



THE WORLD BANK

**INCORPORATING GREEN GROWTH AND SUSTAINABLE DEVELOPMENT POLICIES
INTO STRUCTURAL REFORM AGENDAS**

A REPORT BY THE OECD, THE WORLD BANK AND THE UNITED NATIONS

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I. Introduction and Summary

This report examines how green growth and sustainable development policies can be incorporated into structural reform agendas. Indeed, as demonstrated in the report, many of these policies are closely linked and synergistic with the framework policies applied by G20 governments in their efforts to pursue strong and sustainable growth.

The report, has been prepared in response to the request from G20 Finance Ministers and Central Bank Governors in their Communiqué of 25-26 February 2012 that asked “the OECD, with the World Bank and the UN, to prepare a report that provides options for G20 countries on inserting green growth and sustainable development policies into structural reform agendas, tailored to specific country conditions and level of development”. The report will be an input to the G-20 Leaders’ Summit in Los Cabos and provides a toolkit of policy options from which countries may draw-upon when designing their own green growth strategies. The G20 Development Working Group has also tasked the International Organisations with the development of a non-prescriptive toolkit of policy options to support inclusive green growth in the context of sustainable development and poverty eradication in developing countries.

Motivation for Green Growth and Sustainable Development Policies

The global economy continues to face complex challenges and resolute policy action is needed to restore confidence and put the economic recovery onto a sustainable growth path. A subdued economic outlook underscores the need for G20 countries to advance their structural reform agenda to achieve the shared objective of strong, sustainable and balanced growth.

To ensure that growth is sustainable over the long-term, countries need to confront and implement solutions to rising environmental challenges. Unless countries move to greener growth paths - characterised by economic growth and human development that better conserves natural resources - continuing environmental degradation will lead to significant negative impacts on human well-being. These could result from air pollution and water scarcity, bottlenecks in the availability of scarce natural resources, and the risk of more frequent extreme weather events and dramatic climatic change. These impacts will put economic growth and development at risk, with a disproportionately high share of the burden falling on the poor in many parts of the world.

Over the past four decades, the world’s population has almost doubled, but the world economy has more than tripled and poverty has been reduced substantially. In just twenty years, GDP per capita has increased by 80% in developing countries and living standards have been improved for many, with more than 500 million rising out of poverty and remarkable progress in literacy, life expectancy and malnutrition (World Bank, 2012a). Globally, the Millennium Development Goal (MDG) of reducing poverty by half has been achieved. But massive challenges still remain, including continuing to eradicate poverty, hunger and ill-health and reducing inequality. One person in five (1.3 billion) is without electricity, and even when electricity services are available, millions of poor people are unable to pay for them (UN, 2010). Furthermore, 780 million people lack access to an improved water source, which is approximately one in nine people (WHO/UNICEF, 2012). In short, growth has not been inclusive enough.

Growth is a pre-requisite for meeting these challenges to improving human well-being – however, it has incurred significant costs to the environment. With a world population today of 7 billion and a projected increase of 2 billion more by 2050, a failure to responsibly manage the natural assets on which life depends will have significant economic and social consequences for all. The poor, whose livelihoods are often more

closely tied to environmental resources and who have limited options for either diversification or coping, will face especially adverse impacts.

Without new policy action, a 50% increase in greenhouse gas (GHG) emissions and a significant worsening of urban air pollution are projected to 2050 (OECD, 2012a). The impact on quality of life and human health will be significant, with an increasing economic burden from chronic and costly health problems. The number of premature deaths from exposure to particulate pollutants (PM₁₀ and PM_{2.5}) could double from current levels to 3.6 million people every year by 2050. Global water demand is projected to increase by 55% by 2050, with competition for water intensifying. As a result, it is projected that almost 40% of the world's population would be living in areas categorised as suffering from severe water stress in 2050. Over the past 25 years 60% of the world's major ecosystems have been degraded or used unsustainably, including through declining soil quality, land degradation and deforestation. By 2050, global terrestrial biodiversity is projected to decline by a further 10% (OECD, 2012a). In agriculture, productivity increases have helped to limit natural ecosystem loss in many countries, but poorly managed intensification has also exacerbated agro-chemical and water pollution, soil exhaustion and salinity (World Bank, 2012a). The costs and consequences of inaction on these environmental challenges are enormous, both in economic and human terms, and could jeopardise further progress in economic prosperity and poverty reduction (OECD, 2008a). Future generations could find themselves significantly disadvantaged and their overall welfare compromised.

In other words, current consumption and production patterns stand in the way of sustainable development, an overarching goal that was endorsed and given political expression by Governments at the United Nations Conference on Environment and Development in Rio in 1992. Now, twenty years later, world leaders will meet again in Rio to renew and deepen their collective commitment to sustainable development at the United Nations Conference on Sustainable Development in June 2012 (Rio+20). In this broader context, inclusive green growth policies can help move towards more sustainable development, poverty eradication and improved well-being for all by promoting concrete, measurable progress in the integration of the economic, environmental and social pillars. This should take advantage of arising opportunities and pay due attention to the costs and risks associated with policies aimed at greening the economy, including the costs of diverting resources from alternative uses. Indeed, addressing these concerns is essential to ensure that green growth is inclusive and leads to sustainable development. In order for green growth policies to gain acceptance, it is key that they reflect, in a coherent and cohesive manner, national environmental, economic and social objectives and recognise that they need to be achieved together. Due attention to the risks and costs of government failure, *e.g.* related to inefficiencies in policy implementation, is also necessary.

Green growth aims to foster economic growth and development, while ensuring that natural assets are used sustainably, and continue to provide the resources and environmental services on which our well-being relies (OECD, 2011a). It is growth that is efficient in its use of natural resources, clean in that it minimises pollution and environmental impacts and resilient in that it accounts for natural hazards (World Bank, 2012a). It emphasises environmentally sustainable economic progress to foster low-emission, socially inclusive development (UN ESCAP, 2010), essential for dealing with climate change, and it is closely related to the notion of green economy aiming for improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities (UNEP, 2011). Specific policies and efforts are needed to ensure that green growth is inclusive and that environmental sustainability is not achieved at the expense of greater equity and poverty alleviation. This report responds to one of the five priorities of the G-20 Mexican Presidency, namely to promote sustainable development, green growth and the fight against climate change.¹

1. G-20 Concept Paper on Green Growth, March 2012.

In this way, green growth is a tool towards the broader goal of sustainable development. It implies a medium- to long-term policy strategy that understands and addresses potential poverty and resource scarcity gaps; provides opportunities for fostering alternate economic, production and livelihood models; and intends to shield development and growth prospects from future resource price volatility, as well as the impacts of environmental degradation. Hence, green growth that is inclusive can help to implement social and sustainable development goals, respectful of national conditions and preferences.

Green growth policies acknowledge that services from the natural environment (or natural capital) are an essential, but often undervalued, input into production together with physical and human capital.² They seek to ensure that such flow of services is used in the most productive way, including through continuous innovation and technical progress, and maintained over time. They also recognise that the consumption of environmental services is an important part of individual and social welfare, both directly and indirectly (*e.g.* via the associated health benefits). At the same time, green and inclusive growth has to demonstrably work towards addressing the pressing challenges of eradicating poverty, improving the welfare for all, and reducing inequalities – these are high on the policy agenda of many countries, and green growth strategies themselves may be difficult to maintain if they cannot be seen as fostering these objectives. A key element for success will be to address obstacles to raising the up-front financing for the necessary technology and infrastructure investments in developing countries. Moreover, green growth will require effective governance, and in some cases this may necessitate improvements in capacity development, including in terms of institutions and business environment.

Opportunities and challenges for structural policy

A large-scale adoption of green growth and sustainable development strategies also has the potential to unlock new growth engines and spur global economic growth (Box 1). In this context, well-designed structural reforms to improve framework conditions for green investment and innovation, coupled with appropriate technology transfer mechanisms, can help drive economic growth. These reforms can contribute to macroeconomic stability and resilience. If properly managed, they can help ensure that broader objectives of poverty alleviation, health, education and other pressing priorities are achieved.

As illustrated in Section II of this report, incentives for innovation, greater efficiency in the use of natural resources, reducing waste and energy consumption can enhance productivity and also contribute to addressing core development challenges such as poverty and resource scarcity gaps. The elimination of wasteful and environmentally harmful public spending and appropriate pricing of pollution and natural resource use, can both create incentives for green investment and innovation as well as generate much-needed fiscal space, through reduced government expenditures and additional government revenue. Clear environmental policies can provide greater predictability and stability for markets and boost investor confidence, while stimulating demand for cleaner technologies, goods and services can open up new markets.

2. Natural capital refers to the stock of natural resources that provides flows of valuable goods and services. Major types of natural capital include agricultural lands; subsoil assets (oil, gas, coal, and minerals); forests; water; fisheries; and the atmosphere. Goods and services provided by natural capital underpin conventionally measured economic growth by providing inputs to agriculture, manufacturing, and services and by increasing the productivity of agriculture and the reliability of infrastructure services through climate control (OECD, 2011a; World Bank, 2012a).

Box 1. Green Growth and sustainable development as a new engine for economic growth

Structural reforms based on green policies and practices can contribute to growth through three channels. First, they can promote *efficiency* and help to increase the amount of natural, physical, and human capital available: Better-managed soil is more productive. Healthier environments result in more productive workers. Well-managed natural risks result in lower capital losses from natural disasters (Hallegatte, 2011). In addition, imposing environmental taxes (taxing “bads”) and removing inefficient subsidies creates fiscal space for governments to lower distortive taxes or subsidise green “goods” such as public transport or access to clean water and sanitation services. In London, congestion taxes, besides reducing traffic, helped to finance investments in the aging public transport system, thereby increasing effectiveness of the price signal by reducing the costs or “disutility” associated with switching from single-car use to public transport (Transport for London, 2008).

Second, green policies can stimulate *innovation*. Well-designed environmental policies stimulate innovation by firms, as measured by R&D spending or patents (Johnstone *et al.*, 2010a; OECD, 2010a; 2011b; 2012b). Surveys of firms in the European Union identify existing or future environmental regulation as the main driver for the adoption of incremental innovations. Green growth can also increase trade in clean technologies, supporting their rapid diffusion internationally.

Third, green policies can increase resilience to environmental shocks (such as natural disasters) or economic shocks (such as spikes in commodity prices), thereby reducing natural resource price volatility and bottlenecks. In this context, dealing with the potential unintended effects of green growth policies on other priorities, such as food security and access to energy, is also essential.

Source: World Bank (2012a); OECD (2011a).

The report provides a toolkit of policy options that are available for countries to draw upon when designing a green growth strategy. This includes:

- Reforms of the *structure of taxes and charges*, with due attention to the pricing of negative environmental externalities, such as polluting emissions and the inefficient use of scarce natural resources.
- Reforms that *improve the working of product markets*, as price signals need well functioning markets in order to provide incentives for reducing such externalities and to spur innovation and investment in cleaner activities.
- Other policies, such as *regulations and standards* and *other approaches to address information failures, measurement issues and behavioural biases* to complement price-based instruments. Putting a price on externalities is an important element, but alone will not be sufficient because under certain conditions pricing will be difficult to implement or the price signal may be weak.
- Conditions for assuring the *right policy framework for greening infrastructure provision*. An appropriate mix of market and non-market instruments is especially important in network infrastructure sectors, which are critical for delivering green growth and sustainable development.
- *Innovation policies*, as technological progress is a key lever for fostering green growth and sustainable development. In this context, the rapid diffusion of green goods, services and technologies worldwide will be particularly important. Therefore, there is a crucial role of *trade and international investment policies*.

- Broader *social policies* to better harness the synergies and minimise the possible tradeoffs between social, economic and environmental objectives, including reviewing *labour market policies* that can facilitate the transition to a greener and more inclusive economic structure.

In evaluating the key elements of green growth policies, it should be kept in mind that the design of policy packages will vary according to each country's conditions and level of development, political economy considerations and social preferences. Market conditions will also need to be taken into account in policy design. For instance, intergenerational transfers that could improve the well-being of both current and future generations may fail to take place in countries with less-developed financial markets. Furthermore, the design and implementation of policies often raises governance issues that differ across countries. Difficulties in monitoring environmental performance and compliance, collecting green taxes or setting up new markets may influence the choice of policy instruments in countries with large informal economies and where there is weak capacity in environmental policy design or implementation. Finally, distributional effects may play an equally important role in policy development.

At the same time, the political and social challenges of promoting green growth and sustainable development cannot be under-estimated. Shifting to a green economy will require a radical transformation of the present economic development model (OECD, 2011a). Like all transformative processes, this shift is likely to change the short-term and long-term comparative advantages of countries, industries and population groups. Green growth and sustainable development will also require behavioural changes (World Bank, 2012a). In the short run, some aspects of the transformation may generate costs and trade-offs among alternative policy objectives as well as potential political and social opposition from adversely affected constituencies, even if the sustainability and well-being gains are undeniable over the long run. Consideration of the potential costs and risks associated with green structural reforms need to be adequately reflected in their design and timing.

An essential component of green growth strategies will be a smooth transition - for example to protect poor households who may be affected by pricing or subsidy reforms; help diversify their livelihoods towards more sustainable models; continue to develop social safety-nets where they are insufficient, *e.g.* in developing and some emerging market economies; and minimise skill bottlenecks by supporting training and job search for affected workers (OECD, 2012c). Indeed, the transition to greener growth will not *per se* help reduce poverty or improve the well-being of the disadvantaged, many of whom – small farmers, fisher-folk, pastoralists, rural women – have lives that are closely linked to environmental resources. These groups must be supported and investments in human capital formation maintained to ensure that greener economies are also those where the recent increasing trends in improving the welfare of all can be continued and even accelerated. To this end, any unintended side-effects of such measures should be duly considered in designing policy, such as the possible repercussions of use of agricultural sources of energy (*e.g.* for biofuels) for commodity markets.

This report draws extensively on existing or forthcoming work by the OECD, the World Bank and the UN,³ The remainder of the report is organised as follows. Section II identifies the broad elements of a policy strategy that would allow countries to keep moving towards inclusive green growth, and how they might be combined as part of structural policy packages tailored to different sets of national circumstances and levels of development. Section III undertakes a stocktaking of existing green growth and sustainable development policies in G20 countries. This is based largely on self-reporting by the G20 countries in response to a questionnaire circulated as part of this analysis. It also includes other relevant submissions – for example, as part of the G20 Mutual Assessment Process (MAP) and reporting on progress in phasing

3. In particular, the report makes extensive use of *Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication* (UNEP, 2011), *Towards Green Growth* (OECD, 2011a) and *Inclusive Green Growth: The Pathway to Sustainable Development* (World Bank, 2012a).

out inefficient fossil fuel subsidies that encourage wasteful consumption, country reporting under the Commission on Sustainable Development – as well as comparative data and/or reviews of relevant policies in G20 countries. Finally, Section IV presents a non-prescriptive toolkit of policy options that G20 countries can draw upon to further integrate green growth policies and sustainable development within their own structural reform agendas.

II. Broad Elements of Structural Packages to Promote Green Growth and Sustainable Development

Structural packages that will contribute to more sustainable development need to be tailored to specific national circumstances, priorities, and level of development. This section outlines some broad elements common to such packages, that countries may choose to incorporate, on a voluntary basis. Structural reform policies are reviewed in the context of green growth, that is, in the light of how growth-oriented reforms can be better designed to benefit the environment, bearing in mind the potential social impacts, and how environmental reforms can be made more cost-efficient, while exploiting opportunities to promote economic growth and sustainability together. Considerations are also given towards how to balance the potential trade-offs among policy objectives that are likely to arise, and how an appropriate design of policies can ensure that objectives such as eradicating poverty, reducing inequalities and continuing to improve the well-being of all can be met.

Politically successful measures will likely strike a balance between the above considerations, including by correcting for any adverse distributional impacts. Some of these measures can be compensatory, for example low-income households could be compensated for the withdrawal of inefficient energy subsidies that encourage wasteful consumption through targeted transfers and with skills training to be able to transition to more sustainable livelihoods. Other measures, such as those aimed at facilitating the adoption of energy-efficient lighting and less polluting cook stoves, can have direct social benefits.

Reforming the structure of taxes and charges to promote economic growth and make it greener

A fiscal reform in G20 countries that would benefit economic growth, social inclusion and environmental outcomes will entail changes in the tax structure, increased emphasis on environmental taxation and a review of tax expenditures and potentially inefficient and environmentally harmful subsidies.

As recognised in the context of the Mutual Assessment Process (MAP) exercise, tax structures excessively focused on production factors such as labour and capital may provide insufficient incentives for saving, investment and employment, while a shift towards immovable property and consumption taxes, and greater use of environmentally-related taxes, can stimulate economic growth and job creation (OECD, 2010b; Arnold *et al.*, 2011a; G-20, 2011). There is a significant potential to reduce the growth-distorting nature of tax systems across G20 countries. Several countries make less use of recurrent taxation on immovable property (*e.g.* Argentina, Brazil, Germany, Mexico and Turkey) or of taxes on the consumption of goods and services (*e.g.* Canada, Italy, Japan, and the United States) (OECD, 2011c).

Reducing inefficient tax exemptions or reductions and direct budgetary subsidies can help minimise economic distortions and broaden the tax base, and can also benefit the environment where these measures encourage pollution or wasteful resource use. At the same time, the social objectives of many tax expenditures can often be pursued more efficiently via better-targeted spending measures, in particular to support low-income households, as many across-the-board tax expenditure measures (tax exemptions or reductions) tend to predominantly benefit middle and high-income households.

Better pricing of environmental externalities can encourage sustainable production and consumption patterns, environmentally-friendly innovation, more efficient use of resources and energy, as well as contribute to improved health outcomes through a cleaner environment, with positive repercussions for human capital, labour productivity, and reduced health-related expenditures. Pricing allows the social cost of environmentally-harmful activities to be reflected in private decisions. At the same time, part of the expenditures reduced by removing inefficient and environmentally-harmful subsidies and the revenues generated by pricing externalities can be used to help lower other taxes to limit distortions or soothe possible adverse distributional consequences of the reform through targeted social transfers to poor households, which is a more direct and less expensive form of support than generalised consumption subsidies (e.g. to water or fuel use) as further discussed below. This new fiscal space can also be used to finance the adoption of less polluting and more efficient household energy sources, particularly for the poor, as well as other critical priorities, such as health, education, or infrastructure development. Policies may also be needed to facilitate a transition to new, more environmentally sustainable livelihoods for some poor communities, for example where previous livelihoods relied on unsustainable exploitation of natural resources.

Phasing-out policy-induced distortions that are damaging to growth and the environment

Removing inefficient policy-induced tax distortions that are detrimental to both the environment and growth is a key element of the green growth and sustainable development agenda. Across many G20 countries, governments continue to support a number of activities that encourage pollution, waste or over-use of natural resources (see, for example, Box 2). Removing such inefficient subsidies can improve the functioning of price signals and markets, reduce pressures on public budgets, while benefiting growth, innovation and the environment. This would help restore a level playing field, promoting investments based on their full costs and benefits.

Many G20 countries subsidise electricity and water consumption, which provides the wrong incentives for more efficient use of these resources and may hamper critical infrastructure investment. For instance, when the consumer subsidies are provided indirectly through regulated below-cost prices, electricity and water supply companies may lack the necessary financial resources to invest in infrastructure quality and expansion, leading to reduced quality of service and minimising incentives for expanding access to those not yet connected. With 884 million people lacking access to clean water worldwide and 1.3 billion lacking access to electricity, more efficient use of scarce government funds could improve the development prospects of many. In developing and some emerging economies, where electrification is not yet complete, this is likely to increase reliance on small fossil-fuel generators, which are less efficient and increase local pollution (World Bank, 2012a).

Inefficient fossil fuel subsidies that encourage wasteful consumption can contribute to price volatility by blurring market signals, encourage fuel smuggling, and lower the competitiveness of energy efficient and renewable energy technologies (IEA, OPEC, OECD and World Bank, 2011). Often, energy subsidies can be inefficient in meeting their intended objectives: alleviating the cost of energy for the poor or promoting economic development. In fact, the estimated annual investment to achieve universal access to modern sources of energy⁴ is less than one-eighth the cost of annual subsidies for fossil fuels (UN, 2011a). In this light, G20 countries have already drawn up national action plans to rationalise and phase-out over the medium-term inefficient fossil-fuel subsidies that encourage wasteful consumption.

4. The definition of modern energy access used here refers to a household having reliable and affordable access to clean cooking facilities, a first connection to – and subsequently an increasing level of – electricity consumption over time to reach the regional average. For further details, see Box 1 in IEA (2011). For the calculations, refer to Chapter 4 in UN (2011a).

Box 2. Fossil-fuel support

Many countries provide sizable support to the production or use of fossil fuels. This includes government policies that provide direct budgetary subsidies, intervention in markets that affect costs or prices, assumption of a part of companies' financial risks, tax reductions or exemptions, and under-charging for the use of government-supplied goods, services or assets.

In OECD countries, these measures are estimated to have had an aggregate value in the order of USD 45 billion to 75 billion annually over 2005-2010 (OECD, 2012d).⁵ Using the price-gap approach, the IEA estimates that subsidies to fossil fuel consumption in emerging and developing economies amounted to USD 409 billion in 2010 (IEA, 2011).

Inefficient fossil-fuel subsidies that encourage wasteful consumption are economically costly to taxpayers, can damage the environment through increased emissions of greenhouse gases and other air pollutants, and by distorting the energy mix. Withdrawing such subsidies in emerging and developing countries by 2020 would reduce global energy demand by around 4% and by 5% until 2035 (IEA, 2011). CO₂ emissions would be reduced by 6% in 2035 compared with business-as-usual, and there would also be co-benefits, notably positive health and other effects from reduced emissions of NO_x and SO_x.

At the same time, reforming these subsidies could free up scarce government resources to more directly target social objectives. Several studies have also found that subsidies to fossil-fuel use tend to benefit high-income households more than the poor, due to the former's higher per capita consumption levels (World Bank IEG, 2008). According to the IEG study, the bottom 40% of the population in terms of income distribution received only 15-20% of the fuel subsidies in developing countries. Similarly, a study by del Granado *et al.* (2010) found that in 20 developing countries, the 20% richest households capture 43% of such subsidies.⁶

As it is clear that fossil fuel subsidies to consumers are generally not efficient in achieving their intended social objectives, their removal is likely to lead to overall welfare gains. Still, the practical design and implementation of such reforms have to take into account the social considerations and political economy challenges. These include responding to: opposition to reforms by negatively affected stakeholders (i.e. those who benefit from the subsidies); a potentially low level of public trust in the reform agenda; lack of information about the benefits of subsidy reform among concerned parties; and constraints relating to institutional and administrative capacity (IEA, OPEC, OECD, and World Bank, 2011). Key factors that have been identified in successful reform efforts include increasing the availability and transparency of subsidies data, and a credible commitment by the government to compensate vulnerable groups. Compensation to low-income households or vulnerable groups affected by reforms can be provided through direct cash transfers, changes to social-assistance transfers, or connection subsidies, which benefit only the poor and increase the overall efficiency of energy use (World Bank, 2012a). An important challenge in designing such means-tested compensation measures is to assure that financial incentives to work or move up the income ladder remain sufficiently strong.

Several countries also subsidise other sources of energy, such as nuclear and renewables, and reviewing such subsidies would ensure that they meet their policy goals effectively and efficiently.

Source: IEA, OPEC, OECD and World Bank (2011), IEA (2011), OECD (2012d), and World Bank (2012a).

