Ccycling - the end of the climate catastrophe

A feasibility study

Index Ccycling - The End of the Climate Catastrophe

Summary

We stop the climate catastrophe before it gets catastrophic in just one generation. Each one who is interested becomes a shareholder in an organization that constructs a system for sun energy production for all mankind. The carbon of the combusted fossils is recycled from the atmosphere with sun energy to ‘soloil’ for renewed combustion in the cars and power plants worldwide. The conventional technology for this recycling process exists already. We just need to take the initiative.

The long text following can be read in three ways:

1. **Quick-readers just read the bold-formatted text and thus get an overview over the main statements.**
2. More interested readers read the normal-formatted text too.
3. Those, who want to check and calculate this study, additionally read the small-formatted text. Thus they achieve the certainty to bring in their money ingeniously.

0. Foreword

We are standing at the beginning of a climate catastrophe. We have suspected this since approximately 1970. Since approximately 1990, the facts were clear for each one interested. The last doubters were probably convinced by 2006 and the professional hypocrites will fall silent gradually. All realizations of the scientists and also our own experiences with the 'Century' summers, storms, precipitations, floods, landslides, glacier meltdowns, etc. leave no more doubts. The weather extremes and their consequences will increase further, because the carbon-dioxide concentration of the atmosphere rises inexorably further. A mere reduction of the CO_2-outlet lets the catastrophe increase further. It cannot stop the catastrophe and can not reverse it at all.

What is therefore to be done if we do not want to endure this fate any further and if we do not want to let it aggravate any further either?

In this text I - a diploma-physicist - describe here how we can stop the climate catastrophe with relatively low expenditure within 30 years and then can reduce it again and even eliminate it.

We therefore get out the CO_2 from the atmosphere. We can reduce it again into carbon, into C. We build a cycle process, the recycling of the carbon, as acronym C-Recycling or even more shortly '**Ccycling**.'

The carbon from the fossils mainly from coal, from petroleum and from natural gas by combustion is released into the atmosphere as CO_2 and is collected again from it with solar energy. It is reduced to C and is stored as anthracite, as solid coals.

We build a new energy production system for the entire mankind. It changes the solar energy into technically usable energy. The surface of approximately 2 million square kilometers is covered with particular sun collectors at the edges of the deserts of all continents, for each human being approximately 330 m^2. The collected energy is transformed into electric energy, into chemical energy in form of hydrocarbons, that is diesel fuel or fuel oil, and also in pure carbon in the form of coal or anthracite for deposition.

The liquid fuel is distributed with pipelines worldwide, the electric current is distributed over shorter distances with high voltage nets, and the coal is secured in deposits for the future. The carbon is Ccycled from the CO_2 of the atmosphere.

1. Concrete

We take for example one trillion (10^{12}) Euros per year, gathered from less than 5 percent of the income of all sufficiently earning people of this earth. With it we erect 6.000 sun power plants each of 1.000.000 kilowatts in the desert regions of the earth in the course of 30 years.

That is a total price of approximately 5.000 €/ human being, or 167 € per human being and year for the duration of 30 years, or of 46 cents per day for everyone. - The world national product 2006 amounted to 44,4 trillion dollars (44,4 x 10^{12} US$); 5% of it are 2,2 trillion dollars. That is much more than the required money quantity per year.

This is a 'Mankind Project': The entire mankind is affected by the catastrophe. 5.000 Euros/ human being within a generation is not much, for smaller organizations or states 1 trillion Euros per year however is very much - 'too much'.

The sun power plants optimally suited for this purpose are Thermic Power Plants, 'TPPs'. These are very big, open, circular greenhouses with glass roof and with a high chimney, that generate strong updraft through warming of air, therefore through 'Thermic'.[1]) A

turbine with current generator is at the bottom of the chimney of the ThermicPowerPlant. With the generated wind the ThermicPowerPlant generates electric energy in the current generator. Simultaneously, the CO_2 is filtered out of the used air, and it is transformed to carbon 'C' with the generated energy. For this purpose around the opening of the TPP a felt textile is put up, through which rinses down a watery solvent for CO_2. It picks up the CO_2 from the used air.

[1]) For descriptions and images:
http://www.solarmillenium.de/ > Technologie > Aufwindkraftwerke; >Fakten; & >Funktionsweise; & >Pilotprojekt;

http://www.vdi-nachrichten.com/vdi_nachrichten/aktuelle_ausgabe/akt_ausg_detail.asp?source=mail&cat=2&ID=12158

http://de.wikipedia.org/wiki/Thermikkraftwerk

The CO_2 is reduced to carbon, to 'C' in a chemical process. This process needs the same energy, that becomes free, if carbon is burned. This energy is available through the TPPs.

The carbon is final-deposited in non corroding steel receptacles. **In 35 to 60 years (according to urgency) from the beginning of the project for 30 trillion Euros not only the climate catastrophe is eliminated but even the CO_2-level of the atmosphere of 1880 is restored.** Thereafter the solar energy is available to mankind as **sol**ar generated fuel **oil**, as **'soloil'**, or as electric current or in any other form - including Ccycling - with one kilowatt per human being. And that only for the maintenance costs of the TPPs, that are very low, far under 1 cents per kilowatt hour, for example 0,32 c/ kWh [2]).

[2]) Aufwindkraftwerke: Jörg Schlaich; FVS Themen S. 85 - 89; 2002;

The big investment was invested already in the long time stable installations. Fuel costs do not accrue, because the sun shines gratuitously for us all and gives its energy free of charge to us all. This energy system belongs to mankind, because they paid it with '5 percent' themselves.

If something like a so-called 'ice age' or another atmospheric crisis ever should come again, then the so generated carbon depots stand ready in order to warm up the climate again if it is wished then by finely dosed combustion. They are a fast accessible energy reserve likewise, if unexpectedly more energy is required than was installed.

Mankind hereby attains **control over the climate** of their spaceship, the earth.

We get out of the atmosphere the surplus carbon share of 170 billion tons, that is **28,3 tons of carbon per human being - and that already was all!**

Each of the 6 billion people must raise 258.000 kWhs for it in order to even out the disused atmospheric dump of mankind's last four generations again (including our own).

For investment costs of 2 cents per kilowatt hour, we can eliminate the climate catastrophe:

5.000 € / human being altogether for the end of the climate catastrophe and also simultaneously for the erection of a new, additional, complete, world-wide, decentralized, non-polluting, secure, compatible, solar, long-lasting and furthermore Ccycel-capable energy system almost without operating costs: - A dream to be materialized!

The climate catastrophe not only can be stopped completely with it in approximately one year after completion of the project but the atmosphere even can be restituted again, in that all of the superfluous CO_2 will be removed from it.

Incidentally: In order to become free from fossil energy with nuclear energy, we accordingly needed 6.000 **n**uclear **p**ower **p**lants (**NPP**s) with 1 GW or one million kilowatts each. As the nuclear power was installed on earth, it was said conciliatorily: Statistically only each 10.000 years there will be a 'greatest reasonable accident'. The 'greatest reasonable accident' in Tchernobyl in the year 1986 proved this statistical statement emphatically and concretised its meaning.

Today, approximately 440 nuclear power plants work on earth.

10.000 Years / 440 NPPs = 22,7 years: This is the average time from 'greatest reasonable accident' to 'greatest reasonable accident'. 1986 + 23 years = 2009. Someday soon, a 'greatest reasonable accident' will take place again statistically on earth.

With 10.000 years / 6.000 NPPs = 1,67 years / 'greatest reasonable accident' mankind's sorrow would be indescribably big. Which clear-headed human being wishes himself and his family such a future? Just money-driven minds who want to get their share from money already invested in nuclear technology can respect their money more than mankind's destiny. The investments for NPPs would be bigger than for the equal power of TPPs - and in 70 years the Uranium deposits of earth are exhausted…

The following detailed text shows that the idea of the Ccycling is practicable. It is a 'feasibility-study.' It is written in a way that it is relatively easily legible for scientifically not trained people too.

This text was translated from German into English by me, so that more people can obtain information about Ccycling. It is broken English, just sufficient to understand the information. Whoever feels inclined to correct it is very welcome. Please do not confuse the English style with the content!

The newly created term 'Ccycling' for the concept 'Carbon Recycling' is spoken like the English word 'Recycling', but with the English 'C' instead of 'Re:' 'Cee-cycling.' The verb is called 'to Ccycle.'

The newly created term 'soloil' for 'fuel oil generated by solar energy' is also pronounced English.

I use the abbreviations 'TPP' for 'ThermicPowerPlant', 'CO_2' for 'carbon-dioxide' and 'C' for 'carbon.'

I use numbers like in the German convention: The comma ',' is the decimal point, the point '.' marks each three powers of ten, e.g. one million point zero = 1.000.000,0, following the International System of Measurement Units.

I use the units 'a' for 'year,' 'd' for 'day,' 'h' for 'hour' and 's' for 'second.' I use the units of 'ppmv,' 'parts per million volume,' measured per one million parts after its volume and 'ppmm,' 'parts per million mass,' measured per one million parts after its mass.

1 ppmv is 0,001‰ of the volume, 1ppmm is 0,001‰ of the mass.

I mostly use the energy units 'kW' for 'kilowatt' of power (energy/ time) and 'kWh' for 'kilowatt hour' of energy, because they are the clearest for each human being. I use the unit 'GW' for 'Gigawatt' (10^9 W = 1 million kilowatts) additionally.

'1-GW-TPP' means: One Gigawatt ThermicPowerPlant.

I use 'x' as multiplication symbol and'/ ' as 'division' symbol. The symbol '| x' or '|/' means: I multiply or divide the last equation with the hereupon following expression.

I use the round number of 6 billion as number of the now living people.

Since I had recognized the actuality of the climate catastrophe in the year 1990, I frequently thought about how it is to be remedied. On a car ride in the year 1992 the idea for this project came to me when I had sufficient time in order to weigh up the principles of this catastrophe thoroughly.

I publish it now in 2007 because I hope that the time for this idea finally came.

If one million Euros is met, then the planning of the details can begin, if one billion Euros is met, the construction of the first TPP can begin. If it should be used for the energy supply, then it admittedly does not contribute to the end of the

climate catastrophe, but at least it decreases the output of CO_2 through the energy won with it like any other non fossil power plant, **just with more energy per invested money. Each investor hereby is called upon to start with it now.**

2. The present situation

Since approximately 1990, it was clear that mankind caused an eco-catastrophe, that almost is irreversible: Through the combustion of fossils, that consist of carbon or carbon connections, CO_2 comes into the atmosphere, that lets through the visible rays of the 6.500 Kelvin hot sun, but as greenhouse gas it absorbs the very long-wave infrared-rays of the 300 Kelvin warm earth. So the energy remains on the earth and can be emitted no more into space.

At the beginning of the industrial age by 1750, even still by 1880, just four generations ago, there were 280 ppmv (280 parts of millions volumes) CO_2 in the air, in 2005, it was 380 ppmv CO_2, an increase by +36 percent compared to the starting value, by more than one third of the natural share. The annual increase amounts approximately to 1,5 - 2 ppmv / year at the beginning of the third millennium.

Mankind burns the carbon of the anthracite and the hydrocarbons of the petroleum and natural gas in order to generate energy. This used energy including their waste heat can be disposed of without problems from the earth as infrared radiation into space. This energy is not the problem.

The chemical waste, the 'airy ash' of the combustion that is the carbon dioxide, now provides, however, that the sunlight itself can be disposed of no more.

The sun as source of energy radiates 1,37 kilowatts per square meter earth surface. Of those is emitted again 37 percent as visible light: The Albedo of the earth amounts at the moment to 37 percent. 63% are absorbed by the earth and heats it.

That is 108 trillion kilowatts per earth, therefore approximately 18.000 kilowatts of duration performance per human being.

The calculation to this is like follows:

The surface of the sun-shone earth corresponds to a circle-disk with the diameter of the earth:

$d_{Erd}^2 \times \pi / 4 = (12.600 \text{ km})^2 \times 0{,}785 =$

$= 158.760.000 \times 10^6 \text{ m}^2 \times 0{,}785 \approx 125.000 \times 10^9 \text{ m}^2$

With the performance of the sun of 1,37 kilowatts / m^2 (in the distance of the earth from the sun) follows:

| x 1,37 kilowatts / m^2 = 171.250 x10^9 kilowatts / earth incident radiation

With the absorption of the earth of 63 percent follows:

| x 0,63 = 107.888 x 10^9 kilowatts / earth radiation absorbed

Divided through 6 billion people:

| / 6 x 10^9 people = 17.981 kilowatts / human being ≈ 18.000 kilowatts / human being

The sun beams on the earth 24 hours per day. This therefore is the duration performance.

About one percent of it additionally heats up the earth now, every year proportionally somewhat more, tendency: Over the years constantly farther increasing without end, until we stop it, or better, until we invert it.

The estimate calculation to the warming of the earth is:

The energy radiation E of a body is proportional to the fourth power of ten of its absolute temperature T: $E \sim T^4$. The earth warmed in the last decades by approximately +1°C, from approximately $T_1 = 300K$ to approximately $T_2 = 301K$:

$T_2^4 / T_1^4 = 301^4 K^4 / 300^4 K^4 = 8{,}2085 \times 10^9 / 8{,}1 \times 10^9 = 1{,}0134 = +1{,}34$ percent. The energy radiation increased by approximately 1,3 percent through the temperature increase of +1°C.

The difference between in-radiation and out-radiation leads to the warming. The out-radiation increases through the warming.

The additional isolation of the earth through the CO_2 increases the temperature of the earth, so the out-radiation increases, to bring it again into a new balance with the always constant in-radiation of the sun. If the isolation becomes stronger, so the temperature must increase accordingly further. This simple energetic consideration exposes all claims, that the climate change is not existent as frauds.[3])

[3]) http://blog.rainbownet.ch/umwelt/klima-schwindel-die-klimaluge-bei-rtl

Mankind quite naively began a large scale experiment four generations ago with the spaceship earth without suspecting that we did this - and still we keep on doing it.

It consisted of using the fossils, the peat, the lignite, the stone coal, and then also the petroleum and the natural gas, in order to heat with the energy contained in it, and, to run machines. The ash emerging with the combustion was disposed of. About the waste disposal of the smoke, no one needed to concern, because the atmosphere of the planet was 'sufficiently' big so that it could pick up the exhaust fumes without side effects. In the atmosphere, through the winds they were supplied to the plants again, so that they could recycle the smoke.

The sooty skies,

the stench of the industry exhaust fumes,

the 'sour rain' and the forest decay,

the fine dust and the increase of allergies,

the extinction of many animal and plant species

were indications that also the entire planet is overburdened with the waste disposal of the waste of ten billions of additional 'horse powers'.

This large scale experiment with the spaceship earth went wrong. It leads guaranteed into the catastrophe. It already now leads in supply difficulties that shock our whole social system. It gave already two 'oil crises' after 1970. Wars and euphemically so-called 'civil wars' are led about the petroleum areas.

We now are in the third oil crisis. It began 2006 with the Peak Oil [4]), the maximum production of petroleum on this planet. Since then, the output of the petroleum decreases principally and inexorably. The market counteracts shortages with price increase. The

petroleum price increases up to the drying up the oil wells, or only so long, until we become independent from the petroleum.

[4]) A Crude Awakening - The Oil Crash; A Film by Basil Gelpke und Ray McCormack (P,B,R); CH; 1h22'57"; © 2006 Lava Productions AG; www.oilcrashmovie.com

http://www.peakoil.net/; http://egan.blogs.nytimes.com/2008/03/05/oils-end/

http://www.energywatchgroup.org/fileadmin/global/pdf/2007-12_EWG_Oelstudie_kurz_d.pdf

This end of the petroleum age is withheld on purpose from the population so that the price increase can continue as long as possible. Now, the time of the really big profits of the petroleum companies begins, because it was missed on purpose to invest big into alternative energy forms so that we get involved into a shortage of the energy.

It must be acted anyway, in fact in quite big style and very fast.

The concrete question is:

How do we get independent from the fossil fuels, from coal and petroleum, **retain the advantages of the present technology, dispose of the exhaust fumes of four generations and nevertheless enter the solar age of the third millennium seamlessly and fastly?**

The emphasis is on the word '**fast**', because a retarded development like until now costs too much: Human lives, species lives, labor and also money and quality of life.

I propose a project here that stops the situation in a way not thought of until now and that even can turn it back. I portray the project with elaborate calculations so extensively that each reader himself can check exactly that this project actually is successfully practicable. Because **each reader should be intentionally willing, having thoroughly read the text, to pay this project voluntarily with 5 percent of his income that is over the poverty line.**

I describe many details, so that they - after publication of this text - are no more patentable, if they possibly could have been patentable previously.

I show the feasibility at first and afterwards (in the appendix) the financiability of the Ccycling Project. It contains the following synergically connected part projects:

1. The production of solar energy with 1 kilowatt per human being
2. The collection of CO_2 of the air and its storage
3. The CO_2-transmutation to C
4. The depositing of the C
5. The transmutation of the C to soloil
6. The distribution of the soloil with pipelines over the whole earth
7. The distribution of the electricity over the whole earth

8. The cultivation of foods for all mankind in the outer zones of the TPPs

9. The transportation of the food over the whole earth

10. The desalination of sea water

11. The greening of the deserts of this earth

3. Some more concrete considerations to the actualization of the Ccycling

The locations of the CCyclers should lie at approximately 23° north and 23° south. The first TPPs should lie with inferior distance to an ocean at the edge of deserts.

The big deserts of the earth largely lie approximately at the two tropics near 23° north and south. There the air masses warmed up at the equator, having rained, sink down to earth, thereby warm up again and therefore are very dry. The dryness of this air is the cause of the deserts. At 23° north, they lie in

1. North Africa,

2. the Arabic peninsula and

3. the southwest of North America (Mexico);

at 23° south, they lie in

4. South Africa,

5. Australia and

6. the west of South America.

7. In Asia, they lie in higher latitude at 40° north east of the Caspian sea,

8. likewise in the USA in Arizona.

These eight regions are so gigantic, that it is easy, to find optimized locations and to equip them with infrastructure. The Sahara alone has a surface of nine million km^2. The suitable locations lie at stone deserts, in which the danger of sandstorms is low. (The danger of the sandstorms is low anyway for the CCyclers, because of the felt material covers of the openings.) The locations have strong sun radiation because of a high standing sun almost daily. At the tropics, the sun stands in the zenith in the local summer at noon. In the winter, it stands at 90° - 2 x 23° = 44° over the horizon.

sin 44° = 0,7. The effectivity of the TPPs sinks to a minimum of 0,7 = 70% at winter solstice.

