

The Desertec Mirage

The Validity of DII Skepticism

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The project is ambitious, and the financing not confirmed, but the technology is proven and support is growing stronger with every new study and assessment. The Desertec Industrial Initiative (DII) is a private sector consortium that pursues an ideal that few can discredit in terms of potential environmental merit. The DII envisions a partnership in large-scale renewable energy projects between the European Union and Middle East and North Africa (EU-MENA). The Desertec Foundation predicts that along with providing renewable energies to the MENA region, this project could provide up to 15% of the EU's energy needs by 2050¹. Just 20 GW of Concentrated Solar Power (CSP) energy developments "would save some 80–100 Mt CO₂, if coal power is replaced, which would be a significant step for European climate target compliance."²

Media sources have been covering the progress of the DII, and many positive reports have been made with only a few general criticisms of the proposal. Yet other sources do not react so positively, outlining how the Desertec project is technologically unfeasible and even completely unrealistic. A much-quoted critic, Hermann Scheer, president of both Eurosolar and the International Parliamentary Forum on Renewable Energies, goes as far as saying that "the initiators know: There is no prospect of success"³. In addition, it is

suggested that the DII could possibly even contribute to existing problems in the MENA region. But Desertec's proponents still wield some convincing arguments, which should be duly noted because of the extensive studies already conducted to date, and the research to be undertaken until 2012. In the coming decades many nations will still be emerging from the recent financial crisis and thus the investment of large amounts of resources towards a project of this scale should be carefully scrutinized. In order to better judge the likelihood of success for the DII, it is necessary to look more closely at the validity of the initiative's major criticisms. For the purpose of this analysis we will focus on the issues related to Europe and North Africa, mainly in Algeria and Morocco, and cover the most predominant fears within three main areas of concern: the economic, logistical and political arenas.

THE DESERTEC INDUSTRIAL INITIATIVE: AN OVERVIEW

The Desertec Industrial Initiative is a €400 billion plan for energy sustainability in the European Union (EU) and the Middle East and North Africa (MENA). The primary objective of this project is to build Concentrated Solar Power (CSP) Plants in the Saharan deserts of Morocco, Algeria, and other locations such as Jordan and Egypt. It also strives to complete a sustainable energy grid of high voltage direct current (HVDC) power lines connecting MENA and the EU, including inputs from many different types of renewable energy sources in the region including wind and geothermal⁴.

Desertec began as the Trans-Mediterranean Renewable Energy Cooperation Paper (TREC) for the Arab Thought Forum of the Club of Rome, in Amman in 2003. It included contributors from Morocco, Jordan, Benin, Egypt, Germany and the Netherlands. TREC involved the Club of Rome,

¹ Desertec Foundation. *Press Release: Joint venture DII established and ready to take up work*. 2009. <http://www.desertec.org/en/press/press-releases/091030-01-formation-dii-gmbh/>

² Antonella Battaglinia, Johan Lilliestamb, Amin Haasb, and Anthony Pattc.

"Development of SuperSmart Grids for a more efficient utilisation of electricity from renewable sources." *Journal of Cleaner Production*. (London: Elsevier, 2009) 917.

³ Hermann Scheer. *European power from the desert is a Fata Morgana*. 2009.

http://www.hermannscheer.de/en/index.php?option=com_content&task=view&id=256&Itemid=10

⁴ Redpaper. *Red paper: An Overview of the Desertec Concept*. (Desertec Foundation, 2009.)

http://www.desertec.org/fileadmin/downloads/DESERTEC_RedPaper_2nd_en.pdf

the German Aerospace Centre (DLR), as well as many other European and MENA institutions of research, and organizations for sustainable energies. From the TREC paper materialized three studies commissioned by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU). The German Aerospace Center took the lead, producing the ‘MED-CSP’ and ‘TRANS-CSP’ studies between 2004 and 2006. Another study followed after water security emerged as a prominent area of concern, called the ‘AQUA-CSP’ study. This covered topics such as solar desalination prospects and reached completion in 2007⁵. The DII itself was proposed in the summer of 2009, by the Club of Rome in conjunction with the German Aerospace Centre. Now an in-depth feasibility study is underway for the DII, with funding coming solely from the 12 current shareholder companies. The DII is now legally recognized as a limited liability company, and the current shareholders include: ABB, ABENGOA Solar, Cevital, DESERTEC

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Foundation, Deutsche Bank, E.ON, HSH Nordbank, MAN Solar Millennium, Munich Re, M+W Zander, RWE, SCHOTT Solar and Siemens⁶. These companies represent a diverse assortment, from the world’s largest reinvestment firm, Munich Re, to solar technology companies like Spain’s ABENGOA. They indeed have a wide range of expertise, including MAN Solar Millennium which specializes in large-scale solar thermal development, construction and financing. Another matter of note is Cevital, the only non-European firm currently on board, is an Algerian agro-foods company.

THE TECHNOLOGY: CSP & HVDC

To begin, it is necessary to examine the details of this project, including the technological parameters proposed by the DII. Desertec plans to employ two key technologies in its projects: Concentrated Solar Power (CSP) and High Voltage Direct Current power lines (HVDC). In this section we will review the basic functioning of these two technologies as well as a few of the main concerns regarding their feasibility.

