OPTIMISING THE EU ELECTRICITY SYSTEM

7 April 2014

OPTIMUM Characteristics in a long term vision

- There is only one economic optimum
- The objective is to find this optimum (at EU level) considering all costs & benefits:
  1. Generation Investment Costs (direct costs)
  2. Transmission & Distribution Costs (indirect costs- investments needed to integrate the energy)
  3. Value of the energy to be produced (value for the system of the energy integrated in the system)

OPTIMUM Characteristics in a long term vision

- Investments in RES generation made without considering T&D costs will be inefficient
  - All consumers will have to pay the T&D required or the RES generation will face curtailments
- Investments in RES generation made without considering the system value of the produced energy will be inefficient
  - The energy price at the hours of production could be low, zero o even negative!

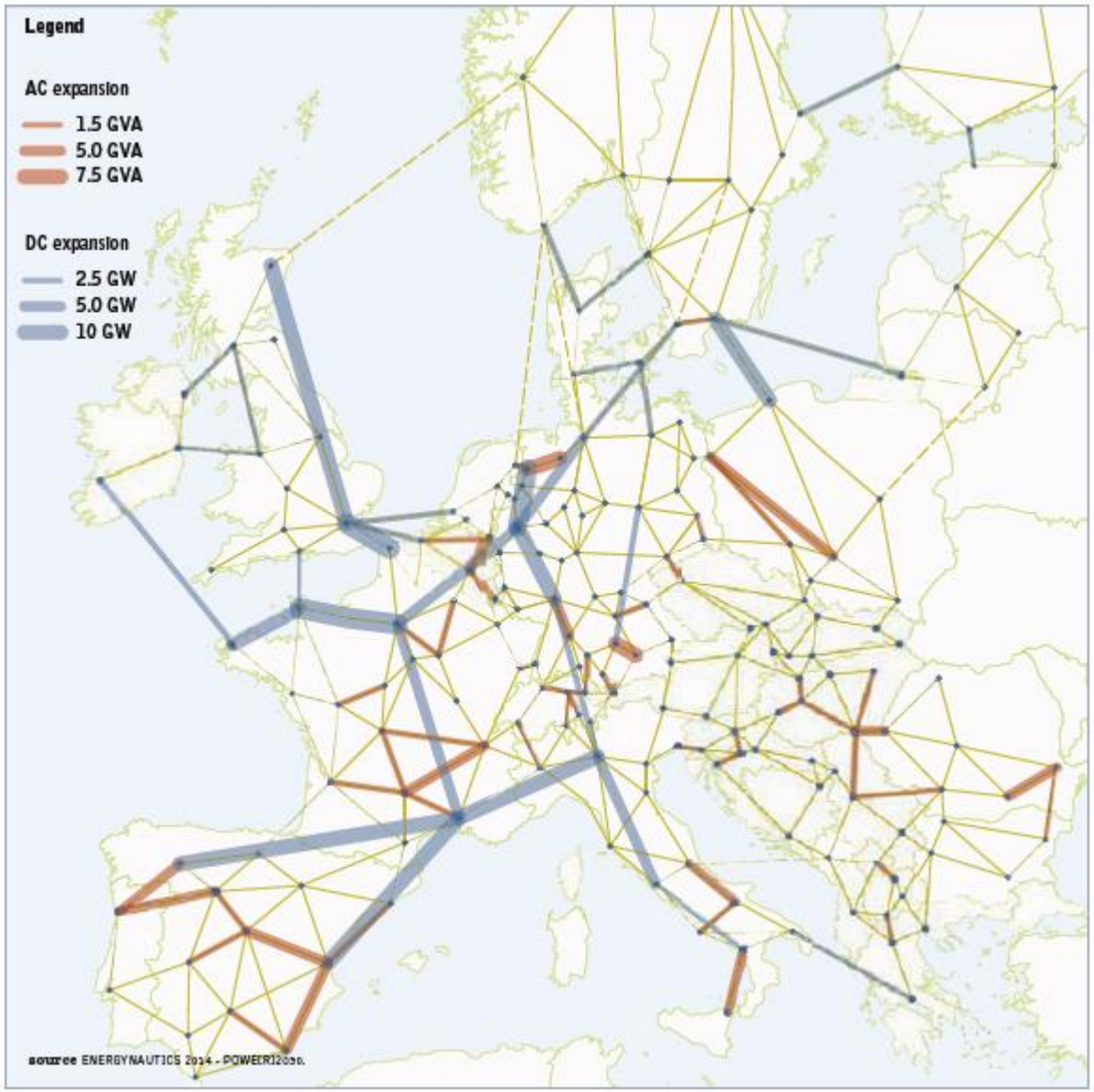
In both cases, the investor will be facing unforeseen risks

