

«L'energia, reptes i perspectives de futur de les energies renovables  
a les ciutats»

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Barcelona, 13 d'abril, Ajuntament de Barcelona

13<sup>th</sup> april 2004

Thank you very much.

I'm speaking I think for the third or fourth time in Barcelona but never in this building and never invited by the City and my first impression when I joined the building was that this architecture is much more intelligent than the modern architecture because it's built in a way of using the whole building for having always enough shadow and cooling in summer but it's built in a way that nevertheless, I suppose, that the heating quantities in winter are not so large, not so much like in modern buildings. If you look to modern buildings, think about the new hotel in Dubai which is going around the world press, then you find a kind of modern "stupidisation" of architecture. A building in the middle of the sun getting tremendous quantities of sun but not using it, and instead of that many electric powers produced in oil power stations for cooling that building and therefore this is very typical way for the present energy system beside nature conditions and in contrast to nature conditions. And this global energy system of fossil nuclear system is at its end.

That is my first remark. It is at its end although it represents 95% of global commercial energy supply and demand. How can I come to such a conclusion? That ruling dominating energy system is at its end. The answer to this is that this nuclear fossil energy system can't create a positive future any more and what can't create a positive future should be replaced. Two reasons speak for that. The first reason is that nobody can contradict the matter of fact that the fossil including nuclear energy sources are running out and the time of running

out comes very fast. If we look to the present world energy consumption on the one side, and to the reserves which are more or less known on the other side, then we should expect that in the run of the next 4 decades the oil reserves will disappear, will come to their end of use, to the final consumption.

Looking to the natural gas resources, we have nearly the same situation, nearly the same situation. Looking to the coal resources, they are based on the present oil consumption, perhaps 120 years more. But who can imagine that after the phasing out, the running out of oil and natural gas that there should be more coal consumption than today. And if you look to uranium, the basic material for nuclear fuel, there is experience based on the reserves in uranium mines that if the number of nuclear power stations would remain in the last 40 years already there are 436 nuclear power stations working, although the nuclear uranium reserves will be out.

That is the situation. That means we are in a race against time. Even if there were not an environmental problem with these resources. But everyone could have enough fantasy, or should have enough fantasy: what happens if the curve of reserves is going down and the curve of energy demand is going up? And it goes up because there are some countries, some regions of the world who now are in a situation to copy our economy of growth based on fossil energies, like China and India. China and India have 2 billion people together, this is one third of total world population. At the present time they consume per capita only 10% of the energy consumption in the so-called Western industrialised world. But they want to have 100%, they want to have the same situation like we. Each day in China there are 20,000 new cars on the road, each day. A tremendous growth, and therefore manifold tensions about the contradiction between demand and possible supply will increase.

And the time of oil wars has just begun. Everyone can imagine, or should know, that the Gulf War in '91 as well as the Iraq war in 2003 and '04 – a war which has not ended – would not have happened if in Iraq there had been plantation of bananas instead of extraction of oil – everyone should know that. And the situation is, since '91, that the American States Government spent, just before

the Iraq war, annually, 60 billion dollars for their military standby forces in the Arabian Peninsula, for having military access if there were problems with oil sources. And this was per barrel of oil which was delivered from that region to the United States, 100 dollars military security cost, sometimes eight times more than the cost of a barrel of oil, actually it would be three times more.

And these costs are in no oil bill but they are originated by the oil, by the oil problem. And what happens if we approach this crossing point of supply and demand, if we should come to that crossing point? Mankind would have the most bloody conflict in its whole history. A real existential conflict. And in the decades before, the oil prices and natural gas prices will go up. More and more people in rich countries will not be able to pay any more their energy bill and more and more countries in the world, more and more national economies will not be able to pay the import costs for oil.

We have already 40 countries in the world – most of them in Africa – who have to pay more for the import of oil than their total export earning is. That means they don't have any economic chance because of this oil-dependency. And their only chance would be to change to indigenous energy sources, and indigenous energy sources are renewable energies. Some countries have fossil resources but renewable energies are in each country there as an indigenous source for meeting energy needs. That means that we come to a situation of increasing international tensions, sometimes military tensions and wars and economic problems and the only answer to this is to mobilise renewable energies everywhere to avoid such conflict.

