ENERGY AND CITY: INTEGRATED SYSTEM FOR SUSTAINABLE DEVELOPMENT

Francesco Gagliardi, Mariacristina Roscia
Università degli Studi di Napoli "Federico II"
Dipartimento di Ingegneria Elettrica
Via Claudio, 21 80125 Napoli-Italia
E-mail: gagliard@unina.it
epetm@unina.it

Abstract

There are very strong connections among innovation, environment and sustainable development. These connections must be enhanced and defined by local and state policies.

Research and education must help understanding the meaning of environmental quality, risk evaluation, cost/benefit analysis, study of the various kind of pollution and the functions connecting each element. To obtain an integrated management system we must formalise economic models including environmental variables, sources, energy, transport management.

It will be fundamental to define the functions of environmental relationship by variables representing environment, energy, transport, sources, resources use, goods and services production, that, put in the model, may lead to an optimisation that respect the environment.[1]

1. POLITICS AND STRATEGY TOWARDS THE ENVIRONMENT AND THE SUSTAINABLE DEVELOPMENT

The need of pursuing a sustainable development determines deep changes in public politics. It becomes necessary to draw up and to manage the environmental variable in a new perspective in which the development process must base on local resources, consolidate in metropolitan dimension and rely on the government support.

The local autonomies, the metropolitan areas administrators and the government must have well defined the actions that they can carry out and also understand what is the existing connection between investments in the sectors of respective authority and the development that today it is worthy to define as sustainable. To this goal, the importance of politics related to the society and the idea of city that enter in the definition of sustainable development are going to be improved because they are fundamental in the harmonisation activity among the development actors' process.

In fact, it is not casual that the today object of harmonisation is also the reaching of a social cohesion and of a modern strategy of the city with the awareness that the cities represent the strategic place where the fundamental operation of the economical system mainly take place. But in the cities also the diversity in culture and identity are concentrated, so a fracture opens between the dominant culture and the "others" ones, those of the immigrant community and of the informal economy, too.

It is consequently agreeable the fight to the social margination and the support to the recovery process of social reliance, together with the localisation of new enterprises in the services to the people and to the firms, for increasing the competitivity of the territorial economical systems, as global objective of the axis "city"[2].

All the interventions that have significance on determining the risk factors are of particular importance on the planning activity. These latter go beyond of those defined in the past as "historical risks" and rise up the energy and the information systems. Under the obvious

consideration that it is not possible to eliminate these risks, it is necessary to examine which are the acceptable choices in social and economical terms.
From this point of view it is of particular significance the local negotiated planning that can become an important reference point and will bring also to the determination of space devoted to the location of energy and communication centers both in terms of generation and utilisation.
In the actual sharing of the territory in sub-systems, it is fundamental to focus on micro-territorial systems inside which the following must be performed: analysis activity, research of prevention, development management. Inside those topics some Institutions as Schools, Educational Centers, Universities, Research Centers must operate with their advice action for supporting the Government Authorities' decisions in a sharp and clear way. In this scenery, the improvement of environmental sources, the recovery of the natural and cultural background, the safety of the people and the respect of the environment assume a priority role.
In fact, any sustainable development politics is strongly conditioned by the social and health-care services, by the transportation structures, by the energy systems that define not only the quality of the territory, but the highly interconnetted quality of life, too.
Therefore, the location of the energy generation and transmission systems, and of the industrial centers influences the territorial development not only on the economical point of view but also – and strongly – on the "quality" point of view. In fact, it is not possible nowadays to think that the pollution of an industry or of a power generation unit is limited to the area where the plant is located; the pollution is also connected to the transportation systems associated to the industry or power unit operation.
It is also not negligible that the sustainable development is determined by the culture of the people that live in the territory, their knowledge of the risk and their inclination to accept or avoid risks.
The politics of the territory management focussed on its sustainable development needs to pass through the decision matrix that correlate the benefit function to each action that is assumed inside to the "nature system" representing the territory under study. The definition of the benefit function pass through the interpretation of the complex interactions that exist between social phenomena, territory and energy. These latter are represented by indicators able to define politics that – as final result – points to the optimum under some settled constraints.
It is important to assert that the politics of city plans is not only limited to town areas, buildings or social aspects, but must take into account also the energy problem. Then these plans must define the areas of generation, transmission, distribution and utilisation of energy. This obviously introduces some difficulties due to he increased complexity of the territory studies that have to introduce some indicators not strictly connected to the classical town-plan, only. For these indicators it is necessary to define the meaning and the value, since no historical analysis exists.
The Authors are however of opinion that in the field of risk analysis there are theories able to design systems – in uncertain conditions or in case of difficult data collection – addressed to foreseeable decisions that make the system capable of self-generation in a way that the sustainable development is not an utopian objective but a daily guide.

