Large scale photovoltaics

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The confluence of fossil fuel price spikes, heightened concerns about the environment and the current likelihood of new governmen-driven economic stimuli has increased the discussion about renewable energy policy and investments around the globe. Beyond the current economic slump, increased electricity demand will be driven by more electronics, the rise of emerging economies and soon, the electrification of transportation. These developments will put even more emphasis on abundant and clean methods of generation. Solar-generated electricity has long been a proposed alternative with promise dating back to discovery of the photovoltaic (PV) effect in 1839, the first silicon solar cell in 1954, and President Carter's 1980 goal to produce 20% of US electricity through solar by the year 2000. But even with today's added motivation, PV currently generates less than 0.1% of the world's electricity.

We present the case that 30 years after Carter's proposal, PV is finally on the verge of becoming a major source of electrical power through a principle similar to that which underlies VLSI – the reduction of unit cost (= Watts) through nanomanufacturing. By connecting electricity economics with learning curves that leverage materials, process, equipment and device technologies together with factory automation and manufacturing scale, significant cost reduction can be achieved for both wafer and thin-film based PV modules (*e.g.* the large scale thin-film module below). As such, it is demonstrated that parity with other forms of grid electricity has now been reached for certain important segments of demand (geographic, time-of-day), and numerous technology directions hold the potential to extend economic viability across the global $1.5T electricity market.