

# TRUE North Mining: Technical Whitepaper

Sergey Vorozhtsov, Michael Che, Roman Novokshonov, and Dmitry Kislitsyn

*TRUE North Mining, Russia*

(Dated: February 6, 2018)

TRUE North Mining<sup>1</sup> is a *boutique* cryptocurrency mining organization positioned to be economically effective in the near and especially in the more distant future. This will be achieved by cutting two major mining costs which can be controlled: cooling and electricity costs. Efficient cooling will be achieved naturally by positioning our crypto mining farms in the Northern Russian territories. Almost zero cost *green* electricity will be obtained by acquisition and reconstruction of the old hydropower plants.

## I. INTRODUCTION

Recently cryptocurrency mining community has witnessed the movement of Chinese mining companies from mainland China to Mongolia.<sup>2</sup> The reasons are clear – the reduction in both cooling and electricity costs. However this change has not been radical enough.

We propose the establishment of mining farms in the TRUE North regions of Russia. We will lower both cooling and electricity costs compared to Chinese mining farms in Mongolia. This will provide our mining organization with competitive advantages for the years to come.

Cooling costs will be lowered by strategically placing our farms at 59° North latitude and further north. FREE<sup>3</sup> electricity will be achieved by refurbishing old hydroelectric power plants. We keep an eye on five of them with the potential energy output ranging from 0.3 to 0.5 mWh. That is why TRUE North Mining is a *boutique* cryptocurrency mining organization.

## II. OUR COMPETITIVE ADVANTAGES

We predict that cryptocurrency mining industry will become more and more competitive. We would like to position ourselves today for the highly competitive market of tomorrow. Below are our key competitive advantages which will allow us to successfully compete in the years to come.

### A. TRUE North

Our office and facilities are already located in the Northern part of Russia. We have a track record of successful operations in Russia in the harsh Northern weather conditions. Already located at 59° North latitude, we plan to expand our mining farms further North. We are second to none when it comes to competing on the cooling costs, see Appendix B.

### B. FREE<sup>3</sup> Electricity

There is no *perpetuum mobile*, however nature provides us with something very close to it. It is called hydropower. Initial capital costs are somewhat high – these are the costs of acquisition and reconstruction of the old hydroelectric plants. But once in operation, the maintenance costs are low and, hence, the electricity costs are low as well.

In 1950s and 1960s Soviet government changed its focus from many small rural hydropower plants to larger strategically positioned power plants. As a result many small rural hydroelectric plants were dismantled but dams have survived. Compared to building from scratch, these old hydropower plants can be inexpensively rebuilt with the brand new hardware equipment installed.

With minimal maintenance going forward these hydropower plants can consistently and reliably generate electricity at the cost of about \$0.01 kWh. Each plant can potentially generate around 0.36 mWh which is enough to mine approximately 14.9 Bitcoins per month, see Appendix C.

### C. Technical expertise

Our staff has experience in reconstruction of the small hydropower plants. We know how to get approval for the reconstruction project, find hydropower equipment manufacturers and experienced subcontractors.

### D. Commitment to green energy

Russia has a vast territory, all climate zones, and abundant natural resources. Hydropower, wind, solar, and tidal energy – you name it – Russia has all kinds of *green* energy sources.

TRUE North Mining company is open minded about other *green* energy sources in addition to hydropower. In fact, we consider them as possibilities for our future growth.

### III. TOKEN

Our token will have **TNM** ticker which is the abbreviation for the TRUE North Mining. We plan to create TNM token as ERC20 token on Ethereum platform.

The number of tokens will be capped at 300,000,000. Our goal is to raise \$15,000,000 from both pre-ICO and ICO participants.

#### A. Initial token distribution

Three hundred million TNM tokens will be distributed as follows:

- 30,000,000 to qualified pre-ICO participants to acquire old hydropower plants (\$0.10 per token)
- 6,000,000 – 20% bonus to qualified pre-ICO participants
- 120,000,000 to ICO participants (\$0.10 per token)
- 99,000,000 – Reserve fund to expand hydropower mining operations in the future
- 30,000,000 – Founders fund (these TNM tokens will be frozen for 2 years to ensure alignment of interests)
- 15,000,000 to Bounty campaign participants, listings on exchanges, etc.

#### B. Possible ICO outcomes

Our goal is to raise \$15,000,000. Reaching this target will allow us to acquire and reconstruct 5 small hydropower plants as well as start our mining operations on all of them.

