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The Linkages Between Government and Utility Strategies in Indonesia Electricity Sector in Supporting the Electricity Network Organization Towards the implementation of Electricity Regionalization

Wildan Fujiansah

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Supervisors:

Dr. Maarten J. Arentsen.

Imke Lammers, M.Sc

Faculty of Behavioral, Management, and Social Sciences

Institute for Innovation and Governance Studies/CSTM

University of Twente

Drienerlolaan 5, 7522 Nb Enschede

The Netherlands

PREFACE

The idea of this research is initiated based on my professional background carrier as the government official in the Directorate General of Electricity, Ministry of Energy and Mineral Resources. Through the scholarship from my Ministry also I could reach my dream to study for my master degree in the Netherlands. Studying abroad in the Netherlands have given me a lot of new knowledge and experience for me to bring it home and share it to all of my family and colleagues.

I also would like to take this opportunity to acknowledge everyone that have supported and helped me to complete this research. First of all, I would like to express my gratitude for my first supervisors, Dr. Maarten J. Arentsen, for the help, comments, advice, and valuable scientific research guidance and writing feedback. Also for my second supervisors, Imke Lammers M.Sc, for the help in comments and feedback for the research project. The support from my family also means a lot to me. Thank you to my mother and father for the prayers and their support when they visited me in the Netherlands. For my wife and children, thank you for the support and understanding, you are the motivation for me to finish this research project within the time framed. Last but not least, I also want to say thank for all the people in the MEEM, especially for the program coordinators, Hilde and Rinske, who helps me a lot in the administration process.

Finally, this research is one of the stepping stone and the beginning of my next long journey ahead. This research is only set of words with analysis and findings, but the most important things to do is to implement it in the actual condition, which is will be a lot of challenges wait. I truly hope this research could be used as the inspiration for Indonesia to improve the electricity organization structure in the future. Let’s hope for the better future in the Indonesia electricity sector.

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LIST OF ACRONYMS

ACM	Autoriteit Consument and Markt - Authority for Consumers and Markets
AG	Aktiengesellschaft - Corporation limited by share ownership
BAPPENAS	Badan Perencanaan Pembangunan Nasional - National Planning Agency
BKPM	Badan Koordinasi Penanaman Modal – Investment Coordinating Board
BMWi	Bundesministerium für Wirtschaft und Energie - Germany Federal Ministry for Economic Affairs and Energy
BNetzA	Bundesnetzagentur – German Federal Network Agency
BritNed	Great Britain-the Netherlands
B.V.	Besloten Vennootschap – Limited Company
CA	Consumer Authority
CASC-EU	Capacity Allocation Service Company European Union
CNES	Centre national d'exploitation du système électrique – France National System Control Centre
CRE	Commission de Regulation de l'Energie – France Energy Regulatory Authority
DJK	Direktorat Jenderal Ketenagalistrikan - Directorate General of Electricity
DNO	Distribution Network Operators
DTe	Dienst Uitvoering en Toezicht Energie - The Dutch Office of Energy Regulation
DSO	Distribution System Operators
EC	European Commission
EDF	Électricité de France – France electricity utility company
EDF SEI	EDF Systemes Energetiques Insularies – EDF subsidiary
EDM	Electricite de Mayotte - semi-public utility in Mayotte, France
EEG	Erneuer-bare-Energien-Gesetz - Germany Renewable Energy Act
EnBW	Energie Baden-Wurttemberg
ERDF	Electricité Réseau Distribution France – France electricity distribution company
EU	European Union
E.ON	European Holding Company for Electricity Service Providers
FCA	France Competition Authority
GDP	Gross Domestic Products
GmbH	Gesellschaft mit beschränkter Haftung - company with limited liability
GOI	Government of Indonesia
GW	Giga Watt
GWh	Giga Watt Hour
IDR	Indonesian Rupiah's
IEA	International Energy Agenc
IPP	Independent Power Producers
ITO	Independent Transmission Operator
ISO	Independent System Operator
JTM	Jaringan Tegangan Menengah - Medium Voltage Network
JTR	Jaringan Tegangan Rendah – Low Voltage Network
Kmc	Kilometers Circuit
kV	Kilo Volts
LDC	Local Distribution Company
MW	Mega Watt

MWh	Mega Watt Hour
MEMR	Ministry of Energy and Mineral Resources
NMa	Nederlands mededingingsautoriteit - the Netherlands Competition Authority
N.V.	Naamloze Vennootschap - Limited Liability Company
OECD	Organisation for Economic Co-operation and Development
OPTA	Onafhankelijke Post en Telecommunicatie Autoriteit - The Netherlands Independent Post and Telecommunication Authority
OU	Ownership Unbundling
PT	Perseroan Terbatas – Limited Company
PLN	Perusahaan Listrik Negara - Indonesia's National Electric Company
PLTA	Pembangkit Listrik Tenaga Air – Hydro Power Plant
P3B	Pusat Pengaturan dan Penyaluran Beban - Transmission and Load Dispatching Center
PPA	Power Purchase Agreement
PPU	Power Private Utility
PSO	Public Service Obligation
RAP	Regulatory Assistance Project
RUKN	Rencana Umum Ketenagalistrikan Nasional - General National Power Plan
RUPTL	Rencana Umum Penyediaan Tenaga Listrik – Business Plan for Electricity Provision
RTE	Réseau de Transport d'Électricité – France electricity transmission company
RWE	Rheinisch-Westfälisches Elektrizitätswerk - Rhine-Westfalia Power Plant (German electric utilities company based in Essen, North Rhine-Westphalia)
SME	Small and medium-sized enterprises
SMI	Small and medium-sized industries
SOE	State-Owned Enterprises
Sumbagut	Sumatera Bagian Utara - Northern Part of Sumatera
Sumbagsel-teng	Sumatera Bagian Selatan dan Tengah - Southern and Middle Part of Sumatera
Sulbagut	Sulawesi Bagian Utara - Northern Part of Sulawesi
Sulselbar	Sulawesi Selatan dan Barat - Southern and Western Part of Sulawesi
SUTET	Saluran Udara Tegangan Ekstra Tinggi - Extra High Voltage Network
SUTT	Saluran Udara Tegangan Tinggi - High Voltage Network
SWE	Southern West Europe
TSO	Transmission System Operator
TURPE	Tarif d'Utilisation des Réseaux Publics d'Electricité - Public Transmission User Tariff in France
TWh	Terra Watt Hour
UK	United Kingdom
VIU	Vertically Integrated Undertaking

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ABSTRACT

Electricity industry around the world is having a global trend of reform, in order to make the industry more effective, efficient, and competitive. However, in some countries, electricity still presumed as goods that should remain have heavily state intervention on it, mainly for the economic and political reason. Traditionally, electricity networks or grids is one of the function in electricity structure that considered as natural monopolies. Nevertheless, presently there are some transforming features in the organization of electricity industry, through liberalization process to introduce competition particularly in the electricity networks. Indonesia also reforms their electricity industry based on new Electricity Law No. 30 the year of 2009, which give the opportunity to regional government and other entities beside the National Electricity Company (PLN) to participate in the electricity provision in Indonesia. One of the reforms that currently implemented is the regionalization of electricity, which for now is only limited to the organization structure of PLN. One of the possibilities in the future is to implement the regionalization of the electricity grid in Indonesia. Thus, the organization and regulation of electricity grid become prominent to support the regionalization of electricity in Indonesia.

Therefore, this research will look for the possibilities to implement the regionalization of the organization of electricity grid in Indonesia, based on benchmark model from some European countries, namely the Netherlands, Germany, and France. The knowledge about how are electricity grid in Indonesia and some European countries being organized and regulated will be provided through some of the assessment criteria derived from the theory of electricity organization and regulation and preliminary research. The key element for succeeding the electricity grid organization and regulation from the European experiences also will be elaborated to be used as an inspiration for Indonesia. In the end, this research will recommend steps that are needed from the lesson gained based on European experiences, towards the regionalization of organization of electricity grid in Indonesia.

Keywords: electricity grid, organization, regulation, regionalization, European experiences

CHAPTER 1
INTRODUCTION

1.1. Background

Indonesia electricity development aims to ensure the availability of electric power in sufficient quantity, good quality and reasonable price In order to improve the welfare and prosperity of the people in a fair and equitable and sustainable development. The electricity sector in Indonesia is controlled by the state and provided through a national and regional government based on the principle of regional autonomy as stated in Electricity Law No 30 of 2009. PT Perusahaan Listrik Negara (PLN) is the vertically integrated state-owned utility that has responsible for providing electricity throughout all of Indonesia from generation, transmission, and distribution. PLN controls and take a near monopoly on transmission and distribution grids in its concession area (IEA, 2015).

With the unveiling of the electricity market as stated in Electricity Law, then PLN is not the only one actors in Indonesia electricity business. However, to protect the public interest as stated in article 33 Indonesia Constitution of 1945, Government of Indonesia (GOI) has given the responsibility of Public Service Obligation (PSO) to PLN (Djohan, 2011). Thus, as the public service as well as a profit-maximizing company, PLN has a huge amount of responsibility and burden to manage. With the status of public service in electricity, PLN has to evaluate whether its own activities have delivered reasonable electricity price for consumers and not at the cost of the government. Compounded with the inefficiency of PLN and electricity theft that happened in Indonesia, this has made in practically, PLN function as PSO is not performed optimally.

Moreover, to meet the electricity demand, Indonesia still needs a huge amount of generating capacity. Henceforth, in 2015 GOI has set the ambitious target for construction of 35,000 MW power project for the next 5 years to overcome this problem with the locations scattered throughout all Indonesia. This power project will make PLN load capacity twofold of its present condition in the coming 5 years. The management of PLN and electricity structure organization will become one of the notable issues to succeed the project.

PLN is still in the structure of state-owned utility (holding) in Indonesia electricity structure, although there are several subsidiaries engaged in the generation. This structure and the responsible of PLN to provide electricity to all of the Indonesian people who live in geographically separated islands needs further consideration. Coupled with the dynamics of society, especially the changes in macroeconomic, socio-economic shifts in society, the dynamics of regional autonomy and dynamics of democracy and reform will greatly affect the quality of life demands alteration (DJK, 2013). In line with this, people demands on the need for sufficient electricity supply, quality, and affordable prices are increased. Noticing to these dynamics, PLN needs further to improve service to the community which certainly has different characteristics in each region by regionalized its concession area. Moreover, the regionalization of electricity is also mandated by Law as stated in Electricity Law No. 30 of 2009 and National Energy Policy that has been recently stipulated in Government Regulation No. 79 of 2014.

In line with the implementation of electricity regionalization in Indonesia, it’s also important to take a look at the framework of government electricity sector relation. The organization of electricity industry is prominent in electricity development in one country to achieve optimal performance. The electricity industry is much related to the economic and political motives. Economic goals are encouraged by

the process of liberalization, whilst ensuring the traditional public task of the electricity industry is the goals of the political motives. In the discussion of electricity reforms, the challenge is to discover effective and efficient ways of combining the public task of the industry with the activities of the market (Arentsen & Kunneke, 1996). To address this, theoretical conceptualization of distinct systems for coordinating industrial activities within sectors of the economy has developed by Arentsen and Kunneke (1996). This conceptualization is useful to implement the notion of liberalization, to differentiating it from the ideas of privatization and regulation, and to design the connection among distinct sectoral organizations and diverse type of governmental regulation. The styles of government regulation also become notable since the reforms in electricity industry also related not only to economic issues but also with politics issues (Arentsen & Kunneke, 1996). Moreover, political intervention is still strongly affected the development of energy policies in Indonesia (Muliadiredja, 2005).

European countries are good examples of the competitive markets in the electricity industry. In European Union (EU), production and supply are revealed to competition market, while the network (transport and distribution) presumed to carry on under natural monopolies which need governmental regulation. Network competition is commonly counted to be not economical. Liberalization will drive the growth of competing ways of electricity transport and distribution. Alternative economic and technological allocation mechanisms could probably result in the electricity supply less relying on certain infrastructure adjustments (Kunneke, 1999). Based on the impressions of other network industries such as the telecom area, the progress of alternative ways of electricity network is away from unlikely. This field need not only scientific research, but also predictive governmental regulation for preserve varied public service obligations as they may happen under new situations and the improvement of the economic achievements of the new electricity industry (Kunneke, 1999).

Based on research in EU telecommunication Industries, Dassler (2006) has proposed an assessment framework for the analysis of regulatory systems worldwide which use two theory of regulation; regulatory intervention and regulatory governance. The EU experience has proven that policy transfer, in relation to regulatory and governmental learning, could lead to expected transformations (Dassler, 2006). Moreover, developing countries have been reputable for their compliance to adopt procedures and processes that emerge in developed countries. The framework based on the European experiences could offer insight into how and why regulatory outcomes are achieved in particular means, which is in consequence of the distinct level of state involvement and distinct levels of control preserved over the regulator (Dassler, 2006). This also could be such as inspiration to Indonesia in the ways of the organization of government electricity sector relation in Indonesia.

1.2. Problem Statement of the Research

It is clearly described in the previous section that Indonesia needs to implement the regionalization of electricity in order to cope with the objective of electricity development as stated in Electricity Law and National Energy Policy. However, electricity development in Indonesia faces several problems, mainly because of the geographical condition that consists of its more than 17000 islands and different characteristics in each region (IEA, 2015). The electricity demand growth also increases while the electricity generating capacity has fallen behind. Furthermore, 39 million people still do not have electricity access especially in the rural and isolated area outside Java-Bali Island (DJK, 2015a). In addition, PLN as a state-owned utility that has PSO obligation to provide electricity throughout all of in Indonesia is not optimal and efficient in their electricity business. Moreover, the

35000 power project program that is very important for the improvement of Indonesia generating capacity will add more load capacity for PLN to manage.

Meanwhile, the reform of electricity industry is always coping with economic and politics issue, or in other words between the market competition and public tasks. The optimal organization of electricity industry structure in a certain national setting is the key to the success of the reform. Taking it into consideration, a compromise has to be made amongst the stimulation of economic performance (which in some extent related with the liberalization of the industry) and maintaining various public tasks entailing government involvement (Arentsen & Kunneke, 1996).

Therefore, this research will try to find the possibilities and the best way in government and utility (PLN) electricity organization strategies to implement regionalization of the electricity grid in Indonesia. This will be done by assessing some features, models, and mechanism in the electricity network organization by using the European experiences compared to Indonesian settings and used it as an inspiration for Indonesia to improve the national electricity grid organization and regulation towards the implementation of electricity regionalization in Indonesia. The theory of electricity organization and regulation will be observed by this research. The research will also look at the possibilities to draw lesson learned from some of the benchmark model countries in European experiences, namely the Netherlands, Germany, and France in organizing and regulate the electricity network as a source of inspiration for Indonesia towards the regionalization of the organization of electricity grid.

1.3. Research Objectives

The aim of this research is to provide knowledge on the organization and regulation of the electricity grid in Indonesia and the recommendation on steps towards regionalization of the organization of electricity grid in Indonesia. This will be done through reviewing the theory on regulation and electricity organization, and the strategies that have been done in European countries such as the Netherlands, Germany, and France and use their experiences as inspiration for Indonesia.

1.4. Organization of the Research

This research is organized as follows:

Chapter 1 describes the background of the research, problem statement, objectives, research questions and the knowledge, insight, and information that will be provided by this research to contribute toward problem-solving.

Chapter 2 elaborates theoretical framework and the results of literature research providing the base for the execution of the research.

Chapter 3 explains the design and methodology of this research including the research framework, research questions, research strategy, methods of collecting data, and data analysis.

Chapter 4 describes the current electricity grid organizational models and regulation in Indonesia and some of the European countries, namely The Netherlands, Germany, and France.

Chapter 5 provides a comparison between Indonesia context and some of the European countries in terms of the electricity grid organizational models and regulation as well as analyze the key elements of electricity grid organization and regulation in European experiences.

Chapter 6 presents the conclusion and recommendation derive from the finding and analysis.

CHAPTER 2
LITERATURE REVIEW

This chapter describes the theoretical framework and preliminary research that set up the perspective of this research. In the next two section in this chapter, the electricity organization and regulation theory will be discussed to gain the analytical framework and gain the better understanding of the government electricity sector relation.

2.1. Theory on Electricity Organization

Electricity is one of the highly prominent necessities in people daily activities and country's development. It's also become one of the most notable infrastructures facilitating modern development and industrialization (Nikomborirak & Manachotpong, 2007). In the more than past decade, the world power sector markets have been stricken with a ripple of institutional reforms with the intention to create more competitive and efficient electricity markets (Purra, 2011). The reforms in electricity industry are highly related to economics and politics issues. The process of liberalization is the incentive for economic goals, while political issue cohesive with ensuring varying public task of the electricity industry that needs government involvement.

Traditionally, the electricity industry is highly related with state involvement on it. Basically, there are two reasons which underlie state intervention: economic and political reasons (Arentsen & Kunneke, 1996). The economical reason is derived from several economic and technical surveillances. First, electricity is a basic good that cannot replace with other energy resources and couldn't be stored with ease. Second, the generation, transmission, and distribution of electricity are presumed to be natural monopolies. Third, the electricity supply is practically contingent on extremely specified infrastructure, the transmission and distribution grid. With the involvement of state, it will reduce the investment risks, and ensure the progress of an effective infrastructure throughout the nation. As the consequences, public interference actually controls access to the grid (Arentsen & Kunneke, 1996). For the political reason arguments, it's mainly to ensuring a secure and continuous electricity provision as it is a prerequisite for a firm and safe economic development for the welfare of the people. Related with that, public involvement also justified for socioeconomic reasons, precisely to assist national industries, and for environmental preservation (Arentsen & Kunneke, 1996).

However, the concept of public tasks in the electricity industry is seemly to transform. In the discussion of electricity reforms, the defiance in the electricity reforms is to discover effective and efficient ways of combining the public task of the industry with the activities of the market (Arentsen & Kunneke, 1996. Thus, it is necessary to elaborate the relation between electricity sector and how the sector regulated by the government.

2.1.1. Models of Organization in the Electricity Industry

Electricity, as others industrial economic structures, could be illustrated as combinations of distinct coordination system on the theoretical degree, with one of them is leading. This creates nine distinct systems of coordination based on a conceptualization with one leading coordination systems, to which, in the modest condition, another system is attached (Arentsen & Kunneke, 1996). A theoretical conceptualization of the liberalization of the electricity industry which identified three pure and six mixed coordination systems has developed by Arentsen and Kunneke (1996), as shown in Table 2.1. The main differentiating element is the preference of one of three dissimilar allocation systems (the price mechanism, voluntary agreement, and governmental hierarchical authority) as a

dominant or additional system. From this conceptualization, it is feasible to operationalize the notion of liberalization as an alteration in the dominant or the additional coordination system (Arentsen & Kunneke, 1996).

Table 2.1 Pure and Mixed Systems for Coordinating Electricity Industry

Added coordinating mechanism	**Dominant Coordinating Mechanism**		
	Price	**Agreement**	**Public Authority**
Price	Full free market	Liberalized coordination	Liberalized hierarchy
Agreement	Coordinated free market	Full coordination	Coordinated hierarchy
Public Authority	Controlled free market	Controlled coordination	Full hierarchy

Source: Arentsen & Kunneke, 1996.

The organization of electricity industry could be viewed in static and dynamic ways. There are two actions that important in order to cope perceptively with it (Arentsen & Kunneke, 1996). Specify the root mechanisms underlying the coherence of economic actions is the first action. Three systems for organizing economic actions could be differentiated at the base analytical degree: markets, networks, and hierarchies (Thompson, 1991: Dahl and Lindblom, 1953: Dahl, 1982). The systems are not the same one to another in three principal means. First, mechanism of decision making. The dominant unit for make the decision could be individual, group or public authority. Secondly, the allocation mechanism. The mechanism that rules the systems could be based on price setting, agreement, or directive. The third means is the objectives of economic activities. The goals are varying, whether for an individual and collective benefit or for national public interest.

Another action that important is to decipher on the structural features of the electricity industry (Arentsen & Kunneke, 1996). The first features that important to elaborate are the entrance restriction. It could be differentiated into three distinct types: natural barriers that led by particular cost structures, artificial barriers came from action plans adopted by players, and artificial barriers from the public authority. Second features are the information needs. Mostly, it could be elaborated to three types: full transparency, information asymmetry due to the voluntary trade of information, and information discrepancy due to public authority. The third features are the governance structures or contractual relations. There are four categories for the governance structures (Williamson, 1985): market governance (all interrelated arrangement parameters are familiar to the actors and there are no certain investments), trilateral governance (unpredictable about the later condition, and actors are also occupied in property specific investments), bilateral governance (the involving actors maintain their economic autonomy in a condition with high level of asset-specific investment and unpredictability), and unified governance (hierarchical organization of economic activities by vertical integration). Another feature is the ownership structures. Three distinguish types could be recognized: private ownership, common ownership, and state ownership. Last but not least, the international trade, which has three probabilities that could be picked out: autarky (economic self-sufficiency), restricted outside trade and unrestricted outside trade (Arentsen & Kunneke, 1996).

