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TOWN PLANNING STRATEGIES TO REDUCE AIR
POLLUTION.

European guidelines, approaches, experiences and experiments.

prof. arch. TULLIO CIGNI*

"It's not because things are difficult that we do not dare, it's because we do not dare that they are difficult " (Seneca).

" The fact remains that we human beings are the only living organisms on earth who are able to consciously change our behaviour. If peace has to be made between our planet and us, it's we who have to "(Barry Commoner).

Over the last two centuries, man has played the anomalous role of leading geologic force, he has been able to shape the planet and to transform the seas, the land masses of the globe, the atmosphere and the climate. He has become more influential than volcanoes, winds, earthquakes and all the other natural geologic forces. The conflict between man and nature has reached alarming levels.

Pail J. Crutzen, winner of the Nobel Prize in chemistry in 1995 for his contribution to the understanding of the ozone phenomenon, has coined the word *Anthropocene*, that is to say the age of man, to describe the current geologic change. P.J.Crutzen reminds us that *"...over the latest century the population of the world has increased fourfold, water is being used 9 times as much, fishing and industrial production have grown 40 times as much and electricity has been used 10 times more than over the latest millennium"*.

Man has modified nearly half the surface of the earth, raising the soil erosion 2-3 times more than natural rythms. By his activity, man moves 40 billion tons ore (for building, in mines, and so on) 10 times more than glaciers and 40 times more than the wind.

But what worries the most is the population rate of growth: mankind has taken two million years to reach the first billion inhabitants in 1830, it has taken 100 years to reach the second billion, 30 years to reach the third, 15 years to reach the fourth, 12 years to reach the fifth,

just 10 years to reach the sixth billion in 1997 and it is expected to grow up to 11 billion inhabitants by the middle of this century.

The corresponding growth of metropolis is as uncontrollable as the growth of population. Since its origin and for about 12.000 years (Gericco dates back to 10.000 B.C.), the history of towns is marked by a linear growth which undergoes an hyperexponential acceleration over the two latest centuries.

In the middle of the second millennium B.C., Thebes was the most populous town in the world with 100,000 inhabitants; in the V century B.C. Babilonia was the most populous with 250,000 inhabitants. In the I century A.D. Rome reached 1 million inhabitants while Italy had 7 million inhabitants and Europe about 30. After the fall of the Roman Empire, the supremacy went to Constantinople with 350,000 inhabitants and in IX century it went to Changan with 800,000.

Only at the end of the XVIII century did a town reach again one million inhabitants, that was Beijing.

In the middle of the XIX century, London was the most populous town with 2,300,000 inhabitants and New York reached the supremacy with 7,774,000 inhabitants in 1925.

However, it's only at the end of 1700, with the Industrial Revolution, that the structural process causing the uncontrollable expansion of metropolis is triggered off. All this, together with the uncontrollable consumer force results into devastating impacts on ecosystems and on ungovernability of the shape and the growth of towns.

It is possible to sum up the problems of urban areas in the following 7 criticalities :

1. THE DEMOGRAPHIC CRISIS

The contradiction between demographic explosion and the limits of environmental and energy resources is becoming more and more acute. In fact the cyclic processes of the ecosphere, which are conservative and perfectly consistent are permanently in contrast to the linear processes of the technosphere which are innovative but ecologically discordant.

2. THE URBAN CRISIS

The urban crisis is function of the hyperexponential growth of the population which tends to concentrate in metropolitan areas. In 1950 it

had a 25.4% growth and in 2000 it doubled (51.2%), in particular, in the most developed regions it had a 79.4% growth.

In the meantime, mononuclear metropolis tend to build up a system with other metropolis until they form a megalopolis which keeps on expanding. In industrialized countries, these galaxies include an enormous amount of diversified places with complementary functions where, however, the synergy among productive potentials results into an intensive exploitation of natural resources.

On the other hand, in underdeveloped countries, the population growth is higher and megalopolis, lacking the support of technology, collapse into chaotic urban heaps that play the role of multipliers of underdevelopment.

In 2005, with the current trend of growth, the most populous towns will be Mexico City, with 37 million inhabitants, Shanghai with 36 and Beijing with 32.

3. THE ECOLOGIC CRISIS

In industrialized metropolis, if it is not planned, the urban expansion tends to cause a destructurant impact on ecosystems mainly because of an intensive exploitation of lands and of non-renewable sources of energy.

Big amounts of industrial toxic waste are produced as well as land and water pollution because of chemical fertilizers and pesticides, air pollution and car emission, liquid and solid waste together with the uncontrollable proliferation of electromagnetic fields.

Every year millions of hectares of productive land are occupied by buildings and various kinds of road systems, but at the same time, over the latest 50 years our planet has lost 1/6 the tropical forests, the level of carbon dioxide has had 13% growth and the ozone layer has undergone 2% reduction all over the globe.

4. THE ENERGY CRISIS

According to the American physicist Conant, every minute the earth receives as much energy as the one issued by the combustion of 100 million tons lignite, thus "our future source of energy will not be the nuclear fission, it will be the sun".

Today, nearly no part of this endless "clean" source is exploited by the technosphere, we however keep on burning the reserves of fossil fuel which are polluting and nearly worked out.

As a matter of fact, 15% of the world developed population consume 85% of energy resources.

5. THE CRISIS OF THE PRIMARY SECTOR

Over the latest 40 years, the population has doubled, our planet has nearly lost 1/5 of its arable lands (only in the USA, 13 million hectares), while the growing demand for water is overcoming the sustainable limits of the ground water and causing the drainage of the course of the most important rivers in the world, as a consequence.

The fall of productivity, above all in the third world countries, has brought consumption below survival level, thus 1,300,000,000 people are estimated to be so poor that they are not able to satisfy their primary needs : eating and having a shelter.

6. THE CRISIS OF INFRASTRUCTURE

The progressive expansion of urban areas entails a continuous growth of road systems, plant-engineering networks and computer networks which are becoming more and more widespread, complex and sophisticated.

Both the human scale town, exploded and widespread on the ground, like Los Angeles, and the imploded, hyperconcentrated and height-developed town , like New York are in crisis.

The widespread model has found itself in difficulties because of time wasted in commuting, high expenses for fuel and huge spaces taken by motorways, traffic exchangers and car parks that occupy 70% of urban areas in Los Angeles.

On the other hand, the height-developed hyperconcentrated model is in crisis as well owing to the huge costs of endless urban restoration of road systems, plant-engineering networks and because of the very high concentration of pollution.

7. THE CRISIS OF TOWN PLANNING

The urban growth is still being thought of as a sort of addition to what is already existing, thus causing the destruction of large areas and a huge consumption of non-renewable energies.

All the past, present and future languages of town planning specifications are metabolized into countless combinations by the expanding megalopolis, with alarming results.

Far from representing the coming of an uninhibited and libertarian era of collective imagination, such a condition cannot but be regarded as consumeristic delirium with incalculable effects in terms of environment destruction. The metropolitan town tends to build up a system with other mononuclear metropolis and to become a widespreading megalopolis with tens of millions inhabitants.

In this way, the interfering effects of the aforementioned critical areas are causing the ungovernability of the shape and growth of towns. If we seriously want to contribute to the great theme of "*reconciliation*"

between technosphere and ecosphere, we need to change radically our way of conceiving town planning, deeply refounding the strategies related to town planning and favouring the establishment of the following fundamental options.

THE DEMOGRAPHIC CONTROL

The attention to demographic control which ONU has reintroduced in world conferences about population, highlightens a zero growth in industrialized countries because of reasons connected to the high level of welfare reached by them; on the other hand, in the poorest areas of the world the abnormal demographic growth is due to the high risk of mortality because of famines, epidemics and natural disasters.

THE SUSTAINABLE ECONOMIC DEVELOPMENT

It is the result of an economy which has to face today's needs but also safeguard those of future generations without compromising natural vital cycles. This new economic order cannot but be based on :

- the revision of productive, agricultural and industrial processes which need to be made consistent with the mechanisms of self-regeneration of nature and on promotion of usage of renewable energies;
- an anticonsumeristic revolution of personal lifestyle which leads to reduction of waste and pollution emissions, to recycling and to reconversion of urban waste, thus regaining thermoelectric power.

PROTECTION OF THE ENVIRONMENT AND OF HISTORICAL PRE-EXISTENCES

It is crucial for the survival of man himself and his memory.

In industrialized countries, where we notice that population is not growing and that there are more rooms than inhabitants, it is possible to preserve nature and biological diversity of species, restoring the previously interrupted natural balances as well as the total safeguard of *the multilayered town* that, characterized by unicity and irreproducibility, represents a small part if compared to the massive construction of the latest decades.

On the contrary, in developing countries, which are still facing an uncontrolled demographic growth and the pressing need of new houses, it does not seem acceptable to export the Western lifestyle.

We will be able to guarantee the protection of the environment and of historical pre-existences more than everywhere else by means of an anthropic intervention in vacant areas through bioclimatic

constructions, which will employ non-polluting elementary technologies, rooted into the *genius loci*.

THE READJUSTMENT OF THE EXISTING TOWN : REMOVAL OF NON-QUALITY CONSTRUCTION, RESTORATION OF THE VIOLATED NATURAL BALANCE, ENVIRONMENTALLY COMPATIBLE RE-ANTHROPIZATION

Generally speaking, over the latest decades nearly all the building has been built on the outskirts of towns, according to no organic plan, with no quality and devastating the environment. For these reasons, it is necessary to work in order to upgrade the areas radically. The urban and metropolitan scale of these interventions forces to face the matter by means of *project-plans*, that it to say tools that connect different subjects, from architecture to town planning, from ecology to sociology, from physical and chemical sciences to landscape architecture, making them collaborate on more and more wide and complex terms, orienting all the plan towards the new horizon of *geo-architecture*

The replanning of large urban areas cannot but be fulfilled through the *desurbanization* of unworthy building, the one especially built in the late 50s and in contrast to the environment balance, the partial *renaturalization* of the areas by means of an environmentally compatible restoration, the *reantropization* of the remaining part which is finally respectful to the environment.

