UNEP

GREEN economy

Using indicators for green economy policymaking

WORKING PAPER

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LIST OF ACRONYMS

CAPP	Chemical Accident Prevention and Preparedness
CBD	Convention on Biological Diversity
CLD	Causal Loop Diagram
CPUE	Catch per Unit of Fishing Effort
DPSIR	Driving force – Pressure – State – Impact – Response
EE	Energy Efficiency
EGSS	Environmental Goods and Services Sector
GDI	Gender-related Development Index
GDP	Gross Domestic Product
GE	Green Economy
GEF	Global Environment Facility
GGGI	Global Green Growth Institute
GGKP	Green Growth Knowledge Platform
GHG	Greenhouse Gas
GII	Gender Inequality Index
GPI	Genuine Progress Indicator
HDI	Human Development Index
IEA	International Energy Agency
IP	Integrated Policymaking
ISEW	Index of Sustainable Economic Welfare
IWI	Inclusive Wealth Index
M&E	Monitoring and Evaluation
MDG	Millennium Development Goals
MPI	Multidimensional Poverty Index
O&M	Operation and Management
OECD	Organisation for Economic Co-operation and Development
PES	Payments for Ecosystem Services
PME	Participatory Monitoring and Evaluation
R&D	Research and Development
RES	Renewable Energy Standards
RIA	Regulatory Impact Analysis
ROI	Return on Investments
SCP	Sustainable Consumption and Production
SD	System Dynamics
SEEA	System of Environmental-Economic Accounting
SIDS	Small Island Developing States
SMART	Specific, Measurable, Achievable, Relevant, Time-bound
SNBI	Sustainable Net Benefit Index
STAMP	SusTainability Assessment and Measurement Principles
UNEP	United Nations Environment Programme
WAVES	Wealth Accounting and the Valuation of Ecosystem Services
WCMC	World Conservation Monitoring Centre
WWF	Worldwide Fund for Nature

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1 INTRODUCTION

At the Rio+20 Conference in June 2012, attending Heads of State and Government as well as high-level representatives recognised that indicators were needed to assess progress towards the achievement of the millennium development goals (MDGs), while taking into account different national circumstances, capacities and levels of development. In this regard, UNEP's green economy approach was endorsed as a means of catalysing renewed national policy development and international cooperation and support for sustainable development.

The present document is a response to the call for the UN system to support countries interested in pursuing green economy policies by providing methodologies for their evaluation. It hopes to provide guidance to policy analysts and advisers, and other stakeholders, who are involved in developing green economy policies by using indicators as a tool for identifying priority issues, formulating and assessing green economy policy options, and evaluating the performance of policy implementation. Emphasis is placed on policy options with "multiple dividends" across the environmental, social and economic dimensions of sustainable development.

The goal of the paper is neither to propose new indicators, nor to identify a catch-all list of indicators to be used in the policymaking process. Instead, it acknowledges the unique geographical and socio-cultural contexts of individual countries, and provides a step-by-step guide on how to identify and use relevant indicators in designing and implementing green economy policies. It provides examples to illustrate what could potentially be considered as a challenge in a given context and how to address it, rather than single out and prioritise global issues. Given the cross-sectoral nature of the analysis and implementation steps proposed, the use of existing indicators across various data sources is encouraged, as well as the involvement of a broad set of stakeholders, to support the design and implementation of a coherent and inclusive green economy strategy.

This paper is applicable to non-environmental issues as entry points. In some cases, the issues may not appear to be environmental at first glance, such as the case of increased prevalence of water-borne diseases among rural farmers, which will initially be perceived as a social issue with implications primarily on health policies. Upon further analysis, a strong connection to environmental problems may be revealed.

1.1 THE GREEN ECONOMY APPROACH

The green economy approach is to a large extent socioeconomic: it seeks to redirect economic investments while taking into account the social implications of both the environmental issues and the possible policy responses. In this regard, the paper recognises that all three dimensions of sustainable development (economic, environmental and social) are relevant. For example, a government programme that aims to restore degraded forest ecosystems in key watersheds would address the following issues:

- environmental dimension: deforestation and forest degradation both to restore forest ecosystems and to address climate change;
- social dimension: provision of safe drinking water as a key service of forest ecosystems in watersheds, thus improving the health of the local population and directly contributing to poverty eradication and social equity; and
- economic dimension: leverage financial cost savings in other policy domains, ranging from lower health-related expenditures, to a lower investment need for water purification plants.

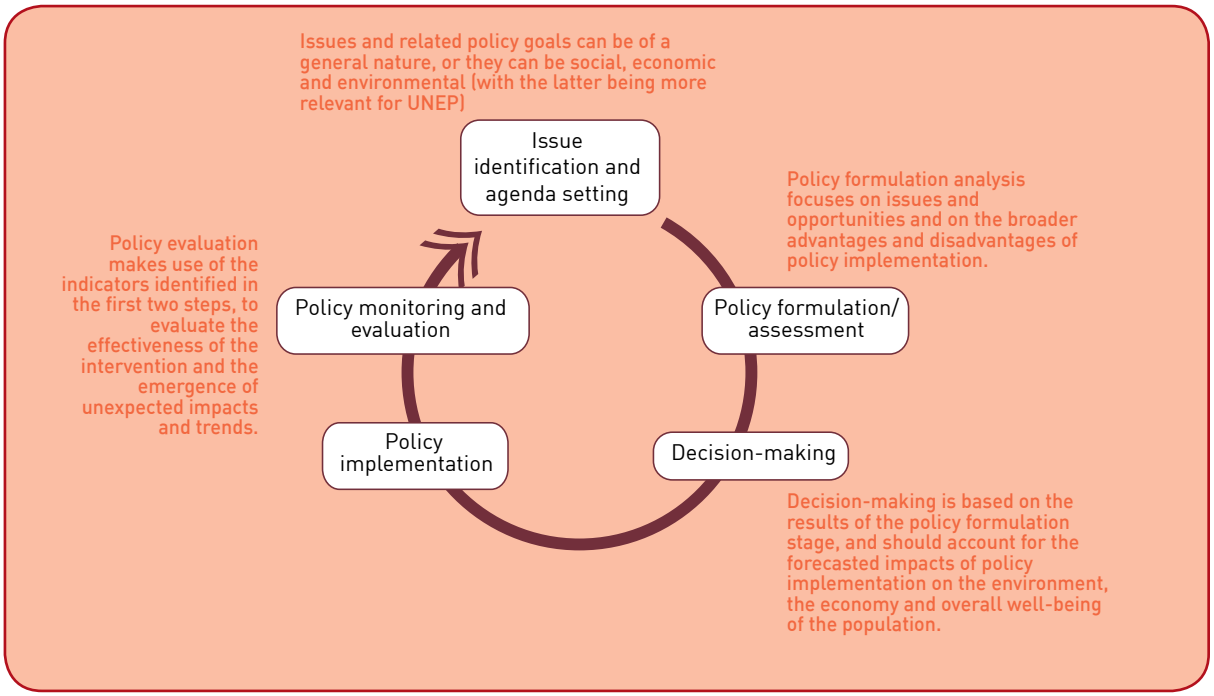
UNEP defines green economy as "an economy that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities".

In line with UNEP's primary mandate, the manual uses predominantly environmental issues outlined in UNEP's Medium-Term Strategy: climate change; ecosystem management; resource efficiency, and chemicals and waste. The paper proposes how these broad themes could be further itemized and allow the identification of more specific priorities to support the development of green economy policy responses. An example would be the issue of climate change, which could be broken down into three concerns: carbon sequestration, energy efficiency and adaptive measures. Likewise, ecosystem management could be itemized as patterns of land use and land use change. As broad environmental issues are reduced to a more specific and manageable level, baseline indicators would increasingly be needed to evaluate relevant thresholds or targets (IISD, 2005) and its socioeconomic impact.

At the policy formulation and assessment stage, what makes the green economy approach different from other approaches is its strong emphasis on the role of redirecting investment to address issues and concerns. The rationale for this approach is that misallocations of capital frequently lead to unsustainable development, where major financial resources are spent on, for example, the use of fossil fuels or unsustainable fishing, while too little is spent on improving public transport, renewable energy, ecosystem conservation and waste treatment (GGKP, 2013). Such misallocations prevail whenever externalities are present (UNEP, 2011a). In such cases, indicators would be useful to define the direction and extent of potential policy responses, and to assess and compare the environmental, social and economic implications of different policy options (UNEP, 2012a; OECD, 2011).

Once policymakers decide on a particular policy option, monitoring and enforcement against a pre-selected set of indicators are essential in the ensuing implementation stage. These indicators can be drawn from the ones used in the agenda setting and policy formulation stages, and applied to assess whether the interventions are effectively addressing the issue, by leveraging the needed investments,

Figure 1. Overview of the integrated policymaking process



and whether green economy policies are generating synergies across sectors, improving the overall well-being of the population (Stiglitz et al., 2009).

1.2 STRUCTURE OF THE PAPER

The structure of the paper follows the integrated policymaking (IP) process composed of the following stages (see Figure 1)::

1. Issue identification and agenda setting;
2. Policy formulation and assessment;
3. Decision-making;
4. Implementation; and
5. Monitoring and evaluation (M&E).

The emphasis of the paper is on the use of indicators in stages 1 and 2, and to some extent on stage 5. The role of indicators in policy implementation, under stage 4, is mainly exercised through monitoring and evaluation (stage 5).

The annex provides examples of how the approach outlined in this guide can be applied to countries with different characteristics.

BOX 1. WHAT MAKES A GOOD INDICATOR?

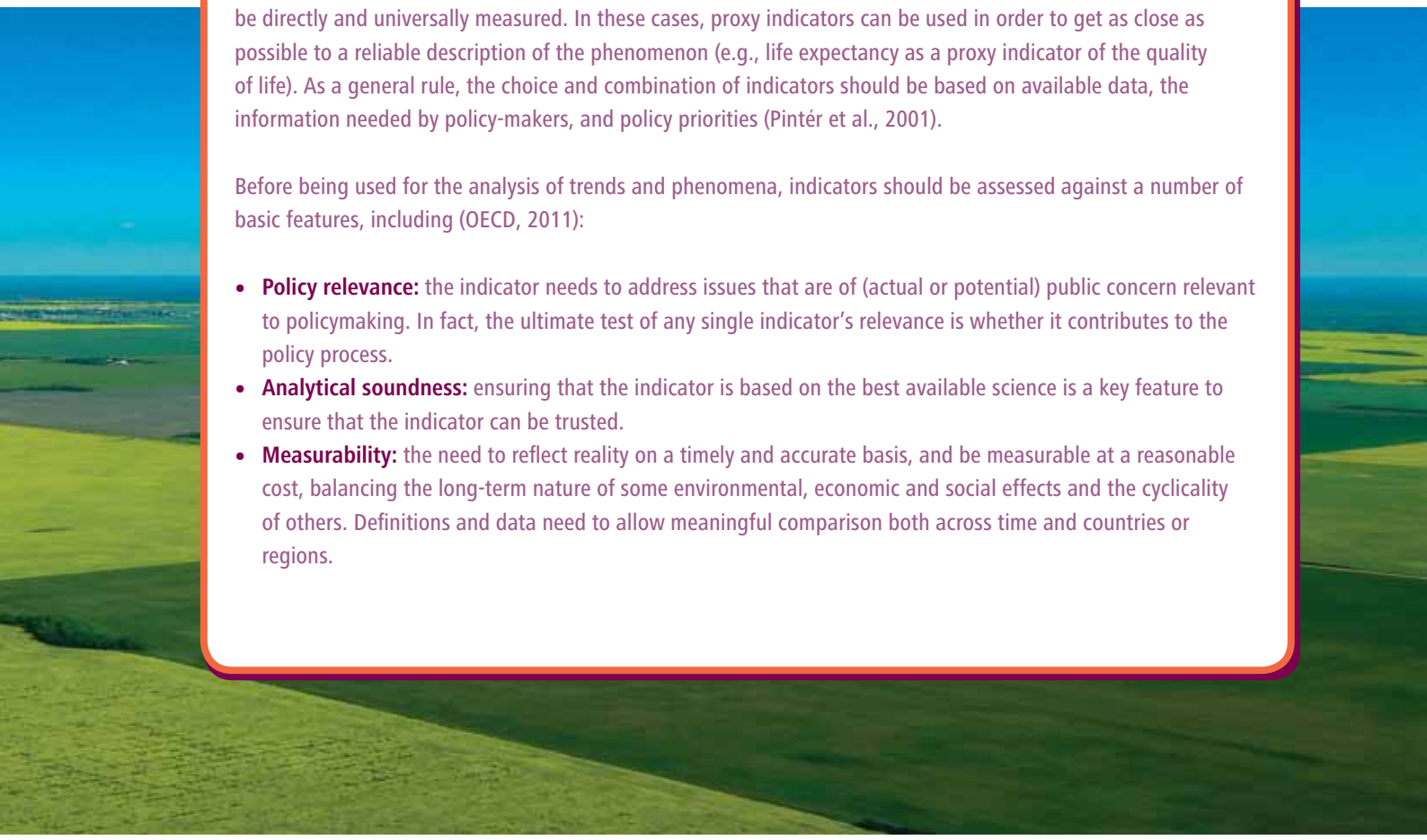
An indicator is an instrument that provides an indication, generally used to describe and/or give an order of magnitude to a given condition. Indicators provide information on the historical and current state of a given system, and are particularly useful to highlight trends that can shed light on causal relations among the elements composing the system.

Both quantitative and qualitative information can be used to define an indicator, depending on the issue that needs to be analysed, as well as on the availability and quality of data. Quantitative indicators provide a standardised and measurable description of a given phenomenon, thereby allowing for more consistent and universal comparison across time and space (GGKP, 2013). In order to facilitate trend identification and comparison, qualitative indicators are often expressed in a quantitative manner (e.g., ranks, percentages).

A combination of different indicators might be necessary to describe complex phenomena, where different concurring causes and effects have to be measured and compared. For example, the causes of a decrease in agricultural productivity, reflected by agricultural yield trends, might have to be explored through a variety of indicators, e.g., soil erosion level, rainfall, workers' productivity etc. Also, there are certain conditions that cannot be directly and universally measured. In these cases, proxy indicators can be used in order to get as close as possible to a reliable description of the phenomenon (e.g., life expectancy as a proxy indicator of the quality of life). As a general rule, the choice and combination of indicators should be based on available data, the information needed by policy-makers, and policy priorities (Pintér et al., 2001).

Before being used for the analysis of trends and phenomena, indicators should be assessed against a number of basic features, including (OECD, 2011):

- **Policy relevance:** the indicator needs to address issues that are of (actual or potential) public concern relevant to policymaking. In fact, the ultimate test of any single indicator's relevance is whether it contributes to the policy process.
- **Analytical soundness:** ensuring that the indicator is based on the best available science is a key feature to ensure that the indicator can be trusted.
- **Measurability:** the need to reflect reality on a timely and accurate basis, and be measurable at a reasonable cost, balancing the long-term nature of some environmental, economic and social effects and the cyclicality of others. Definitions and data need to allow meaningful comparison both across time and countries or regions.



2 INDICATORS FOR ISSUE IDENTIFICATION

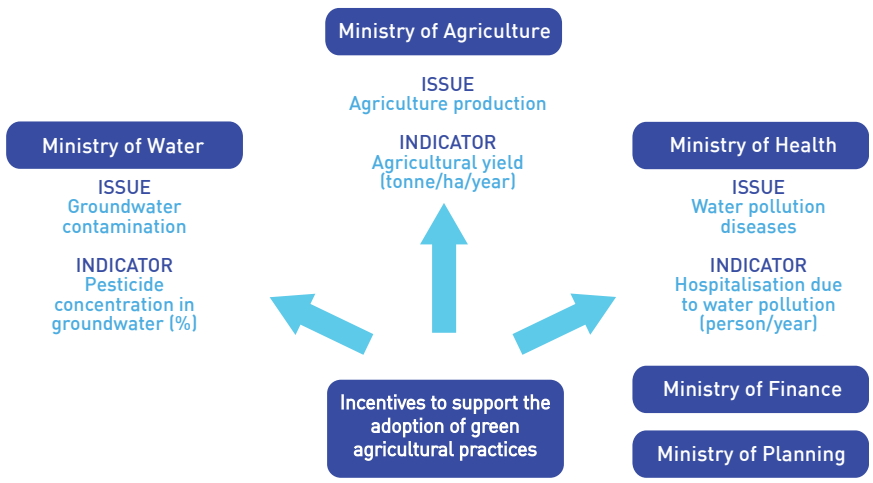
Decision makers face social, economic and environmental issues simultaneously, all of which have an impact, to varying degrees, on sustainable development. This chapter provides guidance on how to identify possible issues of concern relating to sustainable development and how to evaluate whether they are driven (or impacted by) environmental degradation. It uses the systemic approach, promotes multi-stakeholder participation and aims at fully incorporating the environment factor in the formulation of green economy policies that would effectively contribute to sustainable development .

Indicators for issue identification are instruments that help decision makers to identify and prioritise problems, present and/or future, and to set the agenda for policy interventions (UNEP, 2009).

In the past decade, issues such as climate change and ecosystem management have been high on the agenda of decision makers for a variety of reasons. One of these issues is climate change which, through rising temperatures and increased variability in precipitation, could have negative impacts on, for example, land use (i.e. accelerating desertification and lowering the yield of agriculture production), energy (i.e. reducing the generation of hydropower) and infrastructure (i.e. increasing damage to roads and ports).

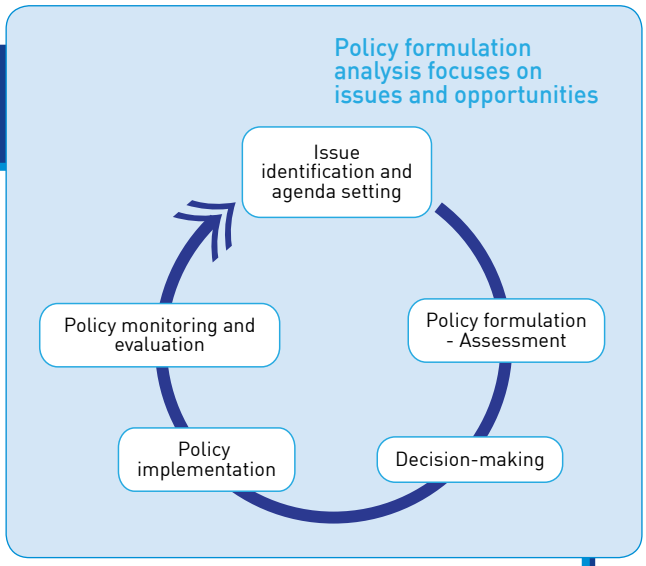
As a result, addressing climate change concerns requires a coherent policy mix consisting of different sectoral interventions, which are ideally designed to work in synergy to maximize their collective effectiveness (UNEP, 2011). In fact, climate change is often addressed simultaneously by different ministries, which rely on a variety of thematic indicators (e.g., related to agriculture, energy and infrastructure), to support policymaking in their respective sectors of responsibility. The ministries typically do not have "climate change" as an explicit or exclusive part of their mission and portfolio. Instead, their respective core missions normally consist of ensuring sufficient agriculture production, reliable and affordable energy sources,

Figure 2. Example of the multiple benefits generated by green economy policy interventions



BOX 2. KEY ACTIONS WHEN USING INDICATORS FOR ISSUE IDENTIFICATION

1. Identify potential issues;
2. Assessment of issues and its links to the natural environment;
3. Analysis of underlying causes;
4. Analysis of impacts on society, economy environment.