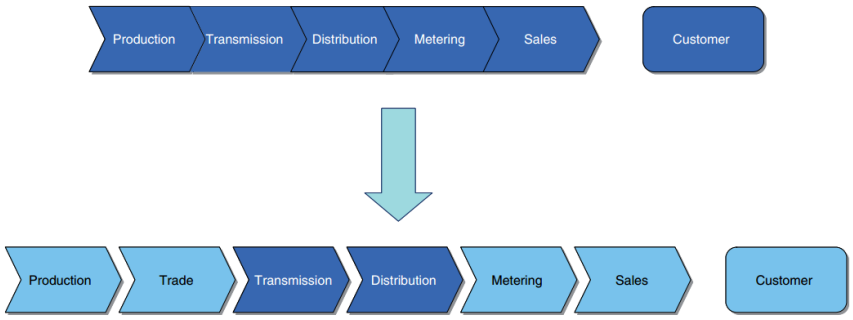
The concept of liberalization could be explained with employ the models of sector organization (Arentsen & Kunneke, 1996), particularly electricity in this case. The notion of liberalization could be seen as a transformation in the dominant coordination system from hierarchy to network, or from network to price setting. Aside from, it also could be noticed as the alteration in the additional

coordination system from hierarchy to network, or from network to price setting. By using this concept, theoretically, liberalization becomes dissimilar from the subject of privatization and regulation. In one hand, liberalization involved with the options of dominant and additional coordination system, while on the other hand, privatization is exempt of this option, due to the shift of ownership structure. It also comes up that regulation will be highly required in the liberalization process with under particular conditions (Arentsen & Kunneke, 1996). By using this concept of liberalization, it will enable us to comprehend the process of liberalization in correlation to the actual structures of electricity structure in diverse nations (Arentsen & Kunneke, 1996).

2.1.2. Electricity Networks in the Electricity Value Chain

Traditionally, electricity networks or grids are considered natural monopolies, with heavy government regulation, intervention, and ownership. There looked to be some sort of natural connection among the network technology and various hierarchical economic allocation mechanisms with only very restricted area for price mechanism. Nonetheless, these electricity sectors have developed due to worldwide tendencies towards liberalization, deregulation, and privatization. Generally, there is three main progress that jeopardized the natural monopoly of electricity network: decentralized generation, the outgrowth of parallel lines, and controlled electricity transport and distribution (Kunneke, 1999). Beside electricity networks that consist of electricity transmission and distribution, there are also other functions in electricity industry such as production or generation, metering, and sales of electricity to the customer. All of this functions are part of an electricity value chain.

Figure 2.1 The Electricity Value Chain: From Vertical Integration to Unbundling



Source: Fens et al., 2005. *Legend*: light blue: market-based commercial functions, dark blue: regulated monopolistic functions

The model of electricity value chain prior and following the liberalization is best illustrated in Figure 2.1. Before the liberalization, electricity entities were could be characteristically as vertically integrated, which means all main components of the electricity value chain were covered in a sole organization as described (in utmost case) in the upper part of Figure 2.1. While the bottom part of Figure 2.1 as the represents of condition after the liberalization, reflects a disintegration of the electricity value chain that creates in the unbundling of monopolistic network-linked services (i.e., transmission and distribution) and competitive business activities (generation, trade, metering, and supply). The electricity grids supply the tangible interconnections between the economic, technical, and services tasks, that enable another activity in the value chain to compete. The bottom layer of Figure 2.1 also depicts the adjustment of commercial purposes to the market requirement as modern functions have advanced, as wholesale trade (Fens et al., 2005). The ownership structure of energy utilities also has transformed along with the restructuring of electricity value chain. Public ownership has become a long custom in European countries. Commercial functions are often privatized in

liberalized reigns. Nevertheless, regarding networks, political aversion to privatization oftentimes emerge, consequently, public ownership somehow becomes common (Kunneke & Fens, 2007).

Electricity grids also become one of the focus that traditionally contemplated in infrastructure-bounded markets. Although in liberalized markets, electricity grids reflect monopolistic functions that basically twist the working of the market. Regulation entails that networks functioning to be detached from other main operations such as generation, trade, metering and sales that permissible to compete. The intention of this is to avoid malicious opportunistic manners by the electricity networks operators. Thus, unbundling could be defined as the segregation among the networks and the other main activities of electricity (Kunneke & Fens, 2007).

There are four diverse models for unbundling that could be differentiated generally in the electricity network. The models served in enhancing level economic and legal segregation are as follows (Kunneke & Fens, 2007):

- Administrative unbundling, which disconnect financial reports for network utilization and for sales or production, but divided operational functions beneath one entity;
- Management unbundling. This is extension of administrative unbundling, where the employees are located to dissimilar business divisions/units that have independent role from other business but are remain organized from a central holding;
- Legal unbundling. The network operations are organized in a different legal company, which will, however, function in a holding enterprises jointly with production and sales activities;
- Ownership unbundling, where the network operations beneath distinct ownership from production and sales, thereby no covering all holding and no operational activities split.

In most European countries, particularly in EU, legal unbundling and administrative unbundling are most prevalent methods applied in the organization of electricity network (Kunneke & Fens, 2007).

2.1.3. Transforming Features of Electricity Networks Organization

The reform in the electricity industry is become global trend presently. One of the sectors of electricity industry that still heavily regulated by the government is electricity grids. After all, obviously the network economics of the electricity grid are transforming. Three interconnected elements might initiate transformations of the network characteristics of electricity industry (Kunneke, 1999):

- Transforming characteristic of network complementarities induced by technological innovations. Network operations could grow economically manageable or could be substituted with regard to linked infrastructures. The economic attributes of the electricity grid then impacted from this, provide a chance for the implementation of new allocation mechanism;
- Enhanced the opportunity for decentralized production of electricity. Decentralized generation could offer individual clients to become less contingent of large-scale electricity providers. Even so, decentralized generation does not automatically signify off-grid electricity supply. Many times a connection to the public grid is legitimized to ensuring the security of supply, reliability, or to make individual generation optimal. Nonetheless, decentralized generation gives chances for establishing private networks, which connect certain customers and suppliers. In one side these private networks could be supporting the public networks and in the other side also could be competing with them.
- Altering political options. The philosophy arguing that central supply of electricity thru an expanded grid provides economic efficiency while also warranting the provision of fundamental public service obligation is still continuing so far. However, the economic and technical situations are shifting, without accommodation of political preferences and therefore institutional frameworks. This is situation that could differ from one country with another.

From those factors mentioned above, there are a couple of potential chances for introducing competition regarding electricity grid (Kunneke, 1999). First possibilities are network competition, which is competition with regard to only the transmission and distribution of electricity. Another likelihood is fuel competition, which is competition with regard to the transmission and distribution of electricity versus other primary energy sources to generated electricity.

Liberalization will introduce the competition in the electricity sector, particularly in network sector, which is traditionally reviewed not economical. It will encourage the evolution of contending ways of energy transport and distribution. In the light of this historical growth, it is a common thing that many energy companies were not capable of measuring distribution or transport costs as detach accounting units until liberalization was the next direction of sectoral developments. The electricity grid might forfeit its importance as the pillars of the electricity industry in liberalized markets. The provision of electricity will less contingent on certain infrastructure organization due to the perchance development of alternate economic and technological allocation mechanisms. Nevertheless, the development of alternate ways of electricity transport and distribution still needs a lot of efforts. This causes not only the call for scientific research but also anticipative governmental regulation so that the varying public tasks could be protected, as they may take place under the new condition and the escalation of the economic performance of the new electricity industry structure (Kunneke, 1999).

Most of the European countries has already undergone the process of Liberalization in their electricity industry structure. One of the requirements that reckoned as the factor which made the liberalization process to succeed is the creation of independent regulatory authorities (Larsen, et.al, 2006). There are several definitions of regulatory independence. In the area of utility regulation, Fesler (1942) stated that regulatory independence is often defined “independence of control by the governor and legislature, independence of control by utility companies, and independence in the sense of integrity and impartiality” (Mitnick, 1980). Another definition stated that the regulatory independence has three central features (Smith, 1997):

- The relation of the regulatory authorities with the government, which comprise aspects of organizational independence such as budgetary control and the exemption from limited civil servants wage ordinances;
- The relation of the regulatory authorities with the stakeholders; and
- The level of authority in the autonomy decision-making.

2.1.4. Style of Government Regulation

The styles of government regulation also take an important part of the organization of sector industry. The style of public regulation could be specified by the degree of coerciveness. To elucidate the range of regulation in each organizational model like we discussed in section 2.1.1, there are three elementary styles of government regulation could be picked out (Arentsen & Kunneke, 1996). Firstly, the facilitating style, in which the government simply stipulate conditions for the functioning of the electricity industry. Secondly, the initiating style, where the government motivates the industry to growth in a particular course. Lastly, the enforcing style, where the government enforces the industry to growth in a particular course. Effective regulation could be attained by choosing the style of regulation which appropriates with the government actual role (Arentsen & Kunneke, 1996).

Likewise with the industrial organization, the style of government regulation also could be dynamic. Based on if the degree of enforcement is lessened or escalate, two major type of transformation could be perceived: deregulation and reregulation (Arentsen & Kunneke, 1996). The first one is called deregulation, which the level of enforcement is decreasing from enforcing to facilitating. The

second one is reregulation, which is the opposite of deregulation, from facilitating to enforcing where the level of coercions is increasing.

The style of government regulation is heavily related to the object of government regulation. It could be used to recognize the style of government regulation. The structure and the conduct of the industry are noticed to be the objects of government regulation. The structural features that could be regulated are the method of allocation, entrance barriers, contractual relation, the ownership, and the entrance to the market. While the conduct, as an object of government regulation, covers the production, transmission, and distribution of electricity (Arentsen & Kunneke, 1996).

2.2. Theory on Regulation

Regulation has many different definitions and based on many kinds of literature and perspectives. Baldwin et al., (2012) have several definition of regulation from following distinct sight:

- Regulation as 'a specific set of commands'. In this perception, regulation implicates the announcement of a binding series of rules to be implemented by an institution assigned to this goals;
- Regulation as 'deliberate state influence'. From this point of view, regulation has a wider thought and consists all government actions that are drafted to determine business or social behavior;
- Regulation as 'all forms of social or economic influence'. In this perspective, where all mechanisms to influence behavior, whether state-based or from another origin (i.e. markets) are perceived regulatory. There is also theory of 'smart regulation' that show regulation also could be implemented by in form of other entities, consist of corporations, self-regulators, professional or trade companies, and voluntary organizations, not only solely by state institutions (Gunningham et al., 1998).

Referring the comprehensive definition above, the deliberation or designed regulatory impacts of a mechanism is not a requirement, rather than simply coincidental to other goals. One thing that should be noticed from the notion of regulation is that regulation frequently perceived as an activity that limits behavior and averts the happening of particular unwanted activities, which is also known as 'a red light concept'. More comprehensive perspective stated that the effects of regulation might also for enabling or facilitative, which is called 'a green light concept' (Harlow & Rawlings, 2006).

In several conditions, certain objects have altered place on the regulation agenda, so as the arguments regarding the goodness and badness of deregulation and privatization have given mean to post-millennium discussions of regulatory improvement and 'better regulation'. In this recent discussion, it has become generally accepted that regulation is prominent for the operation of a market economy. However, regulatory supervision still important in the public task preservation, mainly those entailing naturally monopolistic segments, as well as networks. An earlier focus on economic regulation that was expected to perish over time has been substituted by the awareness that there are an ongoing need for regulatory supervision and a fundamental to enhance environmentally and sustainability goals to the preceding, firstly economic and social, goals (Baldwin, et al., 2012).

Traditionally, there is two theory of regulation that has come up. Firstly, there is a notion of regulatory intervention. There are two different type of this regulatory intervention: market-driven and non-market-driven approach (Trebing, 1987). Secondly, the idea of regulatory governance. There are two models for this concept: a substantive and a proceduralist model (Majone & Baake, 1996).

Regulatory intervention concept could be described as the means on which committed regulatory authorities organize the market intervention, or in another definition, propose to encourage long-lasting competition and consumer advantages. For the market-driven approach, the concerns in the regulation are to erase legal entry restrictions and to promote competition by put performance targets in the shape of price or profit regulation. The second philosophy is the non-market-driven approach, which gives more focus on the public interest or social values. There are two criteria that could be used to assess the regulatory approach, namely control of market power and meeting wider economic interests (Dassler, 2006). In the controlling market power criteria, the regulation of consumer charges become the indicator to assess the approach preferred. While in the meeting wider economic criteria, the assessment is using provision of universal services obligation and setting quality standards as the indicator (Dassler, 2006).

Regulatory governance notion could be defined as the method the regulatory authority moves under the protection of the government, in the shape of legislative acts and other means by which control could be preserved over the sector to be organized. For the substantive models under this notion, the regulator is arranged based on the skill and have a high level of independence. Therefore, the government officials have little influence upon the decision by the regulator. In contrast, the proceduralist model is in principal bound with democratic control, higher accountability of the regulator to the governments, and judicial review of the regulatory activities. To evaluate which regulatory approach is leading, there are three criteria that could be used: regulatory appointment, regulatory decision-making, and regulatory accountability (Dassler, 2006). Under the substantive model, more authorities should be entrusted to regulators and the government have lesser involvement in the regulation decision-making task. In contrast, under the proceduralist model, the government have a bigger involvement in regulation, and fewer authorities are entrusted to regulators (Daßler and Parker, 2004).

By combining those two theories of regulation mentioned above, Dassler (2006) has come up with a framework that could be used to assess the global regulatory systems in a uniform method. To do that, the utility regulation needs to be attached to the whole environment of industry and state chain of command. This method is propped by another argument by Berg (2000), who stated that future research requires targeting at gaining a preferable concept as to why and how regulatory settlements influence business performance. To aware that regulations have an impact on business performance is not adequate anymore. To responding the why-question, it is required to take a look at both of the way regulators involve and to explore the connection between the regulator and the government (Dassler, 2006). Dassler (2006) has used it based on European experiences, showing that the framework could offer insight into how and why regulatory outcomes are achieved in particular means, which is in consequence of the distinct level of state involvement and distinct levels of control preserved over the regulator.

CHAPTER 3
RESEARCH DESIGN AND METHODOLOGY

Research design could be described as types of inquiry within qualitative, quantitative, and mixed methods techniques that present particular course for procedures in research (Creswell, 2013). Others have known them “strategies of inquiry” (Denzin & Lincoln, 2011). While research methods implicate the configuration of data collection, analysis, and interpretation that the researchers offer for their research (Creswell, 2013). Therefore, this chapter will illustrate a comprehensive information that would be needed to answer the research questions content wise (with theoretical approach) and method wise (with research design and methodology).

3.1. Research Framework

Verschuren and Dooreward (2010) has defined research framework as “Schematic representation of the research objective and includes the appropriate steps that need to be taken in order to achieve it”. Thus, it reflects the internal logic of research project. The *step-by-step approach* (Verschuren and Dooreward, 2010) for this research is as follows:

Step 1. Characterize briefly the objective of the research project.

The aim of this research is to provide knowledge on the organization and regulation of the electricity grid in Indonesia and the recommendation on steps towards regionalization of the organization of electricity grid in Indonesia.

Step 2. Determine the object or objects of the research project.

The research objects in this research are:

- Understanding of organization and regulation of electricity grid in Indonesia and in some European countries, namely the Netherlands, Germany, and France;
- To improve the process of regionalization of the electricity grid in Indonesia.

Step 3. Establish the nature of the research perspective.

This research will analyze crucial aspects in the electricity grid organization to make electricity regionalization development and implementation successful. Hence, this research will refer European experiences and the essential part of policy system in those countries as the benchmark of electricity grid organization and regulation towards regionalization of electricity grid implementation in Indonesia. Thereby, this research will conceive the lessons from European to be used as an inspiration for Indonesia. Therefore, the nature of the research perspective is evaluation research. This research also will look the connections of the government and utility’s strategies by means of the type of policy schemes and regulations that could support in the regionalization of the organization of the electricity grid in Indonesia. The research perspective consists of a set of assessment criteria in the fields of electricity grid organization and regulatory systems, all of which will affect the success of the implementation of regionalization of electricity grid in Indonesia.

Step 4. Determine the sources of the research perspective.

The theoretical framework of this research is developed and conducted via document reviews such as scientific literature as well as studying existing documentation. The theories to be used in this research are shown in Table 3.1 below.

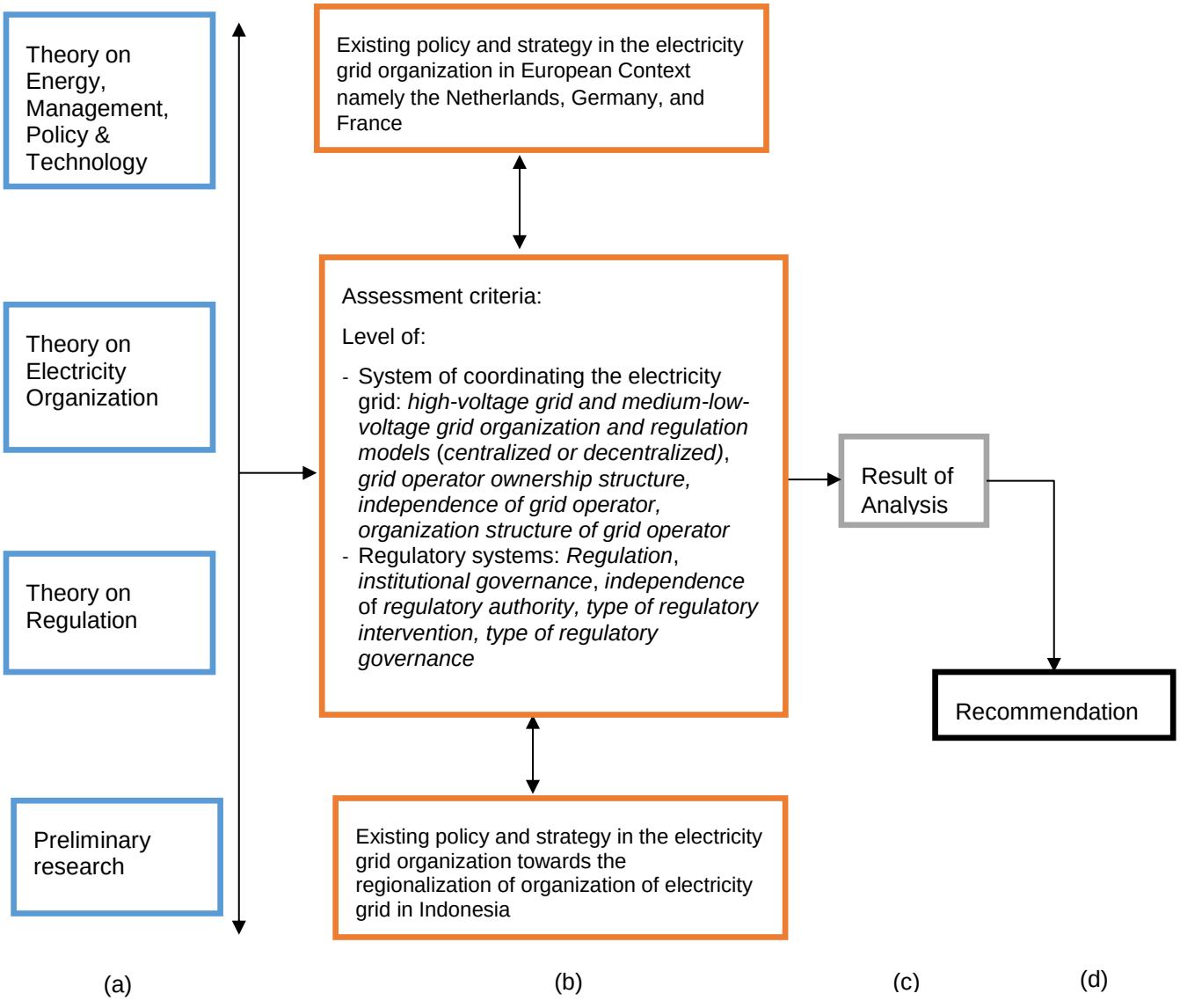
Table 3.1 Relevant Key Theories Needed

Key koncepts	Theories and documentation
Electricity grid organization Electricity regionalization	Theory on industrial and electricity organization Theory on energy, management, policy and technology
Regulatory systems	Theory on regulation
European experiences and Indonesia context	Empricial documentation, literature survey (research journals), governmental data

Step 5. Make a schematic presentation of the research framework.

The framework of this research is schematically presented in Figure 3.1.1 below:

Figure 3.1 Schematic Presentation of Research Framework



Step 6. Formulate the research framework in the form of elaborate argument.

The steps to be taken in the course of the research project are designed as follows:

(a) The theoretical basis for analysis is provided by the literature review on theories in concern to energy, management, policy, and technology, industrial and electricity organization, and regulation. The preliminary research also carried out in regard to electricity grid organization in Indonesia and European experiences;
(b) By means of which the research objects will be analyzed;
(c) A comparison between the evaluations results in an insight and inspiration for Indonesia based on European experiences;
(d) Knowledge of electricity grid organization and regulation in Indonesia and some of European countries and recommendation regarding the regionalization of the organization of electricity grid in Indonesia;

Step 7. Check whether the model developed entails any changes to the research objective

The model does not need any changes.

3.2. Research Questions

The central research questions that need to be answered in this thesis is as follow:

Is it possible for Indonesia to regionalize the organization of the national electricity grid? And if yes, in what way can Indonesia benefit from best practices in some European countries?

This question was then divided into series of sub-questions:

a. How is the electricity grid in Indonesia currently organized and regulated?
b. How is the electricity grid organized and regulated in some European countries, namely the Netherlands, Germany, and France?
c. What lessons can Indonesia learn from the European organization and regulation of the electricity grid with respect to regionalization of the organization of the electricity grid in Indonesia?

3.3. Defining Concept

For the purpose of this research, the following key concepts are described as follow:

Electricity grid: interconnection system for delivering electricity from suppliers to consumers. It consists of generating stations, high-voltage transmission lines, and distribution lines.

Electricity organization: the ways or means in organizing or manage the electricity systems in countries or regions.

Regionalization: the process of dividing an area into decentralized regions.

