REPORT 6

SUSTAINABLE DEVELOPMENT AND FUTURE OF CONSTRUCTION ITALIAN INVENTORY REPORT

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NATIONAL REPORT

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1. INTRODUCTION

The authors suggest that Italian future scenario depends on the capability of the our country to deal with the global economic changes of the present times. The competitiveness in the international market requires the adoption of measures which tend to balance the safeguard of environmental systems with the needs of an economic recovery. Such trends probably will be dominant in Italy for the next year, and will feature the steps required to create sustainable development. For this reason the Italian report intends to analyse first of all the prevailing economic dynamics which can affect the decision-making processes and the implementation of an environmentally conscious strategy.

2. ITALIAN ECONOMIC SITUATION

Italy is going through an economic phase of transition which started in 1992 and is characterised by:

- restrictive policies in public expenditures, set to reduce the great public debt accumulated during the Eighties;
- constant effort of industry to achieve higher productivity rates, as their main strategy in order to participate in the global exchange market,

Present trends in economic policy aim for a rapid and secure economic recovery for the next year, which is considered attainable only by the introduction of Italy into the first group of countries joining the European monetary Union in 1999.

Objectives of an economy on the mend and increasing GNP will lead to great impositions on our country, regarding taxation pressure, cutback in salaries and reduction of expectations from the welfare state. Such aims are pursued, in fact, in a context defined by a socio-economic development model which has the following structural features and problems:

- absence of large amounts of natural raw materials; dependence on foreign countries for 80% of national needs for fossil fuels; in the sectors exposed to international exchange market, vocation to the production of high added value goods (for instance instrumental goods, cars, household appliances, etc.) and intermediate goods (for instance building materials and components) (see Tables 3);
- different growth measure of the advanced northern regions with respect to the southern regions which still lie in a worse economic state generally and with under-utilization of human resources;
- heavy unemployment figures (national average of 12% and over 20% in southern regions, mostly in the youth population);
- negative birth rate;

- drop in the role of the big enterprises (financial services groups, industrial companies, insurance companies) and presence of big public enterprises, raised in previous protective conditions and with a low grade of modernisation;
- development entrusted to small-medium enterprise's vitality, innovation capability and competitiveness in the international market.

3. ITALIAN CONTRIBUTION TO SUSTAINABLE DEVELOPMENT FOR THE NEXT 15-20 YEARS

3.1 Introduction

As regards changes in direction of a sustainable development, objectives formulated for the short-term seem lacking in "strong" options. The three fundamental issues of a sustainable development strategy in our country, i.e.

- protection of productive ecological systems,
- increasing division between the growth of production and environmental damage,
- changing economic objectives from quantitative growth to qualitative development,

are subordinate to the needs of economic pickup and improvement of the employment situation, to which, at least in the short-term, the government is able to respond in terms of a traditional industrial policy.

To realise the obstacles that limit, in Italy, the possibilities of taking decisive action in the direction of sustainable development, one has to consider the distance between the earthly Ecological Footprint of this country (a datum available only for the years up to 1993, expressed in m^2 of area per head and produced in 1996) and the theoretical availability of surfaces for ecological productive systems into its frontiers. The leap of 5/1 means that the Italian socio-economic system uses an environmental carrying capacity of 5 times as much as the national resources may offer. Even though the value is lower than in many other industrialised nations, the evaluation of needs for growth in economy and major consumption styles do not allow for the prediction of a drastic turnabout in the use of natural productive systems (see Tables 1-2).

The first step forward is a progressive reduction of local and global environmental damage. A development model shows that in Italy, however, there will not be trends to withdraw from the improvements gained, as little as they would seem.

3.2 Decisive factors and trends

For the year in progress a trend is foreseen of economic growth based upon the environment capacity of sustaining influences of human activity, as far as the limits defined by environmental laws permit. The national and regional normative system in defence of the environment - which extend quite widely from the control over emissions of industry and urban pollution, the purchase of energy saving measures, the defence of water systems, the defence of the environmental and cultural estate, to the

Environmental Impact Valuation for great infrastructures - at least ensures the minimum level of protection and prevents major environmental risks. In spite of continuous threats to their application, these normative systems form a relatively efficient tool for the sustainement of high quality environmental systems.

Some factors which contribute to a higher grade of sustainability:

- recent activities of the Ministry of the Environment (such as the adoption of a law on waste finalised to reduce the quantity of refuse products, development of waste recycling and utilization for energy purposes; the continuous incorporation of EU directives into national law; the promotion and enlargement of natural parks and protected areas; the special measures for protecting, cleaning up and renewal the city and the lagoon of Venice and the city of Brindisi);
- the research and development activity led by the ENEA (National Authority for New Technologies, Energy and Environment), directed to promote development of renewable energy, productive process efficiency, product innovation finalised to a reduction in the use of scarce raw materials, introduction of solar technologies in buildings, etc.;
- the adoption of the Sustainable Development National Plan (1993) in the execution of the Agenda 21 program (but considered mostly unfeasible);
- the Italian participation in IPCC (Intergovernmental Panel on Climate Change) and the commitment to stabilisation of CO_2 emissions at 1990's level before 2000;
- the participation of the city of Bologna at "Urban CO_2 Reduction Project", co-ordinated by ICLEI (International Council of Local Environment Initiatives);
- the first voluntary initiatives for accession to environmental agreement systems (ecolabel and ecoaudit) by a small but growing number of industrial companies, mostly in the chemical sector.

