

A sustainable energy supply for everyone

A faint, dark blue silhouette of a person standing with their arms raised in a 'V' shape, set against a dark blue background.

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Chairman of the Board
30 January 2009

There is no energy crises

- Energy efficiency world wide is about 2%
- The sun gives us in one hour more energy than the world consumes in a year
- Renewable energy is everywhere but dispersed.

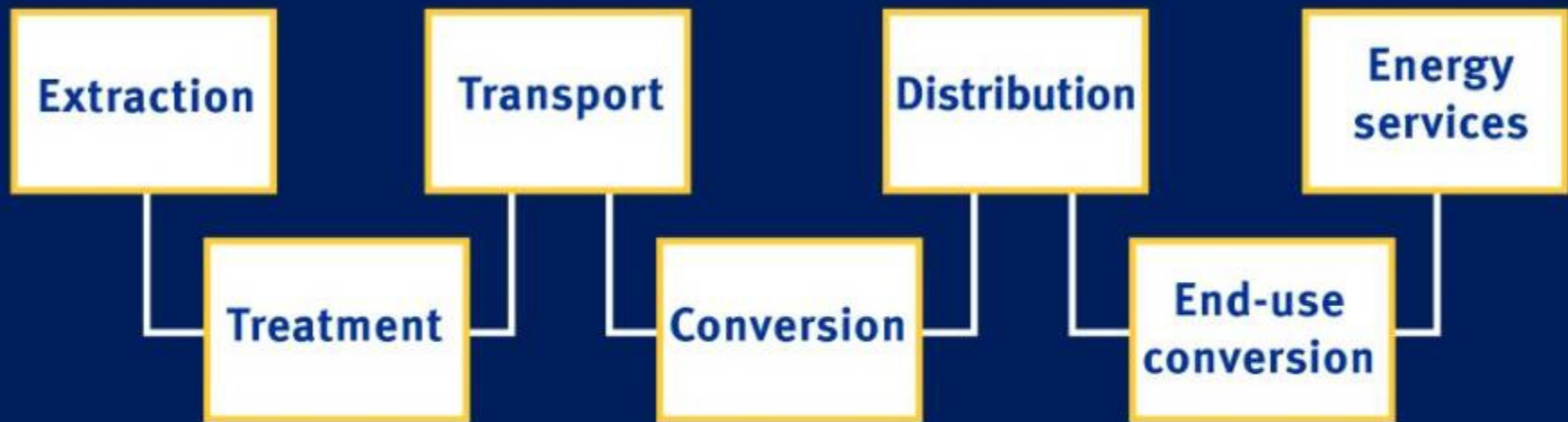
Solar doorbell



Flows of solar energy

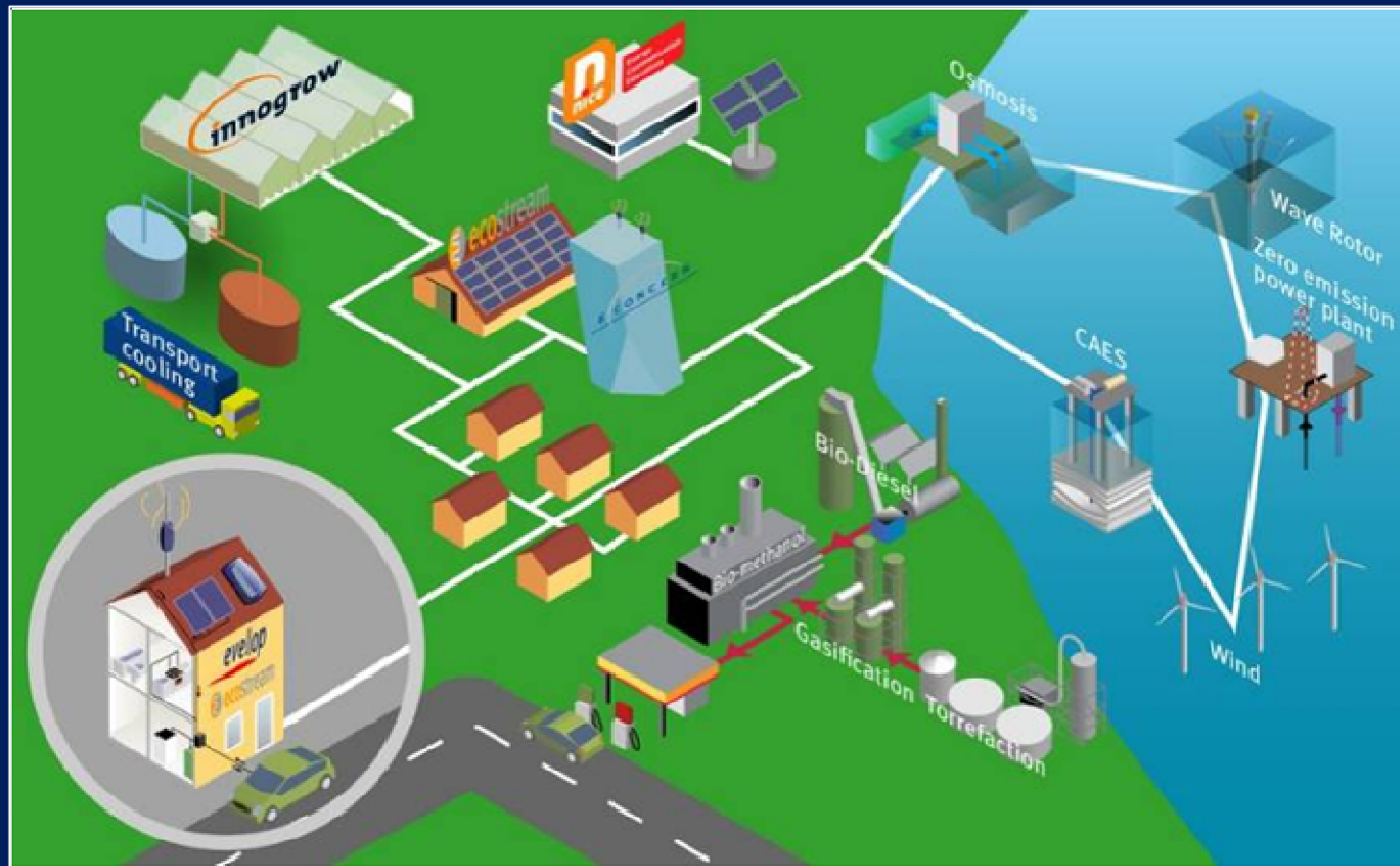
Solar radiation intercepted by the earth	5.450.000 EJ/yr
Solar radiation reflected by the earth	1.640.000 EJ/yr
Solar energy involved in direct heating	2.550.000 EJ/yr
Solar energy involved in evaporation	1.260.000 EJ/yr
Solar energy utilized in photosynthesis	3.150 EJ/yr
World wide energy use 2007	500 EJ/yr

Traditional energy chain From source to service



Sources <--> Technologies <--> Currencies <--> Technologies <--> Services

The sustainable energy chain



Energy system has to be re-invented

- Traditional thinking and technology innovation based on energy chain, from supply to services
- Useful way of thinking when resources are condensed and concentrated in certain areas, like oil, coal and gas
- A sustainable energy system requires another philosophy, in which the energy services are leading and not the supply
- Renewable energy production technology has to be integrated in products, services and systems, because renewable energy is everywhere and not very condensed
- Innovation is needed, but a system approach instead of a technology approach is needed.

Where do we use energy for?

World wide energy consumption	% of total
Climate (heating, cooling,..)	25 - 30
Transport	25 - 30
Electricity	15 - 20
Other	25 - 30

Sustainable energy producing buildings

- Buildings use energy for climate (heating, cooling, ventilation), lighting and various apparatus
- A sustainable energy building can be developed by using the sustainable trias energetica
 - Reduce energy consumption, insulation, heat recovery, low temperature heating
 - Use local renewable energy sources, heat pump, solar boiler, solar PV, urban turbine
 - Buy centrally produced renewable energy; electricity, green gas.

