Exposé on the Thesis for obtaining a doctoral degree (Dr.in iur) at the University of Vienna

The Transformation of the European Energy Industry through Digitalisation

(*Working title*)

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1. Table of Contents

2. Introduction

Throughout the last decades an increasing number of revolutionary digital technologies have arisen. No scientific field has changed faster and more fundamental than computer sciences. One of the newest and most important recent developments is digital ledger technology (DLT), a data structure handling digital assets. The first DLT, the blockchain, was used in the protocol of the cryptocurrency Bitcoin[1] and it was soon determined that blockchain technology has a wide range of possible applications. Lately, several nations carried out first tests to use DLT[2] as support of state administration (land registry, commercial register, tax systems). Furthermore, blockchain technology already changed the financial industry, such as banks and insurances. However, also the energy sector has a high interest in possible applications.

The European power industry has grown over a long time and has always been a primary driver for economic success as most European areas are heavily reliable on stable electric supply. Therefore, this whole industry is heavily regulated, to guarantee affordable prices and high electricity coverage at any time. Due to the rising awareness of environmental issues, the field is changing to produce cleaner, more sustainable and more efficient energy. Especially in Austria, the end of nuclear power became a major part of the political agenda and decentralised energy supply started to replace centralised power plants. These strong movements resulted in international, as well as national, energy law to be adapted comprehensively, fundamentally changing parts thereof.[3] This was owned to the European Union pushing forward agendas such as the reduction of carbon dioxide emissions, the use of renewable energy sources and the reduction of energy consumption manifesting them in EU law.[4] Throughout the EU, regulations and guidelines have been adapted transferring those goals to national legislation.[5]
Although digitalisation is transforming the energy sector rapidly, supply reliability as well as energy security are still major aspects of the European energy policy.

New technologies, in particular blockchain technology, are hoped to balance the variety of interests efficiently, fairly and effectively by coordinating distribution, production, storage and

[1] BitCoins and therefore the underlying blockchain technology were developed in 2008 by Satoshi NakamotoSince then, more than 700 different crypto currencies have been developed. Those differ in the level of anonymity, (de)centralisation or level of encryption.
See also: <https://bitcoin.org/bitcoin.pdf> accessed 03 January 2018.

[2] Sweden started a review on the applicability of blockchain on land registry administration in March 2017,
Pete Rizze, 'Sweden's Blockchain Land Registry to Begin Testing in March' (coindesk 10 Janary 2017)
<http://www.coindesk.com/swedens-blockchain-land-registry-begin-testing-march/> accessed 03 January 2018;
Estonia is offering E-residencies and other administrative services via blockchain: <https://e-estonia.com/> accessed 03 January 2018;
Additionally: Tan Wee Kwang, 'How are governments using blockchain technology?' (enterpriseINNOVATION, 14 March 2017)
<https://www.enterpriseinnovation.net/article/how-are-governments-using-blockchain-technology-1122807855>.

[3] See e.g.: Conference of the Parties to the United Nations Framework Convention on Climate Change, 'Paris Agreement' (2015) UN Doc C.N.63.2016.TREATIES-XXVII.7.d;
also: the EU climate change action plan < https://ec.europa.eu/clima/policies/eccp_en> accessed 03 January 2018.

[4] The European Union emphasises in it 2020 strategy sustainable growth, with a main focus on the reduction of greenhouse gases, fostering renewable energy and energy efficiency: European Commission 'COMMUNICATION FROM THE COMMISSION: EUROPE 2020 A strategy for smart, sustainable and inclusive growth' (2010) COM(2010) 2020.

[5] e.g. Austria: Energy Efficiency Act (Bundesgesetz über die Steigerung der Energieeffizienz bei Unternehmen und dem Bund, EEffG) BGBl. I Nr. 72/2014,
Germany: Federal Immission Control Act of Germany (Gesetz zum Schutz vor schädlichen Umwelteinwirkungen durch Luftverunreinigungen, Geräusche, Erschütterungen und ähnliche Vorgänge, BImSchG) BGBl. I 2017/2771.

consumption. Faster and more precise calculations during the energy trade process may lower the costs for balancing energy. New ways of energy distribution and supply are already implemented and grid systems are increasingly replaced by smart nets. From smart meters, intelligent measuring to Smart-Home-Products, the field of application of new "intelligent" technology seems endless. Various actors from outside the sector such as classical software providers will come into power. Mature companies and organisations will be obliged to adopt their services and products to compete with new emerging platforms. Even though those technologies may bring a variety of economic opportunities and solve demographic and energy transition issues, their application raises legal uncertainty and security issues. Since law has a reactive character and gives answers to social questions, lawmakers are usually not prepared for rapid developments that bring ample changes.