THE SYSTEMIC REINTEGRATION OF ROAD SYSTEMS, PLANT-ENGINEERING NETWORK AND COMPUTER NETWORK

Nowadays innovative potential is grounded on endless fragmentation of work, with more and more diversified specialisation on one side and on the opposite need of interdisciplinary reintegration which is becoming more and more crucial, on the other side. This double movement brings about a continuous multiplication of networks to exchange and distribute streams of information, energies, goods and people all over the area.

They are the supporting framework of the new planetary town and this process is relentless and irreversible.

So, also in order to contain the huge consumption of power resources needed by the enormous urban concentrations, it is vital to consider the *future town* as an integrated system of *junctions* and immaterial *nets*, such as the Internet and material *nets*, such as intermodal traffic exchangers.

Thus inventing it again as a cabled organism and in bioclimatic balance with nature.

From this point of view, town planning will be *intelligent* if it isn't overloaded with plants and installations which will raise the consumption of non-renewable energies and if it succeeds in reducing these plants and installations and in reconverting those necessary for alternative energies, such as solar energy, aeolic energy, photovoltaic energy, geothermal energy.

THE FRAGMENTS OF THE FUTURE TOWN : ENVIRONMENTALLY COMPATIBLE URBAN UNITS AND ARCHITECTURE AS "PROTHESIS OF NATURE"

Architecture will need to change into an organism symbiotically related with natural environment. It will be determined not only according to geo-tectonic restrictions, to ecologic resources and to historic pre-existences, but it will also be structured as a prothesis of nature, that is to say as an organism which is activated by geosphere cycles and by renewable energies.

In general, single or clustered buildings will tend to lose their box-like identity to melt with other urban functions, into complex organisms, into environmentally compatible "urbatecture", into integrated service, birth-controlled urban units where construction will be reduced to the minimum and power and production self sufficiency will be pursued.

From the morphological point of view, they will take the shape of *metropolitan fragments*, they will be well organized, structured and differentiated in order to be consistent with the peculiarities of the areas : thus they will be complex, non-formalistic, asyntactic, anti-geometric, *unfinished*, flexible, discordant, contradictory, changeable, ambiguous organisms, open to plurilingualism and to users' creative transformability.

In short, a living space. Because they are antithetical to closed shapes, box-like, monumental and favourable to the aesthetic of chaos, they are the results of experimentations which go beyond the "*functionalist statute*" and "*post-modernism*", towards a new eco-politan frontier that acknowledges its matrix in organic and bioclimatic architecture and in all those expressionist, informal, deconstructivist, visionary, *action-architectural* researches that, destroying the wall box, set the internal function unlimited plastic potentialities free, no longer subject to prescriptions, theories or laws which don't belong to existential experience and to bioclimatic needs as far as the realisation of the integration of the building, the town and nature.

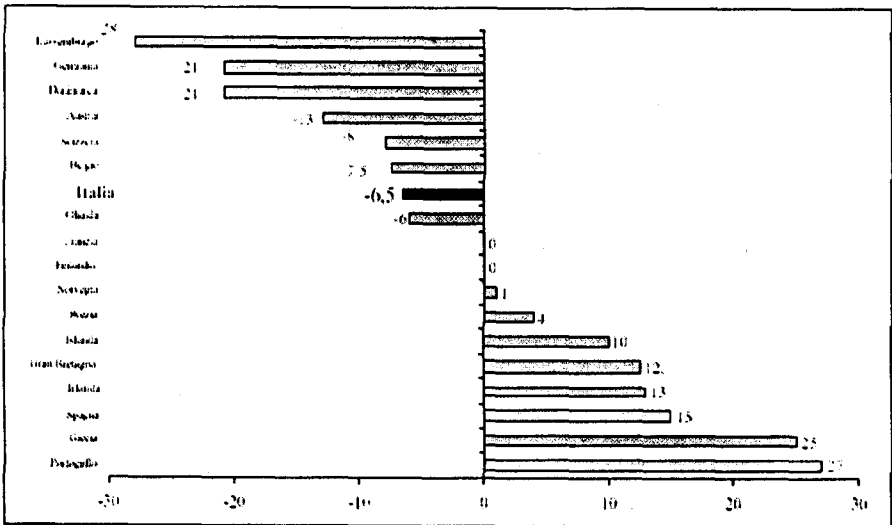
TOWARDS ECO-METROPOLIS

We should imagine a sort of *eco-metropolis*, that is to say a *network habitat* on a planetary scale which would elaborate and exchange culture and information and which would not be neither imploded nor congested. It will be organically articulated over the area, in balance with the eco-systems, powered by renewable energy and by a sustainable economic development, a living space which will be continuously adaptable to the changing needs of behaviour : in a word, it will be able to be included in that new civilization which will have balanced the ecosphere and the technosphere. Thus, the environment problem, the infrastructure of transports and accessibility, the replanning of areas and connections left vacant by industrial restoration will have same dignity, this will be a different way to consider the relationship between the past and the present. The new connections between the centre, the outskirts, the metropolitan area are the themes of the future town plan. It will also be possible to find real opportunities of connection with other scientific sectors, with public and private industry, with local boards and to reorganize the big functional systems of social life activities (education, production, culture, free time).

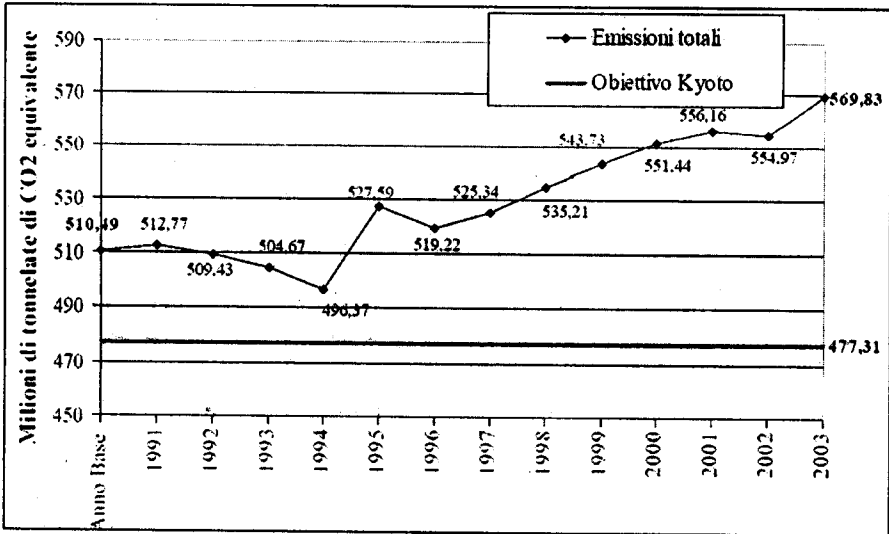
EUROPEAN GUIDELINES

It is known that the Kyoto protocol binds the most developed countries, responsible for 70% emission of greenhouse gases, to reduce 5.2% of their emission in comparison with the 1990 data by 2008/2012. On the basis of this protocol, Italy has issued some Guidelines for a 6.5% reduction of the emission of greenhouse gases corresponding to 90 million ton equivalent carbon dioxide.

In the European Community, the engagements to reduce the percentage of emissions in 2010, compared to 1990, are represented as follows :



The scenery of greenhouse gases is represented in the following diagram:



If compared with the average of European Community countries, Great Britain and Germany are adopting the most severe measures to reduce greenhouse gas. The British Government has presented a bill about climate change which sets a target of 60% reduction of greenhouse gas emission by 2050, delegating the Government to set a five-year carbon budget – the first from 2008 to 2012 – with mandatory limits of emission.

On the whole, today the European Community seems to have become more concerned about global climate changes. Common policies have recently been adopted to deal with the reduction of greenhouse gas, these will be translated by member countries into practical actions within a mandatory and coordinate framework which leaves very little space to pressures from single countries and single productive sectors. On the 20th of February 2007, The Europe Environment Council of Ministers decided to keep on reducing greenhouse gas even above the minimum target set by Kyoto agreement, in order to get to a 20% reduction of emission by 2020. The proposal has been eventually ratified by the European Council in March 2007.

Such recent evidences as the acceleration of the realization of the Kyoto protocol, the adherence of Russia, the targets announced by the United Kingdom and the new attitude of the Government of the USA, demonstrate that today there seems to be more awareness than in the

past about the theme of climate changes and above all about the necessity to pass from words to action.

However, it is not easy to pass from good intentions to good action. The fact that the climate change is a global problem implies that it should be dealt with on a global scale : no matter how virtuous the action of a country can be, it is not enough to reverse a trend. The crucial point lays on how to involve the emergent economies of India and China. Meaningful change is not likely to be obtained without a real adhesion to the targets of the post-Kyoto time by these countries and there is still the risk of provoking a refusal also among the productive sectors of industrialized countries which are forced to compete in a global market in heavily unbalanced conditions. On the other hand, a final and shared agreement on international scale hasn't been reached yet and it is still unclear how to share the sacrifices that all the countries will be supposed to make. The most industrialized countries are for the reduction of emission according to percentages starting from some date; developing countries would like different criteria in order not to be further disadvantaged remaining in a state of permanent backwardness.

