

EVALUATION AND DESIGN OF THE ENVIRONMENTAL QUALITY FOR INDUSTRIAL AREAS: THE TUSCANY CASE STUDY

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Abstract

The APEA project (industrial areas with high ecological standards of quality and innovative services for businesses) introduced in Italy by the Bassanini decree, represents a great opportunity to combine environmental protection, land use planning and company competitiveness. APEA is an acronym of Ecologically Equipped Industrial Areas, and it expresses Public Administrations' purpose to join environmental policy and economical aspects. This new approach to territory planning, at a low environmental impact, promotes the APEA, as a tool to improve the quality of performance of production areas at various levels: in the planning, in the design and management, but also as a tool to implement within these areas, the environmental guidelines of the European Union in terms of improved competitiveness through development innovation.

So the paper describes the key component of APEA model developed in Tuscany Region, including information about planning, the main environmental challenges, creation of resources management plans, and provision of supporting policies. Moreover the document provides details on which industrial areas should be called APEA, with description of indicators and criteria to reach the Regional quality of APEA

1 Introduction

An appropriate change in industrial policy is urgent in order to respect and protect the environment and the welfare and that still need to ensure economic growth. The European concept of new industrial competitiveness is expressed in the economic abilities on a sustainable basis to ensure its population living standards and high growth and high employment rates .

The sustainable management of productive areas has become a crucial issue in the scenario of environmental policies for the industrial system. This sector is usually responsible for negative environmental repercussions, resulting from unsustainable patterns of production. Over-exploitation of raw materials, the use of non-renewable energy resources, and the emission of pollutants and the production of waste have weakened the industrial and manufacturing sectors. The presence of a productive area in a territory generates changes to the elements that make up that ecological environment, to the economic flow and to the supply and demand of social services. The three systems, Environmental, Social and Economic, are often interdependent, and the changes they undergo, due to the presence of an industrial area, may be negative on a system, meanwhile positive on another, or manifest diverse effects over time. Precisely because of the different spheres of government and the different effects that determines an industrial area in a defined territorial context, the industry's management in all its life phases, Location, Design, Operation, Requalification and Dismissal, is characterized by the involvement of a number of individuals, private and public: these individuals often pursue different goals that generate effects with specific consequences within the same local system, that is, a set of Production systems - Territory – Population. Improvements of these environmental, economic and social components, cannot be ignored by a logic of sharing and partnership between installed businesses, institutions and public companies that operate in this context and other parties present in order to achieve new models of development that point towards economy widespread, the ability to improve the quality of life and economic future of our cities.

This approach, in line with the principles of Industrial Ecology, offers a valid alternative to achieve the goals of sustainability in this sector, by adopting the principle of precaution and prevention of pollution and abandoning the end-of-pipe approach that is typical of traditional linear production systems¹.

¹ An important contribution to the discipline was given by H. Tibbs (1992) that has defined: "Industrial Ecology involves designing industrial infrastructures as if they were an of interconnected artificial ecosystems interfacing with the natural

2 From Industrial area to the concept of APEA

A productive area generates environmental 'externalities'² that are governed by regulatory instruments with the task of managing the changes in the territory's ecological system; one way of governing the production cycles in a way that consume raw materials, waste management, energy supply, the flow of traffic entering and exiting and emissions in the water and into the atmosphere follow a series of regulations in response to economic, social and ecological necessities.

For the past few years in the European range, community action has been identified and has advanced the awareness of a harmonious approach for the government to such extended externalities regarding an entire area, that it is capable of combining in a more effective manner an environmental protection and the economic needs of businesses, with a particular connection to their ability to compete.

Despite the presence of these tools, such as the *Framework of Action for Sustainable European Urban Development*³, at an Italian standard, the unified management and sustainable development of industrial areas is a relatively new issue, given the lack there of, until about fifteen years ago, whether it be a regulatory framework or of a cultural fabric that is capable of incorporating this new concept. On the basis of experiences conducted abroad, one of them being the realization of Emscher Park in the Ruhr of Germany in 1999 (*Eco Industrial Park*), and the adjustment of provisions in policies, the reality of Italian production is now changing its approach are exempt, evolving into the application of Industrial Ecology's guiding principles.

The eco-efficient Industrial area is made by technical and management requirements that aims to minimize and manage, in integrated way, ecological footprint in order to start a knowledge process about legislation, economic and social aspects and technical and planning requirements, in order to identify a model of sustainable productive area compatible with the local industrial reality. It's believed that such eco-efficient industrial area initiatives could bring great environmental, economic and social benefits as a contribution to ecologically sustainable industrial local development.

A growing literature is available on the design and development of EIPs. The *Field Book for the Development of Eco-industrial Parks* is one of the most comprehensive and useful frameworks available on the planning and development of eco-industrial parks. EIPs are becoming part of a growing, integrated network of environmentally responsible centres or clusters of development.