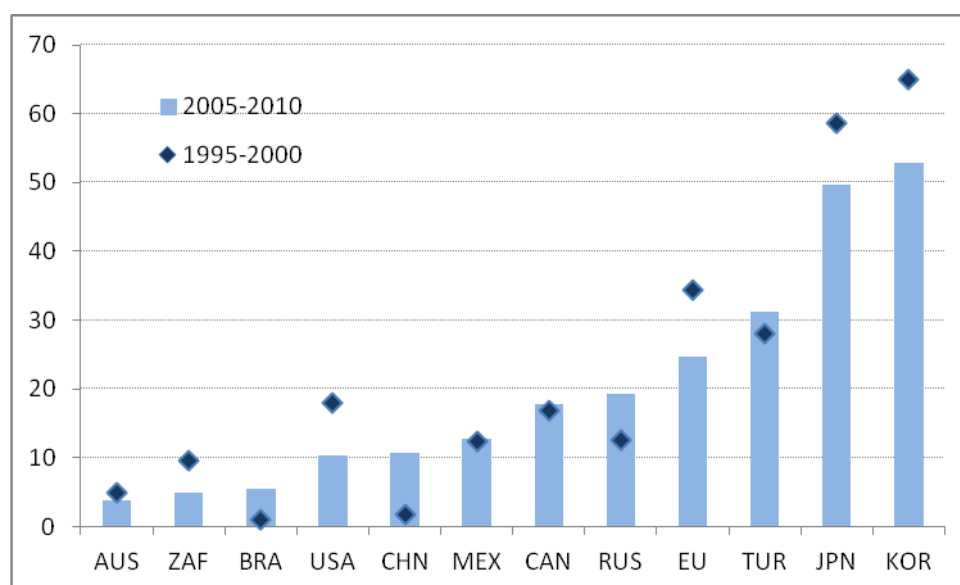
In a similar manner, some kinds of direct subsidies and other support measures to the agricultural and fisheries sectors – especially if not properly targeted or designed - may obstruct the allocation of scarce

5. Caution is required in interpreting the support amounts and in aggregating them. This is particularly true as the majority of support mechanisms identified in the current inventory are tax expenditures. The aggregates are arithmetic totals which do not take into account potential interactions that could affect the financial impact if multiple measures in a country were to be eliminated concurrently. See OECD (2012d), for more information.
6. In a review of energy subsidies across more than 30 countries, del Granado *et al.* (2010) estimate that it costs USD 33 to transfer USD 1 to poor households through a gasoline subsidy. The figure is that high because the vast majority of gasoline is consumed by higher-income households.

resources to more productive activities, and increase the pressures on the environment, for instance through higher greenhouse gas emissions, nutrient balances, resource depletion and increasing the pressures on land and water resources (OECD, 2005a). While considerable progress has been made in some countries and regions in delinking agricultural producer support from production (*e.g.* European Union, Japan, Korea), this support remains high in many G20 countries. In OECD countries, support to agricultural producers amounted to USD 227 billion in 2010 (OECD, 2011d). Support to agricultural producers seems to follow a different trajectory in some emerging and developing economies (Figure 1). A number of countries that support biofuels production are also rethinking the pros and cons of their approaches. Action to identify and tackle inefficient agricultural or fisheries subsidies could contribute to growth by facilitating a more efficient allocation of resources and reduced waste, and to better environmental outcomes. The potential impacts on other policy objectives, such as food and nutrient security, should be considered in the reforms.

At the same time, it must be recognised that the various support measures benefit certain constituents and may prove politically difficult to remove, although the extent of such opposition is likely to vary in different contexts. As countries decide on how to move towards reducing – and ultimately eliminating – inefficient subsidies, they would need to carefully consider how to address potential distributional effects, for example through phased compensation measures, and ensuring that support to those most in need is provided through more effective means.

Figure 1. Agricultural producer support estimates in selected G20 economies
(as share of gross farm receipts)



Note: Producer Support Estimate (PSE): the annual monetary value of gross transfers from consumers and taxpayers to agricultural producers, measured at the farm gate level, arising from policies that support agriculture, regardless of their nature, objectives or impacts on farm production or income. Gross farm receipts are the total value of production (at farm gate) plus transfers received. Certain forms of transfer include subsidies that are not harmful for environment. 1995-2000 figures for Russia may reflect the effects of the financial crisis in this country.

Source: OECD Producer and Consumer Support Estimates database.

Economic incentives to encourage efficient use of natural resources and reduce pollution

Taxes or cap-and-trade schemes are generally cost-effective ways to close the gap between the social and private costs of market activities that is generated by environmental externalities. However, poor design or inefficient implementation of these or any policy measures can weaken their cost-effectiveness and

increase the social cost of achieving the intended policy outcomes. Market-based approaches include taxes or charges on pollution, natural resource use or access to national parks, and deposit-refund systems that encourage recycling and waste reduction and improve environmental awareness. Pricing pollution and natural resource use gives consumers and producers clear incentives to search for ways to reduce the negative environmental effects of their activities, while allowing them to choose how best to do so. When a given pollutant is uniformly priced across the economy abatement costs will tend to be minimised. Examples from energy regulation cited by Anthoff and Hahn (2010) show that the overall costs of compliance with environmental pricing instruments may be considerably lower compared with achieving the same objective through alternative instruments, such as rules and regulations. Appropriate pricing of natural resource use can also help to address scarcity issues. For instance, Grafton and Ward (2010) found that mandatory restrictions on water use and costly and untimely investment in desalination facilities in Sydney, Australia led to welfare losses valued at hundreds of millions of dollars per year relative to an alternative scenario in which scarcity prices would have been implemented earlier, providing better signals to consumers to use water efficiently and leading to a reduced and more manageable demand without necessitating a desalinisation plant.

As a result, price-based instruments are powerful tools in encouraging a more sustainable exploitation of natural resources - such as mineral, forest or water resources and fishing stocks - and reducing landfill waste. For example, an OECD survey of 10 000 households across ten countries⁷ found that, on average, households that paid for the volume of water they actually used were likely to use 20% less water than those who did not (OECD, 2011e). In total, over one-third of OECD countries have reduced their total water use since 1990 (OECD, 2008b), in part due to more effective water-pricing schemes.

Appropriate pricing can also help to raise the financing needed to improve access to basic services. For instance, Colombia achieved near universal access to basic services (water, electricity and sanitation) partly through a series of policy reforms that included bringing tariffs towards cost-recovery levels (World Bank, 2012a; Box 3).

In some cases, subsidising environmentally beneficial activities can ensure that public goods are provided that otherwise would not be provided through normal markets forces. For instance, in the late 1990s New York increased water fees to invest in a land and forest protection strategy to protect water supply in upstate watersheds, compensating farmers and forest producers to curb environmentally harmful activities and improve land and forest management: this resulted in substantial savings for New York City as compared with putting in a water treatment plant (Salzman, 2005).⁸ The Brazilian Water Producer Program offers an example of a payment for environmental services scheme where water users pay for the benefits provided by small farmers who protect water bodies in their lands.⁹

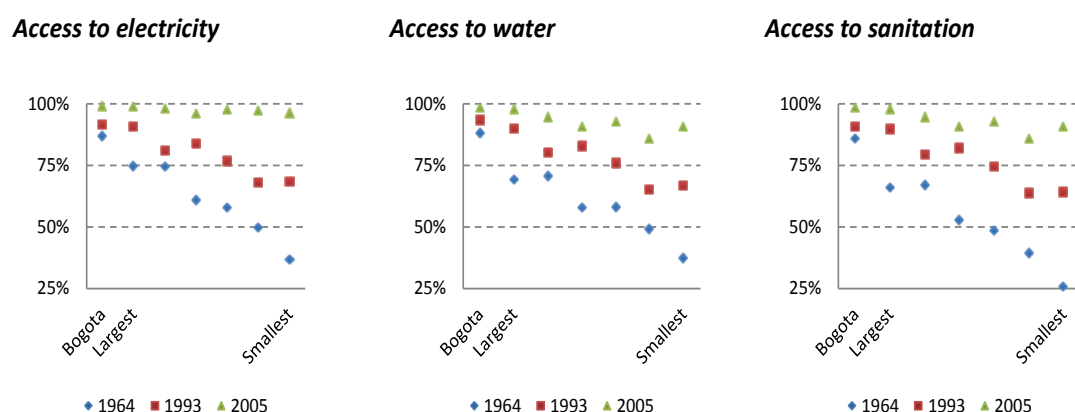
-
7. The countries covered by the survey include: Australia, Canada, Czech Republic, France, Italy, Korea, Mexico, the Netherlands, Norway and Sweden. Household sampling was guided by a number of criteria, including income, age and gender.
 8. The strategy's start-up cost was estimated at USD 1 to 1.5 billion over ten years, as opposed to USD 6-8 billion, plus an annual USD 300-500 million operating costs, that would have been required for a treatment plant.
 9. Currently, twenty projects are being implemented under the Program - six located in water supply areas of state capitals - benefiting a total surface area of 250 000 hectares, and more than 500 farmers, who received payments for environmental services rendered. The program is based on market development, with broad participation of society/water users, as buyers of environmental services, focusing on sustainability requirements and small dependence on public resources.

Box 3. Improving access to basic services through adequate pricing in Colombia

In 1964, only 50% of people in Bogota and other large cities had access to electricity, water, and sanitation (Figure 2). And coverage rates were even worse in smaller cities (about 40% for water and electricity and 20% for sanitation). Today, Colombia has almost universal access to basic services in cities of all sizes. But achieving convergence took more than 40 years.

Figure 2. Access to basic infrastructure services has risen dramatically in Colombia

(access to services, by city size, 1964–2005)



Source: Authors' calculations based on data from the Colombia's National Administrative Department of Statistics (DANE) census 1964, 1993, and 2005.

How did Colombia achieve near universal coverage? The key was a series of policy reforms in the 1990s that brought tariffs toward cost recovery levels. In the water sector, average residential tariffs per cubic meter were increased from USD 0.33 in 1990 to USD 0.78 in 2001 (World Bank, 2004). With almost 90% of households having metered connections, the price increase triggered a decrease in household water consumption from 34 to 19 cubic meters per month over the same period—in the process reducing the need for major new infrastructure. But even with higher prices, water remains relatively affordable for the average household. The tariff structure allows the Colombian government to cross-subsidise the poorest consumers from richer households and industrial users. As a result, the average household was spending less than 5% of its income on utility services by 2004.

Source: World Bank (2012b).

Subsidising environmental “goods” may be desirable in some cases, but it is challenging. Subsidies generally need to be financed, often via potentially distortive tax revenues, and they carry a risk of generating a significant and unnecessary cost (for example subsidising more environmentally-friendly actions that might be undertaken even without the support). Moreover, the effectiveness of subsidies depends on the ability to substitute easily the subsidised activity for the dirty counterpart. And environmentally-motivated subsidies are often provided based on the use of specific technologies or goods, and thus tend to hamper incentives for innovation and lock-in existing technologies which may no longer remain the cleanest option. Where environmentally-motivated subsidies are used, technology neutrality, careful targeting and clear timelines for phase-out can encourage focus on cost-effectiveness.

While environmental taxation and cap-and-trade systems can be cost-effective, their implementation may be difficult when the institutional capacity to implement them is weak or the political resistance to them is strong, for instance due to a fear of potentially adverse distributional or competitiveness effects or due to vested interests. In these cases, alternative instruments might be more effective at least initially until these challenges can be overcome. Other measures, such as standards and regulations described below, will also be needed when markets do not work properly or price signals are ineffective. Moreover, in many developing countries, where the livelihoods of the poor are intimately connected to the environment, promoting a more efficient use of natural resources must be accompanied with approaches that enable these populations to adopt more sustainable livelihoods (OECD, 2005b). Indeed, with natural capital accounting for an estimated 26% of total wealth in low-income countries – as compared with 13% of wealth in middle-income countries and 2% of wealth in advanced economies – improved natural resource management will be crucial for their long-term economic growth (World Bank, 2006 and 2011a; OECD, 2009a). At the same time, although developing countries currently contribute only minor shares to global greenhouse gas (GHG) emissions, their populations are amongst the most vulnerable to the impacts of climate change.

Strengthening markets

Improving the functioning of markets is, however, an important condition for implementing cost-effective green growth and sustainable development policies. Enhancing competitive pressures through product market reforms may facilitate green growth and sustainable development by encouraging more efficient resource use and improving the functioning of price signals. At the same time, providing adequate regulation, incentives, support and opportunities for investment in network sectors (*e.g.* energy, water and transport) is crucial for ensuring cleaner and more inclusive growth and development. Network sectors are often considered the backbone of the economy, and are critical for ensuring inclusive green growth, underscoring the importance of ensuring the right framework policies in this area, in particular regarding investment incentives. Indeed, in a number of emerging and developing economies, there is an important development aspect of easing access to and investing in infrastructure expansion.

A prerequisite for well-functioning markets is that property rights are well-defined, transparent and protected. Indeed, this in itself can in some cases significantly improve the management of natural capital. For instance, rights on land ownership and water access can help with the protection of biodiversity, reduce deforestation and over-grazing, and secure more sustainable use of water resources. The use of individual transferable quotas (ITQs) in fisheries is one example of how establishing property rights over resources that had previously been open access can dramatically improve efficiency and sustainability in the use of resources (OECD, 2011f), even though defining and enforcing these rights remains a challenge in some cases (Box 4).¹⁰ Thus, a fundamental aspect of integrating environmental concerns into framework policies

10. High-sea capture fisheries (beyond the exclusive economic zone) are dominated by large commercial vessels, which are often largely unregulated, overcapitalized through subsidies or both (World Bank, 2012a).

is to provide the legal and institutional basis to attribute those property rights that can play a vital role in the protection of environmental assets

Once property rights are assigned, if the price signals are set appropriately, market competition can help to spur innovation that raises natural resource productivity and lowers the costs of future pollution abatement. As much innovation, especially of the kind that is needed for green growth and sustainable development, is performed by new entrants, an important aspect of pro-competitive reforms is the streamlining and reduction of start-up regulations and administrative burdens that inhibit entry and exit into markets. Empirical research has shown that, among other things, rigidities in product markets can inhibit the reallocation of resources across incumbent firms, specifically from low to high productivity firms, which can be an important hindrance to green growth and sustainable development as capital and labour need to be shifted from high polluting to low polluting activities (Arnold *et al.*, 2011b).¹¹

Box 4. Establishing property rights in fisheries through ITQs

Lack of property rights in the sea has led to overfishing — in some cases with devastating results (World Bank and FAO, 2009). The use of individual transferable quotas (ITQs) can correct this market failure, increasing both output and employment in the fishing industry.

ITQs operate by setting a cap on the total allowable catch (TAC). The cap is set at a level that is consistent with the long-term survival of the species (that is, less than the rate of growth of the fish stock). Once a TAC is set, it is divided into individual quotas, the amounts that particular boats or skippers can catch. Only quota owners are allowed to fish. If the TAC changes from year to year, the number of tons represented by the quota also changes, but the fraction of the TAC assigned to individuals does not. These quotas are transferable: they can be sold, given, or bequeathed to others.¹ The ITQ system provides an incentive for quota owners (fishers) to invest in the long-run health of their fishery. Aligning the interests of fishers and the fishery, generally improving both the health of the fishery and the profits of the men and women who depend on it.

In studies of more than 11 000 fisheries, 121 of which had instituted ITQs, Costello *et al.* (2008) and Heal and Schlenker (2008) find a substantial increase in catch within a few years of the implementation of ITQs and a significant decrease in the chance of a fishery collapsing once it is managed as an ITQ. On average, within 17 years of implementing an ITQ, the catch at fisheries with ITQs rose by a factor of five. The institution of ITQs allows fisheries to prosper, generating better livelihoods for the people who work in them and more food for the world as a whole.

A related approach is that of “catch shares,” under which each boat or owner is entitled to a share of the TAC but the shares are not transferable).

However, such market-based instruments are not limited to any single instrument (like the ITQs above) but represent a continuum of instruments based on defining access rights to fisheries resources characterised by different levels of property rights characteristics (OECD, 2006a). These characteristics (*i.e.* exclusivity, duration, quality of title, transferability, divisibility and flexibility) are bundled together in different combinations to reach different management and societal objectives.

Source: World Bank (2012a),

Another reason for focusing on easier access to markets in the context of green growth and sustainable development is that environmental policy itself may raise entry and operational costs for businesses. For instance, environmental regulation or market-based instruments impose a cost that decreases as companies learn to comply and take-back obligations may require additional investment to be fulfilled. Similarly,

11. Arguably, it is the most productive and innovative firms that will be able to comply with policies aimed at internalising the social costs of pollution.

technology standards based on incumbent production processes may make the deployment of new technologies more difficult. While these requirements tend to spur a selection process that will favour *ceteris paribus* the most productive firms, the fact that some of these policy-induced hindrances may be inevitable reinforces the need to assure that all other, unnecessary barriers and costs are minimised.

Inducing greener behaviour through regulatory and information policies

Reliance on markets and market signals is not sufficient for encouraging green growth because sometimes markets do not exist or cannot easily be induced to work properly. Market failures – such as natural monopolies, missing markets, coordination failures, indivisibilities, network effects, information asymmetries, knowledge spillovers or behavioural biases (such as those due to habits, lack of awareness or preferences) - can undermine the incentives embedded in price signals. In other cases, changing prices, removing inefficient subsidies or increasing taxes may be politically difficult.

In such situations, a broader toolkit will be needed to achieve the economic transformation and implementing other measures, such as rules and regulations or information initiatives, is essential, though their implementation should aim to preserve cost-effectiveness and environmental integrity. To this end, stakeholder consultation, integrated assessment of the economic, social and environmental impacts of policies and ex post policy evaluation are useful tools. One area in which an appropriate mix of price and non-price measures is particularly needed is in infrastructure and network sectors, where market failures are pervasive and which play a key role in determining the extent to which inclusive green growth is possible (see next subsection for a detailed discussion).

Regulatory measures can also be important when a precise pollution or resource use limit needs to be met, for example regarding the use or release of toxic chemicals. They can also be attractive when emissions cannot be measured or monitored at reasonable cost (such as when pollution sources are small and diffuse, such as is the case with agricultural run-off of pollution), and no input or output exhibits a sufficiently close and stable relationship with the pollutant to serve as a proxy. In some cases, for example in countries where the institutional framework is not sufficiently developed to implement pricing measures (*e.g.* property rights are weak or competition is not sufficient), regulatory policies may be needed during a transition period until the necessary institutional capacity can be established.

Regulatory policies generally do not lead to the equalisation of abatement costs across different actors, however, and hence may not minimise the costs of achieving a given environmental goal. Therefore, in order to keep the costs of action low, it is important that these policies are designed so as to provide, as much as possible, producers the flexibility to choose how and where to abate pollution. One of the reasons why regulatory policies are frequently chosen is that the compliance costs of regulation may be less visible than those of direct pricing of pollution and resource use. While this may facilitate their implementation politically, the fact that regulatory policies are often not least-cost approaches may risk imposing higher implicit costs on the economy than pricing approaches. Cost-benefit (or cost-effectiveness) analysis is therefore particularly important in this area.

Rules and regulations often take the form of performance standards (*e.g.* setting a target on emission levels or energy consumption efficiency) or technology standards (*e.g.* imposing the use of a specific product or technology). As policy tools, performance standards are generally preferred to technology standards, as they provide flexibility in how consumers and producers choose to meet the standard and encourage cost-effective innovations. Performance standards can be effective, provided that enforcement can be reliably verified and the system allows flexibility in terms of searching for lowest-cost alternatives. An interesting example is the ‘Top Runner Programme’ in Japan, where the government finds the best-performing product on the market and then uses this as the baseline for discussions with industry to define energy consumption efficiency targets (de Serres *et al.*, 2010).

More generally, a combination of performance standards and subsidies can come close to replicating the set of incentives provided by a price-based mechanism, though they may not be cost-effective. For instance, *green certificates* in electricity (also known as *renewable energy certificates*) are akin to an implicit tax on fossil-based energy coupled with a subsidy to renewable energy. If the administrative costs of monitoring compliance with performance standards are too high, policymakers may opt for technology standards. This, however, inhibits incentives to look for cheaper abatement options and to innovate, and may lock-in technologies that may not remain cutting-edge in terms of efficiency or may never become economically viable without subsidies. Policy-makers can dynamically adjust the standards as new technologies become available, but this increases both compliance and administration costs. Finally, sorting and recycling obligations, common in many G20 countries, can be attractive in encouraging waste recovery and reducing landfill, in part as they may have lower administrative costs than market-based measures such as deposit-refund schemes. While not particularly flexible, they can improve consumer awareness and reduce land fill rates.

Regulatory reform can also be effective in aligning incentives of different agents, to overcome market failures that hamper the adoption of cost-effective environmentally-friendly action. For instance, even where the pay-off in terms of reduced energy costs outweighs the cost of energy efficiency investments, these investments are often not realised for rented housing because of principal-agent problems. While the tenant is subject to the signal coming from energy prices, they are often unable to make the investments as they do not own the building. On the other hand, the landlord may be unwilling to make the investment if there are limited possibilities for them to recuperate the benefits themselves (the tenant benefits from the reduced energy charges). This can lead to suboptimal levels of investment in energy saving. Provisions in rental regulations for sharing the investment costs and the savings of such investments can be found in Germany and France (World Bank, 2012a). In this case, standards – such as those embodied in building codes – will also help exploit cheap abatement opportunities, which would otherwise not be seized due to the various market failures. The upfront adoption of energy efficiency building codes will be particularly important in countries and regions experiencing urbanisation and rapid construction development, to avoid the lock-in of energy-inefficient buildings and infrastructure for decades to come.

Information provision is also an essential part of the policy mix to help shift consumer behaviour. This can take the form of public campaigns to increase awareness, or mandatory labelling of products (such as for the energy or water use efficiency of household appliances). Some types of voluntary approaches also aim to improve information on the environmental performance of products. If designed appropriately, labelling schemes can complement environmental taxes and charges, enabling agents to better respond to the price signals. The challenge is to design these measures in a way that minimises the distortions to innovation incentives and competition, and to ensure that they do not constitute an inappropriate barrier to trade.

Policies focused on educating consumers also have a potential for encouraging more environmentally-friendly behaviour. For example, concern for the environment can be a key driver of water use reductions and increases the willingness to invest in energy efficiency of housing (OECD, 2011e). Behavioural patterns depend on a variety of factors, including habits and lack of awareness, and sometimes small and often cheap measures (such as those informed by social psychology) can go far in greening them (World Bank, 2012a). Nudging of consumers into more environmentally-friendly behaviour can be done, for example, by better informing them of the environmental consequences, economic costs or health risks of their actions, *e.g.* through more visible water or energy metering, or by making environmentally-friendly options the default option from which consumers have to explicitly opt-out ('green default', Pichert and Katsikopoulos, 2008). Other examples include public disclosure programmes, in the manner of "naming and shaming". These increase pressures on polluters via the output market (through the demand for firms' products), input market (the demand for shares of traded companies or ability to hire and retain employees), judicial (encouraging citizens to sue polluters) and community pressure for regulatory change (building consensus for more effective policies and enforcement) as well as by raising managers'

awareness about the company pollution and their importance (Tietenberg, 1998; Blackman *et al.*, 2004; Powers *et al.*, 2011, as cited in World Bank 2012a; see also Box 5).

Partly to respond to consumer and shareholder demand, some companies agree to voluntarily improve their environmental performance. Such voluntary approaches include, for example, self-reporting commitments, or commitments to reduce discharges. They have positive aspects such as contributing to information gathering and dissemination concerning abatement costs and benefits, and providing high political incentives for compliance. However, they do not provide an intrinsic mechanism for ensuring that environmental targets are obtained at least-cost, their effectiveness in addressing environmental concerns often varies, and they can be detrimental to competition as they are generally negotiated amongst existing firms (de Serres *et al.*, 2010).

Box 5. How are Performance Evaluation and Ratings Programmes faring in developing countries?

Performance evaluation and ratings programme (PERPs)—which are increasingly being used throughout the world—appear to generate environmental benefits. Indonesia’s Program for Pollution Control, Evaluation, and Rating (PROPER) spurred significant emissions reductions in wastewater discharges (García *et al.* 2007, 2009). A qualitative evaluation of PERPs in China, Indonesia and several non-G20 emerging economies found that in all programmes examined a large number of plants initially rated “noncompliant” rose to “compliant” over time (in contrast, plants rated “flagrant violators” and “compliant” tended to remain in these categories) (Dasgupta *et al.* 2007). This evidence is consistent with the findings of other studies that concluded that performance ratings led to improvements among plants with moderately poor performance records but not among plants with either very bad or good records (García *et al.*, 2007; Powers *et al.*, 2011).

Source: World Bank (2012a)

Getting infrastructure “right”

Getting infrastructure “right” is at the heart of green growth and sustainable development. The large majority of G20 countries have identified improving infrastructure as part of their structural policy agendas. Many of the large infrastructure investments are associated with network sectors, such as transport, energy, water and sewage. Adequate infrastructure provision and management in water, transport, energy and sewerage can help resolve environmental pressures such as local air or water pollution or pressures on land use. Underinvestment, on the other hand, can undermine sustainable development efforts. The poor suffer most from the implications of insufficient or poor quality infrastructure which also hamper efforts to promote environmentally-friendly consumption behaviour. Examples include ageing and poor quality water infrastructure with significant leakage from pipes (Box 6); inadequate public transport systems which encourage the use of private car transport and increase local air pollution; and poor electricity grid quality, which can hamper the penetration of electricity from renewable sources and encourage the use of back-up diesel generators.

