

Problem II.1 ... ecological bitcoin

3 points; průměr 2,85; řešilo 158 studentů

A certain computer science student is mining bitcoins. His graphics cards yield 0.2 BTC per year and have the energy consumption of 3 000 W. However, the student reaches an epiphany thinking about how much carbon dioxide he releases into the Earth's atmosphere. He therefore decides to use the money gained from Bitcoin mining to buy trees which act as natural carbon capture mechanism. What would the price of a bitcoin have to be to make such an activity profitable? Suppose the price of one tree is 1 000 CZK and each tree can capture $25 \text{ kg} \cdot \text{year}^{-1} \text{ CO}_2$. Consider two energy sources – coal with the price $5.32 \text{ CZK} \cdot \text{kWh}^{-1}$ and emissions of $0.82 \text{ kg} \cdot \text{kWh}^{-1}$ and a hydroelectric power plant with the price of $4.00 \text{ CZK} \cdot \text{kWh}^{-1}$ and emissions of $0.012 \text{ kg} \cdot \text{kWh}^{-1}$.

Jonáš's ecological self was awakened.

First, we need to calculate the annual energy consumption. Let's assume the machines are running non-stop, day after day, then

$$E = Pt \doteq 9.47 \cdot 10^{10} \text{ J} = 26.3 \text{ MWh}.$$

If we multiply this value by the caused emissions and the price per kWh, we get the following values (if we use for the computation the exact value obtained in the first calculation)

Table 1: Price and emissions for different energy sources.

Energy source	$\frac{\text{Emissions}}{\text{t}}$	Number of trees	$\frac{\text{Price}}{\text{CZK}}$
Uhlí	21.6	863	140 000
Vodní	0.316	13	105 000

If we have enough money to plant the required number of trees, our expenses will amount to the 0.2 BTC we have mined. Let N denote the number of trees, C the expenses for cryptocurrency mining and B the price of bitcoin in CZK. The following relationship between these quantities holds

$$1\,000N + C = 0.2B,$$

from which we can express B as

$$B = \frac{1\,000N + C}{0.2}.$$

For coal, we obtain the minimum price of $5.0 \cdot 10^6$ CZK. For a hydroelectric power plant, the amount of money needed is only $0.59 \cdot 10^6$ CZK, which is less than the current price of bitcoin¹ – it seems FYKOS solved the climate crisis!

Of course, both the operating costs and the price of electricity are only an estimation. This proposed situation is highly variable depending on time and location. Furthermore, the construction of the power plant itself produces emissions and it is not easy to find an electricity

¹1.52 · 10⁶ CZK to the 15. 10. 2024

supplier that depends only on a single energy source. It is an interesting thought experiment nonetheless.

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