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Desert Soil Recultivation and Monitoring of (phyto-) Toxicity (DEREMOTOX) A pilot project in three phases lasting four years.

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Abstract

DEREMOTOX is a Research and Development (R&D) pilot project for the development of "smarter" technological modules especially for and in small eco-systems and for optimizing the also necessary monitoring and risk assessments. Mainly it is dealt with the low risk further development of so called "prototype" modules or processes. Smarter in this context means: resource efficient, i.e. with higher resource productivity, long-lived, labour intensive, low cost mass production of simple (user-friendly), basically needed (technical) modules, adaptable for various local situations. It is proposed to combine/apply at least the following methods in the selected area for recultivation, the Kalmykian steppe:

1. The (new), successfully tested "Soil Conditioning Process" proposed in 1994 by J. Kügler et al. under the acronym **SOREC** (<u>So</u>il sealing and <u>Rec</u>ultivation), combined with so called brush walls or so called "Benjes Hedges" (**BENHEDGE**), and complemented with: **Solar cooking and solar water sterilization** at the recultivation location and with the **extraction of fresh water from atmospheric water vapour** in arid regions.
2. Modified and complemented **Phyto-Toxicological Investigations** (**PTI**) as done in context with the EU research project ECCA (see chapter 2). The PTI part is subdivided into three parts: a) Analysis of local pollution pattern and its effects, b) Investigation of pollution transport and deposition mechanisms, c) Concept for a future pollution control and protection from pollution and other external hazards, e.g. through a **greenhouse** which should be simultaneously tested.

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Phase A (*first 12 months*): Determination of boundary conditions in a location to be selected in the Kalmykian steppe with respect to: a) political, legal, and infrastructure aspects, b) geographic and climatic aspects, c) available resources and local soil conditions, d) status of (phyto-) toxicity. (Rough cost estimates and start of fundraising)
Phase B (*the following six months*): Detailed end to end planning using amongst others the so called **MIPS** concept. Assembling of the DEREMOTOX team. Refined cost compilation for phase C and final fundraising for it.
Phase C: (*last 30 months*) construction and evaluation phase
Remarks:

- *These methods are also required when we deal with preservation of still possible agricultural land use but which is endangered by erosion and pollution processes.*
- *Costs for phase A: t.b.d.*
- *MIPS: <u>M</u>aterial <u>I</u>nput <u>P</u>er Service <u>U</u>nit. Concept developed at the Wuppertal Institut für Klima, Umwelt, Energie, Döppersberg 19, D-42004 Wuppertal, Germany. http://www.wupperinst.org*
- ***DEREMOTOX** is a subproject of the already discussed pilot project "**Eco-Village System Development**", which is the part 1 of the proposed pilot project **LEDGEM** (<u>L</u>ocal <u>e</u>co-village system <u>d</u>evelopment and <u>g</u>lobal <u>e</u>nvironmental <u>m</u>onitoring; G.K. Hartmann, 1998.)*
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Contents

Preface

"The significance of **knowledge** in the value-adding process is today just as great as that of the three classical production factors: **labour, land, and capital**. In addition, knowledge in "unattached" form - for example in patents, processes and freely available knowledge - increases the productivity of the other production factors, principally that of work. This enables business to reduce their personnel requirements and increase their return on capital"(16). This statement, made for national states like Germany, needs to be supplemented and modified with respect to countries and areas which have not participated in the so called "first wave industrial development" and to those industrialized countries with fast increasing - especially anthropogenic - produced environmental problems. First of all the just mentioned classic three production factors must be supplemented by water and air. For all three **"existentials": air, water, and land** we have to care for a quality that allows (human) life and which is the **precondition** of any human activity and/or productivity. In an increasing number of regions where human beings live –often since a longer time span - this precondition is no longer fulfilled or the relevant quality (standard) has begun to deteriorate. There we cannot think about using knowledge and capital to reduce work. We have to use labour and knowledge to (efficiently) restore and/or newly create - with as little as possible capital - the necessary preconditions for direct survival and for an onset of future (market) productivity and trade activities. We have to strive for an optimization of technologies, products, and processes - including monitoring - used within and vital for socio-economic-ecologic-technologic, cultural determined "systems", - see fig. 1 - briefly called "**smarter"** (system technology). Smarter in this context means: resource efficient, i.e. with higher resource productivity, long-lived, labour intensive, low cost mass production of simple (userfriendly), basically needed (technical) modules, adaptable for various local situations. It is mainly based on:

1. a synergetic combination of hardware and software from the relevant, but complementary low tech and high tech areas.

