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Ecosystems and Renewable Energies

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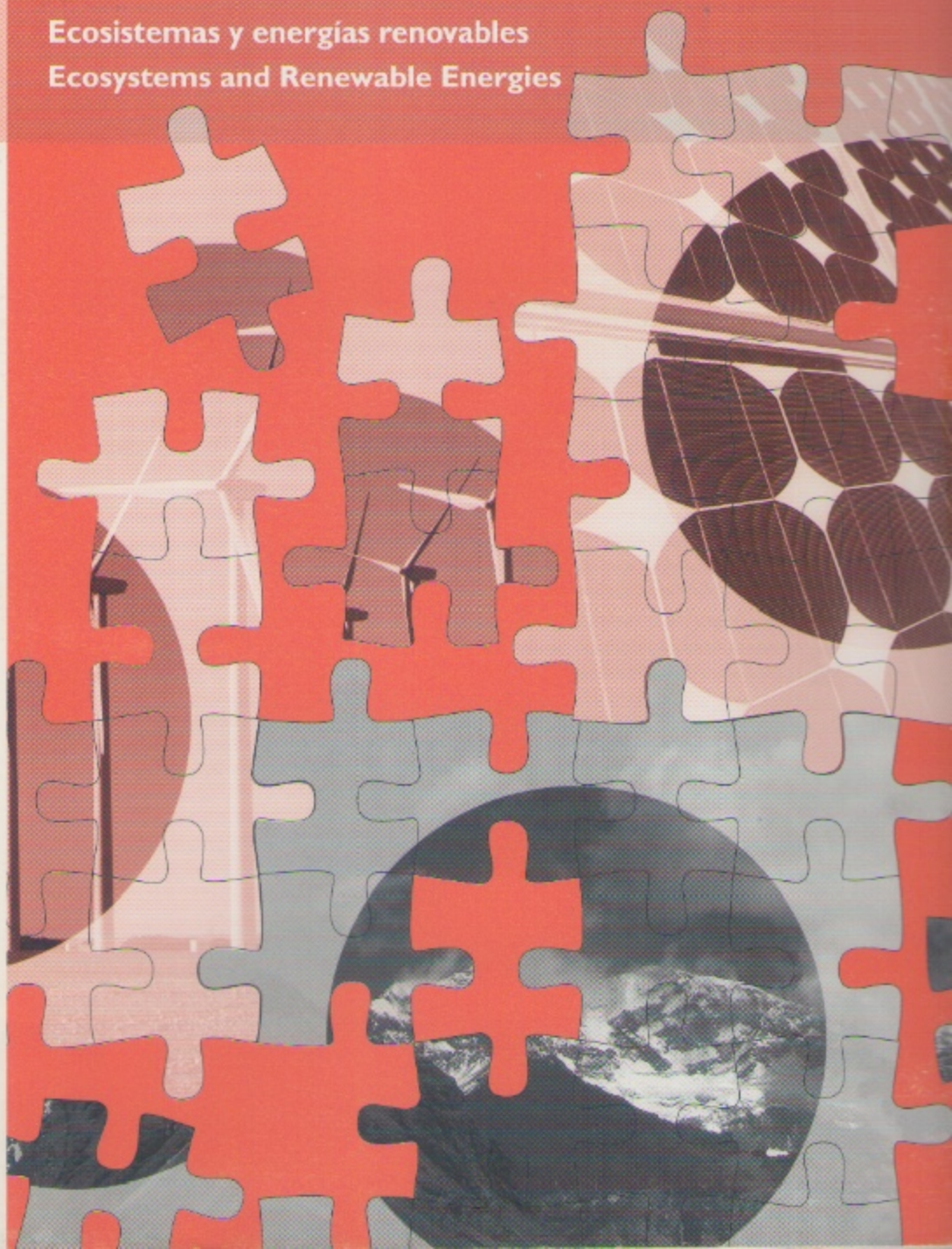

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Renewable Energies, Technology, Ecosystems and Landscapes

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In recent times controversies have arisen over private and/or public sector proposals to utilise shared biosphere resources that can be useful in the production of energy for human use. There has been opposition from some parts of society to the solar and wind energy projects proposed in some areas of the country. The reasons for this opposition have ranged from protectionist and/or conservationist (endangering the habitats of certain animal species) to purely landscape related (modification of the landscape).

Humans are energy transformers, as are all the other living beings with which we share this beautiful planet called Earth. But since the imposition of the industrialist worldview and culture, humans have become energy *consumers*.

