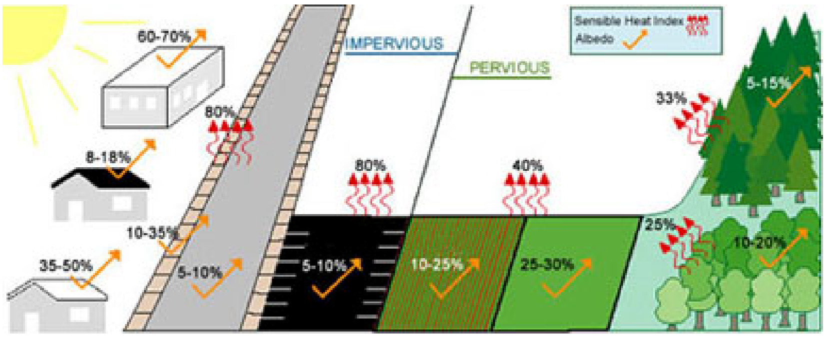
Heliosyn
Dual land use in photovoltaic power plants

PV plants cover large surfaces. The overall energy production of the site is week, most radiation is reflected and stipulates global warming.

PV plants produce energy in different climatic regions. Land cover in mediate climate is forest/shrub/grassland.

Best radiation instead coincides with bare rock, sand and stony soil land cover with ca. 80% radiation reflection.



The transfer of construction standards into different habitats modifies the environmental impact of PV plants. Without plant cover the power plant will contribute to desertification through the unsealed surface or further climate heating caused by soil sealing . With plant cover further solar potentials is sequestered in grassland beneath the Panels.
The potential of solar radiation exploitation on site can be improved with a photosynthesis power plant. This CO_2 sequestering process requires water to start its solar powered self-reproduction cutting the floor heating by half, partly by $2/3^{rd}$.
The PV plant site will be designed as a water harvesting area storing mineral free rain water. The decentralized appearance of rain and humidity will be managed. Water run offs will be reduced to a minimum and manageable storing units will be constructed. Water storing units and distribution pipes are the only relevant cost factor of the Dual Use. Winter rain fall water collection per m^2 will not only fill the reservoirs, most of that collected water can be distributed to natural surface and subsurface storing facilities.

Water availability on site results at first in evaporation, together with designed plantations in EvapoTranspiration, ET.
ET increases the humidity gradient resulting in a cooler micro climate. Today ET research focuses on microclimate generation in agriculture and urban planning.
In agriculture two physical processes, the Irrigation Cooling Effect, ICE, generated by the Vapour Pressure Deficit, VPD are calculated to create an optimum microclimate for plant growth.
In urban centre planning ET is a viable tool for energy consumption reduction. Greening the roofs in a town and covering 12 % of surface with trees would reduce energy consumption in the northern hemisphere by 30% in summer and 20% in winter[1]. The same study determines the atmospheric cooling effect in 2 m height, with reference to the VPD, up to minus 50% of equivalent environmental temperature above bare land.

There is no scientific reason, why an ET based microclimate inside a PV Plant will interact with the physical environment in different way..
It has to be estimated instead, that increased ET above soil surface will result in condensation under the panels at the hottest hours, the hours, when panels above bare ground are at its weakest. PV panels above bare ground reach surface temperature of 90º or more. Inside temperature will be higher, due to the electric processes. The hotter the panels get in Dual

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Use, the higher is the VPD at their surface. This implies that cooling efficiency grows equivalent. Panel inside temperature will be lower as Panel outside temperature above bare ground due to the exponential higher specific heat rate of bare soils.
The system is estimated to increase energy production by 3 to 5 % with less than 1 % additional investment by avoiding heat losses. Heliosyn exploits physical land use - climate interactions in a Dual Land Use system based on a unique new designed land born water cycle.
Scientific data concerning efficiency improvements in Dual Use PV plants are not available yet. The implementation of Dual Land Use with Heliosyn at industrial scale in the southern hemisphere is an Scientific data concerning efficiency improvements in Dual Use PV plants are not available yet.The implementation of Dual Land Use with Heliosyn at industrial scale in the southern hemisphere is an innovation and a step forwards in output optimisation with simultaneous land use value improvement for sustainable development.

Impacts on the physical environment and social space and costs of HELIOSYN Dual Use PV power plants

Physical impacts

Dual Use defines a second use of the surface needed for PV plant installations by adding an independent water cycle to the electrical installation. In consequence land cover with plants is possible. The impacts of land cover are researched sufficiently to apply them with equivalent results to be expected in other physical environments.

- Stored water for maintenance purposes is always independently available on site.
- Independent fire protection
- No soil erosion
- Cooler micro climate
- Lower module temperatures
- CO_2 reduction
- Biomass production
- Fostering biodiversity

Social impacts

Nearly all PV plants will be installed in rural areas with the equivalent social space.
The better the radiation, the less water is available in the area. Due to the missing water table management in Greece and Southern Europe/ Northern Africa, conflicts on water distribution are foresaid for the upcoming years. " Water comes from the Tab" is an insufficient solution under this perspectives. The calculated 20 years live time require the not competitive integration of PV installations in the rural society

Dual Use presents mutual benefits for the social space.

- It is an example of good practice in land management
- Dual Use PV plant green the environment of deserted, or in danger of desertification, landscapes.
- Dual Use eases the permission process due to its European Environmental Policy coherence
- They do not charge the water supply of the agricultural community
- They provide fodder for life stock of the agricultural society
- They provide durable working places in the rural social space
- Caring for the earth is a transparent marketing asset.

Costs

PV plants cover large surfaces. Maybe hundreds of thousands m3 water in a single day. As such landscape architectural designs incorporating environmental impacts over time are essential.
The green of an airport has a different conduct in water absorption as the green of an airport covered with a large PV plant. During construction the green has been compressed. Surface cohesion during strong rainfalls lead to huge amounts of water running down the modules to penetrate the soil just below the lowest module row on the mounting structure. Building architectures operates with half pipes at each roof, knowing that the falling water may harm the houses fundaments. Module mounting tables are same sized like roofs, but no protection measures are applied.
Instead of equally distributed precipitation, the surface is penetrated with unequal chaotic water distribution. Places with nearly no direct precipitation meet places with water discharge quantities dissolving the soil structure in shortest period. Over time this generates a chaotic run off system resulting in mounting structures partially disconnected from the soil. Already to be seen in PV installations in Germany with 3 years of live time. The management of this damages for the next 17 years is a lasting burden for profits, as cable channels will be infected too.
Due to the need for landscape architectural planning and Dachrinnen (half pipes) in order to avoid erosion damages over time, Dual does not involve additional costs on this items.
The additional costs for Dual Use equipment to achieve the above mentioned benefits, related to conventional plants, amount to 90Euro/Kwp.

[1]Energy and Environment Directorate Lawrence Livermore National Laboratories, CA
Department of Global Ecology, Stanford, CA

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