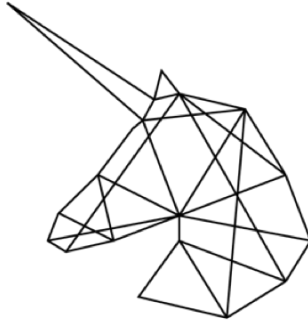




CRYPTOCURRENCY MINING

Project Crypto Currency Mining - A Feasibility Study

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Mr. Chonladet Khemarattana

CEO of Fintech (Thailand) Company Limited

CEO of RoboWealth Mutual Fund Brokerage Securities Company Limited

- **Advisor of Stock Exchange of Thailand on trading tools development project**
- **Most popular analyst voted by Money Channel's audiences**
- **Adjunct lecturer, guest speaker, commentator and judge in academics**
- **Former board of director and head of retail investment sector at Thai FinTech Association (TFTA)**





Before we start ...

... bitcoin is a cryptocurrency
but cryptocurrency $\neq$ bitcoin
there are thousand of cryptocurrencies now

... bitcoin is built on block chain technology
but block chain $\neq$ bitcoin
there are many applications of block chain

... bitcoin price has shown a bullish run
but volatility and drawdown are high
there is no guarantee on bitcoin investment



Today Agenda ...

A. Foundations

B. Bitcoin Mining

C. Mining Feasibility



What is Bitcoin?

Decentralized Digital Currency

How does it work?

Operated through P2P Network

How does the supply grow?

Precisely-controlled (Money) Supply



3-Jan-2009

Genesis Block

494,XXX

Block Count

16.68 million

Bitcoin Count

271 million

TX Count

\$107 billion

Bitcoin MktCap

Update: 14-Nov-2017

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Applications of Cryptocurrency

Exchanges
+ Buy/Sell/Trade +

Remittance
+ Transfer fiat money +

Wallets
+ Receive/Spend +

Mining
+ Invest to get reward +

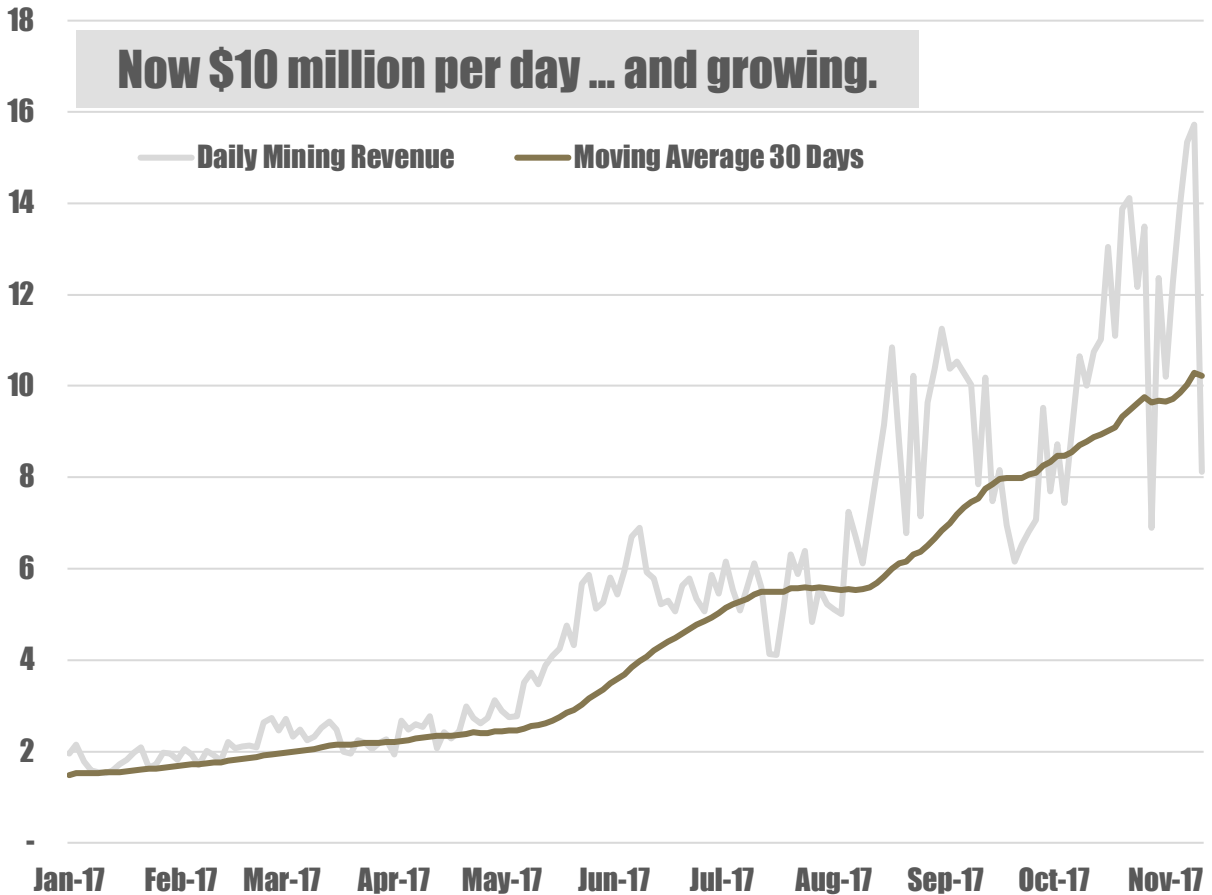
Actually, more business applications have been emerged from cryptocurrency.



