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Improving Energy Transition in Indonesian Industrial Sector through Policy Transfer Approach

Master's Thesis

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Abstract

The industrial sector is one of the largest energy consumers in Indonesia. Thus, it is important to manage the industry's energy system towards low carbon sources to accelerate the energy transition process. Since Indonesia's industrial development plan is still largely dependent on fossil fuels, existing policies are considered insufficient to handle the energy transition challenges. Policy learning from other countries with significant experience in this domain may help Indonesia improve the transition process through policy transfer. This study aims to provide policy recommendations that could improve energy transition in the industrial sector in Indonesia by identifying barriers and enabling factors in the transition process. In doing so, a policy analysis was performed from official policy documents, while empirical data to strengthen the findings was gathered through 8 semi-structured interviews with policymakers and industrial practitioners from Indonesia and the UK. Findings demonstrate that policy transfer helps search for the potential of policy improvement in the industry's energy transition. Accordingly, the study focuses on how the policy transfer process could benefit energy transition in Indonesia's industrial sector by exploring examples with policy transfer potential from the UK's energy policy. The results reveal some barriers related to the policy transfer implementation, prominently the financial barrier. Some recommendations for policymakers on how to deal with those barriers are suggested in conclusion.

Keywords: *energy transition, policy transfer, industrial development, energy policies, Indonesia*

Abbreviation

Bappenas	:	*Badan Perencanaan Pembangunan Nasional* / National Development Planning Agency
BEIS	:	Department for Business, Energy and Industrial Strategy
CCA	:	Climate Change Agreement
CCL	:	Climate Change Levy
DEN	:	*Dewan Energi Nasional* / National Energy Council
DJEBTKE	:	*Direktorat Jenderal Energi Baru Terbarukan dan Konservasi Energi* / Directorate General of New Renewable Energy and Energy Conservation
EPIs	:	Energy-intensive Processing Industries
GHG	:	Greenhouse Gas
IETF	:	Industrial Energy Transformation Fund
IPCC	:	Intergovernmental Panel on Climate Change
KEN	:	*Kebijakan Energi Nasional* / National Energy Policy
MLP	:	Multi-level perspective
MoEF	:	Ministry of Environment and Forestry
MoEMR	:	Ministry of Energy and Mineral Resources
MoF	:	Ministry of Finance
MoFA	:	Ministry of Foreign Affairs
MoI	:	Ministry of Industry
NRE	:	New and Renewable Energy
PROPER	:	*Program Penilaian Peringkat Kerja Perusahaan* / Program for Pollution Control, Evaluation, and Rating
RIPIN	:	*Rencana Induk Pembangunan Industri Nasional* / Industrial National Development Master Plan
RUEN	:	*Rencana Umum Energi Nasional* / National Energy Plan
SIH	:	*Standar Industri Hijau* / Green Industry Standard
TEF	:	Triple Embeddedness Framework

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1. Introduction

1.1 Background

The world's energy demand increases significantly, in line with the rapid population growth and massive industrial development, especially in developing countries like Indonesia. This condition contributes to the increase of greenhouse gas (GHG) emissions; thus, the urgency for the energy transition from fossil fuels to renewable energy is inevitable. Besides electricity, the industrial sector is one of the crucial segments contributing to GHG emissions, which share 21% of the world's GHG production in 2010 (IPCC, 2014). However, in the last decades, the energy transition process has been focused mainly on the electricity sector. The global electricity's carbon intensity declined by 11% between 2005 – 2017 (Spencer & Marthur, 2019). By contrast, the industrial sector's CO_2 intensity reduced insignificantly in the same period, only 4% for cement production and 0.02% for steel (Spencer & Marthur, 2019). Thus, there are struggles for the industrial sector on shifting to low-carbon options.

One of the energy transition issues for Indonesia's industrial sector is the misalignment and conflicts in the national energy policy and the national industrial development plan (RIPIN). Indonesia's government enacted the diversification program as the long-term energy goal is regulated in Government Regulation Number 79/2014 on the National Energy Policy / *Kebijakan Energi Nasional* (KEN). In this policy, the new/renewable energy mix is targeted to reach 23% by 2025 and 31% by 2050. Despite this committed target, fossil energy still has become a preferable option as the main energy source for the industrial sector in Indonesia. In 2018, the energy consumption from fossil fuels (oil, gas, and coal) was approximately 91% of the total consumption, and the industrial sector share 36% of it (DEN, 2019).

Meanwhile, in RIPIN, the bioenergy and green industry are encouraged to grow; at the same time, the coal-based industry is still overlooked as a long-term industrial development goal. The strategy for the transfer of non-fossil energy is not given much attention in RIPIN. These circumstances have led to the weak implementation of energy transition policies in the industrial sector. Therefore, the synergy of energy transition policies for the industrial sector in Indonesia needs to be reviewed and improved.

Consider the importance of public policies in the transition process; this study will explore the energy transition argument towards the renewable energy system, which can help policymakers create future development strategies (Rotmans et al., 2001). The transition management, for instance, combines the transition concept with management strategies to offer "a basis for coherence and consistency in public policy" (Kemp & Rotmans, 2004; Rotmans et al., 2001, p.015). In transition energy, a combination of various generic and sector-specific policy instruments is suggested to cover various transition issues (Falcone et al., 2019; Markard, 2018). Thus, selecting suitable policies becomes an essential means to support a successful energy transition process.

