White Paper – April 2011

Securing our future energy needs by importing solar power from an economic development opportunity for Tunisia

Introduction

Large-scale solar projects in North Africa have the capability to export most or all of Europe's power needs of clean, reliable and safe renewable power can be provided to the EU. This could include exports to the UK, via cross-border exchanges and interconnectors.

Solar power from North Africa would have the following characteristics:

1. Solar power from the Sahara can provide all or most of Europe's power needs,
2. Solar power is produced during the day, matching the demand profile
3. Solar power is generated by an established technology already being used in the USA,
4. Import of power into European and UK grid through new and existing links,
5. The power is significantly cheaper than alternative large scale renewable sources,
6. Projects support socio-economical growth of countries such as Tunisia.

Benefits for the UK and rest of Europe

Large-scale solar projects in North Africa have the capability to meet a large proportion of Europe's power needs, at a price that is competitive with other large-scale zero-carbon power sources such as offshore wind.

The power generated by concentrated solar plants ("CSP") will be at its peak during the day and output can be controlled with the use of storage thus matching the European electricity demand profile. Most importantly the abundant solar resource in the Sahara, along with the very low levelised cost of production of CSP tower technology, will ensure the electricity produced is both reliable and also cheaper than many alternatives thus maximizing the efficiency of the EU renewable energy mix.

1. Solar power from the Sahara can be delivered to Europe on a significant scale.

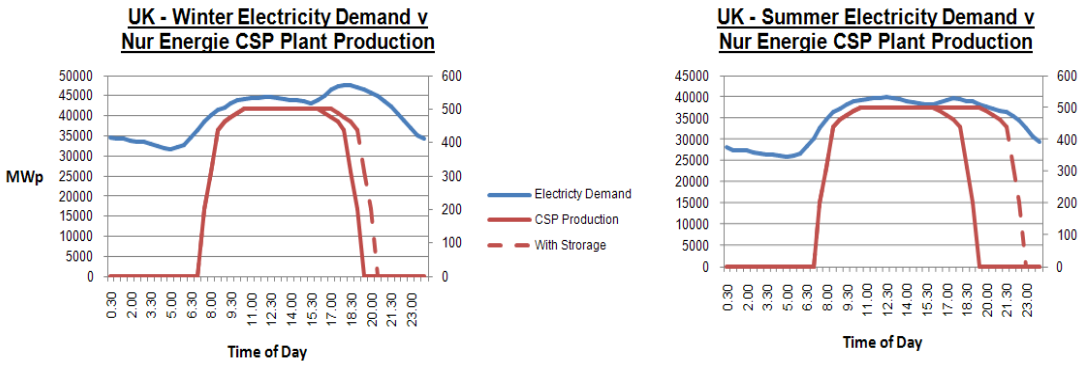
The Sahara provides a vast area of relatively flat land with high DNI resulting in the possibility to build very large scale plants. The amount of power that could, in theory, be produced is more than the whole of the EU's energy requirements. A 2,000MW CSP plant, such as Nur Energie's TuNur project (see later), will produce enough electricity for the equivalent of 2.5% of the UK energy demand.

The following table outlines the potential scale for imported CSP.

Project	Production	Size of Land Required	Percentage of Sahara
TuNur	10 TWh/yr	102 Km^2	0.001%
5% of the UK demand	20 TWh/yr	204 Km^2	0.002%
17% of the EU 2050	2,940 TWh/yr	60,000 Km^2	0.667%

2. Solar power is produced during the day, matching the demand profile.

Power from a CSP plant in North Africa would be typically available from approximately 08.00 to 19.30 (European time). This could be extended to be available until 23.00 using thermal storage. This close match with the day-time demand curve gives a significant advantage over other alternatives.



3. Solar power is generated by an established technology

CSP uses a field of heliostats (mirrors) to reflect the sun light onto a boiler at the top of a tower in the centre of the field. The boiler then creates super heated steam (>550 degrees Celsius) which is then driven down into a standard steam turbine which generates the electricity. The technology can be integrated with a storage whereby the heat is stored and then, when required, can be released back into the boiler to create the steam and start the process again. This allows the plant to adapt its production profile.

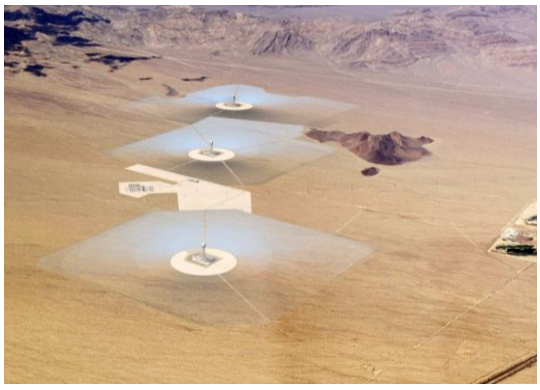


Figure 1 - BrightSource Energy 400MW Ivanpah Plant

Figure 2 - BrightSource Energy 6MWth SEDC Plant

4. Import of power into European and UK grid through new and existing links.

Power from a North African project will reach the European Grid via HVDC transmission lines landing in points such as the Italian Coast, North of Rome. HVDC transmission lines allow long-distance high-voltage electricity transport at minimal losses (less than 3% over 1000km).

