Cost Comparison of Ridge Line Wind and Solar Power

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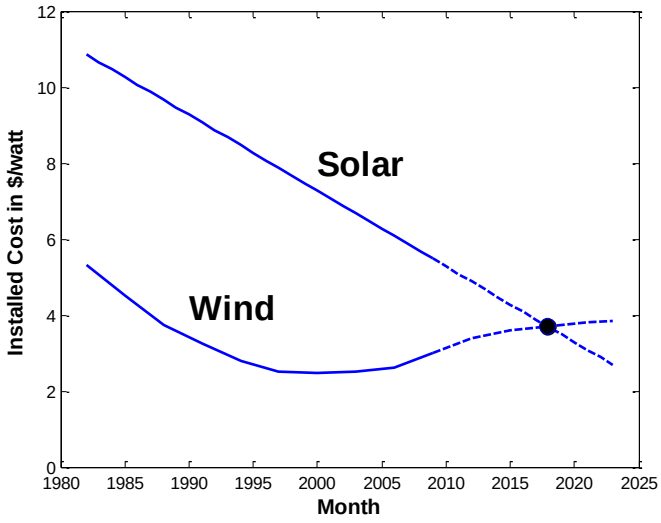
Renewable Energy policy decisions are likely to be most effective and beneficial when based on a comprehensive, objective, and scientific evaluation of renewable energy resources, potential environmental impacts, and cost and technology trend information. This short summary is intended to facilitate this process, specifically with respect to cost considerations.

The following graph shows averaged out past cost trends and future projections for the installed cost per watt of capacity for solar power (photovoltaics) and ridge line wind power, both of which are based on best possible data sources for both (see next page for source information). The basic conclusions are that: **1) Solar is rapidly declining in cost, 2) wind power has been increasing in cost since about 2001, and 3) a cost convergence between the two appears to be imminent (and has already occurred if transmission costs are fully included – see below).**



As late as 2002, the Department of Energy projected that wind power would continue to decrease for another decade or so. This did not occur, apparently due to this technology's intrinsic dependence on relatively large amounts of steel, cement, copper, and other bulk commodities. As a result, the industry has remained deeply dependent of subsidies, and is not competitive with conventional electricity sources today.

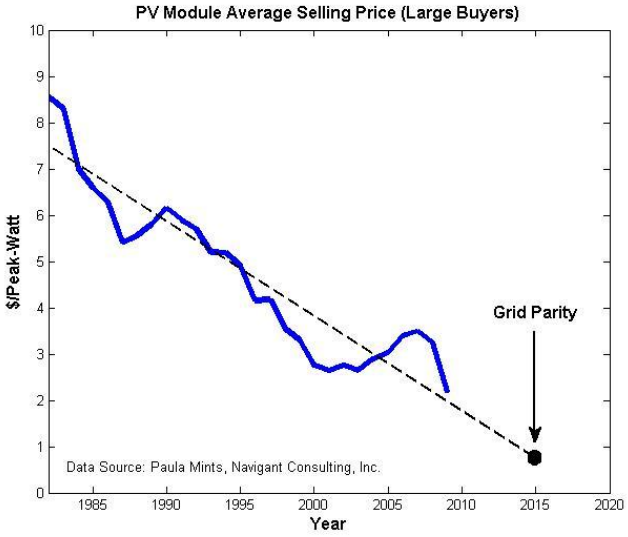
Wind power development also requires very substantial investments in new transmission, which are *not* fully included above. According to the CEO of the New England ISO, "A conservative goal for 5,500 megawatts of wind power and 3,000 megawatts of hydro power through 2030 would carry transmission costs of between $7 billion and $12 billion[1]". Distributed solar generation, however, can potentially require *less* transmission, both due to the wide dispersal of generation, and to the better correlation of solar generation with peak demand in comparison with wind. *In any case, if the $7-12 billion in transmission costs for wind mentioned above are included, the true economic cost of wind power in the Northeast will be approximately that or higher than the cost of power from larger solar projects.*

The trends above are shown on a cost-per-watt-of-capacity basis. The "levelized" cost of wind and solar power, that is, the cost per kWh, *with subsidies*, are presently around at least 10-20 cents/kWh for ridge line wind (not