B. Bitcoin Mining



Total Revenue of Mining in million USD



<https://blockchain.info/charts/miners-revenue?timespan=all>



What is bitcoin mining?

Mining is a process of adding blocks to the blockchain ...

... by using computational power to verify transactions.

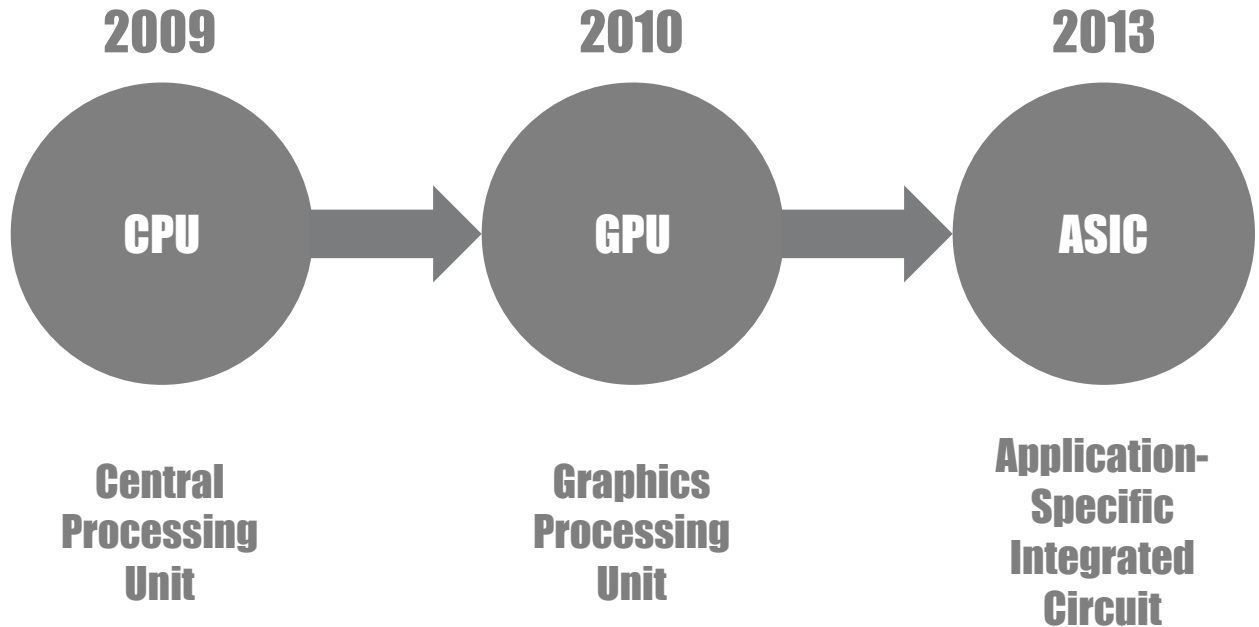
Miner will get block reward plus transaction fees.

Miner can do either SOLO or POOLED mining.

More mining power, more difficult to mine!