Examples of issues and related indicators:

UNEP cross-cutting thematic priorities	Potential issues and concerns	Indicators
Climate change	• Country contribution to climate change • Increased frequency/intensity of storm surges	• Greenhouse gas emissions (Kt of CO_2 equivalent/ year) • Rainfall (mm/year) and evaporation • Storm-related damages (US$/year)
Ecosystem management	• Deforestation • Loss of critical ecosystem services	• Forest cover (ha) • Extent of land and marine conservation areas (ha)
Resource efficiency	• Falling groundwater tables • Low efficiency of non-renewable energy sources	• Water intensity or productivity (m3/US$) • Coal consumption intensity (tonnes/GDP)
Chemicals and waste management	• Air pollution • Soil contamination	• Sulphur oxide (SO_x) emissions (Kg/yWr) • Waste recycling and reuse (%) • Toxic heavy metal concentration, e.g., Hg, Cd, Pb, Cr. (mg/kg)

and providing road infrastructure – all of which affect and are affected by climate change.

Hence, in order to elaborate effective policies to address such issues, a careful analysis of their causes and effects across all relevant sectors could be undertaken to maximize synergies and avoid the emergence of harmful side effects in other sectors (see Figure 2).

The methodology proposed provides four main steps in issue identification:

1. Identify potential issues and concerns;
2. Assess each issue and how it relates to the natural environment;
3. Analyse the underlying causes of the issue; and
4. Analyse how the issue impacts society, economy and environment.

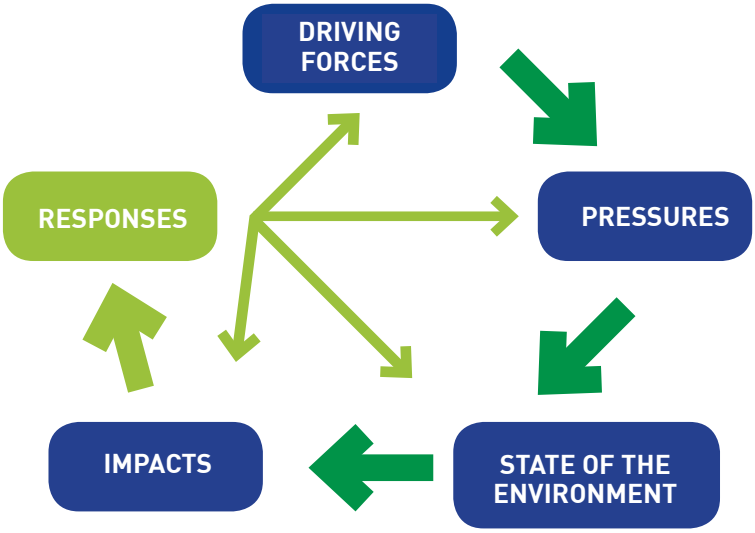
This methodology is consistent with the UNEP's DPSIR framework (UNEP, 2008) (see Figure 3).

If the problem to be analysed is essentially environmental (rather than social or economic), steps 1 and 2 could be merged to move directly to the full analysis of causes and impacts (steps 3 and 4).

2.1. IDENTIFY POTENTIAL ISSUES AND CONCERNS

An initial step towards determining whether an issue might constitute a threat to sustainable development lies in analysing its historical trend. This can be done by using historical quantitative data or, in case reliable statistics are not available, qualitative information. Such a task should be accompanied and complemented by an analysis of national

Figure 3. A schematic representation of the DPSIR Framework



visions and goals, as well as development plans and sectoral policies (World Bank, 2012b). Mapping the institutional landscape and policy framework, coupled with trend and patterns analyses, are likely to facilitate the identification of potential challenges that need to be placed high on the national agenda. UNEP's "Flexible Framework" methodology is an example of such mapping in the field of chemical accident prevention and preparedness (CAPP) through the development of 'country situation reports' (UNEP, 2010; UNEP, 2012b).

Various types of trends and declining trajectories should also be considered, according to the sector and topic analysed, such as the declining trend in forest cover, fish landings or fossil fuel reserves. In other cases, the problem emerges when the trend is on the rise, such as the case of water pollution or energy prices. Some issues may also appear when no change takes place at all, especially those that relate to a target, such as the case of emission reductions, nutrition or access to clean energy.

Indicators may be interconnected, with varying patterns of interactions. In this phase, the cause-effect relation between indicators need to be carefully analysed and based on solid evidence, sound theories and empirical studies. For example, a decline in fossil fuel reserves may lead to an increase in prices (showing opposite trends), and a decline in fish landings may lead to reductions in nutrition (showing similar trends).

Certain historical trends may not appear to be worrisome when analysed in isolation, but may become one when compared to an existing policy target or national vision. For example, a stagnant nutrition level represents an issue of concern for decision makers if a national target is available and is above the observed level.

In some circumstances, international comparisons ('benchmarking') can be very informative (World Bank, 2012a), in particular when indicators and data generation methodologies are adequately standardised. For example, an increasing nutrition level may represent an issue of concern for decision makers if a neighbouring country with very similar conditions and priorities performs significantly better.

Some trends may also present potential challenges because they point to untapped opportunities, which are notoriously difficult to measure. For example, even a slightly increasing share of renewable energy sources in the national energy mix may be of concern for decision makers if renewable sources represent a much higher share of total energy in countries with very similar potential in solar, wind or hydropower.

In certain cases, indicators may only highlight a disturbing trend when compared with trends in other indicators, such as GDP or population growth. For example, an average gross domestic product (GDP) growth of 4 per cent over the last 10 years

may be considered satisfactory when viewed in isolation, but less so if compared to an average 3 per cent population growth during the same period. Similarly, a 2 per cent increase in annual greenhouse gas (GHG) emissions may be considered negatively unless compared to a 4 per cent GDP growth and 3 per cent population growth.

The examples cited highlight the need to jointly evaluate trends in indicators of production and consumption as well as the importance of decoupling economic growth from resource use and environmental degradation (resource intensity and productivity indicators) in order to better identify and prioritise issues of relevance. Table 2 illustrates this joint assessment of indicator trends using sample indicators for climate change (in terms of GHG emissions) and water stress. Indicators of intensity and productivity are also useful for carrying out benchmarking exercises across countries and regions.

The indicators selected in this step can also be considered baseline indicators to be used throughout the integrated policymaking process, and against which the effectiveness of various policy interventions will be evaluated.

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For a summary of key tasks and questions, please see Table 3 at the end of Section 2.

2.2. ASSESS THE ISSUE AND ITS LINKS TO THE NATURAL ENVIRONMENT

Once a trend has been identified and defined as potentially worrisome, indicators need to be selected to further evaluate whether and how the prospective issue of concern is related to the environment. The underlying question is whether the issue under consideration is caused or affected by existing environmental trends, in particular when the issue has primarily social or economic dimensions.

Data on fish production can provide useful information on the performance of the fisheries sector over the years, and on its relation to the environment. A declining fish capture could be attributed to a reduction in the harvesting effort (i.e. reduced number of fishermen and/or fishing boats, perhaps due to emerging alternative livelihood or income opportunities), or of the fish stock itself, possibly being driven by coral reef degradation, water pollution, an increase in water temperature, or overfishing in earlier years. Apart from the possible reduction in effort (with underlying socio-economic causes), all other factors are environmental.

A multi-stakeholder approach will frequently be useful. Various datasets (both qualitative and quantitative) provided by the stakeholders involved in the process could be used and compared to confirm the existence and relevance of environmental factors influencing the problem.

Table 2. Examples of indicators for production, consumption and decoupling (intensity and productivity): the case of climate change and water stress

Topic	Indicator			
	Production	Consumption	Decoupling	
			Intensity	Productivity
Climate change	GHG emissions due to national production	Carbon footprint as global warming potential	GHG emissions per GDP (tonnes/US$)	GDP per GHG emissions (US$/tonne)
Water stress	Water abundance and water use for national production	Water footprint for domestic consumption	Water use per GDP	GDP per water use

Triangulation techniques to compare the coherence of data across sectors and data sources can be used to gauge the relative strengths and the interplay of the various effects, some of which may be social or economic, and others, environmental. It is also useful to evaluate a variety of cross-sectoral indicators, which are often not available in a single, integrated database. For example, forest degradation or outright deforestation may be caused by environmental trends, for instance associated with diseases, as well as human activity, especially the collection of fuelwood, or the conversion of land to agriculture.

It is worth considering that some problems may only, or primarily, have social and/or economic drivers, or may erroneously be perceived as such. In this respect, it is important to identify indicators that can highlight relevant trends in order to be able to design effective policies. For example, an increase in CO_2 emissions can be caused not only by the use of fossil fuels (a source of emissions), but also by deforestation (with forests, and biomass more generally, emitting CO_2 when burnt). Other more indirect indicators showing the linkages between the source of emissions and the environment are the extraction and use of fossil fuels, as well as their stock level (simultaneously influenced by discovery and extraction).

On the other hand, population and economic growth are often identified as other critical causes of rising CO_2 emissions (in absolute terms). However, such indicators are much harder and perhaps less preferable to influence with policy interventions than setting targets for energy efficiency, reduction of forest loss, reforestation and adaption measures.

For a summary of key tasks and questions, please see Table 3 at the end of Section 2.

2.3. ANALYSIS OF UNDERLYING CAUSES

Once a prospective issue has been singled out by analysing and comparing indicators of economic, social and environmental performance, and some light has been shed on the relation between the issue and the natural environment, the underlying causes for the underperforming trend need to be analysed more fully.
At this third step, the pressures and driving forces (i.e. underlying causes) are separated from the symptoms (i.e. impacts and the state of the environment). This could be achieved by focusing on the identification of causes (environmental, social and economic) behind the environmental effects identified in step 2 (section 2.2), which are affecting the issue identified in step 1 (section 2.1).

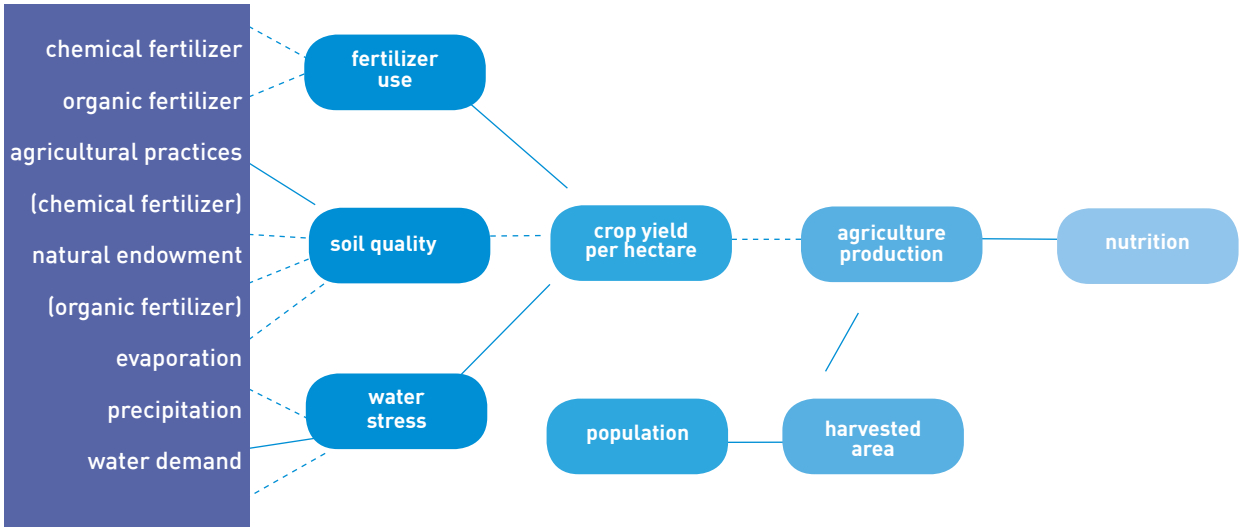
A number of indicators can be used to detect causal relations and to map them systematically, especially if identified through the support of various stakeholders with specific sectoral expertise. In the same way that the value chain for instance in agricultural production can be broken down into several stages from farming, to transport, distribution and customer sales, a causal chain of influence can be defined for indicators. In the case of nutrition, for example, decreasing agricultural production may be identified as an issue of concern, defined by relevant indicators such as the land used and its productivity (crop yield) (see Figure 4). Underlying causes may be socio-economic (e.g., rising prices of fertiliser) or environmental, such as water availability (through irrigation, rainfall and evaporation), or both (e.g., poor agricultural practices leading to erosion or salinisation).

As indicated by the preceding example, several causes may simultaneously affect – directly or indirectly – the issue. Taking a systemic view would help map the links of the various effects and the indicators that interact to create and address the issue.

The use of indicators at this stage is essential for policymakers to be able to disaggregate or 'break down' the system and understand the role played by various variables, including cross-sectoral ones, as well as in determining trends and patterns. The identification of these different causes, and the understanding of how they interact and impact on the issue at hand, will ultimately support the design of a more targeted and effective policy package.

If the reduced availability of water is the issue to be addressed, very different – and potentially

Figure 4. Simplified (and partial) causal tree diagram for the issue of nutrition and possible key drivers, where indicators are linked to each other representing the causal chain leading to the problem.



alternative – policies could be designed and implemented, including: to reduce pollution from industrial waste (addressing water quality), to curb the deterioration of forest ecosystems and their water-related services (again addressing water supply), or to increase water productivity in agriculture by introducing more efficient irrigation technologies or more adapted crops (addressing water consumption). The choice of the appropriate policy mix would then depend on the specific causes identified, the strength or relative importance of their individual impacts, and the analysis of their interplay.

In some cases, the implementation of a single policy helps to address several causes simultaneously. Hence, in setting the policy agenda in the local context, interventions that could generate double and triple dividends and co-benefits could be prioritised for implementation. For example, localised deforestation in many cases is caused by the need to increase agriculture production, which follows population growth and a reduction in soil productivity. An intervention aimed at improving agricultural yields would allow an increase in production without the need to expand agricultural land at the expense of forests. Safeguarding the provision of forest-related ecosystem services would be an important additional benefit.

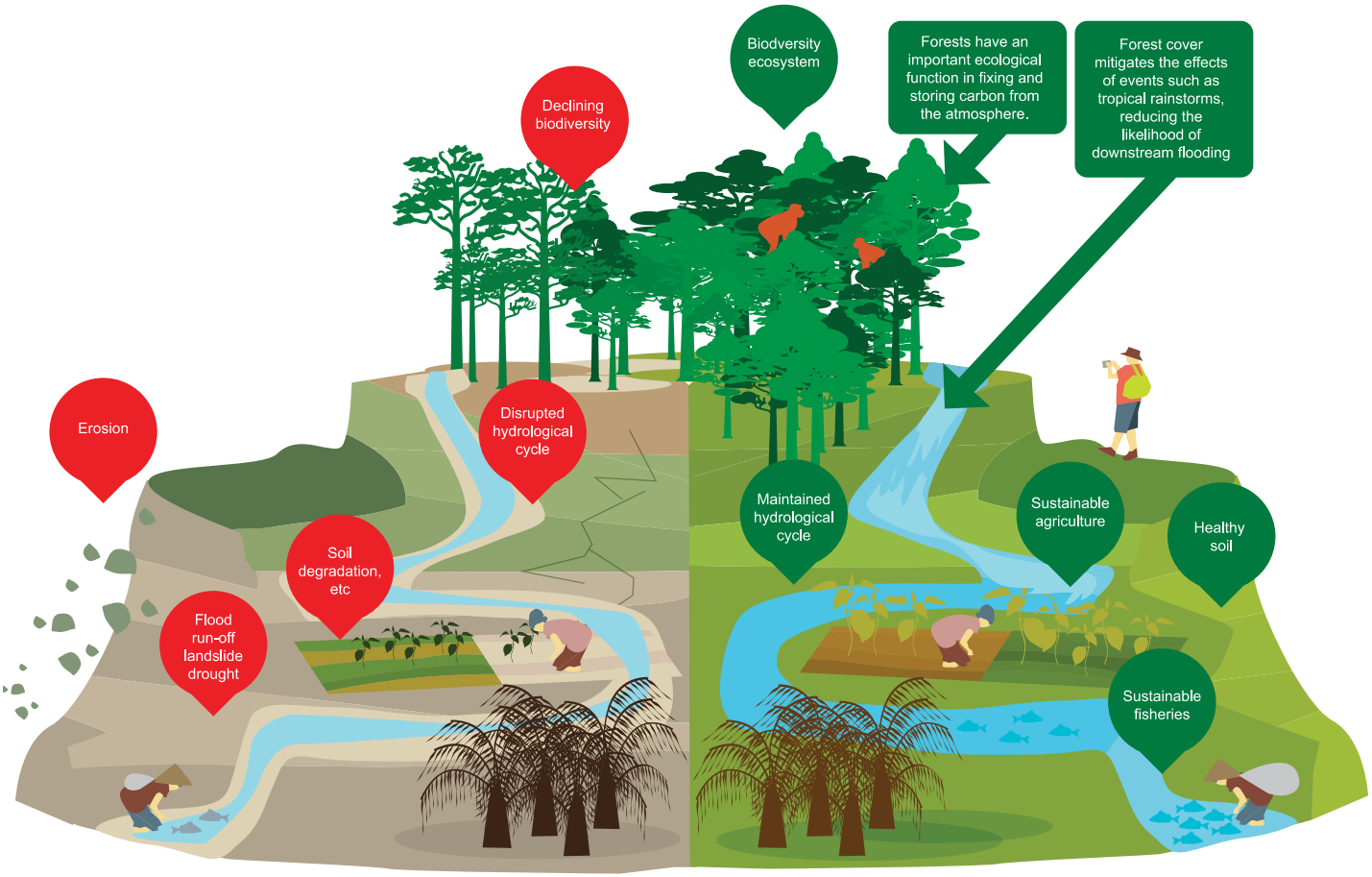
For a summary of key tasks and questions, please see Table 3 at the end of Section 2.

2.4. ANALYSIS OF IMPACTS ON SOCIETY, ECONOMY AND ENVIRONMENT

Given scarce budgetary resources and competition for budget allocation across sectors, great care must be taken in identifying which issues are important enough to be eventually included in the government agenda. This fourth step extends the analysis to the impacts that the underperforming trend may have on other social, economic and environmental indicators. In so doing, additional issues in need of intervention could be identified, addressed and prioritized, thus realising synergies. Step 4 could also be used to identify any negative secondary effects arising from the envisaged policy response (such as weight-based targets in recycling policies hindering rather than promoting recycling of many critical elements in complex products which are usually present in very low concentrations (UNEP, 2013)), as well as possible ways and means to mitigate or otherwise address such effects as they emerge. As a result, the indicators identified in this step could be used to raise public awareness about the issue, and make the case for policy interventions to address it.