THE STERN REPORT

The Stern Report is one of the fundamental documents which somehow represent a cultural change in the identification a new relationship between environment and economy. For the first time, thanks to this report, worldwide famous economists who work in well-established and very important organizations have faced the theme of global climate change and of the adequacy of the resources of the planet under a different point of view.

They no longer see those who consider environmental restrictions as a brake on social and economic development in total contrast to the pure defenders of the environment who recognize a risk of deterioration of nature in every single human action. In a very realistic way, Stern's report analyses the problems of the future development in the light of events which are already taking place (climate changes, appearance of new advanced economies, shortage of energy resources, raw materials, water) and comes to somehow unattended conclusions, such as :

- a. If nothing is done to reduce the impact of climate changes, its cost will be at least ten times higher than the cost of interventions to face and reduce the phenomena which will be taking place;
- b. The aforesaid cost is calculated according to current economic criteria and does not take into consideration the hidden costs due

to the deterioration of the environmental situation and of the quality of individual and common life;

- c. Nowadays, many technological and organizational tools are available to face the climatic emergency with no extra costs for the productive system and even permit a prospective reduction of expenses;
- d. The investments to face climate changes and to compensate for resources shortage will be highly profitable from the economical point of view and will be the developing engine for this century.

IPCC CONCLUSIONS

The IPCC (Intergovernmental Panel on Climate Change) reports confirm that we already possess the technologies and instruments to reach a substantial reduction of CO₂ in a reasonable gap of time so that it can get to acceptable level. It is a question of essentially intervening on the water cycle, making such interventions as, for example :

- ✓ the diversification of energy sources, augmenting the use of renewable sources, of hydrogen and of biomass in place of fossil sources;
- ✓ the rationalisation of the final usage of energy in the industrial sector;
- ✓ the reduction of consumption of energy in civilian sector (low-consumption electrical appliances, bioclimatic building, widespread renewable sources, heat pumps);
- ✓ the reduction of the environmental impact in the transport sector (biocombustibles, hydrogen, railway transportation and sea freight instead of road haulage, optimization of transfers of people and goods).

ITALIAN INTERVENTION POLICY

ENEA (Ente per le Nuove Tecnologie, l'Energia e l'Ambiente – New Technologies, Energy and Environment Board) is a public research organization whose task is to develop technologies to support development sustainability.

As far as global climate change is concerned, it operates on several levels :

- ↻ it takes part in the scientific activities of IPCC to select shared technologies to face climate change and lessen its effects;
- ↻ it develops factual actions aiming at opposing the causes of global climate changes, with specific reference to reduction of greenhouse gas emission, to reduction of consumptions and to the diffusion of alternative energy sources (more meaningful activities are aimed at the photovoltaic solar, at the thermodynamic solar

and at biomass because there is still much to be improved about these sources of energy);

- ↻ it lessens the effects of the climate change that is taking place by means of solutions that safeguard biologic diversity, in order to promote energy saving in building and diversification in agricultural production, as well as the safeguard of water resources and the opposition to desertification;
- ↻ it monitors the quality of the plants that produce energy from renewable sources.

The task is hard, the climate change is already taking place and the consequences become more and more evident.

Unlike what happened just a few years ago, nowadays in every scientific site people think that climate and environment phenomena are linked to anthropic activities, above all after the Industrial Revolution, which has brought about a strong development in all sectors, especially in transport, with the consequent raising of consumption of energy coming from fossil combustibles, besides the usage of technologies that imply the emission of big quantities of CO₂ in the atmosphere.

CO₂ IN THE ATMOSPHERE

According to the data included in the latest IPCC report, from 1750 to 2005 the percentage of CO₂ in the atmosphere has increased from 180 ppm to 379 ppm with respect to a capacity of the "earth system" to bear a rate that does not exceed 280-300 ppm. Also the concentration of marsh gas has exponentially increased and it has passed from a 320 ppb up to above 1700 ppb in 2005.

Between 1961 and 2000, the average temperature of the planet has risen one degree centigrade and the average level of seas 4 cm while in the northern hemisphere the ice surface has reduced from 38,000 to 32,000 square kilometres.

With no corrective interventions, the situation cannot but worsen also because such large geographic areas as China and India are quickly going through the path of industrial development and of improvement of the population's life quality with a massive and growing usage of fossil sources of energy and consequent increase of gas emission in the atmosphere.

It has been calculated that in less than 5 years the increase of greenhouse gases from China only, will be higher than the current one from USA. At the current rhythm of development of the Chinese

economy, the overcoming would take place more than five years earlier than it had been foreseen just 4 or 5 years ago.

The alarm of the scientific community has been underevaluated for a long time both by policy decision makers and by people themselves also because the forecast about climate change were long-term sceneries which even scientists did not completely agree with. Unfortunately, reality has denied this attitude too often, so today we do not talk of climate change as a futurity scenery but as a phenomenon which is already taking place.

The climate will thus have heavy consequences also on the world productive system, making water even rarer and more precious, provoking a cost rise in raw materials and in fossil combustibles, strongly modifying agriculture and having a strong impact on ecosystems and biodiversities, finally forcing to significant changes both in the international work distribution and in the production systems.

APPROACHES

As far as the futurity and virtual reality is concerned, there is not yet a consolidated set of rules and regulations supported by planning tools that are able to start conversion strategies to improve the area, to reorganize in a careful way, spaces, relationships and stratified hierarchies of today metropolis.

From the impossibility to apply town planning to the foreshadowing of great future sceneries comes the necessity to pay a different sort of attention to themes and problems of minor interest but more defined in their characteristics : probably no longer the anticipation of whole towns but rather the determination of those problematic junctions in the town whose planning is determinable in the present.

No more plans of an imprecise future, depending on quantitative and still decisions of a planning conceived in the present, but rather a few and limited projects to be worked out today with the awareness of being able to dominate the phenomena that take place in their specific contests in order to flexibly include them in a more general organizational framework.

From this point of view, the present phase is singly characterised by several approaches and experimentations involving both the borough dimension and, above all, the orientations especially referred to the matter of climate change and to the contribution that architecture can

give to saving and efficient use of energy and natural resources with the aim of reducing CO₂ emission in the atmosphere, to make the building container sustainable from the environmental and energetic point of view.

In Europe the energy quality certification was included in the 93/76/EEC directive, known as SAVE directive. It followed similar preceding dispositions which had been effective in Denmark since 1985 and then were adopted by the 10/91 Italian Act. However, when a first evaluation of the state of implementation of the directive was carried out, it was found out that only a few members of the European Community had adopted it (European Commission Joint Research Centre, 1999).

Recently a new European directive has been issued, it's 2002/91/CE, about energy in building and it has been adopted by member countries in February 2006.

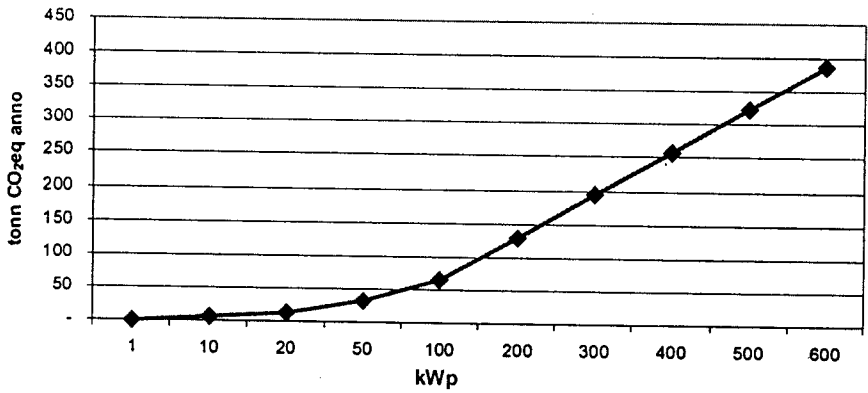
The new Directive mainly aims at promoting the improvement of energy performances of the buildings within the European Community and it guarantees that only energetically efficient and economically convenient solutions are adopted, above all for existent buildings.

The guidelines for the realization of the program underline that the certification must :

- be able to describe the energy parameters of the building;
- give useful information about the energy efficiency of the building also in view of a project of buying or selling it;
- list the possible interventions to improve its energy performance;
- treat the building-plant system as a whole, considering the plant-engineering components both in the substitution-planning phase and in the operation phase;
- be able to include energy saving projects that, in the case of the public sector, can be integrated by feasibility financial studies.

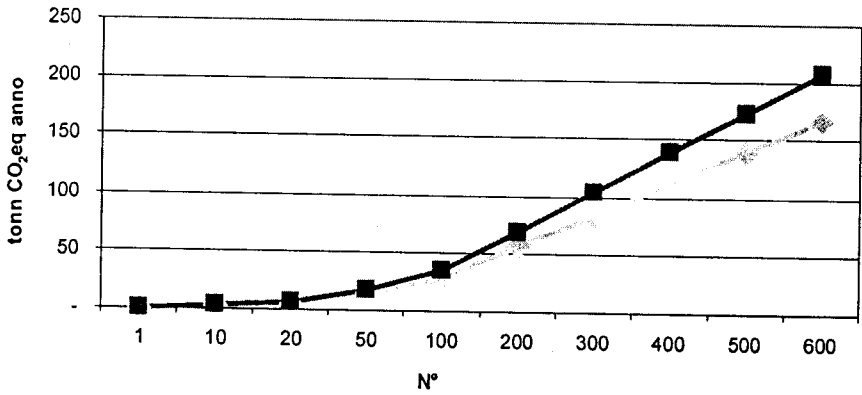
As an example, the following diagrams show the real reductions of tCO₂ eq/year, adopting appropriate plant technologies in building.

