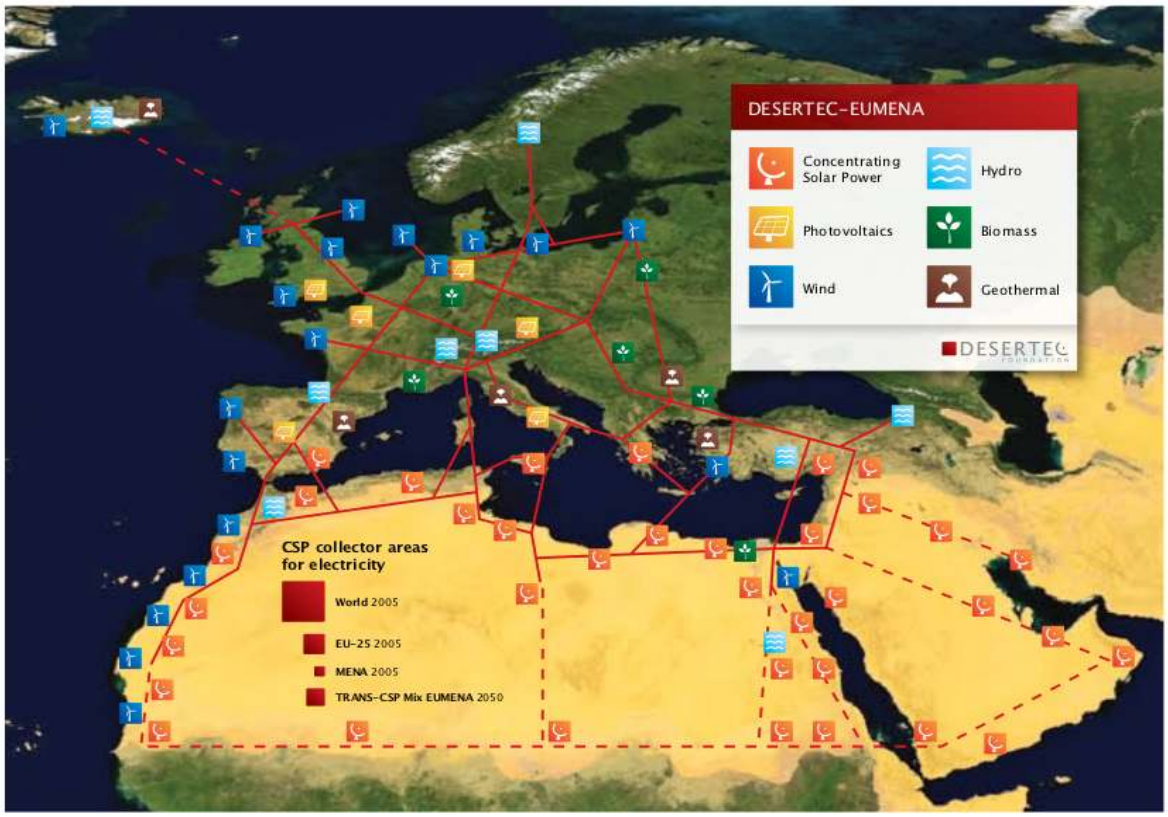
Maps and Legends



A Critical Look at Desertec

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commissioned by The Corner House as a background paper for its report,
Energy Security: For What? For Whom?

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More than 40 years ago the Apollo Space Program was launched to fulfil the old dream of taking man into outer space. Today, we have a bigger dream, to restore balance between man and his home planet, Earth. With the political will, EUMENA countries could now launch an Apollo-like "EUMENA-DESERTEC" Program.

Clean Power from Deserts:
The DESERTEC Concept for Energy, Water and Climate Security MENA
Knies et al. 2007:6

In April 2005, the German Space Agency (Deutsches Zentrum für Luft- und Raumfahrt, DLR) used satellite data to map the solar power potential of the Middle East and North Africa (MENA), finding it to be "several orders of magnitude larger than the total world electricity demand" (Trieb & others 2005:57). The German government-funded study then assessed this potential in relation to "state of the art" technology and an economic assessment, with the results setting out a pathway to a sustainable energy future.

By November 2007, the technical data had been distilled into a 58-page booklet on *Clean Power from Deserts*, which sets out a vision of "an Apollo-like "EUMENA-DESERTEC" Programme for putting deserts and technology into service for energy, water and climate security" (Knies et al. 2007:22). The authors are so fond of the Apollo metaphor that it is repeated nine times in the publication.

But the US space programme (or the Manhattan project to build a nuclear weapon, another commonly used comparison) are poor analogies for researching and developing energy infrastructure, which has more complex (and sometimes contradictory) goals, and requires technological diversity and environmental sensitivity that did not encumber Cold War planners' efforts to land an American on the Moon (Stine 2009).

The experience of mega-projects, from hydro-electric dam building to large-scale urban redevelopment, provides a better analogy – and there is an extensive literature showing that these tend to result in the displacement of communities, a regressive distribution of the benefits, and the infliction (often unintended) of damage on the environment (Gellert & Lynch 2003; Scott 1998). Although the development of solar power in the Middle East and North Africa is at an early stage, the vision of developing large-scale Concentrated Solar Power (CSP) power plants in the region's deserts – or, more accurately, at the populated and water-scarce edges of them – could backfire if it continues to exclude local knowledge, involvement, participation and control; geopolitical pressures and economic uncertainties.

Although a rapid transition to solar and other forms of renewable energy is essential to forestall runaway climate change, over-selling the exaggerated claims of solar mega-project and embedding them within a neo-liberal model of energy market liberalisation serves to undermine this goal and discredit it by association.

This paper introduces the Desertec concept through an analysis of the archetypal maps that have been produced to support it. It identifies an "aesthetic" of large-scale centralised energy in which "North African countries appear at times to be reduced to mere subjects of infrastructure planning" (Supersberger & Abderrahmane 2010:10). The consequences of this approach, which fits within a broader framework of export-led energy development, are examined in relation to threats to water supply, and their tendency to eclipse the varied local regimes of energy demand. It is also noteworthy that the ELMED electricity transmission line from Tunisia to Sicily, one of the few

infrastructure developments corresponding to this project that is already under way, is primarily designed for the export of electricity generated from fossil fuels. When "Energy" production is framed as a resource for extraction and export, and dis-embedded from the diverse contexts of local demands and use, the likely outcome is to exacerbate any existing tension and conflict.

The paper goes on to look at the organisations promoting the Desertec concept, which encompass a research network and the industry-backed initiatives, as well as a cluster of similar formations, such as the Medgrid industry coalition for building transmission infrastructure. In particular, it looks at how the Desertec concept has become embedded in the EU's regional policies as the Mediterranean Solar Plan, and in its energy policies, most notably the Renewables Directive. Finally it sets out the context for developing the concept through the medium of international financial institutions – most notably, the World Bank and African Development Bank. At each stage, challenges have been thrown up regarding the project's economic viability and claimed development benefits.

What is Desertec?

Desertec is a renewable energy plan whose primary objective is to build Concentrated Solar Power (CSP) plants in the Middle East and North Africa, and to connect these up to a high voltage direct current (HVDC) enabling electricity exports to the EU. It also foresees the creation of "a single market in electricity throughout the EUMENA [EU-Middle East-North Africa] region" in order to meet this objective, as well as becoming associated with plans to build a series of water desalination plants in the region (Desertec Foundation 2009:10). Concentrated solar power systems use mirrors or lenses to reflect and concentrate sunlight onto a small area; the sunlight heats water, which turns into steam, which drives turbines to produce electricity.

None of these ideas are particularly new. Since the 1970s, European "energy security" concerns have prompted rising interest in North African energy resources (Al-Widyan and Al-Muhtaseb, 2009: 185-6; Hayes, 2004), while the creation of a Mediterranean Transmission Line Ring was originally proposed as early as 1987 (Mason, 2009:222). The idea of a free market in energy between the two regions was a pillar of the Barcelona Process, an EU-backed regional integration initiative launched in 1995. But attempts to bring these elements together in a single "master plan" are more recent, dating back to the 2003 launch of the Trans-Mediterranean Renewable Energy Cooperation (TREC).

The TREC concept was initially developed by a team of researchers, scientists and engineers[1] (the founder was a German particle physicist) who saw their first task as one of identifying the "technical means" and "physical resources" required to get the project off the ground, which they then packaged into a "master plan" for large-scale infrastructure development (TREC Development Group 2003:5). But the resulting plan, as articulated in the *Clean Power for Deserts* booklet (and indeed the German Space Agency DLR studies upon which the plan is based), "neatly bypasses political issues of interest representation and negotiation in the MENA countries" (Mason 2009: 229). These lacunae reflect a broader problem related to the type of knowledge that is deemed relevant – and that which is overlooked – in seeking out the development of the concept into projects on the ground. Although subsequent attempts have been made to involve a greater number of local researchers and scientific institutes, they have not, as yet, altered the basic framing of large-scale renewable energy development in North Africa.

1 Members of the TREC network: http://web.archive.org/web/20070219011629/http://www.trecers.net/members.html

One way to illustrate this point, and draw out some of its implications, is to look more closely at some of the many maps that have been produced since the Trans-Mediterranean Renewable Energy Cooperation (TREC) concept was first raised.