Concentrated Solar Power energy generation systems use reflection devices, such as mirrors, to concentrate the sun’s direct rays on to a specific location (such as a tube or tower) where it serves to heat a liquid like water or liquid sodium. This liquid is used to create steam which powers turbine-style electricity generators in much the same manner as would a conventional power plant. CSP technologies differ from other types of solar power such as photovoltaic (PV) in many ways, and have

significant advantages for deployment in the MENA region. For example, CSP can be deployed to operate while heating liquids to very high

temperatures to take advantage of vast amounts of solar irradiation in areas such as deserts. In addition, contrary to PV systems, which are excellent for small scale and off-grid electrification, CSP has been proven on numerous occasions to operate best on a large “power plant”-style scale. Exemplar plants exist in the Mojave Desert of Nevada, in California and in Spain, which has six operational plants and an additional 12 under construction⁷. The other matter of interest for CSP is its potential for round the clock energy production and hybridization. Unlike PV systems which transform solar energy directly into electricity, CSP technology directs solar rays to heat

⁵ Desertec Foundation, *Concept: Studies*. 2009 <http://www.desertec.org/en/concept/studies/>

⁶ Desertec Foundation. *Press Release: Joint venture DII established and ready to take up work*. 2009. <http://www.desertec.org/en/press/press-releases/091030-01-formation-dii-gmbh/>

⁷ The Times. *Surfing a wave of Californian sunshine as America looks for renewable future*. (London: Times Newspapers, 2009.) http://business.timesonline.co.uk/tol/business/industry_sectors/natural_resources/article6965633.ece

some medium for the purpose of powering turbines. Since CSP plants have the capacity to heat this medium to a very high temperature, it is possible to store this substance for use at night, or during possible power disruptions. In addition, since the basic functioning of a CSP plant is so similar to those burning natural gas, there is also the option of creating hybrid plants. These could primarily produce solar energy, and have a natural gas backup system for times of power disruption, ultimately creating an exceedingly stable resource. This is also convenient considering that Algeria, one of the proposed locations for CSP development, has the world's eighth largest natural gas reserves in the world⁸. CSP has been extensively studied, and furthermore deployed, in many different countries and is seen as a commercially proven and viable technology. In addition to the DLR studies already noted, Greenpeace has prepared a joint study on CSP energy with The International Energy Agency's Solar Power and Chemical Energy Systems (IEA SolarPACES) and the European Solar Thermal Electricity Association (ESTELA), which has been updated twice since 2003. The most recent revision in 2009 has grown even more convincing and is exceedingly supportive of CSP, calling it "one of the technologies best-suited to mitigating climate change in an affordable way, as well as reducing the consumption of fossil fuels"⁹.

The other technology that is slightly more debated in terms of viability is high voltage direct current power lines, which will connect the EU-MENA region and deliver the desert-generated energy to the homes of Europeans. HVDC cables "connect two separate high voltage AC Systems via a DC link" and are sometimes the only option for long-

distance connections between energy grids¹⁰. There are many benefits to using HVDC over the High Voltage Alternating Current (HVAC) systems which are currently in use in much of the world, namely that energy losses are as low as 3% per 1000 km. This means that "in theory, an HVDC line could be laid from Morocco to London, a distance of 2700 km, with losses of less than 8%"¹¹. Though they would be extremely efficient, "the DLR has estimated that the cost of 20 transmission lines of 5 GW each would be approximately 45bn Euros" which is indeed a large sum¹². On a positive note, the DII has on board companies with experience manufacturing these cables, like ABB and Siemens. Also there are numerous examples of functioning HVDC connections between landmasses, such as between Australia and Tasmania¹³. Since there remain a number of concerns about HVDC technology to be clarified we will further discuss this issue in the sections on economic and logistical issues for Europe.

In terms of geography, the Desertec project plans to target locations in Morocco, Algeria, Tunisia, Libya, Egypt, Jordan and possibly other areas in the MENA region. Many of these states have shown signs of willingness to participate in the development of their renewable resources, or have even already begun this process, and so prospects may be good for the Desertec Industrial Initiative. Notably, Algeria and Morocco have already begun development of solar technology within their borders, with the investment of ABENGOA Solar and its subsidiaries¹⁴. Furthermore, Algeria has even

⁸ EIA. Energy Information Administration. *Algeria Energy Data, Statistics and Analysis: Natural Gas*. 2009.

<http://www.eia.doe.gov/cabs/Algeria/NaturalGas.html>

⁹ Greenpeace, SolarPACES and ESTELA. *Concentrating Solar Power Global*

Outlook 09: Why Renewable Energy is Hot. 2009.

<http://www.greenpeace.org/raw/content/international/press/reports/concentrating-solar-power-2009.pdf>

¹⁰ Siemens AG. *HVDC Classic: General information*. 2009.

<http://www.energy.siemens.com/hq/en/power-transmission/hvdc/hvdc-classic/>

¹¹ Polly Higgins. *Renewable electricity and transmission; HVDC; and supergrids*.

Renewable Energy Focus. 2008.

