

08.03_PH-SUMMER SCHOOL

THE VISION - "WIRELESS HOUSE"

Composition: Ernst HEIDUK

Language support: William GALLAGHER, Rob McLEOD, Michael WILLIAMS

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The "Wireless house" - is a concept for the development of energy autarchic buildings

By Dr. Robert Wimmer (AT) in cooperation with:
Arch. Werner Schmidt (CH),
Arch. Margaret Schwarz (IT)

Which demand do the occupants make?

- Light
- Communication (PC, Telephone, Mobil phone, ...)
- Cooking
- Warm water
- Space heating
- ...
- Cooling

=> But the occupant doesn't ask for electricity!

View from the supply side

- Most domestic appliances produce heat with electrical power
- For example: oven, dishwasher, washing machine, refrigerator,



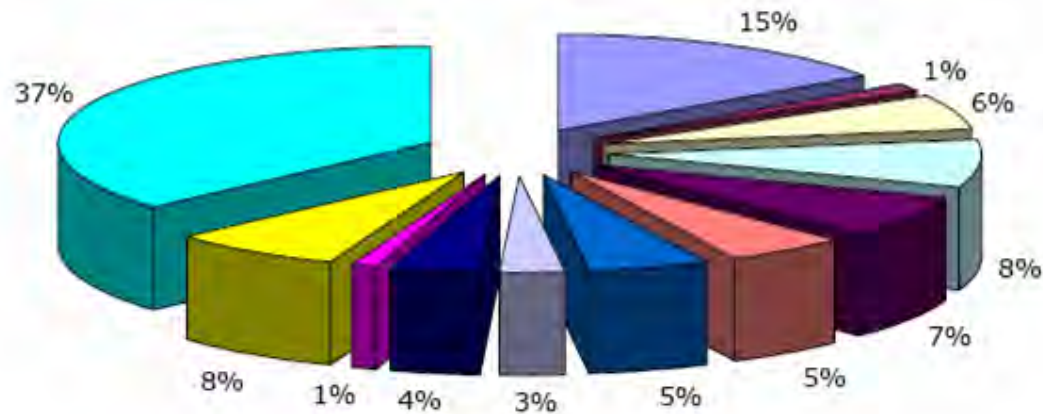
Source: GrAT, Robert Wimmer, TU Vienna

Energy consumption of an average household

Energy use in household	Energy consumption of an average household (kWh)		Energy consumption of a modern household (kWh)			
	total	electrical	total	electrical		
Kitchen stove	1.000	1.000	500	500		
Baking oven	78	78	39	39		
Washing machine	378	378	189	189		
Dryer	528	528	264	264		
Dish washer	456	456	228	228		
Refrigerator	333	333	167	167		
Freezer	356	356	178	178		
Small electrical equipment	170	170	170	170		
TV / HiFi-System	250	250	250	250		
PC	70	70	70	70		
Lighting	500	500	100	100		
Warm water	2.373	2.373	2.373	0		
Heating	14.000	0	6.000	0		
Total	20.491	6.491	10.527	2.154		

Source: Based on GrAT, Robert Wimmer, TU Vienna

Percentage of energy consumption of a household in kWh/a (without space-heating energy)



■ Cooking plates	■ Oven	■ Washing machine	■ Dryer
■ Dishwasher	■ Refrigerator	■ Freezer	■ Small electrical equipment
■ TV / Hi-Fi-System	■ PC	■ Lighting	■ Warm water

