The applicability of the indicators proposed by the European and national regulatory framework to the Energy and Environmental Masterplan of the Sicilian Region.

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Summary

Indicators are useful working tools for the plans to monitor their progress as well as to check *ex-post* the results achieved. There is a large *corpus* of indicators, both at European and national Italian levels which designers and planners can refer to. However, it is worth verifying the effectiveness of general validity parameters when applied to a specific limited territorial area. This paper faces this problem, with a focus to the Energy and Environmental Plan of the Sicilian Region (PEARS) and compares the themes proposed at the European (Eurostat) and the Italian national (ISPRA) levels with those adopted for the enforcement of PEARS. The Headlines indicators (Eurostat) are here used as an instrument measuring the applicability at a regional level in order to verify the degree of achievement of the objectives proposed by PEARS. The comparison shows that the *top-down* scheme is unable to verify the results achieved. The indicators must be rather selected more in detail according to a *buttom-up* scheme able to understand in depth the need of the area under examination.

Keywords

Indicators, Sustainable Development, Energy Policy, Regional Governance
Regional governance, Energy policy, Environmental indicators**.**

Nomenclature

APPA = Provincial Agency for Environmental Protection
ARPA = Regional Agency for Environmental Protection
ODA = Official Development Assistance
EU = European Union
DMC = Domestic Material Consumption
DG = DG
EUROSTAT = Statistical Office of the European Union
ISPRA = The Institute for the Protection and Environmental Research
OECD = Organisation for Economic Co-operation and Development
GDP = GDP (Gross Domestic Product) Gross Domestic Product
PEARS = Sicilian Regional Environmental Energy Plan

PO FESR = OP ERDF Operational Programme European Fund for Regional Development
P / P = Plan / Programme
SDS = SSS = (Sustainable Development Strategy) Sustainable Development Strategy
SEA = Strategic Environmental Assessment
EU = European Union

1. The regulatory scheme of the land policy government

Plans/programs (P/P) act as a single part of a public decision-making process (COM, 2001), while the evolution of an area depends on the synergic effects of each choice of the decision making process (Kagiannas, 2003). Strategies for Sustainable Development (Ministry of Economic Development, 2007) are therefore becoming important tools to define, coordinate and monitor the implementation of policies (Labandeira, 2009) at different territorial scales (Learmonth, 2007). Regulatory compliance required by the EU (COM, 2009) and the EU 2014-2020 regulatory framework suggest to concentrate the efforts of both decision makers and stakeholders aiming at the efficient integration of all environmental information as well as the improvement of the Programs' performance (Chen, 2011).
In recent years the European Union (EU) has integrated sustainable development in a large number of policies playing a leading role in the global fight against climate change and promoting a low-carbon economy (Carlo Andrea Bollino, 2013).
Nowadays, the fragmented regulatory framework and the persistent delays in the implementation of national directives and their application stressed by the lack of the adequacy of the underlying technical and scientific knowledge strongly suggest the need for coordination of the Regions and Local Authorities. (D'Amato A., 2013).
In Italy, the unitary regional strategy (but a similar situation can be encountered in other countries), the priorities and the general and specific targets that involve territory and/or industry level, are implemented and achieved on the basis of a planning process. This process is made of three levels of implementation:
a. the programming level of specific strategy (land and/or sector oriented);
b. the sharing level of institutional of priorities, objectives and instruments;
c. the implementation level and the specific tools by which the unitary regional strategy is realized.
For each level specific tasks are assigned.
The abovementioned levels contribute to establish an unified and iterative process involving the identification of objectives and operational decisions (Oana P.L., 2011).Environmental issues must be adequately considered in the assessment activities carried out at the different stages of programming in order

to ensure the actual integration of environmental concerns into development policies and to create awareness of the environmental effects of the interventions (Rosales N., 2011). Regarding the evaluation activities in support of planning actions, the Strategic Environmental Assessment (SEA) of plans and programs, as required by Directive 2001/42/EC, along with the associated participatory processes, represents a tool to evaluate the activities in support of planning. Specifically, the need to activate a monitoring system is made explicit in Article 10 of that Directive, in order to promptly identify any unforeseen adverse effects and to take appropriate corrective measures. These assessments, as defined in Article 47, "General Provisions", are aimed at improving quality, effectiveness and consistency of interventions, taking into account the objective of sustainable development and of the relevant legislation on environmental impact. The importance of monitoring programs is further underscored by the Directorate General (DG) Environment of the European Commission (EC) in note n°. 009432, 30 September 2008 addressed to the Managing Authority of the Operational Programs.

