North American “Crypto Rush” – A benchmarking study of regulatory and rate design frameworks adopted in 2017 and 2018 to cope with utilities’ dilemma

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NORTH AMERICAN "CRYPTO RUSH" DILEMMA

Cryptocurrencies issues from an energy sector point of view

Financial point of view:

- "Revolution", "Just a dream", Bitcoin, Ethereum, XRP, EOS, Litecoin, Binance Coin, Bitcoin SV, Tether, Stellar, Cardano, Tron, … etc.

https://coinmarketcap.com/all/views/all/

Technical point of view:

- "blockchain", "decentralized public ledger ", "blocks", "chaining", "unique crypted code", "hash", Antminer S9s, PH/s, … etc.

https://www.buybitcoinworldwide.com/mining/profitability/

Energy sector point of view:

- Supply-Demand, MW, $/KWh, public service, utilities, …

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Cryptocurrencies issues from an energy point of view

A real example from a crypto miner facilities here in Québec

- Owns 23 000 Bitmain Antminers S9’s
- Produce 295 Petahashes per second (PH/s)
- Creating a load of 33 MW of electricity
- Utilization factor in 2018 assumed around 90%
- Consumed an assumed 260 GWh or 0,26 TWh in 2018
- Got an average rate at US$ 0,04/KWh from it’s utility
- Paid around 10,4 US$ Millions to the local utility
- Declared production cost total was 3 500 US$ /Bitcoin produced
- Energy cost to mine is said to be between 75% to 90% of total cost

https://www.globenewswire.com/news-release/2019/05/21/1840470/0/en/Vogogo-Bitcoin-Mining-Operations-Update.html

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Cryptocurrencies issues from a public service/policy point of view

- Aside the financial and technological issues;
- Political, economic, social, environmental and legal issues have been raised;
- Sudden energy demand for this crypto mining industries in 2017-2018;
- Conflicting issues for monopolistic electricity distribution for this “public service”;
- Many regulators were forced to answer some basic questions when the “Crypto Rush” got mad !

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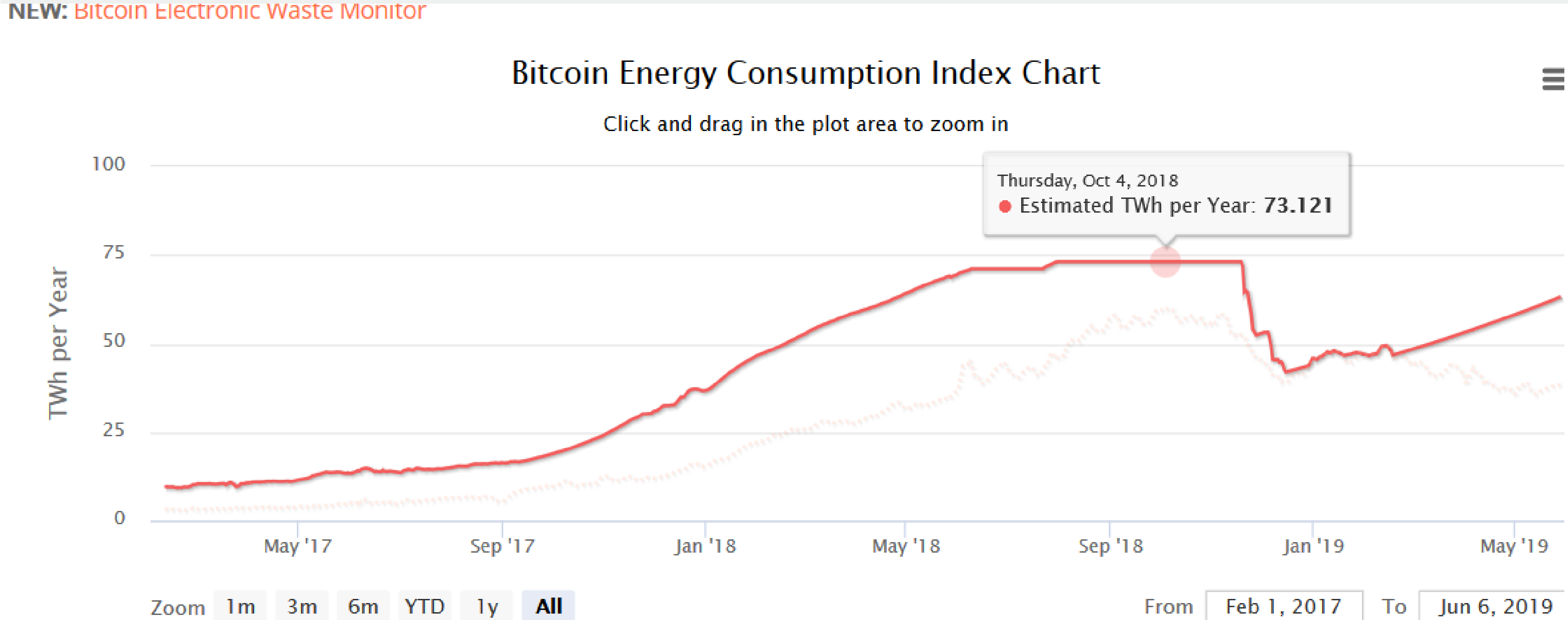
Dilemmas to solve by regulators and utilities

- Should we take into account the industry risk in public service pricing?
- Should utility investors be exempted from their obligation to serve?
- Should we create industry specific rate category?
- If yes, should it be cost based, market based or politically engineered?

