Hybrid PoW for ETC Motivation and Rationale

Presented on ETC Community Call #013

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DRAFT V0.92

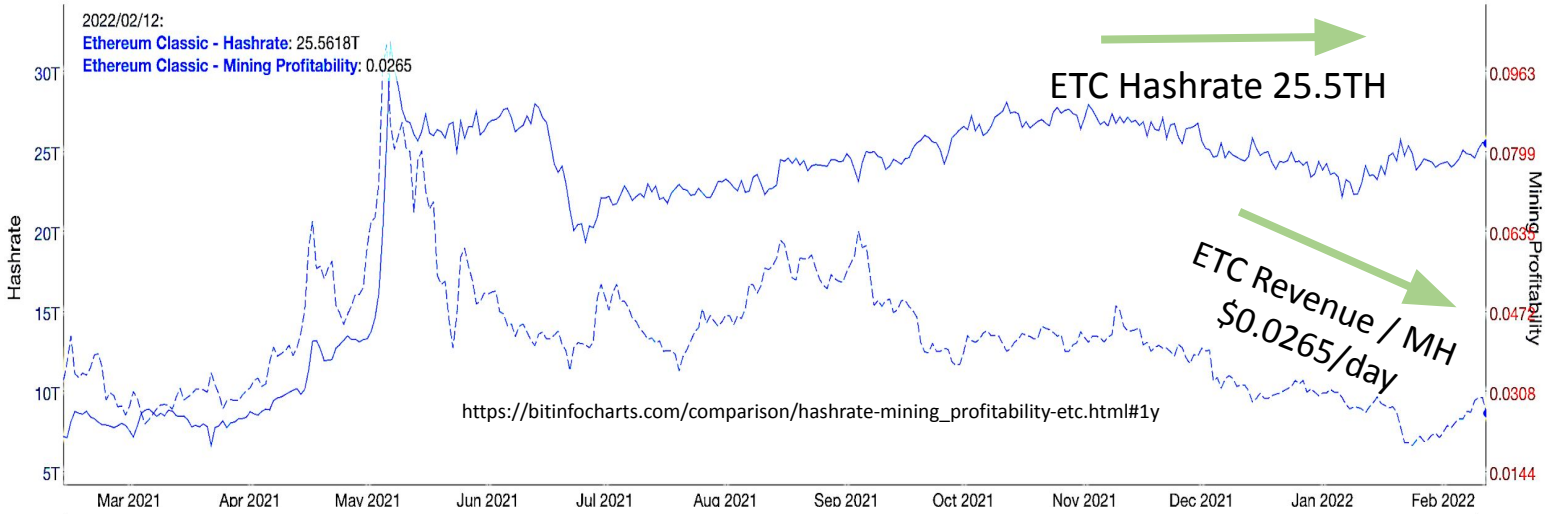
Goals and Objectives

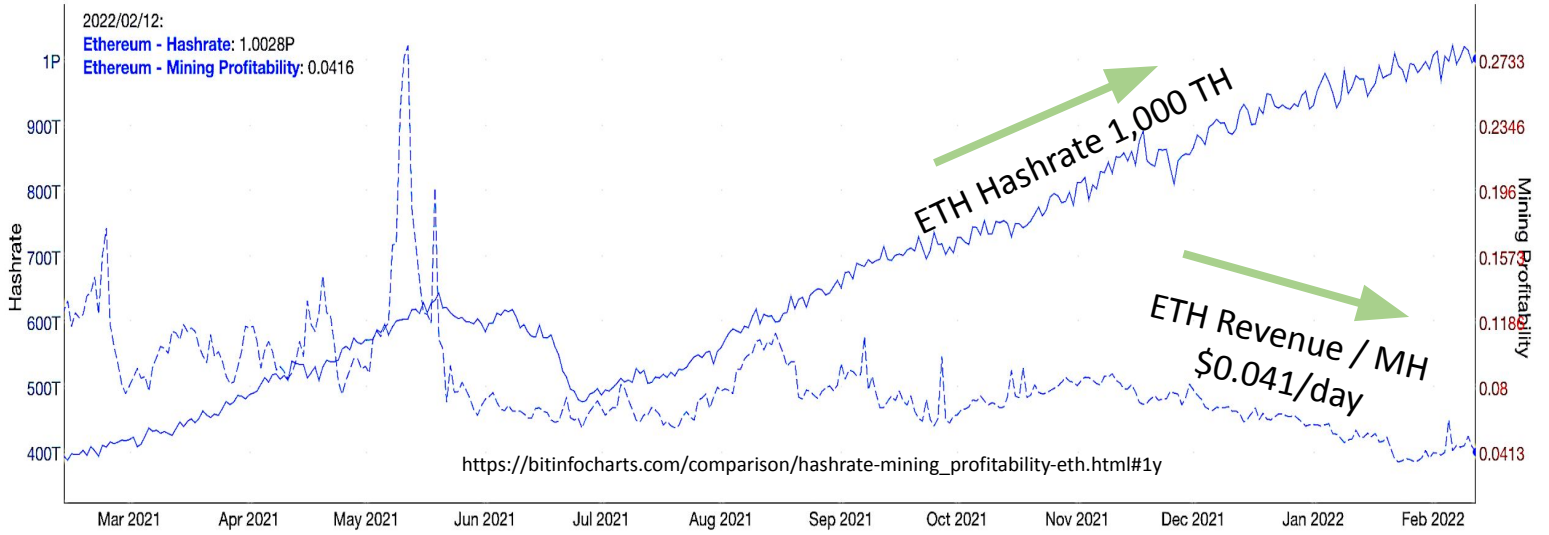
- Discuss motivation for enhancement of ETC security
- Review state of ETC mining
- Show potential impact of GPU & ETC mining after ETH2.0 merge
- Discuss Hybrid PoW
- Constructive Feedback