Learning from successful experience or failure is one of the approaches used by policymakers to create or improve their programs or policies (Dolowitz & Marsh, 1996). European countries, including the UK, are on the move in terms of transition energy. The UK has experienced a long journey of industrial development, from the industrial revolution to the deindustrialisation phase. The transformation of various energy and industrial policies has influenced the UK's energy transition as it now becomes one of the leading renewable energy producer countries in Europe

(IRENA, 2020). Despite the ups and downs of its industrial growth, UK is still in the top 10 largest manufacturers in the world (The Manufacturer, 2020). Thus, I argue that learning from the UK experience on decarbonisation in the industrial sector may be a good fit for Indonesia as I further explore in this research. All in all, this study examines the possible and adaptable approaches of energy transition policy for Indonesia's industrial sector. The lesson learned will focus on the institutional design to improve the implementation of the energy transition policy in the industrial sector.

1.2 Relevance

The energy transition is known as one of the key strategies for reducing future carbon emissions. The main idea of the energy transition is to increase the sustainability of the energy system (Rojey, 2009). Transition theory is one perspective that can help to study the means towards the change of fossil fuels to renewable energy sources (RES) (Loorbach & Rotmans, 2006; Rotmans et al., 2001). The energy transition can be better understood through transition management, which combines transition with a management strategy for policymakers and private actors (Rotmans et al., 2001). Laes et al. (2014) state that the transition management concept indicates an intentional determination and willingness to accommodate the existing structure of energy policies, rules and regulations, and processes to support future development paths. Moreover, Rotmans et al. (2001) urge that government as the policymaker can and should be a leading actor in the transition management by stimulating collective learning and encouraging participation and contribution to the transition process from other actors. However, the transition approaches will have to be customised to the local conditions since the practices are context-dependent (Laes et al., 2014).

The energy transition is goal-oriented because the outputs are planned, and they are managing public actors while orienting the strategic decisions of private actors (Kemp & Rotmans, 2004; Loorbach & Rotmans, 2006). A goal-oriented transition usually can be seen in the regions' or countries' strategic policies. Policies with public support are crucial to make the energy transition works. Markard (2018) resumes some of the transition scholars arguments about basic principles for policymaking, which include policy learning to explain the uncertainties inherent in the transition process, long-term targets for providing guidance, stakeholders participation and engagement to shape community support, and a variety of 'solutions' for navigating unexpected developments.

Over the last decade, the development of energy transition is mainly concentrated in developed countries. Thus, they have more experience in designing suitable policies to stimulate the transition process. Policy learning from these countries can help other countries improve their current strains. One of the approaches is through policy transfer which allows policy adoption at different levels (Dolowitz & Marsh, 2000). A set of policies supporting energy transition is important to increase renewable energy demand (Bößner et al., 2020)

Despite its diversity, most research associated with energy transitions still converges on legal and economic aspects, especially in developed countries, and the context mostly centres on the electricity sector (Marquardt, 2017). However, studies in developing countries' settings remain limited even as these countries significantly contribute to world carbon emission. Other than electricity, the industrial sector also produces a crucial share of the world's greenhouse gas production, up to 21% in 2010 (IPCC, 2014). Meanwhile, the energy transition policy research in the industrial context is still inadequate. Bearing these in mind, a knowledge gap appears in industrial sectors' energy transition, particularly in developing countries like Indonesia. Moreover,

considering the latest commitment from the Indonesian government to support the net-zero emission goal (Government of Indonesia, 2021), the challenges for the industrial sector are getting tougher.

Therefore, this research will elaborate on the barriers to energy transition and focus on the potential of policy learning through a policy transfer approach to overcome potential obstacles in the energy transition policy in Indonesia, especially in the context of the industrial sector. As one of the first research to study energy transition in the industrial sector in Indonesia, this study will seek how the energy transition can interact with local policies, institutional contexts, and infrastructures in the policymaking process. Thus, it can help to achieve the aim of this study, which is to develop strategic policies to improve the energy transition process in Indonesia's industrial sector.

1.3 Objective and research questions

The overarching aim of this study is to develop strategic policies to improve the energy transition process in Indonesia's industrial sector through policy transfer. In order to do so, the primary research question I would like to answer is **"***What are the possible and adaptable policies to transfer for improving energy transition in the industrial sector in Indonesia?*". I will approach this question over a set of secondary research questions, which are as follows:

- **a)** How do existing policies stimulate the energy transition process in the industrial sector?
- **b)** How does institutional setting influence energy transition policies in the industrial sector?
- **c)** What are the enabling factors and barriers for the energy transition in the industrial sector?
- **d)** How can policy transfer help Indonesia to improve the energy transition in the industrial sector?
- **e)** What are the constraining factors and the potentials of transferring the energy transition policies in the industrial sector?

After this introduction, including the objective and research questions, this thesis is organised as follows. In the second section, I provide a literature review on transition theory and policy transfer which support the framework to transfer policy on energy transition in the industrial sector. Following this, I present my methods and analytical approach used for this research. Consequently, I analyse the findings of my empirical data to identify energy transition in Indonesia industrial sector. Finally, I discuss the possible topics for policy learning that can improve energy transition in Indonesia. I conclude with my reflections and key findings from this study, giving insight into a recommendation for policymakers, describing the limitations in this research, and providing recommendations for further study.

2. Theoretical Framework

This section aims to review the literature on strategic policy framework for the energy transition in the industrial sector. This section explains the theoretical debates related to energy transition and its relation to the industrial sector's policymaking. Then, the policy transfer concept is explored to draw lessons from the policymaking process. Finally, the connections between these concepts are taken into the conceptual model.