The Directive does not provide, however, further technical indications and does not establish the ways in which the significant environmental effects, in particular, should be controlled. The EU charges individual Member States to establish the process and to verify the importance of the effects.

Even the Italian national legislation (Fanelli T. 2012), such as that of the EU, provides a form of control on the impacts resulting from the implementation of a plan, as defined in Article 18 of the Legislative Decree 152of April 3rd 2006 amended by Legislative Decree of 16 January 2008 n°. 4 and by the Legislative Decree of 29 June 2010, n°. 128. In addition, in paragraph 8 of Article 34 of this Decree, reference is made to the Environmental Agency and the Higher Institute for Environmental Protection and Research (ISPRA), to collect data on structural indicators. The legislation thus identifies, in the system of "environmental agencies" (ISPRA, 2011a), the subject "catalyst" of monitoring activity.

Starting with the guidelines outlined by the regulations it is useful to compare efficient/productivity objectives to the governance one in order to interpret the ability of the regional structure to respond to the problems (Neves A. R., 2010).

To guarantee the perfect description of the transformations and of the changes that the policy can produce, it is crucial integrate the systems of indicators for each sector in view of their correlation with sets at national and European level

On the background of the existing legislation in the present work is checked the actual applicability of the database of set of available indicators to the different territorial scales. In particular will be verified the usability of the sustainability indicators Eurostat at the regional scale and it will make reference to the experience of the Convention ISPRA/APPA/ARPA which has produced important guidelines on the monitoring of the level of the plans' implementation at a regional scale. At last we will present an application to a

real case, consisting of the Environmental Energy Plan and the Region of Sicily, which required the use of a high number of such indicators. From this critical reading of the method, relevant considerations concerning the transferability of the procedure to a wider audience of Plans/Programs (P/P) will be assumed.

2. Sustainability indicators as a tool for energy and environmental management

The sustainability indicators, in addition to measuring the phenomena and their evolution in comparison to the proposed targets, are able to monitoring economic, social and environmental performance of a given plan/program (Hiremath R.B., 2013).
At the methodological level, the process of selecting indicators in Europe, therefore, follows a logical sequence that includes:
1. the identification of an initial list of indicators, based on international studies and lists of specific actions of European programming;
2. the analysis of their availability and feasibility (when indicators are not available);
3. the revision of the list on the basis of relevance, communicability, scientific validity, applicability to the context.
At international level, the Organization for Economic Cooperation and Development (OECD) and the EU use a sets of indicators:
• for monitoring of progresses concerning sustainable development;
• as a tool for checking the state of economy and environment;
• to evaluate the performance of policies;
• to clarify objectives and set priorities.
Seeing as the EU and its Member States are shifting their policies toward a long-term sustainability, there is need of a growing the convergence between the strategy for sustainable development and the Lisbon Strategy for Growth and Jobs. In doing this, evaluations were conducted mainly on:
• Eurostat monitoring reports;
• progress reports of the Member States on the implementation of the EU strategy for sustainable development;
• periodic reports of the European Agency for the Environment.
Moreover at European level, Eurostat has developed a set of indicators for monitoring the objectives and commitments contained in the European strategy for the sustainable development. In this context the European Commission has developed the European Common Indicators, ECI, that are already widely in use from years.
Currently there is a periodic review of the system of the indicators for sustainability in Europe that is focused on:
• retrieval of basic data;
• organization of a rational and coherent system of indicators;

• development of indicators for the integration and benchmarking.