Further, infrastructure choices have long-lived and difficult-to-reverse impacts on the resource and pollution intensity of future patterns of development (Table 1). Infrastructure decisions can also create substantial inertia in socio-economic systems because the economic system reorganises itself around infrastructure. A delay in greening investments may therefore prove extremely costly if it locks countries into inefficient technologies (due to their excessive land, water or emission intensity) or patterns of development that prove vulnerable to changing climatic or other environmental conditions. Indeed, a key challenge is to make infrastructure both resilient to climate change (rising temperatures and sea levels, more frequent extreme weather events) and as resource efficient and low-emission as possible (World

Bank, 2010a; OECD, 2012e).¹² Environmental Impact Assessment (EIA) of major infrastructure investments can help in this sense, including to enhance the climate resilience of infrastructure if the EIA guidelines are suitably adjusted (Agrawala *et al.*, 2010).

Table 1. Infrastructure sectors can have a long time frame
Typical investment life in selected infrastructure sectors in years

Sector	Time scale
Water infrastructures (e.g. dams, reservoirs)	30–200 yr
Land-use planning (e.g. in flood plain or coastal areas)	>100 yr
Coastline and flood defences (e.g. dikes, sea walls)	>50 yr
Building and housing (e.g. insulation, windows)	30–150 yr
Transportation infrastructure (e.g. port, bridges)	30–200 yr
Urbanism (e.g. urban density, parks)	>100yr
Energy production (e.g. nuclear plants)	20–70 yr

Source: Hallegatte, 2009

Especially in developing economies, the challenges and opportunities of greening infrastructure should be seen in the context of the rapid development, urbanisation and expansion to take place in the coming years. The fact that much remains to be built makes it possible to build more efficiently and in a more environmentally-friendly way. A case in point is urban forms, which are extremely difficult to modify when cities are built. With most of the infrastructure and cities expected to be built in the next few decades, existing energy-efficient technologies can cost-effectively reduce by at least 30% energy use in new buildings (World Bank, 2012a).

Infrastructure investment needs are particularly large in developing countries where some USD 1.0–1.5 trillion annually, or 7% of developing country GDP, are considered necessary to address both growth and social objectives (Fay *et al.*, 2010a). Advanced economies also face mounting challenges and opportunities in greening their infrastructure. Ageing water, transport and energy infrastructure that currently lock-in polluting and natural resource intensive production and consumption patterns will need to be replaced, which implies massive investments in the coming decades.¹³ Large infrastructure gaps combined with scarce resources may create trade-offs between “building right” (cleaner, more resilient, or both) and “building more” (which may be what is required socially or politically).

Fortunately infrastructure is also a domain in which substantial synergies can exist between economic, social and environmental goals. Universal access to clean water and sanitation is good for social welfare and economic growth, but also for the environment. Better public urban transport reduces congestion and air pollution, with large economic and health benefits. Additional initial investment or higher costs may

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12. Damage to infrastructure in the context of climate change and the rising risk of natural disasters can be reduced if these risks are accounted for in the initial design, location and material selection.
 13. The average age of power plants in the United States is 32 years, in Europe, 27 (Davis *et al.* 2010). See also OECD (2012f).

result from efforts to ensure that new infrastructure minimises resource and energy demands. But the additional cost of building greener infrastructure should not be overstated, particularly when considered alongside potentially lower operating costs or the full long-term costs and benefits of the investment. For instance, it is estimated that making new buildings in China more energy efficient could reduce energy use and costs by more than 50%, while increasing construction costs by only 10% (World Bank, 2012a). Over time, the energy savings outweigh the initial investment costs. As mentioned earlier, however, these benefits may fail to be realised unless measures are adopted to overcome principal-agent and asymmetric information barriers in the construction business and in the real estate and rental markets.

Box 6. Water distribution infrastructure and leakage

Reliable and comparable data on water losses due to infrastructure are hard to come by. Nevertheless, the available data show that while a large and increasing share of global population is at risk of water scarcity, (according to OECD simulations, by 2050 as much as 40% of population, or almost 4 billion people may be living in river-basins under severe water stress), ageing and poor quality infrastructure is the source of high rates of water leakage in both high income and emerging economies. Leakage, which in well-run water utilities is usually in the range of 10-20% of water production, frequently exceeds 40% (for instance in London mains), and sometimes reaches 70% in some developing country utilities. Such large losses can undermine the effectiveness of any demand-side policies addressing sustainable use of water. Investing in upgrading water supply and sanitation infrastructure can be critical in reducing high leakage rates, which can also help to reduce demand for new water supply and treatment plants with concomitant investment needs.

Source: OECD (2009b; 2012a).

Thanks to innovation and economies of scale, the difference in cost between green and more traditional infrastructure is narrowing rapidly, with some renewable energies now competitive with fossil fuel based energy in some contexts (*e.g.* where the hydropower endowment is large, where settlements are located far from the grid). The competitiveness of clean energy technologies (*e.g.* carbon capture and storage) and renewables would be further enhanced with appropriate carbon pricing. For countries and urban areas that are rapidly developing and investing in new infrastructure, there is the potential to leap-frog some of the technologies of the past and build more resource and energy efficiency into systems from the start. Argentina, for example, has a programme to provide rural households and public institutions that are not connected to the grid with electricity provided from local renewable sources. And subsidies to establish local grids based on renewable energy sources have helped some isolated localities to bypass other technologies, while lowering the need for costly grid extensions (UN, 2011b; see also Box 12). As already mentioned, better managed demand for energy and water, for example through appropriate pricing, can also reduce the need for additional investment in costly power or water treatment plants.

But greening infrastructure is complex and requires that environmental policies (both market-based and regulatory) be supported by framework policies in network sectors that address both supply and demand management issues, and the increased use or development of financing instruments to ensure the necessary upfront financing. These issues are discussed next.

Framework policies in network sectors

Energy, transport and water infrastructure are broadly associated with high entry barriers and natural monopoly. Generation and distribution of services in such sectors usually involve large-scale initial investment and the need to finance high upfront costs, while at least one segment in the chain of production is purely network-based and therefore not suited for market competition. Demand externalities, by which

the collective gains of extending the network are higher than the private returns to the network owner, are extensive. And inter-linkages between different networks (*e.g.* electricity and water) are complex. In the case of a number of G20 countries, regulatory reform and investment in network infrastructure sectors is considered as a growth priority and significant steps have been taken in this area (OECD, 2012g). Given the characteristics of network infrastructure sectors, a mix of market instruments (such as cost-recovery pricing and entry liberalisation) and non-market instruments (such as effective regulation and public investment) are necessary.

In the context of green growth and sustainable development, it is essential to improve access to networks for providers that use clean technologies and designing regulation so as to ensure that network quality is maintained and negative environmental externalities are minimised. Removing barriers to market access and strengthening competition can increase the incentives to improve efficiency and productivity, encourage entry of new technologies as well as reaching out to new customers (OECD, 2012e). Network access can be regulated in a manner that assures non-discrimination and the recovery of costs as well as sufficient incentives to invest in infrastructure quality and expansion.

An example of a successful strategy to both expand access and improve efficiency is electricity reform in Colombia over the 1990s (Box 3 above), which occurred as a response to capacity shortfalls and low efficiency. Given severe financial constraints, increasing capacity through public investment was not an option and regulatory reform was therefore undertaken to improve efficiency, notably involving unbundling of the various segments and liberalisation. As a result, the drag on public finances of the electricity sector dropped dramatically and, by 2004, Colombia became a net exporter of electricity. Access to electricity services has increased in parallel, with coverage rates rising from low levels to virtually universal access in cities of all sizes (World Bank, 2012a).

Market liberalisation can also facilitate access by providers of renewable energy sources to the system and provide incentives for improving energy efficiency. But careful regulations and public investments may also be needed to encourage utilities and service providers to engage in demand-side management (*e.g.* real-time information on electricity use and metering) and upgrades into smart grids. Moreover, such liberalisation and regulatory reform will not necessarily result in greener and more inclusive infrastructure provision. These policies need to be combined with appropriate mechanisms to price externalities and encourage the scaling-up of promising technologies as well as to promote sustainability and affordability and ensure providers do not avoid poorer districts. Such an integrated approach to reform can improve the environmental performance, economic efficiency, inclusiveness and resilience of electricity services.

Efforts to green network sectors must be carefully designed to avoid inadvertently introducing inefficiencies in liberalised systems, for example by imposing more stringent environmental requirements on new entrants relative to incumbents. Policies that favour incumbents or domestic industries include, for example, grandfathering emission permits under a cap-and-trade scheme based on historical emissions. Such policy design is often motivated by an intention to give existing companies time to adjust and offering them some compensation. However, it can discourage entry and exit and can hamper efficiency improvements and the deployment of new and cleaner technologies. Examples of grandfathering provisions can be found in a number of G20 countries, for instance in the case of the US Clean Air Act from the 1970s and its subsequent amendments and the European Union Emission Trading System, although it is now moving towards increased use of auctioned permits (Nash and Revesz, 2007). Some of the undesirable effects of grandfathering provisions could be addressed via an appropriate policy design, for example a level playing field between incumbents and new entrants could be restored by reserving permit quotas for the latter (as in the EU ETS).

Effective planning and regulation on the supply side

Infrastructure systems are complex and continuously evolving systems, for instance reflecting changes in demand in passenger and freight transportation. Long-term approaches to infrastructure planning may reduce overall costs, and provide greater flexibility in connecting various components of infrastructure. Because infrastructure is lumpy and network based, infrastructure systems need to be planned in a holistic manner. A road or train line cannot be designed without considering other parts of the transport system, land use regulations, and urban planning. Power plants need transmission lines; their contribution to grid supply and stability will depend on the nature of the other power plants already in the system.

Moreover, different infrastructure systems interact across sectors and cannot be designed in isolation. Water availability affects electricity generation, and electricity is critical in water management (for groundwater pumping, for example). Transportation and energy interact closely: energy production often requires transport infrastructure, and different transport modes have different energy needs (from liquid fuel transport to electricity grids for electrified cars). Smart use of information and communication technologies can improve the environment in cities and the efficiency of other infrastructure systems. For example, in the electricity sector, improved monitoring and networked IT systems can help limit losses of electricity along the way and thereby improve capacity utilisation and avoid pollution; such losses represent on average 8% of production worldwide but over 15% in some countries. Smart meters can significantly improve the patterns of electricity consumption and conservation, by simply facilitating the access to information (OECD, 2012h). Introducing new technologies, such as electric vehicles, requires coordination across a range of actors — car manufacturers, electricity providers, city planners. Thus, much can be gained from a planning system that can integrate various objectives and infrastructure systems at both the country and regional level in a sustainable way to significantly reduce infrastructure costs and environmental pressures.

While competition can promote more efficient performance amongst suppliers of infrastructure services, in some cases it may promote technology choices that are least-cost financially, but high-cost socially. This can be the case where externalities are not properly addressed or priced. In these cases, effective regulation is needed to maximise social welfare. Incentives for green infrastructure can, among others, be pursued through performance standards (*e.g.* on energy production facilities or building construction) that do not penalise emerging technologies and allow scope for retrofitting. They can also be achieved by facilitating interconnections (*e.g.* smart grids for renewable sources of electricity) and avoiding inefficiencies arising from multiple incompatible standards.

Regulatory measures can take the form of renewable energy portfolio standards (in which regulators require utilities to include a given percentage or absolute quantity of renewable energy capacity in their energy mix) or feed-in tariffs (which offer cost-based compensation and long-term contracts to renewable energy producers). Feed-in tariffs can also be used as a pull factor to help get a new technology to scale, thereby contributing to reducing its cost and helping them to compete with other existing technologies (as Germany has done for solar). In addition, fuel-economy standards are common across G20 countries. For example, Japan introduced fuel economy standards in 1995 to reduce new car fuel consumption by 19%, and set a new target in 2006 aiming for a further 23.5% reduction. In Europe, automobile manufacturers have agreed with the European Commission on a voluntary fleet average emission target of 140g of CO₂ per kilometre for new passenger cars. In the United States, the 2009 Corporate Average Fuel Economy

(CAFE) regulations impose a stepwise increase in fleet fuel economy standards reaching 54.5 miles per gallon by 2025 (from the current average of 25 miles per gallon).¹⁴

Demand management through price-based and complementary instruments

Improving the delivery of infrastructure services is critical. But in infrastructure, increased supply often translates into increased demand, making a supply-side-only approach both costly and ineffective. For instance, in the case of transport, it is unlikely that supply side technological change alone will solve green challenges so demand-side management is needed (World Bank, 2010b). Similarly, building new roads is often ineffective in reducing congestion, because it incentivises the greater use of individual vehicles.

Price-based instruments are essential to manage demand, but they can be made more efficient by complementary policies. For instance, road pricing is used in most G20 countries, taking the form of road tolls on selected roads or periodic fees for using the roads in general. Congestion charges have been implemented in Singapore, London, and a number of other cities worldwide, and are being explored in even more. However, such demand-side policies are likely to be effective in countries where viable alternatives to car transport, such as flexible and demand-responsive public transport, exist. Similarly, high fuel prices are more likely to trigger a switch to public transport if public transport is available, convenient, safe and affordable, if parking spaces are scarce and expensive, and automobile restricted zones limit passenger car traffic in urban areas.

Policies aimed at managing demand, for example through higher prices for water, gasoline or electricity, can also help to reduce the need for developing new infrastructure – such as additional road networks, power plants or water treatment plants .. For instance, large quantities of water can be saved in India through better irrigation technologies, obviating the need to exploit new raw water sources. In China, industrial water reuse systems can save water, reducing the need to build expensive water conveyance systems (World Bank, 2012a).

Improving the investment climate and financing instruments to tackle the increased need for upfront capital

Financing infrastructure investments in general is a challenge, and financing green infrastructure is even more so (Fay *et al.*, 2010b; OECD, 2012i; World Bank, 2012a; UNCTAD, 2008). Even in cases where building green may not be much costlier and yields clear future benefits, the availability of financing often limits the pace and scale of investments. Indeed, both developed and developing countries are struggling to finance large upfront capital investments in critical infrastructure. Private participation in infrastructure, while significant, is limited by a lack of resources and expertise in many public agencies to prepare “bankable” projects attractive to the private sector (MDB Working Group on Infrastructure, 2011).

Inadequate financing has been identified by a number of developing countries as the greatest obstacle to their rapid adoption of cleaner technologies. While enhanced domestic resource mobilisation (private savings and public revenue) could help in the medium term, many developing countries have poorly developed markets for long-term financing and a weak fiscal basis, which limit the scope for such mobilisation in the near term (UN, 2011b). Innovative financing schemes, such as the Brazilian Watershed Pollution Control Program – PRODES that compensates sanitation providers for infrastructure investments based on the certified removal of pollution in the most polluted watersheds, offer an interesting option where providers receive financial compensation for investments made in sectors that may not attract private investment, but remain important for social and environmental reasons.

14. The United States also recently set for the first time national fuel economy standards for medium and heavy-duty trucks.

Greening infrastructure requires increased upfront financing. For example, renewable energy is characterised by higher capital costs and lower operating costs than fossil fuel based energy; and while energy and water efficiency investments typically pay for themselves they also require upfront financing. Green investments may be uncompetitive on a risk-adjusted return basis, in part because they often involve new technologies which require support and have yet to be commercialised.¹⁵ Or, they may be also uncompetitive due to market failures – with many existing technologies mispriced due to pollution externalities not being accounted for and fossil fuels still being subsidised.

Further, the fact that the profitability of green investments is often dependent on public policies (such as feed-in tariffs or environmental taxation), can make these investments risky. Austerity and financial turbulence have fed through into increased policy risk, restrictions on capital and uncertainty for investors in many markets. For example, Spain's, Germany's and France's decisions to reduce the amount of support for new projects combined to depress the private sector's appetite for renewable energy investments in 2010 (UNEP and Bloomberg New Energy Finance, 2011). Government commitment to transparent policy objectives, and clarity about how it will intervene in markets to promote environmental protection, can help to reduce policy uncertainty and some of the risk associated with green investments.

The scarcity of resources also implies a need to leverage public resources to attract private ones. Public efforts can catalyse private investment, emphasising the importance of increasing public funds to partner with private investors to green infrastructure investment and supporting a positive investment climate and local capacity (e.g. in the commercial banking sector) (UN, 2011a). The public sector, international financial institutions, and bilateral donors can provide funds for project preparation as well as concessional elements for pioneer investments. Such support can go a long way toward changing risk-return profiles and give investors more confidence in the long-term viability of their projects.

Some investments, in particular in large public infrastructure, may be appropriate for public private partnerships (PPPs), whereby government and the private sector share financing and management responsibilities. PPPs can be attractive in the presence of sufficient institutional capacity, under a stable policy environment, and well-designed risk sharing, which can bring down the high contract costs (OECD, 2008c). Environmental performance criteria can also be built into PPPs, thus providing a tool to green infrastructure investment and operations (Kennedy, 2012).

More generally, well-designed public finance mechanisms can help to mobilise private investments (World Bank, 2012c; OECD, 2012e; see also Box 7). In the case of renewable energy and energy efficiency, the following tend to have the greatest leverage:¹⁶

- Credit lines or loan guarantee instruments to engage private banks. The experience of the International Finance Corporation is telling: some USD 65 million in concessional funding, primarily for risk-sharing facilities, generated USD 680 million in sustainable energy finance investments.

15. The cost of clean energy technologies continues to decrease. Solar panels have decreased in cost by 75% in the past three years. In 1985, the average yield from an onshore wind farm was 21%; in 2012 it is 34% (BNEF, 2012).

16. In addition, energy service companies (ESCOs), which provide clients with energy auditing, propose energy-savings measures, and financing can help consolidate multiple small transactions. ESCOs as an industry often require public support to establish: in China it took more than a decade of support by the government and the World Bank before the ESCOs grew to a USD 1 billion industry in 2007 (World Bank, 2010c).

- “Fund of funds” under which the government invests a relatively small amount of long term capital in a range of private, professionally managed funds that then invest in clean energy or energy efficiency.
- Public funds to reduce interest rates for consumer financing, typically through financial institutions or utilities.

The establishment of green investment banks or infrastructure funds by governments is an encouraging development. A green bank can have a mandate to tackle risk that markets currently cannot handle, thereby acting as a catalyst for further private sector investment. Green investment bank initiatives are being developed as a policy initiative in a number of countries, most notably in the United Kingdom, the United States and Australia (Kaminker and Stewart, 2012). In the United Kingdom for instance, the new Green Investment Bank will provide financial mechanisms to accelerate private sector investment in green infrastructure. In addition, a number of multi-national development banks already perform similar functions.

Overall, the relevant mix of financing instruments will depend on the market barriers (access to credit, transaction cost or perception of risk), market segments (SMEs, large developers or polluters), and local context (such as the maturity of the local financial sector) they seek to operate in. In this context, opening up to foreign direct investment (FDI) may help spur productivity gains, and result in foreign infrastructure investment in emerging economies which may suffer from a poorer access to capital: available information suggests that there is wide scope for further reducing barriers to FDI (Golub *et al.*, 2011). More generally, accessing sources of international finance is key to meet the challenge of green infrastructure development (Box 8).

Improved cost recovery for infrastructure development and maintenance (*e.g.* for water supply and sanitation, public transport systems, energy supply) is not only critical for resource allocation, but is also central to increased financing. Strengthening cost recovery through appropriate pricing for the services provided not only contributes to financial sustainability; it also encourages consumers to conserve, thereby reducing the need for new investments. This need not come at the expense of affordability: care should be given to protect the poor notably through better targeted subsidies and support for connections (*e.g.* to water systems and electricity grid) rather than consumption.

While appropriate regulation of financial markets is essential, overcoming some potential imperfections and regulatory barriers in these markets, including for international investment, as well as implementing policies to overcome credit constraint, can improve the access to funding of long-term projects. Loan guarantee programmes can enable small businesses and households to borrow the funds required to cover high up-front (fixed) costs of moving to cleaner technologies that may generate subsequent cost savings through lower operating costs (*e.g.* more water-efficient appliances, insulation). Innovative finance in the development finance area is also a potential option (OECD, 2011g), though most innovative financing mechanisms will require international cooperation, (UN, 2012).

Box 7. The potential role of institutional investors

As public finances have become strained in many developed countries and banking sector provision of long-term finance has become tighter due to deleveraging and new financial regulations such as Basel III, institutional investors potentially have an important role to play in financing infrastructure development. Institutional investors, including pension funds, are responsible for USD 71 trillion in assets in OECD countries. Pension funds and insurers are likely to have a long-term investment horizon, which would be a natural match for many infrastructure investments, and can benefit from the opportunity to diversify their portfolio. Given the low interest rate environment and weak economic growth prospects in many countries currently, they are increasingly looking for asset classes which can deliver low correlation, steady, preferably inflation-linked income streams.

Yet – outside the major pension funds and insurers – institutional investor allocations to infrastructure development remain limited, particularly when it comes to the types of direct investment which can help close the financing gap. Their hesitancy to invest at scale to date arises from a number of issues, including lack of a stable, predictable, simple and transparent policy framework. This is particularly important for investments in green infrastructure. As discussed above, green investments are currently often uncompetitive on a risk-adjusted return basis. In part, this is because they may involve new technologies which have yet to be commercialised. However, they may also be uncompetitive due to market or government failures – such as underpricing of pollution.

A number of well-intended and important regulations may also be inadvertently discouraging institutional investors from investing in longer-term, illiquid or riskier assets such as infrastructure projects. These include unintended consequences from international accounting, risk-based funding and solvency rules. Other barriers include a lack of appropriate investment vehicles and market liquidity, scale issues, regulatory disincentives and insufficient knowledge, track record and expertise among institutional investors about these investments and their associated risks. One reason for the lack of direct investment by pension funds in infrastructure in some countries may be the dearth of appropriate investment opportunities, which is partly confirmed by the fact that pension funds more often invest in infrastructure indirectly, e.g. by holding equity or debt of utility companies or through specialised funds.

For institutional investors to make the effort to understand and allocate to this space, they have to feel that not only are the returns attractive, but that they can count on the safety of the revenue streams. This is most demonstrable in the need for consistency and long-term strategic commitment from various policy makers and the energy markets.

Institutional investors are only beginning to make direct investments, and given that fixed income instruments remain the dominant asset class in portfolio allocations of pension funds and insurance companies across OECD countries, it is likely to require asset-backed securities (ABS)¹⁷ or bonds to further scale up financing through this channel. For instance, in the EU structured assets which allow investors to access secondary markets account for less than 3%¹⁸ of green financing. ABS can be tied to specific infrastructure projects and “treasury-style” green bonds have been issued to raise capital that will be allocated across a portfolio of green projects (such as the World Bank’s issuances).¹⁹ Green bonds, ABS and the most senior asset classes in structured funds targeting institutional investors can allow taking assets off bank and corporate balance sheets, can lower the cost of capital, and recycle funds into new investments. However the market for such bonds is currently a small and nascent one; issuance so far remains but a drop in the pond compared with the USD 95 trillion total global bond markets.

Potential policy responses by governments range from supporting the market directly through preferential tax treatment, or through the provision of partial guarantees, developing insurance and risk mitigation products, robust and transparent rules for debt aggregation (for ABS) and using standards to verify environmental benefits of bond investments (such as the Climate Bonds Standard). The aforementioned ‘green banks’ are likely to issue green bonds in future or develop other vehicles for using public finances to work with and leverage private capital. Governments, multilateral development banks and other public sources are already working on risk mitigation and credit enhancements tools (e.g., the European Project Bond Initiative) to enable institutional investors to gain access to vehicles with the appropriate risk-return profile (Kaminker and Stewart, 2012).

Source: Della Croce *et al.* (2011); Kaminker and Stewart (2012); OECD, (2011h; 2012j; 2012k).

17. Asset backed or securitized bonds are similar to ordinary bonds but have specific assets whose revenues pay the interest and principal. An ordinary bond’s payments are generally guaranteed by the company that issues them. In asset backed or securitized bonds a set of revenue generating assets are put into a special purpose company and these assets pay the bond holder their interest and principal.

18. Accenture and Barclays (2011).

19. <http://treasury.worldbank.org/cmd/htm/WorldBankGreenBonds.html>

Box 8. An important role for international public and private financing in supporting national action on inclusive green growth

Moving towards green growth will require large-scale investments, in particular to support national actions to develop more resource- and energy-efficient infrastructure in sectors such as energy, transport, water and buildings. Estimates of the scale of financing needed for green infrastructure vary widely, but OECD estimates approximately USD 1-2 trillion per year. The scale of current investment at approximately USD 1 trillion per year is at the lower end of what is needed for transformational change. While some of these investments can be raised through domestic sources, international financing will also be essential to support developing countries in their efforts to move towards sustainable growth paths.