We realize that this is quite an ambitious goal. Therefore, we prepared contingency plans to cover various ICO outcomes. The contingency plan will depend on the amount of funds  $F$  raised:

- $\$3,000,000 \leq F < \$15,000,000$  – we will work on the acquisition and reconstruction of some hydropower plants, the remaining funds will be applied towards building mining facilities running on the power grid;
- $\$1,000,000 \leq F < \$3,000,000$  – not enough funds to acquire and reconstruct even one hydropower plant, all funds will be directed towards building mining facilities running on the power grid. Fortunately, these facilities are profitable in the TRUE Russian North environment, see Appendix D;
- $F < \$1,000,000$  – ICO officially failed, all contributions will be fully refunded back to the participants.

### C. Mining proceeds distribution

Cryptocurrency mining proceeds will be distributed as follows:

- $X$  share will be immediately converted to BTC or ETH and used to buy back TNM token on the market;
- $(1 - X)$  share will be immediately converted to fiat and used for operational expenses (including keeping our mining equipment up to date).

The buy back of TNM token on the market should result in its price being driven up.

When the mining is done using our own electricity, this expense line will be greatly reduced, see Appendix D. Hence, we will allocate a larger share of the mining proceeds  $X = 50\%$  towards TNM token buy back.

Some of our mining facilities may run on purchased electricity. For these facilities we will apply a smaller share of the mining proceeds  $X = 25\%$  towards TNM token buy back.

#### D. Proof-of-burn

It is important to note that all bought back TNM tokens will be burned,<sup>4</sup> thus reducing the total TNM token supply. This should force the remaining TNM tokens to appreciate in value, thus, rewarding long-term TNM token holders.

As one can see from Section III A a total of 156,000,000 TNM tokens will be distributed during both pre-ICO and ICO rounds. Unsold tokens will be burned as well.

## IV. MINING RESOURCE ALLOCATION

Most cryptocurrencies can be mined either on ASICs<sup>5</sup> or video cards. Payback periods are different and depend on the cryptocurrency rates which fluctuate. At the time of the writing, ASICs provide 5-6 months payback period, while video cards give around 11-12 months. Possible raise in cryptocurrency rates (in USD) will shorten payback periods. On the other hand, hardware warranty periods for ASICs and video cards are different as well: 1 year for ASICs *vs.* 3 years for video cards.

We believe that ICO participants should determine respective allocation of the mining resources among ASICs and video cards. Once ICO contribution has been made, a participant will be able to vote for the allocation of the funds between ASICs and video cards. The number of votes will be linearly proportional to the contribution amount made.

## V. MAKING A POSITIVE IMPACT

Compared to the competition we offer *green* solution. Hydropower is a clean fuel source that doesn't pollute the air like fossil fuel power plants. Our hydropower mining operations will benefit crypto as well as local communities.

### A. Benefits to the crypto community

In the spirit of Satoshi Nakamoto<sup>6</sup> Bitcoin and altcoin mining operations should be decentralized. Unfortunately, most of them are now concentrated in China. By building more mining facilities in Russia we will take our part in decentralization of Bitcoin and altcoin mining operations.

### B. Benefits to the local communities

Local communities will obtain a backup energy source making them energy independent.

Impoundment hydropower will create a water reservoir that provide a large shallow water surface for the fish spawning. It will benefit both fishing and tourism industries.<sup>7</sup>

## VI. KEY TEAM MEMBERS

*Dr. Sergey Vorozhtsov, CEO and Co-Founder*

Sergey holds Ph.D. degree in Physics (Quantum Computing) from Duke University.<sup>8</sup> In 2005 he co-founded S3 Stores, Inc.<sup>9</sup> – internet retailer rated A+ by BBB.<sup>10</sup> Sergey is both technology and business administration expert with more than 12 years of experience.

*Mr. Michael Che, COO and Co-Founder*

Michael holds B.S. degree in Operations Management from Škoda Auto University, Czech Republic. Working with S3 Stores, Inc.<sup>9</sup> since 2014 Michael brought excellence to everyday corporate operations according to the standards of EFQM.

*Mr. Roman Novokshonov, CTO and Co-Founder*

Roman holds M.A. degree in Computer Science. He has more than 17 years of experience in system programming. Roman is an expert in blockchain technology with hands-on experience in programming smart contracts as well as building cryptocurrency mining farms.

*Dr. Dmitry Kislitsyn, P. Eng.*

Dmitry holds Ph.D. degree in Physics (Hydroelectric Power Plants) from St. Petersburg Polytechnic University. He has more than 30 years of experience designing and supervising the construction of dams and hydroelectric power plants.

## VII. CONCLUSION

Despite the creation of many cryptocurrencies based on the proof-of-stake concept, when it comes to making sure that our digital money are truly secured, there are no alternatives to the proof-of-work concept. Thus, we expect that proof-of-work cryptocurrencies will be around for the years to come.