Regulation: a rule or a directive prescribed and maintain by an authority.

3.4. Research Strategy

This research project is a desk research which proposes to compound aspects from both academic literature reviews and assorted reports on electricity grid organization and regulation with respect to electricity regionalization. Firstly, some assessment criteria will be derived through the observation from the theory on electricity organization and theory of regulation. In the second step, this research will take a look at the existing regulation and policies in Indonesia electricity grid organization that support the implementation of electricity regionalization and the electricity condition and situation in Indonesia at hand. Thirdly, the policies, strategies, and regulation in the electricity grid organization in the European context, namely the Netherlands, Germany, and France will be explored as a

benchmark model. Derived from the discovery, for instance, the regulations and policies, the systems, coordination between government and utility, could be gained as lessons to possibly be used as an inspiration for Indonesia case to implement the regionalization of organization of electricity grid.

3.4.1. Research Unit

The number of research unit is decided by noticing the timeframe that the researcher has for the completion of this master thesis. Besides Indonesia, three European countries namely the Netherlands, Germany, and France, will be selected as research objects. These countries are contemplated adequate to provide comparative analysis regarding the electricity grid organization and regulation towards the regionalization of the organization of electricity grid in Indonesia.

3.4.2. Selection of Research Unit

The selection of some European countries besides Indonesia as the research unit is derived from following criteria:

- The countries have implemented the regionalization of electricity particularly in the organization and regulation of the electricity grid;
- The countries are member of the EU and European Commission (EC) that has implemented European single market program, which considered more advanced in the organization of electricity structure.

3.4.3. Research Boundary

To make sure that the objectives of this research are gained within the certain time then research boundary is determined. The following boundary is applied to this research:

- The electricity function in the electricity structure that will be studied is restricted to electricity grid, which consists of transport (transmission) and distribution of electricity;
- The number of European countries to be explored is limited to three countries as introduced in section 3.4.1, besides Indonesia as the main focus country of this research.

3.5. Data Analysis

3.5.1. Methods of Analyzing Data

Qualitative data analysis method will be applied in this research. The analysis and elucidation of data will commence from the relevant literature review on the existing regulation and policies of electricity grid organization and regulation in the government and utility strategies. This research will use theories on Energy Management, Policy, and Technology alongside with theories on Industrial Organization and Regulation. This research will analyze the government and utility strategies in organizing the electricity grid and regulatory systems towards the implementation or electricity regionalization. The unit of observation is the existing regulation, policies, and strategies of electricity grid organization in Indonesia and European context namely the Netherlands, Germany, and France. The methods of analyzing the data that required in this research are presented in Table 3.2.

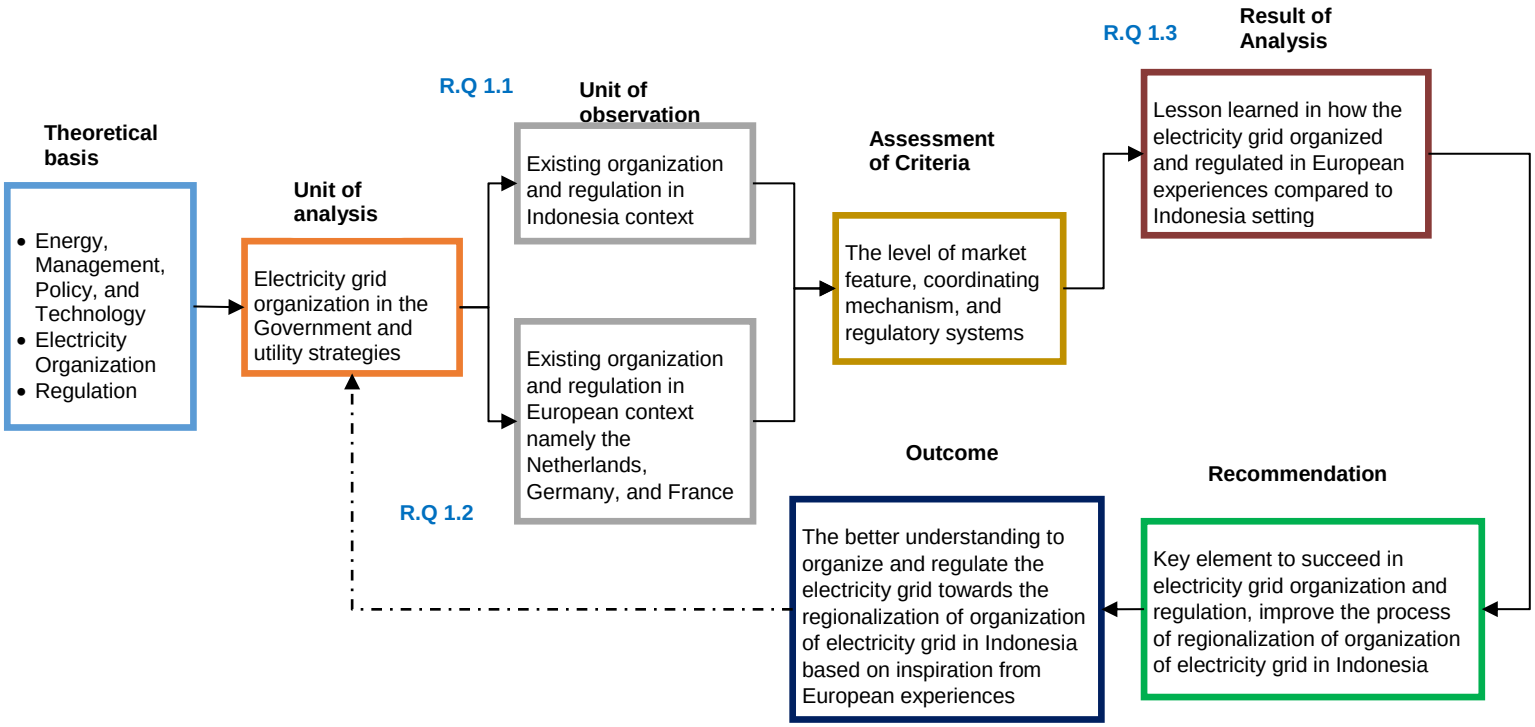
Table 3.2 Methods of Analyzing Data

Research Questions	Chapter Answering RQ	Data/Information Required to Answer the Questions	Data Source	Method of Accessing and Analyze Data	Expected Outcome
How is the electricity grid in Indonesia currently organized and regulated?	4	Current electricity grid organization and regulation models in Indonesia	Literature, Document (Journals, Governmental Data), Websites	Desk Research, Qualitative Analysis	Identification of electricity grid organization models and regulation in Indonesia electricity sector
How is the electricity grid organized and regulated in some European countries, namely the Netherlands, Germany, and France?	4	Current electricity grid organization models and regulation in European experiences, namely the Netherlands, Germany, and France	Literature, Document (Journals, Governmental Data), Websites	Desk Research, Qualitative Analysis	Identification of electricity grid organization models and regulation in the Netherlands, Germany, and France
What lessons can Indonesia learn from the European organization and regulation of the electricity grid with respect to regionalization of the organization of the electricity grid in Indonesia?	5	Key elements for succeeding the electricity grid organization and regulation in European experiences	Literature, Document (Journals, Governmental Data), Websites	Desk Research, Qualitative Analysis	• Identification of key elements for suceeding electricity grid organization and regulation in European experiences • Comparison between Indonesia context and European experiences

3.5.2. Analytical Framework

The schematic presentation of analytical framework for this master thesis is shown in Figure 3.2 below:

Figure 3.2 Framework of Analysis

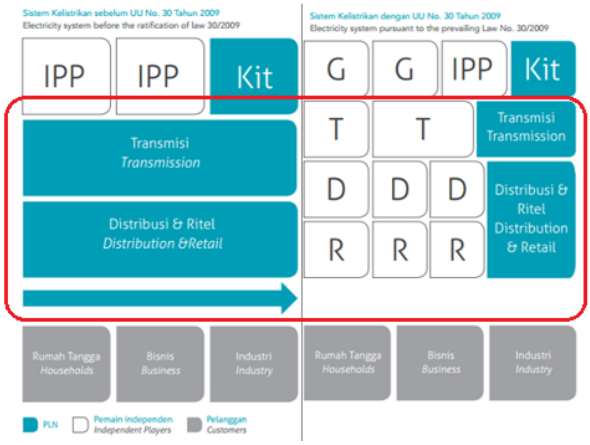


CHAPTER 4
ELECTRICITY GRID ORGANIZATION MODELS AND REGULATION IN INDONESIA AND EUROPEAN CONTEXT

4.1. Indonesia Current Electricity Grid Organization Models and Regulation

The current legal framework under the Electricity Law No. 30 of 2009 is allowing all entities in Indonesia to conduct the electricity business in the generation, transmission, distribution, and sales of the electricity in its concession area. The enactment of the new Electricity Law has several main changes in the electricity grid organization in Indonesia. The illustration of the alteration in electricity system in Indonesia, particularly in transmission and distribution system, prior and after the enactment of Electricity Law No. 30 of 2009 could be seen in Figure 4.1 below.

Figure 4.1 The Electricity Grid Organization after the Enactment of Electricity Law No. 30 of 2009



Source: PLN, 2015b.

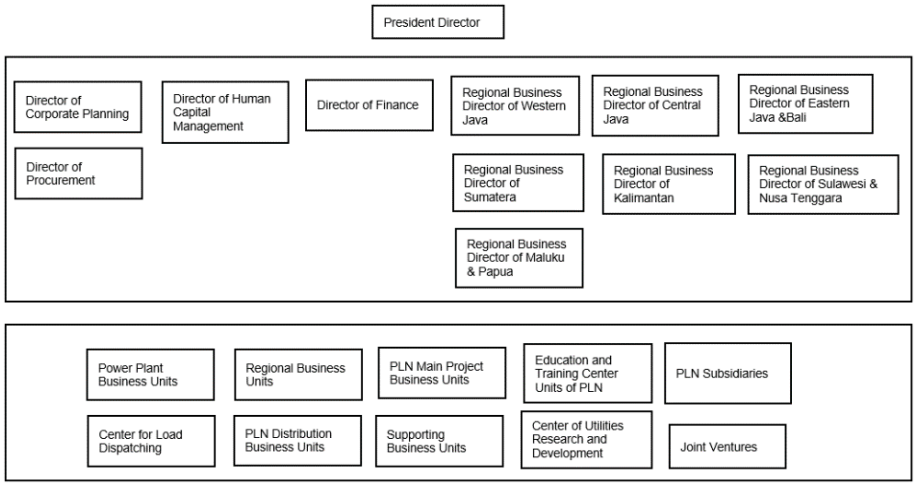
The new Electricity Law confirms the role of the state as the regulator and PLN as the supplier in the electricity grid organization and electricity sector generally. PLN is the vertically integrated state-owned electricity company. The transmission and distribution of electricity in Indonesia is organized by PLN. The transmission load management is managed by Transmission and Load Dispatching Center (P3B), which is actually a unit in PLN organization structure. While for the transmission and distribution of electricity to the consumers in each region of Indonesia are performed by PLN regional and distributive business. These regional units of PLN remain under the central management of PLN head office in Jakarta. More detail about electricity grid organization and regulation in Indonesia will be described in the following section.

4.1.1. The Organization of PLN

PLN is the vertically integrated state-owned utility in the electricity sector in which all of the shares is owned 100% by GOI. PLN has responsibility for the management of generation, transmission, and distribution in Indonesia. PLN controls and take a near monopoly on transmission and distribution grids in its concession area (IEA, 2015). PLN is one of the biggest energy company in Indonesia, with the number of employees as much as 48,068 and have the profit of IDR 11.7 trillion in the year 2014 (PLN, 2015b). PLN has a representative office in all regions of Indonesia. Until 2015, PLN divides its operational area into three geographical regions, i.e.; Java-Bali, Sumatera and East Indonesia area with each area led by one Director Operations. There are 14 PLN's region and

distributive business units in all over Indonesia, with many other representative offices. Although, all of the decision for PLN actions are decided by the PLN headquarter in Jakarta. Recently, in September 2015, due to the implementation of regionalization which initiated by government, PLN has re-organized their organizational structure with added 7 new Regional Business Director in the board of directors: Sumatera, Western Java, Central Java, Eastern Java and Bali, Kalimantan, Sulawesi & Nusa Tenggara, and Maluku & Papua. The intention of PLN's regionalization is that in the future expected to detach the tasks between PLN Head Office and PLN Regions. For example, the head office will focus on the development of new investment while the regions will focus with the existing electricity operational and services (Wicaksono, 2015). The new organization structure of PLN could be seen in Figure 4.2 below.

Figure 4.2 Current PLN Organizational Structure



Source: PLN, 2011; PLN, 2015a.

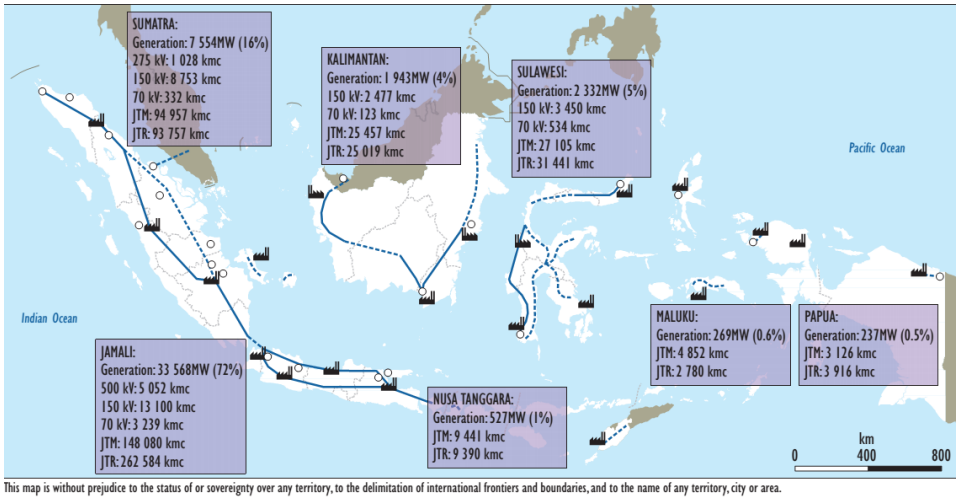
PLN gives great concern to detach tasks in its organizational restructuration. The corporate separate the company strategic functions which are centrally organized, modernized, and give efficiency impact, with an operational business activity which is arranged regionally and integrally to attain an improvement in the effectiveness and organization management accountability. Corporate responsibilities as a holding company (PLN Head Office) in PLN organized by Directors of Finance, Planning, Procurement, and Human Resources. While the operational tasks arranged by the Directors of Regional Business in 7 regions. The Regional Business Directors are currently organizing end-to-end business process in their own regions, from upstream to downstream activities. They have a duty to increase the generation capacity, preserve the available power plant, transmission and distribution grids, and serve the consumers in their regions (PLN, 2016a).

Regarding the electricity grid organization, the Regional Business Directors have duties to lay down and assuring the operation and preservation of transmissions, substations, and distributions in their own regions (PLN, 2016a). For the distribution grids and rural electricity, the macro policies are determined by PLN Head Office, while the regional or distributive units managed the derivatives policies. The distribution grids development also become the responsibility of PLN regional and distributive units (PLN, 2011). Overall, in terms of transmission and distribution activities, the services that provided by PLN as the state-owned electricity company in Indonesia are managed thru PLN's 15 Regional Units, 7 Distribution units, 3 Transmission Units, 2 Dispatcher Center and Transmission Units, which under the supervision of 7 Regional Business Director (PLN, 2016a).

4.1.2. Electricity Transmission Organization and Regulation in Indonesia

In Indonesia, transmission grids managed by PLN consists of extra high voltage network (SUTET) of 275 kV – 500 kV, and high voltage network (SUTT) of 70 kV – 150 kV. Currently, PLN owned and operated almost all of transmission grid throughout all of the Indonesia. The electricity system in Indonesia that already well-integrated is only in Sumatera and Java-Bali Island, whilst in other islands such as Kalimantan, Sulawesi, Maluku, Nusa Tenggara, Papua, and other isolated islands were still not entirely interconnected. Because of the country geographical condition with many scattered islands, other regions within Indonesia remains isolated (DJK, 2015a). This electricity network system in Indonesia could be seen in Figure 4.3. In some region, the transmission networks are not managed by PLN. For instance, in Batam Island, the 150 kV transmission grids is owned and operated by PT PLN Batam which is the subsidiary of PLN (the same condition applied in Tarakan Island). In small parts of Sulawesi Island, the grids are owned by private company but operated by PLN (PLTA Poso), while in Papua the 230 kV grids are owned and operated by PT Freeport Indonesia for its own used in the company area.

Figure 4.3 Electricity Network in Indonesia



Notes: kmc = kilometer of circuit; JTM = medium-voltage network; JTR = low-voltage network. Data are as per up to October 2014. Source: DJK, 2014.

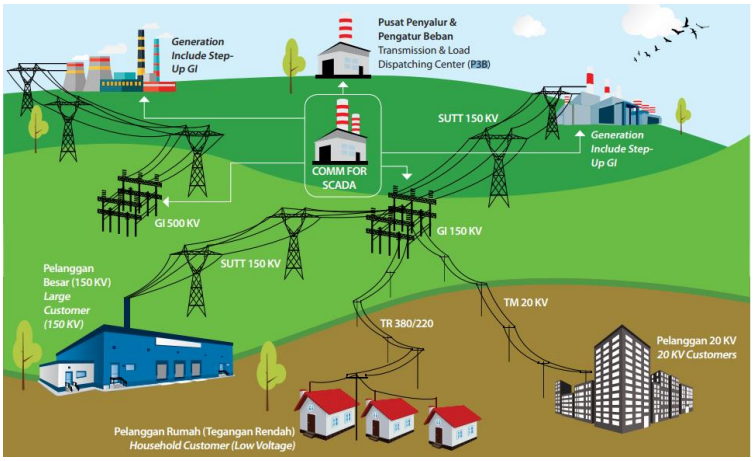
The transmission grids in Java-Bali Island is already well integrated with three types of networks in its interconnection system: SUTET 500 kV as the backbone and SUTT 150 kV and 70 kV as the dispatcher to load center. Most of the coal power plant are located in the eastern part of Java-Bali Island, whereas the industry area, including Jakarta, is located in western part of the island. Thereby, the power flows in Java-Bali Island is moving from east to west, including Jakarta, which has concentrated power demand (DJK, 2016c). The electricity transmission and substations in Java-Bali is managed by PLN under the Regional Business Director and Load Dispatching Center which consists of 3 transmission unit (PLN Transmission Unit for West Part of Java, PLN Transmission Unit for Central Part of Java, and PLN Transmission Unit for East Part Java and Bali) and one load control center (Java Bali Control Center) (PLN, 2016b).

The transmission grids in Sumatera Island is divided into two big system which is both owned and operated by PLN. The first one is Northern Part of Sumatera (Sumbagut) interconnection system that connected two provinces: Aceh and North Sumatera thru SUTT 150 kV. The other system is Southern and Middle Part of Sumatera (Sumbagselteng) interconnection system which linked 6

provinces: West Sumatera, Riau, Bengkulu, Jambi, South Sumatera, and Lampung via SUTT 150 kV. The electricity transmission and substations in Sumatera is organized by Transmission and Load Dispatching Center (P3B) Sumatera under the Sumatera Regional Business Director (PLN, 2016b). Aside from Java Bali and Sumatera that already have well-integrated interconnection system, the transmission of electricity and substations in other main islands in Indonesia (Kalimantan, Sulawesi, Nusa Tenggara, Maluku, and Papua) are managed by the regional business unit of PLN (PLN, 2016b), as depicts in Table 4.1.1 below. Whereas in the East Nusa Tenggara, Maluku, and Papua there are still not have transmission networks since the electricity system remains isolated and scattered, and also the capacity of the power plant in the area is relatively low (DJK, 2015a, PLN 2016b).

Regarding load management, the Transmission and Load Dispatching Center (P3B) is one of the most important units in PLN and has several roles such as become a center regulator of the power load sent thru the grid up to the final customer, preserve sufficient electricity flow in the course of peak load outright, and keep the electricity production efficient when the electricity load is comparatively modest (PLN, 2015b). The Role of P3B could be best illustrated in Figure 4.4. So far, P3B has only represented in the Java-Bali and Sumatera, with the unit name is P3B Sumatera and P3B Java-Bali, in which the interconnected system is already well-integrated. In the end of 2015, PLN has restructured the organization structure and one of the units being restructured is P3B. In the current structure, P3B Java-Bali is separated into 3 transmission unit and 1 load control center whereas P3B Sumatera has remained in same structure (PLN, 2016a).

Figure 4.4 Upstream-Downstream Transmission-Distribution Schemes



Source: PLN, 2016

4.1.3. Electricity Distribution Organization and Regulation in Indonesia

Similar to transmission networks, distribution networks are owned and operated by a utility within a concession area. Practically, all distribution networks belong to PLN. The distribution grids managed by PLN consists of a medium voltage network (JTM) of 20 kV, and low voltage network (JTR) of 220 V. Indonesia's major priorities for the development of distribution networks are to cope with the demand growth, enhance the electricity access, and improve services and system reliability (DJK, 2015a). Distribution development requirements are greatly contingent on regional factors. Planning would give more gain from bottom-up approach given Indonesia's distinct geography and population concentrations, where the first planning is carried out at the local or region level with consent,

prioritization and oversight at the national level by Government or PLN to assure consistency and sufficiency (IEA, 2015).

