

THE RENAISSANCE OF SOLAR CITIES: FROM TIME TO SPACE

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ABSTRACT

The paper deals with the context that could make feasible the rehabilitation of the solar cities. Instead of envisioning extra-ordinary mega structures, reinforcing the utopian projects of moderns, we should understand better the know-how embodied in many ancient cities. Applying to them our today available scientific tools, we could improve the potentials of those cities and make them an effective solution to our energy and communication problems. A discussion is developed about the overcoming of some intellectual obstacles which distort our expectations of the new future cities.

1. TOPICAL SOLAR CITIES

We need to envision the next Solar Cities, for two main reasons: the former, arguments that the end of oil availability is no more in a far future, and the time required for adapting our cities is not very long; the latter says that the climatic changes could anticipate the end of oil powered buildings before oil shortages, due to the planet heating. But the paper aims to show that we should pursue the Solar Cities mainly for a positive purpose, not for escaping the dangers of oil shortages or of climatic changes. Solar Cities, in fact, offer the opportunity of making communicative our cities, as they have been in the past Mediterranean Europe. The oil centred air-conditioning of city buildings is very recent, since up to the XIX century, all the buildings of Mediterranean cities were heated by solar energy, helped by wood stoves.

Producing a history of the use of solar energy in the cities requires a little reflection to bring us to a reality we tend to forget. For much of the past century, every city in Mediterranean Europe was a solar one: there was no other form of heating available. As regards cooling systems in Italy, we arrive at the beginning of this century. We may argue about the efficiency of those solar cities or about the

quality of the natural heating they offered, but it seems clear to me that they were indeed solar in that the transition towards becoming oil-burning cities is relatively recent. There are some recent studies that correct a consolidated belief shared by many mechanical engineers: the comfort conditions are the same all around the year and the same for different people. On the contrary, these new researches show that the temperature which people find comfortable indoors varies with the mean outdoor temperature. M. A. Humphreys, comparing free-running buildings with heated or cooled ones, is able to represent the changes in comfort temperature with monthly mean outdoor temperature.¹ A discovery which explains how much comfortable solar cities were, under a frame of reference radically different from the one developed by the mechanical engineer's approach.

When I speak of solar cities, my listeners think above all of the ancient Greek and Roman cities. Solar cities look a matter of history, bounded to the past. It is not easy to remember houses without all the technological systems they now have, in part because the culture of a house equipped with these systems spread before the systems themselves. It is a matter of value not of fact. Our belief in Modernity & Progress supplies us with a frame of reference where solar cities belong to the past.

These cities did not disappear as it happened for their inhabitants and for many of their buildings. I deal with a kind of history, interpreted from a designer's point of view, that means to avoid a dull description of the past cities, aiming to present the tradition of Solar Cities as still alive, and their potentials available to the future town designers. The problem consists in improving the quality of both our towns and countryside while providing, at the same time, homes and cities for many additional households, in the next 25 years. As we think that at least the 60% of new dwellings should be built on previously developed land, they will be integrated within the urban tissue of pre-existing historic cities. Our issues, different from those of the past century,

have to do with infill interventions where the buildings should be context-centred, not as the context-free “object buildings” of contemporary architecture. At the outset of the XX century only the 10% of the population lived in cities; at the beginning of the XXI century around 50% of the world population lives in cities. In the next 25 years the number of city-dwellers could reach the 90% of the earth inhabitants, of which two thirds in poor countries.

2. SETTLED & NOMADIC COMMUNITIES

In a seminal book, R. Banham, one of the few architectural historians to have studied these systems, distinguished two main archetypes for solving the climatic problems of mankind. Imagining a savage tribe at an evening camp-site that is well supplied with fallen timber, there are two basic methods of exploiting the environmental potential of that timber. Faced with the problem of climate making, of having to warm themselves, two communities in a wooded region react in two different ways: the first uses the wood to build houses that protect the inhabitants from the cold; the other uses it as firewood to keep warm around a fire.² The first response – the structural solution – is slower and more tiring but lasts longer, and it characterises the behaviour of a settled community; the other response – the power operated solution - is more immediate and temporary, and marks the behaviour of a nomadic community. We may say that the solar towns belong to the first of these two cultures, while the oil-burning towns are typical above all of the second; even though we have covered the planet with buildings, we are actually more representative of the second culture – the nomadic wood-burning one – although we burn oil, not wood. I think that the today cities should move from the power operated to the structural solution. The houses and cities in which we live are tending to become increasingly large technical systems within which we will need to resign ourselves to live, a machine system we switch on when we live in the house and switch off when we leave, as though they were huge parked cars. The current trend in the industrial production of buildings is progressively to reduce their lives, so we are not just burning oil to heat them, but also metaphorically burning the buildings to rebuild them. Differently from cars whose function is specific, buildings are characterised by a loose, generic functionality which is continuously changing. A car operates as a car along all its life, an office building can change its use many times. In the cars, changes happen between different life cycles, in buildings they take place within them. Due to their lasting life cycle, buildings require flexible structures for matching such changes. The machine’s frame of reference is so pervasive today that architects prefer to shorten the buildings life cycle and replace them instead of making them more flexible.