WITH PHOTOVOLTAIC SOLAR PANELS - POWER < 20 kWp

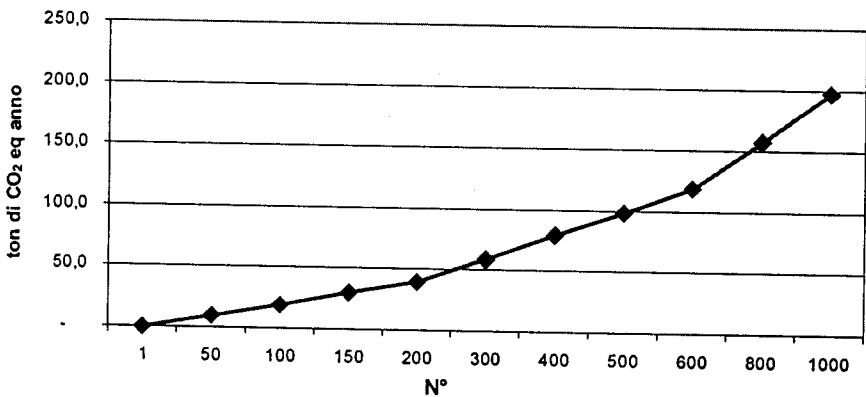


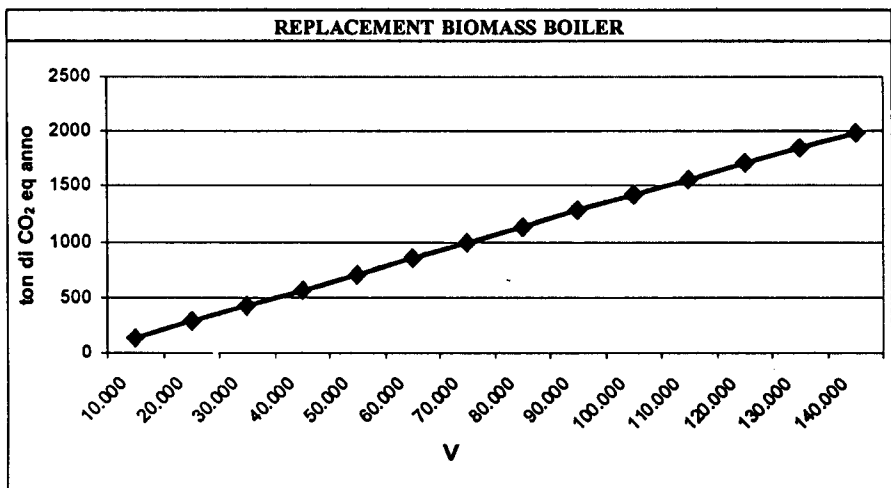
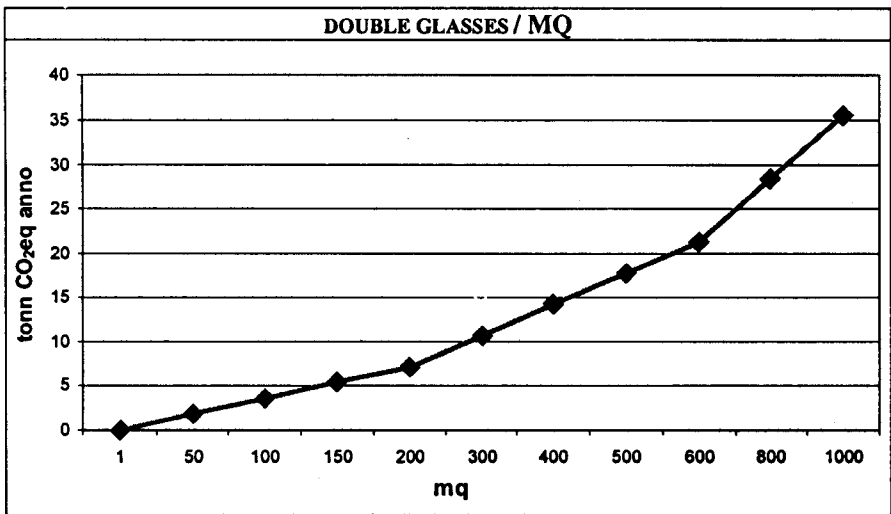
WITH THERMIC SOLAR PANELS 1.20 M X 1.60 M

LEVEL PANELS ■ TUBULAR VACUUM PACKED PANELS



REPLACEMENT OF HIGH WORKING ORDER BOILERS / N° OF APARTMENTS





PAST TIMES CITY

A classic town planning attempt founded on the presumption to obtain efficient environmental balance was the movement for urban parks when the designer thought he had conceived and designed a valid time resistant model. It had been activated in 17th century America but it had links and similarities with European schools.

Between the theories of positivism and the praxis of the government classes to support their power with social control measures there is the presumption of the proposal of some ghettoization models through which the health of future societies was supposed to be guaranteed. Most of the models proposed until the middle of the 18th century, not

as utopias but as realization of an environmental and social system which is scientifically and finally determined, are again melting in the grey and featureless metropolitan entities of nowadays.

In the history of transformations of big cities, the political power has always managed to plan spaces and urban shapes according to its self-preservation needs.

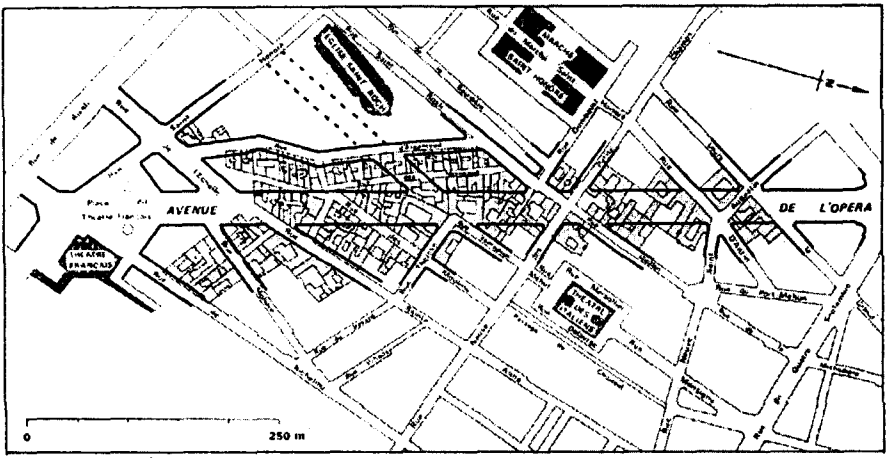
An evidence is in the Parisian transformation made by Napoleon III and by prefect Haussmann over just 17 years: the great supply and treatment services, the equipment needed for development and repression, transports from one place to the other in town and in the country itself, the unsustainable leases, the segregation of functions, the contrast between centre and outskirts and above all the large *boulevards*, the rectilinear axes made inside and outside the already built town, according to a military strategy worried about controlling and repressing riots and revolutions.

Actually, the rectilinear axes system and the consequent demolitions was not an original invention of the second empire, having been already proposed 200 years before by Wren in his project of the reconstruction of London.

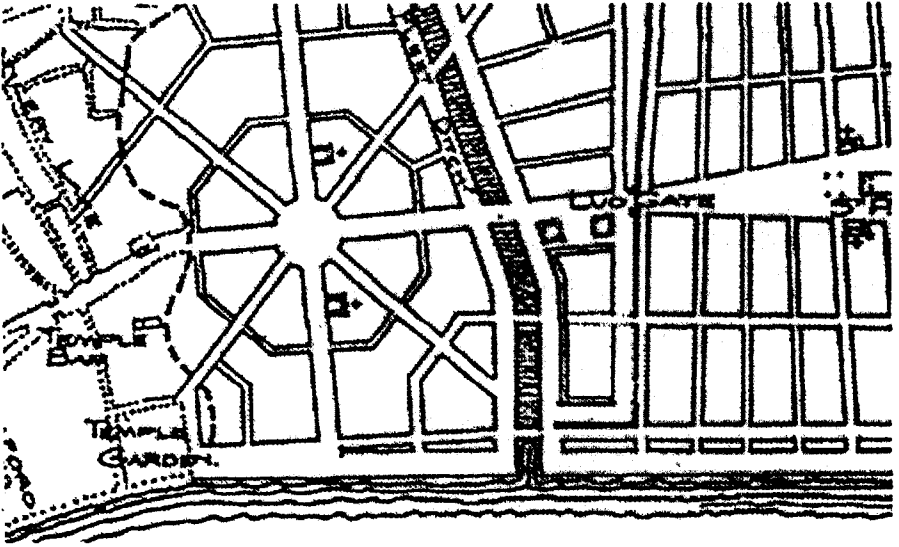
The objectives are always the same, both for the *radiocentric* Parisian design, the *reticular* one proposed by Cerdà for Barcelona and for the *concentric* design planned by Hobrecht for Berlin and Viminale Square in Rome, seat of the Ministry of Internal Affairs which was planned small and impassable to avoid crowds and riots.



