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Renewable Energies – Landscapes of Reconciliation?

Renewable energies reduce changes in landscapes and shifts in land use zones. Unlike conventional power plants, renewable energy installations can overlap with existing structures and generate synergies. Developing these synergies is a task for landscape architects.

The production of renewable energies is increasing all over the world. But regardless of how prevalent the new installations and crops become in the landscape, the most radical landscape changes are caused by other forces: the growing world population, advancing development and modernisation, and the enormous consumption of land and resources. On the other hand, climate change is leading to changes because land use zones are shifting. But that is harmless compared to the nascent fertility of former frost zones and the devastation of Mediterranean soils. The shift in land use zones also causes the displacement of habitable settlements in rural areas. But these dynamic cultural processes are clearly outdone by the increasing disasters in urban and metropolitan areas, particularly in coastal zones and deltas.

The driving forces for changes in the landscape are thus climate change, the growth of populations and economies, lifestyle transformations such as increased meat consumption and mobility, technological development and social conflicts. In world regions where energy consumption is highest or rising most rapidly today – in the USA, China and India – coal mining and crude oil extraction continue to be responsible for the biggest landscape changes.

Why do we set our sights on renewable energies nevertheless? From the point of view of landscape architecture, what makes renewable energies so interesting is the fact that they do not usually involve the total breakup of existing structures but can be fit into available landscapes. Unlike coal, oil or nuclear power, they do not create areas that are off limits.

Instead, they can overlap with other uses, such as habitational, agricultural, recreational and conservational ones, developed in socially, ecologically and aesthetically intelligent and coherent ways, and allowing tolerable ways of life even in areas outside metropolitan regions.

Classifications and trends

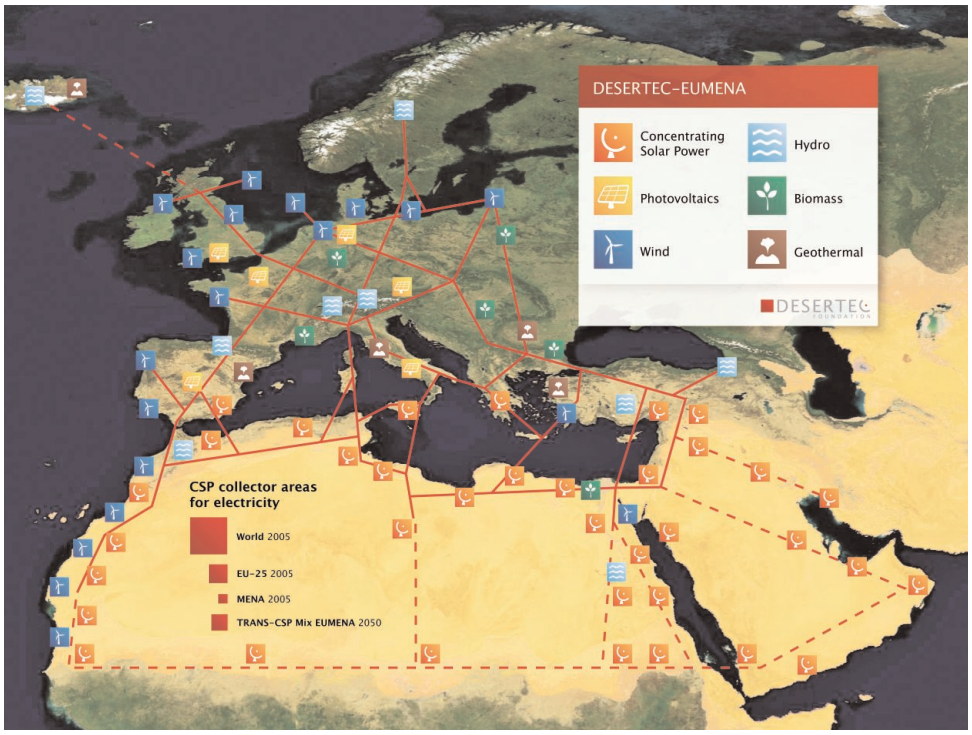
The use of renewable energies is a global activity. Apart from a few exceptions, namely geothermal power and tidal power, the entire range of renewable energies is based on solar irradiation. From the physical point of view, the exploitation of the sun's energy can be classed under three major groups that have specific effects on landscape development.