3 The Headlines indicators of Sustainable Development of the European Union (Eurostat)

As previously reported, sustainable development is one of the fundamental targets of the European Union in sight of improvement the quality of life, the environmental protection and of the social cohesion. This goal must be achieved by sustainable communities that are able to manage resources efficiently and to tap the potential ecological and social innovation economy.
The monitoring of the progress towards these targets is an important part of the sustainable development strategy (SDS). So, Eurostat, together with Member States, has developed a series of 140 sustainable development indicators (SDI), in turn subdivided into 10 subjects. These indicators are up-to-date and published by Eurostat every two years.
The sustainable development indicators (SDI) are organized into themes that reflect the major challenges of sustainable development strategy (SDS) according to a gradient that ranges from economic to social, to environmental and institutional dimensions. These themes are further divided into sub-themes that reflect the operational objectives and actions of the SDS. The set of SDI is flexible: new indicators can be further added in relation to changes in priorities of the SDS, bearing in mind that new problems occur from time to time.

(Insert Table 1)

There are different levels of sustainability indicators that meet the various needs of users (Table 2). For each sub-theme explain in Table 1 different types of indicators are defined according to the levels at which they act. They have the following names as:as follow:
a) Key indicators to monitor the general objectives relating to the key challenges of the SDS:

1. gross domestic product;
2. emissions of greenhouse gases;
3. resource productivity;
4. Common Bird Index fish catches taken from stocks outside safe biological limits;
5. energy consumption of transport relative to GDP;
6. years of life in health and life expectancy at birth by sex;
7. people at risk of poverty or social exclusion;
8. the employment rate of older workers;
9. the official development assistance as a share of gross national income.

b) Operational indicators, related to the operational objectives of the strategy:

1. economic development, innovation, competitiveness and eco-efficiency, employment;

2. climate change and energy, transport and mobility, transport and impacts;
3. resource use, waste, consumption patterns, production patterns;
4. globalization of trade, financing for sustainable development, management of global resources;
5. biodiversity, freshwater resources, marine ecosystems and land use;
6. and health inequalities in the social, health determinants;
7. Monetary poverty and living conditions, access to the labor market, education;
8. demographics, age and income adequacy, sustainability of public finances;
9.coerenza policy and effectiveness, openness and participation, economic instruments;
10. further infringement procedures, environmental taxes.

c) explanatory indicators related to the actions outlined in the strategy and that, for each sub-theme, are, for examples:

1. net national income, energy intensity of the economy, employment rate, by gender;
2. global average temperature of Earth's surface, electricity produced from renewable sources;
3. internal consumption of materials, final energy consumption by sector, Ecolabel licenses;
4. fire state surfaces damaged by defoliation, biochemical oxygen demand in rivers;
5. consumption of energy for transport mode, emissions of oxides of nitrogen (NOx) emissions from transport;
6. mortality rate, Urban population exposure to air pollution by ozone;
7. people at risk of poverty by age group, people with a low level of education by age group;
8. average exit age from the labor market, the rate of migration;
9. EU imports from least developed countries by product group, official development assistance, by income group;
10. transposition of Community law by sector, e-government.

d) contextual indicators, which are part of the set, despite not directly controlling a specific objective of the strategy; these indicators are provided only for 3, 4, 5, 7, 8, 10 sub-themes:

3. number of people in households, final consumption expenditure of households, consumption functions;
4. population living on less than 1USD per day;
5. price indices for transport;
7. Public spending in education;
8. costs of care for the elderly;
10. citizens'confidence level in EU institutions.

(Insert Table 2)