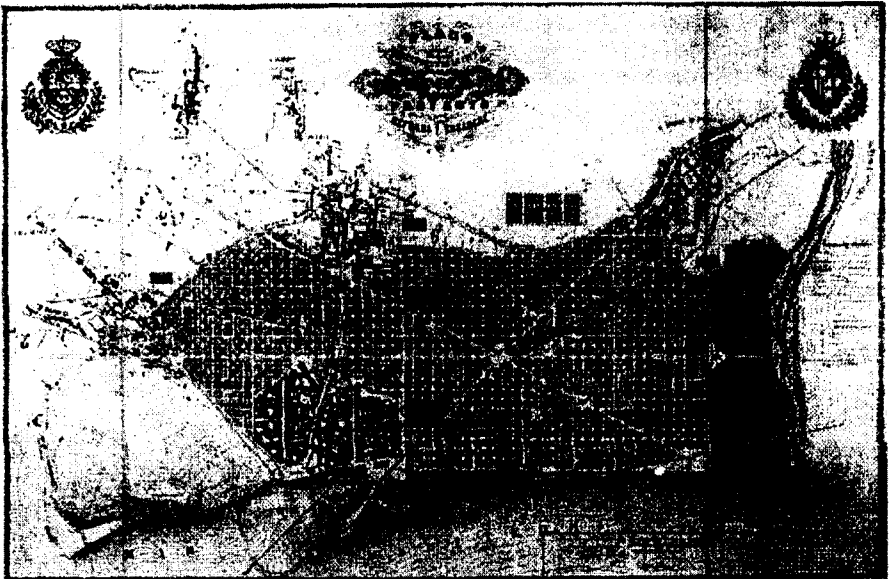
Haussmann-Paris. Black: new roads, red: the Grande Croisée (1852)



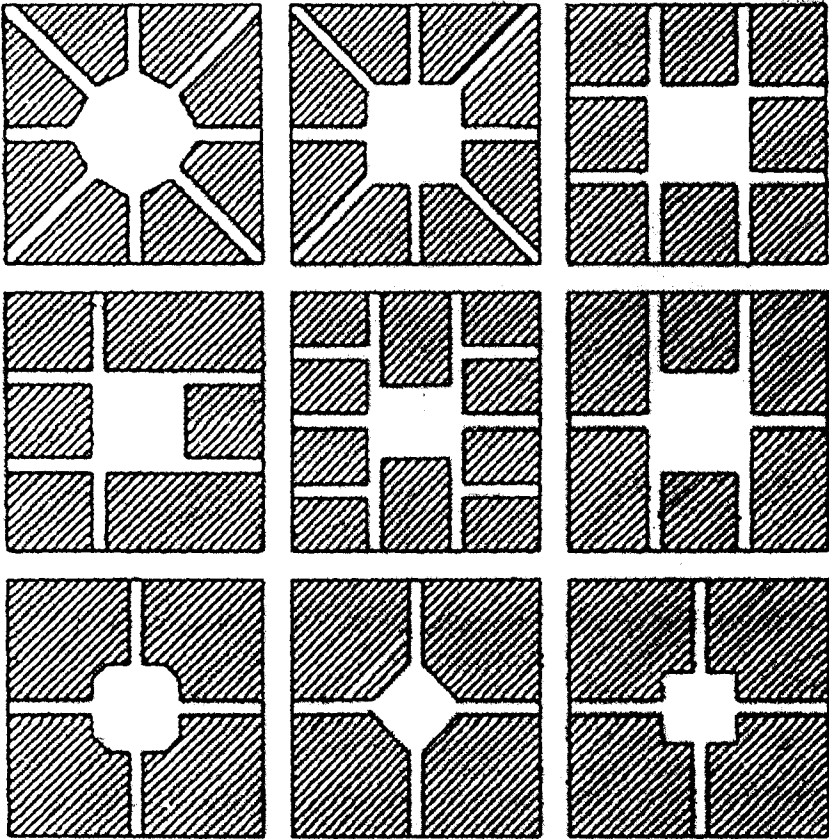
Demolition of a Parisian borough



Wren - London (1666)



Cerdà - Barcelona (1859)



Hobrecht - Berlin (1862)



Piazza del Viminale, Rome (1861)

THE FUTURE HAS ALREADY CAUGHT UP WITH US

In Bolzano, which is the main town of Alto Adige, a new borough has been built and certified A class. There is a hot water steam raised district heating which will work all the year long as well as a district cooling network that guarantees the supply of cool water for users of the Tertiary sector and Services only.

The users will receive 9°C water in delivery and 14°C water in return; the tolerance temperature is +/- 1.5°C.

Specific guidelines have been adopted in order to guarantee energy optimization also for summer cooling. These have been applied in the construction of buildings, for example constructive types characterized by high specific absolute gravity, the installation of proper external solar screen for glass doors and windows, generally leaving any reflective glass aside in order to exploit the free solar supplies as much as possible in wintertime.



Some other relevant cases of use of innovative technologies that emphasize energy efficiency and that would permit to realize sustainability from the point of view of CO₂ emission, reducing energy consumption, and in particular, reducing the emission of fossil combustibles are represented by superwindows. They are built with thin layers, produced with advanced technologies, which allow visible light but reflect infrared rays, permitting a 6-12 times stronger isolation than ordinary glass, they allow ¾ visible light and half solar energy and prevent heat to go out.

For example, Darmstadt passive house, built with these new technologies in a cold area in Germany has a thermal loss of only 15 instead of 500 kilowatt-hour/square metre every year, thanks to the isolation of windows and walls and with the possibility to use only 5% energy normally used in a cold area to heat: the integrative quantity of heat is so small that it can be provided by a gas boiler used

for the kitchen hot water and there is no need of central heating nor stove.

Something similar has been realized in Davis, near Sacramento, California, where a building planned over 255 habitable metres for an average cost of 250 thousand dollars, that is to say comparable with a building traditionally planned, has been planned so that roofs and specifically isolated superwindows, reduce thermal energy need up to 58%, enough to make both heating and cooling systems useless and a consequent saving of 92% energy expenses (including both ventilation and air conditioning).

As a proof that ecologically intelligent buildings can pay for themselves, the University Kings Building in Norfolk, England, 10,200 square metres, is the biggest naturally ventilated building : its narrow plant allows daylight to penetrate all the rooms and allows air to circulate in a nearly completely passive way thanks to a crossing ventilation system and to 8 big decorative chimneys connected to pipes which let hot air pass and fresh air to adduce.

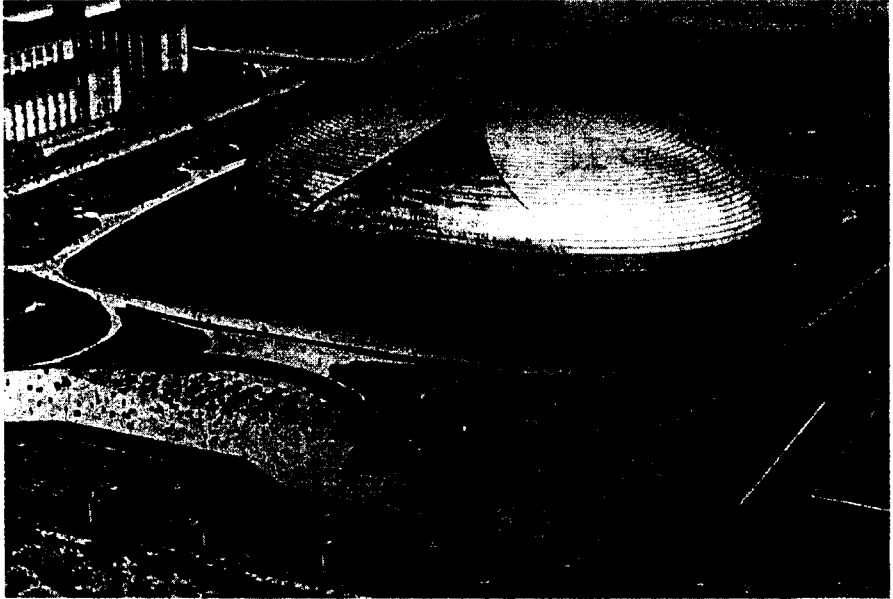
The conditioning need is reduced to the minimum also thanks to special isolating covers and heating is obtained from solar energy with passive processes. This building only consumes 25% energy if compared to the energy needed by similar buildings.

Now we have to focus on technological innovation in the building sector thanks to patent and technology transfer from major sectors like the chemical, electronic and aerospace industries.

Current architectural research is especially geared to including technological innovations that have radically changed our daily lifestyles.

Construction techniques are feasible today that would have been considered utopian only recently.

Although highly diversified, current experimental project research has a common feature in bringing the future closer to us.



Paul Andreu: Beijing's Theatre

The latest excellence examples show buildings whose covering act as a sort of osmotic membrane, able to modify its behaviour according to climate conditions and usage conditions.

The covering has become an element of mediation between outside and inside : its characteristic lightness and transparency are due both to the evolution of structural system where the relationship weight/performance has been improved and to the wider and wider availability of high performance technologies, such as technical fabrics, light aluminium and titanium alloy, structural front sheets of glass, phase change thermoregulating materials, thermally conductive polymers, natural composites, aerogel and hydrogel.