Until approximately 45° latitude it is possible to erect big TPPs economically. In the winter, the sun at 45° latitude still stands at noon 90° - 45° - 23,5° = 21,5° above the horizon, in the summer 90° - 45° + 23,5° = 68,5° above the horizon. The farther the sun stands from the zenith, the surface of the thermic power plant must become bigger for the same

performance (according to the sinus of the angle from the horizon plus atmospheric extinction), the other considerations remain the same. At 20° above the horizon the sunlight must pass three times the amount of air compared to 90°.

The effectiveness of the utilization is optimal with 23° latitude. The southern TPPs power the southern hemisphere of the equator as far south as to the South tops of the continents; the northern TPPs power the northern hemisphere of the earth with solar energy as far north as to the northern polar circle.

The CCyclers are almost self sufficient at the beginning of their utilization: Their energy comes from the sun, their raw material from the air, their final product C is deposited in their proximity. Only later, the other utilization forms of the solar energy join:

Pipelines for soloil,

Pipelines for water desalination and desert irrigation,

High voltage networks for the transportation of the electricity.

Settlements and cities of a new lifestyle are built around them in the parks of the again awakening nature.

Only streets to the building sites, villages for the construction workers and co-workers with their infrastructure and a water connection with an ocean with two saltwater pipelines must originate at the beginning of the construction works, so that the large scale building sites can work and afterwards the CCyclers too. From the saltwater, freshwater is won and the concentrated saltwater is disposed again into the ocean - or it is used for cheap production of healthy sea salt.

There already are different sun power plant types that work with different conversion principles, some of them tried large scale technically:

Photovoltaic with big silicon surfaces,

Photovoltaic with concentrating mirrors as parabolic furrows with approximately 30fold concentration and more,

Heating of water or other liquids in parabolic furrows to steam, whose energy is used by electro generators,

Central towers with a recipient, who is lent to very high temperatures. Very many flat heliostat mirrors are directed to it.

The effectiveness of their utilization of the solar energy is approximately 15 percent.

TPPs, ThermicPowerPlants or UpcurrentPowerPlants. [1])[2]) I describe them more exactly, because they form the basis of the Ccycling: they work with big circular surfaces that are roofed with clear glass. The sun radiation under the glass is absorbed in the ground. The ground becomes heated through it. It gives off its heat to the air over it.

[1]) Descriptions and images:
http://www.solarmillenium.de/ > Technologie > Aufwindkraftwerke; >Fakten; & >Funktionsweise; & >Pilotprojekt;

http://www.vdi-nachrichten.com/vdi_nachrichten/aktuelle_ausgabe/akt_ausg_detail.asp?source=mail&cat=2&ID=12158

http://de.wikipedia.org/wiki/Thermikkraftwerk

[2]) Aufwindkraftwerke: Jörg Schlaich; FVS Themen S. 85 - 89; 2002;

The air is warmed up and so gets thinner and therefore in the middle of the circular surface rises very fast into a very high central 'chimney'. The air drives an air turbine with current generator that is at the bottom of the chimney. ThermicPowerPlants are a type of gigantic round greenhouse that is open at the periphery and has a very high chimney in the middle.

These power plants can generate energy 24 hours per day, in fact all the more even, the bigger their heat buffer is. They will form the energy ground load supply of the earth.

A form of the heat buffer could look like this:

The ground consists of heat storages in form of once filled, extensive water reservoirs that are less than 1 m deep. They are thermally isolated below and have covers of dull black electric oxided aluminium with big cooling ribs up to the air and down to the water that are directional to the center of the TPP. With these heat storages, the TPPs can work uninterruptedly without sun radiation with full performance even several days, according to the depth of the basin. They have a 'sun storage ground heating' so to speak.

With 1 m of depth there are 1.000 l H_2O / m^2 with 1000 cal / (l x °C) = 10^6 cal / (°C x m^2). (1 cal = 1 calory = +1°C for 1ml water)

With 4,2 Ws / cal and 3,6 x 10^6 Ws / kWh follows: (1 Ws = 1 watt second and 3.600 s/h x 1.000 W /kilowatt = 3.600.000):

[10^6 cal/ (°C x m^2)] x 4,2 Ws/cal / (3,6 x 10^6 Ws/kWh) = 3,9 kWh/ °C x m^2 of energy storage.

The sun radiation is approximately 1 kW or 1 kWh / h. With 20°C temperature reduction of the reservoir, I can drive (3,9 kWh / °C x m^2 x 20°C = 78 kWh / m^2) the TPP without sun radiation approximately 80 hours or 3,3 days. The heat storage is thermally filled about a week and from then on is available for the entire term.

TPPs even work with diffuse sun radiation, because the radiation does not become concentrated. Buffered through the heat storages the TPP works extremely economically with constant energy output.

The glass roof consists of prefabricated quadratic double glass elements in modular series production. The glass of the collector surfaces should be double glass in order to minimize the losses through heat conductivity. The glass should be anti-reflection treated, so that the reflection losses of approximately 16% (4 % at each four glass surfaces) are decreased to approximately 5%. Anti-reflection treatment for optical systems is a series process that still nevertheless is expensive today, because it is a treatment of a few square meters per day. If however the glassworks make an anti-reflection treatment for over 1.000 square kilometers of glass, then, the price per square meter only amounts to a few cents: The additional expenditure, in order to achieve some 10 percent more effectiveness with the TPPs, is worthwhile.

The bearers of the roof are e.g. 10 m high steel concrete pillars with streamlined cross-section directed to the center, so that the friction resistance to the airflow is minimized.

The usable sun radiation has approximately 1 kilowatt/ m^2 for daily approximately eight hours or 1/3 days, therefore approximately 330 W/ m^2 continuous input. The efficiency of big TPPs is low unfortunately, approximately only 1,4 percent. For smaller collector Gsurfaces, the efficiency sinks even further to approximately 1%.[2]) Only very big TPPs are therefore economic. However, by the measures described here, the efficiency can be increased by over 50 percent of the standard value from 1,4 percent to over 2%:

1. dull-black absorbers from
2. high heat conductivity aluminium with
3. cooling ribs and
4. constant water temperature,

5. anti-reflection

6. double glass,

7. low turbulence formation in the airflow.

A slightly costlier investment presumably is more favorable with very long terms than a less effective savings version.

The higher the chimney is the bigger the efficiency, with which the incident radiation can be used. Since the high heated air column in the interior of the chimney and also over it is much thinner than the cooler air column, that surrounds the chimney outside, a hypotension is created in the interior of the chimney that is all the bigger, the higher the chimney is. It drives the air upward that streams in below, and it drives in the cooler fresh air at the outside periphery of the TPPs.

A practically realizable TPP could have a circular glass surface of 25 km^2, therefore a radius of 2,82 km. The chimney could have a height of one kilometer, an inner diameter of 170 meters with wall strength of 99 cm below and 25 cm above. In the interior of the chimney, streamlined pre-stressed steel spokes are appropriate to the stiffening against torsion forces. The pre-tension originates through montage of the spokes between an inner ring with small diameter and the outside ring that is tense at the chimney-outside-wall.

The chimney seems gigantic at the first moment. It is to be built relatively simply, however, different than a skyscraper of this height: It has the form of the cooling towers of nuclear power plants. It has a height not even sixfold the diameter. The static is simple, the wind strengths are low. Nevertheless, its foundation must be a big and thick concrete plate, because the weight of the chimney amounts to approximately 500.000 tons.

This TPP has a continuous output of approximately 82.500 kilowatt (**without** the 7 described methods to the increase of the efficiency. Additionally I intentionally assume the efficiency with 1% very low to get the 'worst possible case', also for taking into consideration the efficiency of the following processes. Probably the output power will be two times as high.).

Approximately 13 such single power plants construct a unit, that has 1-GW = 1 million kilowatts of continuous output, a '**1-GW-TPP**.' The diameter of the entire unit is approximately 30 km, comparable to the surface of a city of a million inhabitants. More than half of the surface serves to the influx of the air into the individual TPPs.

6.000 such units must be erected in order to have 6 billion kilowatts of continuous output.

The calculation to this:

r = 2,82 km; d = 5,64 km; F = d^2 x π / 4 = 31,8 km^2 x 0,785 = 25 km^2 = 25 x 10^6 m^2 collector surface of a TPP

| x 330 W / m^2 = 8,25 x 10^6 kilowatts incident performance

| x 1 percent of efficiency = 82.500 kilowatts of continuous output per TPP

| x 13 TPPs = 1.072.500 kilowatts = 1,07 GW. 1 million kilowatts of continuous output of the installation.

25 km^2 x 13 = 325 km^2 = collector surface of the 1GW-TPP

D = 30 km; F_{total} = 30^2 km^2 x π / 4 = 707 km^2 total surface of the 1GW-TPP / 325 km^2 = 2,17-times.

6.000 x 707 km = 4.242.000 km^2; | / 2,17 = 1,955 million km^2 collector surface of the Ccycling Project

6.000 x 1 million kilowatts = 6 billion kilowatts / mankind

The surface of the earth is 510.000.000 km^2.

1.955.000 km^2 / 510.000.000 km^2 = 0,0038 = 3,8‰. **The collector surface is 0,38 percent of the surface of the earth.**

The used materials are concrete, glass, steel and aluminium as immovable, once to build structure and additionally the classic turbine with current generator as single moving part. Concrete and glass are products that can be produced simply and cheaply on the whole earth. The energy required to their manufacture can already be delivered by the first TPPs. For the realization of this mankind project, the accordingly big production places must be erected at the borders of the deserts of the continents.

That main wear-part is the turbine with current generator with very long terms until the next maintenance like in conventional power plants. It furthermore runs day and night with constant performance; therefore it runs wear-poor. And it runs very slowly with approximately 1/2 rotations per second or 0,5 Hertz.

The calculation for the rotation of the turbine:

I restrict the air speed at the turbine, for example to 2/3 sound speed = 2/3 x 340 m/s = 226 m/s (chapter 11).

With 170 m of diameter, the periphery of the turbine is d x π = 170 m x π = 534 m.

226 m/s / 534 m = 0,42 / s < 0,5 Hz.

The most important cost factor of a TPP is the labor that is needed mainly for the construction and afterwards only to a very low extent for the operation and for the maintenance.

A part of the maintenance is **the cleaning of the glass roof**. A roboter for high-pressure water cleaning, that sucks up the water with the mud again, with 10 m of width and a speed of one meter per second cleans on one day, consisting of 24 x 60 x 60 s = 86.400 seconds: 864.000 m^2 = 0,864 km^2, therefore in one month it cleans over 25 km^2 glass roofs. Such a cleaning machine, that is sufficiently light-weight, belongs to each TPP in order to be able to drive on the glass roof.

TPPs work with conventional, long tried technology (greenhouse and turbine generator). They are long time stable. **They now are already - positioned in deserts - more favorably than conventional fossil power plants and essentially more favorably than nuclear power plants.**

Tornado power plants are a possible advancement of the TPP. In them the air is deflected under the glass roof at not exactly radial standing air guides to one side. The air guides are the pillars that carry the glass roof and furthermore, they are the cooling ribs of the heat reservoirs. Also they are the openings of the metal fence, with which the inner part of the TPP is secured, in which the wind speeds are dangerously high. (Compare chapter 6, end.) The streaming air masses get a rotatory impulse by them that generates very high whirl speeds by contraction of the radius from some kilometers to under 85 meters. **On the northern hemisphere of the earth** the wind currents that move to a hypotension area, a 'low-pressure', are distracted through the Coriolisforce contrary to the clock sense (seen from above). On the southern hemisphere, these winds rotate clockwise. This effect can be reinforced with low means. The turbine by these means can change the wind energy into rotation energy to a higher percentage. And the turbine is more cheaply in the manufacture because it can be simpler.

Another possibility to increase the efficiency of the TPPs consists in the combination with the principle of the **fall wind power plant** or catabatic wind power plant, that is applied here vice versa (therefore outside): The vaporization of freshwater generates vaporization cold. It makes the air cooler, therefore denser; therefore it effects a higher pressure. If spray nozzles for freshwater are installed at the outsides of the chimney of the TPPs and through it cool the outside air that therefore becomes denser, then the pressure difference between the warm air that streams in the interior of the chimney and the cooled down outside air rises. The turbine is driven more strongly according to the greater pressure difference. The outside air already is cooler over the glass roof than the environment air of the desert area anyway, because the glass roof consists of double glass so that it remains cool outside. The sun radiation is absorbed only in the ground in the interior. Glass is impermeable for long-wave infrared radiation; the inner glass warms by the warmth of the

air and by the infrared radiation of the ground and the outside glass remains cool. The heat remains in the interior of the glass roof.

There are other sun power plants that work essentially more effectively than the TPPs, calculated in output power to input radiation of the sun. Efficiencies of 15 percent already are exceeded. But calculated as **'investment in money' to 'continuous output', measured in Euros / kilowatt nevertheless the TPP possibly has the lowest number**, because the investment in square meters of double window glass probably can not be undercut. Also the maintenance costs are extremely low because of the simple wind turbine with current generator, exactly like with the technically ripe normal wind power plants. Likewise, **the long-time stability** probably is not surpassable, because of the simplicity of the TPPs. Practically no 'high tech' is used. On the other hand the big surface used by the TPPs is especially good for the collecting of air for the recycling of the CO_2.

Nevertheless it should be considered whether the energy of other sun power plants cannot be shared in order to use it in the conversion of C from CO_2 if the CO_2 was already gathered by the TPPs.

4. Collecting and transmuting of the CO_2 from the air

The energy capacity is the prerequisite for the second and third step of this mankind project: Collecting of the CO_2 out of the air and its transmutation to C.

The air, that streams into the TPP, is led through liquid chemicals at the outside periphery of the installation, for example through a watery solution of Lithiumhydroxid (LiOH) or alternatively through soda-lye (Natriumhydroxid, NaOH) or through lime-water ($Ca(OH)_2$). These materials bind the CO_2, with which they come in connection.

A felt material curtain is vertically fixed at the glass roof construction and at the ground around the entire outside-edge of the TPP. The liquid for the absorption of the CO_2 is supplied by the edge of the glass roof and in the felt material slowly runs vertically downward from above through its weight. The air streams horizontally through this felt into the TPP. This felt with the absorption liquid works like a filter, that binds the CO_2, but lets the air pass through. It decreases the effectiveness of the TPP a little because an inferior pressure difference prevails on both sides of the felt material. Furthermore, some water is evaporated at the passageway of the air. The air becomes somewhat cooler through it.

The hypotension in the interior of the TPP drives the air through the moist felt. The liquid gathers in grooves below the felt filter, and comes to the chemical processing of the CO_2, while the regenerated liquid streams anew through the felt.

The absorption liquid as addition to the water is necessary, because the solubility of CO_2 in water (from air with 1 bar) is 0,5 mg / l (at 20°C); approximately 0,2 mg / l at the higher desert temperatures.) Here is the calculation:

With 380 ppmv CO_2 in air, a $m^3 = 10^6$ cm^3 of air contains 380 cm^3 CO_2.

CO_2 has a density of 1,98 kg / m³ (under normal conditions), air has1,293 kg / m^3.

(1,98 kg/ m^3) / (1,293 kg/ m^3) = 1,53.

The mass parts per millions ppmm of the CO_2 in the atmosphere are 1,53-fold the ppmv.

It is therefore 380 ppmv x 1,53 = 582 ppmm (parts per millions masses) CO_2 in the air. 1 m^3 air contains 380 cm^3 CO_2 or 582 mg CO_2. With pure water as solvent, one needed for this quantity 582 mg CO_2 / 0,2 mg/l = 2.907 liters ≈ 3 m^3 H_2O per m^3 air. That is unrealistically much. One therefore needs another solvent that works more effectively, for example, one of these above mentioned watery solutions.

Possibly, other procedures are even more suitable, for example the electro chemical separation or AluminiosilicatesG2 as receivers of the CO_2-molecules or a unification of several of these procedures. However, the collecting-effect for CO_2

with the streaming of the air through the wet felt material is presumably the biggest and at the same time cheapest method.

Alternatively it could be also done additionally with a mist of the solvent in an area between two felt material filters if even higher CO_2 collecting-effectiveness is wished.

Because of the high wind speeds in the interior of the TPP, the felt material must be very stable. It can, for example consist of a thick web of micro fibers from polypropylene, that is reinforced with fiberglass or coal fibers.

With the gigantic quantities of air, that stream through the felt, the evaporation of the water is not to be neglected, and the supplies of the water in the desert must be solved.

On the other hand, air with higher humidity is created through it in the desert regions. The moisture can rain, because the air directly after moistening reaches a height of several kilometers and cools down very fast very strongly. **This will essentially improve the weather in wind direction behind the TPPs.** Trees, that are planted there, can thrive better through it.

The first forest plantations are therefore positioned in the main wind direction of the TPPs.

The **water** supplies are guaranteed through a double pipeline of non-corroding steel to the next-situated ocean, that is put to any 1-GW-TPP. It leads 3,5% salty sea water to the TPP. It is pressed at high pressure through ion-filters with solar energy and so is changed to **freshwater**. The thinner return-pipeline with 10 percent of the cross-section of the sea water pipeline leads the 10:1 concentrated saltwater back into the ocean, as well as to salina fields in the coast region, in which the sea salt is harvested that was up-concentrated with solar energy. With the saltwater pipelines, it also is secured that enough water is available for the construction and for the workers.

During the construction phase of the first TPP of a group, however, the energy must be available through a small extra-power plant for the construction and for the water desalination.

Later, when the atmosphere has the wanted CO_2-concentration, **the freshwater production can be one of the main goals of the TPPs in order to make the deserts fertile and afterwards also, in order to lift the ground-water level under the deserts again** - another century project, that then will be realized.

(**Compare Appendix 2: The Freshwater Production with TPPs**)

It can be necessary, to erect TPPs for the production of freshwater for the supply of the inhabitants of arid zones independently from the Ccycling, because of the water shortages in many areas of the world.

There are more greenhouse gases than CO_2, for example **Methane CH_4, from the warming permafrost grounds and from other sources: Through other chemicals additionally to the CO_2-solvents also all other climate gases can be removed out of the air simultaneously with the CO_2 and they are recycled or harmlessly stored in other ways. The methane can be processed directly to fuel oil. The nitrogen of the air - it is no greenhouse gas - can be processed to nitrogen-fertilizer.**

From the watery solution, the CO_2 is processed further with chemicals that reduce the carbon at 1000°C.