3.3 State of the environment and the territory in Italy

The main problems emerging in the case of Italy concerns above all:

- structural problems; need for infrastructure modernisation, growth, productivity, moderation in cost of the welfare state ;
- important trends; growth and specialisation of cities: tendency to extend the city borders as a result of the process of sub-urbanisation, also without population growth (taking away territory from agriculture and from woods and interfering with natural areas of global ecological interest); tendency to functional specialisation of uses of the urban ground as an effect of the land market which tends to eliminate the differences between activities from the urban tissue/web ;
- rapid de-industrialisation and accelerated expansion of service industries ;
- stabilisation of big cities and growth of small and average cities ;
- like in the rest of Europe, the decrease of pollution due to industries and heating owing to the substitution of sources of energy (natural gas) and to relocation of industries out of urban areas ;
- increase in the big cities of local atmospheric pollution linked to urban transport on the road (tropospheric ozone, nitrogen oxides, carbon monoxide), of noise and of traffic congestion ;

- increase of the natural resources used and of waste emissions as a consequence of the increase in economic activities and change of life-styles; high levels of energy consumption (domestic sector represents 1/3 of total consumptions), increased use of water (but 30%-50% lost before reaching the end-user) ;
- adoption of trends of economic and industrial politics which are mainly based on the capacity of ecological systems to absorb the effects of the economic growth ;
- cities will suffer the consequences of an environmental change and of the deterioration of global natural resources ;
- the increase in the deterioration of suburban areas around the major cities ;
- the worsening quality of life in urban areas ;
- the increase in the quantity of derelict industrial land in cities, consequently the intensification of de-industrialisation processes ;

The Italian situation, furthermore, features some phenomena and peculiarities, compared to other western industrialised countries, such as:

- the end of the expansion processes in urban areas and the prevalence (already over 50%) of the transformation process of existing buildings over new construction activity;
- the presence of the most important and a considerable quantity of historical-artistic patrimony in the world;
- the high quality of areas of territorial resource (agricultural, coastal, mountain) and of ancient settlements (small cities, central urban structures, networks of small centres);
- the existence of a large preserved and protected patrimony of monumental and historic buildings;
- the trend by some regional and local administrative authorities of implementing activity for the transformation initiatives on territory with advanced objectives towards sustainable development in an independent manner by national programming lines (i.e. Toscana, Lombardia, Trentino-Alto Adige, etc.).

Such issues contribute to partially down-size the framework of existing environmental problems (deterioration of environment in major cities and of rivers are among the principal ones), and would be the basis of endogenous development trends founded on local resources, so that offering good long-term prospects to the alternative and various paths to sustainable development.

3.4 Intervention guidelines for the future

3.4.1 Requalification of territory

The government investments over the next 5-10 years will be probably be concentrated on the interventions directed to modernise and maintain the principal infrastructure networks (urban underground systems, motorways, high speed railways, structures to develop the sea traffic), the most important of which, for the short term of their realisation, concerns the works programmed in the Capital on the occasion of the Catholic “Millennium”. Alongside these, however, there have been defined some urbanistic programs supported with national and European funds and regarded

especially significant because of their nature of demonstrative experience and their ecological contents, such as:

- the ecological urban renewal of the neighbourhood of the city of Rome, well-known with the name of Saline-Ostia Antica (see study-case);
- the initiative of soil reclamation of the derelict industrial settlement of Bagnoli (Napoli), which received state funds in 1996, to allow the project of a complete transformation of the area in order to develop eco-compatible activities and enhance green public areas;
- the plan of reclamation, re-conversion and environmental valuation of the basin of the Lambro, Seveso and Olona rivers (territory which represents the 15% of the area of the Lombardia region, comprises 5 million inhabitants, and at the same time is one of the richest and most deteriorated areas in Europe); the territorial planning of this area has the peculiarity of an organic integration between the objectives of ecological restoration and a development led by alternative approaches which will base on local resources;
- the project for a derelict industrial area in the city of Torino, named "RE-Start, Renewable Energy Strategies and Technology Applications for Regenerating Towns", promoted by the Directorate General for Energy (DG XVII) of the European Commission and co-ordinated by RESET e.e.i.g., which is the most important project approved in the Energy/Building Chapter during 1996; it promotes some targeted demonstration projects concerning an innovative energy-environmental integration on the city scale;
- the plan for environmental safeguard and cleaning of Venezia's lagoon, incorporated in the public financing law of the 1997.

3.4.2 Activity of Research & Development, Process and Product innovation

Among the various strategies of government intervention capable to stimulate further progress towards secure sustainable development are the activities of research and development led at the present time by the ENEA in the sectors of the environmental technologies, the development of renewable sources of energy, of innovation of product and especially in the fields of energy saving and of the application of advanced solar technologies in buildings.