Buckminster Fuller - Geodetic Dome

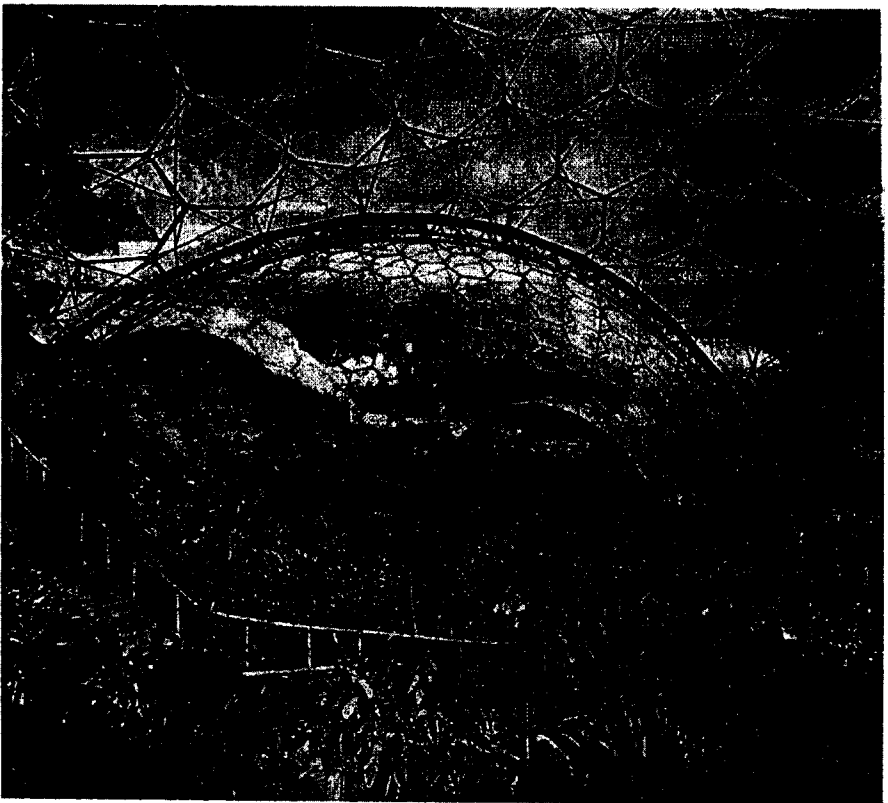
Double covering buildings are undergoing a continuous evolution to improve the cover performance, so that it is possible to install radiant panels conditioning systems which improve comfort and sensibly restrain operation costs.



Nicholas Grimshaw - Eden Park's Domes

The need for buildings to be increasingly flexible and quickly adaptable to diverse user requirements has led recent project and technological research to seek solutions based on transformability and adaptability. Lightweight building envelopes, retractable roofs and enlargeable volumes characterize this radically innovative approach where building materials and technology allow an essential "weakness" of formal building configuration to permit more variable spatial distribution.

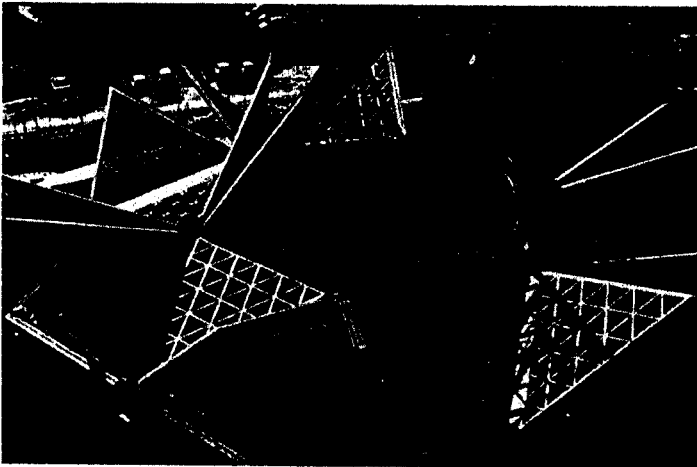
In the glass sector transparent materials are produced in such a way as to make them able to transmit light and heat selectively and according to more and more differentiated projects: screen-printed glasses, reflecting glasses, low emission glasses, chromogenetic, thermochromic or photochromic materials, liquid crystals or electrochromatic devices, isolating transparent materials, all make up a list which offers very interesting opportunities and mostly have not been explored by architecture yet.



Nicholas Grimshaw and Partners, Eden Botanic Park, Cornwall 2001.



Frank O. Gehry - DG Bank, Berlin, 2000



Shigeharu Isaka - Isaka Design Koubou Inc., Sapporo, 2000

ARUP is synonymous with refined, cutting-edge, project-specific technology. As a result, its new headquarters at Solihull near Birmingham, inaugurated in early 2001, has aroused much interest.

In fact the new building sets a benchmark for user- and environment-friendly office complexes of the future. The ARUP Campus meets the overall sustainability requirement by contributing to a better environment, a healthier economy and a more satisfactory social setting. The innovation does not necessarily have to entail complicated solutions, rather requires meticulous planning and inbuilt control tools, that will lead to simple solutions in harmony with nature:

The building has the following peculiarities:

- good ventilation conditions and natural daylight, thanks to big chimneys that open on the roof and to big glass walls that mainly develop on the North-East front, protected by wooden doors and windows with orientable thin layers. The external covering system optimizes the control over the sun and the reverberation : the users can manually control the openings, adapting the inner climate conditions to their needs. Indoor, the structure is scaffolded on Y-shaped columns : the geometry of the section encourages the fluxes of air and the penetration of light.
- Use of at least 155 recycled materials : about 2,900 tons recycled materials have been employed on the whole, that is to say 40% of the total mass of materials, included those employed for the foundations
- A low energy cumulation and a limited consumption of water, low operation and control costs.



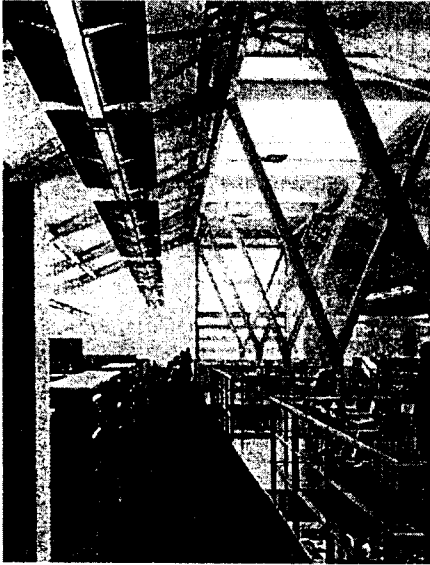
Arup Campus - Solihull, Birmingham

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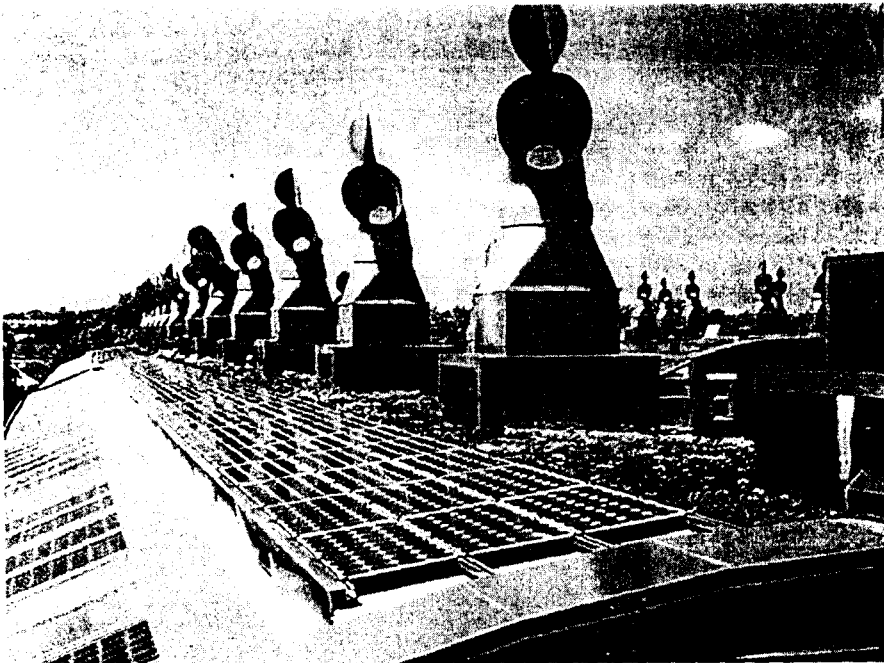
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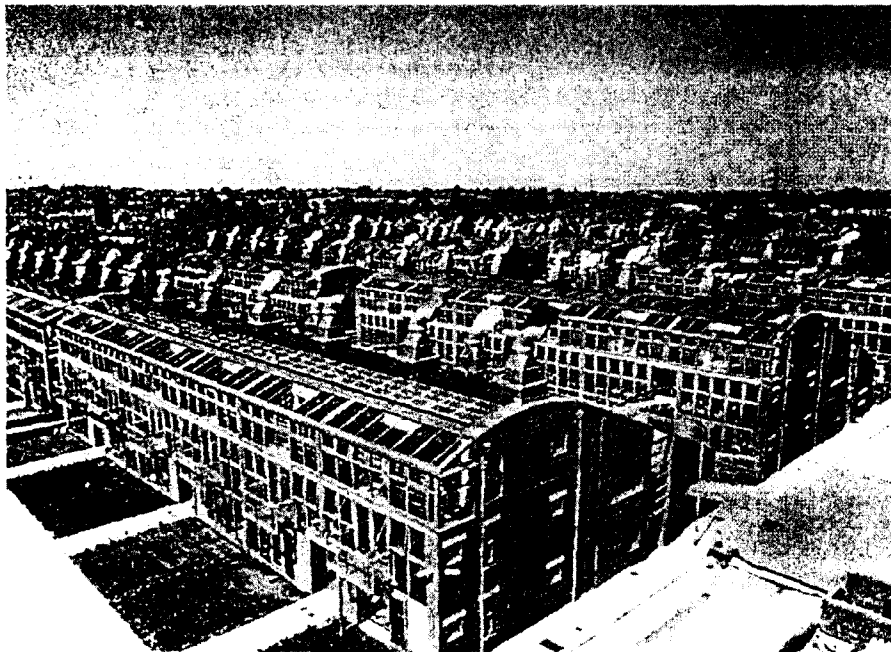
Arup Campus - Solihull, Birmingham

The Beddington Zero (Fossil) Energy Development (BedZED) is a mixed-use scheme based on the principles of sustainability, located on a brownfield wasteland site in the London Borough of Sutton. The development will provide 82 dwellings - flats, maisonettes and town houses - and approximately 2,500 m² of workspace/office and community accommodation including a health centre, nursery, organic café/shop and sports club house.