Photovoltaic systems and solar thermal collectors in temperate latitudes as well as solar thermal power plants in subtropical latitudes use the solar irradiation right on their surfaces. Photovoltaics have been heavily subsidised in the USA and Japan, most recently especially also in Spain and Germany. In Bavaria, solar panels on

Andasol I and II in Spain's Sierra Nevada are Europe's first solar thermal power plants with parabolic trough collector technology. Delivering 50 megawatts of electricity each, they serve as an example for the Desertec megaproject.

every tenth roof are part of the familiar townscape by now. There are 5,800 hectares (14,500 acres) of solar collectors and arrays of cells on German rooftops (in 2008) as opposed to only 1,700 hectares (4,250 acres) of open-space facilities on the ground. Several large solar parks, up to 170 hectares (425 acres) in total area with 50 hectares of purely module area, are nearing completion. In Florida last October, President Obama opened the biggest American park of this kind covering 70 hectares (175 acres). Likewise in the United States is the world's biggest solar thermal power installation with parabolic trough collectors. The nine plants on a total of 650 hectares (1,600 acres) in the Mojave Desert in California provide a foretaste of what is probably the most ambitious renewable energy project for the time being. The Desertec initiative of the Club of Rome is to introduce power supply for humanity from solar thermal installations in deserts. Unlike photovoltaic systems, solar thermal ones can also deliver power at night. Twelve million hectares (30 million acres), the equivalent of three thousandths of the world's desert lands, or 20 square metres of desert per person of today's world population, would be used for construction and linked to inhabited regions via direct current networks. But even these daring projects continue to stake on renewable energies also in temperate latitudes if only to maintain independence for highly developed urban societies. Such regions must stake mainly on the second solar energy group, which exploits the dynamics generated by solar irradiation on the earth. Global temperature differences between the equator and the poles are constantly being balanced by aeolian and hydraulic currents, usable in the form of wind, wave and hydrodynamic power. The natural circulation of water can be used above all for hydroelectric power plants as well as osmotic power plants. The special feature of systems in this second solar energy group is that, until now, they depended only secondarily on surface area but primarily on morphological borderland zones, exposed areas such as mountains and coastlines, and for economic reasons they will continue to do so. In these borderlands, however, they compete with settlement and nature conservation demands. For example, offshore wind farms are therefore not permitted near coastlines in Germany.

Because of the scarcity of accommodation space in such borderlands, the tendency in the exploitation of solar currents, as in the use of solar collectors, is toward increasingly large installa-



The illustration shows possible infrastructures for sustainable power supply to Europe, the Middle East and North Africa (EU-MENA). The red squares indicate the space needed for solar collectors to meet today's power requirements for the world, Europe and MENA.

tions elsewhere. For wind power, this means that on-shore farms in the 1 megawatt category with 80 metre-high towers are being replaced by 2-4 MW installations with towers from 100 to 150 metres high and which make economic sense even across forests and far from coasts and mountains. By their size, they overcome their tie to the borderlands but dominate the natural scenery more than ever. This is even more extreme in the case of hydroelectric power, which overcomes the limits of natural morphologies with waterfalls from mega-dams, as on the Yangtze in China or the Narmada in India. The biggest concrete dams are up to 300 metres high. In view of these dimensions and the risks these installations entail, renewable energies approximate conventional power plants in risk and economic significance.

This ambivalence about renewable energies in landscape development also extends to the third group, the "solar biospheres". Here there is a distinction to be made between the direct use of the energy content of certain plants or animal wastes as biomass (such as firewood or manure) and simple forms of processing (the production of biogas) as well as industrial forms of processing (the production of oils and fuels). These in turn can be subdivided into first-generation technologies whose net energy yield is modest, such as vegetable oils, biodiesel and bioethanol. Second-generation technologies, the biomass-to-liquid processes, promise higher efficiency but also require complex industrial synthesising processes. What all types in this third group of "solar biospheres" have in common, however, is again a definite dependence on land area. Their primary production

Four scenarios for Landscapes of Reconciliation indicate the synergistic effects (red) arising from integrating renewable energies (blue) with the existing landscape (green).

phase even has additional requirements, such as fertile soil, clean water and ultimately the equilibrium of complex ecological relationships in the biosphere. Moreover, the competition between food, animal feed and energy production is currently the subject of intense debate.