From the very beginning, humanity has lived by making use of renewable energy sources. During most of the time that humans have inhabited the Earth, they have transformed sunlight into food (growing crops), heat (burning firewood), and shelter (building). Thus, over millennia, humans learnt to make use of the sun, water, biomass, wind, muscular force, and so on, to cover all of their energy requirements. These were sources of energy that always regenerated and were available to use again, regardless of how much humans used them. And if certain thresholds were crossed, this could even lead to the collapse of society, as is the case with biomass. This meant that humanity had to learn to live to the rhythm of the sun. Living to the solar rhythm means recognising that life on planet Earth has some limitations, because the amount of energy available to use and transform is limited by the solar constant (the amount of solar energy per unit of area that the atmosphere-earth system captures in its journey around the sun).

It is only very recently, from industrialisation onwards, that humanity has been abandoning the use of renewable energy sources and has become addicted to fossil fuel. This fuel is nothing more than solar energy stored in chemical form—the result of the fossilisation of biological material from geological epochs in the distant past. This addiction is so great that today it is even endangering climate stability, because of the release into the atmosphere of the fossilised carbon that has been extracted, and continues to be extracted, from the earth's subsoil for burning and supplying energy. And the most horrifying thing is that, for more than a century, we have burned this non-renewable fossil fuel in thermo-mechanical machines that are very inefficient (for example, water-steam cycle thermal power plants only transform 35% of the energy produced from burning fuel in the boiler into electricity. And modern combined cycle plants still waste more than 40% of the energy produced by burning gas. Even cars with internal combustion engines have a low efficiency (around 20%), because they only transform about 20% of the energy contained in the fuel they burn into movement).

Alongside the development of the fossil fuel addiction, another significant situation came about. It meant the disturbance of the relationships between humans and the renewable energy sources flowing through the biosphere that were available to everyone. These relationships had remained more or less stable for thousands of years. The replacement of free and renewable energy sources with non-renewable energy sources (firstly fossil and later nuclear) meant that energy became less accessible. Human beings stopped directly capturing and utilising free and renewable energy to become (or be made) consumers of energy supplied in different ways, by institutions that had appropriated (or had control) of the non-renewable sources.

The fact that society is based on non-renewable energy sources means that humanity (or at least that part of it with relatively easy access to energy) is able to live a lifestyle that is way beyond the planet's thresholds of sustainability. Thus today one can do almost anything, anywhere, as long as one has cheap and easily accessible fossil fuel. The use of fossil fuel at all levels of society enables us to live in fiction (a kind of fairytale) and it will not be long until the cold hard truth is revealed, because we are close to what is called peak oil.

When proposals are made today to utilise the flows in the biosphere with energy content (renewable energy sources), we don't often take into account the paradigm shift that their capture and use implies. If we were to stop basing our society on the burning of fossil fuels (materials that once burnt, are no longer available to humans) and begin to base it on the capture and utilisation of biosphere flows, then humans could throw off the yoke of energy *consumption*, because they would stop being *consumers* of energy materials and they would become users of energy flows, which would mean they would stop depending on an extraction economy and become members of the biosphere community, thus becoming integrated into its natural cycles.

From protected natural spaces to the protection of shared natural resources

In areas such as the ones that make up the bioregions located in the Mediterranean basin, it is difficult to determine which are the *natural* areas that should be catalogued as protected. It is also difficult to argue why a certain *natural* area has been chosen to be protected while another has not, and why a certain *natural* area has received a particular level of *protection*.

This difficulty lies in the fact that almost all areas of the Mediterranean basin have been modified by human action since ancient times. Humans have interacted with the land and used it to benefit from the shared natural resources that the respective ecosystems offer us free of charge. And they have done this to provide themselves with the services that make life on earth possible. And it is precisely the use that has been made of these shared resources that has often led to the exhaustion of a shared natural resource (because of extraction at greater than replacement rate) or to the upsetting of the natural system that was being utilised (because this was done without respecting the carrying capacity of natural systems).

In our country, the situation inherited from Francoist Spain and the promotion of unchecked development that the dictatorship encouraged led to severe aggression against natural, cultural and social systems. Once democracy was re-established, we began maintaining and encouraging lifestyles based on unlimited growth (the way of doing things and behaving that we have come to know as that of the 'wastrel heir'). And a protectionist policy has been introduced for isolated areas (areas that had been more or less conserved) and/or emblematic areas (marshes, river deltas, and so on). The result is some small, more or less clean islands within a large territory that has been under-appreciated and overly maltreated.

These protectionist policies are heirs of the first conceptions of protection, which originated during the 19th century in Anglo-Saxon cultures. They are obsolete today, as was recognised at the 4th World Congress on National Parks and Protected Areas (Caracas, 1992), and as is being recognised by more and more parts of society.