The reaction-equation is:

$$CO_2 + 393\ kJ / mol <=> C + O_2$$

('kJ / mol' is called 'kilojoule per mol.' 1 kilojoule is one kilowatt-second; 1 mol is the atomic weight as well as the molecular weight in grams. This conversion-equation runs in both directions (<=>): To CO_2 with the combustion (<=), to $C + O_2$ through the Ccycling (=>).

The conversion of kJ or kilowatt-seconds to the unit kilowatt-hour, that is more current in daily life, is:

393 kJ = 393.000 Ws │ / (1000/k x 3.600 s/h) = 0,1092 kWh. The reaction-equation therefore is rewritten:

CO_2 + 0,1092 kWh / mol => C + O_2

The mol is the atomic or the molecular weight in grams:

C has 12 mol, O has 16 mol, O_2 therefore has 32 mol and CO_2 44 mol. The equation therefore further rewritten is:

44 g CO_2 + 0,1092 kWh <=> 12 g C + 32 g O_2

12 grams carbon therefore yield approximately 0,1 kWh with their combustion.

The conversion of 440 g CO_2 **to 120 g C** + 320 g O_2 **therefore costs approximately 1 kWh.**

This is the reverse step to the combustion. Because of this relatively very large energy quantity it is too much CO_2 in the air at all. Therefore, mankind uses this reaction since centuries. The 0,1092 kWh / mol are won with the combustion, that is the exothermic process that the industry uses - and with the C-production, they must be inserted into the conservation of the high temperature so that the endothermic reaction can run in the reverse direction. Whichever type of chemical conversion is chosen: All processes lead to the giving/ receiving of this energy quantity.

The Bosch process produces C directly in that it burns hydrogen at an iron catalyst between 530°C and 730°C with CO_2: (The hydrogen is previously energy-lavishly produced for example through electrolysis of water)

CO_2 + 2 H_2 => C + 2 H_2O + heat

This procedure generates carbon directly. It then is pressed strongly and is deposited as **anthracite** coal.

The Sabatier process transmutes CO_2 to methane at a nickel or cobalt catalyst in an inter-step between 300 and 400°C:

CO_2 + 4 H_2 => 2 H_2O + CH_4 + heat

Possibly this process is the suitable one in order to produce **fuel oil - soloil**.

5. ThermicPowerPlants are ideal for Ccycling

In ThermicPowerPlants, TPPs, large air masses are warmed up, whose buoyancy is converted into air speed, whose energy drives the turbine that is coupled with a current generator. From these air masses, the CO_2 can be extracted simultaneously during the process of the energy production. The produced energy immediately flows into the chemical conversion-reactions.

In this project, the power plants primarily do not serve the production of energy but the production of carbon in very large scale. They must therefore be optimized for this purpose and must have big dimensions, so that they can be effective.

Nevertheless, only easily controllable dimensions should be produced at the beginning of mass production, that however already produce ‘something’. **The TPP-production of a standard type takes place in series production at the conveyor belt in module**

construction manner (for example: 6000 1GW-TPPs x 13 = 78.000 TPPs). With this method the construction costs can be lowered essentially compared to the construction of one single TPP. Likewise, the speed, with which the TPPs can be erected, accelerates. That is important!

The modules, their number and their construction are optimized according to increasing knowledge while producing.

It is ingenious to form groups of several such 1-GW-TPPs (One-Gigawatt-ThermicPowerPlants), as suppliers around a central chemistry work that produces the carbon and deposits it. **The infrastructure of the chemistry work and the receptacles of the depot, the pipelines and the high voltage managements, the saltwater pipelines and the desalination installations are needed only once in that structure.** If one component fails, the others can jump in.

The (for example) 20 times 1-GW-TPPs of a group are arranged 90° to the normally prevalent wind direction in the respective region, so that each 1-GW-TPP can suck in 'unCcycled' ground air - comparably like today large wind power plants are arranged, so that each of them receives the original wind without whirls from their neighbors. The horizontally slowly inpouring 'unCcycled' air still contains the full CO_2-content, the exhaust air in approximately 1 km height streaming out with high vertical speed has only a very strongly reduced CO_2-content.

Any 1-GW-TPP is planned in a way that it can be enlarged without problems later by simple enlargement of the base, by mounting of stronger generators with changed turbine or through further TPPs that are erected at the outskirts of a 1-GW-TPP.

Each TPP is switched off by a stable fence of steel blades, that is built into the chimney and that is closable in some seconds in case of danger by turning of the blades of 90°. So, the inside with the turbine and the generator can be serviced. (With not-demand or with danger, a TPP can be switched off completely in this way.)

The cross-section of these steel blades can be constructed as a thick mesh of hexagonal tubes (honeycombs) that lets the air pass when open and that gives stability to the blades because of its thickness and lightness. The blades can be grouped radially or parallel.

Outside the ring with the moist felt material for the CO_2-absorption a bigger area is assigned for, in which **greenhouse plants** grow, for the nutrition of the construction-workers and co-workers and **for 'exportation' into the remaining world.** 2,82 km is the inner radius of the greenhouse. With one kilometre width of the greenhouse we have over 17 km^2 greenhouse expanses 'in best situation'. With 13-times 6.000 TPPs (= 6.000 1-GW-TPPs) we therefore have over 1.380.000 km^2 or more than **230 m^2 per human being**. This arable land with sufficient water for irrigation is more than sufficient for the vegetarian life of a human being (1 kg per day), above all, since it is in best situation and additionally still in the greenhouse with constant, soft air flow. **The 'rest' of the earth surface is free for uncultivated nature, for parks, for new self-sufficient settlements in the middle of the loneliness, etc.**

The calculation: r = 2,82 km

Circumference U = r x 2 π = 17,7 km | x 1 km of width > 17,7 km^2 (I neglect the bigger outer circumference)

| x 13 TPPs = 230 km^2 | x 6.000 1-GW-TPPs

6.000 x 230 km^2 = 1.380.000 km^2 = 1.380 x 10^9 m^2 | / 6 x 10^9 human beings = 230 m^2 / human being

The fertilizer for the gigantic number of plants at the edge of deserts for supply of the whole mankind is also produced by the TPPs:

The plant quantity is in the magnitude: (a = annum = year)

1 kg / (human being x day) x 6 x 10^9 G7human beings = 6 x 10^9 kg / day | x 365 days = 2,19 x 10^{12} kg / a ≈

≈ 2 x 10^9 t / a = 2 km^3 / a

(1 kg / d) x 365 d = 365 kg / a | / 230 m^2 = 1,6 kg / m^2 x a

Per square meter should be harvested 1,6 kg of food per year - in three to four harvests -. That is very little. Normal profits per harvest are 0,4 to 0,8 kg / m^2 dry-mass of plants or grain mass (for example wheat), according to 1,6 to 3,2 kg dried food per 4 harvests.

Therefore the greenhouses can be narrower than one kilometre or are built only at some of the TPPs.

It can get cold at night in deserts. The greenhouses cannot be closed at night because the TPPs have to work. Therefore only robust plants are cultivated that can endure a temperature above zero degrees centigrade. Moreover outside of the greenhouses there can be installed a heat buffer-'ground heating' from closed water-basins (just like in the Ccyclers themselves), that is heating the night-wind - and is cooling the daytime-wind. In a 1-GW-TPP all the ground between the single TPPs could be covered with them.

The nitrogen-fertilizer for the plants is processed from the nitrogen of the air in the chemistry work through cooling and liquefaction and through ammonia-manufacture by the Haber-Bosch process. The high energy consumption of this procedure, in order to produce the chemical compounds of the nitrogen, is delivered by the TPPs likewise.

(Compare **Annex 1: Pipes - the global transport system for food**)

The inner area of the TPPs, in which the wind speed is over 5 Beaufort or 10 m/s or 36 km per hour, is separated through a sufficiently strong close-meshed metal fence, so that no people, animals, plants or other things can be sucked in through the strong airflow. This fence is cleaned with demand with strong vacuum cleaner robots that drive along a rail outside the fence.

6. How long does it take until the necessary energy capacity is available?

What, if we start this energy project with one trillion Euros per year and with a high urgency?

To the comparison: The Iraq war of the USA 2005/06 has cost the taxpayer of the 'conqueror' power in one year over 0,3 trillion U.S.$. The USA contain 5 percent of mankind's population (0,3 billion people / 6 billion people = 5 percent).

This war corresponds to approximately 6 trillion Euros per year as financial burden for the whole mankind.

The organization 'Ccycling.org' is erected and its funding is regulated, as soon as more than one million Euros are met. It is structured strictly logistical.

The planning starts

for a Standard-TPP in module construction manner with its infrastructure, (streets, factory-buildings, worker-homes, grids for power, water, information, …),

for a group of these TPPs with central chemistry work, (receptacles, pipelines for salty water and soloil, pipes, desalination-works, …),

for the large-scale factories to the manufacture of concrete, glass, armament steel, noble-steel, aluminium, polyurethane, …,

for the factories, in which the TPP-modules are produced, (window-cases, concrete-pillars, water-receptacles, cooling-rips, isolations, turbines, current-generators, steel-blades, towers, …),

for quality-testing,

for the optimal locations in the eight regions of earth.

Big value is put on **optimization of the quality and durability for decades or better centuries,** on corrosion solidity, resistance to wear, etc, because the TPPs should run generation-long without interruption and breakdowns. Then, they are the most economical.

Glass and concrete and steel and aluminium works are erected everywhere at central points of desert-near and at the same time ocean-near regions of the continents. (Polyurethane can be produced in the chemistry-works of the Ccyclers.) The streets are traced. The water pipelines are put. The mass production of the series parts starts. The turbines and current generators are produced in big numbers of pieces. **The many million of until now unemployed persons are trained to construction workers and skilled workers world-wide.** The building sites are levelled. And after three years of construction time for a TPP it goes in operation. The capacity of the concrete, steel, and glass works allows for the maximum speed of the construction.

Everywhere on earth, the wealth grows. Poverty and hunger and thirst decrease in the surroundings of the construction sites more and more each year. The building sites are simultaneous in all eight desert regions of the earth. **The beauty and the benefit of the project cause a zest under all participants,** that is bigger and essentially more justifiable than the one for the project of John F. Kennedy in the USA 1961 for the 'lunar-landing in this decade.'

The participants - that is the whole mankind that takes their way out of the climate catastrophe by themselves.

The TPPs can be created also in the vicinity of cities until about 45° geographical latitude afterwards. **When the goal of 6.000 1-GW-TPPs is achieved, the production of the TPPs can go on and on, according to the needs of energy, food, water and practicability, also in the vicinity of cities (embedded in nature parks).**

Assumed, at the beginning simultaneously 30 times 1-GW-TPPs per year and per continent can be in construction, therefore, 30 x 1-GW-TPP x 8 continents = 240 1-GW-TPP / earth get done in three years, therefore 240 x 1-GW-TPP / 3 years = 80 x 1-GW-TPP per year on the earth could be done after first attempt-postponements. Later, when the series production is running, when the production bottlenecks are removed and when the money flow of 1 trillion Euros per year goes on, then the construction will go even faster with the then-developed special machines, etc., with maybe **300 completed 1-GW-TPPs per year.**

A rough estimation to the number of workers, that can be employed for one trillion Euros per year: If the average month-wage is 1.500,- € per worker, then he earns 18.000,- € per year. With investments into his job of the same size of 18.000,- €, it is 36.000,- € / job per year.

10^{12} € / 36.000,- € **= 27,7 million jobs** │ **/ 300 1-GW-TPPs = 92.330 workers per unit in construction.**

With 300 x 1-GW-TPPs per year and one billion Euros per year we have

1 trillion € / 300 1-GW-TPPs = 3,33 billion Euros per 1-GW-TPP. An individual 1-GW-TPP in mass production approximately costs about 3 billion Euros.

(The price for a nuclear power plant of this performance today would be well over 5 billion Euros - without the nuclear fuel uranium and its subsequent final depositing, which after 40 years of testing is still unresolved! And too without the insurance costs for a greatest reasonable accident with 1 million deaths.)

The remaining costs go in

the chemistry work for the transmutation of the C, later also from C to soloil,

into the depot receptacles for the CO_2 as well as for the C,

into the two pipelines for the saltwater,

into the pipeline for the soloil and the pipes,

into the water desalination installation,

into the high voltage managements for the current,

into the highways,

into the settlements and cities for the factory workers, the construction workers and co-workers and their families, into their education and into the other social benefits for them.

This means **20 years of intensive construction activity with 20 x 300 = 6.000 1-GW-TPPs after approximately 10 years for the start up of the production.**

Possibly the costs will sink with **mass production and synergy of 1-GW-TPP-groups** in a way that not even the amount estimated here will be required.

The complete changeover to Ccycling is to be managed in barely one generation. That means: Far over 100 percent of the world-wide generated CO_2 is recycled then. After all the surplus CO_2 was removed from the atmosphere it is switched gradually to the production of pure solar energy in form of soloil and electricity inclusive Ccycling.

7. How much energy is needed in order to free the atmosphere again from its surplus CO_2?

The atmosphere had a thickness of 7.992 meters ≈ 8 km, if it had the same density everywhere as with atmospheric pressure at sea level. The calculation to this is:

The normal-pressure of the atmosphere at normal-zero amounts to 1.013,246 hecto-Pascal.

1 Pascal = 1 Newton / m^2 = 101,9716 g weight (pond) / m^2

1 hecto-Pascal = 1 hPa = 1 Newton / (1/100 m^2); 1/100 m^2 = 100 cm^2

1.013,246 hPa = 1.013,246 x 101,9716 pond / 100 cm^2 =

= 103.322,3 pond / 100 cm^2 = 1.033,223 pond / cm^2 = 1,033 kp / cm^2

The air under normal-conditions has the density 1,2928 g / 1.000 cm^3.

1.033,223 pond/cm^3 / 1,2928 g/1.000 cm^3 = 799,21 x 1.000 cm = 7.992,1 m

An air column of the density of air at sea level of 7.992 meters height lies on average on the entire earth surface.

The earth surface has the size 510.100.933,5 km^2. The atmosphere therefore (theoretically) has a total volume at normal-pressure of

510 x 10^6 km^2 x 8 km = 4.080 x 10^6 km^3.

How much CO_2 is in the atmosphere?

1 m^3 air contains 380 ppmv = 380 cm^3 CO_2 or 582 mg CO_2 = 0,582 g. (see above)

4.080 x 10^6 km^3 x 10^9 m^3 / km^3 x 0,582 g CO_2 / m^3 = **2,37 x 10^{18} g CO_2 / atmosphere.**

The 100 ppmv = 153 ppmm CO_2, that came in additionally since the beginning of the industrial age, shall be extracted from it. Therefore

2,37 x 10^{18} g CO_2 / atmosphere x 153 ppmm / 582 ppmm = 0,623 x 10^{18} g CO_2 =

= 623 x 10^{15} g CO_2 x 12 g C / 44 g CO_2 = 169,9 x 10^{15} g C ≈ 170 x 10^{15} g C = **170 x 10^9 t C.**

170 x 10^{15} g C x 0,1092 kWh / 12 g C = **1,55 x 10^{15} kWh / Ccycling** | / 6 x 10^9 people

= 258.333 kWh / human x Ccycling.

In words condensed:

2,37 trillion tons CO_2 are in the atmosphere. We get out the surplus carbon share from the atmosphere again in level of 170 billion tons of C in the entire Ccycling process, therefore 28,3 tons C per human being – and that is all already!

We require 1,55 Peta-kilowatthours for all the CO_2, that the human being brought into the atmosphere, to change back again into carbon. **Each of the 6 billion people therefore must produce 258.000 kWh in order to even out the disused dump of mankind's last four generations again.**

130 years have (130 a x 365dx24h/d) / a = 130 a x 8.760 h/a = 1.138.800 hours. Our ancestors (they were fewer than we are now…) of the last four generations therefore have used altogether - with us at the moment -:

258.000 kWh / 1.138.800 h = 227 W duration power / human being. Climbing tendency.

8. What does this cost?

To the estimation: With an arbitrarily assumed price of for example 0,10 Euro / kWh (a sub-'normal' price today) this is the sum of

258.000 kWh x 0,1 € = 25.800 €.

These nominal 25.800 € we give in a generation contract for the objective, that we could build our industry culture from it, without also taking into account in any form the effects on our co-world. We now do this by levelling them out again. The price for the prevention of the catastrophe is low, that otherwise would accompany us over millennia 'till to the fourth generation' as it is called in the Bible (Ex34,7). How much money is this altogether?

Nominally 25.800 € / human being x 6.000.000.000 people = 154,8 trillion Euros.

With one trillion Euros per year and thirty years of construction time we on the other hand get an investment price for the kilowatt hour of only
(30 a x 10^{12} €/ a) / 6 x 10^{9} men = 5.000 €/ man
| / 258.000 kWh = 0,01937 €/ man = 1,94 c/ man, therefore
< 2 c / kWh. The operating expensesG82 , that add to the investment, are approximately 0,32 c / kWh today [2]).

This price is staggered after the height of each citizen's income, distributes therefore justly: Everyone pays only 5 percent as 'Ccycling fee.'

For 2 cents per kilowatt hour, we can eliminate the climate catastrophe.

To summarize: 30 years x 1 billion Euros / 6 billion people =

= **5.000 € / human being. That are the costs for the end of the climate catastrophe and for returning to the CO_2-values of 1880 and simultaneously for the erection of a complete new world-wide energy system, that delivers clean energy as soloil or current practically gratuitously from then on, that provides mankind with foods, that greens the deserts, etc**

9. How long does it take, until this energy is generated by the 6.000 1-GW-TPPs?

(1.000.000 kilowatts / 1-GW-TPP) x 6.000 1-GW-TPP = 6 x 10^{9} kilowatts of performance are at the disposal altogether. In one year, they generate an energy of

6 x 10^{9} kilowatts x 8.760 h / a = 52.560 x 10^{9} kWh / a = 0,0525 x 10^{15} kWh / a.

(1,55 x 10^{15} kWh / Ccycling) / (0,0525 x 10^{15} kWh / a) = 29,5 a / Ccycling

It therefore takes approximately thirty years or barely one generation until all the CO_2 is Ccycled to C, if all TPPs work continuously.

10. How long does it take until the entire atmosphere was led averagely once through the TPPs?

In order to answer this question, I must know the admission opening of the TPPs and the speed, with which the air streams in there.