The theme of Ecologically Equipped Industrial Areas (APEA) was introduced in Italy by the so called D.Lgs. n. 112/98 "Bassanini decree", which refers to each individual region, the task to discipline matters by placing some basic reference points:

- 1) the APEA is endowed by infrastructures and systems necessary to guarantee the right to good health, safety and environment protection;
- 2) are characterized by forms of unified management of infrastructure and services;
- 2) production facilities located within are exempt from the acquisition of permits that cover the use of the services therein.

The aim of the decree was to direct the individuals appointed for the management and area planning to give way to the establishment of an innovative model of a production area whose strategic goal is to reduce resource consumption and the environmental impact of installed businesses to a minimum, using the same principles of industrial ecology, an evolutionary system designed to exchange energy and materials, meanwhile developing, internally, economic, ecologic and socially sustainable relationships.

Despite this decree, the regional legislative dictations in regards adopted until this day to still result in a minority, and diffusion of APEA in Italy depends on disparate and often broad choices influenced by the field of the initial regulations that generate them; in fact due to an analysis of regional legislation of reference it comes to show that the regulations of interest to the management of industrial areas come from different disciplines:

- territorial and Urban planning (25%)
- productive activities (25%)
- environment (50%).

This means that in some regions in Italy, the approach of the production areas to the principles of APEA, especially of new productions, results obligatory as well as determined during urban planning, while in others it's a voluntary choice, or that the methods of involvement of businesses and private operators in general

global ecosystem (...). It takes into account the natural environment schema as a model for solving environmental problems and create a new paradigm for the industrial system in the production process."

² Externalities means that an agent causes to other agents a "damage" without offsetting, or when an agent produced "benefits" to other economic agents without being compensated. Externalities are costs or benefits and are not traded through the market, so do not have a price.

³ Operational tool developed in 1998 by European Commission

show to be too different from what can be done through planning, agreements and contracts, disciplines, adhesions to committees or unions. The still gradual development of the APEA suffers, however, many regional regulations have a very wide field of standards, ranging from waste management, water resources, transport and logistics, security, etc.. in order to cover all environmental aspects in a systematic way.

In this inconsistent national legislative panorama, all the regions that have been active in regards, have had a general objective of verifying the strategic opportunity for the achievement and/or requalification of settled production facilities ecologically equipped in their territories, and thus define a new eco-sustainable anthropic landscape with the achievement of the quality of environmental integration of infrastructures and therefore establish a innovative method to regenerate and design industrial areas targeted towards productive use, with the purpose to convert the process of transformation from an environmental emergency to development opportunities in the territories. This process of execution and transformation may take several years, nonetheless the case studies made throughout the country that are already present, though sometimes only partially, the features provided by national regulations are not many.



Figure 1 APEA project of Zipa verde - Jesi (AN)

3 Planning for sustainable industrial development in Tuscany

If manufacturing development is to become more sustainable, then planning will play a key role in encouraging new synergies and networks by locating activities in eco- and traditional industrial parks. Its function will be to define a kind of strategic architecture or blueprint, which creates the right combinations of industries, infrastructure, technologies, skills, resources and legal frameworks to encourage industrial ecology to develop. For this situation to occur, planning systems need to be flexible, responsive to changes in industry and materials technology, and need to provide incentives to encourage greater integration of development processes.

So, APEA model has a key role to consolidate and attract businesses with a high level of technological content and, on the other hand, to contrast an indiscriminate occupational situation in productive areas based on logistics and heavy industry, which has a low added value and great environmental impact.

APEA have to be planned, realized and managed on the basis of “ecoefficiency” criteria, in order to ensure an integrated system of environmental aspects management, reduction and prevention of air, water and soil pollution, the protection of the health and safety as well as a widespread environmental improvement of territory.

In this contest, Tuscan Region intend the APEA as an innovative productive area developed and managed as a real estate development enterprise and seeking high environmental, economic, and social benefits as well as business excellence. This local authority is an important stakeholder in this commitment and plays key roles in promoting APEA development in its territory, through more aspects as decision making, creating policies, issuing laws and regulations, organizing pilot activities, providing financial incentives, encouraging innovations in technology and systems, fostering new markets and promoting both education and academic research partnership.

After national guideline (art. 26, [decreto legislativo n. 112 del 1998](#)), the regional law of Tuscany (since L.R. Toscana n. 61 22/12/2003) establishes as priority objective to develop a new concept of industrial areas, characterized by quality management systems and infrastructures for protection of health, safety and environment, obtained by local authorities assessment methods that integrate economical, social and environmental issues.

