The return to human scale: Industrial disarmament!

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Dismantling instead of conversion

The talk of the ecological "restructuring" of industrial society has meanwhile become a commonplace across all political camps. It is assumed that we achieve the necessary reductions and ultimately CO_2 neutrality solely by means of more efficient technical processes and that we can easily substitute the energy that has so far come from fossil sources with renewable energies. However, if you calculate seriously, you will come to the conclusion that a conversion must inevitably go hand in hand with dismantling, that we must drastically reduce the absolute consumption of energy and other resources. Actually, common sense tells you: Renewable energy sources have a much lower energy density than fossil fuels, they have a limited potential and their honestly calculated energy balance is rather sobering.

The endenergy consumption in Germany, which in addition to electricity (it currently accounts for only 20 %), includes room heating, transport, process energy, etc., currently amounts to 2,500 TWh per year. A study commissioned by the WWF has calculated that a potential of renewable energies could be exploited in Germany that provides little more than 700 TWh (WWF 2019, 9). After all, that would be significantly more than twice as much of the amount of electricity that comes from renewable sources today. Even if there are somewhat more optimistic estimations here and there, there is a large gap between our current energy consumption and what is theoretically available to us from domestic renewable sources. The conversion of the chemical industry at today's level to decarbonised processes alone requires an additional electricity demand of 685 TWh, significantly more than we generate today in total electricity (DECHEMA/FutureCamp 2019, 9), the conversion to green steel and the replacement of gas and oil heating systems with heat pumps mean a further additional electricity demand of at least 250 TWh, etc.

In the meantime, the oath of revelation has long since been taken. Especially those who have persistently invoked the possibility of a one hundred percent supply of renewable energies in recent decades apparently assume that we will be dependent on natural gas for decades to come and will have to import huge amounts of hydrogen if we want to maintain our level of industrialization. The conversion of our steel production, fuel cells for ships, buses, trucks, aircraft, electricity storage, etc. requires quantities of hydrogen, which – as most scenarios assume – we will have to obtain about 80 % from other countries (Kreutzfeld 2022). However, even in countries with the most favourable conditions for solar and wind power, the corresponding potential is not unlimited, and in many cases there is a lack of freshwater as a resource indispensable for the production of green hydrogen in the very areas that are most interesting for Europe in this respect (North and West Africa)! Our greed for the "champagne of the energy transition" comes at the expense of the immediate living conditions of the people in the potential exporting countries. A new imperialism under green auspices and a dangerous global competition for hydrogen as a resource as well as for other non-renewable raw materials (lithium, cobalt, graphite, neodymium, etc.) that are indispensable for renewable energies and processes are already emerging.

Renewable does not mean inexhaustible

Not least under the pressure of the Ukraine war, the expansion of renewable energies is currently being pushed forward. However, this cannot change the fundamentally limited potential. In addition, the expansion of the corresponding plants together with the necessary infrastructure is initially associated with a considerable input of energy and resources and with corresponding emissions. In a situation in which the CO_2 budget still available to us will be exhausted in just a few years, we are therefore dealing with a "material rebound" of considerable proportions precisely due to the accelerated expansion of renewable energies. The installation of a wind turbine alone, which meets today's standard (with a capacity of about 3.5 MW), consumes – in addition to rare earths such as neodymium for the generator – about 150 tons of steel and also requires a 2000-ton reinforced concrete base.

The public debate is currently suggesting that only bureaucratic obstacles need to be removed in order to advance the expansion of renewable energies. The fundamentally limited potential is obscured.[1]

[1] In the following, I would like to refer in general to Kern [2]2022, 40–90, where I dealt in detail with the energy balances of renewable energies.

