deneum

low-cost energy generation

WHITE PAPER

CONTENTS

INTRODUCTION

During and after the Industrial Revolution, humanity failed to consider the costs and harmful impact that fossil fuels would have on our planet. Energy consumption grew rapidly, but the wisdom of the world community failed to keep apace. Only by the beginning of the 21st century did society start to take heed of the issue, with government-supported renewable energy generation gradually eating into the market share of fossil fuels. This has been a positive move; however, there are obvious signs that this won't last till complete replacement of the sources of pollution. We must accelerate the complete transition to a sustainable future.

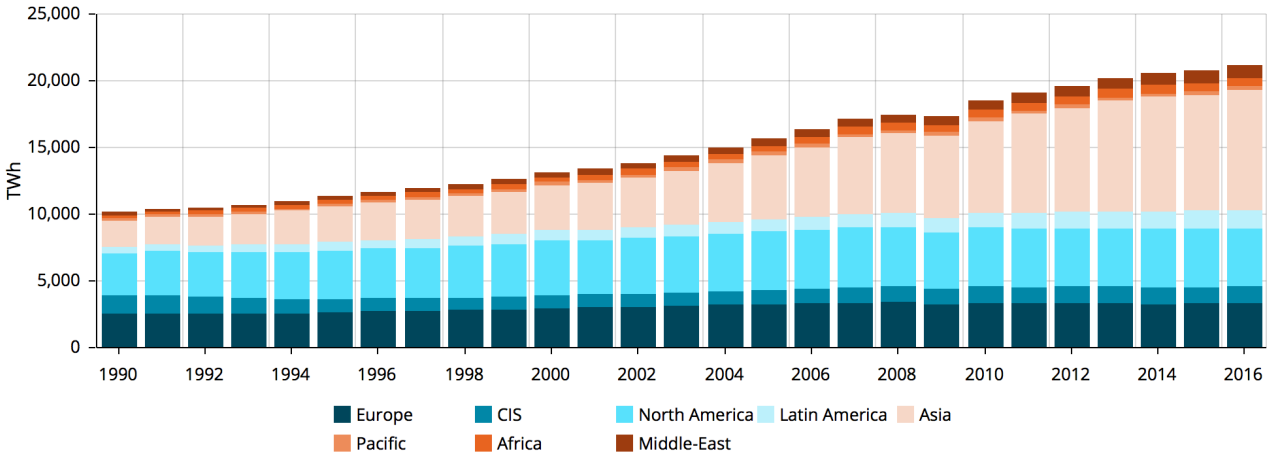
Can you imagine a fully electric aircraft with unlimited range? What if we could pay 80% less for our electricity bills? How many meaningful innovations could be brought to fruition if corporations reallocated the funds they pay for energy towards research and development? How beautiful would our cities look if all transport were fully electric and the air were pure? We believe that the time has come.

The Deneum team is made up of unique people sharing a common philosophy, with deep knowledge in their respective fields and awareness of their purpose. We possess deep expertise in the physical, chemical, and electrical sciences, with research and laboratory experience around the Deneum technology since 1989. Our team has conducted many hundreds of tests and experiments, with consistently positive results since 2012. Now, it is time to scale these results into a full production line.

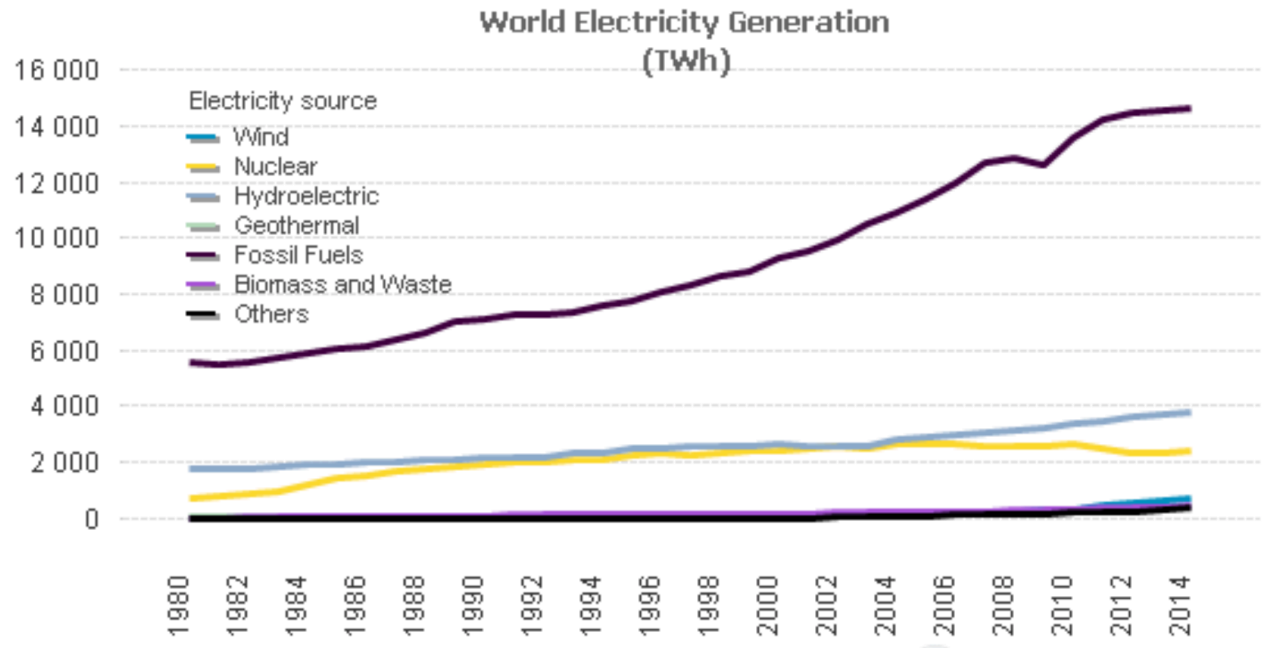
We invite everyone to take part in the energy revolution — creating a better planet for us and the generations to come.

Dmitry Samoylovskikh
CEO and founder of Deneum,
Forbes 30 Under 30

MARKET OVERVIEW



The planet consumed over 20,000 terawatt-hours of electricity in 2016 [1], with around 2% growth each year. One terawatt-hour equals 1 billion kilowatt-hours.



Key trends: Fossil fuels continued to gain, nuclear energy plunged, and renewables started to take off, but their overall share of total generation was still less than 15% [2].

The world's total electricity consumption money-wise totalled at over 2 trillion USD

One significant trend is rapid growth in electricity consumption used for cryptocurrency mining purposes. Consumption has risen from zero to over 0.2% of the world's total consumption (or over 50 terawatt-hours) per year, which is more than the total electricity consumption of Ireland. It is expected to increase by 100%-300% each year [3].

Bitcoin electricity consumption:

Furthermore, there are numerous industries that use primarily petroleum-based fuels, and these are not represented in the numbers above. Moreover, there are potential industries (such as short-haul air transportation) that lack battery density but would grow rapidly if the technology existed.