But this is my second point. Even if there were enough reserves – even if there were more reserves – it would not help because the ecosphere of our globe could not keep just the burning off of all present-known energy reserves. That means that we have – before all these reserves are burnt off – to organise the alternative. The alternative is renewable energy mobilisation and there we have 2 big decisive existential differences. Here are the exhaustible conventional energies, there are the not exhaustible renewable energies, not exhaustible as long as the sun system exists, and the sun system will exist, following

astrophysics, not astronomy, not astrology, will exist 5 billion years more. Once when I gave this number, someone asked me “did you say 5 billion or 5 million?” When I said 5 billion then he answered that he was satisfied.

The sun delivers to our globe each year 15,000 times more energy than the annual nuclear and fossil energy consumption is. That means that the argument that renewable energies are not enough for replacing the conventional energy system is ridiculous. We need only 1 part of 15,000 with the help of technologies for harvesting the natural energy potential and we have solved the energy problem in an environmentally sound way. Because environmental problems, real environmental problems, can't come with renewable energies. This is the second difference. Conventional energies which destroy the ecosphere, renewable energies which are compatible with the ecosphere, which have originated in the ecosphere, because renewable energies are going through our ecosphere, whether we use these energies or not. They are there. There is no possibility to extract it because it is not beneath. It is flowing through the ecosphere and we have to harvest it with technologies.

And now I come to the third difference. The third difference leads us to the structural answers and to the policies. Because many people ask if that is true, that there is enough potential that it would be possible to take this energy supply with the help of technologies, then because it is not done, because it is not implemented, then it cannot be the truth. This argument overestimates the rationality of policy, science and societies. Mainly of science itself. I remember one sentence of Max Planck – Max Planck and Einstein were the most important physicists of history, I suppose – and Max Planck wrote in his autobiography in the 20's of the last century, that his experience of his scientific life is that a new truth, a new scientific truth will not become dominant because of additional learning repressed by representatives of the old scientific truth. It will only become common knowledge if the representatives of the old truth will die out step by step.

But we have no time to wait for that, because we are in a race against time. We have to organise a speed of this development and this can only be done by

political steps. For many reasons, one reason is that at no time in the history of energy, did energy source and energy carrier get its breakthrough only on the market, it was always based on political strategies – always. Very different strategies, but it was always based on political strategies. And such exists also for renewable energies and therefore we can't leave such an existential decision to the market, we have to take the responsibility about all the adequate steps which are necessary for the dissemination, the broad introduction of renewable energies for replacing the existing energy system. But why did this not happen? Why are there so many resistances? The reason is a structural one, and we have to understand this. And if we understand this, then we will find the right answers.

Energy consumption, this is the third difference, between the renewable energy system and the conventional nuclear and fossil energy system. Energy consumption is always decentralised, it happens where people work and live. Energy production and extraction and mining of conventional energies is at very, very few places in the world. And because this nuclear fossil energy soon became dominant, reaching to the last villages in the world, there was a creation of an energy system which became very early internationalised and globalized, where from fuel sources, the energy delivery, the energy transportation to billions of people, happens.

Look alone to the oil situation. Oil represents 40% of world energy consumption. 60% of this oil of this 40% world energy consumption – 60% – comes from 40 so-called giant fields. 26 of these 40 giant fields are in the countries around the Gulf, in the Gulf States. This dependency is dangerous for many, many reasons, and because the way of these energy sources is sometimes very, very long, sometimes around half of the globe.

We in Europe consume coal from Australia. There is a transport line of 20,000 miles. And that means there is a long energy chain. This energy chain consists of sometimes 10, sometimes 15, sometimes 20 single elements. Each element is linked with the others, must be linked, can only work with such a link. Each element is a cashier, and based on this, we created and we have a very

complicated energy delivering system and this complicated system made it possible nevertheless to have relatively cheap energy for us only for one reason. Because there are high quantities that are channelled by this chain, from the sources to the final consumers. High quantities.

And renewable energies are not at very few places in the world. It is a natural potential delivered to us everywhere. There are some differences from region to region. There are some regions in the world that have more solar radiation than others. There are others that have more wind. There are others that have more natural running hydro, running water for getting hydro power. There are some who have the opportunities to use wave powers. Or there are some that have better opportunities to take biomass as a renewable source of energy. There are some countries which have all of these advantages together. But we can show for each country that it is possible to have a total renewable energy supply for all energy needs. But it requires a technological and structural revolution of the energy system.

Renewable energy leads to a system of indigenous supply for regional demand. For decentralised demand. The conventional energy system created a structure world-wide in which there was a decoupling, a separating, a separation, of the places of energy consumption and the places of energy extraction and mining, globally. With renewable energies, we can re-link the spaces of energy consumption and energy harvesting. That means we are coming from a long energy flow, to a short energy flow, from a global energy flow to a regional or local energy flow.