<http://www.renewableenergyfocus.com/view/3287/renewable-electricity-and-transmission-hvdc-and-supergrids/>

¹² Redpaper. *Red paper: An Overview of the Desertec Concept*. (Desertec Foundation, 2009.) 10.

http://www.desertec.org/fileadmin/downloads/DESERTEC_RedPaper_2nd_en.pdf

¹³ Siemens PTD. *Siemens Commissions HVDC Transmission Link Between Australia and Tasmania*. (Transmission and Distribution World, 2006.) <http://tdworld.com/news/SEIMENS-PTD-Australia/>

¹⁴ Greenpeace, SolarPACES and ESTELA. *Concentrating Solar Power Global*

set a national goal of achieving 10% renewable energy consumption by 2025, and was the first OECD country to establish a feed-in tariff system for the encouragement of solar electricity generation¹⁵. The Algerian government went as far as forming a company called New Energy Algeria (NEAL) in 2003 to work toward this goal in the private sector. NEAL has successfully moved forward on a private-public partnership, which has lead to the construction of the Hassi R'mel hybrid CSP plant, which is predicted to be operating by 2010¹⁶. "The current race is to see who will control renewable energy technologies, and we are in the race," Algerian Energy Minister Chakib Khelil told the International Tribune Herald. "We have the human and financial resources, and we have the will."

THE ECONOMIC, LOGISTICAL, & POLITICAL: KEY CRITICISMS

Although the media coverage of this issue has been ample, criticisms of the project have mostly been noted in a general way, stating that continued energy dependency and instability in the region could lead to large obstacles ahead for this ambitious project, but do not often quote particular individuals. There are of course a handful of exceptions, and in particular one individual, Hermann Scheer, has mentioned his lack of faith in the project in numerous media sources. Scheer is a repeatedly quoted skeptic, and is furthermore noteworthy because of his numerous environmental awards and status within the renewable energy industry in Europe. He abruptly states that the DII is simply a mirage something that not even its proponents truly believe could seriously take form¹⁷. In his critical article on the

project he states that this initiative would be a monumental waste of money, since Europe can generate its own renewable energy, and would only support it if all of the energy produced would go solely to MENA nations¹⁸.

Though it is possible to pick away at every detail of the DII proposal, let us break down the key criticisms into three main areas of concern and assess the most pressing matters of each category. This analysis will focus on the separate issues for both Europe and North Africa, including the economic, political and logistical issues of highest priority. It is acknowledged that there are numerous possible uncertainties within these three categories and indeed many issues may be interlinked. For the purposes of this paper it is assumed that these are merely convenient labels in order to discuss some of the key questions and concerns raised by the Desertec Industrial Initiative. In addition to Scheer's concerns about misplacing valuable resources, there are also five other key problems here analyzed that have been gathered from the general statements made by various press releases and media sources. A total of six issues will herein be covered: monumental costs, continued exploitation of African resources for the benefit of the West, inefficiency of long distance transmission, African water security issues, energy security for Europe and political stability in the Maghreb.

ECONOMIC ISSUES: EUROPE

Though the validity of attempting to harness the sun's energy is not under question, ultimately many individuals are unimpressed when they notice the DII's €400 billion price tag. This considerable cost is mainly a reflection of the high costs of installing CSP power plants, and the expensive HVDC cables which would deliver the energy from the MENA to Europe.

Outlook 09: Why Renewable Energy is Hot. 2009. 44.

<http://www.greenpeace.org/raw/content/international/press/reports/concentrating-solar-power-2009.pdf>

¹⁵ Ibid.

¹⁶ International Herald Tribune. *Algeria aims to tap vast sunbelt to export solar*

energy to Europe. 2009.

<http://www.gasandoil.com/goc/company/cna73731.htm>

¹⁷ Hermann Scheer. *European power from the desert is a Fata Morgana*. 2009.

http://www.hermannscheer.de/en/index.php?option=com_content&task=view&id=256&Itemid=10

¹⁸ Ibid.

Though this type of project requires a large initial capital investment, it has been used commercially in the Mojave Desert for 25 years and also more recently on a greater scale in Spain. It is evident through these examples that there is little problem with the technology and feasibility of a commercial CSP plant operation. The construction of CSP power plants in Algeria, Morocco and Egypt show that it is possible politically to invest in the solar energy sector of these economies, not to mention the numerous fossil fuel extraction industries in the region riddled with foreign influence and investment. The example of the United States' CSP projects demonstrates another important factor: that financially it is viable to manage such a power plant in the long term. As well, the proven success of these projects has led to increased interest in the Desertec idea in general; proposals for a Desertec-like initiative have arisen for Australia and China as well¹⁹. It is interesting to note that according to the 2009 Greenpeace study of CSP energy, in the long term these power plants are quite economically attractive:

Although high initial investment is required for new CSP plants, over their entire lifecycle, 80% of costs are in construction and associated debt, and only 20% from operation. This means that, once the plant has been paid for, over approximately 20 years only the operating costs remain, which are currently about 3 cents/kWh. The electricity generated is cheaper than any competition, and is comparable only to long-written-off hydropower plants²⁰

