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GLOBAL CLIMATE: THE PLANET AS A THERMODYNAMIC SYSTEM

Abstract*.*The Purpose of the Study *is to theoretically substantiate the problem of studying the planet as a thermodynamic system in the context of the global climate.* ***The Research Methodology.*** *Methods of analysis, modeling, description and generalization of data were used to study the problem of global climate and formulate conclusions.* ***The Scientific Novelty*** *of the research lies in the integrated focus on the global climate problem and the actualization of the complex study through the creation of mathematical-physical calculation model.* ***The Conclusion****. Joint efforts of scientists and society are necessary for a comprehensive study of the global climate problem. Modern research should use an integrated approach and be based on a mathematical and physical calculation model.*

Keywords*: global climate problem, thermodynamics, entropy, mathematical calculation model, physical calculation model*

The Relevance of the Topic. Technically speaking, our earth is a so-called "system" within the enveloping gas jacket, which can be "viewed" using secure physical principles with the result that a more or less detailed mathematical model is created which is based on measured data in the first step the following is verified: “everything has to fit”... ie the model must confirm the measured data as precisely as possible at all times and for every location. If this is successful, a large number of primary influencing factors (which essentially result from the geometry and the movement of the system) are already known and not only qualified, but also quantified against each other.

As I already said, this initial model should initially be global, i.e. we do not yet distinguish between the earth's surfaces, land and water, and we do not take into account tidal currents or wind systems.

However, we first take into account the geometry of the earth as a sphere with a known diameter of approx. 42,000 km and define the boundary layer of interest to us of, say, a height of 5 km above the earth's surface, which would correspond to an enveloping sphere with a diameter of 52,000 km. The formula for the spherical volume V = 4/3 * p * (d / 2) 3 results in a volume of 3.87924E + 13 km3 for the earth itself and a volume of 7.36222E + 13 km3 for the envelope sphere, i.e. almost double the volume. If you calculate the difference, you get the result of 3.48298E + 13 km3, the gas volume (our air above the earth), the warming of which we want to consider here.

With the formula F = 4 * p * (d / 2) 2 we get the earth's surface as 5.54E + 09 km2 and the surface of the envelope as 8.49E + 09 km2. (Note on scientific number format: E + 13 = 1013)

We now know that the earth has a very hot earth core, which is distributed over the entire surface of 5.54E + 09 km2 and heats it “from below” through an influx of heat. This energy is passed on to the boundary layer that is of interest to us via radiation; this heat influx heats our “atmosphere” (our defined boundary layer at a height of 5 km). Of course, all the heat flows that humans and animals cause add up to this.

On the other hand, we know from the measurement of the outside temperature of high-flying aircraft, for example, that temperatures of -40 to -60 ° C prevail at an altitude of about 10 km. Gases of this low temperature surround our envelope ball –our system- and since they are much colder than the gases (air) in the boundary layer, heat is transported from the warmer boundary layer to the cold space, namely via the surface of the envelope ball of 8.49E + 09 km2 as an exchange area.

So far so good. Now, however, the sun comes into play as a very important factor; solar radiation must be taken into account. And now it gets a little more complicated, because it is not simply “constant” but has a periodic effect on our boundary layer (envelope layer). For this one has to consider the dynamics of the earth's movement (earth's rotation).

In relation to a day the following results: solely from the possible irradiation angle and the fact that the earth rotates exactly once a day around the axis between the north pole and south pole, it results that every point on the earth's surface is theoretically 12 hours long from the sun is heated and then, turned away from the sun, would cool down again in the direction of cold space.

Based on a whole year and taking the seasons into account, the picture is somewhat more complex: the sun does not simply rotate around this one axis between north and south, but around another, which brings us the different seasons. When a body rotates around more than one axis at the same time, this is called a "tumbling motion" in technology and since this all takes place periodically or cyclically, we are dealing with a cyclic tumbling motion in two spatial planes, which is the earth or each point on the surface of the earth under the sunlight.

If one wants to determine the energy equation or the associated temperature curve for any point on the earth's surface at any time, it is also necessary to take into account the respective angle of incidence of sunlight. Everyone knows that at noon at 12 o'clock the sun is "at its highest" or that the angle of incidence is 90 ° to the surface of the earth, which is why the sun warms the most at this time. What I said now for a point on the earth's surface also applies to a gas molecule (oxygen, CO_2, nitrogen, whatever) which we think of standing above the point on the earth's surface, i.e. resting.