In the area of construction; Italy has already led for ,ore than a decade several initiatives in the field of experimentation with passive solar systems and components and of implementation of bio-climatic buildings tanks to the co-operation of corporations, of national research (National Council of Research, Universities, ENEA) and firms. A not very relevant part (5% of the interventions financed by the state), but however significant for its innovative character, the public housing property presents already a large number of technological and installation related integrations aimed at energetic saving whilst the buildings are in use. As a consequence of engagement of the research institutions of the University in the bio-climatic building field, pursued and intensified during these last few years, one expects a further circulation of passive solar concepts and technologies in the implementation of new buildings and particularly in the planning of urban requalifying and of the resources of existing buildings.

A particularly important field in the Italian climatic context will be represented by the research aimed at the summer natural air-conditioning of buildings and at the future application of concepts therein expressed. Such expectations are motivated by the expansion of the demand for better standards of comfort and by the reduction of operating costs; such demands appear to be contradictory in consideration of the technologies currently available.

3.4.3 Protection of the environment and territory

The process of integration in the EU and the consequential normative harmonisation will enable Italy to adopt the measures of environmental safeguards subscribed at European level, significantly more advanced with regard to the national framework and with the possibility of making use of European structural funds for assistance in the clearance and support of depressed areas.

The major boost to environmental safeguard politics (although sectorial) currently due to the initiatives of the Ministry of Environment (parks politics, rules for waste management, incentives for the use of renewable resources and of innovation of product in the industrial field);

Long term actions possibly adaptable in the environment and territory fields, include the following:

- definition of strategies on the base of control standards of pollution (water, air, soil, noise, chemical substances)
- engagements on the physical structure of the city (use of the ground, transport, public open space, planning and zoning);
- development of trends to greater efficiency of compact settlement models and mixed uses of the urban ground; currently tendencies operate in opposite directions (decentralisation and specialisation uses of urban ground), consequential increase in the number of private vehicles, increase in the number of families and the reduction in average household size;
- reduction in the impact of activity on the environment (energetic saving etc);
- in the field of transport, reduction and rationalization of the demand of mobility, increase in the use of public transport (currently only 20% of the total demand);
- management of the natural resources;
- energy efficiency (net consumption of resources per unit of service produced);
- waste recycling

3.5 Conclusion

It may be supposed that, as far as Italy is concerned, the future scenery of a medium/long term period named “considered sustainment”, as a consequence of the processes in operation that synthesise the aspects indicated thus far:

- adoption of engagements in defence of the local and global environment, which is not to be more ambitious than the main indications at international level;
- increase in processes of endogenous development and of independent decision-making processes of individual administrations that tend to counter-balance the

consequences of the lack of economic political lines explicit in the direction of the endurable development on one side and to bringing forward some changes which will in any case be indispensable on the other.

Tables

1. Ecological Footprint for Italy (per head) (date 1993, 57,120,000 pop.)	
Productive ecological systems	**[ha/ph]**
Territory for energy (absorption CO2)	1,10
Agricoltural land	0,27
Pasture	0,55
Woods	0,23
Built up area	0,06
Terrestrial	**2,21**
Sea	0,90
Total productive ecological area used	**3,11**

Ref: P. Lombardi, *L'Impronta Ecologica dell'Italia*, in M. Wackernagel, W. E. Rees, *L'impronta ecologica*, Edizioni Ambiente, Milano 1996.

2. Ecological balance for Italy (1993)	[ha/ph]
	2,21
Availability of terrestrial productive ecological systems in Italy	0,44
Deficit of productive ecological systems in Italy	-1,77
Mean Availability of productive ecological systems in the world	1,53
Deficit of productive ecological systems in Italy with respect to mean Availability in the world	- 1,44

Ref: P. Lombardi, *Italia 2000, Iniziative per un Paese Sostenibile*, in L'Attenzione, rivista WWF per l'ambiente e il territorio, n. 4, Dicembre 1996.

3. Balance of energy in Italy (1996) [millions of tons equiv. to oil]	
Production	34,2
Imports	157,7
Exports	18,1
Deposit variations	1,2
Gross internal consumption	**172,6**
Consumption of Fossil fuels	153,3
Consumption of Hydro-electric Power	19,3

4. METHODOLOGY

The presence in the national territory of a large number of schools on sustainable thought in buildings have persuaded the research group to develop a methodological strategy for the collection of the necessary data for the compilation of this national report. In particular we have developed a questionnaire containing the principles questions on which to have an answer to define in our country the sustainable buildings for the year 2010. This questionnaire was sent to the research centres with interests finalised to the same principles, distributed on the national territory, and in particular to the various university departments, in particular the architecture faculties, to obtain a scientific and technical verification on sustainability themes.

A large number of documentary studies and publications (see Bibliographic references) has been consulted by the task group to define the background of the report and organise the information.

5. ANWER ON MAIN QUESTION AND 5 SUBQUESTIONS

5.1 Main question

The meaning of sustainable constructions, and more precisely of sustainable building, can be defined by the following principles:

- complete interaction with the environment, and its natural phases and its resources availability
- they are designed for efficiency of functioning during the time
- they are designed for the longevity, the re-use and recycling of their materials
- they are designed to optimise energy efficiency
- they avoid the production of refuses and dangerous emissions in the phase of construction and during the life itself of the building
- they foresee air-conditioning elimination, where possible
- they avoid the use of electricity for heating and cooling, through passive design
- for their construction local, recyclable and re-use resources have been used
- they use little exhaustible materials, like wood

To follow these principles does not mean to apply these concepts to our buildings, but means most of all to verify the sufficient conditions for its application in the economic conditions in the way to influence less as possible on consequences that the application of more than one principle could cause on the environment.