Assumed the admission height of a ThermicPowerPlant for the air is 10 m. This means, the glass roof is 10 m above the earth. The admission width for the air is the periphery of a circle of

25 km^2 surface with d = 5,64 km, therefore

π x d = π x 5,64 km = 17,72 km of circumference. **The surface of the admission opening** with this is

F = 10 m x 17.720 m = **177.200 m^2**.

The outside periphery of a TPP is = 17.720 m. The chimney diameter is d_K = 170 m. ('K' for 'Kamin,' the German 'chimney.')

The chimney admission circumference is $U_k = \pi \times d_k$ = 3,14 x 170 m = 534 m. The concentration of the wind speed to the center of the TPP is

17.720 m / 534 m = 33-times, because the in pouring air is like the streaming out air.

One restricts the chimney admission speed v_k of the air through the turbine load to

v_k = 226 m/s = 2/3 sound-speed,

then, **the admission speed v_e of the air into the TPP is** v_e = 226 m/s / 33 = **6,87 m/s** = 4 Beaufort.

(The kinetic energy $E = (m_{Luft}/2) \times v_k^2$ is that, that is transferred to the current generator by the turbine.)

The air volume, that streams in per second, is with 6,87 m/s admission speed of the air into the TPP,

F x v_e = 177.200 m^2 x 6,87 m/s = 1.217.364 m^3 / s.

One day has 24 h x 3.600 s / h = 86.400 s. It therefore per day is

86.400 s x 1.217.364 m^3 / s air = 105 x 10^9 m^3 = 105 km^3/d.

105 km^3 of air per day and TPP are put through.

With 6.000 x 13 TPPs this are 6.000 x 13 TPP x 105 km^3 / (d x TPP) = 8.190.000 km^3/d ≈ 8 x 10^6 km^3/d.

In one year with 365 days, it therefore is 8 x 10^6 km^3 x 365 d = 2.989 x 10^6 km^3 / a ≈ **3 x 10^9 km^3 / a**.

All 6.000 1-GW-TPPs put through 3 x 10^9 km^3 air per year.

The atmosphere has a total volume at normal-pressure of 4.080 x 10^6 km^3 = 4 x 10^9 km^3 (chapter 8)

4 x 10^9 km^3 / (3 x 10^9 km^3 / a) = 1,3 a = 365 d x 1,3 = **16 months** = 475 d.

All 6.000 1-GW-TPPs need 475 days or 16 months or 1,3 years for the collecting of the entire atmosphere for CO_2.

Assumed, the effective yield of CO_2 with the collecting of the atmosphere would be 100 percent, then, after only 1,3 years from now there would be just 0 ppmv CO_2 remaining from the now 380 ppmv CO_2. A new ice age would be caused with it ;-) If the effectiveness of the collecting should be so big, then the end of the CO_2-collecting can be met already after some months: 380 ppmv / 16 months = 23 ppmv / month at the beginning with high concentration in the atmosphere.

100 ppmv / (23 ppmv / month) = 4,2 months.

With 100 percent of effectiveness of the CO_2-collecting, all the superfluous CO_2 could be removed from the atmosphere in approximately 5 months.

The collecting the CO_2 therefore is approximately 70-times faster than the generating of the energy for the conversion of the CO_2 to C.

Even if the yield of the collecting from the atmosphere is not 100 percent, this does not amount to much. Also, the blown out and cleaned air mixes again with the remaining atmosphere. Also the concentration of the CO_2 in the air diminishes in the run of the Ccycling. A sufficiently big rest-concentration of over 280 ppmv nevertheless remains, however. In this respect it is very good that all these effects do not play any important role: The generated energy is the standard that determines the speed of the Ccycling.

This tosses up the question:

11. Where to with the faster collected CO_2?

The CO_2 can only be processed to C completely in approximately 30 years with an energy of 6.000 GW x 30 a.

The CO_2, which cannot yet be processed to C, because the energy was not yet generated for it, must therefore be deposited for the time being.

With the depositing of the CO_2, the climate catastrophe can be eliminated very fast after starting of the project.

From the atmosphere, 100ppmv must be removed. In 29,5 years there is processed (chapter 10)

170×10^{15} g C x 44/12 = 623×10^{15} g CO_2 = **623×10^9 t CO_2**.

In form of water this would be 623 km^3.

Methods for the storage of CO_2 are in the testing:

Storage in deep sea basins is one of the ideas that come from the thinking of the last millennium: Throwing away, just like it also happened with the nuclear waste. Nature shall see, how it continues. 'I don't care if the sea becomes sour, if the creatures suffocate!'

Storage in exhausted natural gas deposits and later retrieval, just like previously the natural gas was won, maybe is a possibility for small amounts of CO_2, because the total volume is not sufficient.

A very elegant possibility of the storage is: Refrigeration of under -78,5°C and **storage as dry-ice in big cooling containers** directly beside the TPPs. An inferior part of the energy of the TPPs is taken for the refrigeration. If sufficient CO_2 is collected, the sun-energy is used no more for the collecting the CO_2 but only for the processing of the dry-ice to carbon.

I imagine e.g. very big spherical receptacles of non-corroding noble-steel, just like petroleum reserve receptacles, with for example 50 meters diameter (if technically possible also essentially bigger). They could be embedded half into the underground beside the TPPs. They are totally surrounded by a polyurethane layer for heat isolation.

With e.g. 1 meter thickness of the isolation the thermal losses of the entire receptacle are far under 1 watt, the isolation can therefore be essentially thinner. The losses through thermal conductivity are to be neglected therefore, even with desert temperatures, with temperature differences of the dry-ice opposite the air of 120°C and opposite the cooler underground of approximately 100°C. This receptacle of 50 m of diameter has the volume of

$V_{Kugel} = 4\ \pi\ /3 \times r^3 = 4{,}19 \times 25^3\ m^3 = 65.400\ m^3$. ('Kugel' means 'sphere' in German)

Alternatively, isolated steel cylinders similarly big would be a probably cheaper depot possibility.

Or alternatively half-circle depot: **Very long depots of isolated non-corroding steel with a cross-section of a half-circle e.g. with 30 m interior diameter upon a fundament of isolated concrete**, constructed in form of a circle (toroidal) around the 1-GW-TPPs. They have a volume of $d^2 \times \pi / 8 = 30\ m \times 30\ m \times 0{,}39 = 353\ m^3$ per meter, therefore **per kilometre $V = 0{,}35 \times 10^6\ m^3$. That is the volume of about 5 of the sphere receptacles.**

Each of the 6.000 1-GW-TPPs gets out of the atmosphere during Ccycling:

623×10^9 t CO_2 / 6.000 1-GW-TPP = $103{,}8 \times 10^6$ t CO_2

With a density of 1, I needed for the storage of the entire CO_2:

$103{,}8 \times 10^6$ t $CO_2 \times 1$ t / m^3 / 65.400 m^3 = 1.588 sphere receptacles.

However, the density of dry-ice amounts to 1.56 g / cm^3, so we have 399,4 $km^3 \approx 400\ km^3$ of dry-ice.

Therefore I need only 1.588 / 1,56 = 1.018 such receptacles per 1-GW-TPP =

1.018 x 65.400 m^3 = 66.559.000 m^3 = 0,067 km^3 / 1-GW-TPP.

This corresponds to one of the big national oil storage fields as security reserve that exist in each big industrial nation at the moment.

The TPPs immediately after completion begin with collecting of the CO_2 and with its conversion to C.

With for example 600 1-GW-TPPs, therefore with just 10 percent of the total project, in approximately 6 years it is possible to collect from the atmosphere all the superfluous CO_2 and store it as dry-ice. With the generated energy of the 6.000 1-GW-TPPs in approximately one generation it will be Ccycled to C.

Assumed, the beginning of the realization of the project is the year 2010. From the year 2020, 300 1-GW-TPPs per year are built. In approximately 2025, the climate catastrophe already is eliminated, turned back to 1880. Until approximately 2060, the CO_2 will be Ccycled completely to C.

The CO_2-technology will spread enormously, because the CO_2 is so cheap and will substitute poisonous substances as solvent completely, that are used until now.

Overcritical carbon-dioxide possesses a high solubility for non-polar materials and can replace poisonous organic solvents. It is used as extraction-means, for example for the extraction of natural materials like caffeine (manufacture of decaffeinated coffee) and as solvent for cleaning and degreasing of wafers in the semiconductor industry for example, and recently also for textiles (dry-cleaning). Currently it is also researched intensively, to use hypercritical carbon-dioxide as reaction medium in the fine-chemical-manufacture (for example) for the manufacture of aroma materials, since isolated enzymes often remain active here and no solvent residues (in contrast to organic solvents) remain in the products.

To increasing extents, carbon-dioxide is put into action as natural refrigerant in air-conditionings.[5])

[5]) http://de.wikipedia.org/wiki/Kohlendioxid

12. How much ppmv CO_2 per year the TPPs can Ccycel to C?

It is 100 ppmv CO_2 / 29,5 a = 3,39 ppmv / a.

At the moment the yearly increasing of the CO_2 in the atmosphere amounts to almost 2 ppmv / a. This number will remain approximately constant with mankind's present efforts to the reduction - viewed optimistically;-)

The decrease of the CO_2-contents in the atmosphere is about the same speed as calculated; just the Ccycling to C therefore seen realistically goes essentially more slowly because additional fossil CO_2 still comes into the air.

But with -3,39 ppmv + 2 ppmv = -1,39 ppmv per year the transmuting to the final product C goes almost as fast into the correct direction like at the moment into the wrong one.

The measure of the **intermediate-storage of the CO_2 is very important** because of the further increase of the CO_2 in the atmosphere through the industrial output, **until sufficient energy exists for the conversion to C.**

This 30-Trillion Euros method described here therefore is a minimum of expenditure. Anything below it remains a drop in the bucket.

13. Which deposit size do the carbon depots have after the end of the Ccycling?

The solid C accrues in form of soot, of small particles of carbon. It can be pressed under high pressure to briquettes of pure carbon, to micro crystal anthracite blocks.

Anthracite has a density of 1,95 g / cm^3.

Altogether, 170 x 10^{15} g C are Ccycled (chapter 7).

170 x 10^{15} g C / (1,95 g / cm^3) = 87,18 x 10^{15} cm^3 / (10^{15} cm^3 / km^3) = 87 km^3.

Approximately 87 km^3 of anthracite will therefore accrue (instead of 400 km^3 dry-ice, that is just 22% of the depot size of CO_2.)

With 6.000 1-GW-TPPs we have for a single 1-GW-TPP

87 km^3 / 6.000 = 0,0145 km^3 / 1-GW-TPP = 14.500.000 m^3, a cube of 244 m of edge-length - or divided through 65.400 m^3, the volume of a sphere of 50 m of diameter,

222 spheres of 50 m of diameter per 1-GW-TPP.

1.018 such spheres per 1-GW-TPP are required for storing of all the necessary CO_2, the initial product of the Ccycling (see above).

The C, Ccycled from the CO_2, therefore can be end-deposited in the depots of the CO_2 that get free by Ccycling. Possibly, the construction of only 250 such receptacles per 1-GW-TPP suffices for the CO_2-inter-storage. This corresponds to a CO_2-reduction of the atmosphere of approximately -25 ppmv CO_2. When almost all of these receptacles are filled with CO_2, then, the CO_2-depots will be changed to C slowly so that more and more of the receptacles are filled with C. If all are filled with C after 30 years, all the CO_2 is Ccycled.

These thermally insulated, pressure-resistant, corrosion-stable receptacles, that are buried half in the underground of the earth and that have a sufficiently big distance from each other,

are the carbon depots of mankind, that are very well protected against fires.

They are spread world-wide, therefore secured very well against local catastrophes.

They are easily accessible.

They are directly beside the chemical works that could process the C further, if there is demand to it.

14. The result and the beginning

The anthracite also is available world-wide if it should be necessary to increase the CO_2-content of the atmosphere again. Reasons for it could be:

The climate becomes colder again,

big volcano outbreaks occur that filter away the sunlight in the dusted atmosphere,

the so-called 'nearing of a new ice age' for whatsoever reasons.

With additional unforeseen big energy needs that cannot be covered by the existing TPPs from the current solar production **this coal depot represents an energy buffer. It is as big, as all the fossil fuel that was used by mankind until now, namely 1,55 x 10^{15} kWh.**

The combustion of this type of coal takes place residue-free to just CO_2.

This anthracite is the energetic treasure of mankind: With the energy quantity of the 6.000 C-depots mankind obtained to arrive in its technological development from the state of the 19th century to the state of the 3rd millennium. It did not know what it got involved in as it naively began with the experiment to use coals for the heat production and later as well petroleum and natural gas.

In its totality it still now does not know really that it got involved in an experiment with a planet as spaceship that has - almost - led to the energetic breakdown by it.

Maybe just in time we with this project manage to prevent the breakdown: **We build a second energy system** with help of the first. It is bigger than the first and gets rid of the consequences of the first. **It will replace the first, when the fossils will have become too expensive compared to the Ccyclable, cheap, waste-free and healthy solar energy.** (The fossils are more expensive already since several years.) It then is available for us in every form we can wish for, in fact **practically free**: Only the operating costs and the conservation of the installations and the distribution of the energy must be paid for by the coming generations. **The CO_2 situated still in the atmosphere, from then on is taken in order to make soloil from it that is released into the atmosphere again as CO_2 into the energy cycle of the renewed Ccycling.**

Is there a more beautiful gift that we can leave our children, grandsons and granddaughters, and their great-grandsons and great-granddaughters?

The time for this idea came.

This time is called (in beautiful German): 'Jede-Tat-Zeit', (any deed time) short: "Jetzt!" -

"Act Now!"

15. Some additional considerations

In the deserts of this earth on all continents, there is sufficient easily convertible solar energy for transmuting the CO_2 chemically, to then store it in the deserts in the simplest case in carbon, shortly C. **The storage as 'anthracite' in big receptacles, as solid carbon, as maximum valuable stone coal is simpler and surer, as if we stored it in form of gaseous or liquid hydrocarbons or in the commencing product CO_2.**

The CO_2 is equally available at each point of the earth world-wide, because it is part of the atmosphere. With its wind currents, it takes care that all the air of the earth is evenly mixed everywhere within a few months. The proof is:

1. Chernobyl: The radioactive cloud from the explosion of the gassed nuclear fuel rods of the reactor of the nuclear power plant of Chernobyl reached the USA after 14 days (to the west) and reached Japan after 10 days (to the east).

2. At a wind speed of 4 Beaufort the wind travels with 25 km/ h, that is with (25 km/ h) x 24 h = 600 km per day and with (600 km/ d) x 30 d = 18.000 km in a month that is halfway around the earth.

3. The CO_2-catastrophe is not limited to the part of the earth, where the CO_2 is produced.

The energy of the sun cares that air currents originate, that distribute the CO_2 evenly everywhere on the earth. Therefore, the CO_2 can be gathered in stationary Ccyclers at arbitrary points of the earth.

It 'just' is important,

1. To have solar energy in enough quantity to the use,

2. To have installations, that let through sufficiently much air,

3. To get the CO_2 out of the air in these installations,

4. To transmute the collected CO_2 chemically to C + O_2,

5. To release the O_2 again into the air,

6. To bring the C into the form of anthracite and to deposit it safely.

This idea is very simple. Simultaneously with this idea the gate is opened into the age of the solar energy.

If carbon is stored sufficiently once and if more of it could be stored anytime, according to demand and then ruling better insight, then, the carbon can thereafter be farther recycled to liquefied soloil with the solar energy. This could happen to all of these installations after approximately thirty years of work, therefore from approximately 2060.

Several procedures stand at the disposal for the manufacture of the soloil, that are large-scale technically tried, for example the Fischer-Tropsch process and the Bergius process.

With the Fischer-Tropsch process, carbonic-monoxide is formed of carbon and is changed with hydrogen at iron or cobalt catalysts to paraffins. The reaction runs under high pressure and with a temperature of 200 - 350°C after the chemical formula: n CO + (2n+1) H_2 => C_nH_{2n+2} + n H_2O; n = 1, 2, 3,…

So, C_nH_{2n+2}, that is fuel gas and diesel fuel (and water as 'waste'-product), are created with differently long chained paraffins according to the reaction conditions. This procedure is large-scale technically tried since 1934 and is improved further since then. Today one single targeted hydrocarbon can be produced with this reaction, for example with n = 8 Octane C_8H_{18}, with the 'octane'-number '100 octane,' (highly antiknock). Normal Diesel-fuel has n = 10 to 22.

In the 1970s after the first oil crisis (1973) the German state started a large-scale technological project in the Ruhr area with billions of 'Deutsche Mark' expenditure in order to become independent from the petroleum with the stone coal by optimizing all conditions for the coal liquefaction. It was said at that time that the petroleum production from stone coal would be competitive from a price of 2 DM / litre = 1 Euro per litre of fuel. Today, the coal liquefaction of 'CtL' (Coal to Liquid) is competitive from a price of 60 U.S.$ / Barrel petroleum = 0,38 U.S. dollars / litre petroleum. It is therefore competitive since 2006, since the Peak Oil. [6])

[6]) http://de.wikipedia.org/wiki/Kohleverfl%C3%BCssigung

The pure hydrocarbons created from the carbon can stand to the disposal with **fewer than 80 pipelines world-wide.** The pipelines have a length on average of approximately 2.500 km, to supply with the entire earth as far as to the polar circle.

The distance of 23° north and south, the tropics, to the equator is 23 x 111 km = 2.553 km. The distance of 23° north to 67° north, the polar circle is (67° - 23°) x 111 km = 44 x 111 km = 4.884 km.

South America is at end at approximately 50° south, Africa at approximately 35° south. Australia lies around 23° south. The islands of the Pacific and Indian ocean have their own Ccyclers. The deserts in USA in Arizona also like in Asia lie more northern than 23° north. The settling at the polar circle is so low that just one to two pipelines per continent suffice for the supply high up north in America, Europe and Asia. The main settling of the continents is less than 2.500 km away from the tropics (Japan, China, Northern France). The pipelines proceed directly in North-South direction in the ideal case. Their distance from each other can be for example 2.000 km. The equator-perimeter amounts to 40.000 km. So, **less** than 20 x 4 = 80 such pipelines are necessary for the supply of the earth.

Many of the pipelines today already exist for natural gas and petroleum. The soloil can be converted into any other energy form with the present technology of the petroleum use. Each continent should have of so many Ccyclers that it is energetically self-sufficient.

The transportation of petroleum over the oceans with trouble-susceptible and energy-costly oil freighters stops.