Notes:
Prices and hashrates used on 2/13/22 unless indicated
Power cost of 6¢ KWh to reflect higher cost of hosting GPU; new contract prices are >8¢/KWh

State of ETC Mining

ETH vs ETC Mining





- ETH has 40x more hashrate (HR)
  - ~1,000TH vs ~25TH
  - ETH HR growing / ETC flat
- ETH mining produces 57% higher revenue
  - 4.16¢/MH/day vs 2.65¢/MH/day
- Worse with May/22 “fifthening”
  - Relative ETC HR will likely drop
  - ETH mining will produce ~2x ETC revenues using current metrics
  - 4.16¢/MH vs 2.12¢/MH

Why Is ETC Hashrate Low?

https://whattomine.com

NVidia 1070 GPU

Name(Tag) Algorithm	Block Time Block Reward Last Block	Difficulty NetHash	Est. Rewards Est. Rewards 24h	Exchange Rate	Market Cap Volume	Rev. BTC Rev. 24h	Rev. $ Profit	Profitability Current | 24h 3 days | 7 days
Ethereum(ETH) Ethash	BT: 13.31s BR: 2.01 LB: 14,194,332	**13,002,816G** 976.85 Th/s 2.0%	0.0003 0.0003	0.06891100 (Binance) -0.3%	$346,778,217,147 **3,274.12 BTC**	0.000021 0.0000[illegible]2	$0.91 **$0.80**	**100**[illegible] | 100% 100% | [illegible]0%
Nicehash-Ethash Ethash	BT: - BR: - LB: -	**-** 61.11 Th/s 1.0%	0.000020 0.000021	0.92522316 (Nicehash) -4.6%	- **58.25 BTC**	0.00[illegible]020 0.00[illegible]021	$0.88 **$0.77**	97% | **97%** 93% | 96%
EthereumClassic(ETC) Etchash	BT: 13.16s BR: 3.10 LB: 14,526,444	**318,553,677M** 24.21 Th/s -2.1%	0.0189 0.0185	0.00074500 (Binance) -1.7%	$4,168,391,070 **77.73 BTC**	0.0000[illegible] 0.000014	$0.58 **$0.47**	**68%** | 6[illegible]% 60% | 63%