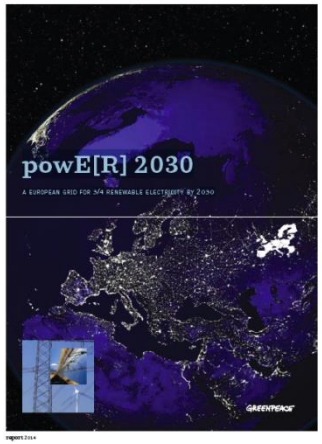
Greenpeace: powE[R] 2030

A EUROPEAN GRID FOR 3/4 RENEWABLE ELECTRICITY BY 2030

http://www.greenpeace.de/sites/www.greenpeace.de/files/publications/201402-power-grid-report.pdf

FRIENDS OF THE SUPERGRID





The following corridors were identified for the HVDC overlay:

1. Scotland to southern England
2. Spain to France
3. Southern Italy to Northern Italy
4. French coast to Paris
5. Northern Germany to the Ruhr and/or Southern Germany
6. France to Germany
7. Italy to Germany

Greenpeace: powE[R] 2030 cont.

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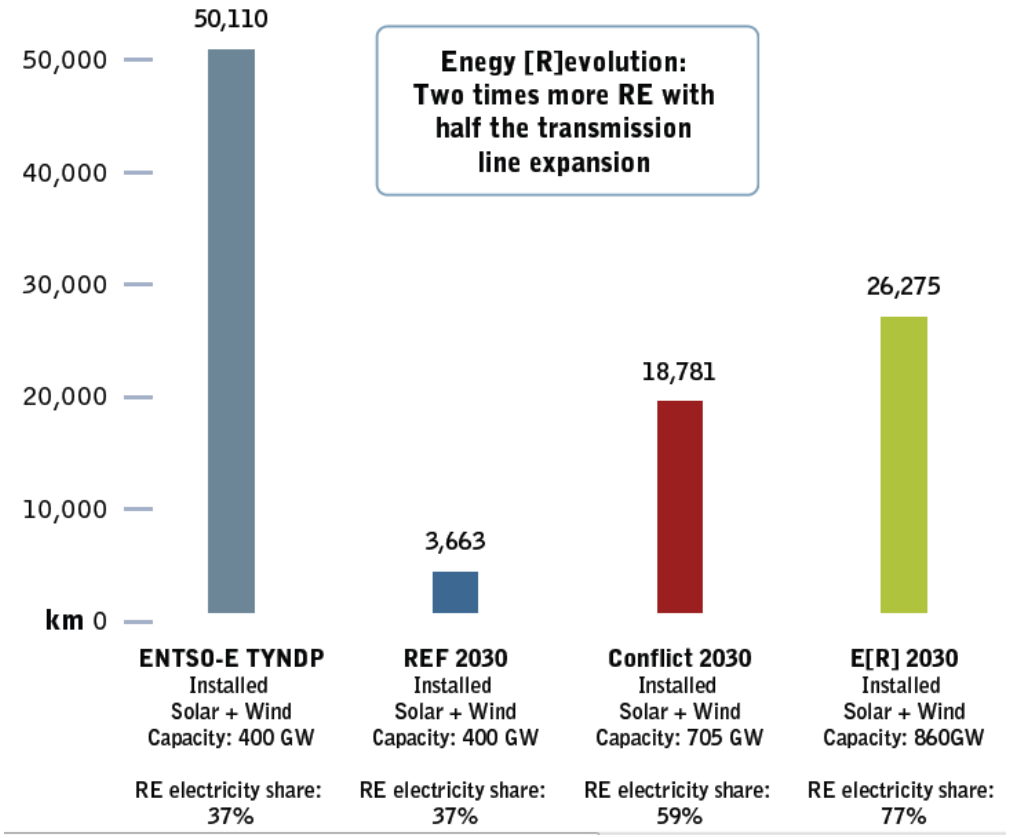