PLN have the units for distributing the low voltage electricity in each main island in Indonesia as described in Table 4.1 below. In Java-Bali, the electricity distribution is managed by 5 distributive business units under the Regional Business Director in Western Java, Central Java, Eastern Java, and Bali. In Sumatera, the electricity distribution is performed by 6 regional units and 1 distributive units under the Sumatera Regional Business Director. For the Sulawesi and Nusa Tenggara islands, 4 regional units are organized the electricity distribution under the Sulawesi and Nusa Tenggara Regional Business Director. Lastly, the electricity distribution for the Maluku and Papua islands are managed by two regional units under the Maluku and Papua Regional Business Director (PLN, 2016a).

Table 4.1 PLN Regional and Distributive Business Unit in Indonesia

Region/Island	PLN Regional/Distributive Business Unit
Sumatera	PLN Aceh Region, PLN North Sumatera Region, PLN Riau and Riau Island Region, PLN West Sumatera Region, PLN South Sumatera, Jambi and Bengkulu Region, PLN Bangka Belitung Region and PLN Distribution Lampung
Java Bali	PLN Distribution Jakarta Raya, PLN Distribution West Java, PLN Distribution Central Java, PLN Distribution East Java, and PLN Distribution Bali
Kalimantan	PLN West Kalimantan Region, PLN Central and South Kalimantan Region, PLN North and East Kalimantan Region
Sulawesi & Nusa Tenggara	PLN North Sulawesi and Gorontalo Region, PLN South, Southern, and West Sulawesi Region, PLN West Nusa Tenggara Region, and PLN East Nusa Tenggara Region
Maluku & Papua	PLN Maluku and North Maluku Region, and PLN Papua and West Papua Region

Source: PLN, 2016a

Regarding transmission and distribution network policy in Indonesia, besides PLN, the private sector also could participate in the transmission development in Indonesia. The example for this is the 275 kV SUTET Poso HEPP – Palopo through the length of 209 km and high – voltage transmission line which dedicated to IPP power plant (DJK, 2015b). Thus, the policy of transmission network, include the pricing of leased networks, need to be regulated due to its natural monopoly characteristics. PLN, as the operator of the electricity grid in Indonesia, conduct the duties under the heavily regulated electricity grid regulation in Indonesia such as the Electricity Law 30/2009, Government Regulation 14/2012 as amended by Government Regulation 23/2014 concerning on Business Activities of Electricity Provision and its derivative regulation in MEMR Regulation No. 1 of 2015 concerning the Cooperation in Electricity Supply and Power Wheeling. Major provisions point of regulation for the electricity grid organization in Indonesia could be described as follows (PLN, 2015b; DJK, 2015a; DJK, 2016b):

- Transmission and distribution activities could be done by entities that hold either the license for electricity provision in transmission and distribution activities or integrated activities that have transmission and distribution networks. It means that the opportunity to participate in the transmission and distribution activities is not only limited to state-owned utility (who have the first

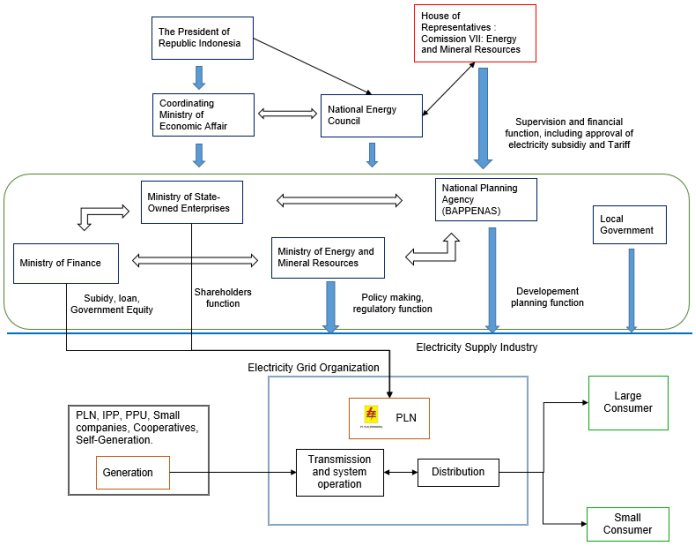
priority) but also given for regionally-owned utility, private entities, cooperation and self-reliant communities with license that issued by Minister or Governor in accordance with its authority;

- The new Electricity Law introduce the determining business area or wilayah usaha (no longer based on the administrative area) for the power supply license holders. There is should be only 1 (one) entity in 1 (one) certain business area. The illustration of electricity business area in Indonesia besides PLN could be seen in Appendix 1 and Appendix 2;
- The operation of transmission network must be open access and organized by the operator who operates the biggest system on the local system, and for the operation of distribution network could give access for joint utilization of the distribution networks;
- The joint utilization of transmission and distribution networks conduct thru network lease between the license holders of electricity provision for transmission and/or distribution activities with another party that will be using the transmission and/or distribution network upon approval of the lease price from Minister or Governor in accordance with its authority. As for the joint utilization of the transmission and/or distribution network should be noticing the ability of the transmission and/or distribution network capacity
- The lease price for transmission network is according to the price from transmission business entity that leases the network that has been approved by the government, and the lease contract should be agreed by both party.
- To assure the safety, reliability, and efficiency of operation and development systems, the network systems operator shall refer to the grid code that has been stipulated in MEMR Regulation 03/2007 (Java-Bali grid code), MEMR Regulation 37/2008 (Sumatera grid code), and MEMR Regulation 02/2015 (Sulawesi grid code). The grid codes are contained network management (grid management code), operation rules (operation code), planning and implementation of the operation rules (scheduling and dispatch), electric power transaction rules (settlement code), metering rules (metering code), and data need rules (data requirement code);
- Other technical agreements that have not been stipulated in grid code shall be set forth in joint agreement and be a part of the lease agreement of power transmission;
- The plan for general investment of transmission (and also distribution) are coordinated by government through General National Power Plan (RUKN), and then implemented in Business Plan for Electricity Provision (RUPTL) PLN that used RUKN as guidance.

4.1.4. Institutional Governance in Indonesia Electricity Grid Organization

Currently, in the electricity grid organization, PLN is under the supervision of several Ministries. First of all, MEMR thru the Directorate General of Electricity for technical perspective supervision in an aspect of policy making and regulation function. Directorate General of Electricity also acts as the regulatory authority. Secondly, Ministry of State-Owned Enterprises for management perspective which is in shareholders function. The third institution is Ministry of Finance for financial perspective in terms of subsidies, loan and guaranteeing the business feasibility in several projects that involve state government budget. Last but not least, PLN also has to coordinate the development planning of electricity with the National Planning Agency. This condition has made PLN difficult to define policy because they receive orders from different Ministries (Idris, 2015). This four-way institutional structure creates the administrative process favorable to political misuse and issue of inter-agency conflict (Purra, 2011). The institutional government structure in Indonesia electricity sector relation and particularly in electricity grid organization could be seen in Figure 4.5 below:

Figure 4.5 Institutional Governance in Indonesia Electricity Grid Organization



Source: Purra, 2011.

4.1.5. Independency of Regulator and Grid Operator in Indonesia

In Indonesia electricity sector organization, the independent regulatory authority and transmission system operator does not exist. In the General National Power Plan (RUKN), it's stated that an independent power system operator is needed in order to attain efficiency and optimization in electricity supply (DJK, 2015a). This is in line with the evaluation from International Energy Association (IEA), which specified the lack of independent electricity regulator or transmission system operator (TSO) in Indonesia. An Independent regulator is prominent due to the free-conflict status, as its only function would be to authorize for suitably balancing cost, reliability, quality, and safety of supply thru the system, from planning to operation (IEA, 2015).

The entity that has a role as the regulator in the electricity sector is the government itself, specifically by Directorate General of Electricity which is in the structure of the Ministry of Energy and Mineral resources. While the transmission system is managed by PLN who also acts as a transmission system operator in Indonesia. As the state-owned enterprises (SOE), PLN also has the responsibility as Public Service Obligation (PSO) to provide electricity and electricity grid infrastructure throughout all of the Indonesia. This has made the government often interfere in PLN function and policy implementation, especially in the electricity grid organization, where PLN holds the natural monopoly status on it. In other words, PLN acts as the implementers of government policy.

Thus, with the status the public service as well as a profit-maximizing company, PLN has to evaluate whether its own activities have delivered reasonable electricity price for consumers and not at the cost of the government. This is heavily related to other characteristics of the Indonesia electricity sector, which is severely subsidized tariff to end costumers (Pintz & Korn, 2005). PLN, as the sole sate-owned electricity in Indonesia, received an amount of subsidy money each year from the government (with the approval of House of Representatives) to cover the gap between electricity tariff to end consumer and the electricity production, transmission and distribution cost. This subsidies tariff effectively embed the government monopoly in electricity sector from supply to end user (electricity retailing) in Indonesia. This subsidized tariff also made PLN highly dependent on the government in terms of company budgeting.

In terms of corporate governance in PLN, the highest decision making is made at the General Meeting of Shareholders, which is held by Minister of State Owned Enterprises due to the shares of PLN is owned 100% by GOI. This is in line with the provision in the State Owned Enterprises Law 19/2003. The organization of the firm and the execution of any settlement made in the General Meeting of Shareholders is performed by the Board of Director and supervised by the Board of Commissioners, which also give suggestion to assure the entity goals and decisions of shareholders are conducted and accomplished (PLN, 2016a).

4.2. Background of European Context as Benchmark Model

The ownership structure of energy utilities in European countries has altered alongside the restructuration of electricity value chain. The tradition of public ownership of energy utilities has long existed in many of European countries. For the commercial functions in electricity value chain such as generation, supply, and retail, are common to be privatized in liberalized reign. However, regarding electricity networks, which is transmission and distribution, oftentimes there is political intervention to privatization and results in public ownership that became slightly prevalent (Kunneke & Fens, 2007). EU thru the EC has released EU regulation in the form of three factual electricity directives which have started the reform in electricity policy within EU countries. The first directive is Electricity Directive 96/92/EC. This Directive was enforced in February 1997 and demanded all Member States to introduce competition in their electricity markets. To fit this, then access to the electricity grid had to be designated to third parties, and needed to steps of unbundling the networks from other functions and newly competitive areas of the electricity industry to set up a level playing field (Green, 2006).

The second directive is Electricity Directive 2003/54/EC as a portion of the electricity markets liberalization in Europe. This regulation demands the legal unbundling of all networks activities (transmission and distribution) from another activity in the electricity value chain. For the time needed, transmission network operators (TNOs) were should have been legally unbundled as of 1st of July 2004, whilst the distribution network operators (DNOs) target date is 1st of July 2007. This directive also demanded all member states create an independent regulatory agency for electricity, which affirmation to the unbundling requisites. The directive contemplated notable improvement for the accomplishments of a single market in electricity services within EU countries (Pollitt, 2009).

The third directive is Electricity Directive 2009/72/EC which included in the third energy package. Main features of the third energy package are the unbundling of transmission network activities from energy production and supply, assure the equitable competition among the entities in EU and in the third country, national regulatory authorities need to be reinforced and the set-up of European energy agency. The third package has also enhanced the independence of the TSOs and their collaboration in EU, via the European Network of Transmission System Operators (ENTSO-E) thru the Regulation EC No. 714/2009. The regulation also provides the foundation to increase the electricity cross-border supply and grid access in EU internal market and required member states to regulate electricity transmission tariffs through the regulatory authorities (IEA, 2014a).

The fundamental principles of the third package are the unbundling, which means the effective detachment of network functions from production and supply functions. The unbundling could take place in a different form: ownership unbundling (OU), independent system operator (ISO), and independent transmission operator (ITO). In the OU form, the full separation of the TSO is conducted from any production and supply concerns in order to able to decide entirely the transmission activity, including the transmission operation. While in form of ISO, the separation is conducted for the

operation of the network and the asset ownerships. For the ITO form, strict fulfillment structures have to be done by the operators to assure the independence of the ITO in terms of assets, instrumentation, employee, organization and identity, network planning and investment (IEA, 2014a). In the next section, more in-depth overview of electricity value chain and the development of electricity network organization in European countries, namely the Netherlands, Germany, and France, will be elaborated.

4.3. The Netherlands Current Electricity Grid Organization Models and Regulation

The Dutch Government stipulates the new electricity act on 1st of August 1998, set up the framework of the liberalization in the Dutch electricity market (Van Damme, 2005). The Electricity Act 1998 dedicates to secure reliability, sustainability, and efficiency in the Dutch electricity sector as the three pillars of Dutch energy policy. The Act embodies regulations for the electricity generation, transmission, distribution, and supply. Since the production and supply of electricity are fully liberalized, the Electricity Act then mainly reckon with non-discriminatory access to electricity grids (Jansen et. al, 2009). The Electricity Act 1998 required the transmission and distribution grid owners to designate a network manager for the organization and operation of their grids and demands legal unbundling of the grid manager (Jansen et. al, 2009).

Tennet is the state-owned transmission network company which owns, operates and expands the Dutch high-voltage network as transmission system operator. The business of Tennet include electricity transportation and observe the electricity supply and demand balance (Tennet, 2010). As the leading transmission operator, TenneT has a responsibility to preserving the electricity system in terms of electricity balance and operational security, based on electricity consumption and production predictions from the market actors which is put forward to Tennet as the TSO (IEA, 2014b). Tennet customers consist of power producers, traders and eventually everyone who utilize electricity (i.e. consumers, residents). Besides in the Netherlands, Tennet also operates a large part of Germany transmission networks (Tennet, 2010).

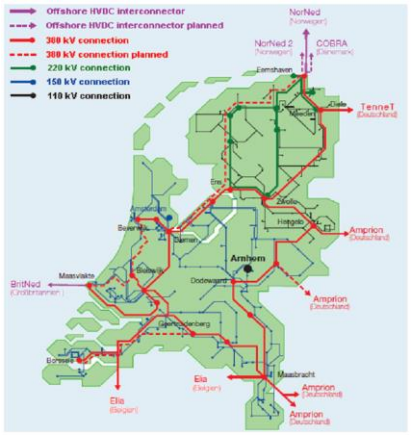
While for the distribution network, currently there are eight regional Distribution System Operator (DSO) that operates the low-voltage grid in the Netherlands thru the concession treaty. There are four DSO that runs over the 90% of distribution grid: Enexis, Liander, Delta, and Stedin. Enexis and Liander are entirely independent and owned by the provincial government and municipalities, while Delta and Stedin are separately managed and still being a portion of Delta and Eneco, respectively, who still denied full unbundling (Deloitte, 2015a). The following section will describe more detail regarding the electricity network organization and regulation in the Netherlands.

4.3.1. Electricity Transmission Organization and Regulation in the Netherland

The electricity transmission grid in Netherlands is as shown in Figure 4.6. The transmission network is operated by TenneT and had a total length around of 20,000 kmc that is composed of 443 substations that services 37 million consumers and 67 GW of installed capacity in 2013 (IEA, 2014b). The numbers then increased in 2015, where Tennet operated 22.245 kmc high voltage lines and serves 41 million consumers (TenneT, 2016). In the electricity network organization, the Dutch government has preferred that all network-linked activities remains to be regulated and fundamentally owned by governmental institutions (Kunneke & Fens, 2007). The electricity transmission network is presently owned and operated by TenneT which is a fully state-owned company. Tennet B.V. is the transmission network company which have a role as transmission system Operator (TSO) and operates the transmission grid in Netherlands and also a significant share of the transmission grid in Germany (Frontier Economics, 2015). TenneT is entirely owned

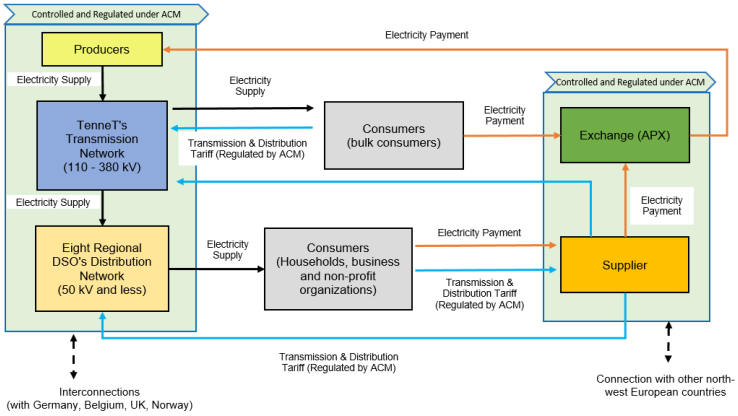
either directly or indirectly by the governments of the Netherlands in 2001. Tennet manages transparent, objective and inequitable entry access to the electricity grid (Boost, 2011). The company operates the Dutch high-voltage transmission network with a voltage of 110 kV and above (150 kV, 220 kV).

Figure 4.6 Electricity Transmission Grid in the Netherlands



Source: Boost, 2011.

Figure 4.7 Electricity network organization in the Netherlands and the role of TenneT



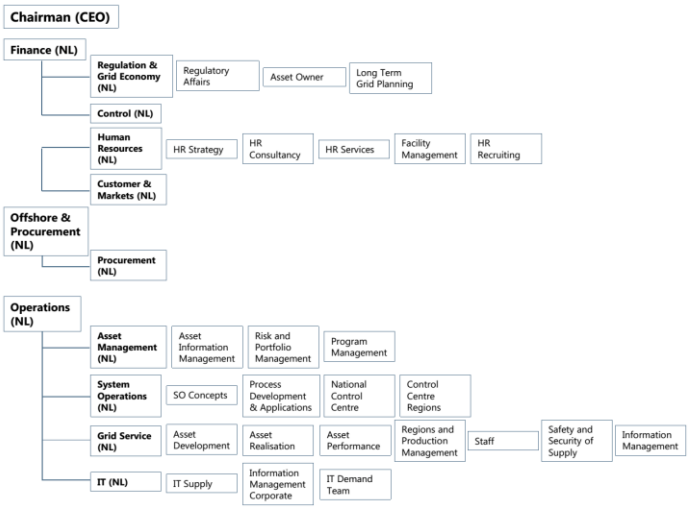
Source: Netherlands Court of Audit (2015).

TenneT performs the significant role and becomes the main actors in the Dutch electricity supply chain, particularly in the electricity network organizations, as shown in Figure 4.7. The high-voltage grid operated by Tennet is linked to regional and local distribution grids operated by other diverse distribution network companies (DSOs) and directly to large industrial consumers (TenneT, 2016). The activities of TenneT as an electricity transmission system operator in the Netherlands are organized and determined by pertinent legislative and regulatory provisions and also supervised by regulatory authorities, Autoriteit Consument and Markt (ACM), to make sure TenneT fulfillment with the regulation. Beneath the system of regulated third party access as defined in the Electricity Act 1998, the regulatory authority (ACM) then determines the tariffs and requirement for the electricity transmission and the extension to the transmission network (Netherlands Court of Audit, 2015).

4.3.1.1. The Organization of TenneT

TenneT is one of the leading electricity transmission system operator in Europe, which have 2,974 employees and profit of 680 million Euro in 2014. TenneT serves end-user consumer of 41 million people in 2014 in Netherlands and Germany (TenneT, 2016). TenneT has a statutory responsibility to provide power transmission services, system services and facilitating the electricity market. This main duty come after the assignment of TenneT as the grid operator in the Netherlands which defined in the Dutch Electricity Act. For the transmission services task, TenneT develops and preserves the high voltage grid that is utilized to transport the electricity in large amount to the lower voltage grids of DSOs and particular industry consumers in the Netherlands and also in a big portion of Germany. Aside from, TenneT also develops and preserves some cross-border interconnection with neighboring countries (Netherlands Court of Audit, 2015).

Figure 4.8 TenneT TSO B.V. Organizational Structure



Source: ACM, 2012

TenneT TSO B.V. head office and National Control Center are located in Arnhem. Regarding system operations and grid service, TenneT TSO B.V. also have regional offices in Hoogeveen (Region Noord), Waddinxveen (Region West) and Weert (Region Zuid) (TenneT, 2014c). These regional offices are supervised under the Chief Operating Officers in the Executive Board. The operational management is performed by the Executive Board which consists of one CEO and three statutory board members and two non-statutory members (TenneT, 2016). The complete organization structure of TenneT TSO B.V. is illustrated in Figure 4.8.

TenneT holding B.V. keep the overall share of TenneT TSO B.V., the subsidiary or business unit of TenneT Holding B.V. which performed the electricity transmission system in the Netherlands. TenneT TSO B.V. organizes the regulated activities in the Netherlands by various subordinate companies which owned the grids of 110 kV above. This organizational structure was initiated for several causes, one of it was the possession of the high-voltage grids owned by Liander N.V., Enexis B.V., and Delta N.V. in 2009. The subsidiaries of TenneT TSO B.V. is as follow (TenneT, 2015):

- B.V. Transportnet Zuid-Hollan
- d. The 150 kV grid and portion of the 380 kV grid in South Holland Province are owned by this entity;
- HS Netten Zeeland B.V., which operates the previous 150 kV and 380 kV grids of Delta N.V.;

- Nadine Network B.V., which operates the used Liander N.V. high-voltage grid 110 kV and higher. The exemption is made for the 150 kV grid of Liander N.V. (known as 'Randmeren grid'), which is conducted by cross-border rent contract;
- Saranne B.V., which is legally owned of nearly all the physical portion of the 220 kV and 380 kV grid of TenneT TSO B.V.;
- TenneT TSO E B.V., which operates the previous Enexis B.V. high voltage grid of 110 kV above; and
- Reddyn B.V., which is a partnership between TenneT TSO B.V. (50%) and Liander N.V. (50%), and has duties to construct, maintain, and give technical support of the previous 110/150 kV and 50 kV grid of Liander N.V.