Take photovoltaik, for example: it currently contributes about 9 % to the electric power supply and will continue to play a rather subordinate role in Germany in the future. It is the renewable form of energy that initially requires the largest material and energy input. In terms of kilowatt hour, the use of resources is more than sixty times as high as in a nuclear plant. The energy return time, i.e. the time from which a corresponding system generates net energy, i.e. the time by which it has generated the energy required for the plant itself (including grid integration, etc.), depends largely on the number of hours of sunshine per year. Many energy balances simply include 1800 hours of sunshine in the bill. In northern Germany, however, we are far from that and do not even reach half of it. There are reasonable doubts as to whether photovoltaics in regions such as northern Germany or Switzerland have a positive energy balance at all– if one calculates honestly. The currently politically demanded solar obligation on all roofs is therefore pure nonsense. Precisely because of the high energy input required, photovoltaic modules should be installed where they promise sufficient efficiency. [2]

With regard to the calculation of the EROEI (energy return on energy invested), i.e. the energy return time, it should be noted in principle: An honest balancing, which is usually avoided, would be the so called *emergy* concept, as proposed by Howard Oddum, for example. Emergy stands for *embodied energy* and means: Proportionally, when balancing a plant, the entire process that was required for its production including grid integration must be considered, i.e. in relation to photovoltaics, the construction of the factories that produce the excavators that shovel the sand from which the silicon is ultimately extracted should be taken into account proportionately. Because of the volatility of renewable energies, the necessary storage capacities would also have to be included in the balance sheet.

The most important and promising form of renewable energy for Germany is undoubtedly wind energy. Here, too, distance regulations and other bureaucratic obstacles determine the public debate. Two percent of our land area, according to the current political requirement, should be available for wind farms. Again, you are lying in your own pocket: Apart from the fact that in view of very scarce land, in view of a larger land requirement for a (more extensive) organic farming, in view of the forests, peatlands (moors), etc. required as CO 2 sinks there

[2] However, the credit side of the balance sheet has an impact only where the corresponding plant was built, so that the impression of a successful energy transition could be maintained for us. For the global climate, however, this makes no difference.

is actually competition for use, one obscures the problem that it is *not* simply about *areas*, *but* about *suitable locations*! The efficiency of a wind turbine depends largely on the average wind speed at a particular location (six meters per second is actually the requirement). Gregor Czich (University of Kassel) already demonstrated in detail in 2004 that these areas are scarce. Of course, the best locations tended to be used first. A significant potential should be tapped through so-called repowering, i.e. by replacing old wind turbines with more powerful ones at locations already in use. The desperate search for further favorable locations for wind turbines today has the consequence that one accepts a considerable degree of destruction of nature, for example deforestation on a large scale – which is likely to worsen the CO 2 balance. The example of Baden-Württemberg is instructive here: there are no distance rules here and since 2011 a Green Prime Minister is in charge. In his first coalition agreement (at that time still with the SPD) the declaration of intent was included to cover 10 % of the electricity demand from domestic wind power. After landing at around 4.4 % ten years later, the current coalition agreement now provides for the opening of state forests. Deforestation on a large scale in the Swabian Alb and the Black Forest! This is what it looks like, the brave new world of renewable energies.

The offshore potential is also fundamentally limited: it is difficult to go beyond a sea depth of more than 30 meters, and the problem of "shading" only allows for a certain expansion density. Studies related to Europe estimate the offshore potential at no more than 25 % of current electricity consumption, and globally it is estimated that there is around 5000 TWh of offshore potential. It should therefore come as no surprise that one of the most prominent climate scientists, who comes from a country with a lot of sea coastline (Great Britain), James Lovelock (who recently passed away at an age of 103!), has mutated into a nuclear power advocate in view of these prospects. Gregor Czich, on the other hand, sees the solution in huge interconnected grids that encompass North Africa as well as the Caucasus, i.e. include about a third of the earth's land area. He hardly reflects the fact that the necessity of setting up redundant structures worsens the energy balance. Such fantastic blossoms result now from the desperation of those who honestly face the limitations of potential.

To be honest, one would also have to include in the energy balance the necessary storage capacities that ensure that electricity is available on demand, which is indispensable for an industrial society. The sheer scale of this task poses significant problems for us. Pumped storage power plants have a high degree of efficiency, but for which, however, the appropriate landscape conditions must be met. Of course, the fundamental question of how much landscape and nature destruction we want to accept for our energy supply is by no means banal. So-called redox flow batteries (based on vanadium, which is currently mainly produced as a waste product in steel production, or lignin) are also very efficient, but require a lot of space. Due to the already existing grid connection, the installation[3] of these storage facilities at sites of decommissioned fossil power plants could be a sensible possibility. Compressed air storage systems are only suitable for short-term storage up to 48 hours, and hydrogen storage systems have a very poor efficiency (about 20 %).

