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Climate change: "Why didn't you do anything about it?"

The extent and consequences of the climate problem are becoming increasingly serious. But if we do not sit back and do nothing, but act adequately, the worst effects and damage can still be prevented. Constantin Huber conducted an interview with Prof. Dr. Eicke R. Weber, who recently joined forces with several other well-known personalities to advocate a complete energy turnaround by 2035 at the latest. Because a delaying tactic until 2050 would only cost the younger generations dearly.

Infobox: Prof. Dr. Eicke R. Weber was director of the Fraunhofer Institute for Solar Energy Systems (ISE) for ten years. With former professorships at the University of California in Berkeley and the Albert Ludwigs University in Freiburg and as a recipient of the Humboldt Research Award, the Electronics and Photonics Division Award, the Einstein Award of Solar World, the Fraunhofer Medal and the Walter Scheel Award, his membership in the Academy of Science and Engineering Acatech as well as numerous influential publications, he is one of the most renowned scientists in his field.

hpd: *Hello Prof. Weber, I am pleased to welcome you as my interview partner. You are known in the academic world for your enormous scientific and political commitment to the energy transition. What have been your main areas of focus in recent years?*

Prof. Dr. Eicke R. Weber: On a scientific level, my main focus is materials science, i.e. primarily defects in silicon materials, which is important for both solar cells and microelectronics. I have also published extensively in this area. In addition, I was particularly concerned with the question of why we no longer have solar cell production in Germany and Europe. After all, we assume that in the future the world will be supplied to a large extent by electricity generated by photovoltaic technology. And I think it would be very dangerous if our entire solar cell production were to be based in China and Asia.

China with Taiwan alone has 83 percent of global solar cell production. In some other Asian countries, such as Korea, Malaysia, Thailand and Japan, there are also a few percentage points. In the entire European Union, on the other hand, only 0.4% and in the USA just 0.3 % of solar cells are produced for the global market. The picture about this delicate situation is blurred by the fact that often just the solar module production is considered, because there are indeed noteworthy percentages outside China and Asia, but not in the cell production itself, i.e. the actual heart of this technology.

This is why I am committed to ensuring that we also produce solar cells of the so-called third generation, heterojunction technology, in Europe on a large scale. Therefore, I am also engaged in this topic as Chairman of the European Solar Manufacturing Council (https://esmc.solar/). This is actually what concerns me most today - in addition to my concern for the climate and the creation of conditions to install the necessary 50 to 60 Terawatts of solar power as quickly as possible, so that we can switch the world over to renewable energies.

Under your leadership, the Fraunhofer Institute for Solar Energy Systems has been able to expand considerably in terms of personnel, ideas and funding. How important are the links between science, business and politics to you, and which adjusting screws do you regard as particularly decisive in retrospect?

Of course, it's very important that science doesn't just work in a vacuum, but also makes its results available to industry. In this respect, I am a great fan of the Fraunhofer model, according to which the institutes must in principle provide for themselves financially, receiving basic funding of about 10 percent, with the rest being entirely self-earned money. Of the budgets, one third is supposed to come from industry. And that, of course, forces the Fraunhofer Institutes to look around to see where they can help industry with innovative solutions and technologies. This does not mean that Max Planck Institutes dedicated to basic research are not also important. But when it comes to working with industry, I think the Fraunhofer model is the most successful.

In addition, especially in the field of renewable energies, politics also plays a very important role, as it sets the framework conditions. The framework conditions can only be set correctly if the politicians realize that the political goal must be the fastest possible transition to renewable energies must be . This is currently not the case in Germany, as can be seen quite clearly, for example, in the last [EEG amendment] (https://www.bmwi.de/Redaktion/DE/Pressemitteilungen/2020/12/20201217-bundestag-verabschiedet-eeg-novelle.html). It still provides for levies on self-generated and self-consumed electricity. It is still the case that owners of old systems have to buy expensive new meters instead of simply consuming the electricity themselves without complications. Also exaggerated distance regulations for wind power plants are a good example. All these measures show that the current political will is to make the introduction of renewable energies as complicated and difficult as possible.