HVDC transmission lines will be another piece of infrastructure that drastically increases the price of the Desertec project. The economic viability of installing such long lines is ultimately in question,

but many examples of successful HVDC projects can be drawn upon to develop a more informative view of the prospects for HVDC transmission. The participation of ABB in the DII is notable because of its expertise in manufacturing and installing such electrical power lines and equipment, notably the second longest HVDC line in the world situated in the Democratic Republic of the Congo (DRC). The Inga-Shaba line “transmits power from the Inga falls in the Congo river to the copper mining district of Katanga” and has succeeded despite political instability in Zaire as well as “extreme line length and (...) difficult logistics along the route”²¹. In addition to ABB's proficiency in the technology, Siemens is also an industry leader, stating on their website that, “Siemens has been one of the leading companies in the HVDC business for more than 25 years”²². Their development of the Australia-Tasmania ‘Basslink’ is in fact the longest in the world²³. Some have noted that HVDC could serve a greater purpose in the long term, leading to the development of a more sustainable EU-MENA grid. This could mean that the line would recoup its costs by the massive amount of energy saved in transmission, and even lead to an extension of the grid which could drastically increase efficiency. These matters concerning the use and expense of HVDC power lines will be further developed in the European section of the logistical issues because of its prominence in criticisms based on technological downfalls of the DII.

While talking about the viability of finance for the DII, it is interesting to look at the repertoire of firms who have decided to support this project. There are many well respected German corporations getting involved, including Munich Re, Deutsche Bank, and Siemens, who despite even the financial crisis are choosing to support such a large and potentially risky investment. A group of

¹⁹ Desertec-Australia. *DESERTEC-Australia: Australia-Clean Energy Superpower by 2050*. 2009.

<http://www.youtube.com/watch?v=yFnnZWpmzYw>

²⁰ Greenpeace, SolarPACES and ESTELA. *Concentrating Solar Power Global*

Outlook 09: Why Renewable Energy is Hot. 2009. 13.

<http://www.greenpeace.org/raw/content/international/press/reports/concentrating-solar-power-2009.pdf>

²¹ ABB Group, *Inga-Shaba*. 2009.

<http://www.abb.com/cawp/gad02181/c1256d71001e0037c1256c7d00387939.aspx?&opendatabase&v=17ea&e=us&m=9f2&>

²² Siemens AG. *HVDC Classic: General information*. 2009.

<http://www.energy.siemens.com/hq/en/power-transmission/hvdc/hvdc-classic/>

²³ Siemens PTB. *Siemens Commissions HVDC Transmission Link*

Between Australia and Tasmania. (Transmission and Distribution World, 2006.) <http://tdworld.com/news/SEIMENS-PTD-Australia/>

such successful firms certainly have their own experts to review the data and would have analyzed very carefully the proposal before becoming such vocal supporters of the Desertec idea. Their support is proven by their commitment of funding for the outlining of a feasibility study which will be completed by 2012. It is similarly noteworthy that Munich Re, the world's largest re-insurer, is spearheading the promotion of this project, and one could assume that a business which focuses so heavily on risk assessment would have taken a thorough look at how risky their investment in the project would be in a very thorough and proven way.

ECONOMIC ISSUES: NORTH AFRICA

For Africa, the possibility of entering in another imbalanced agreement which favours European parties over indigenous people and business, could potentially lead to the exploitation of African resources. If terms of trade are not properly negotiated, such an arrangement could perpetuate the negative terms of trade which have in the past lead to underdevelopment and strife on the continent. Therefore, if investment in the project is not open to MENA firms, and if energy is not distributed within Africa, this could lead to the provision of electricity to Europe at the expense of African nations and their people. But providing a portion of electricity to African and Middle Eastern nations is considered a necessary facet of the project, and in the future DII hopes to include more MENA firms, in addition to Cevital. In terms of electricity distribution, it will likely be possible to allocate an adequate amount, because the total usage of energy in countries like Algeria and Morocco is still low compared to Europe. "Morocco doesn't have even 1 percent of Europe's energy consumption, so let's be realistic," said Said Mouline, the head of Morocco's renewable energy agency, "we would be generating enough power for us, and for export, for the next 100 years"²⁴. This is

aided by the fact that the proposed scale of the project is sufficiently ambitious to easily allocate a portion for both Africa and for export. A basic political agreement should be formulated so that a sizable portion of this renewable electricity will go toward powering African homes and firms. This will ensure that both Europeans and Africans benefit directly from this resource. To illustrate the importance of this point we can compare to the industry of oil and gas, where extraction occurs primarily for export, and few Africans

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benefit from the resource's revenues. In addition, many protest the lack of new sources of employment generated by this industry. In this case, if political agreements do bind, Desertec will distribute energy on the African power grids, and hopefully will also be a source of employment for some Africans. In terms of employment generated by CSP installations, "the construction of only one 250 MW parabolic trough power plant requires 1,000 workers and engineers for a period of two to three years"²⁵. Also, Greenpeace's report on CSP technology comments about investment and the creation of jobs, stating that "under just a moderate scenario, the countries with the most sun resources could together: create €11.1 billion (USD 14.4) in investment in 2010, peaking at €92.5 billion in 2050" and "create more than 200,000 jobs by 2020, and about 1.187 million in 2050"²⁶. Also, some Algerian and Moroccan institutions have expertise in solar energy research and projects, such as

²⁴ Tom Pfeiffer. *Europe's Saharan power plan: miracle or mirage?* (Reuters, 2009.) http://uk.mobile.reuters.com/mobile/m/FullArticle/eUK/CBUSUK/nbusinessNews_uUKTRE57N01H20090824

²⁵ Redpaper. *Red paper: An Overview of the Desertec Concept*. (Desertec Foundation, 2009.) 8. http://www.desertec.org/fileadmin/downloads/DESERTEC_RedPaper_2nd_en.pdf

²⁶ Greenpeace, SolarPACES and ESTELA. *Concentrating Solar Power Global Outlook 09: Why Renewable Energy is Hot*. 2009. 8. <http://www.greenpeace.org/raw/content/international/press/reports/concentrating-solar-power-2009.pdf>

Hassiba Ben Bouali University where researchers have done work on projects associated with solar-powered desalination techniques²⁷.