On the basis of these law information, a new Regulation (R.T. 2 December 2009, n. 74) clarifies and updates the APEA concept as: “an industrial, craft and mixed use areas, included in multifunctional contests,

equipped with pollution and emission control system; APEA are characterized by an integrated and unitary management of infrastructure, services to protect environment, security and health of operators and communities" (Art. 2).

In this way, the Region promotes, through this new regulation, an innovative model in relation to planning, design and promotion of industrial areas equipped with innovative technological infrastructure, which conform to current and future expected environmental standards. The document explains also procedures for checks and acceptance and for performance assessment.

This legislative document, enhances the relationships between different actors – including municipalities, businesses and the local community – and aims to optimize the sustainable use of resources in industrial areas.

The work, was aimed first of all to define the main features of APEA as follow:

- Sustainable urban planning and design of technological and mobility networks.
- Implementation of synergies between enterprises, through a unit management of centralized technological systems, common spaces, and common services.
- Closed production cycle that aims at the re-use of waste streams, and industrial symbiosis.
- Provision of barriers and other systems for the reduction of any kind of pollution.
- Use of renewable or low impact energy sources.
- Setting up of ecological platforms for waste collection, for water treatment, etc.

The Regulation makes difference between new industrial areas, and restoration of existing ones and gives to decision making bodies (Region, Provinces and Municipalities) specific skills in APEA planning and management, including regional financings to promote APEA diffusion on Tuscany territory. For existing area it's important reviews strategies that includes a baseline assessment for the area as a unit. The Regulation explores strategies and method through which managers of existing productive areas can gain the right to call their properties APEA. A global vision of area and a strategic planning process, drive site managers and their tenants to evaluate the benefits of participating in a regional APEA network and by product exchange as well as other means of improving their performance.

Moreover, the work team has elaborated guidelines⁴ of the processes and resources to support new industrial areas and existing ones, improving the environmental, social and economic performance of companies at each scale, through new services offered by APEA management, like:

- An integrated resource recovery system
- A system for encouraging and managing the exchange of by-product between companies
- Training and services in all aspects of eco-industrial development
- A single management/coordinating unit
- Public sector support in R&D, policy development, access to investment, and information management.

This guidelines, according to the Regulation, in detail, offers a rich menu of individual facilities, and shared support services, design options, including ideas for site and infrastructure design; moreover also cover strategies for achieving environmental performance and management.

Several basic strategies are fundamental to developing an APEA so, the Tuscany Regulation identifies the following as key strategies:

Management Entity

APEA members will need a management system that maintains their cohesiveness without compromising their autonomy. Except where external regulation or property covenants are involved, the community will depend on voluntary participation in any common initiatives.

An effective management entity covers a role of primary importance in every productive industrial environment so, the Tuscan Regulation provides for the identification of a Legal Entity (named in the Regulation as *Soggetto Gestore*) with specific role and functions for the improvement of pro-ductive areas, intend as organisms that can grow with the needs and developments decided and implemented with the

⁴ <http://www.regione.toscana.it/-/l-applicazione-della-disciplina-toscana-sulle-aree-produttive-ecologicamente-attezzate-metodologia-e-casi-studio>

actors involved: users, operators of the settlement, local government, businesses and service of the municipality.

Infrastructural feature

The companies in an APEA need a range of general services indirectly related to their production systems. These include governmental relations, dining facilities, purchasing of common supplies, information access, and many others.). Components of this approach include green design of area infrastructure and plants (new or retrofitted); cleaner production, pollution prevention; energy efficiency and inter-company partnering. By acting in common to procure these services, they can reduce indirect operation costs (especially important for smaller companies). By coordinating satisfaction of these tenant needs, the APEA management company can increase its revenues. Sharing services will increase opportunities for communication among employees of different companies and build the community spirit of APEA.

4 APEA rating: the criteria

A full evaluation framework for an Ecologically Equipped Areas combines economic, technical, social, and environmental objectives into a whole system. This means that APEA project can seek a design that optimizes objectives in these four domains as a whole, not separately. Clearly articulated objectives in each area, agreed by project stakeholders, will be essential. With this clarity site managers, and public Administrations will be better able to determine the trade-offs among the objectives in all four domains, economic and environmental objectives, social and environmental, or any other pair of domains.

The Tuscany Regulation establishes requirements to rating Ecologically Equipped Industrial Areas and foresee a score system points in order to evaluate them: each criteria have a specific score to add in order to reach the APEA qualify. There are two kinds of requirements:

1. Minimum: their satisfaction is necessary to obtain APEA status;
2. Flexible: it's possible to choice requirements functional and compatible with the territory, to obtain threshold necessary to obtain APEA status.

