Master Thesis

Combining Bitcoin Mining with Battery Energy Storage to Optimize Renewable Energy Economics

The proposed master thesis is about a novel approach to addressing the challenge of peak oversupply and price volatility in renewable energy sources by strategically integrating Bitcoin mining operations with Battery Energy Storage Systems (BESS). The thesis will conduct an in-depth analysis of the beneficial relationship between these two technologies, aiming to map out their potential synergies and highlight any associated risks.

As a benchmark, a summary of the recent advancements and historical growth of renewable energy, with an emphasis on the role of BESS in mitigating the challenges associated with energy oversupply shall be carried out. A detailed examination of the factors that dictate the electricity prices for BESS-utilizing merchants will be conducted to gain insights into the determinants of average selling prices over the last year.

Central to the thesis is a simulation study designed to ascertain the hypothetical average electricity price per kWh that could have been achieved if Bitcoin mining units were employed alongside BESS. This will involve an integration of historical data, including e.g. network demand, renewable production levels (with local deviations), electricity market prices, Bitcoin network hashrate, Bitcoin valuation, and BESS usage patterns in Germany.

Finally, the thesis will have a strong focus on investigating an optimization problem: whether the addition of a flexible local load, capable of converting energy to Bitcoin and then to Dollar on demand, could have led to an enhancement in the average price realized in comparison to the past year's real performance. This will involve modeling the potential benefits of incorporating a Bitcoin mining load within the BESS infrastructure, offering a unique perspective on the financial optimization of renewable energy systems.

The outcome of this research is expected to provide valuable insights into whether renewable energy projects utilizing batteries can leverage Bitcoin mining to potentially increase their economic viability.