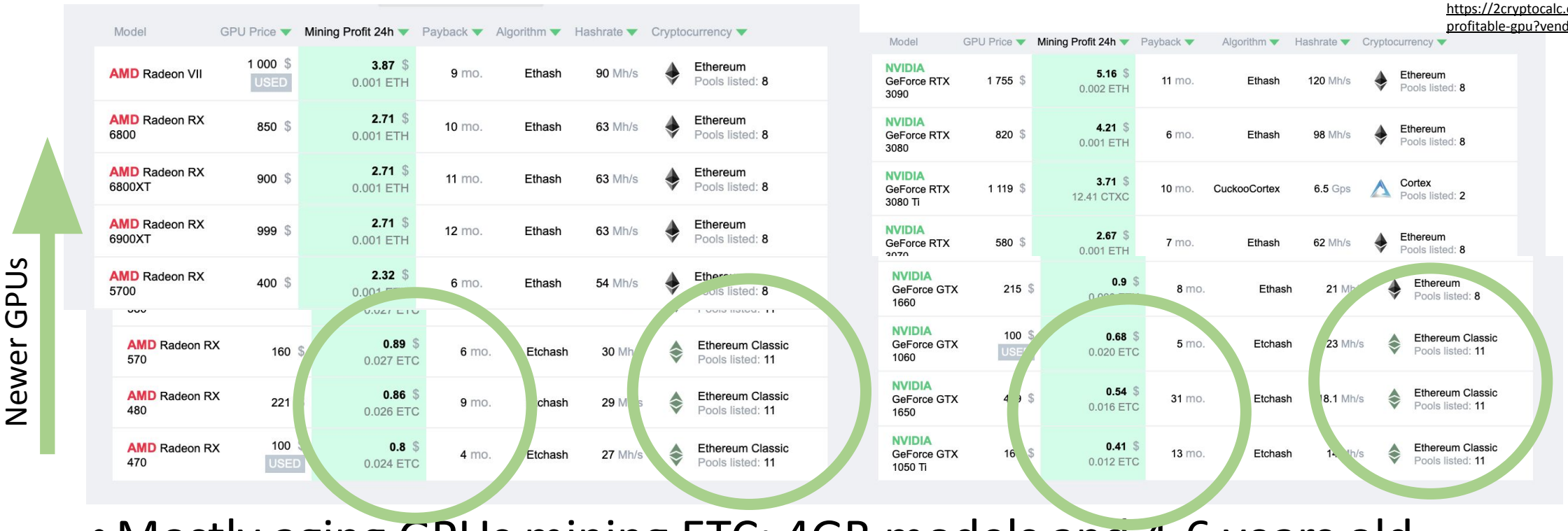
https://www.f2pool.com/coins

Rank	Market Cap	Price	Volume	PoW Produced (24h)
01 BTC-Bitcoin	$807.22B	$42582.10 +0.65%	$16.56B	$38.32M
02 ETH-Ethereum	$351.83B	$2942.61 +0.94%	$9851.11M	$33.90M
03 DOGE-Dogecoin	$20.33B	$0.1533 +7.76%	$855.94M	$2206.83K
04 LTC-Litecoin	$8851.74M	$127.13 +2.35%	$706.84M	$915.30K
05 ZEC-Zcash	$1626.04M	$118.37 -0.94%	$228.25M	$681.84K
06 ETC-Ethereum C...	$4520.39M	$34.00 +7.04%	$654.32M	$391.71K

- Higher profits for miners on ETH
  - 87x more PoW rewards
- Mostly older equipment on ETC
- ”Fifthening” will likely lower HR ~20% net of ETC price changes

Profile of ETC GPU Mining Equipment

https://2cryptocalc.com/most-profitable-gpu?vendor=nvidia



- Mostly aging GPUs mining ETC; 4GB models and 4-6 years old
- Typical GPU rigs has 6-10 GPU cards
- Newer GPUs* earn up to 7.5x more with up to 5x greater HR

* Based on 3090 vs 1060

ETHash ASICs vs GPUs

Model	Release	Hashrate	Power	Noise	Algo	Profitability
Bitmain Antminer E9 (3Gh)	Coming soon	3 Gh/s	2556 W	75 db	EtHash	$174.74 /day
Jasminer X4	Nov 2021	2.5 Gh/s	1200 W	75 db	EtHash	$146.96 /day
Innosilicon A11 Pro ETH (2000Mh)	Coming soon	2 Gh/s	2500 W	75 db	EtHash	$115.35 /day
Innosilicon A11 Pro ETH (1500Mh)	Nov 2021	1.5 Gh/s	2350 W	75 db	EtHash	$85.83 /day

ner	Coins	Hashrate	Power Consumption	Unit Power	Produced (24h)	Revenue (24h)	Daily Cost 0.06 $	Profits (24h)	Electricity Cost Rate
NOSILICON A11	ETH	1500 M	2500 W	1.7 W/M	0.02057474 ETH	$ 60.54	$ 3.60	$ 56.94	6%
H-POWER E1	ETH	1200 M	1100 W	0.9 W/M	0.01645979 ETH	$ 48.43	$ 1.58	$ 46.85	3%
mons L3	ETH	1200 M	2100 W	1.8 W/M	0.01645979 ETH	$ 48.43	$ 3.02	$ 45.41	6%
NOSILICON A10 Pro+ 0M)	ETH	750 M	1350 W	1.8 W/M	0.01028737 ETH	$ 30.27	$ 1.94	$ 28.33	6%
NOSILICON A10 Pro 0M)	ETH	720 M	1300 W	1.8 W/M	0.00987587 ETH	$ 29.06	$ 1.87	$ 27.19	6%

Miner	Coins	Hashrate	Power Consumption	Unit Power	Produced (24h)	Revenue (24h)	Daily Cost 0.06 $	Profits (24h)	Electricity Cost Rate
RX 580 8 cards	ETC	240 M	1630 W	6.8 W/M	0.20212970 ETC	$ 6.87	$ 2.35	$ 4.53	34%
RX570 8 cards	ETC	224 M	1350 W	6.0 W/M	0.18865439 ETC	$ 6.41	$ 1.94	$ 4.47	30%
GTX 1660 8 cards	ETC	172 M	840 W	4.9 W/M	0.14485962 ETC	$ 4.93	$ 1.21	$ 3.72	25%
GTX 1060 8 cards	ETC	192 M	1590 W	8.3 W/M	0.16170376 ETC	$ 5.50	$ 2.29	$ 3.21	42%
R9 390 8 cards	ETC	240 M	2550 W	11 W/M	0.20212970 ETC	$ 6.87	$ 3.67	$ 3.20	53%
JASMINER X4 BRICK	ETC	65 M	30 W	0.5 W/M	0.05474346 ETC	$ 1.86	$ 0.0432	$ 1.82	2%

https://www.f2pool.com/coins

- ASIC vs GPU rig (6-8 GPU)
  - 3-10x performance
  - Power efficient: power is <5% of expenses vs 33% for GPU rig
  - More reliable to operate
  - Better power & space density utilization

Post Merge
Mining Economics

Establish Potential Scenarios and Impact of ETH Merge

Independent View of GPU Chains Post Merge

Will GPUs Get Cheap After Ethereum Ends GPU Mining? … WCCTech.com 12/24/21

"… Right now, the rest of the chains are not that profitable and the hash rate is also quite low. It is unclear if, post-merge, any of these chains can assimilate the massive influx of additional hash rate (and sustain the profit/difficulty)

… as people jump to mining other coins, the total hash rate will increase and the difficulty will increase exponentially but the price stays roughly the same (actually decreasing the profitability of these altcoins even further).