Source: GrAT, Robert Wimmer, TU Vienna

Electricity savings potential

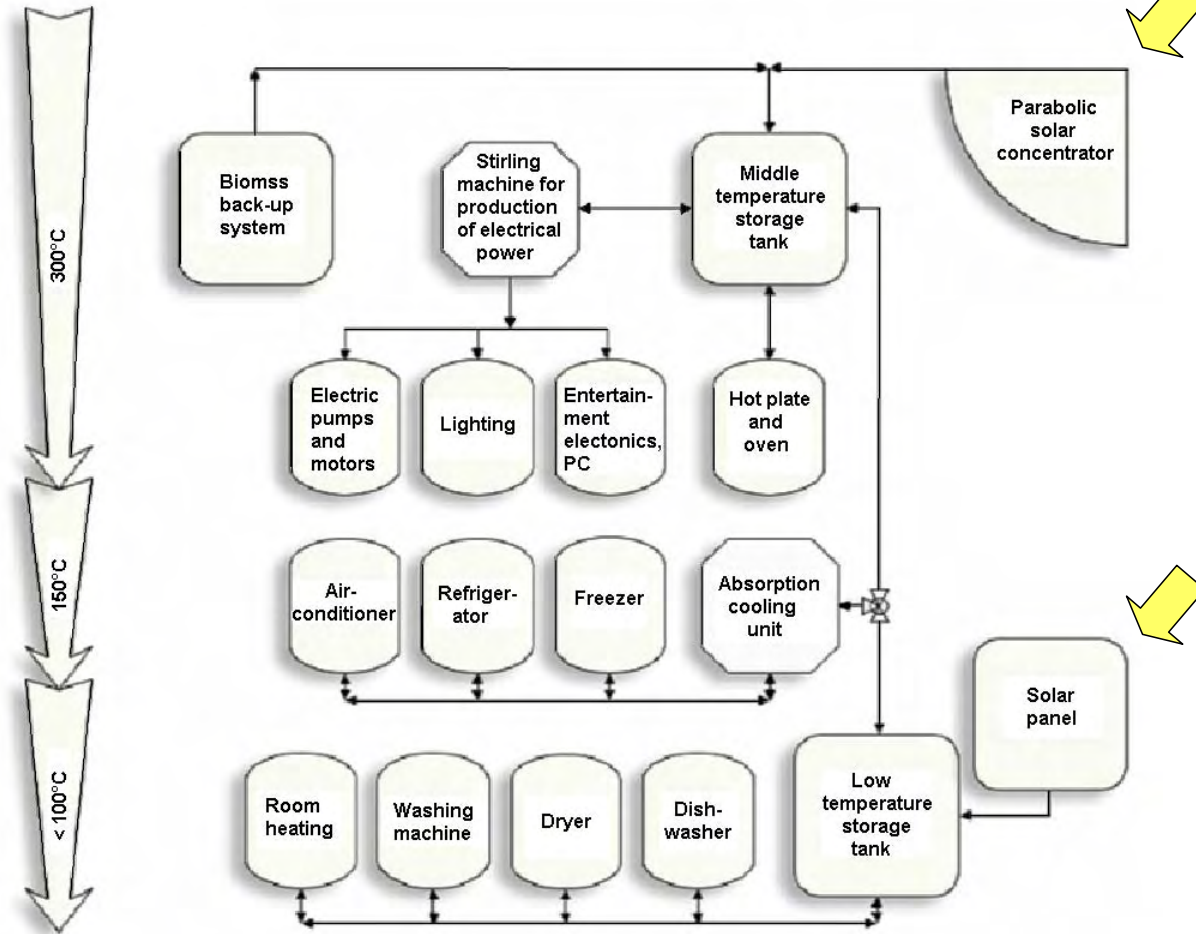
- The „Wireless House“ has an electricity savings potential for electrical energy of more than 80%!
- Substitution of electrical energy with thermal energy for all thermal appliances.