However in the definition of the concept “Sustainable Construction”, it is appropriate to specify that these principles are necessary but not sufficient in order that to build in a sustainable way, it is fundamental to base our foundation on a “sustainable society” where harmony exists inside peoples, between peoples and with the planet.

Which will be the foreseeable consequences of sustainable development in the industry of construction in the year 2010?

The environmental issue in our country, which has by now assumed an historical dimension, has passed from an origin with characteristics of protestation, from which sprung the requirements of limits and prohibitions, to a position which has in time assumed always more a position of proposal, intended as a means to supply new development models.

The old purely defensive position has been abandoned in order to acquire a new one which meets the agreement also with the economical subjects (the productive sector, the industries, ...) for whom this new conception badly reconciles.

The contrast which characterises the economical position relatively to sustainability derives from the certain absence of an acceptability threshold within which interventions aimed at reaching an environmental equilibrium may also be convenient from an economical point of view. Practically, how much are we willing to invest in sustainability terms, and which is the limit over which interventions aimed at an environmental equilibrium are no more sustainable?

According to a statistical study brought forward in these last years in Italy, the environmental issue defined as a better relationship with nature, even if it is broadly perceived, acquires only a role of secondary emergency. In fact, because of the absence of clear and accessible information, it derives that the environmental degradation assumes principally a meaning of “health risk”; this, translated in the building field, and in particular in the role they assume as shelter or dwelling, means a greater attention towards that criteria which interacts above all with the physical health of man. Therefore the consequences of the concept of sustainability in the built environment are translated into:

- use of materials which are not dangerous for man’s health who uses and lives in these spaces;
- less waste of resources (such as water, territory, natural environment) as their distribution or reduction has a direct influence on man’s life;
- quality of the built product (creation of healthy spaces) which implies life quality;
- recovery of pre-existances (existing buildings, unused areas, building principles) which allows the re-appropriation of unused spaces and cultures by now lost.

Transferring these principles directly into the building industry sector, we obtain:

- research of new materials for buildings in order to satisfy the requirement of non toxicity of the built environment;
- rationalisation of the resources present on the territory and utilisation of renewable resources;
- research and introduction into the market of innovative components able to render the built product an efficacious system for the control of dwelling quality;
- greater credits and greater investments of the building industries in the sector of building retrofitting, therefore specific competencies, compatible materials and more information.

The numerous existing building patrimony (historical and not) in Italy favours the trend of the building sector in this direction. In fact, it is believed that in a near future, the beginning of the next century (2010), as it is already taking place in these years, the trend of the building industry in Italy will be directed exactly towards the re-development of existing buildings, not only as a recovery of the historical and cultural patrimony of our country, but above all as it represents a 'renewable' resource which allows in all the phases of the building process, from the urban re-qualification up to the utilising phase, to follow the enunciated principles of sustainability without great waste and dissipation of the resources (just think of the almost total elimination of the phase of destruction, with the re-utilisation of the building materials, of the re-discovery of principles and building qualities of energetic saving inherent in buildings of the past, and of the possibility of integrating innovative technologies which utilise renewable resources such as the sun).

5.2 Five subquestions

1. What is implied in the planning of the cities and of the built environment in the year 2010 ?

Following the principles of:

- increase of settlements with centralised production of energy (ecological village)
- transformation of abandoned areas into natural areas
- constitution of small specialist settlements with "zero" consumption (low consumption)
- ecological revision of the in force rules and procedures for the localisation, dimensioning and organisation of settlements,

the consequences that sustainable development implies in this ambit, lead to the realisation of planning and building processes which:

- evaluate the environmental efficiency of settlement models and diffuse principles of ecological design of settlements;
- utilise vegetation as a symbiotic nature/building technology by means of processes of transformation of micro-climate, reduction of pollution, re-equilibration of cycles, urban agricultural production, etc..

2. What is implied in building design, construction, maintenance, use and demolition in the year 2010?

The impact related to the use, the management, the distribution and the final disposal of the product by now hangs over the impacts determined by fabrication. Therefore the prospect of sustainability requires the strengthening of the processes of dismaterialisation both of the production and of the consumption, the reduction of the intensity of matter, energy and emissions into the environment for each rendered service unit (eco-efficiency).

Following the principles of:
- buildings constructed for man's health and for nature's health
- attention towards life quality and not towards life standards
- respect of local resources
- which follow functioning principles
- which respect the use vocation of the pre-existence and the consequent function
- new typologies and building systems which are ecologically characterising,

sustainable development for buildings implies in a medium term prevision (2010):
- the formation of competencies in the field of conscious design respectful of the environment
- the formation of a consciousness of the "sustainable" in the operators of the project, the process, building and the use of buildings of the future
- control of the building process, with a particular attention towards the problems of buildings' life cycles, materials recycling, demolition of works
- control of the quality of urban and building spaces, in order to define intervention strategies and to define, through the individuation of risk and critical elements, the modes and the procedures which allow the government of the process of retrofitting existing buildings
- buildings which contain not dangerous furnishings for man and which therefore result highly reliable and with best performances in time; i.e. buildings which, having low maintenance costs and optimised exercise expenses, are also economical houses.