4. Indicators for evaluating and monitoring plans and programs at the Italian country level (ISPRA)

A first application to verify the consistency of the indicators at different spatial scales was implemented as part of the Convention instituted in 2009 between ISPRA and fifteen Environmental Agencies (ISPRA, 2011). The Convention, is based on a methodological framework which tends to facilitate the use of the instrument SEA at different territorial scales, and has also aimed at sharing the choices and the use of indicators for creating monitoring systems that allow to compare results.. The database and metadata format (ISPRA, 2009) represent a first experiment of building a shared knowledge framework between national levels and regional one for environment monitoring.
For the definition of an initial core set of indicators to be used in SEA (Helbron H., 2011), it is important start from a common framework of sustainability, which can be declined at every territorial levels, and can be used to derive coherent context analyses.. Therefore has been decided to proceed the analysis of the plans with a survey of sustainability targets established at European, national and regional levels, in order of properly identifying the environmental issues.
The monitoring system is often not sufficiently developed within the documents and it is sometimes merely suggested. Furthermore, in the monitoring phase indicators if any are often unrepresentative and lacking in clear links between the analyses, the objectives of the P/P, the necessary actions to achieve them and the environmental effects thereof.
For the definition of an initial core set of indicators in SEA, the decision makers of the fifteen Environmental Agencies involved have started from a survey of the sustainability objectives and targets ones established by the main Strategies, Directives, Norms at European, national and regional levels common framework of sustainability. The core set has been assessed and declined at various regional levels to derive valid and coherent context analysis.
Table 3 shows the correspondence between the strategic themes and the European environmental components ISPRA/ARPA/APPA: it allows to state the very close correspondence between the themes proposed by the EU and those identified by the Convention ISPRA/ARPA/APPA core.

(Insert Table 3)

The set of indicators is able to highlight the environmental and spatial characteristics of the area potentially affected by the plan, to assess specific measurable objectives, to evaluate the significant effects due to the planned actions and to monitor the level of achievement of targets. The suitable indicators to be populated and at different territorial scales to be compared should be significantly representative of the environmental issues that are considered

Suitable indicators, to be populated at different territorial scales, should be significantly representative of the environmental issue being considered and homogeneous and comparable at all territorial levels.
In a certain regions where sufficient data are not available to suitably populate the core set of indicators, other indicators are used, called "variables", which allow to indirectly obtaining the needed information.
A similar process was applied in the case of utilization of a given indicator from the regional level to the provincial and/or municipal one.
In the study conducted by ISPRA/ARPA/APPA, a "core set" of indicators was gathered in a catalog, identified for the main components and environmental issues and was shared starting from the sustainability objectives of the European and national strategies, thus defining a first point of reference for national and regional plans.
Regarding the cited study of ISPRA/ARPA/APPA, the choice of indicators allowed to:
• identify relevant aspects of the current state of the environment and its likely evolution before the implementation of the plan and/or program has taken place;
• describe the environmental characteristics of areas likely to be significantly affected;
• monitor the significant environmental impacts resulting from implementation of plans and programs, so determining whether a P/P is proceeding in the desired direction.
To define at what extent a P/P is close to its objective, it has been necessary to define another set of indicators called "objectives related to plan " that are divided into “process indicators” and “ of context changing indicators”. To define at what extent a P/P is close to its objective, it has been necessary to define another set of indicators called "objectives related to plan" that are divided into “process indicators” and “ context changing indicators”. The process indicators of are able to describe the status and degree of implementation of triggered actions, for defining the link with the other planning tools that insist on the same territory. The context changing indicators are capable to record and evaluate the extent of impacts induced by the actions.
The indicators of context changing are capable to record and evaluate the extent of impacts induced by the actions.
In Figure 1 is reported a summary of the monitoring system with regards to the relationship between objectives and indicators, both at the general and local levels.
From a methodological point of view, monitoring may be described as a three steps process: *analysis, diagnosis and therapy* (ISPRA, 2011). To the three cited phases an "input phase" must be added in the process, in order of updating the battery of indicators, the reference environmental frame and to assigning criteria and priority actions to be monitored.