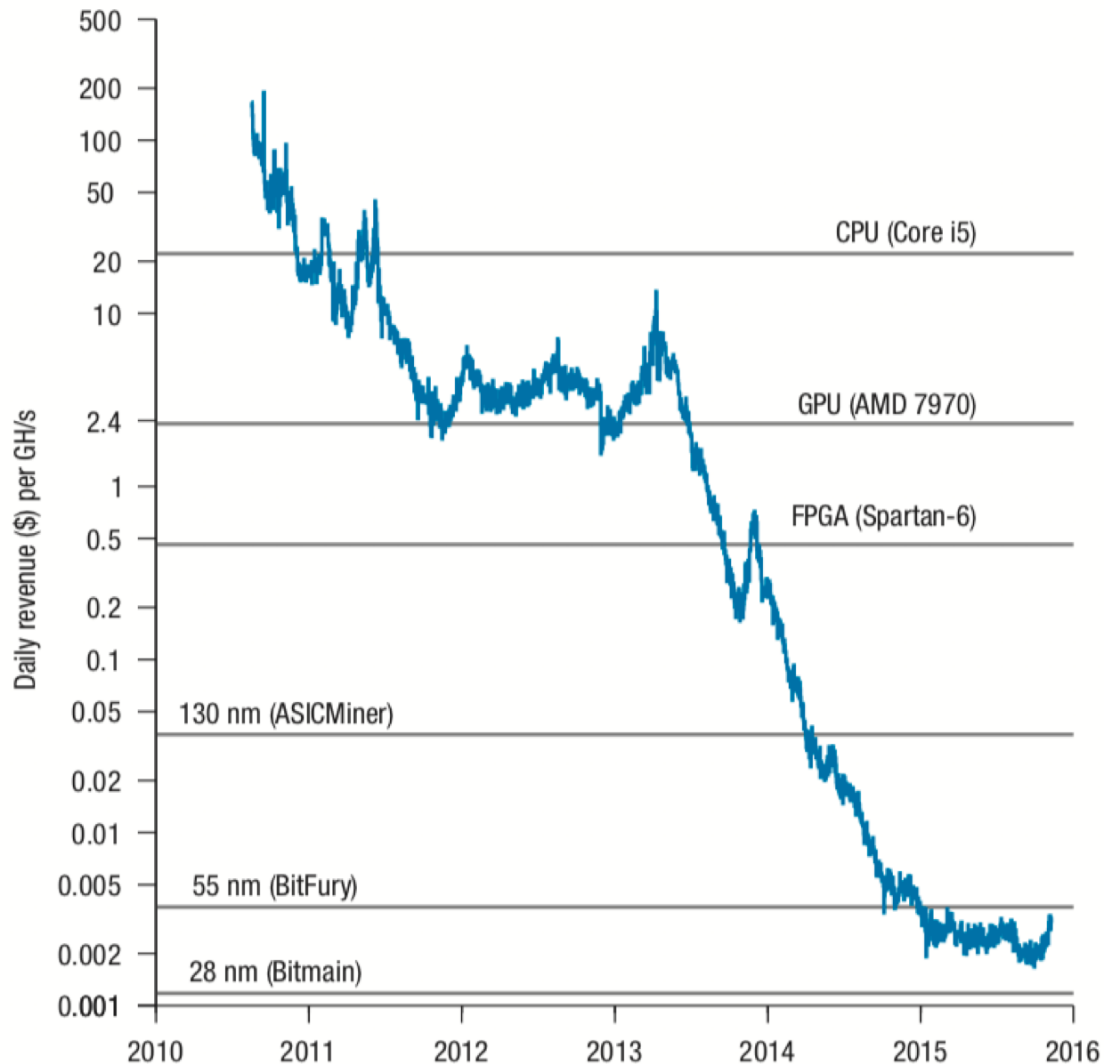
Development of Mining Technology





The Evolution of Bitcoin Hardware

Michael Bedford Taylor, University of Washington





Bitcoin Mining = Perfect Competition?