Besides the statutory responsibilities mentioned above, TenneT also operates some non-statutory activities based on direction from the Dutch government. In 2004, the electricity law was modified due to the reason assuring that TenneT non-statutory activities are given negative impact to the statutory responsibilities. Thus, it allows TenneT to employ a group structure in its organization structure. In 2005, TenneT then altered its articles of association which create a subsidiary company namely the TenneT TSO B.V. running beneath TenneT holding entity, which was created to fulfill its statutory responsibility. This had the consequent of securing grid organization from the business risk correlated with the firm's other activities, which were currently operated by other group entities (Netherlands Court of Audit, 2015).

In terms of corporate governance structures, TenneT is in the form of two-tier board structures as defined in the Electricity Act. It consists of 6 members of Executive Board (four statutory and two non-statutory directors) and 6 members of Supervisory Board and also General Meeting of Shareholders. The Executive Board have responsibility for TenneT general policies and strategy, which comprises of regulated and non-regulated activities. Every board member has restricted individual authority and becomes managing directors in TenneT subsidiaries as follow: two members in TenneT TSO B.V.; two others in TenneT TSO GmbH and one other in TenneT Offshore GmbH (TenneT, 2016).

4.3.2. Electricity Distribution Organization and Regulation in the Netherlands

The overall Dutch distribution grid has length of 325,000 kmc and almost entirely in the form of underground cables. The electricity distribution networks are performed by the regionally reigning utility entities that are owned by provinces and municipalities governmental institutions. The ownership of the distribution networks is still with the municipality and the provincial government even after unbundling, although differentiated from the production, trade, metering and sales activities (Kunneke & Fens, 2007). Similar to transmission networks, the Dutch government determined to carry out the pertinent European law by forming distinct entities accountable for the distribution of electricity. In result, as described in the previous section, Liander and Enexis become the two regional network operators that remain publicly owned by the local government after detached from Nuon and Essent respectively. The distinction of the distribution networks was also specified in the 2006 Independent Network Management Act or known as The 'Unbundling Act'. This Act also made TenneT statutory in control of for organizing entirely 110 kV high grid voltage and above in 2008, while for the low voltage grids operation (50 kV or less), become the responsibility of the eight regional distribution system operator (Netherlands Court of Audit, 2015).

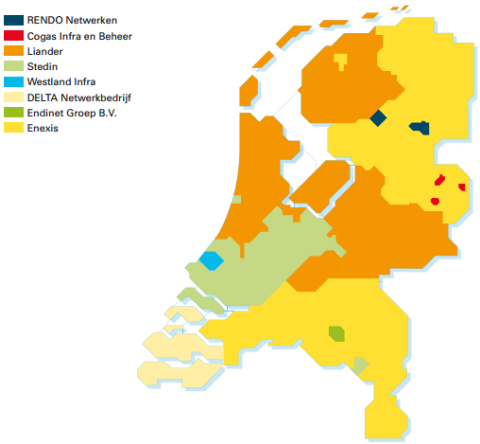
The legal structure of the existing Dutch energy companies is very unique. The entities are managed as private shares companies, with the shares are owned by the provinces and municipalities. The shares couldn't be put on sale in the existing regulation and political situations and would need the

approval of Ministry of Economic Affair to do it. Nevertheless, several public shareholders have the intention to capitalize their assets, and they don't take into account the energy activities as an indigenous public task anymore. The restructuring of the energy sector in the Netherlands have made the privatization of energy firms as a prominent goal when the market is adequately grown. In the Netherlands, ownership unbundling is heavily connected to the farther privatization of the electricity business activities. The network activities principally remain in public authorities by implementing ownership unbundling. Production and supply are managed to conform the commodity model, while the grids are avowed as a public necessity that is structurally organized corresponding to the public utility model. Within these situations, coerced ownership unbundling is a necessary tool to maintain public service obligation of the distribution networks (Kunneke & Fens, 2007).

In the Distribution sector, nowadays there are eight distribution system operators (DSOs) that operate the Dutch electricity distribution network system and mostly also the gas distribution systems. The company names are: Liander B.V., Enexis B.V., Stedin B.V., Delta Netwerkbedrijf B.V., Endinet B.V., Westland Infra Netbeheer B.V., Cogas infra en Beheer B.V., and RENDO Netbeheer B.V. Most of the activities of the DSO's are regulated by the regulatory authorities. In this case, ACM is the regulatory authority that oversees the grid operator services and the charged cost to the consumers by the grid operators (Enexis, 2016). In the Netherlands, some households could have separate electricity and gas suppliers due to the geographical deployment of electricity and gas distribution networks. For the operation of an electricity distribution network, a concession area is needed by the DSOs. The procedure to obtain the concession is stipulated by the Energy Law of 1998 in articles 10 and 12 (Boost, 2011).

On 1 January 2011, the full ownership unbundling of electricity and gas distribution networks from supply functions is mandatory to be fulfilled based on the requirements that stipulated in The Network Unbundling Act in 2006 (Wet onafhankelijk netbeheer). Thus, since 2010 there are six DSOs have been entirely ownership-unbundled while the other two DSOs still being a share of a vertically integrated company (IEA, 2014b). In one hand, Enexis and Liander are already fully independent, which owned by provinces and municipalities. While on the other hand, Delta Netwerkbedrijf remains parts of Delta (as the vertically integrated company) and Stedin is still being parts of Eneco (Deloitte, 2015a). These two companies have refused full unbundling and until now this legal procedure still underway in respect with this case (Deloitte, 2015a).

Figure 4.9 The Area of Distribution System Operator in Netherlands



Source: Netherlands Court of Audit, 2015

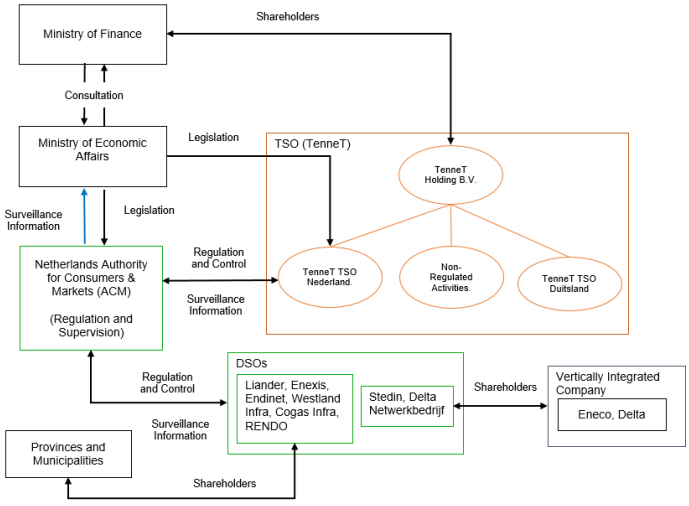
These DSOs operate in the different location in the Netherlands as illustrates in Figure 4.9. Liander, together with Enexis, Stedin and Delta operates more than 90% of the distribution networks in the Netherlands. For the remaining 10% of distribution networks are organized by the others DSO (Deloitte, 2015a). Liander operates the in the provinces of North Holland, Zuid Holland Flevoland, Friesland, and Gelderland (Frontier Economics, 2015). Enexis operates in the Dutch provinces Groningen, Drenthe, Overijssel, Noord-Brabant, Limburg, and through Endinet B.V. (recently), in the Eindhoven (Enexis, 2016). Stedin Cover the area in West Holland, including the biggest port in Europe, and the province of Utrecht (Stedin, 2016). While Delta Netwerkbedrijf serves the province of Zeeland (Delta, 2016).

In terms of electricity grid regulation for the distribution networks, the same conditions are applied likewise for the transmission networks. The grid manager shall operate the distribution services in a coherent and non-discriminatory with respect to general terms and requirements, in accordance with the Electricity Act. Related to the distribution tariff, the regulatory authority defines the maximum price for the electricity distribution and the connection to the distribution network of the distinctive grid managers (Netherlands Court of Audit, 2015).

4.3.3. Institutional Governance in Dutch Electricity Grid Organization

There are several Governmental institutions that have a responsibility in the Dutch electricity sector and particularly in the electricity grid organization. The Ministry of Economic Affairs has the forefront authority to formulate and implement the energy policy. Ministry of Finance is the 100% owner shares of Dutch transmission network company TenneT. Aside from, there are also provinces and municipalities that are the shareholders in some of the distribution system operators (DSOs). The connection between TenneT and the governmental agency in the Dutch electricity network organization is as shown in Figure 4.10. Ministry of Finance deals with Tennet Holding due to its role as the shareholders of the entities of the State interest. While Ministry of Economic Affairs and ACM reckon with TenneT TSO Nederland, which is TenneT business units that assigned for organizing the high-voltage grids and electricity transmission in the Netherlands.

Figure 4.10 Institutional Governance in the Netherlands Electricity Gird Organization Structure



Source: Netherlands Court of Audit, 2015

The Dutch government creates the Dutch Office for Energy Regulation or Dienst Uitvoering en Toezicht Energie (DTe) as a section in Nederlands mededingingsautoriteit, (NMa) in 1998. Within

the Competition Act of 1997, DTe and NMa performs beneath the authority of Ministry of Economic Affairs, who define in the issued regulations the public guidance's on the performance of the duties entrusted to the director of DTe and director general of NMa (Wals et. al, 2003). This regulatory authority functions then become integrated into one agency, namely the Netherlands Authority for Consumers and Markets (ACM) which established in April 2013 by the Dutch Government. ACM came from the integration of several institutions such as the Netherlands Consumer Authority (CA), NMa and its energy subsidiary, DTe, Energiekammer, and the Netherlands Independent Post and Telecommunication Authority (OPTA) (IEA, 2014b).

4.3.4. Independency of Regulator and Grid Operator

The ACM tasks are for enforcing and assuring the fulfillment of 1998 Electricity Act in the Dutch electricity sector. The energy regulator is created as an independent agency with also independent financial account beneath the Ministry of Economic Affair. Associated with the electricity network organization, ACM duties are assured the wholly free access to the electricity grids under balanced conditions, give counsel to the Ministry of Economic Affairs on the designation of grid managers, supply tariff and tariff structures of transmission and system services, and conditions for the electricity transmission. Every two years, the ACM evaluates the grid managers in term of sufficiency and efficiency towards the whole demand for transmission capacity (TenneT, 2014a).

The Dutch government preferred to preserve regulated networks under public ownership, thru the Ministry of Finance that owned 100% share in TenneT. This is based on the reason that the Dutch government and Parliamentary consider electricity supply created such an important public interest and to hinder other parties with strategical interest that want bought shares in TenneT. In 2001, TenneT becomes an entirely state-owned utility to warrant independent access to the transmission network. This provision stipulated in the Electricity Production Sector Transition Act, which released as an adjustment to the 1998 Electricity Act (Netherlands Court of Audit, 2015). TenneT TSO B.V. was 100% possessed by the Dutch government (Ministry of Finance) in 2013 beneath the TenneT Holding structure. TenneT also has been qualified concurrence with the TSO ownership unbundling compulsion stipulated in the EU Third Electricity Package. This is one of the requirements to get a license to perform as TSO by Ministry of Economic Affairs. Previously, in May 2013 ACM has decided to endorse TenneT as ownership unbundled TSO in the Netherlands to comply with the provision in Regulation EC No. 714/2009 and Directive 2009/72/EC (IEA, 2014b).

In the TenneT corporate governance structure, all of the members of Supervisory Boards are independent as stated in the Corporate Governance Code. Moreover, the Supervisory Board fulfill the provision in the Electricity Act, which defines that the majority of Supervisory Board members should keep no connection whether directly or indirectly with legal utilities in the generation, purchase or electricity/gas supply. Within the Electricity Act, only Dutch Government as the owner of TenneT, that may keep voting interests in the firm (TenneT, 2016).

Within the context of the national law, the regionally organized grid companies are independent in their corporate strategy. The electricity Act 1998 and The Act on Independent Network Management of 2006, which is also designated as the 'Unbundling Act', forbid network managers to be a portion of the similar group as the commercial electricity entities (known as group-ban) in order to assure the independence of the Dutch electricity network managers and to make the ownership unbundling effective (Feld & van der Weijden, 2010). In terms of corporate structure, the regionally distribution companies, as well as other Dutch energy firms, are in form of a public limited entity under Dutch legal system with statutory two-tier status, which means the governance model be composed of the two-tier board. The company is organized by Management Board, whilst the Supervisory Board have

a duty to supervise the company. Both of the boards perform independently of each other and responsible for the achievement of their tasks to the General Meeting of Shareholders (Alliander, 2015; Enexis, 2016; Delta, 2016).

4.4. Germany Current Electricity Grid Organization Models and Regulation

The German network system is the most prominent electricity-transport area and becomes center in the mainland European electricity market (IEA, 2013). In the transmission activities, four TSOs manage the grid operation in Germany: Amprion, TenneT, TransnetBW/Elia, and 50 Hertz. Historically, these four TSOs were also possessed by the four main generation companies: RWE AG, E.ON Energy AG, Vattenfall Europe AG and EnBW AG (Deloitte, 2015b). The 1st EU Electricity Directive then became the reason of the deregulation in Germany electricity structure, resulting in the unbundling of transmission business from other activities in three main companies, except for TransnetBW, which is still part of EnBW (DJK, 2016c). While the distribution and supply of electricity are conducted by around more than 900 regional and local vertically integrated entities that have generation assets and also many of the shares are held by the four main companies (BNetzA, 2013; IEA, 2013).

The electricity grid organization in Germany is mainly under the legal framework of federal Energy Industry Act (EnWG). The first Energy Industry Act was stipulated in April 1998 as the compliance of EU directive 96/92/EC of the internal energy market. Under the Act, Germany is the only country in Europe that chose the negotiated third-party access (TPA) in the electricity grid organization (Brunekreeft, 2002). The Energy Industry Act then amended in 2005 as a result of the EU acceleration directive 2003/54/EC. In the new Energy Industry Act, the scheme of TPA then altered to a regulated TPA. The Act also establish the regulatory authorities which one of the duties is to legal unbundling the network sector from production and supply (Brandt, 2006). In 2011, the Energy Industry Act has adjusted again as the alteration of EU third Energy Package. This adjustment set up more stringent unbundling rules with three choices of unbundling modes: ownership unbundling, independent system operator, and independent transmission operator, as well as give new controlling tasks (BNetzA, 2013). The following section will describe more detail regarding the electricity network organization and regulation in Germany.

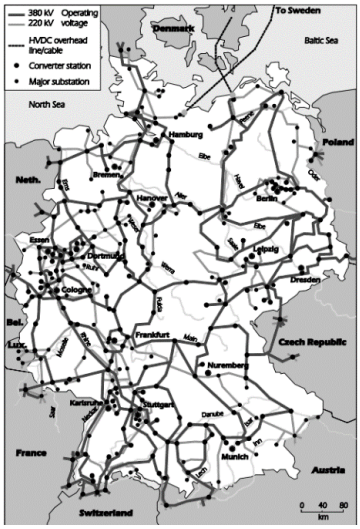
4.4.1. Electricity Transmission Organization and Regulation in Germany

As described in the previous section, the transmission grids in Germany are organized by the four legally unbundled utilities which have a role as the TSOs in Germany electricity network system. In the ownership structure, the four main energy utilities formerly possessed these four TSOs. Nevertheless, in the past years, due to several causes consisting of regulatory insistence following the initiative from the European Commission and the Federal Cartel Office, and also the necessity to reinforce the firm's balance sheets, the ownership structure then altered. The big four utilities then sold their assets to independent shareholders or legally unbundled from the holding entity (IEA, 2013). Currently, 50 Hertz and TenneT structure are already ownership unbundling, while Amprion and TransetBW are in the form of as independent transmission operator (IEA, 2014a). In general, the corporate governance structure of the TSOs in Germany are in a form of two-tier board, consists of the Executive Board which have a responsibility to manage the company operational activities and the Supervisory Board, as the controlling and advisory functions for the Executive Board (Amprion, 2016a; 50 Hertz, 2016; TransnetBW, 2016b).

The electricity network system in Germany could be seen in Figure 4.11. As the TSO conscientious in their balancing region in Germany, these four companies has tasks to provide secure, reliable,

efficient, and environmentally friendly performance, maintenance, and preserving the stability of electricity production and use in the balancing zone overall electricity supply system. The TSOs also obtain the requisite control power (primary control, secondary control, and tertiary control) and the power required for grid's losses substitution by using transparent tender methods in accordance with the regulation. The non-discriminatory third-party access to the grids also become the requirements that have to be fulfilled by the TSOs (IEA, 2013).

Figure 4.11 Electricity Network in Germany



Source: IEA, 2013

Due to its natural monopoly characteristics, the electricity grid in Germany also regulated with respect to network access regulation, including tariff regulation (incentive regulation) thru the derivatives regulation from the Energy Industry Act such as: Electricity Network Access Ordinance (StromNZV), which defines the condition for transporting the electricity to grids and set up the basic arrangement for grid balancing and balancing group management; Electricity Network Charges Ordinance (StromNEV), which defines the method to be used for calculating the grid fees (for transmission and distribution), and; Incentive Regulation Ordinance (AregV), which utilizes incentive-based regulation to determine the costs for access to the electricity networks. It defines provisions to be used to specify the total revenue that grid operators could take from grid charges (revenue cap), and also defines quality requirements (BMWi, 2016);

The Renewable Energy Sources Act (Erneurbare-Energien-Gesetz, EEG) also have an effect on the electricity grid organization in Germany. The Act organizes the exquisite feed-in of electricity from renewables to the grids in order to grant the operation of renewable energy power plants. Under the law, the grid operators are demanded to take the electricity from these amenities and put it on the market. The Act also set up fixed rates of remuneration for electricity produced from renewable energy (Amprion, 2016a).

4.4.1.1. The Organization of TSOs in Germany

The four TSOs geographical division and operating area of the transmission system in Germany could be seen Figure 4.12. The longest electricity transmission grids in Germany is managed by Amprion GmbH, with nearly 11,000 kmc high-voltage lines in western Germany, from Lower Saxony down to the Alps (Amprion, 2016a). Amprion Head Office is located in Dortmund. Previously, Amprion was a portion of RWE until in 2011 RWE decide to dispose the company to a coalition of

financial investors (Deloitte, 2015b), joint operation of M 31 Beteiligungsgesellschaft mbH and Co. Energie KG, a firm which owners mainly encompass German institutional financial investors from the insurance industry and pension funds (Amprion, 2016a). Currently, Amprion is owned by the consortium with 74.9% of shares and RWE with 25.1% (RAP, 2015). As mentioned before, in the Germany network electricity system, Amprion structure is in the form of independent transmission operator, which have certified by the Federal Network Agency in compliance with the German Energy Act (Amprion, 2016b).

Figure 4.12 Geographical Division of the Transmission System by Operator

Source: Deloitte, 2015b

Amprion control and oversees the electricity transmission securely within the extra-high-voltage grids in its balancing zone. This task is conducted by the system management in Brauweiler/Pulheim that assures to keep in the balance between the electricity utilization and production at any times to keep the grid stable. Amprion also organizes the ordinary load and frequency control for the four German TSO control regions (Amprion, 2016c). Overall, Amprion keeps interconnecting grids to nine outside TSO's and satisfy the requirements of European electricity traders with the highest degree of security in the delivery (Netzentwicklungsplan, 2016).

Another TSO in Germany is TenneT TSO GmbH, which bought the transmission network from E.ON in 2009 (IEA 2013b). In October 2010, TenneT TSO GmbH was formed as the German subordinate's entity of the Dutch TSO TenneT (Netzentwicklungsplan, 2016). TenneT TSO GmbH operates transmission grid in Germany with grids length of 10,700 kmc (IEA, 2013b). TenneT operating area in Germany starting from the Danish border in the north part down to Austrian border in the south through the middle of Germany (TenneT, 2014b). TenneT TSO GmbH organizes around 40% of the German transmission network, consist of 380 kV and 220 kV high-voltage lines (TenneT, 2015). The head office of TenneT TSO GmbH is located in Bayreuth with regional offices in Lehrte and in Bamberg. TenneT TSO GmbH also have control centers located in Lehrte and Dacha, near Munich (Netzentwicklungsplan, 2016). As for the ownership structure, TenneT is already in the form of ownership unbundled and fully owned by the Dutch government (RAP, 2015). The organization structure and the board structure of TenneT could be seen in in the section of electricity grid organization in the Netherlands above.

The next TSO in Germany is 50Hertz Transmission, which operates 10,150 kmc of high-voltage lines in the northern and eastern part of Germany. 50Herz transmission is currently owned indirectly by Elia (the Belgian network operator) with shares of 60% and Industry Fund Management (investor from Australia) with 40% shares, after Vattenfall sold these two companies in 2010 (IEA, 2013; 50Hertz, 2016). In the organization structure, 50Hertz is a 100% subordinate of Eurogrid GmbH (50

Hertz, 2016). In the corporate management structure, 50 Hertz have five members of Executive board and six members of supervisory board with two chairman (50Hertz, 2016). 50Hertz has been qualified as ownership unbundled grid operator by the Federal Network Agency since 2012 (IEA, 2014a; 50 Hertz, 2016). 50Hertz manage around 40% of the electricity that produced from Germany's wind energy power plants. 50Hertz assuring a stable electricity supply in company's eight regions. 50Hertz head office is located in Berlin. The network regions comprise Berlin, Brandenburg, Hamburg, Mecklenburg-Vorpommern, Saxony, Saxony-Anhalt, and Thuringia. The grid is organized and observed from the Transmission Control Center in Neuenhagen, near Berlin (Netzentwicklungsplan, 2016).

