



Fotos: Frank Schüssler

The parabolic trough solar power station ANDASOL near Guadix, close to Granada is currently under construction. In the background, the two salt storage facilities allow for up to 7 hours of electricity generation after sunset.

A "Sea of Mirrors" – but where?

Will the Solar Energy Partnership between Europe and Africa Contribute to an Aggravation of Regional Disparities in Africa?

By Frank Schüssler

In view of the current discussion about the threat of climate change and the increasing scarcity of fossil fuels, many groups, including politicians, entrepreneurs, journalists, and our inter-disciplinary working group are looking to Africa for a future energy supply. At first glance, the potential for new energy forms from the long 'forgotten' continent seems gigantic. There is a huge potential for wind farms, along the thinly settled coastal regions of western Morocco and the adjacent Republic of Sahara (occupied by Morocco), as well as Mauritania. The wind blows evenly and throughout the year as a result of the North East Trade Winds. Initially, the promise of solar thermal power facilities in North Africa seems particularly compelling especially as the energy potential is 2-4 times greater than in central Europe. However, a careful evaluation of possible locations from an economic, ecological, and social perspective is of importance.

With the propagation of the practical operating systems and sustainable cost effectiveness of solar thermal power stations, many stakeholders are beginning to make knee-jerk demands that those particular desert regions be transformed into a "sea of mirrors" (DLR 2005, 2006, 2007). There are two aspects that are often only incidentally discussed or completely overlooked. First of all, it is not possible to set up large power stations everywhere in the Sahara. A careful evaluation of locations from economic, social and ecological perspectives is absolutely necessary. To date, no academic research has been carried out to investigate the effects of solar power stations on different regional aspects. Secondly, Sub-Saharan Africa is often overlooked. However, using suitable financial instruments like the Clean Development Mechanism (CDM; also see

the article by Kirsten Westphal,) can make regions in these areas potentially suitable as well. The purpose of this article is to discuss these two aspects.

Locations for Solar Thermal Megapower Stations

In three extensive studies, experts of the German Aerospace Centre (DLR) considered suitable locations in Africa and the realization potential for solar thermal megapower plants (MEDCSP; DLR 2005). Further, they looked at African-European connection points from which to import electricity to Europe (TRANS-CSP; DLR 2006) and possibilities for seawater desalination using locally generated solar electricity (AQUA-CSP; DLR 2007). With the help of quantitative methods, using Geographical Information Systems and remote sensing data and using an exclu-

sion procedure, the DLR identified potentially suitable locations for large-scale technical facilities (See image 1).

For solar experts the answer appears to be simple: solar power stations can be built wherever, terrain grades, existing land use forms, moving dunes, inadequate traffic infrastructure, and other criteria do not preclude construction. However, several criteria remain unconsidered but Winker and Preußner, Speitkamp and Stange as well as Leggewie and Westphal consider the different economic, historical, and political aspects in this journal. However, also from a human geographic perspective additional discussion is necessary.

A set of economic, and societal i.e. social indicators for regional disparity within a spatial context of national states in North Africa can be seen in Table 1. For comparison also Germany and France have been included. What

