Opportunities and Recommendations for Appropriate Technologies in Developing Countries

(translated from German)

DBU-Workshop 3. Sept. 2019 in Osnabrück

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http://solarcooking.org/Seifert

Contributions to solving two global challenges: climate change and misery in developing countries

Global cooperation
in financing emission reduction projects

Creation of millions of permanent jobs per year through Appropriate Technology (AT)
and
Propagation of garden culture

See articles in journal “SONNENENERGIE”: 3/2017, 1/2019, 3/2019, also published (english and german): http://solarcooking.org/Seifert/Documentation

1) Development and dissemination of freely accessible appropriate technology with worldwide participation of universities, foundations etc.

"As an urgent task for the future, I deliberately call the African continent, which deserves the attention of a leading technical university, more than in the past." He then listed the *"great challenges to society": Health and Nutrition · Environment, Climate and Energy · Natural Resources · Infrastructure and Mobility · Information and Communication."* (Translation from German)

Prof. W.A. Herrmann, President of Technical University Munich (TUM) in his speech on April 12, 2018 on the occasion of the 150th anniversary of the TUM: 150 years TUM. Innovation since 1868.

TUMcampus - Das Magazin der Technischen Universität München, 2/2018, p. 12-13

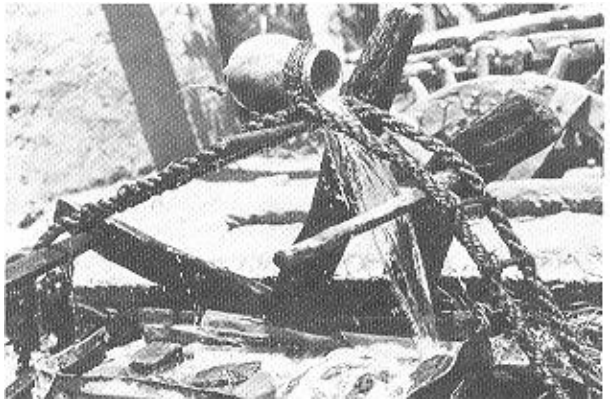
Proposal: Institutes for Development and Dissemination of Appropriate Technologies, e.g. African Research and Technology Institutes for Sustainability (ARTIS)

A famous example of the development and diffusion of appropriate technologies is the D-Lab at the Massachusetts Institute of Technology (MIT), founded 15 years ago by Amy Smith (center of picture), also exemplary through global cooperation.

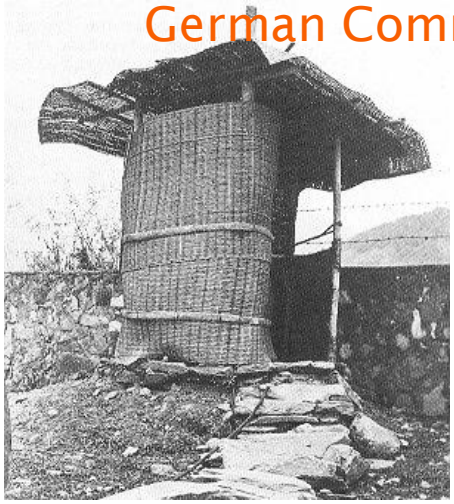
http://news.mit.edu/2017/designing-more-equitable-world-amy-smith-mit-d-lab-1006

Special exhibition in the German Museum 35 years ago: "Technique on a human scale"

Rural technology for women in developing countries



German Committee for UNICEF u. Deutsches Museum (1984)



Plan of a traveling exhibition on sustainable development, 12 years ago

International Colloquium:
"Ciencia y Tecnología para el Desarrollo"
December 17.-18. 2007

The plan for a traveling exhibition for sustainable development from the Parque de las Ciencias, Granada, failed due to lack of funding.

http://parqueciencias.com/exposiciones/CyTDesarrollo/es/

Source: Sama Shrestha, UN Women Nepal

2) Overcoming the firewood crisis by Open Source Appropriate Technology (OSAT)

Reduction of fuel wood requirements of a traditional household with three-stone fire to 1/12

The factor 1/12 also applies to the transition from traditional charcoal in improved hearth to open source appropriate technology (OSAT)

Traditional charcoal in Africa – a continent in danger

"For four days, Alvin and Victor will hack until the Mutondo tree finally falls."

Source: http://www.daserste.de/information/politik-weltgeschehen/weltspiegel/sendung/sambia-holzkohle-100.html

Annual fuel consumption of a household and possible savings

Comparison with traditional three-stone fire (about 10% efficiency)

