

Appendix II. Examples of ongoing work

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Table II.1. Conditions favourable to the use of specific instruments

Market-based instruments		
Circumstances Under Which Instrument Works Best	Examples / Common applications	
<p>(1) Cap-and-trade permit systems</p>	<ul style="list-style-type: none"> - Public-good market failure is not dominated by monitoring and information costs. - Sufficient institutional capacity (experience) and potential size of market sufficiently large to function properly. - Environmental damage depends on overall amount of a pollutant and not on specific location or timing of emission sources - Precise control over emissions is available at reasonable cost - Cross-border spill-over effects are important 	<ul style="list-style-type: none"> - GHG emission reductions (EU-ETS) - Air pollution (SO₂, NO_x, VOC) - Fishing quotas
<p>(2) Baseline-and-credit permit systems</p>	<ul style="list-style-type: none"> - Public-good market failure is not dominated by monitoring and information costs - Insufficient capacity or scope to set-up a cap-and-trade system - Baselines can be set and verified at reasonable cost - Cross border spill-over effects are important 	<ul style="list-style-type: none"> - Clean Development Mechanism - Lead content of gasoline
<p>(3) Taxes or charges on pollution or exploitation of natural resource</p>	<ul style="list-style-type: none"> - Public-good market failure is not dominated by monitoring and information costs. - Pollution sources are small and diffuse - Environmental damage depends on overall amount of a pollutant and not on specific location or timing of emission sources - Temporary deviations in emission levels from target have little consequences for environmental damage (e.g. flat damage function) - Precise control over emissions is available at reasonable cost 	<ul style="list-style-type: none"> - Water effluents - Water abstraction or consumption
<p>(4) Taxes or charges on a proxy (input or output)</p>	<ul style="list-style-type: none"> - Control of direct pollution discharge difficult or costly - Close and stable relationship between use of input or output used as proxy and targeted pollutant - Several pollutants associated with single input or output 	<ul style="list-style-type: none"> - Fuels and coal - Motor vehicles - Fertilisers
<p>(5) Subsidies</p>	<ul style="list-style-type: none"> - Enforcement of alternative pricing instruments is difficult or very costly - Activity to be subsidised is a strong substitute for targeted "dirty" activity - Subsidy programme can be designed in a relatively simple way, for a time-limited period and with minimal secondary effects 	<ul style="list-style-type: none"> - Forest management and conservation - Purchase of environmental-friendly house energy equipment
<p>(6) Deposit-refund systems</p>	<ul style="list-style-type: none"> - Control of pollution source impossible or difficult - Solid wastes involving simple and relatively homogeneous products or heavy metals 	<ul style="list-style-type: none"> - Beverage and chemical containers - Lead acid batteries

Table II.1 continued over page.

Table II.1. Conditions favourable to the use of specific instruments

(continued)

	Non market instruments	
	Circumstances Under Which Instrument Works Best	Examples / Common applications
(7) CAC Performance standards	<ul style="list-style-type: none"> - Pollution control at the source of emissions is infeasible or very costly - No adequate proxy for pollutant that could be object of taxation - Weak response of agents to price signals - Pollution emissions can be measured from application of technology 	<ul style="list-style-type: none"> - Limits on CO₂ emissions of a passenger vehicle - Energy efficiency standards for various manufactured goods.
(8) CAC Technology standards	<ul style="list-style-type: none"> - Pollution control at the source of emissions is infeasible or very costly - No adequate proxy for pollutant that could be object of taxation - Administrative costs of performance standards are too high - Abatement costs are relatively homogeneous across agents 	<ul style="list-style-type: none"> - Minimum percentage of a low-carbon source in the overall fuel mix of passenger vehicle - Specific housing building codes for energy-saving purposes
(9) Active technology support policies	<ul style="list-style-type: none"> - Technology areas where market size and learning-by-doing effects are dominant - Infrastructures in areas where network considerations are important 	<ul style="list-style-type: none"> - Feed-in tariffs for electricity generated by renewable sources - Renewable energy portfolio standard (green certificate)
(10) Voluntary approaches	<ul style="list-style-type: none"> - When the authorities can put strong pressures (credible threat of follow-up actions) - Where information is not too costly to provide 	<ul style="list-style-type: none"> - Agreements to encourage energy efficiency in energy-intensive industries - Publicly-available inventories of various pollutants

Table II.2. Green industries by broad sector of activity and broad environmental area