Source: GrAT, Robert Wimmer, TU Vienna

Energy consumption of a "wireless" household

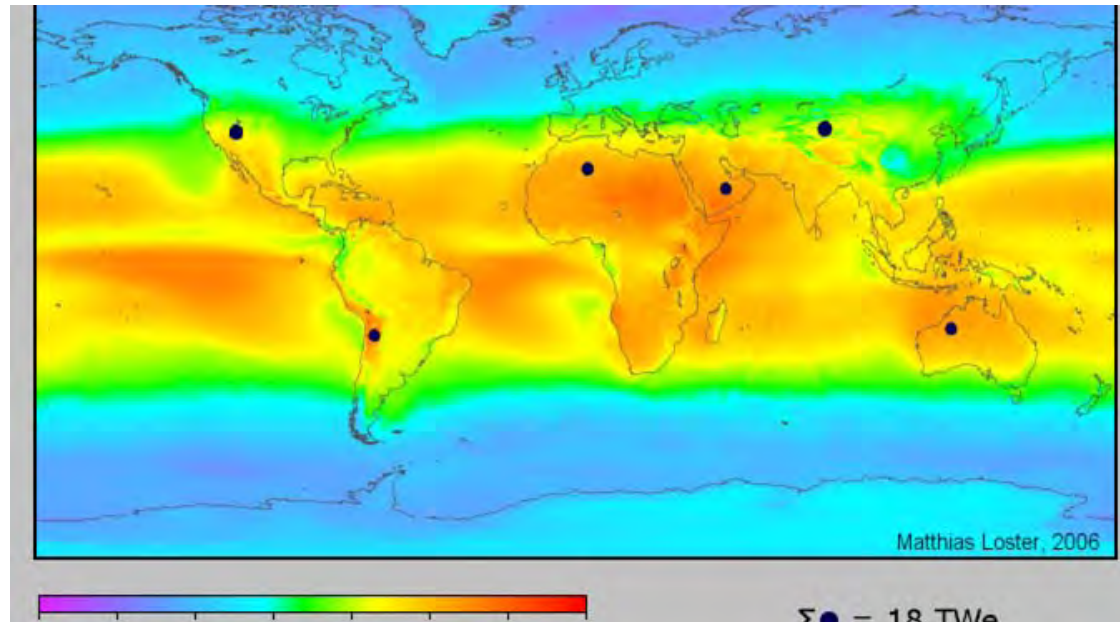
Energy use in household	Energy consumption of an average household (kWh)		Energy consumption of a modern household (kWh)		Energy consumption of a wireless household (kWh)	
	total	electrical	total	electrical	Total	electrical
Kitchen stove	1.000	1.000	500	500	500	small
Baking oven	78	78	39	39	39	small
Washing machine	378	378	189	189	189	15
Dryer	528	528	264	264	264	small
Dish washer	456	456	228	228	228	110
Refrigerator	333	333	167	167	167	small
Freezer	356	356	178	178	178	small
Small electrical equipment	170	170	170	170	170	170
TV / HiFi-System	250	250	250	250	250	250
PC	70	70	70	70	70	70
Lighting	500	500	100	100	50	50
Warm water	2.373	2.373	2.373	0	2.373	0
Heating	14.000	0	6.000	0	600	0
Total	20.491	6.491	10.527	2.154	5.077	665

Source: Based on GrAT, Robert Wimmer, TU Vienna



Source: GrAT, Robert Wimmer, TU Vienna

In 30 minutes the sun delivers more energy to our earth than mankind consumes in a whole year!



The dark spots represent the land area required to supply the primary energy demand in the year 2010 using currently available technology (i.e. with a conversion efficiency of 8%).

Source: http://simple.wikipedia.org/wiki/Image:Solar_land_area.png

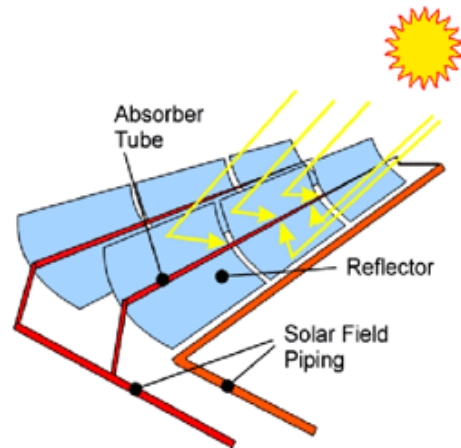
Thermo-solar strategy for the supply side

