

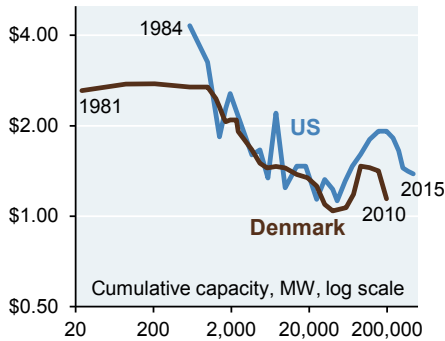


### Appendix VI: Energy learning curves

The first 3 charts show learning curves for solar, wind and storage; capital costs fell as capacity rose. In the case of wind, the learning curve was interrupted in 2004 by a period of rising costs for raw materials (steel, iron, copper, aluminum, fiberglass), energy and labor which led to rising turbine prices.

#### Wind learning curve

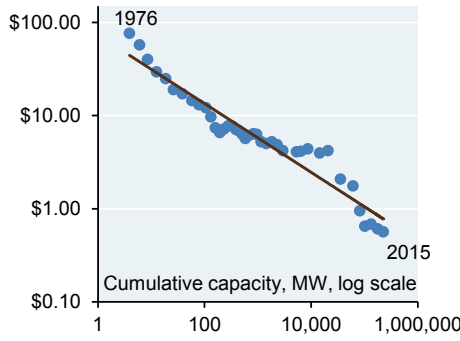
Capital cost, 2005 USD per watt, log scale



Source: NREL, GWEC, JPMAM. 2015.

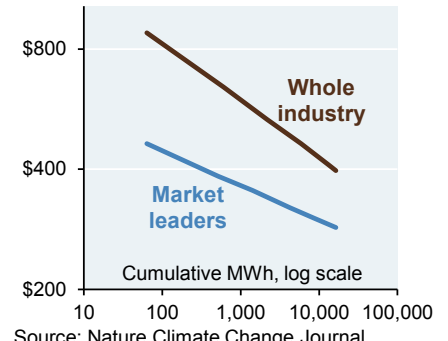
#### Solar photovoltaic learning curve

Module\* price, 2011 USD per watt, log scale



Source: Bloomberg, IEA. 2015. \*Crystalline silicon

#### Lithium-ion battery pack learning curve, 2014 USD per kWh, log scale

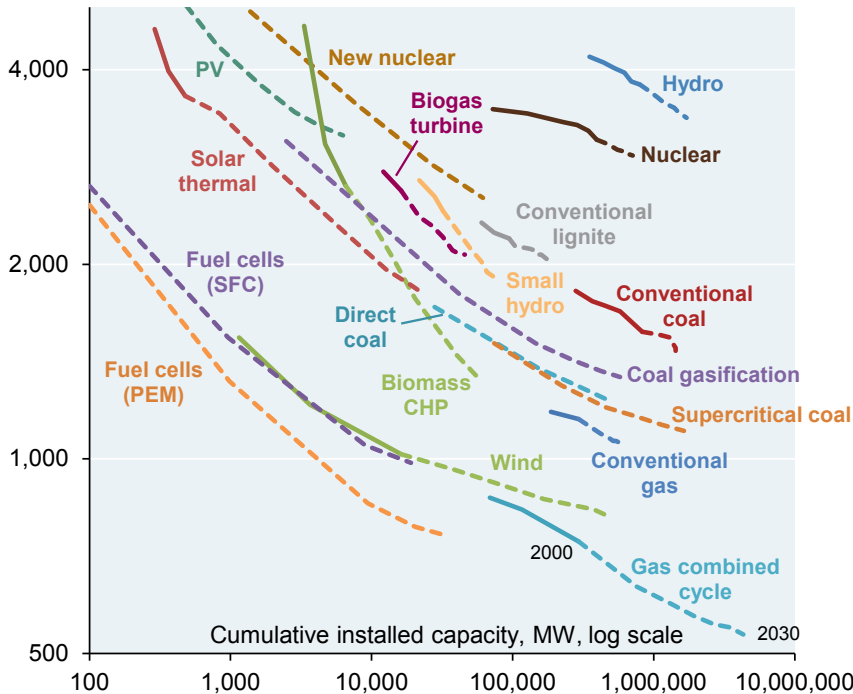


Source: Nature Climate Change Journal (Nykqvist & Nilsson). March 2015.

The next chart was produced in 2003 for the European Commission’s 2030 World Energy, Technology and Climate Outlook report. It’s a bit outdated, but does a good job conveying how analysts used historical data available at the time to project learning curve progress in the future.

#### Learning curves for power generation technologies

Total investment cost, 1999 EUR per kW, log scale



Source: European Commission, Silvana Mima, POLES model, UPMF Grenoble. 2003. Dotted lines represent projections for costs after 2000 until 2030.