We believe that even if the competition could get access to a cheap electricity source we would still be able to compete with our FREE<sup>3</sup> hydropower electricity. In addition, the fact that we are a *boutique* operation will always allow us to find our niche.

When it comes to weather, we already beat Reykjavik, Iceland on average high, average low, and daily mean temperatures. Nonetheless, we will continue to acquire more old hydropower plants located further North.

The energy we will be generating is *green* and our goals are fully aligned with the benefits of the local communities.

More important than all of the above, we managed to assemble a powerful leadership team with deep technical and legal expertise. Should unexpected problems arise we are confident that we will find strong solutions to address them.

## VIII. ACKNOWLEDGEMENTS

We are grateful to Alexei Novikov, Rihard Yary, and Stanislav Skopin for the fruitful discussions. We would like to thank Julia and Michael Okatiev for the graphic work.

### Appendix A: Hydropower equation

The potential energy of the falling water can be written as follows:  $U = mgh$ , where  $m$  is the mass of the falling water,  $g$  is the acceleration due to gravity,  $h$  is the head of the stream or the distance the water falls on its way to the turbine, see Fig. 1.

Power is the rate of producing energy, therefore

$$P = \frac{\Delta U}{\Delta t} = g \frac{\Delta m}{\Delta t} h + gm \frac{\Delta h}{\Delta t}. \quad (\text{A1})$$

The head of the stream  $h = h(t)$  is a slowly varying with time function, hence the second term can be neglected.  $\Delta m/\Delta t$  is the definition of the water flow  $F$  measured in kg (or litres) per second. Thus, our final equation for the hydropower is  $P = gFh$ .

This hydropower is converted to the electric power:  $P_{el} = \eta P$ , where  $\eta$  is the efficiency coefficient. It can be further decomposed into two multipliers:  $\eta = \eta_t \eta_g$ , where  $\eta_t$  and  $\eta_g$  are the turbine and generator efficiency coefficients respectively, see Fig. 1. In the typical modern setups  $\eta_t = 0.92$  and  $\eta_g = 0.95$ , thus resulting in  $\eta = 0.874 = 87.4\%$  efficiency.

## Appendix B: Forced air flow cooling equation

The geometry of the facility shown on Fig. 2 is industry standard and the one used in some of the Genesis mining<sup>12</sup> data centers.

Let us calculate the required air flow  $F$  to cool down our mining facility:

$$F = \frac{Q}{\rho_{air} C_{air} \Delta T}, \quad (B1)$$

where  $Q$  is the heat dissipated inside mining facility,  $\rho_{air}$  is the density of air,  $C_{air}$  is the specific heat of air, and  $\Delta T = T_{in} - T_{out}$  is the difference of temperatures inside and outside the facility.

Let us substitute all the numbers in Eq. (B1):

$$F \left[ \frac{m^3}{s} \right] = \frac{360 \times 10^3}{1.2 \times 10^3 \Delta T [^\circ C]} = \frac{300}{\Delta T [^\circ C]} \quad (B2)$$

Here, we put  $Q = 360$  kWh. The average high temperature during July can be as high as  $T_{out} = 24^\circ C$ . To be on the safe side the temperature inside mining facility should be  $T_{in} \leq 28^\circ C$ . Then, forced air flow of at least  $75 \text{ m}^3/\text{s}$  is required. This is well within range of the modern axial industrial fans.

## Appendix C: Mining rate equation

Let us estimate how many BTC per 24 hours time period TRUE North Mining can produce:

$$\begin{aligned} & \text{TNM mining rate} \left[ \frac{\text{BTC}}{24 \text{ hours}} \right] \\ &= \frac{\text{TNM hash rate}}{\text{Total hash rate}} \frac{12.5 [\text{BTC}]}{1 \text{ Block}} \frac{1 \text{ Block}}{10 \text{ min}} \frac{24 \times 60 \text{ min}}{[24 \text{ hours}]} \\ &= \frac{1,800 [\text{BTC}]}{[24 \text{ hours}]} \frac{\text{TNM hash rate}}{\text{Total hash rate}} \end{aligned} \quad (C1)$$

as at this time Bitcoin block reward is equal to 12.5 BTC.<sup>11</sup>

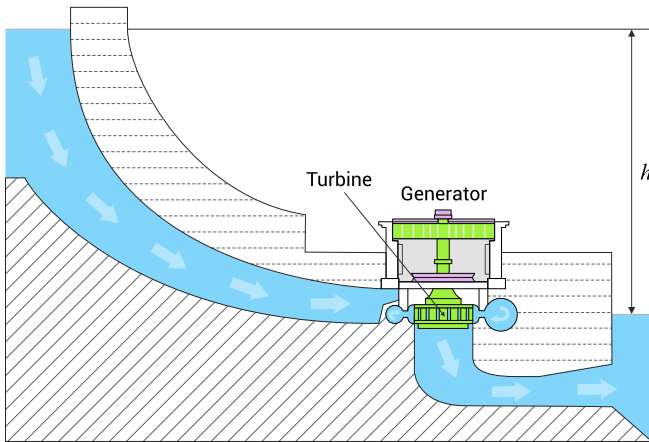


Figure 1. Cross section of a conventional hydroelectric dam.

