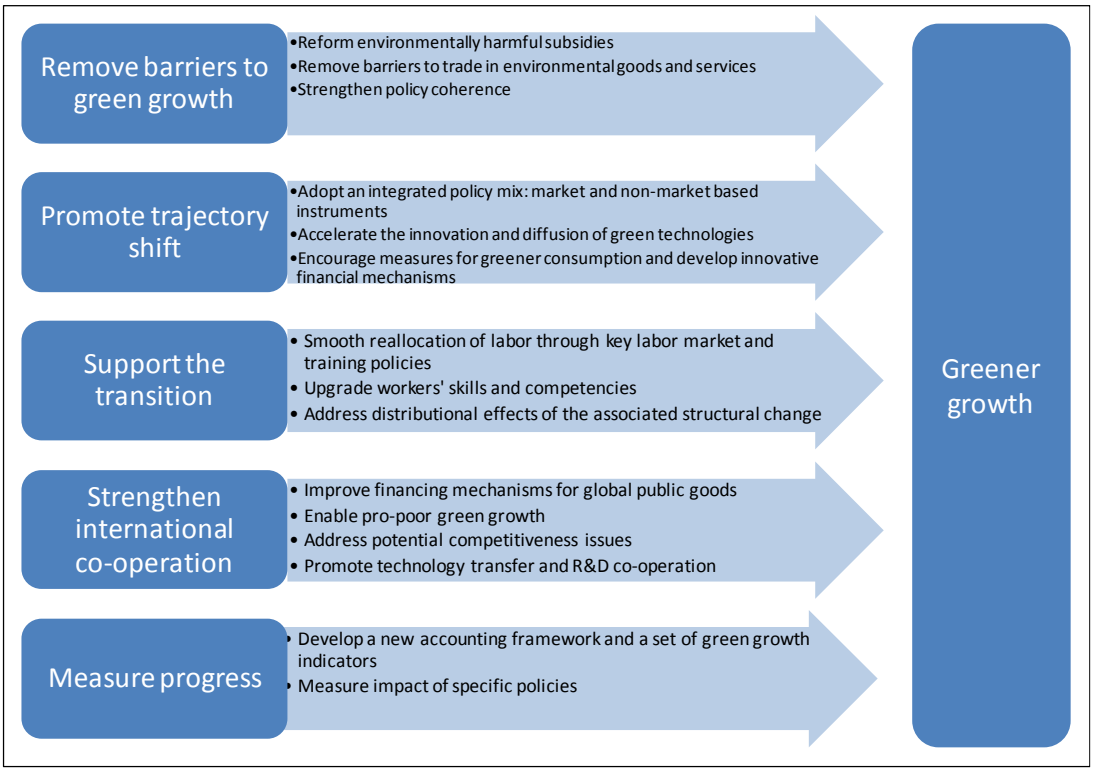
III. Preliminary results on key elements of the green growth toolkit

19. The toolkit developed in the Green Growth Strategy to help countries transition towards green growth will need to be flexible, so that it can be adjusted and tailored to fit differing national and local circumstances and stages of development. It will include:

- An understanding of green growth, elaborating its short-term and long-term objectives, and covering four priority environmental challenges: biodiversity and ecosystem services, climate change, sustainable materials management and sustainable use of natural resources, including forestry and water.
- Approaches to overcome the policy barriers to green growth, such as the reform of environmentally-harmful subsidies and inefficient regulatory interventions, the removal of barriers to trade in environmental goods and services, and strengthening policy coherence.
- The policies that can bring about the necessary shift towards green growth, including the correct pricing of environmental goods and services, measures to foster green technologies, innovative financing mechanisms and policies to move towards greener consumption and production patterns.
- Policies to smooth the transition to green growth, including key labour market and training policies to facilitate the reallocation and re-skilling of labour towards greener activities; and initiatives to foster a better matching between workers and the rapidly evolving demand for labour. Measures to address other distributional effects of the transition, for instance in terms of inequality, will also be covered.
- International co-operation for green growth, including for financing global public goods (climate, biodiversity), enabling pro-poor green growth (Box 4), addressing potential leakage or competitiveness effects of policy action, and for international co-operation on green technology development and transfer.
- A new accounting framework for identifying gaps and measuring progress towards green growth, based on the development of green growth indicators to measure the transition to a more sustainable economy as well as the impact of specific policies.

Figure 1. Overview of the Green Growth Strategy Framework



20. This section provides initial analysis of some of the key challenges facing policy makers in the transition towards green growth. First, it presents an assessment of some of the lessons learned from the green elements of the recent stimulus packages. Second, it discusses one of the policy barriers hampering the transition to green growth – environmentally-harmful subsidies – and what can be done to reform these subsidies. Third, while a broad range of policy instruments will be needed to support green growth, a key element of such a policy package -- the appropriate pricing of environmental goods and services – is discussed, and some recent developments with market-based instruments are highlighted. Fourth, measures and trends to strengthen green innovation are examined, as a critical element of the green growth toolkit, taking into account inputs from the Innovation Strategy. To illustrate how green growth might be understood at the sectoral level, the next section provides an example of the energy sector drawing on analytical results of the International Energy Agency (IEA). Finally, as a key concern in implementing policy measures will be ensuring a smooth transition for affected workers and sectors, some initial insights on the structural impacts of green growth and how to manage the transition are presented.

21. This section presents only a small selection of the initial results stemming from the first stage of the Strategy's work, in order to provide preliminary insights and guidance. As such, this selection should not be seen as projections of the broader range of topics that will be addressed in the Synthesis Report. Appendix II contains a number of boxes to provide an overview of some of the additional ongoing work at OECD that will contribute to the Green Growth Strategy.

Box 4. Key pillars for pro-poor Green Growth

For developing countries, green growth and poverty reduction must go hand in hand and the international community can provide critical support to make it happen. In this regard, the Strategy will focus on three critical pillars of pro-poor green growth: (1) encouraging sound natural resources management and governance; (2) shaping climate resilient growth; and (3) promoting low-carbon growth.

Encouraging sound natural resources management and governance

As compared with OECD countries, many developing countries are heavily dependent on natural resources. Forests, fisheries, lands and wildlife are critical for the livelihoods of the poor. Therefore, natural resource degradation is a threat to both environmental sustainability and poverty reduction. Sound governance is critical to ensure sustainable and equitable management of natural resources. In many countries perverse incentives encourage rapid depletion of the resources base. Institutional and regulatory reforms are therefore often needed to address such perverse incentives. These include securing property or use rights and strengthening the institutions that govern the resources.

Shaping climate resilient growth

Climate change poses a serious risk to lives and livelihoods, particularly for the world's most vulnerable people and countries. According to the most recent UN estimates, the livelihoods of one-third of the world's population could be affected by water scarcity by 2025 and, by the end of the century, half the world's population could face severe food shortages due to rising temperatures. The impacts of climate change may reverse progress towards achieving the Millennium Development Goals. Adapting to climate change will be a critical prerequisite for pro-poor green growth. Climate change adaptation needs vary widely across countries. Therefore, climate change adaptation responses should be country-driven, led by national and local governments, as well as private businesses and civil society actors including at the community level. Recognising climate risk in development planning at all levels allows to minimise the risk of "maladaptation", which increases climate vulnerability.

Promoting low-carbon growth

Although today most developing countries contribute only minor shares to GHG emissions, they will increase their emissions if they follow conventional economic growth patterns. Moreover, deforestation and forest degradation are in many developing countries already a major source of GHG emissions. Less developed countries, therefore, can play an important role in mitigating climate change. Fortunately there are many opportunities for development – climate change mitigation co-benefits. In particular, a shift away from traditional, highly polluting, energy sources (*e.g.* direct burning of biomass) towards modern energy sources provides a host of benefits ranging from enhanced health and safety to improved gender equality. Similarly, combating deforestation, if done right, can generate new income opportunities for forest dwelling communities.

Lessons learned from the stimulus packages

22. The current crisis has provided an opportunity for governments to kick-start efforts towards a greener economy. The stimulus packages that were put in place in a number of countries included measures aimed not only at stimulating the economy, but also moving towards a cleaner, low-carbon, resource efficient economy. While hard to evaluate in practice, many governments have also emphasised the potential job creation from some of the green stimulus measures (Box 5). Many stimulus packages included public investments in green infrastructure – including public transport, low-carbon energy production, smart electricity grids, and water and sanitation – as well as in basic R&D to support green innovation. Some included the introduction or strengthening of environmentally-related taxes. While this range of measures contributes to progress towards green growth, concerns have been raised that they should not lead to protectionism. At the same time, not all of the measures in the stimulus packages will have been good for the environment, and some may have encouraged investments which could lock-in more traditional polluting activities. For example, the large support provided to the automobile industry in a number of countries, investments in road building, and programmes put in place to pay consumers to discard or scrap old cars and buy new ones, may have increased pressures on the environment if not carefully designed (Box 7).

23. Stimulus measures need to be carefully designed if they are to foster both macro-stabilisation in the short-run and the transition to green growth over a longer time horizon. Macro-stabilisation requires that stimulus packages be timely, targeted and temporary. While the considerable potential for green stimulus measures should be exploited fully, governments need to bear in mind that there are limits to the contribution that macro-stabilisation measures can make to fostering greener growth. [2] Some of the green fiscal measures appear to score well on the three criteria. For example, programmes to retrofit existing public and private buildings for greater energy efficiency have a considerable capacity to generate new jobs quickly (timely) that many currently unemployed workers can be quickly trained to fill (targeted) and the fiscal stimulus related to these measures can be phased out as the economic recovery takes hold (temporary). However, many of the policy initiatives required to bring about a transition to green growth do not satisfy the "three Ts". For example, public subsidies to stimulate eco-innovation likely involve a long time lag before many new jobs are created. Furthermore, few currently unemployed workers will be qualified for the R&D jobs eventually created.

2. As was first formalised by Jan Tinbergen, it is advantageous to have at least as many policy instruments as policy goals. While fiscal stimulus packages should contribute as much as possible to making the economy greener, most of the work will need to be done by dedicated green policies, such as those included in the green growth toolkit discussed above.

Box 5. Employment potential of green components of stimulus packages – some examples

Many governments have highlighted the job potential associated with the green investments made as part of the fiscal stimulus packages. For example, some of the official government estimates include:

- The United States Council of Economic Advisers estimates that the approximately USD $90 billion of Recovery Act investments will save or create about 720 000 job-years by the end of 2012. Projects in the renewable energy generation and transmission, energy efficiency, and transit categories would create the most job-years. Approximately two-thirds of the job-years represent work on clean energy projects, either by workers employed directly on the projects or by workers at suppliers to the projects.
- Korea has been implementing its "Green New Deal" policy since January 2009 as a part of an economic recovery package. The policy's aim is to overcome the financial crisis in the short-term as well as to ensure growth potential over the long term. 50 trillion KRW have been invested to create 960 000 jobs from 2009 to 2012 in, for example, an environmentally-friendly transportation network, water management and river rehabilitation, clean energy, green IT, and waste-to-energy.
- China's stimulus package includes the largest green stimulus programme enacted by any country, accounting for almost 40% of the total USD 586 billion package. Although no official estimates of the expected jobs creation are available yet, the potential gross increase in employment in green activities is undoubtedly large.
- France is another example of a country taking the opportunity of the crisis to transition to a greener economy. Its stimulus package totalled USD 33.1 billion, 21% of which was designated for green measures, which are estimated to create 80 000-110 000 jobs during 2009-2010. Along with the fiscal stimulus, the French government announced a longer-term "Green Growth and Employment (Croissance verte et emploi)" plan. The plan is notable for its emphasis on skill development, including a goal of training 360 000 green technicians, including 70 000 youth, every year.

However, caution has to be exercised when assessing the jobs potential of green measures in the stimulus packages. First, these employment gains are in many cases likely to be temporary, in that they involve the employment of some of the cyclically unemployed rather than raising equilibrium employment in the long run. Second, it is clear that the implicit employment multiplier used in the assessment of the jobs potential of the green components of the stimulus packages varies significantly across studies and countries, Finally, while moving towards green growth is likely to involve the development of new growth, employment and innovation opportunities in some sectors, it is likely to involve down-scaling and employment losses in the more traditional, polluting and resource-intensive sectors.