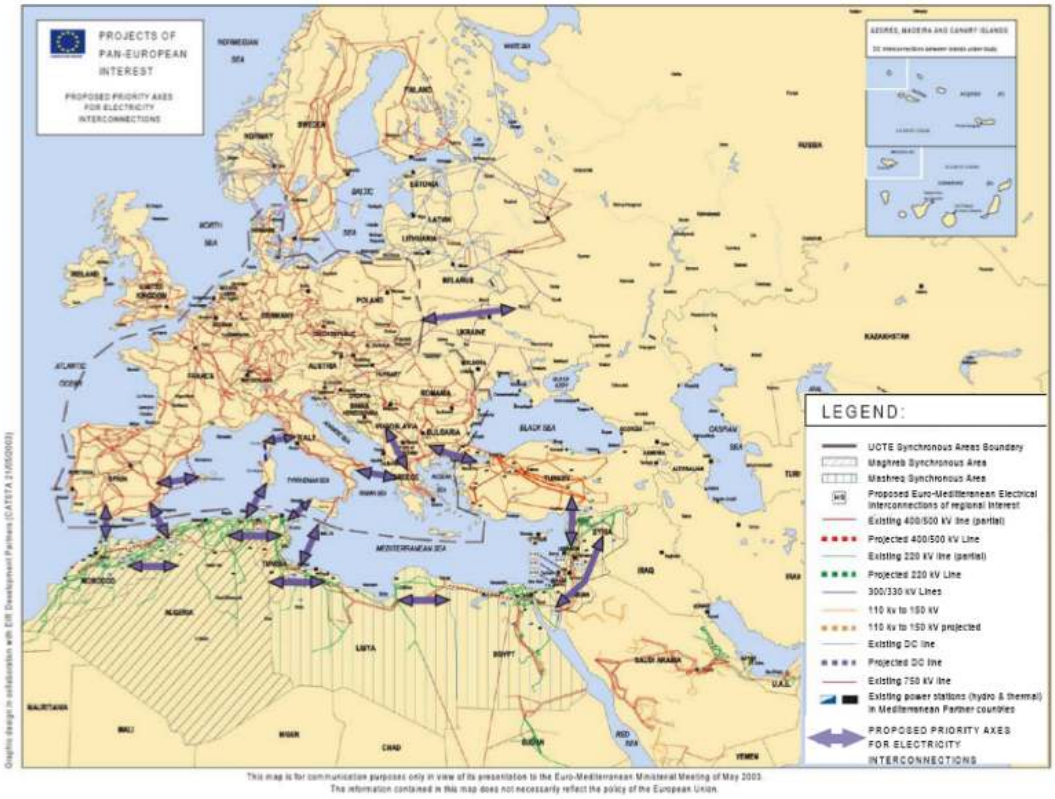


Figure 1. Source: Trieb & others (2005: 117)

The map in Figure 1 was produced by the European Commission in advance of the Euro-Mediterranean summit of 2003, and reproduced in the German Space Agency's 2005 report on the Mediterreanean's Concentrated Solar Power (Med-CSP) potential (Trieb & others 2005:117). It represents "projects of Pan-European interest," with large purple arrows indicating "proposed priority axes for electricity interconnections." The stand-out feature of this map is that the majority of the "priority axes" lie outside the borders of the European Union itself. Five of them envisage interconnection under the Mediterranean to link North African electricity production into the European grid, while three of the other arrows signify an energy corridor from the Middle East and Turkey into the EU. This is consistent with a broader emphasis within EU policy-making on infrastructure development for energy imports from multi-billion euro mega-projects – including the Baku-Tbilisi-Ceyhan oil pipeline; the Trans-Sahara, Medgaz and Nabucco gas pipelines; and the Grand Inga hydroelectric dam – which some commentators have dubbed an EU "energy grab" (Counter Balance 2011).

A second notable feature of the map in Figure 1 is that the majority of the priority electricity connections run across borders – including the Morocco-Algeria border, which had been closed for many years at the time the maps were drawn up. Encouraging cross-border electricity connections is an integral part of EU plans to open up national electricity markets to international competition, consistent with the approach embodied in the European Energy Charter (initially signed as a non-binding commitment in 1991, but upgraded to a legally enforceable Treaty in 1994). The underlying

idea is to encourage physical market integration by loosening the infrastructural constraints on cross-border supply (a lack of interconnected grid capacity) – which is accompanied by political initiatives to harmonise the regulatory, trade and investment frameworks for electricity (Escribano 2010:221-222). This, in turn, has been presented by some proponents as a means to expand human rights and European "soft" power – although the broader experience of export-led energy development makes this assertion hard to maintain (Hildyard et al. 2012: 31).

More details have subsequently been added at a policy level to the approach proposed in this map by the Mediterranean Ring concept, initiated by the European Commission in 2000 and incorporated as a key pillar of the EU's Second Strategic Energy Review (European Commission 2008; Med-EMIP 2010:10). It is worth noting that here, as elsewhere, the development of new energy corridors does not differentiate between the import of electricity generated from renewable sources and the import of fossil fuels, notably gas. In fact, the "energy security" framework under which this proposal is advanced emphasises the diversity of energy-type supply over and above any climate stabilisation objectives.

Although Desertec and the Med-CSP report present the building of high-voltage direct current (HVDC) lines (dubbed a "Super Grid") linking the EU and North Africa as a means to expand renewable energy capacity, the surveys conducted to assess their financial and technical viability tell a different story:

> according to the performed feasibility studies, the main rationale for these interconnectors lies in the trading of energy towards Europe. The energy is projected to be produced by gas fired CC [combined cycle] units to be installed in North Africa. Hence, the economic profitability is related to the arbitrage between exporting gas or selling electricity on the Italian and/or Spanish markets. The feasibility studies did not consider the possibility of building RES [Renewable Energy Sources] power plants in the Maghreb and selling the generated energy to Europe. (Med-EMIP 2010: 208)

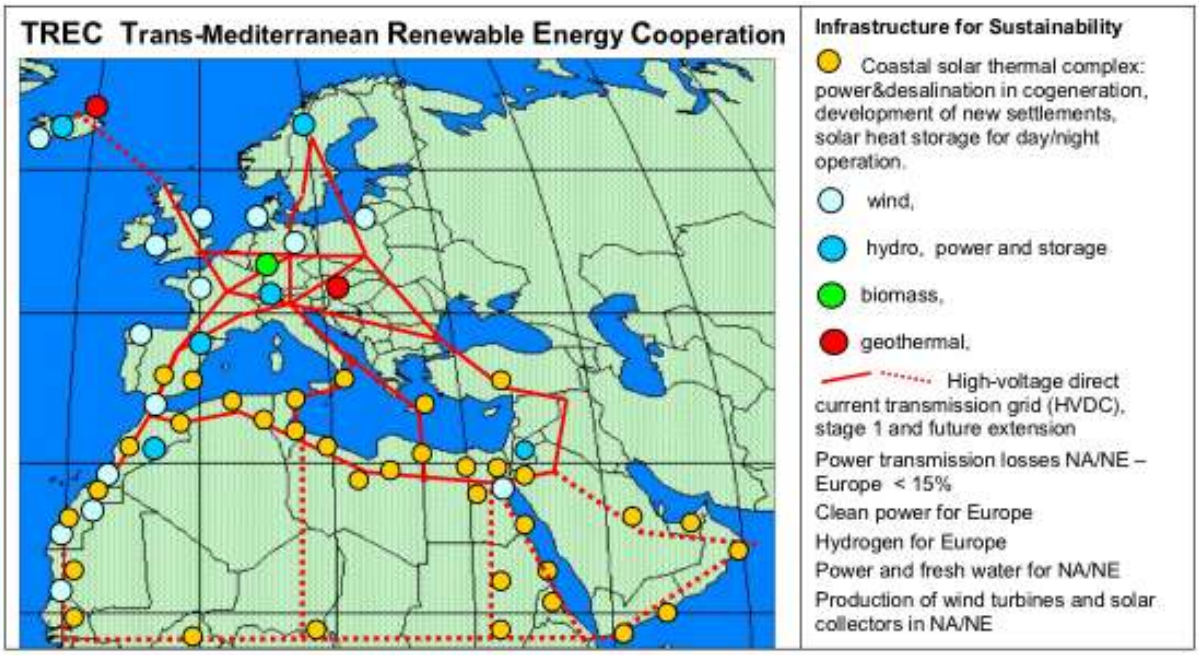
All but one of these interconnections remain on the drawing board. The one project that is being built, between Tunisia and Sicily, is being developed by ELMED, a joint venture which explicitly links its realisation to the construction of a new 1200 MW coal or gas fired power plant in Tunisia (Med-EMIP 2010: 208). Eighty per cent of the electricity transported by this transmission line would come from fossil fuels, with only 20 per cent (200 MW) projected to come from renewable sources (Terna SPA 2010).