2. thorough testing, evaluation, and "invaluation" of the results, - mainly based upon non linear biocybernetic thinking, which essentially means minimization of energy and matter fluxes, in the system.

The less this is based on (a friendly), interdisciplinary, intergenerational, intranational- and international-intercultural "comprehensive" teamwork, and on diversity, the less efficient (successful) it will be. Such teamwork, not only based on competition but also on symbiosis, can help to reduce the socio-economic-ecologic induced threats of large migrations of the poor and also the danger of ethnic cleansing. This finally implies that the less the "classic" management tasks can be complemented by so called **catalytic functions** - denoted by G. K. Hartmann in analogy to a catalyst in chemistry - the less successful these projects will be. (*The great importance of such a catalytic function for the success of a complex, international (scientific technological) project has been demonstrated by G.K. Hartmann in his role as the Principal Investigator (PI) of the MAS (Millimeter wave Atmospheric Sounder) successfully flown with the three NASA ATLAS Space Shuttle missions in 1992, 1993, and 1994* see also Web Side http://www.mpae.gwdg.de/mpae_projects/MAS/

The presented DEREMOTOX pilot project proposal, a first step towards a later Local Ecovillage system Development (LED), emphasizes all these aspects. The envisaged activities for the Kalmykian step will be to a considerable portion **complementary** to those for countries with saturated markets, which are based on short-lived, low cost mass productions. Here we will first of all lay the foundations for low cost mass production (of "basic technical goods") with (new) smarter system technologies especially providing products with a longer lifetime. Excellent scientists and engineers capable and motivated for the above mentioned comprehensive teamwork - some with the additionally necessary catalytic capabilities - will play a decisive role in approaching the goals of this project. The present DEREMOTOX team will meet very well this challenge. (6, 7, 8, 9, 10, 11, 12, 13, 14).

Remark about science. "(Empirically based) Science contributes to a better way of seeing oneself in relation to the cosmos, complementary to the transcendence, enables technical and technological developments, and it is for the scientists a pretentious possibility of self-representation".

Remark about resource efficiency.

According to a research carried in 1994 in the USA (3) there was the following situation: 93% of the worked resources was never transformed into saleable products, 80% of all products was thrown away after the first use, and 99% of the substances contained in the products became waste within 6 weeks. The basic problem lies in the fact that mass production for saturated markets depends on the sale of low cost short-lived, i.e. throw away products. Low costs result from mass production and they must be short-lived so that this mass production can continue.

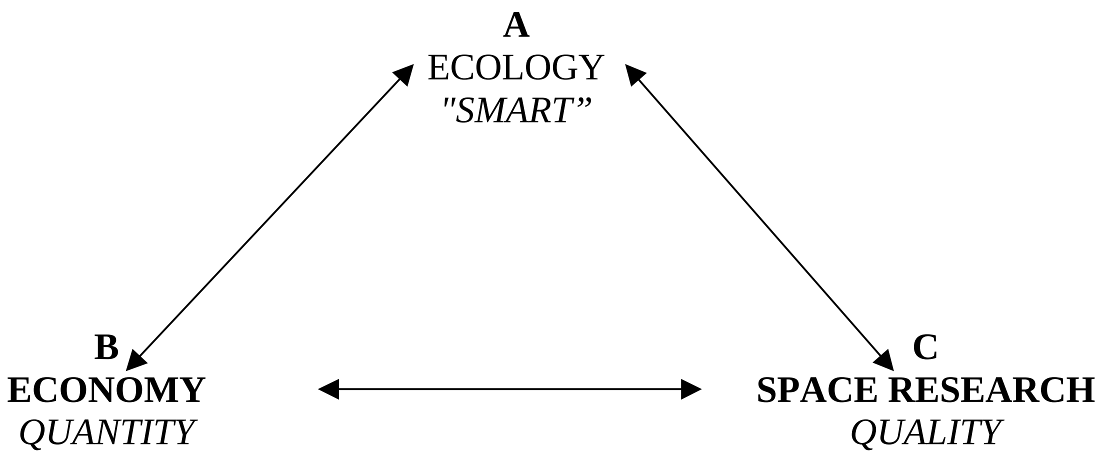
DEREMOTOX, however, has a complementary aim, focussing on presently unsaturated or even barely existing markets - in order to create there a future viable living and market place. This also means in those locations an increase of personnel requirements, i.e. an **decrease of the present unemployment.**