24. Many fiscal stimulus packages have included infrastructure investments to enhance green activities, such as renewable energy production, the upgrading of public building stocks, the expansion of public transport systems or the upgrading of water supply and sanitation infrastructure. In total, infrastructure investments are planned to be large in several countries, as for instance Canada will invest 1.3% of GDP, Australia 0.8%, the United States 0.7% and France 0.5%. In many cases, infrastructure investments have explicit green objectives, with the construction of energy-efficient buildings being particularly common. The French package included investment by public enterprises on rail and energy network developments. Governments in nearly half of OECD countries have also invested in ICT infrastructure, including to foster broadband deployment and to accelerate the development of a digital economy (notably in public services), in many cases with expected green applications such as 'smart grids' and efficient transport systems.

25. These targeted efforts take place in a broader context where the economic and financial crisis has modified the general outlook for infrastructure investment in important ways, re-shaping some key features while exacerbating others. When economic activity and world trade fell sharply in 2009, earlier concerns in many countries about expected shortfalls in infrastructure capacity subsided somewhat. In several sectors – notably natural gas, liquid natural gas, maritime ports, airports – concerns pointed more in the direction of capacity oversupply in the short term. As a result, many infrastructure projects have been deferred and some shelved indefinitely. As recovery and growth gain momentum, infrastructure use is expected to recover over the next two to three years. But the outlook for funding and financing has been adversely affected by the financial crisis. Governments are facing large deficits and increasing debt and the private sector's contribution is also under threat, given the larger risk aversion of potential infrastructure investors and the more binding restrictions on the availability of longer-term finance from the banking system. Under these circumstances, risk of insufficient investment in infrastructure in the medium to longer-term should not be overlooked given the key role infrastructure can play in facilitating and promoting growth (Egert, B et al, 2009).

26. Against this background, there are reasons to believe that the current context of low activity provides an opportunity for new investments in infrastructures that would facilitate the development of green technologies and industries by anchoring beliefs into their commitment to green growth (Box 6). Major projects are being put on hold or are being subjected to close scrutiny to ensure that they inject added value where it is most needed. Such more careful appraisal and prioritisation is an opportunity for reviewing the planning process and attributing more weight to green considerations in project selection. Projects that might benefit from such a shift in perspective include: the choice between improved road or rail connections to economic activity centres, hubs and gateways, absorbing additional air or sea traffic demand through the creation of new secondary facilities, rather than by expanding airport or maritime port capacity in the existing locations, and thereby exacerbating urban congestion, entrenching high fossil fuel use and CO_2 emissions.

Box 6. The scope for moving forward public infrastructure investment

Considering that one likely effect of the crisis has been to raise risk premia and therefore lower private investment in higher-risk projects, governments could consider the possibility of moving forward investment in infrastructures that would facilitate the development of green technologies and industries by anchoring beliefs into their commitment to green growth. One example would be to encourage power infrastructure providers to invest more rapidly in the transmission capacity that greater use of renewable energy sources will most certainly generate in future years, even if this were to lead to temporary excess capacity.

Some tentative indications of the effect of the crisis on the opportunity cost of public investment can be derived from estimates of the employment impact of recent fiscal stimulus packages. Indeed, most OECD countries have introduced large fiscal stimulus packages, which represent on average about 4% of GDP, the largest discretionary fiscal packages being adopted in Korea (6.5% of 2008 GDP), the United States (5.6%), Australia (5.4%), and Japan (4.7%). The average effect of fiscal stimulus on employment in 2010 was estimated to lie between 0.8 to 1.4 percentage points, with a particularly strong magnitude in Australia, Japan and the United States.

Assuming for instance that a stimulus of 4% of GDP would be accompanied by a reduction of 1% in unemployment, savings in social spending could reach 1/4% of GDP, or around 6% of the stimulus. Taking these numbers at face value – and abstracting from other considerations would suggest that moving forward public investment might pay off as long as the cost of government borrowing does not exceed 6%. These estimates are based on average effects, and the scope for bringing forward infrastructure investment would vary across countries, notably according to differences in the size of the labour market gap, in the employment intensity of such investments and the potential mismatch between the skills requirements. In this regard, the sluggish labour market also lowers the opportunity cost of training and hence there could be a case for raising public support for on-the-job training through existing active labour market policy programmes.

Source: De Serres, Murtin and Nicoletti (2010).

27. Yet the bulk of infrastructure that will be present in developed countries in the next twenty years is already in place. Hence, much of future infrastructure spending will be on maintenance and upgrading. Still, there is room to strengthen the green component of such spending while also seeking the most cost effective basis. Examples range from efficiency enhancing improvements of intermodal transport linkages and upgrading of track with intelligent traffic management systems, to the reduction of CO_2 emissions at ports by replacing diesel driven cranes with electric ones.

28. There is also much scope for the development of a greener infrastructure generally, focused on using new approaches for their operation and management. This includes smart metering in water, smart grids that enable users to track electricity consumption and enable small producers to contribute to electricity supply, the use of sensor networks to improve and optimise traffic flows, and strategies to persuade users to adopt environmental-friendly attitudes and technologies that will contribute to the greening of infrastructure use. Within this context, countries could consider increased use of ICT applications, building on the 2010 OECD Council Recommendation on Information and Communication Technologies and the Environment.

Box 7. Car-scrapping schemes and green growth

In most countries with a significant automobile producing sector, governments introduced a "car-scrapping" scheme as part of their policy response to the crisis, including 16 OECD countries. Among the ten largest car-producing countries, only Brazil and India did not introduce one. Car scrapping schemes, also referred to as "cash-for-clunkers" incentives, are time-limited public subsidies for the purchase of a new vehicle to replace old energy-inefficient ones. Clearly, the main objective of these programmes has been to cushion the impact of the crisis on the automobile industry by shifting forward household demand for new cars. In most cases, however, they have also been promoted on environmental grounds. While these measures can help to remove older, less efficient vehicles, from the roads, they may also encourage greater material consumption, vehicle use, and ultimately increased emissions. Their overall economic efficiency also remains questionable.

The schemes have contributed to a substantial boost in new car sales around mid-2009 in both the United States and throughout Europe. In the latter case, there are even indications that car producers in countries with small or no incentives benefited from spill-over effects, in particular from the German programme. And these incentives appear to have contributed to the economy-wide recovery observed in many countries in the latter half of 2009, especially in the United States where motor vehicles output added 1.5 and 0.4 percentage points to third and fourth quarter growth in real GDP.

Even so, the final impact on economic activity is likely to have been lowered by the crowding-out effect on the demand for other household consumption products. Furthermore, since the programmes consist mostly in moving forward car purchases, their full impact on the car industry will depend on the timing and magnitude of the so-called payback effect, *i.e.* the temporary setback in sales that can be expected as the scheme is terminated. Recent estimates suggest that sales appear to be either close to or below trend, with the notable exception of Germany where recent sales may have been pushed far above medium-term prospects. In any case, since most programmes ended in late 2009, a strong payback effect – should one materialise -- could be felt as early as during the second or third quarter of 2010.

Meanwhile, subsidising the premature withdrawal of vehicles that could have rendered useful services for a few more years represents an economic cost to society. However, insofar as these vehicles are replaced by more energy-efficient models, there is also a benefit for society in the form of reduced health-related costs as well as other potential damages caused by climate change. The expected net reductions in greenhouse gases and other pollutants induced by car-scrapping schemes are estimated to be simply too small for the environment-related benefit to offset the cost.

Sources: Haugh, Mourougane and Chatal (2010), and Schweinfurth (2009).

Overcoming barriers to green growth: Addressing environmentally harmful subsidies

29. A number of policy barriers are hampering countries in the move to green growth, including environmentally harmful subsidies, tariff and non-tariff barriers to trade in environmental goods and services, inefficient regulatory interventions and conflicting policy instruments. Policy-induced distortions can lead to a misallocation of resources that affects the transition towards green growth. One example is the absence of, or an inadequate pricing of, natural resource use. For instance, under-pricing of water can lead to wasteful use of water, and reduce the incentives for wide take-up of water-saving technologies or practices such as drip irrigation in agriculture. In addition to distorting resource allocation within and between countries, environmentally-harmful subsidies can also contribute to air, water and land pollution. Their reform or removal could benefit both the economy and the environment and, as such, addressing these distortions is commonly viewed as a "win-win" opportunity.

30. This section presents initial analysis on the opportunities for reforming environmentally-harmful subsidies and highlights some recent developments in countries with regards to fossil fuel subsidies and in the agriculture sector. Fossil fuel subsidies remain high particularly in a number of developing and emerging economies, while agricultural and fisheries subsidies are particularly pervasive in many OECD countries (Box 8 and Table 2).

Reforming Fossil Fuel Subsidies

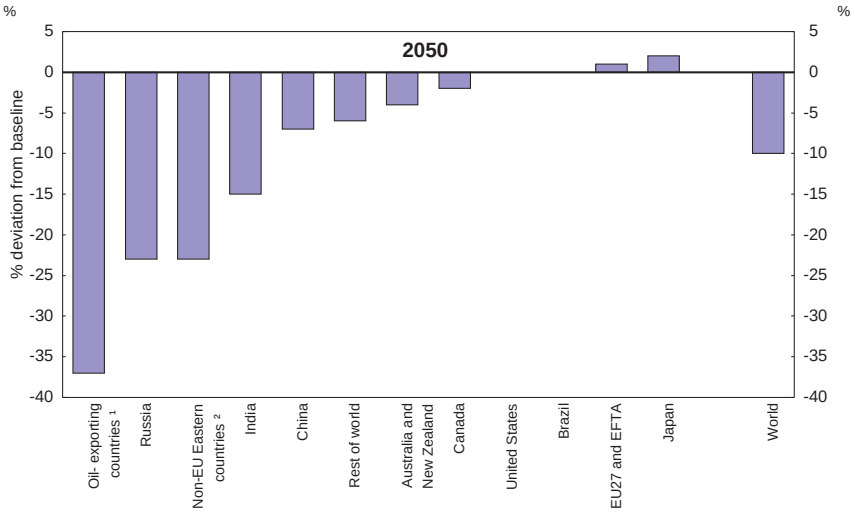
31. Environmentally-harmful subsidies to fossil fuel energy consumption or production amount to a *de facto* reward for carbon emissions. Estimates by the International Energy Agency (IEA) using the price gap methodology suggest that subsidies to fossil fuel energy consumption in 20 developing and emerging economies amounted to USD 310 billion in 2007. Removing these subsidies would lower the global costs of achieving a given goal to reduce greenhouse gas emissions, and would constitute an important contribution towards addressing climate change (OECD, 2009c). For example, new analysis by the OECD suggests that phasing out fossil fuel subsidies by 2020 could reduce GHG by over 20% in 2050 in non-EU Eastern European countries, Russia and the Middle East. As a result, global GHG emissions would be reduced by 10% in 2050 compared with business-as-usual (Figure 2).

Table 2. Some estimates of subsidies to selected sectors

Fossil fuel and electricity subsidies in 20 non-OECD countries *(as measured by the IEA price-gap approach)*	USD 310 billion (2007)
Agricultural subsidies in OECD countries *(as measured by the Producer Support Estimate)*	USD 265 billion (2008)
Fisheries subsidies in OECD countries *(as measured by Government Financial Transfers)*	USD 6 billion (2005)

Sources: OECD (2009b), OECD (2008a) and IEA (2009).

Figure 2. The effects on greenhouse gas emissions of removing fossil fuel subsidies in emerging and developing countries combined with caps on emissions in developed countries

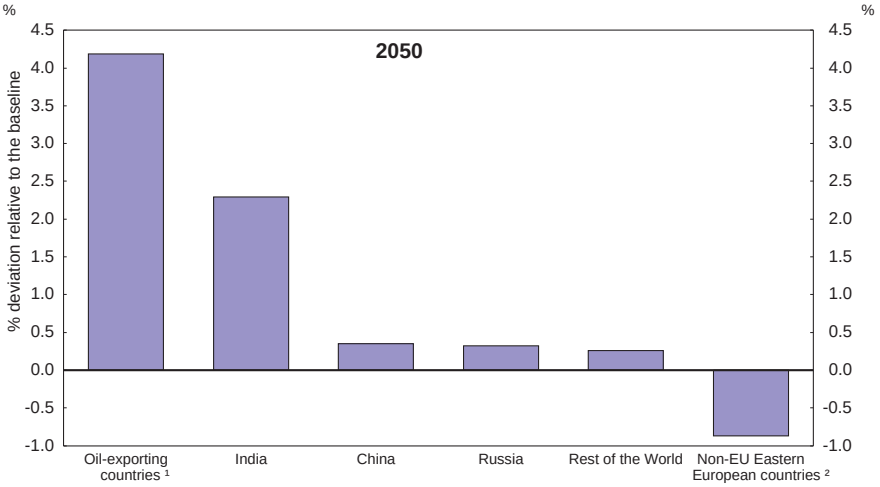


1. The region includes the Middle East, Algeria-Libya-Egypt, Indonesia and Venezuela.
2. These non-EU Eastern European Countries together form the 'Rest of Annex I 'region of the OECD ENV-Linkages model.