The BedZED design concept is driven by the desire for a net "zero (fossil) energy development" that produces at least as much energy from renewable sources as it consumes. Only energy from renewable sources will be used to meet the energy needs of the development, making BedZED a carbon-neutral development, contributing no net carbon dioxide to the atmosphere. The BedZED houses are arranged in south-facing terraces to maximize heat gain from the sun, a system known as passive solar gain. Each terrace is backed by north-facing offices, where minimal solar gain will reduce the tendency to overheat and so the need for air conditioning.

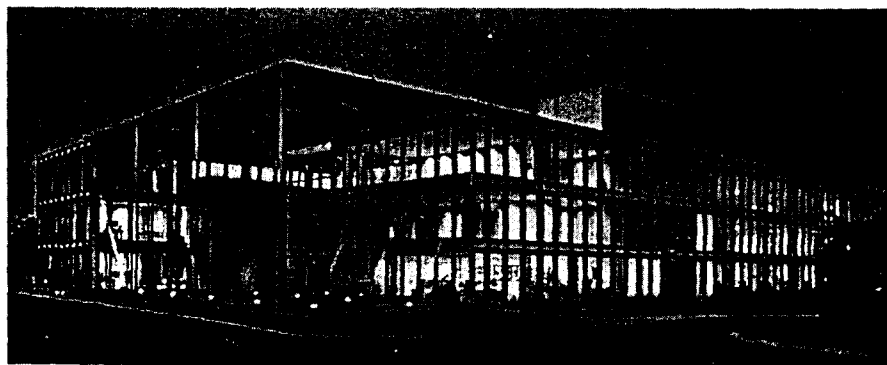


Detail of photovoltaic panel covering

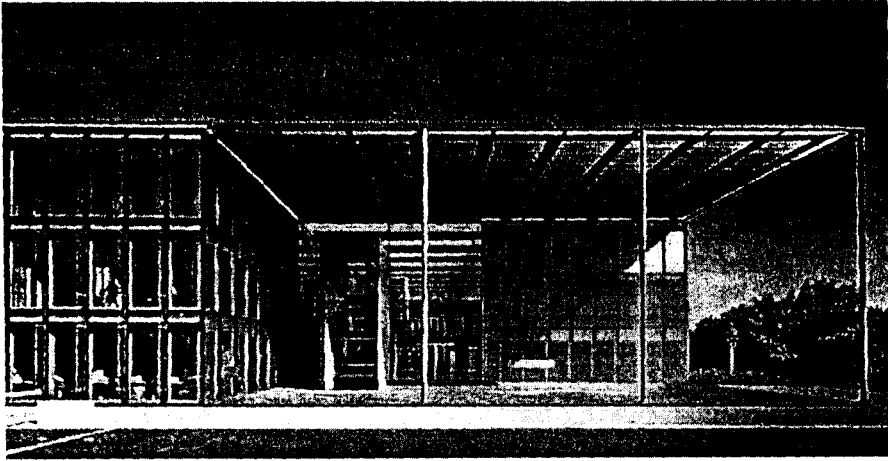


Bed Zed - Panoramic view, Sutton - London

The clear, communicative presence, harmonious volumes and regular component distribution of the new Braun offices tangibly reflect the company's new image. Passive environment control systems have been blended with active controls which, although centrally activated, can be excluded locally by individual users. This highly innovative technological mix makes use of age-old laws and the latest "smart" equipment and machinery, to complement the essential lines of an exemplary architectural achievement.

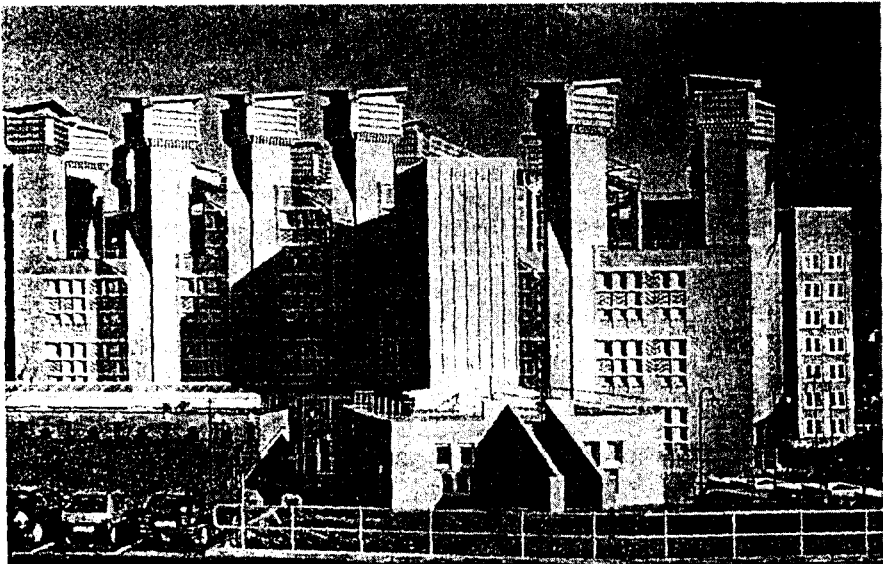


Braun offices - Kronberg

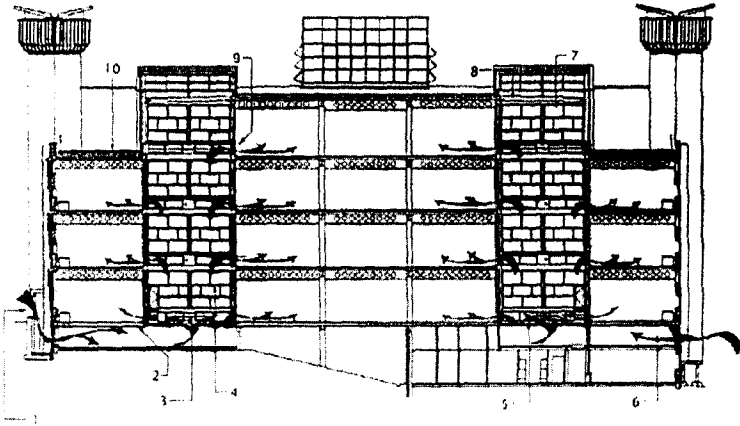


Braun offices – Kronberg

One of the most recent buildings to combine technological innovation and tradition is the "bioclimatic" library of Coventry University, designed by British practice Short & Associates. Energy saving and natural ventilation were key features of the brief, with the result that designers took their cue from factory design rather than the huge glazed constructions of the English speaking world. A system of vent stacks and ventilation and light shafts provides a viable alternative to hermetically sealed volumes of steel and glass requiring complex air-conditioning systems, and at the same time guarantees two other essential prerequisites: natural luminance and sound proofing.



Coventry University

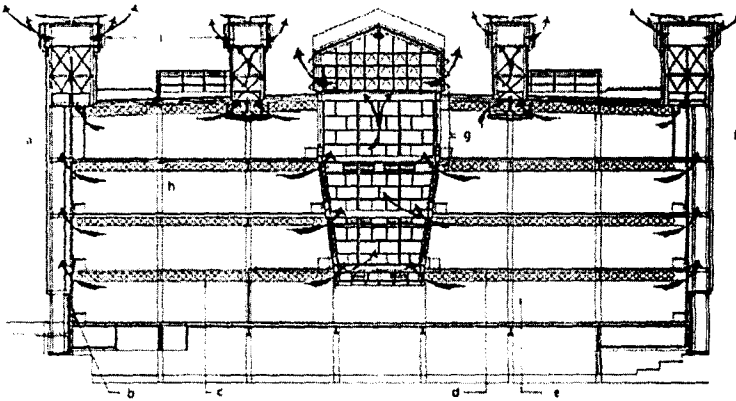


■ INGRESSO ARIA FRESCA

Section of "skylight wells" (scheme of air immission)

Key to symbols

1. fresh air immission
2. floor heating
3. heating batteries
4. skywells for ventilation and natural light
5. heating batteries
6. fresh air plenum
7. ventilated space
8. rotating translucent screens
9. computer controlled ventilation grids
10. isolated covering



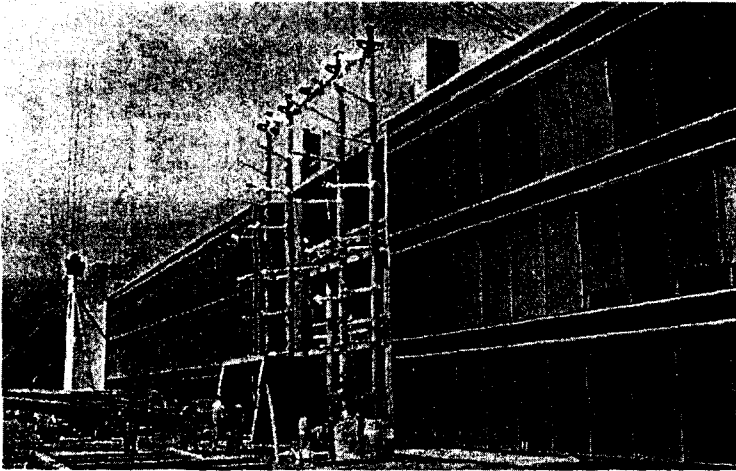
■ ESTRAZIONE ARIA CALDA

Section of central "skylight well" (scheme of air extraction)