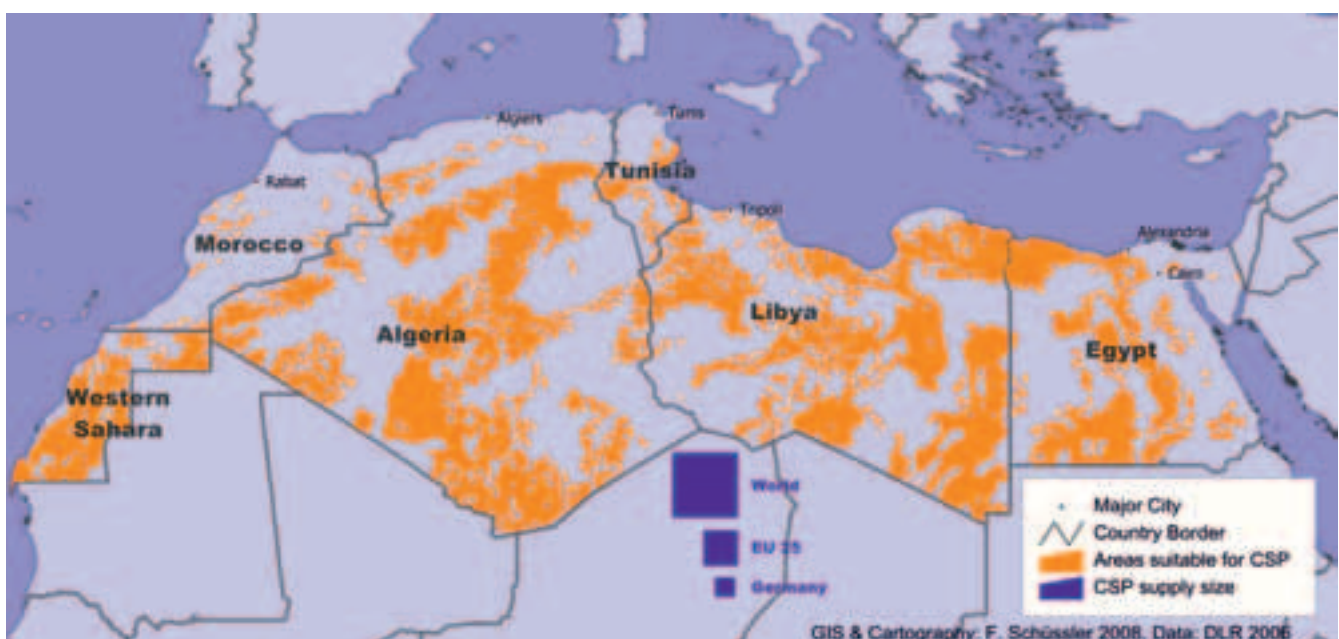


Image 1: Suitable areas for CSP in North Africa and the theoretical size of the CSP for the energy supply of Germany, Europe and the earth. Source: Schüssler 2008

insights can be gleaned from this? Firstly, even using this rather broad regional overview the heterogeneity of the North African states is striking. This heterogeneity must be taken into account in all planning. If the resolution is further increased to enable a comparative view of provinces and districts, significantly greater regional disparities can be recognized. As solar thermal power plants are techno-industrial mega-projects they have significant construction and maintenance requirements. These are not 'hard' requirements or pre-conditions, and were not discussed in the DLR studies.

For the purpose of a better understanding, we will now go on an excursion into the traditional tenets of economic geography as it pertains to location choice. One can discern between cost minimizing (Weber 1909) and behavioural (Pred 1967) models when choosing a location. It must be noted that the latter does not always run along the lines of purely rational and objective considerations. According to Weber, an individual choosing a location makes the decisions of a rational

"Optimiser" who is looking to minimize costs. While, according to Pred, decisions based on limited knowledge about location sites, and individual preferences are consistent with behaviours of a "Satisfizer." As they can have an effect on location choice, how are the influences of planners and politicians integrated? What role do economies of concentration and scale play in the choice of location?

The socio-economic processes involved in site selection are not concluded once a decision has been made. Rather, these new mega-industrial sites have significant effects on not only the immediate area but also further afield. In the economic-geographic literature the term 'site-related factors' is not used alone but rather as part of a more strongly evolutionary view of 'site-related processes.' "Industries create regional resources and not the other way round" (Storper u. Walker 1989: 96). These processes have not been adequately considered in the relevant literature, including the many studies that have been carried out, nor by the various stakeholders.

The second criticism concerns the opportunities provided by the Clean Development Mechanism (CDM). The stakeholders and the literature considering solar thermal power stations do not consider that regions in sub-Saharan Africa also offer excellent conditions for the construction of solar thermal power stations that could be facilitated through the "Clean Development Mechanism." Namibia, the Kalahari Basin in Botswana, as well as South Africa could provide ideal sites for construction.

Although in this case the generated energy could not be exported to Europe, it would be of great importance for the development of southern Africa. Using trading in "Certified Emission Reductions" (CER) an attractive investment incentive could be provided within a mixed-financing framework (i.e. public-private partnerships).

To date, only two percent of all globally registered applications in the CDM framework are from Africa. There is a danger that the relatively low CDM-investment climate index for Sub-Saharan Africa (see Table 1) means

Table 1: Indicators of the development state, political status and investment security in North Africa.

Country/Region	GDP ¹	GINI ¹	HDI ¹	RCM ¹	FS ²	ER ¹	Kyoto ¹	CDM IKI ³
Algeria	7062	35	0,73	34	Not free	98	2005	49
Egypt	4337	34	0,71	28	Not free	98	2005	70
Libya	10335	82	0,82	18	Not free	97	2006	34
Mauritania	2234	39	0,55	78	Partly free	-	2005	37
Morocco	4555	36	0,65	36	Partly free	85	2002	75
Tunisia	8371	40	0,77	20	Not free	99	2003	78
Sub-Saharan Africa	1998	> 50	0,49	102	Mostly not free	26	-	< 40
Germany	29461	28	0,94	4	Free	100	2002	-
France	30386	33	0,95	4	Free	100	2002	-

GDP-Gross Domestic Product per person, GINI: GINI Index, HDI: Human Development Index, RCM: Rate Child Mortality (per 1000 live births), FS : Freedom Status, ER: Electricity rate, Kyoto: Year that Kyoto protocol was ratified, CDM IKI – Clean Development Mechanism Investment Climate Index, ¹Source: UNDP (2008), ²Source: Freedomhouse.org (2008), ³Source: DEG (2008)

that this will not change. Hence, the biggest international streams of CDM money will not go to those countries that require it the most, and Africa will remain among the capital-poorest regions of the world (Collier 2008: 116).