In the most optimistic scenario, electricity produced by Concentrated Solar Power plants would start to become cost-competitive with that generated by coal or gas plants some time after 2030, which would then result in the transmission lines being increasingly used to carry renewably-generated electricity. However, the limited economic modelling that is available (which should itself be treated with caution) does not bear this out (Hirschhausen 2010). Although maps of "Super Grid" expansion show a seamless interconnection between the EU, North Africa and the Middle East, energy markets treat the different sources of energy as competitors on cost grounds, and it is plausible that developments elsewhere (such as the North Sea Super Energy Grid[2]) could undermine the business case for long-distance transmission from Desertec (Hirschhausen 2010:197). Technological obstacles or spiralling costs could further undermine this projected shift towards renewably-generated electricity – in which case, fossil fuel-based electricity imports would continue

2 The North Sea Offshore Grid, one of several proposed European super grid schemes, is a collaboration between EU member-states and Norway to create an integrated offshore energy grid linking wind farms and other renewable energy sources across the northern seas of Europe.

to predominate. The unintended (but highly plausible) consequence would be that renewable energy serves as a trojan horse for expanding fossil fuel-related electricity infrastructure, with the resulting emissions outsourced from the EU to North Africa.

Figure 2. Source: TREC Development Group (2003: 1)



The liberalisation-as-cooperation theme is picked up in presentations of the map in Figure 2, which first appeared in the TREC briefing that launched the "clean power from deserts" concept at a conference in Amman, Jordan in 2003 (TREC Development Group 2003:1). The map is intended to illustrate how TREC/Desertec could stimulate "a common market and an interconnection infrastructure." If the EU were to buy a "substantial volume" of energy from North Africa and Near East (NA/NE), the accompanying text explains, this could:

> turn the formerly contradictory goals of climate protection and economic development into mutual reinforcing objectives by making clean energy production in NA/NE for both local and European markets a motor of industrial and socio-economic development in NA/NE countries [and] help transform the Mediterranean from a region of various divisions and conflicts into a region of harmonised socio-economic development, cooperation and good neighbourhood for renewable energies.

The same map, redrawn slightly, features on the inside cover page of all four editions of the Desertec White Book (its fourth version appears on the cover of this paper). It has some surprising geographical elisions, however. The extent of the power infrastructure plotted onto the map extends way beyond the countries that are generally identified with the Desertec initiative, and falls outside the majority of the institutional architecture usually outlined for EU-North Africa energy cooperation: the southern-most outposts of this map are located in Senegal, Burkina Faso, Nigeria, Sudan and Eritrea.

The Nigerian plot is close to Lake Chad, a rapidly shrinking body of water that is already struggling

to maintain the livelihoods of local fisherfolk and farmers, and which the UN's Food and Agriculture Organisation recently dubbed an "ecological catastrophe" (Salkida 2012). In this map, and those derived from it, a number of other plots for both potential wind and solar energy sites are located in Western Sahara, a country currently illegally occupied by Morocco. The development of Western Saharan clean energy resources by the Moroccan Office National d'Electricité (ONE), a partner in the Medgrid concept, has already become a source of controversy in the case of projects submitted to the Clean Development Mechanism (CDM) of the Kyoto Climate Protocol.[3]

TREC/Desertec planners would point out that the plots in their map are intended to be merely illustrative. However, considerable attention has been paid to placing these imagined solar power plants in close proximity to large inland water sources, which are relatively rare in the region. Concentrated solar power plants use a lot of water to drive steam turbines (more than new coal-fired and natural gas power plants) and to clean the mirrors. Aside from the plots near coastal regions and Lake Chad, others include a potential solar power site next to Lake Bam, the largest lake in Burkina Faso, which is in the advanced stages of drying up. The remainder are plotted at a handful of sites along the Nile – another highly contested waterway – in Egypt and Sudan.

The subsequent versions of the map add a new potential solar power plant near Ghadames in Libya, a town built on the site of an oasis. It has been identified as a possible site on the grounds that its location on the "great man-made river project" (a network of pipes relaying water from the Sahara aquifer to Libyan coastal cities) might eventually be run the other way to pipe water from the coast (International Institute for Applied Systems Analysis 2011: 20).

The potential for exacerbating water conflicts is underplayed in both the TREC proposal and the Middle East North Africa (MENA) Concentrated Solar Power (CSP) project, a US$750 million World Bank-administered Clean Technology Fund programme that is currently one of the main sources of financial support for Desertec-like initiatives (*see below*). Its first project, the Ouarzazate CSP plant in Morocco, is located in an area where "The distribution of water and land entitlements is mainly based on the influential elites and political-economic interest" (Schinke & Klawitter 2011: 22). Its project investment plan states that "water availability is not likely to be an issue" in Egypt, due to the potential use of the Nile and Red Sea as sources, but it fails to take account of the political controversy surrounding the use of water by upstream Nile states, resulting in Egypt getting what many would argue is an unfair share of the Nile's water (Bank Information Center 2010). In Jordan, which is one of the most water scarce countries in the world on a per capita basis, the MED-CSP investment plan proposes to take water from the soon-to-be developed Disi Pipeline, diverting part of it from its intended purpose of providing drinking water. More generally, the water intensity of CSP could limit the ability to 'scale up' such facilities sustainably in future.

The tendency to overlook inequalities and tensions over water distribution use is symptomatic of a broader problem in these mapping exercises: namely, the lack of attention in plotting potential solar power sites in relation to local energy demand and demographics. While some European plots are clearly chosen for their proximity to major urban centres with high power demand (Rome, Madrid and Paris are all clearly visible), the plots in North Africa do not typically attempt similar correlations. In fact, less and less attention is paid to geopolitical details as the eye trains from the top of the map to the bottom, North to South. The southernmost plots and transmission lines are presented on a rectangular grid drawn up with all the sensitivity of the colonial powers who drew up

3 "CDM project in occupied Western Sahara violates international law", Nick Brooks and Jeffrey Smith, February 2012. Mimeo. The original Desertec pilot project avoided Western Sahara for "reputational" reasons, although no guarantees have been given regarding future projects. *See* http://www.guardian.co.uk/sustainable-business/desertec-western-sahara

many of Africa's current borders (without African participation) at the 1884 Berlin conference. No attention has been paid to where local energy demand arises.

Stated another way, the mapmakers have plotted the contours of Energy with a capital 'E', an exportable resource abstracted from "the diversity of social and technological regimes in which different kinds of energy are embedded" (Hildyard et al. 2012: 9). But they have paid little or no attention to energy in the vernacular, the varied local regimes of energy demand and use as they exist on the ground.

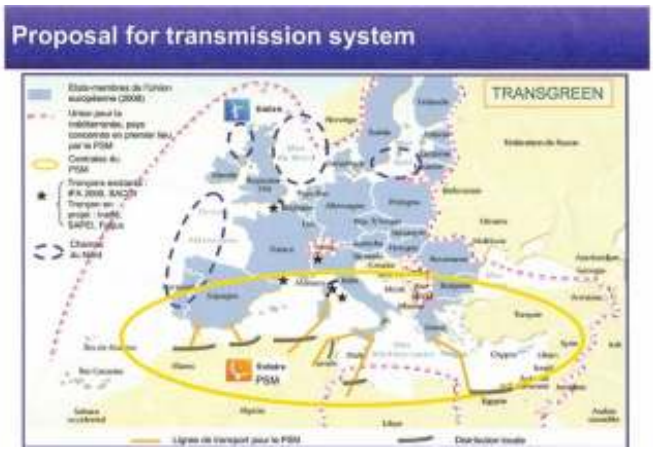


Figure 3. Dubessy, 2010.

Figure 4. Medgrid, 2011

Figures 3 and 4 represent the proposed Transgreen and Medgrid industrial consortium projects (for more details, *see* page 13 below). They were drawn up five or more years after those in Figures 1

and 2 but tell a similar story. At first glance, they appear to correspond closely to the "projects of Pan-European interest" shown in Figure 1. Yet the changes between the mapping of Transgreen (Figure 3) and Medgrid (Figure 4) illustrate some responsiveness in the intervening years to changing geopolitical realities. Whereas the Transgreen representation holds Libya within the semi-quarantine of a dotted line, the Medgrid map now fully integrates it. Most notably, it shifts the location of the envisaged connection to Sicily (from where it could connect to the EU grid) away from Tripoli, with 1.7 million inhabitants, towards Sirte, a coastal city with 75,000 inhabitants (prior to its destruction during the battle that saw the death of Muammar Gaddafi in October 2011), where the project's promised integration with regional grids would be of far more limited use to Libyans.