The last company that has a role as TSO in Germany is TransnetBW GmbH which operates more than 3,200 kmc of high-voltage grids. TransetBW supplies electricity to 11 million consumers in Baden-Wurttemberg. The Germany and European networks (France, Austria, and Switzerland) are also connected to TransnetBW gird. The Head office of TransnetBW is in Stuttgart, while the company's system control center is located in Wendlingen, where TransnetBW organizes the transmission grid and keep the equilibrium of electricity production and consumption (TransnetBW, 2016a). TransnetBW structure is in the form of independent transmission operator and 100% owned by the energy utility, EnBW (EnBw, 2016; RAP, 2015). The ownership structure of the four TSOs and German energy utilities is summarized in Table 4.2 below:

Table 4.2 Ownership Structure of German Energy Companies

Companies		Structure	Ownership
Transmission System Operator (TSO)	Amprion	ITO	Commerz Real AG 74.9%, RWE 25.1%
	TenneT	OU	100% owned by the Dutch government
	50Hertz Transmission	OU	60% Elia, 40% IFM
	TransnetBW	ITO	100% owned by EnBW

Source: RAP, 2015.

4.4.2. Electricity Distribution Organization and Regulation in Germany

Regional and local distribution networks in Germany is divided into high, medium and low voltage lines, which varying from 100 kV to 0.4 kV. The distribution networks in Germany is managed by vertically integrated entities, which means entities that beside own the generation infrastructures, also perform the supply and distribution activities. Data from the Federal Network Agency shown that in 2015, a total of 880 electricity DSOs were listed, with 803 of the DSOs have consumers fewer than 100,000. From the data of 813 DSOs who participated in 2015 survey, the DSOs serve more than 49 million end users with an electricity consumption of 458,9 TWh in 2014 with total grid length 1,722,400 kmc. 80% of the DSOs (635) have grids with a circuit length no more than 1,000 km, while the rest (164 DSOs) have grids with the length above 1,000 kmc (BNetzA, 2016a).

The distribution system in Germany is the most complicated in Europe. Currently, more than 900 DSOs were operating in Germany, providing electricity to 20,000 municipalities in Germany, consisting of the four main utilities as well as about 700 Stadwerke (municipally owned utilities) and a number of regional companies (Deloitte, 2015b; RAP, 2015). The illustration of DSOs operating area in Germany could be seen in Figure 4.13. After the liberalization process, the ownership structure of the regional energy supply companies is in the form of private companies, with nearly all of the regional companies are contingent on the network energy supply companies regarding the

capital investment. Nowadays, the regional energy supply companies are run in production, supply, and also in portion conscientious for sales to end users (Brandt, 2006).

Figure 4.13 Illustration of DSOs Operating Area in Germany

Source: BNetzA, 2013

The DSO's structure still essentially regional with no notable alterations (BNetzA, 2016). The four main companies hold shares and possess many of these DSOs which run the regional and local distribution grids. However, the possession of operators in regional players by the four main companies nowadays is prohibited by the Federal Cartel Office. Regularly, the local network operators are organized by municipalities (IEA, 2013). The municipalities lease their distribution right for up to 20 years to the network operator thru the concession contracts. Nevertheless, under the Energy Industry Act, the requirements of non-discriminatory rules and could be invalidated are set in the renegotiated contracts. This is enforced thru the derivatives regulation from the Energy Industry Act such as Low-Voltage Connection Ordinance (StromGVV), which demanded the local network operator to connect any assets of end users within its area to the local grid and defines the content of grid connection contract, and Concession Fee Ordinance (KAV), which stipulates the concession fees that need to be paid by the energy companies to the local government for the right to utilize public transport routes and to run energy networks (BMWi, 2016b). Presently, many of the Stadwerke have the intention to snatch their own grid organization as many of concession contracts need to be re-evaluated (RAP, 2015).

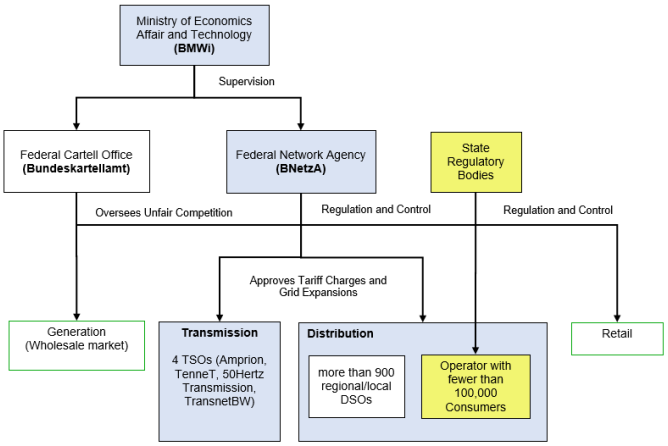
4.4.3. Institutional governance in Germany Electricity Grid Organization

Currently, in accordance with EU Second Energy Package (European Directive 2003/54/EC), the federal network regulator, the Bundesnetzagentur (BNetzA) of Federal Network Agency was created in 2005 as the regulatory authority in Germany. BNetzA is a supreme federal authority beneath the supervision of the Federal Ministry of Economics Affair and Energy, who has the preside charge to draw up and implement energy policy (IEA, 2013). Under the legal framework, the Energy Industry Act, the Federal Network Agency has regulatory duties to supervise the transmission and distribution system operators, as well as consents the tariff charges and grid expansion (DJK, 2016c). The supervision role consists of assuring the non-discriminatory access to the grid, control the network consumption rates from the electricity supply entities, observes of anti-competitive application, and keep watch on the regulations regarding the unbundling of the network areas (BNetzA, 2016).

Besides the Federal Network Agency, there is also local network authorities set up in each region. They have duties to oversee the distribution network on small-scale, which service not more than 100,000 consumers and whose grids do not perform outside their geographical state regions (BNetzA, 2016). The tariff charges level are stipulated independently by each of the states government (DJK, 2016c). Another institution is the Federal Cartel Office (Bundeskartellamt), which

have the task to implement the competition law and supervising the incorporations in the electricity sector in accordance with Competition Act (IEA, 2013). Besides that, the Federal Cartel Office also conscientious for the examination of the energy prices charged by energy suppliers whose working on the national level (BNetzA, 2016). The institutional governance in Germany electricity structure could be seen in Figure 4.14 below.

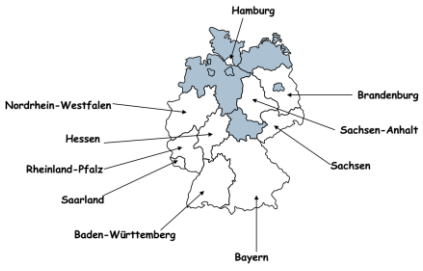
Figure 4.14 Institutional Governance in Germany Electricity Gird Organization Structure



Source: DJK 2016c

In the Federal Republic of Germany, there were 16 Lander (States) throughout the country as shown in Figure 4.15, with each of the states have own constitutions and internal organization. For the electricity organization, there is a division of regulatory authorities between the Energy State Regulatory Authorities and the Federal Network Agency. The Energy State Regulatory Authorities manage tariffs, system responsibilities and unbundling requirements at the state level and for networks not more than 100,000 consumers. While the Federal Network Agency has main tasks for the national level and cross-border arrangement. However, the transfer of authorities is allowed from the States to the Federal Network Agency, where presently 6 of the States already transferred their authorities. Both of the institutions were performing only for regulatory functions, whilst for the permitting charge is under the State Permitting Authorities, which is distinct from the State Regulatory Authorities (BNetzA, 2013).

Figure 4.15 The Area of Federal and States in Germany



Notes: Blue area is the Federal region, while the white area is the States region
Source: BNetzA, 2013.

4.4.4. Independency of Regulator and Grid Operator in Germany

In Germany, network industries were (legally) monopolies with the majority owned by the federal or regional government or leastwise private companies within immense government interfere. The

monopolistic structures then yielding in a deficiency in Germany network electricity industry induce for more dynamics, better efficiency and reduce prices thru the process of liberalization. The role of regulation then become significant in this process. To set-up effective regulation, the national regulatory authority needs to be independent and the independence will be enhanced in a multi-sector regulator situation. In Germany, BNetzA is the higher federal authority in the area of business but detach from the Ministry of Economics Affair and Technology. Under the legal framework of German Energy Industry Act, the staff and management of BNetzA perform independently from any market interest and they do not take straight directive from any government or other public authorities or private company when performing the statutory duties. Moreover, BNetzA also self-determined from the political interfere. However, BNetZA actions also supervised by the Ministry and democratic control also conducted thru the Advisory Council and accountability rules (BNetzA, 2013).

While for the TSOs and DSOs in Germany electricity network industries, mostly they are still regulated by the federal or state government. Even though some of them are in the form of private companies, some of the regulation in the electricity grids is obliged for the transmission and distribution operators. The running of transmission and distribution networks needs the agreements of the pertinent state-level authority. The expansion of overhead grids with a voltage of 110 kV or more also requires an administrative agreement which needs the official planning procedure. The allowed tariffs charged by the network operator also determined by the Federal Network Agency and regulatory authority of the federal state during a stipulated regulatory time (Funke, 2012). Thus, under the Energy Industry Act, the grid operator in Germany are independent in their corporates strategy. The TSOs in Germany are already legally unbundled from the vertically integrated utility with the structure of ownership unbundling and independent transmission operator. While for the DSOs, the provision from the Federal Cartel Office has made the grid operator independent from the vertically integrated utility but still regulated by the local authorities.

4.5. France Current Electricity Grid Organization Models and Regulation

Before the liberalization, the electricity market in France is managed by the incumbent utility, EDF (Électricité de France), which self-regulated the monopoly. After the liberalization, production and supply sector are disclosed to competition, while transmission and distribution activities are remain regulated by the state (Fages & Saarinen, 2012). In the aspect of legal unbundling, transmission utility has adjusted the entity structure from 2004 and for the distribution, are from 2007 (IEA, 2010). The current electricity grid organization in France is mainly regulated under the legal framework of Law No. 2010-1488 of 7 December 2010 concerning new organization of markets in electricity (NOME) or the Electricity Act 2010, which is transplanted the third EU Directives 2009/72/EC, and France Energy Code of 2011

For the high-voltage grid in France, a subsidiary company of EDF, RTE (Réseau de Transport d'Électricité) is the transmission system operator in France. While for the medium-voltage and low-voltage grid, the majority of the network is organized by ERDF (Electricité Réseau Distribution France), another subordinate of EDF. The local distribution companies also involved in the distribution sector. More detail about the electricity networks organization and regulation in France will be described in next section.

4.5.1. Electricity Transmission Organization and Regulation in France

Electricity produced from the generators is transported over long ranges thru high and extra-high-voltage grids organized by RTE. The electricity then altered into medium-voltage electricity for distribution via distribution networks. This alteration occurs in substations. Thus, the high and

medium-voltage electricity are delivered straightly to industrial consumers. While residential and business consumers connected to low-voltage electricity which is already turned before in the transmission substations (Enedis, 2016). The transmission grid in France currently have total length of 105,448 kmc, and be composed of 42.6% ultra-high voltage grids (400 kV and 225 kV), which delivering electricity for heavy industry, and 53.8% regional high-voltage grids (150, 90, 63 kV), which connecting the electricity to SMEs/SMIs and residential consumers. The grid mainly consists of alternating current (AC) overhead grids with a finite amount of underground cables. In 2015, 495 TWh of electricity is transported by the grids and 121 TWh traded at the borders. (RTE, 2016a).

As mentioned before, RTE is the operator of the transmission networks in mainland France area. The transmission networks also belonged to RTE (IEA, 2010). In the business structure model, RTE is in the form of independent transmission operator (ITO), with EDF as the 100% owner of RTE (IEA 2010; IEA, 2014a). As the sole TSO in France, RTE has public service responsibility to assure the safe operation of the electricity system and warrant the open and equitable third-party access to the transmission grid. RTE tasks and operation activities consist of (IEA, 2010; RTE International, 2014):

- Management assets, which include the transmission grid and assets development and budgeting;
- Management of power stream thru the grid, which be composed of balancing supply and the use of electricity, margin valuation and operation, approximation and obtain electricity losses, and settling of unbalances with balance responsible utilities; and
- Management of grid access, which involving contracts with grid consumers in France, transmission grid access, balance responsible arrangements, balancing mechanism, etc.

These tasks are carried by RTE with also consider the most low-cost feasible (RTE International, 2014). Besides mainland area, France territories[1] also include the island area. The electricity system in these territories area is separated and isolated from France mainland area. For the electricity transmission in island area are organized by two reigning utilities, EDF Systemes Energetiques Insularies (EDF SEI), which is the subsidiary of EDF, and Electricite de Mayotte (EDM), which is semi-public utility and owned by the General Council of Mayotte (50.01%), EDF (24.99%), SAUR International (24.99%), and France government (0.01%). In these isolated areas, EDF SEI and EDM are not obliged to the provision of legal unbundling due to the stipulation in European Directives (2009/72/EC) that defined the Member States could make an exemption for the implementation of particular provisions in the small-system area (CRE, 2015).

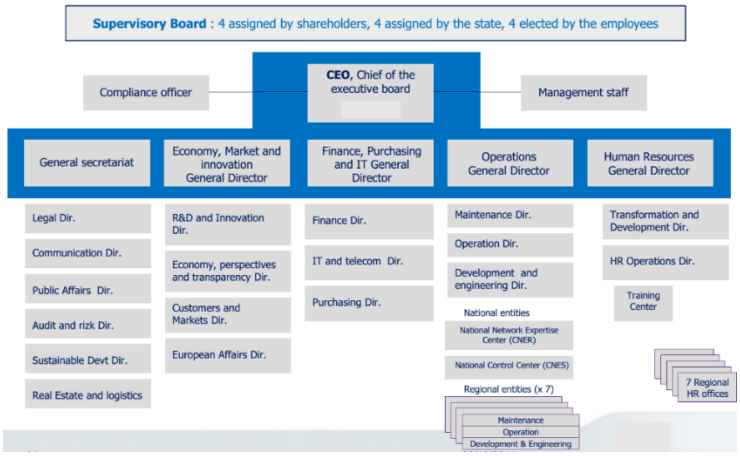
4.5.1.1. The Organization of RTE

RTE was established in 2000 with the form of independent function bounded to EDF, with a different administrative, financing, and management system (RTE, 2016b). Since 2005, RTE then became a public service company in the form of limited company and subordinate in EDF Group. This strengthens the independent characteristic of the relation among EDF and RTE (RTE, 2014b; RTE 2016b). RTE workforce in 2015 is 8,500 employees with revenue 215 million Euro (RTE, 2016a). As a limited company, RTE organized by a Management Board and a Supervisory Board. The autonomy, organizational independence, and impartiality of RTE are assured in its articles of association and mode of governance (RTE, 2016a). The Management Board has a duty to perform actions connecting with the operation, preservation and expansion of the public transmission system. The 5 members of the Management Board is selected by the Supervisory Board after taking a consult

[1] France territories area consists of Corsica, the overseas division and regions (Guadeloupe, French Guiana, Martinique, Reunion and Mayotte), particular overseas collectivities (Saint-Pierre-et-Miquelon, Saint Barthelemy, and Saint-Martin), Brittany islands Molène, Ouessant, Sein, the Glenan islands and the Channel island Chausey.

with CRE. The Supervisory Board main task is to supervise the performance of the Management Board. The Supervisory Board members consist of 4 government delegates, 4 EDF delegates, and 4 administrators picked by the employees (RTE, 2016a).

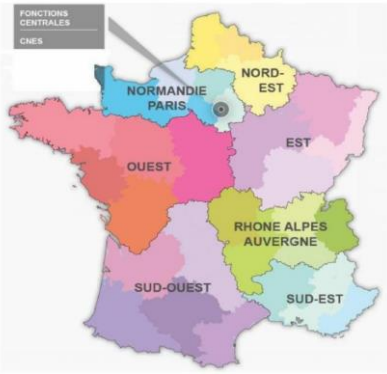
Figure 4.16 RTE Organization Structure



Source: RTE International, 2014.

In the local level, RTE has seven regional representatives and operation area that represent the company (RTE, 2014a). These seven regional representatives have own maintenance, operation, and development and engineering units, under the supervision of the Operations General Director in the RTE organizational structure. Aside from, the regional representatives also have its own human resources offices. The organizational structure of RTE is described in Figure 4.16.

Figure 4.17 RTE Regional Representatives



Source: RTE International, 2014

RTE serve and delivering electricity to 490 customers, consists of 54 Generation companies, 32 electricity DSO who transmit the electricity to SMEs/SMIs and residential consumers, 258 heavy industries, 11 railway utilities, and 135 brokers and suppliers who assembly, buy and trade electricity and demand response (RTE, 2016a). The electricity transmission is organized thru one national grid control center and seven regional control center as shown in Figure 4.17. The national dispatching center (CNES) office of RTE organizes the 400 kV grid, the balance between electricity production and consumption, cross-border connections, and safety of the electricity system. While the regional dispatching center control the 225 kV, 90 kV, and 63 kV grids, assure grid access and the quality of electricity to the consumers, conduct preservation, operation, and expand assets on their regions

(RTE, 2014a; RTE International, 2014). RTE also have several subsidiaries that operate in the competitive field such as Arteria, RTE International, Airtelis, HGRT, and Declarante (also called "valuation" group). Other subsidiaries are the subordinates that operating in the transnational prolongation of RTE's missions and mainly occupied in the regulated sectors (called collaboration group) such as Inelfe, Coreso, CASC-EU, and Medgrid (RTE International, 2014).

In term of network access tariff, RTE performs under a steady and interesting regulated pricing framework set by the France Regulatory Authority, CRE. The framework model is well-known as the tariff to access to the electricity transmission network (in French acronym known as TURPE). This scheme insures the entrance to the resources and budget needed by RTE to implement the public service tasks (RTE, 2016a). This incentive scheme is yield benefit either to RTE and the consumers. In one hand, the incentive boost RTE to organize its operating costs, preserve fluency of supply, expand cross-border connections to sustain the European internal market, and invest in R&D to anticipate future grids. On the other hand, the consumers also pushed to utilize the energy more thrifty (RTE, 2016a). The transmission network charged to the customers are based on a postage stamp basis and not bound on the range. The fees for the consumers rely on the technical parameters such as voltage level, quantity of electricity contracted and used, while the producers also recompense the network access to the 225/400 kV that depends on the quantity of electricity entered (IEA, 2010).

4.5.2. Electricity Distribution Organization and Regulation in France

In the French electricity distribution networks, one utility is dominating the market. ERDF delivers electricity for more than 95% of consumers in France. ERDF is a subsidiary and owned 100% by EDF (EC, 2015). The rest 5% of the consumers then served by local distribution companies (Deloitte, 2015c). The distribution networks are owned by local government (municipalities or group of municipalities). ERDF then rent the distribution networks thru a concession contract with the municipalities for public service delegacy (Deloitte, 2015c; ERDF, 2013). In 2012, ERDF arranged 683 concession contracts, which is enhanced to 730 contracts, currently. These contracts defined the rights and duties of communities and consumers (ERDF, 2013; Enedis, 2016b)

ERDF was established in 2008 under the disclosing of French electricity market into the competition (Enedis, 2016). As one of the prominent players in the energy market, ERDF presently serves 35 million of consumers thru 1.3 million kmc of low voltage grids. ERDF have 39,033 employees with revenue of 13 billion Euro in 2013. As the main electricity DSO in France, ERDF has duties to assuring the quality and safety of electricity distribution and warranting the fair and equitable access to the grid for all players in the market. ERDF also responsible for managing and developing the distribution grids. The performance of ERDF is supervised by CRE and the local government who owned the grid. ERDF roles are conducted under the scheme of a public-service contract and funded by the transmission tariff (TURPE) settled to all consumers of the network (ERDF, 2013).

In order to assure bigger coherency and efficiency in the organization, ERDF set up 25 regional divisions in 2012. The 25 regional directors then actualize the company's diverse business activities and have full powers in their region. The operational functions in the 25 regions are assembled together beneath single management and alter rearrange into 8 interregional divisions (ERDF, 2013). The purpose is to simplify the organization and make it legible to all, whilst reinforcing local source and adjacency for the good of consumers, selected authorities, and employees. Presently, ERDF regions are as follows (Enedis, 2016c):

- ERDF Auvergne Centre Limousin with headquarter in Clermont-Ferrand. On this area, ERDF provides electricity to three large regions of central France: region Auvergne, region Centre, and region Limousin;
- ERDF in Ile-de-France with headquarter in Paris. ERDF supplies electricity to area consists of region Ile-de-France Ouest, region Paris, and region Ile-de-France Est;
- ERDF Mediterranian with headquarter in Marseille. ERDF supplies electricity and contributes to the development in area consists of region Provence-Alpes du Sud, region Cote d'Azur, and region Languedoc-Roussillon;
- ERDF in the West with headquarter Nantes. The area served by ERDF including region Bretogne, region Pays de la Loire, and region Poitou-Charentes;
- ERDF in the Southwest France, with headquarter in Toulouse. ERDF served in region Aquitaine, region Midi-Pyrénées South, region Nord Midi-Pyrénées, and region Landes and Pyrénées;
- ERDF in Rhone-Alpes Burgundy with headquarter in Lyon. ERDF provides electricity to this area which consists of region Bourgogne, region Sillon Rhodarien, and region Alpes;
- ERDF in the East. This area bordering with Germany, Belgium, Luxembourg, and Switzerland, which consist of region Alsace Franche-Comte, region Lorraine, and region Champagne-Ardenne;
- ERDF for manage the North Sea with headquarter in Lille. ERDF serves area involving region Nord-Pas de Calais, region Picardie, and region Normandie.

In terms of company governance, same as RTE, ERDF also in the form of a public limited company with composed of a Boards of Director and Supervisory Board. The members of Supervisory Board picked by the general meeting of shareholders and consists of 1 Chairman and 14 members who be composed of state representatives, shareholder representatives, electricity distribution authority representatives, and employee representatives (Enedis, 2016d).