Harmful chemical substances and hazardous waste can produce a number of negative effects on several sectors. If access to potable water is the issue to be addressed, and water pollution is the

Figure 5. Diagramme illustrating the impacts of business as usual (left) and green economy scenarios (right)



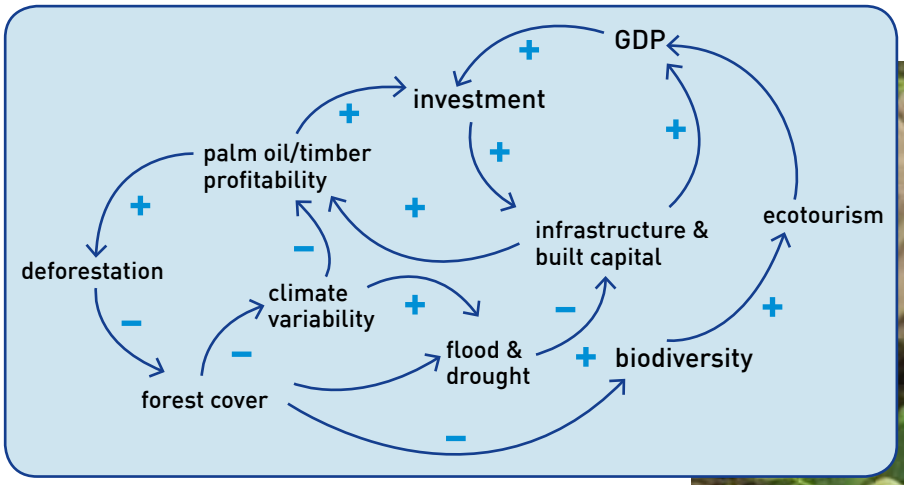
Source: Van Paddenburg et al., 2012.

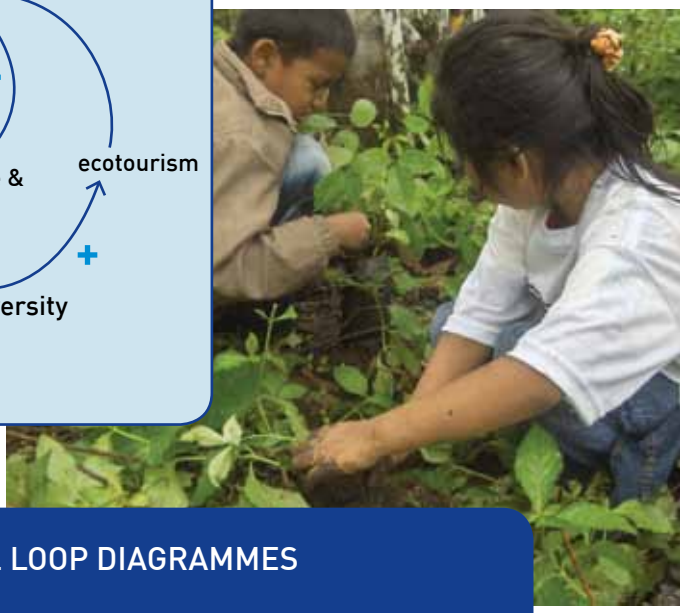
main problem, additional simultaneous impacts may include food contamination, ecosystem degradation, and various consequences on human health (e.g., acute poisoning, cancer and birth defects) and certainly higher costs for purification and/or for increasing freshwater supply.

It is noteworthy that such cascading effects may also characterise the problem analysed. In fact, the impacts of a certain environmental issue can in turn be the cause of other problems in other sectors, further worsening the overall performance of the system. For this reason, both causes and impacts need to be carefully examined from a system-wide perspective, before policy is formulated. For example, ecosystem degradation can have damaging impacts across sectors as a result of the loss of ecosystem services (UNEP-WCMC, 2011). Deforestation in Borneo is causing the loss of biodiversity, erosion and the disruption of the hydrological cycle, leading to more frequent and acute floods and droughts, which in turn cause soil degradation and lower agriculture production, thus reducing the potential for fish catch and tourism revenue (Van Paddenburg et al., 2012).

Accordingly, the use of indicators across several sectors is necessary to correctly identify and assess issues, as well as their impacts. In this respect, it is useful to organise key impacts (and their respective indicators) by sector of pertinence and add them to the causal map developed in step 3, to fully appreciate the ramifications of the problem. Indicators for issue identification can serve to highlight the linkage between environmental degradation and sustainable development. Figure 6 represents a causal loop diagram for deforestation. The arrows depict the causal relationship (positive or negative) between indicators, which includes the issue (deforestation), its causes and cross-sectoral direct and indirect effects. From a short-term economic perspective,

Figure 6. Simplified Causal Loop Diagramme representing the main causal relations existing among the economy and the environment (forest cover) in Borneo.





BOX 3. MAPPING THE SYSTEM WITH CAUSAL LOOP DIAGRAMMES

A Causal Loop Diagram (CLD) is a map of the system analysed – a way to explore and represent the interconnections among the key indicators in the sector, or system analysed.

More specifically, a CLD is an integrated map (because it represents different dimensions of the system) of the dynamic interplay (because it explores circular relations, or feedbacks) existing between the key elements (main indicators) that constitute a given system.

By highlighting drivers and impacts of the issue to be addressed, and by mapping the causal relations existing among key indicators, CLDs support a systemic decision-making process aiming at designing solutions that last over time. By explicitly representing feedback loops, CLDs shed light on possible future trajectories generated, from within or as a reaction to external events, by any given decision. As a result, CLDs enable the identification and use of synergies emerging within and across the key elements of the system, as well as avoiding possible unintended consequences.

palm oil plantations and timber production contribute to economic growth. However, in the medium- and longer-term, an increase in deforestation would reduce forest cover, increasing climate variability and vulnerability (e.g., to floods and droughts), thus negatively impacting biodiversity as well as economic growth because of the need to increase government expenditure to mitigate damage and adapt to higher vulnerability.

Box 3 provides a brief explanation of causal loop diagrams and systems mapping.

For a summary of key tasks and questions, please see Table 3 at the end of Section 2.

Table 3. Summary of key steps and related indicators for issue identification: Examples for deforestation, nutrition and CO_2 emissions

Steps	Description	Indicator typology and tasks	Indicator samples
1. Identify potentially worrying trends	Analyse data and detect worrying trends. • Has the trend worsened in recent years? • Is the trend in line with national, regional or global targets, and with the performance of similar countries?	a. Identify indicators of sectoral performance related to the problem. b. Collect data relevant to the issue under consideration. c. Identify national trends and compare them with existing national, regional and global targets. d. Compare trends with the performance of comparable countries and/or regions.	**Deforestation:** • Value of timber products (US$/ year) • Deforestation (ha/year) • Annual harvest of wood products (m^3/year) **Nutrition**: • Dietary energy supply (Kcal/day per person) • Crop yield (tonnes/ ha) • % of newborns with low birth weight (<2500g) **CO_2 emissions:** • CO_2 emissions (Kt of CO_2 equivalent) • Temperature variability (% annual increase in °C) • CO_2 emissions (Kt of CO_2 equivalent per US$1 GDP - PPP)
2. Assess the issue and its relation to the natural environment	Identify environmental trends that could contribute to the problem considered. • Is the issue influenced by the environment, for instance by natural resource depletion or degradation, erosion of ecosystem services, or the reduced provision of ecosystem services?	a. Identify indicators of environmental performance related to the problem. b. Collect data relevant to the issue under consideration. c. Identify national trends and compare them with existing national, regional and/or global targets. d. Compare trends with comparable countries and regions.	**Deforestation:** • Forest land cover (ha) • Annual desertification of forest area (ha or % of forest land) • Degraded forest land (ha or % of forest land) **Nutrition**: • Rainfall (mm/year) • Droughts (n. of droughts/year) • Fish landing (tonnes/year) **CO_2 emissions:** • Production of fossil fuels (Btu/ year) • Fossil fuel reserves (Btu) • Forest cover (ha)
3. Analyse more fully the underlying causes of the issue of concern	Investigate more fully the causes for the underperforming trends. • Is there a causal relation between the trend observed and economic, social or environmental variables? What are the key drivers and pressures? • Are there multiple, and simultaneous causes?	a. Identify causal relations and map them systemically. b. Evaluate whether multiple causes act simultaneously and are also causally interlinked. c. Evaluate their respective strength.	**Deforestation:** • Agriculture land (ha) • Fuelwood consumption (kg/year) • Population (people) **Nutrition**: • Population (people) • Fish stocks (tonnes) • Water consumption (L/year) **CO_2 emissions:** • Population (people) • Energy consumption from fossil fuels (KWh; % of total) • GDP growth (US$/year)
4. Analyse more fully how the issue impacts society, the economy and the environment	Analyse impacts of the identified worrying trends on the system • How is the problem affecting the system and its socio-economic and environmental performance? • Are the impacts of the problem immediate or emerging slowly, and do they last for a long time?	a. Identify impacts of the issue on society, the economy and the environment. b. Identify indicators relevant to the issue analysed, considering its social, economic and environmental impacts. c. Relate causes to cross-sectoral impacts using the causal relations identified in step 3.	**Deforestation:** • Income of forest communities (US$/year per capita) • Freshwater supply (L/year) • Ecotourism (n. of visits/year; US$/ year; % of GDP) **Nutrition**: • Life expectancy (years) • Agriculture GDP (US$/year) • Primary sector employment (people) **CO_2 emissions:** • Increase in average temperature (°C) • Diseases from air pollution (n. of respiratory diseases/year) • Crop yield (tonnes/ha)

Indicators for issue identification are instruments that help decision makers to identify and prioritise problems, present and/or future, and to set the agenda for policy interventions

(UNEP, 2009)

3 INDICATORS FOR POLICY FORMULATION

The second phase of the integrated policymaking cycle consists of defining policy goals followed by policy formulation. While indicators for issue identification help to frame the issue, indicators for policy formulation help to design solutions. This chapter provides guidance, using a systemic approach, on how to identify indicators that support policy formulation and to analyse the strengths and weaknesses of various possible intervention options. Focus is given to the use of indicators that help to assess the adequacy of the interventions analysed, taking into account their repercussions on the key stakeholders of the economy and impact across sectors.

While the policy options analysed are designed to be implemented at the national level, additional interventions such as those that relate to compliance with international standards, or with regional and global goals (i.e. GHG emissions), may be considered. In this regard, indicators identified can be used to support policy formulation and assessment, regardless of the national boundaries of the impact of the intervention.

This chapter discusses how to utilise the information gathered to set policy objectives and identify the possible policy options and set associated targets. While this process would ideally require the use of several methodologies and instruments, analysing historical qualitative and quantitative information as well as the projections of economic and biophysical simulation models, this manual focuses on the specific contribution of indicators during these two main actions to policy formulation (with additional steps being included in the policy impact assessment stage):

- Identify policy objectives;
- Identify intervention options.

It should be noted that this report differentiates the effects of interventions on **outputs**, **outcomes** and **impact**, all of which are commonly used when assessing or evaluating the effectiveness of measures (see Box 9 for further explanation). Subsequently, the effectiveness of policy interventions could be assessed according to:

- desired outcome and policy objectives (see Section 2.1);
- output and policy objectives (see Section 2.2.); and
- strategic objectives and sustainable development (see Section 4).

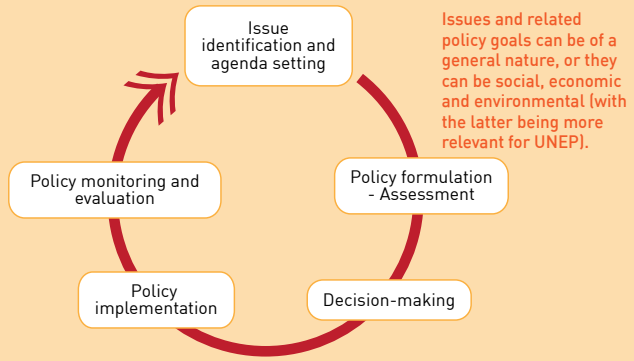
In order to further evaluate the cost-efficiency of alternative policy interventions, policy inputs could also be measured in the form of public expenditures. In this case, input indicators are also used as proxies for measuring output, in particular when it is difficult to measure directly or when the policy intervention relates closely to financial flows, such as when expenditures for public education serve as a proxy for the state of the public education system. An example would be the implementation of a public payment scheme for ecosystem services, where the amount of funds distributed (output) could be approximated by overall expenditures (input) minus the estimated administrative overhead. Clearly, such indirect methods of measuring success need to be applied with due caution, as they may not give a complete picture of the effectiveness of the policy intervention.

3.1. IDENTIFY TARGET OUTCOMES

The identification of desired outcomes in terms of policy objectives is based on the results of the issue identification phase and precedes the definition and choice of policy interventions. It is therefore a crucial step for decision makers, as policy objectives

BOX 4. KEY ACTIONS IN USING INDICATORS FOR POLICY FORMULATION

1. Identify policy objectives
2. Identify intervention options



Examples of issues and related indicators

UNEP CROSS-CUTTING THEMATIC PRIORITIES	POTENTIAL ISSUES AND CONCERNS	INDICATORS
Climate change	• Country contribution to anthropogenic climate change • Increased frequency/intensity of storm surges	• Greenhouse gas emissions (Kt of CO_2 equivalent/year) • Rainfall (mm/year) and evaporation • Storm-related damages (US$/year)
Ecosystem management	• Deforestation • Loss of critical ecosystem services	• Forest cover (ha) • Extent of land and marine conservation areas (ha)
Resource efficiency	• Falling groundwater tables • Low efficiency of non-renewable energy sources	• Water intensity or productivity (m^3/US$) • Coal consumption intensity (tonnes/GDP)
Chemicals and waste management	• Air pollution • Soil contamination	• Sulphur oxide (SO_x) emissions (Kg/yr) • Waste recycling and reuse (%) • Toxic heavy metal concentration, e.g., Hg, Cd, Pb, Cr. (mg/kg)

will frame the specific steps taken in order to address the issue. The definition of associated policy targets will also ensure effective monitoring and evaluation during and after implementation. Given its primary importance in the policy cycle, the definition of policy objectives should be carried out carefully, ensuring that a systemic, cross-sectoral and multi-stakeholder process, such as the Bellagio STAMP (SusTainability Assessment and Measurement Principles) which suggests eight general principles that could be adopted globally (Pintér et al., 2012; IISD, 2013). Objectives should be formulated and phrased according to a shared understanding of the steps needed to solve the specific issue, in accordance with the national vision, if available. High-level government officials should be involved in this process to guide the decision-making process by aligning policy objectives with existing strategies and plans. Moreover, all relevant stakeholders should be engaged and consulted to take into account different points of view and expertise, and to set goals that do not conflict with key social values, norms and beliefs. Finally, scientific evidence is needed to inform the formulation of policy objectives to ensure that objectives are appropriate and achievable.

Defining the policy objective or objectives relates to the desired outcome of the policy intervention. Ideally, policy objectives are stated in a manner that is specific or targeted, measurable, ambitious while achievable or realistic, and time-bound (SMART) (Doran, 1981).

BOX 5. ANALYSING THE EFFECTS OF INTERVENTIONS AS OUTPUTS, OUTCOMES AND IMPACTS

While conceptual nuances exist, in accordance with the mandates and missions of organisations, existing methodologies for evaluation and results-based management commonly distinguish (i) outputs from (ii) outcomes and (iii) impacts. For the purposes of the present manual, these terms are defined as follows:

- Output: is the immediate result of the policy intervention, in terms of the product, process, good or service that it delivers.
- Outcome: is the observable positive or negative change in the actions of social actors that have been influenced, directly or indirectly, partially or totally, intentionally or not, by the output.
- Impact: is the long-term, sustainable change in the conditions of people and the state of the environment that structurally reduces poverty, improves human well-being and protects and conserves natural resources – in a nutshell, that achieves sustainable development.

The key to distinguishing these terms is that policymaking and implementation controls its outputs, influences outcomes, and contributes to impacts.

Source: Wilson-Grau 2008

Indicators play a role in defining policy targets as the explicit statement of desired results over a specified period of time. Expressing targets in a quantified manner will simplify the measure of progress towards their achievement (IISD, 2005). However, it may not be desirable or possible to further specific policy objectives in every case by defining quantifiable targets.

The Government of Indonesia set the following targets in 2011: 7 per cent GDP growth per year by 2014, and 41 per cent carbon emission reductions by 2020 - of which 15 per cent with international support. Additional objectives include improved food security and poverty alleviation (to ensure more inclusive growth) and wise use of natural resources (to support future economic growth but also to provide means of subsistence for rural communities). These objectives are, however, not quantified.

Several social, economic and environmental objectives and thresholds exist at national, regional and global level, and can be used to formulate national policy objectives and targets, such as the following:

- Millennium Development Goals (MDGs) and their respective targets, agreed globally and used to improve national performance (e.g., halving the proportion of the population without sustainable access to safe drinking water and sanitation by 2015);
- Strategic Plan for Biodiversity 2011-2020, adopted in 2010 by the Conference of the Parties to the Convention on Biological Diversity, contains twenty global policy targets ('Aichi Biodiversity Targets') organized under five strategic objectives, some of which are quantified. For instance, target 11 calls for at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, to be conserved through effectively and equitably managed protected areas by 2020; and
- At the regional level, the European Union has established a CO_2 emission target for new passenger vehicles, not to exceed 130 grams of carbon dioxide per kilometre (g CO_2/km) by 2015.

When not explicitly or formally stated, possibly due to the emerging nature of the issues to be addressed, the objectives set at the national level should be aligned, or consistent with, agreed regional and international objectives.

The EU Roadmap to a Resource Efficient Europe, which includes a series of milestones to be reached by 2020, is an example of regional targets. Among

these milestones one refers to resource efficient production: "Milestone: By 2020, market and policy incentives that reward business investments in efficiency are in place. These incentives have stimulated new innovations in resource efficient production methods that are widely used. All companies, and their investors, can measure and benchmark their lifecycle resource efficiency. Economic growth and well-being are decoupled from resource inputs and come primarily from increases in the value of products and associated services."

Targets or objectives could focus on a specific issue, the causes of an issue or the performance of the sector or the economy as a whole. In order to define specific targets or objectives, the choice of indicators at the adequate scale and level of disaggregation is critical. For instance, consider the example of defining policy targets for addressing deforestation where:

1. Setting a target on forest area alone, while helping decision makers to assess the effectiveness of policies against the desired outcome, in itself would not provide focus on the key drivers of forest degradation or deforestation. Decision makers may overlook the key drivers of deforestation, causing the problem to persist and possibly creating unexpected negative side effects. For instance, if the main issue to be addressed is the reduction in GDP in the forestry sector, the allocation of subsidies to lower costs for the industry would make timber production more attractive, stimulating investment in activities that would further push deforestation in the short term, and further undermine the potential growth and sustainability of the sector in the future;
2. Setting additional targets on the causes of deforestation would help to support the design and effective implementation of policies that would directly and specifically address these underlying causes, and could also bring about double and triple dividends (see Section 2), as the causes of deforestation could lead to other problems; and
3. Setting a target on the performance of the sector, or the economy as a whole, would allow decision makers to consider several additional interventions, some of which may actually be more effective than reduced deforestation. In cases where there is high competition for budgetary expenditure across sectors, setting a high level goal may be detrimental to solving very specific issues, despite the fact that these issues have an impact on the overall performance of the system.