LOGISTICAL ISSUES: EUROPE

As Hermann Scheer points out in his editorial on the DII, it is possible for Europeans to harness their own forms of renewable resources²⁸. With sustainable technologies steadily increasing in variety and efficiency, it soon will be equally affordable for Europeans to generate their own green electricity. Scheer notes his dislike for investing great sums of money in power plants for the purposes of export because they will so quickly become obsolete. There are also general criticisms in the media relating to the fact that transporting energy over such a long distance is not efficient, especially when, as Scheer indicates, energy could be generated right in Europe itself. Such long transmission lines may not be feasible, because the cost is too expensive, especially considering that they will ultimately become redundant in the energy sector of Europe.

Long transmission lines would run between Morocco and Spain, Tunisia and Italy and in three other locations between MENA and the EU. As was earlier discussed, examples of successful HVDC long-distance transmission lines include 'Basslink' which connects Australia to Tasmania. The Basslink runs from Georgetown in Tasmania, to Loy Yang, Victoria, covering a total distance of about 360 km (220 miles). Approximately 290-kms (180-miles) of this connection is a HVDC underwater cable, "currently the longest in the world used for power transmission"²⁹. This

connection delivers electrical power at 500MV, and as much as 600 MV for up to 10 overload hours a day. The Siemens website further outlines its capacity for construction of a HVDC line between "two AC systems separated by sea (Distance: a few 10km to 800 km and more)"³⁰. 800 km would be more than enough to connect the most preferable locations between Europe and North Africa, considering the Strait of Gibraltar which passes between Spain and Morocco is very narrow, in places as little as 13 km across³¹. In other locations, for example between Tunisia and Italy, a cable of just over 140kms could be deployed between Ras el Tib and Marsala, or even a slightly longer cable of 200kms could run between the capital Tunis and Marsala³². Even at a distance of 300kms, Darnan and Crete could become connected, based on the success of the Australian example. The benefits of a HVDC link are mutual, exemplified by the Basslink case.

Tasmania, which generates electricity almost exclusively using water power, exports "green electricity" to cover the peak load demand in the state of Victoria. In return, the island can replenish its base load through electricity imports from the mainland in dry periods when Tasmania's reservoirs are not sufficiently filled. Tasmania also gains access to the electricity market on the Australian continent via the HVDC transmission link.³³

In order for a move toward green energy for Europe to be achieved, a diversified array of technologies will be necessary. Wind power as well as solar power, fed in from small-scale sources, will be inherently problematic with the current energy grid in most of Europe and "our grids will need to accommodate these varied, complex and fluctuating loads" in order for sustainability to be

²⁷ Hacene Mahmoudi, Nawel Spahis, Mattheus F. Goosen, Shyam Sablani, Sabah. A. Abdul-wahab, Noredine Ghaffour, Nadjib Drouiche. "Assessment of wind energy to power solar brackish water greenhouse desalination units: A case study from Algeria." *Renewable and Sustainable Energy Reviews*. (London: Elsevier. 2009.)

²⁸ Scheer, Hermann. *European power from the desert is a Fata Morgana*. 2009.

http://www.hermannscheer.de/en/index.php?option=com_content&task=view&id=256&Itemid=10

²⁹ Siemens PTD. *Siemens Commissions HVDC Transmission Link Between Australia and Tasmania*. (Transmission and Distribution World, 2006.) <http://tdworld.com/news/SEIMENS-PTD-Austalia/>

³⁰ Ibid.

³¹ Britannica, Encyclopedia. *Strait of Gibraltar*. 2009. <http://www.britannica.com/EBchecked/topic/233262/Strait-of-Gibraltar>

³² National Geographic. *Atlas of the World Eighth Edition*. 2005. 86.

³³ Siemens PTD. *Siemens Commissions HVDC Transmission Link Between Australia and Tasmania*. (Transmission and Distribution World, 2006.) <http://tdworld.com/news/SEIMENS-PTD-Austalia/>

achieved³⁴. The HVDC cables may not become obsolete so quickly upon the adoption of more European-generated green electricity, as they may be just the beginning of what some are calling the new European ‘Smartgrid’. Airtricity is a leading on- and off-shore wind power firm which operates internationally, and they are one of many groups proposing the creation of a European super-grid. In their proposal Airtricity states:

By connecting and integrating geographically dispersed wind farms across Europe, each experiencing a different phase of the region’s weather system, electricity is produced wherever the wind is blowing and transported to regions of demand, ensuring a reliable and predictable source of energy. By providing interconnection between electricity systems, the Super grid will automatically overcome the most significant barrier to establishing a single internal market for electricity, and thereby will create a more competitive electricity supply for Europe.³⁵

Polly Higgins of Renewable Energy Focus outlines the need for an update to aging European electricity grids, and move toward a “trans-national smart grid, able to accommodate clean energy sourced from locations ranging from wind in Northern Europe, to concentrating solar power farms in the Sahara”³⁶. After these HVDC cables are installed for Desertec, they could be built off of to create an ultimately more efficient and more sustainable energy grid in the EU and MENA regions. These lines will not just benefit the Desertec project, but could possibly have larger benefits to sustainable energy as a more

competitive alternative to fossil fuels. Other sustainable energy projects will in the end be aided by these pre-existing infrastructure developments and be able to add more diverse energy source to the grid which will ultimately make it more stable and secure.