WE NEED TO GET INVOLVED WITH POLICY MAKERS

“Estimated” Energy Consumption of Bitcoin



https://digiconomist.net/bitcoin-energy-consumption

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<u>Opinions and solutions are emerging without enough theory background</u>

This is not a long term or innovative solution!

Without research regulators have to be conservative

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Basic theory principles of rate for a public service

Five goals/function of “fair and reasonable” rate:

(Tomain, J.P. et Cudahy, R.D, 2011, Energy Law in a nutshell, 2nd edition)

1. Attract Capital (Investor can expect a reasonable chance of a fair ROE to provide **public service**)
2. Reasonable price (Consumers/users of **public service** should pay a reasonable price)
3. Market efficiency (Minimum interference incurred by **public service** among it’s consumers)
4. Demand control (Should be set to prevent non necessary costs to the **public service**)
5. Wealth transfer (Can be used to allow **public service** access to some vulnerable consumers)

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Basic theory principles of rate for a public service

Three main approaches to set "fair and reasonable" rate:

(Roger L. Conkling, 2011, Energy Pricing: Economics and Principles)

A) Cost based (Capex + Opex needed to provide public service)

B) Value based (Demand based, adjusted to purchase power of consumers)

C) Public policy or Social engineering (Social externalities? Jobs?)

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A benchmarking study of North American reactions to this dilemmas

- Exploratory study
- Content analysis of regulatory decisions in 2018-2019
- Using the five goals/function of fair and reasonable rate
- Three main approaches to set fair and reasonable rate

(Not yet completed entirely)

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Table 1: Summary of the jurisdictions concerned by cryptomining regulation in North America

Approved public regulation	
Chelan (Washington)	New utility rates, effective April 1st 2019.
Grant (Washington)	New utility rates, effective April 1st 2019
Benton (Washington)	Usage of existing rate
New York (New York)	Creation of a rate rider for high intensity load
Moratorium – Public regulation in process – Not determined	
Plattsburgh (New York)	Moratorium on cryptocurrencies electricity usage
Franklin (Washington)	Moratorium on cryptocurrencies electricity usage
Medicine Hat (Alberta)	Shared 10 years upfront investment risk with crypto miners

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Table 8: Summary of the rates theory functions assessed by the regulatory decisions

Jurisdiction	Attract capital	Reasonable rate	Market efficiency	Demand control	Cross-subsidization
Chelan	√	√/X	X	√/X	X
Grant	X/√	X	X	√/X	√
Benton	√	√/X	X	√/X	X
New York	√	√/X	X	√/X	X

√: Fulfils the function
X: does not fulfil the function
X/√: likely not to fulfil
√/X: likely to fulfil

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Brief key points summary of the demand by the utility (HQD)

- Received for 18 000 MW potential consumers demand from crypto in 2017-2018 (Total actual capacity is around 40 000 MW)

- Wanted an answer from utility within “weeks” compared to “months” usually needed for this kind of large customers

- As a surplus of supply firm contract between 5 to 10 TWh

- No surplus in peak winter for a few hours per year

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Brief key points summary of the demand by the utility (HQD)

Solutions proposed to the regulator by the distributor:

- **New category of consumers** for all “crypto” above 50 KW
- Only 300 MW to be allowed by auction to **highest bidder**
- **Minimum starting bids** at +1cent/KWh (20%-25% increase)
- **Non firm service** (Interruptible) within few hours for 300 hours/year
- **A huge penalty** applied if non declared usage for crypto is found (3 times rates)

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Table 9 : Tariffs M and LG of Hydro-Québec

Tariff M[26]	Costs (in $CA)
Energy demand: < 210 000 kWh > 210 000 kWh	 5,03 cents / kWh 3,73 cents / kWh
Power demand	14,58 $ / kW
Tariff LG[27]	
Energy demand	3,46 cents / kWh
Power demand	13,26 $ / kW

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Summary of the final decision by the Régie (April 29th 2019)

