Riseon Power Technologies Energy Trading Platform

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Abstract

Energy distribution and trading of tomorrow, today. By implementing cutting edge technology it is possible to completely de-centralize energy distribution, eliminating the omnipresent vulnerability of the so called single point of failure*. Based on three simple but adaptive rules the price of the available energy is determined. One central factor in determining the value of an energy quantum is how compatible that particular packet is with the environment. For instance, an energy bundle which needs to be transported over long distances will be more expensive than one that comes from right next door. Further any energy packet originating from renewable sources is cheaper than any other kind. To track an individual energy quantum, thus preventing double spending, it is timestamped and introduced in a blockchain inspired, distributed public ledger. Monetary compensation to the seller is done on the same principle with a cryptocurrency expecially designed for this task.*

I. Introduction

Energy, especially in its electric form, dictates our lives throughout. Imagine only one single day without any electricity. If you are lucky, you happen to have a fully charged cell phone. But even so, the network provider will be blacked out as well, there won't be any service, no internet, nothing to pass the time, or get any productive work done. People will have to resort to paper and pencil to capture their thoughts, but how can one continue working on that important essay stored in the cloud?

If we think about it, we are more dependent on electricity than we are on anything else, that is, to get our daily business done. A person can go three days without water, but can a successful business go even one day without energy?

Nowadays energy is provided by huge centralized entities, and are regulated by governments. This poses a *single point of failure*. If one entity would suffer from a catastrophic event, an entire region would, at least temporarily, be completely without energy. This is not only true for electricity, but for fossil fuel as well. Not only our daily lives, but also our mobility, all hang on one single thread - about to snap.

The consumption of energy is, almost by definition, highly de-centralized. Every household has its own power tap. There are gas stations scattered throughout the city. But all the threads lead back to this one central entity. It seems only logical to provide the energy where it is needed. What if there is a way to gradually de-centralize production, routing, and storage of energy starting right now?

It is already a proven fact (time and again [1]) that mobility will move away from fossil fuel towards electric energy.

II. The Problem

Electric energy in its form is almost in all cases provided by a central power plant. There are certainly several power generators scattered throughout a sovereign state, but they are always, either directly or indirectly, controlled by governments. What makes mat-

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ters worse, governments trade energy among each other. Some countries value the so called *green* energy, while others simply do not want to make the extra effort to contribute in preserving our planet. Exactly these latter countries sell their dirty, polluted energy to a very low price and then simply buy *green* energy from their neighbours. This *energy laundering* is - in a sense - even worse than money laundering. This very behaviour leads to even higher demands on cheap, dirty energy while hindering the investment in renewable energy sources.

As long as the government has control over the energy market, there is little to nothing the grand public can do. However, it must be in all our interests to counteract this rather disturbing practice. In the very immediate future our electric energy demands will rise exponentially, as it will completely substitute fossil energy sources. Some groups have an interest in denying this fact, however the numbers substantiate the truth time and again.

Directly related to these circumstances is the sluggishness in people adapting renewable energy sources, notably photovoltaic power plants and wind generators. Every single property owner on this planet has the possibility to have their very own power plant, directly tapping into everlasting[1] energy sources.

III. The Solution

There are several steps towards complete decentralization and individual self-sufficiency. First and foremost, energy needs to be harvested, produced, or generated on the spot. That is, many more micro power plants are needed in the sense of privately owned PV[2] systems. Of course this is only the most prominent example, right now it is the economically most efficient way in contributing. Also this technology may be applied in most parts of our civilization, short of the rather scarcely populated polar regions. Other interesting technologies might be hydrodynamic and wind based.

In a next step the distribution needs to be intelligent. There have been several attempts in (partly) realizing this very important aspect. One well known term used in this respect is the *SmartGrid* [2]. However, it is not the grid that must be smart, but the overall implementation and the end-points, be that provider or consumer. By moving towards self-sufficiency, entire regions can become self-contained rendering the necessity of a grid virtually obsolete. The mains grid as we know it today will most likely remain as a means of equalizing certain natural fluctuations. To entirely cope with the power demands of tomorrow, considerable investments in expanding the distribution system would have to be undertaken. If a fraction of this investment is spent on locally strengthening each participant node[3], future demands can be easily met.