The more "quick dollar thinking" dominates the acting, the more we have to deal with:

- less (capital) investment in the creation of new future market places.
- less thorough synergetic combination of low tech and high tech hardware and software, a precondition for real significant technical innovations within the (for the future) necessary R&D activities, not only for the sake of better (future) competitive capabilities but also for the sake of a better symbiotic capabilities and thus for a more efficient and stable (economic) cooperation.
- less striving for approaching a dynamic equilibrium between competition and symbiosis and for preserving diversity, an important preconditions of evolutionary processes (14).

(Preface compiled by G. K. Hartmann in May, 1999).

Figure 1 Modern production determining factors and production characteristics.



Example for fig. 1

A
<<Local Acting>>
DEREMOTOX or Local Eco-village -
system Development (LED)
*(LEDGEM part 1)
Sustainable, durable resource efficient mass production of (simple basic) low cost "goods" through Research and Development (R&D). Creation of new markets, medium capital intensive, high labour intensive

B
<<Regional Acting>>
Mass production

Short-lived, low cost throw away products, resource squandering. High capital intensive, fast capital return, low labour intensive.

↔

C
<<Global thinking>>
Global Earth Monitoring (GEM) from Space. (R&D intensive)
(LEDGEM part 2)
Special (single) products, long-lived (durable), expensive, resource extensive. High capital intensive, slow capital return, Medium labour intensive.

*LEDGEM: Local Eco-village System Development and Global Environmental Monitoring (G. Hartmann, June 1998. (14))

1. The ecological situation in large areas in the west and north west of the Caspian Sea

This area with its steppes and semi arid regions constitutes a very complex eco-system. In its Russian parts precipitation between 200 an 260 mm per year have been noted. High temperatures in summer, strong solar radiation, periodically occurring droughts and often hot and dry winds lead to an increase of ecological problems, especially for the agricultural production. The extensive agricultural activities over many years in the past contributed very strongly to this pattern.

The worst situation exists at present in the Russian Republic Kalmykia, in the south east of the Russian European sector. 83% of its land, i.e. 7,6 million hectares (ha) suffer from desertification. Per annum at present an increase of the desertification process of 40000 to 50000 ha has been observed in the Republic Kalmykia and the region Astrachan. It is anticipated by politicians and scientists that in 15 to 20 years this area will cover 1 million ha.

At the end of the 1950ties the largest portion of this unique steppe has been in fairly good conditions and only 9% suffered from desertification processes. Today we talk about more than 80%.

The following causes for the desertification have been investigated:

- over pasturing
- over salting
- blown over (salted) sand from distant regions, e.g. from Middle Asia
- occurrence of airborne anthropogenic phyto-toxic trichloroacetic acid (TCA)
- others t.b.d.

Some remarks about the Caspian Sea

The Caspian Sea lies east of the Caucasus Mountains and dominates the huge, flat expanses of western Central Asia. The elongated sea sprawls for nearly 1200 km from north to south, although its average width is only 350 km. It covers an area of about 386400 square kilometers while its surface lies about 27 meters below sea level. The maximum depth, towards the south, is 1025 meters. The sea is bordered in the northeast by Kazakstan, in the southeast by Turkmenistan, in the south by Iran, in the southwest by Azerbaijan, and in the northwest by Russia. The Caspian Sea is the greatest salt lake in the world. The Caspian Sea is of exceptional scientific interest, because its history, particularly in respect to former fluctuations in both area and depth, offers clues to the complex geologic and climatic evolution of the region. Man made changes, notably those resulting from the construction of dams, reservoirs, and canals on the on the immense Volga River system (which drains into the Caspian from the north), have had their own effect on the contemporary hydrological situation. The Caspian is also of great importance in the transportation network of the region and in the production of oil and natural gas and its sandy beaches are used increasingly for health and recreation resorts.

