Keynote Speech

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Dr. Hermann Scheer, Member of the German Bundestag
General Chairman of the World Council for Renewable Energy (WCRE)

Ignoring the possibilities of renewable energies was one of the greatest failures of the 20th century. At the same time, one of the biggest problems of the 20th century was the worldwide orgy of energy consumption that accompanied it and resulted in man using twice as much energy between 1950 and 2000 than in all prior history of civilization. This process was triggered by the beginning of the Industrial Revolution in the late 18th century. The Industrial Revolution was founded on fossil energies. The fossil energy economy emerged with the availability of power for the steam engine, which became the primary means of energy conversion for more than a century - not only to replace human and animal labour with mechanical power and thus enable the introduction of mass production, but also for steam ships and thus the beginning of a global transport system, for steam trains and thus modern overland transport, and finally for the large condensing power plants driven by fossil fuels - and later by nuclear energy - that still function according to the principle of the steam engine.

We now have worldwide electricity supplies that are based on 18th century technology and the use of fossil fuels that have no future. The energy system prevailing in the world today has come to the end of the line, even though it accounts for over 90 percent of total supply - and even 100 percent in some countries. It is nearing its end because it no longer has a viable future for two irrefutable reasons. First, no one can deny that reserves are limited. Second, we

can no longer afford to burn all the reserves known today because the Earth's ecosphere could not bear it. In fact, the ecological limit of the current energy system will be reached even before our fossil energy resources are exhausted. Nuclear energy is also a fossil energy form, because it is based on the fossil mineral uranium, and uranium is also exhaustible. If the number of nuclear power plants stays at the current level, uranium reserves will be exhausted in less than fifty years.

The people who want to preserve today's energy system have their eye on a second generation of nuclear energy exploitation, namely nuclear fusion. They fail to realise, however, that nuclear fusion would lead to energy supply structures that would further intensify current energy dependencies, because it would inevitably result in more extensive centralisation of energy supplies compared to today's decentralised nuclear power plants. Proponents of nuclear fusion ignore the substantial risks inherent in it. They also forget that we cannot wait until nuclear fusion perhaps becomes technically available sometime in 2050, 2060 or 2070. The world cannot afford to wait until then to change the basis of its energy supply. Once this basis has been switched to renewable energies, there will be no need to look for another energy source. Man has always gone in search of a new energy source when the current one was no longer sufficient or threatened to run out. However, this will not happen with renewable energies. We already know today that the potential of renewable energies is so great, that even if the world population were to multiply, it would still have enough available energy. Renewable energy is inexhaustible as long as the solar system exists. According to the latest findings in astrophysics, the solar system will survive for another 7 billion years - a virtually infinite time span by human standards. Someone once asked me when I mentioned this figure whether I had said 7 billion or 7 million years. When I repeated that it was 7 billion, he said he was relieved, as if 7 million would have been a cause for worry! In other words, we have a potential energy supply that contradicts the idea that "saving energy is the greatest source of energy". By far the greatest energy source is that which comes from the

sun, or the sun itself. Making this potential the basis for all human activity would help man to behave as intelligently as Nature. Our collective intelligence lags behind Nature, which relies exclusively on solar energy. We turned our backs on solar energy when the Industrial Revolution began. Prior to the Industrial Revolution, an attempt was made using non-technical or relatively primitive technical means to exploit solar energy or renewable energy - the two terms being synonymous. If we now want to return to solar energy, we can and must use the available technical means. That is the fundamental difference between today and the pre-industrial period.

A number of international activities have been launched in recent years to get the global energy problem under control. On the UN level, they centred around the search for alternatives – particularly after the Global 2000 report and many other publications, not least the work of the World Watch Institute since the 1980s, made it increasingly obvious that the world was heading towards a crisis. None of these activities has been very successful, and there are naturally reasons for this. However, because we are in a race against time, and none of these initiatives are capable of winning it, we must look for new strategies. The first major attempt was "Our Common Future", also known as the Brundtland Report, which was published by the United Nations in 1987. But instead of recommending actions, it recommended a conference. Conferences are important when they help prepare a decision, or multiply and disseminate an idea. However, conferences that are merely a substitute for action are a bad thing. They are the reason we have been experiencing a process of global negotiation accompanied by national and global postponement for the last fifteen years. We must put an end to this process. We must stop letting ourselves be blinded any longer by false actions. Everything that could have been resolved or implemented on the national level in 1987 was postponed with reference to the forthcoming conference in Rio de Janeiro in 1992.