At the same time, renewable energies cannot be stopped. They are now the cheapest way to produce electricity. Compared with nuclear power, for example, by a factor of two to three, and even compared with coal, they are still cheaper. Solar power can be produced in sunny areas for less than two cents per kilowatt hour. There's just no economic competition there. But many strings are being pulled in politics to continue using fossil fuels for as long as possible. The clearest example in Germany was this crazy coal phase-out law. Without it, coal-fired power generation would have come to an end as early as 2030. For economic reasons alone. After all, if a reasonable price is put on CO2 emissions, then coal-fired power generation no longer makes sense. The billions in subsidies from the coal phase-out law will only delay coal-fired power generation until 2038! Not to mention the subsidies for the nuclear or automotive industries. This is really already an Orwellian kind of argumentation: we call it coal/exit/law and in reality it is a coal/guarantee/law. So you can see from this how important the right political framework would also be, and I'm guessing that in September, when we have the next federal election, there will be some changes in federal politics as well.

There really is no alternative to saving the climate.

Scientists around the world agree that net CO_2 emissions must be reduced to zero in the near future. How can this be achieved?

We have joined forces in the [100 Percent Renewable Energy Strategy Group] (https://global100restrategygroup.org/), which includes very well-known colleagues such as Mark Z. Jacobson from [Stanford University] (https://www.stanford.edu/) and Christian Breyer from [LUT University] (https://www.lut.fi/web/en), who have also conducted major studies on the subject, as well as the author Tony Seba. All of the scientists and experts who have joined together in this group have come to the unanimous conclusion that it is indeed technically and financially possible to switch to nearly 100 percent renewables, even in a very tight time frame of 2030 for electricity and 2035 for the overall energy system.

There is no technical hurdle - even if some people, such as Bill Gates, say that disruptive innovations such as mini-nuclear power plants are still needed - that would prevent a switch. In principle, we can complete the energy transition with the set of technologies we have today, including all the necessary storage technologies and /smart grids/, i.e. load management in the power grid. All of that has to be in place, of course, but fortunately we now have the algorithms and the computer power to do it. So there's really no reason why we can't do it. But, of course, we have to put money into it first, that's quite clear. But to be honest, 1,000 billion, speaking globally now, doesn't scare us at all after what we've just experienced in the last twelve months. The U.S. government just signed a $ 1,900 billion aid package (https://www.nzz.ch/international/us-senat-stimmt-bidens-19-millionen-schweren-konjunkturpaket-zu-ld.1605350?reduced=true).
The European Union has signed a € 1,800 billion package] (https://www.rnd.de/politik/eu-gipfel-woher-kommt-das-geld-und-wie-wird-es-verteilt-die-wichtigsten-antworten-im-uberblick-IFP6RBDBT5A4PHDM5J65KNKAGQ.html).

Field Code Changed

Saving the world from climate catastrophe by spending 2,000 billion if necessary therefore seems possible. And this is not money that will go up in smoke in the chimney, but money that will be used for investments to build factories for photovoltaics and battery technologies and so on. So this is, after all, all a program to stimulate the economy. And we have to do that, there's really no alternative.

With all the achievements that climate research has made for us, however, we must also note that even in the published IPPC reports it has always been far too cautious and far too optimistic. Climate researchers are constantly surprised by the fact that developments they have predicted occur much earlier than they expected. That's why it's incredibly important to point out that our time horizon is not 2050, but clearly 2030. There was this famous publication in the Proceedings of the National Academy of Sciences (/www.pnas.org/cgi/doi/10.1073/pnas.1810141115/), where Hans Joachim Schellnhuber was also a co-author in August 2018, in which it is explained very precisely and in detail that we are already racing towards the cliff in 2030. And if we jump over the cliff instead of taking the last exit of CO2 reduction until 2030, then we will not go into an Earth with plus two degrees Celsius, but into one with three, four or five degrees, the so-called “Hothouse

Earth." (https://www.stockholmresilience.org/research/research-news/2018-08-06-planet-at-risk-of-heading-towards-hothouse-earth-state.html).
Then we are not talking about a meter rise in sea water levels, but 20 to 30 meters higher sea water levels. And who knows what weather and climate phenomena, which we cannot even imagine yet, will then occur. The sooner we realize that when it comes to climate protection, we need a world crash program similar to the one we have had to involuntarily take on so far because of Corona, the better.