Taking into consideration the complex problems in the Kalmykian step and the Caspian region it becomes clear that only a (linear) improvement of the presently used technologies will not be sufficient, i.e. we must consider the following (technological) activities if we want to significantly reduce the problems in this **S**ocio - **E**conomic - **E**cologic – **S**ystem

a) improving the technology used at present
b) combining it with other not yet used available ("prototype like") technologies
c) developing - with respect to hardware and software - real **new, essentially smarter technologies and systems**, e.g. more resource efficient, i.e. with higher resource productivity, and more user friendly (simpler), needed for low cost mass-production of basic technical modules. This means that in the future, for our special case:

1. that we will have to strive for a better balance between machine intelligence and machine labour and human intelligence and human labour (14).
2. that we need to strive for a better synergetic combination of man and machine

Remark
The pilot project LEDGEM, which is described in (14) - see also fig. 1 -, emphasizes especially b) and c). It consists of two complementary parts, the "combination" of which needs - in addition to "normal" management - also "human catalytic" activities, the more the complexer the system gets and especially the more interdisciplinary, international and intercultural cooperation is needed. The DEREMOTOX concept is to a great extent derived from it.

2. Results of biomonitoring

Through biomonitoring measurements at 13 different locations in Southern Russia within the EU project ECCA (L. Weissflog et al.,1998 *) the theoretically predicted occurrence of airborne anthropogenic phyto-toxic trichloroacetic acid (TCA) has been confirmed. The results are in agreement with the meteorological data of the Russian partners (N. Elansky et al. (1998*)) and the Austrian partners (E. Putz et al. (1998*)). The hypothesis claims that high volatile VCHs, (Volatile Chloro-Hydrocarbons) coming from the Caspian Sea, are oxidized by atmospheric chemical processes to TCA and that TCA is deposited in the surrounding vegetation and leads there to phyto-toxic effects. TCA and its derivates were used in the fifties as herbicide for agricultural purposes and were banned in the sixties thus that a direct anthropogenic input is not likely. It is assumed, however, that the measured TCA is produced in the atmosphere by hydroxylradical induced oxidation of C_2-chlorohydrocarbons. These substances are highly used for cleaning purposes in the metal and textile industry and get with waste water from the industry plants into the rivers Wolga, Ural and into the Caspian Sea. However, also oil industry contributes with its emissions to the total C_2-chlorohydrocarbon load of the Caspian Sea. Caused by strong evaporation processes large amounts of VCHs compounds reach the atmosphere and are transported away from the Caspian Sea, e.g. towards the Kalmykian steppe.
It is therefore suggested that modified and complemented **Phyto-Toxicological Investigations** (**PTI**) as done in context with ECCA will be carried out here, too. The **PTI** part is subdivided into three parts:
a) Analysis of local pollution pattern and its effects.
b) Investigation of pollution transport and deposition mechanisms (15).
c) Concept for a future pollution control and protection from pollution and other external hazards, e.g. through a **greenhouse** which should be simultaneously tested.

***** *For references and more details see: Annual project report 1998 for the EU-Project: INCO-COPERNICUS No.: IC15 CT96-0106, "Eco-toxicological Risk in the Caspian Catchment Area" (ECCA). See also e-mail addresses in chapter 12.*

3. Desert Soil Sealing and Recultivation (SOREC) and erosion protection

3.1 SOREC

A recultivation of desert areas can only succeed if it is possible to create a sufficiently thick layer below the surface of the desert with soil temperatures of less than 20 degrees Celsius being typical for some decimeter depth (root depth), to be made of the local available soil plus suitable admixtures. Such a soil layer is characterized by the following properties:

- it must be capable of **accumulating** and **retaining** water and must be **impermeable** (watertight) with respect to the deeper underground to prevent water losses in this direction.
- it must be **rich of nutrients** and comfortable for plants so that they can create roots to be held by the soil.

The basic idea concerning the solution for the recultivation of desert regions in order to prevent desolation from going on is that the above mentioned partly contradictory specifications can be met by means of adding an **extra soil layer** under the surface of the present soil.

In a plantation and water sealing layer with said features the whole drainage can be done underground without significant evaporation processes in the root areas of the plants. Thus water losses will be minimal. By means of an intermittent water circulation a high salt content of the plant nutrient layer and the above "protecting" layer can be avoided. The nutrient and water sealing layer must be designed according to the type of envisaged plantation process and the local soil and climatological conditions, which must be investigated in the planning phase A.

