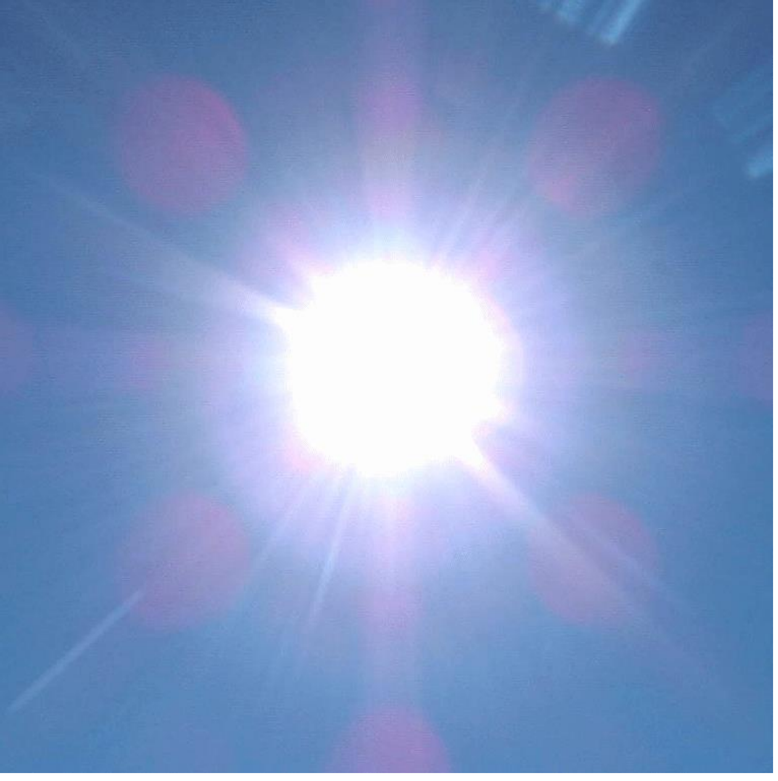


(0-) Energy

Definitions in relation to buildings:
(0 in below definitions refers to zero non-renewable energy)

Renewable energy: All energy that can be regenerated within the time of use, mostly from streaming resources Sun Water, wind geothermal. (and is regenerated, otherwise its not renewable)

0-energy building: All building related operational energy (heating ventilation, lighting) comes from renewable sources generated on the building or building plot. A grid connection is accepted to balance over or underproduction (the net as temporarily storage)

Energy-neutral building : All building related operational energy (heating ventilation, lighting) comes from renewable sources either generated on the building or building plot, or from distant renewable sources,, like wind turbine parks or hydropower installations.

Energy autarkic building : all energy is harvested and generated within the building plot, with no connections to the grid or whatsoever: . Stand alone operation.

Embodied energy (of a building): all energy invested in winning, processes and transporting materials and products incl installations, used to erect the building. Calculated as end use demand, not a s primary energy and normalized for m2 useful floor area.

Exergy: the potential of a resource to produce work (labor, power, to change , to move or to speed up things) . Different forms of energy have different exergetic capacities.
A simplified calculation is in the form of the amount of solar radiation (in m2-year) needed to provide a certain function or service (for instance a trip from A to B, building a m2 floor, etc) (see also MAXergy)

EPBD
Near 0-energybuilding: The EU- directive called EPBD, requires member countries form 2018 on o have all public buildings outfitted as (near) 0-energy buildings, and all new buildings from 2020 on. Practical use: all buildings are designed as 0-energy building, or retrofit plans for renovation, and in actual execution not all measures are applied (the “near” option: for instance not all PV panels are installed due to delayed investment.)

0-energy retrofit of detached houses, (so called “energy invoice less houses”) part of “renovation rapids program

Guiding principles in order of importance, for all applications. Product service or building:

1 avoid demand for energy: (living near work, passive design)

2 integrate labor in services (hand pushed door, bicycling)

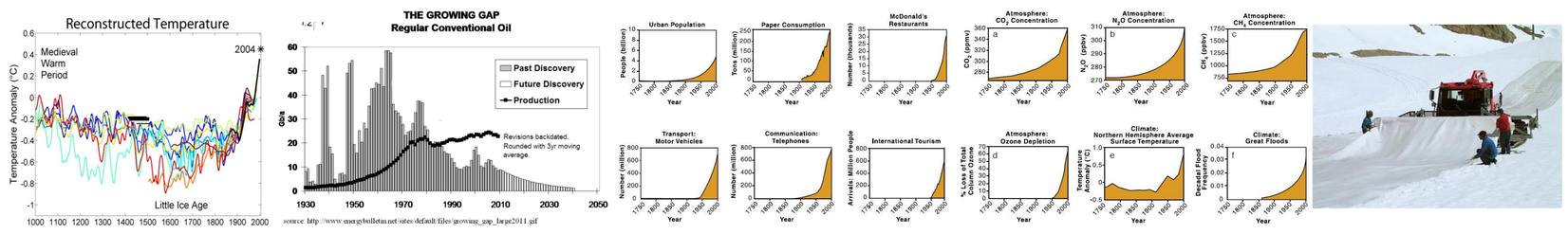
3 re-evaluate functions and re-organise (laundry cleaning: local shop instead of individual machines)

4 reduce energy demand for necessary processes (insulate houses , ovens etc)

5 introduce renewable energy (PV of roofs, sails on container ships)

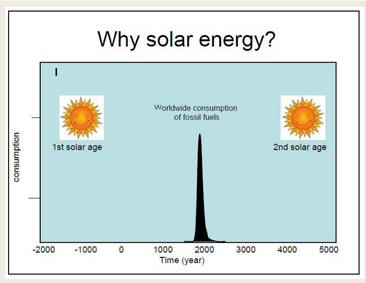
6 optimise for land use in time, for food, energy and materials (biobased economy) see MAXergy poster