The objective of dismaterialisation may be reached by operating on more lines:

1) to increase the efficiency of employment of resources in the phase of process and production, i.e. reduce the indemnity of environmental damage for unit of fabricated product and for unit of generated income.

2) to optimise the employment of environmental resources on the whole life cycle of the product, through a re-design of the product which improves its environmental performances in the phase of finding and choosing the raw materials, in the phase of utilisation of the product or in the phase of its disposal. The development lines of eco-design are numerous: the miniaturisation and the lightening of the products, the employment of renewable or biodegradable products, the reduction of toxic substances, the improvement of the energetic efficiency of the product and the limitation of its releases, the capacity of adaptability and of self-optimisation, the easy maintenance, the re-usability and the possibility of easily dismantling the good.

3) to substitute the satisfaction of consumption needs with services instead of with new merchandise, with dismaterialised services instead of with physical goods, i.e. by expanding the life duration, the intensity of use and the number of users of existing goods. In other words, it means selling information instead of goods.

3. What is implied in the production of components, materials, services and assembly in the year 2010?

With reference to the conditionings of availability and cost of energy, it is necessary to have a programme of development of processes, technologies, innovative systems for production and transformation of energy and exploitation of national resources, renewable sources and energy saving.

Following the principles of:
- use of recyclable materials
- easy dismantling of buildings and possibility of re-utilising employed resources
- reversibility of building processes
- use of local material, energetic and productive resources
- use of high efficiency plants
- plant control and management according to the specific user requirements and not to the services
- employment of technologies and systems which use renewable energies (solar passive systems, photovoltaics, etc.)
- employment of integrated components
- new ecological technologies which act in civil plant design and installation and in the production of sub-systems.

Sustainable development in these sectors implies:
- the evaluation of the penetration of passive and hybrid technologies for climatisation, with particular reference to summer cooling.
- the in depth studying of the issues and of the necessary changes in order to arrive at practising an interactive technological innovation which considers the user and the environment, conscious of the inescapability of the limits of growth.

In particular, from the research sectors which operate in the fields of energy and environment arrives a technological offer with a transversal value and plurality of application camps, principally aimed at:
- process technologies: laser, robotics, irradiating technologies, separating technologies, agricultural bio-technologies;
- plant technologies: fluid dynamics, thermodynamics, combustion physics and engineering;
- materials: functional materials, advanced ceramic materials, materials for high temperatures, membranes, thin films, plasmas;
- modelling and computer science: mathematical models and high performance calculations, artificial intelligence and expert systems, image treatment, decision support systems, territorial informative systems;
- diagnostics and measurements: tele-bearing, agricultural bio-technologies, advanced diagnostics, bio-sensors.

In the energy sector, the technological process is awaited principally for:
- components and equipment which utilise / produce / transform energy, improving its performances (electrical engines, cars, building shells, domestic appliances);

- processes, in particular industrial processes for the fabrication of products of any nature (production of aluminium, heat recovery in brick furnaces, re-utilisation of fabrication rejects and residuals);
- systems, through the substitution of products or actions on the conditions which determine the demand and the management procedures (substitution of transportation method, reduction of mobility demand, traffic fluidification, automation of domestic appliances management).

The development will particularly concern the energetic components for the habitat aimed at the improvement of the dwelling quality through the development of technologies, materials, furnishings and network services, designed for the people's comfort, their safety and protection and considering individual and social needs. The following is foreseen:

- technical and "standard" guides for the intelligent management of the building system, adequate for the climatic profiles and the users' needs with the development of modular systems for new buildings and retrofitting;
- development of connections with external tele-services and their integration into the living system;
- assessment and definition of functional characteristics of new classes of domestic appliances adequate for domotic connections;
- tests on domestic appliances and equipment of illumination with high energy efficiency.
- In the field of new renewable energy sources, the development of the following is foreseen:
- photovoltaic technologies;
- innovative solar thermal components for residential and tertiary buildings;
- application of wind energy;
- energetic qualification of biomass;
- qualification of design methods for bioclimatic architecture and for buildings with low energy consumption with the analysis of spontaneous typologies and the design of components and systems.

4. What is implied for the human resources and the necessary capacities for the building industry in the year 2010?

In the next years, in the building industry a great technological effort is required, oriented in particular towards the transformation of products and production processes through the adoption of innovative technologies able to satisfy the new environmental needs. In this sense the protection of the environment is not so much a constraint to economical progressive, but more of an opportunity for investments and new demands of goods and services.

For an innovation policy it is therefore necessary to promote aimed programmes for the transfer to the companies of the research, of the competencies and the processes, and for the diffusion of technologies with the actuation of new forms of interaction between research - university - production companies - services.

The inter-relations between the different phases of the innovative process are such and so many that it is necessary to operate in a parallel and synergetic way on both the demand and offer sides of research. In a context where the range of available technological options for the industries are ever expanding, no company can count on its own forces to cover the innovation needs and therefore the alliances and the technological exchanges become ever more necessary.

Therefore, following the principles of:
- reduction of the built impact on the environment,
- in depth studying and diffusion of the competencies

The activities of technological support and promotion in the environmental sector for the industrial system will consist of:
- specific but well integrated competencies of the various processes of building, from the design to the construction to the disposal of the buildings;
- increase of the responsibilities on the consequences that buildings may have on the environment;
- validation and certification of products and processes (eco-label, eco-audit);
- development of innovative technologies in the environmental field;
- pre-normative research activity for the safeguarding and improvement of the environment;
- development of evaluation methods of the risks tied to the presence of physical, chemical and biological agents.

