The six myths are as follows:

1. *Photovoltaics will require too much land area to ever meet significant fraction of world needs*:

   Solar radiation is a rather diffuse energy source. What area of PV modules is needed to produce some useful amounts of power? Let's make some very rough estimates to give answers that will be accurate within a factor of 2. Using methods described in detail in Chapter 20 (especially equations 20.50 and 20.51 and Table 20.5), one can calculate how much sunlight falls on a square meter, anywhere in the world, over an average day or a year. We will use an average value of 4 kilowatt-hrs (kWh) per m^2 per day to represent a conservative worldwide average. Now, a typical PV module is approximately 10% efficient in converting the sunlight into electricity, so every square meter of PV module produces, on average, $4 \times 0.1 = 0.4$ kWh of electrical energy per day. We can calculate the area in m^2 needed for a given amount of electrical energy E in kWh by dividing E by 0.4 kWh/m^2. (Chapter 20 contains much more detailed methods to calculate the incident sunlight and the PV module output as a function of time of day, month of year, etc.)

   Let us consider three different-sized PV applications: a family's house in an industrialized country, replacing a 1000 MW (megawatt) coal or nuclear powered generating plant, or providing all the electricity used in the USA.

   First, for a typical family, let us assume that there are four people in the house. Figure 1.1 shows a range of electricity usage for the industrialized countries. Let us use 6000 kWh/person/year as an average. But, this includes all their electrical needs including at work, at school, as well as the electricity needed for manufacturing the products they buy, powering their street lights, pumping water to their homes, and so on. Since people spend about a third of the day awake in their home, let us assume that a third of their electrical needs are to be supplied in their home, or 2000 kWh/person/year. Dividing this by 365 days in a year gives about 5 kWh/person/day, or 20 kWh/day per family of four. This is consistent with household data from various sources for the US and Europe. Thus, they would need 20 kWh/0.4 kWh/m^2 or 50 m^2 of solar modules to provide their electrical power needs over the year. Thus, a rectangular area of solar modules of 5 by 10 meters will be sufficient. In fact, many roofs are about this size, and many homes have sunny areas of this size around them, so it is possible for a family of four, with all the conveniences of a typical modern home, to provide all their power from PV modules on their house or in their yard.

   Next, how much land would it take to replace a 1000 MW coal or nuclear power plant that operates 24 hours/day and might power a large city? This would require 10^6 kW $\times$ 24 hr/(0.4 kWh/m^2) or 6×10^7 m^2. So, with 60 km^2 (or 24 square miles) of photovoltaics we could replace one of last century's power plants with one of this century's power plants. This is a square 8 km (or 5 miles) on a side. For the same electricity production, this is equivalent to the area for coal mining during the coal powered plant's life cycle, if it is surface mining, or three times the area for a nuclear plant, counting the uranium mining area [3]. This is also the same area required to build a 600 km (373 miles) long highway (using a 100 m wide strip of land).

   Finally, we can calculate how much land is needed to power the entire US with photovoltaics (neglecting the storage issue). The US used about 3.6×10^{12} kWh of electricity in 2000. This could be met with 2×10^{10} m^2. If we compare with the area of paved roads across the country, of about 3.6×10^6 km and assume an average width