The complete substitutability of fossil fuels by renewables is therefore illusory. We should be prepared for the fact that we will have to cope with considerably less net energy in the future. Even a certain increase in technical efficiency will not change this much.

Efficiency revolution?

Fred Luks has taken the promises of the efficiency revolution to absurdity with a simple calculation: If resource consumption in the industrialized nations is to fall by a factor of 10 by 2050 (which is largely consensus), and if at the same time a modest economic growth of 2 percent per year is to be assumed, then resource productivity (i.e. the amount of goods and services per unit of a certain resource used) would have to grow by a factor of 27! Economic growth of 3 percent already requires 43 times the energy and resource efficiency (Luks 1997). Efficiency increases are simply subject to the law of decreasing yield, i.e. the more efficiency potentials have already been exhausted, the more difficult it becomes to achieve further efficiency increases. This is also confirmed by empiric data: In industrialized countries such as Germany or Japan, it can be observed that after impressive increases in energy efficiency (the ratio of energy input to gross national product) and at least a temporary *relative* decoupling of GNP growth from energy and resource throughput from the mid-seventies, no further significant efficiency successes could be achieved. In Germany, stagnation has been observed since about 2000 (the special factor GDR, i.e. the liquidation of the very inefficient industrial plants in eastern Germany, is the reason why this effect is

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[3] In particular, I refer to Alexander/ Floyd 2020, 101–103.

delayed compared to other industrialized countries), in Japan even since the beginning of the nineties (Minqi Li 2008, 161–162). The most accurate study worldwide is probably that of the two Canadians Lightfood and Green. They estimate the global efficiency potential from the reference year 1990 to the end of our century (i.e. by 2100!) at 250 to 330 percent (quoted in Minqi Li 2008, 162, among others), whereby such a global view has so far included highly inefficient regions. This is far away from the famous factor calculations of Ernst Ulrich von Weizsäcker. In order to avoid this sobering finding, the eco-capitalist optimists of purpose, such as him, always limit themselves to impressive individual examples in their bestsellers. According to Ted Trainer's judgment, even here 50 % is based on pure beliefs (Trainer 2007, 115–117).

There is therefore no way around it: an absolute decoupling of the economic growth required for the stability of the capitalist economy from energy and resource throughput is an illusion in view of this finding. Today's level of industrial production is incompatible with environmental sustainability. Dismantling must be initiated as quickly and consistently as possible. In my opinion, the most urgent task is to describe it in detail and to show how it should be designed in solidarity.

Industrial disarmament

Let's take a closer look at some fields:[4]

An ecological *transport transition* is of the utmost importance in Germany. Traffic is currently responsible for about 20 % of carbon dioxide emissions and for a total energy consumption of about 750 TWh. Switching to alternative drives is of little help. E-fuels and hydrogen-based fuel cells have a very poor degree of efficiency. In the latter case, less than 20 % of the energy originally used is converted into kinetic energy after the required double conversion process. The necessary liquefaction and the transport contribute significantly to the poor energy balance.

The additional electricity demand for e-cars as an individual means of mass transport cannot be covered from renewable sources, especially when one considers that carbon dioxide

[4] For the following, I refer above all to Meier 2020.

neutrality in other areas requires a considerable additional electricity demand – for example, if the oil and gas heating systems are replaced by heat pumps.
In addition, however, automobile production must already be included in the overall balance! 48 % of the very energy-intensive aluminium produced in the production process (one tonne consumes 14 MWh of electricity!), 26 % of the steel and 12 % of the plastics currently flow into German automobile production. The upstream equipment industries, the production of corresponding production machines, robots, etc., are not even taken into account. The electric car exacerbates this problem: the heavy battery, the generation of which itself is already associated with considerable CO2-emissions[5] (according to a VDI study 17 tons, by technical improvements this is to be reduced in the EU to 12 tons by 2030), must be reduced by more lightweight construction (more aluminum, more carbon composite fibers) ...) so that an electric car consumes considerably more energy and resources during production than a comparable petrol or diesel engine. Converting the 48 million cars currently registered in Germany, let alone the more than one billion cars worldwide, to alternative drives is simply absurd – if only because of the scarcity of the necessary raw materials such as lithium and cobalt. Even the german Green Party, which tend to be optimistic in this area, assume that a maximum of 15 million electric cars will be available in Germany after the end of the combustion engine (2030). The German government, which was in office until 2021, estimated the number of e-cars to only 8 million. In view of this finding, however, the question immediately arises as to who should then be granted the privilege of driving. The proposal of the Ecosocialism Initiative is therefore that by 2030 at the latest, no more cars should be approved for purely private use (except, of course, emergency vehicles, taxis including transport taxis, company vehicles for craftsmen, jointly managed e-car pools in remote rural areas ...). An ecological change in transport can only mean a *farewell to motorised private transport*. As the example of Switzerland shows, a corresponding expansion of public transport can also sensibly connect remote settlements in rural areas. However, we cannot shift today's traffic volume to public transport on a one-to-one basis. This would mean a multiplication of capacities that would be neither logistically feasible nor ecologically meaningfull. Reducing the need for mobility is a challenging structural policy task. Reducing freight traffic through a regionalisation of the economy, which is currently also failing due to the requirements of the EU internal market,