In this scenario, miners will be looking at anywhere between 10-20% of the ETH profit. …

This will cause an influx of dirt cheap, second-hand GPUs in the markets that will trigger a price crash …"

https://wccftech.com/will-gpus-get-cheap-after-ethereum-ends-gpu-mining-unfortunately-it-depends/#:~:text=When%20ETH%20shifts%20from%20proof,mining%20will%20quickly%20become%20unfeasible.&text=If%20they%20want%20to%20stay,more%20ETH%20post%2Dmerge)

Overpopulation of GPU & ETH ASICs

Summary of GPU PoW Rewards based on F2Pool.com 01/26/21

PoW rewards top 7 non-ETH GPU coins	Rank	Daily ($k)	Yearly ($k)
ETC	6	$264	$96,360
RVN	8	$211	$77,015
ERGO	10	$146	$53,290
DERO	19	$37	$13,505
BEAM	25	$18	$6,424
GRIN	26	$16	$5,694
FIRO	34	$6.3	$2,300
Total GPU (non-ETH) PoW			$252,288
ETH PoW	2	~$30,000	>$10,000,000
Top 7 coin as a proportion of ETH rewards			<2.5%
Approx earnings/MH based on 1,000TH			$0.25

Used simplified 1:1 hashrate scaling for other blockchain

- GPU coins are miniscule compared to ETH; <2.5% of ETH rewards
  - Will not support profitable mining
- ETHash ASICs will saturate ETC
- Assuming 30M GPU equivalents (based on 1,000 TH), each GPU equivalent would make less than $1 yearly on other coins
- Unprofitable mining leads to shutdown, liquidation of hardware or alternatives to recover cost

Massive Population of ETH Hardware

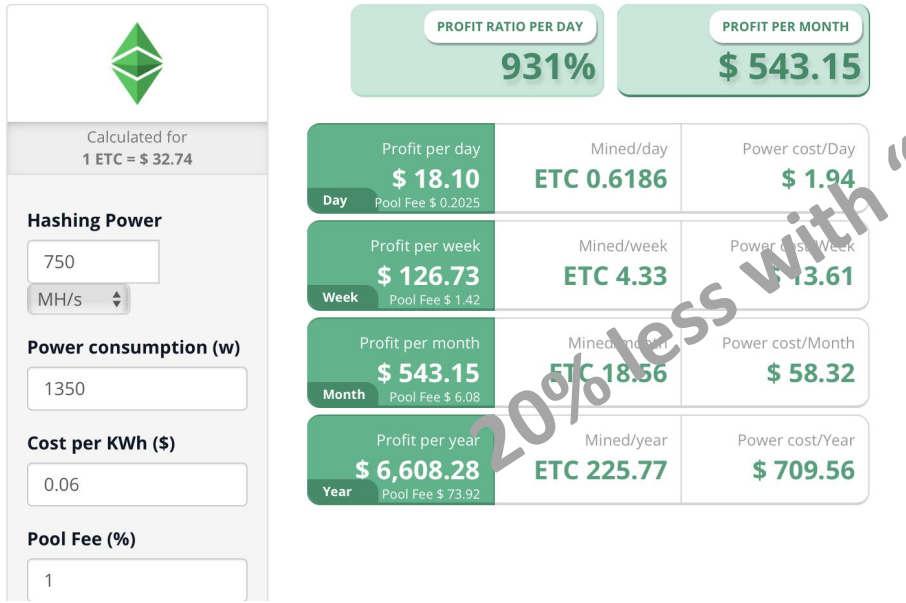
	Age	Est. Hash	Power	QTY for 1k TH
RX570 GPU	2016	30MH	~125W	33.3M
RX570 (GPU) Rig	2016	240MH	~1,200W	4.2M
VU37P FPGA	2020	55MH	~60W	20.2M ✘
A10Pro (ASIC)	2020	750MH	~1,360W	1.3M ✘

- Expressed in equivalent hashrate units and represent high end of bookend
- Actual FPGAs and ASIC population are much lower
- Units are not additive
- ✘ = exceeds size of hardware type deployed

- Massive quantities of GPU and ASICs mining ETH
  - Equivalent to 30M+ GPUs, 4M GPU rigs or 1M+ ASICs
- Est. >$9B invested in ETHash hardware over the years

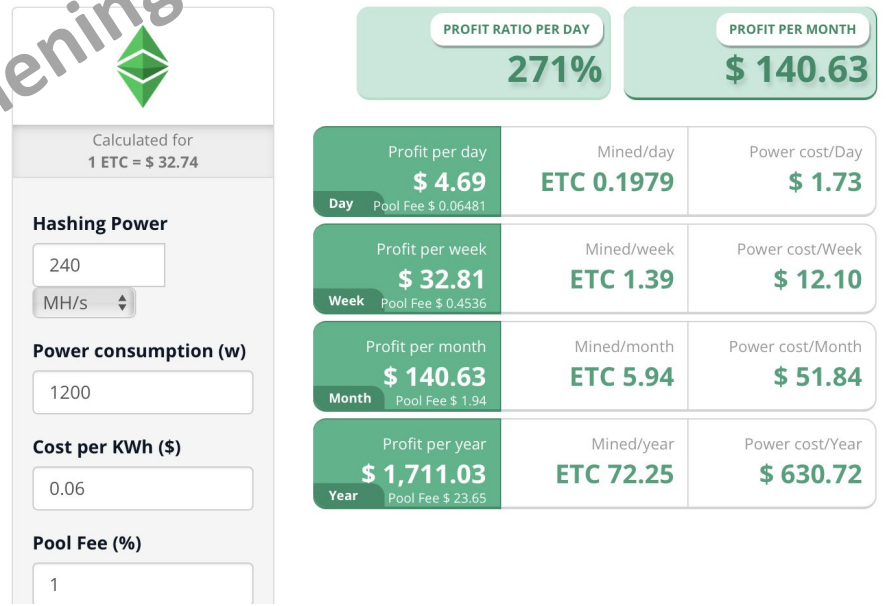
Cost of Operating ETC Mining Hardware

Inno A10Pro ASIC Rig



20% less with "fifthening"