To meet these transformational needs, related investments need to be scaled up dramatically. Public finance will need to be targeted carefully to leverage private sector investment. Bilateral and multilateral Official Development Assistance (ODA) is a relatively important source of international finance for investments in developing countries with underdeveloped capital markets. To date, OECD data finds that ODA supporting the MDGs, with a focus on social and economic development, has increased by 63% between 2000 and 2010. ODA allocated to environmental development has also increased. Between 2001-02 and 2009-10, bilateral ODA for general environmental protection grew from USD 1.9 billion to USD 5.1 billion and support for other activities addressing environmental sustainability rose from USD 5.8 billion to USD 20.3 billion. In terms of international public finance and investment for climate-related activities, for example, bilateral flows are estimated in the range of USD15-23 billion with multilateral flows estimated to be approximately at the same level annually.

International private finance to support green growth can come in different forms, including FDI, other private flows and investment, or finance flows associated with international commitments such as the Clean Development Mechanism. For example, FDI and other private finance flows to drive low-carbon, climate-resilient growth were estimated to amount to USD 37-72 billion in 2009-2010. This further underscores the importance of openness to international investment and trade – along with domestic policy reforms, institutional development and public outlays – for leveraging much larger flows of private or multilateral finance to promote green growth.

Source: Clapp *et al.* (2012); Corfee-Morlot *et al.* (2012); OECD-DAC Creditor Reporting System; OECD (2008d).

Targeting and leveraging investment by international corporate players

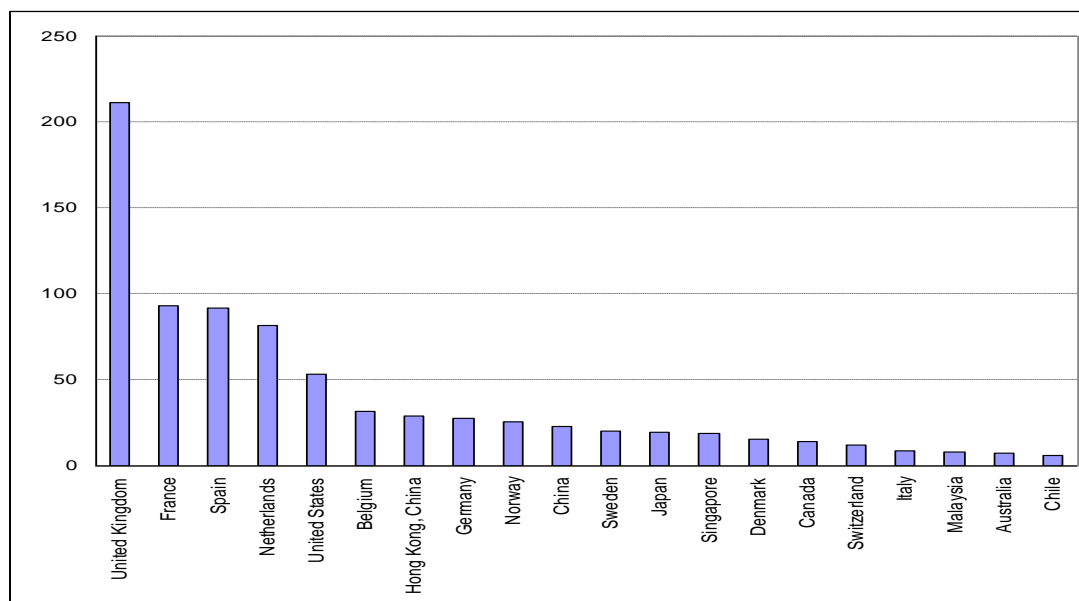
Transnational corporations (TNCs), along with other major private investors, offer a huge potential for fostering green growth and sustainable development because they are a vast reservoir for the financial, technological and other resources that are needed. In 2009 foreign direct investment (FDI) flows into three green business areas (renewables, recycling and low-carbon technology manufacturing) *alone* amounted to USD 90 billion (UNCTAD, 2010). In its totality green FDI is much larger (see below). Moreover, TNC involvement in infrastructure activities such as renewable electricity generation and the manufacturing of related equipment exemplifies the case that TNCs bring much more than just finance to investment. Major generation facilities, for instance, need project developers to plan them – most of them TNCs – as well as transnational equipment manufacturers among the suppliers of relevant technologies.

Harnessing TNCs' contribution to green growth requires open markets and proper regulation, as discussed in earlier sections, as well as dedicated efforts on the part of governments. TNCs can support green growth in a number of ways, in particular by improving production processes in their operations at home and abroad, supplying cleaner goods and services, and providing capital and technology – through linkages and various technology transfer mechanisms – to other actors in the economy. They can contribute across the entire economy. In the context of green growth strategies, TNCs and other major corporate players are important in a number of different industries, including machinery and automotive equipment, agriculture manufacturing, construction and – not least – infrastructure such as power and transport.

Infrastructure is a prime example of the role that TNCs can play in supporting green growth. To address financing and investment gaps, countries have increasingly turned to the private sector for additional sources of funding and to shift the financial risks of projects at least partially away from governments. FDI in infrastructure sectors such as electricity, water, transport and telecommunications in developing countries jumped from a stock of USD17 billion in 1990 to a stock of over USD 800 billion in 2010 (Figure 3 for selected countries). In fact, these figures underplay the true scale of TNCs' investment in countries' infrastructure industries because they also participate through non-equity modes (NEMs) such as management contracts, build-own-operate-transfer (BOOT) and PPP concessionary forms. Indeed by some estimates such concessionary forms account for two-thirds of their activity in poor countries (UNCTAD, 2011 and 2008)."

Until this millennium, most infrastructure TNCs were from developed countries. As a result, countries such as the United Kingdom, France, Spain, the Netherlands and the United States retain the largest FDI stocks in this sector (Figure 3). More recently, the rise of infrastructure TNCs from developing countries has diversified the sources of international investment on which host countries can draw. For example, in the power and energy sector, companies such as Malakoff, MMC, Zelan (all Malaysia); Banpu, EGCO, Ratchaburi (Thailand); Power International and Asia Power (Singapore); Tata and Reliance Group (India); and Alusa and Votorantim (Brazil) have all become major investors in other developing countries. Specialised infrastructure funds are also playing a role in supplying financing need for infrastructure development in developing countries (see above on limitations to pension fund financing).

Figure 3. Outward FDI stocks in infrastructure industries
(USD billions, 2010)



Notes: Infrastructure includes "Electricity, gas and water" and "Transport, storage and communications". In most cases, the latest year is 2010 but in a few cases it is 2008 or 2009.

Source: UNCTAD.

An array of policy measures can be taken to leverage TNC contributions, ranging from investment promotion and facilitation measures, through setting the right policy framework for the dissemination of green technologies, to competition and industrial policies. In addition, making use of mechanisms inside the private sector (*e.g.* GHG emission reporting) is a tool in this respect.

Effective investment promotion programmes with a focus on green investment are needed to best harness TNCs. Such programmes need to build on national policy frameworks for achieving inclusive green growth. Of particular importance within an enabling policy framework for green FDI are adequate investment promotion, protection and legal security. Investment promotion agencies will have to play a key role in such endeavours through investor targeting, image-building, aftercare and policy advocacy; complemented by explicit linkage creation. The latter is of particular importance in the dissemination of green technologies. Open investment frameworks based on the structural separation of network industries and applying the principle of national treatment for investment incentives can also help maximise investment flows in low-emission and climate-resilient infrastructure.

An enabling framework is needed to foster the transfer and dissemination of green technologies. This involves putting in place a mechanism to facilitate cross-border technology flows, foster linkages between TNCs and local firms to maximise spillover effects, enhance local firms' capacities to be part of global value chains, strengthen developing countries' absorptive capacity for cleaner technology, and encourage partnership programmes for technology generation and dissemination between countries (see also the section on innovation below).

In the same vein, initiatives to promote responsible business conduct can be supported on a voluntary basis. This includes working with the private sector to achieve more consistent reporting on GHG emissions and other environmental issues through several channels, including standard-setting bodies or listing requirements for stock exchanges. A good example at the international level is the Sustainable Stock Exchanges Initiative, which is a forum – provided by the United Nations – for exploring how stock exchanges can work together with investors, regulators, and companies to enhance corporate transparency. This ultimately affects companies' performance on environmental, social and corporate governance issues and encourages responsible long-term approaches to investment.

Fostering innovation for greening growth to support sustainable development

Innovation, supported by appropriate policies, can lower the costs and boost the benefits of more inclusive and environmentally sustainable growth. Figure 4 gives an overview of public and private R&D spending in G20 countries devoted to environmental technologies. However, it should be noted, that the development and adoption of new technologies and technological improvements with positive green growth consequences may come from across all sectors of the economy.

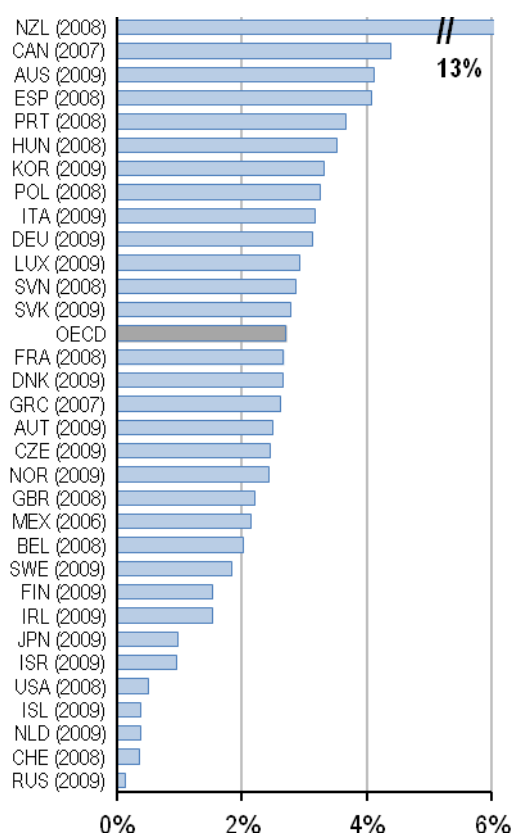
The conditions under which green innovation can thrive build on those for all-purpose innovation. This reinforces the need to set an appropriate general framework to encourage innovation and new-technology adoption – including opening up to foreign investment, and reducing barriers for start-ups and entry as new entrants tend to be more responsive to new technological or commercial opportunities and to benefit from foreign know-how (Baumol, 2002; 2006). Enhanced competition and international trade openness also improve the incentives to innovate, emphasising the need for more flexible product markets (see above). Adequate intellectual property rights protection is also crucial in securing the returns to innovation, hence providing the incentives to invest in research and development, but excessive or ill-designed protection can inhibit technological progress or its dissemination and be counter-productive. Access to financing is also a key issue. Government funds are likely to be most effective if concentrated in basic and long-term research, addressing fundamental scientific challenges aiming to foster research in areas that are too risky and uncertain for the private sector to step-in.

A number of the technologies that support greener growth are already available but vary according to their maturity and commercial viability. These include, for example, the range of options for generating renewable energy (wind, solar and hydro power, biofuels and biomass, among others), technologies for carbon capture and storage (CCS) and for more efficient energy use, substitutes for non-biodegradable

resources, and sustainable farming and forestry techniques, as well as technologies to render coastlines and infrastructure less prone to natural disasters. In this respect, the main challenges to jump-starting the shift to green growth and sustainable development lie in how to further improve these techniques, adapt them to specific local conditions and needs, scale up the applications so as to contribute to bringing down significantly their costs, and provide the incentives and mechanisms to facilitate their wide-spread and rapid diffusion (UN, 2011b). TNCs hold many of these technologies (see above).

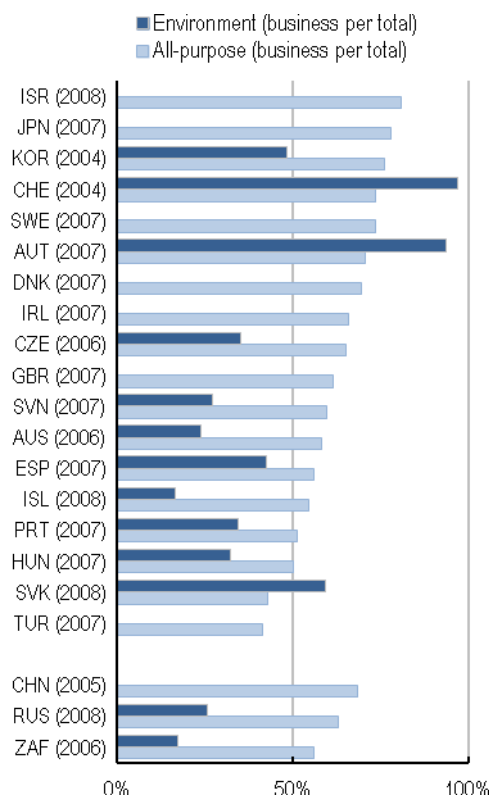
Figure 4. Data on R&D investments supporting green growth in G20 and other countries

**Government R&D budget related to the environment,
OECD countries, 2009 or latest**
As a % of total government R&D budget



Source: OECD (2011) Science and Technology Indicators Dataset, government budget appropriations or outlays for R&D.

**Business R&D investment, selected countries,
2008 or latest**
As % of total R&D (incl. business, government and other)



Source: OECD (2011) R&D expenditure database. R&D by sector of performance and socio-economic objective in NABS2007.

Appropriate pricing of environmental externalities will provide important incentives for more environmentally friendly innovation.²⁰ For example, those firms that pay the full price of the Climate Change Levy in the United Kingdom have been found to have higher patenting activities than those that benefit from exemptions from it (OECD, 2012a). The pricing incentives are likely to be stronger where the commitment to environmental policy action is credible and long-lasting. Nevertheless, it is often argued that the existence of a ‘twin-market failure’ in the area of eco-innovation (Jaffe *et al.*, 2005; Popp, 2012;

20. An example from Sweden shows that environmental taxes can promote economic efficiency and foster innovation. Sweden’s tax on NO_x emissions has promoted the adoption and development of low-cost abatement technologies (OECD, 2010a).

Dutz and Sharma, 2012; UN, 2011b) calls for going beyond conventional framework policies and implementing dedicated support policies. This is because private investors in R&D are unlikely to be able to capture both the positive innovation externalities and the public good benefits of reducing negative environmental externalities that arise from new environmental innovations, leading to an under-investment in innovation in the environmental domain.

Box 9. The Sustainable Energy for All Initiative

The United Nations Secretary-General recently launched a new initiative, “Sustainable Energy for All,” to support three objectives to be achieved by 2030:

- Ensure universal access to modern energy services.
- Double the global rate of improvement in energy efficiency.
- Double the share of renewable energy in the global energy mix.

Its primary aim is to mobilise action by all stakeholders – businesses, governments, and civil society: to improve regulatory and institutional policies and capacity; support technological and value chain innovation; ensure that limited public resources are used to maximise the flow of private investment; and stimulate end-user demand through education and new delivery models.

The initiative, using the convening power of the UN Secretary-General, will:

- Support the development of national plans of action for sustainable energy for all, aimed to facilitate access to best practices and knowledge and leverage large scale investment by tapping into vast networks of businesses, financiers, and international organisations;
- Mobilise commitments to action by all stakeholders around “game-changing” public-private partnerships in key “high-impact” thematic opportunity areas, in support of Sustainable Energy for All.

In the lead-up to Rio+20, the UN Conference on Sustainable Development, the UN Secretary-General is inviting all stakeholders to announce their commitments in support of an Action Agenda that generates game-changing momentum for a sustainable energy future.

Source: United Nations

Insufficient opportunities to benefit from learning-by-doing and market size effects, with the associated lack of scale economies, may also inhibit the development and diffusion of new technologies. Additional government action may thus be warranted to facilitate the emergence and scale-up of new technological options, including through supporting demonstration of new technologies, combined with further R&D and engineering studies to address shortcomings that are revealed by the demonstrations. Related public procurement approaches may be effective in overcoming impediments to green products and technologies, be it through addressing network externalities, economies of scale or working through demonstration effects. In the presence of learning-by-doing, for instance, higher feed-in-tariffs may be desirable for technologies whose potential is estimated to be larger but that have not yet been scaled-up (del Rio Gonzalez, 2008; Johnstone *et al.*, 2010b).

Under some circumstances, subsidising clean alternatives may be an effective option for encouraging the diffusion of new technologies (Box 10), although subsidies (as well as public procurement requirements) should be used with caution as they can be expensive and risk “picking winners”, thus reducing incentives for innovation and waste of public resources. Examples of such subsidies may include direct financial support for production of renewable-based electricity (e.g. grants, tax breaks or low-interest loans) or of a

guaranteed sale price that is sufficiently high to cover the production costs (*e.g.* feed-in tariffs in electricity). Depending on the form chosen, the cost of the subsidy is borne by taxpayers or end-consumers, or both. The effectiveness of subsidies with respect to their goals merits periodic evaluation; in particular as in a number of cases the sums in question appear high with respect to the environmental benefits. For instance, the cost-effectiveness of support to first-generation bio-fuels in reducing greenhouse gas emissions can be questioned (Box 11). Similarly, according to some estimates, in many EU countries feed-in tariffs exceed market electricity prices by an order of magnitude, being particularly high for solar and wind power (OECD, 2011i). Setting explicit and predictable rules for periodic assessments and possible policy revisions can help reduce regulatory uncertainty.

Box 10. Support to PV and global spillovers

Germany and China are emerging as leaders in the global photovoltaic (PV) market, thanks to developing a dual industry composed of vertically integrated firms and segment specialists (Grau *et al.*, 2011). Public support aims to trigger cost reductions through economies of scale and additional technological innovation. It is directed at three activities:

- *Direct R&D to support innovation.* Both China and Germany provide support to R&D, especially to promote radical innovation that is not the usual focus of the private sector. But this support remains limited, with only 1% (in China) and 3% (of Germany) of the total support these countries provide to PV panel production (Grau *et al.*, 2011).
- *Standard environmental policies to support deployment.* Both China and Germany are using feed-in tariffs to support the large-scale deployment of PV modules. The German example points to the inherent risks resulting from a stable, long-term commitment to buy electricity generated by PV sources. When the price of PV modules dropped in 2009, the sudden surge in profitability led to a rush to install PV modules, inflating the total cost of the programme and jeopardising its existence.
- *Investment to support manufacturing plants.* Investment to support manufacturing plants embraces direct subsidies, reduced taxes, public guarantees, and reduced-interest loans. Neither China nor Germany links investment support to specific innovation requirements.

Striking the right balance among the three forms of support is critical for reducing costs. But support schemes are further complicated by information asymmetries between the industry and the government and by market power exerted by different actors in the industry.

Has public support made a big difference? There is little doubt that it helped achieve the large reduction in solar panel costs, which yielded global benefits. But there are growing concerns that this support is increasingly focused on the interests of domestic producers rather than global welfare objectives.

In Germany the issue is whether hefty feed-in tariffs mainly benefit Chinese PV manufacturers who export to Germany. In China, producers are concentrated in the downstream segments of the PV panel supply chain, which are highly labour-intensive and where the country has a comparative advantage (de la Tour *et al.*, 2011). These downstream segments have limited margins and small profits compared with upstream segments, such as silicon production, where industrial countries, including Germany, still dominate. (Germany also manufactures some of the machinery used in China for PV production). In China the issue is whether the policy leads to the import of mature technology, thus preventing the takeoff of an internal innovation capacity for more radical technological changes.

The efficiency and cost-effectiveness of strong support to PV as well as for other renewable energy sources should also be subject to careful evaluation, as it can be expensive and potentially hamper innovation, for instance by trapping excessive resources in the subsidised activity or overlooking cheaper abatement options (de Serres *et al.*, 2010). Egert (2011) shows that the abatement cost implied through feed-in tariffs for solar PV and wind energy in many EU countries can reach hundreds of euro per tonne of CO₂. Such calculations must be treated with caution as they disregard any additional benefits (or additional policy instruments in place to promote renewable energy).

Source: World Bank (2012a).

Box 11. Support to first generation biofuels

Liquid fuels made from biological sources (biofuels) have been around since the dawn of mechanised transport. In the 1970s, following a sharp increase in world prices for crude oil, several countries began to give biofuels a second look, and to subsidise the production and consumption of fuel ethanol, as a gasoline blending agent and substitute, and biodiesel, as a substitute for petroleum-derived diesel. More recently, several countries have started to encourage the substitution of biomass-derived substitutes for jet fuel (Round Table on Sustainable Development, 2012). By 2006, when the average international price for crude oil was still below USD 60 per barrel, total government support to biofuels in the OECD had reached some USD 11 billion a year (Steenblik, 2007). By 2010 that number had grown to over USD 20 billion (IEA, 2011).

Various benefits have been expected from increased production and use of biofuels. Growing the feedstock for biofuels — sugar cane, sugar beets, maize and other grains for alcohol, and vegetative oils for biodiesel and bio-jet — creates a larger demand for those crops, and contributes to upwards pressure on crop prices. Processing those crops close to where they are grown increases local employment. Using them reduces some air pollutants, and was assumed initially to reduce emissions of CO₂, a greenhouse gas (for a meta-analysis on the U.S. situation, see Farrell *et al.*, 2006). The displacement of petroleum fuels by domestically produced biofuels reduces imports (or allows greater exports) of crude oil or petroleum products, which is sometimes viewed as contributing to energy security objectives.

These benefits are all possible, but there are important costs as well. Studies carried out by the Global Subsidies Initiative in the late 2000s showed that support levels in many countries range from USD 0.45 to more than USD 2.00 per litre of petroleum equivalent (Steenblik, 2007). This burden is paid generally by a combination of taxpayers and consumers (especially where the market is guaranteed through government regulations mandating that specific shares or volumes be used), whereas the benefits are often regionally concentrated. Even the benefits to producers are mixed. Although some crop farmers benefit, ultimately among the largest beneficiaries are owners of arable land. Moreover, through helping to drive up the prices of feed grains, biofuel-support policies related to grain-derived ethanol have at times increased the cost of feeding livestock. This effect, plus the more direct effect on grains and oilseeds used in the production of food for humans, has also contributed at times to increases in people's food bills. The increased use of crops for biofuels has not been the only factor behind short-term agricultural price rises, of course, but it can exacerbate an already tight market.

Estimating the cost effectiveness of these support policies when multiple benefits are claimed from a single policy is hazardous. However, single-objective metrics at least give some insight into the upper bound of the cost. Studies of support to first-generation biofuels made from grains or virgin vegetable oils are generally over USD 100 per tonne of CO₂-equivalent emissions avoided, and can range as high as USD 1 000 (OECD, 2008e). And that is for those biofuels that actually reduce GHG emissions compared with the petroleum fuels they displace. Some estimates suggest that, measured over their entire life-cycle (and taking into account indirect land use change), some crop-based biofuels actually emit more GHG emissions than they save (Searchinger *et al.* 2008), though evidence remains mixed in this area, partly due to methodological challenges in estimating indirect land-use change. Similarly, the cost per litre of imported gasoline, diesel or kerosene displaced may be as high as the wholesale price of those fuels. Supporting biofuels also fares poorly as an employment-generating policy, when net employment is considered (including, for example, job losses in competing industries) (see, e.g., Swenson, 2006, 2007 and 2012; Karp and Stevenson, 2012).

The experience with first generation biofuels, particularly ethanol produced from sugarcane in tropical areas, has differed somewhat across countries. In Brazil, for example, the use of ethanol has helped to reduce greenhouse-gas emissions and mitigate urban pollution. Several other developing countries located mostly in the tropics also show potential for growing some biofuel-producing crops sustainably and competitively. Well-designed efforts to increase biofuel production in developing countries should take into account environmental and social objectives — notably protecting carbon-rich soils and biodiversity, alleviating rural poverty and protecting the rights of indigenous peoples. Access to green technologies and advice on sustainable farming can also be important.

In countries with low taxation of petroleum products that are producing feedstock for transformation into biofuels, there is often an opportunity cost to diverting those feedstocks to the domestic biofuels market, however. That is to say, many areas would earn more income by exporting, for example, vegetable oil than processing the oil into biodiesel, which is often a lower-value product. For most of the last two years, for example, the export price of palm oil has averaged around USD 1 050 per tonne, or USD 0.96 per litre (World Bank GEM Commodities database, IEA, 2012). Assuming that the feedstock represents 70% of the final biodiesel cost, that suggests a final biodiesel price of USD 1.37 or greater. By comparison, the pre-tax price of automotive diesel in most palm-oil producing countries has been USD 0.90 or less (IEA, 2012). Of course, each case should be evaluated with respect to local circumstances. In remote areas, for example, the cost of delivering diesel fuel may exceed the opportunity cost of diverting locally grown vegetable oils to fuel.