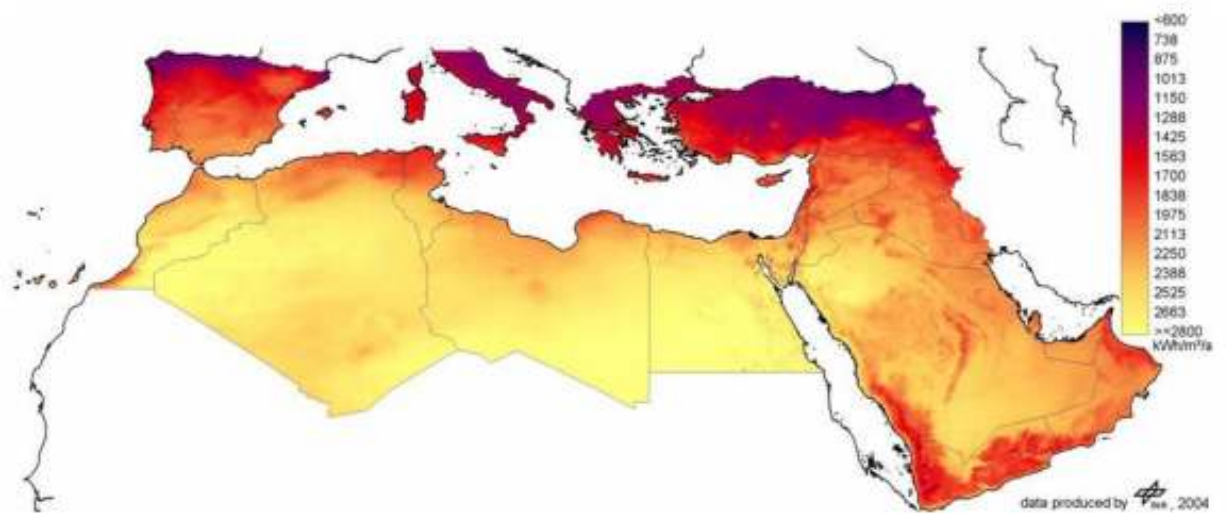


Figure 5. Source: Concentrating solar power for the Mediterranean region, *Trieb & others (2005)*

Finally, the map in figure 5 is a typical example of a different sort of map, representing "Annual Direct Solar Irradiance in the southern EU-MENA Region." This last type of map has become increasingly ubiquitous, not only in discussing the project itself, but more generally as a feature of renewable energy discussions. For example, Professor Jim Skea of the UK Energy Research Centre recalls how, at the International Scientific Congress on Climate Change in Copenhagen in March 2009, "the renewable energy session was full of maps of North Africa covered with CSP plants and new electricity grids" (University of Exeter 2009). Similar images are reproduced as part of the *Desertec Atlas*, an educational volume produced by the Austrian chapter of the Club of Rome (an international network that published the book *Limits to Growth* in 1972).

The map shown here was developed by the German Space Agency DLR as part of its "Solar Energy Mining (SOLEMI)" project, and is based on Meteosat (EU Meteorological Satellite) data. It is less notable for the data it presents – a more nuanced version of the common sense understanding that a lot of sun is reflected from the Sahara desert – than for the interpretation put upon it. The legend associated with the map explains that the colour coding represents solar irradiance in terms of its potential convertibility to kilowatt hours of electricity, while the commentary explains a similar point in relation to barrels of oil. The 4th edition of the *Desertec White Book* explains that, on this basis:

> each square kilometre of land in MENA receives an amount of solar energy that is equivalent to 1.5 million barrels of crude oil. A concentrating solar collector field with the size of Lake Nasser in Egypt (Aswan) could harvest energy equivalent to the present Middle East oil production (Knies et al. 2008: 29).

In this version, the map has also been redrawn with an overlay showing the relative land area required to meet global EU, MENA and global energy demand (at today's levels), as well as MENA demand in the context of a projected increase in water desalination. This is intended to show that "any conceivable global demand of energy, today or in future, could be produced from solar energy in deserts" (Knies et al. 2008: 19). In this latest articulation of the scheme, the Sahara desert becomes a metonym for renewable energy potential globally. The mapping exercise embeds the concept of extractable renewable energy resources, but simultaneously dis-embeds the development of this electricity generating capacity from locally articulated needs.

The Desertec mirage

What do these representations tell us? As with any maps, they simplify real world complexities into a heavily schematised picture in order to render it legible and amenable to certain interests. Such an activity is essential to all planning process, and has no inherent political consequences: in certain cases, mapping can be used as a resource to re-envisage the world and help to challenge embedded power structures, while in others it can lead planners to overlook the complex actual social phenomena it presumes to typify with disastrous results for local populations (Scott 1998: 46). The point at which the latter possibility kicks in – as it may do in the case of Desertec – is where a self-awareness of the schematic and generalising nature of the exercise is lost. Desertec focusses on Energy with a capital 'E', transforming the sun's energy into "resources for Concentrated Solar Power," whose utility is calculated in terms of their equivalence of barrels of oil.

Several consequences follow from this. First, the framework of extraction and export within which these resources are set is commensurated with the other forms of exportable, extractable Energy through which the European Union is seeking to diversify its supplies in the name of energy security concerns. Although the Desertec authors suggest that their proposed "purposive transition" to renewable energy amounts to a "new development paradigm" for the region, "it has largely been framed in accordance with future European energy needs and in line also with a European economic ideology of energy sector liberalisation" (Mason 2009).

The EU made some initial headway in its approach of making energy liberalisation a conditionality for investment in renewable energy infrastructure, with Egypt and Morocco reforming their national energy laws to feature long-term power purchase agreements and competitive private sector bidding, as well as the creation of renewable energy feed-in tariffs (Mason 2009: 4408).

This Eurocentric approach could end up undermining the case for renewable energy, however. "Many Africans are skeptical," according to Daniel Ayuk Mbi Egbe, who coordinates the African Network for Solar Energy. "[Europeans] make promises, but at the end of the day, they bring their engineers, they bring their equipment, and they go. It's a new form of resource exploitation just like in the past" (Friedman 2011).

Embedding renewable energy within an export-led and market-oriented framework has already stimulated political skepticism from some potential partners. Chakib Khelil, who was Algerian energy minister in 2009 when the Desertec Industrial Initiative was formed, has stated that:

> We have a clear policy with regards to solar energy. The precondition is that there is a partnership between Algerian and foreign companies and that there is a technology transfer in the area of engineering, manufacturing and construction. If these conditions are not fulfilled, we are not interested . . . We don't want foreign companies to exploit our solar energy resources (cited in Supersberger & Abderrahmane 2010:44).

This caution has been expressed by his successors in the country's energy ministry, while their counterparts at Sonalgaz (Algeria's national oil and gas company charged with responsibility for developing domestic solar capacity) have expressed a preference for partnering more closely with other members of the Arab-Maghreb Union than with the European Union (Supersberger & Abderrahmane 2010: 45).

In Egypt, meanwhile, the 2011 Arab Spring opened up some space for a more popular questioning of the free market reforms of the Mubarak regime in Egypt (Atris 2011). This may be compounded in the field of electricity production as the full economic implications of liberalisation – higher residential rates, but cheaper corporate rates – become more clear.

Second, as the biases exhibited in the maps above make clear, the Desertec project favours "expert" knowledge while slighting the salience of local contexts – a blind spot that can be characterised as a form of production of ignorance (Lohmann 2008: 359). This has led to complaints that desert people have not been consulted about their energy needs and existing land uses (Tatalovic 2011). Hamed El-Mously, an engineering professor who also chairs the Egyptian Society for Endogenous Development of Local Communities, points out that a more diversified range of smaller-scale energy options would better provide for local people's needs, and that the swathes of desert needed for large CSP solar arrays will dispossess nomads and pastoralists of the land that supports their livelihoods. The water distribution issues discussed above represent a further example of how ignoring local knowledge risks exacerbating existing inequalities.

Third, the centralised model of energy provision favoured by the project is likely to perpetuate the dominance of a few large energy corporations (Eurosolar 2009). This is also, arguably, a factor written into the technology choice. According to the World Bank, "CSP is a technology that is of particular interest to utilities", because it "is more scalable and more consistent with a centralised and dispatchable generation model" (World Bank 2009b). It is far from clear that it is the most favourable technology choice for encouraging broader and affordable energy access, however, while CSP is also currently losing out to photovoltaic technologies in terms of production costs and market share in the race to commercialise solar technologies.[4]

The centralised approach has potentially negative consequences on both sides of the Mediterranean. On the European side, the large subsidies sought by Desertec (*see* next section for its institutional composition) could have the effect of delaying and undermining efforts to develop local renewable energy capacity. Given the declining costs of wind and solar power, the long time-scale involved in constructing these mega-projects could see their supposed cost-benefits eclipsed by the unit costs of emphasising more local renewable capacity in the EU (Eurosolar 2009a).

On the North African side, the considerable underestimates of both the potential development costs and the lead times for realising these projects could undermine many of their claimed benefits

4 Whereas concentrated solar power systems use mirrors or lenses to reflect and concentrate sunlight onto a small area which heats water that turns into steam, which drives turbines to produce electricity, photovoltaic solar panels convert solar radiation into direct current electricity by means of semiconductors.

(Eurosolar 2009b). The tendency with mega-projects has also been to underplay uncertainties about development costs, leading to consistent underestimates (Schinke & Klawitter 2011: 37-8).

Eurosolar President Herman Scheer, a renewable energy pioneer and German parliamentarian prior to his death in 2010, warned that Desertec was an "absurd" mirage whose main purpose was to prolong "the structure's of today's energy supply into the age of renewables – a means to reinforce the monopoly of large energy suppliers." He saw the major German energy companies becoming increasingly central to the Desertec approach, and warned that "a switch to renewable energy will not work without structural change. Eon and RWE are bracing themselves against 'creative destruction', as Schumpeter calls it. But they have these bad ideas" (Kaufmann 2009).

Embedding ideas in institutions: Who is transforming Desertec from concept to reality?