If, in addition, the warming from the side of the earth were assumed to be evenly distributed in the first step, we would have created all the prerequisites for an energy balance for a gas molecule from the layer around the earth that is of interest to us, namely what we call the atmosphere. And the temperature is ultimately derived from the energy balance; the air temperature that interests us so much.

The Formulation of the Problem. To verify this mathematical-physical basic model, we must ask or answer a few questions: Can temperature changes also be determined at measuring stations at high altitudes, for example in the Andes or on the 8,000ths in the Himalayas? How is the determined warming distributed over the earth's surface (map)? What about altitude measurements in general, do we have any significant readings at all? Gases have different weights! The CO_2 molecule, for example, is heavier than the oxygen O_2 by the weight of the additional carbon atom; consequently, in a tall vertical glass tube, after some time a higher concentration of CO_2 would set in at the bottom of the tube, while oxygen dominates in the upper area. However, there are winds on the real earth that whirl the whole thing up again. The decisive question, however, would be what was measured where exactly and at what altitude on the planet (pressure, temperature, humidity and the composition of the air), for example by a measuring system of tethered balloons at different heights.

Once this basic mathematical model is in place, we can refine it step by step: we first take into account the influence of land areas and oceans. When this is done, we can try to integrate the influence of human activity in the form of industry, air traffic and other heat-generating processes into the model.

The Purpose of the Article is to theoretically substantiate the problem of studying the planet as a thermodynamic system in the context of the global climate.

The Presentation of the Topic. *Energy supply to the system. "Earth's envelope" = atmosphere.*

Ultimately, it is simply a matter of adding energy to the air in its lowest form, namely in the form of heat.

CO2 as a practical common measure for the generation of heat from fossil fuels. This statement is so important because it is by no means the now “famous” CO2 that supposedly “warms the earth”. This is nonsense. When fossil fuels are burned, a certain amount of CO2 is always produced in proportion to the burned mass (gas, oil and oil derivatives, coal, wood), which, via a conversion factor, allows conclusions to be drawn about the amount of fuel used. That's all. Apart from that, the CO2 behaves like any other ideal gas in the air: in each case in its molecular structure-related natural frequencies it absorbs energy during the day, for example when exposed to sunlight (becomes warmer) and emits this energy again to the cold night sky via the same frequencies as a radiator cools down in the process. The same applies to all other gases in the air. The game repeats itself on the following day.

General heat inflow into the shell layer as the core of the problem. In our thought model, we have defined a 5 km thick layer of air as a covering layer around the earth and its energy balance is at stake: there are inflows and outflows of heat and if this balance is disturbed, it either becomes warmer or colder. At the moment it is getting warmer.

While the outflows in the direction of cold space would have to be investigated in more detail, for example by creating the aforementioned mathematical-physical calculation model, and are still largely uncertain today, a lot can already be said about the inflows, at least as long as it is human-generated heat.

Every energetic process leads − partly through several stages of the conversion of energy into another type of energy - at the very end to one, namely to heat as the lowest level of the forms of energy. The end of the flagpole is reached when this heat has been distributed so far over a large amount of mass that the existing “residual heat” in this mass can no longer be used by any processes. The thermodynamicist speaks of entropy, which is constantly increasing.

If we even rub our hands in winter, the use of mechanical energy from rubbing immediately creates heat in the form of frictional heat, which our hands release to the surrounding air and − strictly considered energetically − consequently heat the atmosphere. Something similar can be said about a rail vehicle, which is easy to move. But where does the energy used for the drive ultimately go? Rail and wheel deform elastically when rolling and the wind absorbs energy in the form of frictional heat when the air resistance is overcome. Everything we do adds warmth to the atmosphere.

Fossil and regenerative primary energies. From the previous paragraph it becomes clear that it doesn't matter which type of energy - fossil or regenerative - we use. The only thing that matters is the amount of energy used, because this is ultimately converted into heat and heats the air.

This is exactly where the danger of the “CO2 lie” is: this CO2 bashing suggests that only the use of fossil fuels would be harmful to the climate in the sense of global warming. That is a fallacy!