Cars

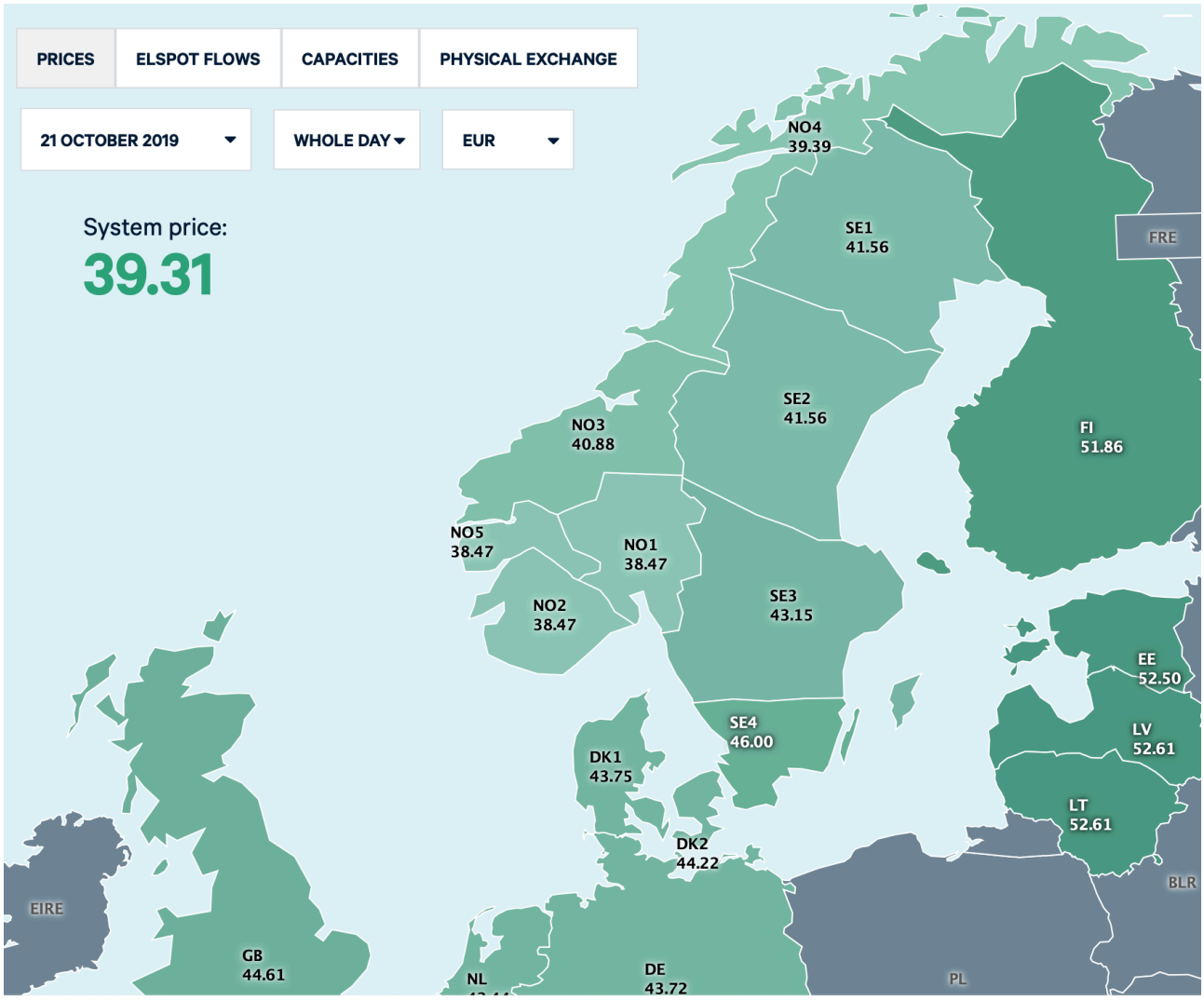
1,100+ billion USD

Aviation

130+ billion USD

The European electricity market is well interconnected and democratized, Nord Pool being the largest European electricity market driven by market rules. This electronic exchange brings together electricity producers, retailers, and consumers in Denmark, Sweden, Finland, Norway, Estonia, Latvia, and Lithuania. An electricity producer based in any of these countries can sell electricity through the grid to a customer located in any other country on the list.

Nord Pool Grid Capacity and Current Price, megawatt-hours [4]:



A producer with a disruptive low-cost technology can sell to the grid at ~39 EUR/MWh
or directly to corporate consumers at 70-90 EUR/MWh.
The market is liberalised and it's capacity is huge.

CHALLENGES

Stagnating industry with high prices and high costs

Solar and wind energy are often mistakenly associated with free or low cost. Governments tend to massively support solar and wind to increase the share of renewable resources in their country's total energy production. In most countries, this support eventually comes to an end, so they cannot be expected to grow on their own – wind and solar plants are dramatically less efficient than natural gas-burning plants, in terms of both capital and operating costs.

There is little room for conventional (natural gas-burning) plants to increase efficiency and reduce costs. Moreover, their costs are correlated with gas prices, which are not likely to drop much below current levels.

Think of this scenario as the space industry when SpaceX entered the fray. The only difference is that we already have the technology – unlike SpaceX, we do not have to start from scratch.

Exciting breakthrough opportunities in transportation and more

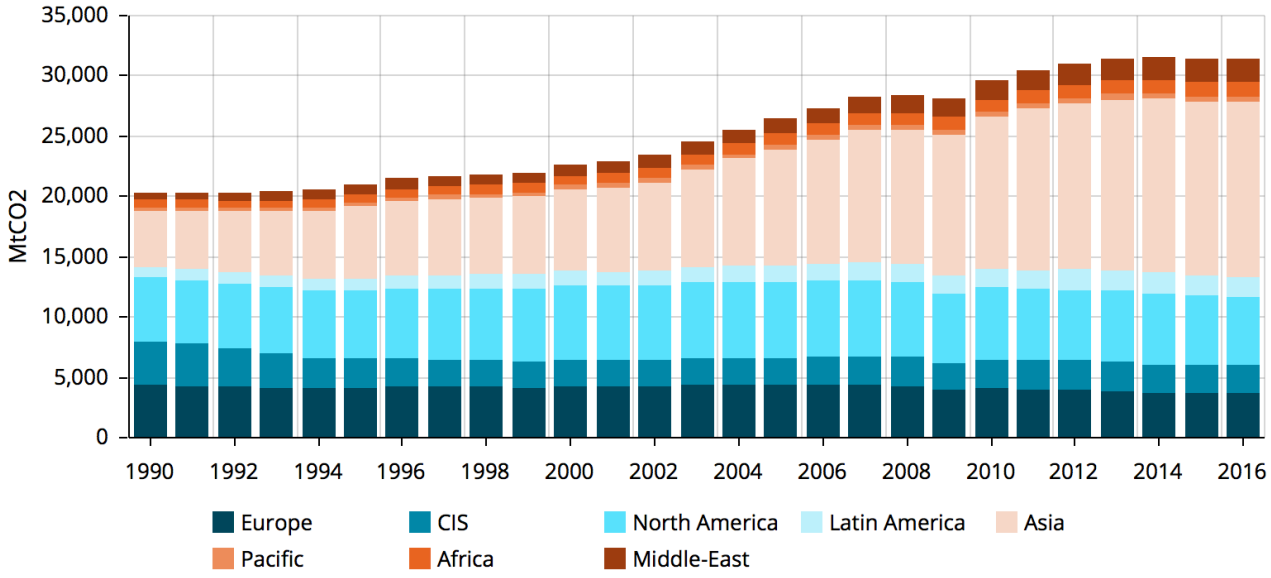
Entire industries, such as road, sea, and air transportation, could change dramatically. The transportation sector is currently responsible for up to 75% of the world's total energy consumption. With the gradual shift towards electrical engines, that number will continue to rise over time. However, this is not happening quickly, for two main reasons: 1) a lack of technology (low battery density, high weight) and 2) a lack of infrastructure.

