IV. How do we measure progress towards green growth?

97. Developing and implementing framework conditions that promote green growth requires a good understanding of the determinants of green growth and of related trade-offs or synergies. It also requires appropriate information to support policy analysis and to measure progress.

98. Progress can be measured through indicators that monitor trends and changes, and levels and that attract attention to issues that require further analysis. The indicators that are being developed capture major aspects of green growth in line with the Green Growth Strategy, and pay particular attention to efficiency and productivity issues, as well as to past and future developments. The focus is on the environmental performance of production and consumption, and on drivers of green growth such as policy instruments and innovation activity. In addition, it is important to measure whether green growth actually delivers reduced pressure on the environment and whether environmental quality is improving as a result. Interactions of environmental quality with people's well-being are also being captured. The challenge will be to go beyond conventional measures at hand and develop indicators that capture the long-term implications of current policies and production and consumption patterns.

A pragmatic approach

99. The indicators and the underlying measurement framework are being developed on the basis of existing work and experience[13] in the OECD, the IEA, other international organisations, and in member and partner countries (Box II.9). The indicators are selected according to their policy relevance, analytical soundness, and measurability (Table 4). The work is closely coordinated with the project on "Measuring and fostering well-being and progress" and is steered by a horizontal Task Force led by the Statistics Directorate.

100. The indicators and the measurement framework are kept flexible enough to adapt to different national contexts. As the indicators' relevance may vary across countries and circumstances, they will be supported by additional information to put them in a broader context and facilitate interpretation. This would cover both information about countries' ecological, social, economic, structural and institutional features, and information to explain the factors behind changes in the indicator values. For certain indicators, it may also be possible to explicitly control for economic structure with a view to distinguishing between structural and other effects in cross-country comparisons. Furthermore, an effort will be made to present both cross-country comparisons at a given point in time and evolutions of indicators over time to track patterns of convergence or divergence for example in resource efficiency.

A measurement framework combining production, consumption and the environment

101. The framework used for organising the indicator development builds on an extended growth accounting approach and on a selection of the most pressing environmental issues that are of relevance to green growth.

At the core of the framework is a production process that relates economic output (made up of goods and services) to economic, social and environmental inputs that are used to produce it. Inputs comprise traditional inputs (for which there are market prices that more or less reflect society's valuation) in the form of labour, capital, energy, materials and

13. Examples include experience with: decoupling indicators, resource productivity indicators, energy efficiency indicators, policy integration indicators, core and key environmental indicators, innovation indicators, sustainable development indicators, etc.

a set of inputs that are not normally accounted for, in particular environmental services: flows of natural resources (water, fish, certain materials) and sink functions for air emissions and discharges into soil and water (Figure 10). In addition, there are wider ecosystem services, such as a stable climate/weather patterns, water regulation and purification services, services from biodiversity such as pollination and general resilience of ecosystems.

The environmental issues that will be given prominence include: (i) climate change, (ii) ecosystems and environmental media (in particular biological diversity, air, soil and water quality); (iii) environmental resources (water, fish, forests), and (iv) waste and material resources (*e.g.* metals and other minerals).

A set of indicators capturing major aspects of green growth

102. Five groups of interrelated indicators will be distinguished: (i) indicators reflecting the environmental efficiency of production as well as the absolute pressures associated with production, (ii) indicators reflecting the environmental efficiency of consumption as well as the absolute environmental pressures associated with consumption (iii) indicators describing the natural asset base of the economy, (iv) indicators monitoring environmental quality of life, and (v) indicators describing policy responses and instruments.

Monitoring the environmental efficiency of production and changes in production patterns

103. The environmental efficiency of production can be measured by the use of environmental services per unit of output (expressed in monetary and/or in physical terms). A declining use of environmental services per unit of output is a necessary condition for decoupling environmental pressure from economic growth and an indication of substitution processes where environmental inputs are replaced by other inputs or by more efficient production processes. The first group of indicators thus includes resource productivity and environmental efficiency measures that track quantities of residuals such as pollutants or waste in relation to conventional outputs or ratios of the natural capital input (water, energy, biomass and other materials) over quantities of conventional output. Such indicators would be based on a domestic perspective and rely on data by industries, activities or sectors[14] (*e.g.* agriculture, manufacturing, energy, transport). Given that efficiency gains in resource use and improvements in pollution intensities can be offset by the volume effects of increased production and consumption levels, the set of indicators would also include measures of absolute changes in resource use and pollution emissions so as to indicate the environmental burden.