A wonderful document was adopted there, known as Agenda 21. Its drawback, however, is that it excluded the core issue, energy.

Agenda 21 very accurately lists all the global development and environmental problems that exist - from acid rain and the change in the Earth's atmosphere, to desertification and dwindling water supplies. Separate strategies for tackling these problems are recommended for each individual category. This work has kept thousands of experts busy right up to today. However, if you consider, or try to analyse the real reasons for most of the problems listed in Agenda 21, you directly or indirectly come to the conversion of fossil or nuclear energy into useable energy in virtually every case. The conclusion is then logical and unequivocal: the core of the solution to the global ecological crisis is the switch to renewable energies. If the wrong energy is causing all these problems in such a wide variety of sectors and ways, then switching to a type of energy that cannot cause such difficulties would solve a host of problems all in one go. That's why we decided to call this forum: "Renewable Energy – Agenda 1 of Agenda 21", to ensure that this issue is no longer excluded from Agenda 21 as it was in the past. Agenda 21 can only be successful if all strategies focus on the switch to renewable energies. That is the message of this forum, which we must spread all over the world and also publicise for the Johannesburg Summit.

One of the follow-up activities of Agenda 21 is the Kyoto Protocol to the Climate Framework Convention. A total of eight negotiation meetings have been held in nine years. The final outcome was that industrial nations that ratify the protocol are obligated to reduce emissions by five percent compared to 1990 by 2012 (for the first commitment period from 2008 to 2012). However, the actual reduction is only around two percent, because other circumstances, such as sinks (vegetation, soil, etc.) can be deducted. As we all know, the USA is not participating in this agreement. The developing countries are not included, because the

participants concede, and rightly so, that developing countries need to use more energy to support economic growth. However, this fact alone illustrates that the world climate negotiations have given hardly any consideration at all to renewable energies, as if life without fossil fuels were unthinkable. The most probable outcome of this situation is that worldwide emissions will increase by another ten percent by 2012 compared to today. Many say that a minimum result is better than none at all, and they support the continuation of the world climate negotiation process in the hopes that more ambitious goals will be adopted for the period after 2012.

The Intergovernmental Panel on Climate Change (IPCC) says that 60 percent of CO_2 emissions must be reduced by the middle of the century to stabilise the world climate. In other words, even if the current agreement included the USA and the emerging countries and implemented the two percent reduction by 2012, who can realistically imagine that the continuation of this negotiation approach will ever result in the big jump to 50 or 60 percent in the subsequent 38 years after 2012? No one can realistically foresee that happening. This is due to a fundamental error when considering CO_2 reduction, which spawns even more fundamental errors. The Rio and Kyoto processes are both based on the same false premise that the switch to renewable energies and all measures to reduce fossil energy emissions are an economic burden - a burden that cannot reasonably be borne by only a few national economies. Therefore, a way must be found for the burden to be shared by all. Only then can the switch be accomplished. Anything that is considered to be an economic burden leads to haggling over the sharing of the burden. Because all these negotiations can only lead to a result by reaching a broad consensus, without which there can be no valid agreement under international law, those who want to slow the process, or who perceive the result to be a particularly heavy burden, have virtually every opportunity to water down the resulting actions or prevent them from ever coming to fruition. Consequently, the process in itself is a

contradiction. And especially on an issue that demands rapid action, it is also a contradiction to make initiatives dependent on consensus, because rapid action and consensus are contradictory.