To experience a boom in growth, the industry needs a solution with autonomous and efficient power stations that give vehicles sufficient power. This solution would open the floodgates for such exciting concepts as cost-effective local air commuting, which many companies are currently considering.

Stop burning carbon fuels

CO_2 emissions are not getting lower; instead, they have stabilized and are likely to mirror growing energy consumption in the coming years. The chart below shows the emissions trend from 1990-2016. One green source of energy, provided it is more efficient than current polluting technologies, will trigger the movement towards a greener planet. That is *the* challenge of our generation – and we believe we must play an active role in it.

The global CO_2 Emissions, 2016:



Breakdown of Contributors:

The industry is awaiting a breakthrough.

TECHNOLOGY & EXPERIMENT

Nuclear fusion means bumping two atoms together with a result of significant energy release. Essentially, this is what happens in the core of the Sun. Nuclear fusion has been of great interest for scientists for over 50 years, starting with first experimental units called TOKOMAK in Russia. It is again on the rise these days with several projects around the world, like $23b-worth ITER in France.

The goal is to one day produce clean, almost limitless energy by fusing atoms together rather than splitting them apart which is what happens in every nuclear power station.

But this process of hot nuclear fusion requires enormously high temperatures of hundreds of millions Celsius which implies extremely high costs and puts the energy generation well below the breakeven point. Another significant problem is tritium which would be used in such future fusion reactors as fuel, since it is radioactive, non-existent in nature and can be produced in uranium fission reactors.

Luckily, there is a way to trigger nuclear fusion at much lower temperatures, even at room temperature and below. One such method has been known since the 1950s and is called **muon catalyzed fusion**. Advanced research and experimental validation in multiple countries show that this method does work well. Muons are pretty similar to electrons, but 207 times heavier, letting nuclei fuse easily, provided that certain conditions are met. The fuel in this method is non-radioactive deuterium (heavy hydrogen), which is sourced from normal sea water.

The only significant issue with this type of nuclear fusion is that muons do not live long and all known methods of their creation require more energy than the energy that can be obtained as a result of the reaction.

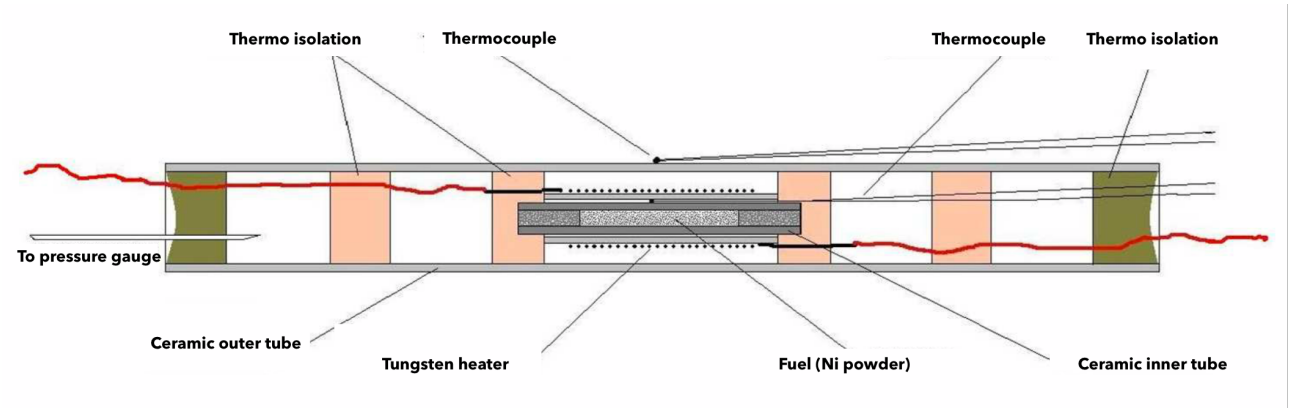
DENEUM's research is about finding the way to catalyze nuclear fusion at relatively low temperatures (below 1500C) which would be efficient enough to be above the breakeven level.

IMPORTANT NOTES

Several experimental setups with different configurations, materials, temp & pressure conditions and triggering methods have shown positive results.

In context of this paper we would like to present the results of the longest experiment so far which has shown remarkable performance.

It is necessary to admit that such performance still lacks reproducibility which is a vital criteria in experimental research: since this longest run we have done tens of experiments with worse or null performance. And only since September 2019 several back-to-back experiments have been successful, producing more energy than consumed.



The reactor consists of a ceramic tube with 1.2 gram of Nickel powder inside. This tube is placed into another ceramic tube with a tungsten heater on the outer side of it. A thermocouple is placed between the two tubes.

PREPARATION STAGE.

A vacuum pump is used to evacuate residual gases and water from the reactor chamber at the temperature of 300C. Then, after switching the pump off, Hydrogen is injected to the level close to the atmospheric level. The reactor is left at 350C for 3 hours to ensure the nickel grains surface is cleaned off. The next evacuation run is made to remove water created as a result of nickel oxide reduction with hydrogen. Once removed, another H injection is made to the same level and the reactor is left for 3 days at 350C. Two more runs of evacuation-injection was made and after that the reactor was moved for the main run.