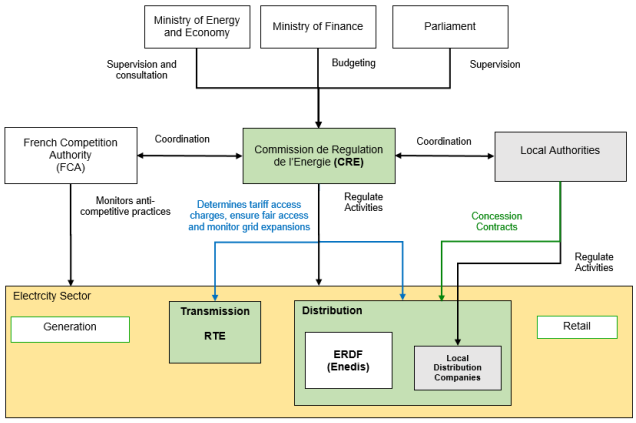
Besides ERDF, the electricity distribution network in France is also organized by the local distribution companies (LDCs), who have the responsibility to conduct the public service electricity distribution for around 5% of mainland France. The total number of LDCs currently is 160 LDCs. For the company structure organization, these LDCs could be distinct each other. For instance, the LDCs could be organized by local authorities or in a form of entities with diverse states, such as public utilities, limited companies, etc. Moreover, regarding its size, some LDCs might connect several dozen delivery spots, while others can manage over a million (Enedis, 2016a).

4.5.3. Institutional Governance in France Electricity Grid Organization

Energy Regulation Commission or Commission de Regulation de l'Energie (CRE) is the independent regulator in French electricity and gas market. This agency is established under the legal framework laws of 10 February 2000 and of 3 January 2003 (IEA, 2010). While the legitimate framework appropriate to the CRE is stipulated in the French Energy Code (Fages & Saarinen, 2012). For the operational budget, CRE needs the approval of Ministry of Energy and Ministry of Finance where it will be embraced in the budget law (CRE, 2016). The Minister of Energy also have authority to consents the expansion plans for the transmission grids, determines specifications for the grids and could resist tariffs if not suitable with energy policy (RTE International, 2014). CRE mission related with electricity grid organization are as follows (CRE, 2015):

- Warranting the non-discrimination access to public electricity grids and infrastructures;
- Assuring the suitable operation and development of electricity grids and infrastructures;
- Warranting the independence of grid operators.

Figure 4.18 The Institutional Governance of Electricity Grid Organization in France



Source: IEA, 2010; CRE, 2015; CRE, 2016.

The institutional governance on the French electricity grid organization is illustrated in Figure 4.18. CRE is corresponding with many other institutions in the France. With the parliament, the Chairman of CRE obliged to reports the CRE activities to the parliamentary. CRE also have intense relation with the local authorities. One of the tasks of local authorities is to distribute the energy and also organize and develop the energy in their regions. Due to its key role of the distinct level of communities, CRE is reinforcing its relation with selected local delegates. Aside from CRE, there is also an independent public authority, the French Competition Authority (FCA), which CRE needed to cooperate with (CRE, 2015). FCA has the authority to avert and give punishment for anti-competitive activities in any economic section, including electricity. FCA also monitored any incorporation or acquisition of company's assets in the energy sector (Fages & Saarinen, 2012).

4.5.4. Independency of Regulator and Grid Operator in France

In terms of independence from government, the independent of CRE is defined in the French Energy Code. Within the laws, CRE is not bounded to the hierarchical power or surveillance of the executive government. The law demands members and staff of the commission to perform independently and neutral as well as enforces compulsory of secretly. CRE is arranged into two independent bodies: the Board and the committee for dispute settlement and sanctions. The Board is composed of five members selected for their competence in the legal, economic, and technical areas. The Board carries out their tasks full time and they are unchangeable with the exemption of obligatory retirement, incompetence, or heavy misbehavior. The dual affiliation of the Board member with a local government or European voluntary office is forbidden by the law as well as any direct or indirect importance in any activities within the energy sector (CRE, 2015).

The Third EU Energy Package guidance's transplanted into French law in 2011 also induce to the establishment of Compliance Officer in each TSO and DSO. The Compliance Officer have a duty to monitoring the utility fulfillment with the commitment of good practice program, and for assuring that TSO and DSO actions meet with the independence ordinances (CRE, 2012). For the independence of the transmission grid operator, the French Energy Code specifies and regulates RTE independence as the electricity TSO in France. Specifically, the relationship between RTE and EDF as a Vertically Integrated Undertaking (VIU) and the owners of RTE are stipulated in this law.

The French Energy Code also mandates CRE to certificate the TSO in order to evaluate the compliance of TSO with the function of independent transmission operator model (CRE, 2015). In January 2012, RTE was certified by CRE as the independent transmission operator in France (RTE,

2015). This certification is based on the report from the Compliance Officer that said the independence of RTE from the supplier or producer who included in the identical integrated group has been substantiated (CRE, 2012). RTE don't have any direct or indirect share ownership in a subordinate of the holding company group. The management of RTE and all connected judgments are made independently and without the intervention of EDF. RTE also have detached accounts from EDF (Balorre, et.al, 2016). Thus, RTE as the TSO in France is respected to be adequately developed and independent to be able to comply with the provisions of the third EU directives. Although, more efforts are required to fully meet with it (Balorre, et.al, 2016). Nevertheless, in terms of independence from the government, the Ministry regulatory authority to defining the TSO's legal structure has made the legal independence of RTE is limited. The legal independence of RTE reflects a modest enforcement of the EU directive. RTE is still in the position beneath the EDF hierarchy. Also, CRE means of initiating more market models of governance is confined by the regulatory decisions of the Ministry on the regulated sales tariff and the legal structure of TSO (Niesten, 2006).

For the DSO in France, some of the DSO are stills mixed in terms of the fulfillment with the ordinances of independence (EC, 2015). The report of Compliance Officer in several DSOs, particularly in the local distribution companies, mentioned that the DSOs should keep on or even speed up the amplification of the independence. In practices, many of the DSOs are not renowned is being irritated to the markets disclosing to competition (CRE, 2012). While for the main DSO, ERDF, based on a report from the Compliance Officer is considered more positive to preserve two new concepts clarifying accordingly the foundation of independence: management autonomy and image distinction (ERDF, 2014).

Concerning the images, in 2012 indicate an intense degree of ERDF's name acknowledgment as an electricity distributor. The regional offices of ERDF have created ERDF secured in the country, with a firm adjacency with selected delegates, utilities, and communities (ERDF, 2014). Furthermore, CRE demanded ERDF to change its name due to its similarity of name with EDF, induce to flurry and misconception regarding the electricity market. Therefore, ERDF then changes its name into Enedis in May 2016 (Selectra, 2016). Regarding the services splits or exchanged between ERDF and EDF or with utility beneath EDF group, CRE and Compliance Officer has suggested for ERDF creates its independent practical stipulations to show how it observes its connections with the EDF group, to assure appropriate practice of ERDF's management autonomy concept (ERDF, 2014).

CHAPTER 5
FINDING AND ANALYSIS

5.1. Comparative Analysis between Indonesia Context and European Experiences in the Electricity Grid Organization

From the explanation in Chapter 4, the summary of regulatory authority, TSO and DSO in Indonesia compared with the three European countries could be seen in Table 5.1 below.

Table 5.1 Regulatory Authority and Grid Operator in Indonesia and Three European Countries

Country / Features	Indonesia	Netherlands	Germany	France
Regulatory Authority	MEMR thru Directorate General of Electricity	ACM	BNetzA, State Regulatory Bodies	CRE, Local Authorities
Transmission System Operator	PLN	TenneT TSO B.V.	TenneT TSO GmbH, Amprion, 50Hertz, Transnet BW	RTE
Ownership structure of TSO	State ownership	State ownership	Common ownership	State ownership
TSO Business Structure Model	Regional Business Units	OU	OU, ITO	ITO
Distribution System Operator	PLN	Liander, Enexis, Stedin, Delta, Endinet, Westland Infra, Cogas Infra, Rendo	More than 900 regional companies	ERDF, Local Distribution Companies (LDCs)
Ownership Structure of DSO	State ownership	Public ownership by provinces or municipalities	Common ownership	Public (ERDF) and Private ownership (LDCs)
Grid Owner	PLN (Transmission and Distribution)	TenneT (Transmission), Local government (Distribution)	Four TSO (Transmission), Local government (Distribution)	RTE (Transmission), Local government (Distribution)

Hence, based on Table 5.1 above, the comparison of Indonesia and three European countries and the analysis for the option to be implemented in Indonesia with respect to regionalization are discussed in the following section.

5.1.1. High-voltage grid organizational models

Indonesian organization of the electricity high-voltage grid is conducted thru one entity PLN, with regionally spread units under central management of the head office in Jakarta. These models are identical with the France who also have centralized organization models in the high-voltage grids thru RTE with regional units. This model also applied in the Dutch high-voltage grid organization which is centrally organized and managed by sole TSO, TenneT TSO B.V., which also have regional offices for the system operations and grid service. While Germany has different models, with decentralized organization thru the four TSOs which is operating in the different region.

In terms of the TSO ownership structure, Indonesia has a similar structure with the Netherlands and France which is chosen to keep the shares of the TSO in the hand of the state. While for the TSOs in Germany is in the structure of private ownership. The notable differences between Indonesia and the three European countries in terms of electricity grid organization is in the unbundling requirement

for the TSO. The TSOs in the three European countries has legally unbundled from the vertical integration companies. These TSOs are in form of ownership unbundling (TenneT, 50 Hertz) and independent transmission operator (RTE, Amprion, TransnetBW). While in Indonesia, the vertically integrated utility (PLN) take the role as TSO in the electricity grid organization thru PLN regional business unit.

5.1.2. Medium and low-voltage grid organizational models

The organization of medium and low-voltage grids in Indonesia is similar to the high-voltage grid organization, which is centrally organized by the state-owned utility, PLN, thru its regional and distributive units. This model in Indonesia is dissimilar with the three European countries. In the Netherlands, for the medium and low voltage grid are regionally managed and performed by independent, publicly owned entities as the DSOs. In the case of Germany, they have a combination of regionally independent private and publicly entities for the TSOs. For France, the medium and low-voltage grid is organized centrally by one big DSO and regionally thru local distribution companies which are in form of private ownership. ERDF as the main DSO in France is in form of state ownership under subsidiary structure of the vertically integrated company, EDF.

5.1.3. Regulatory Authority and Regulation

Indonesia does not have an independent regulatory authority in electricity structure organization as well as the independent transmission system operator and distribution system operator. This is different with the system in the three European countries. Regarding the electricity grid, in the Netherlands, both of the companies act as TSO and DSOs are regulated under the national law through a national regulator. ACM is the independent regulatory authority in the Dutch electricity grid organization structure. In Germany, the electricity grid organization is regulated under the national law with an independent national centralized regulator thru BNetzA and regional authorities. The electricity grid in France is regulated under the national law by a national energy regulator or Commission de Regulation de l'Energie (CRE) and local authorities.

In the Indonesia context, the national law for electricity grid organization is the Electricity Law 30/2009. The law defined the state as the regulator and PLN as the policy implementers, which is as the sole TSO and DSO. While for the three European countries, the national law in their country is mainly transplanted from the three European Directives. In the Netherlands, the legal framework for the electricity grid organization is the electricity act 1998. Germany has organized the electricity under the Energy Industry Act. The France Energy Code is the national law for France regarding the electricity grid organization. All of the national law in the three European countries emphasizes and defined the provision of the independence of the regulatory and grid operator as well as the unbundling requirements. These provisions are not stipulated in Indonesia national law.

5.1.4. Regulatory Governance and Regulatory Intervention

In Indonesia, a public authority is a dominant unit in the decision making with the goals of electricity activities, particularly for the electricity grid, is mainly for the national interest. Therefore, the type of regulatory governance in Indonesia electricity grid organization is more appropriate with the proceduralist model, due to the heavy interference from government, with no independent regulatory authority. While for the regulatory intervention, Indonesia applies the non-market driven approach in consequence of the PSO responsibility given by the government to PLN.

The type of regulatory governance and intervention in the three European countries are dissimilar with Indonesia. The Netherlands, Germany, and France have applied the substantive model and market-driven approach to the regulatory governance and regulatory intervention, respectively. In

the Netherlands, within the context of the national law, the regulatory authority (ACM) is an independent agency who regulate the electricity grid organization with respect to grid access and the tariff charges. For the grid operator, the regionally organized grid companies are autonomous in their corporate strategy, whereas for the centralized organization (TenneT) is in form of ownership unbundled TSO and owned by the state. As for Germany, BNetzA as the regulatory authority performs independently under the national law. While for the grid operator in Germany are independent in their corporate strategy but also regulated in terms of network access regulation, including tariff regulation (incentive regulation). In France, CRE is the independent national regulatory authority and have the same responsibility as the Dutch and Germany regulatory authority defined in the national law. RTE and ERDF are considered independent in terms of corporate strategy, while some of the LDCs need to increase their level of independence. However, towards the government, CRE and RTE legal independence is narrowed by the Ministry authority.

5.1.5. System of coordinating the electricity grid

Indonesia currently has a centralized grid organization with regionally operating units. From the explanation above and previous chapter, the current electricity grid structure in Indonesia could be classified as a full hierarchy, with heavy state intervention through PLN as national champion in the electricity sector, mainly in the electricity grid. This system is almost alike with the system in France which is a nearly full hierarchy (Arentsen & Kunneke, 1996) where the high-voltage grids are monopolized by RTE, while the medium and low voltage grids by ERDF (mainly) and the LDCs. Therefore, France has a combination of centralized and decentralized grid organization regulated under the national law thru a national energy regulator.

While the Netherlands also have the similar organization system in the high-voltage grid thru TenneT as the sole operator. The Netherlands have a mixed centralized and decentralized grid organization in combination with a national centralized regulator. The Dutch system of coordinating the electricity grid cold be classified as the controlled coordination (Arentsen & Kunneke, 1996). For Germany, the system is close with the Netherlands, but give more opportunity to regionally private entities to involve. Hence, the system could be incorporated as full coordination (Arentsen & Kunneke, 1996). Germany has a decentralized grid organization with the independent, regionally private and publicly entities manage the high voltage grid, medium voltage grid, and low voltage grid.

The summarized of the comparison of the electricity grid organization models and regulation between Indonesia and the three European countries could be seen in Table 5.2 below:

Table 5.2 Electricity Grid Organizational Models and Regulation in Indonesia and Three European Countries

Country / Subject	Indonesia	Netherlands	Germany	France
High-voltage organizational models	Centralized with regional operating units	Centralized	Decentralized	Centralized with regional operating units
Medium and low voltage Organizational Models	Centralized with regional operating units	Decentralized	Decentralized	Centralized and Decentralized
Regulator	Government	National Centralized Regulator	National Centralized Regulator and Regional Authorities	National Centralized Regulator and Regional Authorities
Regulation	Electricity Law 30/2009	Electricity Act 1998	Energy Industry Act	France Energy Code

System of coordinating the electricity grid	Full hierarchy	Controlled Coordination	Full Coodination	Nearly full hierarchy
Regulatory Governance	Proceduralist model	Substantive model	Substantive model	Substantive model
Regulatory Intervention	Non-market driven	Market-driven	Market-driven	Market-driven

5.2. Key Elements of Electricity Grid Organization and Regulation in European Experiences

From the analysis in the previous section, there are several key elements in the three European countries with respect to the regionalization in the electricity grid organization that differ with the Indonesia context and could be implemented in Indonesia System. The key elements consist of the existence of independent regulator, independent grid operator, and the provision of unbundling requirements thru national law. These key elements will be elaborated in the following section.

5.2.1. Independent Regulator

Through the provision in the European directives, an independent regulatory authority is created in the Netherlands, Germany, and France. With respect to the electricity grid organization, the independent regulator is important to keep the transmission (and distribution) grids neutral and independent. The fundamental purposes for the regulators are in the market transparency and competition, whilst there also some ancillary purposes such as security of supply, environmental aims and goals on public service price policies (Larsen, et.al, 2006). In terms of independence, there are three measurements of regulatory independence: independence from the government, independence from the stakeholders, and Integrity in the decision making (Smith, 1997).

The regulators in the three European countries mentioned above are legitimately independent of stakeholder interest, which is defined in the European directives. In terms of independence from the government, the three energy regulators (France, Germany, and the Netherlands) independence is defined in their national law where they hold substantial independence towards budget control and internal organization. In the decision making, the Dutch and Germany regulator have full competency in the decisions such as network tariffs and access, licensing, system operations, disputes and enforcement (Larsen, et.al, 2006). For the French regulator, some of the decisions are confined by the regulatory decisions of the Ministry, such as on the regulated sales tariff and the legal structure of TSO (Niesten, 2006).

5.2.2. Independent Grid Operator

The successfulness of the TSO is relying on the independence of ownership and control by the market player (Glachant, et.al, 2008). In the three European countries, alike with the regulator, the independence of the TSO also regulate through the national law transplanted from the European directives. France and Netherlands have a sole state-owned TSO to organize the high-voltage grids, while Germany has four private and public utilities act as the TSO. These TSOs are already legally-unbundled with the structure of OU and ITO.

In the Netherlands, TenneT as the TSO is owned by the Dutch government but independent in its corporate strategy. For Germany, the TSO are in form of private ownership and the TSO also independent in the context of the corporate organization. In the case of France, the TSO is remained the subordinates of the incumbent state-owned monopoly company, provided that RTE is organized independently from its shareholders and granted an economic and financially self-sufficient.

Aside from the TSO, the role of DSO has become importance in the decentralized electricity system. DSO have two major functions on the electricity grid organization. The first function is to act as the system operators, where the DSO warrant a reliable power transport through their grid to the end users. Secondly, the DSO acts as neutral market facilitators, where the DSOs are had the responsibility to provide fair access to their grids for other players in the electricity system (Eurelectric, 2015). Therefore, the independence of the DSO is prominent in the electricity grid organization.

Similar with the TSOs, the DSOs independence in the three European countries is defined in the national law transplanted from the European directives. In the Netherlands, the regional DSO public limited entities are independent in their corporate management. This conditions also applied for the regional distribution companies in Germany, but still regulated by the local authorities. In France, the big DSO, ERDF, is independent in the management autonomy. As the DSO that also part of the vertically integrated company, ERDF also forced to satisfy the unbundling requirements as stipulated in the Third Energy Package (Eurelectric, 2015). Yet, for the LDCs, the degree of independence should be increased.

5.2.3. The unbundling requirements under national law

The EC Third Energy Package has given more effort to the enforcement of unbundling in its member states electricity sector. The electricity grid in most of the European countries should be operated by detached entities, fully separated from the electricity suppliers. Based on it, the Netherlands, Germany, and France then organize their electricity grid structure with separate the transmission and distribution companies from the production and supply entities thru the national law in each country. All of the TSOs and DSOs in the three European countries are obliged to this obligation of unbundling. However, there is an exemption from the provisions of both legal and functional unbundling for small DSOs distributing not more than 100,000 consumers (Eurelectric, 2015). The same condition applied to the isolated and small-system area.

The unbundled and independent grid operator, particularly TSO, is prominent due to several reasons such as to grant the competition in equal basis, to provide the requisite coordination to all participants in the electricity industry, and to play a non-discriminatory role in the market design. This is in line with the EU directives of 2009/72/EC which stated that “without effective separation of networks from activities of generation and supply (effective unbundling), there is an inherent risk of discrimination not only in the operation of the network but also in the incentives for vertically integrated undertakings to invest adequately in their networks”.

5.3. Option Model for Electricity Grid Organization in Indonesia With Respect to Regionalization

With respect to regionalization, then the centralized organized models thru state-owned utility and regional units are the best option to be implemented in Indonesia. This is after considering several reasons. First, the geographical condition of Indonesia that be made of separated main islands and scattered islands comprises more than 17000 islands. Another notable consideration is the responsibility of public service obligation, especially for the isolated and remote area. This could be maintained under the state ownership in the grid operator. Last but not least, the existence of PLN as the incumbent monopoly in the electricity sector in Indonesia. However, in terms of unbundling requirements, Indonesia should take an experience of the three European countries that already implemented it on their TSOs and DSOs.

For the electricity grid organization, the French case could be an option to be implemented in Indonesia, due to the similarities in the system of coordinating the electricity industry. in the high-voltage grids, RTE is the state-owned independent transmission operator and also the subsidiary of EDF. The Dutch TSO, TenneT also owned by the government but its structure is different with RTE, where TenneT is already in form of ownership unbundling. While two of the Germany TSOs are private companies with the structure of ownership unbundling (TenneT, 50Hertz) and independent transmission operator (Amprion, TransnetBW). For the medium and low-voltage grid, the three countries are using a decentralized model with regionally public and private entities acts as the DSOs. Nevertheless, in France, ERDF which also subsidiary of EDF operates 95% of the distribution networks.

This Dutch and Germany system are not fit with the condition of electricity structure organization in Indonesia, especially for the electricity network. In Indonesia, PLN monopoly status still largely untouched, although the new electricity law has given good indicators to improve the organization in the electricity sector (Setiawan, 2014). This condition has made the private companies in Indonesia are largely only interested involved in the generation and supply of electricity. Indonesia geographical condition where a lot of isolated and small system area has made the cost of electricity transportation become high. Therefore, this problem is handled by the PSO responsibility carried by PLN and the subsidies from the government for PLN. as the consequences, this has made the Indonesia electricity sector, particularly in the electricity network, is not competitive.