AMD RX570 GPU Rig

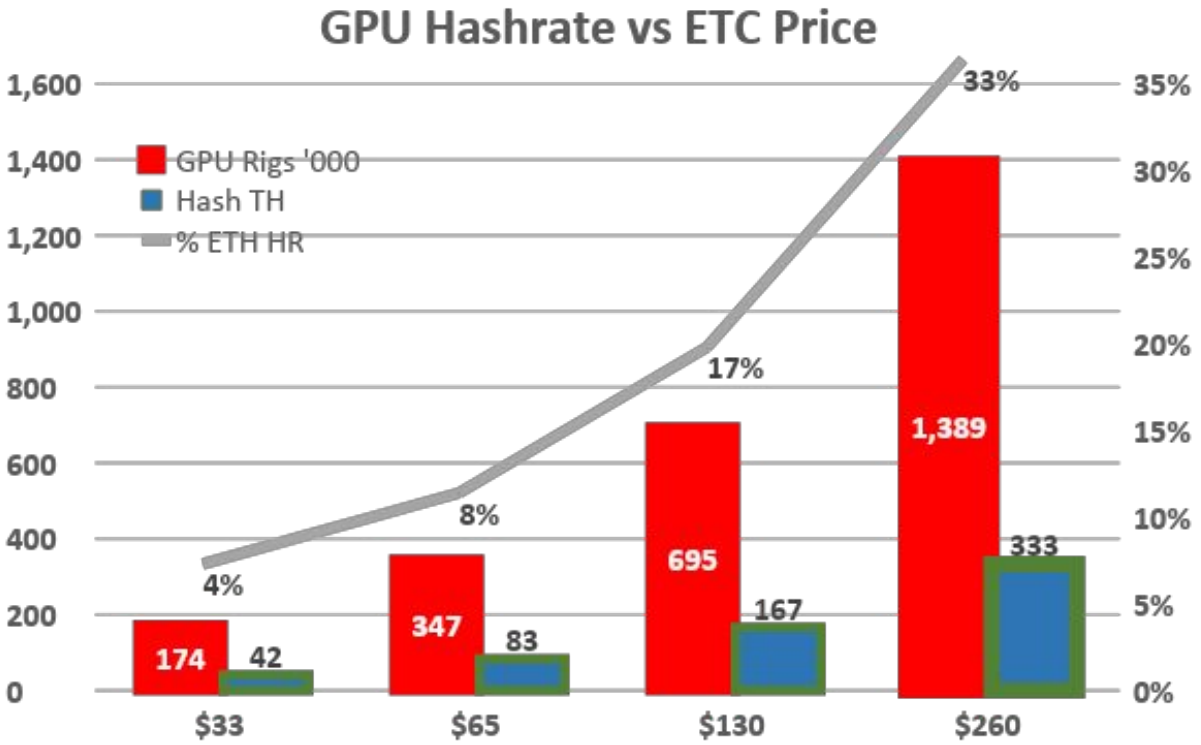


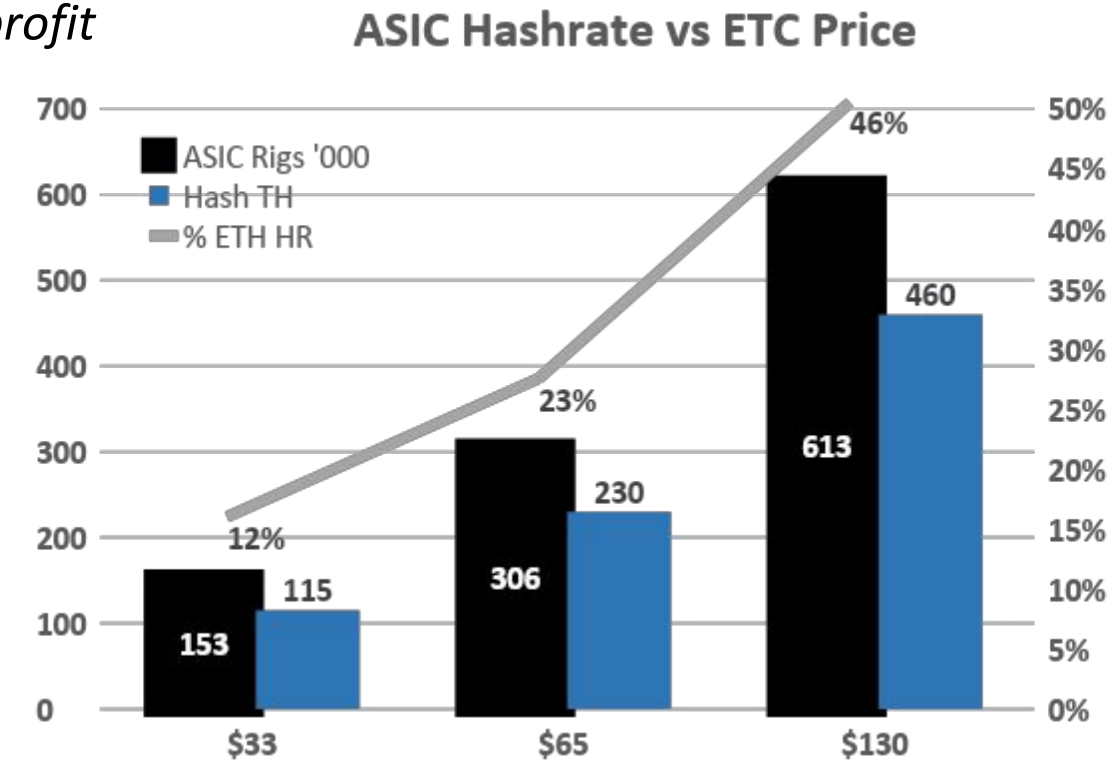
- ~$630-710/year rig power cost
- Often on fixed term contract
- Some rigs financed at 10-20% pa interest
- Selling used equipment can result in large losses
- Alternatives to reduce losses or recovering capital???