Production sectors	Environmental sectors				
	Climate change			Other environmental areas	
	GhG emissions from: Fossil-fuel power generation	GhG emissions from: Building energy consumption	GhG emissions from: Transports	Bio-diversity / air, water and land preservation	Waste management
Electric/ Utilities	- Wind power - Geothermal power - Solar power - Hydroelectric power - Nuclear power	- Electrical power distribution (energy conservation and planning)		- Water supply and irrigation system	- Sewage treatment facilities
Agriculture	- Bio-methane production (energy from animal waste)		- Bio-fuels crop production (especially non-food)	- Organic farming - Aquaculture	
Construction	- Renewable energy plants - Power lines and related structure construction	- Roofing contractors - Electrical and wiring installation contractors - Retrofitting of existing buildings (insulation) - Plumbing and air-controlling contractors			- Waste water and sewer line
Transport			- Public transit systems (urban and inter-urban) - Fluvial transport - Rail freight transport		
Manufacturing	- Wind turbines - Solar panel components (semi-conductors) - Storage battery equipment	- Smart systems and equipment - Electric lamp bulbs - Solar panel components - Automatic environmental control equipment	- Transportation technology (electrical, hydrogen, bio-fuels, hybrid) - Processes for bio-fuel production - Fuel efficient vehicle manufacturing - Transportation and logistics equipment	- Monitoring equipment for fishing stock - Water metering equipment	- Automatic environmental control for commercial, residential and appliance use
Services	- Engineering services - Plumbing and heating equipment wholesalers - Environmental consulting services	- Architectural services - Engineering services - Residential and non-residential property managers	- Repair and maintenance of fuel-efficient vehicles - Logistic consulting services - R&D in biotechnology	- Eco-tourism activities, conservation and wildlife organisations - Watershed conservation and management - Emissions and pollution control - Environmental consulting services - Survey and mapping services	- Solid waste collection - Hazardous waste collection - Engineering services

Source: Centers of Excellence of California Community Colleges and OECD.

Box II.1. The role of regulatory policy and reform

Regulation, together with taxation and expenditure, is one of the key levers governments can use to promote green growth. But without proper oversight and sound regulatory policy, there is a risk of regulatory incoherence and overlap, between both new regulatory proposals and the stock of existing regulations. This can impede the entry of new firms and exit of older, inefficient, ones, a process which is necessary to transform economic activity and stimulate growth. While regulation may be necessary to stimulate the uptake of green technologies, the careful selection of instruments is important to ensure that regulatory proposals are targeted, efficient and do not constrain market dynamics.

Market-based instruments need to be complemented by regulatory measures that encourage the adoption of low carbon technologies through, for example, updating building codes and higher energy efficiency standards. Regulatory failure, as demonstrated by the creation of unintended distortions or unnecessary administrative burdens impedes dynamic economic efficiency, which will in turn slow green growth. Country experiences can guide regulatory management and reform to target those areas where efficiency gains for green growth are greatest. This involves selecting an appropriate instrument among a set of regulatory and non-regulatory approaches, taking account of the incentives for firms and consumers, and the promotion of a coherent regulatory framework.

Coherent regulatory policy increases confidence in the entire regulatory system and underpins investment certainty, while ensuring that regulatory policies do not overlap and potentially waste scarce resources. Coherent regulatory policy requires multilevel regulatory co-ordination, across departments and policy areas and at the national and sub national level. The adoption of new regulations as part of a green growth strategy must be accompanied by a thorough vetting of the extant regulatory stock to eliminate those that are in conflict or those that may inhibit the growth strategy. *Ex ante and ex post* assessment of the costs and benefits of different instruments can assist in selecting the optimal approach to achieve desired policy goals.

Although the tools for regulatory policy are well-tested in developed countries, the pursuit of a green growth agenda is likely to challenge regulatory management systems. The transition to a green, low-carbon and resource efficient economy that creates new sources of growth is a long-term process and will require fundamental shifts in regulatory approaches and institutions.

Achieve positive environmental and economic outcomes

Integrating both economic and environmental considerations in regulatory decision-making is a key feature of green growth strategies. Existing tools and methods, such as Cost-Benefit Analysis (CBA), Regulatory Impact Assessment (RIA) and ex-post evaluation provide a framework to consider economic, social and environmental costs and benefits of proposed regulation. However, while almost all developed countries have implemented some form of RIA for new regulatory proposals, countries nonetheless find it administratively and technically challenging, particularly with ensuring the use of these tools early in the policy process. To improve both the uptake on these tools and quality of the analysis associated with major policy and regulatory initiatives, formal agreements between central regulatory oversights and regulating departments could be considered. Canada has implemented such agreements such with some success. Similar agreements could be specifically targeted towards attaining green growth objectives.

Strengthen evidence-based decision-making to foster support

OECD research indicates that a reliance on particular modes of regulation is often more a case of habit than sound design. Traditional command-and-control and end-of-pipe type regulations often lead to input substitution and sub-optimal allocation of

resources that are counterproductive for green growth. Among alternatives, performance-based regulations may work better but can be difficult to enforce without paperwork and inspections. As explained in section II, market-based instruments on the other hand can improve both environmental quality and optimal allocation of resources, but are not always considered by regulators. To increase the likelihood that alternatives to regulation are considered and adopted, a broad range of potential instruments should be considered early in the policy planning and regulatory process, including market-based measures and voluntary approaches.

