Policy Brief

Assessment of Policy Interrelationships and Impacts on Sustainability in Europe

The usefulness of sustainable development indicators for evaluating the effectiveness, efficiency and efficacy of policy instruments

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In APRAISE *we aim towards assisting European policymakers to achieve environmental objectives under different circumstances, by designing effective, efficient and efficacious policy mixes, which are socially acceptable and secure Europe's competitiveness.*

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APRAISE in Brief

Assessment on Policy Interrelationships and Impacts on Sustainability Europe (APRAISE), is a project funded under the European Union's Seventh Programme for research, technological development and demonstration, that **aims to assist European policymakers to achieve environmental objectives** under different circumstances, by designing **effective, efficient and efficacious policy mixes**, which are **socially acceptable** and **secure** Europe's competitiveness.

Indeed the end result of an environmental policy often differs from expectations. In order to understand how and why such differences emerge, APRAISE has developed a methodology, which helps to explain, for a range of environmental policy case studies:

- Whether and how the political and economic context during policy implementation differs from the anticipations;
- Whether and how the design and implementation of policies and policy instruments differs from planning;
- Whether and to what extent the effectiveness of environmental policy has been affected (positively or negatively) through interactions with other (environmental) policy areas.

The APRAISE methodology was applied in a series of country case studies, in the areas of renewable energy, energy efficiency and resource efficiency such as:

- The impact of the EU Renewable Energy Directive on other environmental objectives: Austria and UK,
- The impact of hydropower generation of river basins: Slovenia and Austria,
- Policies supporting renewable energy sources: Greece and Slovenia,
- Waste management – prevention, reuse and recycling of plastic package material: Germany and the Netherlands.
- Policy interactions in the fields of sustainable buildings: The Netherlands and Greece.

More information is available at http://apraise.org

Introduction: Genesis and evolution of SD indicators

After its emergence on the international policy agenda in the wake of the Brundtland Report in 1987, sustainable development was adopted as an overarching objective of EU policies in the 1997 Amsterdam Treaty. This was followed by the adoption of the first EU sustainable development strategy at the Gothenburg Summit in June 2001. To support this policy work, the EU launched a concerted effort to develop indicators of sustainable development, led by Eurostat, a Directorate-General of the European Commission

This EU work joined the broad range of similar initiatives undertaken to develop SD indicators at various levels of policymaking. The currently existing SD indicators have been produced by a wide spectrum of institutions, and for a variety of purposes (e.g. Dahl, 2012; Rametsteiner et al., 2011), leading to great diversity of indicators.[1] The development of SD indicators across the world built largely on earlier work to develop environmental indicators (especially within international organisations such as the OECD, EEA, and the UN), which had by the late 1990s become increasingly interdisciplinary and cross-sectoral (Hezri 2006, 162). An increasing number of composite indicators, measuring sustainability through a single index, was developed in parallel with broad SD indicator sets. The most recent trend has been the development of indicators of societal progress and well-being (e.g. Stiglitz *et al*. 2010; Sébastien and Bauler 2013; Seaford 2013).

Functions of indicators

In broad terms, indicators can be classified into three categories: *descriptive* indicators that measure states of affairs without an ambition to judge, *performance* indicators designed to measure the quality of specific policies or policy actors against pre-established criteria, and *composite* indicators, which aggregate measurements along a range of dimensions into a single figure to produce an overall judgement. More specific functions attributed to indicators include notably (e.g. Moldan and Bilharz 1997; Rosenström and Lyytimäki 2006, 33):

- communication and awareness-raising
- monitoring and evaluation of performance
- engaging stakeholders
- supporting policy evaluation
- providing early warning functions
- political advocacy
- control and accountability
- transparency
- improving the quality of decisions
- guidance to policy analysis and formation
- improvement of government effectiveness
- setting targets and establishment of standards
- promotion of the idea of integrated action, and
- focusing of policy discussion.

Indicators can serve as 'signals' that enable or prescribe an action or management function, and condense information complex situations, helping policymakers to decide whether or not to act (Gudmundsson 2003, 2). Whichever the primary objective, indicators are expected to simplify and facilitate communication by

[1] Indicators can be defined as "variables that summarise or otherwise simplify relevant information, make visible or perceptible phenomena of interest, and quantify, measure, and communicate relevant information" (Gallopin 1996, 108). The underlying assumption is that of "indication," that is, assessing a phenomenon that is not directly measurable (e.g., biodiversity or sustainability) through a limited set of measurable parameters (Turnhout 2009, 403). Unlike many other knowledge types, notably data and statistics, indicators are based on an underlying conceptual framework, which anchors indicators in theory, establishes a logic to the selection of indicators, and provides the supporting technical definitions, metrics, and linkages, thereby situating an individual indicator within a broader network of information (Gudmundsson 2003, 4; Pintér et al. 2005, 16).

reducing ambiguity (Mascarenhas et al. 2014, 75).