2.1 Energy transition in the industrial sector

Energy has become an important part of our life used for a wide range of activities to strengthen urban and economic development, such as operating infrastructure and business, including industrial activities (Monstadt, 2007). The industrial sector is one of the largest energy consumers. In 2010, the manufacturing industry consumed up to 170 EJ (Exajoule[1]) or approximately 38% of the global energy usage (Worrel, 2018). Moreover, in 2018, this share increased up to 50% of the global energy, including the non-combusted use of fuels (British Petroleum, 2020). Since fossil fuels still dominate the world's energy sources, the industry is highly dependent on non-renewable energy.

Energy-intensive processing industries (EPIs), such as steel, iron, cement, chemical, and pulp, still lead the proportion of energy use in industry (Fischedick et al., 2014; Worrel, 2018). The structure of these industries characterised by high capital investment makes it difficult for the industries to change their energy system. Nevertheless, climate change puts pressure on EPIs to move toward zero-emission in the future. Thus, energy transition is inevitable. How to get EPIs to sustainable energy sources can be assisted by understanding the concept of transition. This subject is what I turn to in what follows.

2.1.1 How transitions work

In literal definition, a transition is known as a process of change from one stage to another, but in transition research, the specific context of non-linearity is added to this term (Loorbach et al., 2017). Transition refers to the result of co-evolution from various non-linear processes and development at different levels and multiple domains that interact, producing changes in the societal system (Rotmans et al., 2001; Loorbach, 2007; Loorbach et al., 2017). It is a complex interaction involving various actors and their institutions in a continuous process of societal change; thus, the transition can happen in a long time (Loorbach, 2007). The idea of transition is understanding how structural change could happen to shift from the prominent unsustainable system toward a more sustainable state. This sense is supported by three fundamental concepts in transition theory: *multi-phase*, *multi-level*, and *transition* management (van der Brugge, Rotmans, & Loorbach, 2005). I will elaborate on these in turn.

Multi-phase

The concept of multi-phase looks at transition as a phenomenon of change from one equilibrium to another in three system dimensions: the change speed, the changing size, and the time of change (Rotmans et al., 2001). These dimensions differentiate four sequential phases of transition: the pre-development phase, the take-off phase, the acceleration phase, and the stabilisation

[1] 1 Exajoule = 10^{18} Joule

phase, which can be illustrated in an S-curve (see **Figure 2.1**). In the pre-development phase, the speed of change is slow, and only minor changes are visible from the surface, which does not alter the status quo. Many experimentations happen in this phase to seek means towards a sustainable goal (Loorbach, 2007). The next stage is a take-off phase, where some significant changes start to happen that make the system begin to shift. Following this, an acceleration phase occurs where an accumulation of socio-cultural, economic, and institutional push structural changes visibly. There are dynamics processes of collective learning, diffusion, and embedding throughout this phase until achieving a stabilisation phase. In this final stage, the speed of societal change decreases and reaches a new equilibrium state (Rotmans et al., 2001).

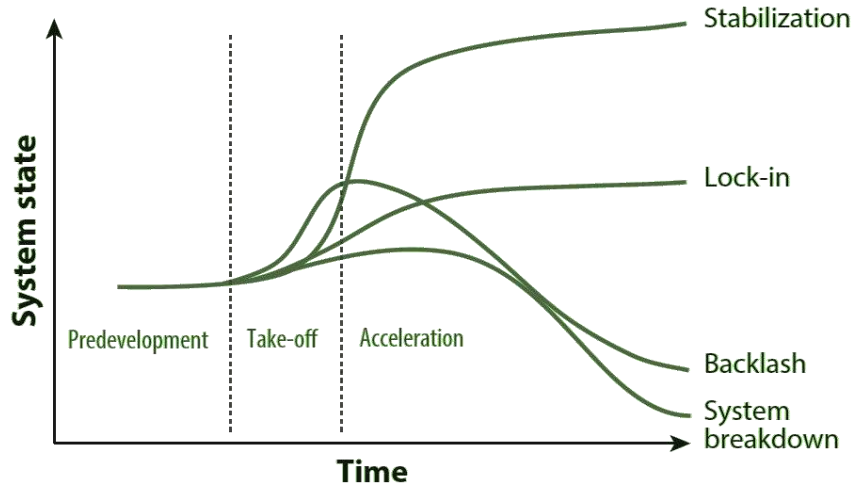


Figure 2.1. *Illustration of transition phase adapted from Rotmans et al., 2001 (Source: Loorbach et al., 2017 modified by the author)*

However, in practice, these smooth transition phases to the stabilisation stage may not always take place (see **Figure 2.1**). If there is any incompatibility during the process, the transition could be trapped in a 'lock-in' situation, haltering the process towards the transition goal. This 'lock-in' situation is closely related to the dynamic of path dependency, which explains the condition where structure and function are affected by past decisions. Lock-in means our systems are difficult to change because a certain 'path' that has been devoted in the past is limiting the options for changes. For example, the fossil-based energy system is difficult to transform because infrastructures, regulations, and institutional settings have already been set up to support this system. Identifying the structural changes in the transition process and developing solution options will help avoid and escape 'lock-in' conditions (Kemp et al., 2007; Loorbach, 2007).

Meanwhile, it is also possible, when the process is not well understood in the take-off phase, the transition becomes a 'backlash' (Chang et al., 2017). It is a situation that may occur when quick results do not materialise. Instead of moving towards the goal, setbacks are encountered (Rotmans & Kemp, 2003). Another possible outcome after the take-off phase is that the innovation networks fail to become self-sustaining; consequently, the transitions may collapse (system breakdown) (Chang et al., 2017).

To acknowledge the multi-phase transition pattern, historical analysis can be done by recognising the causal relationships of (i) dynamics changes over time, (ii) success and failure factors, and (iii) governance patterns (van der Brugge et al., 2005).