More specific targets require more focused policy formulation. A more targeted policy formulation exercise, carried out within specific boundaries, reduces the risks related to policy implementation, increase effectiveness and reduce the possibility of policy resistance. Table 4 presents a summary of tasks and key questions relating to this section.

That being said, macro targets (such GDP growth) remain important as the combination of all policies implemented to reach specific targets should lead anyway to an improvement of the overall performance in the system. Macro indicators, in fact, could be useful in measuring impact on key sectors. The impact of policy implementation from a macro and cross-sectoral perspective is discussed further in Section 4.

3.2. IDENTIFY INTERVENTION OPTIONS AND OUTPUT INDICATORS

Once policy objectives and targets are defined, it would be easier to consider appropriate interventions as well as the indicators that would help evaluate the effectiveness of these options once implemented. These indicators address the output of the policy intervention. For example, in the case of the transport sector, private motor vehicles represent a rapidly increasing share of the transportation network of a major city. This situation could have an impact on public health and quality of life, in general, as well as increase economic costs associated with travelling longer because of traffic. Subsequently, because of this worrying trend, the city administration could decide to reduce the modal share of private motor vehicles (outcome: policy objectives) from, for example, 80 per cent in 2010 to 55 per cent in 2020 (outcome: policy target and

indicator). As part of its adopted policy package, and in co-operation with the federal government, it could launch a massive investment programme into public transportation, with a view to expand its metro system by 50 km, its public bus system by 150 km, and to implement 30 per cent of bus lines on dedicated lanes (output: targets and indicators).

In this context, there are four main ways to influence behaviour and shape future trends in order to reach stated objectives: investments, provision of incentives or disincentives, public targets mandated by law (regulation) and social interventions. Current and past policies adopted for solving similar issues (i.e. address similar causes) should be analysed to evaluate their efficiency and effectiveness as well as identify the emergence of potential side effects. The analysis of the adequacy of these options, as well as their impacts, will certainly benefit from the adoption of a multi-stakeholder approach (UNDP, 2012).

3.2.1 Investment

Investment by the government is a direct intervention, which arises from budgetary allocation, aimed to create new or improved green infrastructure or to restructure existing public services. These investments can be implemented for several purposes, including for upgrading public infrastructure (i.e. climate resilient transport infrastructure) and modernising other services (e.g., expansion of the power transmission network or investment in renewable energy supply such as wind power). For example, investments in well-designed public transport, support the reduction of liquid fuel consumption and CO_2 emissions, while reducing traffic congestion and accidents, as well as lowering transport and health costs for households.

Public capital investment can also contribute to the abatement of costs for green activities, thus potentially influencing future private expenditure and investment. Such is the case where, in decreasing agricultural production, investments in pilot projects for the adoption of micro irrigation systems would show the benefits of the technology in saving water and increasing land productivity, thus potentially triggering private investment. Indicators relevant for the analysis and use of capital investments are monetary flows, such as R&D investment (percentage of GDP), EGSS investment (US$/year) and specific sectoral investments, such as renewable energy expansion (MW/year and US$/year).

3.2.2 Incentive measures

Incentives and disincentives can be used to stimulate or dissuade private investments. They are powerful instruments to guide the market through price signals towards more sustainable production and consumption. Incentives and disincentives occur in different forms, including taxation and subsidies. For example, investments in renewable energy can be stimulated by the introduction of feed-in tariffs, an incentive that allows households to sell the excess energy produced and increase their return on investment. Providing payments for ecosystem services can redirect the incentives of land holders, in particular farmers, toward undertaking activities that are beneficial (or, at least, less harmful) for ecosystem conservation.

Indicators can be used to target, monitor and evaluate the adequacy and performance of incentives. This analysis requires a cross-sectoral approach, as the impacts of these interventions typically have social, economic and environmental ramifications even beyond the targeted sector.

From a green economy perspective, particular emphasis is put on the removal or phasing out of harmful subsidies and the introduction of taxes or fees that reflect the full opportunity cost of nature's goods and services. Full-cost pricing means that prices are corrected for the external costs of transactions, and ensures that consumers and producers face a price that restores socially-efficient decision-making. For example, the removal, phasing out or reform of environmentally-harmful subsidies, such as those that subsidise the use of fossil fuels, would lead to higher prices thus lowering demand and consumption and generating energy savings or substitution of fossil fuel use with less carbon-intensive energy sources.

Moreover, the effectiveness of the programme (or lack thereof) against stated social or development policy objectives is an important factor in identifying

appropriate indicators for the reform or removal of harmful subsidy programmes, such as the share of subsidy beneficiaries along income brackets. Removing harmful subsidies could leverage scarce public resources that can be put to better use (also an important indicator).

3.2.3 Public targets required by law

The establishment of laws and standards can be seen as the formal enactment of a target to ensure that it is reached. In fact, unless required by law, targets remain well-specified objectives that will be attained only if policy interventions are effective in stimulating the investment required. For example, several countries adopted Renewable Energy Standards (RES) which require utilities to generate a certain percentage of their supply from renewable energy, usually to be attained by a specific year. Without these targets, utilities would presumably rather invest in expanding the cheapest option for power generation capacity, regardless of its carbon intensity. Similarly, fuel efficiency standards exist in the EU and USA that mandate yearly improvements in the efficiency of engines, with the aim to modernise the car fleet and reduce energy consumption and costs.

A sound regulatory framework is therefore essential for a successful green economy transition, and, as presented in the following sections, public targets required by law are typically coupled with other interventions to share the economic burden among the private and public sectors.

3.2.4 Social interventions

All the policy options mentioned above are aimed at stimulating behavioural change (both for producers and consumers). Other types of interventions, also requiring investment, aim primarily at informing the public with a view to stimulate voluntary changes in behaviour, without relying on economic incentives. Such interventions include, among others, capacity building (personal and institutional) and awareness-raising activities (IISD, 2013).

Voluntary behavioural change is a major driver for the shift to sustainable development. Individuals, communities and private companies can change their behaviour in response to an increased awareness of the consequences of unsustainable production and consumption. For example, in the case of decreasing agricultural production and the planned adoption of micro irrigation systems, training could be carried out to inform farmers of the advantages of using this technology. Such capacity building may be particularly effective as farmers will already be aware that action is needed to reverse the trend of declining incomes. Noticing that water has an impact on their production, and its availability is more and more limited, they might decide to use water more effectively and invest in micro irrigation.

Indicators can be used to monitor changes in consumption patterns, and should be compared to the effort the government is making to change these patterns. For example, relevant indicators include the expenditure in awareness-raising and training activities (input), the number of farmers adopting micro-irrigation (output), the productivity of water use (outcome) and the effect on agricultural production and income (outcome).

The policy instruments mentioned above will be analysed in the following chapter, taking into consideration their strengths and weaknesses for solving the problems identified in Chapter 2, as well as the potential synergies that can be harnessed by designing a policy package that combines several intervention options.

For a summary of key tasks and questions, please see Table 4.

Table 4. Summary of key steps and related indicators for policy formulation: Examples for deforestation, nutrition and CO_2 emissions

Steps	Description	Indicator typology and tasks	Indicator samples
1. Identify desired outcomes: define policy objectives	• Based on the worrying trend and its environmental causes, define policy objectives and set targets for their achievement. – What is the desired outcome that can be reached through policy interventions? – What is the key	a. Analyse indicators of sectoral and environmental issues. b. Select target indicators tailored to the national context, with the help of existing global and regional targets: – Set specific targets to address the causes of the problem. – Set specific targets to reduce the impacts	**Deforestation** • Reduced deforestation (e.g. 50% reduction by 2030) • Increase in protected area (ha) • Certified timber production ($/year; ha) **Nutrition** • Increased nutrition levels (e.g. 2000 kcal/day per person) • Increased production of agricultural products (tonne/year) • Higher water productivity in agriculture (L/tonne) **CO_2 emissions** • Decreased CO_2 emissions (Kt of CO_2 equivalent) • Increased renewable energy production (KWh) • Lower electricity losses (% of electricity generation)
2. Identify intervention options and output	• Establish an initial list of potential policy instruments. • Carry out an analysis of past interventions adopted to address the same issue, and their outcomes. – What are the policy instruments available to address the negative environmental trends? – What are current and past policies adopted for the same objective? What should be changed?	a. Identify indicators representing and measuring the main policy instruments considered. b. Identify indicators representing and measuring the sectoral effectiveness of the intervention considered.	**Deforestation** • PES (payment for ecosystem services): funding transferred (US$/year and/or US$/ha) • Agroforestry development: investment per ha (US$/ha/year) • Timber certification: activities certified (#/year and output) **Nutrition** • Ecological fertilisers: investment and productivity (US$/ha/year, tonnes/ha) • Water efficiency: investment and productivity (US$/ha/year, tonnes/L) • Improved fishing practices: public subsidy (US$/person/year) **$CO_2$ emissions** • Renewable energy: feed-in tariffs (US$/MWh) • Energy efficiency: national standards (CO2 emission % reduction)

While indicators for issue identification help to frame the issue, indicators for policy formulation help to design solutions.

4 INDICATORS FOR POLICY ASSESSMENT

A green economy is one that results in improved human well-being and social equity while significantly reducing environmental risks and ecological scarcities (UNEP, 2011). In this regard, the ultimate objective of a green policy intervention would be to protect the environment while ensuring the well-being of the population in a sustainable way. Impact indicators are thus needed to highlight the linkage between green economy and sustainable development.

Once objectives and targets are defined, and intervention options identified, a policy assessment needs to be carried out to estimate the long-term impacts of implementation, evaluate the effectiveness of each option in supporting sustainable development, and to informed decision-making. While indicators for problem identification help to frame the issue and indicators for policy formulation help to design solutions, impact indicators support the estimation of the cross-sectoral impacts of the interventions chosen.

This chapter focuses on the use of indicators already identified in Section 2 (issue identification) and Section 3 (policy formulation), with an emphasis on indicators for socioeconomic impacts and well-being. Complementing these indicators are several impact assessment methods that support a systemic analysis across sectors and actors.

Once a policy has been designed, its expected impact has to be estimated to informed decision-making and implementation. In this phase, a clear understanding of the time needed to progress from policy formulation to decision-making and implementation needs to be developed. The use of a multi-stakeholder approach is encouraged, and roles, responsibilities and procedures should be clearly defined and agreed upon (UNDP, 2009). In addition, policy assessment should take into account the time needed to implement the policy and for its impact to emerge. While being equally effective in the longer term, certain policies may generate positive results already in the short term and others may require more time to show any meaningful impact.

The expansion of forest protected areas, for example, is a policy intervention that may require the engagement of a number of relevant stakeholders, including, when applicable, forest dwellers, logging companies, government representatives from different ministries, enforcement agencies, civil society organisations, research institutions, etc. The time needed to consult different actors and reach an agreement on general objectives and principles, as well as respective roles and responsibilities for implementation (e.g., who is responsible for monitoring the area; what is the protocol to follow in case of violations; what are the exceptions, if any, for local dwellers). Moreover, the assessment should include estimations of the time and costs needed to implement and enforce new regulations, including relocating companies and communities, creating the capacity to control the area, and an assessment of when results of policy implementation would be visible (e.g., employment may be generated in the short term, but impacts on biodiversity may take longer).

The evaluation of policy effectiveness should account for possible "rebound effects", where part of the policy-induced gain is offset by system responses. These can be a feedback involving the price, income and/or the economy-wide rebound effect. A rebound effect could limit the desired impact of the policy, thereby influencing the time required to achieve policy objectives. This is the case of a policy targeting a 10 per cent improvement in energy efficiency, when energy consumption can only be reduced by 6 per cent. This is due to a reduction in energy consumption and expenditure (policy impact), which could possibly lead to a re-

allocation of resources and ultimately lead to higher expenditure and consumption (system response).

Economic, social and environmental impacts have to be forecasted and evaluated to support the creation of a policy package that would lead to double or triple dividends. The results will help to further develop and refine the policy options. Such feedback loops are typical for the policy cycle.

Policy impact indicators are also fundamental for the evaluation of the performance of policies during and after implementation, and also contribute to the next policymaking round (starting with issue identification).

The approach used for the identification of policy impact indicators covers a broader set of consequences of a social, economic and environmental nature, and thus requires a multi-stakeholder approach. These indicators include information on the state of the environment, directly related to the environmental issues and target indicators, as well as indicators of sectoral performance and socio-economic progress, such as employment and well-being. For example, the adoption of standards and regulations for the exploitation of fisheries are expected to have positive effects on the preservation of fish stocks, and thus the long-term profitability of fishing activities. At the community level, policy impacts could be measured through the development of small-scale fisheries, which are directly linked to food security and employment generation. The restoration of damaged marine ecosystems could also help to prevent future floods and coastal erosion, thus protecting coastal communities and their livelihoods, as well as crucial industries and infrastructure. In addition, revenues of marine ecotourism activities (i.e. accommodation and entertainment services) could be analysed to quantify the benefits of healthier coasts.

Another example comes from the waste sector, where the adoption of the 3R approach (reduce, reuse, recycle) is mainly aimed at reducing pollution and contamination derived from inappropriate waste disposal and management. Together with positive impacts on the environment, the success of innovative policies for industrial and municipal waste management could be reflected in improved health conditions (e.g., reduced pollution), water quality (e.g., reduced water contamination), energy supply (e.g., energy generation from waste), increased fish stocks (e.g., reduced contamination of ocean and inland water resources). Moreover, economic and employment opportunities could be created by collecting, sorting and reusing waste.

Impacts are notoriously more difficult to identify and assess. In the absence of more definite impact indicators, early pointers of impact may be used during implementation to indicate progress toward achieving policy objectives. For example, output indicators and indicators of risk factors can serve as suitable intermediate or leading indicators of impact.

The methodology proposed here focuses on three main steps to identify indicators for policy monitoring and evaluation:

1. Analyse policy impact across sectors;
2. Analyse impact on the overall well-being of the population;
3. Analyse advantages and disadvantages, and inform decision-making.

4.1 ESTIMATE IMPACT OF POLICY ACROSS SECTORS

After having measured the effectiveness of the policy intervention in addressing the issue at hand, cross-sectoral impacts should also be measured to evaluate whether the policy is effectively contributing to sustainable development. Given the high degree of interdependence between social, economic and environmental indicators, every green policy implemented in one sector is likely to impact (either positively or negatively) on other sectors. For this reason, an integrated cross-sectoral impact analysis of green policies should be carried out in order to provide a coherent evaluation of synergies, side effects and ancillary benefits. For example, greening the agriculture sector is expected to improve soil quality, increase yields and production, and consequently farmers' incomes. Additional potential positive effects and synergies could include improved nutrition (social), reduced food imports (economic), and decline in the rate of deforestation (environmental).

A policy example includes energy subsidies, which are effective instruments for supporting economic growth in the short term, by lowering the cost of energy to consumers. On the other hand, economic growth leads to higher energy demand, which leads to higher energy prices, offsetting the initial advantage gained by introducing subsidies. This side effect indicates that subsidies should be phased out over time to maintain competitiveness, not only for fossil fuels, but also for renewable energy.

In another case, subsidies on solar capacity reduce market prices, pushing demand higher which then leads to an increase in the price of the raw materials used to produce solar panels, making such panels more expensive. This is a case that has particularly affected production in China and consequently the global market. Additional interventions could therefore be designed to mitigate the strength of the side effect, such as the introduction of incentives for energy efficiency (while removing fossil fuel subsidies) and for a less material-intensive production process for solar panels (while also phasing out consumer subsidies).

For a summary of key actions and questions, please see Table 5 at the end of Section 4.

4.2 ANALYSE IMPACT OF POLICY ON THE WELL-BEING OF THE POPULATION

Green economy is a vehicle for attaining sustainable development. For this reason, economic, social and environmental impact indicators need to be identified in the policy assessment phase and monitored, focusing on how green economy interventions contribute to the improvement of well-being. In particular, potential co-benefits and ancillary benefits of green policies should be measured in order to assess the impacts on the quality of life of communities, and to identify additional opportunities to create positive synergies between green growth and sustainable development (OECD, 2011; UNEP, 2012a).

Several indicators can be used to estimate the impact of green economy policies on well-being, including employment and income generation (ILO, 2013), total wealth (i.e. value of natural resource stocks), access to resources (e.g., energy, water, sanitation) and health (e.g., harmful chemicals in water, people hospitalised due to air pollution).

The impact of green interventions on well-being can be both direct and indirect:

- Direct benefits include employment generation (I.e. new jobs for installing and maintaining renewable energy infrastructure), improved access to energy and water, increased food security (i.e. as result of ecological agriculture practices; and
- Indirect benefits include health (e.g., reduced occurrence of diseases linked to air or water pollution, adoption of healthy lifestyle), education (i.e. higher quality education and business skills resulting from capacity-building activities on innovative green techniques and technologies).

A number of well-being indicators could be considered when evaluating policies on green agricultural practices. These could include improvements in health conditions (i.e. less cases of malnutrition or intoxication due to water pollution), employment (i.e. new jobs in agriculture and related sectors), food security (e.g., share of food insecure people, MDG hunger target), education (e.g., technical knowledge on improved management practices or higher household income) and reduction of the risk of flooding (i.e. better management of land and water upstream).

The impact of green policy interventions can also be estimated through compound indicators (aggregated indicators, composite indicators and indices) of well-being which measure progress towards sustainable development (IISD, 2005), such as:

- Human Development Index (HDI)
- Gender-related Development Index (GDI)
- Millennium Development Goals (MDGs)
- Genuine Progress Indicator (GPI)
- Gender Inequality Index (GII)
- Multidimensional Poverty Index (MPI)
- Inclusive Wealth Index (IWI)
- Index of Sustainable Economic Welfare (ISEW)
- Sustainable Net Benefit Index (SNBI)

Compound indicators are the result of a compilation of single indicators on the basis of an underlying model (Nardo et al., 2005; Hak, 2011) and are more accessible to policymakers and are useful in determining the aggregated impact of green policies on quality of life and human development, with particular attention on vulnerable groups.

However, they could be perceived subjectively, since value systems influence the theoretical framework for the selection and combination of individual indicators, and in particular with regard to the relative weights given to the individual components. As suggested in a previous study (UNEP, 2012a), methodological pluralism coupled with stakeholder participation and open and informed debate could reduce subjectivity and increase the value of compound indicators for measuring policy impacts on well-being.