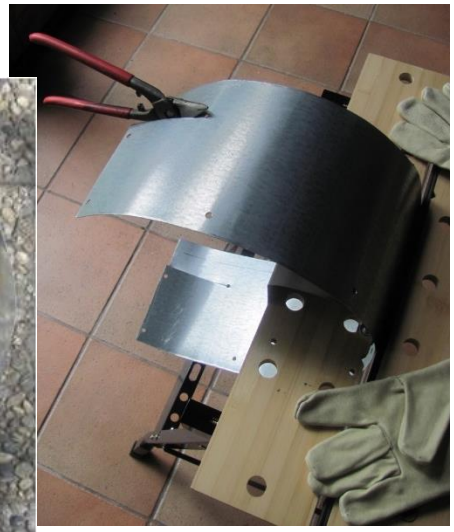
Fuel Consumption per Year	Equipment	3-Stones	Ben 2	Charcoal tradit.	Charcoal improved
	Fuel	Firewood	Firewood	Charcoal	Charcoal
	Unit	Assumptions	03.02.2015	Assumptions	Assumptions
Net Energy Demand E_eff per Household per Year	MJ/Year	6.000	6.000	6.000	6.000
a) Fuel Consumption B per Household per Year	kg/Year	4.000	985	1.101	667
Percentage of Saving f_thermo via Thermos Technique		45%	45%	45%	45%
Percentage of Saving f_solar via Solar Technique		45%	45%	45%	45%
b) Fuel Consumption including Thermos Technique	kg/Year	2.200	542	550	367
c) Fuel Consumption including Thermos- and Solar Technique	kg/Year	1.210	298	303	202
Conversion to Fuelwood Consumption per Household per Year:			Short rotation plantation	Thick stems and branches for charcoal	
Mass Ration Wood/Charcoal (IPCC default value)	kg/kg			6	6
a) Without Thermos- and Solar Technique	kg Wood/Year	4.000	985	6.005	3.999
b) Including Thermos Technique	kg/Year	2.200	542	3.303	2.200
c) Including Thermos- and Solar Technique	kg/Year	1.210	298	1.816	1.210

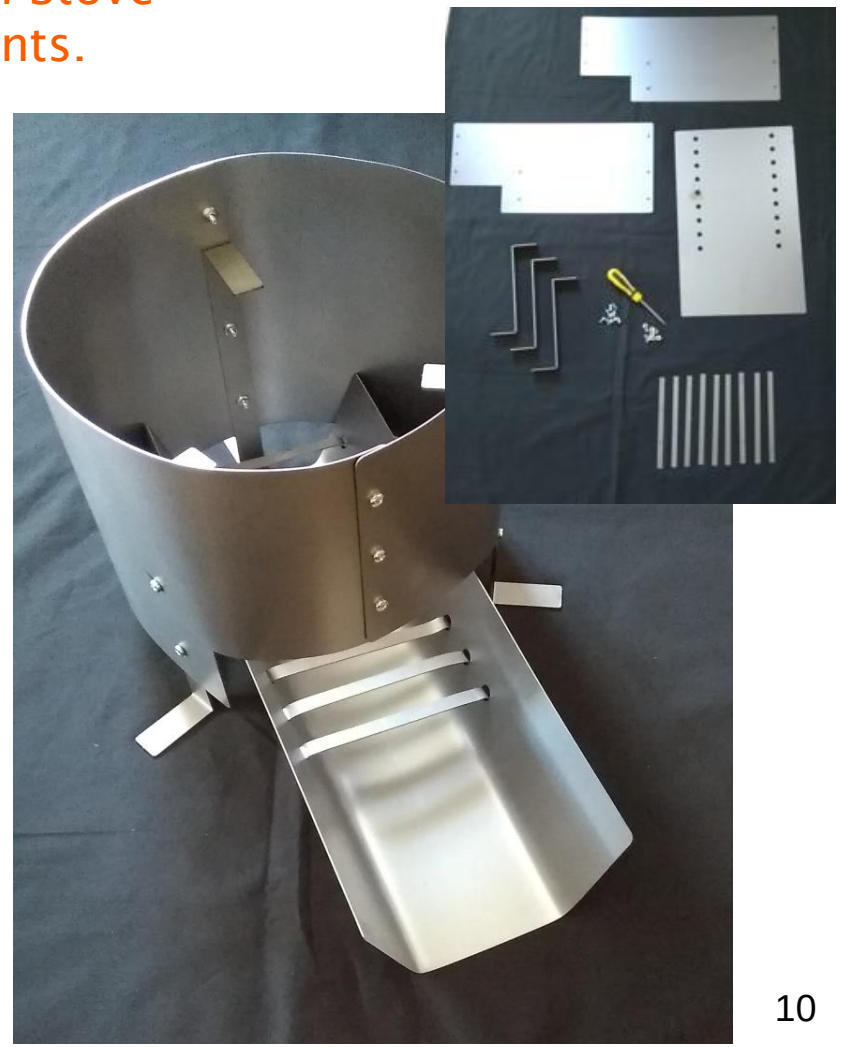
Result: The annual consumption of wood per household can be reduced from 4000 kg to approx. 300 kg.
Higher savings are possible when replacing the traditional charcoal

Example for OSAT: adaptation of the Ben-Stove in Sri Lanka

As an open source, the design of the Ben-Stove can be easily adapted to local requirements.