I have many times asked myself how is it that our industrial civilisation, able to develop extraordinary products, remains unable to produce decent cities. Clearly, despite all the efforts and intelligence of designers and politicians, the city remains a problem we are unable to resolve, as is the case for some regarding the question of ecology.³ Both belong to a permanent settled culture, the one which did not know how to make our industrial products but which knew how to make cities that are still standing.

When we celebrate the nomadism of our civilisation, we tend to believe that it belongs to time, to the process of modernisation. Reflecting on the solar cities and their topicality, however, it seems increasingly clear to me that this nomadism belongs instead to space, and the rhetoric that transfers it to time aims to convince us that we need to embrace that way of thinking and living.

Describing the history of solar cities I became aware that the historical frame of reference was driving me into a time reality where events were quite instantaneous, their beginnings coincide with their ends. History looks like a series of changeable facts which follow one another at short intervals. Cities, on the contrary, last and buildings too. A roman city that lasts up to now belongs to the past or instead to the present? Or rather, it cannot be described as an instantaneous event. It began many centuries ago but it has not passed, or not passed completely. The historical frame of reference is embodied within the language used in the descriptions, it plays an important role in the making of the historical world. There is one only world or instead different frames of reference making different worlds? What are worlds made of? Shifting from time to space the characterization of the cultural identity of solar cities, means to consider them signs of a regional civilization or, on the contrary, signs of old fashioned ideas embodied into those civilizations. Within the world making of this historical culture, one is invited to get over the solar cities concepts that no longer should have any meaning in our advanced time. In order to evocate the desire of considering out-of-date the oil centered metropolis, a history of solar cities should operate quite differently.

There are two different cultures sharing the same land in western countries, they are not belonging to different times (the present and the past), they live in different spaces with different traditions. The tradition of the Mediterranean Europe is less nomadic and better rooted, than the one of Continental Europe. A set of Solar Cities emerged from a culture which created, in Greece, Italy and Spain, many types of settlement systems, mainly oriented toward various form of ray-conditioning, in which the building envelopes themselves were fitted to collect, store and distribute the thermal energy produced by the sun. I want to summarize the potentials of the existing urban structures for pursuing a

solar civilization that improves, not only the environmental quality of our cities and buildings, but also their communicative power.

To some extent, it may be maintained that nomadism belongs more to the culture of Continental Europe than to that of Mediterranean Europe. Those great movements of populations and cultures that were the barbarian invasions and the various forms of colonialism are more frequent in Continental Europe, which has also developed to a greater degree a culture that is compatible with these migratory processes. Visiting a major exhibition on the Celtic culture in Venice some time ago, I was astonished to find beautiful objects, ships, machines, arms and so on, but no towns or even an architectural culture comparable to ours. Reflecting on this discovery, I began to discern that many discussions typical of the architectural culture on the effects of the industrial technology in the evolution of buildings and settlements, start off on the wrong foot. The clash between those who want to accentuate the contribution of technological innovation and accelerate progress to resolve our current problems and those who, instead, blame technology for all our ills, cannot be resolved because it makes no distinction between the various types of products, in particular between movable ones (cars, computers, televisions, etc.) and immovable ones (buildings, towns, settlements, etc.). The representative slogan: the home as “machine à habiter”, has led to a situation in which there is a widespread belief that immovable products too could be produced like movable ones, a belief motivated by the many successes attained in realising movable products.

The long life-cycle, the network of relations with the context, the multi-functionality, are just some of the major differences that distinguish these two production processes, and which also explain some of today’s problems.