In view of this variety of intended functions and targeted governance levels, it is hardly surprising that none of the currently existing multiple sets of sustainability indicators has emerged as hegemonic and universally applicable. Many are relevant only at the subnational level, since they are designed to help a specific city, community or organisation to improve, and to "empower" citizens[2] especially through participatory processes of indicator development and by rendering the concept of sustainable development concrete (AtKisson 1996, Roberts 2000, McAlpine and Birnie 2005, Tasser et al. 2008; Mascarenhas et al. 2014, 76), others serve particularly accountability, by facilitating comparisons across cities, organisations, or countries (Turcu 2013, 699).

Furthermore, despite the proliferation of indicators, evidence suggests that the actual use and influence of indicators is modest (e.g. Rosenström 2009; Lehtonen 2013; Sébastien et al. 2014). Obstacles to use include factors associated with the nature and design of indicators and of the policy-making/strategic processes, but also with the specific context within which the indicators are used.

Use and influence of indicators in APRAISE

One of the objectives of the APRAISE project was to test, through case studies, the applicability of existing sustainable development indicators in assessing the effectiveness, efficiency and efficacy of environmental policy instruments. The work drew particularly on indicators developed at national and supra-national levels (e.g. UN Commission on Sustainable Development, EU, and OECD), but also applied sub-national indicators when appropriate.

Indicators were used (or could in principle have been used) for three different purposes in APRAISE: to describe the socio-economic and political context factors that might influence policy effectiveness and efficiency; to describe and examine the aspects in policy implementation processes that might affect policy effectiveness; and to measure the impacts of policy interactions on policy effectiveness. The usefulness and applicability of indicators for these three purposes was explored, yet in practice, it soon turned out that the existing SD indicators – drawn from the Eurostat Sustainable Development (SD) Indicator database – were truly relevant only for the first purpose, i.e. for describing the general policy context.

This Policy Brief will illustrate the potential and the limitations of SD indicators by examining in depth two APRAISE case studies, from the perspective of the following questions:

1. How, when, and why were the SD indicators useful, moderately useful, or not useful at all in helping to answer the central question(s) addressed in the case study?
2. Which types of information were used and found relevant answering the key research questions?
   - existing SD indicators
   - other existing indicators (e.g. sectoral environmental indicators)
   - new indicators specifically designed for the case study in question
   - none of the above (e.g. unable to develop new indicators)
3. How to explain the usefulness or the lack of usefulness of the existing indicators? (e.g. lack of data; ambiguous evidence; impossibility to describe the issue in quantitative

[2] An example of such empowerment objectives comes from community-based monitoring, which denotes a range of activities through which citizens collect systematic observations about environmental and social aspects, often in collaboration with government, industry, academia or community organisations (Whitelaw et al., 2003).

terms; lack of time to analyse indicator data)

The role of indicators in the UK biofuels case study

The aim of the biofuels case study was to asses the effectiveness and efficiency of key transport biofuel policies in the UK, notably the Renewable Transport Fuels Obligation (RTFO)[3]. The biofuels sector in the UK is highly influenced by both the national and international context. The economic, environmental, technological, and socio-political "context factors" were taken into consideration when studying the effectiveness of biofuel policies and the interactions with other policy instruments at the stakeholder level. Contextual factors were initially accounted for using an existing set of indicators from the Eurostat Sustainable Development (SD) Indicator database. The SD indicators provided background information on the economic and environmental situation in the UK. Social political, technological and other indicators were taken from sources including national databases that were more relevant to context studied (Other indicators will be discussed further below). The aim of the indicators was to help create a more detailed narrative of the national context, which could subsequently help to explain if and how certain contextual factors shaped effectiveness of biofuel policies. For instance, economic indicators, such as the GDP growth rate, and the share of investments by institutional sector (percentage of the GDP) provided insight for the biofuel sector. This way, by providing quantifiable information over a period of time, indicators helped to help set the stage for analysing policy effectiveness as well as policy and stakeholder interactions.