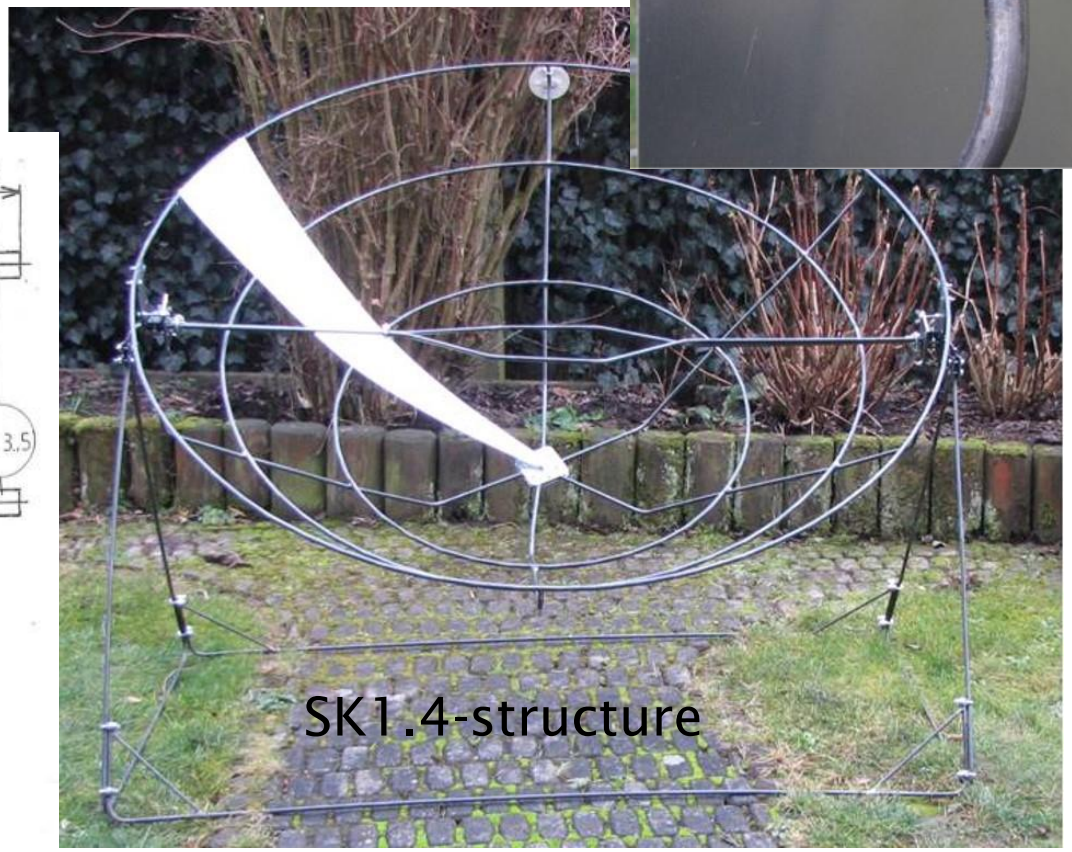
The pictures on the right show an adapted (no weld) construction in Sri Lanka.

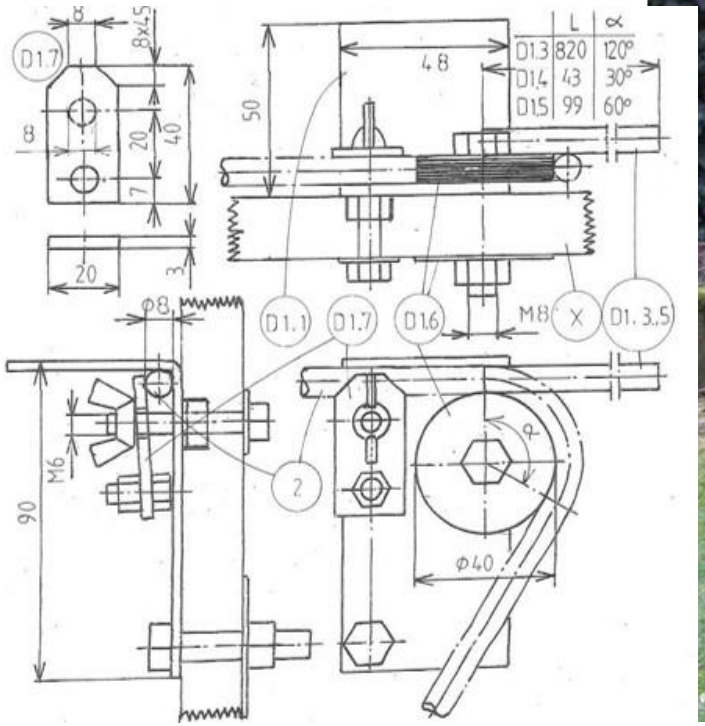




Adaption of SK design (welded structure)

The detailed documentation for an SK construction with a structure of round steel is published on the Internet as Open Source SK1.4:
http://solarcooking.wikia.com/wiki/SK1.4





Bending device for SK1.4: the workplace costs are very low

Sterilizing water by boiling – a main task for the solar cooker

On a sunny day, the parabolic solar cooker (1.4 m reflector diameter) can boil more than 40 liters of water.