- Creation of a **new category** for customers using electricity for blockchain cryptomining operations.
- Creation of a “**300 MW energy bloc**” for cryptomining purposes in addition of current contracts (Total of more than 600 MW).
- No specific rates for this category: **current rates “tarifs M et LG”** for large industrial activities will be applied to cryptomining
- Maximum of **300 hours of service interruption** during critical situations (mainly in winter).
- Cryptominers are financially **responsible for any additional costs** (e.g. grid connection).
- **Jobs creation** and **energy efficiency** criteria’s to get the 300 MW

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Table 10 : Criteria with their weighting for step 2 of Québec selection procedure

Criteria of selection	Weighting
Economic development criteria:	
- Number of direct employments in Québec / MW	30
- Total payroll of direct employments in Québec / MW	30
- Investments in Québec / MW	30
Environmental criterion:	
- Energy efficiency: electricity efficiency / total electricity consumption*	10
Total	**100**

* Electricity efficiency through heat recovery: minimum threshold: 7.5%

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Although Québec case is quite different from previous jurisdictions because its energy production has great surplus, we can say that the regulatory decision allows to:

- **Avoid heavy discrimination** for cryptominers through high rates increase since the service is ensured through surplus electricity.

- **Secure traditional customers** from any undue increase rates that could affect their ability to pay.

- **Ensure the sustainability of energy facilities** and long-term financial planning by recovering all additional costs and managing the risk of non-payment fees.

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Tableau 11 General classification of US States and Québec beside rate design theory

Jurisdiction	Attract capital	Reasonable rate	Market efficiency	Demand control	Cross-subsidization
Chelan	√	√/X	X	√/X	X
Grant	X/√	X	X	√/X	√
Benton	√	√/X	X/√	√/X	X
New York	√	√/X	X	√/X	X
Québec	√	√	X/√	√	√

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In conclusion for the Québec case:

- Québec will be one of the most competitive areas for cryptomining operations in the world for those using this 600 MW.

- Québec regulator demonstrates its intention to considerer cryptomining as another industry to serve, without jeopardizing energy security, acting from a “public service” point of view;

- It also manage the risk to welcome and develop cryptomining investments and operations and control the long-term viability of this new industry.

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Could other innovative solutions be explored further?

- Modeling of different alternative should be studied by academics when confronted with sudden new industry large demand like crypto or others

- Keeping in mind the importance of the 5 key goals of rate design
  - Attract capital for public service (Give access to the service)
  - Reasonable rate (Short and long term)
  - Market efficiency (Let the best win)
  - Demand control (Energy security)
  - Cross subsidization (When needed)

- Dogmatic “cost based” rate design might prevent innovation needed in new future economy (Risk?, Value of service? Social engineering?)

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<u>Risk based</u> rate design could be a way to explore innovation

Industry Name	*Number of Fir*	*Beta*	*Cost of Equit*	*E/(D+E)*
Chemical (Diversified)	7	2,03	12,74%	78,63%
Steel	37	1,82	11,64%	73,41%
Food Wholesalers	15	1,79	11,48%	72,75%
Drugs (Biotechnology)	459	1,44	9,72%	86,33%
Office Equipment & Services	24	1,37	9,39%	65,94%
Oil/Gas (Integrated)	5	1,37	9,38%	86,74%
Shipbuilding & Marine	9	1,34	9,22%	68,05%
Beverage (Alcoholic)	28	1,33	9,15%	79,27%
Telecom (Wireless)	18	1,30	9,02%	45,46%
Engineering/Construction	49	1,27	8,86%	77,09%
Tobacco	24	1,26	8,82%	85,37%
Oil/Gas (Production and Exploration)	311	1,26	8,80%	70,47%
Coal & Related Energy	30	1,25	8,75%	68,77%
Brokerage & Investment Banking	42	1,24	8,70%	31,26%

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<u>Value based</u> can be explored aside from classic cost based approaches

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<u>Social engineering </u>can also be explored aside from classic approaches

Criteria	Project 1 (100MW) 0,8 TWh	Project 2 (100 MW) 0,8 TWh	Project 3 (100 MW) 0,8 TWh	Project 4 (100 MW) 0,8 TWh	Project 5 (100 MW) 0,8 TWh
Jobs /MW (25)	20 25 points	15 20 points	10 15 points	5 10 points	1 5 points
Wage $ /MW (25)	2 000 000$ 25 points	1 500 000$ 20 points	1 000 000$ 15 points	500 000$ 10 points	100 000$ 5 points
Invest $$ /MW (50)	10 000 000$ 50 points	7 500 000$ 40 points	5 000 000$ 30 points	2 500 000$ 20 points	1 000 000$ 10 points
Total Points	**100 points**	**90 points**	**60 points**	**40 points**	**20 points**

Toute chose étant égale par ailleurs, les projets sélectionnés seraient ceux avec le plus grand potentiel de développement économique, en accord avec l’esprit du Décret.

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Concluding remark's