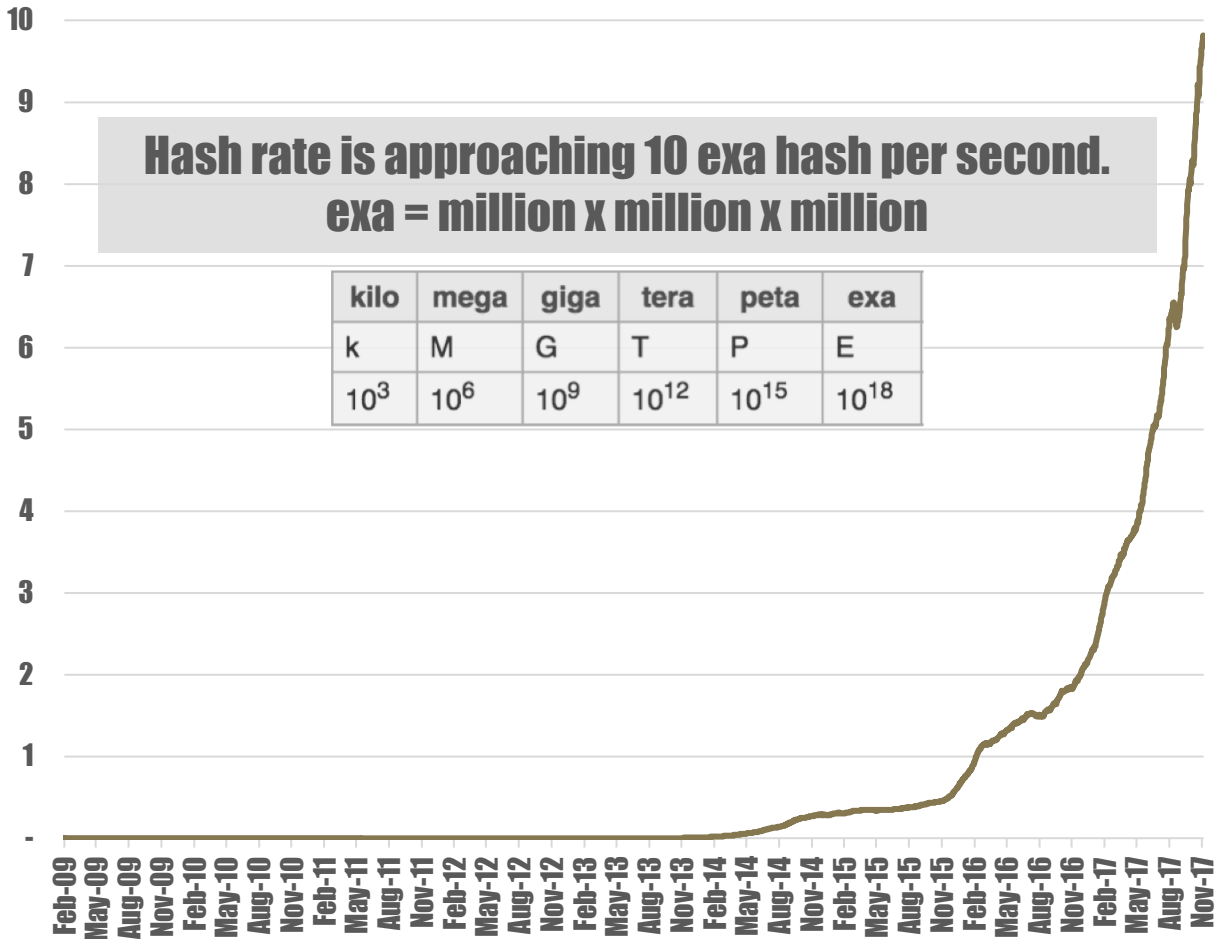
Properties of Perfectly Competitive Market	Bitcoin Mining Early Days	Bitcoin Mining Nowadays
Identical Product	Yes	Yes
Price Taker	Yes	Yes
Small Market Share	Yes	No
Freedom to Entry and Exit	Yes	No

**Democratization of money
“one-CPU-one-vote”**

???