Source*: OECD ENV-Linkages model based on subsidies data from IEA for 37 emerging and developing countries in 2008.*

32. Removing the subsidies would also increase the efficiency of economies, reduce the financial burden on government budgets, and alleviate the potentially distortive effects of subsidies on competition. Thus, the analysis suggests that most countries or regions would record real income gains from unilaterally removing their subsidies to fossil fuel consumption, as a result of a more efficient allocation of resources across sectors. These real income gains could be as much as 4% in oil exporting countries and more than 2% in India in 2050 (Figure 3).

Figure 3. Impact of unilateral removal of fossil fuel subsidies on the real income of selected countries and regions



1. The region includes the Middle East, Algeria-Libya-Egypt, Indonesia and Venezuela.

2. This region includes Croatia and the rest of the former Soviet Union (integrated by the following countries: Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Tajikistan, Turkmenistan, Ukraine, Uzbekistan) according to the data aggregation in the GTAP database.

Source*: OECD ENV-Linkages model based on IEA data.*

33. If all countries that subsidise fossil fuel consumption were to remove these subsidies multilaterally, this would reduce energy demand at the world level, thus inducing a drop in international fossil fuel prices. The changes in international trade, measured both in terms of volume as well as terms-of-trade, associated with this would lead to a distribution of real income gains and losses across countries, favouring fossil fuel importing countries but with losses for fossil fuel exporters. While a multilateral removal of fossil-fuel subsidies brings some real income gains at the world level, these gains would be unevenly distributed across countries (Figure 4). Some oil-importing OECD countries would experience real income gains of around 1%. Most fossil fuel exporting countries, particularly Russia and the non-EU Eastern countries, would incur real income losses. With the exception of Russia, however, the reductions in GDP growth compared with the baseline scenario would generally be marginal (Figure 4).

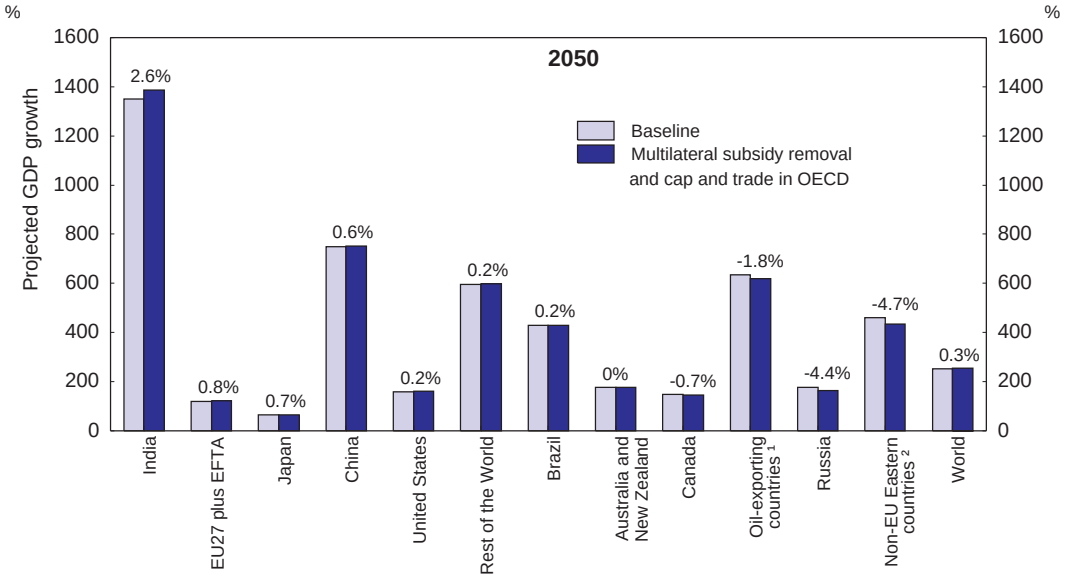
34. Often subsidies to fossil fuel consumption are provided through across-the-board reduced prices for electricity or fuels, which may primarily benefit middle and higher income households (*e.g.* those that can afford cars). Reducing these across-the-board subsidies would generate large budgetary savings, with OECD analysis suggesting that the suppression of fossil fuel subsidies could lead in 2020 to extra government revenues equal to almost 6% of the GDP in Russia, 5% of GDP in the Middle East region, 1.8% in India and 0.4% in China. The funds from these budgetary savings could be used to reduce other distorting taxes, which would increase the real income gain from subsidy removal, to contribute to fiscal consolidation, or they could be used to reduce poverty in a more targeted and efficient way than through an across-the-board subsidy to fossil fuel consumption.

35. Subsidies that create a differential between the domestic price and a (higher) world-market price are not the only subsidies being provided to fossil fuels, of course. Several OECD countries provide assistance to low-income households that enables them to pay their heating bills in the winter. A number of countries also fully or partially exempt their farming, forestry, fishing and mining sectors from excise taxes on fossil fuels. Many countries, both OECD and non-OECD, also support the production of fossil fuels (or

electricity based on fossil fuels), through grants, loans and loan guarantees, or targeted tax concessions. The total value of this support has never been estimated.

Figure 4. Impact of multilateral fossil fuel subsidy removal on GDP

Percentage deviation from 2005 levels[1]



1. Percentages noted on top of the columns indicate GDP change in 2050 relative to baseline.
2. This region includes Croatia and the rest of the former Soviet Union (integrated by the following countries: Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Tajikistan, Turkmenistan, Ukraine, Uzbekistan) according to the data aggregation in the GTAP database.
3. The region includes the Middle East, Algeria-Libya-Egypt, Indonesia, and Venezuela.

Source: OECD ENV-Linkages model based on IEA data.

36. Experience shows that it is not easy to reform or phase-out environmentally-harmful and costly subsidies, given the vested interests of those that benefit from them and limited available data on these subsidies. Some of the key elements of successful subsidy reform include: availability of good quality data on the magnitude of the subsidies, who benefits from them, and who pays; a strong communications effort to raise awareness of the benefits of subsidy reform; packaging of subsidy phase-out in broader structural reforms; and well-targeted, time-limited compensation for those that might be adversely affected by the subsidy phase-out (OECD, 2007).

37. Following a request by G20 Leaders in September 2009, and discussions in OECD Committees, the OECD is working on *(i)* establishing methods for estimating subsidies to fossil fuel production and consumption, and gathering data on fossil fuel subsidies in OECD countries, *(ii)* using modelling-based analysis to better understand the economic, trade and greenhouse gas impacts of phasing-out fossil fuel subsidies; and *(iii)* providing advice on how to phase-out fossil fuel subsidies, based on lessons learned from country experiences and taking into consideration the importance of addressing potential social impacts of subsidy phase-out. First results of the analysis will be made available through a joint IEA, OPEC, OECD and World Bank report to the G20 Finance Ministers meeting in April 2010 and the G20 Leaders Meeting in June 2010.

Box 8. Agricultural subsidies and green growth

Although agriculture plays a relatively minor role in most OECD countries in terms of its contribution to GDP and employment, a wide range of government policies provide significant support in many OECD countries. The OECD has been annually monitoring and evaluating policies since the mid-1980s and a key indicator in the evaluation is the OECD's Producer Support Estimate (PSE). Support to farmers in OECD countries has fallen in the last two decades as measured by the percentage PSE, from 37% of farmers' total receipts in 1986-88 on average to 23% in 2006-08. In total, it amounted to an estimated USD 265 billion in 2008.

Agricultural policies and the resulting support are relevant to green growth. Support influences the amount of agricultural production and the allocation of resources between agriculture and the rest of the economy (the "growth" dimension), and environmental performance (the "green" dimension). However, it is not only the overall amount of support but also the way in which it is provided and implemented that influence production, the allocation of resources and environmental performance.

Agricultural support tends to keep more resources in the agricultural sector than would be the case in the absence of support and, from an economic growth perspective, diverts some resources from more productive uses elsewhere in the economy. Moreover, the closer the link between support provided to inputs used in agriculture and outputs produced the greater the impact on production. Over recent decades, as a consequence of policy reform in many OECD countries, there has been some shift away from production-linked support (decoupling) which has thus enabled the sector to respond to a greater extent to market signals, with potentially positive implications for growth in the economy. But support for commodity production and unconstrained input use is still the most significant element, accounting for around 55% of overall support in OECD countries. However, overall support, as measured by the percentage PSE, varies from under 5% in Australia and New Zealand to over 50% in Iceland, Japan, Korea, Norway and Switzerland. In Japan and Korea, around 90% of support is production-linked whereas in Norway and Switzerland the share has declined over time to around 50% at present. In the US and EU – which account for the largest share of OECD agriculture support – the production-linked share is respectively 30% and 40%.

The effect of policies and policy reform on the environment is more complex and varies across and within countries. Policies to subsidise inputs (such as water) or outputs (such as price support) can maintain or increase production above what would otherwise be the case, using greater amounts of inputs that have harmful environmental effects – causing water pollution from greater use of fertilisers and pesticides (and from manure run-off due to higher numbers of livestock), soil erosion, loss of biodiversity, and increased GHG emissions. But in some regions such policies can maintain production, farming systems and practices that are associated with the preservation of environmentally sensitive land or valued ecosystems, or the maintenance of flood, drought or soil erosion control.

Not all forms of agricultural support are environmentally-harmful, and some support measures are linked to achievement of specific environmental objectives. Some support, for example, pays for research and development, information and advice, food inspection services or the provision by farmers of non-marketed environmental services, such as biodiversity, flood and drought control, sinks for greenhouse gases and carbon storage. In some countries, income support is conditional on the respect of environmental and other regulations. A key message from OECD work is that targeting policies to specific objectives is likely to achieve greater economic efficiency and better environmental performance. Further work is underway or planned in the OECD on deepening the understanding of the linkages between agricultural policies, support and green growth.

Sources: OECD (2010a), OECD (2010b), and OECD (2009c).

Getting the prices right for green growth: Environmentally-related taxes and tradable permits

38. Taxes and other market-based instruments are key policy instruments for providing clear and sustained incentives to reduce environmental damage. Businesses need a reasonable degree of certainty that innovation and investment to reduce the scale of environmental damage will be worthwhile. Similarly, a clear and sustained price signal can provide an important incentive for households, for example to reduce their energy consumption or to increase the extent to which they recycle waste, and underpin other policy instruments such as information campaigns (*e.g.* on the fuel efficiency of new cars or white goods) or the wider use of 'smart' meters for water, gas and electricity.

39. Preliminary findings of an ongoing OECD project on Taxation, Innovation and the Environment further highlight the ability of environmentally-related taxes to induce innovation (Box II.5). By imposing a direct cost on the polluter, 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).

40. The use of environmentally-related taxes, charges and emission trading schemes is spreading across OECD and emerging economies. Charges for water use, waste disposal, and the use of natural resources are used in many countries, although under-pricing remains common. Taxes are applied to NO_x emissions, packaging waste, pesticides and fertilisers in some countries. However, the majority of environmentally related taxes in OECD countries are those related to motor vehicles and fuel use.