LOGISTICAL ISSUES: NORTH AFRICA

One logistical issue that cannot be underestimated when talking about the Sahara desert is water security. Many North African and Middle Eastern countries are water-poor regions that must use their valuable fuel resources to desalinate seawater to provide drinking water to their populations. Excessive water use by CSP plants would create an additional strain on fresh water resources and could potentially exacerbate water scarcity problems in the MENA region. The argument stands that development of a water resource-heavy project could tap finite resources, such as the underground aquifers, which are already relied on heavily and may already be used unsustainably. The largest contributor to water consumption in a CSP plant is its cooling system, but advanced dry-cooling methods have shown that a large reduction in a CSP plant’s water needs could be achieved by ‘dry cooling’.

Dry cooling when applied for any of these plants will reduce water consumption to zero for the heat rejection system of a Rankine power system, requiring only a minimal amount of water for boiler blowdown, mirror washing and miscellaneous domestic plant uses. A dry-cooled trough plant requires about 80gal/MWh for cycle makeup and mirror washing. This compares to a wet-cooled plant that requires 800gal/MWh³⁷.

Directly heating water to create steam to power the plant’s turbines could also be a portion of this figure, but liquid salt could replace water and may

³⁴ Polly Higgins. *Renewable electricity and transmission; HVDC; and supergrids*.

Renewable Energy Focus. 2008.

<http://www.renewableenergyfocus.com/view/3287/renewable-electricity-and-transmission-hvdc-and-supergrids/>

³⁵ Airtricity. *Supergrid: the power to connect*.

http://www.airtricity.com/wind_farms/supergrid/?region=international

³⁶ Polly Higgins. *Renewable electricity and transmission; HVDC; and supergrids*.

Renewable Energy Focus. 2008.

<http://www.renewableenergyfocus.com/view/3287/renewable-electricity-and-transmission-hvdc-and-supergrids/>

³⁷ US Dept of Energy. *Concentrating solar power commercial application study*:

reducing water consumption of concentrating solar power electricity generation. 2007. 11. <http://www.solarthermalworld.org/node/644>

even be a more economical option because of its properties of retaining heat for overnight plant operation. Besides the use of water for boiling inside the plant, there is also the argument that sandstorms in the Sahara desert will dirty the mirrors which will thus have to be washed with water to continue being efficient. There may, of course, be other ways to clean these mirrors, but if not it can still be noted that according to the U.S. Dept of Energy only 2% of a CSP plant's water needs would go toward mirror washing, or roughly 16 gal per MWh³⁸. It is possible that this number could even be reduced, possibly by using manual labour or compressed air, so there may be a number of ways to clean off these sand particles without using large amounts of water resources.

There are a number of ways to reduce the water consumption of a CSP plant but it is evident that even then some water will be needed. So how will Desertec offset CSP water usage in MENA's water-scarce regions? In this case Desertec argues that solar power will not be a contributor to water insecurity, but will actually help create more water resources by powering operations which desalinate sea water.

For building a sustainable water supply by desalination, clean and inexhaustible forms of energy are required at large quantities. The MENA countries can provide such energy from their deserts and make the shore lines of North Africa and of the Middle East to inexhaustible sources of fresh water. In fact, our studies (MED-CSP, 2006, AQUACSP, 2007) show how the imminent water crisis in the MENA region could be coped with by desalinating sea water³⁹.

If the CSP energy can be used to desalinate sea water then it should be made assured by a political body/document that water usage of the power plant be reliant on this process, and not on the access to finite aquifers and other bodies of fresh water.

POLITICAL ISSUES: EUROPE

Europe already struggles with energy security issues and, as is outlined in the 2000 European Commission's 'Green Paper', this could become a very pressing matter in the near future. In this report it is shown that "the EU meets 50% of its energy needs through imports and, if no action is taken, this will increase to 70% by 2020 or 2030"⁴⁰. The countries topping the charts for exports to Europe include Russia at 40% of natural gas imports, and the Middle East delivering 45% of oil imports⁴¹. Since the DII will not contribute to the construction or enhancement of sustainable sources of energy in Europe, investing in such a large project would seem to only enhance Europe's dependency, which is not seen as very favourable in terms of bolstering energy security for the region. This argument is a well-founded one, and logically we can speculate that since energy resources are coming from outside the region, this will continue to feed Europe's dependency. Still, some speculate that renewable resources in Africa could shift some of Europe's imports away from Russia, which is at the present time considered fairly unstable and could be possibly considered a method of diversifying energy sources. This could possibly lead to a relatively more secure energy balance and as up to "6 000 MW of CSP in 2020 from Algeria to Europe would comply with energy dependency limits" points out NEAL's Eng. Tewfik Hasni, and furthermore states that "Of course, this could lead to an equivalent reduction in exports of gas, if necessary"⁴².