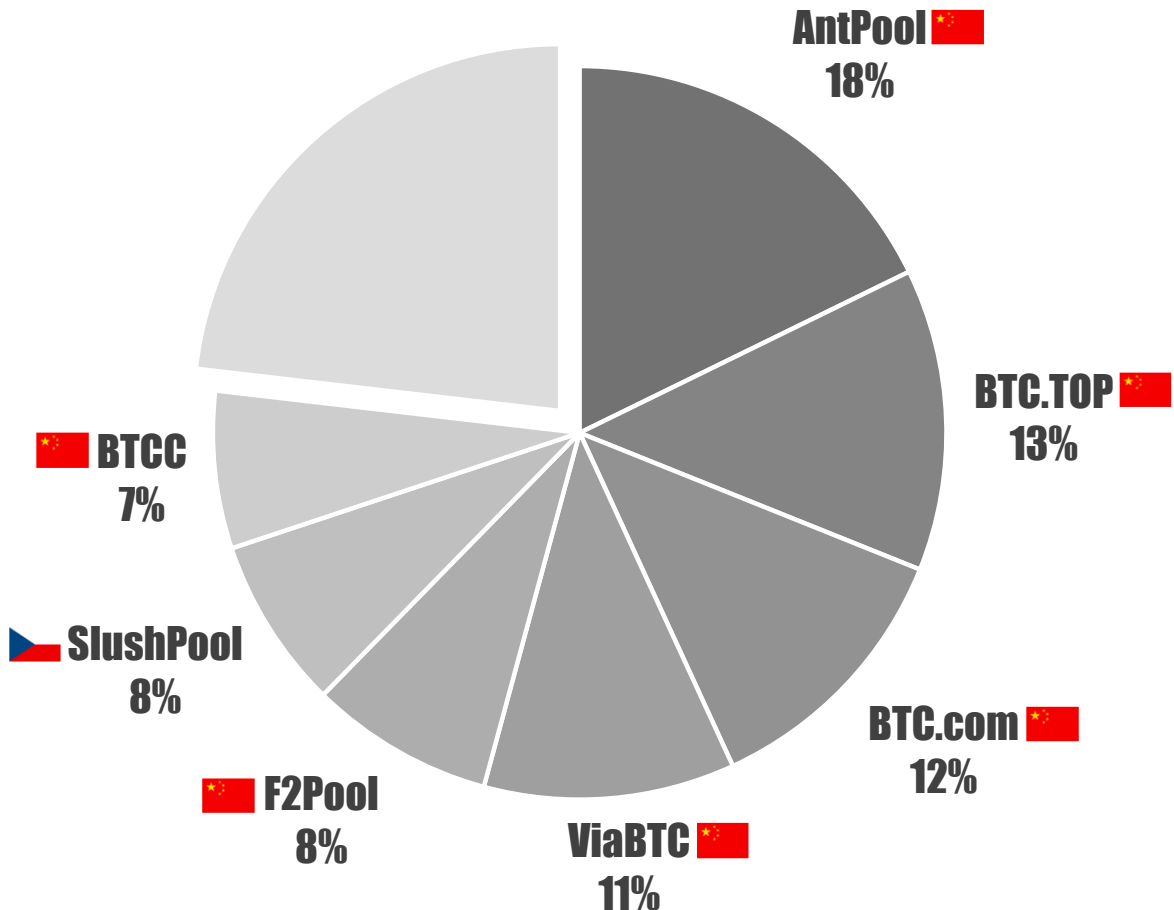
Historical Network Hash Rate (EH/s)



<https://data.bitcoinity.org>



Market Share of Pool - 1 month



https://btc.com/stats/pool?pool_mode=month

Bitcoin is designed as a decentralized platform ...

... but 80% of mining is centralized in China.

Reason is cheap electricity = 0.04 \$/kWh.

C. Mining Feasibility





Revenue and Cost Component

**Block
Reward**

**Transaction
Reward**

Revenue

Cost

**Hardware
Cost**

**Power
Cost**



How to calculate mining revenue?

**How many seconds
to mine one block?**

$$\frac{2^{32} \times \text{Difficulty}}{\text{Hash Rate}}$$

**How many days to
mine one block?**

$$\frac{\left[\frac{2^{32} \times \text{Difficulty}}{\text{Hash Rate}} \right]}{24 \times 60 \times 60}$$

**How many bitcoin
we can generate
each day?**

$$\frac{24 \times 60 \times 60 \times \text{Block Reward}}{\left[\frac{2^{32} \times \text{Difficulty}}{\text{Hash Rate}} \right]}$$



How to calculate mining revenue? (2)

**How many bitcoin
we can generate
each day?**

$24 \times 60 \times 60 \times \text{Block Reward}$

$$\left[\frac{2^{32} \times \text{Difficulty}}{\text{Hash Rate}} \right]$$

$24 \times 60 \times 60 \times \text{Block Reward} \times \text{Hash Rate}$

$2^{32} \times \text{Difficulty}$

Finally, expected USD we can generate each day is ...