Where do we encounter the greatest problems? In the cities, in buildings, in agriculture, in ecology, in the many ethnic and territorial conflicts, etc.; that is, in those situations which involve immovable products. Thus, the culture of Mediterranean Europe, capable of producing cities, would belong to past history and that of Continental Europe to the future opening up before us. The myth of progress describes this choice as a destiny as time cannot stop: it is thus only a question of time. This picks up from that “science of history” which has given us other ideologies with results that it would be best to avoid. If the Industrial Revolution was born in Continental Europe and only reached the Mediterranean much later, there are reasons we need to understand. Continental Europe spread the culture of the Reformation which led to the liberal societies of modern economies and mobile products. Mediterranean Europe instead produced an urban culture that was not only taken away from it but which must also be seen as being without

return: it is the culture of cities as systems of communications.

The cities of Mediterranean Europe, together with their language, developed a highly evolved system of interpersonal communications through the organisation of their civic architecture. They also taught the entire world how to build these cities.⁴ It is no coincidence that through the codification of orders, the architectural culture of the Mediterranean cities also developed the double lives of architecture that regards both the works themselves and their symbolic system. The classical system deriving from it is fundamental in rendering the coherence of the networks of civic architecture legible, and the city built with it communicative.

3. MOVABLE VERSUS UNMOVABLE PRODUCTS

It was solar energy that kick-started life on earth: intrasomatic (biological) and extrasomatic (cultural evolution). To this last, I have added what I have called intersomatic evolution, which affects our communications and interactions.⁵ Intrasomatic evolution has made organisms evolve, while extrasomatic evolution involves the development of tools which help us survive, and intersomatic evolution causes us to develop our systems of communication/interaction both with other people and with the “natural” environment. The urban machines we live in aim increasingly to resemble those mobile products with which they are filled. The consumption which brings into play the economy of the “welfare societies” is formed almost exclusively of movable products (car, computer, aircraft, ships, motorbikes, furniture, clothes, etc.), and none stimulates them to desire better cities; indeed, they are rather convinced that these cities have become impossible. We must decide whether we wish to accept the existence of this Mediterranean European culture and integrate it with the currently dominant one of Continental Europe, or whether we intend to continue believing in a single culture, considered “authentically modern”, of Continental Europe, and whether alongside the “American dream” of city typical of Continental Europe, we wish to place the “European dream” marked by the convivial cities of Mediterranean Europe.⁶ These are also two radically different technological cultures, which in part can be complementary and in part alternative.⁷

Even if oil were not to run out and the planet were to stop warming up (both of which are extremely unlikely), the construction of the solar cities should in any case be restarted, not because there is no other choice but because of their environmental and human qualities which render them communicative. The most singular aspect is that we already live in towns that have been solar, and which therefore already have the potential not only to continue in this

vocation, but also to improve it. In Mediterranean Europe, we live in solar cities without knowing it; even though the historic towns have been confused by recent interventions unable to read the sense of their project and so understand it.

4. ESSERGY SAVING SOLAR CITIES

The current use of oil is wrong from another point of view as well: from a scientific and thermodynamic one. In order to understand the problems posed by the choice of this type of energy, we need to consider the two dimensions of energy: the first, which defines its quantity and might be referred to the first principle of thermodynamics, by which the quantity of energy entering every process of transformation is equal to the quantity that emerges from it; the second, which defines its quality and might be referred to the second principle of thermodynamics, by which in every process of transformation of heat in work, the quantity of heat-energy entering the process is different to the quantity of heat-energy that comes out of it: a certain quantity of the heat is dissipated in the immediate environs of the process. In this case, the quantity of energy affected by the transformation is unchanged but its quality is changed.

That quantity of energy as heat that has reached the temperature of the surroundings is no longer distinguishable from it; it is in a position of equilibrium and is no longer able to be converted into work-energy. What has been lost is the difference between the two; only the form has changed, not the quantity of energy, which is still the same. From this, we may make two observations: there is no possibility of transforming all of the heat-energy into work-energy; only when the heat-energy is distinguishable from the external surroundings, that is when it is in a state without equilibrium, can it be transformed into work-energy. What we need is the difference, a formal resource that is a distinction, not a material resource that is measurable in terms of quantity.

Our ability to recognise a system depends on the fact that it is in some way different to its external surroundings. As with language, in order to be able to define something, I need first to be able to distinguish it.⁸ We can also note that the level of distinction between system and surroundings is equivalent to the degree of distance from the state of equilibrium and the level of “thermodynamic information”. If we consider the entropy of the system separate from the surroundings, and the entropy of the same system within the surroundings, and thus no longer distinguishable, the thermodynamic information will be defined as the difference between these two entropies. This measures the loss of information that occurs through no longer being able to distinguish the system from its surroundings.