The seven objectives that this congress proposed for protected areas are to:

1- Safeguard outstanding areas of living richness, natural beauty and cultural significance as a source of inspiration and an irreplaceable asset.
2- Maintain the diversity of ecosystems, species, genetic varieties and ecological processes that are vital for the support of all life.
3- Protect genetic varieties and species that are vital for meeting human needs, especially for food and medicine.
4- Provide a home to communities of people with traditional cultures and knowledge of nature.
5- Protect landscapes that reflect a long history of interaction between people and their environment.
6- Meet the scientific, educational, recreational and spiritual needs of society.
7- Provide benefits to local and national economies and models of sustainable development that may be applied elsewhere.

Here and now, this all starts from the premise that what must be protected are not just areas but also the shared resources that the natural systems in these areas make available to humans. Because, in short, the services that these shared resources supply are vital to society. And the protection of these shared resources should be based on criteria of the sustainability of the shared resource, to enable its continued production and reproduction, as well as its use.

Sustainability criteria for human activities

Below we will look at the criteria that mark whether an activity is to be considered sustainable or unsustainable.[1]

We can say that an activity is sustainable when:
- It uses materials in closed cycles.
- It uses continuous clean and renewable energy sources.
- It comes from human qualities: communication, creativity, coordination, appreciation, and intellectual and spiritual development.

Likewise, we can say that an activity is unsustainable when:
- It requires continual inputs of non-renewable resources.
- It uses renewable resources faster than their rate of renewal.
- It causes environmental degradation.
- It requires resources in quantities that will never be available to everyone.
- It leads to the extinction of other life forms.

Natural areas, shared resources and services for all humans

The shared resources that natural areas offer to all humans include water, air, sun and biomass. Natural systems also supply humans with many of the services that are necessary to maintain life including clean water to drink, clean air to breathe, fertile soil to grow healthy plants and food (biomass), places and environments to enjoy and visit, and so on.

But all natural areas, as well as containing plant and animal communities that must be preserved, are traversed by natural energy flows that move through the biosphere: solar radiation, currents of air and water, the earth's heat, etc. The flow of solar radiation, while heating differently the different surfaces where it falls, causes the movement of air masses (winds) and water masses (the water cycle, ocean currents). Solar radiation is also the foundation for the growth of biomass (solar energy accumulated in the form of plant tissue).

The interaction of the general circulation of the atmosphere (which gives rise to the weather conditions at any given moment), together with the forms and relief of natural areas, mean that in certain areas more than others there is a manifestation of shared natural resources with energy qualities. Also, some of these areas have certain characteristics that make them, rather than others, more suitable for the utilisation of the shared energy resources that manifest in the area.

These energy flows that appear in specific areas and that are concentrated in specific natural systems should also be considered shared natural resources. And not only that, but the criteria that rule their utilisation should be the same ones that rule that of any natural resource: the criteria of sustainability.

Natural spaces and energy

Until today there has been a tendency to divide areas into separate compartments and this applies to both natural areas (to which different protection levels are granted) and areas where energy exploitations are carried out (and these exploitations are often authorised to do whatever they like, however they like). Some examples of this are the dams for hydroelectric exploitation, the areas assigned to thermal and nuclear power stations, the areas assigned to mining of energy minerals (coal, uranium) or areas allocated to petroleum or natural gas extraction offshore or onshore. Conventional energy actions have normally been accompanied by large ecological impacts in the place where the action is carried out. But now we realise that their impacts also affect much greater areas of land (acid rain, global warming, radiation poisoning) rather than just the land where the action is carried out.

Today, however, we are beginning to develop and carry out energy actions that will not necessarily have large and/or irreversible impacts on natural systems in the areas where they take place. Firstly, because they are smaller scale actions (lower installed capacity). And secondly, because they utilise a shared resource (wind, sun) that manifests in a dispersed and non-concentrated way, requiring dispersed exploitations.

The issue of the compatibility or incompatibility of a specific action to make use of a shared natural resource, such as the wind or the sun, in a natural area, depends basically on the scale of the action, the technology used and the sensitivity of the people involved in the action (developers, builders, public works agencies, engineers, government, etc.). The action will also be conditioned by other present or future uses of the space where the action is proposed (agricultural and/or stockbreeding uses, leisure uses (hiking, tourism), and so on).

In the example we are looking at, the utilisation of biosphere flows with energy qualities, such as the force of the wind or solar radiation, in specific natural areas through specific actions should be done so that utilisation follows sustainability criteria of both the shared resource (wind or sun) and in terms of the natural systems and the human communities that live in the places where the wind or sun are present.