Source: OECD

In all cases of public support, a crucial challenge is to minimise the risks of policy failure associated with picking winners and technological lock-in. An approach aimed at supporting a broad portfolio of investments and technologies, and that puts stronger emphasis on basic and long-term research in technology areas in their infancy, can help minimise such risks. In general, it may be useful to target support to innovation in areas that are “technology neutral” in the sense of being likely to support the development of a large range of new technologies, for example supporting generic or general purpose technologies such as materials technologies, nanotechnologies, life sciences or energy storage. Limiting the duration of subsidies by specifying explicit sunset clauses as the technologies become more competitive, can make them more efficient and encourage the focus on developing innovative solutions that are economically viable without continuous support (Kalamova *et al.*, 2011). Support policies can also be used to address practical limitations affecting the implementation of the pricing of externalities: for instance, with CO₂ taxes focusing on proxies (such as fossil-fuel use) they may not provide sufficient incentives to encourage investment and research in new technologies that capture and reduce emissions, which therefore may need specific measures. Finally, active support measures may have the potential for reaping green growth and sustainable development opportunities that are outside the reach of traditional market-based measures (Box 12).

Box 12. Combining renewable energy diffusion and development objectives

An interesting recent example on how carefully designed active support policies may have ‘win-win’ opportunities for inclusive green growth can be seen in Indonesia and in Bangladesh. In these countries, a number of local governments, NGOs and foreign aid agencies have run pilot programmes of supplying rural households, outside the reach of the electricity grid, with renewable energy sources (such as PV, small wind generators or mini-hydro) and energy storage devices. They aim at spurring rural development by providing lighting outside standard day hours and electrical power (e.g. for charging a mobile phone) and can improve environmental outcomes by reducing the needs for dirty fossil fuel generators as well as contain associated fire hazards. While assessments fall short of comparing all the costs and benefits of such initiatives or assessing their potential scope, there are some indications that such policies, if properly designed, may show opportunities to improve both environmental outcomes and well-being.

Source: Mondal *et al.* (2010) and Retnanestri *et al.* (2003).

In the case of projects initiated by start-up firms, the development of highly-specialised intermediaries such as venture capitalists can help bridge the funding gap and assist with the development of the project. This is particularly likely when the project relies essentially on intangible capital (such as R&D spending), which cannot be easily used as collateral. Across the G20 countries, the large differences in the provision of venture capital suggest that a re-assessment of policies influencing their development may be warranted, notably in the area of taxation and regulations governing the types of institutions that can invest in such funds.

Lowering barriers to the diffusion of green goods, services and technologies

Since technology transfers often take place through market channels such as trade, FDI or licensing, they occur more frequently between open economies. Opening up markets to foreign producers can facilitate the benefits of exploiting comparative advantages, economies of scale and technological progress. It can also be beneficial for environmental outcomes when this leads to the more rapid diffusion of more environmentally-friendly technologies. The trade of green products and services provides a means to promote green growth for developing countries and emerging markets. In these countries, openness to trade can also be a way to facilitate capacity-building for producing and providing green products, services

and technologies. In some cases, attracting foreign investment and facilitating domestic acquisition of foreign technology through appropriate trade and investment policies can facilitate technology transfer to developing countries.

Much of technology and skill transfer occurs through the purchase of manufacturing equipment on global markets, because suppliers usually provide worker training with their equipment, and also due to the existence of global value chains. Some are knowledge-based processes or business models that diffuse through movements of people attached to multinational corporations. For instance, development of Chinese PV panel production was facilitated through this channel (de la Tour *et al.*, 2011).

The diffusion of technologies that can help stimulate growth and address environmental problems is, at times, hampered by tariff and non-tariff barriers to trade. These concern, for example, high import tariffs on bio-fuels in a number of advanced economies (ICTSD, 2011) and relatively high tariffs on cooling and heating equipment, or other (potentially more efficient) energy-using appliances in several emerging economies (Steenblik and Kim, 2009; Akimoto *et al.*, 2011). Most studies show that tariff and non-tariff barriers, and fossil fuel subsidies do more than patent protection to limit the transfer of clean technologies (Barton, 2007, and Copenhagen Economics, 2009, as cited by Hall and Helmers, 2010). A World Bank (2008) study finds that eliminating tariff and non-tariff barriers in the top 18 developing countries ranked by greenhouse-gas emissions would increase imports by 63% for energy-efficient lighting, 23% for wind-power generation, 14% for solar-power generation, and 4.6% for clean coal technologies.²¹ These could have some significant environmental and social benefits in the importing countries.

Lowering barriers to trade in services can also be important. For example, the deployment of more environmentally-friendly technologies often depends on the availability of specialised services, including those imported from other countries, notably business services, construction, environmental and energy services. Foreign investment can be encouraged through a reduction in formal barriers as well as a healthier business climate, including adequate governance and institutions.

An interesting example on how trade can reduce the costs of greening production comes from the electricity sector. Exploiting countries' natural advantages in renewable-energy sources can increase the productivity and lower the costs of electricity from intermittent renewable sources. Integrated regional electricity markets can significantly reduce the need for back-up capacity enabling higher penetration levels of electric power generated from intermittent renewable sources (Benatia *et al.*, 2012). There seems to be a notable potential for increasing the integration of electricity markets in, for example, Europe, North America and within Japan where such markets are still largely regional. In Africa, where many countries are too small to build power plants at an efficient scale, USD 2 billion of energy investment could be saved if opportunities for trade in electric power were to be fully exploited (Foster and Briceño-Garmendia, 2010). Regional power pools (for example, in West and East Africa) could help capture benefits from economies of scale and smooth the effects coming from the intermittency of solar and wind energy sources. Cross-country coordination could also help countries to efficiently use local or common natural resources (such as shared water resources).

Technology diffusion between high-income and developing country markets, as well as among developing and emerging markets, can increase opportunities for the adoption of greener technologies and in some cases enable countries to leap-frog dirty solutions and go straight to the use of modern, cleaner technologies. Recent OECD analysis finds that a number of factors have been influential in encouraging the transfer of environmental technologies (Haščić and Johnstone, 2009; Johnstone and Haščić, 2012). For the transfer of climate change technologies, while access to the Clean Development Mechanism is

21. The assessment is based on first-round approximations rather than full general equilibrium effects, and may be influenced by the small bases in case of some of the categories.

important, strict environmental protection in host countries and domestic absorptive capacity were also found to be critical factors – countries with high domestic technological capacity are more likely to import technologies from overseas. The higher the level of domestic human capital, the denser the foreign technology transfer, as well as the local spillovers from trade and FDI. This highlights the importance of long term education and capacity building policies in promoting technology transfer (see also UN, 2011b). Multilateral action is also crucial to support the more rapid diffusion of clean and affordable technologies (Box 13).

Box 13. Innovation and scaling-up green technological development and transfer

Access to green technology and related financing will be essential to support developing countries' domestic policies for moving towards a low-emission, resource-efficient and climate-resilient pathway, while continuing to develop and grow economically.

Ensuring a wide diffusion of green technologies will be as important as their invention, in particular in addressing global environmental challenges. International science and technology cooperation can be strengthened to deliver more rapid scientific and technological progress and lead to a quick and wide diffusion of innovation. Proven co-operation strategies include: joint investment in basic research; mapping of R&D needs; collaborative research in international networks; technology transfer initiatives; and scholarships and fellowships for the international mobility of researchers. For example, the Major Economies Forum on Energy and Climate Change has developed Technology Action Plans for ten climate-related technologies, including carbon capture and storage (CCS), bioenergy, energy efficiency, wind energy and smart grids. Each Plan includes a menu of specific individual and collective country actions that could help to reduce market barriers and realise the full potential of the clean energy technologies. In order to build on and implement these Plans, the Clean Energy Ministerial (CEM) was created as a high-level global forum to promote policies and programmes that advance clean energy technology and to share lessons learned and best practices. Specific CEM initiatives (11 in total, spanning a range of technologies) are based on the Technology Action Plans and areas of common interest among participating governments and other stakeholders. A number of international partnerships have developed to help facilitate the development and sharing of major technologies to tackle key environmental challenges. For example, 24 countries and the European Commission have established a Carbon Sequestration Leadership Forum (CSLF) focused on the development of improved cost-effective technologies for the separation and capture of carbon dioxide (CO₂) for its transport and long-term safe storage. The IEA Greenhouse Gas R&D Programme (IEAGHG) is an international collaborative research programme established in 1991 that studies and evaluates technologies that can reduce greenhouse gas emissions derived from the use of fossil fuels. It is an Implementing Agreement under the International Energy Agency (IEA).

Discussions can arise around technology diffusion and the need to maintain appropriate incentives for investment in innovation, in particular in the context of encouraging take-up of clean technologies by developing countries. IPRs provide an important incentive to invest in innovation by allowing firms to recover their investment costs. Empirical evidence suggests that effective IPR protection is a means to promote technology transfer towards developing countries when foreign technology providers face the threat of imitation by local competitors (Maskus, 2010). Along the same lines, stronger IPR protection encourages FDI and licensing, which induces technology transfer that goes beyond the mere export of equipment or goods. At the same time, ensuring that patent design includes adequate disclosure of information can facilitate access to technology after the protection period. To diffuse green technologies on a wider scale, multilateral and domestic action could be taken to reduce the cost of green technologies. Some options could include covering licensing fees, or even buying out patents on key technologies. Experience in other areas, such as health, shows this can work if well designed and involving the private sector from the beginning. Enabling all countries and firms to build more systematically on the knowledge resulting from basic research undertaken by public institutes would also help.

Source: OECD (2011j).

Non-tariff, often implicit, trade barriers also merit attention. Technology diffusion can be aided through increasing transparency in public procurement practices, a re-assessment of technical regulations such as

technology standards) where the latter differ substantially from international standards, and an evaluation of custom procedures to see whether they could be streamlined as needed, without compromising security and quality controls. In this context, avoiding ‘green protectionism’, national environmental policies and regulations that distort international trade and investment flows or that are being used in an anti-competitive manner, is an important consideration. Sometimes the undesired effects on the openness to trade and FDI that may arise from some support policies are inadvertent; and even well-intended policies could be self-defeating because they increase the prices of the protected green goods and services, discouraging their take up by consumers and firms. Though monitoring processes have not identified significant examples of such “green protectionism” (Box 14), continuing vigilance is important.

Box 14. Monitoring and vigilance against green protectionism

It is important that green growth measures observe key international trade and investment principles (including creating an equal playing field for domestic and international investors). The OECD and UNCTAD were requested by the G20 to monitor investment protectionism. The OECD-hosted Freedom of Investment (FOI) Roundtable has issued a communication on “Harnessing Freedom of Investment for Green Growth,” which aims at making governments’ environmental and investment policy goals mutually supportive. This process is most effective and efficient if it is integrated into policy design at an early stage.

The FOI Roundtable communication also addresses the concern, expressed by some countries, that investment could be affected if the green growth policy agenda were captured by protectionist interests. However, its policy monitoring suggests that this is not a major problem. Importantly, none of the 43 countries (34 OECD member countries, and 9 non-member countries: Argentina, Brazil, Colombia, Egypt, Latvia, Lithuania, Morocco, Peru and Romania) that report regularly to the Roundtable about investment measures have reported overt discrimination against non-resident or foreign investors in relation to environmental policy. Participating countries have also not reported serious concerns about such measures by other countries.

UNCTAD also monitors and reports investment protectionism, in the context of its assessment of Global Investment Policy Developments, through its annual World Investment Report, the quarterly Policy Development Monitor and the deliberations of the Commission on Investment, Enterprise and Development.

Source: OECD (2011k).

Encouraging job creation and equity for inclusive green growth

Green growth and jobs

Understanding the links between environmental sustainability and equity is critical (UN, 2011a). Harnessing the growth opportunities and avoiding social costs in the transition to green growth depends on the ease with which resources such as capital and labour can be reallocated across sectors or firms to their most productive use. A focus on ensuring inclusive green growth will be essential, to ensure that green growth contributes to achieving the broader goal of sustainable development and poverty eradication. For example, labour markets will need to be reformed to increase their inclusiveness, facilitate job creation and reduce persistent unemployment.

Integrating green growth considerations in structural reform plans will entail technological change and an important transformation of the structure of different economies. There is little doubt that as consumption and production patterns change, green growth will both create and destroy jobs. It will also change the nature of some existing jobs. Still, the exact effects on aggregate employment or skill requirements are difficult to anticipate (Box 15). A number of countries are investing in improving knowledge about the

implications of green growth for jobs. For example, the Canadian government funds work on a definitional model and data collection methodology for Canada's green economy by the Environmental Careers Organization (ECO), a non-profit organisation which aims to ensure an adequate supply of skills and knowledge required to meet the environmental human resource needs of the public and private sectors. This research aims to improve environmental labour market intelligence in Canada to create a more efficient labour market. The US Bureau of Labor Statistics recently released a formal definition of "green jobs". In 2008–2009, the US resource on occupational competencies, an online searchable database known as the Occupational Information Network (O*NET), began research to integrate information on green jobs.

Box 15. Labour market policies need to be guided by an accurate diagnosis of how green growth will reshape labour markets

Assessing the effects of green growth policies on job creation is a very challenging task. Many uncertainties arise from the complexity of building the different effects of environmental policies, induced innovation and related infrastructure spending into economic models. Moreover, a large part of the structural and technological change, along with job turnover, is likely to take place within sectors making it difficult to model. It is also important to keep in mind that delaying policies that help to internalise environmental externalities may eventually undermine the sustainability of economic growth, as extreme weather events and negative impacts on human health, to name but a few examples, undermine productive capacity. As these effects are rarely captured in economic models, they will underestimate the positive employment effects of green growth policies in the long run.

Limiting environmental externalities will involve costs, but can also induce technological change, as companies look for cleaner and generally more efficient policies, and can improve overall company performance (Porter, 1991; Porter and van der Linde, 1995). The empirical evidence regarding this so called Porter hypothesis is mixed, but a positive impact of environmental policies on technological progress is more likely when countries improve the functioning of their general innovation policies at the same time. Similarly, green growth will also require additional investment in infrastructure in many countries. This can have a particularly positive impact on overall employment in economies in cyclical downturns that operate below capacity, provided that the state of government finances allows for higher public spending.

Pricing externalities is likely to bring about some sectoral change. Analysis based on a multi-sectoral computable general equilibrium model suggests that there will be some change in the sectoral composition of employment as a result of climate policies for example, with fossil-fuel industries experiencing the steepest employment declines and renewable energy industries the sharpest increases (OECD, 2012c). However, this policy-induced job turnover appears to be modest compared to labour reallocation already observed in G20 economies. The model suggests that transition cost in terms of GDP can be limited if labour markets are flexible, but they will increase in the presence of labour market rigidities. In this case, recycling carbon revenues to lower labour taxes may be able to yield a "double dividend", leading to lower emissions and higher employment at the same time. Furthermore, several studies concerning South Africa, India, China and Brazil (cited in World Bank, 2012a), suggest some net job creation potential of green growth policies. Nevertheless a study of South Africa (World Bank, 2011b), suggests that the idea of developing green industries, while appealing, has little chance of improving labour market outcomes unless general structural problems are addressed, such as regulatory obstacles to better performance of small and medium-sized enterprises and skill scarcity.

A number of countries and organisations have started work to gain a better understanding of the skills that will be required by green growth. Preliminary findings suggest that strengthening general education and training systems will make it much easier for workers and economies to seize the opportunities of green growth related structural and technological change (OECD, 2012c). This is in part why green growth needs to be an integral part of the broader structural policy agenda.

Source: OECD (2012c), World Bank (2011b; 2012a).

The prime policy challenge is to minimise the costs of labour market adjustments and increase the chances of making the most of any arising opportunities. Labour market and skill policies can make an important contribution in this context despite the large uncertainties about the effects of green growth on labour markets (see Box 16). The right framework policies, supporting competition and innovation can aid this objective. So would a reduction of labour taxation as environmental taxes increase. More efficient and effective education and (re)training programmes would address skill shortages and make sure that workers can develop their skills, re-train to avoid job loss as a result of changing labour market demands or quickly find a new job when they are unemployed. High quality education and training will not only facilitate workers' ability to adjust to labour market changes but also improve the capacity to generate and adopt new technologies. Also, employment subsidies can be useful if made conditional on working in the export-oriented or greener sectors (World Bank, 2012a). Lessons from adjustments to trade liberalisation confirm that such measures will help minimise the human and financial costs of the transition (Porto, 2012). More generally, labour market institutions that put more emphasis on income support and job-search assistance to unemployed workers rather than strict protection of specific jobs are better suited to increase the flexibility of economies and facilitate the economic transformation towards green growth.

Box 16. The role of labour market and skill policies

The general approach

Labour market and skill policies should play an active role in helping workers and employers to make the transition to green growth and sustainable development. However, it is important to bear in mind that the main policy drivers of green growth will need to be environmental policies, which align economic incentives with environmental responsibility, and innovation policies, which encourage the development of the new technologies that will be required to decouple economic growth from depletion of environmental stocks. Labour market and skill policies can contribute to an overall sustainable development policy strategy by helping to foster the structural changes required to green the economy while lowering the associated social costs and assuring they are shared equitably. Doing so will result in a quicker and fairer transition towards inclusive green growth, while also making it much easier to develop and sustain political support for this essential but difficult policy agenda.

Labour market policies and programmes can play a significant role in helping employment adjustments by providing:

- support to enterprises for retraining workers
- matching of workers with new jobs
- prompt identification of skills needs through surveys and other instruments
- income support measures, such as unemployment benefits, to help limit the downside adjustment process for workers
- information to workers on the range of active and passive labour market programmes available to them to minimise disruption

Efforts to diversify local and regional economies that are heavily dependent on shrinking industries may be needed to allow them to more readily absorb the necessary shifts in labour resources.

While moving towards green growth is not unlike other structural changes, national policies and programmes should nevertheless be tailored to address specific challenges and specific industries in line with each country's assessment of their needs. The challenge for emerging and developing countries is to address employment adjustments in high-emission industries, and more importantly to seize growth opportunities based on new technology and clean energy.

Both general and green-specific labour market policy measures will be required

In addition to adapting familiar labour market and skill policies so that they better address transition challenges related to green growth, there also appears to be a role for specific policies. However, the role for specific measures is

likely to emerge only incrementally, as the environmental policy framework needed to support inclusive green growth develops and experience with managing the labour market dimension of the transition to inclusive green growth accumulates. An OECD questionnaire sent to labour and employment ministries reveals that about 60% of the 27 responding countries have implemented at least one labour market measure targeted on green growth, with training being the most common type of measure. However, most of these programmes are new and quite small. Furthermore, some countries that are leaders in environmental policy, such as Germany and Denmark, are among the 40% not operating any green-specific programmes. This suggests that good general labour market and skill programmes may be adequate in some instances, particularly if they are designed to be responsive to the evolving needs of employers and workers.

Four areas where policy action may be particularly important

Meeting the emerging job-skill requirements of a greening economy

The available evidence suggests a significant mismatch between the skills of the workers who will be displaced from declining economic activities with a large environmental footprint and growing green activities. This disjunction will increase the need of mid-career workers for re-training opportunities. However, the greening of existing jobs is likely to affect a greater number of workers. For example, labour-intensive activities such as construction and agriculture will need to significantly change production methods as they move toward environmental sustainability. Continuing vocational training will be key, but the challenge should be manageable because there appear to be few fully new green skills.

Assuring a just transition to inclusive green growth

While the benefits of a transition towards green growth should be broadly shared, there is a risk that the costs of the transition could fall disproportionately on certain labour force groups, households and localities. One priority for assuring a just transition is to make sure that workers who are displaced from declining firms and sectors receive the help they need to maintain their living standards while reintegrating into the labour market. This is essentially the challenge to reconcile structural adjustment in labour markets with social protection and re-employment services for workers. It is not clear that sustainable development calls for different types of policy responses than other types of structural change, but the transition towards inclusive green growth makes it more important to meet the “flexicurity” challenge. In emerging and developing countries, a top priority is to introduce or strengthen social protection floors.

Since the spatial distribution of the costs and benefits from green growth will also tend to be uneven, there may also be a role for place-based policies, such as economic revitalisation strategies for local economies previously specialised in fossil-fuel production. Workforce development initiatives can play a positive role in such efforts, but generally would not play a leading role.

Assuring workers' rights in growing green activities, while seizing opportunities to promote social inclusion

Assuring workers' rights in line with international labour standards in growing green activities while promoting high-quality jobs is also a key to achieving a just transition. While green growth probably does not call for different types of measures to promote these goals, it will be necessary to be especially vigilant about worker rights, extensive social dialogue and minimum job standards during this period of intense structural change. In the context of developing and emerging economies, it will also be important to assure that emerging green jobs are formal jobs, while existing and currently informal activities, such as in waste picking, are formalised.

The job creation associated with the transition towards sustainable development represents an opportunity to promote social inclusion, provided disadvantaged groups in the workforce are assisted to access these new green jobs. Important gains can also be achieved by upgrading existing jobs to decent work with incomes lifting families out of poverty. This could be achieved for tens of millions of smallholder farmers, forest dwellers and informal waste pickers for example. Programmes in a number of G-20 countries demonstrate the development gains from improving existing jobs.

The greening of enterprise, particularly SMEs

The ‘greening’ of enterprises refers to the promotion and implementation of sustainable production and consumption patterns at the enterprise level. This entails the adoption of practices that are energy and resource-efficient, low-waste, low-emission, and non-polluting so as to reduce an enterprise's environmental footprint.

The role of small and medium-sized enterprises in the transition towards green growth will be critical. Enabling SMEs to successfully navigate the shift to a greener economy and to seize the opportunities will be important to ensure that the employment balance is positive and inclusive. In addition to a generally enabling regulatory and institutional environment which makes it easy for businesses to start and grow as part of the formal economy, SMEs are particularly sensitive to access to information and to green markets, to skills programmes, technologies and to finance. Public procurement which can be a major pull factor for green products and services should ensure that SMEs can be suppliers. Similarly, environmental regulation and research and development need to be mindful of the needs and limitations of SMEs. Cooperatives and business associations play a fundamental role to support SMEs to grow and become sustainable.

Source: Extract from ILO/OECD report on green jobs for G20 Employment and Labour Ministers

Green growth and equity

Green growth policies can also improve welfare through distributional impacts. For instance, with inefficient fossil fuel subsidies tending to primarily benefit rich and middle-income households in developing countries (see above), retargeting the subsidies to more directly support poor households can increase equity. To this end, policy makers can use existing safety nets (where available) or ad hoc targeted measures, for example to support household connections to electricity or gas rather than energy consumption (Kanbur, 2010). Replacing energy subsidies with targeted cash transfers can free resources for public investment (in schools or infrastructure) and benefit the poor and the environment. Indeed, public investments in basic health and education that directly benefit the poor and the disadvantaged are an essential ingredient of inclusive policies in many countries, and green growth paths need to ensure that such equity-enhancing interventions are sustained. Another example of an inclusive green growth policy that is having positive distributional impacts is the Bolsa Verde (green allowance) programme in Brazil, which rewards communities living in protected areas for their commitment to contribute to the promotion of environment conservation (Box 17).

Box 17. The “Green Allowance” in Brazil

Pursuing the strategy of integrating poverty eradication and environmental protection efforts, the Brazilian government has been implementing a national Program to Support Environmental Conservation, popularly known as Bolsa Verde (Green Allowance). This programme is part of a broader set of income transfer and productive inclusion measures conducted by Brazil in the past few years, managing to raise 30 million people out of poverty.

The Green Allowance targets families living in extreme poverty conditions and based in *i)* environmental protected areas, *ii)* environmentally sensitive rural settlements and *iii)* territories occupied by indigenous and traditional people. The programme aims at combining incentive to ecosystems conservation, sustainable use of natural resources, promotion of active citizenship, improvement of life standards and income growth for populations in extreme poverty that promote conservation of natural resources.

By participating in the Green Allowance, families commit to respect certain environmental conditions without compromising the sustainable use of natural resources. Regular monitoring will assess the conditions of forest cover in recipient areas. The programme has benefited 18 thousand families living in the Amazon region, encouraging the conservation of a 14.5 million-ha area so far. By the end of 2012, 50 thousand families will benefit by receiving BRL 300 (USD 158) every three months. Funds come from the Brazilian public budget and are added to those of the Family Grant (Bolsa Família), one of the world's largest income transfer programmes, thus reconciling the poverty alleviation and environmental agendas. Initially aimed at populations living in areas with forest cover, the Green Allowance may be extended to degraded areas where recovering actions are desired.

Source: Brazilian Ministry of Environment.