We know that various levels of thermodynamic information exists and that, as this indicates a distancing from a state of equilibrium, it represents the possibility of transformation of the heat-energy into work-energy. Various possibilities of transformation are thus expressed through various levels of thermodynamic information, which can thus be taken as a generalised measurement of the availability of the energy to undertake work.

This availability, characterised by the Carnot’s yield coefficient, by Gibbs’ free energy and by Rant and Evans’ essergy,⁹ measures the potential work of a given system. Although energy is preserved in every process of energy transformation, the essergy is lost. This then characterises the second dimension of energy, its quality.

When we speak of energy-saving and research into the conservation of energy, we speak metaphorically of something that in scientific language must be expressed differently. Energy cannot be conserved, it cannot be saved. What must instead be saved is the potential work, the availability of energy to transform itself into work: the essergy.

In periods of plentiful energy, we have used systems with a high degree of thermodynamic information, in part to respond to requests of a low level: the energy of the flame burning oil, easily distinguishable from the surroundings, to heat rooms in which the air must have been little distinguishable from that outdoors. As though having large and small boxes and equally large and small objects, we had opted to use the large boxes even for the little objects, trusting to the limitless availability of large boxes and without having a problem of having to match boxes to objects. But now that we are short of boxes, we need to use even the smallest ones, finding objects that can fit within them. Homes and towns are, in the metaphor of the boxes, small objects because of the low temperature required for heating them, and for these solar energy would be appropriate, in the metaphor represented by the small boxes. Through laziness of the designers who do not want to look for the small boxes, we continue to use large ones, represented by oil, which would be more gainfully used for other purposes. Naturally, the high degree of concentration of the energy required lesser design skills and introduced fewer problems of regulation and control. But now that we are in a period of difficult energy, it has become necessary to adjust every request regarding a specific level of thermodynamic information to the lowest level possible allowed for by the system’s limits. Hence the need to plan energy technology that matches needs more closely, thus reducing the consumption of energy or thermodynamic information.

We have seen that oil is wasted when used for heating buildings; moreover, it needs to be extracted and transported

to our homes, then burned at high temperatures that are then reduced to a usable level; solar energy, instead, is already distributed over the planet, and at the right temperature. More it is delivered free of charge.

In seeing a new power station, with its steel structures, reinforced concrete and glass, alongside an old windmill, it looks ready to defy the centuries, whereas the windmill looks as though a puff of wind would blow it over; thus do the defenders of today's windmills appear today, like latter-day Don Quixotes charging at dreams, even though the objectives have changed and it is the power stations that are under attack.¹⁰ A moment of reflection enables us to understand that while the power station stands only as long as the corrosion of the materials with which it is built allows, and the flow of oil feeding it continues, the windmill will last as long as the sun. The wood used to make its vanes and the frame, and the wind that makes them turn, are all produced by solar energy and are thus renewable as long as the sun causes plants to grow and warms the air, generating wind. It is useful to distinguish the material and energetic resources used in the production of the power station or windmill from those used to operate them: the first are resources of manufacture, the second of operation. We can thus compare cement and wood – that is, the resources used for building the power station and the windmill – and oil and wind, the operating resources for the two.

The material and energetic resources man can have access to originate from two different sources. The first source is a stock of mineral resources: on the surface for cement, below ground for oil. The second is a flow formed by the solar radiation that becomes biomass for the wood and air currents for the wind. We need to highlight the radical differences between these two sources. Man has an almost total control over the reserves the earth is supplied with: he could, if he so wished, make use of all of them in a single year. On the other hand, he has no control at all over solar radiation, with respect to the practical results he would like to achieve, either in terms of space, as no-one can transport solar energy where there is none, nor in terms of time as he cannot today use future flows of solar energy.

To come back to our windmill, we may say that in many cases it represents the most suitable type of energy for saving thermodynamic information, when it is not used, as some propose, to produce electricity for heating buildings. It should be clear by now that faced with a broad variety of requests for energy, it is necessary to set up an equally broad variety of technologies, able to adapt renewable energy to these requests and extend the varieties and so respond correctly to many requirements for use.