After analyzing the three European countries electricity grid model and regulation, the French experience is considered to be the most suitable for Indonesia electricity grid organization with respect to regionalization. PLN as the vertically integrated utility should form a subsidiary in charge of the electricity grid organization in Indonesia as the transmission system operator and distribution system operator, instead of organized it thru PLN regional and distributive business unit. To implement it, then the legal framework for unbundling requirements is needed for the electricity sector, particularly for the electricity network organization. Thus, Indonesia requires a national law to regulate regarding the creation of independent regulatory authority and the unbundling requirements for the transmission and distribution system operator. The existing regulation in Electricity Law 30/2009 needs to be revised to accommodate it, or through derivatives regulation such as government regulation or ministerial decree.

Hence, the regionalization of the organization of electricity grid in Indonesia is not impossible to be implemented consider the opportunity given under the legal form of Electricity Law 30/2009 and its derivatives regulation. The implementation of regionalization in PLN organizational structure is one step of the commencement of the reform in Indonesia electricity industry to create the electricity business more efficient and optimal. Regionalization also stated the National Energy Policy (Government Regulation No. 79 of 2014). It stated that “Government and/or the local government carry out institutional strengthening to ensure the achievement of the targets and objectives in energy supply and energy utilization. Institutional strengthening carried out at least with, among others: the regionalization of electricity supply to minimize electrical supply disparities outside Java Island”. However, the implementation of electricity regionalization in Indonesia, particularly in the organization of electricity grids, should be done by conscientiously and consider many aspects. The implementation of regionalization should ultimately meet the goal of electricity development in Indonesia that aims to ensure the availability of electric power in sufficient quantity, good quality and reasonable price In order to improve the welfare and prosperity of the people in a fair and equitable and sustainable development.

CHAPTER 6
CONCLUSION AND RECOMMENDATION

This chapter will describe the summary of the research findings that have been analyzed in the previous chapter regarding the electricity grid organization in Indonesia and the three European countries with respect to regionalization. It comprises of the conclusion and the recommendation for the further researches.

6.1. Conclusion

Derived from the research questions and overall findings and analysis which was elaborated in earlier chapter, following conclusion could be presented:

a. The current electricity grid in Indonesia is organized with centralized grid organization models by the state-owned utility and its regional units. The electricity grid organization is regulated under a national law thru the government as the regulator and PLN as the grid operator for the both of the transmission and distribution grids;
b. The electricity grid organization in the Netherlands is conducted with using mixed centralized (for the high-voltage grid) and decentralized (for medium-low-voltage grid) organization. The grid organization is regulated under the national law thru an independent national regulatory authority and independent grid operators. The state-owned utility, TenneT is the grid operator for the high-voltage grid, while the medium and low voltage grids are managed by the regionally publicly owned entities;
c. In Germany, the electricity grid is managed by applying the decentralized grid organization combined with an independent national regulator and local authorities under the national law. The transmission and distribution grid are organized by regionally private and public entities;
d. In the case of electricity grid organization in France, the method used is the combination of centralized and decentralized grid organization regulated under the national law via an independent national regulatory authority. The state-owned entity, RTE, and its regional operating units managed the transmission grid. Whereas for the distribution grid is organized by the local distribution companies under the regulation by local authorities;
e. With respect to regionalization, several key elements of electricity grid organization from the European experiences could be derived. The key elements are the existence of independent regulatory authorities and independent grid operators. In order to create it, the unbundling requirements stipulated in the national law then become prominent;
f. Based on the analysis and comparison with the European experiences, the regionalization of the electricity grid organization is possible to be implemented in Indonesia context. The French system, with adopting the centralized organized models thru state-owned utility and regional units could be best implemented in Indonesia. This is due to the resemblance in the system of coordinating the electricity grid between Indonesia and France. Moreover, in bigger picture, the regionalization of electricity sector in Indonesia is defined in the Indonesia Electricity Law and National Energy Policy;
g. To get the benefit from the implementation of regionalization in the electricity grid organization in Indonesia based on the European experiences, then GOI should take several measures. In the electricity grid organization, GOI should separate the transmission and distribution functions from the production and supply activities, by creating a subsidiary of PLN that in charge for the transmission and distribution activities. To be able to do it, then the GOI should formulate a legal

framework for the establishment of an independent regulatory authority and the unbundling requirements for the grid operator.

Eventually, to resume, this study has been able to provide information on how the organization and regulation of the electricity grid in Indonesia is conducted as well as in the European countries such as the Netherlands, Germany, and France. With regard to regionalization on the electricity grid organization, after analyzing and comparing with European experiences, then Indonesia could best implement the regionalization of the electricity grid organization and regulation by taking the key elements in the European countries as an inspiration to be applied in Indonesia system thru several steps described in this study. The implementation of regionalization in Indonesia, particularly in the organization of electricity grids, should be done by conscientiously and consider many aspects that become the characteristics of Indonesia electricity grid sector.

6.2. Recommendation

Aside from the notable findings and result, this study is limited in terms of research context and sample size. Therefore, this study needs to be developed in the future. Within this topic, several recommendations for further research could be described as follow:

a. This study is limited to only concentrate on the electricity network activities. Hence, there is still another room to develop in future research. The next study could analyze not only in the electricity grid organization, but also involving another function of electricity value chain such as the production and retail activities;
b. In terms of sample size, it is also possibly for future research to analyze and compare the electricity grid organization in another country apart from the three European countries described in this study. It could be interesting to analyze and comparing the electricity grid organization and regulation in Indonesia neighboring countries in South East Asia region, or with large countries that have many islands such as Japan and Korea, or with countries that have large territory areas such as USA, China, Russia, Australia, etc.;
c. The future research could develop additional criteria and key elements of the electricity grid organization and regulation with respect to regionalization. The future research also could elaborate more detail about the steps that should be done by the GOI and PLN to implement the regionalization based on the findings from this study;
d. Regarding the regionalization in Indonesia electricity sector, further research also could not only focus on the organization and regulation in the electricity functions but also could analyze the possibility of the regionalization on electricity tariff in Indonesia. This tariff regionalization could emerge as the effects of the regionalization in the electricity grid organization in Indonesia;
e. Aside from tariff regionalization, another effect could arise from the implementation of regionalization in the electricity grid organization and regulation in Indonesia. The further research then will be needed to analyze on it and connected it to the government role to manage the effects.

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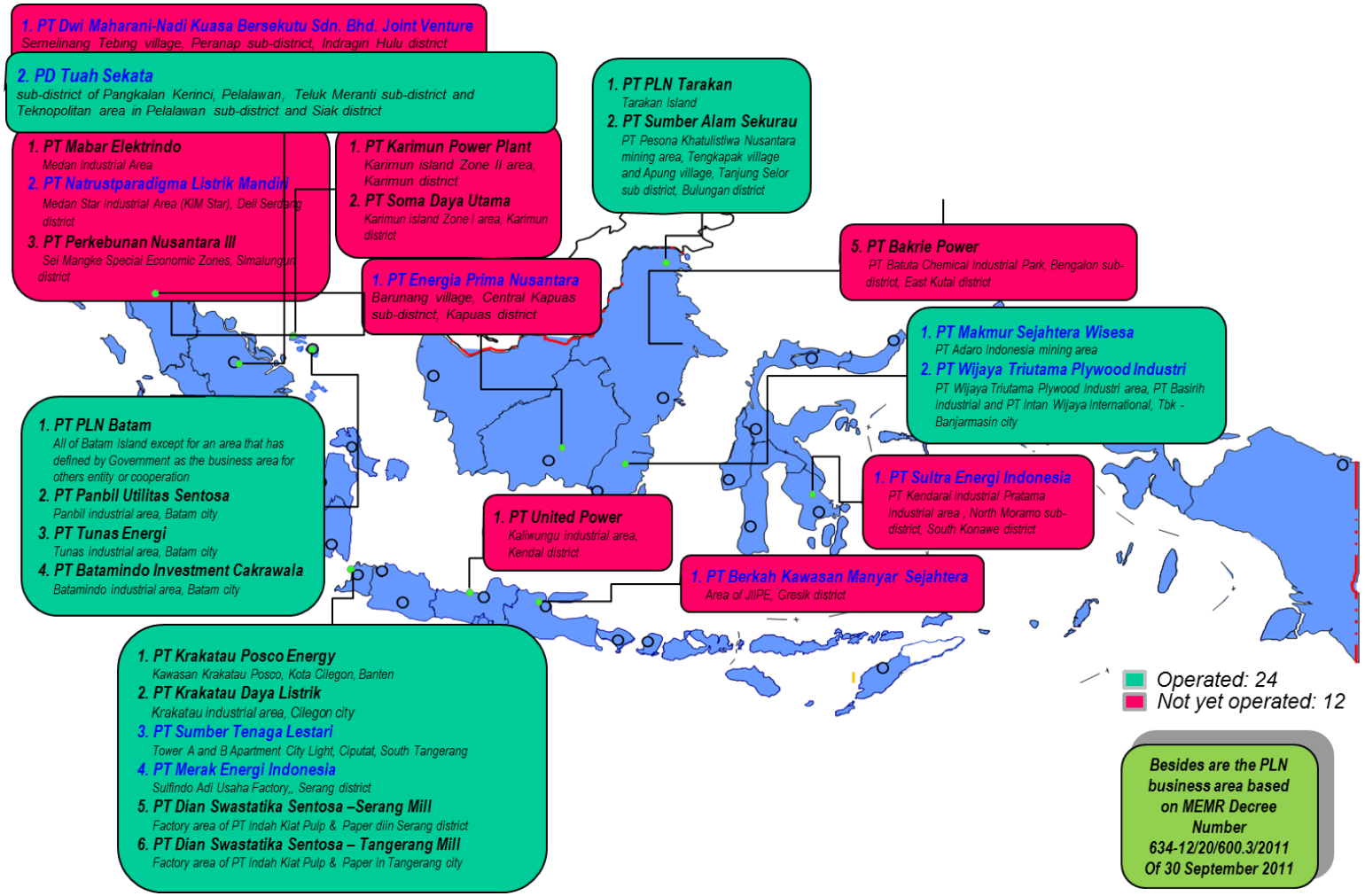
Appendix 1 Map of Electricity Business Area in Indonesia (status of August 2016)



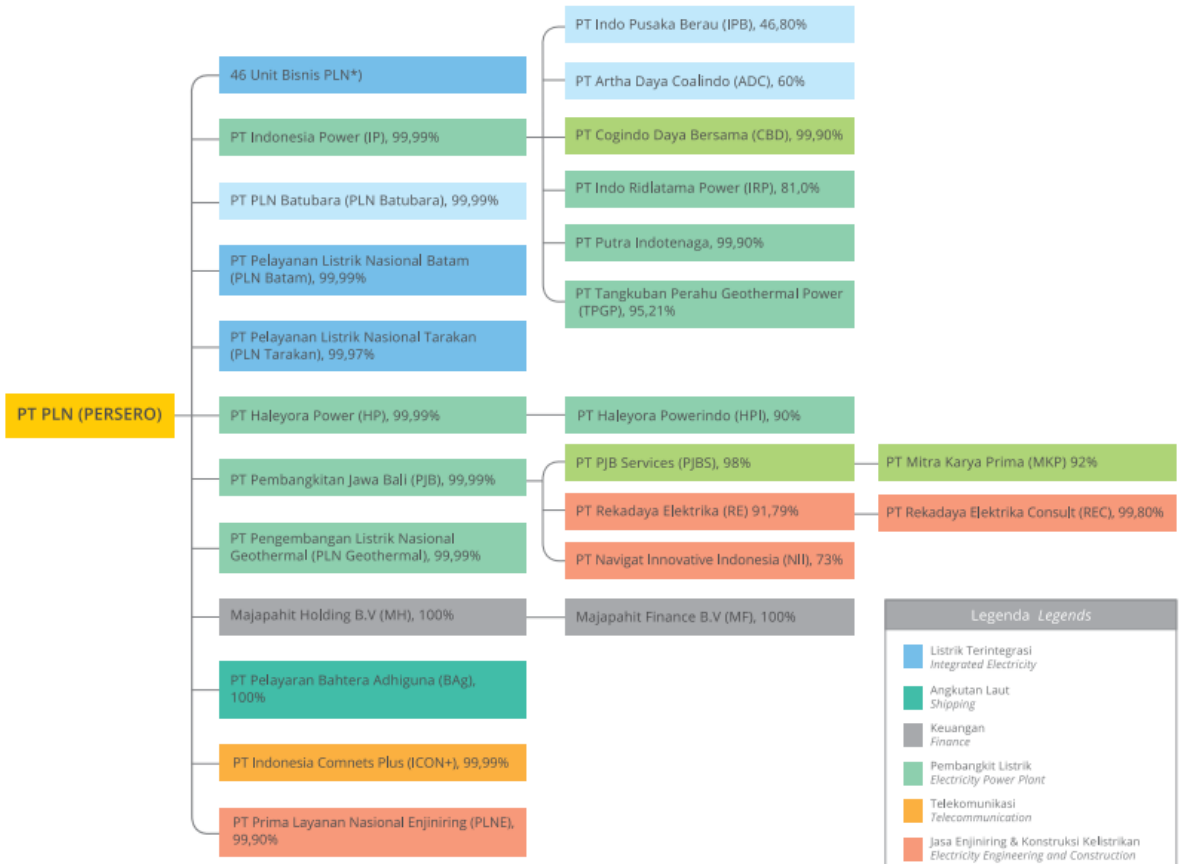
Appendix 2 Business Area of Business Entities Operating in Indonesia beside PLN (status of August 2016)

Province/ Area	No.	Business Area Holders	The Scope of its Business Area	Legal Basis/Decree		STATUS
				Number	Date	
REPUBLIK INDONESIA	**1**	**PT PLN (Persero)**	**All of Indonesia territory except for an area that has defined by Government as the business area for others entity or cooperation**	**MEMR Decree Number 634-12/20/600.3/2011**	30 September 2011	Already Operated
West Java	2	PT Tatajabar Sejahtera	Industrial area of Kota Bukit Indah Cikampek, Karawang district and Purwakarta	1252-12/20/600.3/2012	26 December 2012	Already Operated
	3	PT Cikarang Listrindo	Industrial area of Jababeka, Megalopoplis Manunggal 2100, East Jakarta Industrial Park, Hyundai Inti Development, and Gunung Cermai Inti (Lippo Cikarang) with its expansion	3887/31/MEM.L/2003	9 December 2003	Already Operated
	4	PT Bekasi Power	Area of PT Gerbang Teknologi Cikarang, Bekasi district	283-12/20/600.3/2010	7 June 2010	Already Operated
	5	PT Dian Swastatika Sentosa - Karawang 1	To electricfy PT Pindo Deli & Paper Mill in Kel. Adiarsa Barat, Kec. Karawang Barat, Kab. Karawang	1/1/PWUPTL/2016	16 May 2016	Already Operated
	6	PT Dian Swastatika Sentosa - Karawang 2	To electrify PT Pindo Deli & Paper Mill di Desa Kuta Mekar Kec. Ciampel, Kab. Karawang	2/1/PWUPTL/2016	16 May 2016	Already Operated
Banten	7	PT Krakatau Daya Listrik	Krakatau industrial area, except for Krakatau Posco area (PT Krakatau Posco Energy business area), Cilegon city	489 K/20/DJL.3/2014	9 May 2014	Already Operated
	8	PT Dian Swastatika Sentosa - Serang Mill	Factory area of PT Indah Kiat Pulp & Paper in Serang district	954 K/20/DJL.3/2013	1 August 2013	Already Operated
	9	PT Dian Swastatika Sentosa - Tangerang Mill	Factory area of PT Indah Kiat Pulp & Paper in South Tangerang City	1136 K/20/DJL.3/2013	23 October 2013	Already Operated
	10	PT Krakatau Posco Energy	Krakatau Posco area, Cilegon city	255 K/20/DJL.3/2014	25 March 2014	Already Operated
	11	PT Sumber Tenaga Lestari	Tower A and B Apartment City Light, Ciputat, South Tangerang	5/1/PWUPTL/2016	1 June2016	Already Operated
	12	PT Merak Energi Indonesia	Sulfindo Adi Usaha Factory, Jl. Raya Bojonegoro, Mangunreja village, Puloampel sub-district, Serang district	10/1PWUPTL/2016	26 July 2016	Already Operated
Jawa Tengah	13	PT United Power	Kaliwungu industrial area, Kendal district	930 K/20/DJL.3/2014	13 October 2014	Not yet operated
Jawa Timur	14	PT Berkah Kawasan Manyar Sejahtera	Area of Java Integrated Industrial and Port Estate (JIIPE), Gresik district	8/1/PWUPTL/2016	17 June 2016	Not yet operated

Province/ Area	No.	Business Area Holders	The Scope of its Business Area	Legal Basis/Decree		STATUS
				Number	Date	
North Sumatera	15.	PT Mabar Elektrindo	Medan industrial area	866 K/20/DJL.3/2014	18 September 2014	Not yet operated
	16.	PT Perkebunan Nusantara III (Persero)	Special Economic Zones of Sei Mangkei, Simalungun district	966 K/20/DJL.3/2014	31 October 2014	Not yet operated
	17.	PT Natrustparadigma Listrik Mandiri	Medan Star industrial area, Tanjung Morawa, Deli Serdang district	4/1/PWUPTL/2015	8 October 2015	Not yet operated
Riau	18.	PT Dwi Maharani-Nadi Kuasa Bersekutu SDN. BHD. Joint Venture	Semelinang Tebing village, Peranap sub-district, Indragiri Hulu district	1/1/PWUPTL/2015	29 January 2015	Not yet operated
	19.	PD Tuah Sekata	sub-district of Pangkalan Kerinci, Pelalawan, Kec. Teluk Meranti dan Teknopolitan area in Pelalawan sub-district and Siak district	11/1PWUPTL/2016	26 July 2016	Already Operated
Riau Islands	20.	PT PLN Batam	**All of Batam Island except for an area that has defined by Government as the business area for others entity or cooperation**	1221-12/20/600.3/2012	29 November 2012	Already Operated
	21.	PT Batamindo Investment Cakrawala	Batamindo industrial area, Batam city	756 K/20/DJL.3/2013	16 May 2013	Already Operated
	22.	PT Tunas Energi	Tunas industrial area, Batam city	1260 K/20/DJL.3/2013	20 December 2013	Already Operated
	23.	PT Panbil Utilitas Sentosa	Panbil industrial area, Batam city	146 K/20/DJL.3/2014	14 February 2014	Already Operated
	24.	PT Soma Daya Utama	Karimun island Zone I area, Karimun district	943 K/20/DJL.3/2014	20 October 2014	Not yet operated
	25.	PT Karimun Power Plant	Karimun island Zone II area, Karimun district	965 K/20/DJL.3/2014	31 October 2014	Not yet operated

Province/ Area	No.	Business Area Holders	The Scope of its Business Area	Legal Basis/Decree		STATUS
				Number	Date	
North Kalimantan	26.	PT Sumber Alam Sekurau	PT Pesona Khatulistiwa Nusantara mining area, Tengkapak village and Apung village, Tanjung Selor sub district, Bulungan district	986 K/20/DJL.3/2014	14 November 2014	Already Operated
	27.	PT PLN Tarakan	Tarakan Island	724 K/20/DJL.3/2013	1 May 2013	Already Operated
South Kalimantan	28.	PT Makmur Sejahtera Wisesa	PT Adaro Indonesia mining area in Tabalon district and Balangan district	4/1/PWUPTL/2016	26 May 2016	Already Operated
	29.	PT Wijaya Triutama Plywood Industri	PT Wijaya Triutama Plywood Industri area, PT Basirih Industrial and PT Intan Wijaya International, Tbk - Banjarmasin city	3/1/PWUPTL/2015	29 September 2015	Already Operated
East Kalimantan	30.	PT Bakrie Power	Chemical industrial area of PT Batuta Chemical Industrial Park, Bengalon sub-district, East Kutai district	1010 K/20/DJL.3/2014	26 November 2014	Not yet operated
	31.	PT Kariangau Power	Kariangau industrial area, Balikpapan city	327-12/20/600.3/2008	2 September 2008	Already Operated
	32.	PT Kaltim Daya Mandiri	Kaltim Industrial Estate, Bontang city	3/1/PWUPTL/2016	16 May 2016	Already Operated
	33.	PT Kalimantan Powerindo	Forestsrial industry concession area of PT Sarana Bina Semesta Alam and PT KD Mineral IDN, in Muara Kaman sub-district,Kutai Kartanegara district	6/1/PWUPTL/2016	1 June 2016	Already Operated
	34.	PT Indo Pusaka Berau	PT Berau Coal mining area (Site Lati, Site Suaran and Site Binungan), Berau district	9/1/PWUPTL/2016	29 June 2016	Already Operated
Central Kalimantan	35.	PT Energia Prima Nusantara	Barunang village, Central Kapuas sub-district, Kapuas district	2/1/PWUPTL/2015	31 July 2015	Not yet operated
Southeast Sulawesi	36.	PT Sultra Energi Indonesia	PT Kendarai Industrial Pratama Industrial area , North Moramo sub-district, South Konawe district	7/1/PWUPTL/2016	3 June 2016	Not yet operated

Appendix 3 PLN Business Structure and Subsidiary



Catatan:
(*) Unit Bisnis adalah Unit Operasional PLN yang melakukan fungsi usaha tertentu. Daftar unit bisnis ini serta bidang kegiatannya masing-masing mengacu ke Lampiran "Data Perusahaan" per 31 Desember 2012.

Note:
(*) Business Unit is PLN's Operational Unit that executes certain business function. The list of this business unit along with the respective field of activities refer to the Appendix of "Corporate Data" as of December 31, 2012.