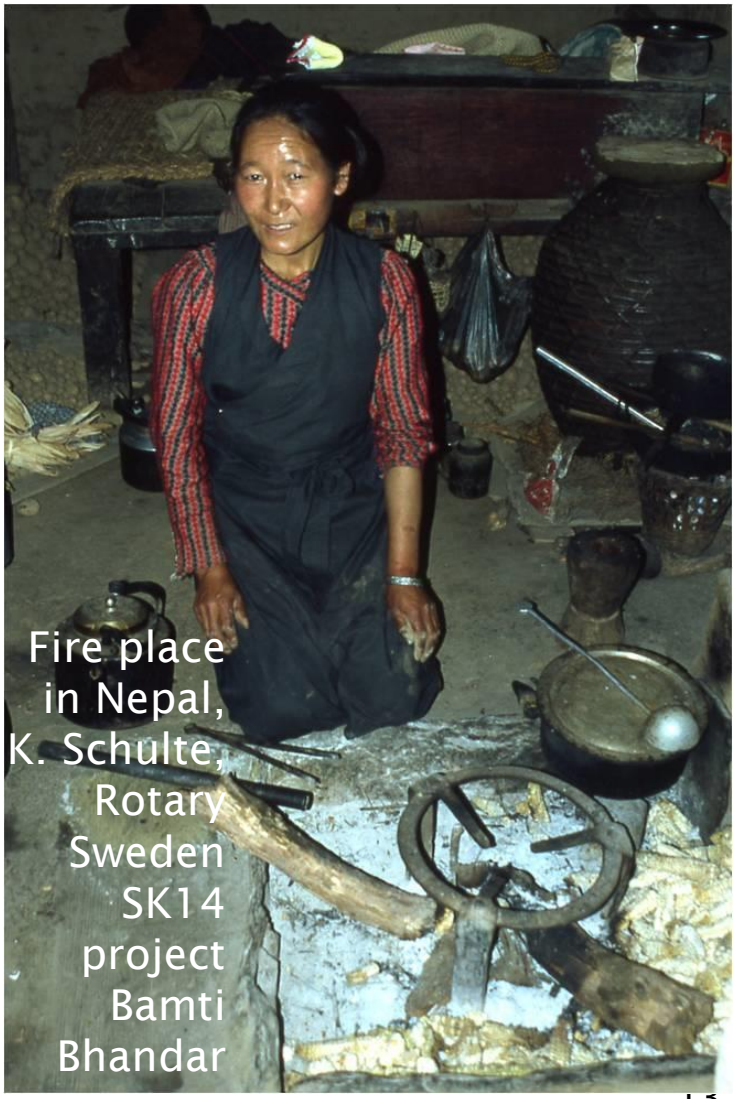
ECSCR test, Almería, (1994): 48 liters

Photo from solar cooker course by Imma and Dieter Seifert in ICNEER, organized by Shirin and Deepak Gadhia, Valsad / Gujarat (2004)

3) Financing of sustainable technology by using revenues from the compensation of greenhouse gas emissions in accordance with Article 6 of the Paris Agreement

Equipping 200 million households in developing countries with sustainable technology can be used for compensating of approximately 800 million tonnes of CO_2eq per year

Cooking of maize porridge with charcoal, Lusaka, 2010



Fire place in Nepal, K. Schulte, Rotary Sweden SK14 project Bamti Bhandar

Example: Household energy equipment

One-third of humanity uses wood or charcoal for cooking, with catastrophic consequences, in particular cooking in urban households with traditionally produced charcoal.

Equipping 200 million households with approximately 1 kW household energy means 200 GW of installed capacity. This corresponds to the capacity of about 200 nuclear power plants, but without their disadvantages and with less than 5% of the investment costs.

Each household can save about 4 to 8 tons of CO_2 emissions per year, a total of more than 800 million tons per annum, which is roughly the annual emissions of Germany.

1 PV and LED-lamps
2 Thermos-basket
3 Efficient stove
4 Parabolic solar cooker

Costs of around 25 euros for avoiding 1 ton of CO_2 emission from household energy projects in developing countries (7 years term)

Opportunities to overcome the poverty trap

Example: Equipping the household with:
Fuelwood saving stove, Parabolic solar cooker,
Thermos basket, Thermos flask,
PV-panel und LED-Lamps

As far as possible with creation of local jobs

Traditional charcoal in African households – A continent in danger

Annual Saving of CO2-Emission per Household	Stove:	3-Stones fuelwood	Charcoal traditional	Charcoal improved
Emission Factor EF of wood (IPCC 2006)	kg CO2/MJ	0,112	0,112	0,112
Net Calorific Value NCV of wood (UNFCCC, default value)	MJ/kg wood	15	15	15
Share f_nr of non renewable wood (assumption)		85%	85%	85%
Saving of CO2 per kg of saved wood	kg CO2/kg wood	1,428	1,428	1,428
Consumption of fuelwood per household without thermos and solar technology (see leaf 8)	kg wood/year	4.000	6.000	4.000
Consumption of fuelwood per household with efficient stove, thermos and solar technology	kg wood/year	298	298	298
Saved fuelwool per household with efficient stove, thermos and solar technology	kg wood/year	3702	5702	3702
Saved CO2-Emission through effcient stove, thermos and solar technology	t CO2/year	5,29	8,14	5,29

For traditional kilns, up to approx. 6 tons of logs and thick branches are used per household per year.

The reduction of this wood consumption with the help of Appropriate Technology corresponds to a saving of approx. 8 tonnes of CO_2 emissions per year.