Synergies between green economy strategies and sustainable development become more evident in this phase of the policy cycle, with an integrated evaluation that touches upon direct and indirect impacts of green interventions on the economy, society and the environment. For example, higher quality education and business-related skills would contribute to an improved Human Development Index (HDI) and in many cases potentially to a better Gender-related Development Index (GDI) as well. Further, access to energy and water would improve the overall MDG performance, and natural resource conservation would increase adjusted net savings.

For a summary of key tasks and questions, please see Table 5 at the end of Section 4.

4.3 ANALYSE ADVANTAGES AND DISADVANTAGES FOR INFORMED DECISION-MAKING

The goal of policy formulation, including the assessment of the likely impact of the interventions chosen, is to design a policy package that can effectively solve the problem and equitably allocate the economic burden, as well as the benefits, across the key actors in the economy.

An analysis of advantages and disadvantages is necessary to identify the winners and losers, concerning both required investments and benefits. Simply put, this analysis would generally compare investment and avoided costs, or added benefits, depending on the issue. For example, the adoption of energy efficient technology requireing upfront investments (capital expenditure) will reduce energy

consumption and expenditure (avoided cost), while possibly creating new jobs and income (added benefit).

Added benefits and avoided costs may change depending on the problem analysed, and can be compared with indicators of the historical and current performance of the sector to assess whether the investment can be sustained, and how the economic burden can be allocated across the main actors impacted by the intervention (e.g., public versus private investment). For example, in the case of deforestation, avoided costs include the replacement of deteriorating ecosystem services with built infrastructure (e.g., roads), and the lowered production and income from ecosystem goods (e.g., rubber and other non-timber forest products). In fact, aggressive deforestation may cause siltation, or the accumulation of sediments in rivers, impacting negatively on navigation, water supply, fishing communities, hydropower infrastructure, among others. As a consequence, companies involved in mining, for example, can either build roads to offset the loss of river use for transport, plant trees, compensate communities or contribute to the clean-up of river beds.

The following steps could be followed to carry out an analysis of advantages and disadvantages:

4.3.1 Establish the baseline and estimate the cost of inaction

This includes an analysis of trends, especially of baseline indicators (see Chapter 2) and the estimation of economic, biophysical, social and cultural damage resulting from inaction. These include, for instance, costs of biodiversity loss (expressed as lost ecotourism GDP); crop losses due to extreme weather events (expressed as income and production loss, increased imports, as well as nutrition and relative health impacts); costs of health treatment for respiratory diseases (expressed as the number of people hospitalised, the cost of treatment and the impact on GDP through reductions in labour productivity).

In all these examples, a variety of indicators should be monitored simultaneously in order to properly establish cause-effect relations, and assess the actual impact of interventions. In the case of tourism, for instance, biodiversity loss does not necessarily lead to a decline in revenues. In fact, while this could be true for ecotourism services, it may not be the same for traditional tourism business. In this case, considerable short-term growth could be achieved by expanding hotel capacity at the expense of forest cover and biodiversity.

4.3.2 Quantify the costs of policy intervention

Each policy instrument may imply several typologies of costs, for various stakeholders (e.g., planning, capacity-building, research, operation and management), and some of these costs may be prolonged or even become regular (e.g., operation and management). These include, for instance, salaries for park rangers, training, management and operational costs for the establishment of forest protected areas; investments in research for the identification of locally-adapted varieties, training and awareness-raising activities for the introduction of climate-resistant crop seeds; project and capital upfront costs, and maintenance and capacity building expenditure for investments in renewable energy infrastructure.

4.3.3 Quantify the advantages or benefits of policy intervention

Benefits to all stakeholders include avoided damages, direct and indirect economic and/or biophysical positive impacts, qualitative and/or quantitative social improvements (e.g., well-being) and cultural impacts, and more. Specific methodologies for quantification can be found in several sectors. For biodiversity these include, among others, market and non-market valuation techniques (UNSD, 2003; EC et al., 2012). In the case of policies that involve the private sector, (e.g., incentives to EGSS), expected returns on investments (ROI) and more conventional cost-benefit and multi-criteria analyses could be carried out. Further, reputational benefits deriving from enhanced corporate social responsibility could also be estimated.

It is important to underline that such advantages will not just include benefits in a narrow sense, such as monetary or financial benefits. Examples

of financial benefits include revenues from forest products; avoided costs for the replacement of watershed management and other ecosystem services; increased revenues from ecotourism activities and from the sustainable management of forests; increased agricultural production and value; increased food exports (or decreased imports); avoided costs of health treatments for nutrition-related diseases or intoxication from polluted water caused by the use of climate-resilient crop-seeds; reduced fossil fuel costs; avoided cost of health treatments for respiratory diseases caused by polluted air; increased employment; and lowered volatility of electricity prices from investments in renewable energy.

4.3.4 Compare advantages and disadvantages

Several methods can be used to estimate advantages and disadvantages of the policy options, depending on the information available. These methods include the use of simulation models for ex ante analysis (see Box 16) which can facilitate the analysis of the forecasted impact of policy implementation across sectors. Furthermore, if an exclusively economic analysis, such as a cost-benefit analysis or a cost-effectiveness analysis, is not deemed adequate or appropriate in the specific situation, multi-criteria analyses could be applied whereby policy options are ranked against a variety of criteria, including social and cultural ones, chosen ad hoc, as well as analyses of distributional impacts, as applicable.

Given the need to consider the many ramifications of the impacts of policies in the context of a green economy analysis, the comparison of costs and benefits is likely to require cross-sectoral expertise. In fact, this activity should be carried out using a multi-stakeholder approach in order to ensure that assessments are objective (UNDP, 2009).

For instance, since the removal of harmful subsidies has several measurable impacts, a variety of indicators should be utilised to evaluate the performance of the intervention. These include indicators on government accounts (for the foreseen reduction in public expenditure), production costs and market prices of certain goods and services (kept artificially low and potentially increasing) and their consumption (potentially decreasing if prices increase).

The three main direct consequences have several indirect ramifications that require the utilisation of an even broader set of indicators:

- Reduced public expenditure frees up resources for other interventions that could potentially

reduce the burden on households;
- Reduced consumption of natural resources, often being traded as commodities, would reduce upward price pressure, partially offsetting the impact that subsidy removal would have on prices and, as a consequence, on household costs;
- Reduced consumption would allow a reversal of the current downward trends of some natural resource stocks (such as forests and fisheries) due to overexploitation;
- The higher prices of unsustainable goods and services would immediately increase the profitability of green economy interventions, triggering further investments;
- Last but not least, higher prices could also have adverse distributional consequences, which would need to be identified accurately and, if judged significant, mitigated by additional measures.

4.3.5 Informed decision-making using results of analysis and formulate related policy interventions

Once the various policy options available to address the issue and attain the policy targets have been further analysed with the help of indicators on advantages and disadvantages, as explained above, and further fine-tuned based on the results of the assessment, the best combination of interventions needs to be chosen by policy-makers considering the distribution of advantages and disadvantages across key actors in the economy.

The selection of policy options should be based on three criteria, also supported by quantitative modelling exercises (see Box 16): (i) the equitable sharing of costs; (ii) the effectiveness in addressing the issue; (iii) the promotion of cross-sectoral double and triple dividend opportunities (OECD, 2011; World Bank, 2012b). More specifically:

- Indicators should be analysed to evaluate and select the options that would not put an onerous burden on vulnerable groups or the poor. For instance, regulations (i.e. mandates), in the absence of incentives, imply that individuals and the private sector would be required to bear all the costs needed to comply with the law (e.g., such as in the case of a mandate for energy efficiency) (World Bank, 2012b). A multi-stakeholder approach is necessary to identify and evaluate inconsistencies in the cost allocation as well as impacts across stakeholders, and to determine the indicators necessary to evaluate the expected impacts of policy interventions. In fact, indicators of household investment as well as disposable income could be used to evaluate whether the new policy would require a considerable reallocation of resources (possibly reducing consumption and savings) that could lead to negative economic impacts. In such a case, the gradual phasing in of the regulation, possibly coupled with additional incentives, could be considered. In the case of additional incentives, their impact on government accounts – using indicators associated with the annual deficit and debt - should be carefully monitored.
- Indicators should be analysed to evaluate the effectiveness of the interventions available. For example, investments to set up a public system to collect and sort waste may be very effective in creating employment, but may prove to be very expensive and ineffective in supplying the required quantity of waste to recycling facilities. On the other hand, investments in public awareness and installation of waste disposal units in several parts of the city may not generate jobs, but may reduce implementation costs and increase the flow of waste reaching recycling facilities, all thanks to voluntary action.
- Indicators should be used to design policy packages that make use of synergies and create double and triple dividends. While an investment in renewable energy may be perceived to be very effective in reducing fuel consumption (import and cost), the impacts of the various policy options available to reach a renewable energy target can be many and varied. Importing manufactured capacity from abroad alone, through a direct capital investment, while minimising costs, will not create local employment and capacity. On the other hand, incentives for the expansion of capacity will stimulate local operators to learn about the technology and either import it or create it locally, generating knowledge and employment.

For a summary of key tasks and questions, please see Table 5.

BOX 6. EX ANTE AND EX POST MODELLING IN SUPPORT OF POLICY FORMULATION AND EVALUATION

Due to the cross-sectoral impacts of green policy interventions, an integrated approach is needed to design an effective policy package.

As indicated in Chapters 2, 3 and 4, policymakers should use multiple indicators in order to better understand the functioning of the system, maximise synergies across sectors and avoid unintended consequences. Indeed, policies can have very positive impacts for certain sectors and create issues for others. Furthermore, successful policies in the longer term may have negative short-term impacts, for which mitigating actions may be designed and implemented.

Integrated policymaking requires a holistic perspective and constant monitoring of multiple, simultaneous changes in the drivers of the system. Integrated simulation models that address social, economic and environmental factors within a single analytical framework can support decision makers in identifying upcoming problems, estimating and evaluating the prospective impacts of policy implementation. More specifically, simulation models can be used ex ante - in the problem identification and policy formulation phases - and ex post - when policies are under implementation and their performance needs to be monitored and evaluated.

Ex ante modelling can generate "what if" projections on the expected (and unexpected) trends, as well as on the impacts of proposed policy options on a variety of key indicators across sectors. In addition, well-designed models that integrate various economic and biophysical variables and sectors can assist in the analysis of advantages and disadvantages and the prioritisation of policy options. The use of structural models that explicitly link policy interventions to their impacts can generate projections on how a certain target could be reached, and when.

Ex post modelling can support impact evaluation by improving the understanding of the relations existing among key variables in the system. Comparing actual with projected performance under given initial conditions and historical data enables improvements in the model and understanding of the system, and ultimately supports the refinement of objectives, targets, and policies.

The System Dynamics (SD) methodology, coupled with econometrics and optimisation in the sectors of relevance, has been successfully used to develop and test green economy principles at the global level, and to design several national green economy strategies in collaboration with the respective governments. One of the main advantages of SD - a methodology that emphasises causal relations and highlights the complexity of the system - is its transparency, and also its capacity to explicitly account for feedback loops, delays and non-linearity.

Table 5. Key steps and related indicators for policy impact evaluation: Examples for deforestation, nutrition and CO_2 emissions

Steps	Description	Indicator typology and tasks	Indicator samples
1. Estimate policy impacts across sectors	Evaluate the direct economic, environmental and social benefits (and potential side effects) of the interventions implemented. Use integrated simulation models to project the future impact of the interventions on key sectors and indicators. • Is the policy having positive/ negative impacts on other sectors?	Evaluate the direct economic, environmental and social benefits (and potential side effects) of the interventions implemented.	Deforestation • Increased revenues from river transport activities (US$/year) • Increased water supply (L/year) • Reduced flood risk (US$/year; % of GDP) Nutrition • Revenue creation for food processing industries (US$/year) • Water savings due to micro-irrigation (L/year) • Increased water availability for hydropower (KWh/year) CO_2 emissions • Reduced cost of energy imports (US$/ year) • Lowered road transport costs (US$/year) • Households consumption and savings (US$/year)
2. Analyse impacts on the overall well-being of the population	Identify impacts of policy implementation on sustainable development, including poverty alleviation, equity, social inclusive-ness, inclusive wealth etc. • What is the impact of the policy on the overall well-being of the population?	a. Select and analyse indicators of policy impacts on: – Employment, total wealth, access to resources, etc. b. Select and analyse composite indicators of well-being, such as: – HDI, GDI, MDGs, GPI.	Deforestation • Employment and income generation, e.g., in sustainable forest management (people /year, US$/year) • Deaths from landslides and floods (deaths /year) • Revenues from ecotourism (US$/year) Nutrition • Employment and income generation, e.g., in agriculture (people/year, US$/ year) • Malnutrition (people hospitalised/year) • Newborn health (% of newborns with low birthweight) CO_2 emissions • Access to modern forms of energy (%) • Employment and income generation (people/year, US$/year) • Respiratory diseases due to smoke inhalation from indoor burning cooking stoves (people hospitalised/ year)
3. Analyse advantages and disadvantages and inform decision-making	Analyse short, medium and long-term advantages and disadvantages of the various policy options considered. Compare options based on the analysis of advantages and disadvantages. • What is the economic cost of the targets and intervention(s) proposed? How does it compare to the cost of inaction? • What are the economic and cross-sectoral benefits of policy options in the short, medium and long-term? • Which options are expected to generate the maximum cross-sectoral benefit at the minor cost?	a. Identify indicators to estimate the costs of reaching selected targets through various policy interventions (e.g., include, capital and O&M cost, training expenditure, etc.) b. Identify indicators to evaluate expected benefits and avoided costs of the investment and interventions considered. c. Identify and analyse indicators that highlight the presence of possible synergies and/or side effects.	Deforestation • Cost of reforestation (US$/ha) • GEF benefits index for biodiversity • Income creation for rural communities (US$/year) Nutrition • Cost of interventions: material inputs and training (US$/year, % of GDP) • Reduction of child malnutrition (% and %/US$ invested) • Avoided food imports (US$/year or % change) CO_2 emissions • Investment in renewable energy (US$/ year, % of GDP) • Rural access to clean energy (%) • Avoided energy costs from savings (US$/year, % of GDP)

The approach used for the identification of policy impact indicators covers a broader set of consequences of a social, economic and environmental nature, and thus requires a multistakeholder approach.

5 INDICATORS FOR POLICY MONITORING AND EVALUATION

The last stage of the integrated policymaking cycle is the monitoring and evaluation of policy impact. Indicators for policy monitoring and evaluation support the assessment of the performance of the intervention implemented. This approach focuses on the use of indicators already identified in Section 2 (issue identification) and Sections 3 and 4 (policy formulation and assessment).

5.1 THE ROLE OF INDICATORS IN POLICY MONITORING AND EVALUATION

The integrated policymaking cycle is continuous and requires constant monitoring and evaluation of impacts not only to support the agenda-setting stage but also to undertake corrective actions. For example, the impact of interventions in public transport should be measured in relation to initial expectations, such as the reduction of CO_2 emission, which may have been perceived as a priority issue in the agenda-setting stage. Initially, data monitoring may reveal that emission levels, although declining, are still above desired targets. However, this could be due to an underestimation of secondary impacts, such as transit-oriented development, resulting from the extension of the public transport infrastructure. In particular, the expansion of railway networks connecting urban and lower density areas might result in increased urbanisation, with the growth of suburbs. As a result, corrective measures need to be identified and implemented.

Monitoring and evaluation is also crucial in identifying and anticipating patterns and trends, through the analysis of emerging and unexpected events. During this process, unforeseen policy responses, in the form of negative side effects or potentially positive synergies, may only be detected during the implementation stage and lead to a redefinition of targets and the modification of policies. For example, policy interventions to reduce CO_2 emissions have included incentives for the cultivation of sugar or starch crops – such as corn or sugarcane – to produce energy and reduce fossil fuel exploitation. However, subsequent assessments or monitoring and evaluation during implementation have, in a number of cases, highlighted a trend towards shifting land use from food crops to biofuel crops, with consequent increases in food prices and negative impacts on food security and nutrition. Such crops require large amounts of water and fertilisers to obtain adequate yields, which lead to the reduction of water availability for other uses, soil degradation and groundwater pollution from chemical fertilisers. These early warning signs may induce policymakers to consider lowering the target for biofuel production, or implementing interventions that mitigate the negative effects of existing production practices (such as more stringent water efficiency standards or land use regulations, or the provision of incentives for ecological agricultural practices).

In order to conduct comprehensive monitoring and evaluation, a broad range of stakeholders need to be engaged in the process to provide feedback on the perceived performance of implemented policies. Stakeholder participation could be enhanced through the organisation of public hearings, the establishment of special consultative committees and task forces (UNEP, 2009). Different perspectives on policy impacts are particularly relevant in this phase, when political biases can compromise the transparency and efficacy of the evaluation process.

Based on stakeholder consultations, policies can be reformulated and adjusted according to evolving needs and observed synergies or unintended consequences. In particular, new target indicators can be designed that are more in line with the system's response, and acknowledge possible delays in transitioning towards new behavioural patterns.

BOX 7. KEY STEPS: INDICATORS FOR POLICY MONITORING AND EVALUATION

1. Measure policy impacts in relation to the environmental issue indicators for issue identification);
2. Measure the investment leveraged (indicators for policy formulation);
3. Measure impacts across sectors and on the overall well-being of the population (indicators for policy assessment).

The methodology proposed focuses on three main steps to identify indicators for policy monitoring and evaluation:

1. Measure policy impact in relation to the environmental issue (using indicators for issue identification);
2. Measure policy performance (using indicators for policy formulation);
3. Analyse impacts across sectors and on the overall well-being of the population (using indicators for policy assessment).

5.2 MEASURING POLICY PERFORMANCE: EFFECTIVENESS, INVESTMENT AND WELL-BEING

Monitoring implementation of the policy is a fundamental step of the policymaking cycle. It allows decision makers to verify whether the policy is generating expected results, and eventually leads to the formulation and implementation of corrective measures (UNDP, 2009). In addition to policy impacts, the effectiveness of the implementation process can be evaluated.

The implementation of a policy often requires simultaneous or sequential actions in different sectors or administrative divisions. The actual responsiveness of different stakeholders involved in the execution of policy measures, the effectiveness of their actions as well as the suitability of the implementation and enforcement procedures established, can be measured with the help of qualitative and quantitative indicators. In this context, monitoring and evaluation becomes a powerful process to strengthen stakeholder coordination, enhance accountability and reinforce the understanding of the integrated nature of the system.

An illustrative example at the global level is the monitoring of the implementation of Kyoto Protocol. A number of indicators are constantly monitored to assess compliance of the Parties with the rules established by the Protocol, such as the quality of measurements taken to calculate emission levels which is evaluated periodically. The annual GHG inventories, as well as national information dissemination, are mandatory outputs that Parties have to produce in order to allow the monitoring of key compliance indicators.