Multi-level

Transitions are conceptualised as the result of the dynamic socio-technical interaction at multiple levels (Geels, 2011; Loorbach et al., 2017). The prominent approach of transition theory is considered to be in this concept of multi-level perspective (MLP), which explains that disruptive change occurs in the dominant order of societal (sub) systems called *regimes* (Loorbach et al., 2017). This dominant configuration (regimes) interacts with changing preferences and external factors (*landscape*), as well as with evolving innovations and alternatives (*niches*). Thus, this multi-level framework explains that transition come through dynamic processes within and between these three analytical levels: landscape (the context), regime (the dominant configuration), and niches (the alternatives) (Geels, 2002; Geels, 2011; Rotmans et al., 2001; Loorbach et al., 2017; Köhler et al., 2019).

The landscape-level relates to the wider general society (macro) perspective, including cultures, social values, worldviews, and paradigms (Rotmans et al., 2001). The dynamics at this level tend to change slowly and are rather self-organised. The second level, regimes, entails the dominant practice, rules, guidelines showed in regulations and institutional design (Rotmans et al., 2001). This institutional structure tends to replicate patterns that fit with the regime and hinders innovation conflicting with the status quo (de Boer & Zuidema, 2016). Meanwhile, the niches level relates to individual actors, technologies, and local practices generating innovations, alternatives technologies, and social practices (Rotmans et al., 2001). The illustration of MLP can be seen in **Figure 2.2**.

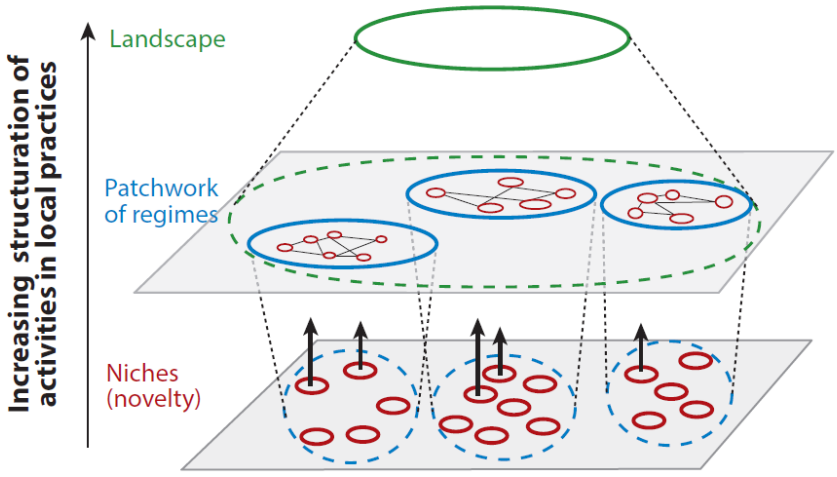


Figure 2.2. *Multi-level perspective based on Geels (2002) (Source: Loorbach et al., 2017)*

The essential point of MLP is the interactions between these levels. Innovations are not only affected by the process within the niches but also by the activities at the regime and landscape level (Geels, 2002; Geels & Schot, 2007). Changes in the landscape level build pressure on the regime, and destabilisation of the regime give chances for innovation at the niches (Geels & Schot, 2007). For instance, society's demand for clean energy to the existing institution (regime) makes policymakers give renewable energy research incentives; thus, new technologies increase. On the

other hand, pressure from both landscape and niches also could push regimes to changes and cracks windows of opportunity (van der Brugge et al., 2005; Köhler et al., 2019). For example, the global attention on the importance of green industry increases innovations for cleaner production. The accumulation of innovation then drives industrial energy efficiency regulation at the regimes.

In this study, multi-level perspective, together with multi-phase concept, helps identify activities, processes, and development that contribute to lock-in situations (disable factors) or affect progressing energy transition process (enable factors). MLP also incorporates the stakeholders involved in the energy transition and how they interact based on the landscape, regime, and niche framework.

Transition Management

Transition management is a policy-oriented approach that combines concepts from complexity and governance studies (Rotmans et al., 2001; Loorbach, 2010). In this transition management, transition arenas have a critical role since networks of innovators and decision-makers develop long-term visions for the basis of transition agenda and experiments (Loorbach & Rotmans, 2006).

The transition management has a prescriptive framework that suggests four sequential steps to shape the transition process: strategic, tactical, operational, and reflexive (Loorbach, 2010). These steps also relate to the type of management style used to define stakeholders' capacities from the multi-level governance framework. Transition management helps to understand the activities in practice reflected from the strategic, tactical, operational, and reflexive activities.

Strategic activities reflect the development of a long-term vision. They aim to identify prospective transition pathways involving strategic discussion, collective goal formulation, and long-term anticipation, such as strategies for the energy transition to achieve the Net Zero target in 2050 (IEA, 2021). In this sense, policymakers work with energy producers and consumers to develop the same vision, changing fossil-based energy to a clean, zero-carbon energy source. The focus of this process is the institutionalised process and addresses society as a whole.

Meanwhile, tactical activities relate to a dominant structure (regime), including all the establishment of patterns such as rules, regulations, routines, organisations, and networks. Due to these broad patterns, almost all types of stakeholders are involved in the daily activities. These activities develop specific plans for more concrete routes; for instance, the Net Zero 2050 vision will be implemented in program, financial and institutional framework. Tactical activities also support collaboration and partnership for these routes.

Next, transition management activities as operational activities have a short-term period and include on-the-ground activities such as innovation researches, demonstration projects and programs, and implementation activities. These activities relate to the management style mainly activated by individual interests, entrepreneurial abilities, or prospective innovations, for instance, pilot projects for implementing new low-carbon technology in the industries.