$24 \times 60 \times 60 \times \text{Block Reward} \times \text{Hash Rate} \times \text{BTC Price}$

$2^{32} \times \text{Difficulty}$



Mining Revenue Formula

24 x 60 x 60 x Block Reward x Hash Rate x BTC Price

2³² x Difficulty

$$\frac{24 \times 60 \times 60 \times 12.5}{2^{32}} \times \frac{\text{Hash Rate}}{\text{Difficulty}} \times \text{BTC Price}$$

Adding transaction reward to revenue ...

$$\frac{24 \times 60 \times 60 \times 12.5}{2^{32}} \times \frac{\text{Hash Rate}}{\text{Difficulty}} \times \text{BTC Price} \times (1 + \%TX)$$



Hash Rate = 14 TH/s

Power User = 1372 W

Price = 1417 USD



Bitcoin Mining Feasibility

Assumptions

Revenue Assumptions

BTC Price (USD)	6,000.00
Growth of BTC Price (bi-weekly)	0.00%
Block Reward (BTC)	12.50
Transaction Reward (% to block reward)	10.00%
Total Seconds per Day	86,400
Difficulty	1,364,422,081,125
Growth of Difficulty (bi-weekly)	5.70%
Hash	14,000,000,000,000
Pool Fee	2.00%

Cost Assumptions

Total Hardware Costs (USD)	1,417.00
Power Use (W)	1,372.00
Electricity Cost (USD/kWh)	0.12

Discount Rate Assumptions

Discount Rate (Annual)	10.0000%
------------------------	----------

Projection

Initial Revenue Projection

How many seconds to mine 1 block?	418,582,015.4552
How many days to mine 1 block?	4,844.6993
How many bitcoins we can get each day?	0.0026
How many \$ we expect each day?	15.4808
Plus Transaction Reward	1.5481
Minus Pool Fee	0.3406
Expected Revenue per day	16.6883
Expected Revenue for 1st week	116.8184

Cost Projection

Power Consumption (kW per day)	32.9280
Power Cost per day (USD)	3.9514
Power Cost per week (USD)	27.6595

Results

Profit and NPV

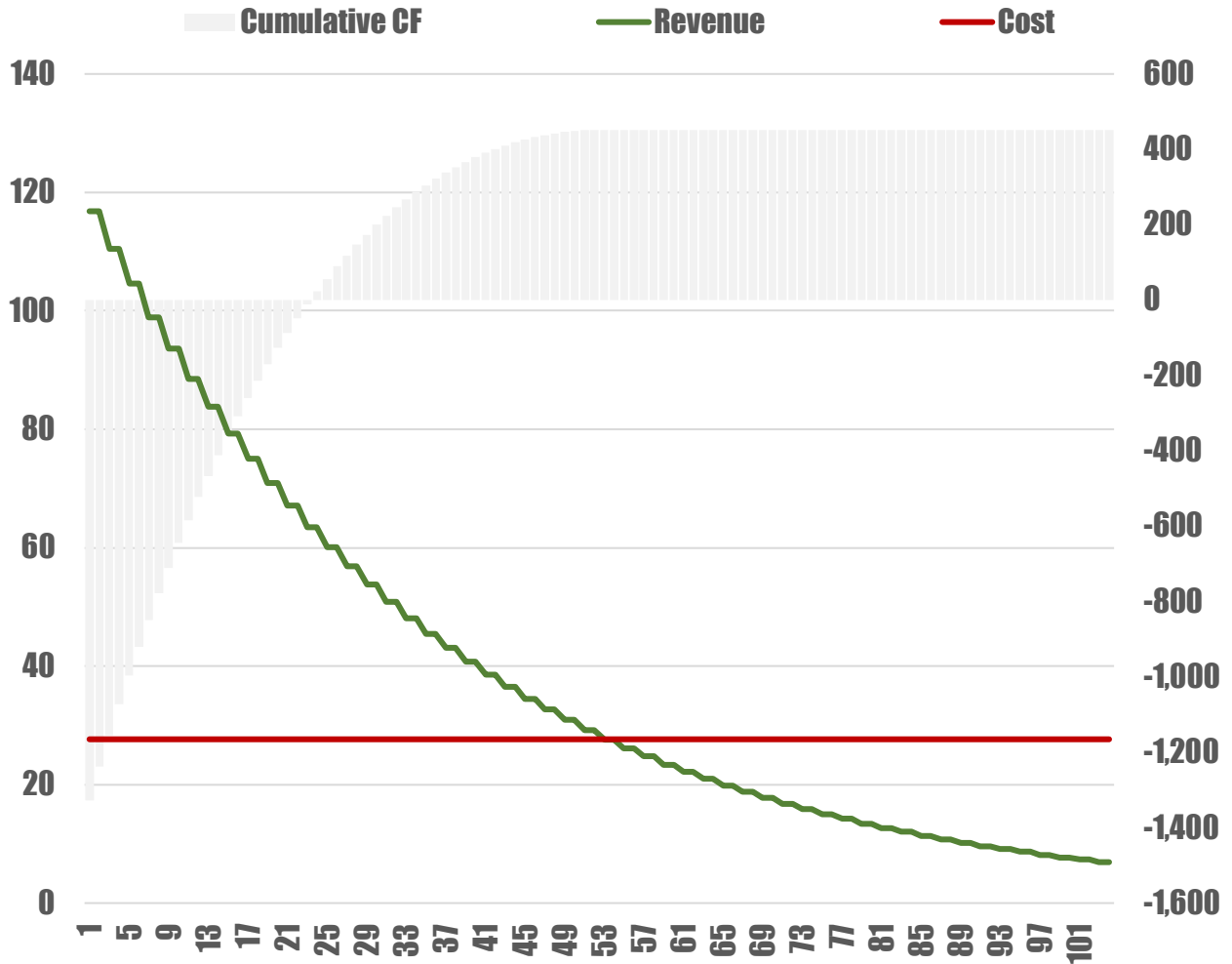
Total Net Profit (USD)	452.0728
Net Present Value (USD)	399.0413