Protecting the most vulnerable households from the possible adverse distributional effects of greening growth is essential to ensure that green growth is inclusive and contributes to sustainable development and poverty reduction in the longer term. It is also likely to increase political support for the reforms. Most environmentally harmful subsidy measures are poorly targeted to address poverty – the IEA estimates that only 8% of global fossil fuel reach the lowest income quintile (the bottom 20%) - making them an expensive tool (IEA, 2011). Well-targeted transfers or other types of social policies to protect the poor and empower them to take advantage of the opportunities offered by green economies would be less expensive and more efficient. Social transfer systems are well-established in high-income countries, but need to be further developed in many developing and emerging economies. Australia is increasing social transfers, such as pensions, family and the general tax allowances, to cushion the impact of the introduction of carbon prices this year on low- and middle-income households' real income. Such strategies can also be effective in the G20 emerging economies. Brazil is one country that has replaced fuel subsidies with direct cash transfers: the Bolsa Familia cash transfers to low-income families were supplemented by an extra amount to compensate the removal of subsidies on LPG, commonly used for cooking by the poor (Grosh *et al.*, 2008). Mexico is also planning to compensate low-income households for lower fossil fuel subsidies with increases in cash transfers within its *Oportunidades* programme. One important challenge in designing means-tested benefits is to assure that financial incentives to work or move up the income ladder remain sufficiently strong.

III. Stocktaking of Green and Sustainable Development Policies and Commitments by G-20 Countries

G20 countries have already experimented with policies in most if not all the areas discussed above. Policy tools vary from country to country, reflecting amongst other things the level of development, preferences, industrial structures and resource availability. This section summarises G20 countries' self-reported green growth policies in response to a questionnaire circulated for this report, complemented with information on policies highlighted in the G20 Mutual Assessment Process (MAP) that have a green growth angle, and information from other sources, such as OECD, World Bank, and UN reports.²²

National green growth and sustainable development strategies

A number of G20 countries have developed a framework for their green growth and sustainable development policies. Korea has developed a comprehensive green growth strategy, and many other countries have given their national development plans or their growth strategies an important sustainability dimension. Many countries have sustainable development plans which integrate economic and social sustainability with environmental sustainability. Some countries have developed environmental policies in different areas, including climate change, resource productivity or biodiversity, which taken together provide a framework for addressing green growth and sustainable development objectives. Some examples are provided in Table 2.

Some countries, such as Brazil and France, have tried to build consensus through open and participatory approaches involving political parties and civil society. Brazil created the Brazilian Forum on Climate Change, which brought together representatives from government, civil society, business, universities, and nongovernmental organisations to mobilise society around a climate plan of action. Public participation

22. Most G20 countries plus Chile and Spain have provided responses to the self-reporting questionnaire. The following countries have replied: Argentina, Australia, Brazil, Canada, European Union, France, Germany, Indonesia, Italy, Japan, Republic of Korea, Mexico, Russia, South Africa, Turkey, United Kingdom, United States.

took the form of a national conference on the environment and sector dialogues, which contributed to the preparation of its National Plan on Climate Change.

Table 2. Examples of major green growth and sustainable development strategies or plans in G20 countries, Chile and Spain

Country	Green growth, green economy, green development strategies or inclusive green growth elements in national economic plans or strategies
Argentina	Creation of a Government on Climate Change Policies in 2009, underpinned by programmes to promote energy efficiency and renewable among others.
Australia	The <i>Clean Energy Future Plan</i> introduces carbon pricing and aims to promote energy efficiency, innovation and investment in renewable and abatement in the land sector. Carbon capture and storage (CCS) continues to be promoted through complementary measures.
Brazil	Sustainable Development is a key principle to guide the government's four-year plan aiming at achieving economic growth, social inclusion and job creation coupled with respect for the environment. Energy, infrastructure (via the Growth Acceleration Program). Programa Brasil Sem Miséria (Brazil without Poverty Program) and Programa Brasil sem Fronteiras (Brazil without Boundaries) stand out as reform areas with integrated sustainable development policies. The Action Plan for Prevention and Control of the Legal Amazon Deforestation (PPCDAM), under direct coordination of the President's executive office, involves more than 10 ministries, different levels of government and the private sector. It uses regulation, accountability mechanisms and the development of economic alternatives for producers to achieve its results.
Canada	The <i>Federal Sustainable Development Strategy</i> of 2010 outlines government strategies to attain environmental sustainability. Progress is measured with a set of Canadian Environmental Sustainability Indicators that track environmental status and trends related to air, water and nature. .
Chile	The <i>National Energy Strategy</i> seeks to promote energy efficiency and the deployment of traditional (hydropower) and intermittent renewables (wind and solar energy) through an expansion of transmission systems and regional interconnection as well as strengthened competition.
China	The 'Green Development' section of China's 12th Five Year Plan (FYP, 2011-2015) reflects the country's aspiration to move towards a greener economy. The 'Green Development' theme has identified six strategic pillars: climate change, resource saving and management, circular economy, environmental protection, ecosystem protection and recovery, water conservation and natural disaster prevention.
European Union	The EU's ' <i>Europe 2020: A Strategy for Smart, Sustainable and Inclusive Growth</i> ' includes a focus on sustainable growth to promote a more resource efficient, greener and more competitive economy, similar to the EU <i>Sustainable Development Strategy</i> . It includes a resource efficiency strategy and a flagship initiative on innovation. The latter provides for the development of European Innovation Partnerships that aim to foster cooperation among partners in view of exploiting the potential for innovative breakthroughs. EIPs are being developed in fields such as agriculture, water efficiency, raw materials, smart cities, etc. The EU also has an <i>Environmental Technologies Action Plan</i> to promote environmental innovation.
France	France's second <i>National Sustainable Development Strategy</i> seeks to establish a decarbonised economic model that preserves natural resources and integrates human and social concerns. Progress is monitored with a set of indicators.
Germany	Germany's <i>National Strategy for Sustainable Development (2002)</i> , underpinned by concrete targets and sustainability indicators, aims to achieve intergenerational equity (including resource protection, climate protection, renewable energy, land use, species diversity and innovation), a good quality of life (including mobility, farming and air quality), social cohesion and international responsibility.
Indonesia	Indonesia's strategic long term development plan (2005-2025) aims to achieve a "green and

	ever-lasting Indonesia”. The government has set up programmes on food resilience by implementing sustainable agriculture, sustainable forestry management, energy efficiency and renewable energy usage, clean technology support, waste management, low carbon transportation management and green infrastructure development.
Italy	The <i>Environmental Action Strategy for Sustainable Development</i> (EASSD) was developed in 2002, although implementation is lagging. The strategy is currently being revised to bring it more in line with the EU Sustainable Development Strategy. The government stated that it wants to strengthen its efforts to integrate the sustainable development goal into national policy making and ensure policy coherence. An Agenda for the Green economy to 2030 is currently being developed.
Japan	Japan’s <i>New Growth Strategy</i> contains a green dimension. Greening the tax system is one of the instruments that will be used to promote green innovation. Key priority areas include renewable energies and innovative technologies, such as energy-efficient facilities, low carbon emission cars, zero-emission residential and commercial buildings and so on. The <i>Strategy for the Rebirth of Japan</i> reviews energy policies reflecting on the effects of the Great East Japan Earthquake and the ensuing nuclear accident. It refers to a new <i>Innovative Strategy for Energy and the Environment</i> that contains the Green Growth Strategy.
Republic of Korea	The National Strategy for Green Growth and the Five-Year Plan (2009-2013) aims to: (1) promote eco-friendly new growth engines, (2) enhance peoples’ quality of life, and (3) contribute to international efforts to fight climate change. Under the plan, the government will spend about 2% of annual GDP on green growth programmes and projects.
Russia	The Concept of long-term social and economic development in Russia up to 2020 seeks to reduce the negative environmental impact of economic activity. The Energy Strategy through 2030 seeks to promote renewables and there is a programme to promote energy efficiency.
Mexico	Sustainable development is one of the guiding principles of the <i>National Development Plan</i> , which integrates sustainable water, forest and biodiversity management, as well as commitments to contribute to reducing climate change and solid, as well as hazardous waste. The National Energy Strategy envisages energy efficiency improvements and better environmental performance of the energy sector. The Strategy for Energy Transition and the Sustainable Use of Energy aim to promote renewables
Spain	. The <i>Strategy for Sustainable Development</i> (2007) includes goals and actions aimed at environmental, social and global sustainability. Strategies, plans and specific measures have been approved for target key sectors, such as the Spanish Strategy for Sustainable Mobility, the Spanish Strategy for Energy Efficiency 2004-2012, corresponding plans, and the Renewable Energy Plan 2011-2020.
South Africa	South Africa’s <i>National Framework for Sustainable Development</i> seeks to improve access to more sustainable energy provision, improve material efficiency and waste minimisation and build sustainable cities, while promoting better freshwater resource management and sanitation. The <i>New Growth Path Framework- Green Economy Accord</i> signed by the government and social partners in November 2011 seeks to green the economy as a jobs driver for the future.. Some of the main commitments relate to increased use of renewable energy as well as mass installation of solar water heaters; investment in mass transit and a shift of freight from road to rail. The <i>National Development Plan</i> and the <i>Industrial Policy Action Plan</i> both have a green growth dimension.
Turkey	The sustainability goal has been an integral part of the 8 th (2001-05) and 9 th (2007-13) National Development Plans. In the 9 th NDP the protection of the environment and improving urban infrastructure was associated with the objective of increasing the competitiveness of the Turkish economy. The stated goal of the National Action Plan for Climate Change is to integrate climate-change objectives into national development policies and promote renewable and energy efficiency. With <i>Energy Efficiency Law</i> , <i>Energy Efficiency Coordination Board</i> was established to carry out energy efficiency studies within all relevant organisations all over the country, monitor the results and coordinate efforts. <i>Renewable Energy Law</i> provides a <i>Renewable Energy Support Mechanism</i> , which covers different incentives and benefits for renewable energy projects including feed-in tariffs.

United Kingdom	<i>Enabling the Transition to the Green Economy</i> sets out the UK government's overall approach to building the green economy. It outlines the range of policy tools the UK Government is using to support the transition to a green economy, the timeline for Government decisions, the opportunities that are created and the implications for the way in which businesses operate. The Growth Review of 2010 includes structural reforms to improve productivity and the investment climate, including for low-carbon technologies. The National Infrastructure plan contains measure to reduce regulatory burdens and make infrastructure investment less costly and to ease financing constraints, including through the establishment of a new Green Investment Bank. The Carbon Plan outlines policy measures that would help the United Kingdom meet its emission reduction targets.
United States	The <i>Blueprint for an America Built to Last</i> (2012) seeks to promote home-grown clean energy to provide 80% of electricity through clean sources by 2035

Source: UN Conference on Sustainable Development <http://www.uncsd2012.org>, country submissions

Reforming tax structures

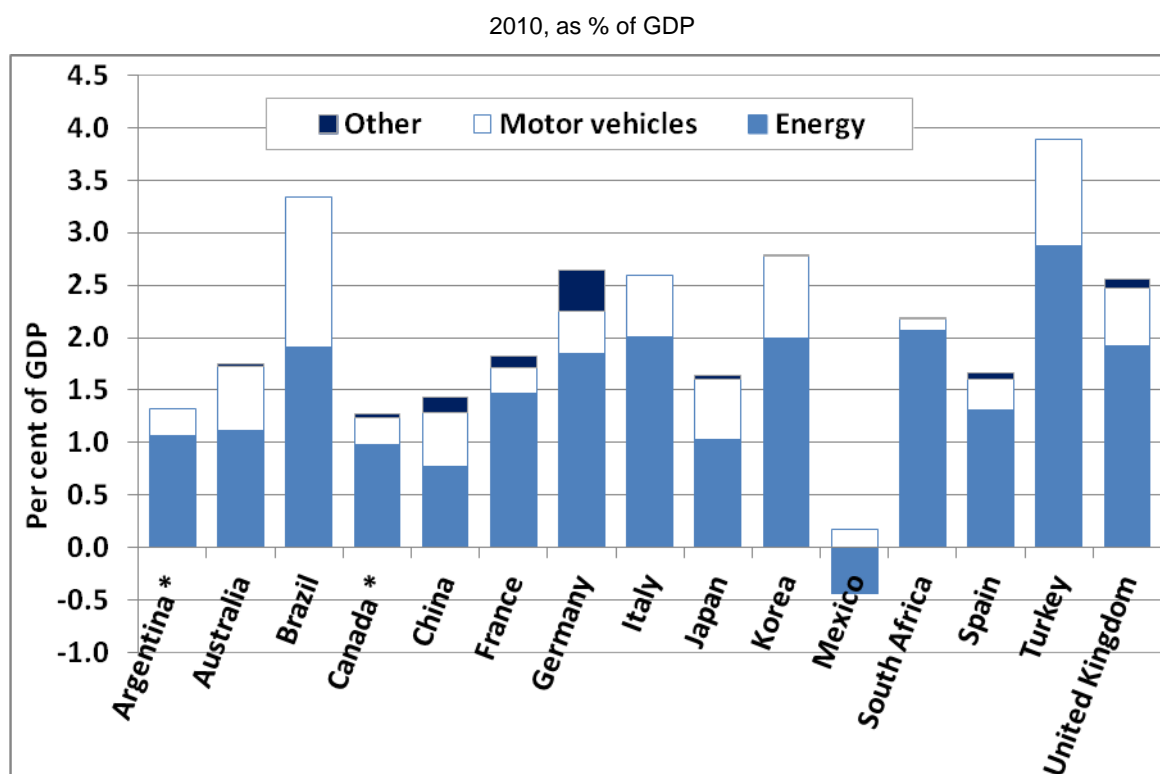
Phasing out of inefficient subsidies that encourage wasteful consumption

Most, if not all, G20 countries subsidise environmentally-harmful behaviour in some ways. Following the 2009 G20 Summit, a number of G20 countries have identified inefficient fossil fuel subsidies that encourage wasteful consumption and established action plans to rationalise or phase-out these subsidies. An update on G20 country progress in implementing these reforms will be provided to the Los Cabos Summit in 2012.

Pricing externalities – tradable permit systems and taxes

G20 countries also have in place a number of environmentally-related taxes, predominantly excise taxes on energy. So far, the importance of environmentally-related tax revenues varies widely among G20 countries for which comparable data are available (Figure 5), and the bulk of revenues come from taxes on fuels and motor vehicles.

Figure 5. Revenues from environmentally-related taxes in selected countries



1. (*) indicates 2009 data

Source: OECD Environmental Policy Instruments Database

Some examples of cap-and-trade systems in OECD countries are listed in Box 18.

Box 18. Examples of tradable permit systems in some G20 countries

Australia: *i)* individual transferable fishing quotas for a number of species; *ii)* trading scheme for saline discharges into Hunter River, *iii)* pilot interstate water trading system; *iv)* a carbon price mechanism planned to commence from 1 July, 2012, beginning with a fixed price of AUD 23 per tonne and increasing by 2.5% a year in real terms, before transitioning to a fully flexible cap-and-trade emissions trading scheme from 1 July 2015.

Canada: Quebec and Alberta currently have provisions for as emission trading schemes.

European Union: European Union Emission Trading System for most emitting industries, power sector and air transport. It was launched in 2005 and covers 30 countries (EU Member States plus Iceland, Liechtenstein and Norway)

France: *i)* White Certificate Trading for End-use Energy Efficiency; *ii)* Tradable development rights for landowners for landscape preservation

India: *i)* Trading of Renewable Energy Certificates started in 2011; *ii)* The Perform Achieve and Trade scheme is a market-based mechanism to enhance energy efficiency in the "designated consumers" (large energy-intensive industries and facilities) which started in 2009.

Italy: White Certificate Trading for End-Use Energy Efficiency

Japan: Voluntary CO₂ emission trading system (launched in 2005) and trial CO₂ emission trading system (launched in 2008). Tokyo CO₂ emission trading system (city-level), introduced in 2010.

Korea: Greenhouse gas emission trading system for large emitters to be introduced in 2015

United Kingdom: Trading of emission rights for dust, SO₂ and NO_x under the National Emissions Reduction Plan

United States: *i)* NO_x missions rights trading scheme in the North East, *ii)* tradable permits for lead in gasoline traded among oil refineries, *iii)* NO_x and SO₂ emission rights trading under the Clean Air Interstate Rule for power plants and some other industrial sources, and for other firms under the Mobile Sources Averaging, Banking and Trading Scheme, *iv)* national tradable emission rights system for ozone depleting substances, *v)* transferable fishing quotas; *vi)* greenhouse gas emissions trading scheme in northeast US states under the Regional Greenhouse Gas Initiative (RGGI); *vii)* greenhouse gas emission trading scheme set to begin in 2013 in California.

Source: OECD/European Environment Agency (EEA) database on instruments used for environmental policy and natural resources management; OECD (2010c), OECD (2012a),

Based on country submissions, case studies and OECD economic surveys of advanced and emerging economies, the following conclusions stand out regarding progress in internalising environmental externalities with price instruments in an efficient way:

- While there has been significant progress in the use of pricing instruments, it is unlikely any country has yet implemented a comprehensive pricing system that reflects the social costs of externalities. Pricing of greenhouse gas emissions remains piecemeal and uneven across countries.
- While most of the examined countries tax fossil fuels in some way, the tax rate is rarely aligned with the externalities related to fuel use. In many cases no price is put on CO₂ emissions related to fuel use or on local externalities, such as congestion or health costs related to other pollutants. This leads to different prices for the same externality, making abatement more expensive than necessary, because of exemptions and interactions with other energy taxes (Braathen, 2011).
- Most countries tax diesel more lightly than petrol, although related externalities in terms of CO₂ emissions and air, water and soil pollution with negative impacts on human health, agricultural productivity and biodiversity are stronger in the case of diesel. There are many exemptions in fuel and environmental taxes, further contributing to differences in abatement costs for the same externality.
- Taxation of the extraction and use of natural resources is very limited, and there is significant potential for increasing this tax base to incentivise more efficient use of the scarce resources and as a source of government revenues.

Many G20 countries provide reduced tax rates, deductions or other types of tax expenditures to promote environmentally friendly behaviour. For example, Canada has a tax credit for public transit costs of regular commuters and an accelerated capital cost allowance for businesses investing in clean energy generation or energy savings. To improve the energy efficiency of buildings, Italy allows taxpayers to deduct 55% of the costs incurred for certain energy retrofit operations from personal or corporate income tax obligations. As cautioned above, such subsidies need to be carefully targeted to ensure that they continue to provide the right incentives and do not constitute an unnecessary burden on government budgets.

Subsidies and other direct support schemes

Direct government subsidies, or indirect subsidies at the expense of consumers, aimed at promoting sustainable behaviour or compensation for eco-system service can sometimes be effective in encouraging more sustainable consumption and production patterns and the diffusion of green technologies. Some G20 countries also run programmes to pay businesses or individuals for positive environmental externalities, for example through Payments for Ecosystem Services (PES) schemes. An example would be Mexico's Proarbol programme, under which it administers a range of payments for owners of forest areas for conserving rather than using the land for agriculture. Canada provides tax incentives to promote donations of ecologically sensitive land, which includes protected forest areas and helps non-governmental organisations to secure forest areas through subsidies.

Many G20 countries, *e.g.* Canada, Mexico, Germany, France, the United Kingdom, provide financial help for households or firms to retrofit their buildings and firms who want to improve the energy efficiency of their machinery. Many G20 countries also support retro-fitting of houses to improve energy-efficiency with tax reductions or subsidised loans, including Italy, Korea, Germany and France. This state intervention can be justified as owners and tenants often have different information about the energy-efficiency of their buildings and depending on the type of the lease, the benefits of energy efficiency improvements or energy savings often do not accrue to the person who bears the cost. In this respect, the United Kingdom has recently established a new mechanism to finance energy efficiency improvements in buildings. In essence, private capital can finance the investment and bill-payers (tenants or owners) can pay for the improvements through their energy bills (*i.e.* with the savings generated by the investment) rather than paying upfront.

Most countries run programmes that are specifically directed at supporting the use of renewable energy. Many G20 countries use either feed-in tariffs or renewable portfolio standards to promote renewable energy. An overview is provided in Table 3. In addition, many countries provide further subsidies for renewable energies, for example Canada through its ecoEnergy for renewable power programme. Indonesia promotes micro hydro power plants and energy generation from biomass that integrates waste recycling and energy generation. Korea subsidises the installation of renewable power generation in households. South Africa subsidises solar water heaters. Brazil provides financial incentives for the integration of power plants that generate energy from alternative sources (wind, solar, biomass) into the grid. Plants that generate up to 30 MW are entitled to a reduction of at least 50% of the tariffs for utilisation of transmission and distribution systems. As indicated above, it is essential that such support for environmentally-friendly alternatives is well targeted and time-bound, to ensure cost-effective policy action. Turkey provides a Renewable Energy Support Mechanism, which covers different incentives and benefits for renewable energy projects including feed-in tariffs. The renewable energy law provides different feed-in tariffs (fixed minimum electricity sale prices) depending on the type of the renewable energy.

Table 3. The use of Renewable Performance Standards and feed-in tariffs in G20 countries

Name	Feed-in-Tariff	Renewable Energy Certificates/ Obligations/Standards (Generation)
Argentina	Yes	
Australia	Yes ¹⁾	Yes
Brazil		
Canada	Yes ¹⁾	
China	Yes ¹⁾	
France	Yes	
Germany	Yes	
India	Yes ¹⁾	Yes ¹⁾
Indonesia	Yes	
Italy	Yes	Yes
Japan	Yes	Yes
Korea	Yes	
Mexico		
Russia		
South Africa	Yes	
Turkey	Yes	
United Kingdom	Yes	Yes
United States	Yes ¹⁾	Yes ¹⁾

Note: 1) state-level, only solar PV is national in China, only Ontario has feed-in tariffs in Canada

Strengthening markets

As laid out in the previous section, competition policies are a common element of both the Green Growth and the structural reform agendas. A number of structural reform approaches underway in G20 countries can contribute to green growth, including:

- Within the Mutual Assessment Process (MAP), Korea, Mexico and Turkey plan to strengthen private sector participation in the economy, which could contribute to stronger competition and can help provide the financing and expertise necessary to support sustainable development,
- Australia, Brazil, Canada, India, Mexico and Turkey have implemented or plan policies to reform or simplify product market regulations, which could spur market entry and growth of incumbents, thus promoting competition.
- Argentina, Canada, China, European Union, France, India, Indonesia, Japan, Mexico, South Africa have committed to reducing barriers to foreign ownership, investment and trade. This, as well, will promote competition and can facilitate the diffusion of green technologies and systems.
- Many G20 countries have committed to reducing regulatory barriers to competition, including Australia, Brazil, Canada, China, Germany, European Union, France, Italy, Korea, Mexico, South Africa, Spain, United Kingdom. Mexico has passed a competition reform in 2010, enhancing the power of the competition authority.

Regulatory and information policies

Complementary environmental policies, such as regulation, standards, subsidies and information campaigns are used in many countries, in particular when price signals are unlikely to work because markets in resource and energy-intensive sectors are not functioning well. Most G20 countries have in place programmes to improve energy efficiency, resource efficiency or waste management and recycling. Such programmes often combine a range of measures including standards for buildings, appliances and vehicles, voluntary approaches as well as labelling and nudging policies, and are sometimes coupled with the subsidised loans or tax policies discussed previously. These programmes include:

- Most G20 countries have emission standards for vehicles. The EU, for example, has set emission standards for vehicles, which are binding for member countries. Canada harmonises emission standards for vehicles with the United States.
- Many countries apply performance standards. This can include emission standards for specific sectors or ambient air quality standards. Japan has made significant efforts to improve energy efficiency, including through its top runner programme highlighted in Section II. Russia has recently introduced a similar programme to regulate on the basis of the best available technology.
- France and the United Kingdom impose energy efficiency improvement targets on energy suppliers. They can achieve these targets by helping their customers to improve their energy efficiency. Alternatively, in France they can buy certificates from other suppliers who have achieved energy efficiency improvements that go beyond their target.
- A number of G20 countries have imposed quotas for the recycling of waste from products or packaging materials on the manufacturer of the products or the manufacturer of products that use the packaging materials, including Korea, Germany, France the United Kingdom, Japan, Mexico and Brazil.
- Many G20 countries also use labelling to inform consumers about the energy efficiency of buildings, appliances and other products. In Germany and, more widely, in the EU there is voluntary labelling for environmentally-friendly products. In Italy, the market share of environmentally-friendly products has increased since 2000 as a result of a growing interest by industry to participate in the EU Ecolabel certification process. The French government, as another example, is in the process of developing, with industry and stakeholders, a general environmental footprinting system (methodologies, databases, calculators, etc.) and is conducting a national experiment on the display of consumer product environmental footprint, in which more than 160 companies of all sizes and from all sectors, including foreign ones, are taking part. The United States introduced voluntary energy-efficiency labelling and a label based on the environmental attributes of electronic products. In Russia, energy efficiency labelling is mandatory for buildings and appliances.
- Germany, the United States, the United Kingdom and Japan, to name but a few examples, have developed resource efficiency and material management programmes mainly based on support for voluntary measures in industry and society. This includes research projects to enhance resource efficiency; consulting programmes for small and medium-sized companies to help them improve their resource efficiency; integrating resource efficiency aspects into technical standardisation processes and public procurement; and strengthening voluntary product labelling and certification processes. The EU, as well, has developed a roadmap to resource efficiency. Canada encourages citizens to donate or sell their electric equipment before recycling it. The United States buys old computer equipment that complies with certain environmental standards.