5. What is implied for the issue of R&D in the year 2010?

In Italy, in the environmental sector the finalisation of the R&D activities must consider the following issues:
- territory government from an urban and hydro-geological point of view;
- reduction of air and water pollution;
- minimisation of the production, recycling and disposal of refuse;
- management of the marine resources and of the coastal pollution;
- limitation of the impact of activities related to the agricultural, industrial, mobility and transportation systems;
- diffusion in the production system of low environmental impact technologies;
- correct management of the water resource (minimisation of the use of stratum water, efficiency of purification, re-use distribution).

In terms of development of research themes, sustainability implies:
- interest for the great horizontal issues such as energy, environment, mobility.
- interest for the issues of environment and man’s health safeguarding and the promotion of strategic researches directed towards these.

In the energy field one of the principal objectives is the development and the modernisation of the national energetic system oriented towards:
- rational and efficient use of energy and resources (demonstrating interventions and experimentation of new energetic technologies for residential employment and

building retrofitting, energetic-environmental diagnosis, innovations in production processes, formations of technicians and diffusion of information);
- innovative technological solutions for the exploitation of renewable and alternative energies (research, experimentation and diagnostics on advanced photovoltaic systems, certification and diffusion of solar thermal systems, qualification of eolian sites, processes of thermal-physical conversion of biomass and industrial refuse and their energetic utilisation);
- realisation of advanced plants and infrastructures for the best exploitation of combustible fossils and energetic diversification;
- new technologies for the reduction of consumption and of the polluters produced by urban transport systems;
- technological solutions for the problem of radioactive refuse;
- technologies and systems for the feasibility of energy production from nuclear fusion.

6. MAIN GENERAL CONSEQUENCES FOR WHOLE CONSTRUCTION INDUSTRY

6.1 The resource “built and natural inheritance"

Among the resources mentioned in the common methodology for the phase III it has been retained to emphasise the resource “built and natural inheritance”, which is intended as the exploitation of the urban, territorial, natural and archaeological settlements, characterised by the particular historical, architectural, environmental value, often protected and internationally recognised (UNESCO) as a resource and inheritance of the whole human kind.

In Italy, particularly, this resource is of great interest because of its importance and diffusion and it is also of increasing value for all the human activities in all sectors and not only in the field of construction.

6.2 Main combinations between principles and resources and consequences for phase

6.2.1 Planning

Combinations
- preservation and exploitation of the built ant natural patrimony
- reuse to the territory in terms of re-qualification and restoration of areas in bad conditions

Consequences
- development of rules and standard at each level of planning and design, defined on a environmental and geographical basis

- development of strategical programmes for the production/transformation/use of renewable energy resources and the recycling of resources water and materials
- development of new systems for the land mobility
- development of restoration and re-qualification programmes
- increasing analysis of environmental consequences for all the phases of the building process and risk analysis related to the transformation process on the environment.

6.2.2 Design

Combinations
- reuse and restoration of built and natural patrimony
- extreme exploitation of the renewable energy resources
- pursuit of excellent quality of materials, their durability and non-toxicity
- reuse of the resource water

Consequences
- increasing centralisation of design as the synthesis of the conditioning factors of the whole building process
- revaluation and re-integration of “traditional” technologies from an innovative point of view
- study and implementation of innovative technologies for the exploitation and reuse of energy resources, water and materials
- study and implementation of innovative technologies for the building envelope.

6.2.3 Construction

Combinations
- use of recyclable and non-toxic materials
- protection of the land and preservation of the resources water and nature

Consequences
- minimising of the effects of the construction activities on the environment
- specialisation of the construction companies and manufacturers in the sector of restoration, recycling and demolition
- specialisation of the construction companies and manufacturers in the systems for the building envelope
- increasing intersectorial partnership between construction companies and manufacturers
- development of control and monitoring of the construction activities

6.2.4 Operating

Combinations
- energy conservation
- reuse of the resources water and materials
- protection of the nature (land and build and natural inheritance)

Consequences
- sensitisation of users to the problems of building operating and maintenance
- development of tools of regulation and control (manuals, codes of practice, etc.) for the operating and maintaining activities
- introduction of computerised systems for the building management

6.2.5 Demolition

Combinations
- land and built and natural patrimony conservation
- reuse of the resources water and materials
- protection of nature (land)

Consequences
- definition and development of selective demolition techniques
- development of methods and tools for the technical and economic assessment of the deconstructing activities
- definition and development of methods and techniques for recycling materials and their destination

7. MAIN RECOMMENDATIONS

7.1 Introduction of rules and standard for the sustainability and eco-compatibility in the planning and design activities

- systematic introduction of the principles of sustainability and eco-compatibility in the land and urban planning tools, by means of rules and standard at each level of the transforming activities of the land and human settlements
- definition of the correlations and verification of the suitability of the interdipendencies between the different levels of planning and design
- definition of the evaluation and approvation criteria of the planning and designing results in terms of sustainability and eco-compatibility.