Monitoring the environmental efficiency of consumption and changes in consumption patterns

104. The second group of indicators will look at the environmental efficiency of consumption and at changes in consumption patterns. This is important because many policy instruments, for instance price signals through taxes and subsidies or regulations, are directed at consumers, and changing consumer demand structures will affect the supply structure of our economies. This group also includes indicators that lie at the interface between production and consumption and that go beyond the domestic perspective. The resource productivity of a country's production system can rise when products that are environmentally inefficient are imported and resource extraction and residuals arise abroad so that there is a displacement effect: domestic environmental services are replaced by imported inputs. Such indicators can build on input-output tables, data from life cycle analysis used with trade data and information on the environmental

14. Note that no attempt is made to define green industries or green production statistically. The indicators would rather reflect changes in the environmental efficiency or in the resource productivity in key sectors or activities.

content of certain products. This permits tracking the international flows of residuals or natural resources that are embodied in consumer products.

Monitoring the natural asset base of the economy, including natural resource and material stocks, and biodiversity

105. It is necessary to not only track whether there is decoupling of environmental pressures from economic growth, but to ensure that pressures on the environment and extraction of renewable resources are at a level compatible with available stocks, and with the environment's carrying capacity. Hence, a crucial ingredient to measure progress is to look at stocks, along with flows, and to identify indicators that reflect the extent to which the asset base is being maintained in terms of quantity, quality or value. Tracking stocks and their changes empirically implies monitoring cumulative effects of extraction and renewal for a given type of natural resource. This group of indicators will thus monitor important stocks of natural capital and material resources[15], with focus on key natural resources and on biodiversity**,** supplemented by selected information on environmental quality (air, water, soil).

Monitoring the environmental quality of life

106. Closely associated with the consumer perspective is how pollution and changes in environmental services affect people's quality of life. This group of indicators would include measures covering (i) people's exposure to various pollutants and the associated health effects, (ii) people's exposure to environmental risks; and (iii) the access that different groups have to environmental services (water, green space, etc.). Such objective indicators could be complemented by subjective measures of environmental quality of life reflecting (i) people's perceptions about the quality of the environment they live in, and (ii) environmental quality as one of the determinants of overall subjective measures of well-being.

Monitoring policy responses and instruments

107. The fifth group of indicators looks into the responses (policies, measures, instruments) put in place by economic actors to promote green growth, including economic and fiscal instruments, social and regulatory instruments. Response indicators would include:

- Indicators on *green innovation and technology*, covering aspects such as technology development and uptake, patents, R&D expenditure, etc.
- Indicators on *public and private expenditure and transfers*, including capital expenditure, taxes, fees, subsidies.
- Indicators on *international transfers*, including technology transfers, international investments, and development aid.

108. They could be complemented with selected indicators reflecting training policies and skill development measures.

15. A statistically challenging question is how to reflect in-use resource stocks (*e.g.* materials contained in existing buildings and equipments) and stocks contained in waste that can potentially substitute for natural stocks (in particular non-renewable ones) through improved recovery, recycling etc.

Box 16. Key principles in selecting indicators to monitor progress with green growth

Policy relevance

The indicator set should have a clear policy relevance, and in particular:

- provide a balanced coverage of the key features of green growth with a focus on those that are of common interest to OECD member and partner countries
- be easy to interpret and transparent, *i.e.* users should be able to assess the significance of the values associated with the indicators and their changes over time
- provide a basis for comparisons across countries
- lend itself to being adapted to different national contexts, and analysed at different levels of detail or aggregation.

Analytical soundness

The indicators should be analytically sound and benefit from a consensus about their validity. They should further lend themselves to being linked to economic and environmental modelling and forecasting.

Measurability

The indicators should be based on data that are available or that can be made available at a reasonable cost, and that are of known quality and regularly updated.

Figure 10. Framework for Green Growth Indicators