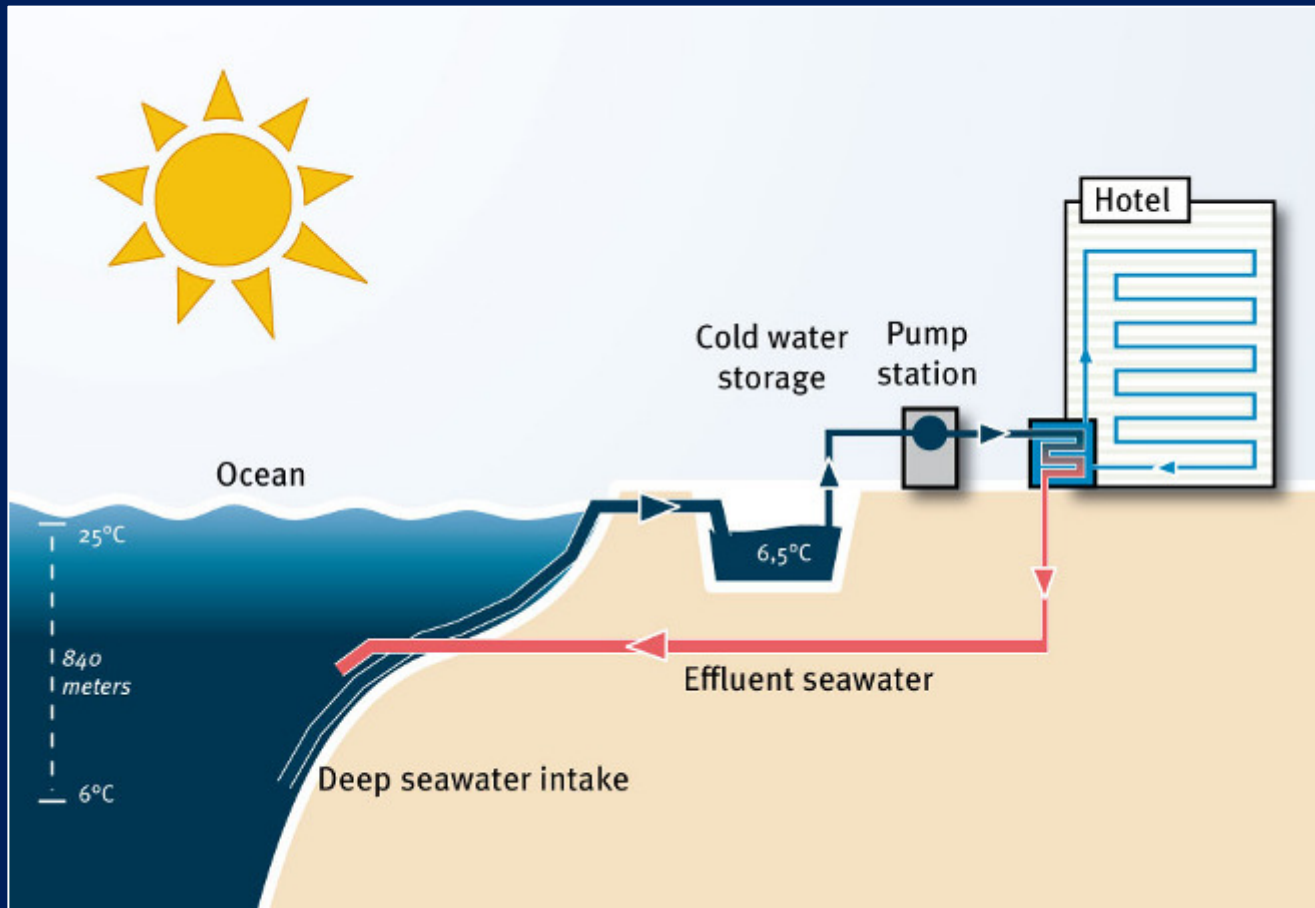
Sustainable energy producing buildings

- The sustainable trias energetica can lead to a sustainable energy building. But we could do it even better by taking into consideration:
 - Heating and cooling is not an energy problem, but a storage problem
 - Even lighting is in principle no energy problem but a storage problem.

Cooling buildings

- Around the equator we need to cool our buildings the whole year.
- 50% of all electricity in these area's is used for cooling (air conditioning).
- But why do we produce from electricity cold water if there is a cold water resource available in the ocean?

Sea Water Air Conditioning



Distributed sustainable energy

- In the future energy supply, consumers and companies can also be energy producers and feed into the grid
- Electricity could be produced by solar systems, small wind turbines, micro-(co-)generation (biomass) plants
- Fuel cell cars can produce electricity and deliver it to the grid as well
- Electric cars can store electricity in their battery system, which can be used to feed in the grid in order to balance supply and demand
- The new energy infrastructure will therefore link electricity generation, heating / cooling and transport.

Virtual power station

- 7 million cars in the Netherlands times 50 kW is 350.000 MW, which is over 20 times present capacity
- Cars are in operation 7% of their time



The sustainable energy system

- Will be a total different energy system for which a paradigm change is necessary
 - Services not supply is leading
 - Systems innovation not technology alone
 - Intelligent, multi-functional and 'internet-control'
 - But above all sustainable.

Lessons learned

- A sustainable energy system requires of course new technologies and systems, but it requires also new business models, new financing models, new regulations and new infrastructure, both the hardware as well as the software.
- Implementation requires much more co-ordinated action, with task forces that have ultimate decision power
- Be creative, think out of the box and be persistent