Sound analysis, *ex ante* and *ex post* evaluation are not only important for decision making, but also facilitate consultation and garner both public as well as political support and acceptance. Industry, NGOs, think-tanks and other stakeholders are more likely to support - or not oppose - initiatives that are transparent and present a solid rationale and analysis that can be independently assessed. Quantitative analysis and results in particular can prove an effective way to communicate complex issues. For example, improved compliance outcomes can be achieved through the communication channels of Web 2.0 technologies which can empower civil society to advocate greener industry performance beyond the limits that may be achieved through direct regulatory measures.

Ensure coherence of analyses and policies

Green growth initiatives are inherently complex. Climate change related regulatory proposals typically involve a wide range of independent regulators which may lead to diverging policies and incoherent outcomes that undermine a national strategy. Some countries, such as the US, have had success in engaging and co-ordinating between regulators at the planning stage to ensure that different regulatory initiatives are assessed against a common analytical framework. More work needs to be done in this area, as countries are not all at the same level in terms of analytical quality and scrutiny of regulatory proposals.

Global issues, including climate change, also highlight the importance of international regulatory co-operation and the need to ensure a global level playing field in terms of environmental regulation. Failure to do so could result in "regulatory arbitrage" by firms, which could choose to operate where regulations are the least stringent. Global dialogue on the application of regulatory policies and regulatory initiatives is required if we are to achieve the necessary convergence in both analysis and policy design for green growth initiatives to be coherent on a global scale.

Box II.2. Markets and competition

Green growth policies and competition policies are complementary. Effective and well functioning competition supports the achievement of environmental goals in a cost effective way including in setting an appropriate price on pollution; lowering barriers to starting new businesses; favouring exit of obsolete firms; and fostering innovation and the development of new green technologies.

Market solutions to promote green growth are often sought through a government intervention designed to recognize an externality, such as a tax on carbon that allows open competition between energy sources afterwards; creation of a regulated product (tradable emission permit) that is traded in a market; or organisation of a new market (such as recycling programs). The view underlying many government interventions for green growth is that once externalities are priced appropriately, markets are likely to promote the most effective use of resources. For markets and competition policy to operate well, policy makers need to understand the consumer and efficiency impacts of different policies in order to ensure that government restrictions are appropriate.

The OECD is examining competitive effects in markets related to renewable energy, standard setting and emissions trading. The approach is to examine the purpose of the government intervention and seek to identify the best, practicable alternatives for achieving government objectives taking into account effects on competition in markets.

In the 2009 Council Recommendation on Competition Assessment, the OECD recommends reviewing and revising regulations to promote better market structure and operation. To help with such reviews, the OECD has developed a Competition Assessment Toolkit that provides a framework to guide policy makers in deciding how to assess and address competition concerns that may arise in government interventions. It draws on cross-sector regulatory experience across many countries. Further work is needed to customise the framework for achieving green growth with market outcomes that deliver efficient and effective outcomes. The Toolkit focuses especially on three principles.

Promote the starting of new businesses

Green growth policies can promote entry of new competitors. Without new competition, individual businesses may also have a greater ability to raise prices. This can hurt government purchasers or other consumers. Examples of policies which may restrict the entry of new businesses include: those that grant exclusive rights over a good or service; establish a license, permit or authorisation process as a requirement of operation; or create a geographical limit to the ability of companies to supply goods or services, invest capital or supply labour.

Ensure businesses can take a broad variety of actions to compete

The actions that businesses take to compete with each other can be limited by regulations that set standards; control prices; favour particular firms or production processes; and restrict advertising and marketing. When businesses are restricted in how they can compete, the vigour of rivalry between businesses is reduced, potentially yielding higher prices for consumer and government purchasers and less product variety.

Maintain the incentive of businesses to act as vigorous rivals

Regulations that reduce the incentives of businesses to act as vigorous rivals may facilitate co-ordination between suppliers. Co-ordination between suppliers over terms of competition can restrict output and raise prices, leaving consumers and government purchasers worse off. Examples include regulations that create a self-regulatory or co-regulatory regime; require or encourage information on business outputs, prices, sales or costs to be published; or exempt the activity of a particular industry or group of businesses from the operation of general competition law.

Box II.3. Consumer policy

Well-informed, empowered consumers are a powerful ally in supporting and driving green growth. For example, they can contribute to the reduction of carbon emissions by using available energy more efficiently or moving to innovative climate-safe technologies. Similarly, consumer demand for green goods, such as alternative-fuelled vehicles and energy-efficient appliances, will play an important role in the development of new generation green goods. To play this positive role, however, a major behavioural change is required by consumers, but also in markets and society as a whole. On the policy side, to support this behavioural change, there is a need for understanding how consumer behaviour is changing and to provide information and ways to expand consumer choices that can lead to sustainable consumption and green growth.