Central networks – distributed subsitence

This glance at the wide variety of groups and types of renewable energies shows that they can be used in two fundamentally different sytems, each seeming to belong to a different world. One of these worlds is that of urban, industrial, centralised and at the same time highly networked regions. The other world is that of rural, agricultural, decentralised regions that need to be self-sufficient. In developed countries these two worlds are usually (still?) close together. Electricity, petrol and fuel are available even in remote areas, and feed-in compensation and subsidies make small energy systems as a part of the grid economically worthwhile even in urban spaces. This is completely different in emerging and underdeveloped countries. In India thousands of towns are not linked up to the public power supply grid; fluctuations in supply are massive. In China, too, there are worlds of difference between the metropolitan areas on the east coast and rural ones far inland.

These two worlds not only have completely different parameters for developing renewable energies and hence for the development of new landscapes. They also perceive landscape itself in completely different ways, namely as the everyday world of lived experience (isotopia) in one; as the counterpole to the demands of urban life (heterotopia) and a preview of a better world (utopia) in the other. A "reconciliatory" overlapping of the existing landscape, comprising settlements, agriculture, recreation, natural scenery, etc., with renewable energies must expect the coexistence of these two worlds. What seems appropriate for one world can be inappropriate for the other one. Reconciliation between humanity and nature through the use of renewable energies must therefore be contemplated on completely different levels in these two systems. Nevertheless, there are common basic rules. The landscapes of renewable energies should:

- serve first and foremost to benefit the general public and not predominantly the political and economic elites,
- not separate spatially but bring together and overlap the functions of settlement, agriculture, recreation and natural scenery, even if on different levels of scale,
- take into account the competition between food, building material and water supply as well as the necessary removal of carbon dioxide from the atmosphere,
- diversify regional and local economies and subsistence systems not only in agriculture, trades and crafts but also on the highly industrialised scale
- contribute to the preservation of biodiversity and not sacrifice it to short-term gain from monocultures,
- maintain the accessibility and ability to experience spaces aesthetically and not erect new barriers, either by destroying routes or building fences for the enclosure and surveillance of installations and cultivation.

Landscapes developed according to these basic rules have the potential to be experienced as another form of nature created by humanity, as an achievement in the evolution of civilisation and not as a work of destruction or the reflection of a guilty conscience.

Many of the projects being discussed for the establishment of renewable energies all over the world at the moment observe these basic rules. For example, as a side effect of power production, the Desertec Project intends to use the by-product heat from desalination plants to guarantee the economic blossoming of the desert countries and their integration into a peaceful world community. Several large-scale outdoor photovoltaic installations in Germany and the USA have targeted functions designed for the conversion of former military grounds, the decontamination of polluted sites and the creation of regional economies. Corresponding to these strategies in the world of central projects connected to the power grid are self-sufficiency strategies in the rural areas.

In the latter world, renewable energies are to enable not only basic electricity and water supply but also additional forms of employment in the local processing of agricultural products and the formation of regional production clusters in trades and crafts.

The most important contribution of landscape architecture in the domain of renewable energies is probably especially in helping to develop and facilitate these specific "synergies".

The matrix on page 59 shows 1) the relationships between renewable energies and synergies and the landscape, and 2) the correspondence between central projects connected to a power grid and self-sufficiency strategies.

MATRIX OF EXAMPLES:

LANDSCAPES OF RECONCILIATION = ENERGY + SYNERGY + COHERENCE

	CENTRAL-GLOBAL-GRID SUPPLY		DECENTAL-LOCAL-SELF SUPPLY
SOLAR GROUP	**SOLAR LAND**		
Renewable Energy	Photovoltaic	Solar thermal	Solar collector
Synergy	Bomb Disposal / Conversion	Desalination of sea water	Self-sufficiency
Coherence	Resettlement / revitalisation /re-linkage	New ground / reclaimed land / social stability	Autarchy on the fringes
SOLAR GROUP	**SOLAR STREAMS & CIRCUITS**		
Renewable energy	On / Offshore power	Water power plant	Small Wind / Water facilities
Synergy	Integration into landscape / artificial reefs	Drinking water storage / flood protection / disaster prevention	Drinking water storage / local flood protection within large scale disaster prevention
Coherence	Increase of acceptance / citizens or community Wind farms	Nature reserve / leisure landscape / gentle tourism	Self-sufficient regional work cluster
SOLAR GROUP	**SOLAR BIOSPHERE**		
Renewable energy	Biogas	Liquid Energy Production (BtL)	Biomass
Synergy	Regional heat supply / product refining	Increase of biodiversity	Self-sufficiency / subsistence
Coherence	Diversification of income / Food + Energy + Forestry	Food + Energy + Variety	Firewood forestry / sustainable carbon cycle