7.2 Continuous and permanent education

- promotion of programmes of initial and continuous and permanent education of the operators in the construction sector, at each level and for all the operative phases, in order to create a common conscience of the problems of the sustainability in the professional activities and to train specialised operators with finalised competencies.

7.3 Control of the constructing activity

- definition of means and activities minimising the effects of the constructing (site), maintaining and deconstructing activity, with respect to the surrounding life conditions as well as the waste of resources (materials, water etc.) and environmental pollution; this in the perspective of an increasing development of the building and urban restoration activity

- responsabilisation of the construction companies and manufacturers on their activities, also by adopting criteria of company management aimed to quality in terms of eco-compatibility (Quality Systems)

7.4 Exploitation of the resource “built and natural inheritance”

- exploitation of the land and human settlement patrimony in terms of resource more than constraint, in the perspective of real economic development with effects in all sectors (industry, tourism etc.)

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9. CASE STUDIES

The choice of the cases study have take into consideration the great field of buildings interventions needed for the following research, therefore examples are among the most significant of three different field of interest: urban planning, retrofitting (multi-storey building in historical centre) new building construction (scholastic building) and building component. The cases of study on urban planning are the following two; one regarding urban regeneration, Saline-Ostia Antica close to Roma and the other is the urban masterplan of the Municipality of Cavalese in the Province of Trento. Both examples are very significant, in the first case, there is a considerable sustainable intervention of urban planning, in a consolidate urban structure, the other is an example of big interest for the possibility to diffuse the Town planing instruments to increase energy savings strategies especially in other Italian Municipalities.

The schedule of the retrofit is about the Bianchi Palace, a early XIX century building in the historical centre of Perugia, this choose was given by the necessity to individuate the retrofit principles, in historical buildings.

For what concern the new building construction we have chosen a school building to point out the building construction processes phases in design, construction, and practising. The last schedule is referred to the building component, a window, studied and realised to maximise ventilation, solar gains radiation and shading factor.

The chosen cases study are the most representative in the sustainable scenery for the Italian Industrial construction of 2010.

The schedules are divided in four parts, at the top on the left side, there is the description of the project, the location with the indication of the name designers.

On the right side is indicate the typology of the intervention.

The schedule is divided in two columns, one for text description and the other with photographs and drawings.

A stripe at the bottom indicate the processes phases, resources and principles of the examples analysed.

P1 Urban Planning case study

URBAN REGENERATION, SALINE -OSTIA ANTICA, ROMA, 1995

Architects: F. Sartogo, J. Eble, M. Bastiani, V. Calderaro

Saline-Ostia Antica represents an urban organism covering 900 ha on the outskirts of Rome, whose history has alternated between consolidation and cycles of decline. With the recent agricultural reclamation operation, it has regained its structure and identity. But today the agricultural crisis and progression of the built city are compromising the morphological and structural continuity. The project will reconstruct the relationship between built city, agriculture, and natural environment in a visibly global system.

The organisation of innovative technological elements such as the "Energetic Power Ecostations" will restablish the flow of circulation, infrastructure, and create new urban polarities.

Water Concept
- Introduction of rain-water channel, and water point systems.
- Support of bioclimatic urban vegetation bu the water system.
- Cleaning lagoon system as new landscape.

Urban vegetation and bioclimatic system
- Bioclimatic green central spine
- Green belt against pollution and noise from the two roads
- Inter-relation of specialised agricultural border gardens and the internal
- green space of the new solar buildings.
- Urban forest connecting the lagoon system and the green border.

Ecological and Energy Concept
- Use of solar energy for water control (canals and ponds)
- Photovoltaic innovative technology for public lighting
- Ecostation, covered market, social and activity space, covered by
- photovoltaic panels producing energy.
- Biogas power station
- Mixed function district
- Solar district
- Urban district
- Solar pilot project with example of zero-energy building

BUILDING PROCESS PHASES: urban planning
RESOURCES: land, existing building, energy and water
PRINCIPLES: nature protection, renewal and recyclable

P2 Urban planning case study

THE NEW URBAN MASTERPLAN OF CAVALESE (Trento) 1991

Architects: G.Stelzer, G. Carlino

The urban masterplan of the Municipaly of Cavalese promotes a series of technical and co-ordinated measures, normative for energy savings interventions, discouraging law elusion, for an adequate solar energy use in the new buildings constructions and/or in retrofitting and in general in the research of building quality and in the valorisation of existing buildings.

Five levels of building intervention are checked in the Cavalese masterplan, some of them enter directly in the normative and technical advisory, while some other belong more properly at the dimensional-program- management of the administration. The first two levels individuate the planning level and the building level which much more are involved in the sustainable development of the city.

Planning level

- Individuation of new edifying areas.

For the individuation of the new building areas Municipality have produces the "solar plans", to use in parallel to other instruments for territorial analysis.

- Building density and forms of edification.

From the energy point of view is foresee the possibility to build adjacent "jointed" in the way to reduce losses from the building.

The building level

- Right to sun

The new projects have to take into account a series of typological schemes foresee by the plan , to verify the graphical envelope shadows buildings.

- Thermal insulation

This point facilitate all the intention to insulate in a consistent way the own building, and define the use of the insulating and the quantity.