Simultaneously with monitoring the policy implementation process, the effectiveness of the policy itself needs to be carefully assessed from the very beginning of its implementation. In order to ensure that a consistent approach is adopted throughout the entire policy process, the same indicators that were designed for each step of the policymaking cycle should apprise the monitoring phase. Therefore, when monitoring and evaluating impacts of green policy interventions, the indicators for issue identification (see Section 2) should be analysed to test the actual effect of the interventions implemented. Additionally, indicators for issue identification should be compared to target indicators (see Section 3) to evaluate whether the situation is improving and matching desired targets. For instance, if deforestation has been identified as a worrying trend and the establishment of new protected areas has been selected as a green policy option to protect forests and reverse the trend, the first indicators to monitor are deforestation and its causes. If a target is available for the reduction of deforestation, a comparison should be made to evaluate whether the trend is

improving enough to reach the stated target on time.

If the analysis indicates that the problem has not been effectively addressed, the emphasis should be put on the causes of the problem to evaluate whether the inertia of the system (i.e. the lag between the implementation of the policy and its impact) is preventing sudden and measurable changes. For example, in the case of fisheries, despite the introduction of natural reserves to reduce catch and support the natural growth of the fish stock, it may take months or years for the fish stock to reach desired levels due to the biology of fish reproduction and other natural processes (e.g., natural predation, growth of corals) affecting the system.

If no change is still visible, a more specific policy analysis should be carried out to evaluate the impact of the intervention on the causal chain and to identify weak links, including side effects and unintended consequences. For example, in the case of energy efficiency, despite the success of incentives for energy efficient light bulbs and appliances, household energy consumption may not decline as much as expected because of the rebound effect, whereby the avoided energy costs resulting from the energy saved, may be spent on purchasing more energy intensive appliances (i.e. a larger TV or refrigerator) or simply using them more (i.e. light bulbs being left on for a longer period of time).

The performance of the policy in addressing the problem should be evaluated in relation to the resources it has mobilised. For this reason, to assess the effectiveness of the policy instrument chosen, the investment disbursed should be measured, either directly (i.e. in the form of capital investment and/or incentives) or indirectly (e.g., private investment triggered by the allocation of incentives, laws and regulations or by the pricing of externalities). For example, the monitoring and evaluation of renewable energy incentives may reveal that progress towards reaching a desired renewable energy growth target is below expectations. As a result, possible direct and indirect causes of failure should be analysed, such as the possibility that government incentives are not adequate (or sufficiently attractive) to trigger the required private sector investments. In this case, the incentive package could be revised. Another possible explanation may be that the target set was too ambitious compared to the private financial resources available (with low access to credit, even an attractive incentive may prove unsuccessful).

Finally, green economy being a vehicle for sustainable development, the elaboration of monitoring and evaluation of policy impacts should also be extended to all sectors as well as on well-

being. Since a green economy is expected to favour inclusive growth, the distribution of costs and benefits across actors also needs to be carefully evaluated. Participatory Monitoring and Evaluation (PME) is strongly recommended as an effective approach to understand multiple perceptions of policy impacts on well-being (UNEP, 2009). For example, in the ecotourism subsector, co-benefits should also be measured in other parts, such as the provision of local services and the manufacturing of tourism-related goods (e.g., beds, souvenirs and equipment). These, and other activities, impact on the well-being of the population through job creation, income, and new knowledge and skills. All these factors contribute to poverty reduction and well-being.

Another example can be taken from the waste sector, where the success or failure of integrated waste management policies could be evaluated in terms of health impacts and access to clean water and sanitation, resulting from reduced pollution. In particular, groundwater pollution due to open dumps and illegal landfills could also be monitored in conjunction with the incidence of diseases from water contamination in the areas close to the landfills. Similarly, data on air pollution and related respiratory diseases caused by emissions from municipal solid waste landfills could be analysed to assess additional health impacts of waste management policies.

Monitoring and evaluation is an action-oriented phase of the policy cycle. Indeed, the purpose of the evaluation is to take prompt decisions with regard to the continuation or modification of the policy. If indicators of policy outcomes reflect expectations, the behaviour of the system needs to be continuously monitored to ensure that potential delayed negative effects do not emerge. On the other hand, if the evaluation shows that results are not being properly achieved, an in-depth analysis has to be conducted, including a study of the evolution of key indicators, in order to detect the main causes of failure, and design effective corrective measures in the next policymaking cycle. In particular, the breadth and depth of policy failure need to be measured and understood, and different solutions should be found accordingly.

BOX 8. SUMMARY: MEASURE POLICY PERFORMANCE

Tasks:

- Measure policy impacts in relation to the environmental issue
  - Use target indicators selected in the policy formulation phase.
  - Use indicators of sectoral performance identified in the issue identification phase.
- Measure the investment leveraged o Use indicators for policy formulation.
- Measure impacts across sectors and on the overall well-being of the population
  - Use indicators for policy assessment.

Key questions:

- Is the policy implemented contributing to solving the problem?
  - Are the costs estimated in line with actual implementation expenditure?
  - Is implementation progressing as planned, with coordinated actions across key stakeholder?
  - Is investment (from public or private sources) being effectively leveraged by the policy implemented?
  - Is there any cross-sectoral impact being observed as a result of policy implementation?
  - Is the policy contributing to inclusiveness and well-being?

6 CONCLUSIONS

Policymakers and stakeholders often face resource and information constraints when it comes to implementing large-scale transformation. This paper has sought to provide guidance on how to use indicators in designing and implementing green economy policies at the national level, following a basic policymaking framework, namely, on the use of indicators as a tool for: (i) identifying priority issues, (ii) formulating green economy policy options (iii) assessing those policies, and (iv) monitoring and evaluating their implementation.

Through an incremental, issue-driven approach to green economy policies over the design and implementation of comprehensive green economy strategies, it calls for prioritisation during the agenda-setting stage and builds on existing policy priorities.

One of the significant challenges to using indicators for green economy policies is the availability and quality of data, which tends to be found not only with government ministries or agencies but also academic and other research institutions, and even private sector and non-governmental organisations. As a critical element of green economy policymaking, it is therefore important to forge partnerships and cooperation among agencies and institutions in order to bring together the best quality data available.

Ongoing international efforts on implementing or improving environmental accounting can be used as a complement to existing systems of national accounts. For example, the recent adoption by the United Nations Statistical Commission of the revised System of Environmental-Economic Accounting (SEEA) as an international standard has generated considerable interest and political momentum among countries towards making progress in this field. As the time this paper is published, 66 countries have expressed their commitment to advance natural capital accounting by signing the communiqué of the 50:50 Initiative of the World Bank-led partnership on wealth accounting and the valuation of ecosystem services (WAVES).

Helping partner countries develop and use indicators to guide a green economy transition is part of UNEP's efforts under the Partnership for Action on Green Economy (PAGE). The initiative brings together UNEP, the United Nations Industrial Development Organisation, the United Nations Institute for Training and Research Institute and the International Labour Organisation to provide a comprehensive suite of green economy services to partner countries.

UNEP has been providing green economy advisory services to several dozen countries in Africa, Asia and the Pacific, Eastern Europe, Latin America and the Caribbean. This consists of policy advice, technical assistance and capacity building to support the efforts of partner countries in transforming their economies.

UNEP's work emphasizes that an appropriate green economy measurement framework is necessary in order for policymakers to assess the progress towards a green economy. In this regard, UNEP is ready to help countries develop indicators that can help them make a successful green economy transition.

ANNEX 1. LAND-LOCKED DRY AND SUB-HUMID COUNTRY, WITH DOMINANT AGRICULTURE AND IN EARLY PHASES OF DEMOGRAPHIC TRANSITION AND URBANISATION

Given their socio-economic and environmental context, land-locked, dry and sub-humid countries relying heavily on agriculture might face a number of direct or indirect environmental challenges. Examples include:

- A reduction in soil quality, possibly due to climate change impacts and unsustainable agricultural practices, leading to a decrease in food production.
- Increasing water stress, due to growing demand for municipal and agricultural uses, and to variability in precipitation.
- High demographic growth, leading to urbanisation and creating pressures on the provision of basic services, such as access to sanitation and health care.

Sample indicators are presented for each step of the policymaking process to address the problem of decreasing agricultural production in this specific country context.

2. Issue identification

Step 1: Identify potentially worrying trends. In the first step of the issue identification phase, past and current trends are monitored in order to identify potential issues that might compromise national development.

The problem can be identified by analysing production (tonnes/year) and productivity (tonnes/ha), or indirectly, with the help of indicators related to food availability, such as food security, average nutrition level (Kcal/day/person) and health (% of newborns with birth weights inferior to 2500g).

Step 2: Assess the issue and its relation to the natural environment. Once the issue has been identified as potentially harmful for national development, indicators are used to clarify the relation (if any) between the problem and the environment.

In the case of decreasing agricultural production, a number of cause-effect relations might be explored between soil fertility, agricultural practices and environmental quality. On the one hand, the adoption of unsustainable cultivation and irrigation practices is likely to put pressure on natural resources, thereby impacting the overall performance of the sector. On the other hand, the sector can also be affected by environmental trends (such as increased climate variability, leading to water scarcity). Key indicators that can support this type of analysis include, among others, water use (L/year), rainfall (mm/year), irrigated land area (ha), water intensity in agriculture (L/tonne), use of fertilisers and pesticides (tonnes/ha), drought occurrence (n. of droughts/year).

Step 3: Analyse more fully the underlying causes of the issue of concern. After a general analysis has been conducted on the key elements having an influence on agricultural production, a more in-depth study is carried out to clearly identify causes and effects. For example, lower yields might be caused by soil erosion, in turn determined by a number of unsustainable practices, such as intensive use of chemical fertilisers (tonnes/ha), limited crop rotation, deep tillage etc. Another concurring cause could be the lack of water, attributable to low water productivity (m3/US$), reduced or highly variable rainfall (mm/year) and temperatures as a result of climate change.

Step 4: Analyse more fully how the issue impacts society, the economy and the environment. Once the key causes of the problem have been detected with the help of indicators and causal maps, the effects of decreased agricultural production on national socio-economic and environmental performance need to be measured.

For example, economic impacts could be evaluated by analysing trends in agriculture value added (US$/year); social impacts may include reduced employment (people/year), as well as increasing malnutrition (n. of malnutrition-related diseases/year); environmental impacts might derive from unsustainable practices to increase production at the expense of ecosystems; these may include deforestation (ha/year), more intensive use of fertilisers (tonnes/ha) leading to further soil degradation (% of agriculture land) and groundwater pollution (BOD mg/L), etc.

3. Policy formulation

Step 1: Identify desired outcomes: define policy objectives. The information provided by indicators of problem causes and effects is used to define the desired outcomes of policy

interventions. The main goal of the policy could be the improvement of agricultural practices for the achievement of adequate and sustainable production. Time-bound targets could be defined with the help of relevant indicators in order to track progress towards desired outcomes. These may include crop yield (% increase), reduced use of chemical inputs (% decrease in use, measured in tonnes/ha), water efficiency (% reduction of irrigation water losses).

Step 2: **Identify intervention options and output indicators.** Once broad policy goals and related specific targets have been set, an initial list of potential policy interventions is designed. Examples of potential green policies for this specific country context are incentives and training on sustainable agricultural practices and investment in efficient irrigation technology.

Output indicators are used in this phase to measure the suitability of each policy option with respect to the identified goals and targets. Indicators may include, for example: investment in and productivity of organic fertilisers (US$/ha/year; tonnes/ha), investment in water efficient technology and avoided water losses (US$/year; % of GDP; L/year), investment in and outreach of training activities (US$/year; n. of farmers involved).

4. Policy assessment

Step 1: **Measure policy impacts across sectors.** The impact of each policy option is measured with respect to the main sector addressed (i.e. agriculture) as well as to other key sectors. First of all, expected impacts are evaluated using indicators of agricultural production (tonnes/year). In addition, cross-sectoral impacts can be measured, such as revenue creation for food processing industries (US$/year), increased water availability for hydropower (KWh/year).

Step 2: **Analyse impacts on the overall well-being of the population.** Relevant indicators should be used to assess the impact of different green policy interventions on well-being. For example, an increase in agriculture production through the adoption of more sustainable practices is expected to bring health benefits (e.g., number of people hospitalised due to malnutrition or diseases related to water pollution), improve access to potable water and sanitation, and generate employment (number of new jobs in agriculture and related sectors).

Step 3: **Analyse advantages and disadvantages, and inform decision-making.** A comparative analysis of costs and benefits is essential to evaluate the feasibility of the policy. The overall investment needs to be estimated (US$/year), including training of farmers, storage facility construction and maintenance, incentives for organic fertilisers etc. Investments are then compared with benefits, such as additional value added (US$/year), avoided chemical fertiliser and water use, as well as food imports (US$/year or % change), additional income generated through employment (US$/year), reduced mortality (%), etc.

5. Monitoring and evaluation

Step 1: **Measure policy impacts in relation to the environmental issue.** Once the policy is under implementation, progress towards the stated targets has to be measured. Target indicators, such as % increase in crop yield, % decrease in the use of chemical inputs, % reduction of water losses, are compared with actual results in order to evaluate the effectiveness of the selected interventions.

Step 2: **Measure the investment leveraged.** Similarly, the indicators of expected costs and benefits identified in the policy formulation and assessment phases are monitored to evaluate the actual response of the system.

Step 3: **Measure impacts across sectors and on the overall well-being of the population.** Finally, actual policy impacts on well-being indicators are evaluated, using the same indicators identified in the assessment stage.

ANNEX 2. LAND-LOCKED DRY- AND SUB-HUMID COUNTRY WITH DOMINANT AGRICULTURE AND IN EARLY PHASES OF DEMOGRAPHIC TRANSITION AND URBANISATION. KEY STEPS AND SAMPLE INDICATORS TO ADDRESS DECREASING AGRICULTURAL PRODUCTION

Stages	Steps	Indicator samples
Issue identification	1. Identify potentially worrying trends	• Agriculture production (tonnes/year) • Dietary energy supply (Kcal/day per person) • Crop yield (tonnes/ha)
	2. Assess the issue and its relation to the natural environment	• Rainfall (mm/year) • Droughts (n. of droughts/year) • Soil erosion (% of total agriculture land)
	3. Analyse more fully the underlying causes of the issue of concern	• Population (people) • Use of chemical fertilisers and pesticides (tonnes/ha) • Water consumption (L/year)
	4. Analyse more fully how the issue impacts society, the economy and the environment	• Agriculture GDP (US$/year) • Employment (people) • Access to potable water and sanitation (%)
Policy formulation	1. Identify desired outcomes: define policy objectives	• Increased nutrition levels (e.g. 2000 kcal/day per person) • Increased agriculture production and productivity (tonnes/year, tonnes/ha) • Higher water productivity in agriculture (L/tonne)
	2. Identify intervention options and output indicators	• Organic fertilisers: incentive and use (US$/year, ha) • Water efficiency: investment and productivity (US$/ha/year, tonnes/L) • Training: support to public outreach (people, US$/person/year)
Policy assessment	1. Estimate policy impacts across sectors	• Revenue creation for food processing industries (US$/year) • Water savings due to micro-irrigation (L/year) • Increased water availability for hydropower (KWh/year)
	2. Analyse impacts on the overall well-being of the population	• Employment and income generation (people/year, US$/year) • Malnutrition (people hospitalised/year) • Newborn health (% of newborns with low birth weight)
	3. Analyse advantages and disadvantages and inform decision-making	• Cost of interventions: material inputs and training (US$/year, % of GDP) • Additional GDP and income created (US$/year) • Avoided food imports (US$/year or % change)
Policy monitoring and evaluation	1. Measure policy impacts in relation to the environmental issue	• Water intensity in agriculture (L/tonne) • Use of chemical fertilisers and pesticides (tonnes/ha) • Soil erosion (% of agriculture land)
	2. Measure the investment leveraged	• Cost of interventions: material inputs and training (US$/year, % of GDP) • Training: support to public outreach (people, US$/person/year) • Organic fertilisers: investment and productivity (US$/ha/year, tonnes/ha)
	3. Measure impacts across sectors and on the overall well-being of the population	• Employment and income generation (people/year, US$/year) • Malnutrition (people hospitalised/year) • Newborn health (% of newborns with low birth weight)

ANNEX 3. TROPICAL OR SUB-TROPICAL SMALL ISLAND DEVELOPING STATE WITH DOMINANT SECTORS BEING TOURISM AND FISHERIES

Small island developing states (SIDS) are exposed to various environmental challenges, especially due to their high vulnerability to climate change impacts. Moreover, the performance of key sectors such as tourism and fisheries is strongly dependent on the environment and climate.

Examples of problems that may affect SIDS are:

- Increased risk of floods and storm surges due to climate change.
- Lowered and erratic fisheries production and productivity, possibly due to overfishing and marine ecosystem deterioration.
- Decreasing tourism arrivals and profitability due to the deterioration of marine and coastal ecosystems and the depletion of key natural resources, among others.

Sample indicators are provided below for each step of the policymaking process to address the problem of decreasing fish catch in this specific country context.

2. Issue identification

Step 1: Identify potentially worrying trends. Decreasing fish catch is a problem that can be identified with the help of various indicators. In particular, worrying trends can be detected through the monitoring of fish landings (tonnes/year) and, possibly, fish stocks (tonnes), but also through indirect indicators such as food security (number of food insecure people) or average household income (US$/year), especially when a large part of the population depends on fishing activities for nutrition and livelihoods.

Step 2: Assess the issue and its relation to the natural environment. The relation between fish catch and environmental trends can be assessed through the health of marine ecosystems, measured through coral reef degradation (% of live, bleached, broken coral), water pollution (BOD mg/L), number of fish species threatened with extinction, among others. Also, indicators of climate change impacts on marine ecosystems can be analysed, including average ocean temperature (°C), sea level rise (mm/year), etc.

Step 3: Analyse more fully the underlying causes of the issue of concern. The underlying causes of declining fish production can be further explored with the help of causal maps, which would include climate change impacts on ocean water temperature (°C) and possible relative changes in migratory patterns, intensive fishing practices (e.g., leading to overfishing and destruction of marine habitats), impacts of tourism activities on water pollution from waste (BOD mg/L) and coral reef deterioration (% of damaged coral cover), and limited extension of marine protected areas (ha).

Step 4: Analyse more fully how the issue impacts society, the economy and the environment. Once key environmental and other causes of the observed problem have been analysed, the multiple impacts of reduced fish catch can be measured. In particular, the depletion of fish stocks is likely to have negative impacts on the national economy, which can be quantified through fisheries value added (US$/year); social impacts include a reduction of direct and indirect employment (number of jobs/year), as well as reduced food security (% of food insecure people); finally, the progressive decline of fish stocks might encourage companies to further increase their fishing effort (Catch per Unit of Fishing Effort, CPUE), in turn leading to water pollution and further overfishing.

3. Policy formulation

Step 1: Identify desired outcomes: define policy objectives. The overall objective of the policy intervention would be to achieve sustainable levels of catch in order to allow fish stocks to regenerate. Specific targets could be set to facilitate the monitoring of policy results. The same indicators used in the issue identification phase can be used to quantify the expected outcomes of the policy intervention within a given time frame. Targets in this specific context could refer directly to the observed problem (e.g., % increase in fish catch, % increase in fisheries GDP, stock value, average weight of fish caught) or to the causes of the problem itself (e.g., % expansion of marine protected areas, % regeneration of damaged coral reef).