This corresponds to the emission of a car drive of about 50,000 km, more than the length of the equator (50,000 km * 0.16 kg CO_2/km) per year!

see article: http://solarcooking.org/Seifert (Publications, Sept 2016)

Press release of the
German Federal Environmental Agency
from 20.11.2018:

"High costs due to failure to protect the environment"

"One ton of CO_2 causes damage of 180 euros

Federal Environmental Agency provides updated cost rates "

https://www.umweltbundesamt.de/presse/pressemitteilungen/hohe-kosten-durch-unterlassenen-umweltschutz

4) Benefits of cooperation in the compensation of CO_2 emissions for host countries

School kitchen with "Three Stone Fire" in the Zaroli Monastery in Gujarat

Examples of possible compensation projects: Sustainable equipment of households, small businesses, schools

- Household energy equipment
- Equipment for school kitchens and school workshops
- Household biogas plants combined with solar cookers
- Small businesses: e.g. for preserving food, bakeries ...
- Gardens and nurseries with biochar sinks associated with soil improvement

Program example: Household biogas plants combinded with solar cookers

"Smoke-Free Villages" in India are examples of this type of projects

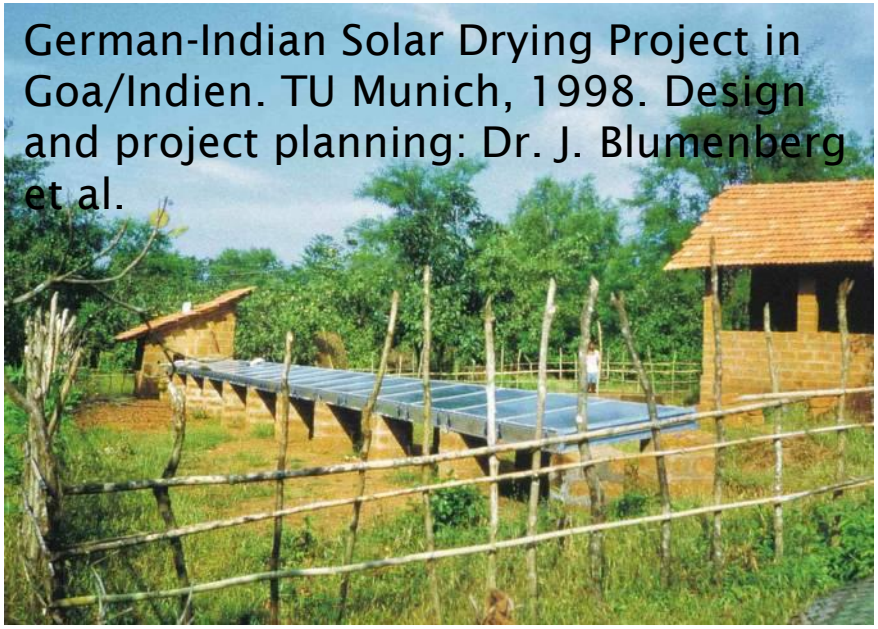
Source:
Deepak Gadhia and Jagadeeswara Reddy: „Smokeless Villages“

The parabolic solar cooker is more than just a cooking device

above:
Pastries by Imma Seifert for 400 participants at an "Encuentro Solar" of Fundación Terra, Barcelona

Program example:
Food preservation

„Estimates of production losses in developing countries are hard to judge, but some authorities put losses of sweet potatoes, plantain, tomatoes, bananas and citrus fruit sometimes as high as 50 percent, of half of what is grown."


German-Indian Solar Drying Project in Goa/Indien. TU Munich, 1998. Design and project planning: Dr. J. Blumenberg et al.

FAO: Prevention of post-harvest food losses: fruits, vegetables and root crops

http://www.fao.org/3/T0073E/T0073E00.htm


Preserving

5) Opportunities of combining climate protection and poverty reduction with voluntary compensation of emissions

What is needed is a simple, transparent process for generating Voluntary Emission Reductions (VERs) for holistic projects combining poverty reduction and climate protection

Source: K. Schulte, Rotary Schweden
SK14-Project Bamti Bhandar, Nepal

Two examples of portals for voluntary compensation of GHG emissions

ADES Association pour le Development de l'Energie Solaire (Suisse – Madagascar) cooperates with myclimate, Zürich

6) Garden settlements with appropriate water technologies instead of slums, camps and "reception centers"

It is a matter of
the solution of
the social question,
to which funds from
the compensation of
greenhouse gas
emissions can make a
decisive contribution.

Notes on the transformation of Africa into a "garden continent"

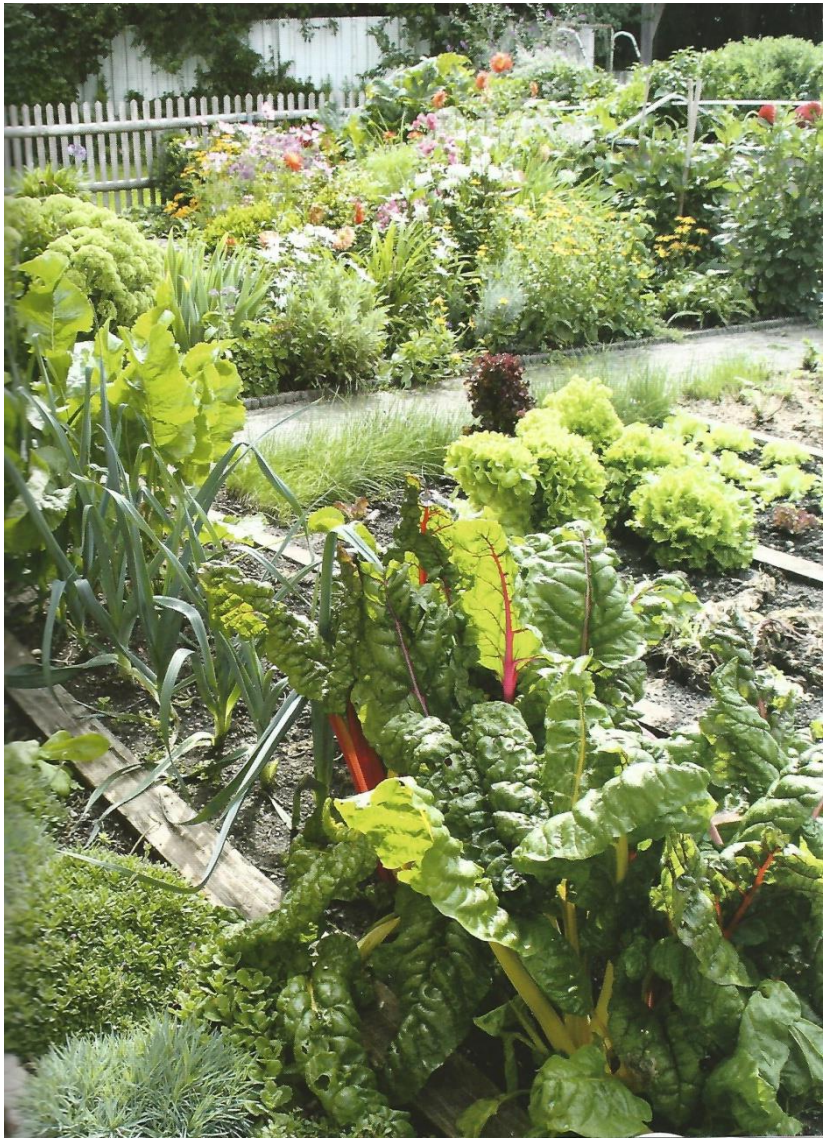
About space requirements of a pilot garden city