This pure sun fuel of 'soloil' exactly like petroleum consists of hydrocarbons (C_nH_{2n+2}) and is exactly used like it. The soloil is burned like the oil until now and it transmutes into pure $GCO_2 + H_2O$ and is released into the atmosphere, and the CO_2 then is Ccycled in the deserts of the earth. Fossil petroleum, natural gas, coal, etc. still can be used, like until now. They are replaced by the soloil when it (seen economically) is cheaper than the fossil fuels that are coming to an end. **Already because of these final days of the fossil fuels, it immediately is necessary to transfer into the new technology. This transfer however must take place as fast as possible.**

The strongly risen oil prices compared to the 20th century also make it economically meaningful to immediately invest big capital amounts into the solar energy production instead of giving it to the fossil energy concerns over the petroleum prices like until now.

'To relinquish on the energy industry with the transfer to the solar energy utilization means to leave mankind to ruin.' (From: Hermann Scheer: Sonnenenergie - Politik ohne Alternative [Solar energy - politics without alternative]; ISBN 3-492-12135-7; Piper-Verlag 1995; page 182 [written in German; Hermann Scheer is member of the German federal legislative assembly 'Bundestag' since 1980 for 7 election periods])

The motor vehicles still can go with the previous motors with the previous technology. The 'Hydrogen'-fuel-variant is interesting only for cars with electric motors, in fact only then, **if** the conversion of hydrogen from electricity and back to it **should** be solved satisfactorily and also the storage of hydrogen easy, space-, and mass-saving and accident-safe (Think of the challenging 'Challenger' catastrophe).

Incidentally: Other projects, that are seemingly cheaper, to generate fuel or coal with plants 'unfortunately' are completely uneconomic: The efficiency, with which plants produce combustible substances from solar energy, lies under 0,25 percent. (The 'Biomass to Liquid' process, 'BtL', the most successful until now, in that it processes the entire plant body to fuel, just renders 0,23 percent of the incoming solar energy.)

Do I really want to fire green, fertile nature surface around me as a petroleum substitute?

How much surface is needed for humanity? - The calculation is:

1 kilowatt / human being x 6×10^9 people = 6×10^9 kilowatts = 6×10^{12} W

| / (333 W / m^2) x 0,23 percent = 0,8 W / m^2 ;

= $7,5 \times 10^{12}$ m^2 = 7,5 million km^2 = 750 million hectares.

This corresponds to 1.250 m^2 / human being.

Europe's entire country surface (together with the sterile areas and the inhabited areas) amounts to **10,5 million km^2**.

Do I really want to fire the wheat, in order to use it as electric light in this form, or does my conscience oppose it? Do I really want mono-cultures of 'energy plants' around about myself worldwide so that I can go on living farther as I want to, as I however can do it no more, exactly because of it?

It occurs that this form of the solar energy conversion is very labor-intensive, it is plowed with tractors, it is fertilized with fertilizer, it must be sprayed with insecticides, it must be harvested with tractors, it must be converted to fuel chemically. Earth still is further exploited by it. The total-efficiency of this method sinks to far under 0,2 percent, possibly to 1‰ and moreover the price is much higher, because of the labor invested in the production each year.

The social subsidy of farmers should not be connected to uneconomic and unethic projects!

Who voluntarily wants to risk the starving of millions of people for being able to drive a car?

For the transportation of energy over big distances, the pipeline is the most economic way. It costs only the energy for the pumping of the soloil and doesn't have any further losses. The energy can be stored like now easily and cheaply in large quantities in the regionally existing security reserve receptacles (reserves for several months energy consumption already are realized everywhere). So, mankind's energy supply is secured. **The conversion into other energy forms like electricity**, that practically can not be stored because it is a 'current', can take place in the respective states **in power plants with heat coupling** that stand in the cities and release pure CO_2 into the atmosphere, without expensive filtration. The current then is distributed favorably in distances of far under 1.000 km with the existing high tension mains. The electricity power plants for the combustion of soloil in the cities are connected to the big pipelines with small side-branches.

A soloil pipeline with one meter of diameter and a flow speed of for example 5 m / s **can transport an energy quantity of 138 GW.** One therefore needs only one 1-m-pipeline for more than 100 times 1-GW-TPPs, or **one minimally needs approximately 45 such pipelines for the 6.000 1-GW-TPPs for the whole earth.** High voltage managements cannot compete with it, not from the investment and not from the loss performance. It is just the energy of the pumps with the pipelines. The loss performance gains something with higher current speed of the soloil through turbulence losses, the current speed of 5 m / s is approximately the economic optimum. However, in crisis times without further investments, it could be more than doubled. This also is one point that would not be possible with high voltage managements without further investments.

The calculation to this: **A tube of d = 1 m** of diameter has a cross-section of $d^2 \times \pi / 4 = 3{,}14 / 4 = 0{,}785\ m^2$. With 5 m / s of oil speed, $3{,}925\ m^3 / s = 3.925\ l / s$ of soloil flow through. Diesel fuel has an energy density of 9,8 kWh / l (> Wikipedia > Diesel fuel). 1 kWh = 1.000 W x 3.600 s = $3{,}6 \times 10^6$ Ws. Therefore per second flows through:
$(3.925\ l \times 9{,}8\ kWh/l \times 3{,}6 \times 10^6\ Ws/kWh) / s = 138.474 \times 10^6\ Ws / s = 138\ GWs / s = 138\ GW$ = **138 million kilowatts. That is an energy quantity that is sufficient for 138 million people.**

The other forms of the utilization of solar energy should be developed further independently from the Ccycling: The **wind energy utilization**, the hydraulic power plants, the tides power plants, the wave power plants, and too the utilization of the earth warmth. They are used for the autarchy of the energy supply in the future in their nearer surroundings (< 100 km).

Likewise, the private autarchy of the individual people and families should further been promoted with private sun collectors for heating water. Likewise, the **photovoltaic with concentrated solar energy** can be an interesting source of energy for the autarchy of private houses. (**Compare: Appendix 3: PS – Personal Sun**)

The Ccycling assures mankind's ground supply with energy and the stability of the climate and it makes the CO_2-collection near the soloil users unnecessary.

16. Sources – Chapter (Ch…)

[1]) For descriptions and images:
http://www.solarmillenium.de/ > Technologie > Aufwindkraftwerke; >Fakten; & >Funktionsweise; & >Pilotprojekt;

http://www.vdi-nachrichten.com/vdi_nachrichten/aktuelle_ausgabe/akt_ausg_detail.asp?source=mail&cat=2&ID=12158;

http://de.wikipedia.org/wiki/Thermikkraftwerk; Ch. 1; 3

[2]) Aufwindkraftwerke: Jörg Schlaich; FVS Themen S. 85 - 89; 2002; Ch. 1; 3

[3]) http://blog.rainbownet.ch/umwelt/klima-schwindel-die-klimaluge-bei-rtl; Ch. 2

[4]) A Crude Awakening - The Oil Crash; A film by Basil Gelpke and Ray McCormack (P, B, R); CH; 1h22'57"; © 2006 Lava Productions AG; Ch. 2; www.oilcrashmovie.com

http://www.peakoil.net/

http://egan.blogs.nytimes.com/2008/03/05/oils-end/

http://www.energywatchgroup.org/fileadmin/global/pdf/2007-12_EWG_Oelstudie_kurz_d.pdf

[5]) http://de.wikipedia.org/wiki/Kohlendioxid; Ch. 11

[6]) http://de.wikipedia.org/wiki/Kohleverfl%C3%BCssigung; Ch. 15

[7]) http://www.spiegel.de/wissenschaft/mensch/0,1518,530501-2,00.html; Ch. 16

[8]) http://de.wikipedia.org/wiki/Bestechung; Ch. 17

[9]) http://www.weltderphysik.de/de/4245.php?ni=813; Ch. 19

[10]) http://www.spiegel.de/wissenschaft/natur/0,1518,539372,00.html >
Interaktive Karte Kipppunkte des Weltklimas No. 5; 12; 14; 15; Ch. 19

[11]) http://www.spiegel.de/international/0,1518,443287,00.html 10/19/2006; Ch. 19

[12]) http://www.spiegel.de/wissenschaft/erde/0,1518,435127,00.html (4.9.06) Ch. 20

[13]) ISBN-13 9783100139047
http://de.wikipedia.org/w/index.php?title=Bild:Jared_diamond.jpg&filetimestamp=20071101150407; Ch. 21

[14])
http://www.faz.net/s/Rub2542FB5D98194DA3A1F14B5B01EDB3FB/Doc~EBAF24BC7F82F45E39578AD1C23A62C1D~ATpl~Ecommon~Scontent.html; Ch. 21

Annex 1: Pipes

Comments to chapter 5:

In the outside-areas of the Ccyclers greenhouses are built for mankind's ground supply of food.

So the question arises: Is it meaningful to harvest the food so far away from the people? How can the problem of the distance be solved?

Here is the answer:

Pipes - the global transportation system

In the Ccyclers food is generated in the magnitude of 2 km^3 / a = 2 x 10^{12} l / a.

Food has approximately the same density as water that is 1 kg / l.

We have per 1-GW-TKW and year 2 x 10^{12} kg / 6.000 1-GW-TKW = 2 x 10^9 kg / 1-GW-TKW.

This quantity is to be transported to the people of the earth in one year.

How is this done optimal, therefore economical, energy-saving, fast and global?

One year has 365 d x 24 h/d x 60 min/hG x 60 s/min = 31.536.000 s ≈ 3 x 10^7 s.

Each 1-GW-TKW produces 70 kg per second:

2 x 10^9 kg / 3 x 10^7 s = 0,7 x 10^2 kg / s = **70 kg / s**.

I will describe a transportation system, the **'pipes'** that has the following qualities:

Parallel to the soloil pipelines, **a second pipeline system**, the 'pipes' are built as a compact unit. The system consists of **two tubes, each of 1 m of inner-diameter**. Therefore, there are three parallel, equally big tubes side by side - or with demand also one on the other. These two 'pipes' are **thermally insulated** on the outside through a layer of polyurethane or another insulation of for example 10 centimetres thickness and through blanc metallic or white color.

So, the temperature in the interior can be held sufficiently cool.

Its mechanical stability is adjusted to the outer conditions over ground or under sea by thinner or thicker noble-steel.

In the interior, these tubes consist of **two halves**, the left and the right half. They are both **electrically conductive** and are **electrically isolated against each other**. For example the left half has an electric tension and the right half is grounded. So, the entire pipe is used for the conducting of the current. Therefore the voltage can be held low and the entire metal cross-section of the tube serves for the current and energy transportation.

In the interior of these 'pipes' **transportation vehicles called 'cars'** can move. They are driven with the electric energy that is led by the halves of the pipeline wall. It is transferred

to the cars by their rubber tires. The rubber is electrically conducting by admixture of soot, etc. The wheels run in grooves that are on the left and right underside of the pipes. The cars have a round cross-section of for example 90 cm and a length of for example 10 m. They consist of a chassis with two times three tires of for example 10 cm diameter. All tires are driven directly by one electric motor each.

The power of a car is laid out in a way that for example it can drive 10 metric tons = 10.000 kp weight with a velocity of 5 m/ s up a 5 percent slope. This corresponds to a performance of:

5 m height / 100 m of length with 5 m/ s that is 5 m height / 20 s.

10.000 kp x 5 m / 20 s = 2.500 kp x m / s

| / 75 kp x m / s = 33,3 bhp (brake horsepowers)

| x 0,735 kilowatts / bhp = 24,5 kilowatts.

If the wheels have a distance from each other of 2,50 m and a distance of 1,25 m from the front and rear-edge of the cars, then, there are three wheel-pairs per car or 6 wheels (1,25 m + 2,50 m + 2,50 m + 2,50 m + 1,25 m = 10 m).

Therefore, **each wheel** needs an electric motor of 24,5 kW / 6 **≈ 4 kW**.

The cars are firm tube-racks, into which the 'containers' can be clicked in. The wheels are fitted into the racks so that **the clearance of the containers amounts to approximately 85 cm.**

The '**container**s' consist of a tube that can be tucked up at the side on its whole length. So, they easily can be loaded with corresponding 'palettes'. We also have 'semi-containers'. They are just 5 meters long so that two of them fit on a car.

When loading, the palettes are clicked in to the interior of a container, the hinged cover of the container is shut, and the container is clicked on to a car. The car then comes into the **loading stations, named 'loads'**, on the threading rail and is threaded into the stream of the other cars.

The distance of the loads from each other at all pipes is approximately **100 km.** At these loads the stream of the cars can be threaded out or in for a single car or also for several cars. Big shunting-stations are used for the loading and unloading of the containers or their **transhipping on automobile trucks for the supply of the nearer surroundings.** Four or six of these containers are clicked on the trucks.

At the loads, crossings and branch-lines of transverse pipes can be realized likewise, in each case controlled per computer and radio.

Each container has an RFID-Chip with an unambiguous identification. So, the cars with their containers destined for a load can automatically be threaded out or in.

Big ventilators are at each load: at the Ccyclers, at the service-loads, at the endloads with the users in the cities, and at the cross-loads, where two pipes cross and east-west-pipes take over the cross-transportation along the degrees of latitude. The ventilators make an overpressure in the pipes 'from behind' and a hypo tension 'from in front.' So, the cars drive without headwind, but in the contrary they can be driven from this pressure

difference, like in a tube mail. This pressure difference is so low that a **wind speed** is generated in the pipes of approximately 20 m/ s that are approximately 72 km/ h. So, the cars can go with the wind with very little power of their own.

The cars have a **clutch** at the back and in front, that closes automatically with contact and that can be solved per radio. So, they themselves can construct chains of cars of many kilometers that can immediately be solved with demand. If long chains are formed, mountains can be run over with high speed, because the cars that drive downhill pull the cars that drive uphill. A high performance of one single car therefore is not necessary. However with inferior traffic also one single car can drive slowly downhill and uphill.

So, we have an autarchy of each individual car and simultaneously all advantages of a train system of almost infinite length.

When for example an **average-speed of 70 km/ h** is used, then the wind-speed is set so and the rotational speed of the wheels of the cars is regulated in accordance. This corresponds to a wind speed of 8 Beaufort. A trip of 2.500 km from the greenhouses of the Ccyclers to the loads near the consumers lasts with it
2.500 km / (70 km/ h) = 35,7 h or **1,5 days**. There are no traffic jams. Human labor is used only for loading and unloading. The energy consumption of this transportation system is very low and consists of a low pressure difference in the pipe through the ventilators and in the electric performance of the motors of the cars for a **horizontal movement without air friction only against the friction resistance of the rubber-wheels.** This may be in the magnitude of less than **1 kilowatt / car**. The electric motors therefore run with less than 10% of their maximum performance.

The pipes are built in connection with the soloil pipelines as a unit of approximately four meters of width. They run if possibly **along the highways** of the states.

There are service-cars to the **maintenance of the pipes** in each load, with which accidents can be cleared in these pipe units of approximately 100 km length. Broken down cars are pushed forward to the next load. Spray-cars with own accumulators clean the walls of the pipes, directed and observed by the men of the staff, when the power supply is switched off. So, accident-places are passable again within hours.

In each container, a piece of e.g. **10 kg dry-ice - that is frozen CO_2 of -78,5°C -** can be put, according to the length of the trip and the wished cooling temperature. So, the driven **food is well cooled during the trip of one to two days without own cooling equipment.** Each container is cooled, and **so the entire pipe is cooled too. The in-blown air can also be pre-cooled**, for example to 0°C. So, low cooling temperatures are possible for each freight - from for example + 10°C to for example - 50°C for special deep-frozen food, freely chosen for each single container independently. The isolation lies around the pipe only once and is not transported.

The remaining maximum distance to the people between the loads is 50 km along a pipe. Between two pipes, however, it can be up to 1.000 km in east-west-direction. When the practicability of this system is proven, it can be further extended in east-west-direction to a **general long-range transportation system for every type of things on the surface of the earth.**

A container of l = 10 m length and a cross-section of d = 85 cm on average (not exactly circle-round, but approximately) has a volume of

$V = l \times d^2 \times \pi / 4 = 10\ m \times 0{,}852\ m^2 \times 0{,}785 = 5{,}67\ m^3 = 5.670\ l$

| / 70 l / s = 81 s.

The **transportation capacity** should be at least 70 litres per second, therefore a container should depart each 81 seconds. With a speed of 70 km/ h = 19,4 m/ s we need for 10 m of length / (19,4 m/ s) = 0,515 s, that is 81 s/ 0,515 s = 157. The capacity of these pipes can be increased at will until a limit of approximately **160 times of the capacity that is necessary for the food transportation.** For groups of 20 times 1-GW-TKWs therefore also only one pipe is necessary - still with gigantic reserves. Each pipeline has two pipes, so **over 200 km^3 per year can be transported from the Ccyclers and back again**. The capacity therefore is sufficient also in top-times of the harvest in order to deliver fresh food to the people. **Each pipe at 70 km/ h can transport 352 Mio t / a ≈ 1 Mio t / d. The speed and with it the capacity can be changed if needed.**

There are **two parallel pipes**, one for each transportation direction. The **air-turbines** for the wind in the pipes at the loads therefore **suck in the air from one pipe and blow it into the other pipe** simultaneously and chill it on that occasion according to demand. With 70 km/ h = 19,4 m/ s the turbines have to move air and cool it in the amount of

0,785 m^2 pipe-cross-section x 19,4 m/ s = **15,3 m^3/ s** - if no container is in the pipe, otherwise accordingly somewhat less.

The containers normally drive back to the Ccyclers on their cars, filled with **compost** of already processed organic mass. This cycle of the food therefore consists of the recycling of the compost to the greenhouses and in the recycling of the cars and containers to renewed loading. With the nutrients for the plants that are won as nitrogen-connections from the air and additional minerals **a complete recycling-system is formed here. So, mankind's food can grow in the deserts.**

This system is

essentially more effective than the previous truck system.

It needs **much less energy**.

It almost does not need **any personnel** - no waste of human labor.

The drivers are free for activities that are more interesting.

It needs much less place.

It transports much faster and

much more and

much safer

over longer distances

and more effectively cooled

also cheaply underwater between continents.

And the **investments will be inferior** to another lane on the highways, above all, when this system is integrated with the design and the construction of the highways of the continents.

Annex 2: The greening of the deserts (compare Chapter 4)

The freshwater-production with TPPs

If I use one of the 13 TPPs of a 1-GW-TPP for the production of freshwater from sea-water then I have 82,5 MW for it, that means in one year I have the energy of

82,5 MW x 24h x 365 d = 722.700.000 kWh/ a ≈ **720 million kWh/ a**.