Consumer policy regimes and consumer education and awareness-raising can support consumers in making informed and environmentally-responsible choices, therefore strengthening competition and fostering green innovation. An essential element of this process is ensuring that the information available to consumers is readily understandable, reliable, easy to compare and presented in a manner that takes into account how people process information. Results from an OECD survey on household behaviour confirm that information-based measures can be very effective complements, allowing consumers to make informed decisions reflecting their underlying demand for environmental quality. Yet, information alone is not necessarily sufficient for consumers to make well-informed choices. Studies from behavioural economics show that much potential consumer decisions for green products and services is prevented due to a lack of empowerment and motivation.

To respond to these challenges and opportunities, policy makers need to understand what changes in consumer behaviour are taking place, and what policy interventions are most effective in underpinning green consumption. Against this backdrop, the OECD is addressing consumer protection and empowerment for green growth, through work on green claims, consumer economics and consumer education.

Central to enabling consumers to make informed choices for green products and services is consumer trust in green claims, defined as information presented by business about a product or service concerning its environmental impacts. Such claims have the potential to play an important role in encouraging consumers to make choices that support green objectives, while rewarding innovative companies for their efforts in this regard. The impact of claims will be reduced, however, to the extent that they are unclear, unsubstantiated, confusing, deceptive or fraudulent. When this occurs, there is a risk that consumer interest and confidence in green and innovative products and services will diminish.

The OECD is examining current practices in consumer protection against fraudulent and misleading environmental claims, with an aim to identify the steps that policy makers and other stakeholders can take to enhance the value and effectiveness of these claims for consumers. Differences and similarities across countries with regard to defining sustainable products, requiring company sustainability reporting, and monitoring, advertising and labelling will be highlighted.

Further work is needed to select and implement the most appropriate policy interventions to promote green growth and achieve lasting systemic and behavioural change. The OECD has developed a Consumer Policy Toolkit, which provides a framework to guide policy makers in deciding when and how to intervene in markets to address consumer problems. It draws on what has been learned in the field of behavioural economics, as well as in neoclassical and information economics. The Toolkit can be applied to reviewing the conditions under which governments may want to intervene in the markets to promote sustainable consumption, foster innovation and green growth.

Box II.4. Responsible business conduct in support of a low carbon economy

An increasing number of companies is taking initiatives to address climate change, but levels of corporate action vary significantly, depending on companies' size, industry and region. The Guidelines for Multinational Enterprises are recommendations to companies by forty-two OECD and emerging economies on responsible business conduct, including in the area of environment. They have an important role to play in helping build international consensus and spread knowledge about advanced management practices in support of a low carbon economy. This box documents business practices in light of selected recommendations of the Guidelines.

Disclosing information on GHG emissions: Enterprises should provide the public and employees with adequate and timely information on the potential environment, health and safety impacts of the activities of the enterprise, which could include reporting on progress in improving environmental performance. (Chapter V of the Guidelines, Environment).

Increasingly, leading companies both in OECD and in emerging economies estimate and publicly disclose greenhouse gas (GHG) emissions relating to their operations (in 2009, 70% out of Global 500 did so). GHG emissions accounting is an essential step in companies' assessment of their impacts on climate change and of the risks of climate change on their operations, and constitutes a key element in the development of corporate climate change plans. Public disclosure of GHG emission information helps consumers, investors and other stakeholders assess companies' performance and risks, and can assist governments in developing climate change policies and monitoring progress. The variety of reporting methodologies currently in use, however, makes it difficult to compare companies' progress in meeting their commitments.

Establishing emission reduction plans: Enterprises should contribute to economic, social and environmental progress with a view to achieving sustainable development". (Chapter II, General Policies). Enterprises should establish and maintain a system of environmental management appropriate to the enterprise, including: establishment of measurable objectives and, where appropriate, targets for improved environmental performance, including periodically reviewing the continuing relevance of these objectives (Chapter V, Environment).

A key step for companies' contribution to a low carbon economy is setting quantitative emission reduction targets and developing plans to reach those targets. Here also, the trend is upwards: over 50 % of Global 500 companies disclose emission reduction targets. By implementing corporate emission reduction plans, many companies are also saving energy costs, increasing efficiency and reducing climate change related risks. For leading companies, fighting climate change and making profits have proved to be compatible, and many have seized new business opportunities, *e.g.*, in the renewable energies sector.

Engaging suppliers and consumers: Enterprises should encourage, where practicable, business partners, including suppliers and sub-contractors, to apply principles of corporate conduct compatible with the Guidelines. (Chapter II, General Policies). Enterprises should continually seek to improve corporate environmental performance, by inter alia, promoting higher levels of awareness among customers of the environmental implications of using the products and services of the enterprise. (Chapter V, Environment).