If Desertec is a *conceptual* framework for solar power expansion in the Middle East and North Africa, it is also the *organisational* and *institutional* framework for bringing that plan to fruition. This framework has three main components:

- research and lobbying in favour of the concept;
- industry collaborating on technical research and lobbying; and
- the embedding of the concept in the plans of intergovernmental bodies and financial institutions – most notably, the European Union and the World Bank.

The institutional history of Desertec begins in 1998, when the German Federal Ministry for the Environment, Nature Conversation and Nuclear Safety (BMU) promoted research support for the project, including a series of studies led by the country's space agency, DLR. This resulted in a series of technical studies, published between 2004 and 2006, which focussed on the potential for concentrated solar power (MED-CSP) and the transmissions infrastructure associated with it (TRANS-CSP). With water availability emerging as a major concern with the project, a third study (AQUA-CSP) sought to identify the potential for using CSP in conjunction with water desalination plants. The German ministry also supported a series of Middle East and North Africa Renewable Energy Conferences (MENAREC) to promote support for these concepts.

In parallel, the elaboration of the Trans-Mediterranean Renewable Energy Cooperation (TREC) concept coincided with the formation in 2003 of a grouping of the same name, which encompasses researchers, think-tanks and renewable energy lobbyists. TREC was coordinated by the German section of the Club of Rome, in partnership with the Hamburg Climate Protection Foundation and the National Energy Research Centre (NRC) of Jordan, and focussed its political lobby activities on Berlin and Brussels (Supersberger & Abderrahmane 2010: 11; Schink & Klawitter 2011: 8).

TREC was renamed the Desertec Foundation in 2008, and formally registered as a non-profit association in Berlin. In July 2009, under the initial guidance of German insurance giant Munich Re, it was joined by the Desertec Industrial Initiative (DII), a collaboration between several major German and international corporations.[5] In its founding declaration, the DII claimed that it would be

5 The Desertec Industrial Initiative (DII) was announced in July 2009, and registered as a limited company in October of that year. Its founding partners were almost all German-based engineering, power-sector or financial corporations: Desertec Foundation, Deutsche Bank, E.ON, HSH Nordbank, MAN Solar Millennium, Munich Re, M+W Zander, RWE, SCHOTT Solar, Siemens, with the addition of Abengoa Solar of Spain, the Swedish-Swiss ABB group, and the Algerian agribusiness company Cevital. It has since expanded and become more internationally

willing to invest an estimated €400 billion over the next 20 years in large-scale renewable power projects in the MENA region, although only a fraction of that amount has been invested to date (DII 2009).

Since then, the institutional framework has become more fragmented. While the EUMENA concept remains central to the work of the Desertec Foundation, it is also promoting a parallel "Super Grid" that would link together wind and solar power projects in Asia (Desertec Foundation 2012).

Meanwhile, the private sector DII has been joined by a similar initiative, originally called the Transgreen Consortium and now known as Medgrid, which was launched at a meeting of energy ministers from the EU, North Africa and the Middle East held in Cairo on 25 May 2010. Medgrid's main stated aim is to study the technical, economic and institutional feasibility of developing a Mediterranean transmission system which, by 2020, would enable the export to Europe of up to 5 GW of electricity generated from renewable sources generated in the MENA countries.

Medgrid is an industrial consortium, and is structured in a similar way to the DII. It currently has 21 shareholders, led by major French electricity utility EDF, and includes manufacturing firms (such as Siemens, also a partner in Desertec) and the Moroccan state electricity provider, ONE (Office National de l'Électricité).

Medgrid was launched to rebalance the German-bias of the Desertec Initiative, although this act of intra-European Union political positioning looks unlikely to endure as a lasting political rivalry. A cooperation agreement between DII and Medgrid was signed in November 2011, with the support of the Polish Presidency of the European Union Council, the European Energy Commission, the French Minister in charge of Industry, Energy and Digital Economy, and the German Federal Ministry of Economics and Technology (Dii & Medgrid 2011). This move was praised by the European Commission for its potential to have a "positive impact on market integration" (European Commission 2011b).

The Commission's involvement in brokering the collaboration agreement between DII and Medgrid is one of a number of interventions in support of Desertec. These include a series of Ministerial Conferences under the framework of the Euro-Mediterranean Partnership, as well as a Euro-Med Energy Forum bringing together major energy companies from the region.

The EU Commission's flagship involvement, however, comes via the Mediterranean Solar Plan (MSP), one of the leading projects being promoted by the Union for the Mediterranean (UfM), a regional cooperation initiative launched in 2008. The European Union has funded a €4.6 million technical support project to develop this plan, which bears a close resemblance to the Desertec and Medgrid initiatives; in January 2012, the UfM signed a Memorandum of Understanding with Medgrid, committing the latter to help implement the MSP (ENPI 2012).

The limits of Mediterranean regionalism

Beyond the flurry of paper-signings, however, there is a yawning gap between the Desertec vision and the EU's ability to facilitate the implementation of the project. At a conceptual level, Desertec's founders sought to "initiate a common market and an interconnection infrastructure for renewable energies among the countries surrounding the Mediterranean Sea" (TREC Development Group

diverse, to include 21 shareholders and 33 other associated partners (Desertec Industrial Initiative 2012) .

2003). The project was presented as having the potential to emulating the founding moments of the European Union itself, creating:

> an opportunity for the Mediterranean riparian regions of Europe, the Middle East and North Africa (EUMENA) to form a community for energy, water and climate security – with some similarities to the Community of Coal and Steel established in Europe some 60 years ago – for a prosperous and peaceful future (Knies et al. 2008: 8).

This finds its closest echo in the promotion of the project by the Union for the Mediterranean, which has made the MSP one of six flagship projects. Yet this French-led initiative has very limited buy-in from the Member States that are formally signed up to it: "To put it in politically incorrect terms, the UfM was launched because a very small group cajoled an uninterested majority into yet another initiative for the Mediterranean" (Bicchi 2011:7).

In this regard, it echoes a series of stuttering attempts by the EU (and European Economic Community) to develop closer ties with its southern neighbours, dating back to the 1970s (Bicchi 2004:5). The first of these, also driven forward by the French government, was the Global Mediterranean Policy of 1972, which aimed at setting bilateral trade and aid agreements between the EEC and Mediterranean Non-Member Countries. It failed – and in the context of the Cold War and low oil prices, there were few attempts to revive it as a priority (Adler & Crawford 2006: 26). The situation changed in 1990, when the European Community began an initiative called Renovated Mediterranean Policy, which culminated in the launch in 1995 of a Euro-Mediterranean Partnership (also known as the Barcelona Process). But that floundered, too, when EU attempts to push migration controls up the agenda prompted a walkout by almost all the southern Mediterranean heads of state at the Partnership's tenth anniversary conference in 2005 (Bicchi 2011:11).

Meanwhile, the Barcelona Process had already been partially eclipsed by the European Neighbourhood Policy (ENP), a broader framing for the EU's external relations with countries to the East and South. "A strategic energy partnership with neighbouring countries" was billed as a "major element" of this, with an emphasis on ensuring the security of oil and gas imports to the EU (European Commission, 2004:17). The agenda further informed the European Neighbourhood and Partnership Instrument, which replaced the Euro-Mediterranean Partnership in 2007, as well as the Union for the Mediterranean, which laid the groundwork for the Mediterranean Solar Plan and envisaged the development of closer maritime and overland infrastructure corridors.

Mediterranean Solar Plan

The MSP was approved by the European Council in 2008 as one of the six priorities of the Union for the Mediterranean initiative. It envisages a total installed capacity of 20 gigawatts of "renewable" energy (including hydropower and biomass) by the year 2020 (Supersberger & Abderrahmane 2010; Schinke & Klawitter 2011: 10). The European Commission's Directorate-General for Energy and Transportation has even projected that this could rise to 700 TWh/year of electricity by 2050, providing about 15 per cent of European electricity demand by solar imports (Salazar 2008:50).

Stakeholders in the Mediterranean Solar Plan have assessed its immediate aims as "the production of a master plan study, the construction of the Moroccan Ouarzazate CSP plant, and the test of the application of article 9 of the new EU energy directive" (Supersberger & Abderrahmane 2010:16). However, the MSP is only a means of coordination between existing initiatives and development of

compatible regulatory frameworks. It does not have its own significant funds to facilitate large-scale power projects.

The evidence to date shows that it will fall significantly short of its ambitious targets. As of 2010, the European Commission was projecting that just a quarter of this total [?? OSCAR? What total?] would come from Concentrated Solar Power projects (Lorec, 2010: 8). By 2012, even this scaled-down goal looks far from being met. Luis Crespo Rodríguez, general secretary at Protermosolar, the Spanish CSP industry association, claims that "the Mediterranean Solar Plan is stuck. There is no definition of the project or the execution plan" (Deign 2012).

It is not hard to identify the reasons behind this lack of progress. On the EU side, the sovereign debt crisis (and the austerity programmes pursued following the 2008 financial crisis) has eaten into potential bilateral funding sources, while in North Africa and the Middle East, the Arab Spring has shaken up the institutional environment. It is worth noting, in this regard, that the majority of funding from the European Neighbourhood Policy went to the governments of Egypt and Tunisia, which were deposed by popular protests in 2011 (Swidlicki, 2011).