Regional Disparities as a result of Industrial Mega-projects

Regional disparities mark the differences among characteristic indicators in defined spatial units i.e. international differences between nation-states or intra-national differences within one state. Disparities arise through differences in environment (i.e. local solar radiation) and its utilization in poles of growth (i.e. through solar thermal power stations.), but also through differing site-related assessments, or decisions from public bodies (i.e. subsidies) as well as segregation processes like the disproportional distribution of population groups.

With respect to economic inequities, regional economic geography theory developed several models explaining the development of salary disparities. Alternately, social geography explores the life opportunities and participation possibilities of individuals and groups influenced by disparity.

In those countries with solar thermal power stations a higher national income is to be expected as a result of European direct investment and local capital investments. Already now large properties are being traded, employees for the start up and running of the facility have to be paid, and taxes are being collected. How this income is distributed is a different question. The GINI-Index, which measures income distribution, is higher in North African countries than e.g. in Germany or in France (See table 1). This means that in all likelihood the elites of these countries will benefit disproportionately from the investments in the country.

From an intra-continental perspective, greater disparities will be seen after the expected investment wave. The or-



Image 2: Solar tower power station PS10 near Sanlúcar la Mayor, west of Seville. 120 mirrors focus sunlight onto a 115 m high tower. In this way 6,000 homes are supplied with electricity.



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organisational inclusion of the North African states in the Mediterranean Union will result in enhanced investment security and it is to be expected that many projects will be realized in the Maghreb. Sub-Saharan Africa will remain untouched by this and will once again be disconnected from development.

Conclusion and Analysis

The partly subliminal hope of politicians that the entire continent of Africa could benefit and grow from the influx of private capital for solar thermal power plants and then no longer require the IV-drip of economic aid is unlikely to be fulfilled for the foreseeable future. Instead, after the expected boom of solar thermal mega-power stations in Africa, regional disparities along longitudinal lines as well as inter-

national disparities along latitudinal lines will develop to different degrees.

In the North African countries of similar latitude, inter-regional disparities between the Maghreb states will develop. The investment of several hundred million Euros per power station will flow into the countryside and will attract city dwellers to construct the facility and a regional centre will develop. This tendency can even be observed at the solar power stations in Spain, in Guadix and Sanlúcar la Mayor in Andalusia (See image 2 and 3). Here, numerous firms are engaged that source their employees from the larger cities of Granada or Seville. In Algeria, Morocco, and Tunisia there will be regions, which were previously unpopulated and economically irrelevant and that suddenly appear on the map as islands of prosperity.

The prioritization of investment de-

isions in favour of solar power stations in North Africa as opposed to CDM investments in the region of sub-Saharan Africa can be seen as subsidizing international disparities. How far sub-Saharan Africa is dependent on the economic development of the greater Maghreb is shown in Table 1. Even exploited Mauritania that is governed by a military junta has a gross domestic product (GDP) per person that is higher than in southern Africa. In the other North African states the GDP per person is at least two to five times that of southern Africa.

It should be emphasized again, that the solar thermal mega power stations will be an important building block of the energy mix of the 21st century. As a result of the Mediterranean Union this boom is about to begin (please see the article by Westphal). However, even so or perhaps exactly because of this, care



Image 3: The ANDASOL parabolic trough solar power station near Guadix province, Granada. This power station will cost 310 million Euros to build and will supply 200,000 people with electricity.

should be taken in the decision making process. Not only 'hard' factors but also 'soft' factors should be taken into account, and the effects on the location should be considered in the form of scenarios. Then it will be possible to look forward to the energy transition in a relaxed fashion: "It is necessary to discuss CSP projects and its effects intensively and to pave the way for the realization of this revolutionary idea" (Töpfer 2007: 8). Collier notes that in Africa there is a dearth of private capital that theoretically could be provided by globalisation (Collier 2008: 117). This has worked in China. Whether Africa can use solar thermal power stations to generate poles of growth and whether this can have positive effects on the economies of many countries remains an open question. •

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