This thesis will discuss the variety of possible application of DLTs in the energy sector and give an overview on the technical and legal background, necessary to face the specialties of this sector. Due to the specific requirements (for example physical barriers of energy connection and transport) of the energy industry, blockchain technology may face more barriers and challenges than in other economic sectors (e.g. bitcoins). Even though blockchain technology is quite young and suffers from a multitude of barriers and realisation problems, several promising projects emerged.[6] Big energy companies, as well as individuals, may use this technology to supply energy by using blockchain based "smart contracts" that change the way electricity is distributed. For example, several startups have emerged developing new possibilities to recharge electric cars more efficiently and without intermediary.

3. Research Topic

The thesis aims to answer the following questions:

> *Which regulations for blockchain technology are necessary to establish a fair, secure and efficient legal regime*
>
> a. *in the case of blockchain applications within the European electricity industry especially for efficient production, transport and supply of energy,*
> b. *with regards to blockchain based, decentralised community supply projects*
>
> *to foster sustainable energy economy and to guarantee a balance of all interests influenced by the European energy market.*

The focus will lie on the evaluation of European Union Law as well as of the national law of selected member states, focusing on Austrian public law. Furthermore, a comparison with other national and international legal regimes will be provided as blockchain technology is a cross border, non-territorial phenomenon.

The dogmatic focus of this thesis and the analysis of the research question will lie on the definition of legal terms.

[6] e.g. Brooklyn Micro Grids: Hubertus Breuer, 'New York neighbours power up blockchain-based Brooklyn Microgrid' (silicionrepublic 27 September 2017)
< https://www.siliconrepublic.com/machines/brooklyn-microgrid-blockchain-energy-networks > accessed 03 January 2018;
The Dutch Transmission Grid operator TenneT started pilot projects in Germany and Netherlands using blockchain solution: <https://www.tennet.eu/our-key-tasks/innovations/blockchain-technology/> accessed 03 January 2018;
Scanergy develops blockchainbased solutions for energy trading between prosumers < http://scanergy-project.eu/> accessed 03 January 2018.

To evaluate the applicability of several relevant legal regulations, their scope has to be defined. Therefore, it is important to examine decisions and opening cases of European courts as well materials during the law making process in a comparative way.

4. Motivation

Energy consumption increases at a rate of 2% per year in Austria[7], which is why an efficient and stable energy market was never more important. Blockchain technology is increasingly used to distribute energy between private electricity producers, consumers and energy producing companies.[8] In particular, load flow and consumption calculations as well as faster processes at the energy exchange may support the expansion of renewable energy sources. As current national and international regulations do not cover the application of these technologies in the energy sector uncertainties arise. Consequently, investors as well as startups or private parties avoid using blockchain technology.

Furthermore, blockchain technology supports the emerging of decentralised structures of the energy market as the European energy market is currently unable to target climate change and environmental issues sufficiently while fulfilling the needs of customers. Therefore, energy sources for individual production were promoted and sponsored in recent years.[9] Besides photovoltaic power plants, small wind turbines, hydropower and biomass power plants are operated by individuals, families or small communities. Originally thought for self consumption, many of those energy sources now feed into public grid. A few, so called micro grids emerged based on blockchain technology, like the Brooklyn Micro Grid[10] project or the Island Grid project in Wildpoldsried (Germany)[11]. Those projects have entirely different problems to deal with than trans-regional electricity supply, such as temporary local lack of resources (e.g.: lack of sun, wind or water flow).

Even though some state entities experiment with blockchain technology, legal aspects are usually not considered. However, new technologies contain chances but also risks for individual persons, enterprises and/or the society. Due to the rapid change in the field of computer science, the current applicable law is not anymore able to ensure that these technologies cannot be exploited to avoid damages. Regulations do not target blockchain technology sufficiently or may not be executed effectively. Therefore, it is necessary for the current national and European legal framework to be adapted in order to limit and regulate the application of blockchain technology to guarantee all parties to act under fair, secure and efficient conditions to foster a sustainable energy economy.

[7] Oesterreichs Energie, 'Daten und Fakten zum Stromverbrauch' <https://oesterreichsenergie.at/daten-fakten-zum-stromverbrauch.html>

[8] supra note 7.

[9] e.g. funding in Austria is organised by the Kommunalkredit Public Consulting GmBH <https://www.umweltfoerderung.at/> accessed 03 January 2018.

[10] supra note 7.

[11] TenneT, Sonne, 'Europe's first blockchain project to stabilize the power grid launches: TenneT and sonnen expect results in 2018' (Press release, 2 November 2017) <https://www.tennet.eu/fileadmin/user_upload/Company/News/German/Hoerchens/2017/20171102_PM-Start-Blockchain-Projekt-TenneT-sonnen_EN.pdf> accessed 03 January 2018.