The use of wind turbines, photovoltaics or tidal power plants also generates energy, which at the very end is converted into heat and fed to the envelope under consideration. The only difference is that one does not notice the efficiency, which is always below 1, because nature tacitly compensates for the amount of energy that is required to compensate for the otherwise visible efficiency-related power losses: energy simply comes out of the apparatus; man doesn't really have to “spend” it.

Actions: what can we do? The mathematical-physical calculation model for the planet presented at the beginning must be set up in the medium time term. No, I am not in a position to do this on my own this afternoon when I wrote this essay, and it is not my core competence either. But if you put a capable physicist and an equally capable mathematician at the same table with a mechanical engineer, you can get useful results very quickly. The task of the engineer is to ensure that the presentation of the solution at the respective stage of development does not remain in the sky of incomprehensible differential equations but is converted into a representation with which one can work sensibly - also in the direction of politics.

State of science, Concentrated in a global institution. Quite clearly: such considerations have long been undertaken by colleagues from science ... somewhere in the world and again and again. But it is not published sufficiently ... as is so often the case and probably not translated into a generally understandable language.

It is a global task and we will not get any further if the one is investigated in the USA, the other in Germany and something else in India. ONE institution with worldwide authority − similar to the UN, for example − must be created that can justify and comprehensibly say with constantly updated figures how the situation is and what measures are required and can explain the effects.

Only in this way will we be able to convince even the brightest president in the world! With this model or with extended physical considerations it could well emerge that the earth's atmosphere warms up due to increased solar radiation or a deteriorated filter effect through the upper gas layers ... more than the heat introduced "from below" by humans. How these two heat sources are related to each other would have to be clarified by the calculation model.

Energy balance of the earth in publications. Of course, you can already find publications on the Internet by certainly very well-known scientific colleagues. If you look at Wikipedia under "Greenhouse Effect", you will find the following statement, for example:

The earth is currently not in thermal equilibrium. It heats up due to the increased concentration of greenhouse gases as a result of human activity. The irradiation of 341.3 W / m² contrasts with a radiation of 340.4 W / m². (Reference period 2000−2004).

That is a difference of 0.38%! There are three things that bothers me about this statement: Firstly, I don't know whether this information has been scientifically independently confirmed. Second, I don't know how accurate this calculation is, and 0.38% is a small number. And third, it says "due to human activity". Is it really like that ? The following picture shows − certainly very well − what it is about:

The “received solar radiation 100%” is essentially based on the so-called “solar constant”, which is by no means constant over a whole day, as the word suggests. Thruth: it is currently not constant but calculated! And: the smallest change in the assumptions necessary for the calculation of the balance can change the result significantly for a balance sheet that is unbalanced by the 0.38% quoted, and in any direction! This shows how sensitive such bills are.

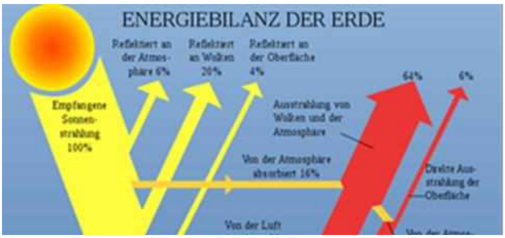

Figure 1. Energy balance of the earth

I would like an internet calculation model that has been scientifically cross-checked by the aforementioned global institution and published officially and bindingly for everyone (!) And which allows (example) to look directly at the impact on the energy balance after entering a fictitious gas consumption for Germany. All countries with all types of energy would have to be considered.

Another clear picture about the world energy balance:

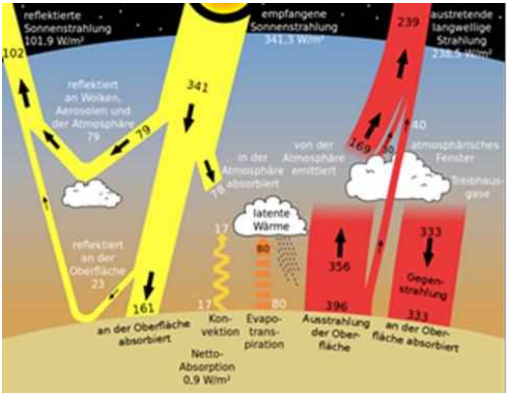

Figure 2. The world energy balance

Did you notice that the term CO2 does not appear in either of the images? Such representations are certainly correct according to the textbook and make it easier to get started with understanding.