Present-day big-installations for the so-called **reverse-osmosis from saltwater to drinking water, have an effectiveness of 1 m^3 of produced drinking water per 2 to 3 kWh.** With the reverse-osmosis, saltwater is pumped with very high pressure through a semi permeable membrane, through which only H_2O-molecules pass, but no salt-ions. The pressure overcomes the naturally existing osmotic pressure, which would lead to equally dense concentration on both sides of the membrane. The energy is used in order to drive the pressure-pumps for up to 80 bars. This is at the moment by far the most effective form of sea-water-desalination.

The next favorable freshwater-production method would be with the procedure of electro-dialysis with approximately 10 kWh / m^3. Vaporization or evaporation use much more energy (over 20 kWh for one cubic meter).

If I take the value of 3 kWh/ 1 m^3 freshwater, then I can generate 240 million cubic meters of freshwater per year:

With 82,5 MW x 24h x 365 d/ (a x 3 kWh/ m^3) = 240 million m^3 drinking water/ year ≈

≈ 0,25 km^3 / year.

I can therefore desalinate 0,25 cubic-kilometer of water per year. This is enough for over 6 million people with 100 liters per human being and day:

240 million m^3 / [0,1 m^3 / (human being x d) x 365 d] = **6,57 million people**.

A long pipeline in the magnitude of a few hundred kilometers connects the installation with a water-removal-place in an ocean that lies in bigger water-depth. Before the openings of the big area of removal-tubes, strainers are appropriate with increasing delicacy that keep back all solid particles until approximately 15 microns of diameter. The cross-sections of all removal-openings together should amount to approximately 100 m^2 so that the current-speed of the removal certainly is under 1 m/ s and does not evoke any dangers.

With a rustproof **noble steel tube of d = 1m diameter** and a pressure of 100 bar I can reach water speeds of approximately 30 m/ s with tubes of 100 km length. With it I can transport 0,7 km^3 saltwater per year:

$d^2 \times \pi/4 = 0{,}785\ m^2$

| x 30 m/ s = 23,55 m^3 / s

| x 31,5 million s/ a = 742 million m^3 / a ≈ **0,7 km^3 / a**.

A pipeline of 1 m diameter therefore is fully sufficient in order to provide one to three TPPs with saltwater for the freshwater-preparation. The return pipeline for the up concentrated saltwater can have 10 percent of the cross section, with approximately 35 percent of salt concentration:

0,0785 m^2 = d_{return}^2 x 0,785; d_{return} = 0,32 m

Sea-salt can be gained at the coast with demand from a part of the concentrated salt solution. The total amount of the sea salt per year from the 24 million cubic meters of concentrated salt water is

240 x 10^6 m^3 H_2O x 0,035 NaCl/ H_2O = 8,4 x 10^9 kg NaCl = 8,4 billion kg sea salt.

The technology of the salines with sun-evaporation of the water is many millennia old and becomes ten times more efficient through the application of concentrated saltwater.

The salt-consumption for food-purposes of human beings and animals from biologically more valuable sea-salt is covered by it more inexpensively. The consumption of sea salt will spread, while now mainly NaCl from industrial mines is used.

Assumed, one needs approximately 2.000 mm precipitation per year or 2.000 liters = 2 m^3 per cubic meter for an optimal plant-growth with the strong heat in the desert-regions, then, 500 km^2 need 1 billion cubic meters = 1 km^3 per year. One therefore can rinse agriculturally about 500 km^2 x 0,25 = 125 km^2 = approximately 11 km of x 11 km with 0,25 km^3 water.

When I install 13 greenhouses of 1 km of width around the 13 TPPs of a 1-GW-TPP, then I have over 17 km^2 greenhouse-expanse per TPP, therefore 13 x 17 km^2 = 221 km^2 per 1-GW-TPP. I can therefore rinse 7 greenhouses of a 1-GW-TPP with the energy of one single TPP with 2 m^3 of water per m^2 and year and still keep water for the evaporation of the CO_2-absorption liquid for the Ccycling and too for the workers who oversee the energy production, maintain the installations, and plant, fertilize, tend, harvest and transport the food through the pipes.

If I therefore want to provide all 13 greenhouses with freshwater, I must use most of the energy of a second of the 13 TPPs additionally.

The greening of the deserts

When the 6.000 1-GW-TPPs went in operation and the CO_2-concentration of the atmosphere declined and all the TPPs are used for the soloil-production, then it is worth to consider whether 1-GW-TPPs should be built further in order to get rid of the drinking water-shortage of the people in the areas with low rainfalls. The expenditure for such TPPs is certainly no more as high as at the beginning after a series of 6.000 x 13 = 78.000 TPPs.

When also mankind's drinking water-problems are solved, then it is time to think about another improvement of our earth and to execute it vigorously.

The groundwater in the deserts sank after the end of the ice age in the last millennia more and more, also and above all through the human consumption of the reserves, particularly in the last decades by the industrial and agricultural exploitation of the reserves in big depth.

A large-scale project of mankind can be to turn parts of the deserts of the earth to fertile land again. That admittedly is simple, but nevertheless costly:

By planting of trees the increase of the humus-layer is provided. With artificial irrigation and with sufficient humus per plant, less than $1m^3$ / tree, **the forests and parks are regrown that grew there approximately 10.000 years ago.**

They are available for the isolated settlement of people, for hermits, for small village-communities, but also for vacation-installations. The particularly remarkable nature-landscapes of the desert are put under nature conservancy as desert-regions.

These projects are generation treaties and mankind projects: The deserts of the earth around the 1-GW-TPPs will be blooming paradises again in a generation if we want it.

The calculations showed that one single TPP can generate 0,25 km^3 / year freshwater, therefore a **1-GW-TPP can generate 13 x 0,25 km^3 / year = 3,25 km^3 freshwater per year.**

For the saltwater-transportation I need 5 noble-steel-pipelines with 1m of diameter or **one pipeline with 2,15 m of diameter and a return-pipeline of 0,68 m of diameter.**

(3,25 km^3 / a) / (0,7 km^3 / a) = 4,64 ≈ 5

4,64 x 0,785 m cross section = 3,64 m^2 = d^2 x π/4; **d = 2,15 m**

d_{return}^2 x π/4 = 3,64 m^2 / 10 = 0,364 m^2; **d_{return} = 0,68 m**

With this water-quantity I can rinse 1.625 km^2 with $2m^3$ / m^2 irrigation per year. That is the surface of a circle of 46 km of diameter:

3,25 x 10^9 m^3 / 2 m = 1,625 10^9 m^2 = 1.625 km^2 = d^2 x π/4 with d = 46 km.

If I therefore build 1-GW-TPPs especially for the freshwater-production, then I can rinse and cover with greenery a desert-surface of 46 km of diameter with each of such TPPs.

If sufficiently big woodlands are grown, they will become self-sufficient gradually and provide for their own climate: The evaporation of cubic-kilometers water through the trees will generate rain that is used additionally to the artificial irrigation.

In this situation, the no more additionally required freshwater can finally be led into the underground reservoirs, that are under many deserts. In the underground are strata that are impermeable for water. Through a rain-excess 10.000 years ago a high water level had established over them that could be used by the vegetation at that time that lowered itself again since then, however. If these reservoirs are replenished again, then, the deserts that do have such reservoirs, become green again just like at that time. Human then just must provide enough water so that the water level does not fall again. No irrigation is necessary any more. The suitable feeding points for the replenishment of these reservoirs are for example the oases in the deserts. With our present-day technology, we can turn back again the process of the desiccation that lasted for 10.000 years.

A reservoir of for example 1.000 km x 5.000 km of expansion and 50 meters of depth, has a volume of 10^6 m x 5 x 10^6 m x 50 m = 250 x 10^{12} m^3. It is approximately filled by 50 percent with sand and stones. The other half can be filled with water between the sand-grains, therefore 125 x 10^{12} m^3. A 1-GW-TPP produces 3,25 x 10^9 m^3 freshwater per year. **6.000 1GW-TPPs therefore need**

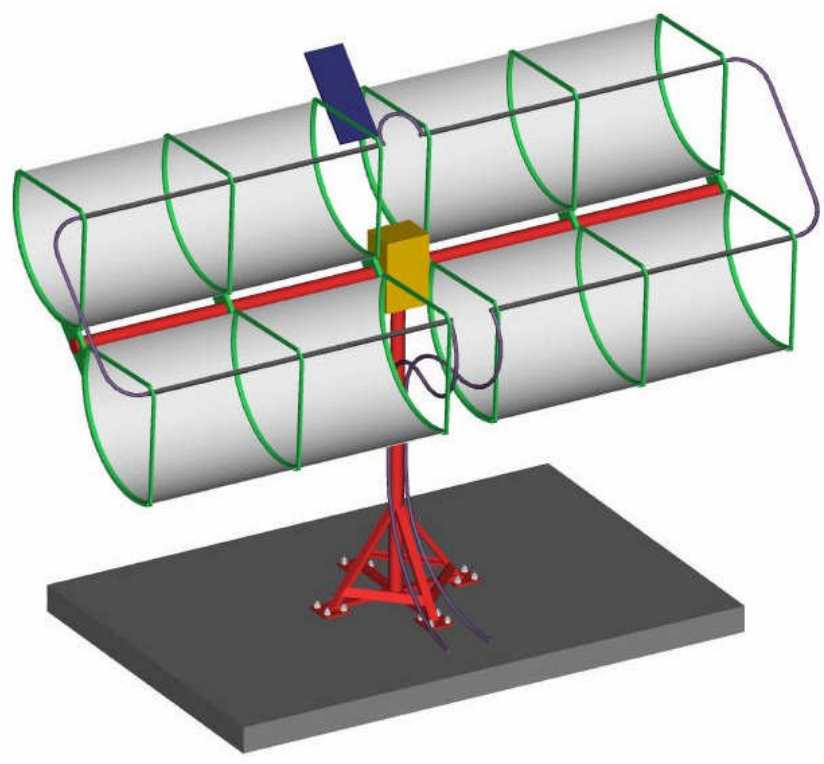
125 x 10^{12} m^3 / 3,25 x 10^9 m^3 x 6 x 10^3 1-GW-TPP = 125 / 19,5 = **6,4 years, to fill such a reservoir.** Maybe 1.000 1-GW-TPPs suffice thereafter, to keep it filled with the consumption of a forest from this reservoir.

This surface of 1.000 km x 5.000 km = 5 million square-kilometers is approximately half as big as the surface of Europe of approximately 10,5 million square-kilometers.

This consideration illustrates that **the greening of the deserts of this earth is just as big a project as the Ccycling-Project.** With the Ccycling, it is only about the balance of 4 generations, with the irrigation of the deserts, it is about the balance of 300 generations, therefore of 10.000 years. It can be begun when we got out of the climate-catastrophe, solved the water-shortage, and if we then want it as **persons being responsible for our spaceship earth.**

Annex 3: PS – Personal Sun (compare chapter 15)

PS – Personal Sun



(Picture: Design of 'Personal Sun'; © Olaf Upnmoor 2005)

Summary

The ‘Personal Sun’ or short ‘PS’ is an installation for one or several people, which delivers both the electric energy (with 770 W constant power) and the heat energy as hot water (with 2,3 kilowatt constant power) for a one-family house with low financial expenditure. It makes this residential unit energetically self sufficient. It consists predominantly of low-tech material, is little susceptible to faults and easily repairable and is the energetic form of the **P**ersonal **C**omputer or **PC**, a ‘**P**ersonal **S**un, **PS**’. (The ‘PS’ is like in German ‘**P**ferde**s**tärke’ for ‘Horse Power’, short ‘HP’) It uses the waste heat of the photovoltaic elements too and therefore has a very high efficiency of approximately 80 percent. It is the supplement to mankind’s solar energetic ground-supply with ‘Ccyclers’.

Ccyclers are the CO_2-recyclers that will produce approximately 1 kilowatt/ human being of ‘Soloil’ (solar generated oil) in the desert regions of the continents that is distributed economically over the earth in pipelines and there, where it is used, is changed into the exactly required energy form.

Introduction

The first idea for the ‘SunMachine 3’, that I now call ‘Personal Sun’ or shortly ‘PS’, I described to Hellmuth Costard in a letter of 11th June 1996. I was at that time the physical advisor of the filmmaker Hellmuth Costard for his long feature film with the working title ‘The SunMachine’, that later got the final title ‘Vladimir Günstig - A Trojan Affair’ (© 2001 B-Pictures, WDR; ‘Günstig’ in German means ‘favorable’).

Hellmuth Costard at that time was developing the **‘SunMachine 2’**: Its main part is a big plain mirror that follows the sun as a fixed radiation-source, as a heliostat. It shines on many fixed parabolic mirrors of 28 inches of diameter, whose common focus lies in the interior of **a kiln for ceramics**. This construction is to be seen in the film (compare photo at the end of this article). It is primarily intended for countries of the Third World, where fuel can be saved by it. With it they get a sustainable heat source, which they can produce themselves and which they can repair themselves, with exception of the control unit of the heliostat in form of a simplistic, cheaply interchangeable PC.)

The idea of Hellmuth Costard is to produce a machine utmost favorable in price that changes solar energy to heat or to other usable energy forms. Through the low manufacture price, it can compete with the conventional energy prices without subsidy already today -, and it could compete already even at that time. The low price of the construction is gained by the following principles:

If possible use recycled parts.

If that is not possible, use parts from the mass-production of other industry products.

And if even that is not possible, the few rest-parts are produced economically in modular mass production.

The whole construction of the Personal Sun in the form presented here is patent-free.

It is no more patentable ten years after the idea through this publication at the latest. With it a production favorable in price is secured for the future.

Hellmuth Costard made up the name ‘SunMachine’ in 1992. It was occupied end of the 1990’s years by a foreign company with a registered trademark™ for their product and can therefore be used no more for this idea. I therefore use as a shortened name ‘PS’, that in German is generally current and that cannot become ‘registered.’ It is legally freely usable. I would be astonished, if someone would acquire the name ‘Personal Sun’ for his own brand design, because he has not enough intuition to find another name for himself.

Some calculations and thoughts, that are not essential for the understanding, are represented in smaller writing.

Central terms and statements are accentuated with boldface.

The objective

The Personal Sun delivers a maximum of solar energy in a most effective way in form of electric energy and simultaneously in form of heat energy for a one-family house or a corresponding unit of people. Through this it gets a very high effectiveness, one that is not achieved until now with solar energy.

Some general considerations

The kit for the Personal Sun is manufactured by construction companies and is sent to the customers together with a building instruction.

The manufacture price of the kit is approximately 5.000 Euros at mass-production. The total construction of the installation costs approximately 20.000 Euros together with water reservoir, heat-swappers, connections with the power supply, controlling circuitry and gauges and with heating- and hot water-managements.

As construction surface, a place of approximately 6 m x 6 m = 36 m^2 base and 5 m of depth (in the ground) and 6 m of height (over the ground) is used, that gets sunshine as full-time as possible, that for example is before the south side of a house or in a garden.

Alternatively, the Personal Sun can be included in the construction of a house as well. It then crowns the house, has the foundation walls of the house as foundation and can line up on the sun independently from the direction, in which the house was built. It even gets more sun because of its basic height above the roof than if it stood on the ground. The movements of the Personal Sun are invisibly slow and inaudible. It is like 'Art at the construction' (German ‚Kunst am Bau'), **a technical sculpture, that serves a purpose additionally as solar power plant with heat coupling.**

The technical performance data of the Personal Sun are

with an average sunshine-intensity in one year of ≈ 1 kilowatt/ m^2 and with 1.700 h/ year sunshine, (that is on average with 4,66 hours of sun per day or 39 percent of 12 hours per day and 1 year = 365 d x 24 h = 8.760 h):

Electric maximum performance with sunshine: 4 $kW_{el.Max}$

Annual electric energy output: 6.800 kWh_{el} / year

Average electric constant performance: 770 W_{el}

Thermal maximum performance with sunshine: 12 $kW_{th.Max}$

Annual thermal energy output: 20.000 kWh_{th} / year

Average thermal constant performance: 2,3 kW_{th}

In areas with more hours of average sun radiation and with clearer air and a sun standing higher in the sky than in Europe's middle latitudes **the output can be far over double of these values.** In the south of France and Spain, there are areas with more than 3.400 hours of sunshine per year, that is 9,3 hours per day or more than 78 percent on average of 12 h / day.

The construction

A vertical central axle stands as support unity **on a stable foundation**, in the simplest case on the water reservoir for the storage of the thermal energy. Its length is approximately 3 m, its diameter is approximately 15 cm.

The central axle consists of the recycled axle of a railroad car.

A **gearbox** is installed upon it. It moves a rigid unit in two levels. The unit is symmetrical and consists of **two branches** left and right.

As branches, recycled axes of railroad cars are used likewise.

Their scrap metal value was approximately 400 Deutsche Mark or 200 Euros in 1995. 800.000 such axes accrue as scrap metal at the federal railway in Germany annually. Alternatively two steel tubes of approximately 15 cm of diameter can be taken with approximately 0,7 cm of wall strength: They are essentially lighter, because they are hollow, they have ca. 18 percent of the weight, their price however is ca. 2.000 Euros per piece. With them the static load becomes lighter at the gearbox, the montage is simpler, etc

The movable unit can be directed after the sun-run with help of computer control.

On the two branches upward and downward stable metal **racks** are installed. They carry:

Four furrow parabolic mirrors, shortly **'parabola furrows'**,

Concentrating photovoltaic silicon cells, shortly **'cells'**,

and a **cooling water installation**.

The centre of gravity of the movable construction lies precisely balanced in the pivot in the middle of the mechanism.

Above each horizontal railroad axle, a **parabola furrow** is installed and below also. Their openings lie parallel to the surface of the Personal Sun in direction to the sun. The Personal Sun carries four parabola furrows for the focusing of the sunlight on four focal lines. The sub-edge of the low furrows is approximately 1,10 m over the foundation of the Personal Sun.

In the focal lines of the parabola furrows are the **cells** that can transform the 30-fold normal sun radiation into electric current, in fact into the 30-fold electric performance of normal sun cells. In design they differ from normal cells above all in current lines with 30-

fold cross-section. However, the cells need the same temperature of their silicon-layer. Therefore, cooling is necessary.

For the **cooling**, U-shaped-rectangular aluminium or copper furrows are installed watertight on the flat rear of these cells, through which cooling water is pumped.