Disclosure: Mining metrics are calculated based on a network hash rate of **25,103 GH/s** and using a ETC - USD exchange rate of **1 ETC = $ 32.74**. These figures vary based on the total network hash rate and on the ETC to USD conversion rate. Block reward is fixed at **3.104 ETC** . Future block reward and hash rate changes are not taken into account. The average block time used in the calculation is **12.9536** seconds. The electricity price used in generating these metrics is **$ 0.06** per kWh. Network hash rate varies over time, this is just an estimation based on current values.

Post Merge: Rig Support* vs ETC Price

*Shows quantity of rigs supportable at **ZERO** mining profit*





- GPUs mining unprofitable due to overpopulation
- Only 1/3 of ETH GPUs supported with 8x ETC incr

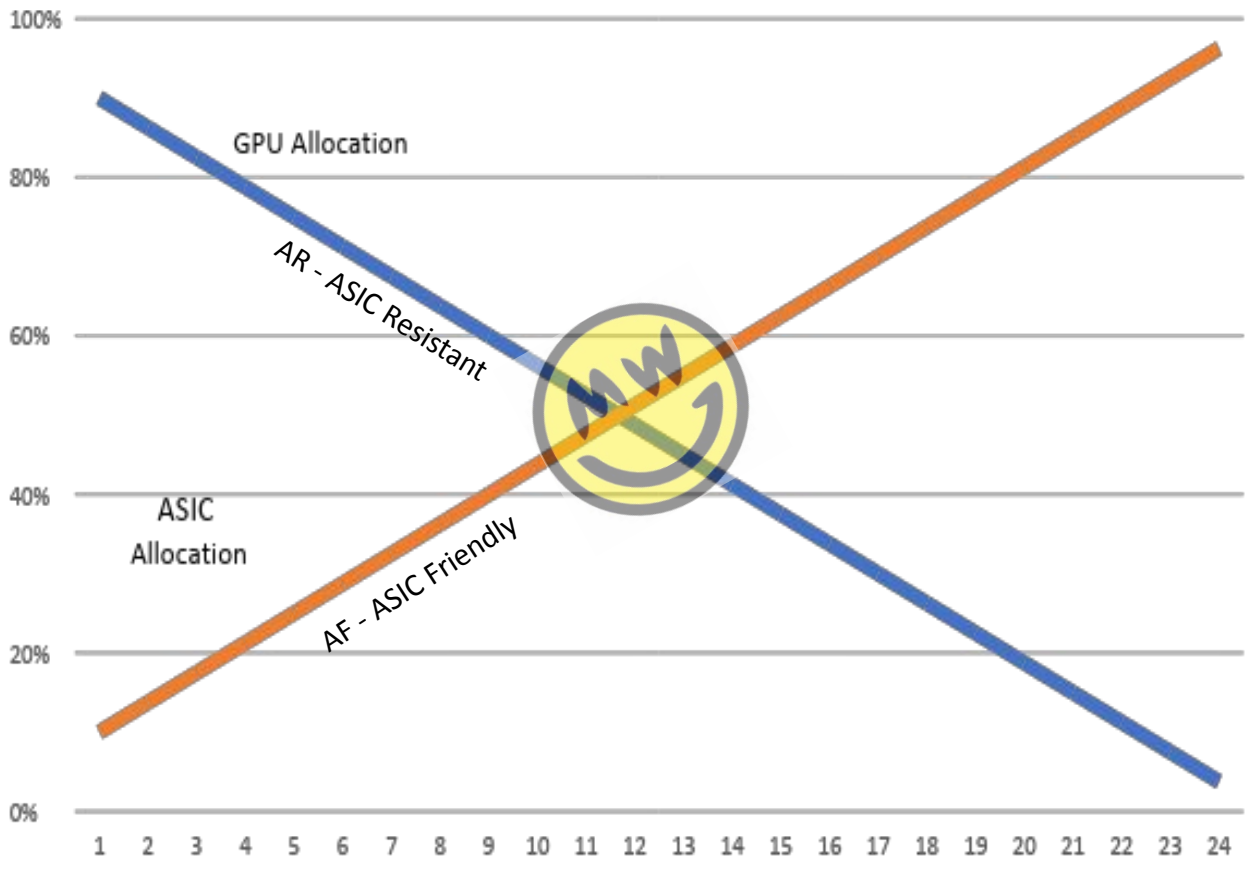
- ASIC mining supportable if ETC doubles in price (but profits will be slim)
- FPGAs & high end GPUs may co-exist with ASICs but profits will be minimal

