

RESPONSES TO “REACTIONS TO THE TREC PROPOSAL” BY DAVE ELLIOTT

Franz Trieb

I would add three things (to comments by Gerry Wolff, below):

1. one of the major advantages of CSP imports vs. domestic wind or PV in Europe is (besides of the cost) the provision of balancing power capacity for base and peak load (firm power on demand) due to

a) more constant solar irradiance over the year in MENA (see TRANS-CSP page 56)

b) thermal storage (==> 75 - 95 % solar share)

c) hybrid operation (==> 100 % firm capacity)

PV and wind always require firm backup capacity from other, more reliable sources (PV over 95 % and wind over 80 % of its installed capacity). Hydrogen storage (which would be needed for seasonal storage in Europe) would eliminate at least 50 % of PV and Wind power and require to install twice as much capacity to compensate for the losses. Alternative PV capacity with seasonal (hydrogen) storage would require the installation of a multiple of the required capacity due to storage losses and lower electricity yield of PV in Europe. Wind and PV should be used in Europe to the possible extent shown in TRANS-CSP and complemented by CSP imports to provide a sustainable and functional mix.

2. in a balanced mix of renewables, the overall import dependency is reduced in spite of CSP imports (TRANS-CSP, page 68). Not using CSP imports would require equivalent amounts of gas imports and coal plants (for base load and peak load power) which would equally lead to more import dependency and in addition pollute the atmosphere.

3. In any case, CSP imports can only increase the portfolio of sources and thus security of supply. An additional HVDC grid can also only increase redundancy and not reduce it. Both add to the diversification of the portfolio that is part of the EU strategy for energy.

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Gerry Wolff

Reactions to the TREC proposal

Dave Elliott

The TREC scheme sounds wonderful and if it worked it would clearly have major implications for reducing emissions: see the graph right. But is it feasible?

Certainly it's useful to have the EU renewable potential analysed in such positive terms. But what about imported power from CSP? That's pretty daunting. What are the problems? Firstly, there are the obvious practical issues to do with running CSP in deserts- sand storms would cut output.

On the Sahara Wind website (<http://www.saharawind.com/>) it says "According to our measurement recordings, sandstorms are fairly rare in occurrence. Winds blowing eastward from the desert account for less than 5 % of the normal wind regime. Sandstorms make only one part of this 5%."

As Gerhard says, there is now a lot of experience of the operation of CSP plants in deserts.

TREC say that the plants could store solar heat in water tanks for a while, but of course that would add to the cost.

Heat is stored at a much higher temperature in melted salts (eg nitrates of sodium and potassium). Storage can increase the value of the electricity by shifting production into periods of high demand. So CSP plants with storage may be more profitable than CSP plants without storage.

TREC also seems very optimistic about overall costs falling- but CSP is a fairly well established technology- e.g there have been units in use in the USA for decades and so major improvements may be less likely, although of course technological breakthroughs are always possible.

Costs are brought down by economies of scale and refinements in the technology and neither of these have had much chance to operate. For most of the 20th century, fossil fuels have been so cheap that there has been no incentive to develop CSP. Also CSP has not received the kind of support from governments that has been provided for wind power. Hence, volumes are still relatively small and there is still plenty of scope for refinements in the technology itself and in production methods that will bring costs down.

There is also the potential local environmental impact of CSP on fragile desert ecologies,

CSP plants will certainly change the ecology in areas where they are set up. But since less than 1% of the world's hot deserts could produce as much electricity as the world currently consumes, plenty of untouched desert would be left.

There are no pollution problems associated with CSP that are comparable with the kinds of problems that are sometimes associated with oil extraction or ship breaking.

and the environmental and social implications of installing giant HVDC links across Europe.

With the HVDC 'Supergrid' concept proposed by Airtricity, power cables would all be laid under the sea. Of course, environmental impacts would need to be assessed but they are likely to be small, and visual intrusion which is an issue with overhead lines, would largely disappear.

Burying them underground would be very expensive.

This is true for HVAC. But with ABB's "HVDC Light" technology over long distances, costs are only about 10 to 20% more than overhead lines. Submarine cables, as proposed for the Airtricity Supergrid, may be cheaper to lay than underground cables.

The HVDC grid would also present major terrorist targets- the chance the cripple whole regions. TREC say that there could be some duplication of links in a web-like network, which would be proof against interruption, but of course that would add a lot to the cost.