For a better heat transfer from the cells to the water, cooling ribs that conduct the heat of the cells into the water, can be installed (within these 'rectangular tubes') at the rear of the cells. They lie parallel to the flow direction of the cooling water. Probably, however, these cooling ribs are not necessary.

The cooling 'tubes' therefore consist of the rear wall of the cell and a U-profile. The rear of the cooling tubes is dull black. It is directed to the sun at current generation while the cell is directed to the parabola-furrow. The cell is directed exactly away from the sun. So, the cooling water gets heat not only from the cells directly 30-fold but as well 'one-fold' through the sun.

Every row of cells is connected with the neighboring one with a heat-resistant, elastic, black hose (or also rigidly) so that the cooling water flows through all the cells one after the other. The water-admittance from the water reservoir over a pump is at the right below of the central-axle. The pump with computer operated cocks controls the quantity of the water flow according to the wanted final temperature, it can fill in water with cooler beginning-temperature, etc.

From the pump, the elastic hose leads to the inside of the right low focal line. 'Inside' means 'near the central-axle', 'outside' means 'in maximal distance from the central-axle.' From the outside of the right low focal line a hose connects vertically upward to the outside of the upper right focal line. From the inside of the upper right focal line a hose connects horizontally to the inside of the upper left focal line and from its outside vertically downward to the outside of the lower focal line and from its inside back to the reservoir with its heated water having gone through all of the focal lines.

The process water and the heating water for the residence are taken over heat-swappers. The water cycle of the Personal Sun therefore is closed in itself. If there should be problems with kettle scale or something similar, one would fill de-ionized water into this cycle.

On the one hand electric current is generated through the cells with an effectiveness of approximately 20 percent of the incident solar energy, on the other hand the generated heat in the water is collected and concentrated. It can also be used, since it is concentrated up to almost 100°C. **Until now, it has not yet been tried to use the 'waste'-heat of the photovoltaic-generators.** To get rid of it, it was diverted as quickly as possible through cooling ribs to the air of the environment. **The heat is actually usable with this 30-fold concentration of the solar energy, because its temperature can be increased completely to taste until almost 100°C, also in the winter, provided only the sun shines. And it can be stored for half a year or even longer for the times when the sun does not shine sufficiently.**

This heat-energy after all amounts to a multiple of the current effectiveness, in fact approximately to 60 percent of the incident solar energy or approximately to the triple of the electric effectiveness. So, **the total effectiveness can be increased very strongly: The Personal Sun has a total efficiency of approximately 80 percent.**

The four **parabola-furrows** consist of normal, flat mirror glass that favorably can be bought as big plates in each glass or mirror business. It is pressed in parabola form with a tension clamp.

In the focal line of the parabola-furrows, **concentrating solar cells** of the company BP-Solar (UK) [1]) are mounted.

[1]) THE DEVELOPMENT AND TESTING OF SMALL CONCENTRATING PV SYSTEMS; George R. Whitfield, Roger W. Bentley, Clive K. Weatherby and Alison Hunt; Dept. of Cybernetics, Univ. of Reading, Whiteknights, PO Box 225, Reading, RG6 6AY, U.K.

These are Laser Buried Grid cells or shortly LBG cells. Their current conductors with very large cross section are embedded underneath the usable solar plate. They are only unimportantly more expensive than 'normal' photovoltaic cells for just one sun. They can convert the at most 30-fold concentrated light of the sun into electric energy with an **effectiveness of more than 20 percent**. They are in continuous operation since about 1995. Their dimensions are 4,8 cm of width and 9,6 cm of length. The cells are delivered as 12-times-unit with 1,20 m of length. These 12-times-cells can be assembled in longitudinal direction. If, for example, three such cells are given into each focal line, then, the length of the focal lines is 3,60 m, the total-length of the four focal lines therefore is 14,4 m.

Mirrored plate glass has an effectiveness of fewer than 100 percent. The silver on the rear reflects approximately 98 percent, but the light travels through the window glass lying over it to-and-fro. The glass is greenish blue and absorbs light, the more thickly the glass is, all the more.

The reflection of the light at the forefront of the plate glass of approximately 4 percent can be neglected, because the forefront is parallel to the rear: This light too is reflected to the focal line.

The flat mirrored plate glass is bent to a furrow and then occupies the surface of the furrow. The sunlight is collected from the opening of the furrow – not from its surface: Only that light can be focused, that enters into the opening. The mirror surface therefore must be bigger than the 30-fold width of the cells.

The parabola-furrow should not enclose the cells to 180°, because the light, that meets the cells from the side, 'sees' only a narrow line and not the broadside of the cell surface.

The effectiveness decreases with (more than) cos α.

α is the angle between the perpendicular of the cell surface and the light beam.

cos 0° = 1; cos 30° = 0,87; cos 45° = 0,7; cos 60° = 0,5; cos 90° = 0

Furthermore incident light coming from the side is reflected by the glass surface of the container of the cell almost completely and therefore is not usable.

A good solution can consist of an angle for the sunlight of ±45° around the cell surface. That means an angle of bending of the mirror plate to the cell of half of it or 22,5°.

The parabola-furrow is bent in a way that it generates a **blurred** line-picture of the sun, whose width has exactly the width of the productive surface of 4,8 cm of the cell.

If the line-picture would be sharply reproduced, the width of the image of the sun-disk would be dependent of the focal length of the furrow. By the blurred reproduction, that is equally concentrated everywhere, the width of the sun is adjusted to 4,8 cm, independent from the focal length of the parabola-furrow and also independent of reproduction errors of the mirror plates in mass-production.

The height of the mirror glass, therefore the surface of the mirror-furrow is chosen in a way that the cells can absorb the 30-fold sunlight including all losses and despite the reflection at the cell surface.

The losses of this favorable optical concentration device can be compensated completely through enlargement of the mirror surface, therefore extremely cheaply.

The 30-fold width of 4,8 cm (or approximately 5 cm) is 1,44 m. This is the opening of the furrow with 100 percent effectiveness. The effective width of the mirror glass is 2,25 m as 'slab measurement' ('Tafelmaß' in German) – that is1,5-fold 1,44 m.

The usable surface of the glass is diminished by the piece of the glass that is put into the holder above and below, approximately 5 cm each. Remaining are approximately 50 percent of reserve surface to the balance of losses.

The so-called 'Tafelmaß' is the measurement, in which glass plates and also mirrored glass plates are manufactured by the glassworks or mirror factories.

The 'slab measurement' of glass plates is 2,25 m x 3,21 m = 1 / 1,4267.

The thickness is 3, 4, 5, or 6 mm, on order prestressed (deterred, security-glass).

The prices (from 2002) are in Euros, net, per square meter:

3mm 20,25 4mm 26,49 5mm 17,61 6mm 33,50

The most inexpensive way is naturally, to take the slab measurement of the glass for the construction of the Personal Sun. With the test of the installation, it is determined how big the used surface should be so that exactly 30 suns reach the cells. If there are cells in future, that can tolerate even more concentration, the slab measurement is taken horizontally (215 cm / 5 cm < 43-fold sun) - or even taken high (311 cm / 5 cm < 62-fold sun).

For getting the length of 3,60 m, that is the length of three cells, a part of a second mirror plate must be taken, because the maximum width of the plates is only 3,21 m (respectively 2,25 m with 62-fold concentration).

The plane plate glass can be bent amazingly strongly without shattering. (That is to be seen in the film 'Vladimir Günstig'. Also, one of the cells is to be seen in the film.)

The plane plate glass is pressed by a **chuck** of plastic and metal against a **mirror-holder**, that has the form of a parabola and that can hold the tension of the glass permanently. The holder is something like a 'picture frame', seen from the front with rectangular opening, seen from the side the vertical framework-parts have the form of a parabola. The chuck is attached at the holder with hinges below. It is tensed with clamps at the holder above. The very stable railroad-axes are a 'backbone' for the whole construction, at which the mirrors are assembled distortion-stiffly.

The gearbox

The center of the Personal Sun is the gearbox upon the vertical axle. The two wings with the parabola-furrows and the cells with their cooling are mounted in their center of gravity.

They transform the energy of the light of the sun into electric and thermal energy.

The movement of the sun in the skies goes from east to west around the earth-axle. (This is the visible effect of the actual rotation of the earth from west to east around its own axle.) The mirror-furrows must follow this daily movement so that the sun always shines vertically on them.

In the annual run of the earth around the sun, the sun at noon stands up to 23,5° higher in the summer than in the spring, and in the winter it stands up to 23,5° lower than in the spring. The mirror-furrows must follow this annual, very slow movement likewise.

The simplest solution for it would be the parallactical mount in the way as also astronomic telescopes are mounted: The axle of rotation is parallel to the earth-axle, pointing on the polar-star, the other axle is vertical to it. However, this mount has considerable disadvantages with the long mirror-furrows.

Instead, better the normal mount is used here with a **v**ertical **v**- and a **h**orizontal **h**-axle. The more complex movement around these two axes can be carried out without problems with computer-control.

The movement around the v- and around the h-axle takes place with one **12-volt direct current motor** each, for example in its most inexpensive and billion-times tried most durable form as car-windshield wiper-motor. Windshield wiper-motors were developed in mass-production over decades and represent a technical final product.

A reserve-motor for each of these can click into place, if one of these motors should fail.

The low performance of these motors of approximately 30 watts is geared down strongly with pinions, elastic tooth-belts or very stable snail-wheels, so that they have gigantic reserves with the slow movement of the wings. The rotation of the earth around its axle is **1°/ 4 minutes**, the variation with the seasons is on average

23,5° x 2/ 180 days = **0,3°/ day**.

The center of gravity of the movable part of the Personal Sun (if it is filled with cooling water) lies in the pivot. The motors just need to overcome the friction of the gears and the forces of the winds and need very little energy.

For security reasons above the gearbox an independent small conventional photovoltaic installation with accumulator can be installed for feeding the 12-volt direct current motors and the computer and the water pump, for example sufficient for 200 operating hours without sunlight. So, the operating of the Personal Sun is completely self-sufficient from all possible disturbances. The accumulator additionally can still become buffered with mains – or with the Personal Sun directly.

If the navigation or the pump control nevertheless should fail, then the Personal Sun simply does not work optimally, however it cannot cause any damage. It cannot suffer any damage either provided only the cell temperature does not rise over 200°C. An 'emergency breaking' is programmed in the computer software as a fast way-spin from the sun by some degrees or completely downward, if the water pump should fail and the cooling water should begin to cook after that.

The 12-volt direct current motors are controlled by a computer, in which the sun-formula and the geographical installation place are imputed. The sun-formula shows the position of the sun-center at every time for each place of the earth.

To the additional security, the in-radiation direction of the sun can be measured with shadow-sensors, and if it does not stand vertically on the surface of the Personal Sun, the motors get current.

Furthermore an optimization program in the first year can execute small variations in the two angles once per day or per week, so that the effective maximum of the output is adjusted. This value is stored and used in the following years.

The movement around the other axle with 2 x 47° per year is executed by another 12-V motor ('up/down') and is regulated with the same control electronics.

After sunset, this second 'up/down' motor swings the Personal Sun to the earth with the opening of the parabola-furrow completely downward and the first ('east/west') motor swings the wings back into the start position vertically to the sunrise in approximately 30 minutes and parks the Personal Sun there for the night. This nightly park position directed downward protects the Personal Sun from each inconvenience. In storm, a position can be steered to, in which the parabola-furrow lies parallel to the actual main wind direction. Then, the wind forces are minimized. This position is steered to, when the wind should reach strength of for example > 6 Beaufort, measured with a small anemometer above the gearbox that always remains vertical. Also thus parked maintenance works can simply and safely be carried out. In this position, a mechanical brake can hold the Personal Sun in its two axes so that the gears can be disconnected and are released.

In the morning before sunrise, the second 'up/down' motor drives the personnel Sun into the right height for this day in the year and the first 'east/west' motor begins with its daily west-swing.

The foundation

The recipient surface for solar energy of the two wings of the Personal Sun is about

3,6 m x (<)2,15 m x 2 **< 18 m^2**, the wind-load is accordingly big. The foundation must be able to pick up this load. (compare image)

I would like to describe a possibility to use the foundation as water reservoir here.

The heat-energy-storage

In the ground, a square pit is dug out 6,00 m x 6,00 m x 5,00 m of depth with smooth vertical sides. On the sides of the excavation, a layer of polyurethane ('PU') foam of 30 cm thickness is applied, whose inner surfaces are vertical and perpendicular to each other. They serve as outer formwork for the concreting of the reinforced concrete walls of 20 cm thickness for the interior with the dimensions of 5,00 m x 5,00 m with 4,00 m of height. Its volume is 4 m x 5 m x 5 m = 100 m^3. **The concrete ceiling of this waterproof and heat isolated reservoir is the foundation-plate of the Personal Sun.**

The reservoir has an entry for maintenance-works and contains heat-swappers, with which the water of the custom water cycle and the heating water cycle are warmed up.

Floor heaters can be driven with water temperatures of 28°C or above. With a maximum temperature of the water of approximately 80°C, one gets an **energy-storage of**

100.000 liters x 1 kcal/liter x (80 - 28)°C = 52 x 10^8 cal x 4,2 Ws/ cal =

= 220 x 10^8 Ws/ 3.600 s/ h = 0,61 x 10^4 kWh = **6.100 kWh**. With 3 kilowatts of constant consumption, this reserve holds without supplies 2.033 hours or 85 days, therefore almost three months non-stop.

Over additional heat pumps (the reverse refrigerator), the rest-heat of 28°C can be used with demand until 0°C as well, in order to warm up the heating water. It gives well the half of the heat content to it once again, however it uses approximately 30 percent of the additional energy as electric energy.

In order to fill this reservoir with 80°C hot water for the first time with 13°C entry temperature one needs 100.000 l x 1kcal/ l x (80 - 13)°C x 4,2 Ws/ cal = = 282 10^8 Ws/ 3.600 s/ h = 7.820 kWh.

With 2,32 kW_{th} constant performance, the Personal Sun needs for it

7.820 kWh/ 2,32 kW = 3.370 h x 1 day/ 24 h = 140 days ≈ 4,7 months.

This reservoir therefore is a buffer, that can be filled in 4 - 5 months for the first time and that can be sucked empty with 3kW in 3 to 4,5 months without further energy-supply.

With 30 cm of PU isolation, the heat losses are to be neglected.

Surface: 4 m x 5 m x 4 (walls) + 5 m x 5 m x 2 (floor and ceiling) = 80 m^2 + 50 m^2 = 130 m^2;

outside temperature for example 5°C; temperature difference 80°C - 5°C = 75°C;

It is with 4 cm PU = 1 W/ (m^2 x °C) and it is 30 cm = 7,5 x 4 cm.

With 30 cm PU follows: $2^{-7,5}$ W/ (m^2 x °C) = 5,6 mW/ (m^2 x °C);

5,6 mW x 130 m^2 x 75°C = 54.167 mW = **54 W**. One year is 8760 h

8.760 h x 54 W = **475 kWh** are lost under extreme conditions, in reality < 200 kWh/ year or

< 3 percent of the energy-capacity are lost.

Another solution to the heat-storage will possibly be applied at mass-production, because it is the form of the lowest expenditure and the lowest losses because of the sphere-form: A prefabricated **hollow sphere** of rustproof steel of 5,76 m of inner-diameter has the volume 100 m^3 likewise (The index '$_K$' means 'Kugel', that is 'sphere' in German) :

$V_K = \pi\, d^3 / 6 = 3{,}14 \times 5{,}76^3\ m^3 / 6 = 100{,}0\ m^3$

Surface $O_K = \pi \times d^2 = 3{,}14 \times 5{,}76^2\ m^2 = 104\ m^2$, (instead of O_Q = 130 m^2 for a cuboid ['$_Q$' = 'Quader' in German]: only 80 percent of the cuboid-surface!)

(PU-foam is used in the quantity:

$V_{K1} - V_{K2} = \pi\,(5{,}76\ m + 0{,}3\ m)^3 - \pi\,(5{,}76\ m)^3 = 34{,}7\ m^3$;

with the cuboid, the PU foam is 51,7 m^3, therefore the 1,49-fold multiple.)

As two hemispheres with 2,88 m radius this sphere can be transported with a low-truck as special transportation. At the installation place, the two hemispheres are bolted or welded together (with heat-stable dense-cuff). With two likewise prefabricated PU-hemispheres as isolation, it is lowered into the pit dug out in the ground of approximately 6,40 m of diameter.

Whoever should like a bigger heat reservoir chooses **two such spheres** side by side. They can just be filled in the warmer season with 2,32 kW_{th} constant power thermally as energy storage of each 6.100 kWh, and

they allow to take 6 kilowatts over 85 days or 2,83 kilowatts for half a year. That is interesting particularly with longer sunshine duration per year, because more heat can be collected.

Both spheres together are totally energetically uploadable in 220 days or in 7,3 months:

2 x 6.100 kWh/ 2,32 kW_{th} = 2 x 2.629 h = 2 x 110 days = 2 x 3,67 months = 7,3 months.

An important advantage of a bigger reservoir is that it has the same storage capacity with lower water-temperature. So, the final temperature of the cooling water can be held essentially lower. A higher effectiveness of the current generation is resulting. Just so much heat is stored, as one actually requires and no more - in accordance with experience.

Probably the most inexpensive possibility of heat storage are one or two cylindrical tanks, one or two cylinders with welded hemisphere-caps of 100 m^3 contents each. If the diameter is 3 m, for example, then the length of l = 14 m gives $V_Z = d^2 \times \pi/4 \times l = 99\ m^3$, if the diameter is 4 m, then with l = 8 m is:

$V_Z = 4^2 \times 0{,}79 \times 8\ m^3 = 101\ m^3$. ('Z' for ‚Zylinder' in German).

In the here portrayed model, the Personal Sun has the following data:

One single cell has the surface of 9,6 cm x 4,8 cm = 46,08 cm^2

12 x 3 cells per furrow x 4 furrows = 144 cells

Cell-surface 46,08 cm^2 x 144 = 6.635,52 cm^2 = **0,66 m^2**

It is to be paid just 0,7 m^2 photovoltaic cells!