2. SECTORAL AND TERRITORIAL PLANNING

The definition of the objectives described above needs the right methodological approach that requires the individuation of the program plan and the attribution of the appropriate priorities.
The formulation of a sustainable model pass through a participation process that – as a system – involves all the interested sectors, evaluates the possible strategic options, adopts action plans with measured objectives devoted to the sustainability, and sets up procedures of interaction and monitoring of the plan realization [3].

It is, then, fundamental the role of the economical – environmental modelling as concerns the possibility both to give the connection between social and physics sciences – increasing the information exchange -, and to transform the scientific results in cost-advantage evaluations.
The objectives that qualify a new method of city plan are the following:

1) the identification of the general system for the definition of a sustainable development plan;
2) the identification of the problems connected to the realization of territorial politics and of renewable energy technologies;
3) the analysis of the impacts associated to the implementation of different alternatives;
4) the definition of a support to the decision process through successive steps of the problem of creating territorial strategies and renewable energy sources;
5) The correlation between the city and the relevant territory development with reference to the places of generation and transportation of the necessary resources and their discharge [2].

The need of defining the connections between city planning, environment and general use of the sources, clearly comes out to demonstrate the till today lack of attention to the environmental parameters on the planning activity. The inadequate analytical and methodological instruments, the lack of consequence between analysis and definition of the objectives, the incoherence between choices and objectives, the inability of foreseeing the results, the lack of control in the operation process have shown the intrinsic failure of the development plans in these last years [3,4].
On the basis of these observations, the problem areas to be considered for defining a politics of sustainable development consist of :

– the formulations focussed on underlining the methodologies for management models and for continuous process of territory government (analysis, planning, management);

the need of creating instruments for the definition of constraints and standards, taking into account not only the relation among different sectors and the strategic vision of the city and territory development, but also criteria of quality on the social, economical and environmental point of view.

3. INDICATORS TO ENVIRONMENTAL POLITICAL SUPPORT

Indicators of sustainability are different from traditional indicators of economic, social, and environmental progress. Traditional indicators -- such as stockholder profits, asthma rates, and water quality -- measure changes in one part of a community as if they were entirely independent of the other parts. Sustainability indicators reflect the reality that the three different segments are very tightly interconnected.
Sustainability requires this type of integrated view of the world -- it requires multidimensional indicators that show the links among a community's economy, energy, environment, and society.
Sustainability indicators (SIs) are indicators which would be used to reveal and monitor the conditions and trends in the any sector. They would allow monitoring the sustainability, development policy and management performance in relation to the various components of the any parts of system: the environment, the target resource, the energy, the economic and social conditions, the cultural context. Ideally, sis should look at environmental, resource, economic and social elements of sustainability in an integrated manner[5]**.**
An indicator is something that points to an issue or condition. Its purpose is to show you how well a system is working. If there is a problem, an indicator can help you determine what direction to take to address the issue. Indicators are as varied as the types of systems they monitor. However, there are certain characteristics that effective indicators have in common:

- Effective indicators are **relevant**; they show you something about the system that you need to know.
- Effective indicators are **easy to understand**, even by people who are not experts.
- Effective indicators are **reliable**; you can trust the information that the indicator is providing.

- Lastly, effective indicators are based on **accessible data**; the information is available or can be gathered while there is still time to act.

Indicators can be useful as proxies or substitutes for measuring conditions that are so complex that there is no direct measurement. For instance, it is hard to measure the 'quality of life in my town' because there are many different things that make up quality of life and people may have different opinions on which conditions count most. A very simple substitute indicator is 'Number of people moving into the town compared to the number moving out[6].

'Just as sustainability is about finding the balance point between a community's economy, environment, energy and society, developing a set of indicators for a sustainable community requires balancing many different needs within that community. A brainstorming session might produce hundreds of indicators. Deciding how many to keep can be difficult. More is not better. Less is not better. The right number depends on many factors including what type of audience the indicator report will have, how much time is available to research the data, the number of issues involved, and any specific needs of the community.

The development of sustainability indicators requires:

- consensus among interested parties;
- reference to agreed sets of principles, rules and concepts:
- standard protocols for their calculation, based on accepted, peer-reviewed scientific methodologies and "the best scientific information available".

Indicators should be accompanied by detailed information related to:

(1) type (pressure, state or response indicator);
(2) purpose;
(3) relevance to policy;
(4) relevance to sustainable development;
(5) linkages with other indicators;
(6) targets;
(7) relations with international conventions and agreements;
(8) data requirements;
(9) appropriate methodology.

It is think rightly that none of these indicators are the best indicator. Different indicator work well for different purposes. It is understood that countries will chose to use from among the indicators those relevant to national priorities, goals and targets.

Care to the energetic problem, set up from the point of view of the transport of the finished product or of the sources of energy production, the indicators for the energy assume relief which:

- meaningful environmental aspects
- environmental quality to the contour of the plant
- expenditure on air pollution
- use water resource and drainage in the water shape
- management waste
- contamination of the land
- noises, smell, visual impact
- place of job
- industrial accident research

courses transport which:

- air pollution concentration
- anthropogenic emission
- effectiveness systems
- level current/goal
- and indirect, social and economic indicators environmental[7].