But it is impossible with renewable energies – with some exemptions – but in general, it is impossible to take the existing energy system, which also was constructed for the energy flow of the energy processing of conventional energies, to take the system order for renewable energies – that's impossible, or only partly possible. Because the energy flow is very different, we have to be aware about the point that the determinating element or factor for an energy system is the source of the energy and its flow. This source we want to have determinates which kind of technologies we need. It determines which kind of

infrastructure we need; it determinates which kind of power stations and power technologies and conversion technologies we need and which kind of transportation technologies and systems we need. And because the energy flow is totally different, also for the question of energy, the question of different energy densities, we need for renewable energy harvesting other technologies, other infrastructures, other storing technologies and so forth. And because we have the chance to re-link the spaces of energy consumption and energy harvesting, the main activities for coming to such a future energy system must happen at a local level.

The change to renewable energies is a change not only of the sources; it is a change from a few big power suppliers to many. That means we need many people who have learned and who are trained for the application of renewable energies. It is a way in which there are many new winners and some losers, as happens with each structural change. The main loser will be the present suppliers of primary energy for oil, gas, uranium and coal. Because it is impossible to change from being a supplier of oil to become a supplier of solar radiation. Solar radiation as a primary energy is not commerciable. Because nobody can privatise the sun. And nobody can install cashiers for solar radiation. It is impossible. It's the same situation with wind. Only if we look to biomass, there is a commerciable primary energy but behind this there is agricultural work, which means that the energy bill doesn't go to the sheiks any more or to the big oil companies, it goes to the farmers.

And this again is a very principle difference. And that means we have to look for all the preparations at a regional and local level to take over the opportunities for renewable energy acceleration. Which kind of strategies are needed? And how can we overcome the point, the main argument which is used against renewable energies? It is the argument that it costs too much.

Therefore, let me say some words about the cost. If we were to take into account all the costs of the present energy system, which are not in the energy bill, we would all come to the point that the conventional energy system is no longer payable. Look at this last summer, the electric power crisis last summer

in Europe, mainly in Italy. The economic costs of these four or five weeks of electric power crisis, it was about 15 billion euros, for the Italian economy. And it is not possible to take into account the 5,000 people who died because of the climb of the electric power system and the heat wave, and the heat wave was originated because of the climate change. Nothing was in an energy bill.

Rare was a programme up to now for 15 billion euros pushing renewable energies, nowhere. This means we have more and more and more and more countries with ecological crisis and catastrophes which must be paid, which must be compensated with public money, and these total expenditures could be better spent in avoiding such developments. But we can come, in general, to the conclusion that one point is obviously the cost for renewable energy will go down – that is a kind of technological economical law, because the history of technologies show that with each technology costs go down with mass production and technological improvement. And technological improvements will not end – not really. And because all costs for renewable energies are only costs – with exception of biomass – for technologies nothing else, not any more for primary energy, we have the future view that for sure all costs for renewable energies are going down, and if not in the biomass case, it will recreate agricultural economy.

But the costs of the other side, of conventional energies, will go up, because of the reasons I have mentioned at the beginning of my speech. And therefore we are now staying at a watershed. What will we do? The longer we postpone the push to renewable energies, the more damages we will have in the future, the more the present system will become unpayable. And the best opportunities we have to do this are at local level, mainly in the building planning, the construction planning. Some elements for that are done in Barcelona, with the Barcelona solar ordinance; there are not many big cities, I think this is the only one of the big cities that took such an initiative. But this is only one step. The experience we have in Germany now is that there are three thousand private homes in Germany – in Central Europe, with less sun than in Spain – three thousand private homes that do not need any more conventional energy for their heating, for their energy needs in their houses. In Central Europe, we have



- I think it is a little less in Spain – we have 40% of the total of energy consumption for the heating of the buildings. 40%. Here it is perhaps a little less but on the other side you have perhaps more energy needs for cooling the buildings in summer with electric power from conventional power stations. And that means more and more heat processes for more and more cooling.

This is not very intelligent in general and if you look at the opportunities we have for coming to purely solar buildings, that means we have to look at all the requirements how to organise this in general. And this means education of architects, that means education of engineers, that means mobilising of hand-craftsman for that, in the whole construction of buildings. And these are public challenges. And that means to continue and to extend all the public obligations in the construction sector, towards a replacement of conventional energies. This is one strategic key.

Another strategic key at the local level is, in my point of view, to overcome the present situation of having so-called heat power stations. The heat power stations which represent 90% of the electric power production in the whole of Europe are a technology of the 18<sup>th</sup> century. It is the technology of the steam-engine of James Watt, not more, a little bit more efficient. And these steam power processes can never lead to a real efficient energy system.