5. A COMMUNICATIVE CIVIC ARCHITECTURE

The solar city makes up the technology that we need to save energy, it is the best available know how for solving the energy problem in many climatic regions. Looking at the world energy consumption, buildings consume half of the energy that is used by human beings. History is not the best way for understanding the concept of a solar city, the date of its construction or the reference to the spirit of the age, that it should represent, are not pertinent characteristics. The practice within which we use the solar city concept consists in developing good solutions to the energy problem. The solar city concept, realized both by archeological cities as Palmira and Priene or by actual cities as Verona and Turin, presents these distinctive characteristics: two interactive components, the streets & square network and the buildings which shape it and make such place system a meeting point. A relationship analogous to the one connecting the language and its speakers. No language can exist without communicating speakers but the language survives the vanishing of speakers; moreover it produces the new speakers. The language life cycle lasts more than the speakers one. The urban network, shared by the buildings facing it, survives the replacement of such buildings and it produces the new buildings. The civic architecture network and the buildings along it have different turn over, in many Italian cities we still have the roman civic architecture with quite all the buildings replaced by new ones. The world making of cities, considered as symbolic systems, produces a civic realm, it realizes an urban culture, what is called urbanity as a way of life¹¹. In solar cities we find a civic architecture network oriented following the solar geometry and the building types differentiated with reference to the various positions they occupy within such urban network. In the cities where still operates an oriented urban network we could rehabilitate through appropriate urban plans the existing buildings and build the new ones following the solar building types in various positions. A process that could be integrated within the current yearly maintenance interventions.

Man lives his conscious life by expressing it, by transforming impressions into expressions. To express means to give form to the reality with whom man interacts. Symbolic forms are the various ways through which man expresses his relationships with the environment, language, myth, art, history, science, etc. I think the city as one of these symbolic forms, or symbolic systems, as it gives form to the man's expressions. Cities mediate symbolically the complex relationships that men entertain with the world and make them communicative. Cities are not only the places where communication happens, it is in itself an important mean of communication.¹² The history of the ancient Solar Cities shows that the urban grids (the networks of their civic architecture) were oriented following the geometry of sun

and wind. Their building types were asymmetric in order to collect the solar radiation and since Vitruvius there was the know-how to orient and size the porticos or the roof overhangs, for getting the sun in winter, when it was needed, and the shadow in summer. This solar technique, documented by some archaeological researches, became antiquate when the heating and cooling systems overcame the solar ones. Many European cities preserve the ancient solar networks of civic architecture traced out in the roman times, replacing the previous solar building types with the new oil-dependent building types.

Sustainable development recommends compact cities. There are two ways of reaching the urban compactness which allows for increasing the pedestrian circulation and shift the traffic from the today intra-urban circulation to the future inter-urban one. The former one deals with the construction of skyscrapers, the latter one pursues compactness through the construction of urban blocks (as it has been done in the historic cities). Following this latter trend, we could better integrate the new developments with the existing urban tissues. The high density of these low rise cities offers a good solution for the renaissance of Solar Cities.

In order to increase the awareness of citizens and designers about the claim that Solar Cities belong to the present and not to the past, we must recognize that the solar grids are under our foot, that many of our cities have civic architecture networks designed to meet the solar energy requirements and that only buildings require some adjustments to become solar ones. In the programmed maintenance of these buildings as in their rehabilitation we could replace the present practices with the solar and energy saving ones.

A leading ecologist, J. Lovelock, who discovered our planet to be a living organism rather than a mass of independent organisms, stated in an interview in "Le Monde"¹³ that global warming has reached such dangerous levels as to require a replacement for oil before it runs out and that the only energy able to substitute it right away is nuclear power. However much this unexpected, disarming declaration might shock us, those who believe in solar energy must change tack. Another question bothers me in this Italian scenario: reducing the consumption of oil also means reducing the government's considerable receipts from this sector, and this at a time when it should cut taxes to potential users of solar power to induce them to change source of energy. Some expert should study the way to resolve this problem.

I have written this introduction to present the solar cities in the hope that we may now look at them with something other than the eye of someone who sees their applicability only in terms of a historical association – beautiful but now out of date (and freed of any requirement to change). I

would like to see these solar cities present themselves as contemporary as today's ones, alongside them but rendered invisible by an ideology which in nominating them interprets them as something separate in time, but not in culture or space. These are two different views which do not aim at the same objectives; one has the ideals of nomadism, producing extraordinary mobile products, which we find in today's industrial towns; the other has the ideals of settlement which may produce marvellous non-movable products, which we see in the network of civil architecture in our historic towns. The "American dream" is the expression of that culture, as yet extrasomatic, which is overwhelming the entire planet, while the "European dream", which could embark on an intersomatic culture of the town, is the other. An appropriate project can integrate these dreams.

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