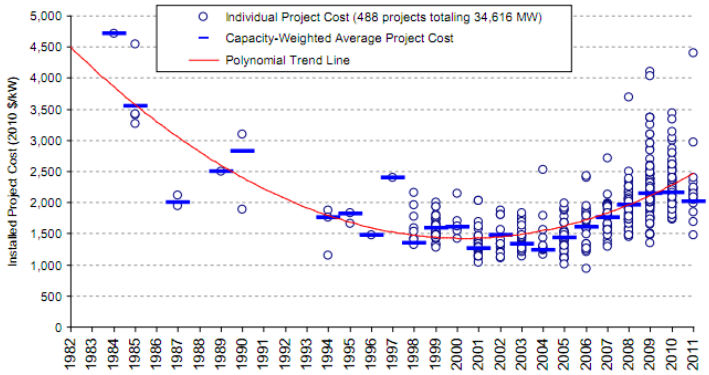
[1] Gordon van Welie, president and chief executive officer of ISO New England Inc, from "New England grid chief: Cooperate on wind power", by David Sharp, Associated Press Writer, August 16, 2010.

including the cost of a major transmission build-out), and a little over 20 cents/kWh for solar (but varying substantially with system size and type).

As the graph below from MIT manufacturing design scientist Emanuel Sachs shows, the levelized cost of solar is presently projected to equal typical US retail power prices around 2015, and to be directly competitive with wholesale wind power costs around 2020, which is consistent with the installed cost data presented above (see also graph at right).

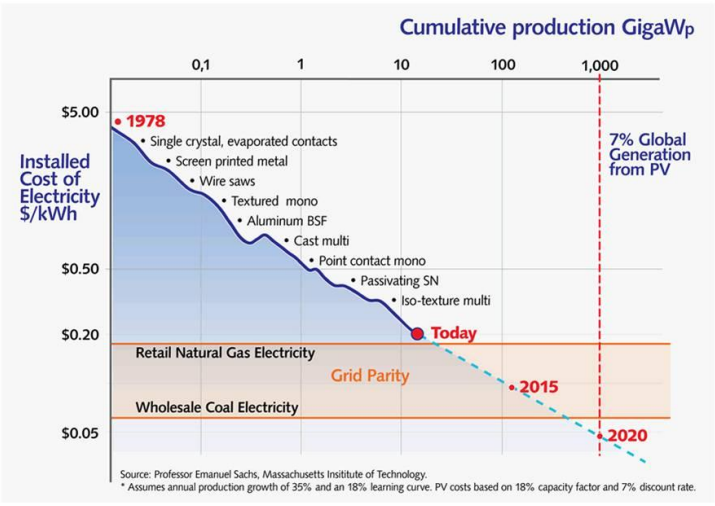


Data Sources: The graph at right shows the base data used for the PV trend estimate above (the dotted line and grid parity point are my additions). The base data is from Paula Mints, a widely respected PV industry analyst (Mint's data is currently used by the Department of Energy in their solar technology market reports). The second graph, below right, shows the trend for the *levelized* cost (cost per kilowatt-hour) for PV, as estimated by MIT professor Emanuel Sachs. Both data sets clearly suggest an imminent convergence of PV power with retail power costs in the near future. The graph below shows the wind data from the 2010 DOE Wind Technology Market Report, which summarized data for 488 wind projects (the best objective and most comprehensive data source available on this technology).



Note: 2011 data represent preliminary cost estimates for a sample of 17 projects totaling 1.1 GW that have either already been or will be built in 2011, and for which reliable cost estimates were available.
Source: Berkeley Lab (some data points suppressed to protect confidentiality)

Figure 28. Installed Wind Power Project Costs over Time (including preliminary sample of 2011 project costs)



Solar Cost Data Links:

- http://www.electroiq.com/index/display/photovoltaics-article-display/1113181755/articles/Photovoltaics-World/industry-news/2010/april/pv-industry_pricing.html
- http://ewh.ieee.org/r6/scv/eds/slides/20081002-Paula-Mints-Navigant.pdf (and other presentations by Mints, which can be found online).

Wind Cost Data Link: http://www1.eere.energy.gov/wind/pdfs/51783.pdf

Assumptions used in the cost comparison: Installed Costs for ridge line wind power installed costs were estimated by adding $1/watt to the averaged DOE data, to account for extra costs specific to ridge line sites and the relatively small size of these projects. The resulting estimate is still likely quite conservative: Real typical costs are probably somewhat higher. Solar costs were estimated using a least squares fit to the data for large PV buyers from Paula Mints. An amount of $3.5 was added to the PV module (panel) cost trend to account for inverter and other balance of system costs, with no decrease assumed for these components. PV costs will likely level out but it is not possible to determine yet when this will occur.