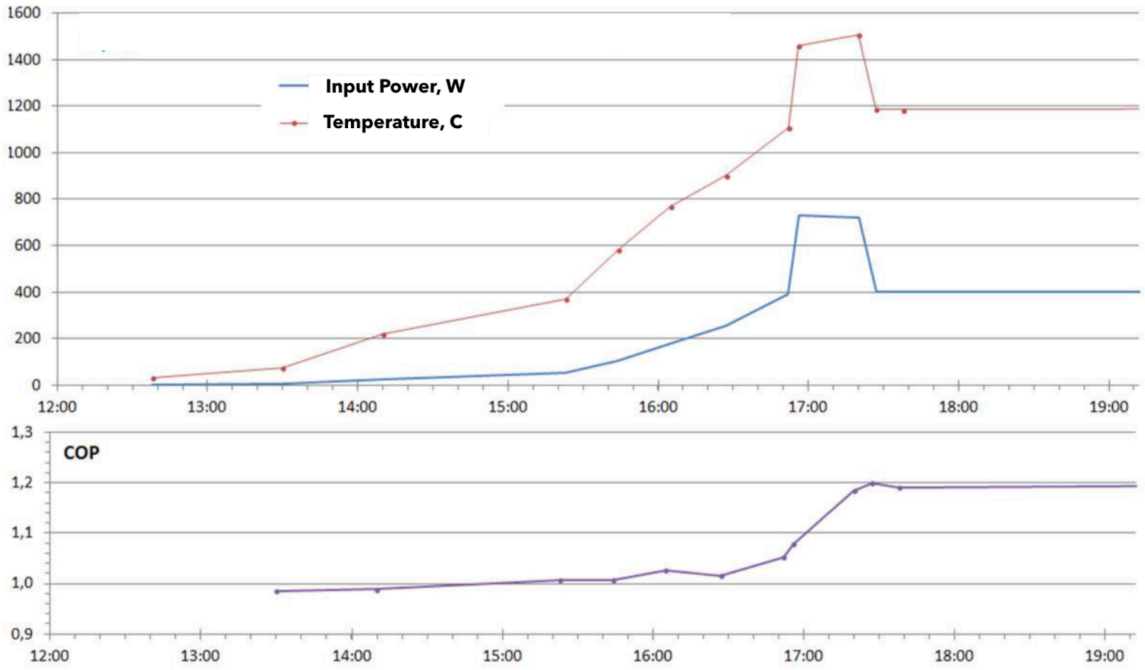
MAIN RUN.

During the first day the input power was gradually increasing which was followed by the gradual rise of the temperature on the inner thermocouple up to 1100C while consuming 400W of electricity. The following increase of input power to 700W led to 1500C inside the reactor. This exceeded the input power by 130W. After decreasing the input power back to 400W, the excess heat decreased to 80W, while the COP (coefficient of performance) stayed at the same level — 1.2. The method of COP measurement and calculation is based on calibration: performance of the reactor filled with the active fuel is compared to performance of the same reactor in the same conditions, but not containing the active fuel.

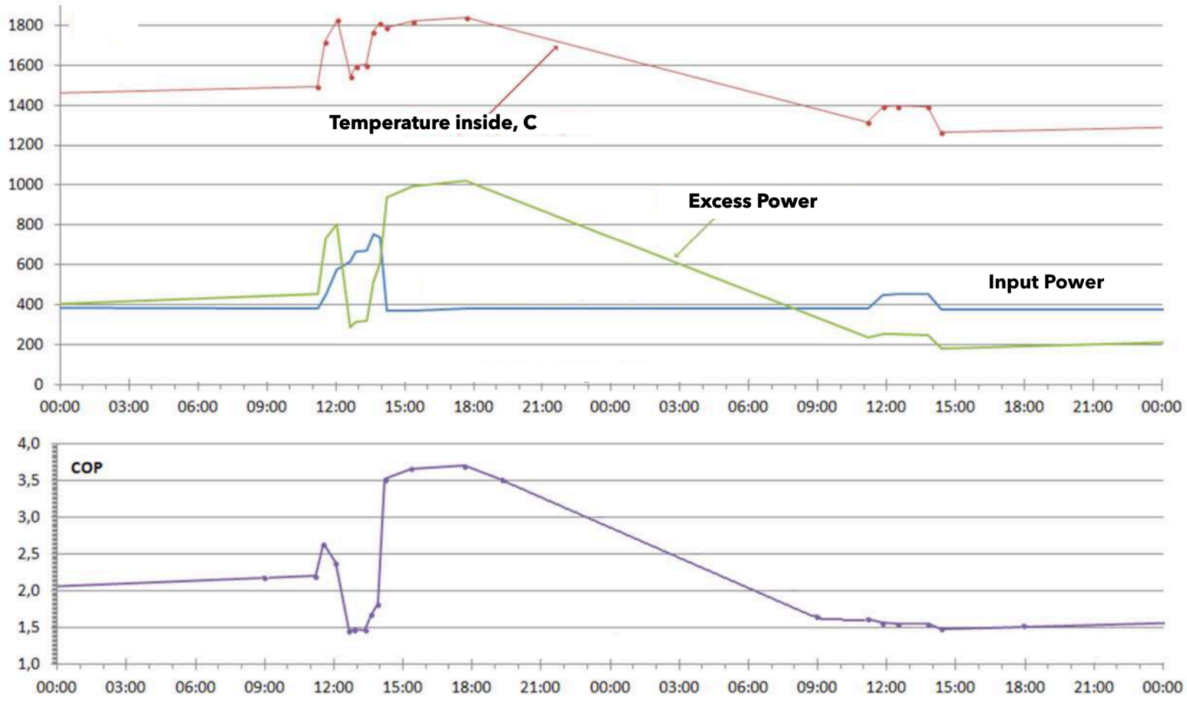
While keeping the same input power, the temperature inside the reactor rose from 1200C to 1500C during 18 hours. The COP increased from 1.2 to 2.3. When the input power was again increased to 700W the temperature spiked to 1800C and COP 2.7. But shortly after at the same input power the temperature and COP swiftly declined. About two hours later the temperature and COP rose back to 1800C. Moreover, after lowering the input power to 400W the temperature did not decrease and remained at 1800C and the excess power reached 1000W, meaning a COP of 3.6. This performance remained for approximately 6 hours followed by a gradual decline. 24 hours later, with the input power of 400W the temperature declined to 1300C and the excess heat was only 200W.

The next long-run phase of the experiment was conducted within the input power range of 350-380W, except a few short- time spikes. These spikes were resulted in temperature and COP rise, except the last one of May 17th when the temperature also rose, but the COP remained close to 1, which we assume is explained by the fuel exhaust.