³⁸ US Dept of Energy. *Concentrating solar power commercial application study*:

reducing water consumption of concentrating solar power electricity generation. 2007. 4. <http://www.solarthermalworld.org/node/644>

³⁹ Whitebook. *Clean Power from Deserts The DESERTEC Concept for Energy*,

Water and Climate Security. (Desertec Foundation. 2009.) 12. http://www.desertec.org/fileadmin/downloads/DESERTEC-WhiteBook_en_small.pdf

⁴⁰ Green Paper. *Towards a European strategy for the security of energy supply*. (Brussels: European Commission, 2000.)

<http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52000DC0769:EN:HTML>

⁴¹ Ibid

⁴² Whitebook. *Clean Power from Deserts The DESERTEC Concept for Energy*,

Another important way to frame energy security is through the lens of sustainability. If the energy resources of a nation are based on nonrenewable fossil fuels, whether from internal or external sources, there also exists a level of threat to national security, i.e. climate security. The shift to renewable sources of energy is exceedingly important for avoiding the catastrophic effects of global warming predicted by climate change science. Scholars from numerous streams of thought argue that the issue of climate change represents an overwhelming security threat for the entire globe. Indeed, nations must strategically analyze where their energy resources are generated and where they are consumed, but much more pressing is the matter of developing forms of renewable energy quickly and decisively in order to prevent the continued release of greenhouse gasses into the atmosphere. If climate-related energy security were to be addressed as a key component of energy security then it would be necessary to account for not only where the energy comes from, but the nature of the energy itself to be fully secure. In that case, shifting European dependence on Russian fossil fuels, to more renewable energy from multiple African nations, would likely be a net move towards a more secure system. To illustrate this point it can be noted that it may not be possible to adopt a completely, or even a nearly completely, renewable energy economy in European countries, without imports, because of the nature of renewables available within the geographical limits of the region. George Monbiot in his book *Heat* sets out to formulate a plan where Britain could become a carbon-neutral society, or at least very close at a 90% emissions cut by 2030. In the end he concludes that going beyond 50% renewables would lead to periodic collapses in the

entire grid, because Britain's main renewable, wind power, has a tendency to fluctuate wildly⁴³. He notes that since a reliable energy source is necessary in order to meet the drastic fluctuations in demand, some coal or nuclear power would be necessary to create a viable base supply⁴⁴. This secure supply could in some portion be replaced by a more secure renewable energy source where fluctuations do not

“Indeed, nations must strategically analyze where their energy resources are generated and where they are consumed, but much more pressing is the matter of developing forms of renewable energy quickly and decisively in order to prevent the continued release of greenhouse gasses.”

occur as radically. It has been shown in earlier sections of this paper that solar energy from the Sahara, backed up by Algerian natural gas, could very well provide such a source of renewable energy to complement the ebbing a flowing nature of wind power. Importing solar energy from nations that are relatively better at producing it may be necessary to get another step closer to a renewable

energy grid; a secure grid in terms of climate security. This of course will take a certain level of international trust and cooperation, but the shift to low-carbon economies and the mitigation of climate change in general, has always been considered a matter that relies heavily on the continued cooperation of many nations. Indeed international cooperation may be a fundamental pre-requisite to a successful transition to carbon neutrality, and to achieving climate security for any nation. Whether it is Desertec or some other agreement/project, climate change mitigation is a problem of international scope and for its success we will rely heavily on other nations to reach their commitments.

POLITICAL ISSUES: NORTH AFRICA

The Maghreb region has been noted as an area where political stability would potentially add an

Water and Climate Security. (Desertec Foundation. 2009.) 51.
http://www.desertec.org/fileadmin/downloads/DESERTEC-WhiteBook_en_small.pdf

⁴³ George Monbiot. *Heat*. (London: Penguin, 2006) 123.

⁴⁴ *Ibid.* 99.

element of risk to a large investment such as Desertec. Criticism relating to the security of the region has arisen, with individuals noting that energy sources could be disrupted by political uprisings, and the plants or transmission lines could become a target for terrorist attacks. The argument may be well placed considering that borders are currently closed between Morocco and Algeria, because of a dispute over Western Sahara. But the argument can also be made that business goes on as usual in the energy industry, even in such unstable areas as the Sudan and Equatorial Guinea. There has also been mention of an increased amount of foreign investment in the Maghreb in recent years, in such articles as *The Rise of the Maghreb* in Business Week, which points to the notable investments by Sumimoto, BP, Airbus, Boeing, Renault, Groupe Safran, Royal Dutch Shell and ExxonMobil.

“Led by Morocco and Tunisia, the region of 84 million people is attracting serious investment—more than \$30 billion over the past five years—to build everything from auto and aerospace factories to five-star resorts and call centers for multinationals. Even Algeria and Libya, long shunned on the international stage, are starting to revive their stagnant economies. Both are opening up to foreign investment and, with pipelines under the Mediterranean, have become important suppliers of natural gas to Europe as it seeks alternatives to politically unstable Russia. The Maghreb countries all “have very different politics, but they’re on track, moving in the same direction,” says André Azoulay, a former French bank executive who is an economic adviser to Morocco’s King Mohammed VI”⁴⁵.