Finally there must be a highly automated and distributed mechanism, which allows trading of energy in local sub-grids among producers and consumers. The involved details will be elaborated in section *IV Solution Details*. This trading platform shall be embedded in a self contained ecosystem based on the idea of a distributed anonymous public ledger [3]. In a first step, there will be two ledgers, one keeps track of the available quantified energy packets, the other will record the micro-transactions of the Riseon Power Technologies cryptocurrency[4]. Later the ecosystem can be augmented with other services, such as the possibility to spend *RPTcoins* on different means of transportation. The entire topic of individual vs. public transportation will be addressed in a separate paper, directly building upon the foundation laid out here.

IV. Solution Details

The energy is quantified in packets which cannot be further divided into yet smaller units called a *quantum*. For technical reasons the smallest measurable packet of energy is defined to be one Watt Hour [Wh], which is equivalent to 3600 Joules. One Joule corresponds to 0.239006 Calories. A Calorie is

[1] by human standards

[2] **p**hotov**o**ltaic

[3] That may be an energy provider, an energy consumer, or a mixture of both

[4] RPTcoin

defined as the amount of energy needed to increase 1 gram (1ml at STP[5]) of water by 1°C. These quanta of energy can be traded among producers and consumers. However, in contrast to the classic scheme, the price of the energy is not pre-defined by a constant over a given period of time. The price is calculated per quantum at the time of transaction, and is governed by these three simple rules:

1. the further the quantum needs to travel, the more expensive it is
2. the older a given quantum is, the more expensive it is
3. energy produced by renewable sources is always cheaper than energy produced by conventional (fossil) means

Rule number one ensures that the energy is preferably absorbed in close proximity of where it has been produced. Rule number two sees to it, that energy is produced when needed or is consumed when it is available. Rule number three may actually also apply to stored energy. It implies that even if energy reaches a certain age, it will always be cheaper than presently available energy from polluting sources.

Now that the quantization and cost computation is established, energy can be thought of as some concrete thing that can be produced[6], transported, stored, and consumed. The possible life cycles are visualized in figure 1. There are basically two logical locations where energy should be stored, either at the site where it is produced, or at the site where it will eventually be consumed. If the storage facility were somewhere in the middle, it would mean that there is a central point in the system which generates unnecessary fees[7]. Furthermore, whoever operates this storage facility would have control over the providers as well as the consumers connected to it. Why does energy need to be stored, when the second rule clearly advises against it?

To answer this question, let's consider the example of PV energy. It has a rather interesting property in regard to its availability. In general it can only be harvested during daytime and is in quantity directly proportional to the position of the sun in relation to its local celestial meridian. In other words, from dusk to mid-day there is an increase of energy-availability to its maximum and then again a decrease to zero until dawn[8]. On top of that there are the rather unpredictable effects of the local weather. In short, PV energy is either available or not, there is no reliable way to determine how much can be provided at a specific point in time. This entails the incorporation of some kind of energy storage system.

Finally let's consider the second rule, which states that the older an energy quantum gets, the more expensive it is. This might be counter intuitive, because it basically states that a good sales person will stock energy to the rafters, let it age like a good bottle of wine and then sell it to the highest price possible. However, there is more to it. Energy is constantly needed and there is no difference in quality whether a buyer purchases old or new energy. So the buyer naturally chooses to acquire the cheapest energy quanta on the market. There are several advantageous scenarios for the consumer. Ideally the consumer produces their own energy, that way there are no costs involved at all. Obviously, this is not always possible[9], so the next best thing is to get the energy from someone else at the exact instance when the seller produced the energy. This minimizes costs according to rule number two. Rule number three motivates the buyer to choose someone who can offer renewable energy. The producer should not be too far away, otherwise costs rise as dictated by rule number one. Coming back to the somewhat central second rule, it makes most sense to store energy where it will eventually be consumed. That way a consumer can choose to buy the cheapest, thus most environmental friendly, energy. If the acquired quanta age at the location where they are eventually used, the second rule will not have a negative effect on the expenses. Figure 2

[5] Standard conditions for temperature and pressure

[6] in this context *to produce* can also mean *to harvest*

[7] construction and maintenance

[8] There are several ways to counteract this bell-shaped energy profile. The easiest approach is to orient half the PV field towards east while the other half faces west. Another example is the solar tracking system.