Often, the most significant amounts of GHG emissions relate to supplies and to use and disposal of products. More and more companies are revising their logistics and interacting with their suppliers to ensure that emissions are reduced throughout the supply chain. This is a challenging task but it also provides additional benefits, such as reducing overall risks and costs, increasing efficiency and providing additional experience in managing emissions. Leading companies are also making efforts to better engage with consumers, by raising awareness to climate change and responding to consumer demand for low carbon goods and services.

Box II.5. Taxation, innovation and the environment

Case studies undertaken as part of an ongoing OECD project on Taxation, Innovation and the Environment highlight the ability of environmentally-related taxes to induce innovation. By imposing a direct cost on the polluter, these taxes, in addition to providing incentives for pollution abatement, also encourage innovation to seek out new products and processes that can reduce the polluter's tax burden. This innovation both reduces emission levels for a lower economic cost as well as lowering the tax burden on the polluter (or provides a revenue stream to a third-party inventor).

Looking, for example, at the innovation impacts of the United Kingdom's Climate Change Levy on fossil fuels and electricity, it was found that firms patented significantly more when they were subject to the full rate of the levy compared to firms that were subject to a rate only 20% of the full rate, suggesting that the tax had powerful impacts. In Switzerland, the imposition of a tax on volatile organic compounds (VOCs) – quickly vaporising substances that contribute to smog – affected a wide range of small producers, such as printers, paint makers, and metal cleaners. Most of these firms did not have dedicated R&D units or develop patentable ideas. Nevertheless, interviews with the firms highlighted that the adoption of existing technologies coupled with small, firm-level innovations discovered through trial and error produced significant reductions in VOCs use.

Preliminary findings of the project suggest that:

- Taxes are effective at encouraging the adoption and diffusion of existing green innovations across economies and within firms. Even for firms that do not have the resources or inclination to undertake formalised R&D activities, the presence of environmentally related taxation provides increased incentives to bring in the latest technologies that have already been developed elsewhere. In Sweden, for example, the introduction of a tax on NO_x emissions led to a dramatic increase in the adoption of pre-existing abatement technology: only 7% of firms had abatement technology in the first year of the tax but the fraction rose to 62% by the following year.
- The overall setting in which taxes are levied plays a significant role too: a country's intellectual property rights regime, the system of higher education and cultural norms towards innovation all contribute to a country's innovation capacity. In the case study of Israel, innovations in the water sector may be considered representative of an innovative culture spanning several decades, in addition to the presence of high water prices and taxes.
- Firms are impacted by environmentally related taxes not only in relation to their incentives but also in relation to their profits. Since the imposition of taxes increases firms' costs, it may negatively impact the amount of resources that firms have free to dedicate to innovation. In the case study of the United Kingdom's energy tax, firms having an 80% reduction in tax rates were less innovative, suggesting that the tax did not adversely impact the innovation resource constraint. In Switzerland, taxes on Volatile Organic Compounds and CO₂ have been proven to stimulate day-to-day innovations.
- A conducive environment for innovation, characterised by general predictability and credibility in tax rates, is also a critical ingredient to encourage investment in innovative activities. Unlike market uncertainty (such as oil prices), policy uncertainty is more difficult to hedge against. As seen with Japan's SO_x charge, the unpredictability of the rate and the uncertainty surrounding the viability of the overall scheme had negative effects on patenting, despite very high tax rates.
- As with many green policy instruments, there are concerns over levying policies that are too stringent and that can cause emission-intensive

firms to relocate to other jurisdictions. International co-operation and co-ordination in setting environmental taxes can significantly minimise this possibility. Doing so also provides an additional benefit for innovation: the use of environmentally related taxation maximises the international movement of innovation.

- Consumers may not be aware of the full impact of their purchase over the long-term and taxes may not encourage some agents to take mitigation measures when it is others who have to pay the tax. Thus, information campaigns and regulations may help complement green taxes and increase their impact. Such complementarities can help reinforce each instrument, provided that similar instruments do not overlap.

Box II.6. “Smart” ICT applications enabling green growth

Governments are increasingly investing in R&D and encouraging applications to reap environmental and economic benefits, as well as to create employment in new areas. The potential environmental benefits include increased energy efficiency, but they can go further. The “smart” grid is a good example of how ICT-enabled applications can contribute to limiting GHG emissions from the energy supply industry – one quarter of all man-made emissions. ICT firms are partnering with utilities to roll out smart electricity meters that enable final consumers to closely monitor their electricity consumption. Microsoft, Siemens and Google are, for instance, working with utilities in the United States (Xcel Energy), Italy (Enel) and Germany (Yello Strom), respectively. Pilot projects indicate instant feedback on energy use can reduce household electricity consumption by up to 20%. Even higher reductions can be achieved when smart meters are integrated with home automation systems.