Several basic strategies are fundamental to developing an APEA; individually, each adds value and together they form a whole greater than the sum of its parts so, the requirements of Tuscany Regulation to satisfy in order to reach APEA status are articulated in:

- *urban*, about planning and design
- *infrastructural*, about innovative technologies and services
- *management*, about organizational requirements.

Urban criteria

Criteria for the APEA localization, are finalized to warrant a complete efficiency of urban and environmental systems, and they must:

- privilege reuse and fulfillment of existing industrial areas and buildings;
- evaluate urban system efficiency and functionality, about standard infrastructures, social and economical local factors that can warrant actual and future stability of enterprises;
- evaluate accessibility to major communication routes, fostering rail transport and intermodal transport;
- realize urban and area programs in spite of single isolated initiatives;
- assess the presence of environmental, historical, and urban bond, monumental, archeological, geological constraints, protected areas like natural parks, etc.
- evaluate environment quality and livability and promote innovative instruments.

Infrastructural criteria

APEA promotes environmentally improved performance, concerning industrial ecology and environmental sustainability. In respect of energy and environmental aspects, APEA are:

- equipped with infrastructures and networks coordinating system, to improve integrated prevention by air, water and soil pollution, and suitable instruments to make a constant emission monitoring;
- realized in geological and environmental safety;
- provided with system to maximize energy efficiency (cogeneration systems, renewable energies use, heat waste recovery, etc.);
- equipped by the presence of:

- environmental data station detection
- waste management systems
- water safe management systems
- collecting and treatment waste water system
- collecting and treatment emission system
- production and distribution energy system

Management criteria

The management of an APEA, entails both traditional and innovative responsibilities and generates potential new revenue streams for the property manager. It's an APEA priority, according to regulations of Tuscany Region, the creation of a single entity, who represent complex industrial settlement enterprises, able to act as interface with municipality and other public stakeholders, to arrange operative planning program, to promote contracted formulas with municipality, to manage action settlement through infrastructural and services creation and to arrange for maintenance and management of common services and facilities. Management entity can be represented by Municipality, industrial development unions, mixed public/private societies, etc...A wide distribution and a correct application of the management of industrial areas, if done, may have great potential in the Italian context strongly characterized by small and middle sized businesses, which in size, hardly ever detains financial and human resources to devote to the implementation of a system of environmental management. The attempt to apply the management system to entire production areas could therefore offer advantages in this sense, allowing the area obtain a better overall environmental image with consequent benefits in terms of attracting businesses and investments.

In detail, urban and infrastructural criteria provides with technical requirements directed to diminish and to manage the pressures on environment in an integrated way, applied to buildings, industrial facilities and common areas, bought in, have the ambition and the aim of transforming the entire area in a system to serve its users. A system, which is in its integration, becomes a tool for its users by creating and providing content for environmental sustainability: living healthy, active safety, passive safety, comfort, but also socialization and connection services. Infrastructures (for sustainable mobility, energy saving and production, for water management, lighting, waste management, access control, the web server, WiFi access points, video surveillance, irrigation, etc..) will be centralized, and they are characterized by simplicity available to all actors involved. The APEA planning aims that buildings and infrastructure are designed optimizing the efficient use of resources and minimizing pollution generation. It's essential to minimize ecosystem impacts by careful site preparation and environmentally sensitive construction practices. The whole area will be designed to be durable, maintainable, and readily reconfigured to adapt to change. At the end of its life, materials and systems can be easily re-used or recycled.

The realization of Ecologically Equipped Industrial Areas, become such a tool for local governments and for the entire areas to support the economic and social development, since the implementation phases, will generate jobs and opportunities for the construction industry and support socio-economic area.

5 Lessons learned

Multifunctionality, a shared vision of development, the use of innovative technologies, simplifications in the procedures, special arrangements and good management, all in accordance to the rules and environmental standards, seem to be the essential elements towards the key to resolving the problem of industrial areas that effect a large part our country. But the solution is to be found primarily in the dissolution of conflicts between innovation, development and a harmonious environment, where harmony means that natural balance in the environment, whether it be anthropic and their natural communities that share it, keeping alive the issue of mitigation caused in an industrial area because of them. In that case priority goes to action that interfere primarily on local development policies that are to be directed towards limitations in the phenomenon of dispersed building forms installed that generates less control of land destination, consenting the limitation of land usage, a real national emergency (an progression of cementation has seen an increase in built areas of 166% from 1956 to 2012), for example through privileges of redeveloped areas rather than incentives of new establishments, just as they become necessary procedures of approximations between fields of scientific knowledge and communication, to go against the perception of environmental hardship, all for a better scheduling of operations for productive establishments in our country. The process for those marginally confronted in the national legislation to APEA standards may represent an answer to the anticipation these tools have generated, yet that up until today have not given light to that well awaited environmental competitiveness.

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