

Life Cycle Analysis of 'Bitcoin Mining': A Case Study of Greenidge Power Plant, Dresden, NY.

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Executive Summary

- Bitcoin mining utilizes computing power to harvest block rewards for their monetary value.
- Greenidge currently dedicates 13.5% of its capacity to support behind the meter Bitcoin mining, resulting in **annual emissions of 88,940 metric tons of carbon dioxide equivalent greenhouse gases (mT CO₂-e) per year**. Annual emissions would total 660,600 mT CO₂-e if the plant devotes 100% of its generation to Bitcoin mining.
- At full capacity, the annual emissions of CO₂ is **comparable to the annual emissions from burning 727 million lbs of coal, 143,000 passenger vehicles, or the annual energy use by 76,000 homes**.
- These emissions make Greenidge a significant contributor to global warming at a time when New York State is attempting to radically reduce its greenhouse gas emissions by 85% by 2050 and to have 100% carbon-free electricity by 2040.
- This analysis is based on a Life Cycle Analysis using published EPA data and other protocols modified to fit the Greenidge Power Plant.
- Additional environmental and human health concerns arise from the emissions of particulate matter (PM_{2.5}) and precursors to acid rain (SO₂ & NO_x), stratospheric ozone depletion (CFCs), eutrophication (NO_x), and ground level ozone (O₃).

Bitcoin Mining and Life Cycle Analysis

- Greenidge now uses a portion of its capacity (14 MW) to operate 7,000 mining units (aka computers)
- Bitcoin “mining” process is highly energy intensive
- To estimate the environmental impact of this new “business activity” at Greenidge, we conducted a Life Cycle Analysis (LCA) for the current and future proposed Bitcoin mining operations at the Greenidge Power Plant

