# 2. Literature review

The term ‘Blockchain technology’ refers to distributed databases with consensus algorithms that contain cryptographically concatenated data structure on which applications are built. The disruptive element is the ability to maintain a database that is shared in which everyone has access to all of the data however no one party has the ability to take over total control or perform modifications. Blockchain is essential when trust needs to be established without a central authority and value needs to be transferred between stakeholders.

We find that for EWZ, being the central authority, which establishes trust, having a blockchain is not essential for storing virtual energy from users that produce sustainable energy. EWZ should use a business model like the one used by eon to store solar/wind energy produced by charging the producers a fixed rate and sell the energy for a profit. However, we see that blockchain has a potential application in the heavily regulated power industry (eg. certificates) when both utilities and consumers will produce and sell electricity. Blockchain could in that case offer a reliable, low-cost way for financial or operational transactions to be recorded and validated across a distributed network with no central point of authority.

Since sustainability has been ranking higher than ever before on the global agenda of companies and governments alike, there have been considerable research and development on renewable sources of energy. The energy system will become more decentralized and versatile wind turbine parks and household solar panels are a growing trend in the generation of electricity and primary energy in general. This transition towards renewable energy means that energy production will become unpredictable and intermittent due to weather dependency associated with solar and wind energy, and hence requires long/short term demand-supply balancing.

The idea is that by creating a distributed marketplace powered by employing a blockchain consensus Blockchain technology could offer a way to circumvent this problem by providing a neutral ground where all the parties can operate on a shared platform, on completely equal footing. Instead of the platform provider like EWZ, BKW being the dominant player to the power of whom all others must submit, blockchain technology could enable all the participants to produce a platform together in a distributed manner, without having to trust each other in almost any capacity. Some earlier use case concepts have been drafted which focus on allocating distributed renewable energy resources between neighboring households using blockchain technology. For example, in New York state, [neighbors are testing their ability to sell solar energy to one another](http://brooklynmicrogrid.com/) using blockchain technology (Brooklyn-microgrid). In Austria, the country’s largest utility conglomerate, Wien Energie, is [taking part in a blockchain trial](https://www.wienenergie.at/eportal3/ep/contentView.do/pageTypeId/67831/programId/74495/contentTypeId/1001/channelId/-53365/contentId/1801137) focused on energy trading with two other utilities. Meanwhile in Germany, the power company Innogy is [running a pilot](https://innovationhub.innogy.com/news-event/2isB4LLzhKwwi4MiagAa46/blockchain-car-payments-at-ces) to see if blockchain technology can authenticate and manage the billing process for autonomous electric-vehicle charging stations. Another example is PriWatt, which is a token based energy trading system that allows to trade energy in a peer-to-peer network without a central price signal. The prosumer uses photo-voltaic panels harvests solar energy and makes profit by selling the generated energy surplus to the other smartgrid consumers. In a conventional power grid, energy prices are determined by a central authority like EWZ, BKW. In a smartgrid, agents are allowed to negotiate energy prices, hence creating a dynamic market of energy trade. Such a market-based energy trade decreases dependency of agents on a central energy provider, as energy supply and demand are matched directly between individual agents, resulting in a more decentralized and competitive environment. PriWatt satisfies this requirement and enables peers to anonymously negotiate energy price and securely perform trading transaction.

In our opinion although we might think that blockchain may at first appear to be a form of technological disruption that the power industry should avoid, it could prove to be the solution that is required to keep up with evolving demand for electricity. Established utilities like EWZ are best placed to evaluate and make strategic bets on blockchain technology’s potential applications. If EWZ can seize the moment, they may turn out to be the true disruptors, and usher in a new era of decentralized power.