In terms of the shared resource, whether wind or sun, it must be used in such a way as to allow renewal and prevent exhaustion.

In regard to natural systems, firstly, these ecosystems can serve as a foundation to support conversion systems for wind energy (wind turbines) or solar energy (water heaters, photothermal generators, photovoltaic generators) that utilise a shared natural energy resource (wind or sun). And secondly, since ecosystems are the foundation that supports other services (agricultural, stockbreeding, landscape, aesthetic, and so on), they must be able to renew, so that utilising the wind or solar energy does not endanger the continuity of the set of services that the natural area offers.

In terms of human communities, the people who live in the places where wind or sun are present are entitled to continue living there. And that is not all—their right to capture and utilise the wind and sun must be recognised. At the same time, these communities should see how the utilisation of the wind or sun brings specific and tangible benefits to the local community as a whole.

And in short, we must guarantee the continuity of supply of the services that shared natural resources offer to humans, without the use being made of them endangering the continuity of life of the plant, animal and human communities in the area where the utilisation takes place.

The right to access shared natural resources

Conflict may arise in relation to the utilisation of a shared natural resource, such as the sun or the wind, in a particular area. Although the conflict appears to be about environmental impact or effect on the landscape, when you scratch the surface you will almost always find a deeper conflict: the right to access a shared natural resource. Who has the right to profit from the sun and the wind in a particular area? The owner of the land? The community that lives there? The people who use the area? Whoever has easy access to capital to invest there?

Since the advent of industrialism and the modern state that justifies and defends it, shared natural resources with energy qualities, and above all the energy materials in the earth's crust, have been publicly owned (a euphemism to camouflage state ownership). This means that when an energy deposit is found (coal, oil, natural gas, uranium), the person or community that owns it ends up losing its ownership and the deposit is given over to the state (expropriation), which directly exercises the right to exploit it, or concedes the exploitation to large energy consortia.

But what happens with the sun and the wind? Who owns them? Who has access to them? The sun and the wind are shared natural resources with energy qualities that have always been freely available to humans for their completely free use.

The solar radiation that the land receives, at ground level, has traditionally being used by humanity for millennia, especially by peasant farmers for growing plants, which are also collectors of solar energy for the creation of another type of renewable energy stored in the form of biomass. The force of the wind that manifests on the land in the lower layers of the atmosphere has traditionally been used by humanity for millennia, by peasant farmers and by the nascent middle class for milling grain, pumping water, crushing, and so on, and since the end of the 19th century, to generate electricity. Many municipalities in rural Denmark saw electric light for the first time from wind generators at the beginning of the 20th century.

Many people are familiar with the cases of Denmark[2] and Austria[3] where, as a result of the first oil crisis in 1973, citizens' initiatives laid the foundations for what today are the modern industries of wind generator and solar thermal collector manufacturing. In both of these cases, the citizens exercised their right to the wind and the sun, directly and without intermediaries.

In the case of the Danish wind power cooperatives, the interested people searched for a suitable location (usually a rural location) and formed a cooperative to generate electricity from the wind. It is worth noting that the legal framework facilitated this and did not throw up obstacles in their path (grid feed-in law and premium feed-in tariffs for electricity sold to the grid).

In the case of the Austrians who built their own solar thermal collectors, a conventional roof was transformed into a capture device to heat water.

In Catalonia, although the system theoretically favours the use of solar energy and wind energy, in practice a citizen would have many difficulties in trying to exercise his or her right to capture and use shared natural resources such as the sun and the wind. At the end of the nineteen-nineties and the beginning of the 21st century, many municipalities adopted solar ordinances[4] (requiring developers to install solar thermal systems in newly constructed buildings and those undergoing complete restoration) and since 2006, the Spanish Technical Building Code has obliged developers to fit new buildings with solar thermal collectors. However, any family that would like to install solar power systems (whether thermal or photovoltaic) on an existing building must overcome numerous hurdles (which are even greater if they live in a building with multiple owners). Not to mention how bad things would be if they wanted to install a wind turbine. In practice the right to access shared natural resources with energy qualities is hindered (or at least made more difficult) by legislative frameworks designed to suit large companies or large capital investors rather than the citizens.

An example of this can be seen in the decree regulating the utilisation of solar photovoltaic energy and wind energy in Catalonia.[5]

Renewable energies and the landscape

This decree introduces a new concept called the landscape impact of installations for the utilisation of solar energy and wind energy. In practice, the decree means that there are many more obstacles in the path of those who wish to access clean and renewable energy sources, such as the sun and the wind, with the excuse that this utilisation will have an 'impact on the landscape'.