Designing market-based instruments

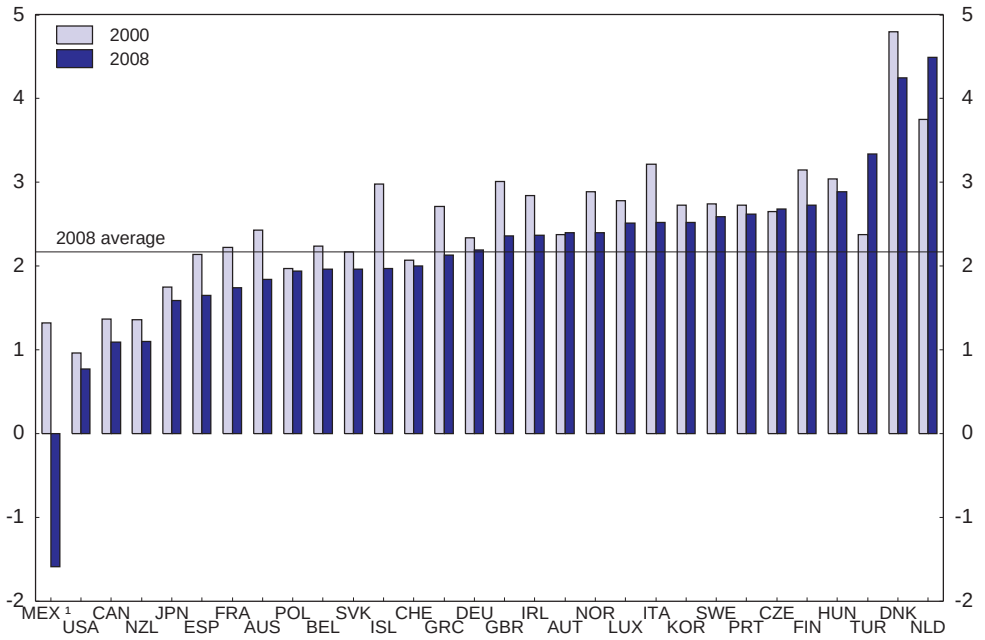
41. Implementation of market-based instruments requires consideration of a number of factors. First, the base for the tax, charge, or emissions cap needs to be defined. The more closely it can be applied to the actual polluting activity, the better. In the case of carbon dioxide emissions this can be relatively straightforward, as the tax can be directly related to the carbon content of fossil fuel inputs. Second, the rate of the tax or charge or the level of the emissions cap should reflect the amount of damage done at the margin. In some cases, this can readily be measured, while, in other cases, there are practical problems in quantifying the costs of environmental damage, such as for a loss of biodiversity.

Environmentally-related taxes

42. Across OECD countries, revenues from environmentally-related taxes amount to about 1.7% of GDP, varying from about 0.7% on average in North America to 2.5% in Europe. Over 90% of these revenues come from taxes on fuels and motor vehicles. While the number of environmentally related taxes has been increasing in recent years, revenues from these taxes have been on a slight downward trend in relation to GDP (Figure 5). In part, this reflects the drop in demand for fuel in response to recent high oil prices, which in turn has led to a reduction in total revenues from taxes on energy products. Preliminary analysis suggests that in the long-term, the reduction in fossil fuel consumption induced by a rise in carbon price would potentially lower revenues from various taxes applied on fossil fuel consumption in many countries.

Figure 5. Environmentally-related taxes revenues

As a percentage of GDP



1. In Mexico, fluctuations of consumer prices on motor vehicle fuels are smoothed out. In 2008, when world market prices were particularly high, the excise tax on fuels turned into a subsidy – equalling 1.8% of GDP.

Source: OECD/EEA database on instruments used for environmental policy and natural resource management.

43. A number of countries are considering the introduction of carbon taxes as part of their national climate change policies. CO2 taxes have existed for a number of years in a few countries, such as Sweden. More recently, countries like Iceland and Ireland have decided to introduce CO_2 taxes as part of their fiscal consolidation measures, and CO_2 taxes are also under consideration in, for example, France, Japan as well as several emerging economies (Box 9). The scope for the expanded use of green taxes in OECD countries still remains considerable, including for addressing climate change.

Box 9. Examples of renewed interest in CO_2-related taxes

Canada/ British Columbia

The province of British Columbia introduced an explicit Carbon Tax in 2008. It applies to energy products that are commonly subject to excises, such as diesel and petrol but the tax base also includes natural gas, heating oil, coke and aviation fuel for flights within the province. The rate is equivalent to CAD 15 per tonne of CO_2 emissions and is set to rise to CAD 30 by 2012.

Ireland

A tax of EUR 15 per tonne of CO_2 emissions was introduced with the 2010 Budget covering petrol, diesel, heating oil, natural gas, peat and coal used by households and businesses not covered by the EU ETS. The tax will contribute to fiscal consolidation with revenues of 0.2% of GDP.

Japan

A wide set of tax measures have been introduced and are now under preparation to reduce GHG emissions. Vehicle taxation has been reformed to create incentives to replace old cars with high fuel efficiency vehicles or new low-emission vehicles like natural gas, electricity or hybrid vehicles. Tax incentives for home insulation and industrial investments in energy efficient or renewable energy facilities have also been introduced.

Sweden

Sweden introduced a CO_2 tax already in 1991 covering the same energy carriers as the existing energy tax. Although the energy tax was reduced by 50% for affected fuels, the reform implied a net tax increase for all fossil fuels. For households, where the CO_2 tax is fully applied, the rate has risen from the equivalent of EUR 40 in the late 1990s to over EUR 100 per tonne of CO_2 emissions in 2009. Further reforms legislated in December focus on scaling back reductions for agriculture and industry not covered by emission trading, where the tax would rise from EUR 23 in 2009 to over EUR 60 per tonne in 2015.

Source: Presentations by national authorities to the Joint Meeting of Tax and Environment Experts and the OECD Database on environmentally related taxes.

Cap-and-trade schemes for emissions and natural resource use

44. Cap-and-trade schemes put an upper limit, or "cap", on the total amount of emissions or resource that can be used, and then individual permits or rights are issued up to this limit, which can be bought and sold among the cap-and-trade scheme participants. Cap-and-trade schemes have mainly been used to reduce air pollution, GHG emissions and, in some cases, for fisheries management. In the United States, such schemes were put in place in the 1990s to mitigate acid rain by limiting sulphur dioxides (SO_2) emissions and to limit ozone formation by lowering nitrogen oxides (NO_x) emissions. Outside the United States, emissions trading schemes to control air pollution have been used in Chile, Canada, Korea, Netherlands, Slovakia and Switzerland.

45. However, the majority of systems that have been recently introduced or that are currently planned aim at reducing GHG emissions, in particular CO_2 emissions, as part of policy strategies to mitigate climate change. The most important in terms of market size and participation is the EU emission trading scheme which began in 2005, but similar systems are now either in place or under development in most OECD countries. In the long term, the gradual linkage among different cap and trade schemes could lead the market to deliver a common world price for carbon that should level the playing field of the energy-intensive manufacturing sectors whose competitiveness might otherwise be affected by different carbon tax policies in different countries (Box 11).

46. Trading systems have also been used to a more limited extent to address other environmental concerns, such as water management (Australia, Chile and the United States), fisheries (Australia, Canada, Iceland, Netherlands, New Zealand and the United States) and agricultural nutrients (Canada (Ontario), Netherlands and the United States).

Pricing greenhouse gas emissions could be an important source of financing

47. Putting a price on environmental externalities, for example through carbon taxes or auctioned permits in emissions trading schemes could be an important source of government revenues. Many countries that have successfully implemented environmental tax reforms have used these revenues to offset reductions in other taxes, such as taxes on labour, in a revenue-neutral setting. Recycling the revenues in a way that reduces more distortive forms of taxation can result in welfare gains. In emerging economies, revenues from environmentally-related price instruments could be sources of finance for other pressing priorities, such as education, health care, and poverty alleviation.

48. Following the recent economic crisis, many countries will in the coming years have to tighten expenditures and raise government revenues in order to reduce the debt accumulated as a result of the fiscal packages adopted in response to the crisis . Revenues from carbon taxes or proceeds generated from auctioned permits could contribute to fiscal consolidation.

49. The revenues that can be raised by such instruments are substantial. For instance, if all industrialised countries were to cut their emissions by 20% by 2020 relative to 1990 levels, and this was done via emission trading systems with full permit auctioning – the amount of proceeds generated in 2020 could be as high as 2.5% of GDP on average across countries (OECD, 2009c). As indicated in Table 1 above, there is considerable potential for revenue-raising in many countries if the climate targets or actions they declared following the Copenhagen Conference were to be achieved through auctioned permits or taxes. Only a fraction of this would suffice to meet the financing commitments to support adaptation to climate change and mitigation efforts in developing countries. Germany is already using some of the proceeds from auctioned permits under the EU Emissions Trading Scheme to provide financing for climate action in developing countries (Box 10).

Box 10. Proceeds from auctioned emissions trading permits: some examples

Under the EU Emissions Trading Scheme, Germany will be auctioning the largest amount of emission allowances. Between 2008 and 2012, 200 million allowances will be auctioned equivalent to almost 10% of total allowances for the period. For 2008, 40 million allowances were auctioned with a valuation of EUR 933 million. Germany has indicated that at least 50% of the projected annual revenue will be spent on climate initiatives, EUR 120 million of which will be allocated internationally to developing countries through their International Climate Initiative (ICI). The ICI fund will support sustainable energy supply projects, climate change adaptation and forest protection. The ICI already supported 112 projects in 2008-2009 in emerging economies, disbursing an estimate EUR 151 million. Some of the revenues from the auctioned permits are also used to cover the administrative costs of implementing the emissions trading scheme.

The Regional Greenhouse Gas Initiative (RGGI) was the first mandatory, market-based effort in the United States to reduce greenhouse gas emissions. Ten states (Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Vermont) have capped and will reduce CO_2 emissions from the power sector by 10% in 2018. RGGI states have decided to auction at least 86% of allowances for public benefit. As of April 2010, the auctioned revenues had generated USD 583 million. Auction proceeds are being used for a number of activities that vary among states, but include energy efficiency programs, low-income weatherization, low-income heating assistance and clean energy research and development.

Putting green tax reform in place in practice

50. Implementing environmentally-related taxes or charges can elicit significant political economy challenges. Concerns about the potentially regressive nature of taxes, particularly taxes on water and energy use for heating, have made it difficult to implement these taxes in many countries or have led to modifications in the tax design in order to reduce the burden on low-income households. While progressivity is a consideration, it is the progressivity of the entire tax/social system that is important. Therefore, such concerns are best addressed through other means -- such as lower personal income taxes, tax credits and increased social benefits -- rather than by reducing or exempting low-income households from the environmentally-related tax, and thus removing their incentives to use water or energy more efficiently. OECD country experiences show that strong communications and credible institutional arrangements, such as a green tax commission, can help to overcome some of the concerns regarding green tax reform.

51. There are also concerns that environmentally-related taxes can encourage trade-exposed, pollution-intensive firms to relocate their production to countries where such taxes are lower or non-existent. To address these concerns, many countries have provided significant tax breaks or even tax exemptions to their energy-intensive industries. Thus, the OECD/ European Environment Agency database on environmental instruments lists more than 1,500 exemptions to environmentally-related taxes in OECD countries and about 200 tax refund mechanisms. A better approach to overcome potential competiveness concerns is international co-operation (Box 11).

Box 11. Addressing carbon leakage and competitiveness impacts of climate policies

Many countries fear their industries may lose competitiveness if they take on ambitious climate action without similar efforts by other countries. This fear is perhaps the greatest political obstacle to the introduction of the policy measures needed to achieve ambitious emissions reductions. To protect their energy-intensive industries, a number of countries have exempted these industries from emissions reductions or provided them with relatively less ambitious targets, or allocated emission permits for free. Yet exempting energy-intensive industries from carbon pricing could raise the cost of achieving global emissions targets substantially, making achievement of a given emissions reduction target as much as 50% more costly than if these industries participated in action according to OECD analysis.

Fears of competiveness losses or "carbon leakage" - the risk that emission reductions in one set of countries are partly offset by increases in other countries - are a major concern in many OECD countries, making it difficult in some cases to put in place the policy measures needed to meet ambitious climate goals. However, analysis by OECD and others suggest that these concerns may be exaggerated. Unless only a few countries take action against climate change, carbon leakage rates are almost negligible. For example, OECD analysis found that in an illustrative scenario whereby the EU acted alone to reduce GHG emissions (by 50% in 2050), about 12% of their emission reductions would be offset by emission increases in other countries. However, if all industrialised (Annex I) countries took action, this leakage rate would be reduced to below 2%.

Despite this, a fear of competitiveness losses or carbon leakage is a major concern in many countries implementing ambitious climate policies. In addition to measures such as those that exempt the trade-exposed industries from carbon taxes or emissions caps, or allocating emission permits to these industries for free, a number of countries have also started considering other measures to address competitiveness effects, such as through the use of border tax adjustments (BTAs) which place a carbon tax on imports from countries that do not restrict carbon emissions. OECD analysis finds that while BTAs may reduce carbon leakage if only a few countries take action on climate change, they could be costly to both the country implementing them and their trading partners, while doing little to address competitiveness impacts. In the scenario described above whereby the EU achieves a 50% reduction in emissions by 2050, adding a BTA would have negligible effects to prevent the output losses of the EU energy-intensive industries and would raise the cost of action in the EU to achieve these emissions reductions from 1.5% of GDP to 1.8% of GDP in 2050. In addition, BTAs would be administratively burdensome to implement, and could raise trade issues.