- Korea has implemented a carbon point system to encourage consumers to buy environmentally-friendly goods. Consumers collect points when they buy environmentally-friendly goods or services with the “green card”, a bank issued credit card. They can use these points to receive discounts when using public transport, national parks or local government services. Reducing electricity, water or gas consumption compared to prior monthly averages is also rewarded with points. Russia has launched a large-scale information campaign to promote different energy savings solutions among household, along with recently introduced mandatory metering. Before consumers paid for energy used based on estimates of their consumption.
- Turkey has voluntary agreements with industry to enhance energy efficiency, coupled with various financial support instruments to investments in energy efficiency. As of March 2012, 32 energy efficiency projects have been supported and implementation of 13 projects has been completed. The total investment in these projects is of TRY 5.1 million, with a financial support component of TRY 643 000. Once completed, the projects are expected to save TRY 6.3 million. A voluntary agreement for social and environmental sustainability has been signed in Brazil by public and private banks. Italy has widely used voluntary agreements on waste management, mostly at the provincial and regional levels.
- The US government also helps the chemical industry and consumers through analyses and information campaigns to choose safer alternatives to hazardous chemicals.
- Public procurement that gives due consideration to environmental criteria can also serve to help scale-up clean alternatives to make them more competitive. A number of G20 countries have implemented related public procurement policies at the national or sub-national level. Canada issued a green procurement policy in 2006 to ensure that environmental performance criteria are given due consideration in the public procurement process, including planning, acquisition, use and disposal. Brazil, Italy, Japan, Korea, China and a number of European countries also have green procurement policies. The United States has a public-private partnership with the freight sector to improve energy efficiency, mainly by providing the sector with assessments of fuel consumption and efficiency.

Some G20 governments have decided to lead by example, by imposing energy, water and waste reduction targets on the government and its agencies. In the United States this is underpinned by data provided through sustainability or energy scorecards for federal departments and agencies. In Russia, public enterprises and regions are subject to reporting rules based on energy audits.

Getting infrastructure “right”

Setting framework policies in network sectors

Well-functioning markets in environment-intensive sectors play an important role in ensuring that price signals result in a more efficient use of natural assets. This concerns particularly network industries, such as the energy and transport sectors, where competition is often difficult to establish, as parts of these markets have natural monopoly features. As part of the G20 Mutual Assessment Process a number of countries have committed to reforms in network industries (Box 19). The OECD’s *Going for Growth* exercise has identified this area as a policy priority for the European Union, Japan, Korea and South Africa. The Commission of the European Union is working to improve competition in energy markets in Europe, including by promoting cross-border transmission capacity and a more integrated European electricity market.

Box 19. G20 Mutual Assessment Process: policy commitments on improving competition in network industries

Australia: Roll-out of a wholesale-only open access National Broadband Network, thus separating network and retail service provision. Creation of national regulators for heavy vehicles, maritime and rail safety. Promotion of competitive international gateways.

China: Promotion of private business opportunities, especially in monopolistic sectors.

France: An electricity market reform passed in 2010 aims at reinforcing competition

Germany: Extension of the gas network, the development of the LNG market and the European spot markets, as well as the introduction of auctioning of capacity has improved competition in the gas market. Plans to establish an authority for market transparency in the electricity and gas wholesale markets. Draft law to liberalise long-distance coach travel.

Mexico: Increased flexibility for the national oil company, PEMEX, to bring in private investors. The government auctioned part of the radio spectrum and a fibre-optic network in 2010.

Russia: 2007-2011 measures to liberalise entry in the electricity and heat markets coupled with cost-recovery price regulation in network industries to prevent abuse of market power.

Turkey: Under the Electricity Market Law (2001 – EML), an independent regulatory body, the Energy Market Regulatory Authority (EMRA) was established to regulate and supervise the market. Pursuant to the EML, electricity market activities consist of generation, transmission, distribution, wholesale and retail, as well as import and export activities.

The electricity strategy paper was published in 2004 and was revised in 2009. According to the strategy document the main goals of Turkish electricity policy include; completing privatisation of distribution and generation assets; promoting energy efficiency and reducing energy losses, therefore decreasing electricity prices; promoting new technologies, diversity of resources and the use of domestic and renewable resources; structuring and operating the market in a way that supply security is ensured; and considering climate change and its environmental effects in energy sector activities.

Ongoing privatisation and deregulation of energy, postal and telecommunication sector.

Encouraging infrastructure investment

Pursuing inclusive green growth is likely to require large-scale investments in new or upgraded energy, transport and building infrastructures, as discussed in Section II. Box 20 summarises G20 policy action or engagements to improve public infrastructure to stimulate green growth and sustainable development.

Box 20. Examples of G20 Policies to enhance public infrastructure with a green angle

Argentina: The *Programa Energía Renovable en Mercados Rurales* seeks to provide rural households and public services, that are not connected to the grid, with electricity generated from local renewable sources.

Australia: Public investment in energy and transport infrastructure, including railways, and measures to facilitate private participation.

Brazil: Public investment (USD 545.7 billion over 2011-2014) in urban development, housing, water (USD 11.6 billion on sanitation), electricity, transportation (among which USD 9.5 billion on low-emission transportation) as part of the Growth Acceleration Programme.

Canada: Building Canada, announced in 2007, is supporting public infrastructure projects that contribute to

cleaner air, water and land. In addition, through Canada's Economic Action Plan, the government established the Green Infrastructure Fund (2009-2014). This programme specifically targets projects that promote cleaner air, reduced greenhouse gas emissions and cleaner water. Overall the federal government has invested over CAD 2 billion for environmental infrastructure projects across Canada, most of it in wastewater projects, but also in green energy generation and transmission infrastructure projects as well as in solid waste management infrastructure projects to reduce the environmental impacts of solid waste management.

China: Various infrastructure projects have been announced, including those aiming at ecological conservation, energy saving and emissions reduction.

EU: Around 10% of the cohesion policy budget for 2007-13 is planned for direct environmental investments in areas, such as solid waste, waste-water and water treatment, improvements in air quality, nature and biodiversity protection, natural risk prevention, pollution control and the rehabilitation of industrial sites. A further 20% indirectly supports environmental improvements, for example by developing greener transport, sustainable and renewable energy and urban rehabilitation.

France: Public investment in transport and buildings

Germany: Investment in expansion of the electricity grid to facilitate the deployment of renewable energy. Investment in the infrastructure for a large-scale introduction of electric vehicles.

India: Increasing power generating capacity over 2007-2012.

Indonesia: Energy policy aims to increase capacity including through the use of renewables. Programme to move towards gas. For 2011 priorities for public investment included energy, water resources and flood management.

Italy: investment to upgrade and extend water and waste infrastructure, especially in southern regions (partly funded by the EU cohesion and structural funds); investment in high speed rail transport and in the electricity grid (including to facilitate the deployment of renewable energy).

Japan: the 2011 Strategy for the Rebirth of Japan includes investment priorities such as in zero-energy housing, urban renewal, compact cities, public transport, and renewable energy systems.

Mexico: The National Infrastructure Fund finances water treatment and management projects, bus systems, waste disposal systems and renewable energy generation. In partnership with Japan's Development Bank and the Inter-American Development Bank it provides technical assistance in the fields of renewable and energy efficiency. The federal government provides financial incentives and technical assistance to urban development projects that are deemed sustainable.

Korea: Investment in railways, water and public transport.

Russia: Development of infrastructure for renewables, including for consumers currently not connected to the grid. Subsidies on interest rates for the creation and implementation of energy efficient technologies.

South Africa: The state-owned Industrial Development Corporation will provide more than USD 3 billion for investments in green economy activities over 2011-2016. Private financial institutions committed to funding investments in the green economy and pursue investment opportunities in manufacturing linked to renewable energy initiatives. Organised labour committed to promoting retirement fund investment in green investment vehicles that will create jobs and support the broader goals of the green economy.

Turkey: Infrastructure investments in transportation and drinking water among priorities. The national Electricity Generation Company (EUAS) makes flue gas desulphurisation plants investments in order to reduce CO₂, SO₂ and other emissions from existing power plants. EUAS also invested and built Çan Thermal Power Plant which is fluidised bed combustion thermal power plant. By this way, emissions from electricity production are reduced.

United Kingdom: A new Green Investment Bank will develop financing mechanisms for investments in green infrastructure. The Energy Market Reform, through long term contracts with suppliers of low carbon electricity, and the carbon price floor are aimed at improving certainty for investors, thus stimulating private investment in green infrastructure. More generally, the national infrastructure plan aims to reduce the costs of investment by reducing

regulatory hurdles.

United States: Public investment in railways, water and waste. Extension of the electricity grid to foster the deployment of renewable.

Source: Country Submissions for the Mutual Assessment Process and the Green Growth Paper and OECD Economic Surveys

Innovation

Policy frameworks that support innovation and the rapid development and diffusion of less polluting and less resource intensive technologies are essential for green growth and sustainable development. Many G20 countries have policies in place that promote innovation in general, and which will also benefit green growth (see Box 21).

Box 21. G20 policies to foster innovation

Argentina: Measures to promote innovation and improve technological infrastructure. Increase in financing of scientific and technological research and in the creation of high-tech companies. Deepening of regional integration in technology and science.

Australia: Enhanced support of innovation over 5 years, including research, business innovation and commercialisation.

Brazil: Planned increases in public R&D. Creation of technical universities with a focus on poor regions and expansion of grants for low-income students to attend private university.

Canada: Increased spending on general R&D. Higher funding for post-secondary education.

China: Some plans to further develop the national innovation system. Target to increase R&D spending to 2.2% of GDP.

European Union: Plans to raise total R&D spending to 3% of GDP by 2020.

France: Measures to foster public and private investments in R&D, innovation and higher education, such as the reform giving universities more autonomy. National "competitive cluster" policy to promote synergies and cooperation between business, research centres and training institutes. Increased expenditure on R&D, innovation and higher education.

Germany: Initiative for excellence promotes graduate schools, excellence clusters and competition among universities. The Hightech Strategy seeks to promote cooperation between science and industry. The Central Innovation Programme is targeted at R&D in small and medium-sized enterprises.

Italy: A new policy for innovation based on industrial property rights to achieve a more efficient relationship between the market and government policies. Improved organisation of tenders to grant subsidies in favour of R&D. 2009-2013 National Research Program proposes actions to remove barriers to research.

Japan: New Growth Strategy, currently under review, supports human-resource and technology development in strategic innovation fields, through promotion of R&D and deployment of new technologies. Strategic areas include green innovation.

Korea: Plans to increase R&D expenditure as a percentage of GDP.

Turkey: "Investment encouragement" programme aims at fostering R&D, mainly through tax breaks. Furthermore, Energy Efficiency Law supports energy efficiency projects and voluntary agreements in industrial establishments. The General Directorate of Renewable Energy provides investment support for energy efficiency projects with a maximum payback period of five years. The investment support covers 20% of project costs up to a maximum of TRY 500 000. For industrial establishments that have undertaken a voluntary agreement to reduce their energy intensity by 10% on average over a period of 3 years, the EIE will reimburse up to 20% of their energy costs.

The Renewable Energy Law provides a Renewable Energy Support Mechanism, which covers different incentives and benefits for renewable energy projects including feed-in tariffs. The new law provides different feed-in tariffs (fixed minimum electricity sale prices) depending on the type of the renewable energy projects.

United Kingdom: The Green Investment Bank and the carbon price floor are also meant to enhance incentives to invest in new technologies with improved environmental performance and ease financing constraints for such investments.

United States: Increase in funding of civilian research and development and funding for national research agencies.

Source: Country Submissions for the Mutual Assessment Process, the Green Growth Paper and OECD Economic Surveys

An overview of some examples of innovation policies that are specifically targeted to green innovation is provided in Box 22.

Box 22. Green innovation policies in some G20 countries

Australia: A new Clean Energy Finance Corporation will invest in the commercialisation and deployment of renewable energy, energy efficiency and low pollution energy technologies. The independent Australian Renewable Energy Agency will streamline and coordinate the administration of existing public financial support for research and development, demonstration and commercialisation of renewable energy technologies. Further public funds will support innovation through grants for business investment in renewable energy, low emissions technology and energy and water efficiency.

Brazil: The Growth Acceleration Programme devotes USD 67.4 billion to promoting energy efficiency and renewable, including hydropower, biofuels, wind and solar energy. Financing green projects (including green technologies) through e.g. the National Fund for Scientific and Technological Development and the recently launched Climate Fund.

Canada: Direct funding and tax breaks for clean energy and energy efficiency, e.g. through the Clean Energy Fund and the Sustainable Development Technology Canada Programme

EU: The NER300 programme supports demonstration projects for Carbon Capture and Storage (CCS) and innovative technologies to tap renewable energy sources. It will be funded from the sale of 300 million emission allowances held in the New Entrants Reserve of the EU Emissions Trading System.

France: The investissement d'avenir programme and the fonds démonstrateur provide financing to promote the deployment of new technologies, covering in particular renewable, carbon capture and storage, waste management and eco-design.

Germany: Ongoing promotion of the development of electric cars. EUR 3.5 billion for energy research over 2011-2014. EUR 200 million are directed at research on energy storage. Public support for co-generation (heat and power). Low-interest loans for investments in solar and wind energy. Policies to promote environment-friendly mobility. There is a framework programme "Research for Sustainable Development", which is intended to enhance technology development in the fields of climate change, sustainable resource management and innovative environmental technologies.

Italy: The industrial policy programme 'Industria 2015' comprises support for the adoption of the industrial innovation projects related to energy efficiency and sustainable mobility, technology.

Japan: Green innovation is one strategic area for Japan's innovation policy.

Korea: Korea has developed a roadmap for green technology development. Increased tax credit for R&D in green industries. Incentives to move economic structure towards sustainable sectors, planned for 2011-2014. The government has set up a programme to train students to become entrepreneurs or employees in the green sector.

Russia: Financial support for scientific research and education in the field of energy efficiency, electricity and heat storage and smart grid technologies.

Turkey: Parts of the "Investment encouragement" programme targeted at ensuring sustainable development and supporting investments for environmental protection, mainly with tax breaks.

United States: The Advanced Research Projects Agency-Energy (ARPA-E) with USD 400 million that supports high-risk, high-reward efforts to develop transformational energy technologies. The ARPA-E has supported more than 120 individual projects covering, for example, improved energy storage devices for the electric grid; intelligent building systems; next generation vehicle batteries for electric cars and groundbreaking new liquid fuels. Many of the investments have triggered considerable private outside funding several new ventures have already formed spin-off companies from ARPA-E-funded projects. The United States promotes the deployment of renewable energy through subsidised loan programmes and tax credits. It has created energy innovation hubs that bring together teams of researchers and engineers to develop innovations in energy efficiency, clean energy and energy storage. More basic research is conducted in government-funded energy frontier research centres.

A number of countries, including the **United States**, **Germany** and **Spain**, provide public support to develop specific technologies, such as hybrid or electric cars.

Source: Country Submissions for the Mutual Assessment Process, the Green Growth Paper and OECD Economic Surveys

Lowering barriers to trade and promoting technology diffusion

The rapid diffusion of green technologies will require openness to trade and investment and promotion of adequate local conditions – including human capital and access to financing – in order to improve the capacity to absorb innovation.

- In a number of advanced economies there are important trade barriers on biofuels.
- The United States recently let lapse a tax credit and specific-rate import tariff that previously protected domestic producers of fuel ethanol.
- Russia, as part of its accession to the WTO (approved at the end of 2011), will start to reduce import tariffs on all industrial goods, including environmental goods.

Encouraging job creation and promoting equity

Labour market institutions that provide sufficient labour market flexibility with adequate protection of workers' rights, financial, training and job search support for job seekers will help reduce the costs of transition to green growth. Some relevant country experiences include:

- As indicated in the G20 Mutual Assessment Process Canada, China, Germany, the European Union and Russia have recently reduced barriers to labour mobility or are planning to do so.
- France has eased job protection in 2008 and improved incentives for low-wage workers to take up work with a more gradual withdrawal of benefits and efforts to improve the efficiency of public job intermediation services.

High-quality education and training will foster countries' ability to develop and adopt greener technologies, while enhancing the adaptability of the workforce to structural change. All G20 countries are engaged in efforts to improve their education systems. Some countries have put in place training and other active labour market programmes with a specific green angle, including for example:

- The Australian Green Skills Agreement seeks to build the capacity of the vocational education and training sector to deliver the skills for sustainability required in the workplace and to enable individuals, businesses and communities to adjust to and prosper in a sustainable, low-carbon economy.
- As part of Brazil's policies for biofuel production and use, the “RenovAção” programme will retrain manual cane cutters displaced by the total mechanisation of the sugarcane harvest in the state of São Paulo, expected to be completed by 2014. More than 7 000 workers in six sugarcane regions in the state will be retrained and re-qualified for jobs either in the sugarcane sector or in other sectors such as reforestation, construction and tourism.
- India's Natural Rural Employment Guarantee Act provides at least one hundred days of guaranteed wage employment to every household whose adult members volunteer to do unskilled manual work in the areas that help limit drought, soil erosion or contribute to sustainable development in other ways. Turkey has a temporary employment programme for the unemployed focussing on landscaping and planting work.
- Mexico runs a temporary employment programme that includes jobs sponsored by the National Forestry Commission, involving soil conservation, wildlife conservation and sustainable use, prevention of forest fires, integral waste management, ecotourism, reforestation and water conservation.
- Working for Water is a government programme in South Africa that employs and trains jobless individuals to clear alien invasive plants. These are heavy water users in South Africa's arid climate, so their removal frees water resources for both human needs and the environment.
- Under agreements signed between the Ministry of the Environment and the Ministry of National Education the “15 million seedling for 15 million students” campaign has been organised as part of large-scale afforestation programmes in all Turkish provinces.
- Argentina seeks to promote job creation in the primary sector through financial and technical help for afforestation projects organised by rural communities.
- The United States, through its Green Jobs Grants, provides funding for a competitive grants programme for research, worker training and placement, and labour exchange in the energy efficiency and renewable energy sectors. These grant programmes have played an important role in connecting with other Federal agencies' green training and job creation programmes. The Green Jobs for Youth programme provides education and training for at-risk youth. The Environmental Protection Agency also funds training grants in the environmental field.

Social policies are needed to help the poor shoulder the costs of – and benefit from – green growth policies. Improved public transportation can help further reduce emissions, while at the same time providing an affordable alternative to private transportation, where costs may rise as a result of higher fuel taxes and subsidy withdrawal. India, starting in Ahmenabad, and Mexico, starting in Mexico City, have put in place very successful Bus Rapid Transit Systems, that have induced many passengers to switch from private vehicles or minibuses, thus reducing travel time and emissions.

As explained in Section II, a number of G20 countries including Australia, Brazil, India and Mexico have increased social transfers to compensate poor and sometimes middle-class citizens for the effects of pricing environmental externalities or removing environmentally harmful subsidies. The United States government helps fund energy efficiency improvements in low-income households. The United Kingdom imposes energy efficiency improvement targets on energy suppliers that they need to fulfil specifically by supporting lower-income households to achieve these savings. The Brazilian government has created a programme, Bolsa Verde, of income transfer for families in extreme poverty that contribute to environment conservation in protected or rural settlement areas. .

Assessing environmental impacts and monitoring progress towards green growth and sustainable development

It is important for G20 countries to ensure that their environmental policies are effective and efficient. To do so, a number of countries review environmental policies through regulatory or Environmental Impact Assessment (EIA). These can also assess the environmental impact of policies that are not necessarily intended as environmental policies. Canada, as an example, systematically assesses the environmental impact of policy, plan and programme proposals. Italian regions have also been carrying out EIAs over the last decades, as well as strategic environmental assessments to ensure that the environmental implications of proposed plans and programmes are taken into account before their approval. More generally, the EU requires its member countries to conduct EIAs for individual projects and strategic environmental assessments for broader public programmes and plans. The common aim is to ensure that projects, programmes or plans that are likely to have a significant environmental impact are subject to an environmental assessment with public consultation prior to authorisation.

Many G20 countries have developed environmental satellite accounts to complement national accounts with information about the environment in production and consumption (*e.g.* Canada, France, Germany, United Kingdom, Australia and South Africa). The United Kingdom plans to enhance the measurement of its natural capital and it has developed guidelines to better assess the environmental impact, including by making use of the ecosystem services framework. A Natural Capital Committee is going to advise parliament to what extent natural assets are used unsustainably and how policies could help improve and protect natural capital.

Many G20 countries use sustainability indicators to measure progress towards their sustainability and green growth objectives. This includes for example Canada, Germany, France, South Korea and Mexico.

IV. Assessment of Existing Actions and Policy Toolkit

Green growth and sustainable development strategies need to be crafted to fit each country's specific context. The objectives, priorities and the optimal policies will vary depending on the country's national priorities, level of economic development, social and economic structure, human capital, geographic and environmental issues, and institutional capacity. In this context, this section presents a preliminary outline of a non-prescriptive toolkit of policy options from which policymakers can draw when designing an inclusive green growth strategy for their country. After setting forth key elements of such strategies, the section reviews major policy tools, indicating their main strengths and weaknesses. The section is largely based on insights from the OECD's Green Growth Strategy (OECD, 2011a) and the World Bank Report on Inclusive Green Growth (World Bank, 2012a).

Crafting a green growth strategy for promoting sustainable development

Much can be gained from framing environmental policies as national strategies with positive long-term goals. Doing so increases the acceptability of immediate costs by the population and the private sector. It

also improves consistency among policies and fosters policy certainty — which creates a friendlier climate for investments, making it more likely that private resources will be invested in long-term projects. But building a national strategy creates some challenges of its own, including the need for coherent cross-government collaboration, multi-stakeholder engagement, interagency coordination, private sector engagement, and the definition of relevant long-term goals and indicators. In this respect, national green growth strategies will need to consider country-specific local economic, social and environmental conditions but could usefully incorporate:

- An assessment of environmental conditions and risks going forward, including risks related to irreversibility or unsustainability of paths.
- Addressing the factors that limit the incentives to adopt green and inclusive consumption and production patterns and curb the returns to green investment and innovation.
- Links to structural and social reform priorities, with explicit recognition of trade-offs among them and well-targeted measures to take these into account.
- A transparent evaluation of the inter-temporal tradeoffs, *e.g.* in terms of the upfront costs to be faced relative to the longer-term benefits of action
- Regular review of policies to minimise the risks and costs of government failure and measurement of progress.

As discussed in Section III, most G20 countries already have some type of national sustainable development strategy or plan in place, and many have specific environmental or climate plans (Table 3). However, identifying how to fully integrate green growth and sustainable development strategies in the structural policy agenda is an important step towards realising the broader goal of sustainable development. In this context, considering such strategies can involve:

- *Establishing environmental, economic and social objectives jointly*, to construct national strategies to best exploit possible synergies among growth, environmental sustainability and social inclusiveness, minimising potential trade-offs and building consensus around inclusive green growth strategies.
- *Diagnosing the key constraints to green growth* – identifying the key reasons for which green growth does not materialise on its own, calling for the intervention of policymakers. Identifying the constraints is crucial in integrating green growth aspects in the structural policy agenda, as constraints can arise from a combination of market and government failures and imperfections, leading to the low attractiveness of green activity, investment and innovation.
- *Constructing policy packages that will address the impediments to green growth* in the most effective and cost-efficient way given specific country characteristics. This includes establishing an adequate institutional framework for green growth, carefully considering interactions among instruments, trade-offs (*e.g.* across time, between local and global effects or between objectives) and avoiding overlapping tools to address one objective.
- *Prioritising and timing* – adapting the sequence of policies to the urgency of problems and the likely benefits of action. Issues worth considering include:
 - Picking the low-hanging fruit by exploiting synergies between growth and environment and social objectives, such as by replacing environmentally harmful subsidies with better targeted

support for those most in need. In particular, such policy failures can work against the cost effectiveness of other reforms. For example, it would not be cost effective to introduce policies to control nutrient run-off on farms while fertiliser use is being subsidised.