However, representations of this kind are not suitable when the aim is to quantify the effect of individual concrete measures on the energy balance in an up-to-date quantified manner!

Only when a globally binding computational model exists, as described above, can international politics move at a nominal value. At the moment the connection between measure and effect cannot be seen or the resulting impression depends too much on the factual presentations of individuals and on counter-opinions (myself included).

With regard to the “internal heat supply” generated by humans, it can be said in any case that even the smallest contribution contributes to the warming of the climate and that humanity should be recommended to cease to exist in order to maintain the planet. However, without knowledge of the external influences, it would not even be ensured that the climate development would stabilize or that a further increase in temperature would not take place, because there have always been developments on earth.

Since such a radical proposal would not be able to reach a consensus, we have to consider which steps we can actually take - broken down according to effectiveness and feasibility.

The options are: Energy saving in general and isolation wherever possible. Based on the knowledge that global warming is by no means directly related to CO2, as derived above, but rather to the energies "used" or introduced to the system, some of the proposed measures appear in a completely different light: it is of no use to ban the devil using Belzebub.

Global system and microclimates. Since environmental protection does not only consist of the global energy balance, but also of air pollution, I would also like to go into that in the whole context. It is easily conceivable and also verifiable that microclimates form over urban areas, which may differ significantly in terms of temperature and, of course, air pollution from smoke, exhaust gases, fine dust and so on, from the values measured in untouched nature, no question about it. Nevertheless, it must be pointed out that, due to the area ratio, these phenomena have a negligible influence on the global system about the energy balance.

Diesel reloaded - the return. Although this topic is not the main goal of this article, I would like to point out that, thankfully, word is slowly getting around that modern diesel vehicles with exhaust gas aftertreatment do not pollute the intake air, especially about fine dust pollution, but on the contrary to clean. Cleaning performance of 90% was measured while driving in Stuttgart and not on the test bench! Here, too, there are sensible approaches to action!

Electromobility. "Measures" such as comprehensive electromobility quickly turn out to be sheer nonsense, as the energy required to charge the battery has to be generated somewhere and transported over long distances. In the very end the result - production and supply system included - is worse than with an ancient diesel that generates its energy on site without loss, even if it does not significantly exceed an efficiency of 30−33%. Other environmental damage, such as lowering the groundwater level due to the extraction of lithium, has not yet been taken into account.

Anyone who calculates the necessary charging capacity for a charging network that does not exist nationwide and then asks where the electricity for the many cars should come from will quickly realize that this is not possible. The consumption of copper cables would be immense, laying them would take decades, the production of the necessary batteries is extremely polluting, and lithium extraction is a disaster.

The city buses in Solingen have been running electrically for more than 30 years, powered by an electrical overhead line as in rail transport. And there is nothing against equipping these buses with batteries that are charged during normal travel and that enable them to supply power to smaller non-electrified routes. Just like the company UPS, Deutsche Post is treading a sensible path with its electrically powered parcel vehicles: wherever calculable routes have to be covered in daily use, electric drives can be used sensibly. But it only gets rid of the exhaust gases that come out of the exhaust; the energy entry remains.

A politically supported will to want to convert a country completely to electromobility is not just technical and scientific nonsense, but rather borders on advanced madness in view of the consequences.

Correct and encouraged would be the production of (a) hybrid vehicles and (b) the strong expansion of mobile hydrogen technology in accordance with the paragraph below!

Economy: Suppliers are already going bankrupt with thousands of jobs lost because electric cars do not need pistons, cylinder heads, filters or other components. Hybrid vehicles and hydrogen vehicles with piston engines are primarily combustion engines and do not cause this economic damage!

Home office as a contribution to reducing energy consumption. In fact, the home office – for which one party is currently advocating for more social reasons – saves the trip to work and thus actually helps to reduce the input of energy into the system, not insignificantly if it is related to the respective person.