5. The repeatability of the method in Sicily applied to the monitoring of PEARS Masteplan

In this section we will verified the applicability of the Headline indicators of the European Union at the Regional Environmental Energy Plan (Albanese, 2011) of the sicilian region.
In Sicily, the regional environmental policy (Regione Siciliana, 2009c) has identified, by means of the PEARS (Regione Siciliana, 2009a) Masterplan, proper actions in order of achieving effective results concerning climate change and energy use issues. The implementation of local actions at provincial and local scale is structured on three levels which start from directives and decrees established at country level . The above described scheme concerning the use of indicators at local levels, is here checked out with regards the PEARS Masterplan of the Sicilian Region (Regione Siciliana, 2009b). This verification, by the way, presents a specific relevance in sight of the application of the strategic environmental assessment (SEA) of the plan (Federico G. Lascari, G., La Gennusa M., Rizzo G., Traverso, M ., 2006).
The PEARS consists of informative sheets (Regione Siciliana, 2009d) referring to each specific action related to the so-called "Action Plans". These sheets represent suitable case-studies for given regional situations, starting from the definition of proper energy basins, from the assessment of the potential introduction of renewable energy sources (RES) and from the energy savings achievable through the improvement of the energy end-uses efficiency.
The procedure also provides for the introduction of a monitoring system that, as defined in the Directive 2001/42/EC (Directive, 2001), has not been designed as a tool to simply collecting and updating territorial data. It was intended as an active, complex and detailed system, which also contemplates assessment activities, support decision, data interpretation and elaboration of recommendations for the possible re-routing of PEARS (Fig. 1).

(Insert Figure 1)

As further example of the ex-ante/ex-post comparison of indicators which are reported in Figure 1, we can also usefully indicate energy saving and energy consumption decrease by sectors; CO_2 emission reduction by manufacturing sectors (ex-ante indicators) and energy final consumption by sectors; global emission CO_2 by sectors (ex post indicators)
This three levels scheme requires the definition of some specifications and in particular:
1) the establishment of a target P/P related to the overall sustainability, as defined by Directive 2001/42/EC;
2a) the singling out of the P/P measures
or
2b) the singling out of the measures defined at higher-level plans;

3) the singling out of proper “process” indicators (see Section 4), able to account for the degree of implementation, by means of information referring to:
a. the type of relationship between the degree of implementation of the measure and their effects;
b. the link with the higher and lower levels planning;
4) the identification of proper indicators referring to “change of context” (see Section 4);
5) the control of the congruency between the general sustainability targets and the local ones.
In order to check the consistency between the planning approaches at the Sicilian regional level, at Italian country and at European one, a first comparison has been assessed between the EU topics, ISPRA themes and the Sicilian components related to PEARS Masterplan. Table 4 synthesizes the above cited process of correspondence.

(Insert Table 4)

Defined the correspondence, three more detail levels of coherence have been established; each of them has been characterized by a proper symbol that will be used to quantify if and at which extent the EU indicators are able to measuring the performances of PEARS in relation to the established target or if it is needed a further implementation of the set of indicators. To this end, it has been suggested a "direct coherence", in the event that there is a complete matching between EU topics and themes of the PEARS; an " indirect coherence" when, although a direct correspondence is not encountered, there is an evident link between objectives of the PEARS and EU topics; an "indifferent correspondence" when no correlations can be found between the objectives of the PEARS and EU topics.

(Insert Table 5)

The identification of the level of coherence between the EU indicators and those of PEARS was carried out starting from the definition provided by Eurostat for each indicator.
Here below, some of the definitions of the Eurostat indicators are reported, in the aim of clarifying how they are utilized for checking the level of correspondence.
• GDP per capita
Percentage change over the previous year, in terms of euro per inhabitant; GDP includes goods and services on the market.
• Resource Productivity
The value of GDP divided by domestic material consumption (DMC). DMC measures the total amount of materials used directly by a national economy.
• Number of people at risk of poverty or social exclusion

This indicator is the summation of people who are at risk of poverty or severe material deprivation or living in households with low labor intensity.

• Employment for older workers

It is calculated by dividing the number of employed people aged between 55 and 64 years for the total population of the same age group.

• Life expectancy at birth and years life expectancy in good health , by sex

It measures the number of years in good health which a person at birth is expected to live.

• Emissions of greenhouse gases

Total emissions of greenhouse gases (CO_2 equivalent), referred to 1990. This indicator shows the evolution of total anthropogenic emissions in relation to the 'reference year of the Kyoto protocol"(1990 for non-fluorinated gases and 1995 for fluorinated gases).

• Consumption of energy in transportation sector with reference to GDP

This indicator is defined as the ratio between the consumption of energy in the transportation sector and GDP in a given year.

• Biodiversity

It is 'an aggregate index that integrates the abundance and diversity of the population of a given species associated with a specific habitat.