[5] With regard to the life cycle assessment of e-cars, I refer to: Hunger for raw materials in e-cars in 2021.

is indispensable. In addition, we will also have to develop a different attitude to mobility and say goodbye to certain demands (cf. Kern [2]2020, 78–85; 165).

Another problem field is the *construction industry*, which, among other things, consumes 35 % of the steel we produce. Steel production is not only associated with considerable energy consumption, but also carbon dioxide is produced as a result of the process. Now there are technically mature processes that replace the reducing agent coke with hydrogen and process the pig iron obtained in this way into steel in electric arc furnaces. The efficiency can be further increased by obtaining the hydrogen from water vapour and using the waste heat from the blast furnaces for this purpose. But even if all these possibilities are exhausted, this "green steel" will only be available to us in considerably smaller quantities in view of the scarce supply of the necessary energy (for example for hydrogen production). The conversion of today's level of steel production to emission-free processes requires about 130 TWh more electricity! The Thyssen-Krupp steelworks in Duisburg alone needed 3,500 wind turbines to convert to decarbonised processes – more than are currently installed in NRW. Cement production – which alone has so far consumed a total of 28 TWh of energy – is not only energy-intensive (limestone must be heated to 1400 degrees Celsius), the crushing of the limestone releases large amounts of CO 2 bound in it. Even if the necessary energy requirement is reduced by alternative processes, this only affects the smaller part of carbon dioxide emissions. Little known is also that sand suitable for building (desert sand is not!) is now a very scarce raw material. An *absolute reduction in construction activity* is inevitable, i.e. a complete renunciation of prestige buildings and everything that serves the old, fossil infrastructure. As far as the necessary living space is concerned, mechanisms for the redistribution of existing housing must be developed politically. The laws and regulations concerning building must be reformed in such a way that they prevent excessive dimensions, detached single-family houses, etc. Beyond steel and concrete, in the future we will have to rely on alternative construction materials, especially timber construction, which, as the example of Austria shows, is now highly developed.

For the important *chemical industry*, too, it is true that it could in principle be made completely greenhouse gas neutral, that both the process-related and the emissions caused by heat generation (for example, for so-called steam cracking, by means of which the long hydrocarbon compounds are split) could be completely avoided. However, the associated additional consumption of electricity of 685 TWh has already been pointed out above. In this area, too, there is no way around a significant reduction in overall production. In addition to the areas already discussed, the construction industry (22 %) and the car industry (12 %), the packaging industry in particular currently has a considerable *demand for plastics* (35 %). However, it is precisely in this area that regulatory intervention could be made very easily: A significant proportion of today's plastic packaging (canned food of all kinds, cleaning agents, beverage containers) could easily be replaced by appropriate reusable systems. Non returnable plastic bottles could be banned without further ado, as could tinplate aluminium cans. For a remaining remnant of hard-to-avoid plastic packaging, a high recycling rate could be ensured by prescribing color and material purity. In addition to avoiding emissions, this would also have solved the waste problem to a considerable extent.

A return from the current agricultural industry to a *peasant agriculture* that can do without artificial fertilizers makes ammonia production using the energy-intensive Haber-Bosch process superfluous. Only a shutdown of production with the help of such drastic measures will enable a completely emission-free chemical industry.