Let's stay for a moment with the switch to renewable energies that has been mentioned, which is to take place in the electricity sector by 2030 and in all other sectors by 2035 at the latest. In a joint [statement] (https://global100restrategygroup.org/), you and your colleagues call for exactly that. What is required in political terms to achieve this?

It's about setting the right course. Politicians must seriously commit to these goals. And then it's quite clear what can be done about it. For example, subsidies for the construction of solar factories. If we wanted to, Germany could be the world's solar supplier. So the role that China has today, we could have just as well in Germany and Europe. Producing solar cells is a technology that doesn't consume an insane amount of resources, and you can then deliver the solar cells to the entire world. The modules, i.e. these large boxes that are screwed onto the roof, can be manufactured locally. That means they don't have to be shipped around the world. But the German government, or better yet the European Commission, must commit to such a program. If only 100 billion of the 790 billion from the [Green Climate Fund] (https://www.greenclimate.fund/) were initially made available to enable company founders to set up their first companies and production facilities, then a lot would already have been gained. In addition, a purchase guarantee could be given, so that investors are willing to invest there, or the funds could be given as loan guarantees. The importance and effectiveness of the latter has been demonstrated in China, among other places.

The big solar boom in China was not driven by gigantic subsidies from the Chinese government, but by the fact that the Chinese government provided around 50 billion dollars in loan guarantees in a five-year plan in 2008/09. To put it bluntly, anyone who could spell the word /photovoltaics/ correctly in China in 2008 received a billion dollar loan guarantee to build a solar factory. And the big joke is that 80 to 90 percent of the guarantees never had to be paid, because the companies were profitable. Such guarantees have a great advantage over subsidies, they cmay ost the taxpayer nothing at all. If the company flourishes, the loans are serviced and the guarantee is not drawn. But the guarantees, of course, result in the companies getting money for the lowest possible interest rate. And that would be interesting especially today, when interest rates are down at one to three percent. Of course, loan guarantees could be used to kick-start a gigantic economic stimulus program - for solar modules, wind power, batteries and other industries that are necessary for the energy transformation.

With the right political decisions, that could be done. And the great thing is that in Germany we also have the companies on the ground. I would like to mention BayWa, GE Renewable Energy, ING WB or RWE, which also supply and assemble these modules all over the world. They have already served gigawatt-scale portfolios and could of course easily ramp this up

further. Just think of the enormous demand on the African continent. So we don't need to wait for 2025, we could get that going before then. And in the years from 2025 to 2035, we would then have to run the right crash program. We're talking about building 100 photovoltaic cell and module factories worldwide, each with an annual capacity of 60 gigawatts, so that we could produce 6,000 gigawatts a year and actually have the required 60,000 gigawatts installed in ten years. This would then allow 80 percent of the world's energy consumption to be provided directly by harvesting solar energy. This is all already calculated, possible and feasible. But of course, you need the right political will, and that is still opposed by the very strong interests of the fossil fuel industry.

They are happy about every month and every year that they continue to make billions in profits with the help of the fossil fuel industry. But I think that if CO2 emissions in China, the U.S. and Europe were charged with a reasonable price of 100 to 150 dollars per ton, as corresponds to the damage caused by the emissions, then the issue would be resolved very quickly for economic reasons alone. Then no one would talk about coal and oil still being needed to make electricity.

Many concernd colleagues, such as Jeremy Legget in England or Tony Seba in the US /https://www.rethinkx.com/energy-lcoe/ point out that the fossil industry will be in a huge mess, as it is still investing billions in technologies that will no longer be needed in a few years.

Future generations will curse us if we do not act now.

Some of the so-called tipping elements in the Earth's climate system, such as the melting of the Greenland and West Antarctic ice sheets or the thawing of permafrost in Siberia, releasing large amounts of methane, are considered irreversible. How optimistic are you that the worst can still be prevented?