[9] for example due to the limitations of one's power plant

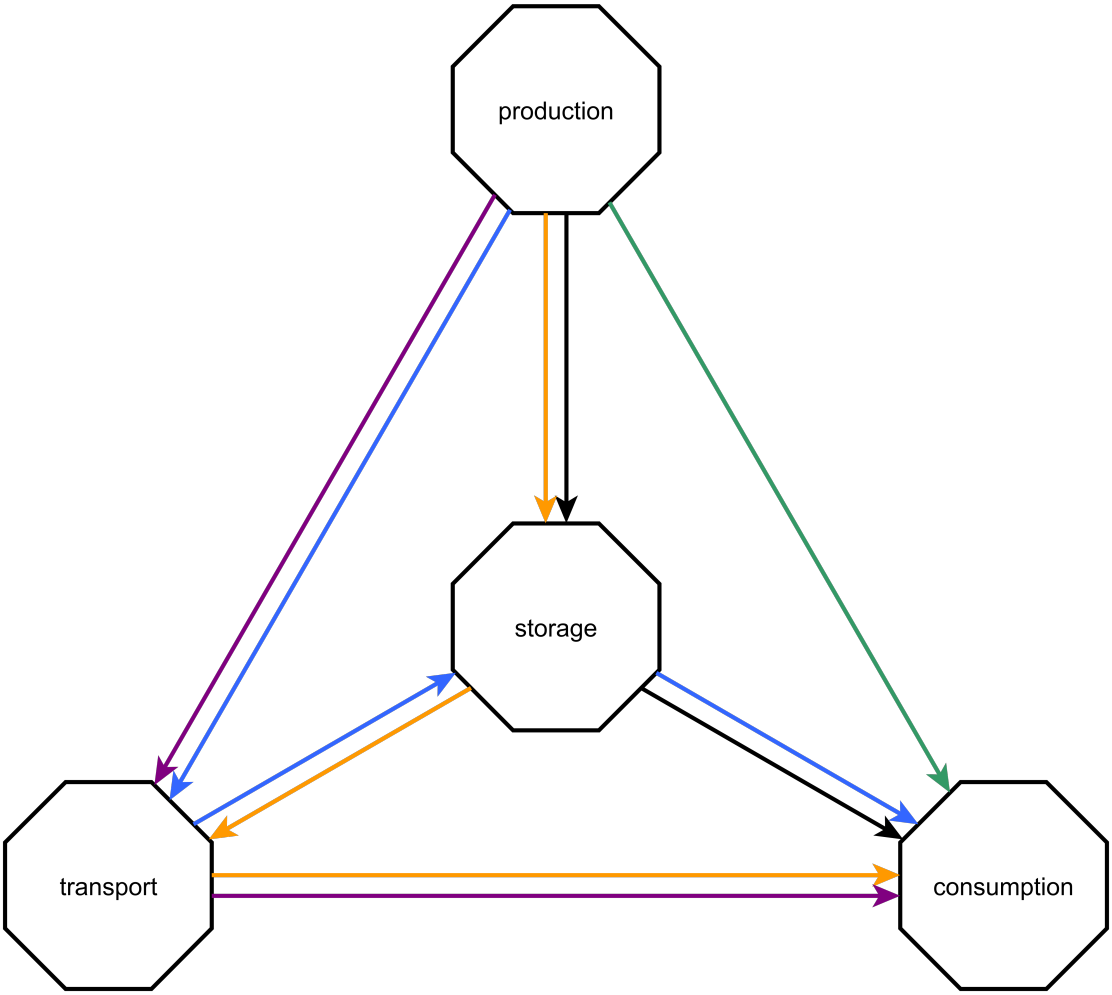

Figure 1: *Life cycles of an energy quantum. Each color depicts a full cycle from production to consumption through possible intermediate states.*

visualizes the impact of each rule.

Putting all this together, one reaches the conclusion, that the ecosystem is most efficient when energy is produced at the same location where it is consumed. If the production rate (or for that matter the rate of consumption) greatly fluctuates, it makes sense to also store the energy at the very same location.

V. Business Benefits

Because electric energy nowadays almost always has to be bought by some government controlled entity, we propose a completely independent trading market place where all participants can freely exchange energy quanta for cryptocurrency (RPTcoins). That is why the trading platform can immediately be deployed and run in parallel to any existing imposed business model. People would be able to gain RPTcoins by selling their harvested energy quanta and they could spend them for extra energy in case it is needed. In a next step the market place would be extended to additional services such as transportation. The generated RPTcoins can be spent to travel from A to B. It is even imaginable that currency may be earned by providing a means of transportation, whatever form that may be.