On the basis of these three large fields, it becomes clear in which dimension we have to achieve a dismantling of production and consumption as quickly as possible. It should be emphasised that this is possible with the appropriate political will with the regulatory instruments already available. Wisely, in order to take a majority of people on this difficult path, one will start with all the measures that do not affect anyone's quality of life, but are simply due to capitalist mechanisms without meaning. The packaging industry has already been mentioned. The lifetime of a large proportion of household appliances, electronic devices, etc. could be significantly extended by effective measures to stop "planned obsolescence", by imposing appropriate warranty periods, and by requiring product design requirements in terms of repairability and recyclability in the sense of the "cradle to cradle" principle, production in this area could be significantly reduced. However, it should not be withholded that a consistently advanced dismantling also calls into question the consumption patterns of a large majority of the population. This also applies to the large number of digital devices, the possession of a smartphone, which is so common today, etc. The scarcity of available resources results in competition for use. This means that we will have to reach a political agreement on what we are using these resources for: for the construction of cruise ships or for sufficient MRI machines in our hospitals (see Kern [62]2020, 158–162).

In addition, it would be necessary to negotiate politically which products we want to do without completely, because they have no social or individual benefit, but on the contrary are harmful, pathogenic, dangerous. First and foremost, of course, is *the production* of armaments. It is hard to beat the absurdity that we are preparing for future wars for increasingly scarce resources with a gigantic expenditure of resources (cf. Zumach [2]2005 in particular). According to the latest data, the military infrastructure (excluding foreign missions) and the armaments industry in Germany alone are responsible for around 5 million tonnes of CO_2emissions per year (Waack 2022). A ban on arms exports without exception and an end to procurement by the Bundeswehr are not only required by peace policy, but are inevitable in view of the scarce resources.

Of course, we must shape this dismantling in solidarity and ensure that the material existence of the people affected is secured. In the short term, the conversion will create a need for skilled workers in many areas, for example for the construction of public transport, for the energy-efficient renovation of buildings, etc. In the long term, the exit from industrial society as we know it means an increased need for human labour in a number of areas, such as agriculture, repair shops and traditional crafts. In addition, there is already a significant need for workers in the care and education sector.

In order to materially secure the people in this enormous necessary dismantling of industrial society, Helge Peukert has proposed to build up a social-ecological employment sector by means of central bank money (i.e. independant of the revenues of the capitalist growth machine). A "conditional basic income" issued by the central bank as "gift money" (in contrast to an unconditional basic income, this should be linked to a necessary, reasonable work performance, for example to eliminate environmental damage, etc.) can alleviate

[6] Elsewhere, I have explained in detail why so-called "market-compliant instruments", i.e. the political influence on prices by taxes, emissions trading, etc. are unsuitable to shape this dismantling. Among many other reasons, my main argument is that these instruments only work as far as the corresponding reductions can be achieved by more efficient procedures. But when it is about absolute reduction of production, this strategy turns out to be unfit. Would the CO_2-price be set so high (for example, through a corresponding design of emissions trading) that the 1.5-degree target of global warming could still be adhered to, then this would have led to the collapse of substantial parts of the Industrie and the end to the business model of a large part of the corporations. It is also often argued that a correspondingly high CO_2price solely could elegantly displace coal-fired power plants from the market, because ithey would then become uneconomical compared to other types of electricity generation. However, this argument would only be valid on the condition that alternatives were available to a sufficient extent! Cf. above all Kern [2]2020, 91–115.

people's existential fears associated with these transformations and make them active protagonists of this change (Peukert 2021, 465–479).

The bottom line, however, is that the decisive promise of prosperity associated with the dismantling of production is a new prosperity of the times. The overall less time spent in the production area can simply be distributed fairly by general reductions in working hours (weekly and lifetime working hours). The loss of consumption opportunities, some of which are quite questionable and cannot increase our happiness in life due to the large number of options, will therefore be offset by a significant increase in time that we have available for shaping our relationships, for active participation in our social environment and for the development of our personality. After all, our lifetime is the scarcest and most valuable resource we have.

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Abstract:

The potential of renewable energies and efficiency technologies is generally limited and cannot maintain the current level of consumption. In the future, we will have to cope with much less net energy. The restructuring of the economy in the rich industrialized countries must therefore be accompanied by a consistent, solidary dismantling. Consistent regulatory measures can initiate this inevitable process of shrinkage.