Average sunshine-intensity in the run of one year ≈ 1 kW/ m^2

Electric maximum performance with sunshine: 3,98 $kW_{el.Max}$

1 kW/ m^2 x 0,664 m^2 x 30-times-concentration x 20% effectiveness = 3,98 $kW_{el.Max}$ **≈ 4 kW**

With 1.700 h / year sunshine and 1 year = 365 d x 24 h = 8.760 h

and 1.700 h / 8.760 h = 19,4 percent of sunshine follows:

Annual yield: 3,98 $kW_{el.Max}$ x 1.700 h = 6.766 kWh_{el} / year **≈ 6.800 kWh_{el} /** year

Average electric constant performance: 6.766 kW_{el} / 8.760 h = 772 W_{el} **≈ 770 W_{el}**

The maximum thermal performance, the annual thermal yield and the average thermal constant performance amount to the triple of the electric data, therefore the thermal effectiveness is assumed with 60 percent:

Thermal maximum performance with sunshine: 11,94 $kW_{th.Max}$ **≈ 12 kW**

Annual yield: 20.298 kWh_{th} / year **≈ 20.000 kWh_{th} / year**

Average thermal constant performance: 2,32 kW_{th} **≈ 2,3 kWh_{th} / year**

In the computer program of the PS, it can be chosen whether current or heat should be generated preferably. If current should be generated preferably, fresh cold water is fed into the cooling cycle so that the final temperature of the cooling water amounts to only approximately 25°C. This can happen, for example, when the heat storages are filled completely. With this temperature, the cells have an effectiveness of over 20 percent. It gradually is somewhat inferior, the higher the cell temperature rises - as with each other silicon cell too.

If heat should be generated preferably, then the water influx is reduced in a way that the final temperature of the water having cycled the Personal Sun amounts approximately to 80°C or 95°C. Also with 95°C, the functionality of the cells is not damaged, just their electric efficiency sinks somewhat. (The cells still function until 200°C.)

The width of the Personal Sun is 7,60 m:

With three 12-cells per focal line in two wings lying side by side and a width of the gearbox of ca. 40 cm emerge as total width:

3 x 1,20 m x 2 wings + 0,40 m = 7,60 m.

With 5 cm of distance of the furrows to the horizontal axle and the diameter of this axle of 15 cm follows:

The height of the wings of the Personal Sun is

< 2,15 m x 2 + 0,15 m + 2 x 0,05 m < 4,55 m.

The total-height of the Personal Sun over the ground is smaller than 5,70 m:

Height of the central-axle + 1/2 height of the gearbox (with an assumed height of the gearbox of ca. 80 cm) + 1/2 wing height =

= 3,00 m + ca. 0,40 m + (<2,28 m) < 5,70 m.

The sub-edge of the wings is > 1,12 m over the foundation:

Height of the central-axle + 1/2 gearbox height - 1/2 wing height =

3,00 m + ca. 0,40 m - (<2,28 m) > 1,12 m.

The Personal Sun has a total mass of ca. 2.400 kg.

I make the following assumptions to the estimation of the mass of the Personal Sun (without concrete-foundation and without water reservoir with heat-swappers, etc):

Density iron = 7,8 kg/ l; thickness mirror glass = 6 mm, density of glass = 2,7 kg/ l; foundation compared as a metal-plate of 1 m of diameter and a thickness of 1 cm;

cooling cycle cross-section 25 cm^2; mass cooling cycle empty = 20 kg; gearbox with motors: average density = 3 kg/ l; mass of racks 200 kg; mass of mirror holders = 370 kg; mass of accessories: solar panel and accumulator for motor-drive, sensors, counters, cocks, cables, water pump, anemometers, etc = 150 kg:

From this are resulting the masses:

1. Foundation = 61 kg; 2. Central-axle 413 kg; 3. Gearbox = 384 kg;

4. Wings (3m-tubes) = 76 kg; 5. Racks = 200 kg; 6. Mirror glass = 500 kg; 7. Mirror holders = 370 kg;

8. Sun cells = 115 kg; 9. Cooling cycle filled = 75 kg; 10. Accessories = 150 kg.

Total mass of Personal Sun = (61 + 413 + 384 + 76 + 200 + 500 +370 +115 +75 + 150) kg = 2.344 kg ≈ 2.400 kg.

With small changes, the Personal Sun can be enlarged in its electric and thermal output data by 33 percent with four 12-cells per furrow.

The width of the '33percent+Personal Sun' is increased with the factor 1,33, therefore it is 10,00 m.

4 x 1,20 m x 2 wings + 0,40 m = 10,00 m width of the '33percent+Personal Sun.'

The other dimensions remain the same.

The price of the 33percent+Personal Sun rises only slightly higher.

If one adds up the thermal and the electric performance, then

the 33%+Personal Sun has a maximum total performance of over 21 kW_{tot}.

Organization, development and funding

It has to be established a charity, the **'PS registered charity'** (Not-for-Profit Organization) with the intents,

1. to further optimize the Personal Sun in its construction,
2. to produce the prototype,
3. to produce different variations for different necessities,
4. to measure their characteristics in the outdoor trial and
5. to improve weak points that were not recognized in advance.

After concluding the development that will last approximately three years, the charity has to develop the following kit:

1. It is modular producible in several variations.

2. It is easily installable.

3. It will run for decades as maintenance-free as possible.

4. It is optimally favorable in price.

5. It can be given away to reliable workshops and factories in license for construction all over the world that can offer the kit at established prices.

The charity has to develop a building instruction for the users in form of a DVD, on which is shown the building of the kit as documentary film, showing especially all possible peculiarities and local difficulties, mistake sources, repair possibilities and similar things.

Furthermore, the kit contains the construction drawings and all further records as DVD-ROM, so that each owner of the DVD in principle can build the Personal Sun himself and even can develop it further. But the large-scale series has prices that one cannot undercut.

By this the following is secured:

The Personal Sun reaches its world-wide utmost possible spread and its development is advanced by its owners as an '**Open Source community**' in utmost possible effectiveness on and on, so that the human being finally becomes free from his present disastrous dependence on the fossil fuels.

Each human being shall possess - if he wants - his own decentralized and private current and heat supply. So, the electricity supply system - like the internet - turns into a connection of many private users, that are producers and consumers at the same time, with some few big energy-'providers', that produce the load-buffer for the constant load. The big providers get the buffer-energy from Ccyclers in the desert-regions of the earth.

In analogy to the PC - the Personal Computer - the 'Personal Sun' is the 'own, personal source of sun energy.' Many of these Personal Suns are interconnected together through the energy-internet.

How can such a project be pushed and be financed that manages without patents and that should share its high-qualitative final product favorably just a little over the cost price - therefore with small margin?

Everyone, who is interested in the purchase or in the development of the Personal Sun, pays one permille of the expected total costs of a Personal Sun, that is 20 Euro, on a special-account of the 'PS registered charity' as a down payment or as an interest-free loan. The development of the kit is begun with this sum. Approximately 2 million Euros are required in total for the industry qualification; therefore we need 100.000 interested people. The more there are, the sooner it is done.

With 1 percent down payment or 200 Euro we just need 10.000 interested people.

Who wants to take part under these conditions?

Whoever establishes the PS, registered charity, as a start-shot?

Maybe a small department of Ccycling.org is in the situation, to manage these tasks advantageously?

Possibly Ccycling.org can develop the formerly so-called **'SunMachine 2'** (suggestion for its name in future: **'Sun Kiln', short 'SK'**) to the large-scale series too with its strong heat for ceramics production for the underdeveloped regions of the earth? (See photo below!)

(**Photo: 'SunMachine 2'** at shooting of 'Vladimir Günstig' in winter 1998/1999 in Almeria, Spain. Left in front the heliostat consisting of three recycled axles of railroad cars, gearbox with PC for control and plate mirrors of 8 m^2; in the middle many parabolic mirrors of 28 inches diameter each made of plate mirrors; to the right in front the **Sun Kiln** for ceramics with a concentration of the sun of: heliostat with 8 m^2 mirror area through focal area of 10 cm diameter, that is 8 m^2 / [(10 cm)^2 x π/4] = 1019-fold or about 1.000 Kilowatt/ m^2.)

Annex 4: The financing of the Ccycling

A critical part in a feasibility study is the financing of a project. Here is a possible model of it.

The climate catastrophe is stopped in less than a generation and can then be turned back at will to the level, that is the best for all people, in very big speed after the discretion of the then living people.

And not only this.

'We' built a new energy system with it:

1. It is non-polluting.

2. It is sure.

3. It is totally recycling.

4. It is in the property of all people and delivers cheap energy that is released without profit margin,

5. since all people are the entrepreneurs. They all together took part in the transaction of this project after their abilities with 5 percent of their productivity.

6. It grants all energy wishes of mankind until into the most distant future.

7. It is built to very long term stability.

8. It is variable almost at will.

9. It can also be enlarged in the surroundings of the cities up to approximately 45° of geographical width.

10. It can be used as gigantic greenhouse simultaneously for the food production in the outer periphery of the power plants.

11. The nitrogen of the air is processed to fertilizer.

12. The other climate gases like methane become recycled too.

13. It works with conventional technology, 'low tech' that has been tested since decades or centuries and is ripe.

14. It is decentralized. It is spread over the five continents of the earth (even in Southern Europe).

15. It brings together mankind in cooperation to common welfare.

16. It regenerates the deserts to again greening nature paradises.

17. They turn into settlement areas for new forms of human living together.

18. It gets rid of mankind's freshwater problems.

19. It does end with the old unclean combustion technology, with which many pollutants accrue. It just burns to $CO_2 + H_2O$.

20. It enables to uphold the present individual traffic on oil basis.

21. It connects seamlessly to this running out technology model.

22. The gone wrong global experiment reaches completion in a technology that is optimized for this spaceship earth: We circle around an inexhaustible source of energy.

The world economy is increased very strongly with the realization of the project through the gigantic building sites on all continents and the world-wide activity of many people that are unemployed until now and that want to work meaningfully.

Nevertheless, this project is not unrealistically big: In the one year 2005 over 10 trillion Euros were raised as foreign-investments by capitalism alone. This is 10-fold the here required means and this only through the rich people, the investors alone. (Foreign investments are all investments outside the own country of the investor.)

And in the same year 2005, there were 200 million job-hunting people on this earth without work possibility.

Nothing actually hinders the successful transaction of the project, since

1. The information of this text will become known fast enough.

2. Its representation convinces sufficiently many people.

3. An organization is established that is under public law, non-profit, government-independent and state-independent, democratic and international, that belongs to all human beings to same sharing: **Ccycling.org**.

4. Capable and ethically proved and organizationally outstanding people are found that are ready to collaborate leading at this project.

5. **The states of the earth** agree to this project and **grant their support through freedom from tax, through collecting of the membership rates** like for example with the church tax (in Germany), **through lending of ground for the required surfaces** (at the edges of the deserts) and through other suitable laws. **The costs for the states are zero.**

6. **Each human being of the earth can put 'just 5 percent' of his income that is over the poverty line, into this project, on average 167 € / human being and year or 46 c / day**.

7. The unemployed people of the earth, that are free, are paid to take part in such a work after they were trained for this work. The productive ability of mankind that until now is lying fallow, because the capitalism does not need it, is used for mankind's own general advantage.

8. Possibly, **a CO_2-tax is drawn in by all states competition-neutrally additionally world-wide and handed over to Ccycling.org.** This tax serves exclusively the goal to pay the complete Ccycling of the carbon. (It does not serve the goal to stuff the holes in the pension insurance - like the energy-tax in Germany today;-)

   Until now, the price for the waste disposal of the exhaust fumes is practically not taken into account but only the price for the first half of the cycle: to the support of the petroleum, its preparation and its distribution until the utilization. **With a Ccycling tax of for example 1 Euro per litre of fuel are obtained 1 trillion Euros per 1 km^3 fuels.** The members of Ccycling.org could possibly be freed from this tax if the citizens of the democracies wish it of the majority.

9. Also **the money for emission certificates to the output of the CO_2 can be used for this project** as well, if the citizens of the democracies wish it.

   'The EU-commission expects 50 billion Euros revenues annually from the now planned auction of the contamination right. The money should be put in for climate innovations above all.' [7])

[7]) http://www.spiegel.de/wissenschaft/mensch/0,1518,530501-2,00.html of 23rd January 2008

With 300 million Europeans, this auction gains per European: 50×10^9 € / 300×10^6 Europeans = 166,67 € / European. **If the emission certificates are auctioned world-wide like in Europe, then, this is per 6 billion people:**

6×10^9 people x 166,67 € / human being = 1 trillion Euros per year.

Annex 5: The Organization of the Ccycling

This is a mankind project. It has the characteristics:

1. It serves the entire mankind.

2. It is too big to be executed by one of the existing organizations.

3. It is paid by all the human being **proportionally** after their respective possibilities.

4. The works are executed mainly from people that until now are **unemployed**, independently from other differences.

5. The co-workers are paid with a salary above a **minimum salary**, like the majority of all people hold it for just. Each human being should perform the work as a co-worker for this salary gladly and should like to pay the salary as an employer likewise gladly. As **social benefits** for the construction workers and for the future co-workers of the Ccycling.org and for their families originate useful lasting settlements at the edges of the Ccyclers, that are offered as part of the salary.

6. **Patents are not given by the patent offices of the states for procedures that are developed for mankind projects, in principle.** Existing patents, that are used, are

paid a fee for these purposes with an appropriate amount. They of course can also be 'donated', that is put to the disposal gratuitously.

7. An organization, in which **each human member has exactly one voice**, carries out the project. This organization is under **public law, non-profit, 'transparently open', government-independent and state-distant, international and democratic.**

8. Its name is **Ccycling.org**

9. Each member has exactly **one voice**, independent from the membership rates or from the donation height.

10. The **communication** with its members, therefore with mankind, takes place **over the internet**; likewise the planning of the project, the public opinion formations, decisions, elections, improvement suggestions and stimulations.

11. **Ccycling.org must not pick up credits.** It must not get into **any debts**. It can only invest the money quantity that it gets as membership rates and donations. It must by no means repeat the mistake that (almost) all states of this earth are to blame for and that restricts their freedom of action narrowly. The states must do what their money lenders want. Ccycling.org must remain capable of acting in the sense of their members.

12. Very big value is put on '**Glasnost**', on glassy openness of all processes to the prevention of corruption, felt and nepotism, because very big sums are at stake that belong to us all, and also an utmost high quality is at stake that should serve us all.

    That is possible through **complete enlightenment** of all suspicions and public protocol in the internet, because each living human being is involved in the organization ideally and in fact and therefore information-justifiable. **A censorship of its web site does not take place in any country of the earth.** Only long-time proved, ethically perfect managers may practice leading functions. Own 'Glasnost departments' are directly responsible for the enlightenment of every single irregularity. Each reported suspicion - also anonymously - is cleared up completely.

    Passive **bribery** of the Ccycling.org co-workers is punishable by disproportionately high contract penalties. Therefore only these men will become co-workers that detest and fight any bribery. Each active bribery leads to public proscription and to the call to long-term boycott of the products of the organization responsible by all Ccycling.org-members - additionally to the legal penalty.

13. The structure of Ccycling.org principally is **decentralized and synergic**: Self-sufficient part-organs build and administer the individual factories and TPPs. Additionally, there are a steering central administration and a system-planning.

14. Leading co-workers get salaries that must not be over comparable salaries in the region or in the remaining market economy. Their total profit must not exceGed certain upper limits. **It is an honor** to actively and meaningfully be able to collaborate with this essential mankind project.

15. As a first step in the formation of Ccycling.org the CEO (Chief Executive Officer) and the **leading managers are elected** in a meeting of the 12 biggest environment and human rights organizations of the earth. These managers build the organization structure of Ccycling.org that can begin to work. Some of these organizations, which

work for the environment, the human rights and the conscience decisions of the people, are for example:

ai -	amnesty international -	www.amnesty.de/
attac -	Globalisierungskritisches Netzwerk -	www.attac.de/
Avaaz -		www.avaaz.org
BIEN -	Basic Income Earth Network -	www.basicincome.org
FIAN	International - 'Face It - Act Now' -	www.face-it-act-now.org/
Greenpeace -		www.greenpeace.org/
HRW -	Human Rights Watch -	www.hrw.org/
icbl -	International Campaign to ban Landmines -	www.icbl.org/
IPPNW -	International Physicians for the Prevention of Nuclear War -	www.ippnw.org/
tdh -	Terre des Hommes -	www.terredeshommes.org/
Welthungerhilfe -		www.welthungerhilfe.de/
WWF -	World Wildlife Fund -	www.wwf.org/

15. Through such and many further measures and through the constructive and communicative business climate **the very severe corruption danger is minimized**. Here too, the politics of all countries deliver sufficient illustrative-material. ('field-clearing'; 'landscape-cultivation'; 'loopholes'; 'Amigo-Affair'; ...) [8])

[8]) http://de.wikipedia.org/wiki/Bestechung

16. **Each member gets his percentage share of the generated energy** as return for the membership rates **completely gratuitously,** that is nominally a duration performance of **1 kilowatt / person** from 33 years after beginning of the project. It is inherited tax-free. (With 365 days at 24 hours that is 8.760 kWh / a. The membership rates will decrease by under 1 percent of the income after completion of the CCyclers and their infrastructure, therefore to approximately 30 € /a or approximately 3 c / kWh.)

National borders play a subordinate role with mankind projects. The best suitable places of the earth are chosen as locations for the Ccyclers. If some governments should decide not to support this project, then their territories are not used. At the selected locations, test-installations are built already at the beginning in rationally big standard that are enlargeable, because the time is scarce. Every year counts. With the experiences in the operation of the first installations, the following ones are continuously further optimized. **All installations are constructed flexible and modular so that all possibilities of improvement remain realizable in the future.**

All experiences with this project are published without exception in the internet so that the new technology upswing also immediately is available to the entire mankind without patent dues. All members are asked for the constructive cooperation as today with the Open Source Culture (Linux, etc).

A learning process of mankind begins, against which the moon-landing of the Americans in the 1960s was 'one small step for mankind.'

Neil Armstrong at the moon-landing: "One small step for man, one giant leap for mankind."

This is a gigantic jump for the whole mankind. All experiences benefit each human being directly and indirectly (Anti-mirror-coating, thermic isolation, food production and transport,…). Because almost all people are the entrepreneurs, some of them are also the workers, that are paid for it by the others and they again themselves are their own entrepreneurs with 5 percent of their salary.

The affluence in the surrounding regions rises. Through mankind projects mankind grows together.

Mankind projects promote peace among the people. **The defence budgets of the states can be put in for these projects, if the majority of the citizens of the democracies wishes it.** For

peace-making measures and

full employment in meaningful labor and

supranational cooperation and

general, democratically assigned justice and

personal and stately energy autarchy and

work to the common survival in the affluence on our spaceship

are better and surer arms than all weapons collectively that are developed until now.