Other targeted and time-bound measures are also being used in a number of cases to help ease the transition for sectors and industries affected by competitiveness concerns. For example, revenues from carbon taxes or auctioned emission permits can be recycled back to the affected sector in compensation, but in ways that would not undermine the incentive to reduce emissions. In a number of cap-and-trade schemes with auctioned permits, the trade-exposed and energy-intensive sectors have been provided with free permits.

However, by far the most effective way to tackle carbon leakage is to ensure broad participation in action to reduce emissions by all large emitters. The more comprehensive the coverage of climate policy, in terms of countries, sectors or emission sources, the lower the costs of achieving ambitious climate policy targets and the less likely that carbon leakage or competitiveness concerns might arise.

Source: OECD (2009a).

Green innovation

52. Increasingly, industry leaders and policy makers are looking at innovation as a key to making radical improvements in corporate environmental practices and performance. Continuous improvements in economic and environmental efficiency are a large part of the effort of a transition towards a green economy, and the spread of existing best available technologies is important. However, more radical innovation of new goods and services and alternative ways of consuming and disposing of products are also essential. These aspects are considered of particular importance by many countries, as innovation and the accompanying creative destruction could lead to new commercial ideas, new entrepreneurs and new business models; while also contributing to the establishment of new markets and new industries.

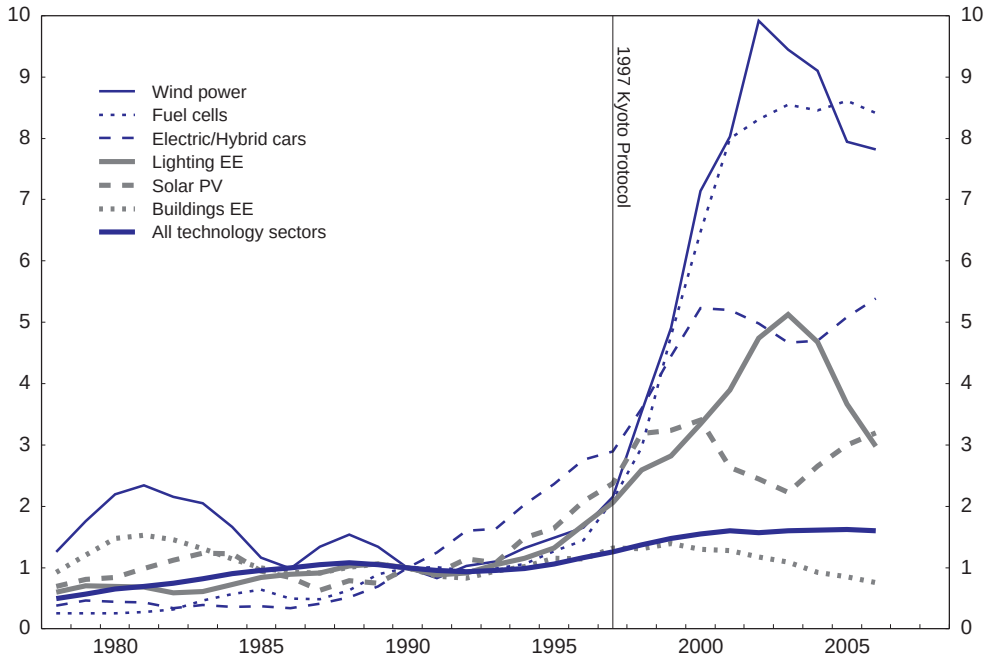
53. There are indeed signs that investment in green technologies and innovation is taking pace. For example, Deloitte's 2009 survey on Global Trends in Venture Capital reports that 63% of surveyed venture capitalists anticipate an increase in their investment in clean technologies over the next three years, the highest percentage among all sectors considered. Similar venture capital surveys confirm this trend (*e.g.* NVCA, Deutsche Bank/Bloomberg New Energy Finance).

54. The crisis has affected the flow of funds to innovative ventures in clean technologies, but less so than it has in other areas of investment. Venture capital flows to clean technologies dropped by around one third in 2009, with strong declines in solar, wind, agriculture, biofuels (Cleantech Group, 2010). At the same time, other clean technology areas attracted more investments than before, such as electric and hybrid cars, battery technologies, energy efficiency and smart grids. Moreover, the global volume of mergers and acquisitions (M&As, an indicator of commercial activity) in clean technology sectors declined only marginally between 2008 and 2009, while the overall volume of M&As was cut by half (OECD calculations based on data by Cleantech Group and Dealogic).

55. Beyond the context of the crisis, there has been longer-term evidence that green innovation is accelerating in certain areas. Figure 6 presents trends in high-value patents for a number of clean technologies relative to the rate of innovation in general. It indicates that there has been a sharp increase in some of these innovations since the late 1990s, coinciding with the signing of the Kyoto Protocol. OECD empirical work has shown that, in the past, increases in fossil fuel prices, targeted R&D expenditures, as well as policy measures such as feed-in tariffs, investment grants and obligations have been a significant inducement to innovation with respect to renewable energy technologies.

Figure 6. Innovation trend in climate change mitigation technologies, compared to all sectors

Number of patent applications by Annex I ratification countries, 3-year moving average, indexed on 1990=1.0



Source: OECD Project on Environmental Policy and Technological Innovation (www.oecd.org/environment/innovation).

56. OECD analysis also shows that the scope of green innovation is increasingly broadening and involves both technological and non-technological innovation. For example, efforts in industry to reduce environmental impacts have shifted from "end-of-pipe" pollution control to a growing focus on integrated environmental strategies and responsible management practices, which involve a large amount of non-technological changes and innovations. Some businesses have started to explore more systemic and radical green innovations involving new business models and alternative modes of provision. Businesses that perform well on radical innovations are also better aligned towards green innovation.

57. New technologies contribute to improving environmental performance and achieving green growth targets by replacing resource-intensive and polluting activities or improving the environmental and economic efficiency of existing ones. Incentivising the development and use of new technologies is also important in view of the positive spill-over effect on society. These include, for example, ICTs for smart urban transport and power systems. Biotechnology, particularly industrial biotechnology, can play an important role in delivering eco-efficiency and tackling green growth issues. Nanotechnologies for renewable energy production and storage as well as water management offer a wide range of environmental benefits under the provision that potential safety issues are being addressed at the same time as the technology is developing. Non-technological innovations will also contribute to sustainable growth and, for example, changes in the way production is organised may be just as important as changes in technology.

Fostering green technologies

58. Accelerating the development and diffusion of clean technologies, which are safe and sustainable, will be crucial within the overall policy mix to promote greener economies. This is primarily due to the fact that most of the low-carbon technologies available today are too costly to compete in the marketplace against today's incumbent fossil fuel technologies.

59. Both environmental and knowledge externalities may however stand in the way of moving towards economies based on greener technologies. Without public intervention, the related market failures, *i.e.* market prices that do not fully reflect the environmental degradation generated by economic activity, learning-by-doing and R&D spill-over effects, can generate path dependency and delay or even prevent the development and diffusion of clean technologies. In some cases, private investment may not occur at all, especially in areas such as basic research, where it takes considerable time to deliver outputs, which are often not immediately marketable. Furthermore, in sectors such as electricity, network effects arising from existing infrastructures create additional barriers to the adoption of alternative ways of provision, further hampering incentives to invest in new technologies.

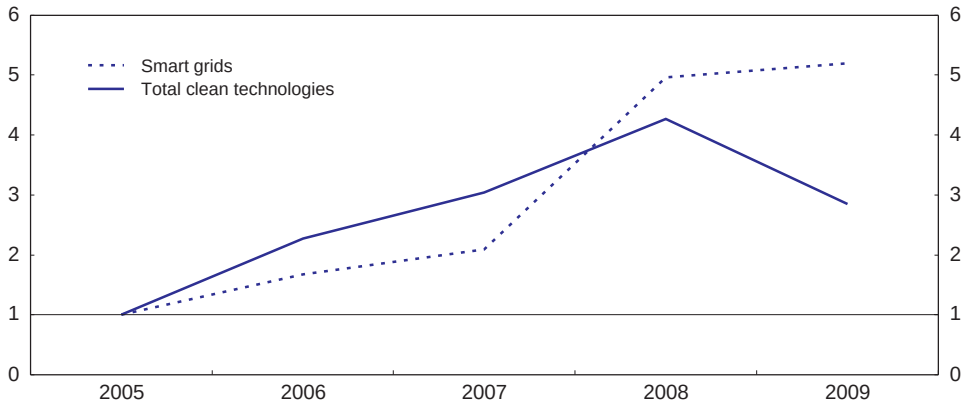
60. Unleashing green innovation requires a policy response on several fronts, which will need to build on a sound overall framework for policies for innovation, as set out in OECD's Innovation Strategy. This will entail a choice of different policy tools including, but not limited to, *e.g.* environmental taxes and incentive policies, such as R&D tax credits or direct subsidies to firms engaging in green activities, as well as public procurement and the funding of basic research.

61. As demonstrated in a range of OECD work, green innovation will greatly benefit from clear and stable market signals that may result from carbon pricing or other market instruments. Such signals will enhance the incentives for firms to adopt and develop green technologies and enhance efficiency in allocating resources by establishing markets for green innovation. Market-friendly approaches that avoid "picking winners" and encourage competitive selection of investments using, for instance, outcome-based tax incentives rewarding the best observed practices and performances, are likely to be the most efficient.

62. Policy signals, for instance, stimulate private investments in "smart" electricity grid technologies. The "smart grid" is an umbrella term for a large array of mostly ICT-based technologies to radically lower the environmental impacts of energy generation, distribution and consumption (Box II.6). In the United States, legislation such as the Energy Independence and Security Act (2007) and the American Recovery and Reinvestment Act (2009) provide government support and funding for a nation-wide modernisation of the electrical grid – and stable mid-term prospects for private investors. This contributed to continued growth of commercial investments in innovative smart grid ventures, even during 2009 when overall clean technology investments tumbled by 33% (Figure 7). Three of the top five VC investments made that year (each over USD 100 million) went to smart grids companies in the areas of smart metering, smart energy storage and smart grid communications (Cleantech Group, 2010). These investments are expected to generate high value-added jobs in OECD countries and emerging economies.

Figure 7. Global venture capital amounts: smart grids vs. overall clean technologies

Indices: 2005 = 1.0



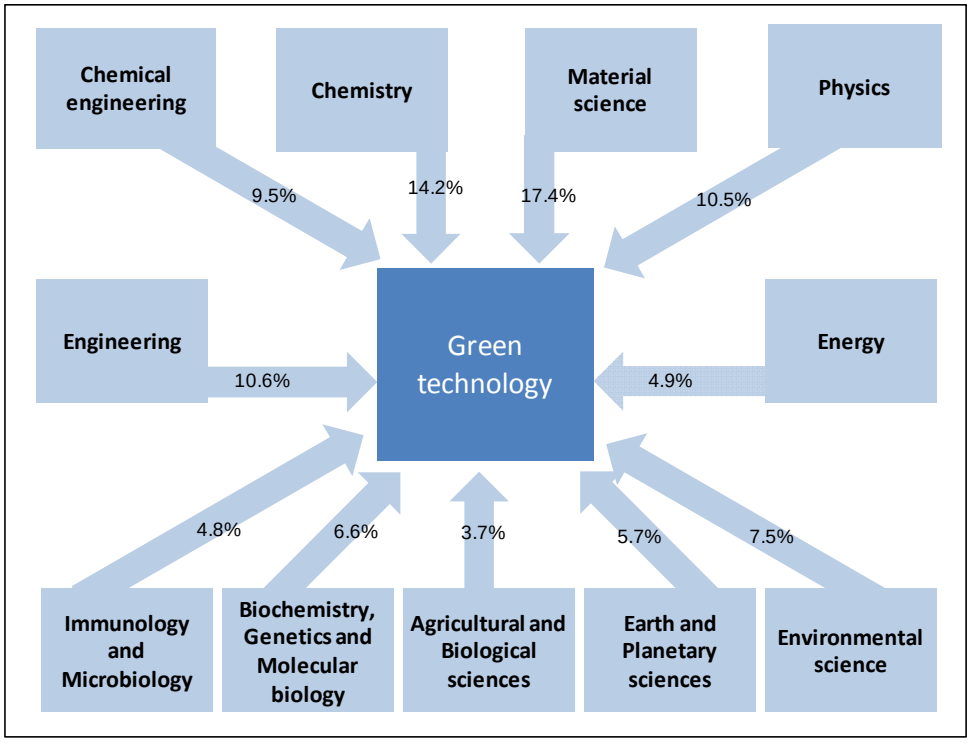
Source: OECD calculations, based on data by Cleantech Group.