- Win-win cases - where constraints on inclusive green growth also result in constraints on growth or development more generally, or contribute to inequality. In these cases policy action can contribute to the broader structural reform agenda, including, for example, policy approaches aimed at improving infrastructure (*e.g.* reducing leaks in water infrastructure) or increasing innovation incentives.
 - Addressing the most pressing issues, where environmental pressures are most binding to - or pose the highest risk to - growth and well-being, even if they involve some trade-offs between short and long term or local and global goals.
 - Acting now to avoid long-lasting negative consequences - minimising the risk of irreversible damage or locking in of more polluting technologies, and possibly leap-frogging inefficient and resource- or energy-intensive processes in the case of developing and emerging economies. Assigning higher priority to areas with stronger lock-in risks is desirable.
 - Addressing areas with immediate and direct local co-benefits can improve the political acceptance for green growth policies. For example, policies that address local air or water pollution.
 - At the same time, viable alternatives will need to be provided; for example adequate public transport provision can improve the acceptance of measures to reduce the negative effects of private transport.
- *Facilitating the adjustment and addressing any potential social impacts of green growth reforms*, in order to ensure inclusiveness and that the reforms contribute to the broader objectives of sustainable development and poverty eradication. This can mean using tools such as improvements in social safety-nets, specific conditional (income-based) and in some cases unconditional transfers or grid connection subsidies; promoting the adoption of cleaner and more efficient energy sources in households. This should be considered in the context of policies to reduce poverty and inequality.
 - *Addressing political economy considerations in a way that does not reduce the effectiveness of the policy instruments*. For instance through adjustments in the design of policy packages (*e.g.* recycling environmental tax revenues to reduce labour taxation, focusing on policy actions that produce local and rapid benefits, such as reductions in air pollutants), timing (*e.g.* phasing in) and information campaigns to improve the acceptance of green growth policy measures and their coherence in the context of sustainable development. Open, participatory approaches can also address such issues, involving all parts of society in the inclusive green growth strategy. Broad social participation is indispensable for the development of these policies, as well as for their implementation – particular attention is needed to guarantee the active involvement of those most affected by environmental degradation and climate change, such as traditional communities and indigenous peoples.
 - *Moving towards comprehensive wealth accounting*. Green accounting extends national accounts to include the value of the damage and depletion of the natural assets that underpin production and human well-being. In particular, net saving, adjusted for the depreciation of produced assets and the depletion and degradation of the environment, indicates whether well-being can be

sustained into the future. With green accounting, the scorekeeping indicators (such as wealth accounts) can be used alongside GDP to better assess how a country is doing for the long-term. It also provides detailed accounts for management of natural capital, which many countries have adopted over the past 20 years – especially for water, energy and pollution. To date only a few countries have adopted the revised macroeconomic indicators. The United Nations Statistical Commission is leading a multi-year process of revision of the System of Environmental-Economic Accounts (SEEA), together with other organisations such as the European Commission, IMF, OECD and World Bank. The Central Framework of the SEEA has been completed and was adopted by the United Nations Statistical Commission in 2012, as the first international standard for environmental-economic accounting. It consolidates internationally agreed standard concepts, definitions, classifications, accounting rules and tables for producing internationally comparable statistics on the environment and its relationship with the economy. A new partnership – Wealth Accounting and Valuing Ecosystem Services (WAVES) – is an effort to improve understanding of how to value ecosystem services, an important yet still not fully developed part of wealth accounting.

- *A cautious but pragmatic country-specific approach to the complexity of transforming the set of objectives and considerations into a workable strategy, including by monitoring policies and outcomes with appropriate indicators.* This will pose some challenges of its own, including the case for interagency coordination, private sector engagement, and the definition of relevant long-term goals and indicators (Box 23). In this context, developing a set of indicators of progress made towards green growth, both on the policy side and in terms of ensuring the desired growth and environmental outcomes, could be useful.²³ Well-being measures going “beyond GDP” can also be useful to capture some aspects of green growth.

Box 23. Formulating green growth strategies in practice

OECD (2011a) notes that an iterative process can be useful for the formulation of a green growth strategy in a national context:

- Setting objectives informed by an assessment of business as usual (BAU) projections with respect to economic and environmental trends (taking into account population and economic growth) and the evaluation of potential risks to the BAU scenario.
- Assessment of BAU to form the basis for developing a long-term vision, with high-level buy-in and through dialogue with major stakeholders within and outside government.
- The establishment of a long term vision informed by robust cost-benefit analysis.
- A policy process needs to proceed to identify least-cost policy options for achieving the priorities and areas for intervention - to identify policy priorities and sequencing. One challenge is to design policies so that they are robust but flexible, with capacity for adaptation as new information becomes available.
- Implementation of policies incorporating regular monitoring and review of the effects of policy and procedures for adapting policy settings.

The diagnosis of key constraints will require country-specific information and data from across the environment and the economy as well as an appreciation for links to global economic and environmental trends. Overall, operationalising such a process requires caution due to constraints linked to poor availability of some of the data and substantial knowledge gaps concerning effects of economic activity on the environment, environmental deterioration on growth and well-being effects as well as impacts of policies.

23. OECD (2011) provides a framework and data concerning green growth indicators. See also OECD’s “Better life index” at <http://oecdbetterlifeindex.org>

Taking up these challenges requires an understanding of the economic and political issues to be dealt with in a given country in the context of inclusive green growth policy implementation. This includes the identification of knowledge gaps and widespread diffusion of information on policies adopted by different countries. In this respect, countries may draw on knowledge platforms such as the Green Growth Knowledge Platform (GGKP) jointly established by the OECD, UNEP, the World Bank and the Global Green Growth Institute.²⁴

Effective governance is a prerequisite for driving the complex and sensitive process of putting together an inclusive green growth strategy, fraught with uncertainties and apprehension. To get the wide range of policies moving in the same direction, governments must be able to understand and harness the connections between them. Policymakers need to be able to identify and combine the multiple solutions which can bring economic, environmental, and social benefits. Achieving this puts a premium on having a capable public service and effective governance mechanisms which can weave the economic, social, and environmental strands of sustainable development together.

Careful assessment of the potential costs and benefits of policy interventions will facilitate the choice of the most efficient and effective combination of tools. In principle systematic use of transparent cost-benefit analysis (CBA) can be useful in this respect, though in practice it has to address challenges related to ensuring adequate valuation of non-market goods (*e.g.* human life or biodiversity) and high uncertainty accompanying the effects and choices regarding fairness, for instance concerning the balancing of benefits and costs across current and future generations. Given these difficulties, multi-criteria analysis and a broader approach to CBA, going beyond pure monetary values of various effects or objectives, can be useful. In this respect, countries may find it useful to incorporate – if at times only qualitatively – a broad set of criteria in screening policy options, objectives and the trade-offs among them, as for instance presented in Table 4. Additionally, to minimise the potential costs of government failure, systematic *ex post* analysis can be used to evaluate the performance of the green growth and sustainable development policies with respect to the strategy and the necessity to introduce corrective actions. Such evaluation can also be of benefit to *ex ante* analyses, by improving the parameters and policymakers' awareness of policy effects.

Table 4. Possible indicators for measuring potential benefits from green growth policies in the context of sustainable development

Type of benefit	Channels	Examples of indicators
Environmental	Improved environment	Indicators specifically developed for the domain in question (for example, reduction in greenhouse gas emissions, natural area protected from development, air or water quality).
Economic	Increase in factors of production (physical capital, human capital, and natural capital)	Measured by the additional production from increased capital (potentially measured by the value of ecosystems or renewable resources), or by the value of additional capital.
	Accelerated innovation, through correction of market failures in knowledge	Measured by productivity indicators (for example, efficiency of photovoltaic panels used to produce electricity) or dissemination indicators (for example, the fraction of the population with access to photovoltaic electricity).
	Enhanced efficiency, through correction of non-environmental market failures	Measured by indicators for resource efficiency (for example, the material or energy intensity of production, reduction in the time of in the value of time lost from congestion), or by additional production.

24. GGKP was set up in 2012 and is accessible at <http://www.greengrowthknowledge.org>

Social	Increased resilience to natural disasters, commodity price volatility, and economic crises	Measured by metrics related to the project, from avoided disaster losses (in monetary terms) or number of people at risk from floods to a measure of the vulnerability to oil price volatility.
	Job creation and poverty reduction	Measured by the number of jobs created or an indicator of the impact on the poor (for example, reduction in the number of people without access to drinking water and sanitation).

Source: World Bank (2012a)

Overcoming constraints to growth by incorporating green growth and sustainable development aspects in the structural policy agenda: a review of the main tools

Policies for greening growth and making it more inclusive will differ across countries, however, in all cases they will need to integrate the natural resource base into the same dynamics and decisions that drive growth, and focus on mutually reinforcing aspects of economic, social and environmental policy. Inclusive green growth structural policy tools, described in detail in Section II, include broad structural framework policies to stimulate investment and innovation, the removal of policy-induced distortions that harm both environmental and economic outcomes and tools that specifically address environmental and social issues (Table 5).

Table 5. Green growth structural policy instruments in the context of sustainable development

Policy instruments	Examples and Common applications
Improving framework policies	
Competition policies	<ul style="list-style-type: none"> - reducing barriers to entry and exit and administrative burdens - improving enforcement of competition rules and ensuring level playing field - adequate definition and enforcement of property rights
Tax reform	<ul style="list-style-type: none"> - shifting tax burden away from income to other taxation (in particular environmental taxation)
Labour market policies	<ul style="list-style-type: none"> - improving labour market flexibility and mobility - preserving workers rights - reducing skill mismatches (education, training) -adequate active labour market policies - improving social safety nets,
Investment policies	<ul style="list-style-type: none"> - better business climate for (private) investment - removing barriers to FDI - facilitating access to financing and remove regulatory barriers to the finance of long-term infrastructure investments - public investment in 'green' infrastructure or restoration of degraded landscapes - investment in infrastructure to support access to basic services (e.g. water supply and sanitation, clean energy, public transport)
Network sector policies	<ul style="list-style-type: none"> - regulatory reform - improving competition in the market segments of network sectors, especially if accompanied by appropriate regulation - road pricing or congestion charges to manage demand - replacement of consumption subsidies with connection subsidies - improving incentives for investment in network segments (e.g. facilitating the appropriation of benefits through cost-recovery pricing) - improved urban planning, including adequate provision of public transport

Innovation	<ul style="list-style-type: none"> - public support to basic research - adequate protection of IPRs and conditions and mechanisms for technology transfer - more competition, more flexible product and labour markets, - lower barriers to trade and FDI
Removing policy-induced distortions	
Removal of policies that have negative environmental and economic effects	<ul style="list-style-type: none"> Removing inefficient fossil fuel subsidies that encourage wasteful consumption Removing environmentally harmful agricultural or other natural resource sector subsidies (e.g. fisheries, forestry) Removing barriers to trade and investment in green goods and services -Ensuring well-targeted compensatory measures for the poor
Implementing environmental policy instruments	
<i>Market-based</i>	
Cap-and-trade permit systems	<ul style="list-style-type: none"> - GHG emission reductions - Air pollution (SO₂, NO_x, VOC) - Fishing and hunting quotas
Taxes or charges on pollution or resource use	<ul style="list-style-type: none"> - Water effluents - Water abstraction or consumption - Forest stumping charges - Air pollution emissions
Taxes or charges on a proxy (input or output)	<ul style="list-style-type: none"> - Fuel use (by fuel type) - Motor vehicles - Fertilisers
Baseline-and-credit permit systems	<ul style="list-style-type: none"> - Clean Development Mechanism - Lead content of gasoline - support to the purchase of environmentally-friendly equipment, insulation or energy-efficiency investments, etc.
Subsidies and other direct support	<ul style="list-style-type: none"> - Feed-in tariffs for electricity generated by renewable sources - conditional cash transfers to poor communities
Deposit-refund systems	<ul style="list-style-type: none"> - Beverage and chemical containers - Lead acid batteries
<i>Non-market based</i>	
Performance standards	<ul style="list-style-type: none"> - Limits on emissions of passenger and freight vehicles - Energy efficiency standards for various manufactured goods. - general renewable energy portfolio standards (e.g. coupled with green certificates) - resource recovery and reuse obligations
Technology standards	<ul style="list-style-type: none"> - Minimum percentage of a low-carbon source in the overall fuel mix of vehicles (e.g. biofuels) or electricity (e.g. renewable energy) - Specific housing building codes for energy-saving purposes
Voluntary approaches	<ul style="list-style-type: none"> - Agreements on energy efficiency targets for energy-intensive industries - Publicly-available inventories of various pollutants
Information and regulatory policies	<ul style="list-style-type: none"> - Labelling schemes (e.g. for organic food, energy efficiency) - public information disclosure - other instruments aimed at nudging consumers into more environmentally-friendly decisions - environmental education and awareness policies - promotion of sustainable practices (e.g. in agriculture, forestry) - land regulation and urban planning and their coordination (e.g. taking into account natural hazards and natural area protection, public transport design)

Conventional structural reform priorities often concern areas where the key constraints to green and inclusive growth occur. Setting the appropriate framework conditions in areas like innovation or investment can sustain growth and help the development and diffusion of green technologies, leading to improved environmental and social outcomes. Improvements in the functioning of markets can support the effectiveness of market-based environmental policy instruments, while reforms of the tax system can benefit growth and provide incentives to make it more environmentally friendly. Similarly, labour and product market reforms are also an essential part of the green growth toolkit as they can facilitate the adjustment to structural change.

Framework policies, combined with environmental instruments (see below) can eventually alleviate a large part of the constraints to green growth. However, in areas such as green infrastructure or green innovation additional public support may be needed due to constraints related to a combination of market failures, path dependency, market size and learning by doing effects. Such direct intervention can be particularly important where, for example, even small additional initial costs of greener infrastructure may otherwise prevent it from materialising. In a similar manner there may be a case for facilitating access to financing, *e.g.* through loan guarantees or preferential loans, of economically viable green investments (*e.g.* in energy efficiency) for households that face liquidity constraints. These sorts of actions carry both a high risk of policy failure and a potentially high pay-off in terms of reducing systemic environmental risk. Ex ante and ex post policy evaluation can help maximise pay off and reduce the cost of policy failure.

The removal of at least some of the existing policy-induced distortions that harm both growth and the environment are a prerequisite of any well-designed green growth and sustainable development policy strategy. In this respect, G20 countries committed to phase-out or rationalise inefficient fossil fuel subsidies that encourage wasteful consumption. The removal of such distortions can be facilitated by a careful assessment of to what extent they actually achieve their objective (often poverty alleviation), what additional costs they carry (*e.g.* what part of the subsidy reaches households not at risk of poverty) and their replacement with a more effective and better targeted measure.

Strengths and weaknesses of the principal policy tools

Because they provide decentralised incentives to greener behaviour in a cost-effective way, market-based policies are an essential part of the green growth policy toolkit. However, the effectiveness of such instruments will rely on rather precise measurement of the environmental damage or the existence of a reasonably good proxy, and on the institutional ability to enforce them. For instance, countries with lower institutional capacity to measure emissions or collect taxes may find price signals less effective.

Some of the main strengths and weaknesses of such instruments are presented in Table 6. In the context of pricing, the availability of viable cleaner substitutes (*e.g.* public transport as a substitute for the private car) will often be critical to their effectiveness. For subsidies, which are fiscally costly, the option of pricing the externality instead of subsidising good behaviour should be evaluated. Similarly, the review of measures already in place can be desirable, for instance with the aim of scaling back exemptions and special provisions in the case of taxes or marketable permits, or evaluating the role of market power and entry barriers in the case of cap-and-trade systems.

Table 6. Relative strengths and weakness of market-based environmental policy instruments

Market-based instruments	Strengths	Weaknesses	Conditions for favourable use
Cap-and-trade permit systems	<ul style="list-style-type: none"> + Tend toward equalisation of pollution abatement costs (static efficiency) and can raise revenues (double dividend). + Once in place will be defended by stakeholders + More certainty over pollution emission levels, once path for cap is established + Continuous incentives to innovate to reduce abatement costs (dynamic efficiency) 	<ul style="list-style-type: none"> - Steep learning curve and strong learning-by-using effects. Potentially high start-up administrative and transaction costs - Costs to producers or consumers reduce (political) adoption incentives though less so than in the case of taxes - Concerns of competitiveness and income distribution - Potential price volatility and frequent adjustments to cap - When permit auctioning is infeasible (e.g. politically), allocation of permits is difficult and creates a risk of capture. 	<ul style="list-style-type: none"> • Public-good market failure is not dominated by monitoring and information costs. • Sufficient institutional capacity (experience) and potential size of market sufficiently large to function properly • Environmental damage depends on overall amount of a pollutant, not specific location or timing of emission sources. Precise control over emissions is available at reasonable cost..
Taxes or charges on pollution	<ul style="list-style-type: none"> + Tends to equalise pollution abatement costs (static efficiency) and can raise revenues (double dividend). + Implementation can be done through existing national institutions + Lower adoption and compliance incentives than permit systems + Continuous incentives to innovate to reduce abatement costs (dynamic efficiency) 	<ul style="list-style-type: none"> - Potentially high monitoring costs for pollution emission controls - Incentives to adopt tax tools are lowered by costs to producers or consumers (more visible than with permits) - Concerns of competitiveness and income distribution - Uncertainty about level of pollution emissions 	<ul style="list-style-type: none"> • Public-good market failure is not dominated by monitoring and information costs. • Insufficient capacity or scope for a cap-and-trade system.
Taxes or charges on a proxy for pollution	<ul style="list-style-type: none"> + Lower monitoring and administrative costs than permits or taxes on pollution + Implementation can be done through adjustment to existing taxes 	<ul style="list-style-type: none"> - Loss of part of the static and dynamic efficiency relative to taxing directly pollution sources which can be large in the case of distant proxy. 	<ul style="list-style-type: none"> • Public-good market failure is not dominated by monitoring and information costs. • Pollution sources are small and diffuse. Temporary deviations in emission levels from target have little consequences for environmental damage. • Environmental damage depends on overall amount of a pollutant, not on specific location or timing of emission sources. Precise control over emissions is available at reasonable cost.

Baseline-and-credit permit systems	<ul style="list-style-type: none"> + Tend toward equalisation of pollution abatement costs (static efficiency) + Relative simplicity and flexibility. Can be linked with, or turned into, a cap-and-trade system 	<ul style="list-style-type: none"> - Potentially high running costs associated with ensuring that emission reductions are real, additional and verifiable - Perverse incentives to raise pollution emissions - Uncertainty about level of pollution emissions 	<ul style="list-style-type: none"> • Public-good market failure is not dominated by monitoring and information costs. • Insufficient capacity or scope to set-up a cap-and-trade system • Baselines can be set and verified at reasonable cost
Subsidies and other direct support	<ul style="list-style-type: none"> + High adoption and compliance incentives relative to permits or taxes + High incentives to invest in research and development of new technologies 	<ul style="list-style-type: none"> - Potentially large budgetary costs and deadweight or additionality losses (e.g. due to supporting actions that would have been taken spontaneously) - Can lead to low-cost available abatement options being overlooked - May trap excessive resources in subsidised “clean” activity - Uncertainty about impact on negative externality - No incentives to search for cheaper abatement options - Do not directly address negative environmental externality - Possible lock-in of resources in obsolete activities or technologies 	<ul style="list-style-type: none"> • Enforcement of alternative pricing instruments is difficult or very costly • Activity to be subsidised is a strong substitute for targeted “dirty” activity • Subsidy programme can be designed in a relatively simple way, for a time-limited period and with minimal secondary effects • Technology areas where market size and learning-by-doing effects are dominant • Fiscal space
Deposit-refund systems	<ul style="list-style-type: none"> + Low monitoring costs + Higher adoption incentives than taxes or permits 	<ul style="list-style-type: none"> - Potentially high administrative costs - Uncertainty about impact on pollution level 	<ul style="list-style-type: none"> • Control of pollution source impossible or difficult • Solid wastes involving simple and relatively homogeneous products or heavy metals

Source: extended from de Serres *et al.*, 2010.

Non-market based policy tools are crucial for a full policy package, in particular to overcome market failures and where in practice enforcement of market-based measures may be too costly or not feasible. While regulations may be more politically attractive in many cases, largely because the associated costs of the regulations are not immediately as visible as they are for market-based instruments, the merit of each policy should be carefully evaluated to ensure that no unnecessary or costly burdens are introduced. Overall, some of the main strengths and weaknesses of non-market based instruments are highlighted in Table 7.

In countries where institutional capacity is insufficient or framework policies regarding competition, investment or innovation are weak, regulatory instruments can also be used temporarily to address issues which can eventually be addressed with market based instruments. Once the effect of the framework reforms allows the price signals to be more effective, regulations can be phased out, for instance through a pre-defined sunset clause.

Table 7. Relative strengths and weakness of non-market environmental policy instruments

Non-market instruments	Strengths	Weaknesses	Conditions for favourable use
Performance standards	<ul style="list-style-type: none"> + Leave flexibility to search for cheapest option to meet standard + High adoption and compliance incentives relative to pricing instruments + Certainty over pollution emission levels + Preserve incentives to innovate to reduce costs of meeting standard though incentives may be weaker than with pricing instruments + can often be designed to improve such incentives (<i>e.g.</i> by basing on best performer) 	<ul style="list-style-type: none"> - Do not naturally tend towards equalisation of marginal abatement costs - Potentially high administrative costs - Weak adoption incentives in an international context given difficulty in reaching agreement on burden sharing. - More information required than for permits and taxes in order to be effective and efficient 	<ul style="list-style-type: none"> • Pollution control at the source of emissions is infeasible or very costly • No adequate proxy for pollutant that could be object of taxation • Weak response of agents to price signals • Pollution emissions can be measured from application of technology
Technology standards	<ul style="list-style-type: none"> + Low monitoring costs + High adoption and compliance incentives relative to pricing instruments + Certainty over pollution emission levels (at individual units level) 	<ul style="list-style-type: none"> - Provides no flexibility to search for cheaper abatement options. - Cannot be easily adapted in response to new information about costs and benefits - Tend to limit innovation incentives, <i>e.g.</i> to incremental rather than radical innovation (dynamically inefficient) 	<ul style="list-style-type: none"> • Pollution control at the source of emissions is infeasible or very costly • No adequate proxy for pollutant that could be object of taxation • Administrative costs of performance standards are too high • Abatement costs are relatively homogeneous across agents
Voluntary approaches	<ul style="list-style-type: none"> + Contribute to information gathering and dissemination on abatement costs and benefits. For this reason they can be a first step to implement other measures (<i>e.g.</i> cap-and-trade, standards) + High (political) adoption incentives 	<ul style="list-style-type: none"> - No intrinsic mechanism to encourage adoption of least-cost abatement options - Uncertainty about outcomes as effectiveness varies with perceived benefits of participants - Risk of collusion among participants 	<ul style="list-style-type: none"> • When the authorities can put strong pressures (credible threat of follow-up actions) • Where information is not too costly to provide
Other important non-market based policy tools			
Green public infrastructure investment	<ul style="list-style-type: none"> + can help to provide critical infrastructure to support development and social well-being (<i>e.g.</i> access to water, energy, public transport, etc). + can improve the working of market-based instruments (<i>e.g.</i> providing viable alternatives to private transport) + can be less costly than overcoming all market failures 	<ul style="list-style-type: none"> - High budgetary costs - High costs if there is policy failure and itself carries a risk of lock-in, - often does not address negative externalities directly - potential risk of squeezing out private investment, at least in some areas 	<ul style="list-style-type: none"> • Where network infrastructure considerations are important (<i>e.g.</i> smart grids, water, energy, transport) • large potential particularly in countries where major new infrastructure developments are foreseen (<i>e.g.</i> emerging economies) or large-scale infrastructure renewal is needed (<i>e.g.</i> water supply and sanitation)

	<p>that prevent or complicate private provision and financing (<i>e.g.</i> due to perceived policy instability, long investment time horizons or capital market imperfections)</p> <p>+ can be a tool to remove the environmental externality (<i>e.g.</i> investment in wastewater treatment or sanitation)</p>	<p>- risks due to maintenance costs (<i>e.g.</i> under below cost-recovery pricing)</p>	<p>in many developed countries)</p> <ul style="list-style-type: none"> Fiscal space
Information policies	<p>+ can overcome information failure or behavioural biases that prevent or diminish responses to other instruments, the diffusion of green technologies etc.</p> <p>+can help build social and political support for green growth</p>	<p>- effects may be difficult to assess</p> <p>- can prove complex to design, and may be costly to implement effectively</p>	<ul style="list-style-type: none"> When information failure or behavioural biases prevent or diminish the response to other policies (<i>e.g.</i> pricing instruments) often used in combination with other tools
Land and urban planning	<p>+ can avoid lock-in into inefficient urban and transport patterns and facilitate reallocation of resources to more productive uses</p>	<p>-high risk and cost of policy failure</p> <p>-does not directly address negative externalities</p>	<ul style="list-style-type: none"> often used in combination with other tools such as transport policies (<i>e.g.</i> road pricing, public transport provision)

Source: Extended from de Serres *et al.*, 2010,

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