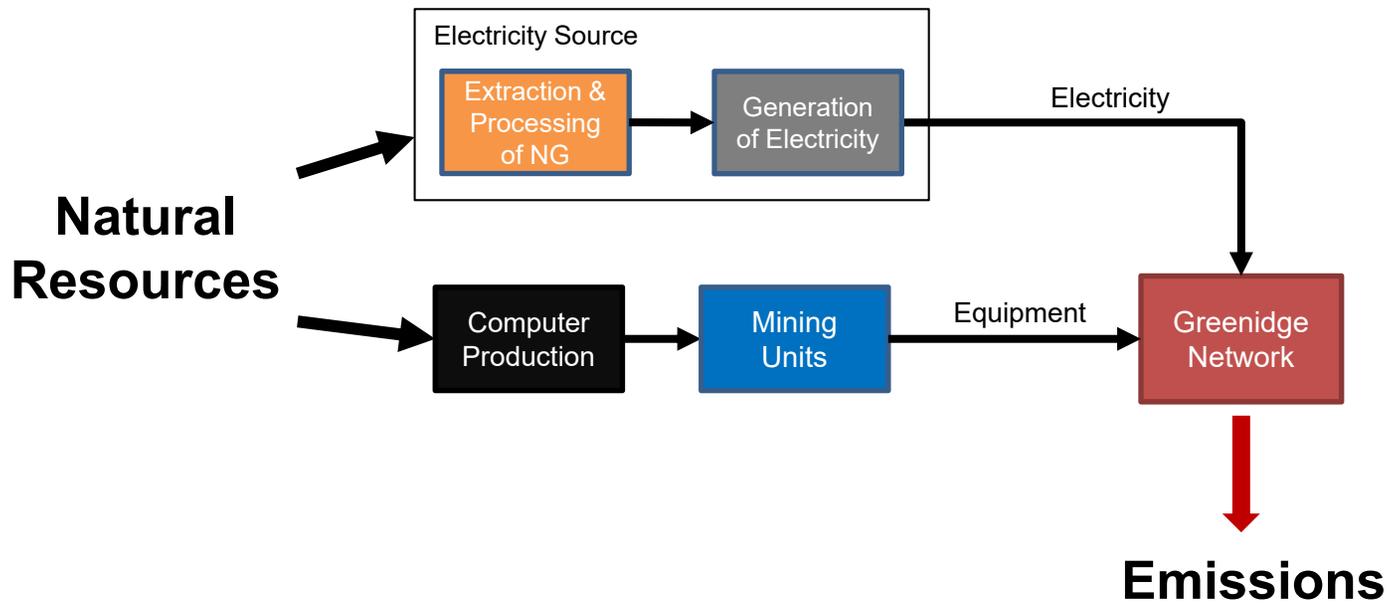


Life Cycle Analysis

- An LCA assesses all pathways associated with the lifecycle, divided into the production phase and the use phase.
- In the case of Greenidge,
 - Production phase includes:
 - Extraction and transportation of the fuel source (natural gas)
 - Production of the mining equipment (computers)
 - Use phase includes:
 - Generation of electricity
 - Operation of the mining equipment
- This LCA relies on open-source resources including:
 - US Life Cycle Inventory Database (USLCI) from the National Renewable Energy Lab (electricity generation)
 - Federal LCA Commons (computer manufacturing)
 - EPA Webfire Engine (emissions from electricity)

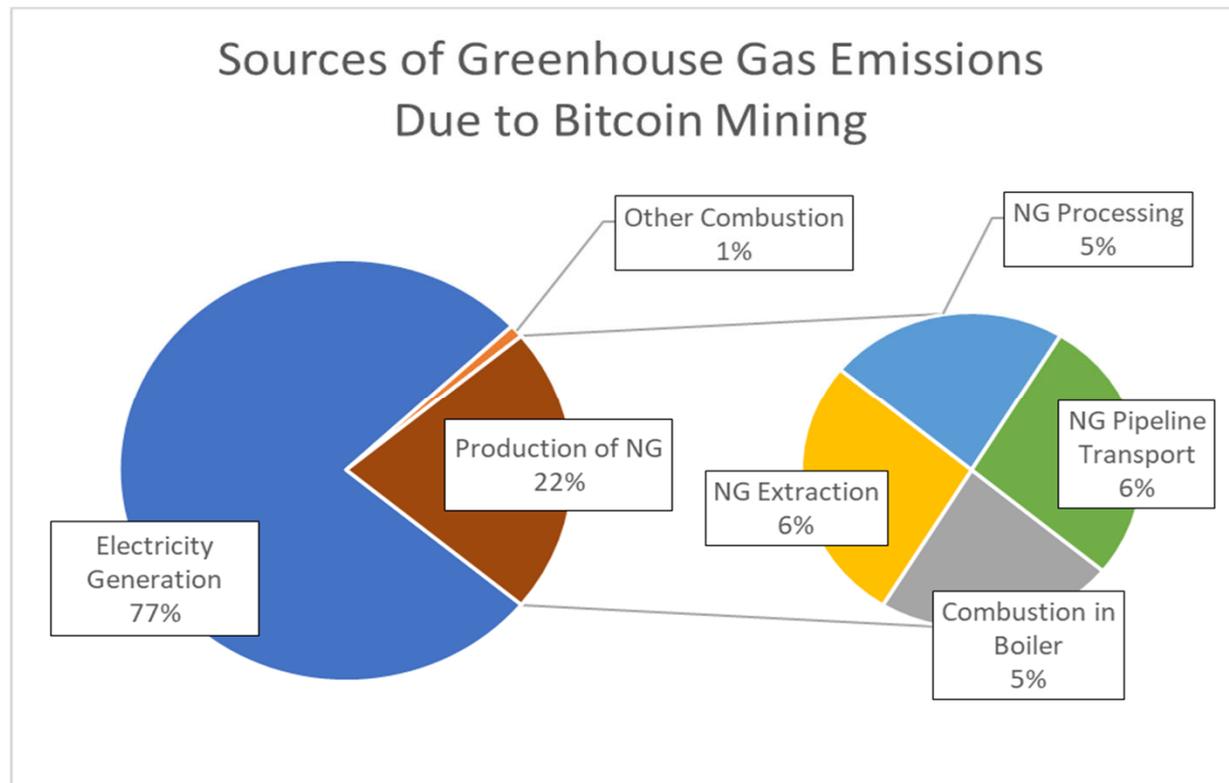
Life Cycle Analysis

Overview of Model Flow:



Results

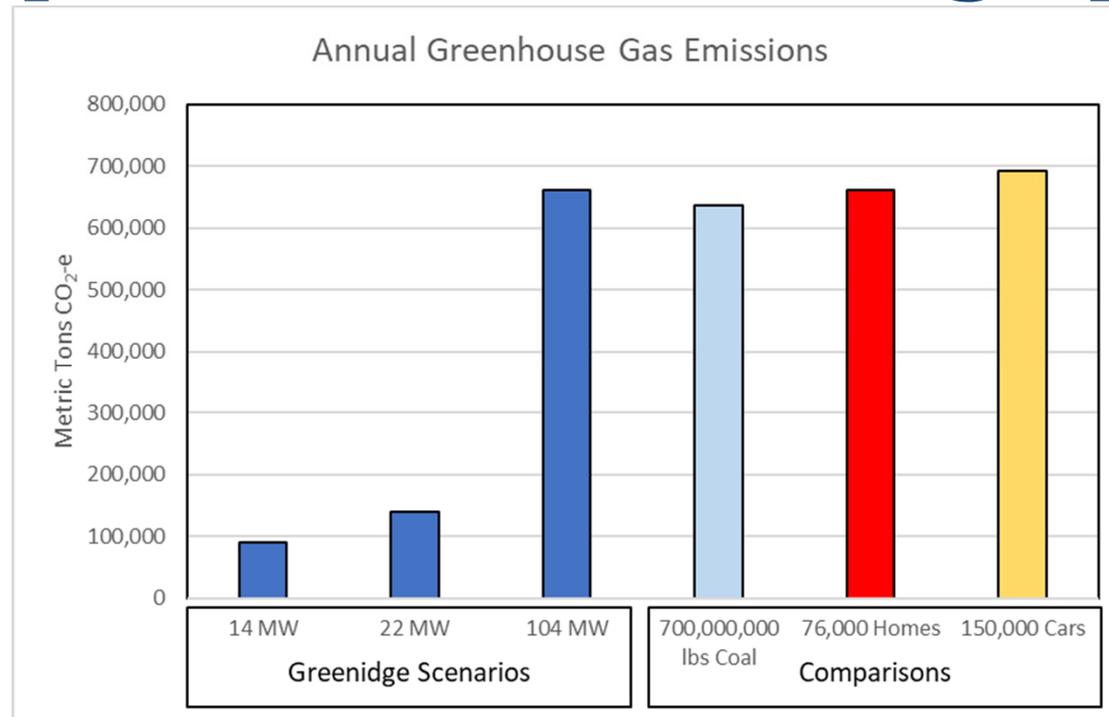
The mining of Bitcoin by Greenidge results in the emission of up to 88,940 mT CO₂-e each year. Electricity generation is the predominant source of emissions.



Additional Environmental or Health Impacts

- Fossil-fuel fired generators are a significant source of other pollutants, which impact human health and/or the environment
 - Particulate matter (human health, $PM_{2.5}$)
 - Tropospheric ozone (smog formation, O_3)
 - Sulfur (acid rain, SO_2)
 - Nitrogen oxides (eutrophication, NO_2)
 - Chlorofluorocarbons (stratospheric ozone depletion, CFC-11)

Implications of Scaling up



- Due to the enhanced profitability of Bitcoin mining, Greenidge is seeking approval to expand its mining operations.
- At full capacity (104 MW) the associated emissions would be equivalent to those associated with 143,000 vehicles.

Implications of Scaling up

- As an older, inefficient power plant, it is difficult for Greenidge to sell its electricity into the NY state wholesale market.
- Greenidge has learned that it can increase its revenues by using electricity to mine for Bitcoin using “behind the meter” electricity.
- The emissions associated with mining for Bitcoin make Greenidge a significant source of greenhouse gases at a time when New York State is attempting to achieve 100% carbon-free electricity by 2040.