63. Appropriate pricing of externalities and general innovation policies can go a long way in stimulating green innovation, but the emergence of new technologies – especially breakthrough technologies is a process that generally requires considerable and long-term investment, often initiated in public research institutions before being picked-up by firms. More specific and possibly temporary support for clean technologies may therefore be needed to demonstrate their applicability and to break path dependence effects that favour existing, dirtier technologies.

64. In order to reach ambitious emission reduction targets, for example, the high development and deployment costs of largely untested zero-carbon emission technologies - such as fuel cells or advanced biofuels– will require large R&D investments at the initial stage. However, government spending on energy R&D and on environmental R&D have not kept pace with the growing urgency of the energy and climate challenge, and government spending on environmental R&D is typically less than 4% of total government spending on R&D. In addition, considering the recent spending trends in energy-related R&D over the 30 years, average public energy-related R&D expenditure has declined dramatically across the OECD since the peak of the early 1980s. Supporting the emergence of breakthrough green energy technologies will require, in addition to a carbon tax, a high level of R&D subsidies up-front, but that should be phased out over time. Indeed, model simulations show that policy intervention would help redirecting private research towards untested clean technologies early on, while learning-by-doing effects would then gradually decrease their investment cost, subsequently making policy intervention less relevant (Acemoglu, 2009).

65. Radical innovations and breakthrough technologies will require investment in public research to address fundamental scientific challenges and develop technologies that are considered too risky or uncertain for the private sector. Such research will need to cover a wide range of areas, as green technologies draw on a wide range of scientific fields (Figure 8). Policies for public research will need to be well-designed to complement private investments in research, should provide stable signals for long-term research investments, and should aim for areas in which social returns are likely to be greatest.

Figure 8. The innovation-science link in "green" technologies, 2000-07



Note: The figure shows the degree to which green patenting between 2000 and 2007 draws on specific areas of scientific research, as measured by references to scientific research in patent documents.

Source: OECD calculations, based on Scopus Custom Data, Elsevier, July 2009; OECD, Patent Database, January 2010; and EPO, Worldwide Patent Statistical Database, September 2009.

66. Public procurement can also play a role, particularly in markets characterised by network externalities such as infrastructures for electric/hybrid vehicles or where "demonstration effects" (*i.e.* consumption externalities) are important. In such cases, initial barriers to market creation are high, and can be overcome through public demand. However, it has to be ensured that the introduction of obligations on contracting authorities (to take into account energy efficiency criteria or other environmental criteria in their public procurement decisions) does not eliminate competition in procurement markets (*e.g.* because of the lack of sufficient market development for products satisfying the requirements imposed).

67. OECD analysis shows that a large share of radical innovations for greener growth emerges from new firms. New and young firms are prone to exploiting technological or commercial opportunities, which have been neglected by more established companies, often because radical innovations challenge the business models of existing firms. Moreover, analysis for the United States shows that new firms contribute heavily to the creation of new jobs (Haltiwanger, *et al*, 2009).

68. Both firm creation and destruction will accompany the experimentation process that leads to the development of new green technologies and markets. However, most OECD countries face significant challenges in fostering the growth of new firms. Simplifying and reducing start-up regulations and administrative burdens can reduce the barriers to entry. Costly exit also discourages firms from entering the market. Bankruptcy laws can be made less punitive to entrepreneurs and should offer more favourable conditions for the survival and restructuring of ailing businesses, with due regard to risk management and the need to avoid moral hazard. Arranging a proper environment for promoting

entrepreneurship to accelerate green growth will also contribute to enhance the activities of innovative SMEs.

69. Access to finance is a key constraint for business-led innovation, in particular in the aftermath of the economic crisis. Green innovation is inherently risky and investments may require a long-term horizon. Financial constraints are especially high for new entrants into the innovation process, since they have no history of success and often only limited access to internal finance. Well-functioning venture capital markets and the securitisation of innovation-related assets (*e.g.* intellectual property) are key sources of finance for many innovative start-ups (Box 12). Policy can take steps to ease the access to finance for new and innovative small firms, both with respect to debt and equity finance. This could involve risk-sharing schemes with the private sector.

Box 12. Patents and international technology transfer

Enhancing international transfer of green technologies will be a key aspect for ensuring that the benefits of green growth, both from an economic and environmental standpoint, are reached at a global level. Especially for environmental concerns that are international in nature, there are significant advantages to technology and knowledge transfer, since both source and recipient countries (and others) benefit environmentally from the transfer. Moreover, the deployment of green innovations to emerging and developing countries will be a strong driver of expanding markets for eco-innovation and ensuring sustainable economic development.

Various new mechanisms to accelerate the diffusion of innovation to developing countries are being explored. Knowledge markets and knowledge networks could potentially play a key role in this transfer, *e.g.* innovative collaboration mechanisms in intellectual property (patent pools are but one example) which allow for a greater flow of research, development and adoption of green technologies in the developing and developed world alike. Some good practice already exists (for example, in networking R&D for emerging infectious diseases) but significant scale-up will be required. Governments can support this development by supporting the development of a knowledge networking infrastructure; implement measures, such as the OECD Guidelines on Access to Research Data from Public Funding, to share public-sector knowledge; and foster the development of collaborative mechanisms and knowledge brokerages to encourage the exchange of proprietary knowledge and help ensure a fair return on investments made.

The role of patents is significant in fostering innovation and entrepreneurship, which need to be sustained for shifting to a green growth pathway. IPRs provide an important incentive to invest in innovation by allowing firms to recover their investment costs. Patents are particularly important for small firms, as they can facilitate entry into new markets and enable competition and collaboration with other firms. Policies in this field should aim at enhancing the diffusion of new technology while encouraging investment in research and development; and they should address tech transfer beyond patents (*e.g.* know-how, which is often important for users in addition to patents themselves).

Proposals have been made for significantly weakening patents (compulsory licensing, patentability exclusions, etc.). However, while IPR-weakening measures could enhance the diffusion of certain currently patented technology in the short-term, they would significantly reduce the incentives for firms to invest in innovation or would lead them to keep their inventions secret (not patented), which would in turn harm diffusion. Patent pools (bundles of complementary patents) can be efficient for facilitating the access to new technology. To do so, they would need to be operated on a voluntary basis and compensate contributing businesses adequately. Broader technology transfer agreements (*e.g.* involving local universities and companies of the recipient country) may also be helpful. In fact, the limited absorptive capacity of recipient countries is often a stronger obstacle to technology adoption than the price of patented inventions itself: co-operation aimed at building local capacities to adopt and adapt new technology might be more effective than purely patent-centred measures for boosting the use of environmental inventions.

Green growth policies in the energy sector[3]

70. The greening of the energy sector will be a key element of green growth strategies, providing a unique combination of benefits, including enhanced energy security, reduced CO_2 emissions and lower energy costs. The IEA World Energy Outlook 2009 (WEO-2009) shows how these objectives can be achieved in its "450 Scenario", which reduces CO_2 emissions by 34% compared to the Reference scenario in 2030.[4] The WEO-2009 also shows that the path to green growth in the energy sector will require an integrated mix of policies, ranging from pricing carbon to energy efficiency policies as well as support to low-carbon technologies, including renewables.

71. Energy efficiency, renewable energy, carbon capture and storage, nuclear power and new transport technologies will all need to be deployed to achieve the IEA 450 Scenario. Improved energy efficiency accounts for over half of total abatement by 2030, while renewable energy provides a further 20% of abatement.

72. The cost of the additional investments needed to put the world onto a 450-ppm path is at least partly offset by economic, health and energy-security benefits. The WEO-2009 calculates that energy bills in transport, buildings and industry are reduced by USD 8.6 trillion globally over the period 2010-2030, while the corresponding investment is USD 8.3 trillion. The undiscounted fuel-cost savings over the lifetime of these investments exceed USD 17 trillion. Using a discount rate of 3% or even 10% there are still net savings over the lifetime of the capital stock. In the IEA 450 Scenario, energy security is enhanced compared with the Reference Scenario. In OECD countries, oil and gas imports and their associated bills in 2020 are lower than in 2008. Other implications include the reduction in emissions of air pollutants mentioned above. By 2030, SO_2 emissions are 25 million tonnes, or 29% lower than in the Reference Scenario. NO_x emissions are 19% lower.

Energy Efficiency

73. Studies show that investing in energy efficiency provides several important advantages: increasing energy security, reducing energy costs and improving the environment. According to IEA analysis, governments are engaging in a wide array of energy efficiency policy activity, from national strategies to minimum energy performance standards for appliances and equipment. There are also signs of energy efficiency policy innovations, including the development of markets to trade energy savings and innovative financial instruments to encourage energy efficiency investment. However, OECD countries have not captured the full energy efficiency potential of the possible suite of policies. Untapped energy efficient potential is hidden across all sectors (*e.g.* buildings, industries and transport).

74. Energy efficiency continues to face pervasive barriers including lack of access to capital, insufficient and asymmetric information and externality costs that are not reflected in energy prices. Countries' commitment to maximising implementation of energy efficiency policies may also have been challenged by the current economic crisis. In addition, energy efficiency programmes must compete for funding with other priorities such as employment, health and social security. In making decisions about how to allocate limited resources, it should be kept in mind that the benefits of implementing energy efficiency extend beyond energy security and climate change mitigation. Experience shows that energy efficiency investments can deliver significant co-benefits – including potentially net job creation[5] and health improvements.

3. This section was contributed by the International Energy Agency.

4. The 450 Scenario is so named because it is designed to limit the long-term concentration of greenhouse gases in the atmosphere to 450 ppm CO_2-eq.

5. See for instance ACEEE (2010).

75. The 25 IEA recommendations to the G8[6] can guide countries in addressing the need to significantly increase the rate of energy efficiency improvement. Indeed, there is great room for further energy efficiency action in countries. IEA estimates that 40% of the potential energy savings from the IEA 25 recommendations, or from measures that achieve similar outcomes, remains to be captured. If implemented globally without delay, these recommendations could save an estimated 8.2GtCO_2/yr by 2030. On a sectoral basis, across all OECD economies, policies for transport stand out as having the least substantial implementation – although a number of policies have been planned.

76. Recognising that more needs to be done to improve energy efficiency, a number of countries established the International Partnership for Energy Efficiency Cooperation (IPEEC) in 2008.[7] This aims to facilitate those actions that yield high energy efficiency gains, while allowing participants to take action in the areas of their interest on a voluntary basis.

Renewable Energy

77. Greater deployment of renewable energy is another important component of a green growth strategy for the energy sector. As with energy efficiency, renewables can contribute to multiple policy objectives including reducing CO2 emissions and local pollution and improving energy security.

78. Renewable energy currently accounts for 18% of global electricity generation and 1.5% of global transport fuel consumption.[8] In OECD as well as emerging countries, there are significant possibilities for improvement of policy design and considerable realisable potential across all renewable energy technologies (RETs). If effective policies were adopted at a more global scale, this potential could be exploited more rapidly and to a much larger extent.

79. While some RETs are commercial today, others are close to being commercial and both groups should be deployed on a massive scale. Other RETs, which have a large potential, are less mature and require a long-term vision. Reducing their costs will require a combined effort in research, development and demonstration (RD&D), and technology learning resulting from marketplace deployment. Thus far, only a limited set of countries have successfully implemented support policies that effectively accelerated the diffusion of renewables.

80. A wide variety of incentive schemes can be effectively applied depending on the specific technology and country. However, non-economic barriers have significantly hampered the effectiveness of renewable support policies and driven up costs in many countries, irrespective of the type of incentive scheme. It is therefore necessary to move beyond discussions over which specific incentive scheme functions best to an assessment of the entire policy framework into which incentive schemes are inserted. Overall, the effectiveness and efficiency of renewable energy policies are determined by the adherence to key policy design principles outlined below, as well as the consistency of measures.