The cheap excuse is frequently heard that someone wanted to take action, but couldn't because the others unfortunately didn't go along with it. Ten years ago, I participated in a hearing of the US Senate's Financial Committee. After I explained the great possibilities of renewable energy, the chairman asked a government member why it was not being promoted. The government member said that although everything I said was correct, there was no broad consensus on it in society. My response to that is: "Whenever a government really wants something, it doesn't necessarily ask whether a consensus exists, if it is convinced of the importance of the issue. It just goes ahead with it and calls it *leadership*. When it doesn't want something, it says there is unfortunately no consensus on it." The reference to consensus is the same as admitting that no one wants to take *leadership*. The reference to consensus is a sign of political weakness. However, what we need for the switch to renewable energy is political fortitude.

People have to be actively motivated to show this kind of political fortitude. In other words, we must determine how to build up new momentum for renewable energies - and we can learn a lot from the history of the Industrial Revolution and the numerous, minor technical revolutions that have occurred since then. This new momentum comes from three sources: pioneers who recognise the advantages of this alternative, those who overcome the initial difficulties that inevitably arise, and those who, by doing so, set a new development in motion and get others to join in. I can remember an example: the Club of Rome published a report in 1978 that discussed the extensive impact that the introduction of microelectronics would have on economic structures. The report said that microelectronics would make hosts of people

superfluous in industrial and service occupations, because more and more jobs would be handled much more quickly and accurately by modern information technology; that entire branches of the economy would disappear while several new ones would emerge. The report also predicted that all societies were heading towards a comprehensive economic structural change that would lead to new challenges and burdens. Every structural change has winners and losers, which illustrates why all hopes of "win-win" situations are illusory. Those who rely on "win-win" concepts for the energy switch would have to promise to leave the fossil energy economy intact. But if it remains intact, we can just forget the whole idea, because it is relatively meaningless to the fate of the world whether renewable energies make up five or ten percent of the total energy supply. What is of paramount importance is whether we succeed in triggering the change at all. If the share of renewable energy were to remain at five or ten percent, we would be able to check the risks of fossil energies - from ecological to safety risks - but not overcome them. However, our objective is to overcome these risks, and that's why we are dealing not with "win-win" concepts, but with questions such as: What happens when a structural change takes place that affects numerous economic sectors? How was such a structural change triggered? The authors of the Club of Rome Report would have made fools of themselves if their recommendations had said in 1978 that, because the introduction of microelectronics is a structural change that will cause major social problems, it can only be promoted on a basis of consensus, meaning on the basis of an international agreement that defines quotas and allows the introduction of two or three percent microelectronics a year in order to enforce a slow structural change and cushion the extensive consequential effects. They would have been ridiculed as economic amateurs who know nothing about the dynamics of economic processes. And their critics would have been absolutely right. So, what's the difference between non-energy and energy technologies when it comes to the problems of structural change? There basically are none!

If we want to develop momentum for the introduction of renewable energies, we have yet another reason why we cannot wait for a consensus that will never come, is formulated too indecisively or is more crippling than supportive. I am not necessarily criticising the Kyoto Protocol. I am only saying that we cannot expect much more from such negotiations. It is wrong to rely solely on these instruments and make them the definitive standard. We must have separate standards, set by numerous individuals and formulated on the basis of examples that have been successful now and in the past.

Numerous successful examples already exist. All the ecological advantages associated with renewable energies must be demonstrated. In addition to realising that the consensus principle is not suitable for triggering comprehensive conversion to renewable energies, we must also abandon conventional ways of thinking. There is an energy mind-set extending even into the ranks of the energy economy that is subjectively based on nuclear and fossil energies, but not objectively on all energies. Many energy experts don't even notice this one-sided thinking any more. It developed during the period of absolute dominance of nuclear and fossil energy sources. The degree to which this thinking penetrates the scientific community can be seen today in any energy statistics. The global action plan of the World Council for Renewable Energy (WCRE) calls for new energy statistics and the reason can be explained by the following example: In Germany, we have four million square kilometres of installed solar collectors to heat buildings and replace the corresponding fossil energies. Not one of these collectors is included in the energy statistics. The energy statistics only reflect commercial energy flows and thus only those renewable energies that are distributed through the power or gas lines. The other types are not acknowledged, as if they didn't even exist. Consequently, the actual percentage of renewable energies is already much higher than all the energy statistics indicate. It is even more extensive if we consider - and this is a question of the scientific paradigm - that human energy use first and foremost includes the natural use of