Usefulness of SD indicators in answering the research questions

The UK case study used 16 indicators from the Eurostat SD database, covering economic and environmental context factors. Other contextual factors, including technology, social-political environment, good governance, as well as external policy and institutions, were measured using other existing indicators that are not included in the SD Eurostat database. Table 1 lists the indicators and criteria applied in the UK case study to assess the importance of the context factors. Indicators from the SD Eurostat database were used for economic and environmental context factors whereas national indicators were applied for socio-political and good governance factors. For other context factors, including those relating to technological and external policy, no sufficiently appropriate indicators were available; thus qualitative judgement by the researchers was used instead.

Table 1: Overview of context factors in the UK case study

Context factor	Indicator/criterion	Explanation
Economic	Annual GDP growth percentage	Domestic biofuels sector can contribute to local/national economy
	Investment by institutional sectors - % of GDP	Can indicate the trend on general investments including biofuels
	Total R&D expenditure- % of GDP	Can indicate how much gov't/institutions are willing to invest in advanced biofuels
Environ-mental	Municipal waste generation and treatment, -kg per capita	Potential feedstock for biofuels production

[3] The case study can be downloaded at: http://www.apraise.org/content/case-studies

Context factor	Indicator/criterion	Explanation
	Consumption of certain foodstuffs per inhabitant- kg per inhabitant Cereals (excluding rice) (kg/head)	Food versus fuel competition
	Motorisation rate- Cars per 1 000 inhabitants	The key end-user base for biofuels consumption
	Area under organic farming- %	Competition for land from higher value sustainable food production
	Emissions of sulphur oxides (SOx), by source sector - tonnes	Biofuels can contribute to lowering SOx emissions
	Emissions of nitrogen oxides (NOx), by source sector- tonnes	Biofuels can contribute to increasing NOx emissions
	Urban population exposure to air pollution by particulate matter- Micrograms per cubic metre	Biofuels can contribute to reducing particulate pollution
	Total GHG emissions (CO2 equivalent) indexed to 1990= 100%	Depending on the feedstock, biofuels can contribute to decreasing/increasing emissions
	Share of renewables in gross final energy consumption %	EU/national obligations to meet goals, partly through biofuels
	Share of renewable energy in fuel consumption of transport %	EU/national obligations to meet transport goals through biofuels
	Energy dependence- % of total	Motivation to invest in RE for energy security
	Implicit tax rate on energy- EUR per tonne of oil equivalent	Determines a large portion of fuel prices
	Availability of land	Can limit the amount of feedstock produced domestically
Techno-logical	Technological developments	Feasibility of advanced biofuels
	Infrastructure for bioethanol and biodiesel	Impacts the short to medium term development for bioethanol
Socio-Political	Number of jobs created	New jobs created from the development of the domestic biofuels sector
	Official view towards biofuels	Government's position towards biofuels can influence policies
	View of general public towards biofuels	Public pressure can influence government policies
Good Governance	Monitoring RTFC sustainability requirement	Related to the issuance of RTFC and consequently RTFC prices
	Monitoring environmental permits	Additional monitoring scheme (aside from RTFO sustainability critiera) for biofuels waste products
External Policy & institutions	Biofuel/feedstock subsidies in key biofuels exporting countries	Decreases competitiveness of biofuels /feedstock produced in the UK
	Regulation regarding taxes on imported biofuels	Decreases competitiveness of biofuels /feedstock produced in the UK

The SD economic indicators – GDP growth and share of R&D as percentage of GDP – gave a broad overview of the *macro-economic development* and provided a general indication of the *investment* activity in the economy. These factors are likely to affect investments also in the biofuels sector, including notably the willingness to invest in advanced biofuels technologies.

The SD environmental indicators cover the areas *of sustainable production and consumption* (e.g. motorisation rate, area under organic farming), *climate change* (e.g. GHG emissions, SOx and NOx emissions), *energy* (e.g. renewable energy consumption, energy dependence) and *natural resources* (e.g. land availability). These indicators provided more specific information on the UK environmental context. For instance, sustainable production/consumption demonstrated the trends of waste streams, which could be potential biofuel feedstock (e.g. municipal waste generation) as well as the demand for motor vehicles (e.g. motorisation rate), which impacts the demand for transport fuel including biofuels. Climate change and energy indicators were directly related to achieving policy goals of emissions reductions and renewable energy targets in the transport sector. Natural resources defined as 'availability of land' indicates the potential agricultural land available in the UK for producing biofuels feedstock from crops.