ICT applications are beginning to impact the entire energy sector value chain (generation, transmission, distribution, consumption) and traditional business models. Broadband networks, smart sensors and software management systems are building blocks for integrating decentralised energy generators into the central grid, linking different energy storage systems and efficiently managing plug-in electric vehicles on a national scale. Energy sector challenges are different in emerging economies, but in countries such as India, where one third of electricity is lost along distribution, intelligent grid technologies have major potential to contribute to economic growth.

Governments can act to enable environmental and economic opportunities:

- Governments can kick-start initial long-term deployment where private investors are hesitating. The US Recovery Act funding for smart grid R&D and deployment is an example.
- Government policy can complement private investments in areas with potential long-term socio-economic benefits. The private US-Israeli venture “Better Place” (electric vehicle deployment) has established cross-industry partnerships to integrate renewable energy generation, sustainable personal transport and improved grid management. It has raised over USD 700 million in venture capital since 2007 and has backing from the Israeli and Danish governments for national roll-outs.
- Joint programmes with emerging economies are important to adapt new technologies to specific conditions and requirements. Scientific co-operation and technology transfer can be fostered by government policy, but must be coherent with development goals.

Despite the potential for ICTs to contribute to green growth and employment, most government programmes and industry initiatives have focused narrowly on improving the efficiency and performance of ICT equipment itself, most recently in the area of data centres. ICTs contribute only about 2-3% to global greenhouse gas emissions and the potential of ICTs to enable improvements across the economy has been relatively neglected. Although this has been partly remedied in some national economic recovery packages, there are still considerable efforts to be made, not only in designing policies and programmes, but also in developing tough but achievable environmental and economic targets and in evaluating and measuring programme impacts.

Box II.7. Regional innovation systems for eco-innovation

Embedding green innovation policies within a regional framework can help maximize their impact and effectiveness. OECD analysis shows that much of eco-innovation is concentrated in space and occurs in “green clusters”. In addition, systems organized around regional networks can better address commercialization challenges and early stage capital constraints for business start-ups. While it is hard to design effective policy packages that can replicate ex-novo the most effective innovation ecosystems, public policy can accelerate their development, by directed R&D, enabling infrastructure, and institutional platforms for collaboration.

Regional cluster policies can stimulate innovation

While there is a need for a comparative overview of policy options, there are certain concrete steps that governments could consider to spur the growth of regional green innovation clusters. The most ambitious ones involve a radical decentralization of innovation policies in the energy and environmental domains. Another, more promising, route rejects the central-regional dualism in favour of coordinated public policy to enable local, endogenous innovation dynamics. Multi-level and multi-agency policy coordination will be needed to put in place hard technology infrastructures, such as science parks, that can encourage new private investments in R&D for eco-innovation. Other instruments to enable private investments are publicly sponsored research and joint ventures between public and private laboratories within a region. Complementary policies that are more suited to the local scale include environmental technology verification schemes, development of marketing tools, demonstration tests, and simplification of red-tape regulation for technology adoption.

Increasing the eco-efficiency of production relies on regional systems

Regional responses are also warranted to improve the eco-efficiency of existing industrial production and of large incumbent energy service providers. One of the most promising phenomena in this field are eco-industrial parks, another example of organizational and process innovation producing both efficiency and environmental benefits at the regional level. Kalundborg in Denmark is the most well known example of the economic gains that can be achieved by connecting waste and energy exchanges in an eco-industrial park, with annual estimated savings of US \$ 12-15 million.

The capacity of Small and Medium Enterprises (SMEs) to innovate and reduce their carbon footprint will also depend even more on knowledge flows and institutional support available within their region. Even if technologies to increase energy efficiency are available “globally”, SMEs can fail to adopt them without “locally” available public services to facilitate access. In particular, there is the need to consolidate the effort of universities and public research centres to engage with SMEs, providing problem-solving and auditing services. Several tools, such as innovation vouchers, are being developed at the regional level and should be analyzed with a comparative approach.

The large-scale deployment of low-carbon technologies will depend not only on advanced scientific research but also on how fast firms and people learn to appreciate their added value. As discussed above, behavioural changes are as important as end-of-pipe solutions. These changes and learning processes happen at the local level. Better understanding what drives the demand for green goods and services as well as the main resistances behind slow adoption of new technologies is thus of critical importance. Strengthening the regional dimension of innovation policy would thus provide an opportunity to exploit real differences between regions with respect to capacity to adapt and to push forward systemic changes.