The soil sealing or impermeabiliziation effect of water glass will play a major role in this recultivation process. Water glass is a melting product obtained from quartz sand and soda or quartz sand and potash. Its pH values range from 11 to 13 and for a 1% solution between 10 and 12. With decreasing pH value – 9 and smaller – the polymerization of silica acid species strongly increases and leads to unsolvable polymeric silicate structures. The surface of these structures contains further so called silanol groups that foster further condensation processes. Gels and "precipitation" products can also be produced by reaction of water glass solutions with metallic salt solutions, e.g. salts of alkaline earth metals etc. Furthermore the gel formation will also be influenced by organic matter (4).

3.2 Erosion Protection

An erosion protection of the new recultivated area should be supplied, e.g. by creating so called **brush walls**, also known as **Benjes Hedges** (5) from biomass that is normally used as firewood.

4. Extraction of fresh water from atmospheric water vapour

Many countries suffer from absence of fresh water though its content in the atmosphere is significant. The use of natural processes allows to obtain large quantities of fresh water without destroying the environment. Usually atmospheric vapor content gives a possibility to extract 10-20 g of water per each cubic meter. The use of atmospheric vapor has minimal effects on the environment contrary to desalting sets. There are no exhausts and there is practically no energy supply needed. This resource shall be reused. The condensate contains on 2-3 orders less toxic metals in comparison with sanitation's norms. It practically does not contain microorganisms and is well aerated. The cost of one cubic meter of water may be 10-50 cents, depending on the equipment characteristics and the atmospheric conditions. In Russia, until the 80‘s of the last century, the town Feodosiya (in Krimea) got fresh water by this method. The water was supplied by gravity through potter pipes, which originated from artificial detritus heaps. During the heyday of the city - in the Middle Ages - there were up to 100 fountains, which provided water for 80 thousand city dwellers. A system includes heap-condenser and well-accumulator of the water. The purpose of the project is the creation of an experimental autonomous water-supply system, imitating the condenser of Feodosiyan type. It will have a volume about 1/10 of typical Feodosiyan condenser, i.e. approximately 200 m^3. The areas of the coasts of Cyprus, Greek and Israel **– and the Caspian Sea -** have a sufficient diurnal temperature course and sufficiently high absolute humidity. It is supposed that a system will give approximately 20 m^3 of fresh water per day. As an output of the project realization the evaluation of system effectiveness for various seasons and various scales, and the check of theoretically calculated efficiency will be obtained. See also (1, 2, 18). *The estimated costs for the proposed experimental system are 200.000 - 300.000 U.S $.*

5. Solar reflector community cooker and water sterilization

In order to avoid that the biomass needed for the brush walls is burned, e.g. for cooking purposes a **community solar cook**er should be installed at the location where the recultivation takes place. It should also be modified/used for the **sterilization of water** perhaps also for solar destillation. For more information contact: K.H. Weiler, Solarprojekt Emden, Web Site: http://spot.fho-emden.de/hp/weiler/solar.html or ..../weiler/links.htm which is described in the following chapter.

More than 2 billion people worldwide have been using firewood for cooking. However the northern industrialized countries, 20% of the earth's population, have been using too much of the planet's ecological capital, that is 85% of the global non-renewable fossile fuel consumption. Global climatic change, as well as deforestation or soil degradation, demand the development of renewable substitutes for the use of firewood, a sustainable treatment of the environment in both, high industrialized and low industrialized national states.

After some hundred thousand refugees from Burma have penetrated into the poor south of Bangladesh, and the rest of the former tropical rain forest were cut down, the new ecological training center of Ukhia was planed by Bangla German Sampreety (BGS), and with help from the Fachhochschule Ostfriesland (FHO), the Solar Project Emden started in the beginning of 1995. This is a joined project between the two departments of Applied Natural Sciences and the Social Science at the FHO with Prof. Walter Dissinger[1]. After a mobile system (OSOW1) in Emden, the first solar reflector community kitchen in appropriate technology (OSOW2) was built in Dhaka end of that year and integrated into the Ukhia center. A second one was carried to Tangail (OSOW3), in the north of Dhaka.

Now there are three different solar reflector kitchen in Emden, 2 in Bangladesh, another one in Nepal, where two Reflectors were set into operation on Jan. 9, 1999 (OSOW6, OSOW7) in Itahari. There also biogas can be used alternatively in case of no or poor sunshine. OSOW4 is stationary at the Ecological Center Oekowerk Emden. OSOW5 is at the FHO; its Reflector carries 428 glass mirror facets, producing a very small focal spot at the entrance window of the oven. There are now (1998) more than 150 Solar Reflector Community Kitchen (SRCC) of the Scheffler-Type[2] world wide.