Other indicators (technology, social-political environment, good governance and external policy and institutions)

The other contextual factors (technology, social-political environment, good governance and external policy and institutions) could not be assessed using indicators from the SD Eurostat database. The importance of these contextual factors was assessed through quantitative indicators drawn from various national indicator sets as well as through expert judgement based on a broader range of evidence. Under social-political factors, the indicator (provided by the now defunct UK Renewable Energy Association) measuring the number of jobs created in the biofuel sector across the country helped to quantify some of the social and economic impacts of biofuel policies such as those caused by the Renewable Transport Fuel Obligation (RTFO). Other indicators included those relating to "good governance", such as monitoring, which

was measured through biofuel sustainability criteria established within the RTFO scheme. The Department for Transport monitored the rate of compliance on the sustainability criteria and published the statistics. The rate of compliance was used in the UK biofuels cases study as an indicator for demonstrating the existence of a monitoring process and also indicated the extent to which biofuel suppliers complied with policy requirements.

Qualitative criteria used when indicators were absent

For some contextual factors, no indicators were available, and qualitative judgement by researchers was used to describe the national context. These factors included political and societal support. This information, identified through stakeholder interviews and secondary material, provided context for the political and societal views towards biofuels, which helped to facilitate or hinder the development of the sector.

Some of the factors concerning technological developments and external and policy context for which indicators were not available were in fact among the most crucial for the effectiveness of biofuel policies. These were descriptive explanations that identified key factors that negatively impacted the biofuel producers in the UK. This information was also obtained from stakeholder interviews and desk research and was not presented through national or SD indicators. For instance, biofuels tariffs in other countries significantly decreased the competitiveness of the non-subsidised UK biofuel feedstock. These policies were unforeseen by actors in the UK biofuels sector and negatively interacted with existing regional and national biofuel policies.
Although the existing SD indicators were helpful in providing background information, they had a limited role in helping to explain how key contextual factors influenced the development of biofuels in the UK. Indicators drawn from national databases (e.g. the number of jobs created and rate of compliance in the RTFO sustainability criteria) as well as qualitative criteria identified through expert interviews and secondary research provided a better explanation of how both national and international factors influenced the UK biofuels system.

The role of indicators in the Greek RES support case study

The National Policy Strategy for RES deployment, introduced in Greece with a view to conforming to the EU 20-20-20 objective, was translated into a Feed-in-Tariff (FiT) scheme, aimed at contributing to the achievement of a RES share of 18% in final energy consumption. This target was to be reached through a combination of RES support measures and energy efficiency measures mainly in the building sector. The case study examined the interplay of RES support policies with EE promotion measures in the building and power sectors, by exploring the reasons behind possible deviations in the observed effectiveness. Those reasons (i.e. factors/criteria/themes) were explored at three levels: 1) the general country-specific context; 2) the design and implementation of the policy instruments; and 3) the interaction with other policies in the sector. Indicators were therefore used to describe and measure the potential impact of these factors on the achievement of the main objective of the FiT policy (i.e. installed capacity per RES technology).

Usefulness of SD indicators in answering the research questions

Seven indicators drawn from the Eurostat SD database were used to describe context factors in the area of economics, market structure and the environment. Factors related to technology, social aspects, and governance were measured using indicators from outside of the SD database. Table 2 lists the indicators used in the Greek case study.

Table 2: Overview of context factors in the Greek case study

Context factor	Indicator/criterion	Explanation
Economic	Annual GDP growth percentage	Liquidity problems restraining RES investments
	Household consumption expenditure	Decreased available expenditure, affected residential end users response to incentives offered
	Domestic price of electricity	Higher energy costs in combination with the lack of liquidity reduced energy demand.
	Oil world market price	
	Degree of liberalisation and market access	
Environ-mental	Final energy consumption	Reduced energy demand did not directly affect RES policy instruments
	Energy consumption in the household sector	
Techno-logical	Technological developments	Increase in returns on investments, lowering the FiT scheme efficiency
	Building activity	Construction and building activity was focused on building renovations while almost no new buildings were constructed
	Capacity of the grid-network	Limited grid capacity constrained the effective exploitation of national RES potential and the efficiency of the FiT
	Building arbitrariness	Peculiarities regarding legality and ownership of public buildings and other infrastructure caused long delays in project implementation
Socio-Political	Political support to RES	Shaped the deployment of RES plants
	Stability of the legal framework	Legal uncertainty induced great risk for prospective investors
	Local investment culture	Local opposition against RES projects causing delays in project implementation
Good Governance	Transparency of approval and licensing procedure	Delays in project implementation