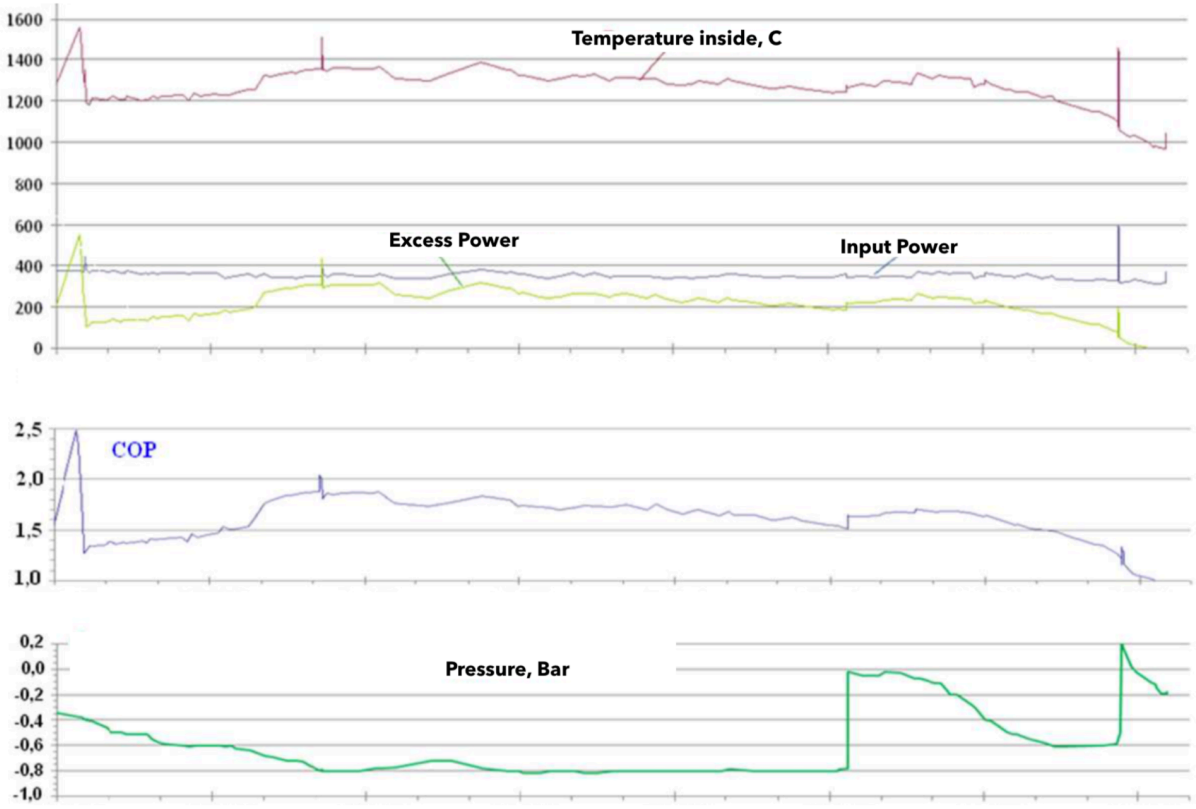
DAY 1


Input Power, W
Temperature, C
1600
1400
1200
1000
800
600
400
200
0
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
COP
1,3
1,2
1,1
1,0
0,9

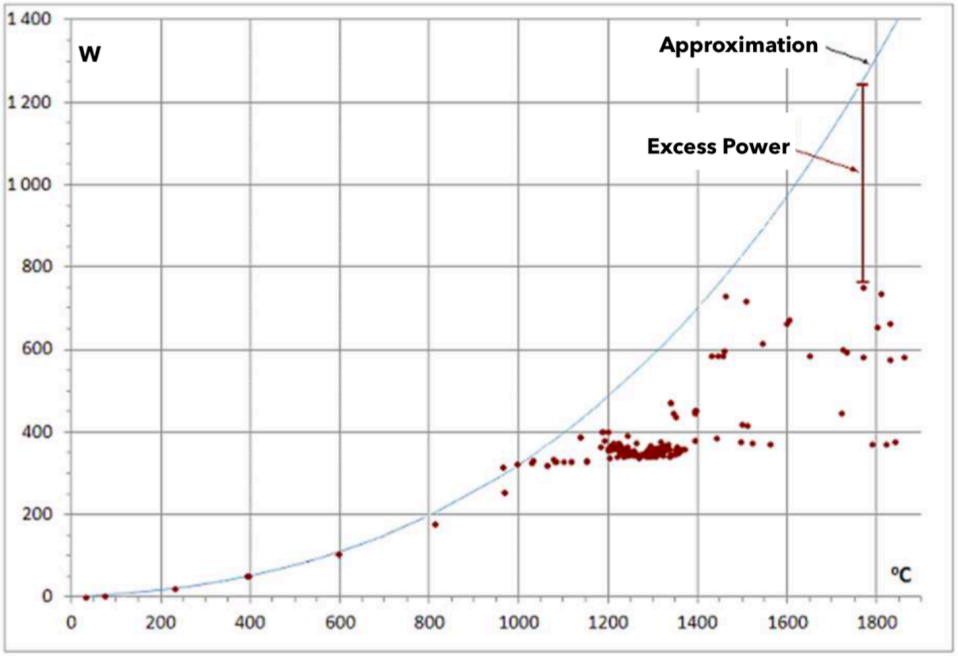
DAY 3 - 4


Temperature inside, C
Excess Power
Input Power
1800
1600
1400
1200
1000
800
600
400
200
0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
COP
4,0
3,5
3,0
2,5
2,0
1,5
1,0

DAY 5 — 225



Input Power Vs Temperature. Multiple dots over 225 days.



The full report in details is available here in Russian: http://www.unconv-science.org/pdf/23/parkhomov2.pdf.

BUSINESS MODEL

Deneum will adopt two approaches once the project is launched. We expect this to happen not earlier than late 2020, and it will take additional time to obtain the necessary certificates to comply with regulations in certain countries. The first tests are expected in late 2020.

Our business model assumes obtaining control over crucial material supplies to prevent prices from soaring when demand spikes. Proven global reserves of titanium well exceed the amount needed to switch all energy production to Deneum technology, while deuterium reserves are almost endless, since deuterium is part of the global ocean.

Both approaches take advantage of the very low electricity costs that Deneum technology provides.

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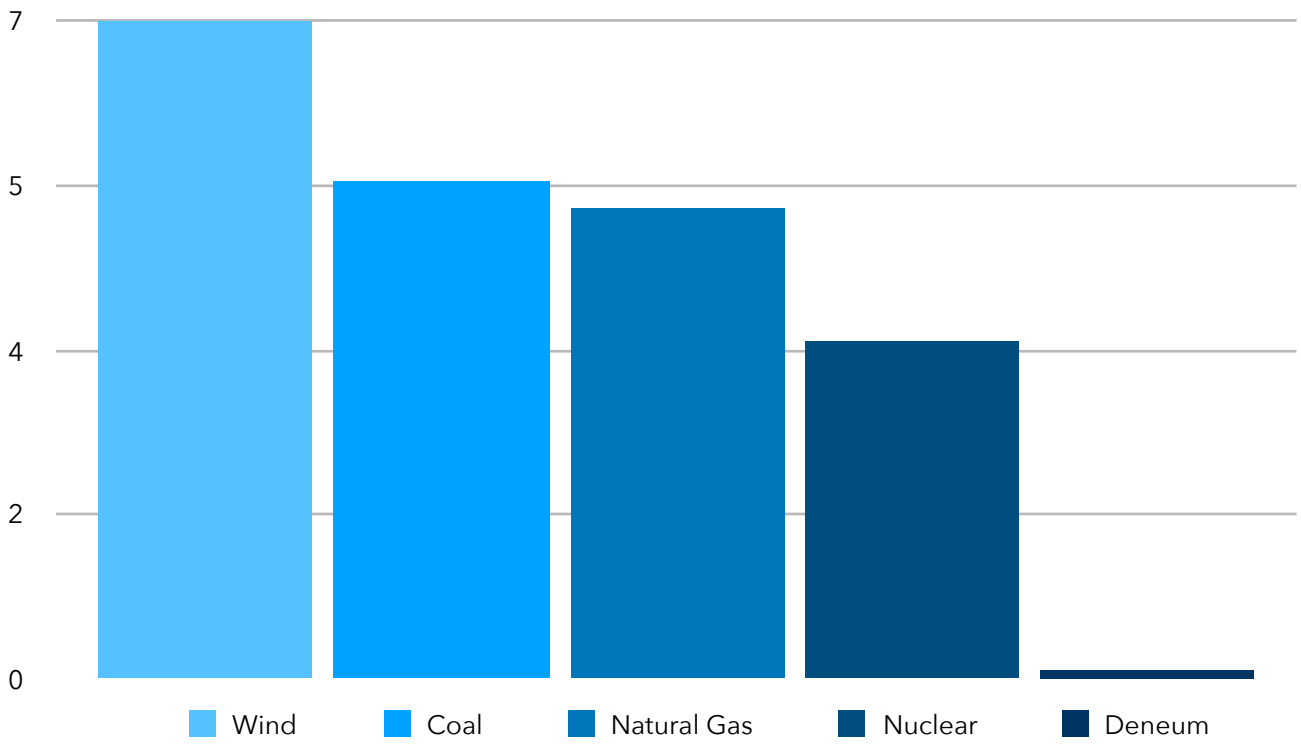
Electricity Costs by Source, Average, Eurocents per 1 kW-h, 2016:



This unique advantage allows to reach ROI of up to 87%

Main Consumer Groups:

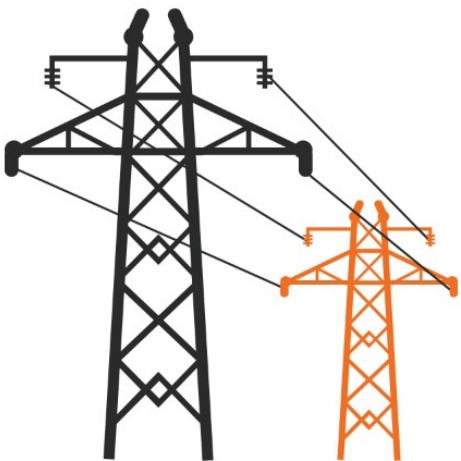
Manufacturing	Crypto-mining	Transportation
Electricity producers	Residential	Governments

Selling Electricity to End Consumers and to the Grid

Instead of selling Power Stations, our strategy suggests selling electricity. Any new or existing facility or residential district can be powered by Deneum Power Stations at a lower price than off-the-grid retail prices. These Power Stations also eliminate the need for major investments into refurbishing existing grids when you need to connect to the grid.

We plan to sell electricity to both end consumers and to the grid. We plan to build our own large plants and wholesale low-cost electricity to the grid. We aim to start with three small-size 10 MWh plant, generating and selling up to 220 gigawatt-hours in the first year of operations to the grid in Northern Europe through the Nord Pool system.

Ultimately, we plan to have extend to hundreds of plants on five continents, with a total capacity of more than 1,000 terawatt-hours per year by 2035. The current average wholesale price of 1,000 terawatt-hours is around $100 billion USD.



TEAM & ADVISORS

Dmitry Samoylovskikh

Founder, CEO

Forbes 30 Under 30 Europe

Co-founder of Tesla Amazing — a successful international company, founded on Kickstarter. All obligations fulfilled on time.
Interview on Russian National TV Russia 24.

Higher School of Economics, Management, Stock Exchange and Investments. Master degree

Alexander Parkhomov, PhD

Research and Experimenta

Leading global researcher in the field of low temperature fusion and transmutation.

Dr. Parkhomov led a research team at the Moscow Aviation Institute, which studied the properties of ultra-low-energy neutrinos.

Author an co-author of 130 scientific publications.

Sergey Godin

Research and Measurementz

Expert in digital and analogue electronics, electrotechnics, measuring devices, signals analysing and experimental setups.

Main fields of expertise: experimental plasma physics, electrodynamics, and vortex plasmatic stations. Author of numerous scientific works and patents. Moscow Institute of Electrotechnics

Fedor Zaitsev, PhD

Science

The representative of Russian Federation in the ITER project.

Scientific research: fundamentals of new energy sources; physics of plasma, electromagnetic and gravitational phenomena;

Author of 200 scientific publications, 8 books.

Moscow State University.

Vladimir Bytchkov, PhD

Science

Member of Russian Academy of Science: low temperature plasma.

Leading researcher at Moscow State University.

Scientific research: low temperature plasma physics, chemistry and dynamics; atmosphere physics.

Author and co-author of 237 publications and books.

Konstantin Klimov, PhD

Science

International scientist of the year — Gold Medal Award, 2007.

Professor at, Moscow Aviation Institute.

Main fields of competence: Electromagnetic Analysis and Engineering, Microwave Engineering, Plasma.

Author of 122 publication, 6 patents, 71 citations.

Evgeny Yaschchenko

Lead Coordinator

Extensive experience on the technical side of experimental physics, Space Aircraft Life Support Systems, cryogenic and extra-high temperatures.

Assessing bio protection systems at Kurskaya Nuclear Station's fuel assembly storage and recycling complex.

Bauman Moscow State Technical University

Vadim Antonov

Product Design

UX Design, branding and interfaces specialist.

Art directing "Svyaznoy Bank" brand creation, which was awarded "The Brand of the Year, EFFIE Russia" award in 2011.

Former Head of UX at Storiqa that raised $25,000,000 USD on public token sale.

Maria Lapuk

Public Relations

Over 10 years of experience in digital PR. One of the most recognized PR leaders in the region.

Maria's awards include «PR Profile of the Year 2015», «Most Influential Networker 2013», «PR Professional of the Year 2012"

Евгений Ященко

Ведущий координатор

Обширный опыт в следующих областях: техническая сторона экспериментальной физики, системы жизнеобеспечения космических станций, криогеника и сверхвысокие температуры.

Оценка систем биологической защиты на Курской АЭС.

МГТУ им. Баумана.

Bogdan Fiedur

Советник

Разработчик смарт-контрактов, крипто-инвестор и консультант, предприниматель.

Президент blockchainexperts.io

Более 24 лет опыта в области IT: электронная коммерция, блокчейн, машинное обучение.

Wulf Kaal

Советник

Ведущий мировой эксперт на пересечении областей права, бизнеса и технологий. Фокус на исследовании инноваций, технологий, применения блокчейн технологий, смарт-контрактов, первичных размещений токенов, хедж-фондов и регулирования.

Директор Private Investment Fund Institute (PIFI).

TOKEN SALES

Deneum Token (Ticker: DNM) is a utility token. It is not a security and it does not grant shareholders rights. The legal opinion is available here: https://ieo.deneum.com/Legal_Opinion_HK.pdf.
Token sale is held by Deneum OU, the company registered in Tallinn, Estonia, EU.
Commercial Name of the project: "Deneum".
Deneum Tokens are provided though a smart contract based on the Ethereum platform that meets the ERC-20 standard and token holders can store them in numerous wallets and services.