These heat power processes create another increasing problem, mainly in Mediterranean countries already, later on also in Central European countries. It is a problem which is mostly ignored in the energy debate, and it is also ignored in the water debate.

I speak about the increasing scarcity of water – the water crisis that is running in many countries. And we should look to the matter of fact that the largest, in most countries in Europe, the largest water consumers are the heat power stations. In Germany, it is 74% of the total water consumption happens in heat power stations. For taking water, for producing heat, for producing steam and to take the steam for producing electric power. Then you have a lot of water losses, and if you think about nuclear power stations, we have the situation that

a lot of water is needed for cooling water otherwise nuclear power plants can't work. That was the reason why during the heat wave of last summer all nuclear power stations in France along the Rhone River had to be stopped. There was not enough water any more for cooling. And this water problem is not a problem of the past – it is an increasing problem of the future. Therefore, it is irresponsible to build new heat power stations in the Mediterranean Basin, for instance. At least, in these countries in which the water scarcity increases, and that water scarcity can come very surprisingly – it is a follow-up of the climate change process.

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It is useful to think about mobilisation not only waiting for private activities; the mobilisation of all power processes by renewable energies not only with photovoltaic but also with wind and biomass.

[pausa llarga]

In European countries, mainly in countries with coastal regions there are, more or less, increasing wind energy conditions. Increasing because there is a technological development which allows – if I take the newest ones – which allows to have with 4 or 4.5 megawatt wind power plants which allows to have seven, seven thousand five hundred or eight hundred - eight thousand hundred hours of wind-energy production through the year, that means nearly continuously.

And my last point would be: one should take every way at the local level a look to mobilise bio-fuels in collaboration with the agricultural sector, with the agricultural environment around the cities. The main fuel for the path for the future and the most clues for implementation is not hydrogen – much closer is the opportunity to take bio-fuels in a modern way based on gasification processes and then producing bio-ethanol or bio-methanol and to substitute by this way the traditional fossil fuels which are now delivered everywhere. This is at the same time the most important European answer to the oil troubles in the

Arabian countries – the coming oil troubles which are political and economical ones. And if we ask ourselves who could be the carrier of a renewable energy transport fuel strategy we should not wait for the mineral oil companies.

The adequate carrier for that would be in my point of view – I have written this in my last book which was also published in Spanish, and I am pleased that my Spanish publisher **Hans Meike (?)** is sitting here of Galaxia Guttenberg and the title is *Economía Solar Global* – and here I have pointed out that it is possible and necessary that local utilities will become transport fuel producers in collaboration with the agricultural sector in their region, which will lead to new economic surpluses for the whole regional economy. It is a main economic strategy for the revitalisation of regional and local economies and for this I want to give finally one quantified example.

I must take the numbers of Germany, but you could make a comparison with the numbers in Spain or in Barcelona: the annual energy costs, energy prices, one person has to pay has a total amount in Germany of an average of 2,500 Euros per capita. That means a four-people family pays annually 10,000 euros for their energy needs. It is the energy bill, the heat bill, the fuel bill, it is the electric power bill, and also involved in that number is all the energy costs you have to pay for all the goods you are buying. Whatever you are doing, paying energy costs is involved. And this leads to a total of 2,500 euros per person per year, energy payments. This is in a city of 1 million people, 2.5 billion euros. In a city of 2 million people, 5 billion euros and now in a region with 3 million people or 4 million people in the region, 10 billion euros. And if the whole energy – and this is the case in many regions in Europe – is imported, is coming from other places, such as is the case in the fossil energy system, that means before something can happen there is a payment in a 4 million people region of 10 billion euros. This must be paid anyway – this money leaves the economic space of this region anyway. And now imagine what will happen if step by step there is a replacement in the coming decades of this energy importation by energy production and conversion of renewable energies from the region itself. That means the energy bill for the region, the money which leaves the region for the payment of energy will go down and down to the point of zero, to the point

of zero which is reached when all energy comes via renewables. It is the same as an annual economic promotion programme for the region each year of 10 billion Euros. No government in the world was ever able to give such a promotion. And it is distributed, this money, without bureaucracy. That means, this indicates a structural change in the course of economic development, not more and more globalisation of all economic activities will happen – if we change to renewable energies we will have in the resources field – there is no economy without resources – a recreation of regional economy and that for the whole future. And this will re-stabilise our economic structures and will keep it social.

Thank you very much.