Subsea HVDC transmission has already been used in a number of circumstances including the recent cable between Holland and Norway.

Italy currently imports a significant quantity of the electricity it consumes and it is likely that the majority of the power from a project in Tunisia will be consumed in Italy. However Saharan Solar is seen as a European project, and other market options are being developed alongside Italy.

Power could be transferred to Switzerland through exchanges, by reducing the amount of power that currently flows south from Switzerland into Italy. In the same way, solar power can then be transferred to Germany, Holland and the UK, by booking transfer capacity at the relevant cross-country interchanges.

5. The power is significantly cheaper than alternative large scale renewable sources.

Large scale CSP generated power could be delivered at a significantly lower cost than competing large-scale technologies. (E.g. in the UK CSP would be cheaper than offshore wind). Furthermore, the power would be produced in a predictable and dispatchable manner, making it easier to integrate it into European power grids and matching the demand profile in most European countries.

Large-scale CSP projects in the Tunisian desert put a value on land that has no or little alternative use. No European country has similar large areas of open and available land for large-scale renewable energy projects. Hence, the costs of solar export projects will be reduced dramatically due to economies of scale, employment of local people and low land use costs. Furthermore, the solar radiation is estimated to be at least 20% better than at the best sites in Europe, dramatically increasing the energy yield.

6. Projects support socio-economical growth of countries such as Tunisia.

CSP is highly adaptable to a locally built supply chain; for its 2,000MW TuNur project, Nur Energie studied the socio-economic impact in Tunisia and estimated that up to 60% of the total value-add could be generated locally.

These benefits will be generated throughout the supply chain and life of the project in the following ways:

- Local specialist work using local partners and local engineering firms for geo technical and socio impact assessments.
- Project development will require local management and development teams to run the development work.
- Job Creation during Construction will have a significant impact on the local economy. Nur Energie's social economic impact assessment established that throughout the 4/5 years of construction of a 2,000MW plant up to 1500 direct jobs will be created with a further 20,000 jobs created indirectly.
- Indirect jobs creation through manufacturing the 825,000 heliostats needed for the 2,000MW project which will have to be done locally.
- In addition to the jobs created during construction there will be an estimated 500 jobs created during the 25 years (plus) of the plants operational life.

Why is Imported CSP an important part of the future EU energy mix?

The need for energy security is increasing and with the recent rise in oil prices the requirement for alternative and reliable sources of energy is increasing.

Nur Energie believes that the prospect of solar power from the Sahara being imported to the UK would provide an important additional source of energy for the energy mix and in turn this will increase the efficiency of the energy mix for example by sending a strong signal to the offshore wind industry that there is a lower cost alternative potentially available. We believe UK consumers would welcome this.

The development of solar power in North Africa and transmission to Europe creates potential business and employment opportunities in the UK and EU. Nur has so far used UK subsea specialists Metoc in its assessment of the transmission route. Alstom would be a potential supplier of transmission equipment from its Stafford plant. In addition, Nur would likely use UK/EU financial expertise (Nur is already working with the UK team from Deutsche Bank) and legal expertise (from companies such as Watson Farley Williams) on pursuing its development activities.

UK energy policy has already identified the main sources of incremental low carbon electricity for the period to 2020 (nuclear, offshore-wind & CCS). Thereafter DECC's pathways to 2050 provide a framework for assessing and evaluating alternative ways to get to a zero-carbon generating mix by 2050. 4 of the 5 pathways identified by DECC show a rapid growth in renewable output from 2020. In its 2050 Pathway analysis DECC highlights CSP from North Africa as a viable and feasible option for that period. DECC also recognizes that the proportion of the power from developments in North Africa that will reach the UK is likely to depend on the extent of UK participation in the development of the industry and the markets for exported power.

Nur Energie's TuNur project

Nur Energie is a UK company, developing large-scale concentrating solar power (CSP) projects in North Africa for transmission into the European grid. CSP from North Africa is capable of making a material contribution to UK renewables targets and power supplies in the medium and longer term. Nur Energie's initial project is due on stream in 2016 – 2018 and is capable of delivering 10 Twh. If this were delivered to the UK, it would supply approximately 2.5% of UK demand.

Nur Energie's 'TuNur' project combines a 2,000MW CSP tower plant located in the Tunisian Sahara with an on land and subsea transmission line from the plant directly into the Northern section of the Italian electricity grid.

The subsea route has been surveyed by a UK marine engineering specialist, Metoc plc, and a number of potential landing sites in Italy have been identified. It has been confirmed that the Italian Grid could take the power at these points. Nur has recently submitted an application to Terna, the Italian Grid operator for a 2GW grid connection to accommodate the cable from Tunisia.

Nur Energie

Nur Energie's mission is to develop, build and operate solar power plants in the Mediterranean region using the most advanced technology available to provide electricity at the lowest possible cost. Nur aims to provide superior returns to its shareholders while making a significant contribution to climate change mitigation and regional integration and development.

Nur Energie has over 3,248MW (gross) of solar power plants under development using Concentrated Solar Power ("CSP") technology. Core operations are in France, Italy, Greece, Morocco and Tunisia. Headquartered in London, UK with local subsidiaries based in France, Italy and Greece and Tunisia. The team is comprised of local on the ground development experts combined with experts in energy, finance and international policy.

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