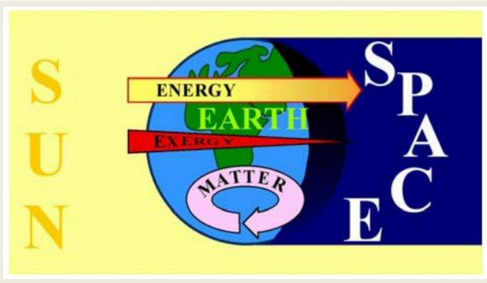
The world is at fire. Literally, if you sea what is combusted and fills the air with smoke and smog, via coal power plants, wood stoves in Africa, cars in cities, and defrosting swamps. But even more by way of speaking: food prices rise in competition with biofuels, the weather related disasters are rocketing, there is turmoil around material stocks, governed by a handful of countries, millennium targets are behind schedule, oil production cant keep up with consumption, and the economy of industrialized world countries is a mess. Fossil energy, the driver behind “development” , is itself cause of the problems, first by environmental and climate damage, and when it runs out, chaos in society. At this very moment alle systems are exploding or are about to do so. If its about population, the amount of Macdonald's, or etc or etc. Its all about energy, and how we manage it.

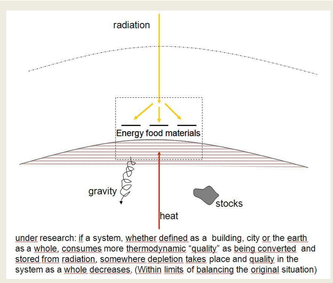


From left to right: Global temperature development; discovery and consumption of oil stocks; International research shows explosions in many fields; glaciers in Switzerland are packed during Summer, to avoid too fast melting(for tourism)

“Solar radiation, and induced flows (like wind and water) , are the only net contributors to the earth energy budget , All others deplete stocks, and are in some form harmful to our environment.”







Society, or better the world was once fully organized around solar energy (especially food-labor and wood(burning) , and will that way again somewhere in future. In between we deplete all solar energy stocked in in millions of years in coal oil and gas via biomass.

Energy will never get lost. However the quality to do something with energy (to deliver work, to change things) does get lost. We call this Exergy. (usually energy ends up in usefulness infrared radiation into space. And the only addition to the earth capacity to function, is by a constant flow of exergy in the form of solar radiation. .

Without the sun, and Solar radiation energy , the earth very soon would be frozen and uninhabitable . It all comes down to how smart we are to produce food and materials form solar radiation, for which land is needed to intercept and convert that flow.
A little bit of gravity can help, as well as some floor heating from the earth core heat flowing up.
The stocks of oil gas and coal are temporarily, and depleted, sooner or later. In any case.

“If all energy is generated from renewables, energy is not an issue anymore. By then the only issue is to optimise the materials input, to harvest and convert renewable sources. “

Application/products: Energy in fact does not have a closed cycle ! We can only take care not to use more then is daily captured from solar radiation, thus creating a eternal balance. Which will leave some of the oil available as resource for some highly needed materials and medicines. The transition towards unlimited renewable (streaming) resources,, will require a lot of creativity in providing daily functions: change for e-cars, or car-sharing as an example.
In the technical application its about developing new systems and functions , which can work without fossil fuels, and introduce these in say the next 40 years. Think of retrofitting all houses for a 0-energy performance! (255 million in the EU alone) .

From left to right: Services, electrical car-sharing, Amsterdam; Vegetable greenhouse on the roof of supermarket, Montreal, Canada; Stealing solar power from the neighbors-shadow by empire state building, USA; 40% energy reduction by use of a sail-parachute; Solar mirror plants for High temperature and power -Julich Germany; Future flying turbines, In permanent airflows.

Energy and Storage
Most streaming renewable energy sources do not have a constant flow. This requires either a living pattern that is adapted to the availability of energy or solutions for (temporarily storage. Water basins at height are a solution, like in Norway, but for most countries this is a challenge. Phase change materials might provide a partly solution (heat in salt) or batteries. For seasonal storage , mainly for electricity, its still a quest. Hydrogen has the best papers (but with efficiency losses of course

Energy and labor
Energy consumption starts with labor: the food, needed anyway, supplies a person with energy, to make work (to change things) . Bicycling is a nice example of labor energy. Other energy sources are required, that can deliver pressure, heat , or electricity. The best energy saving measure therefor is unused energy or use of labor energy: A hand pushed door instead of an electrical door, or a hand pushed revolving door. This way there are many practical solutions, not needing limited energy stocks.

Energy conversions
Energy is constantly changed from one form in another, with losses in potential work/power as a result. Its a main task to limit these losses : by double use of energy (like heat & power coupling, or PV panels integrated with hot water supply) , and/or choosing the best type of energy for a specific task: a solar panel produces 12 V : better to couple a laptop directly, instead of first making 220V an then use an adapter to make 12 V again, like is currently the case.

Materials and energy
To use (renewable materials for energy generation, is destroying of quality: We need materials as well, and mass should remain mass, as long as possible, is the principle. First provide a useful function as a material, generating energy can also after service life (the energy content does not get lost) Production of materials also requires energy , which is termed Embodied energy. Different materials for the same function can have large difference sin embodied energy: always compare, per function delivered (not per kg)

More background in:
Rovers R. et all, 2011 , Designing for only energy: suboptimisation. PLEA conference 2011 Louvain la neuve, Belgium
Without the hot air, book by David MacKay , downloadable at http://www.withouthotair.com/
MAXergy documents, see www.sustainablebuilding.info/maxergy
Het autonome huis: ebook: http://www.hetautonomehuis.be/e-book/?expandable=0

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