If 2000 family gardens with 500 square meters each are connected to a garden city with community facilities, then such a garden community has an area requirement of approximately one square kilometer

In addition, a 35 times larger economic area (35 sq km) (for cultivation of staple foods, trade, energy plantations, bio-carbon sequestration ...)

On an area of the size of Zambia (about 750,000 sq km) about 1/3 billion people could live (largely self-sufficient) in pleasant garden communities.

Role models: Cottage gardens

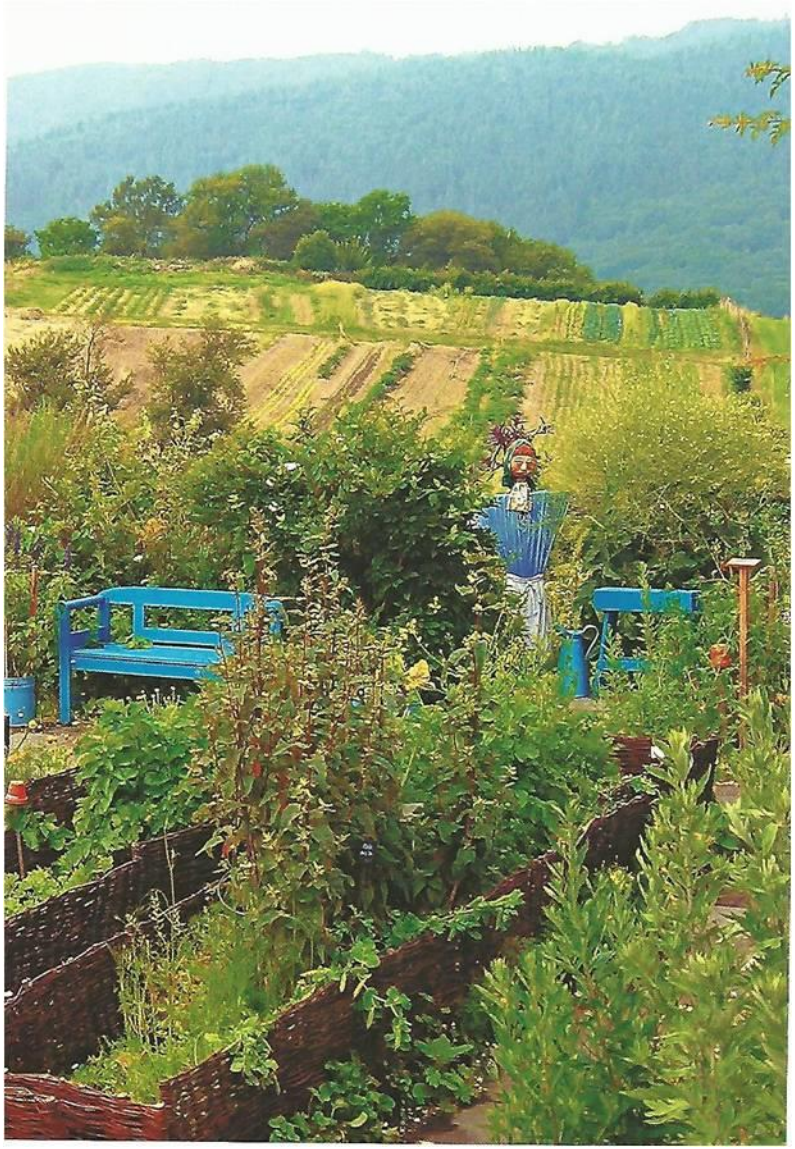


Children need gardens

Source:
R. Jarczok u. M. Backfischer:
Alte Handwerkskunst. Kapitel
„Grundversorgung mit Nahrung“

Dort-Hagenhausen-Verlag
www.aus-liebe-zum-landleben.de

Role models: Monastery gardens



The picture shows gardens on the Waldbreitenbacher Klosterberg above the Wiedtal near Coblenz as an example of the exemplary monastery garden tradition