Another interesting way of gauging the political stability of a region is by taking a look at the World Bank’s ‘Governance Indicators’. This set of

indicators was formulated by the World Bank for research purposes by aggregating the indicators of many business and political related assessments such as the Global Insight Business Conditions and Risk Indicators, the Reporters Without Borders Press Freedom Index, the Political Risk Services International Country Risk Guide and the World Economic Forum Global Competitiveness Survey. In terms of political stability Algeria ranks in the 13th percentile, which is comparable to Thailand (13), and higher than Bangladesh (10), the Philippines (11), Venezuela (12), Kenya (12) and Nigeria (3). Morocco’s indicators are more favourable, ranking in the 29th percentile, making it much more stable than Mexico and Russia (24), and comparable to Angola (30) and Madagascar (30) as well as Saudi Arabia (31) and even China (33). Tunisia (54) and Libya (63) look better still ranking well above Spain (43), Brazil (38), Argentina (42) and South Africa (42). Libya, in terms of stability is even surpassing Italy which ranks in the 60th percentile⁴⁶. Out of the 10 African nations which rank within the 0-10th percentile on the continent, such as Ethiopia, Zimbabwe, Sudan and Cote D’Ivoire, none are in the Maghreb region and only Algeria ranks anywhere near this lowest bracket. Also it is notable that the energy industry has for many years worked in countries within this lowest percentile, including Nigeria and Sudan, and have been operating in Algeria for many years extracting natural gas, which is transported via trans-Mediterranean pipeline to Europe for export. The energy supply from the region has been arguably increasing in stability and as the CEO of the New Energy Algeria, Eng. Tewfik Hasni, stated “in the last 30 years, there has not been a single interruption in energy supply coming from our region to Europe”⁴⁷.

Creating new vested corporate interests in the success of a sustainable energy project could even

⁴⁵ Carol Matlack and Stanley Reed. “Manufacturing: The Rise of the Maghreb.” *Business Week*. (New York: Bloomberg, 2009) http://www.businessweek.com/magazine/content/09_11/b4123038640646.htm

⁴⁶ World Bank. *Governance Matters 2009*. (Washington: The World Bank Group, 2009.)

<http://info.worldbank.org/governance/wgi/index.asp>

⁴⁷ Whitebook. *Clean Power from Deserts The DESERTEC Concept for Energy, Water and Climate Security*. (Desertec Foundation. 2009.) 51. http://www.desertec.org/fileadmin/downloads/DESERTEC-WhiteBook_en_small.pdf

take something that seemingly works inherently against green energy and put it behind the cause. So involving big business interests in Europe, and especially in the Maghreb, will possibly increase the DII's likelihood for success. Through NEAL, Algeria has been working on receiving foreign investment in the area of solar power since 2003, and have continuously partnered with the US and the EU to develop strategies to make renewable energy projects happen in the Maghreb. The US-Algeria Energy Forum of 2009 was focused on the topic of renewable energy development in Algeria, and about highlighting roles that the US can play in investment in sustainable energy projects⁴⁸.

CONCLUSION

The Desertec Industrial Initiative is an ambitious venture in terms of scale and monetary investment. There exist numerous criticisms of the project, but in this analysis it has been demonstrated that many of these criticisms do not hold true under careful investigation. At first glance it seems that the project is too expensive, too risky, and not politically viable, but it can be demonstrated that this project actually does have some prospect for success and could even create some positive spin-off effects, such as the beginning of an EU-MENA Smart-grid. In order to meet the commitments that Europe has made it will have to develop an arrangement to generate more of its consumed electricity from sustainable sources. This goal might be partially achieved through Saharan solar power energy projects such as the DII. The mitigation of climate change demands change, and it demands it soon, so Europe should start thinking 'big' about its move toward sustainable energy, and support large scale transitions to renewable electricity use. The progress made during the current feasibility study will likely dictate whether the DII will come to fruition, and for the sake of the climate, let us hope that the private sector begins paving the way to a more sustainable status-quo for Europe and North Africa.

Freedom to Develop

Free/Open Source Software in the Developing World

Jean-Francois Arseneau

YouTube, Facebook, Google, Microsoft Word and the dreaded PowerPoint presentations: technology has become ubiquitous in our post-industrial lives. Students wander around their university campuses with laptops while office workers remain glued in front of their computer monitors for their entire workday, sipping coffee while filling out endless spreadsheets. This has become the landscape of what is often termed the "Information Age." However, often left out of the story of the information age are the developing countries, most of which manufacture the parts that make up the backbone of our worldwide information technology infrastructures. For reasons of costs and even issues such as lack of localization, developing countries are not always able to benefit from the same unlimited access to information technology than users in the developed world can enjoy.

More pertinent to governments is the inability of developing world start-ups to penetrate a software market dominated by corporations in the developed world who have access to resources that can, for example in the case of Microsoft, even outstrip the funds of their entire country. Having to compete with such powerful competitors is not an easy challenge. It becomes even harder to compete when software products are usually widely pirated with impunity in developing countries. Any attempt to create a domestic software industry has to simultaneously be able to innovate with the limited resources available to them, be staffed with programmers who could have been brilliant but rarely have had access to the best training, and cope with the reality that the more lucrative markets are usually in the developed world where native products have more ready access to market.

⁴⁸ US-Algeria Business Council. 2009. www.us-algeria.org