* Based on 2/13/22 F2pool daily PoW adjusted for fifthening and 6¢/KWh. on RX570 and A10Pro rigs.

Hybrid PoW Discussion

Use Hybrid PoW with a 50/50 split
between ETCHash and Keccak-256

Grin Coin: Hybrid PoW Implementation



Detailed implemention code from Grin and Tari

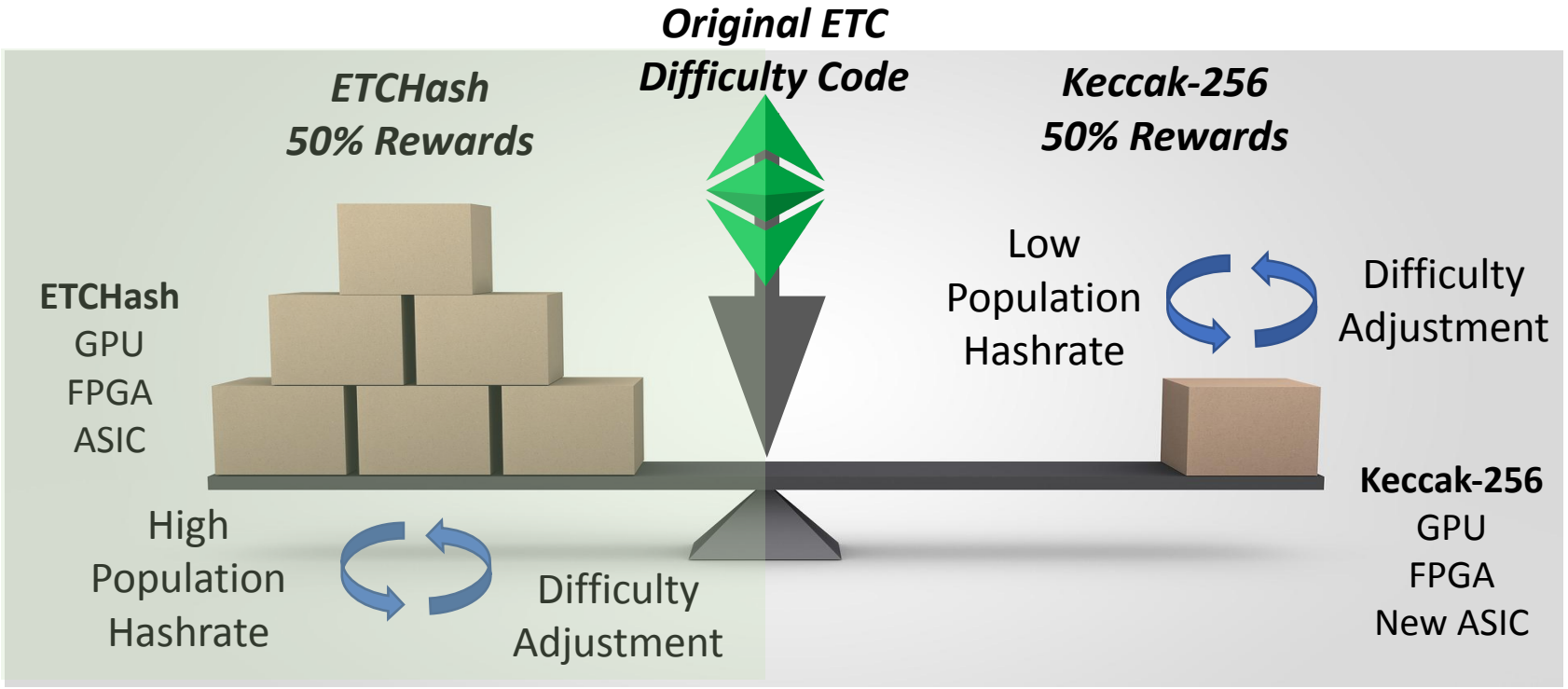
Hybrid PoW for Grin Coin

- 2 year transition to full ASIC PoW
- Enabled GPU (AR) to secure network while ASICs (AF) ramped in product
- AR algo phased out over 2 years
- GPUs mine either GPU or ASIC algo

Observations

- GPUs secured network for both algos
- Difficulty adjustments made it hard to exploit algo switching
- High end GPUs made more money on ASIC algo than on AR algo
- Grin secure on hybrid PoW but attacked after transition to single PoW