- Solar components

The volume of solar components, such as, the volume of greenhouses and veranda south, south-west and south-east exposed, can be added to the maximum allowed building volume.

- Glazing surfaces

The Cavalese masterplan define also the form and the dimension of the windows and their number in relation of the size.

BUILDING PROCESS PHASES: development and planning, design
RESOURCES: land, existing buildings and energy
PRINCIPLES: conserve, re-use

P3 Historical building retrofitting case study

PILOT PROJECT FOR THE INTEGRATION OF RENEWABLE ENERGIES BIANCHI PALACE PERUGIA, 1995.

Architects: F. Sartogo, M. Bastiani, P. Baldugrani

The basis of the case study project for Bianchi Palace derives from historical-critical research on the environmental and climatic morphological matrices, the project take part at the Rubuild Pilot Project and was launched under the RECITE Programme of the European Union, in response of their policy for the promotion of renewable energies.

Principal concepts of the project

- Functional and energetically rationalisation in the use of the building (atrium, elevator, services, horizontal and vertical distribution elements).
- Elimination of the sixth floor addition.
- Emphasis on the reconstruction of the "Atrium", as a reminder of the original "corte, with the function of vertical element distributing energy flows for solar passive heating, passive cooling and natural illumination of the internal spaces.
- Utilisation of the consistent masses of the wall structure as thermal accumulation elements (for cooling or heating according to the different seasonal conditions).
- The transparent covering system, composed holographic- optical elements and photovoltaic modules, allows to direct solar radiation into the atrium below in order to illuminate the internal spaces and thermally charge the existing wall masses during warm periods, while it allows to intercept direct solar radiation during warm periods, directioning it towards the photovoltaic modules in order to produce electric energy. Due to the "chimney-effect", the atrium also permits the cooling of its wall masses during the night-time in warm periods, for the passive cooling of the building.
- Integration of the bioclimatic system with technical systems through the use of the same air circulation system; expulsion air as cool source for the heat pump during warm periods in order to increase its efficiency.

BUILDING PROCESS PHASES: operate
RESOURCES: existing building
PRINCIPLES: Conserve, re-use

P4 New building case study

ELEMENTARY SCHOOL OF PONZANO IN EMPOLI 1996

Architects: Marco Sala Associates

The project of the school building poses an interesting problem for the energy designer from the point of view of energy conservation. Occupancy is both various and impermanent: classrooms are used to a greater or lesser extent according to their function; the length of a school day is generally shorter than a working day but after hours activities in the form of cleaning and extra curricular/adult education courses result in the extension of energy utilisation in any given day. Defining the areas where energy is used and sequentially identifying the areas of waste is the logical and essential process which must be executed. Many are the energy saving strategies used in this school building:

1. Ventilated roof
A metallic roof with controlled openings is realized above the classroom ceiling structure. Vasistas ventilation windows, internally operated by command rods, permit the obtainment of a transverse ventilation under the roof.

2. Super-insulation of walls and roof
Super-insulation of walls and roof is obtained by means of panels in expanded polystyrene with closed cells.

3. Insulating glazing
Reduction of winter heat losses and of the "cold wall" effect both for walls and ceilings.

4. Natural ventilation
The incorporated ventilation in the window frames excludes the possibility of annoying gusts of air for children.

5. Thermal bridges
Exclusion of thermal bridges, by means of interposition of a continuous insulation layer on the heads of walls and floors. Insulation of the ground floor from the earth.

6. Buffer space
The central distribution space also acts as a southern solar caption greenhouse during winter.

7. Special glazing
Use of a special glazing with air exchanger, reduction of heat losses from direct window ventilation.

BUILDING PROCESS PHASES: design, operate
RESOURCES: energy, materials
PRINCIPLES: conserve, renewable

P5 Building component case study

NEW FACADE TECHNOLOGIES,ACTIVE INTELLIGENT WINDOW

Architect: Marco Sala Associates

The Active Intelligent Window. is comprised of a range of elements each with a specific or variable functions depending on outdoor conditions. The elements are contained in two main sections: the upper section contains the glazing panels, which in turn enclose variable transparency film operated on a roller system. The lower section is within a compartment clad on the interior by a filter panel and on the exterior by a punctured opaque glass panel; contained within these panels is the rotary heat exchanger and an upper and lower fan for air intake and exhaust respectively. The intelligent control system and sensors are also located here, as well the local control for the different configurations. The heating strategy of the window covers the concepts of solar collection, heat storage and heat distribution; while the cooling strategy refers to solar control, internal gain minimising and heat dissipation.

The entire unit is contained by a P.V.C. frame that allows the insertion of the whole element into the building structure, as well the substitution of damaged elements.

The glazing is made up of two panels: the external laminated glass panel and the internal low emissivity double glazed panel. The aim of low emmisivity glass coatings is to reduce the radiation exchange between the internal and external panels of an insulating glass unit.

The movable film within the glazing panels is utilised at all times of the year: along its length it has a section that is 100% reflective which may be wound onto one of the upper rollers, another that is 50% reflective onto the other upper roller and linking the two is a transparent film.

At the bottom of the glazed section is a tensioner to keep the film taut and allows free movement of the film; this configuration allows control of solar gain and insulation levels in an innovative manner.

BUILDING PROCESS PHASES: design, construct
RESOURCES: energy, materials
PRINCIPLES: renewable