Lastly, reflexive activities relate to projects evaluation and progress monitoring which can be found in every management style. Reflexive activities can be one of the learning processes for actors. Thus, these activities should adjust visions and best practices articulation (Köhler et al., 2019).

In this study, transition management assesses actors' management styles in policymaking for the industrial sector's energy transition. The key principle is that all relevant actors must simultaneously and collaboratively carry out their capacities.

2.1.2 Energy transition in the energy-intensive processing industry

Energy-intensive processing industries (EPIs) are industries that require high energy input in processing natural resources into basic materials (Wesseling et al., 2017). The EPIs include metal (iron, steel, aluminium), chemicals, cement, glass, and paper industries that manufacture the essential basic supplies for social welfare development (Wesseling et al., 2017). Globally, the industry contributes to at least 30% of all GHG emissions, most of which come from EPIs (Fischedick et al., 2014). Although the EPIs sector has made some significant improvements in energy efficiency over the last decades, stricter international targets such as the Paris agreement requiring EPIs emission to zero before 2070 make it very difficult to achieve (Fischedick, 2014; Wesseling et al., 2017). Thus, extensive energy efficiency and major transformation towards renewable energy sources in EPIs are crucial.

However, the bottom-up innovations from the industry (niches) have to be supported by a broader socio-technical transition that entails changes in user behaviour, mindset, culture (landscape), and also policies, strategies, and infrastructure (regime) (Geels, 2002; Wesseling et al., 2017). This condition closely related to the multi-level perspective concept. To facilitate this transition process, studies on socio-technical and innovation (ST&I) systems have provided valuable insight to identify drivers and barriers to new technology innovation, development, and diffusion in practice and to understand the lock-in situation of established regimes around existing energy-intensive technologies (Wesseling et al., 2017). Thus, the characteristic of the ST & I system of EPI by Wesseling et al. (2017) will further be used to analyse barriers and enabling factors in the policy implementation in this study.

(1) Industry structures

The structure of EPIs is characterised by economies of scale and high energy and capital investment. The need for high energy relates to the process attributes which takes place at high temperatures or requires intensive energy to create the desired chemical reaction. These processes involve high capital, and the upscaling requires high upfront cost. Thus, it takes a long payback period with typically 20-40 years of an investment cycle. As a result of this scale, energy, and capital intensive, there are barriers to market entry. The new businesses have difficulties competing with the more established mature players, while the unsuccessful industries are difficult to exit due to the high sink cost. Such barriers might halter the transition process because the existence of new entrants has been recognised as important drivers for sustainability transitions in other sectors (automotive and energy) (Wesseling et al., 2017).

(2) Innovation strategies

EPIs innovation strategies are strongly influenced by the industry structure. Because of the high cost and investment for new plants, the process innovation in EPIs tends to follow predefined technology, hence mainly focus on enhancing productivity and efficiency. Also, many innovation processes are outsourced to or developed together with the technology providers. Moreover, EPIs' research and development funds are low (except for chemicals), which leads to low rates of innovation.

EPIs enterprises are considered to have little motivation for reducing GHG emissions, given the lack of demand and limited supporting policy to stimulate innovation (Wesseling et al., 2017). Any initiatives for innovation drive by the commercial cost-benefit consideration. For instance, they will replace fossil fuel with renewable energy as long as the energy cost is lower than the existing business as usual. The EPIs do not perceive sustainability as competitively beneficial compared to business-to-consumer sectors such as the food and the automotive industry (Wesseling et al., 2017).

(3) Networks

The specific technology and innovation relate to EPIs make strong relations between the industry and technology providers. Collaboration with competitors, technology owners and universities to pool ideas and resources typically supported by public funds at the national or international level to share the R&D costs. Thus, the network for technology and innovation in EPIs is considered to be solid. This type of relationship also can be seen in the supply-chain network. EPIs in specialised markets have stronger customer-supplier connections than the bulk markets for commodities (Wesseling et al., 2017).

(4) Government policy

Environmental issues that directly impact local stakeholders, such as air, water, and soil pollution, are often well regulated. Firms tend to obey because if they do not comply, the risk of losing their licence to operate is high. This situation is different from regulation for GHG emission or energy efficiency. The policy is more relaxed from the former case because of the safeguard economic competitiveness consideration. Voluntary participation is likely to be encouraged, but the effectiveness is being criticised. Moreover, the government regulations that considered to threaten EPIs competitiveness could be condemned as they usually have well-coordinated and powerful lobbying groups to fight back (Wesseling et al., 2017). These barriers can be pulled or push factors that affect how the transition process takes place in the industrial regimes.

(5) Markets

There are two markets types of EPIs, markets for basic materials and markets for specialised materials. The bulk basic material markets or commodities are the largest in EPIs. Its price volatility often characterises this market. The international supply-demand imbalance fluctuates in pricing and profit margins. With high fixed operating costs and inflexible manufacturing technologies, EPIs cannot take full advantage of their cyclical profit.

Meanwhile, markets for specialised materials only have a little room for product differentiation, so the market size is small. The demand is limited; hence, they have a low volume. The competition for this market focuses on quality, reliability and time delivery in result reducing price elasticity. Thus, these markets create higher and more stable profits margins (Wesseling et al., 2017).

These five characteristics of EPIs have correlations with Geels' (2014) Triple Embeddedness Framework (TEF) of firms-in-industries, which unravel industrial regimes' dynamics. TEF conceptualises industry as a population of firms in two environments with different pressures: economic (task) and socio-political environment. The economic environment accommodates customers and suppliers, which in EPIs' attributes refer to networks and markets. On the other hand, the socio-political or institutional environment accommodates policymakers, social

movement, and wider public perceptions (Geels, 2014; Kungl & Geels, 2018), referring to the government policy from EPIs' characteristics.