Existing Sustainable Development (SD) indicators were found to be useful for describing the development of general macro-economic and market trends (e.g. economic development, level of liberalisation and market access) and the state of the environment. SD indicators used were annual GDP growth, household consumption expenditure, retail price of electricity for households, and oil price. In addition to general trends, these indicators revealed unexpected changes that might affect the performance of RES policies. However, the indicators did not help much in establishing a causal relationship between the evolution of the contextual factors and the observed policy effectiveness. Energy consumption trends (final energy consumption, and energy consumption in the household sector) were the only SD indicators that helped to demonstrate both the development of the contextual factors, and the influence of these trends to the effectiveness of policies (i.e. reduced consumption levels for the case of EE policies and increasing energy supply/installed RES capacity for RES support policies). In the case of EE policies, the observed policy effectiveness (measured in KWh saved per sector or in total), was directly correlated to the observed and projected trend in energy consumption.

For some contextual factors, either a SD indicator was not available or the factor in question was difficult or impossible to measure with an indicator in the first place. Typical examples of the first case were the legal and regulatory issues concerning the existing building stock in Greece, for which the indicator "the number of issued building permits" was applied. Examples of the latter case were clear in the area of socio-political issues (transparency of procedures, local investment culture, stability in the legal framework) and access to the grid, where qualitative expert judgement was used instead of indicators. In principle World Governance Indicators could have been used for measuring legal stability.

At the second level of assessment, the main question that we addressed was: "Did the policy design or implementation evolve differently than planned and how did this influence policy effectiveness?"

At this level of assessment factors identified were policy-specific and were often assessed in the light of general criteria, rather than indicators. No SD indicators were used, because these would not have provided the level of detail required for policy-specific assessment and this evaluation level included mostly qualitative assessments. Where data was available, evaluation proxies were used or invented to enable the evaluation. For instance, for criteria such as motivation to invest, indicators like total investments (€/year/technology), demand for permits and average depreciation time were used to

measure the policy signal of the FiT to RES-investors. Likewise, administrative set-up and feasibility was measured by looking at the number of staff in the associated service, the length (in years) of experience of regulators in administering and supporting the implementation of the instrument.

However, empirical policy data from ex-post evaluations were most of the times scarce and although specific definitions were provided for the quantitative evaluation of criteria with the use of existing non-SD indicators, measurement scales were determined and used instead. The criterion of "familiarity" was defined as the public awareness of the scheme, which could have been measured by looking at the number of visits at the related website or calls made at the ministry's help-desk. However, such information was not available and the criterion was measured through evidence gathered from a carefully selected set of stakeholders participating in RES and EE policymaking in Greece. The stakeholders were asked to attribute values to each criterion along a Likert scale of 1 to 5. More complex criteria such as policy coherence and consistency were measured in a similar fashion.

The criteria established were inclusive of key relevant aspects describing the different functions of the various environmental policy instruments when addressing the diverse set of associated barriers. This means that their relevance and usefulness varied according to the sectoral scope of policy instruments in question. In addition they involved various overlaps inter se, owing also to the interconnected nature of barriers (Chai & Yeo 2012). For instance institutional coordination and management is partially (but not totally included) in the institutional capacity criterion. In turn policy consistency explores whether a policy performed consistently towards attaining its own targets taking into account other policy targets, while depending upon monitoring and control as well.

Conclusions

The usefulness of SD indicators for policy evaluation following the APRAISE 3E method showed a mixed result. The existing SD indicators proved to be very useful for the definition of the broader socioeconomic context that may impact the effectiveness and efficiency of environmental policy instruments. They illustrated the development of contextual factors over time and, at a later stage combined with models, also helped to forecast the evolution of different future framework conditions. For the second, and arguably crucial, task in the 3E method – improving our understanding of the factors that influence policy interactions and the implementation of policy instruments – quantitative SD indicators were rarely useful and qualitative, more tailor-made means of assessment were used instead. In these cases semi-quantitative methods, with expert judgement presented and summarised through Likert scale were applied instead. However, the factors measured through these semi-quantitative methods were crucial for assessing the effectiveness and efficiency of policy instruments.

National indicators were also useful in providing more specific information on the ability of policy instruments to achieve their objectives.. The national indicators also helped to better understand the impact of policy mixes within a given country. For instance, the number of jobs created in the biofuels sector was largely due to the incentive mechanisms or quotas established to encourage biofuels development.

Overall, a varied set of indicators from existing SD and national indicators, together with general criteria defined during the course of the empirical research, were needed to provide a broader systems perspective of the national, regional and international contextual factors that influenced the effectiveness and efficiency of policy instruments.

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