The RPTcoin, unlike any other cryptocurrency, cannot be mined, this will ensure stability of the currency. The value of the coin is assumed to be constant, only the price of the goods varies depending on well defined factors such as availability. For instance, at any given point in time it is possible to exactly determine the amount of energy quanta available. Since the number of coins in the ecosystem remains constant, it is very easy to see that the energy quantum's value can be determined as follows:

$$energy_{value}(t) = \frac{\sum coins}{\sum energy(t)}$$

Another important consideration is that an energy quantum has a finite lifespan, as demonstrated in figure 1. Though theoretically one individual quantum could exist indefinitely inside a storage device, this would mean it became infinitely expensive according to the second rule.

VI. Summary

Our future depends greatly on the lingering question on how to solve the energy problem. Unfortunately the problem is not yet a crisis and thus eludes the grand public. We, as the inhabitants of earth, are forced to move away from fossil fuels and find alternative sources more in line with the environment. There are many political aspects which greatly hinder advances in this field. By gradually decentralizing one form of energy - electricity - the power is shifted away from governments and central entities. It is possible to slowly regain control over the energy situation and all this with a minimal investment of each and every one of us. By steadily building up distributed power plants tapping renewable energy sources and by decreasing distances between production and consumption it will be possible to stabilize and even enforce energy availability for the future.

One way to get there is to enable the people to choose from where they want to buy energy, guided by three simple and transparent rules which define the price at any given instance in time. To make this possible, it is necessary to implement a de-centralized trading system with its own cryptocurrency. Trading ledgers are based on the original idea of blockchains, but with some substantial modifications to overcome the well known limitations [4]. There are no transaction fees of any kind and the need for miners is completely eliminated.

VII. Call to Action

Many of the needed hardware components have already been developed or are in the active development phase. The entire data gathering equipment necessary to track energy quanta has been in beta testing for roughly two years already. However, to finalize development and kick-start production of the hardware, as well as fine-tuning software components, additional funding is needed.

To this end *Riseon Power Technologies AG* will shortly launch an ICO[10], where you will have the once in a lifetime opportunity to

[10] Initial Coin Offering

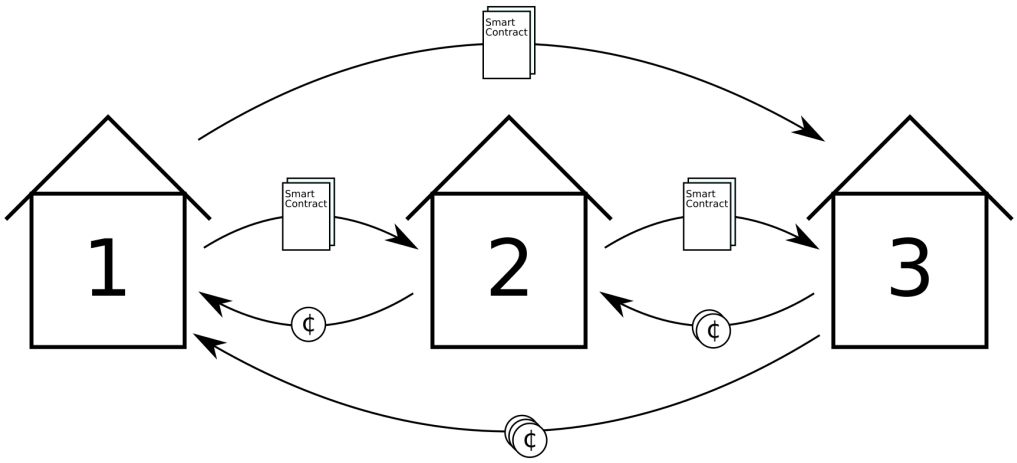

Figure 2: *Producer 1 sells the energy at the moment of production to consumer 2, this is the cheapest energy 2 can get from an external seller, because 1 is geographically closest. 2 has a huge battery pack and thus is able to store some of the energy and resell it to 3 at a later time, that is why 3 has to pay more than 2 had to pay when buying the energy from 1. 3 has to pay even more if the energy is bought directly from 1 because the geographic distance plays an important role. For simplicity the case where a producer consumes its own energy is not shown here, that energy is virtually for free and thus does not show on the public ledger.*

stock up on the brand new *RPTcoin*. This will be your equity to immediately start trading for energy quanta once the first decentralized systems go live. Check back regularly on our web page (www.riseon.ch) for details about the coin offering.

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