Humans have been interfering with the landscape since they have been on the earth. And they do this with whatever action they perform: when they grow crops, when they cut trees for firewood or to build shelter, when they open up a road, and so on. Everything has an effect on the landscape. Landscapes are nothing more than the result of human action. The problem is not so much the modification of the landscape that may be caused by human action, but rather the changes that this action may cause in the ecological functions of the natural systems that the landscape hosts. Too many times we look at the natural systems and only see the landscape, instead of seeing the ecological functions that the natural systems perform. An action can modify the landscape and at the same time improve the functioning of the natural systems. In contrast, too often actions are taken that are justified as improvements to the landscape when in reality they upset the ecological functions of the natural systems.

1 Nickerson, M. *Planning for Seven Generations: Guideposts for a Sustainable Future*, Voyageur Publishing, Hull (Quebec), 1993.

2 Cooperatives - a local and democratic ownership to wind turbines', *Danmarks Vindmolleforening*, August 2009, on the website of the Danish Wind Turbine Owners' Association: www.dkwind.dk/eng/index.htm.

3 Ornetzeder, M. Old Technology and Social Innovations. Inside the Austrian Success Story on Solar Water Heaters, 165-3990, volume 13, issue 1, 2001, p. 105-115.

4 Puig, J. 'Barcelona and the Power of Solar Ordinances: Political Will, Capacity Building and People's Participation', in *Urban Energy Transition: From Fossil Fuels to Renewable Power*, edited by Peter Droege, Elsevier, Amsterdam, 2008.

5 Decree 147/2009, of 22 September, regulating the administrative procedures applicable for the installation of wind farms and photovoltaic installations in Catalonia, (DOGC) no. 5472 – 28.9-2009.

Landscapes also reflect the worldview that humans have at any moment in history. The industrialist worldview of natural systems just sees them as a set of things to exploit. A forest is seen as lumber and firewood to cut down, a river as water to pipe or store, a mountain valley as a place to flood with a reservoir, a mountain as a source from which to extract materials, and so on. This worldview has been imposed on rural cultures, which have suffered the consequences of so-called industrialist development.

Thus the idea that 'the utilisation of solar energy directly on the earth could involve a landscape impact', and that 'the utilisation of the force of the wind could involve a landscape impact', are ideas belonging to a certain industrial urban culture. For a long time this culture has strived to impose its particular conception of the world on the traditional rural conception of utilisation of shared local resources (domination of nature in contrast to co-operation with nature), while making the landscape a consumption value for the people who live in the city, instead of a use value for the people who live off the sustainable utilisation of natural systems.

Thus in practice the supposed impact on the landscape becomes a subjective entelechy, designed by people who are at the service of social forces that want to maintain the present energy system. This system is inefficient, dirty, non-renewable and dominated by a small handful of large corporations that monopolise energy, impede its democratisation and prevent free, clean and renewable energy sources from becoming the dominant energy system of society, even possibly supplying 100% of its requirements.

Today, with the technology that is available to capture solar radiation and the force of the wind, we cannot pretend that the actions that could be carried out to utilise these would be carried out without interfering with the landscape. Some years ago, when wind turbines had capacities below 50 kW and a height of 10 m (of the tower) and a diameter of 15 m (of the circumference of the turning blades), to achieve wind power of 20 MW it was necessary to install 400 wind turbines and occupy the corresponding amount of space. Today this can be done with 10 wind turbines of 2 MW each, occupying much less space, but more visible in the landscape (the turbines are bigger: the blades turn in circles with a large diameter and the towers are higher). We could ask ourselves which option is better. Better for the landscape or better for natural systems or better for society? This is an issue that the decree regulating the utilisation of solar photovoltaic energy and wind energy in Catalonia does not even come close to resolving.

The question of size

Some time ago now, E. F. Schumacher's famous motto 'small is beautiful' became fashionable, but he wrote that this motto should not be interpreted to the letter: 'Small, of course, does not mean infinitely or absurdly small but the order of size, or scale, which the mind can fully encompass'. But what exactly is this order of size or scale? Godfrey Boyle, pioneer of the alternative technology movement in the seventies, questioned it in the context of the Alternative Research Group[8] of the Open University in the UK, while asking: 'How big can something small get before it stops being beautiful?' and 'how small can something big get before it stops being efficient?'[9]

The types of energy technology that are often produced by large industrial corporations tend, by default, to reinforce the trends of the industrialist, consumer and wasteful society. Thus the artefacts produced help to maintain centralised control over energy sources. This is the case with large thermal power stations and large hydropower dams. But what happens when these same large corporations notice that utilisation of the sun and wind is starting to become effective and decide to develop technologies and systems to exploit the sun and the wind?