Wind turbines and tidal power plants, nuclear power plants. As already said, these also generate energy, which sooner or later gets into the atmosphere in the form of heat. But at least they do not produce any exhaust gases, since no combustion takes place. But: a power plant is and remains a power plant and these do not save energy, they generate it.

Photovoltaics and solar thermal in the private sector. Due to the limited performance per area and the available areas, it results that these are solutions for the energetically rather "small area", i.e. usually not suitable for industrial applications. But: for new buildings such as private homes or office buildings, combined with good insulation and e.g. LED lighting, they are an excellent alternative, on the one hand to significantly reduce the energy requirement and, on the other hand, to be pollutant-neutral – i.e. to cover without burning fossil fuels.

Regenerative energies for hydrogen production H2 on a large scale - the egg of Columbus? Yes ! In fact, the large-scale industrial production of hydrogen - which would initially withdraw a lot of energy from the atmosphere - precisely because more energy is required for the necessary electrolysis than is subsequently available in the form of combustible hydrogen – is a good idea, as from the envelope system under consideration would be withdrawn a remarkable amount of energy... more than would later be fed back into the system when the hydrogen was burned to water.

The worldwide existing filling station network could also be used after minor modifications and there would be all the advantages of a fuel that can be filled up in tanks!

This is followed by a whole new piece of information that very few people should be aware of: a colleague in Bavaria has succeeded in developing a pressureless method for storing hydrogen in oils, which no longer requires any pressure vessels and the transport capacity of hydrogen in relation to transport – ton is multiplied.

A certain amount of energy is required to move a mass m; you can do that however you want. But due to the described connection between the energy-guzzling electrolysis process and hydrogen production, I consider the hydrogen drive to be the egg of Columbus, provided that either photovoltaics or tidal power plants or wind turbines are used to supply the process.

According to the principle of energy conservation, the initially hopefully poor efficiency of H2 production does not help to cool the environment because, as described above, the loss of usable energy is ultimately returned to the environment in the form of process waste heat. In terms of energy and pollution, there is at least a clean zero balance.

Energy savings in the industrial manufacturing process. From my insights into the state of production chains in companies, I know that many old systems are still in operation and production processes are carried out whose energy requirements could be reduced by 20%, sometimes by 80%, which the companies themselves are mostly not even aware of. There is a lot to be gained from that, which for some companies extends into the megawatt range per year.

Although I am not a fan of additional legal obligations, I have already referred to the need to submit an independent energy report every 5 or 10 years for companies with high energy consumption in connection with an investment plan that must also be submitted.

Economy: I would like to point out that this would not harm companies, but actually benefit them through the savings in energy costs, because, according to our calculations, most of the necessary investments will have paid for themselves after a maximum of two years. After that, the companies permanently save production costs.

The federal government and its CO2 package with influence on the world climate. Like a thoughtless or helpless mantra, I experience the talk of climate protection goals only in the form of x% CO2 savings by year xy. supposedly to save our planet, crowned by the CO2 tax, which can be presented as a political achievement. Don't we already have high taxes on energy and could it not have simply been increased in the same way as one would otherwise do it silently? No, as a political action that can be presented to the outside world, it must of course be a separate fee that can be presented. At this point, the mainly loud environmental screams of certain groups of schoolchildren come to the foreground.

As I already said, it is generally about the energy supply to the system resp. to the imaginary covering layer and its removal in the direction of cold space. Whether this happens with or without CO2, in view of the small amount of CO2 of 0.038% by volume according to literature, I think it doesn't really matter, despite all the radiation curves presented, which allegedly prove a "greenhouse effect" or which are supposed to hinder the transmission of radiation in the direction of cold space. And what about the other 99.962% gas content in the air ... and at what level of Hight measured? And what if the strength of the solar radiation, the so-called solar constant, only changes minimally ... in the calculation or in fact?

The Conclusions. The only thing we can really do is to reduce our energy consumption or the introduction of energy into the shell layer in the form of heat as much as possible.

However, one must be aware that in relation to the global system the influence of Germany alone is not too great and therefore even drastic cost increases only for Germans will bring little benefit to the global system. In addition: living people always add energy to the system through their personal turnover and the earth's population increases. Joint efforts of scientists and society are necessary for a comprehensive study of the global climate problem. Modern research should use an integrated approach and be based on a mathematical and physical calculation model.

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