An 8 m² parabolic reflector concentrates the sunlight on a small secondary reflector under a 50 liter pot or a plate, thus producing up to 2400 Watt at the bottom of the pot. Automatic solar tracking by means of a pendulum clock driven bicycle chain and gears keeps the focus on the solar oven. Thus one can cook for about 80 people, which means a reduction of about 100 kg firewood per day. Operation after the same principle was proved from Emden (53° North) to the Equator (0°), provided the sun was shining

The SRCC can also be used for water heating, sterilisation, destillation and water vapour production. In some locations in Africa and India the SRCCs use a storage tank during times of no cooking. Thus the water temperature is always high and the time needed for cooking can be reduced. In many cases the temperatures are above the boiling point so that sterilization is possible. Properly insulated tanks keep the temperature even over night. Furthermore a heat

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storage with stones or rocks is possible, i.e. a relevant device can be put into the focal area of the SRCC reflector and "loaded" with enough energy so that cooking is still possible after sun set. In India at the location of Mount Abu, Rajastan, a battery of SRCCs generates 600 kg of steam per day to feed a kitchen.

Solar Reflector Community Kitchen, OSOW2, Reflecting Foil, Dhaka, Bangladesh, Oct. 10, 1995

6. A Greenhouse for comparison and protection from phyto-toxicological effects

It is also envisaged that parallel to the open air recultivation activities **a greenhouse – with glas fiber structures –** will be installed – G. Reisinger with H. Ch. Heydecke - to investigate what type and design has the greatest advantages in that area, especially compared to the open air agricultural activities, which very likely suffer from phyto-toxicologic, atmogen deposits coming from the Caspian Sea and which need to be investigated as described in chapter 2.

Remarks on the greenhouse

To produce vegetables, spices, herbs and flowers with high quality and to produce theses products independent of season foil tunnels or greenhouses are of advantage. Such protected production reduces the cultivation risks (e.g. natural hazards, storm, heavy rain, hail, frost and anthropogenic ones like "man made phyto-toxic air pollution) and the specific irrigation water demand drastically. For any healthy plant production without or with only a minimum of pesticides sufficient technical standard of the equipment is necessary which furthermore needs to be adjusted to the local conditions. Low level of automation for irrigation and venting are important for success. Thus the design of a resource efficient, locally adjusted, full operational greenhouse – which uses primarily local available materials - requires some time, a good know how and a good teamwork (cooperation of all involved parties). The protecting structure can be used for rainwater collection which might be stored in a cistern or a pond. G. Reisinger (GMT) has designed and built such an experimental greenhouse in Crete supported by the German Ministry of Research and Technology. It is planned to build also such an experimental greenhouse in context with DEREMOTOX parallel to the outdoor recultivated and agriculturally used areas in order to be able to compare the cost efficiency of the two methods, outdoor versus indoor. The greenhouse might be covered with either glass or plastic foil.

A greenhouse constructed with **Math-Web glassfiber** elements (H. Ch. Heydecke) has several advantages:

a) the material is of high strength but low weight. A Math-Web structure has only 25% of the weight of a comparable steel construction. This means a greenhouse could even be put together by persons with only average physical strength.
b) The Math-Web structures allow the construction and production of technical parts with exact defined physical properties and high dimensional exactness and stability. Strength and load properties will be calculated absolutely precise. Fastening points like bearings and bushings will be worked in during the production process which makes the assembling with other parts easier. It is also possible to increase the strength of the product at specially loaded points.
c) even after bending by overloading (wind pressure, high rainfall, snow) the Math-Web structure will return to the original shape and will be able to accept again the full load.
d) The structures do not need any maintenance or service. They are resistent to corrosion and chemical attack, as example by fertilizers.
e) a local production is possible without high investment. The production costs at present are comparable to steel and other materials. Math-Web structures could also be used for masts for communication purposes, wind power stations, as support or frames for solar energy systems, for small bridges and structures for houses and stables.
f) to work with Math-Web structures does not need expensive or sophisticated tools. And the low weight of the construction units lead to substantial cost savings by foundations: saving of material, time, wages and salaries and again very important, no maintenance, e.g. painting, is needed.