Step 2: Identify intervention options and output indicators. A variety of policy instruments can be identified and assessed, depending on the specific national context. Public investments could be redirected to strengthen fisheries management and lower fishing capacity to facilitate fish

stock regeneration, including through de-commissioning of vessels and relocation of employment in the short term. Moreover, harmful subsidies that encourage overfishing could be redirected to green activities, such as incentives for sustainable tourism along the coast. Regulatory measures could also be introduced, such as the expansion of marine protected areas. Key indicators could be used to measure the costs and benefits of investments, e.g., investment in re-training of fishermen to find alternative employment (US$/year) and expected income generated (US$/year); expected short-term reduction in fisheries revenue (US$/year) compared to long-term profitability after fish stock is regenerated (US$/year), as related to the value of fish stocks, among others.

4. Policy assessment

Step 1: **Measure policy impacts across sectors**. The different policy options identified need to be carefully assessed before a final decision is made. In particular, the expected cross-sectoral impacts of interventions can be measured. For example, the protection of marine ecosystems is likely to strengthen ecosystem services, such as the prevention of floods and coastal erosion, with positive impacts for tourism activities, measurable as damage avoided (US$/year) and additional tourism value added (US$/year). Also, the availability of marine resources is likely to increase revenues of local fish processing industries (US$/year). Finally, healthier coasts could encourage ecotourism development and related business opportunities such as hotel and entertainment services (e.g.,,: diving) (number of ecotourism enterprises; US$/year).

Step 2: **Analyse impacts on the overall well-being of the population.** In addition to impacts across key sectors, green policy interventions should be evaluated based on their capacity to improve well-being in an inclusive way. For example, the long-term availability of marine resources could facilitate the development of small-scale fisheries at the community level, possibly improving food security (% of food insecure people) and generating direct and indirect employment (number of new jobs in fisheries). Moreover, the restoration of damaged marine ecosystems would help preventing future floods and coastal erosion, thus protecting livelihoods (avoided damage cost, US$/household per year) and health (number of flood victims/year) of coastal communities.

Step 3: **Analyse advantages and disadvantages, and inform decision-making.** Once costs and benefits of the identified policies have been estimated, a comparative analysis is needed to identify those measures that would maximise benefits at the minimum costs. Investments are calculated (US$), including costs of capacity building, subsidies and incentives, operation and management (O&M) etc. The costs are then compared with expected benefits, e.g., improved food security (% of food insecure people) and potential increase in consumption (US$/year), fish stock regeneration (%/year) and its economic value (US$), avoided damage costs (US$/year), additional fisheries value added (US$/year), employment and income (new jobs/year, US$/year), etc.

5. Monitoring and evaluation

Step 1: **Measure policy impacts in relation to the environmental issue.** Monitoring policy performance during implementation includes an evaluation of current impacts on the environmental causes of declining fish catch. In particular, the health of marine ecosystems is evaluated through the same indicators selected in the issue identification phase, such as fisheries production (US$/year) and landings (tonnes/year), coral reef degradation (% of live, bleached, broken coral), water pollution (BOD mg/L), number of fish species threatened with extinction, etc.

Step 2: **Measure the investment leveraged.** The actual effectiveness of investments is then evaluated using indicators of expected costs and benefits identified in the policy formulation and assessment phases.

Step 3: **Measure impacts across sectors and on the overall well-being of the population.** Improvements in the overall well-being of the population, as well as the inclusiveness of implemented policies, are monitored and evaluated through the same indicators identified in the assessment stage.

ANNEX 4. TROPICAL OR SUB-TROPICAL SMALL ISLAND DEVELOPING STATE WITH DOMINANT INDUSTRIES BEING TOURISM AND FISHERIES. KEY STEPS AND SAMPLE INDICATORS TO ADDRESS DECREASING FISH CATCH

Stages	Steps	Indicator samples
Issue identification	1. Identify potentially worrying trends	• Fish production (tonnes/year) • Fish stock (tonnes) • Average nutrition level (Kcal/day per person)
	2. Assess the issue and its relation to the natural environment	• Coral reef degradation (% of total reef) • Average ocean temperature (°C) • Sea level rise (mm/year)
	3. Analyse more fully the underlying causes of the issue of concern	• Fishing effort (vessels) • Water pollution (BOD mg/L) • Marine conservation areas (ha)
	4. Analyse more fully how the issue impacts society, the economy and the environment	• Fisheries GDP (US$/year) • Food security (% of food insecure population) • Depletion of fish stock (%)
Policy formulation	1. Identify desired outcomes: define policy objectives	• Fish catch (% increase) • Marine conservation areas (% increase) • Coral reef regeneration (% of regenerated reef)
	2. Identify intervention options and output indicators	• Investment in re-training of fishers (US$/year) • Establishment of marine protected areas (enforcement cost per ha) • Reduction in vessel stock (US$/year)
Policy assessment	1. Estimate policy impacts across sectors	• Ecotourism revenues (US$/year) • Revenues of fish processing industries (US$/year) • Avoided costs of flood damage to infrastructure (US$/year)
	2. Analyse impacts on the overall well-being of the population	• Food security (% of food insecure population) • Employment (people/year) • Income generation (US$/year)
	3. Analyse advantages and disadvantages and inform decision-making	• Total costs of interventions (US$/year) • Fish stock regeneration (% of previous year's stock, US$) • Income generation for fishing communities (US$/year per capita)
Policy monitoring and evaluation	1. Measure policy impacts in relation to the environmental issue	• Coral reef degradation (% of degraded reef) • Fish stock regeneration (% of previous year's stock) • Water pollution (BOD mg/L)
	2. Measure the investment leveraged	• Total costs of interventions (US$/year) • Fisheries GDP (US$/year) • Fish catch (tonnes/year)
	3. Measure impacts across sectors and on the overall well-being of the population	• Food security (% of food insecure population) • Revenues of fish processing industries (US$/year) • Employment and income generation, e.g. in fisheries (people/year, US$/year)

ANNEX 5. LOW-LYING COASTAL MIDDLE INCOME COUNTRY WITH RAPID INDUSTRIALISATION AND URBANISATION, AND RELATIVELY ADVANCED DEMOGRAPHIC TRANSITION

Middle-income countries that are rapidly transitioning to an industrialised and service economy can experience various environmental challenges that could undermine their development. In particular, if the industrialisation process is achieved at the expense of the environment, side effects are likely to emerge. Examples include:

- Increasing pollution from industrial processes could lead to public health problems, in turn requiring higher public expenditure (e.g., for water purification, sanitary assistance).
- Unplanned urbanisation, coupled with rapid industrial growth, could lead to an increase in the average price of basic services in urban settings, and consequently to an increase in the number of low-income families in urban areas.
- Intensive exploitation of natural resources for industrial purposes might result in a rapid degradation of ecosystems, leading to an increase in public expenditure to cover replacement costs of environmental goods and ecosystem services.

Sample indicators are provided below for each step of the policymaking process to address the problem of increasing pollution and growing cost of living.

2. Issue identification

Step 1. Identify potentially worrying trends. Different indicators can be monitored to identify worrying trends related to unsustainable industrial expansion. Key indicators include, among others, the cost of basic services, e.g., water price (US$/L), electricity price (US$/Kwh), air pollution (ppm), water pollution (BOD mg/L), public expenditure for water purification (US$/year), CO_2 emission levels (Kt of CO_2 equivalent), diseases from air and water pollution (number of respiratory diseases/year; number of diseases related to water pollution/year), urban poor (% of urban poor population), etc.

Step 2: Assess the issue and its relation to the natural environment. A more in-depth analysis should focus on the relation between the problem and environmental trends. For example, indicators of pollution can be compared with the number of hospitalised people due to water and air pollution diseases. Also, indicators of availability and use of natural resources could be analysed in order to understand the level of environmental stress, e.g., fossil fuel consumption (Btu/year), forest land cover (ha).

Step 3: Analyse more fully the underlying causes of the issue of concern. Increasing pollution and growing costs of living might be determined by, among others, fossil fuel consumption (KWh/year), resource intensive industrial production processes (e.g., Btu/US$, and the use of chemicals), as well as demographic pressure (% of urban population). Industrial and municipal pollution, if not treated can also be an important cause of water contamination among others.

Step 4. Analyse more fully how the issue impacts society, the economy and the environment. Once the main causes of the problem, and their respective weightings, have been identified and analysed with the help of the causal map, attention should be paid to economic, social and environmental impacts of pollution and increasing costs of basic services. Relevant indicators include, among others: contribution of the manufacturing sector to GDP (US$/year), access to basic services in urban settings (%), subsidies to the urban poor (US$/year), incidence of pollution-related diseases (number of hospitalised people/year).

3. Policy formulation

Step 1: Identify desired outcomes: define policy objectives. The main objective of green economy policy interventions is to ensure long-term economic development while minimising social and environmental impacts of industrialisation and urbanisation. Specific targets can be set to measure progress towards the achievement of policy objectives within a given time frame. These may include, for example: emission reduction targets (% reduction in CO_2 emissions), energy efficiency targets for industries and buildings (% increase in energy efficiency), waste collection, potential recycle and reuse targets, increase in access to basic social services, etc.

Step 2: Identify intervention options and output indicators. Decision makers can assess a number of different instruments that can create the enabling conditions for a shift to more sustainable industrial and urban development. These include, mong others, incentives for life-cycle approaches that enable dematerialisation and expanded service

systems; incentives for the purchase of energy efficient technology and the adoption of less resource-intensive industrial processes; investments in public transport infrastructure; investments in monitoring and metering devices that provide real time information on resource use; and introduction of stricter industrial pollution regulations and standards. Output indicators can be used to measure the adequacy of policy options with respect to expected outcomes. Indicators may include, for example: investment and avoided costs deriving from energy efficiency incentives (US$/year), investment and reduced emissions deriving from public transport infrastructure (US$/year; % CO_2 equivalent) etc.

4. Policy assessment

Step 1: Measure policy impacts across sectors. Greening the manufacturing sector and investing in more sustainable cities is likely to have positive impacts across key sectors. For example, water and energy savings in industrial processes would increase resource availability for the development of other sectors, e.g., allowing an increase in irrigated agriculture land (ha), or potentially lowering prices for municipal water consumption. In general, efficient energy use in industrial production might reduce the vulnerability of the sector to external (and internal) shocks, and its reliance on volatile energy sources. Also, reduced pollution and improved environmental quality are factors that could positively impact on the tourism attractiveness of the country, thereby improving annual revenues from tourism activities (US$/year).

Step 2: Analyse impacts on the overall well-being of the population. Indicators can be used to evaluate the expected impact of green policies on well-being. In particular, measures to reduce pollution are expected to positively impact on health (number of water and air pollution related diseases/year). Moreover, incentives and investments in resource efficient industrial production are likely to increase resource availability and reduce the price of basic services, with a possible reduction in the number of urban poor (% of urban poor). Also, increased productivity of the industrial sector would likely generate employment (number of new jobs in green manufacturing).

Step 3: Analyse advantages and disadvantages, and inform decision-making. A final comparison between costs and benefits of different policy options can guide policymakers towards the most effective solutions to the problem identified. Total investments (US$) would include incentives, subsidies, capital investments, capacity building, research and development etc. The benefits of different policy options should include avoided water purification expenditure, lowered energy imports, expected income generation (US$/year) also through a reduction in work days lost due to illness, increase in GDP (US$/year), and also environmental and social benefits, such as reduced emissions (Kt of CO_2 equivalent) and related health problems (number of pollution-related diseases), reduced price of basic services (%) etc.

5. Monitoring and evaluation

Step 1: Measure policy impacts in relation to the environmental issue. The actual impact of the policy should be monitored after implementation. Indicators of environmental trends, such as carbon emissions (Kt of CO_2 equivalent), pollution indices, availability of natural resources, should be monitored to measure policy effects on sustainable growth.

Step 2: Measure the investment leveraged. Expected costs and benefits, identified in the policy formulation and assessment phases, should be compared with the actual results obtained during implementation.

Step 3: Measure impacts across sectors and on the overall well-being of the population. The actual positive effects on the performance of key sectors need to be evaluated using the same indicators of the policy assessment phase. Similarly, the advancements in well-being and the level of inclusiveness of green policies should be constantly monitored, using the indicators selected during policy assessment.

ANNEX 6. LOW-LYING COASTAL MIDDLE I NCOME COUNTRY WITH RAPID INDUSTRIALISATION AND URBANISATION, AND RELATIVELY ADVANCED DEMOGRAPHIC TRANSITION. KEY STEPS AND SAMPLE INDICATORS TO ADDRESS INCREASING POLLUTION AND GROWING COST OF LIVING

Stages	Steps	Indicator samples
Issue identification	1. Identify potentially worrying trends	• Air pollution (ppm) • Water pollution (BOD mg/L) • Electricity price (US$/KWh)
	2. Assess the issue and its relation to the natural environment	• Fossil fuel reserves (Btu) • Consumption of fossil fuels (Btu/year) • Forest land cover (ha)
	3. Analyse more fully the underlying causes of the issue of concern	• Population (people) • Urbanisation (% of urban population) • Energy intensity in manufacturing (Btu/US$)
	4. Analyse more fully how the issue impacts society, the economy and the environment	• Manufacturing GDP (US$/year or %) • Access to basic services in urban settings (%) • Waste generation (tonnes/year)
Policy formulation	1. Identify desired outcomes: define policy objectives	• Carbon emissions (% reduction in CO^2 emissions) • Waste collection, recycle and reuse (tonnes/year, %) • Access to basic services (% increase)
	2. Identify intervention options and output indicators	• Subsidies: energy efficiency improvement (US$/year, %/year) • Investment: public transport infrastructure (US$/year, % of travel) • Incentive: waste collection, recycle and reuse (US$/year, tonnes/year)
Policy assessment	1. Estimate policy impacts across sectors	• Manufacturing value added (US$/year) • Avoided cost for fossil fuel and water purification (US$/year) • Water stress and access to sanitation (%)
	2. Analyse impacts on the overall well-being of the population	• Health (number of water and air pollution related diseases/year) • Employment (number of new jobs in green manufacturing) • Urban poor (% of population)
	3. Analyse advantages and disadvantages and inform decision-making	• Total investments, i.e. incentives, infrastructure, capacity building (US$/year) • Manufacturing GDP (US$/year or %) • Reduction in water and electricity prices (%)
Policy monitoring and evaluation	1. Measure policy impacts in relation to the environmental issue	• Carbon emissions (% reduction in CO^2 emissions) • Water pollution (BOD mg/L) • Energy bill (US$/year)
	2. Measure the investment leveraged	• Total costs of interventions (US$/year) • Manufacturing GDP (US$/year) • Energy and water intensity in manufacturing (Btu/US$)
	3. Measure impacts across sectors and on the overall well-being of the population	• Health (number of water and air pollution-related diseases/year) • Employment (number of new jobs in green manufacturing) • Urban poor (% of population)

ANNEX 7. MOUNTAINOUS COASTAL COUNTRY WITH MINING, AGRICULTURE AND FISHERIES

The preservation of ecosystems is an essential priority in this country context, since two of the driving sectors of national development - i.e. agriculture and fisheries - depend on the availability and quality of ecosystem services. A number of issues can threaten sustainable development, including, among others:

- Deforestation, driven by mining, agriculture expansion and timber production, can cause the disruption of the hydrological cycle, with negative consequences across sectors. These include for example, an increase in the occurrence of floods, whose impacts are often devastating for livelihoods, as well as for agriculture and infrastructure.
- Unsustainable agricultural practices, such as intensive use of chemical fertilisers and pesticides, can have an impact on soil quality and agricultural productivity, as well as on water pollution and fisheries.

Sample indicators are provided for each step of the policymaking process to address the problem of increasing frequency of floods.

2. Issue identification

Step 1: Identify potentially worrying trends. Indicators of issue identification are used in the initial phase of the policy cycle in order to detect worrying trends linked to the frequency of floods. Indicators for this purpose include the frequency of floods (number of floods/year) and flood damage (US$/year; % of GDP). In addition, the deforestation rate (ha/year), soil erosion (% of total land area), annual harvest of wood products (m^3/year) and rainfall (mm/month or year) could be used to identify key trends.

Step 2: Assess the issue and its relation to the natural environment. The link between increased floods and environmental trends could be measured through the analysis of the deforestation rate (ha/year) and rainfall (mm/year). Other indicators include forest area (ha), as well as siltation and sedimentation.

Step 3: Analyse more fully the underlying causes of the issue of concern. A more in-depth analysis of the underlying causes of floods can focus on causal relations between key economic, social and environmental indicators. For example, the size of the mining area (ha) could provide additional information on current and expected deforestation trends. Another underlying cause could be the increase in population (people) leading to higher exploitation of wood resources for cooking and heating purposes, and to the expansion of agriculture land.

Step 4: Analyse more fully how the issue impacts society, the economy and the environment. High deforestation rates and increased floods have negative impacts across sectors and actors. For example, the income of forest communities (US$/year/person) is likely to be affected by uncontrolled deforestation. Similarly, the attractiveness of the country for ecotourism activities would be reduced due to the loss of biodiversity, with a consequent decrease in ecotourism revenues (US$/year). In addition, the disruption of the hydrological cycle might lessen the availability of freshwater (L/year), thereby reducing access to safe drinking water (% of population). Floods might also have economic impacts on agricultural production and revenues (tonnes/year; US$/year), and cause damage to housing, transport and other infrastructure (US$/year).

3. Policy formulation

Step 1: Identify desired outcomes: define policy objectives. The main objective of green economy policies in this specific case could be to reduce deforestation resulting from mining and agriculture activities, thereby preserving key ecosystem services, and improving resilience to floods. Specific targets could be set for a given time frame, including deforestation (% reduction), forest protected areas (% increase) and certified timber production activities (% increase in certified activities, and reduction of illegal logging), etc.

Step 2: Identify intervention options and output indicators. A variety of policy interventions can be analysed and combined to tackle the problem of unsustainable deforestation and increasing floods. Examples of possible options are, among others: investments and regulations for the expansion of forest protected areas in order to limit harmful land-use practices; improved forest management certification; payments for ecosystem services (PES) schemes; investments in planted forests, primary forests, natural modified forests; incentives for the development of agroforestry. Output indicators could be used to measure

the expected costs and benefits of interventions, such as payments for ecosystem services (US$/year and/or US$/ha), investments in afforestation and reforestation initiatives (US$/ha/year), incentives for agroforestry development (US$/ha/year).

4. Policy assessment

Step 1: Measure policy impacts across sectors. Impacts of reduced deforestation can be measured in terms of improved ecosystem services and reduced frequency of floods, but also in relation to other key sectors. For example, reduced sedimentation might improve the navigability of rivers, thereby increasing revenues from river transport activities (US$/year). Agricultural revenues (US$/year) might, in general, benefit from reduced deforestation (i.e. due to reduced soil erosion and floods), and also from the expansion of agroforestry activities. In addition, the improvement of environmental quality and biodiversity in forest ecosystems might lead to an increase in forest ecotourism revenues (US$/year). Furthermore, there is potential for revenues derived from the carbon market (US$/year) which could be used to support the green economy transition of other sectors, on top of providing incentives for natural resource conservation.