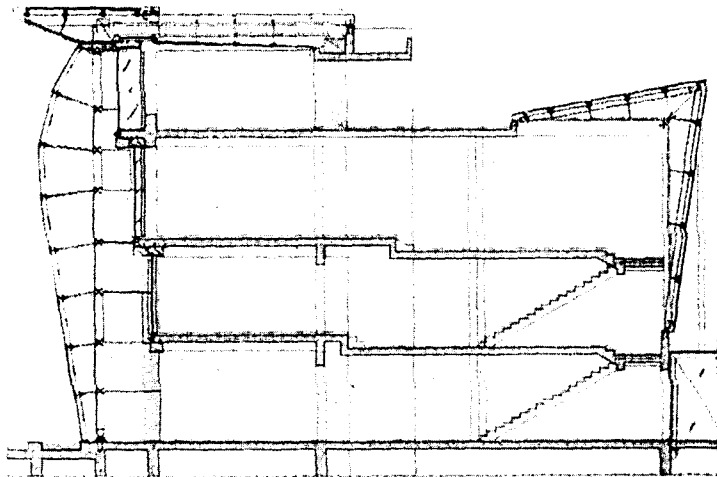
Key to symbols

- a. external solar screen
- b. perimeter radiator with thermostat
- c. lightened metal beams
- d. white cls ceilings that make natural light penetration easier
- e. dioxide and temperature sensors
- f. low submissiveness double sheets of glass
- g. computer controlled ventilation grids and windows
- h. height of ceilings : 4,20 m
- i. wind protection

A key area of innovative, international architectural research is concerned with building systems that will guarantee maximum indoor comfort. A wide range of opaque or transparent solutions of varying forms and components today provides improved performance in terms of energy and light transmission, and thermal and acoustic insulation. The new headquarters of Permasteelisa, a world leader in its sector, has an innovative, transparent, interactive façade able to adapt to changing external climate conditions and so provide constant optimal luminance levels and indoor comfort.



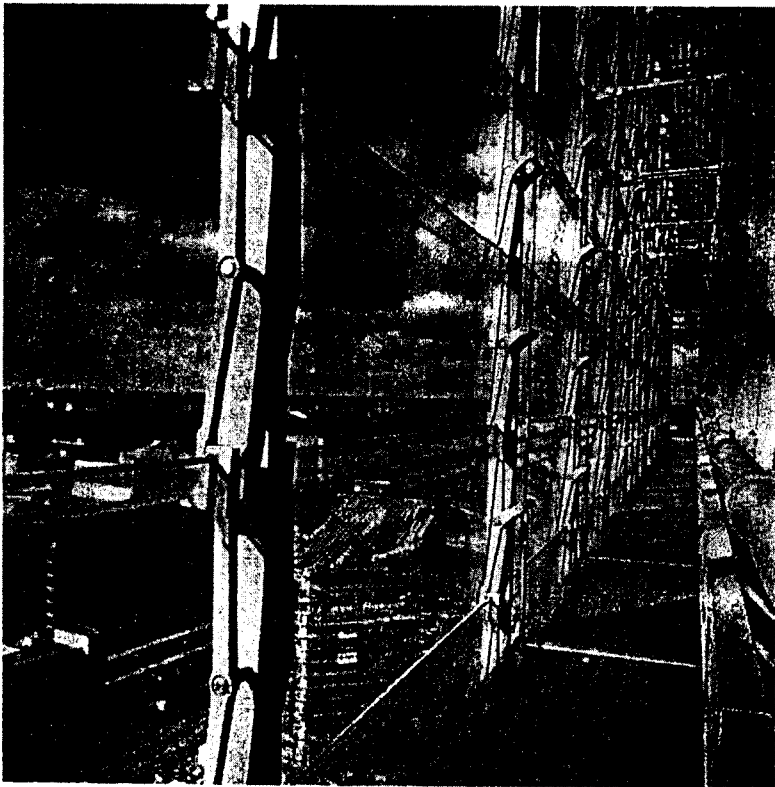
Permasteelisa - New offices - Vittorio Veneto, Italy



Vertical section of the entry front. The glass body is scaffolded by a tensile structure specifically planned with hooking elements, it intersects the parallelepipedal office body.

The "sustainability requirement" in the construction sector is a complex issue involving all phases and players. Life Cycle Assessment tools are being developed for the building industry to ensure that the sustainability label is conferred to buildings or building products having not just one but a whole range of environment-friendly characteristics. The long life-cycle manufactures typical of the building industry require high sustainability performance during product use rather than during the production stage. Designers and manufacturers are increasingly required to ensure that products and processes are "sustainable" especially during use and on decommissioning.

After the first, and not always trouble-free, generation of double envelopes, we are now seeing a new series of different products using diverse forms and technologies that are more suitable to meet the wide range of different climatic, cultural and economic conditions. A double envelope system is an external cladding made up of two diaphragms, one of which a glazed surface, that provides a range of complementary functions. A key feature of these systems is that the all important control functions, although complex, are ensured by simple, high-performance mechanisms not requiring the use of artificial energy.

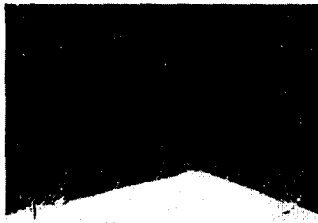


Renzo Piano, Building in Posdamer Platz - Berlin

Product innovation is fundamental to maintaining industry competitiveness. Examples of innovative materials of particular pertinence to the construction industry are natural composites, naturally water-repellent materials, thermo-regulating materials, flexible photovoltaic films, thermally conductive polymers and metallic foams. The study of adaptive structures looks at how these can be made to adapt to load variability by varying force and stress distribution and so reduce peak loads and ensure optimal force and stress dissipation. Nano-technology has played an essential role in developing adaptive systems and elements in which sensors convert variable incoming signals like pressure or vibration into an definite output signal, such as a voltage.



Smart Wrap is a very thin film which includes several layers able to heat, cool, visualize images and light.



Aerogel, a silica based material made up of 98% air. This material is an extraordinary non-conductor : a 2,5 cm thick piece of it is as insulation as 32 glass layers. The high adaptability of aerogel (a surface of aerogel can modify its physiognomy from transparent, to translucent to opaque) and its liquid origin bring about a process of

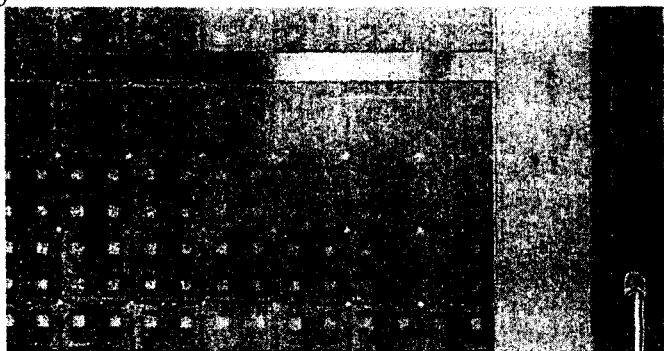
reconsideration of the conceptual schemes in the organization of material systems.

A very recent innovation in both horizontal and vertical surface interfaces has been the introduction of Phase Change Materials (PCM). The system uses eutectic salts or paraffin whose change of state in the presence of heat - from solid to liquid or solid to gel - cause delayed heat transmission. As a result, insulation no longer depends exclusively on the thermal inertia afforded by the mass of building components.

The advent of PCM will transform buildings from passive to reactive entities, since heat can be distributed as required on the basis of external conditions and internal comfort requirements without adding to the weight and volume of structural components.



Applications of plaster working as thermic accumulator (cooling in summer and heating in winter) thanks to microencapsulated paraffin.



PCM integrated usage : the glass South front is made interposing plastic containers filled with paraffin able to supply the surface with thermal inertia.

CONCLUSION

Last but not least and even crucial, comes the role of politics and institutions as change engines. On this point, I would like to quote one of Mahatma Gandhi aphorisms : *“in Democracy, no event escapes from politics”*.

Democratic institutions produced by politics are particularly relevant for town planning. In political and institutional systems they have the power to make the planning choices. Even though town planning prepares designs and outlines possible options and costs and benefits for each of them, nevertheless the final decision always lies with the political power.

The connection between town planning and political institutions is really very strong and when they start losing their original features of *representative democracy*, the consequences are the impoverishment of the legislative efficiency of parliaments, the raised power of technical and financial organisms, the wide-spread distribution of wealth culture or, better, of the myth and idolatry of wealth.


In every single activity, action or thought, we should always remember that :

“We haven't inherited the world from our forefathers, it has been lent to us for our children”. (Anonymous author)

***Architect, Professor of Architecture**

He has been a professor at IUAV University, Venice, Faculty of Architecture since 1964. He has written several essays and contributions; his studies have specifically concerned Architectural Design, Land Use Planning and Town Planning and Models of Urban Development.

From 2003 to 2006 he was appointed counsellor of the Vice-Minister of Infrastructure for Land Use Planning and Town Planning and since 2004 he has also been a town-planning consultant for Regione Veneto.

At the moment he is dealing with Environmental Impact Assessment as well as planning, recomposition and improvement of degraded and dismantled sites. [ studio.cigni@tiscali.it - cigni@iuav.it]

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