"Sahara Power" needs pan-European grid operator

A consortium of leading European – mostly German – companies plans to invest €400 billion in a megaproject to generate solar power in the Sahara desert. "Desertec", as the project is called, could cover 15 percent of European electricity demand. The problem is, how do you transport this power to Paris and Berlin? 'It will not work without a pan-European grid operator.'

by Gert van Wijland

The figures for the Concentrated Solar Power (CSP) project Desertec are impressive: 100,000 megawatts – equal to 100 large coal-fired power stations – are to be generated on a piece of unproductive land in the Sahara, the size of a postage stamp on the globe. The European energy market is literally a cable length away – albeit a long cable. Sales are guaranteed. And CSP has already proven itself in Spain and the US.

It is for good reason that the German and international business community has embraced CSP in the Sahara. Industrial suppliers, such as Siemens and ABB, large German energy companies Eon and RWE, and solar energy companies Abengoa Solar, MAN Solar and Schott Solar, are backing Desertec. Its financial prospects look promising as insurance company Munich Re is one of the initiators and Deutsche Bank has also signed on. 'It indicates that large parties believe in its profitability,' says renewable energy manager Sven Teske of Greenpeace International. 'The project has our support, of course, as well as that of other idealistic organisations such as the Club of Rome.'

Teske classifies CSP plants – along with wind energy and solar cells – as one of the three most important new sources of energy. He is the co-author of "Global CSP Outlook 2009", published by Greenpeace last spring. This report concludes that CSP 'could meet up to a quarter of the world's energy needs in 2050. Up to 4.7 gigatons of CO_2 could be saved per year. We need this technology to fight climate change'.

The companies involved are aware, however, that there are still major obstacles to overcome. In an essay published in German newspaper Tagesspiegel, RWE senior executive Fritz Vahrenholt listed the following points requiring special attention:

- The political situation in North Africa does not always allow for foreign investments

Concentrated Solar Power at Kramer Junction in the US. Photo: Joson/Corbis

- The availability of millions of cubic metres of cooling-water required for CSP
- The risk of blackouts due to "natural or planned violence"

The issues can all be solved, Vahrenholt says. 'We will select our sites with considerable care.'

But the RWE executive believes the biggest challenge will be transmitting the power to Europe. 'To get 15 percent of Europe's power from the Sahara would mean that 75,000 megawatts must be imported. Almost 100 new 800 MW power transmission lines will be needed to achieve this. If we use the most modern High-Voltage Direct-Current cables of 2500 megawatts, we will need 30 cables. These require very heavy-duty masts and must be laid straight through Spain and Italy, which will not be easy to realise.'

Power queues

'An understatement,' counters Valentin Hollain, senior scientific advisor of the European Association for Renewable Energies, Eurosolar. This association was established in 1998 and is chaired by Hermann Scheer, energy expert and German MP. Eurosolar is a strong advocate of decentrally generated, small-scale sustainable energy.

Hollain points out, on behalf of Scheer, the practical drawbacks involved in the construction of the Desertec cables. 'Imagine the resistance this will cause in the transit countries. Even small-scale projects lead to protests from the local population. The resulting delays will inevitably cause rising costs.'

Antonella Battaglini, researcher at the German Potsdam Institute for Climate Impact Research, is also concerned about possible "power queues" if Desertec is not accompanied by sufficient investment in the grids. 'An investigation into possible future grid architectures for different

Technical and social challenges

The construction of high-voltage cables may not be too difficult, technically speaking, but their installation could run into years of delays due to protests from people living in the vicinity. Examples of protests against the installation of high-voltage cables can be found all over Europe,dusually based on fears for the alleged risks of radiation or famage to the environment. A well-known example were the protests from environmentalists against a proposed high-voltage line between France and Spain, which suffered years of delay as a result. In 2008, it was decided to lay 60 kilometres of the cable underground. This environmental gain came at a financial cost of €900 million.

To prevent similar problems, the German government requested the German Aerospace Center to look into the environmental effects the Desertec cables would have. The researchers came up with three possible trajectories in which environmental damage is minimised. The report's overall conclusion is that the general environmental benefits of the Desertec project amply outweigh (local) drawbacks.

From a technical point of view, to transmit 100,000 megawatts of electricity from North Africa to Europe is certainly not impossible, says Han van Asten, a project manager at NorNed, the 700 megawatt cable stretching nearly 600 kilometres across the bed of the North Sea between southern Norway and the northern Netherlands. The cable, able to transmit electricity in two directions, took three years to build and has been operational since 2008 without too many problems. 'This cable has linked fossil and wind energy from western Europe to Scandinavia's hydropower, thus creating an ideal mix with maximum supply security for further sustainability,' says Van Asten.

To limit loss of power during transmission, the alternating current is converted into a high voltage direct current (HVDC) upon entering the cable and converted back to an alternating current upon exiting. In this way not more than 3 percent of power is lost per 1000 kilometres of cable, says Van Asten, in addition to 4 percent "normal" conversion losses. Investments amount to roughly €1 million per kilometre of cable, excluding the costs of the conversion stations. By this count, Desertec's transmission grid would cost around €50 billion. A lot of money, but in Van Asten's opinion not extravagant when held against a total investment of €400 billion. 'In this type of project, ten to twenty percent of investment costs are generally spent on the associated transmission grid.'