Source:
M. Kauko, O. Lechner:
Orte der Stille –
Berühmte Klöster und ihre Gärten (Places of Silence – Famous Monasteries and their Gardens)
Ellert & Richter Verlag (2007)

Role models: City gardens

Garden of the museum Schölerberg, Osnabrück

https://de.wikipedia.org/wiki/Museum_am_Sch%C3%B6lerberg#Beschreibung

Poverty in Lusaka

Opportunities for gardens in drylands

Prevent and reverse desertification:

Gardens and gardening in drylands

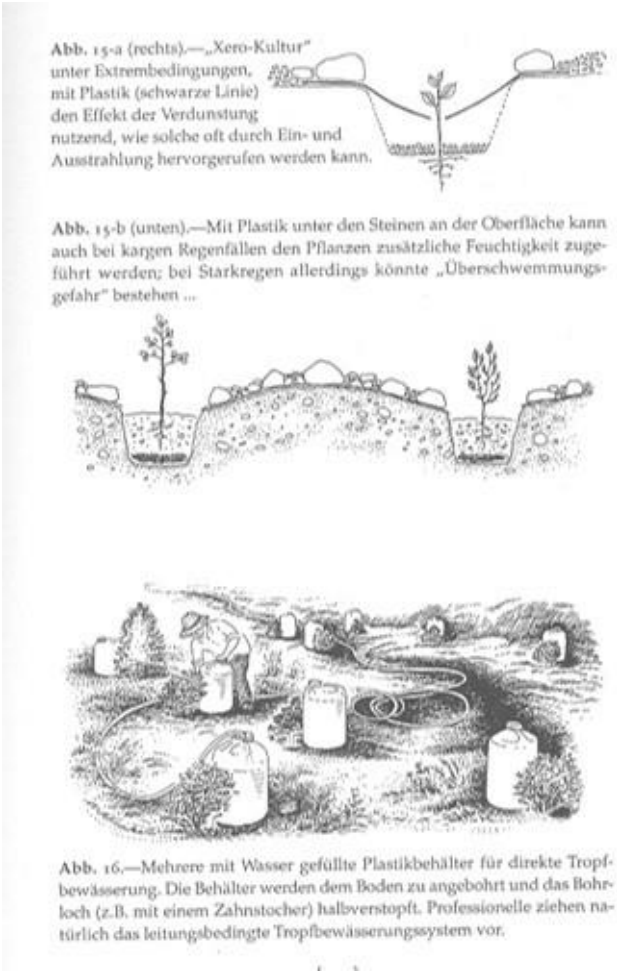


Abb. 15-a (rechts).—„Xero-Kultur" unter Extrembedingungen, mit Plastik (schwarze Linie) den Effekt der Verdunstung nutzend, wie solche oft durch Ein- und Ausstrahlung hervorgerufen werden kann.

Abb. 15-b (unten).—Mit Plastik unter den Steinen an der Oberfläche kann auch bei kargen Regenfällen den Pflanzen zusätzliche Feuchtigkeit zugeführt werden; bei Starkregen allerdings könnte „Überschwemmungsgefahr" bestehen ...

Abb. 16.—Mehrere mit Wasser gefüllte Plastikbehälter für direkte Tropfbewässerung. Die Behälter werden dem Boden zu angebohrt und das Bohrloch (z.B. mit einem Zahnstocher) halbverstopft. Professionelle ziehen natürlich das leitungsbedingte Tropfbewässerungssystem vor.

Günther and Mary Anne Kunkel:
JARDINERÍA EN ZONAS ÁRIDAS / Gärten und Gärtnern in Trockengebieten. ed. Alhulia, Salobreña/Granada
www.lafertilidaddelatierra.com ISBN: 84-95136-43-0

Bio-carbon as carbon-sink by storage in the soil of gardens and nurseries

Not only projects to reduce emissions are needed, but also sink projects where biochar from biowaste or invasive plants (such as water hyacinth) is produced and permanently stored in the ground.

School garden in the Institute for Rural Women of Dr. Janak McGilligan, Indore

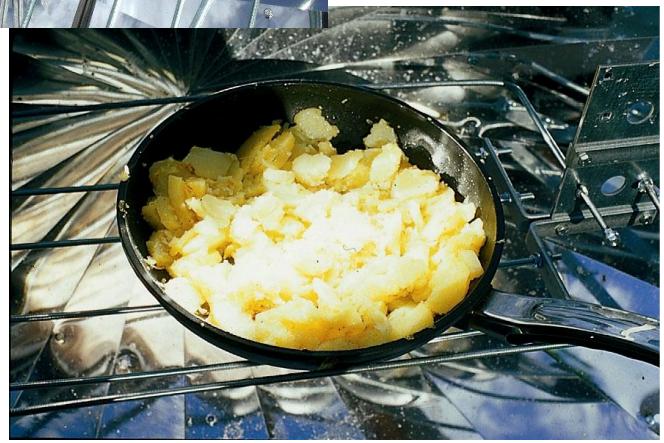
7) Ways out of the poverty trap by creating millions of jobs per year by Appropriate Technology and horticulture

Cost per OSAT workstation on the order of percentages (or less) of industrial jobs

Picture:
Project SOLIN, Bolivia,
of J.A. Garrido Vázquez,
Madrid






Example: Solar Restaurant

(above: GTZ-Solar Restaurant at WSSD Johannesburg 2002)

How can we overcome the barriers to spreading of Appropriate Technology?