- Extreme reduction of transformation losses
- Thermo-solar energy is much cheaper than PV
- Thermo-solar is more efficient than PV
- Solar concentration for higher temperature levels in all thermal appliances of a household



Source: GrAT, Robert Wimmer, TU Vienna

Solar concentration for higher temperature

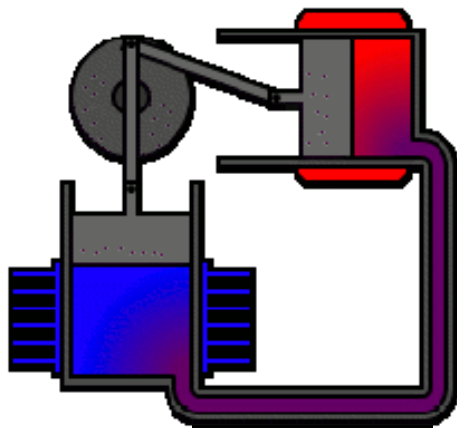


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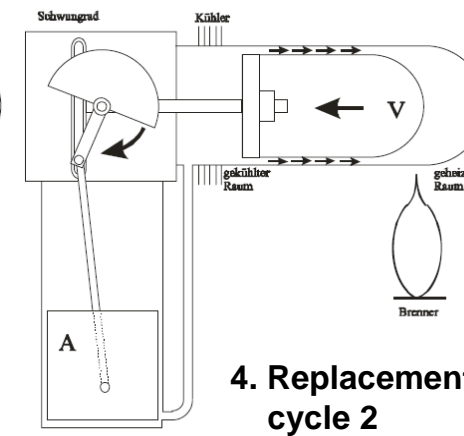
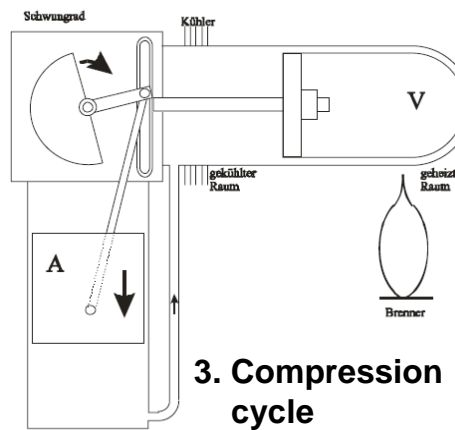
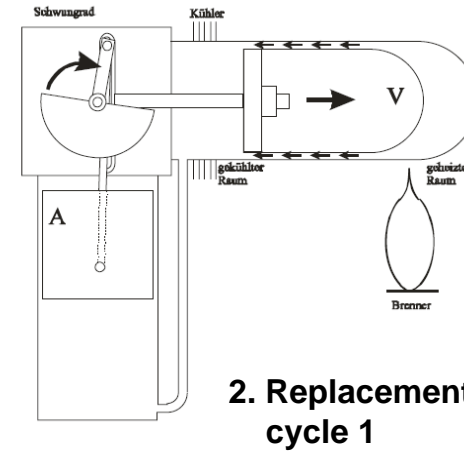
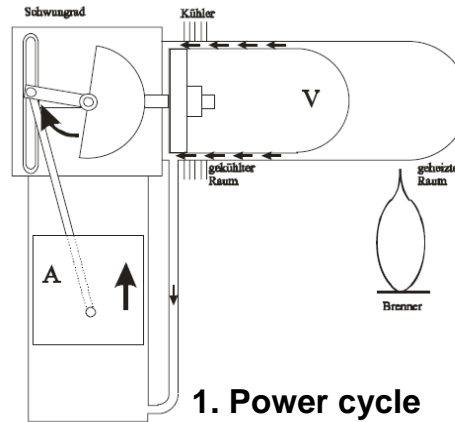


.... via a Stirling motor for electricity and the use of thermal appliances in a household

The "Sterling"-engine works with a warm and a cold side and can produce electricity.