More difficult than the technical issues, would be the coordination between the many countries involved, says Van Asten. 'Dealing with two parties at NorNed required much consultation, let alone bringing all North African and European operators into line.'

The question will not just be who pays, but also who will profit. 'Why would a country such as Austria have a cable laid if there is no benefit to them? Transit countries must also gain something. This could be a transmission fee or the connection of their hydropower stations to the transmission grid.'

power mix scenarios is urgently needed,' she says in an interview with EER.
Her concerns have prompted her to form a new lobby group, called the Renewable Grid Initiative (RGI), an international cooperative of national and international grid operators and NGOs. Since it was formed in July, the RGI has attracted as its members the NGOs Germanwatch and WWF (Worldwide Fund for Nature), as well as Tennet, the Dutch Transmission System Operator (TSO), and grid operator Vattenfall Transmission, part of Swedish Vattenfall. 'We welcome new members,' says Battaglini.

RGI's objective is a European lobby for a 'new mandate for energy regulators to enable the development of European grid architecture capable of rapidly and efficiently transmitting renewable energies.'

'The current grid planning time frame is 10 years, and is based on business-as-usual and observation of current developments,' Battaglini explains. 'There is no strategic plan for longer periods, or for alternative scenarios. A power system grid largely based on renewables may need to be rather different from a grid for which only, say, 20% renewables are foreseen.'

In order to minimise the risk of delays and poor coordination between the countries involved, all experts say it is essential to have a pan-European grid coordinator, or better yet, a pan-European grid operator. 'Someone has to have an overview of how much electricity is produced, and where, and of consumption patterns', says Teske. 'This is the only way supply and demand can be balanced.'

Teske is pleased to see that the beginnings of a European operator have started to take shape in the European Network of Transmission System Operators for Electricity (ENTSO-E), which got started this summer. However, questioned about its competencies, spokeswoman Els Ruysen of ENTSO-E explains that they are momentarily limited to regulating and coordinating activities among the various national grid operators. 'The 3rd Energy Package, which was adopted by the Council of the European Union on 25 June 2009, gives ENTSO-E a clear mandate

to keep improving the cooperation of the European TSOs and to play an active and important role in the European rulesetting process', she says.

The development of ENTSO-E's pan-European Ten Year Network Development Plan is an important instrument in this respect, according to Ruysen. 'The plan provides a common, non-binding vision for the development of the pan-European high-voltage transmission infrastructure.' But there is little more Ruysen can say. 'A first draft for consultation is foreseen for early 2010. We can make no specific comments on any particular wide-area connections.'

'Imagine the resistance this will cause in the transit countries. Even small projects lead to protests from the population'

According to Battaglini, it is clear that ENTSO-E is not yet an actual coordinator or operator. 'At the moment, there is no such thing as a pan-European grid and consequently there is no manager either.'

Obstacles

It has nevertheless dawned on Brussels that the EU must become involved in the necessary grid extension. The Commission has proposed to replace the existing Trans-European Networks for Energy (TEN-E) by a new structure, the EU Energy Security and Infrastructure Instrument. This would allow for the development of a grid accommodating large amounts of renewable energy.

Battaglini says she is pleased with Brussels' increased involvement. 'There are obstacles on several fronts and an intervention by Brussels is necessary and urgent. The grid should be planned at least at a regional level and better yet at a European level. It should take possible imports of renewable electricity from remote areas within Europe and from outside of the European borders into consideration. It should also consider the need to link production sites to load areas as well as storage sites in the Alps and Scandinavia.' Battaglini believes it is necessary for the European Commission to stimulate investments that 'are not the most economical at this point in time'.

The last point of course gets to the heart of the problem: who is to pay for the new grids? One of the main objections to Desertec that Hollain puts forward is what he believes to be the excessive influence business will get on the grid. Hollain: 'RWE and Eon, both part of the Desertec initiative, are at the same time neglecting the modernisation of the German grid which is necessary to prepare it for increased amounts of renewable energy.' He says it is 'a shame that the largest part of grid use fees is not reinvested in the grid but used as company profits. This neglect of the domestic grid as it exists today is not acceptable and raises severe doubts as to whether the responsibility for the grid should remain in the hands of these companies.'

Dr. Gerhard Knies, Chairman of Desertec
Photo: Desertec

Others see the close involvement of business in Desertec and its transport network as an advantage. 'Neither the government nor the private sector can generate these amounts of investment alone', says Teske of Greenpeace. 'Of course there will have to be regulations to ensure proper use of the network. That is why we need a pan-European coordinator or operator.' ■

The next steps

Desertec will take the following steps in the coming months:

- Seek cooperation with the yet-to-be-established Union for the Mediterranean
- Commence negotiations with the EU and North African countries
- Join projects and funds against climate change
- Initiate an information campaign introducing inhabitants of the countries involved to the concept
- Immediately prepare feasibility studies clarifying pending political, organisational, financial, technical and ecological issues
- Implement a 1000 MW pilot power station; this should, for humanitarian reasons, be planned in Egypt in order to provide the Gaza strip with drinking water and electricity
- Build industrial and human capacity