6. For the full set of recommendations, see www.iea.org/textbase/papers/2008/cd_energy_efficiency_policy/index_EnergyEfficiencyPolicy_2008.pdf

7. The founding members of IPEEC were Canada, the People's Republic of China, France, Germany, India, Italy, Japan, the Republic of Korea, the Russian Federation, the United Kingdom, the United States of America, and the European Community, represented by the European Commission

8. IEA Energy Statistics.

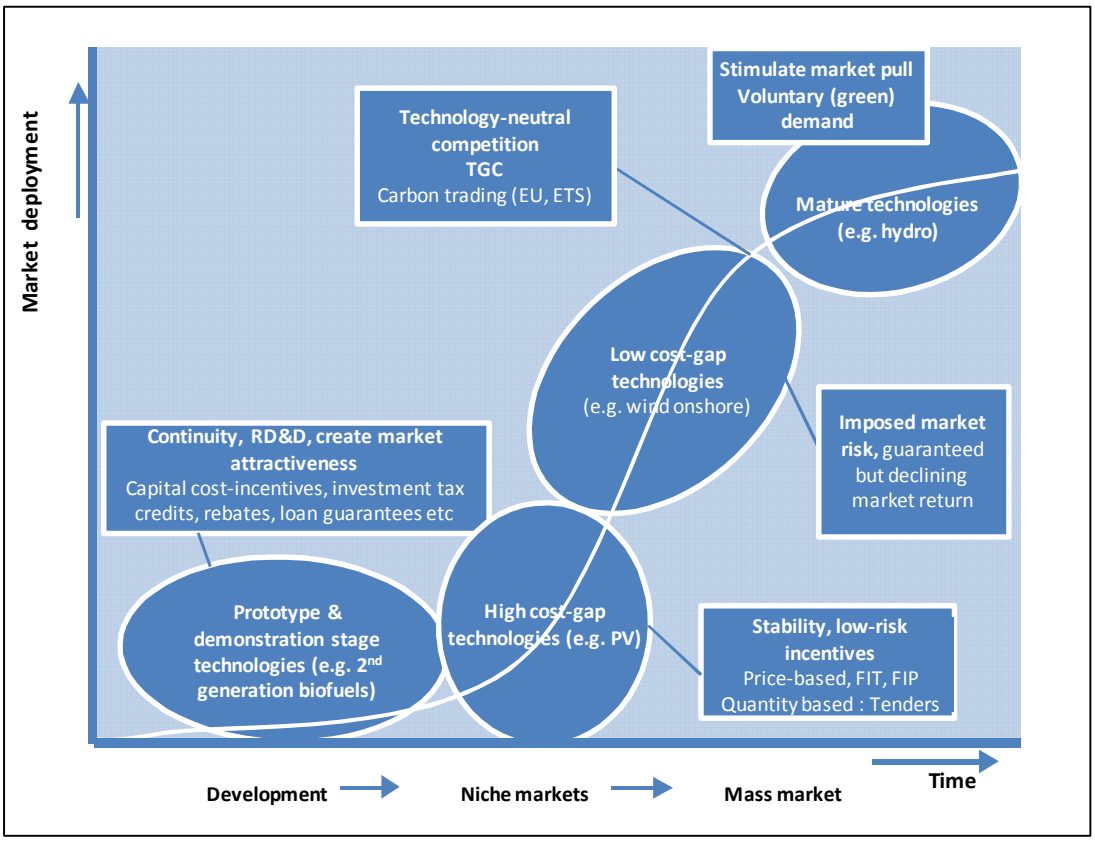
81. Renewable policy design should reflect five fundamental principles:

- The removal of non-economic barriers, such as administrative hurdles, obstacles to grid access, poor electricity market design, lack of information and training, and the tackling of social acceptance issues, in order to improve market and policy functioning;
- The need for a predictable and transparent support framework to attract investments;
- The introduction of transitional incentives, decreasing over time with eventual phase out, to foster and monitor technological innovation and move technologies quickly towards market competitiveness;
- The development and implementation of appropriate incentives guaranteeing a specific level of support to different technologies based on their technological potential, degree of technology maturity and scope for cost reduction, in order to exploit the significant potential of renewable energy technologies in the future at the lowest-overall cost; and
- The due consideration of the impact of large-scale penetration of renewable energy technologies on the overall energy system, especially in liberalised energy markets, with regard to overall cost efficiency and system reliability.

82. Reflecting these five principles in an integrated approach allows two concurrent goals to be achieved, namely to exploit the abundance RETs which are closest to market competitiveness while preserving and implementing the long-term strategic vision of providing cost-effective options for a low-carbon future.

83. Achieving a smooth transition towards mass market integration of renewables will require a profound evolution of today's markets so that RETs can compete with other energy technologies on a level playing field. The evolved market should place an appropriate price on carbon and other externalities as well as help to develop an infrastructure to accommodate large-scale RET integration. Once this is achieved, specific support for RETs should be phased out leaving their deployment to be accelerated by consumer demand and general market forces (Figure 9).

Figure 9. Combination framework of policy incentives as a function of renewable technology maturity



Source: IEA (2008a) Deploying Renewables. Principles for Effective Policies.

84. The deployment of renewables will require the development of a combination policy framework increasingly applying market principles as technology maturity and deployment increase. This is possible with a range of policy instruments, including price-based, quantity-based research, development and demonstration (RD&D) support, support to innovation and technology transfer and regulatory mechanisms. As a general principle, less mature technologies further away from economic competitiveness will need, beyond continued RD&D support, very stable low-risk incentives, such as capital cost incentives, feed-in-tariffs (FITs) or tenders. For low-cost gap technologies, such as on-shore wind or biomass combustion, other more market-oriented instruments like feed-in premiums (FIPs) and tradable green certificate (TGC) systems with technology banding may be more appropriate.[9] Depending on the specific market and resource conditions as well as on the

9. FITs and FIPs are granted to renewable energy producers for the electricity they feed into the grid. They are preferential, technology specific and government regulated. FITs take the form of a total price per unit of electricity paid to the producers whereas the FIPs are additional to the electricity market price. An important difference between the FIT and the premium payment is that the latter introduces competition between producers in the electricity market. TGC are used where a government sets a particular target for renewables and put a corresponding obligation on producers, suppliers or consumers to source a certain percentage of their electricity from renewable energy. Under this scheme, an obligated party failing to meet its quota obligation has to pay a penalty. This provides the incentive to either directly invest in new renewable electricity plants or to buy green certificates from other producers or suppliers. The certificates are finally used to prove compliance with the obligation.

level of market integration across countries, technology banding may be necessary only in a transitional phase or may be bypassed in favour of a technology-neutral TGC system. Once the technology is competitive with other CO_2-saving alternatives and ready to be deployed on a large scale, and when appropriate carbon incentives are in place, these RET support systems can be phased out altogether.

85. National circumstances (RET potential, existing policy framework, existence of non-economic barriers, degree of market liberalisation, and energy system infrastructure) will influence the actual optimal mix of incentive schemes. The choice of when to complement R&D support with deployment support will be critical to the overall success of support policies. All RET families are evolving rapidly and show significant potential for technology improvement. Renewable energy policy frameworks should be structured to enable the pursuit of technological RD&D and market development concurrently, within and across technology families, in order to address the various stages of development of different renewables and markets.

Other low carbon technologies

86. Enhanced research, development and demonstration will also be crucial for other low carbon technologies that are not currently commercial. Examples include carbon capture and storage and electric vehicles. The IEA has been developing roadmaps for the most important technologies that can guide environmental and energy decision makers on the path to needed innovations. At the request of G8 leaders and IEA energy ministers, the IEA is also developing an international low carbon energy technology platform that will bring together policy makers, business representatives and technology experts to discuss how best to encourage the spread of clean energy technologies.

Box 13. Transport – a growing source of CO_2 emissions[1]

While there seems to be a consensus that countries should reduce GHG emissions from fossil fuel use, there is rather less consensus on which instrument would best achieve that goal. This issue is briefly discussed for different passenger land transport and international aviation and maritime transport.

A carbon tax is the most direct and least-cost method for addressing CO_2 emissions from fossil fuel use because it directly targets the externality (CO_2 emissions) that may not be captured by market prices. A carbon tax has multiple impacts. It acts as a signal to manufacturers on what level of fuel economy might succeed in the market, it guides consumer choices for new vehicles and it may influence travel behaviour. However, most fuel taxes were not designed as externality-capturing instruments, but as a stable and significant source of government revenue since demand for fuel is relatively price-inelastic, at least in the short-term.

Elegant in its simplicity, direct in its application, carbon taxes (and its proxy – fuel taxes) are nonetheless highly contentious and difficult to implement. This is partly because of potential regressive effects of such taxes as lower-income households are more exposed to its burden. There is also a clear political aversion to increasing the fiscal burden on such a wide voter base. However, there is strong evidence that the level of fuel prices has an impact on overall new vehicle fuel economy.

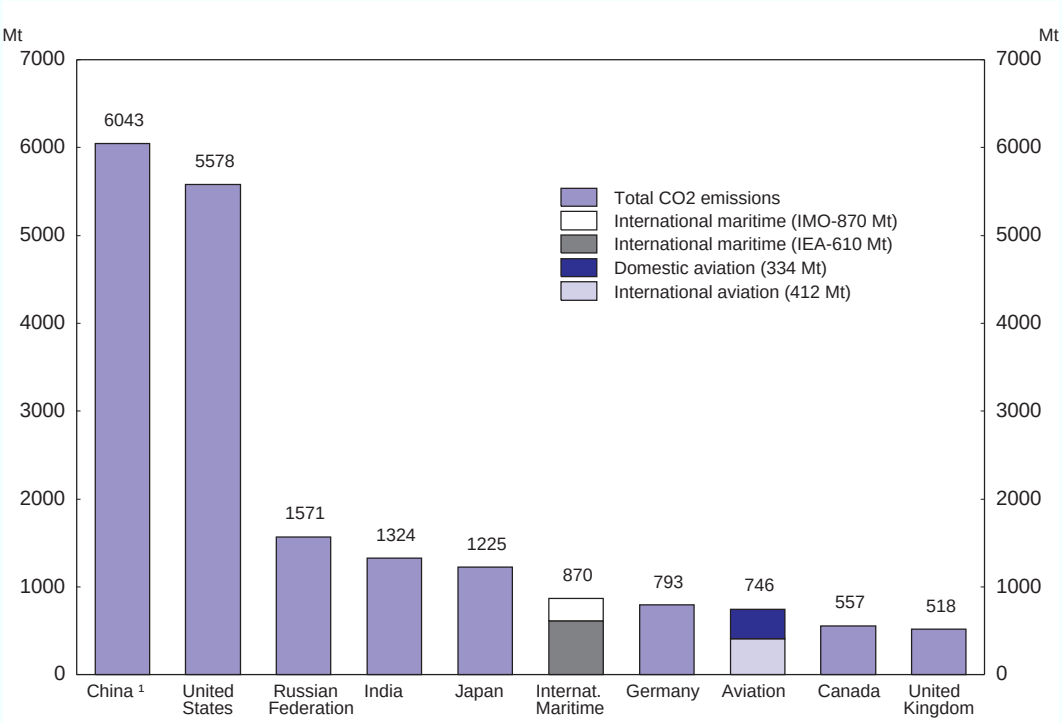
This has led countries to deploy a number of complementary instruments to guide fuel economy investments and lower carbon emissions. Foremost among these are standards, which have the benefit of providing a strong signal to manufacturers on societal preferences for fuel economy. Other instruments include CO_2-related feebate schemes (as in France), CO_2-differentiated vehicle purchase, registration and/or circulation taxes. These policies do not address emissions from the rebound in use-based emissions stemming from lower per-kilometre fuel costs. Thus, many non-carbon tax-based policies will require flanking instruments in order to replicate the theoretical impact of a well-designed carbon tax. These flanking instruments, however, may better target the supply-side innovation necessary for a move to a radically different energy base for transport

because they hit much closer to technology innovators than a carbon tax would.

At a minimum, CO_2 policies for transport should be based on as close to an externality-capturing carbon-tax and flanking instruments should be as least distorting as possible. There are two important transport sectors that, for historical reasons, are exempt from any carbon-price signal since their fuels are untaxed: the international maritime and aviation sectors.

International Maritime and International Aviation emissions have been growing at approximately 3% per year since 1990, outstripping the global rate of growth in CO_2 emissions (~1.9% per year). They represent a significant and rapidly growing source of CO_2 emissions, which remain largely devoid of any CO_2-internalising fiscal mechanism.