More generally, the Union for the Mediterranean has followed a similar course to the Barcelona Process in being politically sidelined. The Union was originally scheduled to hold biannual Heads of State meetings, but the 2010 summit was postponed and subsequently cancelled after Arab states threatened a boycott over the stalled Israel-Palestine peace process (Vogel 2010). No further Heads of State summit has been scheduled for 2012.

Most recently, on 16 March 2012, the European Commission gave its formal approval to the Mediterranean Solar Plan Project Preparation Initiative, the first financial tool associated with the project. This will cover modest technical assistance costs for preparing sustainable energy investment projects in Algeria, Egypt, Israel, Jordan, Lebanon, Morocco, Syria, Tunisia, West Bank and Gaza – although no funding has yet been allocated.

EU energy policy

While the regional framework within which Desertec sits remains weak, the concept is increasingly becoming lodged as a pillar of EU energy policy. On 8 March 2011, less than a month after the fall of President Hosni Mubarak in Egypt, the Commission and the EU's High Representative for Foreign and Security Policy sought to use the Arab Spring as an opportunity to promote the idea of an EU-South Mediterranean Energy Community, as part of a "Deep and Comprehensive Free Trade Area":

> It is desirable to open a credible perspective for the integration of the Southern Mediterranean in the EU internal energy market based on a differentiated and gradual approach. In the mid to long term, this would mean establishing a form of 'EU-Southern Mediterranean Energy Community' starting with the Maghreb countries and possibly expanding progressively to the Mashreq (European Commission & High Representative of the Union for Foreign Affairs and Security Policy 2011: 10).

The 2011 Communication on Energy Security, released in September 2011, builds upon this. It formalises this commitment to an EU-Southern Mediterranean Energy Partnership, and claims that "Promising exploratory talks with partners in the region such as Morocco or Algeria suggest that this initiative meets interest and deserves to be fully explored" (European Commission 2011a: 7). It

also notes that the demise of the Gaddafi regime in Libya opens up the possibility of incorporating the country into these "EU-Mediterranean energy cooperation structures" (European Commission 2011a: 10).

The Communication envisages various means of achieving these goals. It stresses the role that the EU can play to "facilitate large-scale infrastructure projects linking the EU network to third countries," in particular with regard to legal harmonisation (European Commission 2011a:4). The Communication uses the example of the Commission's mandate to negotiate a legal agreement for a Trans-Caspian gas pipeline system, and foresees a similar role in securing the "appropriate legal and political basis for the import of renewable electricity from the Southern Mediterranean" (European Commission 2011a: 4-5). It also sees an opportunity to revive the Energy Charter Treaty, which had stalled under Russia's failure to ratify it (European Commission 2011a:13).

These proposals are re-affirmed in the European Commission's 2050 Energy Roadmap, which plots a long-term path towards diversifying the EU's energy supplies – although it is notable that "the development of renewable and low-emission sources of energy in the Southern Mediterranean and interconnections with European distribution networks" plays second fiddle to measures to strengthen the gas market (European Commission 2011c:10, 12-13).

In addition to its attempts to legitimise its regional energy market framework, the EU has also established a regulatory framework that is highly favourable to renewable energy imports. Under the Directive on the Promotion of the Use of Energy from Renewable Sources (EU 2009), all Member States have committed themselves to an increased share of renewable energy in their overall energy mix by 2020.[6]

The EU targets allow member states to include support schemes and measures of cooperation "with third countries," so long as the imported electricity is produced by a "newly constructed installation that became operational" or by the increased capacity of an installation that "was refurbished" after January 2009. This could drive new export-capacity to capitalise on the EU's targets – but it also undermines the integrity of the bloc's environmental claims.

Notably, the EU Directive allows for the possibility that, "under certain conditions, electricity from renewable sources produced and consumed in a third country can be counted towards the EU member states' targets in the context of the 'construction of an inter-connector with a very long lead-time', e.g. between Italy and Tunisia" (World Bank 2009a:11) In other words, Italy can count Tunisian consumers' use of Tunisian produced energy as part of its domestic renewable targets, on the grounds that a transmission line between the two countries (ELMED) is under construction.[7]

New funding may also be forthcoming for the MSP and related initiatives in the EU's next budget cycle. Support for "interconnections between Italy/Spain and North African countries in view of their longer term renewables potential" feature in the European Commission's 2014-2020 budget, as one of the many projects to receive support under a €40 billion Infrastructure Facility.(European Commission 2011a: 68). This forms part of a larger emphasis on "Connecting Europe" that is a key pillar of the Commission's budget – although it is worth noting that gas and oil connections remain a greater priority for the EU public purse (€100 billion in the form of direct grants, and €100 billion

6 The overall increase of 20%, although the absolute figures range from 10% (Malta) to 49% (Sweden) (EU 2009).

7 Article 9 of Directive 2009/28/EC allows "virtual" accounting of renewable energy imports even before the operation of export cables, if cable projects are already implemented and foreseeable to be connected within a defined time frame. The Directive explicitly limits this provision to cases where construction of connecting lines has started by 2016 with a scheduled completion date no later than 2022.

to “leverage” private capital) (European Commission 2011a: 55). In the European Commission’s proposed budget for 2014-2020, the European Neighbourhood Instrument also attracts €16.1 billion, part of which could be allocated to CSP and “super grid” connections (European Commission 2011a). It is worth noting, however, that the emphasis of both the renewables’ target and the budget measures is only on imports of energy to the EU, shorn of their more lofty MENA regional development framing.

The Middle East North Africa Concentrated Solar Power Programme (MENA CSP)

Development banks represent the other major constituency seeking to implement the Desertec project in some form. The World Bank and African Development Bank, in particular, are backing a Middle East and North Africa Concentrated Solar Power (MENA CSP) programme, which is by far the largest proposed activity of the World Bank-administered Clean Technology Fund (CTF).

The MENA CSP is intended to fund nine projects across Morocco, Egypt, Tunisia, Algeria and Jordan, resulting in the installation of around 1.2 gigawatts in new generation capacity by 2018, as well as two “transmission corridors” linking them to the European electricity grid (World Bank 2009b; World Bank 2010: ii). The CTF is providing US$750 million, channelled through the World Bank, the International Finance Corporation (IFC, its private sector investment arm) and the African Development Bank (AfDB). It is seeking an additional $4.85 billion from a mix of different funding streams within these same multilateral development banks, other multilateral investors such as the European Investment Bank, bilateral agencies and private sources.

The initiative has also featured as a flagship project for G8 and G20 initiatives in the region. In May 2011, the G8 launched the Deauville Partnership to support economic “modernisation,” free trade agreements for “improved mutual market access,” and the extension of the European Bank of Reconstruction and Development’s mandate to operate in the Middle East and North Africa (G8 2011b). The MENA CSP is presented as one of the key examples of joint IFI work to encourage this integration process (G8 2011a).

The G20, for its part, recently convened a High Level Panel on Infrastructure, which included “Scaling-up Solar Energy in MENA for Export to European Markets ” as one of 11 “exemplary” infrastructure initiatives (High Level Panel on Infrastructure 2011: iv; Appendix 11). The MENA CSP is also being incorporated into the World Bank’s *New Partnership for Inclusive Growth in the MENA Region* (World Bank 2011).

The initial concept note for the MENA CSP project stresses that the priority is “to develop IPP [Independent Power Producer] type private sector projects where CTF support for private sector investments could be channelled through the IFC or the AfDB following a market aggregation model where incentives could be provided on a competitive basis” (World Bank 2009a:8). In other words, it foresees the principal use of public funds as a tool to stimulate private investment. But private interest at any significant scale has yet to materialise.

The CTF’s $750 million is a tenth of the “total financing in the range of US$ 6-8 billion” that the World Bank estimates is needed to install a gigawatt of new CSP electricity generating capacity in the region (World Bank 2009a: 12). As of November 2011, the project was experiencing significant delays “due to the political situation” in Tunisia and Egypt (Climate Investment Funds 2011b). In Algeria, too, there were “delays due to unconfirmed interest from the authorities to pursue the

project" (Climate Investment Funds 2011b).

Further evidence of these difficulties can be seen in the case of the Ouarzazate project in Morocco, the first MENA CSP project to be approved (although it is not yet under construction). The plan for Ourzazate is to build a 160 MW CSP plant, which could later be expanded to a 500 MW project.

On 18 November 2011, the World Bank approved $297 million in loans for the Ouarzazate Concentrated Solar Power Plant Project. The full cost breakdown is:

Source	**Amount (US$ millions)**	
Public-Private Partnership partners (including MASEN)	379	
Clean Technology Fund	197	AfDB $100m IBRD $97m
International Bank of Reconstruction and Development	200	
African Development Bank	245	
AFD (French government development agency)	123	
KfW (German government development bank)	123	
European Investment Bank	123	
European Commission/Neighbourhood Investment Facility (grant)	37	
Total Amount	*1,427*	

Source: World Bank (2012: 7)

The most remarkable statistic here is the total projected cost of US$1.43 billion – more than trebling the US$440 million original cost projection for the site. No account has yet been given as to whether other cost projections across the whole MENA project would rise according to a similar scale and, if so, how this shortfall would be met.

