in the CCS Shell Quest project. In the same vein, Austria’s new Energy Research Initiative (ERI) provides support for the creation of prototypes that use hydrogen and carbon dioxide as energy sources.

A common problem with adoption policies, notably direct subsidies, is that they involve large budgetary costs per unit of effect (including high transaction and monitoring costs). Without adequate phase-out schedules they can trap resources in subsidised “green” sectors. In addition, subsidies can provide perverse incentives that may lead to an increase in energy use (“rebound effects”). Evaluation is required to assess the sustainability claims of the respective sectors and to limit the risk of costly but ineffective intervention.

In practice, adoption policies are often used as an extension of industrial policy. Most OECD countries’ support for renewable technologies amounts to industry policy instruments. They may build local manufacturing capacity to support deployment of renewable electricity technologies or provide support to local vehicle manufacturers. Government support may be in conflict with World Trade Organization (WTO) rules if it involves subsidies that can disadvantage foreign competitors and distort competition. However, whether or not subsidies, such as feed-in tariffs, constitute a breach of WTO rules depends on the actual design and implementation of the policy programme.

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