• Official development assistance (ODA), as a share of the gross national income

ODA consists of grants or loans that are awarded in the public sector for the promotion of economic development and welfare in recipient countries.

The application of this matrix, corresponding to the objectives of PEARS and to EU Headlines indicators, is given in Table 6. Table does not contain the EU theme "Good Governance" since it is not associated with any Headlines indicator. This matching scheme allows to achieve an integrated assessment of the effectiveness shown by Eurostat indicators in capturing the needs of the objectives of PEARS.

(Insert Table 6)

Table 7 shows for each Headlines indicator the numerical value of coherence with the objectives of PEARS. This numerical value is computed as the ratio between the number of correspondences (direct, indirect or indifferent) of each PEARS indicator with the pertinent UE Headlines indicators. This allows us to infer that the indicators "gross domestic product", "energy consumption of transport relative to GDP" and "official development assistance as a share of income" have a prevalence of indirect coherence with the objectives of PEARS; indicators "people at risk of poverty or social exclusion", "employment rate of older workers" and "birth rate and life expectancy by sex" have an indifferent correspondence; while the only indicator "greenhouse gas emissions" shows a direct coherence. Finally, the indicator "biodiversity" has the same degree of coherences, indirect as well indifferent; moreover, for the indicator “resource

productivity" the same degree of direct and indirect coherence with the objectives of PEARS has been found.
This simple comparative scheme allows establishing that the Eurostat indicators do not seem to be particularly effective in intercepting the requirements of the objectives of the Plan, since a low coherence between them and PEARS seems to prevail.

(Insert Table 7)

Conclusions

The main goal of this work is to verify the applicability of the indicators of the European regulatory framework, the so-called Headlines, to plans operating at the regional levels. Indeed, these indicators are important since they play an essential role in the control of the ongoing progress of the plans.
We are perfectly aware about the need and the importance to put in an actual context the comparison among ex ante and ex post indicators, since different territorial, environmental and law contexts could likely lead to the selection of different indicators, in relation with the role played by the involved administrative levels. This is why we have here shown the role of indicators with a close link to a real plan, like the PEARS of the Sicilian Region is.
In doing this, we referred here to the Italian national methodology for the identification of the indicators, as proposed within the ISPRA Convention of 2009. Specifically, the verification process has been applied to the case of the Sicilian Regional Environmental Energy Masterplan (PEARS). In this regard, it has been here conducted a critical analysis of the ISPRA methodology for the evaluation and monitoring of the plans and the system of indicators.
The comparison, developed in two phases, has led to the preliminary identification for each EU topic and subtopic, of the corresponding indicators of sustainable development (Eurostat) to be applicable to PEARS.
In the first phase, to highlight the top-down structure of the process, as proposed by the EU and by ISPRA, it has been undertaken an analysis of the correspondences between the issues of the EU Headlines indicators and the environmental components of ISPRA. This allowed us to verify that there is some coherence for six out ten EU topics.
In the second phase, according to the cited top-down framework, we proceeded with the verification of the applicability of the Eurostat indicators to PEARS Masterplan. This two-phase verification process allowed us to draw some interesting conclusions about the features of Headlines indicators and their applicability for the monitoring of a plan.
First of all, as it was expected, the Headlines indicators are not characterized directly with respect to the territory specifications, since they were designed for a general European global level. In other words, despite they show an intrinsic structure that allows some applicability to a local territorial level, actually they

do not intercept exhaustively the specificity of these local areas. In the meanwhile of a more appropriate specifications of the indicators Eurostat in order to render them closer to the local situations, it is here suggested that the energy and the environment planning processes of a given territorial area should proceed by following a bottom-up approach. This, in fact, will allow to directly single out indicators that are able effectively to be utilized to local plans to lead a better governance process of the given territory.

In conclusion, while it is confirmed the full validity of a policy scheme that relies the government of a given land to a suitable grid of indicators (relating to issues defined at European level), it is here suggested that these indicators, at least at the present state of their definition, should not merely derived from those proposed at the central European level since they instead should require a stronger coherence check with the requirements of the local plan.

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