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7. Planning and construction phases

Phase A (first 12 months):

Determination of the boundary conditions in a location to be selected in the Kalmykian steppe with respect to:

a) political, legal, and infrastructure aspects,
b) geographic and climatic aspects,
c) available resources and local soil conditions,
d) status of (phyto-) toxicity.
e) Rough cost estimates
f) fundraising

Phase B (the following six months): Detailed end to end planning applying as far as possible the so called **MIPS concept (***Material Input Per Service unit***)** of the Wuppertal Institut für Klima, Umwelt, Energie GmbH, (Döppersberg 19, D-42004 Wuppertal, Germany), Web Side: http://www.wupperinst.org should be applied. Assembling of the final DEREMOTOX team. Refined cost compilation for phase C and final fundraising.

Phase C: (last 30 months) construction and evaluation phase

8. Conclusions

DEREMOTOX is a Research and Development (R&D) pilot project for the development of "smarter" technological modules especially for and in small eco-systems and for optimizing the also necessary monitoring and risk assessments. Mainly it is dealt with the low risk further development of so called "prototype" modules or processes. Mainly it is dealt with the low risk further development of so called "prototype" modules or processes. Smarter in this context means: resource efficient, i.e. with higher resource productivity, long-lived, labour intensive, low cost mass production of simple (userfriendly), basically needed (technical) modules, adaptable for various local situations. The envisaged DEREMOTOX activities for the Kalmykian step will be to a considerable portion **complementary** to those for countries with saturated markets, which are based on short-lived, low cost mass productions. This also means in those locations an increase of personnel requirements, i.e. an **decrease of the present unemployment** and to create there a future viable living and market place**.** The longer lifetime of the new products – mainly from already existing "prototypes" - will to a considerable part be guaranteed by (simple) maintenance and/or service activities by man. Excellent scientists and engineers capable and motivated for (a friendly), interdisciplinary, intergenerational, intranational- and international-intercultural "comprehensive" teamwork cooperation - some with the additionally necessary catalytic capabilities - will play a decisive role in approaching the goals of this project. The present DEREMOTOX team will meet very well these challenges and thus the risks for a successful execution of this project are very small. Furthermore the chances to use these optimized technical modules in context with a future eco-village system development are very promising and high, however, there the aspects mentioned in the LEDGEM proposal – see fig. 1 - should also be considered (14).

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6. SOLO Kleinmotoren; A. Baumueller (Sindelfingen, +49-7031- 301202): Solar thermal low temperature stirling engines.

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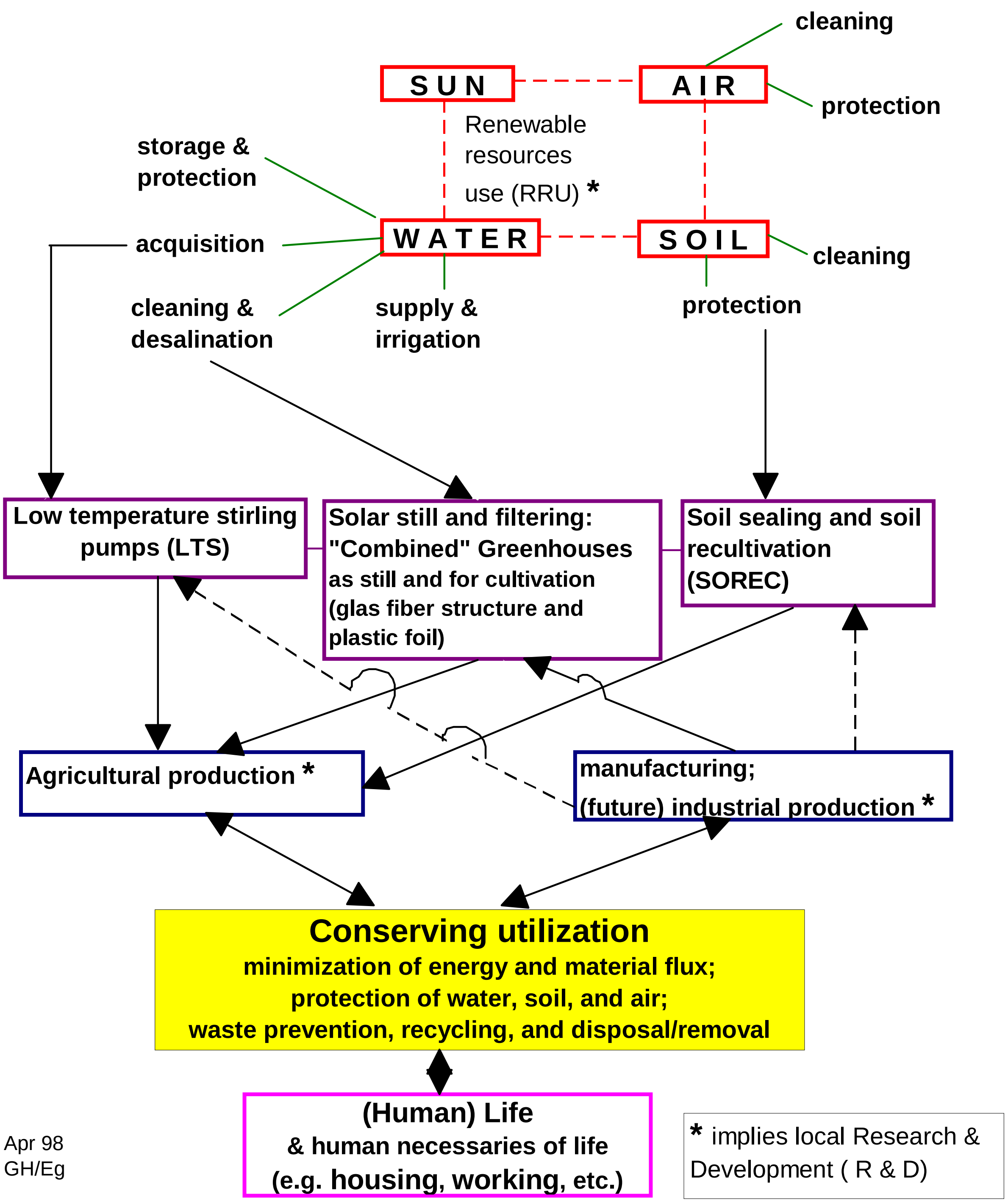
11.Figures and Tables