- No spreading of "poor people technique"
- The criteria of Appropriate Technology (AT) should not become a real obstacle (for example, not just allow local material ...)
- So do not adhere to primitive manufacturing processes and materials
- Use funding sources
- Address institutional support and create jobs
- Use the opportunities of television, not just the internet

200 million efficient firewood stoves, thermos containers, solar cookers, PV-panels and LED-lamps

200 million times 1 kW = 200 Gigawatt (GW)
installed capacity, i.e. the output of
approx. 200 nuclear power plants,

with about 1/20 of installation costs, no danger,
no disposal problems, no ongoing energy costs,
with complete and easy recycling

A contribution to achieving the global development goals

Exhibitions for sustainable development

Encuentro Solar, Parque de las Ciencias, Granada/Spain

Exhibitions on sustainable development can help in the dawn of the necessary changing in our use of the resources of our planet.

and they can provide a forum for global peacekeeping cooperation.

"Each new workshop has been a source of immense joy, a point of hope from which the solar cookers, little by little, begin to radiate their magic."

Source:
José Angel Garrido Vázquez:
Hermano Sol – Guía práctica
para la producción
de Cocinas Solares.
Fundación Cultura de Paz,
Madrid (2008)

8) School solar cooker projects

Relation of solar technology to all subjects

practice teamwork

Project week Antoniushaus Marktl/Obb.

Solar cookers from kits

Production without special equipment (only spanner)

Large quantities in a short time possible

high quality and long service life

easy transport

especially suitable for school programs

can cook for up to 22 people

Kit of solar cooker „alSol 1.4“ (reflector diameter 1,4 m)

http://alsol.es/cocina-1-4/

School kitchens and school workshops

Equipping school kitchens in developing countries with highly efficient firewood ovens, solar cookers and thermos technology is an urgent task that has a particularly high potential for reducing emissions.

José Manuel Vílchez:
School Project in Barcelona

Renée Schulz: “Sonne macht Schule”;
Mohrvilla Munich

Sama Shrestha, CRT/Nepal

Summary:
Cooperation in overcoming poverty and lack of prospects in developing countries

A) Cooperation in the transfer of know-how and the overcoming of obstacles to the development and dissemination of freely accessible appropriate technology (Open Source Appropriate Technology OSAT)

B) Financing: Using opportunities to compensate for emissions and creating millions of jobs each year in developing countries with appropriate technology

C) Garden Cities instead of slums, camps and reception centers; bio-carbon storage in the soil as carbon-sink in the gardens

D) Solar programs for schools

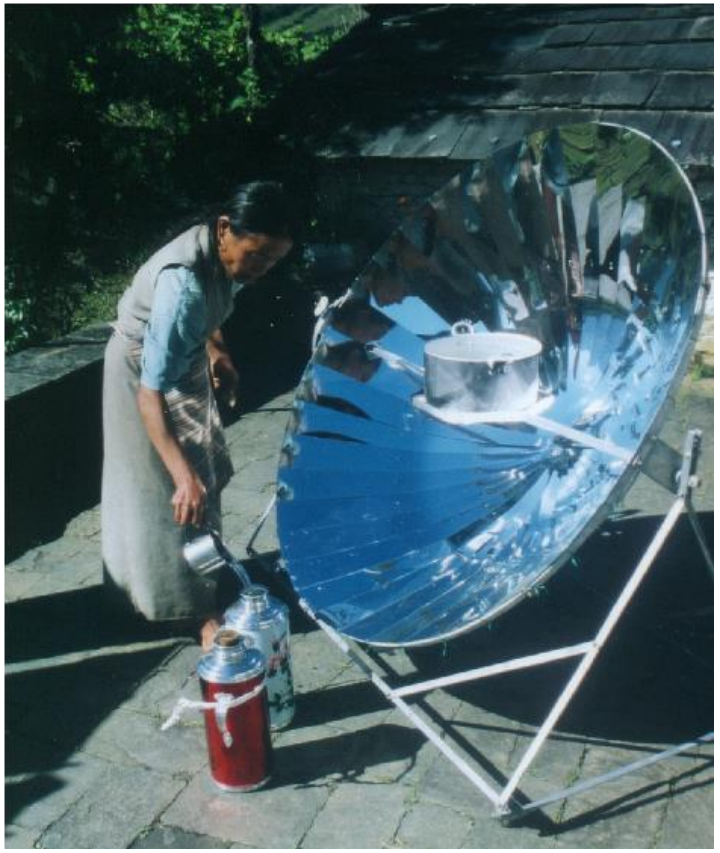


Photo: K. Schulte, Rotary Schweden
SK14-Projekt Bamti Bhandar, Nepal

Recommendations for the DBU: Showing opportunities for transformation

To promote a great traveling exhibition comprehensively presenting the opportunities and challenges of sustainable development: "Towards Sustainability"

To promote pilot projects for garden settlements (with bio-carbon sequestration and water technology), showing a way out of the environmental refugee crisis

To promote sample projects for school programs "Solar Energy in Theory and Practice"

Thank you

„"The future should belong to the gardens
and to the sustainable technologies,
not to the slums"

Garden on the edge of
the desert of Almería
of Günther und
Mary Ann Kunkel
in Vélez Rubio