Time Line

Break-even Time (weeks)	24
Life Time (weeks)	52



Sample ASIC Mining Revenue & Cost





Bitcoin Mining Feasibility

Assumptions

Revenue Assumptions

BTC Price (USD)	6,000.00
Growth of BTC Price (bi-weekly)	0.00%
Block Reward (BTC)	12.50
Transaction Reward (% to block reward)	10.00%
Total Seconds per Day	86,400
Difficulty	1,364,422,081,125
Growth of Difficulty (bi-weekly)	5.70%
Hash	14,000,000,000,000
Pool Fee	2.00%

Cost Assumptions

Total Hardware Costs (USD)	1,417.00
Power Use (W)	1,372.00
Electricity Cost (USD/kWh)	0.12

Discount Rate Assumptions

Discount Rate (Annual)	10.0000%
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Projection

Initial Revenue Projection

How many seconds to mine 1 block?	418,582,015.4552
How many days to mine 1 block?	4,844.6993
How many bitcoins we can get each day?	0.0026
How many \$ we expect each day?	15.4808
Plus Transaction Reward	1.5481
Minus Pool Fee	0.3406
Expected Revenue per day	16.6883
Expected Revenue for 1st week	116.8184

Cost Projection

Power Consumption (kW per day)	32.9280
Power Cost per day (USD)	3.9514
Power Cost per week (USD)	27.6595

Results

Profit and NPV

Total Net Profit (USD)	452.0728
Net Present Value (USD)	399.0413

Time Line

Break-even Time (weeks)	24
Life Time (weeks)	52



Lower BTC price will directly worsen the profit.

Assumptions

Revenue Assumptions

BTC Price (USD)	5,166.95
Growth of BTC Price (bi-weekly)	0.00%
Block Reward (BTC)	12.50
Transaction Reward (% to block reward)	10.00%
Total Seconds per Day	86,400
Difficulty	1,364,422,081,125
Growth of Difficulty (bi-weekly)	5.70%
Hash	14,000,000,000,000
Pool Fee	2.00%

Cost Assumptions

Total Hardware Costs (USD)	1,417.00
Power Use (W)	1,372.00
Electricity Cost (USD/kWh)	0.12