With ABB's "HVDC Light" technology, a 10 GW transmission line would be made up of 10 pairs of cables, each pair carrying 1 GW. Laying a single 10 GW cable or pair of cables is not an option. Catastrophic failure is much less likely with 10 pairs of cables than with one high-capacity pair.

Moreover, do we really want the EUs energy still to be imported on large scale -swopping oil for solar? Is that reliable, or even ethical? TREC say that some of the power would be used locally not least for desalination. Fair enough. And there could be some political and social benefits form a new interaction with N Africa- as long as it wasn't exploitative. But the whole project seems to assume a degree of political and economic integration that is, sadly, a long way off.

There is a whole range of reasons why security of supply is much less of an issue in the TREC proposals than may superficially appear. The main reasons are given on http://www.trec-uk.org.uk/csp_sections/csp_security.htm .

Regarding ethics, the potential benefits for local people include: desalination of sea water using the waste heat from CSP plants; the creation of shaded areas under CSP mirrors (protected from the harsh tropical sun) with many potential uses including horticulture using desalinated water; jobs and earnings; and plentiful supplies of clean electricity. I don't see any ethical dilemma here—quite the reverse in fact.

We buy all sorts of things from China, Japan and many other places around the world without having political or economic integration with those countries. Likewise, investments are made in many countries around the world most of which are not

‘integrated’ with the UK.

Airtricity’s Supergrid idea for the North sea is proving quite hard enough to sell to the EU and its constituent countries- who are at present busily arguing about whether a single EU energy market can really work, when much of the capacity is owned by a few giant companies. ‘Unbundling’ is the buzz word at present, so it may be a while before anyone can really consider how giant new pan EU-and-wider schemes can be put together. On the more positive side, it is true that energy losses can be relatively low with HVDC cables (TREC say 3% /1000km), and in theory you can bury them, to reduce the visual impact- but at a large extra cost.

A large-scale HVDC grid does not have to be built in a ‘large-scale’ manner. The World Wide Web is, by any standards, huge but it has grown organically from small beginnings. Even when it was small, it was useful and functional. In a similar way, large-scale HVDC grids can be built up in stages, with benefits at every stage.

Regardless of any case for distributing CSP electricity, the case for large-scale HVDC grids is very strong:

- Over a wide area like Europe, wind energy is much less variable than it is in any one spot. Large-scale HVDC grids can greatly reduce the variability of energy sources like wind power.
- If there is a surplus of electricity in any one area (eg a lot of wind blowing in Scotland or more hydro power in Norway than the Norwegians can use), a large-scale HVDC grid allows it to be moved to areas where it is needed. Without that kind of grid, and without the ability to store large quantities of electricity, that surplus energy is simply wasted.

For these kinds of reasons, there are now at least two proposals for a world-wide HVDC grid (see http://www.trec-uk.org.uk/transmission/hvdc_article1.htm and <http://www.carbonfree.co.uk/cf/news/wk10-07-0001.htm>).

Costs are not as high as one might assume (see above).

But it still seems rather a long way off.

Ban Ki-moon, Secretary General of the UN, has said that climate change is as big a threat as war. If the development of renewable forms of energy was treated as a war-time priority, the necessary infrastructure could be put in place very fast.

And finally, why go to all the expense of reconcentrating solar energy and then having to transmit it long distances when it is naturally distributed to every place on earth? Maybe not as much, in terms of intensity, everywhere as we might like, but still enough to be usable for on-the-spot heating & electricity production.

There is certainly a place for PV in countries with less sunshine. But the quantities of energy falling as sunshine on hot deserts is so enormous that it should not be ignored, especially in view of the additional benefits that may come with CSP (see

http://www.trec-uk.org.uk/csp_sections/csp_bonuses.htm).

At some point, TREC's long distance transmission ideas may be worth exploring, if not for the EUMENA area then elsewhere in the world.

As mentioned above, there are at least two proposals for a world-wide HVDC transmission grid.

And there have also been even more ambitious ideas for global level power integration- then you can always get power from the sun from the sunlit hemisphere!

However, nice though it might be to hope for regional and even global solidarity being forged by mega projects like this, for the moment, sadly, it seems unlikely that politically we are up to it.

As mentioned before, these things can be developed in stages. There is no need to treat them as mega projects.

But that's not to say we shouldn't try- although its not clear if CSP is the right technology.

If PV became much better and cheaper and if things like flow batteries became cheap, then it might make more sense to use them instead of CSP. But, in hot deserts, CSP is the most attractive option right now and is likely to be for some time.