5. Structure

As different as the blockchain applications are, as different are the legal challenges they face, which is why this thesis will focus on two broad aspects of blockchain application:

The first aspect will be the application of blockchains for energy distribution and trade between organised energy suppliers.[12] Some renewable energy sources, in particular wind and photovoltaic facilities, are strongly dependent on weather conditions, which is why a sustainable, efficient and diverse mixture of energy sources and a fast exchange between energy providers is essential. Furthermore, the European transmission grid is not sufficiently expanded to limit short and long-term congestions, which cause the redispatch of energy mainly produced by renewable energy sources.[13] The financial loss every year is immense and can be reduced by faster and more precise energy input controlling supported by blockchain technology. Additionally, the European energy exchange would benefit from data coming directly from energy suppliers to generate fairer and more efficient pricing methods.

The second aspect will focus on the steadily growing influence of local and community energy producers with respect to new technology. The European electricity grid was built for centralized large (fossil or atomic) power stations, which creates technical as well as legal barriers for the emergence of decentralised power production.

Both aspects will be described using the following structure: The rapid developments of emergent digital technology have to be supported by a legal framework to guarantee a safe, efficient and non-discriminatory use. Due to the revolutionary character of blockchain technology, it is highly questionable that current regulations are applicable and form a sufficient framework. This insecurity inhibits the emergence of these businesses and so delays the change to a sustainable energy economy. Therefore it is necessary to find whether the relevant existing laws can be applied to blockchain technology and whether they form a sufficient legal framework for new technologies. As a consequence, it is important to analyse which specific norms are supporting or opposing the application of blockchain technology in the energy market.

At the moment, the use of blockchain is accompanied by a high amount of legal uncertainty which blocks an efficient use and further development of these new technologies. However, due to the significant impacts distributed ledger technologies have on the rights and freedoms of individuals, companies, and state entities, it has to be examined to which extend the application of these technologies is preferable to the current solutions. Using recent judicial history, relevant goals and principles of legal understanding such as the balance between the needs of enterprises, consumers and the public economy as well as environmental sustainability, grid security and public welfare, will be defined. Different possible regulative scenarios reaching some or all of these goals will then be portrayed and compared.

[12] The term „organised energy supplier“ does not indicate the existence of a specific legal entity, such as a GmbH. or Ltd. but covers all organisations different from individual producers and community projects.

[13] Agency for the Cooperation of Energy Regulators, ‘Implementation Monitoring Report on Contractual Congestion at Interconnection Points – Period Covered 2016’ (2017) 3.

6. Suggested Bibliography and References

a. Books

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Aichele Christian, Oliver D. Doleski, Smart Market: vom Smart Grid zum inteligenten Energiemarkt (1st edn, Springer Fachmedien Wiesbaden GmbH 2014).

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Primavera de Filippi, 'Bitcoin: a regulatory nightmare to a libertarian dream' (2014) 3 Internet Policy Review 2.

Stefan Höltinger, Johannes Schmidt et al., 'Austria's wind energy potential – a participatory modeling approach to assess socio-political and market acceptance' (2014) Energy Policy 98, 49.

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Jordan Murkin, Ruzanna Chitchyan, Alastair Byrne, 'Enabling peer-to-peer electricity trading' (4th International Conference on ICT for Sustainability, Amsterdam, August 2016)

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c. Internet Sources

Estonian E-Governant: <https://e-estonia.com> accessed 03 January 2018.

EU climate change action plan < https://ec.europa.eu/clima/policies/eccp_en> accessed 03 January 2018.

Kommunalkredit Public Consulting GmBH <https://www.umweltfoerderung.at/> accessed 03 January 2018.

Scanenergy: <http://scanergy-project.eu/> accessed 03 January 2018.

TenneT: <https://www.tennet.eu/our-key-tasks/innovations/blockchain-technology/> accessed 03 January 2018.

d. Legislation, Documents and Jurisdiction

Agency for the Cooperation of Energy Regulators, ‘Implementation Monitoring Report on Contractual Congestion at Interconnection Points – Period Covered 2016’ (2017).

Conference of the Parties to the United Nations Framework Convention on Climate Change, ‘Paris Agreement’ (2015) UN Doc C.N.63.2016.TREATIES-XXVII.7.d.

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7. Time Table

14 W- 16S	• mandatory courses:
	  ○ VO, Legal Methods
	  ○ SE/KU, Judicature analysis/text analysis
	  ○ SE, Seminar for doctoral candidates in the field of doctoral theses
	  ○ SE, Seminar for doctoral candidates

17 W	• writing a draft version of the exposé • SE, Seminar for the presentation and discussion of doctoral

	projects • research of rulings and literature • regular meetings with supervisor
18S	• writing the final version of the exposé • publication of the exposé • at the SCC website • research of rulings and literature • regular meetings with supervisor
18W	• regular meetings with supervisor • writing a draft version of the thesis • elective courses
19S	• regular meetings with supervisor • redrafting of the former version of the thesis • elective courses
19W	• finalizing the thesis • final meeting with supervisor • presentation (defensio)

8. Approbation

This exposé and its content (especially the working title and the research topic) are approved by the supervisor.

Date/Signature of the Supervisor

Date/Signature of Student