Discount Rate Assumptions

Discount Rate (Annual)	10.0000%
------------------------	----------

Projection

Initial Revenue Projection

How many seconds to mine 1 block?	418,582,015.4552
How many days to mine 1 block?	4,844.6993
How many bitcoins we can get each day?	0.0026
How many \$ we expect each day?	13.3315
Plus Transaction Reward	1.3331
Minus Pool Fee	0.2933
Expected Revenue per day	14.3713
Expected Revenue for 1st week	100.5991

Cost Projection

Power Consumption (kW per day)	32.9280
Power Cost per day (USD)	3.9514
Power Cost per week (USD)	27.6595

Results

Profit and NPV

Total Net Profit (USD)	-0.0001
Net Present Value (USD)	-36.9078

Time Line

Break-even Time (weeks)	No Break-even
Life Time (weeks)	48

In this case, -14% in BTC price wipe out all profits.



Bitcoin Mining Feasibility

Assumptions

Revenue Assumptions

BTC Price (USD)	6,000.00
Growth of BTC Price (bi-weekly)	0.00%
Block Reward (BTC)	12.50
Transaction Reward (% to block reward)	10.00%
Total Seconds per Day	86,400
Difficulty	1,364,422,081,125
Growth of Difficulty (bi-weekly)	5.70%
Hash	14,000,000,000,000
Pool Fee	2.00%

Cost Assumptions

Total Hardware Costs (USD)	1,417.00
Power Use (W)	1,372.00
Electricity Cost (USD/kWh)	0.12

Discount Rate Assumptions

Discount Rate (Annual)	10.0000%
------------------------	----------

Projection

Initial Revenue Projection

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Power Cost per day (USD)	3.9514
Power Cost per week (USD)	27.6595

Results

Profit and NPV

Total Net Profit (USD)	452.0728
Net Present Value (USD)	399.0413

Time Line

Break-even Time (weeks)	24
Life Time (weeks)	52



Higher-than-expected growth of difficulty is dangerous.

Assumptions

Revenue Assumptions

BTC Price (USD)	6,000.00
Growth of BTC Price (bi-weekly)	0.00%
Block Reward (BTC)	12.50
Transaction Reward (% to block reward)	10.00%
Total Seconds per Day	86,400
Difficulty	1,364,422,081,125
Growth of Difficulty (bi-weekly)	7.72%
Hash	14,000,000,000,000
Pool Fee	2.00%

Cost Assumptions

Total Hardware Costs (USD)	1,417.00
Power Use (W)	1,372.00
Electricity Cost (USD/kWh)	0.12

Discount Rate Assumptions

Discount Rate (Annual)	10.0000%
------------------------	----------

Projection

Initial Revenue Projection

How many seconds to mine 1 block?	418,582,015.4552
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Cost Projection

Power Consumption (kW per day)	32.9280
Power Cost per day (USD)	3.9514
Power Cost per week (USD)	27.6595

Results

Profit and NPV

Total Net Profit (USD)	0.0000
Net Present Value (USD)	-30.6545

Time Line

Break-even Time (weeks)	No Break-even
Life Time (weeks)	40

This case shows that profit is highly sensitive to difficulty.



Potential Risk Management for Miner

1. Short BTC Futures to lock the selling price in USD



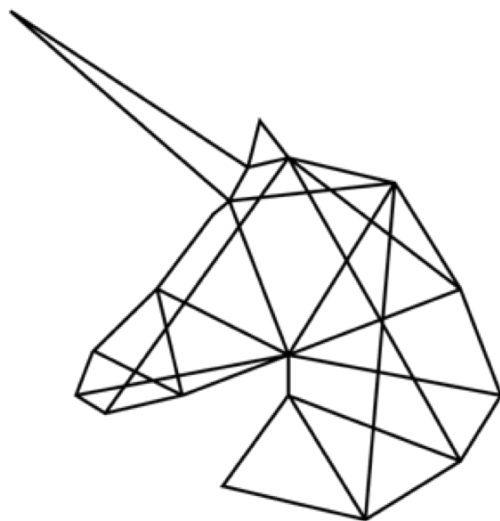
Coming Soon: Bitcoin Futures

CME Group will launch Bitcoin futures, based on the CME CF Bitcoin Reference Rate (BRR), in **Q4 2017**, building off of the success of the BRR and demand for a regulated trading venue for the digital asset market.

<http://www.cmegroup.com/trading/bitcoin-futures.html>

2. Pay power plant BTC, instead of fiat currency

3. Can difficulty risk be hedged?



Thank You

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