Aside from covering capital costs, a second element in the project financing is a quasi feed-in tariff – a government subsidy to cover "the gap between the costs of CSP generation and conventional fossil fuel-fired generation" (Climate Investment Funds 2011a: 13). The Solar Power Company (a public-private company established to run the project) will sell electricity to MASEN, which sells it on to the Moroccan state electricity provider, ONE, according to the country's wholesale electricity price at the time of sale, which is mainly determined by the cost of coal generation (Climate Investment Funds 2011a:13). The law creating MASEN guarantees that it "will buy costly CSP production and sell it to ONE at a price equivalent to the cost of coal-generated power" (Climate Investment Funds 2011a:18). The amount is not precisely costed, and could fluctuate according to fossil fuel prices and the general financial standing of the Moroccan government. However, the current CSP price is over double the average electricity wholesale price, so it is likely to require significant subsidies (Climate Investment Funds 2011a: 22).

This price gap will, in principle, be met by the government of Morocco, although the World Bank has offered a loan towards these costs "when economic and fiscal conditions warrant it" (Pariente-David 2011:2; Climate Investment Funds 2011a: 14, 18). If MASEN runs into financial problems due to cost over-runs – a not unlikely scenario, given the evidence to date from the Ouarzazate project – it would ultimately bear the costs and may be forced into further dependency on loans

from the World Bank. In effect, the proposed structure asks Morocco to subsidise the creation of a risky mega-project whose primary purpose is to export electricity to the EU.

Meeting the repayment costs on these loans could also force up electricity prices, actively reducing energy access. The World Bank notes that "the project's financial viability is contingent upon a very high sale price of the electricity generated" (Climate Investment Funds 2011a: 22). This is consistent with the World Bank's broader approach, which foresees "substantial changes in energy policy to increase electricity prices" (Energy Sector Management Assistance Program 2010: 13). In Egypt, for example, this could mean increases in tariffs for residential users of 47 per cent a year over five years (Energy Sector Management Assistance Program 2010: 32). The backdrop to these increases is a neoliberal model that envisions replacing state support for electricity with a model of "full cost recovery," a key condition for electricity markets to be opened up to further competition.[8] Ultimately, redistribution of the costs of electricity would exacerbate access inequalities, benefitting corporations (which can negotiate cheaper rates as part of longer term power-purchase agreements) at the expense of residential users.

Conclusions

The Desertec concept sets out an ambitious agenda for renewable energy development in North Africa and the Middle East, promising a potential transformation to clean sources of power, which could also result in financial gains (from exports to the EU) for the host countries and their populations. In many respects, this is a laudable goal given the clear need for a rapid transition to solar and other forms of renewable energy globally. However, over-selling the claims of large-scale solar mega-projects, and embedding them within a neoliberal model of energy liberalisation, can serve to undermine this goal and discredit it by association.

The Desertec concept has conceived of Energy as an exportable resource abstracted from varied local regimes of demand and use. In so doing, it tends to privilege technocratic, "expert" knowledge over local specificities – be those water usage patterns, or inequalities in how any benefits of projects are liable to be distributed.

Its vision of vast solar arrays in the Sahara, integrated into a regional free market, is presented as a means of promoting human rights and European "soft" power, but currently look more likely to feed into a broader EU "energy grab." It is notable, in this regard, that the early evidence from the electricity "corridors" being promoted as part of renewable energy deployment is that the majority use for these transmission lines will be the export of fossil-fuel based power.

The project's centralised model of energy provision is also likely to perpetuate the dominance of a few large energy corporations – many of whom have clubbed together to form the DII and Medgrid industry initiatives that aim to transform the Desertec concept into a reality. This approach could also serve to delay and undermine efforts to develop local renewable energy capacity within Europe, where these corporations are increasingly vocal in demanding subsidies to implement Desertec.

Despite the central emphasis on private actors, however, these large energy corporations have so far done little to implement the project. The key actors remain state and development institutions. On the European side, the implementation of a Mediterranean Solar Plan mirrors the ambition of the

8 For a critique of the "full cost recovery" approach to service delivery, *see* MacDonald & Pape 2003.

Desertec founders to initiate a common market similar to that which set the European Union itself in motion. However, the current incarnation of this project – the Union for the Mediterranean – is suffering from the same institutional weaknesses and geopolitical conflicts that have dogged similar European attempts to develop closer ties with their southern neighbours (on distinctly parochial, European terms) since the 1970s.

The evidence to date shows that the implementation of the MSP is falling significantly short of its ambitious targets. In the words of one observer, it is "stuck." However, while the regional framework for promoting the MSP (the institutional translation of Desertec and Medgrid) remains weak, the concept is increasingly strong as a pillar of EU energy policy. New funding for the project's electricity inter-connection lines could be forthcoming – notably, via the infrastructure facility contained in the EU's 2014-2020 budget.

The EU's domestic renewable energy targets also provide a source of demand (and may encourage importers to pay a "green premium"), although transfers of renewable energy can be counted towards EU targets even if they are only virtual. This casts some doubt on the environmental integrity of the EU targets.

The World Bank and African Development Bank are also backing the creation of a Middle East and North Africa Concentrated Solar Power (MENA CSP) programme, which could help to bring Desertec to life. Here, too, the emphasis is on "leveraging" private investment with public funds – although private interest at any significant scale has yet to materialise. The flagship Ourzazate project, the first to be approved under the MENA CSP framework, has already seen its projected costs more than treble to over US$1.43 billion. This could reduce the commercial viability of the project, while also threatening to load increased costs onto the Moroccan state, which hosts the project. If further cost over-runs are experienced, Morocco could be forced into further dependency on loans from the World Bank – in effect, bearing much of the cost of electricity production whose primary purpose is for export to the EU. The distribution of these costs, particularly when set within an electricity market reform agenda that would increase domestic electricity prices while reducing those paid by corporations, could significantly undermine the case for renewables. For all the lofty claims made by the project, it is therefore urgent to scale-back the ambition, deepen understanding of local needs and geopolitical conditions, and reframe the project of solar power provision in the region away from the development of mega-projects whose main purpose is to export electricity to the EU.

Bibliography

Adler, E. & Crawford, B., 2006. *Normative Power: The European Practice of Region Building and the Case of the Euro-Mediterranean Partnership (EMP)* E. Adler et al., eds., University of Toronto Press.

Al-Widyan, M. and Al-Muhtaseb, M., 2009. Institutional Aspects of a Regional Energy System. In A. Mason, Michael Mor, ed. *Renewable Energy in the Middle East*. Springer, pp. 177-196.

Atris, A., 2011. A revolution against neoliberalism? *Al Jazeera*. Available at: http://english.aljazeera.net/indepth/opinion/2011/02/201122414315249621.html .

Bank Information Center, 2010. Concentrated Solar Power in MENA. Available at: http://www.bicusa.org/en/Article.11853.aspx.

Bicchi, F., 2011. The Union for the Mediterranean, or the Changing Context of Euro-Mediterranean Relations. *Mediterranean Politics*, 16(1), pp.3-19. Available at: http://www.tandfonline.com/doi/abs/10.1080/13629395.2011.547365 [Accessed March 9, 2012].

Climate Investment Funds, 2011a. *Morocco: Ouarzazate I Concentrated Solar Power Project*, Washington DC.

Climate Investment Funds, 2011b. *Semi-annual report on CTF operations , 26 October*, Washington DC.

Counter Balance, 2011. *Energy Security or Energy Grab? 1 The European Commission's View of Our Energy Future , and What it Means for People , Politics and the Planet*, Available at: http://www.counterbalance-eib.org/wp-content/uploads/2011/05/Energy_Security_Submission_CB.pdf.

Deign, J., 2012. Mediterranean Solar Plan: drifting off the radar. *CSP Today*. Available at: http://social.csptoday.com/emerging-markets/mediterranean-solar-plan-drifting-radar.

Desertec Foundation, 2009. *An Overview of the Desertec Concept*, Hamburg.

Desertec Foundation, 2012. Asian Super Grid for Renewable Energies: DESERTEC Foundation signs Memorandum of Understanding. Available at: http://www.desertec.org/en/press/press-releases/120310-01-asian-super-grid-for-renewable-energies-desertec-foundation-signs-memorandum-of-understanding/.

Desertec Industrial Initiative, 2012. Desertec Industrial Initiative. Available at: http://www.dii-eumena.com [Accessed March 12, 2012].

DII & Medgrid, 2011. Industrial Initiatives Dii and Medgrid join forces for the development of industrial-scale renewable energy. Available at: http://www.medgrid-psm.com/en/2011/11/dii-and-medgrid-join-forces/ [Accessed March 12, 2012].

Dubessy, F. 2010. Le projet Transgreen devient la société Medgrid. Available at: http://www.econostrum.info/Le-projet-Transgreen-devient-la-societe-Medgrid_a4023.html

ENPI, 2012. UfM and Medgrid to cooperate in implementing Mediterranean Solar Plan. Available at: http://www.enpi-info.eu/medportal/news/project/27772/UfM-and-Medgrid-to-cooperate-in-implementing-Mediterranean-Solar-Plan [Accessed March 14, 2012].

EU, 2009. Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources, in: Official Journal of the European Union, 5.6.2009, L140/16-62.

Energy Sector Management Assistance Program, 2010. *Potential of Energy Integration in Mashreq and Neighboring Countries*, Washington DC.

