

Electrical Energy Costs for Manufactured Protein – 2025 Figures

In this note, I update the electrical energy costs of manufactured bacterial protein using 2025 figures, using essentially the same methodology as set out by George Monbiot in his 2022 book *Regenesi*s.

Monbiot's calculation for annual global protein requirements in *Regenesi*s was:

- (1) Daily individual protein requirement x Global population x Days in the year =
- (2) 50g x 8 billion x 365

So, updating this with 2025 figures gives this result:

- (3) 50g x 8.22 billion x 365 = 1.5×10^{11} kg protein

(Population data from the World Bank's World Development Indicators, <https://databank.worldbank.org/reports.aspx?source=world-development-indicators>).

In *Regenesi*s, Monbiot wrongly stated that the electrical energy requirement of manufactured protein was 16.7 kWh/kg. A definitive figure of 69.3 MWh/t = 69.3 kWh/kg is now available from a paper by [Fasihi et al.](#) Hence the total electrical energy requirement to meet global protein needs in 2025 would be:

- (4) 1.5×10^{11} kg x 69.3 kWh/kg = 1.04×10^{13} kWh

It must be noted that this figure applies only to the energy used to produce the protein from its ingredients in the factory, not the total energetic costs of the whole process.

The total amount of electrical energy generated worldwide in 2025 was 3.22×10^{13} kWh (data from the Energy Institute's Statistical Review of World Energy, 2026 – <https://www.energyinst.org/statistical-review>).

So, the proportion of global generated electricity that would be required to energise the factory production of bacterial protein to meet global protein needs is:

- (5) $1.04 \times 10^{13} / 3.22 \times 10^{13} = 32\%$ additional global generated electricity

If we consider only renewable electricity from solar and wind, as discussed in *Regenesi*s, total global generation of this renewable electricity in 2025 was 5.5×10^{12} kWh (data again from the Statistical Review of World Energy, 2026).

So, the proportion of global electricity from solar and wind that would be required to energise the factory production of bacterial protein is:

- (6) $1.04 \times 10^{13} / 5.5 \times 10^{12} = 188\%$ additional solar/wind energy

In other words, to energise the factory production of bacterial protein to meet global protein needs in 2025 using solar and wind generated electricity would require nearly twice as much as was generated.

Chris Smaje
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