National CO_2 Emissions (minus Domestic Aviation) Compared to Aviation and International Maritime Emissions: 2007



1. Including Hong-Kong.

Source*: International Maritime Organisation, IEA and ITF.*

This increase is largely the result of the international nature of these two sectors combined with various practical, regulatory and/or historical artefacts. For one, no one "owns" these emissions (and related fuel sales) since there is no international agreement on the allocation of emissions from international bunker fuels. This is largely because some countries with large ports and airports and/or share of international bunker sales would be disproportionately impacted by allocation on the basis of national fuel sales. Against this backdrop, non-sector-wide taxation of international bunkers in these countries would distort competition. Furthermore, the risk for leakage would not be inconsequent, especially for ocean-going vessels, which can bunker large amounts of fuels and thus could potentially evade taxation. For aviation, there is a widely upheld interpretation that the Chicago Convention's restriction on taxing fuel in arriving aircraft represents a prohibition on the taxation of all international aviation fuel, although the Convention allows waiving this tax exemption on a bilateral basis. Finally, there is the complicating matter of a CO_2-internalising tax potentially contravening the "common but

differentiated responsibility" clause of the UNFCCC, even though the Convention does not have application in the IMO and ICAO. Developing countries have maintained that any carbon tax on international bunkers should only apply to Annex I countries, rendering such a tax ineffective and hard to apply given concerns regarding competitive distortions and the relative ease with which assets, especially ships, can be re-domiciled in non-OECD countries.

Both the IMO (International Maritime Organization) and ICAO (the International Civil Aviation Organization) have sought to address a global fuel tax or levy, but have, thus far, failed to reach an agreement on a global fiscal framework. Thus work on "second-best" options has moved to the forefront. Focus on new vessel and aircraft standards has progressed and both bodies have investigated operational improvements without, nonetheless, determining a binding framework for these. IMO and ICAO are actively exploring the development of a global emission trading regime (with emission trading for flights arriving and departing in the EU already an obligation from 2012 on), though this is contentious for some countries. ICAO is also actively pursuing the development of "drop-in" biofuels, though, as with many biofuels, questions remain as to total lifecycle impacts and elevated marginal abatement costs. The outcome of COP 15 has provided no guidance to parties regarding emissions from international aviation or shipping and it is currently unlikely that there will be any pressure to accelerate emissions reduction or deviate from the strategies already underway.

The risk with the above approaches outlined is that none (possibly with the exception of a well-designed and open emissions trading scheme) provide a comprehensive signal leading to reduced CO_2 emissions from international aviation and maritime transport and may even lead to increased emissions rates if efficiency improvements lower transport costs and generate additional travel. While many countries have achieved environmental policy outcomes with these approaches, they are an inefficient way forward and may generate welfare losses countries cannot afford.

1. This Box was contributed by the International Transport Forum, an inter-governmental organisation within the OECD family: for more information see www.internationaltransportforum.org.

Greener jobs, labour market transition and skills development

87. Achieving ambitious environmental goals, notably in the climate change area, raises important transitional issues as OECD and emerging economies have to adjust to new patterns of growth (OECD, 2010c). In particular, the transition towards green growth may lead to an intensification of structural economic changes, including significant reallocation of labour and other factor inputs within and across broad economic sectors (*e.g.* power generation, transport, construction and agriculture). Moreover, the application of new technologies and production practices throughout the economy suggests that job skills requirements are also likely to change significantly across the board. This raises the possibility of skill mismatches that could slow the expansion of green activities or become a source of rising structural unemployment. Labour market and training policies can play a key role in facilitating the structural adjustments required by the transition to green growth, while at the same time minimising the associated social costs.

Labour market implications of the transition to green growth

88. In the current context of high economic slack, the green investments included in many recent fiscal stimulus packages can have a significant short-term, positive impact on employment, while also accelerating the transition towards green growth. The long-run impact on total national employment is however uncertain across most green growth scenarios. One likely outcome is that in advanced countries, where the share of the working-age population that is employed is already relatively high, the impact will be relatively small. In the case of developing countries, which are often characterised by large

reserves of unemployed or under-employed persons in the informal sector, there will be relatively more scope for green growth initiatives to raise overall productive employment.

89. The reallocation of labour across sectors, firms and regions/localities required by the transition towards green growth may well be sizeable. OECD modelling work on the economic impacts of climate change mitigation indicates that employment in renewable energy sectors will tend to grow at the expense of employment in fossil fuels and coal mining while the employment patterns in other sectors is more variable depending on the country and policy scenario.[10] Table II.2 provides an indicative disaggregation of the types of green industries and services that stand to gain from the implementation of green growth policies, while Box 14 describes how OECD modelling of long-run labour market adjustment is being extended.

90. How the transition to green growth will affect job reallocation across firms within the same sector has yet to be studied. However, OECD evidence suggests that job flows between firms in the same industry are an order of magnitude larger than sectoral reallocation.[11] Furthermore, the acceleration of eco-innovation and the diffusion of green production technologies will further intensify these within-industry flows as new technologies often diffuse via the displacement of existing firms by innovative start-ups.

91. OECD work shows that the employment impact of green growth will be uneven across geographical areas. Localities that have specialised in what will become declining sectors (*e.g.* fossil fuel production) will face the challenge of developing new specialisations, but green growth will also provide new opportunities for local economic development initiatives (Box 15). Many workers in declining regions and sectors may require public assistance to relocate or acquire new skills.

92. While it is clear that the transition to green growth will significantly change job skill requirements, much remains to be learned about the types of skills that will be in increased demand. Evidence from a number of countries shows that skill shortages have already developed in certain sectors or occupations where green growth policies have created a need for new skills, or new combinations of familiar skills. For example, a report to the French government recently identified a number of emerging occupational specialties in the construction sector (*e.g.* energy auditors and solar panel installers), which are not well served by traditional training institutions and hence face potential recruitment bottlenecks (COE, 2010).

10. OECD calculations based on ENV-Linkages simulations.

11. On average in the OECD countries 15 to 20% of the jobs are created or destroyed every year as new firms are created while other exit the market and incumbent firms are engaged in a continuous process of adaptation to changes in demand and technology.

Box 14. An extension of the OECD ENV-Linkages model

As part of the new analysis being conducted for the Synthesis Report to the 2011 MCM on the OECD Green Growth Strategy, the Secretariat is extending its capacity to analyse the labour market impacts of the transition to green growth. One focus of this work is to enhance the ENV-Linkages simulation model — which the OECD has used to analyse the economic impact of climate change mitigation (OECD, 2008; 2009a) — so as to enable the long-run, general equilibrium impacts of green policies on labour markets to be analysed in more detail.

The current version of the ENV-Linkages model does not distinguish between skilled and unskilled workers. The size of the labour force is also assumed to be exogenously determined and the labour force to be fully employed in every period. Although the exact specification of a more elaborate labour market will only be decided after a survey of the literature and available data, the main extensions foreseen for the model will be to relax these assumptions by differentiating workers by skill level and taking account of both frictions in the reallocation of workers across sectors and endogenous changes in labour supply behaviour (*e.g.* in response to changes in wages or the risk of unemployment). While simulation of specific labour market policies may remain beyond the reach of the extended model, their effects on different mitigation scenarios can be investigated indirectly to clarify important policy questions, including:

- Can increased labour market adaptability in reallocating workers across sectors, such as that associated with structural economic reforms, significantly lower the overall economic cost of a transition to green growth or the distribution of costs and benefits across the workforce?
- How will the demand for skilled workers evolve in different industries? Will skilled or unskilled workers face the greatest pressures to change industry?
- How will the wage premium for skill be affected by the transition to green growth? Can (exogenous) increases in the share of skilled workers, such as what could be achieved by strengthening education and training policies, significantly lower the overall economic cost of a transition to green growth or the distribution of costs and benefits?
- Can the net employment gains from green growth be significantly increased if revenues from environmental taxes or auctioning carbon quotas are used to lower the taxes on labour use? Will such a tax reform simultaneously improve household welfare?

An active role for labour market and training policies in managing the transition

93. Labour market and training policies can play a key role in facilitating the structural adjustments associated with green growth, while at the same time minimising the associated social costs. The Re-assessed OECD Jobs Strategy provides a suitable framework for identifying policies and institutions that by facilitating a continuous redeployment of labour from declining to growing industries and firms can help to achieve a high level of employment and shared prosperity. This framework is also relevant to identify specific policies to promote a transition towards green growth. In general, a strong skill development system and active labour market programmes that facilitate a quick re-integration of jobseekers into employment will be key supply-side policy elements for reinforcing the structural adaptive capacity of labour markets. On the demand side, moderate employment protection and strong product market competition are important. OECD work also highlights the need to combine policies that increase the adaptive capacity of labour markets with flanking measures, such as unemployment insurance and in-work benefits, which assure that dynamism is not achieved at the cost of excessive insecurity or inequality for workers and their families.

94. A number of more specific measures can also help to meet the labour market challenges occasioned by the transition to greener economies. In particular, pro-active short-term policy initiatives to foster green employment will be useful to jumpstart job creation, while also accelerating the transition -- especially in the current context of high labour market slack and the risk of prolonged labour market stagnation in many countries. Where there is fiscal space to do so, this may be an opportune time for a surge of public investment in green infrastructure or initiatives to train unemployed workers to meet anticipated or existing skill shortages in strategic sectors for making progress towards green growth (*e.g.* retro-fitting buildings for greater energy efficiency). Additional options such as immigration, settlement and skill recognition policies, which can help ensure an adequate supply of skilled workers may also be considered.

95. Dedicated labour market programmes could help workers to participate fully in the emerging green economy, such as initiatives to overcome specific shortages of "green skills"[12] or special measures for declining sectors or large plant closings. However, as in earlier debates about the labour market impact of globalisation, previous OECD work suggests that general programmes should be relied upon as much as possible. There is considerable scope to enhance the effectiveness of these general programmes, particularly the coordination of educational and training institutions to upgrade the job skills of an ageing and increasingly diverse workforce. Governments should also encourage multi-stakeholder strategies for achieving green growth, as exemplified by the "Green Workplaces' initiative in the United Kingdom, the "Grenelle de l'Environnement" in France and social dialogue where this is consistent with national institutions and practices.

96. Ensuring that small and medium sized enterprises (SMEs) fully participate in the efforts towards green growth and benefit from policy changes to promote it is a key challenge for the transformation ahead. SMEs are often unaware of the technological and operational adaptations required by green growth and do not have easy access to that information. For example, results from an OECD survey of SMEs in New Zealand and the UK indicate that most SMEs have little awareness of the impact of environmental regulation in their industry and future needs for new green skills. Furthermore, their investments in green training and knowledge-intensive activities are very limited.

12. For example, the French government is setting up regional action plans (Contrats de Plan État-Région) to provide a framework for cooperative efforts related to meeting economic development and vocational training needs.

Box 15. Regional and local implications of a transition towards a low-carbon economy and green growth

Adjustment pressures might put additional strains on several local economies badly hit by the crisis. In recent years, local governments in many countries have already opted to invest in renewable energy utilities and photo-voltaic installation, resource-saving, recycling activities and green area management in order to spur job creation (IEA, 2009). Major long-term infrastructure investments are expected over the coming years to increase the energy efficiency of buildings, transport and power generation and large-scale building retrofit program have taken a dominant role within local policies for sustainable recovery.

Forward looking regional skill strategies will be needed to anticipate what the employment effects and labour reallocation across industries will imply in terms of future skill needs and absorption of laid-off workers. Efficient co-ordination between actors at different level to implement effective education and training policies will also be necessary. The rising demand for green products will require the simultaneous development of very diverse skills. For example, the rising demand for low-emission residential estates will require developers knowing the building materials with low-embedded energy use, engineers and designers able to embed energy efficient products in the building, manual workers with the technical capability to install and maintain these products, and salespeople able to promote such estates in the market.

Renewable energy options should integrate the policy package for regional development, including for lagging-behind regions in need of finding new development pathways. Venture capital investments in renewable energies might target areas with lower prices for land. Areas having suffered the largest manufacturing job losses, such as the "rust-belt in the United States, might have the right endowments of trained labour to attract investments in renewable energies. The effects on employment are likely to be relevant, since jobs in installing, operating, and maintaining renewable energy systems tend to be local in nature. Moreover, the investment in skills to sustain renewable energy production is likely to raise the overall level of human capital and reduce pressures for out-migration of the young. To sum, renewable energy development should be suited to local characteristics, as there is not a one-size-fits-all technology or strategy.

Against this background, local authorities have a role to play in the creation of opportunities for the expansion of green activities and investments; and the reduction of emissions levels within their localities. Designing an integrated strategy for managing and enabling green growth requires taking into account a multiplicity of policy fields and target groups. Successful experiences have shown that re-skilling of the workforce, while keeping up productivity levels in the greener economy and expanding to new economic activities, requires the public sector to adopt a multi-stakeholder approach, working in partnerships with unions, the business sector, the education sector, and other local institutions.

Source: OECD (2009d), and Martinez-Fernandez, Hinojosa and Miranda(2010).