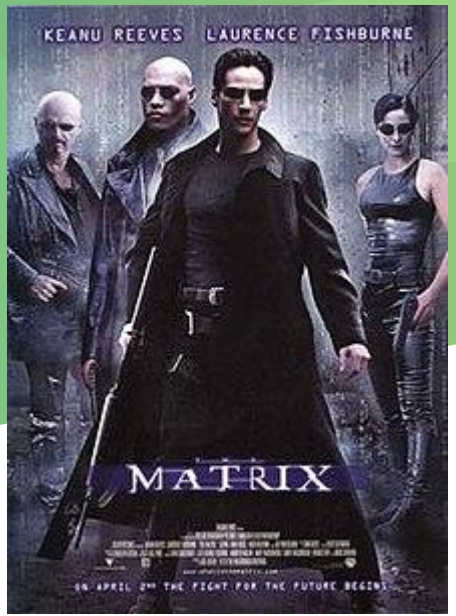
Science in The Matrix (1999)



Synopsis

Thomas Anderson, also known as Neo, is a programmer by day and hacker by night. He is contacted by Morpheus, and is awakened to the reality of the world: robots have taken over and are breeding humans to use as a power source.

“The human body generates more electricity than a 120 volt battery, and over 25,000 BTUs of body heat.” - Morpheus

What is BTU?

- BTU stands for British Thermal Unit
  - Amount of heat required to raise temperature of 1 pound of H_2O by 1 degree fahrenheit
- Equal to about 1055 joules
- 25,000 BTU is roughly 26,375,000 joules

Breakdown

Firstly, we must identify a common unit of measurement between the two pieces of information that we are given.

To convert voltage to joules, we can use the formula:

$$E_{(J)} = V_{(V)} \times Q_{(C)}$$

120 Volts x 9,000 Coulombs = **1,080,000 Joules**

Total energy?

27,455,000 Joules per human!

For reference:

This is the energy released by 6.56kg of TNT

The estimated amount of energy released by the bomb dropped on Hiroshima was equivalent to 15,000 tons of TNT (15,000,000kg), 62,760 gigajoules

Not all hope is lost!

Converting joules/person to gigajoules, we get 0.027455 gj/person

Multiplying the current global population, (I used 7.8 billion) we get a grand total of: 2,14,149,000 gigajoules of power!

This is: 51,182,840 tons of TNT, or 3,412 Hiroshima bombs

Thermodynamics:

- Energy can neither be created nor destroyed
- 180-pound person burns about 56 calories/hour at rest
  - About 1,350 calories in a day
  - Roughly 5,648 Joules

Thermodynamics (cont.)

- Sum of entropies of 2 or more interacting systems always increases
  - More randomness = more energy unable to be converted into work
- Basically, energy produced in “human farm” will be less than the energy consumed

Thermodynamics (cont.)

- As a system moves towards absolute zero (-273.15° Celsius, or -459.7 Fahrenheit), randomness decreases
- However, by decreasing the temperature of the system, machine batteries would not function

Conclusion

The idea of using human beings as batteries is absolutely absurd, as it is super inefficient, and the laws of thermodynamics oppose this.

Not to mention the amount of food that needs to be produced and burned in order to sustain the amount of humans in that farm!

Sources:

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