The token sales stages:

Private Sale	**IEO**
$2.95	$5.65
Hard Cap: $720,000 RAISED: $720,000 May 22, 2018	Max Tokens Issue: 210,000 1st round cap: 40,000 DNM 2nd round cap: 55,000 DNM Hard Cap: $1,186,500 Oct 29 - Nov 12, 2019

The Sales Run ends upon the end date or upon reaching the Hard Cap of the stage.
The total tokens available for issue: 15,000,000.
As DNM is a utility token, the company may issue new tokens and the two Token Sale stages for new consumers to purchase electricity supplies – but no earlier than December 1, 2020, or once retail sales are launched. New tokens may only be issued when the supply by current Token Holders is not sufficient for a new consumer to efficiently purchase Deneum electricity and when the Token price is above $20 USD per Token.

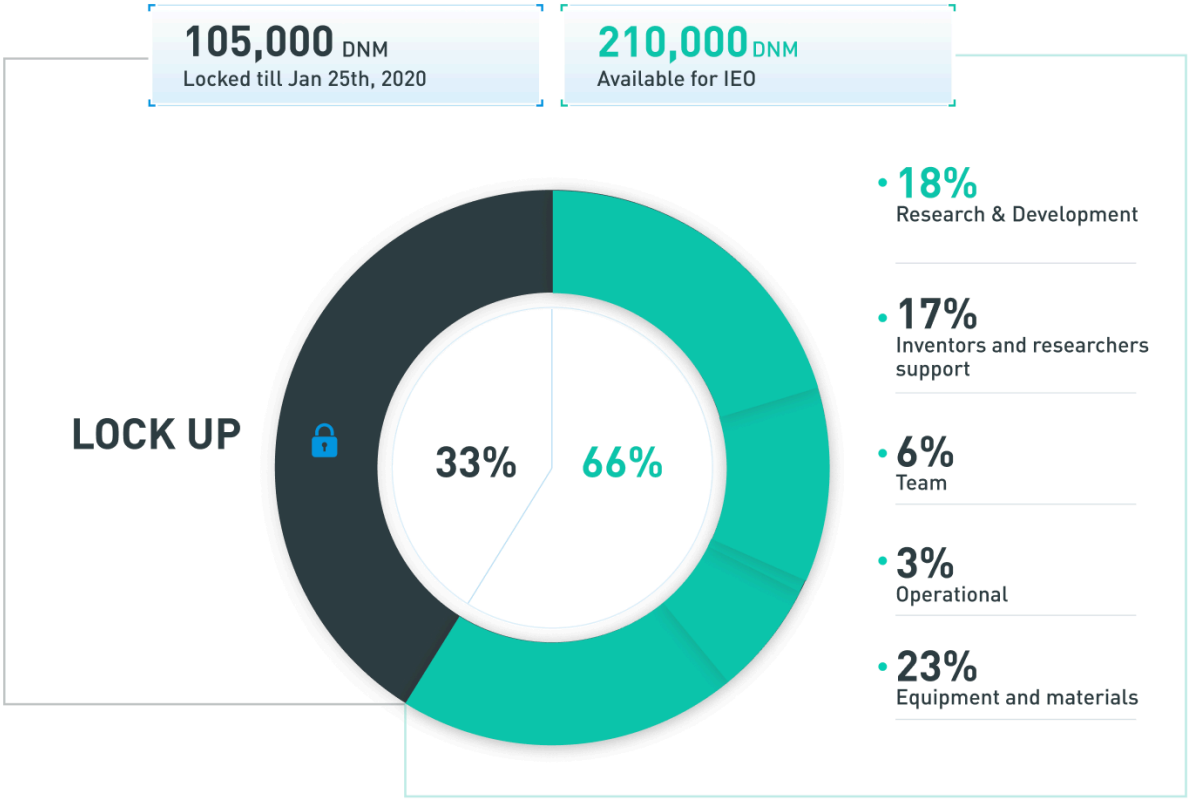
The IEO will take place at livecoin.net crypto exchange.

The IEO company website: ieo.deneum.com.
The main corporate company website: deneum.com.

Bonuses might be offered to early stage and large investors. Information about additional incentives will be published at the official Telegram channel (https://t.me/deneum_chat).

The whole Token Sales campaign will be supported via multiple communications channels, primarily via the official Telegram group (https://t.me/deneum_chat).

OVERALL IEO TOKEN DISTRIBUTION



AFTER LAUNCH	TEAM	RESERVE	PARTNERS	ADVISORS
11,400,000 DNM	2,250,000 DNM	600,000 DNM	450,000 DNM	300,000 DNM

The Team members' Tokens have a two-year lock-up, with four equal six-month vesting periods.
The Advisors' tokens are locked for six months.
The Reserve tokens are locked for 12 months.
During IEO all circulating tokens are locked till December 12, 2019.

USE OF TOKENS

Exchange into electricity

Deneum Tokens (DNM) are the currency consumers use to purchase Deneum electricity. Any consumer will be able to purchase a certain amount of Deneum electricity, which we will physically supply.

The minimum delivery amount is currently 3,000 MWh, or 3,000 DNM. This means that any Token Holder with 3,000 DNM or more will be able to order a Power Station that supplies 3,000 MWh over the course of one year (or a shorter period if the electricity is consumed faster).

In this case, the Power Stations will be owned by us and rented out free of charge to the consumer for one year. After one year, the consumer will have the option to purchase more DNM for the next period; otherwise, the Power Station will be returned to us.

All logistic expenses related to delivery and return of the Deneum Power Stations to and from the consumer are to be covered by the consumer.