More simplistically, many activists have believed that the solution was at the other extreme: energy microsystems on a family scale, without realising that this way of looking at things can benefit the industrialist economic system because the material requirements for constructing multiple artefacts on a domestic scale involve much more than the ones for constructing larger systems.

Godfrey Boyle, at the end of the seventies, already advised us to 'concentrate efforts on the development of technologies and products to cover human needs not so much on a family or domestic scale, but on a community scale', even though he recognised that 'certain types of technologies make sense on a domestic scale, other types on a small community scale, others on a regional or even national scale'.

The question of technology

Today's industrial society is facing problems that come from technology and from the current mode of production, and for which it is difficult to find a solution based on the same principles on which this society has been founded up until now: hierarchy, division and exploitation of work, and the spoiling of nature, among others. For E. F. Schumacher, 'the choice of technology is the most critical choice that today's societies must face.' On their own, neither science nor technology, in the words of Robin Clarke, 'will be able to find a solution to the current crisis, but any real solution will involve science and technology, even if in the future, these activities, both qualitatively or quantitatively, may not have anything to do with what we now consider science and technology to be.' [10]

The technological alternative consists of the machines and the tools, the political and social structures, and the organisation of work, through which both people and nature would be liberated of the domination and exploitation that are inherent in our current technology. For Michel Bosquet (pen name of André Gorz), 'without a fight for different technologies, the fight for a different society is in vain.'[11] The change in technology must take place alongside other changes in social relationships so that it can have the desired effects.

Today's science and technology, as a whole, are the cause and effect of the development of today's industrialist-consumerist capitalism. The division of labour, the social classes, and the dominion over the human person are a consequence of the principle of dominion over nature. For this reason industrialist relationships would be reproduced, even if private property disappeared.

Ivan Illich[12] dedicated most of his efforts to eroding the worship by industrialised societies of certain institutions: the school, transport, medicine, and so on. He did this work as part of the Centro Intercultural de Documentación (CIDOC). They organised innumerable seminars on the ways and means of avoiding an expansion of the radical monopoly of industry and professional domination in Latin America. They explored the conditions under which the benefits of modern science could be employed equitably in a society, not just for the people but by the people. The theorisation he proposed of the *concepts science for the people and science of the people is basic for anyone involved in science and techno-science.*

He coined the term *convivial* tool to refer to modern devices, programmes and institutions that enable the common people to generate use values that liberate them from the needs produced by commercialised markets. He especially addressed the growing dependency of the people on intangible merchandise, that is, services. He specifically explored the ways and the means that people could use to live without the professional diagnosis and the professional treatment of their needs; needs such as learning, curing for health, or administration and work place advisers.

Also within the context of the CIDOC he clarified what he meant by *convivial society:* a society where the centre of the economy is what the people create or do personally, in primary groups; a society in which priority is given to the activities through which the people determine and satisfy their needs; a society in which social value is assigned to merchandise inasmuch as it promotes the ability of the people to generate use values.

Illich also recognised that 'it is not easy to imagine a society in which industrial organisation is balanced and compensated with production modes that are distinct and complementary and highly efficient. Our lives are so distorted by industrial habits that we do not even dare consider the range of possibilities. For us, giving up mass production means

going back to the chains of the past, or adopting the utopia of the good savage. However, if we are to widen the angle of our vision towards the dimensions of reality, we must acknowledge that there is not only one way of using scientific discoveries, but there are always at least two opposing ways. One consists in applying the discovery that leads to specialisation of tasks, to institutionalising values and centralising power. This way, humans become accessories to the mega-machine, a cog within the wheels of bureaucracy. But there is a second way of making the invention fruitful. That which increases the everyone's power and control, allowing each to exercise his or her own creativity, with the sole condition of not restricting this same possibility for other people.'

André Gorz said that the fact that conviviality demands convivial tools does not mean that these convivial tools themselves automatically enable us to live together in harmony. There is no tool that is inherently good. Tools will be or remain convivial only if the people using them expressly want them to be so. People will never free themselves with technology alone. All that we can say is that some technologies leave room for convivial self-determination, whereas others do not. But no technology can determine self-determination and any technology can be used in a way that makes self-determination possible. Any technology can be corrupted according to the sociopolitical context in which it is used.

In her book *Reference Guide to Convivial Tools,*[13] Valentina Borremans put it like this: '[...] scientific discoveries can be used in at least two ways. The first leads to specialisation of functions, institutionalisation of values, and centralisation of power. It turns people into accessories of bureaucracies or the machines. The second enlarges the range of each person's competence, control and initiative, limited only by other individuals' claims to an equal range of power and freedom.'

