

Sustainable Energy Goal

Imagine a world without fossil fuel. This could be either because we have consumed it or because we curtailed consumption for environmental reasons. How much energy needs to be derived from sustainable resources? Assume this transition to a post fossil fuel economy takes 100 years. The question becomes how much energy civilization will require in CY 2113.

World primary energy consumption today is 1.48×10^{17} Wh/y ⁱ

Assume that in 100 years the per capita energy requirement for the whole world will increase to be the same as the US today. ⁱⁱ This would increase the primary energy consumption goal by a factor of 3.84.

Another factor is population growth and there is much uncertainty in population growth estimates. The United Nations “medium fertility” estimates ⁱⁱⁱ that in 100 years world population will grow by a factor of 1.46, from 7×10^9 people to 10.2×10^9 .

Based on these factors ($3.84 \times 1.46 = 5.60$) our primary energy production goal from sustainable sources is:

$$8.3 \times 10^{17} \text{ Wh/y.}$$

This corresponds to an annual energy growth rate of 1.7%.

ⁱ 12,717 Mtoe (million tons oil equivalent) equals 1.48×10^{17} Wh. Source: International Energy Agency, Key World Energy Statistics 2012, p. 48, available at: <http://www.iea.org/publications/freepublications/publication/kwes.pdf>

ⁱⁱ Ibid IEA p. 49, 1.86 toe world today, p. 57, 7.15 toe US today, increase factor 3.84

ⁱⁱⁱ United Nations Secretariat, World Population Prospects, the 2010 Revision, available at: <http://esa.un.org/unpd/wpp/index.htm>