solar power. Absolute zero is minus 273 °C, although this temperature does not exist anywhere on Earth. The temperature in Central Europe is roughly plus 20 °C in summer and 0 °C in winter. In winter, we make up for the difference between 0 °C and 20 °C with the help of conventional energy. If we had to pay for the energy output of the sun, which bridges the gap between minus 273 °C and 0 °C or plus 20 °C, fossil energy would be exhausted after just one year. In other words, if we were to view energy correctly, and not just consider its commercial forms, and also document it statistically, then renewable energies would account for 99% or more in the world energy statistics, while fossil energies would total less than 1%. This is more than just a numbers game. It is scientifically more correct and also significant from a psychological and technological point of view. If this approach were to be adopted, the potential of renewable energies would be given more conscious consideration and integrated in the process of technological development, e.g. in the subject of how to build a house. And it is psychologically important, because when people today see energy statistics showing over 90 percent nuclear and fossil energy, they can hardly imagine how that 90 percent can be replaced by renewable energies. However, if they had complete energy statistics and the percentage of fossil/nuclear energies were substantially lower, virtually everyone would come to the conclusion that we can easily replace this share.

The necessity of adopting a different view of energy is illustrated by the current debate on emissions trading, which is based on a misleading view of the energy system: for example, if the efficiency of a power plant is increased from 30 to 40 percent, the Kyoto Protocol allows that to be credited to the CO_2 debt account - or traded if the debt account has been paid off. In reality, however, the emissions can end up rising despite the efficiency improvement, namely if the power plant used coal from a German mine one day and then switched to coal from Australia that is transported over long distances and entails corresponding energy losses. In other words, acting as if there were no energy chain upstream and downstream of the power

plant is not scientific, because it results in an isolated view. When figures of 30 or 40 percent efficiency are mentioned today in reference to a power plant, the actual efficiency is frequently less than 10 percent once everything from mining to energy consumption is correctly included in the calculation. Emissions trading concepts act as if the current energy chains of fossil and nuclear energies were unalterable, as if they would also apply to renewable energies. The calculations do not include the energy lost during mining, processing of the mined energy source, transport, storage, distribution over thousands of kilometres of power lines in some instances, or disposal. In other words, they consider isolated equipment and not systems, meaning that their calculations are wrong. A correct calculation would immediately show that energy efficiency is virtually impossible with fossil fuels.

It would also show that renewable energies are always better in terms of efficiency, unless the mistake were to be made of supplying renewable energies in the same way as fossil energies, that is from a source thousands of kilometres away instead of from regional sources. The structural difference, which characterises and leads to the new energy concept, is that the longer the dependence exists, the more the regions of energy consumption must be de-coupled from the regions of energy production in the case of fossil energies. The potential of fossil energies, including uranium ore, is restricted to a few locations around the world. But if this energy is in demand everywhere, down to the last village on Earth, a global energy chain forms, comprising numerous links and collection points, where each energy link is dependent on the existence of the other. That's why I speak of humanity as being fettered by "fossil energy chains" in my book, "Solar Economy" - an energy chain that even holds the energy companies captive. It will not be easy for them to break free from this chain.

In contrast, local and regional supplies of renewable energies are available everywhere for decentralised use. This is related to the shortening of the energy chain. The energy chain of a

photovoltaic system starts in the system itself, that of wind energy in the wind mill. These systems obviously require technologies that themselves consume energy, but the same is also true of the fossil energy chain - and not only for the power plant, but also for the mining, transport and distribution technologies. So, let's examine the energy flow alone. If we also consider all the energy used in these technologies, renewable energies are even more advantageous. Logically, renewable energies would gain decisive productivity advantages with the promotion of the technology, its mass production, the improvement of its working efficiency, the improvement of its material strength, quality, durability, and the improvement of people's ability to handle, install, operate and service it. At a certain point, renewable energies will be economically unbeatable, even in an isolated price comparison. This is the logical consequence of renewable energies. They have an inherent dynamism that even disproves the theory that the introduction of a new energy source takes many decades. This theory stems from the experience that it takes 50 years for a new energy source to make up a share of ten percent; this has always been the case in the past and has, it is claimed, been confirmed for coal, oil, natural gas and nuclear energy. Only nuclear energy never achieved ten percent. None of this can be applied to renewable energies because they do not require an extensive infrastructure. A conventional power plants takes ten, twelve or fifteen years to build before it can go into operation. A wind mill can be set up in one day, as can a photovoltaic system. Miscalculations cannot occur in the process; these systems do not require the elaboration of an energy forecast or estimates of how much energy will be required in year X to ensure the availability of corresponding capacities; the calculations can be very tight and based on current demand; if the calculations are off because the demand is higher, a few additional systems can quickly be installed. In other words, planning errors are avoidable and that provides greater investment security.