The temperature difference must be more than 70 K.



Source: http://en.wikipedia.org/wiki/Image:Alpha_Stirling.gif

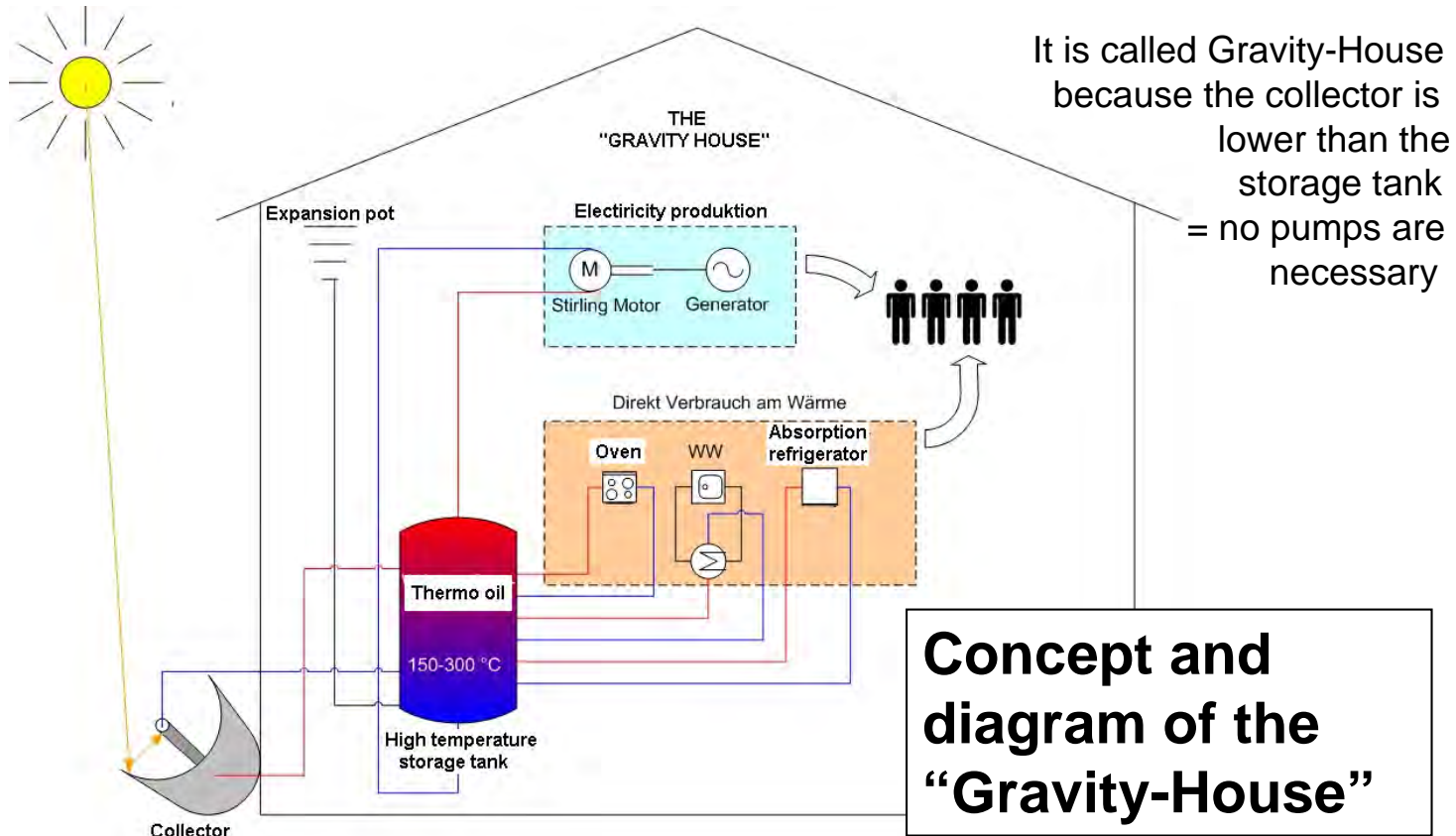
The heat of the sun can be used directly



Stirling engines can be powered by the heat of the sun.
Each mirror dish heats the Stirling engine at its centre with the sun's heat.