Well, if you had asked me two years ago, I would have said 10 percent optimism. If you asked me today, I would say I am 30 percent optimistic. So I'm still of the opinion that the most likely scenario is that by 2050 we will have converted the entire global economy to renewables and will no longer have any CO_2 emissions, but that we will then realize that we have acted too slowly and are now too late. So that we will then have passed the 500 ppm CO_2 in the atmosphere and the tipping points. But I think that because of what we're seeing in the last few years, we do have reason to hope. In particular, I want to point to Fridays for Future (https://fridaysforfuture.de/). This movement plays an enormously important role. Because quite honestly, we old gray-haired people, we have 10 to 20 years, some maybe 30 years left to live in this world and that will still be reasonably possible. But those who want to live another 60, 70 or 80 years on this planet, they have this threat very clearly in front of their eyes that they are living into a world that will be absolutely no longer comfortable, but quite terrible and horrible. I'm thinking of the increased occurrence of weather phenomena such as floods, droughts, strong storms, and the other consequences that are not yet exactly foreseeable.

So I would say that the probability is increasing that we might still manage to prevent the worst, but it's still below 50 percent for me, because I don't see this big turnaround yet. I

see the right signs, of course. What's very important is what's happening now in the U.S. with President Joe Biden who has appointed his heavyweight John Kerry, the former Secretary of State, to be the US climate 'czar'. John Kerry, after all, already hit Brussels last week (https://www.welt.de/politik/ausland/article227934531/Bruessel-Besuch-John-Kerry-ist-Joe-Bidens-Klima-Mann.html). And if we now finally manage in Europe to interpret these signals correctly and also to recognize the opportunities that arise for us from the whole process, then my assessment and my optimism increases.

I think that at least President Biden and John Kerry have recognized for the U.S. what opportunities lie in the fact that it has now rejoined the Paris climate agreement (https://www.dw.com/de/usa-versprechen-klimaschutz-kehrtwende/a-56633512). After all, there are also strong forces in the U.S. calling for radical CO_2 reductions such as the 350.org movement (https://350.org/). So, there are the strong forces in the US society just as they are here, and it might even be that we then feel downright driven by the US instead of it being the other way around. California in particular, which is half the size of Germany in industrial terms, is much further ahead than we are. There have been no coal-fired power plants there for a long time, and except for the last nuclear power plant, Diablo Canyon, all of them have already been shut down. So when people always say that we in Germany are the lonely lunatics in this world who are wasting our time on climate protection and the energy turnaround, as claimed by Hans-Werner Sinn, for example, we have to clearly counter that there are already regions that are much further ahead than we are.

Even today, there are still many people who regard the reduction of greenhouse gases as nonsensical or who proclaim in a defeatist manner that global warming of four to eight degrees Celsius can no longer be stopped. What would you say to them?

Well, if we put our hands in our laps, they will be absolutely right. Then global warming of this magnitude can no longer be stopped. But then we'll get into this Hothouse Earth scenario, which would really result in an incredibly uncomfortable state for all people. But I would mainly counter that, contrary to what many say, we already have the technologies that are necessary. We just need to set the right course for them and then the worst effects can be avoided. Future generations will curse us for all that we are not doing now.

I just remember that we liked to ask our parents and grandparents if they knew what was coming in 1933. You could buy "Mein Kampf" in the bookstore and read exactly what this Hitler was up to. Just as we asked the question: "Why didn't you do anything about it?", the same question will be asked by the children of the coming generations. And this is well founded, because we have the technologies, we have the scientific knowledge and we also have the money, and yet this knowledge and these means are currently not being used sufficiently to secure the future of the earth. And it's not just about the future of the Earth until the end of the century, but also about the fact that we may still be able to live well on this planet 500 years from now.

I always say that we should simply refer to Immanuel Kant here. He already recognized this exactly a few hundred years ago when he said: "You must live as an individual in such a way that the principle of your life could also be the general principle of the life of society. And I say we have to extend these lines by, "We have to learn in our generation to live in such a

way that the principles of our life can still be principles of people's lives in 100, 200 years." To do that, we have to learn to become sustainable, to achieve a circular economy and everything that goes with it. Otherwise, humanity will not be able to continue to survive. The sustainability issue is, after all, an even bigger issue. But among all the upcoming sustainability issues, the energy and climate issue is of course the most urgent now. But that is only the first step in the transition of the entire global economy to a sustainable economy.

We will, I suspect, say later that in these 250 years from 1850 to 2100 we wasted resources like savages, but now in 2150 we know that we can only think in terms of a circular economy. There is simply no other way. We have to learn that. And that's what our generation has to achieve. Ultimately, this is the great human task of our generation.