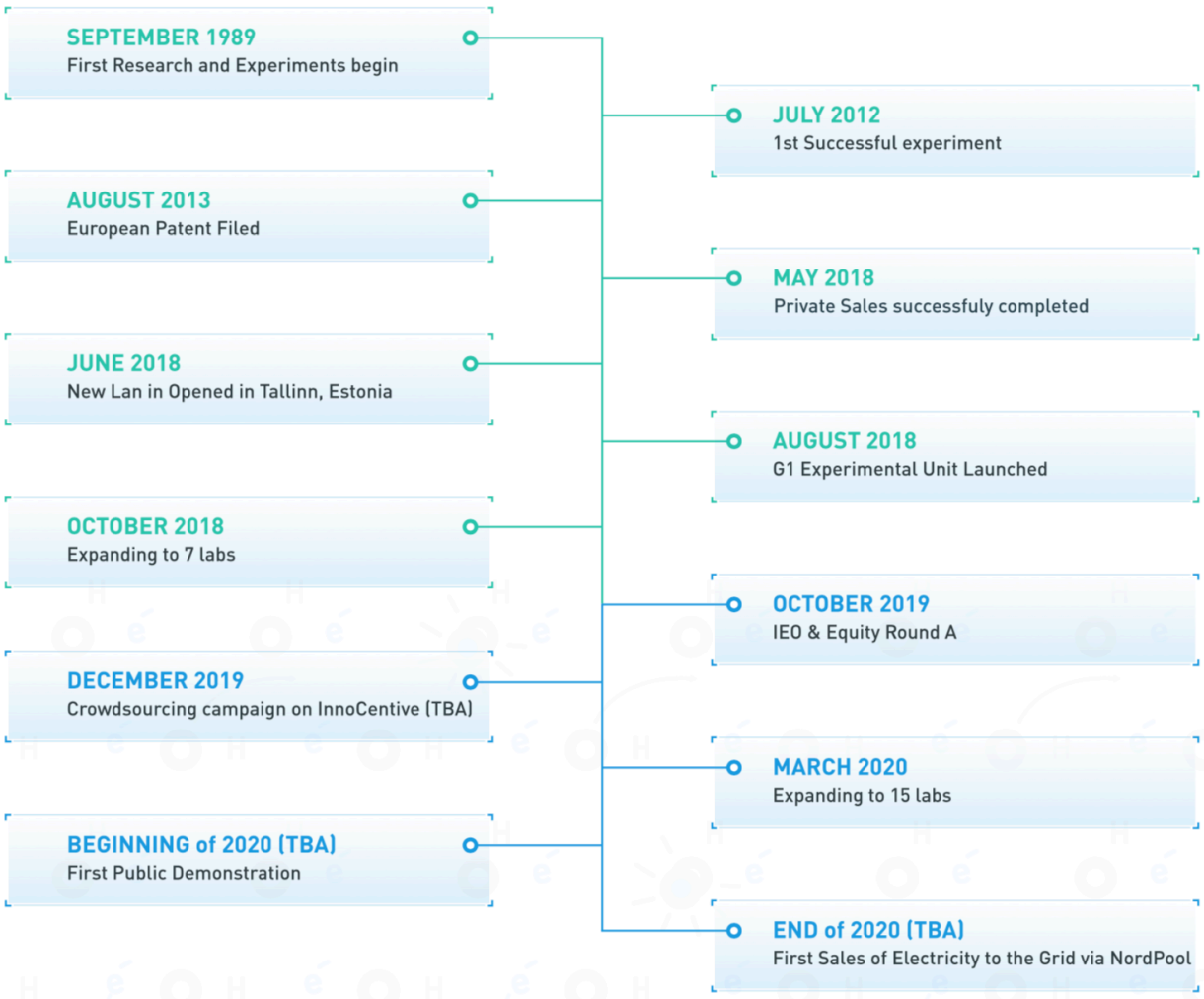
Price Justifying

As the project gets nearer to the launch of initial sales and power supplies, the DNM price will approach the average electricity price in countries within our coverage – an inevitability due to arbitrage opportunities.

Otherwise, anyone can purchase electricity from us and sell to consumers (or to the grid) at a higher price, which will inevitably happen. Over time, increased demand for DNM will be pushing its price higher, closing the price gap between DNM and the average market price.

The average wholesale market price in Northern Europe (where initial sales are likely to happen) is currently around 39 EUR, while the average retail price is around 100 EUR).

ROADMAP


SEPTEMBER 1989
First Research and Experiments begin
AUGUST 2013
European Patent Filed
JUNE 2018
New Lan in Opened in Tallinn, Estonia
OCTOBER 2018
Expanding to 7 labs
DECEMBER 2019
Crowdsourcing campaign on InnoCentive (TBA)
BEGINNING of 2020 (TBA)
First Public Demonstration
JULY 2012
1st Successful experiment
MAY 2018
Private Sales successfuly completed
AUGUST 2018
G1 Experimental Unit Launched
OCTOBER 2019
IEO & Equity Round A
MARCH 2020
Expanding to 15 labs
END of 2020 (TBA)
First Sales of Electricity to the Grid via NordPool

LEGAL

Certain statements, estimates, and financial information contained within this White Paper constitute forward-looking, or pro-forma statements, and information. Such statements or information involve known and unknown risks and uncertainties which may cause actual events or results to differ materially from the estimates or the results implied or expressed in such forward-looking statements.

This White Paper does not constitute an offer to sell or a solicitation of an offer to buy a security in any jurisdiction in which it is unlawful to make such an offer or solicitation.

Personal information received from Token Holders, customers, vendors, employees, and others, including quantities obtained, payments received, account information, etc. may be disclosed to law enforcement, government officials, and other third parties when Deneum is required to disclose such information by law, subpoena, or court order. Deneum will claim no responsibility nor be held responsible for any such information disclosure. The company will not share information unless required by law.

Given that Deneum is a European-owned and -operated company, Token Holders are required to comply with all applicable domestic and any applicable international laws. Deneum does not claim to make any representations regarding legal matters. Consult with your legal professional. The Token Holder is responsible for complying with the applicable laws and regulations that exist now and any subsequent changes to legislation that would apply.

The project is subject to multiple risks, such as:

Regulatory. Creating a Power Station that is tremendously more efficient and cost-effective than any existing technology means that the creators may encounter some resistance or barriers along the way to bringing their product to market. It may be challenging to obtain the necessary certificates for retail sales and/or to get permissions to sell electricity onto the grid.

Financial. Although there are sufficient quantities of the materials needed to produce the Power Station, increased demand could drive up the prices of these materials. The project may encounter the need to hire more staff and/or expand its premises. Prices for electricity could decrease, reducing margins. All this and other risks may impact the initial business plan.

Innovations. As is the case for any company creating a new technology, there are numerous risks associated with being a pioneer. For example, some parts may have to be produced in-house to keep costs down, which will require more time and resources.

External fraud. Token sales are often vulnerable to scam risks, including tokens being stolen. We will take every precaution to prevent such scams.

Price fluctuations. The price of tokens may fluctuate over time. Token Holders may incur financial losses, and profits are not guaranteed.

REFERENCES

1. Global Energy Statistical Yearbook 2017: https://yearbook.enerdata.net/electricity/electricity-domestic-consumption-data.html

2. The Worlds Bank - World Development Indicators: http://www.tsp-data-portal.org/Historical-Electricity-Generation-Statistics#tspQvChart

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

4. Nord Pool: https://www.nordpoolgroup.com/Market-data1/#/nordic/map

5. Fusion Technology Magazine, 1991, Vol. 20, Issue 2, pages 234-238: https://www.researchgate.net/publication/292036859_Laser-Induced_Cold_Nuclear_Fusion_in_Ti-H2-D2-T2_Compositions

EDITS

– **Version 1.22, March 10, 2018.**

– **Version 1.23, August 6, 2018.**
Token Sales: Token sale is held by Deneum OU, the company registered in Tallinn, Estonia, EU.
The Sales stages dates are corrected.

– **Version 1.24, January 21, 2019.**
The Sales stages dates are corrected.
The Roadmap is corrected.

– **Version 1.24, October 21, 2019.**
IEO information is added.
The Sales stages are corrected.
The roadmap is corrected.
The Technology and Experiment is edited.
The Team is upgraded.