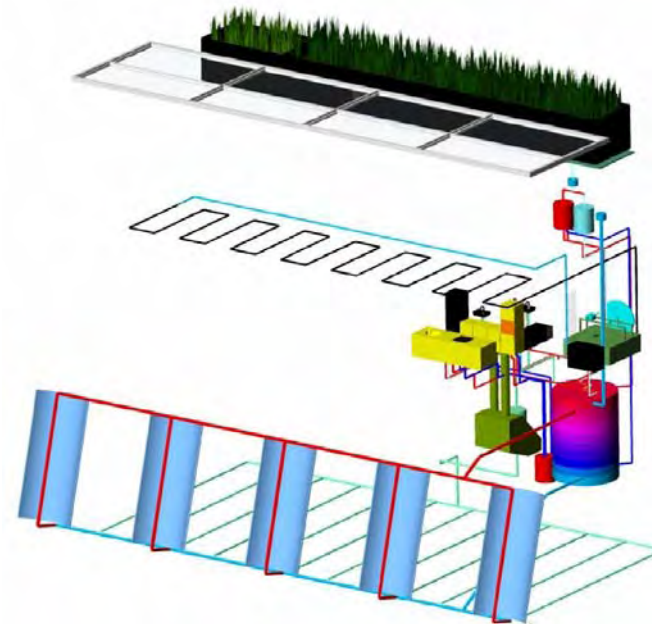
Source: http://simple.wikipedia.org/wiki/Image:Dish_Stirling_Systems_of_SBP_in_Spain.JPG

... or it can be used by heated up thermo oil



Source: www.fh-htwchur.ch/uploads/media/Konzept_Energiegewinnung_01.JPG

An autarchic living – concept in Switzerland



Concept: Prof. Christian Wagner, FH-HTW Chur (CH)
Realisation: Architect Guarino Felice, FH-HTW Chur (CH)

An autarchic living – concept in Switzerland



A house, independent of drinking water, waste water system connection, electricity and oil, which does not create any operating costs. Working exclusively with that which nature provides: Water, heat, cold, air and ground.

.... and it should be affordable for a family of five.

Concept: Prof. Christian Wagner, FH-HTW Chur (CH)
Realisation: Architect Guarino Felice, FH-HTW Chur (CH)

Source: www.fh-htwchur.ch/de/htw/bau/institut-ibg/projekte/autarkes-wohnen/

Cooking with "Thermo Oil"



In bakeries - Thermo Oil techniques
are used for high quality ovens
(using a central heating unit)



Source: www.webbaecker.de/r_branche/2004/1004MIWEthermoel.PDF

Cooking with "Thermo Oil"

For "normal sized" cookers there are actually no heating elements available.

Self-made test units with pipes for the thermo oil.



Source: www.fh-htwchur.ch/de/htw/bau/institut-ibg/projekte/autarkes-wohnen/

Cooking with "Thermo Oil" - absorption refrigerator (modified)



Source: www.fh-htwchur.ch/de/htw/bau/institut-ibg/projekte/autarkes-wohnen/

- Back up system when solar irradiation is insufficient
- Highly efficient biomass stove
 - delivers thermal energy in the upper and middle temperature levels
 - high user comfort
 - simple handling
 - heat collected in the outer 'skin' can be used to post-heat the ducted air supply



Source: GrAT, Robert Wimmer, TU Vienna

- This strategy will work for “southern” countries very well,
- for “northern” countries we will need more “back-up” energy (Economical solutions to this problem are still an open question !)