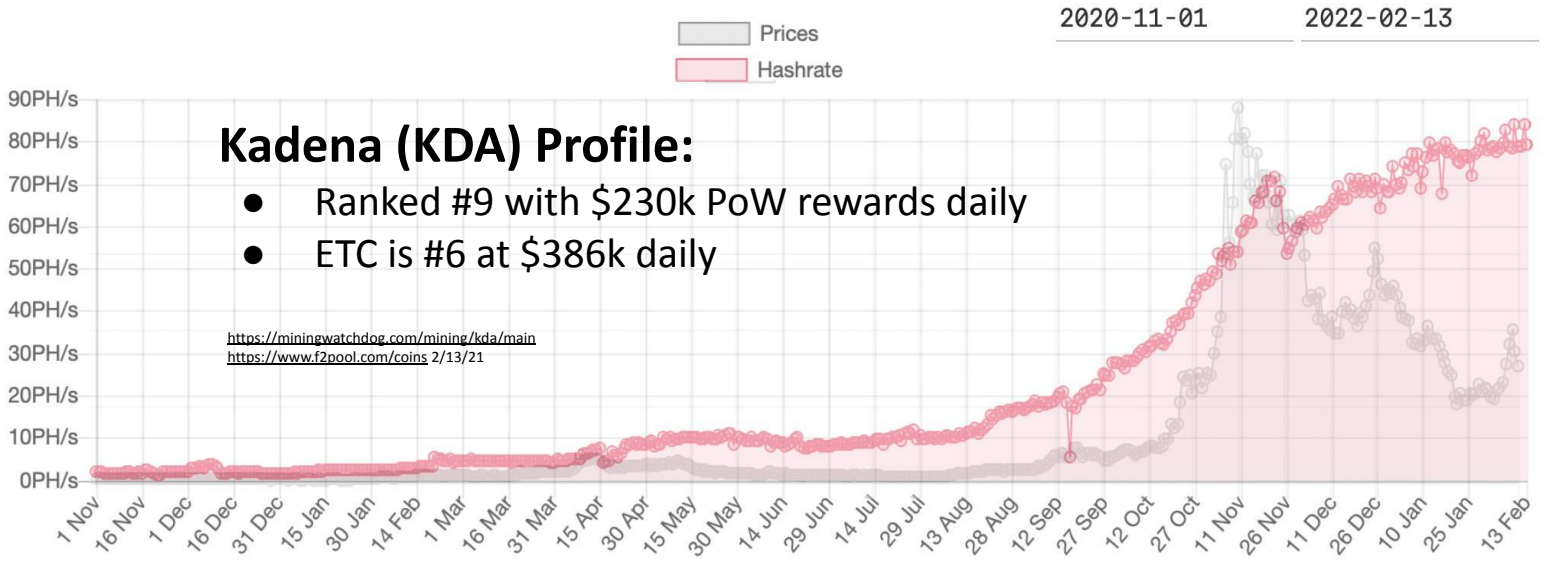
Hybrid PoW for ETC (Conceptual Diagram)



- 50 / 50 split for dual PoW
- Analogy: “Great Wall of China” defense against powerful forces
- Conceptual framework – needs to be adapted for ETC

Case Study: ASIC Ramp on New KDA Blockchain

Controlled rollout of ASIC hardware



Kadena (KDA) Profile:

- Ranked #9 with $230k PoW rewards daily
- ETC is #6 at $386k daily

https://miningwatchdog.com/mining/kda/main
https://www.f2pool.com/coins 2/13/21

Model	Release	Hashrate	Power	Algo
iBeLink BM-K1	Nov 2020	5.3 Th/s	835 W	Kadena
Goldshell KD5	Mar 2021	18 Th/s	2250 W	Kadena
Goldshell KD2	Mar 2021	6 Th/s	830 W	Kadena
Goldshell KD-BOX	May 2021	1.6 Th/s	205 W	Kadena
iBeLink BM-K1+	Sep 2021	15 Th/s	2250 W	Kadena
Goldshell KD6	Apr 2022	26.3 Th/s	2630 W	Kadena

https://www.asicminervalue.com. 2/13/21

Hashrate Notes:

- Steady hashrate growth with KDA price & profitability
- Steady HR growth >40x from 1.8 PH to 84 PH
- No evidence of attacks found
- FPGAs augmented HR

ASIC Notes:

- 2 small rig vendors supporting KDA
- Available 0-4 mos after Mainnet
- 5x HR increase over 18 mos
- Shows new miners with new investments committed to network

Similar pattern expected for keccak-256 rollout

Impact on ETC Network

- Enhances ETC security: 50/50 split between ETCHash & Keccak-256 is *critical defense against overpopulation* of ETHash hardware
- ETC will be majority chain on Keccak-256
- FPGAs & newer GPUs may be more profitable mining Keccak-256 than ETCHash in the first 6-12 months
  - Based on Grin and Kadena experiences
- Establishing the ETC brand
  - Replacement network for ETH smart contracts
  - Enhanced security with Hybrid PoW (no overhang of attacks)
- Have a plan for post-merge for ETC success rather than reacting

Next Steps

- Publish ECIP Hybrid PoW by Friday 2/18/22
- Full implementation for end of 2022
  - Estimate 7-9 months of development and testing to complete
  - Work needed on difficulty checking and clients
- Primary plan should be ECIP:1049
  - Code is done for 1049
  - Hybrid is backup (discuss)

ETC PoW implementation needed ahead of ETH2.0 merge