A typical small hydropower plant generates about 360 kWh 24x7. This electric power can support 276 BITMAIN AntMiners S9. Each miner has a hash rate of about 14 Th/s. Total hash rate of the Bitcoin network as of December 31st, 2017 is about  $14 \times 10^6$  Th/s. Let us substitute these numbers into Eq. (C1):

$$\begin{aligned} & \text{TNM mining rate} \left[ \frac{\text{BTC}}{24 \text{ hours}} \right] \\ &= \frac{1,800 [\text{BTC}]}{[24 \text{ hours}]} \frac{276 \times 14}{14 \times 10^6} = \frac{0.4968 [\text{BTC}]}{[24 \text{ hours}]} \end{aligned} \quad (C2)$$

Thus, small 360 kWh hydropower plant and AntMiner S9 mining farm can potentially generate approximately 14.9 BTC per month.

Likewise one can build mining farm on video cards or a mixed mining farm on both ASICs and video cards. In fact, we will use crowd intelligence of our ICO investors to determine exact ratio.

## Appendix D: Financials

Click the following link to review [TRUE North Mining projected Income Statements](#).

The first/second tab presents the projected Income Statement for the mining site powered by hydropower/electric grid. One can notice that while initial capital investments are significantly higher for the hydropower mining site, down the road hydropower provides important savings in the electricity cost moving break even price point to \$2,260 per BTC as compared to \$3,505 per BTC for a regular electric grid setup.

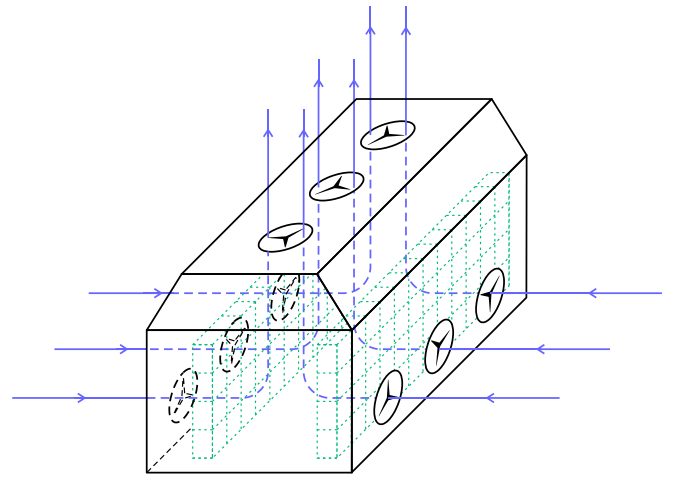


Figure 2. Proposed design of the mining facility. Mining racks are shown in green. Circles with three blades indicate the positions of the fans. Blue arrows show the direction of the cooling air flow.

- 
- <sup>1</sup> For up to date information about TRUE North Mining organization visit <http://www.truenorthmining.com> website.
- <sup>2</sup> <https://spectrum.ieee.org/computing/networks/why-the-biggest-bitcoin-mines-are-in-china>
- <sup>3</sup> Almost FREE or infinitesimally small compared to other costs.
- <sup>4</sup> Burned, *i.e.* sent to 0x000... Ethereum address. No tokens can be recovered from this address as the corresponding private key is unknown. By viewing deposits to 0x000... Ethereum address anyone will be able to verify that TNM tokens were burned indeed.
- <sup>5</sup> ASIC abbreviation stands for Application-Specific Integrated Circuit.
- <sup>6</sup> Satoshi Nakamoto, *Bitcoin: A Peer-to-Peer Electronic Cash System* (October 2008)
- <sup>7</sup> <https://energy.gov/eere/water/benefits-hydropower>
- <sup>8</sup> For a list of scientific publications refer to <https://arxiv.org/find/all/1/all:+vorojtsov/0/1/0/all/0/1>
- <sup>9</sup> <http://www.s3stores.com>
- <sup>10</sup> <https://www.bbb.org/western-ontario/business-reviews/online-retailer/s3-stores-in-chatham-on-1054268>
- <sup>11</sup> <http://www.bitcoinblockhalf.com>
- <sup>12</sup> <https://www.genesis-mining.com>