TEF framework (see **Figure 2.3**) further proposes that 'industry regime' shapes the firm-level opinions and responses to those environmental pressures (Kungl & Geels, 2018). This 'industry regime' contains industry-specific institutions: (1) mindsets, belief systems, (2) mission, identity, norms, (3) technical knowledge and capabilities, (4) formal-regulatory institutions (rules, taxes, subsidies), contributing to path dependence and lock-in situation (Geels, 2014; Kungl & Geels, 2018). EPIs characteristics relate to this industry regime are industry structure and innovation strategies.

The key strategies (externally-oriented) to respond to these two environments pressure are (1) placing economic strategies (take-overs, pricing, marketing, supply chains management), (2) strategies for innovation (R & D, technology collaborations), (3) corporate political strategies (lobbying, information strategies, financial aids to political parties), and (4) framing strategies (public relations, advertising) (Kungl & Geels, 2018).

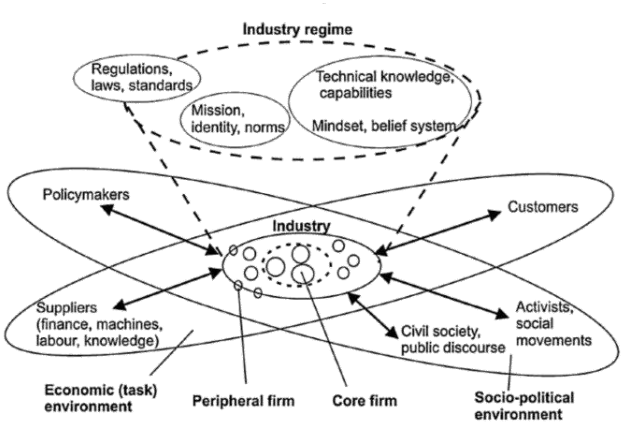


Figure 2.3. *TEF Framework by Geels (2014). The bidirectional arrows indicate a reciprocal relationship: industries are affected by external pressures and also respond to this pressure within the regimes.*

2.2 Policy transfer in energy and industrial context

Understanding how sustainable energy policy can be transferred across nations is highly relevant today since many countries find themselves at energy policy junctures and search for inspiration toward sustainability goals (Steinbacher, 2015). This understanding includes acknowledging the effects of similar or different policy objectives on the policy transfer result. Most of the policy transfer for renewable energy or energy transition policy entails key fiscal incentives policies to stimulate the transition process (Bhamidipati et al., 2019).

Since drawing lessons can be done through several approaches, it is important to understand what policy transfer is, what can be transferred, and how the process works. These approaches are crucial since the role of policy transfer in the energy and industrial context can be determined properly according to the success of policy transfer in many contexts. Thus, this is what I explain in what follows.

2.2.1 What is policy transfer

The policy transfer concept has been broadly reviewed in academic literature in the past decades, initially within political science and international relations subject (Stone, 2012). The most prominent idea of policy transfer comes from Dolowitz & Marsh (1996), which until today, most policy transfer articles or related concepts refer to them. They describe policy transfer as "*a process in which knowledge about policies, administrative arrangements, institutions etc. in one time and/or place is used in the development of policies, administrative arrangements and institutions in another time and/or place*" (Dolowitz & Marsh, 1996, p. 344). Even though policy transfer can be both done in time and place-form, this study only describes the later form of policy transfer to scope limitation.

Policy transfer can be distinguished into three categories: voluntary, indirect coercive, and direct coercive policy transfers, which they related to each other on a continuum between two extremes (voluntary and direct coercive) (Dolowitz & Marsh, 1996; Dolowitz & Marsh, 2000). Most policy transfers have both coercive and voluntary transfers, so they occur somewhere in the spectrum. Meanwhile, direct coercive policy transfers mostly take place because of disproportional power relations, with the involvement of supranational organisations or on the international level due to, for instance, economic pressure (Dolowitz & Marsh, 1996; Dolowitz & Marsh, 2000).

2.2.2 What to transfer

There are several objects that can be transferred through policy transfer. The popular categories identified by Dolowitz & Marsh (2000, p.12) include: *"policy goals, policy content, policy instruments, policy programs, institutions, ideologies, ideas and attitudes, and negative lessons*". To give an illustration for a better understanding of these objects, Dolowitz & Marsh (2000) make a clear difference between policies and programs. Policies are viewed as broad statements of intention used to define the direction, while programs are perceived as concrete ways to implement those policies (Dolowitz & Marsh, 2000). Most of the time, best practices are the object that wants to be transferred, but negative lessons can also be taken as a transferred policy (Dolowitz & Marsh, 1996). Negative lessons are not for implementation; they will be the object of learning how to avoid the same mistakes. When choosing what kind of policy to transfer, it is more effective focusing on achievable, practical implementations than on large-scale reforms, considering resources limitation and the risk of public resistance (Stead et al., 2008).

Transferring the policy can be differentiated into four gradations: copying, emulation, hybridisation, and inspiration (Dolowitz & Marsh, 2000). The most straightforward degree of policy transfer is copying, which means adopting the whole policy into a new setting without any alteration. However, the implementation is difficult in practice since the different institutional setting, and local context needs to be considered (Rose, 1991).