Box II.8. New models for international co-operation on eco-innovation

In strengthening international co-operation on green technologies and innovation, the key will be to identify and implement policies, frameworks and governance mechanisms that can deliver rapid scientific and technological progress as well as lead to a quick and wide diffusion. Existing schemes of co-operation on science, technology and innovation may have to be evaluated and improved, while new mechanisms that enhance green transfers to developing countries (*e.g.* patent pools and other collaborative mechanisms for leveraging IP) will need to be developed. This issue will be explored further for the Synthesis Report for the 2011 MCM.

Moving towards this new model will require focusing on priority setting for work, funding and institutional arrangements, procedures that ensure access to knowledge and transfer of technology, capacity building, as well as delivery of new innovations into widespread use. The OECD, in co-operation with non-members, is working to bring forward agreed principles underpinning such governance.

As an important consideration, such a model should give priority to the development of indigenous eco-innovation capabilities. Preliminary research indicates that the majority of existing policy mechanisms fail to recognise the critical importance of developing such innovative capacity amongst developing country firms. Indigenous eco-innovation capabilities are essential to facilitating both the diffusion of existing eco-innovations within developing countries and sustainable economic development based on the adoption and development of green technologies that fit with the bespoke conditions faced by developing countries.

Building up eco-innovation capabilities in developing countries will require a shift away from the current focus on large project based approaches that emphasise the transfer of the hardware aspects of clean technologies, towards approaches that emphasise flows of underlying knowledge (know-how and know-why) and tacit knowledge. Policy also needs to be improved to better respond to the context-specific technological and cultural requirements, both across as well as within countries. Development assistance can play an important role in this regard and may be instrumental to support regionally tailored programmes and policies that stimulate green innovation that meets local needs.

The shortfalls of current international policy processes must also be addressed by putting in place institutional and funding structures that achieve maximum leverage from public investment, both in terms of maximising the impact on indigenous eco-innovation capabilities, and maximising the potential to attract sustained private sector investment in eco as opposed to conventional innovation. Precedents do currently exist, such as the Carbon Trust's proposed network of Low Carbon Technology Innovation and Diffusion Centres, and Fundacion Chile (a not for profit organisation geared towards facilitating access to relevant international innovations and increasing indigenous innovation capabilities). These provide potentially viable models for a more focused, needs-based approach to developing eco-innovation capabilities in developing countries than can be achieved by the centralised, large project based approach that tends to characterise current international efforts. Some guiding principles derive from these analyses for informing the post-Kyoto approach to technology transfer to developing countries.

Box II.9. Enhancing the cost-effectiveness of biodiversity policies

Despite the significant economic, social and cultural values of biodiversity and associated ecosystem services, biodiversity worldwide is being lost, and in some areas at an accelerating rate. The OECD projects continued biodiversity loss to 2030, driven primarily by land use changes (*e.g.* conversion to agriculture and infrastructure), unsustainable use and exploitation of natural resources, invasive alien species, climate change and pollution (OECD, 2008b). Given these trends in biodiversity loss, enhancing the cost effectiveness of biodiversity policies is an increasingly important issue. There is an urgent need for both (i) greater application of incentives, including Payments for Ecosystem Services (PES), to address biodiversity and ecosystem service conservation and sustainable use, and (ii) more efficient use of available finance in existing programmes.

PES or PES-like programmes are being increasingly applied across developed and developing countries to help internalise the local and national public good benefits of biodiversity and associated ecosystems services. PES provide direct payments to private landowners or users to support the conservation and provision of ecosystem services. PES are defined as “a voluntary, conditional agreement between at least one ‘seller’ and one ‘buyer’ over a well defined environmental service – or a land use presumed to produce that service” (Wunder, 2007).

There are more than 300 PES programmes implemented worldwide (Blackman and Woodward, 2010) at both national and local scale, with payments estimated to channel over USD 8.2 billion per year for biodiversity and ecosystem service provision, increasing by 10 to 20% a year.

Work of the OECD, which will input into the Green Growth Strategy, is examining the following issues:

- What are the key features and criteria that must be addressed in PES programme design to maximise their cost-effectiveness?
- What are the different potential sources of finance for PES programmes, and how can they be secured? In particular, how can private sector engagement in PES be leveraged?
- How can PES be best targeted to channel the available finance most cost-effectively? How can other socioeconomic objectives be addressed within PES design?
- How can the use of inverse auctions contribute to this?
- What are the lessons learned from existing PES programmes and insights for current and future programmes, including international PES?

Twelve key features identified to enhance PES cost-effectiveness are:

1. Remove perverse incentives
2. Clearly define property rights
3. Clearly define PES goals and objectives
4. Identify buyers and ensure sufficient and long-term sources of financing
5. Identify sellers and target ecosystem service benefits
6. Consider bundling or layering multiple ecosystem services
7. Establish baselines to ensure additionality
8. Reflect ecosystem providers opportunity costs via differentiated payments
9. Address leakage
10. Ensure permanence
11. Deliver performance based payments
12. Develop a robust monitoring and enforcement framework

Box II.10. Outcome of the February 2010 OECD Agriculture Ministerial Meeting

Ministers from OECD countries, Chile, the EU, Estonia, Israel, Romania, the Russian Federation, Slovenia, Argentina, Brazil and South Africa met in Paris to identify policy actions to address the challenges and opportunities facing the agri-food sector over the next two decades and the role of the OECD in supporting these efforts.