Step 2: Analyse impacts on the overall well-being of the population. Reduced frequency of floods is likely to have a direct impact on the well-being of the local population, both in terms of avoided re-building, or relief costs (US$/year) and reduced deaths and injuries (number of deaths attributed to floods/year). Also, the possible loss of employment in the mining and logging sectors (if constrained in its development) might be more than compensated by new employment (number of new jobs /year) in other expanding sectors, such as ecotourism and agroforestry.

Step 3: Analyse advantages and disadvantages, and inform decision-making. An evaluation of advantages and disadvantages of the selected policy options would imply the comparison of investment (US$) - including subsidies, capacity building, operation and management costs - and expected benefits, in the form of income generation for forest and rural communities (US$/year), avoided flood damage costs (US$/year), as well as the value of natural resource stocks.

5. Monitoring and evaluation

Step 1: Measure policy impacts in relation to the environmental issue. Once the strategy has been drafted and implemented, the expected effects of policy interventions on deforestation rates and ecosystem preservation need to be monitored and evaluated. Indicators of issue identification, in particular target indicators, can be used to verify the effectiveness of policy instruments.

Step 2: Measure the investment leveraged. The actual benefits deriving from targeted investments need to be verified by comparing expected and current results through indicators of policy formulation and assessment.

Step 3: Measure impacts across sectors and on the overall well-being of the population. The well-being of the population is expected to improve thanks to reduced negative impacts on health and income from uncontrolled deforestation and increased floods. In the monitoring and evaluation phase, the actual impacts need to be confronted with ex ante assessments, in order to detect potential early warning signs and gaps in policy implementation.

ANNEX 8. MOUNTAINOUS COASTAL COUNTRY WITH MINING, AGRICULTURE, AND FISHERIES. KEY STEPS AND SAMPLE INDICATORS TO ADDRESS INCREASING FREQUENCY OF FLOODS

Stages	Steps	Indicator samples
Issue identification	1. Identify potentially worrying trends	• Flood frequency (number of floods/year) • Deforestation (ha/year) • Annual harvest of wood products (m3/year)
	2. Assess the issue and its relation to the natural environment	• Forest land cover (ha) • Rainfall (mm/year) • Degraded forest land (ha or % of forest land)
	3. Analyse more fully the underlying causes of the issue of concern	• Agriculture land (ha) • Population (people)
	4. Analyse more fully how the issue impacts society, the economy and the environment	• Income of forest communities (US$/year per capita) • Freshwater supply (L/year) • Ecotourism (n. of visits/year; US$/year; % of GDP)
Policy formulation	1. Identify desired outcomes: define policy objectives	• Reduced deforestation (e.g. 50% reduction by 2030) • Forest protected area (ha) • Certified timber production (US$/year; ha)
	2. Identify intervention options and output indicators	• PES: funding transferred (US$/year and/or US$/ha) • Agroforestry development: investment per ha (US$/ha/year) • Timber certification: activities certified (#/year and output)
Policy assessment	1. Estimate policy impacts across sectors	• River use for transport activities (days/year and US$/year) • Value of natural resource stock and ecosystem services (US$ and US$/year) • Revenues derived from the carbon market (US$/year)
	2. Analyse impacts on the overall well-being of the population	• Employment, e.g. in sustainable forest management (number of jobs/year) • Deaths from landslides and floods (deaths /year) • Income generation from ecotourism (US$/year)
	3. Analyse advantages and disadvantages and inform decision-making	• Cost of reforestation (US$/ha) • GEF benefits index for biodiversity • Income creation for rural communities (US$/year) • Deforestation (ha/year)
Policy monitoring and evaluation	1. Measure policy impacts in relation to the environmental issue	• Forest cover (ha) • Flood frequency (number of floods/year)
	2. Measure the investment leveraged	• Total investment, i.e. capital investments, incentives, O&M etc. (US$/year) • Reduced flood risk (US$/year; % of GDP) • Revenues from ecotourism and river transport (US$/year)
	3. Measure impacts across sectors and on the overall well-being of the population	• Employment, e.g. in sustainable forest management (number of jobs/year) • Deaths from landslides and floods (deaths /year) • Income generation from ecotourism and ecosystem goods (US$/year)

ANNEX 9. DEVELOPED COUNTRY WITH LIMITED NATURAL RESOURCES BUT HIGH POTENTIAL (AND FINANCIAL RESOURCES) FOR EFFICIENCY IMPROVEMENT

Developed countries make use of capital, advanced technology and knowledge to foster economic growth. In this specific country context, the limited availability of natural resources requires investments in resource efficiency to maximise the productivity of key economic sectors. Examples of problems that might arise in relation to resource constraints include, among others:

- Excessive dependency on fossil fuel imports, possibly sustained by harmful subsidies, can limit the exploitation of renewable energy sources, thereby increasing the vulnerability to fossil fuel price variability.
- Intensive use of fossil fuels in key sectors, such as transport and manufacturing, leads to an increase in greenhouse gas emissions, in turn contributing to global warming and pollution, with consequences for health and environmental quality.

Sample indicators are suggested for each step of the policymaking process to address the problem of rising energy costs, with negative impacts on competitiveness.

2. Issue identification

Step 1: Identify potentially worrying trends. Indicators of issue identification include, among others, energy demand and supply (Mtoe/year), energy productivity (Btu/US$) and energy price and cost (US$/Btu).

Step 2: Assess the issue and its relation to the natural environment. There is a strong relationship between the intensity in fossil fuel use and impacts on environmental quality. These can be analysed through air pollution (ppm), CO_2 emissions (Kt of CO_2 equivalent), , all being related to unsustainable production and consumption.

Step 3: Analyse more fully the underlying causes of the issue of concern. A reduction in the competitiveness of national industries due to increasing energy costs can be traced back to several concurring causes, which should be mapped and carefully analysed. These include, among others, energy prices (US$/Btu), energy intensity (Btu/tonne, or Btu/US$) as well as the existence of fossil fuel subsidies and taxation (USUS$ or % of GDP) and the reliance on imports, or fossil fuel dependency (%).

Step 4: Analyse more fully how the issue impacts society, the economy and the environment. High energy prices can have a negative influence on economic, social and environmental indicators. Indeed, the performance of key economic sectors is highly dependent on energy prices (their absolute value and relative change over time). This relation can be assessed, for example, by comparing the energy bill (USUS$/year) of selected sectors and their contribution to GDP (US$/year). Energy prices also have a direct impact on households through an increase in the price of basic services and inflation, e.g., electricity (US$/Kwh), as well as food prices, which will affect consumption and private investment (US$/year). Finally, environmental impacts can be measured by analysing, for example, pollution indices and CO_2 emission (Kt of CO_2 equivalent).

3. Policy formulation

Step 1: Identify desired outcomes: define policy objectives. One major goal of green economy policy interventions is to maximise energy efficiency in production processes, while stimulating the growth of the renewable energy sector, and progressively loosening the dependence on carbon-intensive energy resources. Specific targets could be set to foster the achievement of stated objectives within a given time frame, including targets for renewable energy power generation (% of power generation), energy efficiency (% efficiency increase), CO_2 emission reduction (% decrease in Kt of CO_2 equivalent).

Step 2: Identify intervention options and output indicators. A successful combination of energy policies can be explored, with the help of relevant output indicators to estimate the feasibility of each option. Examples of interventions are: upfront investments in renewable energy infrastructure, phasing out of fossil fuel subsidies and introduction of carbon taxes; incentives for the purchase of energy efficient technologies in households and industrial processes; feed-in tariffs, direct subsidies and tax credits for private companies interested in renewable energy investments; investments in public transport infrastructure. Relevant indicators that can be used in this phase are, for example, renewable energy feed-in tariffs (US$/MWh); investments in renewable energy infrastructure (USUS$ or % of GDP); avoided costs of fossil fuel subsidies (US$/year); avoided costs from energy consumption and losses (US$/

year); expected increase in energy supply (Btu/year; %); cost of capacity building, institutional capacity, research and development (US$ or % of GDP).

4. Policy assessment

Step 1: Measure policy impacts across sectors. Reductions in the energy bill and improvements in efficiency are likely to influence the performance of key economic sectors, possibly leading to higher productivity and competitiveness, leading to higher revenues (US$/year) and lower costs, thus improving profitability and GDP (US$/year), among others.

Step 2: Analyse impacts on the overall well-being of the population. Energy efficiency and renewable energy policies could reduce production costs in key sectors, with positive impacts on prices and overall cost of living. Moreover, since the renewable energy sector is labour intensive, impacts can be measured on employment generation (number of new jobs in renewable energy), taking into account possible negative effects in fossil fuel-related sectors. In addition, impacts of reduced use of fossil fuels on health can be assessed through indicators of air pollution-related diseases (number of people hospitalised due to respiratory diseases). Finally, the reduction in CO_2 emissions would more generally contribute to mitigate the negative effects of climate change on livelihoods, resource availability and health.

Step 3: Analyse advantages and disadvantages, and inform decision-making. Costs and benefits of green energy policies could be measured through the analysis of investments (USUS$), taking into account incentives, upfront capital expenditure on infrastructure, capacity building, operation and management as well as research and development. These can be then compared with expected benefits for the economy, society and the environment. Indicators would include reduced energy costs (US$/year), increased competitiveness (GDP growth), income generated from new employment opportunities (US$/year) as well as avoided health costs (US$/year).

5. Monitoring and evaluation

Step 1: Measure policy impacts in relation to the environmental issue. The monitoring and evaluation phase should start immediately after the implementation of the policy package. First of all, the environmental impact of the interventions should be measured, focusing in particular on energy consumption and CO_2 emissions and pollution.

Step 2: Measure the investment leveraged. At the same time, the effectiveness of implemented policies needs to be evaluated by comparing indicators of expected costs and benefits (i.e. policy formulation and policy assessment indicators) with actual results.

Step 3: Measure impacts across sectors and on the overall well-being of the population. The actual improvement of the overall well-being of the population is measured using indicators of policy assessments, with particular consideration for the distributional and inclusive character of the implemented policies.

ANNEX 10. DEVELOPED COUNTRY WITH LIMITED NATURAL RESOURCES BUT HIGH POTENTIAL (AND FINANCIAL RESOURCES) FOR EFFICIENCY IMPROVEMENT. KEY STEPS AND SAMPLE INDICATORS TO ADDRESS RISING ENERGY COSTS, WITH NEGATIVE IMPACTS ON INVESTMENTS AND COMPETITIVENESS

Stages	Steps	Indicator samples
Issue identification	1. Identify potentially worrying trends	• CO_2 emissions (Kt of CO_2 equivalent) • Fossil fuel consumption (Mbtu/year, US$/year or % of GDP) • Energy productivity (Btu/US$)
	2. Assess the issue and its relation to the natural environment	• Production of fossil fuels (Btu/year) • Fossil fuel resource and reserve (Btu) • Natural resource endowment (e.g., GWh from solar and wind power)
	3. Analyse more fully the underlying causes of the issue of concern	• Population (people) • Energy consumption from fossil fuels (Btu/year; % of total) • Fossil fuel subsidies and taxation (US$/year or % of GDP)
	4. Analyse more fully how the issue impacts society, the economy and the environment	• Electricity and other energy prices (US$/Btu) • Diseases from air pollution (n. of respiratory diseases/year) • Increase in average temperature (°C), or climate variability
Policy formulation	1. Identify desired outcomes: define policy objectives	• Decreased CO_2 emissions (Kt of CO_2 equivalent) • Increased renewable energy production (KWh) • Lower electricity losses (% of electricity generation)
	2. Identify intervention options and output indicators	• Renewable energy: feed-in tariffs (US$/MWh) • Energy efficiency: national standards (CO_2 emission % reduction) • Public transport: ridership for the bus network (%)
Policy assessment	1. Estimate policy impacts across sectors	• Reduced cost of energy imports (US$/year) • Lowered road transport costs (US$/year) • Household consumption and savings (US$/year)
	2. Analyse impacts on the overall well-being of the population	• Reduced electricity prices (US$/KWh or % reduction) • Employment and income generation (people/year, US$/year) • Respiratory diseases (people hospitalised/year)
	3. Analyse advantages and disadvantages and inform decision-making	• Investment in renewable energy (US$/year, % of GDP) • Competitiveness, productivity and GDP (US$/year) • Avoided energy costs from savings (US$/year, % of GDP)
Policy monitoring and evaluation	1. Measure policy impacts in relation to the environmental issue	• CO_2 emissions (Kt of CO_2 equivalent) • Fossil fuel reserves (Btu) • Energy productivity (Btu/US$)
	2. Measure the investment leveraged	• Total investment, i.e. capital investments, incentives, O&M etc. (US$/year) • Avoided energy costs from savings (US$/year, % of GDP) • Competitiveness, productivity and GDP (US$/year)
	3. Measure impacts across sectors and on the overall well-being of the population	• Employment and income generation (people/year, US$/year) • Respiratory diseases (people hospitalised/year) • Transport fatalities (people/year)

ANNEX 11. KEY STEPS AND SAMPLE INDICATORS FOR ISSUE IDENTIFICATION AND GREEN ECONOMY POLICY FORMULATION, ASSESSMENT AND EVALUATION

Stages	Steps	Indicator samples
Issue identification	1. Identify potentially worrying trends	Deforestation Value of timber products (US$/year) – Deforestation (ha/year) – Nutrition Dietary energy supply (Kcal/day per person) – Crop yield (tonnes/ ha) – CO_2 emissions CO_2 emissions (Kt of CO_2 – equivalent) – Energy consumption (Btu/year)
	2. Assess the issue and its relation to the natural environment	Deforestation Forest land cover (ha) – Degraded forest land (ha or % of forest land) – Nutrition Rainfall (mm/year) – Fish landing (tonnes/year) – CO_2 emissions Fossil fuel reserves (Btu) – Average temperature (°C)
	3. Analyse more fully the underlying causes of the issue of concern	Deforestation Agriculture land (ha) – Population (people) – Nutrition Use of chemical fertilisers and pesticides (tonnes/ha) – Fish stocks (tonnes) – CO_2 emissions Urbanisation (% of urban population) – Fossil fuel subsidies (US$/year; % of GDP)
	4. Analyse more fully how the issue impacts society, the economy and the environment	Deforestation Income of forest communities (US$/year per capita) – Freshwater supply (L/year) – Nutrition Agriculture GDP (US$/year) – Primary sector employment (people) – CO_2 emissions Increase in average temperature (°C) – Diseases from air pollution (n. of respiratory diseases/year)
Policy formulation	1. Identify desired outcomes: define policy objectives	Deforestation Reduced deforestation (e.g. 50% reduction by 2030) – Certified timber production (US$/year; ha) – Nutrition Increased nutrition levels (e.g. 2000 kcal/day per person) – Increased production of agricultural products (tonnes/year) – CO_2 emissions Decreased CO_2 emissions (Kt of CO^2 equivalent) – Increased renewable energy production (KWh)
	2. Identify intervention options and output indicators	Deforestation PES: funding transferred (US$/year and/or US$/ha) – Timber certification: activities certified (#/year and output) – Nutrition Organic fertilisers: investment and productivity (US$/ha/year, tonnes/ha) – Improved fishing practices: public subsidy (US$/person/year) – CO_2 emissions enewable energy: feed-in tariffs (US$/MWh) – Energy efficiency: national standards (CO_2 emission % reduction)
Policy assessment	1. Estimate policy impacts across sectors	Deforestation Increased water supply (L/year) – Reduced flood risk (US$/year; % of GDP) – Nutrition Revenue creation for food processing industries (US$/year) – Water savings due to micro-irrigation (L/year) – CO_2 emissions Reduced cost of energy imports (US$/year) – Household consumption and savings (US$/year)
	2. Analyse impacts on the overall well-being of the population	Deforestation Employment and income generation, e.g. in sustainable forest management (people /year, US$/year) – Deaths from landslides and floods (deaths /year) – Nutrition Employment and income generation, e.g., in agriculture (people/year, US$/year) – Malnutrition (people hospitalised/year) – CO_2 emissions Access to modern forms of energy (%) – Respiratory diseases due to smoke inhalation from indoor burning cooking stoves (people hospitalised/year)
	3. Analyse advantages and disadvantages and inform decision-making	Deforestation Cost of reforestation (US$/ha) – Income creation for rural communities (US$/year) – Nutrition Cost of interventions: material inputs and training (US$/year, % of GDP) – Avoided food imports (US$/year or % change) – CO_2 emissions Investment in renewable energy (US$/year, % of GDP) – Avoided energy costs from savings (US$/year, % of GDP)
Policy monitoring and evaluation	1. Measure policy impacts in relation to the environmental issue	Deforestation Forest land cover (ha) – Degraded forest land (ha or % of forest land) – Nutrition Use of chemical fertilisers and pesticides (tonnes/ha) – Soil erosion (% of agriculture land) – CO_2 emissions CO_2 emissions (Kt of CO_2 equivalent) – Fossil fuel reserves (Btu)
	2. Measure the investment leveraged	Deforestation Total investment, i.e. capital investments, incentives, O&M etc. (US$/year) – Reduced flood risk (US$/year; % of GDP) – Nutrition Cost of interventions: material inputs and training (US$/year, % of GDP) – Avoided food imports (US$/year or % change) – CO_2 emissions Total investment, i.e. capital investments, incentives, O&M etc. (US$/year) – Avoided energy costs from savings (US$/year, % of GDP)
	3. Measure impacts across sectors and on the overall well-being of the population	Deforestation Employment, e.g. in sustainable forest management (number of jobs/year) – Deaths from landslides and floods (deaths /year) – Nutrition Employment and income generation, e.g. in agriculture (people/year, US$/year) – Malnutrition (people hospitalised/year) – CO_2 emissions Employment and income generation, e.g. in renewable energy (people/year, US$/year) – Respiratory diseases (people hospitalised/year)

NOTES

[1] This document needs to be read and understood in the context of the *Manual on Green Economy Policy Assessments,* which provides the general framework by covering the needs, services and tools offered by UNEP in an introductory and non-technical manner. The importance of modelling as a tool in green policy interventions is addressed in the manual on *Using Models for Green Economy Policymaking*.

[2] Triangulation consists of the evaluation of the consistence and coherence of data, across sources and sectors. Given the cross-sectoral nature of causes and effects in the context of a green economy, the trend of a social variable may be affected by the behaviour of an environmental one, requiring data collection from different sources. Trends for these variables should be evaluated to determine the presence of behavioural patterns that would reflect the presence of causal relations.

[3] Government of Indonesia, 2011.

[4] *Communication from the Commission to the European Parliament, The Council, The European Economic and Social Committee and The Committee of the Regions. Roadmap to a Resource Efficient Europe* (European Commission, 2011).

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www.unep.org
United Nations Environment Programme
P.O. Box 30552 Nairobi, 00100 Kenya
Tel: (254 20) 7621234
Fax: (254 20) 7623927
E-mail: uneppub@unep.org
web: www.unep.org

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