Has Europe a need for solar plants in Africa?


Solar electricity is the most promising new source of electricity in the world [1]. The idea to produce solar electricity in southern European regions and in northern Africa to serve Europe has been discussed for decades [2]. One of these ideas is from the company ABB who aims to link different production places of solar, wind- and hydro-energy in Europe and northern Africa through their high voltage DC-lines (Image 1). Wind and solar would act as a spontaneous electricity producers. Hydro energy would be used as production for “band energy” and “peak-power”. With hydro energy in higher regions such as the Alps in central Europe, we can produce “peak power” and act as a “battery” with pump storage hydro plants. Some of these facilities are still on line mainly in Switzerland, Germany, Norway, Austria and other European countries. In Switzerland, the region with storage lakes in the maximum height in Europe, the pumping power of pumping storage plants will be enhanced from about one Gigawatt to about 5 Gigawatts.

Renewable energies for Europe

 PV most important new electricity source in Switzerland

Many countries (like Switzerland) have production targets for the replacement of electricity from nuclear power plants. In the “Energy Strategy 2050” [3], PV is the most important new electricity in 2050. The mechanism driving this market expansion is the “feed in tariff”, invented for photovoltaic in the Swiss city of Burgdorf [4]. Burgdorf is the home of the PV Laboratory (PV LAB) at Bern University of Applied Sciences (BFH).

Energy transition in Switzerland

For the 50 GWh energy production of a plant with the same production as “Puerto Errado 2” (30 MWp), we need a 50 MWp PV-plant in the Swiss Basin, which costs about 100 Mio. Swiss Francs (without the price for the land). For the production goals of the “Energy Strategy 2050” of the Swiss Government, the surface of roofs and facades in Switzerland is sufficient to produce the solar electricity needed in 2050. We can save the costs for land. Another advantage is the existing electric infrastructure in Switzerland. The cost per kWh in the biggest PV-plant in Switzerland is half the price of “Puerto Errado 2”. This demonstrates the progress of PV-electricity. The freezing capacity of the Migros warehouses (Image 3) could act as a short term storage.

Table 1: The PV-production at high altitude sites (calculated) is similar to North Africa and South Europe

<table>
<thead>
<tr>
<th>Location</th>
<th>PV product [kWh/kWp]</th>
<th>Diff. [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burgdorf</td>
<td>1'010[kWh/kWp]</td>
<td>+1%</td>
</tr>
<tr>
<td>Muottas Muragl/</td>
<td>1'490[kWh/kWp]</td>
<td>+49%</td>
</tr>
<tr>
<td>2'453 m</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diavolezza/</td>
<td>1'560[kWh/kWp]</td>
<td>+56%</td>
</tr>
<tr>
<td>2'978 m</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Almeria (Spain)</td>
<td>1'410[kWh/kWp]</td>
<td>+41%</td>
</tr>
<tr>
<td>23 m</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ouazzazate (Morocco)/</td>
<td>1'590[kWh/kWp]</td>
<td>+59%</td>
</tr>
<tr>
<td>1'160 m</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Conclusions

With the decline of the PV-electricity costs [8], it becomes less and less interesting for Swiss (and European) utility companies to make investments in northern African PV-sites. The conditions in Switzerland are equally interesting. It’s not astonishing that a consortium like “Desertec”, founded in 2003 [9], still hasn’t built an installation. On the other hand, North Africa has big cities and a growing population needing electricity. To address this need, solar electricity can be produced locally at lower costs than in mid-Europe. Due to the lower costs of PV, the “grid parity” is reached now in northern Africa and in Europe. This makes PV-electricity an interesting electricity source for both North Africa and Europe!

Detailed information can be found on www.pvtest.ch

References


Image 1: Production of 100% electricity by renewable energies “wind, solar and hydro” and connected through high voltage direct current HVDC-lines (ABB 2005)

Image 2: Puerto Errado 2 has a 1-axis tracker with a Fresnel lens

Image 3: Part of the biggest PV-installation in Switzerland (>5 MWp) at the freezing and distribution center of the warehouse chain Migros in Neundorf (SO)

Image 4: New BFH test site on the avalanche barrier installation at Bellwald (VS), built by the owner Mr. Lehmann

Image 5: Railway to Muottas Muragl near St. Moritz 2'453 m asl with 64 kWp p-join solarmodules and a planned production of 3'400 kWh with productions of up to 1'600 kWh/ kWp (>100 kWh/a)

High alpine measurement sites of Bern University of Applied Sciences (BFH)

The Photovoltaic Laboratory at BFH has operated a measurement network of PV installations for more than 20 years. Two installations are at high altitude sites in the Swiss Alps. They show high production rates similar to South Europe [5] [6] [7]. See Table 1.

PV in mid-Europe is now cheaper than concentrated solar power in southern Europe

One of the latest solar thermal plants is “Puerto Errado 2” in Calasparr in the south of Spain paid by Swiss utility companies (Image 2). The installation will produce 50 GWh with an installed power of 30 MWp. Based on company information, the cost is about 210 Million Swiss Francs (about 175 Million €).

Image 3: Part of the biggest PV-installation in Switzerland (>5 MWp) at the freezing and distribution center of the warehouse chain Migros in Neundorf (SO)

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