In their Communiqué, “Ministers recognised that green growth offers opportunities to contribute to sustainable economic, social and environmental development, that agriculture has an important role to play in the process, as do open markets that facilitate the sharing of technologies and innovations supportive of green growth, and that, in this context, care needs to be taken to avoid all forms of protectionism. Climate change presents challenges and opportunities for the agricultural sector in reducing greenhouse gas emissions, in carbon sequestration, and the need for adaptation”.

“Ministers asked the OECD to identify policy options and market approaches that would encourage “green growth,” including mitigation of the food and agriculture system’s contribution to climate change, as well as adaptation to its impacts”.

Some of the key implications of the Ministerial discussions in terms of green growth and agriculture include:

- Providing enough food for an increasing global population while reducing the carbon footprint of the agri-food sector and sustainably managing scarce natural resources - especially land and water - presents formidable policy challenges.
- Historically, agriculture has shown an impressive capacity to meet growing demands for food, feed and fibre through significant productivity increases, although this has often been achieved at the cost of environmental damage and greater pressure on scarce natural resources.
- Moreover, one billion people remain undernourished due to poverty and there are long-standing problems in the food distribution system.
- However, green growth can be enhanced through improvements in the functioning of global food markets and institutions, technological innovations, and the dissemination of knowledge, which are key elements in the pursuit of a more sustainable and resilient agriculture and food system.
- A mixture of public policy and private actions will be needed, including policies to improve the efficiency of natural resource use, minimise waste in the food supply chain, foster innovation and productivity growth in both OECD and non-OECD countries, and harness the benefits of open markets.
- Adjustments required in the agri-food supply chain leading to green growth should be economically and environmentally sustainable, as well as equitable.

Source: www.oecd.org/agriculture/ministerial

Box II.11. Relevant work for green growth measurements

The indicators needed to measure progress with green growth are founded on existing OECD work that will be refined to suit the Green Growth Strategy. Continued co-operation is taking place with other international organisations, the European Commission, and international institutes.

Measuring environmental performance and resource productivity

The OECD has developed several sets of **environmental indicators** to support policy analysis and country reviews: key and core environmental indicators to track environmental progress; sectoral environmental indicators to monitor policy integration; and indicators to measure the decoupling of environmental pressures from economic growth. The indicators are supplemented with environmental data, including on environmentally related **taxes and expenditure**. Recent work has been focusing on the measurement of **material flows and resource productivity** in support of an OECD Council recommendation and of the G8 Kobe 3R Action Plan.

Monitoring trends in energy use and efficiency

The IEA maintains several databases, including energy balances, energy statistics, energy prices and taxes, and publishes various types of **energy indicators**. Recent work has been focusing on the measurement of **energy efficiency** in support of the G8 Gleneagles Plan of Action for Climate Change, Clean Energy and Sustainable Development and on improving the mandatory reporting of energy efficiency-related data.

Monitoring technology developments and innovation

The OECD maintains several databases and indicator sets keeping track of developments in technology and industrial performance: main science and technology indicators; indicators on the information economy, globalisation, and entrepreneurship; international patent database, input-output tables and estimates of carbon embedded in trade. Recent work has been focusing on indicators in support of the OECD **Innovation Strategy**, and on an indicator toolkit to promote and monitor **sustainable manufacturing** at corporate level.

Measuring the environmental performance of agriculture

The economic and environmental performance of agriculture is monitored through a set of **agri-environmental indicators**, supported with the measurement of producer subsidies.

Monitoring international transfers

The OECD maintains two major databases monitoring international monetary transfers: international **investment flows** and official **development assistance**. Recent work aims at developing indicators of “green” foreign direct investment flows and at mapping relevant international investment flows by country and sector of destination.

Measuring sustainable development

The OECD has been promoting the development of indicators and coherent approaches to measure sustainable development. Recent work has been focusing on improving the measurement of different types of capital with emphasis on **human and social capital**.

Measuring well-being and progress	The OECD promotes the development of better measures and indicators of people's well-being and societal progress, to be used alongside standard economic measures such as GDP. Recent work aims at implementing the recommendations of the Stiglitz-Sen-Fitoussi Commission with emphasis on well-being and sustainability .
Other relevant work	To underpin its socio-economic analysis, the OECD further maintains databases on a wide range of other topics that are important to characterise economic growth and its outcomes. Examples include: national accounts, international trade, balance of payments, prices and taxes, productivity, government debt, employment, education, health, etc.