Escribano, G., 2010. Convergence towards Differentiation: The Case of Mediterranean Energy Corridors. *Mediterranean Politics*, 15(2), pp.211-229. Available at: http://www.tandfonline.com/doi/abs/10.1080/13629395.2010.485048 [Accessed April 11, 2012].

European Commission, 2011a. A Budget for Europe 2020 - Part II: Policy fiches. *Direct*. Available at: http://ec.europa.eu/budget/library/biblio/documents/fin_fwk1420/MFF_COM-2011-

500_Part_II_en.pdf.
European Commission, 2011b. Commission welcomes Desertec and Medgrid cooperation on solar energy in North Africa and the Middle East. Available at: http://europa.eu/rapid/pressReleasesAction.do?reference=IP/11/1448&format=HTML&aged=0&language=en&guiLanguage=en [Accessed March 12, 2012].
European Commission, 2011c. Energy Roadmap 2050.
European Commission, 2004. European Neighbourhood Policy STRATEGY PAPER. *Communication*.
European Commission, 2011d. On security of energy supply and international cooperation - "The EU Energy Policy: Engaging with Partners beyond Our Borders." , p.19.
European Commission, 2008. Second Strategic Energy Review: AN EU ENERGY SECURITY AND SOLIDARITY ACTION PLAN. *Energy Policy*. Available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2008:0781:FIN:EN:PDF.
European Commission & High Representative of the Union for Foreign Affairs and Security Policy, 2011. A Partnership for Democracy and Shared Prospecrity with the Southern Mediterranean. , p.17.
Eurosolar, 2009a. DESERTEC: Why roam far and wide, as the Good is found close to home. Available at: http://www.eurosolar.de/en/index.php?option=com_content&task=view&id=358&Itemid=98 [Accessed March 11, 2012].
Eurosolar, 2009b. European power from the desert is a Fata Morgana. Available at: http://www.eurosolar.de/en/index.php?option=com_content&task=view&id=356&Itemid=98 [Accessed March 11, 2012].
Friedman, L., 2011. Can North Africa Light Up Europe With Concentrated Solar Power? *New York Times*. Available at: http://www.nytimes.com/cwire/2011/06/20/20climatewire-can-north-africa-light-up-europe-with-concen-79708.html?pagewanted=all.
G8, 2011a. Deauville Partnership Finance Ministers' Meeting: Communiqué,. Available at: http://www.g8.utoronto.ca/finance/fm110910-deauville-en.html.
G8, 2011b. Declaration of the G8 on the Arab Spring - G8 Summit of Deauville. Available at: http://www.g8-g20.com/g8-g20/g8/english/live/news/declaration-of-the-g8-on-the-arab-springs.1316.html.
Gellert, P.K. & Lynch, B.D., 2003. Mega-projects as displacements. *ISSJ*, (175).
Hayes, M., 2004. Algerian gas to Europe: the transmed pipeline and early Spanish gas import projects. In *Geopolitics of Gas Working Paper Series, The James A. Baker III Institute for Public Policy, Energy Forum, Stanford University, Stanford*.
High Level Panel on Infrastructure, 2011. *Recommendations to G20 – Final Report*,
Hildyard, N., Lohmann, L. & Sexton, S., 2012. *Energy Security For Whom? For What?*, Available at: http://www.thecornerhouse.org.uk/sites/thecornerhouse.org.uk/files/Energy Security For Whom For What.pdf.
Hirschhausen, C.V., 2010. Developing a " Super Grid ." In J. P. and R. S. Boaz Moselle, ed. *Harnessing Renewable Energy in Electric Power Systems: Theory, Practice, Policy*.
International Institute for Applied Systems Analysis, 2011. *Renewable energy in North Africa: A policy road-map for 2050 Final Activity Report*,
Kaufmann, M., 2009. Wüstenstrom "Die Kalkulation von Desertec ist absurd." *Manager Magazin*. Available at: http://www.eurosolar.de/de/index.php?option=com_content&task=view&id=1145&Itemid=254.
Knies, G., Möller, U. & Straub, M., 2007. *Clean Power from Deserts: The DESERTEC Concept for Energy, Water and Climate Security MENA. 1st edition.*, Hamburg.
Knies, G., Möller, U. & Straub, M., 2008. *Clean Power from Deserts: The DESERTEC Concept for*

Energy, Water and Climate Security MENA. 4th edition, Hamburg.
Lohmann, L., 2008. Carbon Trading, Climate Justice and the Production of Ignorance: Ten examples. *Development*, 51(3), pp.359-365. Available at: http://www.palgrave-journals.com/doifinder/10.1057/dev.2008.27.
Lorec, P., 2010. *Union for the mediterranean Towards a mediterranean solar plan*, Paris.
MacDonald, D. & Pape, J., 2003. *Cost Recovery and the Crisis of Service Delivery in South Africa*, London: Zed Books.
Mason, M., 2009. Conclusion. In M. Mason, ed. *Renewable Energy in the Middle East*. Dordrecht: Springer, pp. 219-235.
Med-EMIP, 2010. *MEDRING UPDATE VOLUME I: Overview of the Power Systems of MED-EMIP*,
Medgrid, 2011. Medgrid: Opening New Lines of Sustainability. Available at: http://www.medgrid-psm.com/en/files/2011/08/Brochure-Medgrid-EN.pdf
Pariente-David, S., 2011. *MA-Ouarzazate Concentrated Solar Power: Integrated Safeguards Data Sheet, 27 July,*, Washington DC. Available at: http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2011/07/27/000003596_20110728110422/Original/Integrated0Saf0et000Appraisal0Stage.doc .
Salazar, C., 2008. *An Overview of CSP in Europe, North Africa and the Middle East*, Available at: http://www.aperca.org/temppdf/CSP_11_08.pdf.
Salkida, A., 2012. Africa's vanishing Lake Chad. *Africa Renewal*. Available at: http://www.un.org/en/africarenewal/vol26no1/lake-chad.html.
Schinke, B. & Klawitter, J., 2011. *Desertec and Human Development at the Local Level in the MENA-Region: A human rights-based and sustainable livelihoods analysis*, Stuttgart.
Scott, J.C., 1998. *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed* J. C. Scott, ed., Yale University Press. Available at: http://books.google.co.uk/books?id=PqcPCgsr2u0C.
Stine, D., 2009. *The Manhattan Project, the Apollo Program, and Federal Energy Technology Programs: A Comparative Analysis*, Available at: http://fpc.state.gov/documents/organization/128397.pdf [Accessed April 17, 2012].
Supersberger, N. & Abderrahmane, A., 2010. *Algeria – A Future Supplier of Electricity from Renewable Energies for Europe? Algeria 's Perspective and Current European Approaches*,
Swidlicki, P., 2011. *The EU and the Mediterranean: good neighbours?*,
TREC Development Group, 2003. Trans-Mediterranean Renewable Energy Cooperation "TREC" for development, climate stabilisation and good neighbourhood. Available at: http://www.desertec.org/fileadmin/downloads/media/TREC_Amman_2003.pdf.
Tatalovic, M., 2011. North Africa's Solar Energy Desert Plan Comes Under Fire. *SciDev.net*. Available at: http://oilprice.com/Alternative-Energy/Solar-Energy/North-Africas-Solar-Energy-Desert-Plan-Comes-Under-Fire.html.
Terna SPA, 2010. Elmed Project for Tunisia. Available at: http://www.terna.it/default/home_en/the_company/about_terna/terna_group_abroad/growth_abroad/elmed_project.aspx.
Trieb, F. & others, 2005. *Concentrating solar power for the Mediterranean region*, Stuttgart. Available at: http://www.dlr.de/tt/Portaldata/41/Resources/dokumente/institut/system/publications/MED-CSP_complete_study-small.pdf [Accessed March 12, 2012].
University of Exeter, 2009. Energy Security in a Multi-Polar World. Available at: http://www.exeter.ac.uk/energysecurity/documents/ESMW Meeting 1 Session 3 020409.pdf.
Vogel, T., 2010. Union for the Mediterranean summit postponed. *European Voice*. Available at: http://www.europeanvoice.com/article/2010/05/union-for-the-mediterranean-summit-postponed/68043.aspx .

World Bank, 2009a. *Clean Technology Fund: Concept note for a Concentrated solar power scale-up program in the Middle East and North Africa region World Bank Group*, Washington DC.
World Bank, 2009b. *Clean Technology Fund: Investment plan for Concentrated Solar Power in the Middle East and North Africa region, 10 November*, Washington DC.
World Bank, 2012. *Project Appraisal Document on a Propsed Loan in the Amount of US$ 200 million and a proposed Clean Technology Fund Loan in the amount of $97 million to the Moroccan Agency for Solar Energy (MASEN)*, Washington DC. Available at: http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2011/11/18/000406484_20111118174227/Rendered/PDF/09725281.pdf.
World Bank, 2011. *Towards A New Partnership for Inclusive Growth in the MENA Region*,
World Bank, 2010. *Update on the CSP-MNA Investment Plan, 29 October,*, Washington DC. Available at: http://siteresources.worldbank.org/INTMENA/Resources/CTF+Inf+2+CSP+MNA+IP+Oct29-2010[1].