For André Gorz, 'all technology can be used to reinforce the control of the bureaucracy over the people, because there are no unambiguously "good" technologies, if what we mean by that is that a technology cannot be used in any way other than a convivial way. However, there are bad technologies such as those that because of their characteristics require a technocratic domination of many by few. The large tools are means of centralisation and control regardless of the intentions of their inventors'.

For André Gorz, the only possible sense of the post-industrial revolution and the purpose of political action is to use heteronomous production so that it enables each person to expand their level of autonomy—something that involves rethinking and remodelling technology and social organisation in an appropriate way. The other projects are roads to hell.

Convivial energy technologies

Today, in the middle of the energy debate, it is good to remember what Ivan Illich wrote in 1974: 'To believe in the possibility of high levels of "clean" energy as a solution to all evils is an error of political judgement. It is to imagine that equity in the participation in power and the consumption of energy can grow together. Victims of this illusion, industrialised men do not put the slightest limit on growth in energy consumption, and this growth continues with the sole purpose of providing ever more people with more products coming from an industry controlled by fewer and fewer people. [...] My thesis is that it is not possible to achieve a social state based on the notion of equity and at the same time increase the energy available, unless it is with the condition that per capita energy consumption stays within certain limits.' And he continues by saying: 'Now it is necessary that politicians recognise that once physical energy has crossed a certain barrier, it inevitably corrupts the social environment. Even if we manage to produce non-polluting energy on a large scale, the massive use of energy will always have the same effect as intoxication with a drug that is physically inoffensive but psychically enslaving. The people can choose between a substitute drug and a voluntary detox; but they cannot aspire simultaneously to the evolution of freedom and conviviality on one hand, and an energy-intensive technology, on the other.'

It is also good to remember what some authors wrote about so-called cold fusion, which was supposed to be an unlimited energy source. For example, in 1989 Donella Meadows wrote:[14] 'There are "people who have thought deeply about the role of energy in human affairs." Their conclusion was summed up by Stanford biologist Paul Ehrlich. If we were to tap cheap, inexhaustible energy, he said, it would be "like giving a machine gun to an idiot child." Imagine what might happen if all energy constraints were lifted [...] We would never run out of materials, they say, because we could grind up ordinary rock for its copper or palladium—forgetting that over 99 percent of ordinary rock is ordinary rock and would be left behind in huge, leaching piles. We could produce fertilizer for all the world's farmers, they say—forgetting that fertilizers run off to pollute waters. We could manufacture anything we want—with all the accompanying wastes But we could use some of our abundant energy to combat pollution they say—unaware that most "pollution control" methods simply move waste from one place to another, from air to sludge, for instance, or from Philadelphia to Africa. If material desires remain unlimited and our planetary consciousness remains primitive, we would just use unlimited energy to generate waste. With no energy constraint, we would run into environmental constraints all the faster. [...] I'm one of those who hope that tabletop fusion is a mirage—which it probably is. I hope that we human beings have more time to bring ourselves to live within limits, to live in harmony with each other and the earth, and to find purposes more worthy than the accumulation of power or wealth. The funny thing is, if we ever do become willing to live gently, moderately, and unselfishly, we will see that we already have cold fusion at our fingertips. Fusion is the power that lights the stars, including our sun. Fusion power falls on our heads in quantities much larger than we need, generated from a reactor located a safe 93 million miles away, with an expected lifetime of several billion years, and with no need of investment or maintenance from us. We don't think much of this power, because it comes at a regulated pace that can't be hustled. It is difficult for anyone to corner. By the crazy reckoning of our economics, which counts only benefits to some human beings and discounts costs to most human beings and to the environment, we think it's expensive. But it's not expensive, it's not polluting, and it's there for us to use, as soon as we are wise enough to use it.'

André Gorz already warned us that 'some ecologists ingenuously believe that renewable energy is good in and of itself and that its development will be a source of liberty and conviviality'. And Valentina Borremans also warned us against this ingenuous belief: 'The fact that such production may be less destructive of the physical milieu does not necessarily mean that it is a convivial tool.' And she gave examples: the production of methanol from wood, or biogas from organic waste, or electricity from solar cells and wind turbines can be convivial or technofascist.

6 SCHUMACHER, E. F. *small is beautiful: economics as if people mattered,* Blond & Briggs, 1973.

7 SCHUMACHER, E. F. 'The critical question of size', *Resurgence* (3), 1976.

8 Today it is known as the Sustainable Technologies Group. See: Energy and Environment Research Unit. http://eeru.open.ac.uk/.