2.2.3 Policy transfer processes

The process of policy transfer is often messy and needs to be done at the right moment so that the transfer process works properly (Dolowitz & Marsh, 1996). Donor party as well as recipient party usually involved in the policy transfer process. From the donor's perspective, typically, there are specific strategies or agendas prior to policy transfer, determining whether the voluntary or direct coercive transfer will be performed. Meanwhile, most policy transfers start as voluntary action from the recipient's perspective as the primary force is dissatisfaction with the status quo (Dolowitz & Marsh, 1996). This dissatisfaction can be caused by (1) perceived uncertainty, such as

due to lagging in technological development; (2) changes of policy environments, for instance, the effect of existing policy no longer positive; or (3) changes in political values, like power changes from elections (Rose, 1991). When the government status quo is disrupted, policymakers will try to solve problems first with their own capability. If their knowledge is limited and sufficient to solve the issues, policymakers will search for satisfaction across their boundary (space and time).

In the search for satisfaction, the policymakers' past experience is the first place to look (Rose, 1991). If learning from the past is still insufficient, policymakers could search for a new program that would work in the future or search for other places facing similar issues. When seeking out across space, policymakers can search for lessons learned at different governmental levels (Dolowitz & Marsh, 2000). However, most often look for policies at the same level organisations simply because they are less complex to transfer.

2.2.4 The role of policy transfer in the energy transition

A combination of different generic and sector-specific policy instruments is suggested to cover various transition issues (Falcone et al., 2019; Markard, 2018). Thus, selecting suitable policies becomes important to support a successful energy transition process. Policy transfer is one of the methods to search for those suitable policies.

Policy transfer in the energy sector is mainly driven by international efforts to mitigate climate change. The frontrunner countries in climate change mitigation, including energy transition, is led by industrialised countries, especially in Europe (Bhamidipati et al., 2019; Bößner et al., 2020). The United Nations Framework Convention on Climate Change (UNFCCC) mandates that mitigation measured also need to be followed by less-industrial countries, for instance, through technology transfer. However, the transfer processes are enabled by factors such as innovation policies, incentive frameworks, and market creation (Bhamidipati et al., 2019). Thus, policy transfer will support the implementation of technology transfer for these mitigation efforts.

The main goal of policy transfer in the energy transition is mostly to stimulate demand for renewable energy technology in as many regions as possible, so these new technologies become more cost-competitive and adaptive to the local context (Bößner et al., 2020). In recent years, the popular subjects of donor-funded projects to transfer from the European Union (EU) to lower-income countries are essential policies such as feed-in tariffs, tradable permits, and auctions (Bhamidipati et al., 2019). A recent study from Bößner et al. (2020) identifies that European countries dominate the sources of inspiration for local policymakers in global South countries such as Peru, Thailand, and Uganda in designing renewable energy support policies. Germany, the US, the UK and Spain are identified as the key countries providing some substantial knowledge transfer to those global South countries (Bößner et al., 2020).

2.3 Conceptual model

A conceptual model is drawn to answer the research question(s) by connecting several concepts that have been explained in the previous section:

(1) The multi-phase is used to analyse transition stages of energy transition in the industrial sector, indicating the country's position in the transition process. This aim is accomplished by analysing historical policy change, examining the enabling and disabling factors from the past decisions, and identifying governance systems in Indonesia. Also, it is essential to define conditions that are susceptible to lock-in situations.

(2) A multi-level perspective incorporates the stakeholders involved in the energy transition based on the landscape, regime, and niche framework. Together with the multi-phase concept, lock-in conditions can be identified and addressed.
(3) Transition management helps to understand the activities in practice reflected from strategic, tactical, operational, and reflexive. In this study, transition management is used to assess actors' management styles in energy transition policymaking.
(4) EPIs characteristics of ST&I system (industrial structure, innovation strategies, network, government policy and markets) give the insight to identify drivers and barriers to new technology innovation, development, and diffusion in practice
(5) The policy transfer concept is applied to take lessons from EPIs energy transition policy from one country's experiences to be used elsewhere.

The interrelation between these concepts is shown in the conceptual model in **Figure 2.4**.

Finally, a comparative analysis based on these concepts is performed to answer the overarching research question: "*What are the possible and adaptable policies to transfer for improving energy transition in the industrial sector in Indonesia*?"

