in 2000 was 1220 MW (500 MW divided by 41%), an estimate of the energy generated will be 2.4 TWh, or about 0.02% of the world consumption. The projected average annual growth of electricity consumption over the period 1999 to 2020 in [14] is 2.7% worldwide, resulting in consumption of 22 230 TWh in 2020. Extrapolating this to 2025 as 25 398 TWh, the contribution of PV at 300 TWh would be 1.2%. While this is a small fraction, it still could, as the Siemens article points out, make a significant contribution to the lives of people where conventional grid-connected electricity is not available.

Looking at these varied projections of growth in PV sales, it is clear that the penetration of the future electricity market by PV systems is difficult to predict. It depends on many factors whose outcomes are uncertain, among them being the following factors:

- Continued progress in performance and cost reduction of PV systems. This is perhaps the most certain of the factors to be achieved, assuming that the deep-pocket firms now engaged in PV system development continue to be involved. Participation by government and industry associations through support of research and development will also contribute to this factor.
- Increase in the cost of fossil fuels. Numerous predictions made in the past of the cost of oil rising well above US$30 per barrel have failed to materialize on any consistent basis. The price of oil is a strong determinant of the cost of electricity that competes with PV electricity. The price of oil, largely determined by the international cartel, can only be raised so far without decreasing their market size. Major new fields in the Caspian Sea area or elsewhere will be an influence if they materialize, but such finds will become less likely over time.
- Increases in environmental costs for fossil-fuel-based electricity. Global warming concerns may prompt added costs of production due to greenhouse gas control or regulatory constraints or restrictions on competing uses, especially as the energy use of developing nations goes up. These factors will make PV more competitive.
- Accommodation of users to the variable character of the PV source. PV delivers energy when the sun shines, but there is much demand at other times. This characteristic can be overcome by the integration of PV into utilities, by sharing PV capacity among groups of users (a utility of a different sort), by adding storage to the PV system (e.g. electric storage batteries, hydrogen production and storage, hydroelectric storage), or by lifestyle changes. All of these are possible, but each accommodation has its own barriers.
- The need for off-grid electric power is very large and the capacity required for individual sites is usually small. PV systems are more modular than almost any other source, and they provide insurance against rising fossil-fuel prices. If ways can be found to make them affordable, PV has an enormous off-grid market.

All of these projections suggest that PV systems will continue to increase their market penetration and make a useful contribution to energy supply over the next several decades. The likelihood of their becoming an economically significant fraction of the energy supply, say 5% or more, within the next 20 to 30 years appears to be small at this point. Such an event will require fundamental changes in the way energy is delivered, and those changes will have to be driven by economic and environmental forces beyond the control of the PV industry.