9 BOYLE, G. 'Community Technology – Scale versus efficiency', *Undercurrents* (35), 1979.

10 CLARKE, R. 'Technology for an alternative society', New *Scientist*, 11, January 1973.

11 BOSQUET, M. (ANDRÉ GORZ). *Écologie et Liberté,* Éditions Galilée, Paris, 1977.

12 All the works of Ivan Illich are available at: http://www.ivanillich.org.mx/Principal.htm

13 BORREMANS, V. *Reference Guide to Convivial Tools,* Library Journal Special Report #13, Bowker, New York 1979.

14 MEADOWS, D. 'When We're Ready for Fusion Energy, It's Ready for Us', The Donella Meadow Archive, 1989. http://www.sustainer.org/dhm_archive/index.php?display_article=vn277fusioned

These will be convivial if the people have direct access to them and complete control over the materials and tools that enable them to determine their own needs and the way to meet them. The obvious link between production and consumption, level of needs and quantity of work that would need to be performed will require transactions and it will translate into spontaneous self-limitation of needs. So methanol, biogas and electricity will be technofascist if they are produced in enormous plants owned by large corporations or on gigantic geostationary satellites that capture sunlight and send the energy to earth, or with gigantic wind turbines at high altitudes in the jet streams. Renewable energy can be captured and used in the same way as electricity is made in a nuclear reactor and with the same social results. The only social difference between nuclear and solar technology is that solar energy favours convivial decentralisation and self-determination, whereas nuclear technology does not.

Solar collectors, solar energy farms, wind farms, and so on can be used as instruments of technofascist control, but they can also not be, because they can also be used in a convivial way. This is why André Gorz called these technologies ***open-ended technologies***. In contrast, nuclear power plants can only be used in one way, which is basically technofascist and appropriates the future options. This is why André Gorz called these technologies ***dead-end technologies***.

For political ecology, this distinction between *open-ended technologies* and *dead-end technologies* is as important as the distinction between *hard technologies* and *soft technologies*.

In contrast to conventional energy technologies, which are based on degradation and destruction of energy materials, and prevent these from being available to future generations, technologies to capture and utilise renewable energy sources can be used in two opposing ways. On one hand, they can be employed to reinforce the social trend of maintaining the centralised control that the technobureaucracy holds over energy sources (and also over renewable sources that are naturally decentralised), which increases the degradation of natural systems. But on the other hand, they can also be used to favour the autonomy of people and communities, while respecting the integrity of ecosystems.

Whether they are used in one way or the other has quite different repercussions on natural systems. This is because it is the manifestation of the worldview incorporated in this choice: domination of nature (breaking open the earth's crust to extract energy materials, with ecological and social aggressions of all kinds; burning them and emitting greenhouse gases into the atmosphere or fissioning them and radioactively poisoning the biosphere, and so on) or cooperation with nature (integrating into the biosphere flows to capture them, respecting nature's cycles). ●

Moving beyond the Theoretical Energy Model to Reconcile Landscape and Renewable Energies

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Interviewed by Michele Catanzaro
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Catalonia has hardly any natural resources and historically has moved heaven and earth to have the necessary energy available to develop. Today, renewable energies, particularly wind power, are considered a good alternative for Catalonia, but implementing their use is no easy task. Quim Corominas and Joan Nogué talk about the bottlenecks that hinder the deployment of renewable energies and reflect on how to reconcile landscape preservation with the country's need to develop renewable energies.

MC: Setting up wind turbines and solar panels can lead to conflict: are landscape and renewable energies incompatible?

JN: They shouldn't be, because it has been proven that they can be perfectly compatible. But you have only to take a trip through Catalonia to realise that conflict is generated in this respect. There are reasons for this. For example, lack of information, present in most regional conflicts, not only those relating to renewable energies. The root of most regional conflicts is dreadful communication policy, with textbook examples of communicative incompetence, as is the case of the very high-voltage lines (MAT). The second reason is the energy model, that is, the energy control and management model we have adopted, in regard to renewable energies, too: we have never thoroughly discussed—let alone agreed by consensus—the prevailing model. And I would mention a third reason, which is important: unlike many European countries, Catalonia has only just started including landscape into its town and country planning, also in regard to energy infrastructure, including renewable energies. There are more reasons, but I think these are the three main ones.

MC: Do we lack a landscape culture?

JN: Notable advances have been made over the last few years, starting with the passing of the Catalan Law on landscape protection, management and planning. Let us not forget, however, that this is a recent law, passed in June 2005, and the decree