

Networking for Renewables: Supergrids

Meeting the EU's Renewable Energy Targets

“We produce thirty year predictions of oil prices without realizing that we cannot even predict those for next summer.”

Nassim Nicholas Taleb, The Black Swan

The bottom line

The European Union has set itself the ambitious target of increasing the share of renewable energies to 20% of the total energy mix by 2020, yet it is highly unlikely in the present circumstances that this deadline will be reached without mapping out a clear plan for their development.

Whatever the strategies adopted by the Member States, a prerequisite for the 2020 goal is an enhancement and enlargement of electricity grids. Incentives designed to encourage investment in the renewable sector will be useless, even counter-productive, because Europe's grids are simply not powerful enough to handle the increased loads that would result from boosting the number and output of renewable energy power stations.

The Supergrid concept addresses this issue by integrating (not replacing) regional and national grids into an extensive network of HVDC power lines (High Voltage Direct Current), a proven technology which efficiently transfers electricity from production centers to large consumer zones. Laying “fast track” electricity routes to resolve the bottleneck limitations of the current grid networks would have much the same effect as motorway development: connecting remote production areas, speeding up delivery times and lowering costs. Just as pipelines and tankers allowed the expansion of the fossil fuel based energy economy, so international electricity grids would permit renewable energies to bring about a clean, secure and sustainable energy system.

Developing the Supergrid concept does not imply setting aside delocalized “roof top” production. The two approaches are very complimentary, with local renewables being topped up by long distance production (much in the same way that a household heat exchanger provides the base load but operates in conjunction with the national grid).

Dirk Hendricks
Brook Riley

World Future Council
EU Liaison Office

Rue Marie-Thérèse 21
B-1000 Brussels
Belgium

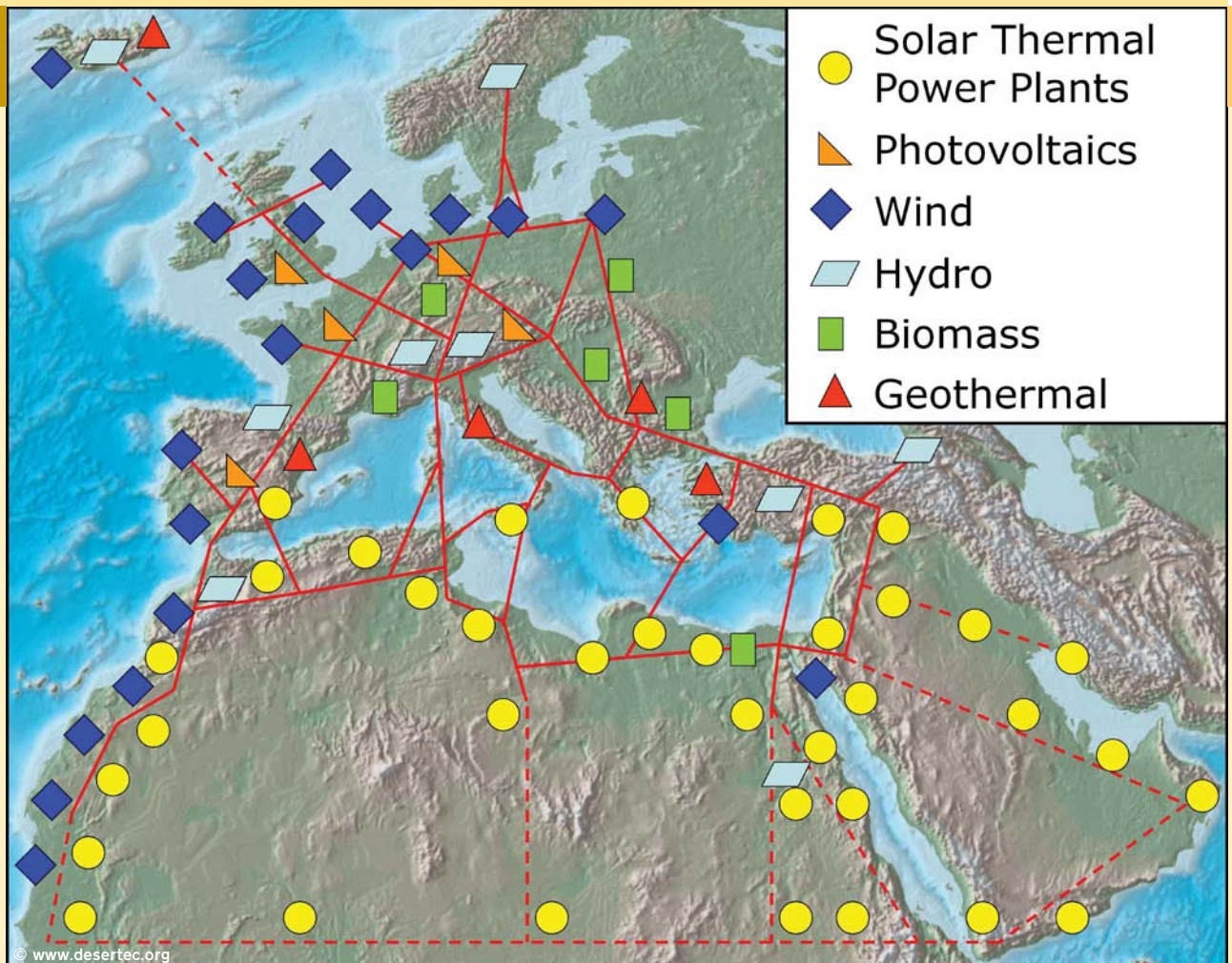
Phone: +32(0)2 2101780
Fax: +32(0)2 2101789
info.eu@worldfuturecouncil.org