An important research project is also necessary, at international level, to codify the indicators and the related methodologies as a basis for eco-labelling or certification and in order to characterize of the plans energetic regulators.
In the paper makes to see, between the various methods for organizing sustainability indicators, a methodology that encloses the indicators in a dynamics and homogenous matrix, that it concurs of report all the parameters of interest, so that can " inform " and that it is also in a position to helping to define development objectives and to set up an Agenda of political addresses[8,9].

4. DECISION MATRIX AND ENVIRONMENTAL RISK ANALYSIS

It has been pointed out that the indicators, which consent to measure system sustainability, are often complex and affected by randomness: the analytical model, which associates all the indicators, must take into account these properties. It is possible to approach the problem adopting the decision and risk theories [10,11].
Defined m state for the environment, called “environment state”, the decision analysis identifies the sequence of actions, which, acting on the environment state, produce an effect on the system, [10]. In particular, it is possible to value this effect with a number on the basis of the selected indicators. Obviously, each action produces a different value which depends on the E_j “environment state”, where the action acts on; hence, each value is related to action/“environment state” couple and it can be defined as a specific quantity of a “benefit function”.
All these values can be reported in a matrix A, called “decision matrix”: each row of A is related to an action and each column is related to an environment state, which is characterised by a proper probability value. Basis on the estimates of indicators, any component A_{ij} represents the benefit function of the i^{th} action performed on the j^{th} environment state and is computed through the indicators which take into account correlations between components. The benefit function A_{ij} is associated to the probability value of the E_j, which is evaluated on the actual degree of knowledge on the state. In particular, if new data on the state are know, it is easy to adjourn this value of probability adopting the Bayes’theorem; it provides a mechanism for combining the initial (“a priori”) probability concerning the occurrence of an event with related experimental data to obtain a revised (“a posteriori”) probability, reducing the randomness of the analytical model. Starting from the “a priori” probability function of each environment state, p(E), it is possible to compute the “a posteriori” probability function of the state by:

$$p(E_j \mid X) = \frac{p(X \mid E_j)\, p(E_j)}{p(X)}$$

where E_j is the j^{th} environment state and X is the random vector of new data.
Obviously, a decision model can be optimised with reference to a objective function and, since the optimal decision doesn’t exist in deterministic manner for the presence of randomness, it is suitable to solve the proposed model using risk analysis theory [11].
The risk factors are defined as the product of the damage for the probability that the damage occurs. The risk analyses are assessed on the basis of subjective data, observations and experiences, performed during the risk factors individuation. Sometimes, the use of objective methods and tools to measure physic quantities, can oriented the subjective assessment. However, the subjective risk assessment is of account, since it permits:

- To establish a risk index,
- To define the acts to adopt,
- To indicate the lacked adoption of a prevention act.

Using the risk factors, it is possible to make the operators able to operate choices to define, manage and act systems.

Since the results of a decision process can be more than one, the optimal decision can be obtained selecting the result associated to best value. Assumed, in probabilistic manner, that the environment states E_i are mutually exclusive and $\sum_j P(E_j) = 1$ defined A_{ij} the benefit function of i^{th} act/j^{th} environment state, it is possible to define the benefit function associated to the i^{th} act as:

$$L_i = \sum_j P(E_j) A_{ij}$$

which looks like the probabilistic mean value of the random variable A_{ij}. The optimal choice is the one which presents the min value of benefit function L_i.

The risk index is defined as the probabilistic mean value of the damage random variable D:

$$\rho = \sum_j P(D_j) D_j \quad j=1,\ldots,n$$

where D_j is the j^{th} value of the random variable.

Hence, it is evident that the optimal choice of the decision process is the one which present the risk lowest value, assuming the benefit function as a damage.

5. CONCLUSIONS

The city and the industrial system play, therefore, a central role in the economic development of the territory from the moment that consume environmental energies and resources to one always increasing speed. The sustainable development is introduced, therefore, as the only realistic solution closely correlated to chosen the environmental and energetic political and the relative ones are characterized from dynamic decisional contexts, uncertain and, to times, conflict. They are necessary therefore arranges of support to the able decisions to reflect these characteristics and to manage the complexity that achieves. It will be able , therefore, the valorization of the single territory if it will be exited from logic of sporadic participations, in order to act in a system vision, in the synergy between local agencies and civil society. In the effort to catch up the sustainable , the services of planning and the competent authorities optimal with industries, energy, transports, takeovers, auxiliary services and infrastructures of support, adapt to the ability to acceptance of the atmosphere must guarantee one. This integrated planning will represent a particularly important element for the creation of the social and economic cohesion of the community.

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