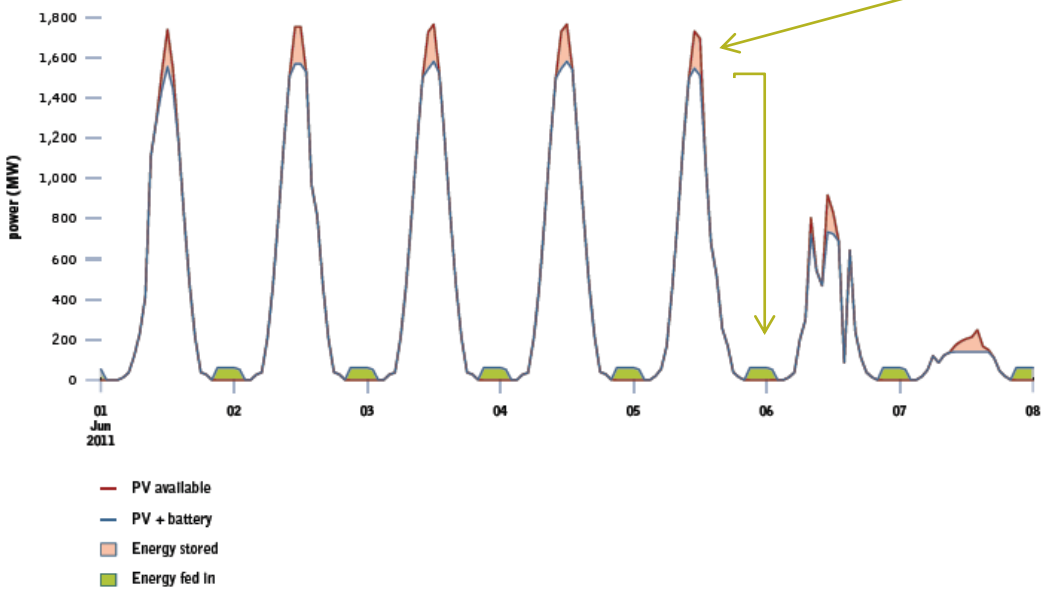
- 3rd report focusses on new innovative “overlay-concept” or “super grid” which uses HVDC instead of HVAC for 2020 and 2030 scenarios
- Simulation based on a 200+ node network model for the ENTSO-E area (30 countries) with 400+ AC lines, existing HVDC lines, and TYNDP 2012
- Overlay HVDC grid vs. extension of the HVAC transmission network would reduce length of new transmission lines from 39,000 km to 26,000 km, but would accommodate 77% renewables by 2030 (860 GW Wind & PV with only 2.8% curtailment)

How is the reduction in total km transmission lines achieved?

1.7.5 dispatch of PV batteries

In 2030 only will PV batteries be installed at each node with a nominal power corresponding to 10% of the total installed capacity of PV at the node. They have an energy storage capacity corresponding to two hours at nominal power (so a 1 kW battery can store 2 kWh).

figure 1.10: **PV peak capping by battery with consumer-orientated operation at node DE02**



- Optimize the overlay HVDC grid based on todays network instead of TYNDP: - 40%
- Preferring HVDC vs HVAC: - 19%
- Peak shaving PV batteries in PV nodes (nom. power 10% of PV capacity): - 10%
- 90% x 60% x 81% = 44 %
- DC transmission needs fewer lines because the power is transferred directly from one region to another and stops electricity from spreading out in the neighbouring network (“loop flows”) and AC network stress