The ideas to remember

- Like Al Gore or Stephen Chu in America, e-Parliament (a worldwide forum for democracy) argues that large scale development of renewable energy is impossible without a Supergrid of HVDC lines linking countries and regions, which would then be able to specialize in their own best suited technology. This would allow renewable energy production to be easily and rapidly transferred to any part of the network and would address the sector's biggest disadvantage – its variability. Another advantage of the supergrid is the possibility of extending pumped storage technology (pumping water up into dam reservoirs during off peak hours, then releasing it to power turbines when demand increases) to provide on-hand and easily exportable power at an international level.
- DESERTEC is a club of Rome initiative to install Concentrated Solar Panels (CSP) in the North African deserts, develop the local renewable energy sector, then export electricity to Europe with HVDC lines. Studies by the German Aerospace Center estimate that high solar radiation in the Sahara would outweigh transfer losses and allow DESERTEC to provide cheaper electricity than similar plants in Spain or Italy. A precondition for development is increased regional stability around the Mediterranean basin, perhaps within the framework of the Union for the Mediterranean treaty. The long term goal is to provide a large share of the European Union's electricity consumption by 2050.
- Dr Gregor Czisch, formerly of Kassel university, believes that a cost competitive 100 % renewable electricity scenario is only possible with a very large catchment area of up to 1 billion people, including all Europe as far as the Urals, North Africa and parts of the Middle East. Focusing on wind power as the best technology for large scale development, Czisch claims that EU production alone would not provide reliable year round supply and would require prohibitively expensive reserve generation and storage capacities. His answer is to integrate more distant production centers (such as Morocco) into a common HVDC Supergrid to even out seasonal fluctuation and provide clean power to all participating countries.
- Developed by the European Climate Forum, the SuperSmartGrid concept combines Supergrid and Smart Grid technologies into a single package. HVDC



54.4 % of the European Union's energy consumption is imported. Of these 1010 million tons of oil equivalent (Mtoe), 86.5 % are oil and natural gas, and 35 % of the total imports come from Russia. Since 1990, fossil fuels imports into the EU have risen by 60 %. (DG Energy figures)



A large catchment area integrating Europe, North Africa and parts of the Middle East into a single grid allows each region to specialize in the renewable technologies that suit it best – Algeria, for example, has superb solar radiation, while Iceland is rich in geothermic and wind resources. The result: consistent and reliable renewable energy production. The drawback? The difficulty of implementing such a large project.

power lines would rapidly and efficiently transfer large amounts of power to high demand areas, using multi-national production sources to minimize renewable energy's variability. At local or regional level, smart grid distribution networks would then employ advanced "drip irrigation" technology to bring the power to consumers. (By precisely calculating demand and promoting the adoption of industrial and household appliances that adapt their duty cycle to off peak hours). Meanwhile, supply from long distance lines would be modulated according to local, decentralized production (such as small hydro, wind or solar).

■ **Mainstream Renewable Power** (an electricity generation company) promotes the Supergrid concept at a smaller level, essentially developing offshore wind farms then connecting them to the mainland with HVDC lines (Airtricity, another energy group, has a very similar outlook). The first stage would involve joint Anglo-German participation in a large North Sea wind generation project called Supernode. This would act as a regional pilot testing bilateral cooperation, funding procedures and new technologies, reviving Britain's flagging offshore energy sector and confirming Germany's lead in wind turbine production. Supernode could take on a more regional outlook with an HVDC connection to Norway's pumped storage capacities, and, if successful, could be extended to other maritime Member States with the EU's Enhanced Cooperation mechanism.

A solution waiting for a problem

The European Union is one of the most energy dependent regions of the world, currently importing over 80 % of its oil, close to 60 % of its gas and approximately 97% of its uranium. This is a costly and unpredictable threat to Europe's energy security which has been underlined by the regular energy crises between Russia, Ukraine, Belarus and Georgia. Meanwhile, global warming has become a major issue that people wish to see addressed – and renewables are the best choice. Despite the much promoted possibilities of Carbon Capture and Storage allowing a durable, fossil fuel based economy, large scale CCS has not yet reached the trial stage (and radioactive waste storage is no more advanced). Overall, renewables are much less vulnerable than fossil fuels or nuclear, simply because they are not finite.

The five scenarios presented in this report are all technologically feasible. The supergrid approach has been successfully used at a regional level on America's western seaboard for the past 40 years, with HVDC lines connecting California to major hydro plants in Washington and Oregon. The basis for a European HVDC grid already exists: A 550 km submarine cable – the longest in the World – connects Norway to the Netherlands; France currently provides 5 % of Britain's electricity demand with a 2000 MW cross channel line. In all there are 15 major HVDC links in Europe, with more under construction.

To be sure, there are a number of major issues to be addressed. Developing renewable energy production in North Africa, for example, is contradictory to the sector's "home grown" energy security selling argument,

and projects like DESERTEC have become politically top-heavy by seeking to promote regional peace *and* electricity production. High voltage power lines pose health risks, require safety zones and divide environmentalists over their perceived benefits. A supergrid would allow increased energy trading, perhaps requiring a standard EU-wide feed-in-tariff (or renewable energy quota) and considerable legal headaches. Finally, what steps will be taken to stimulate and protect investment, and who would coordinate the development of the Supergrid concept? After all, the EU will only move away from fossil fuels if the case for renewable energy is financially as well as environmentally convincing.