Therefore, it is easy to describe how countries like Brazil or China, where there is plenty of hydroelectric power from high-capacity hydroelectric power plants and the corresponding grids, can quickly reach a power supply comprising 100 percent renewable energies based on a combination of water and wind power. In general, it is easy to describe how 100 percent energy supply with renewable energies would be possible and that the development can go faster than many expect - even without having to elaborate complex scenarios. Electricity consumption in Germany is in the region of 500 billion kWh a year. A wind mill with a capacity of 1.5 MW produces an average of 3 million kWh a year. Even if we wanted to satisfy the entire German electricity demand of 500 billion kWh with wind power only, which is unnecessary, we would need 166,000 wind mills with this capacity. So, where is the problem that is supposedly so insurmountable? To this end, we would need to produce as many wind mills as the automotive industry produces trucks. With the current state of the art in photovoltaic technology, we would need 5,000 km^2 of solar cells in Germany to produce 500 billion kWh. That is less than ten percent of the roof surface area. Germany represents four percent of total worldwide electricity production, meaning that, using only wind mills with an average capacity of 1.5 MW, 4 million wind mills would be required to produce as much electricity as the world demands today. To compare, there are 50 million trucks on the road around the world. Alternatively, we would need 125,000 km^2 of solar cells (not all in one place) according to the current state of the art in photovoltaic technology.

In reality, of course, we have a mix of renewable energies. And when it comes to replacing the electricity used to heat buildings, we need not replace it with electricity from wind power or photovoltaic power, but rather the technology of solar construction, in which electricity is replaced by non-electricity. In other words, entirely new substitutions will result. We must abandon our perception of the segments that make up the conventional energy system and avoid simply trying to copy these structures for renewable energies. This idea is a mental trap

that makes us blind to the actual potential, diversity and new opportunities of an increasingly less complex system of energy utilisation based on renewable energies. To this end, we need sophisticated technologies, but less complex energy systems. This is why a switch can also occur more quickly. No one can tell us today how long we will need. A prediction is impossible because it depends on the activities of countless people and on the rate at which governments change their course, if they do so at all. However, it is still important to realise and emphasise that it is possible to replace nuclear/fossil energies entirely. Why? Because as long as people - parliamentarians, governments, scientists, journalists or the general public - believe that renewable energies cannot fully replace conventional nuclear/fossil energies, then fossil energies will be considered indispensable. It is easy to make the average person understand that renewable energies are environmentally friendly and sustainable. The reason we are not implementing them as quickly as possible is still because most people don't believe it's possible. And that is the origin of the myth of the indispensability of the current energy system, which continuous to be perpetuated. If the proponents of the nuclear/fossil energy economy would admit that renewable energies are capable of complete substitution, no one in the world would understand why "future-oriented" investments are still being made in new, conventional power plants.

This is why it is so important to illustrate the prospect of complete substitution, because it frees the mind, inspires the imagination and gives courage. The rather defensive position into which environmental issues have recently been forced in many countries is also due to the fact that many people no longer believe the problem can be solved. People only commit to goals that seem achievable, that can really happen. The days are gone when people can be motivated simply by disaster warnings about the threat to the global environment. If these disaster warnings are not followed by a strategy for disaster prevention, then we are abandoning people to cope with the disaster on their own. Therefore, it is clearly of great

psychological importance to explain the full range of prospects. That is the most important message we can and must spread here. It will help concrete proposals for action finally make a real breakthrough.