Figure 1:

Ecovillage System Development (ESD)



12. The authors

12.1 Scientific curriculum of the first author Gerd K. Hartmann

Gerd Karlheinz Hartmann, born in 1937 in Eschwege, Germany, studied physics from 1957 to 1964 at the Georg-August-University in Göttingen, where he received his PhD. in 1967. Since 1965 he has worked as a scientist at the Max-Planck-Institut für Aeronomie, D-37191 Katlenburg-Lindau. From 1975 to 1978 he was the provisional director of a division of the institute, the Institute for Long-term Control of Geophysical Environmental Conditions (ILKGU). For over ten years he concentrated his activities on studying the upper atmosphere using satellite beacon signals. Since 1980 his main area of specialization has been studying the lower atmosphere by means of microwave radiometry. He is the Principal Investigator of the **M**illimeter Wave **A**tmospheric **S**ounder (MAS) experiment which as a joint enterprise of Germany, Switzerland, and the USA has been flown as core payload of the NASA ATLAS (Atmospheric Laboratory for Applications and Science) Space Shuttle Missions (ATLAS-1 (1992), ATLAS-2 (1993), ATLAS-3 (1994); http://www.mpae.gwdg.de/mpae_projects/MAS/

In addition to these studies, since 1967 he has been dealing with general and specialized information and documentation problems, from the viewpoint of large volumes of time dependent and space dependent data, especially of the type collected in his research projects. At present he works as a consultant on several national and international committees and holds lectures and seminars throughout Europe, and especially in the USA., in Argentina, and Chile countries he has often visited in the course of his scientific projects. Since 1986 he is a guest professor and guest lecturer for filter and information theory at the University of Mendoza, Argentina. This task was extended in 1988, now also including problems of conserving utilization of the environment (sustainable development). In this context he is the international coordinator of the environmental program PRIDEMA started by the University of Mendoza (UM) in 1988.

Since 1991 he is full professor for "remote sensing for a conserving utilization of the environment" (sustainable development) at UM and also "external scientific director of the institute for environmental studies (I.E.MA.)" of the University of Mendoza (UM). In December 1991 he received the Dr. Luis Federico Leloir Award for international cooperation with Argentina in the domain of environmental research from the Argentinean minister for Science and Technology, Prof. Dr. R.F. Matera.

Right now he works on the value added validation of remote sensing data from the Earth's atmosphere and is manager of an international experiment proposal for the investigation of the MARS atmosphere in context with the MARS EXPRESS Mission of the European Space Agency (ESA).

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