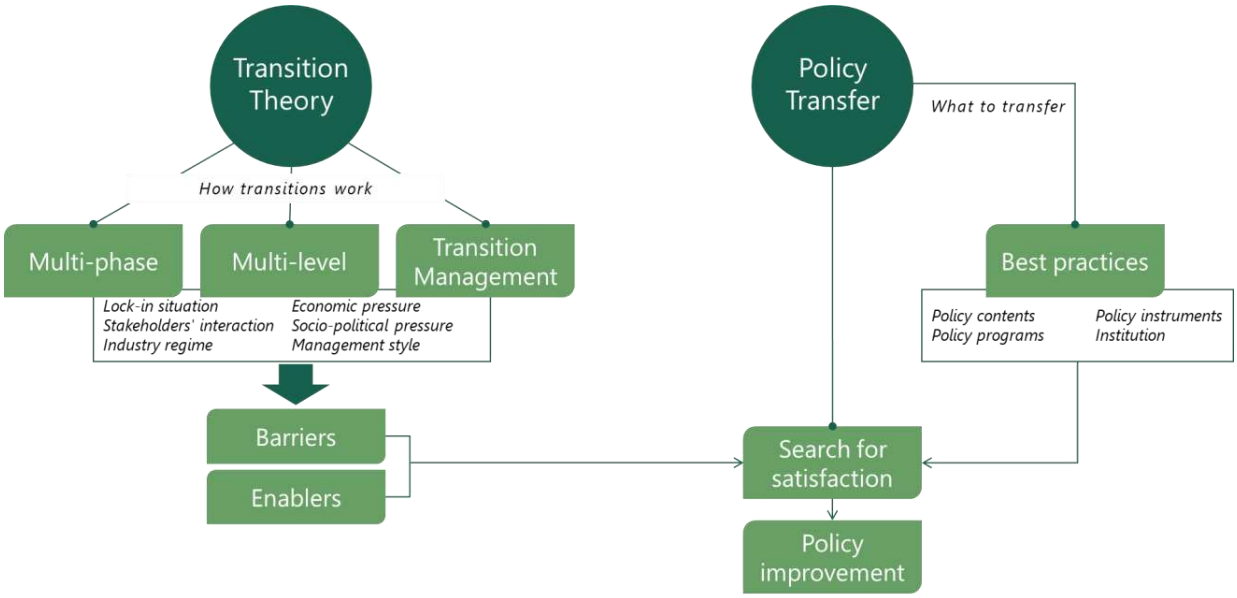


Figure 2.4. *Conceptual model (source: author)*

3. Methodology

This section explores the method used in this research in order to answer the research question. The first part describes the research design. The next part explains what kind of sources are used to collect the data. And lastly, this chapter elaborates on the method of analysis used in this study.

3.1 Research design

The aim of this research is to develop strategic policies to improve the energy transition process in Indonesia's industrial sector by using the UK's energy policy as an example case to see what potential collaborations can be taken for policy learning. Since the nature to explain the goal is how and why a qualitative approach is suitable to use. A qualitative approach is appropriate for research that focuses on the reconstruction of complexity system (Flick, 2015). The complexity of energy transition and the dynamic of industrial context requires a method that can explore the process. Furthermore, qualitative studies try to answer critics on the earlier quantitative study on policy transfer which only concentrating on general pattern and not considering the variety of policy transfer process (Stone, 2012). Qualitative research has a benefit since it offers researchers to explore subjective, complicated, irrational, and conflicting processes driven by human behaviour (Clifford et al., 2010; Bryman, 2012). However, the qualitative approach outcomes are mainly context-specific; thus, the results are only generalisable to a minimal extent (Flick, 2015).

In this research, I conducted a case study to understand the role of policy in the energy transition for EPIs. Simons (2009, p.21) defines a case study as "an in-depth exploration from multiple perspectives of the complexity and uniqueness of a particular project, policy, institution, program or system in a 'real life' context". A case study as a research approach may help the complexity of the energy transition process, which adds to the complicated, messy, and sometimes irrational policy transfer processes. Moreover, in this study, a case study allows the possibility to study energy transition and policy transfer in a specific context which helps to create in-depth knowledge. Although a case study provides context-specific results that are not directly generalisable (Flick, 2015), this method still adds perspective on the complex process of the energy transition, and policy transfer process as Flyvbjerg (2006, p.227) describes, "that knowledge cannot be generalised does not mean that it cannot enter into the collective process of knowledge accumulation in a given field or a society". This statement also means that the additional views found in a case study will give a more comprehensive picture, leading to a better understanding of both the energy transition and policy transfer process.

3.2 Data collection

The main data collection for this study consists of a literature review, content analysis, and semi-structured interviews. This multiple method approach is suitable for the research goal, and it also strengthens the findings. Using multi-methods and sources is known as triangulation, giving in-depth knowledge from different perspectives (Clifford et al., 2016). The triangulation method for this research is illustrated in **Figure 3.1,** and the complete framework of data collection is shown in **Table 3.1**.

Table 3.1. *Data collection framework*

Research questions	Which information is necessary?	Moment of retrieval	Source	Method of retrieval	Documentation method	Method of analysis	Output
a. How do existing policies stimulate the energy transition process in the industrial sector?	Policy insight about energy transition in the industrial sector, Key milestones of energy transition development	January 2021	- Interviews with related stakeholders - Policy documents, government/official reports, articles from scientific journals	Collecting policy documents and reports from official sources, Semi-structured interviews,	Writing in narrative, Transcripts note, and summarise output in tables and/or figures,	Explorative, content analysis, and examining the policy	Factors in policy design affected energy transition in the industrial sector and transition phase
b. How does institutional setting influence energy transition policies in the industrial sector?	Insight of institutional design for energy transition and industrial development	Spring 2021		Collecting policy documents and reports from official sources, Semi-structured interviews,	Writing in narrative, Transcripts note, and summarise output in tables and/or figures	Explorative, content analysis	The institutional arrangement for the energy transition in the industrial sector
c. What are the enabling factors and barriers for the energy transition in the industrial sector?	Key information on energy transition policies and their milestones in the industrial sector	Spring 2021		Semi-structured interviews, literature study, and critical reading	Transcripts note from interviews and summarise output in tables and/or figures	Explorative, content analysis, and examining the policy	Factors influence energy transition in Indonesia's industrial sector
d. How can policy transfer help Indonesia to improve the energy transition in the industrial sector?	Information from output a, b, and c; policy similarities and differences	Spring 2021		Collecting policy documents and reports from official sources, Semi-structured interviews	Transcripts, notes from interviews, writing in a narrative, use referencing	Explorative and comparative analysis, content analysis	Potential policy to be transferred from the donor country
e. What are the constraining factors and the potentials of transferring the energy transition policies in the industrial sector?	Information from output a, b, c, and d; key limitations and capabilities of transition energy implementation	End of spring 2021		Semi-structured interviews, literature study, and critical reading	Transcripts, notes from interviews, writing in a narrative, use referencing	Explorative and content analysis	constraining factors and the potentials for policy transfer of energy transition policies in the industrial sector

Source: Author

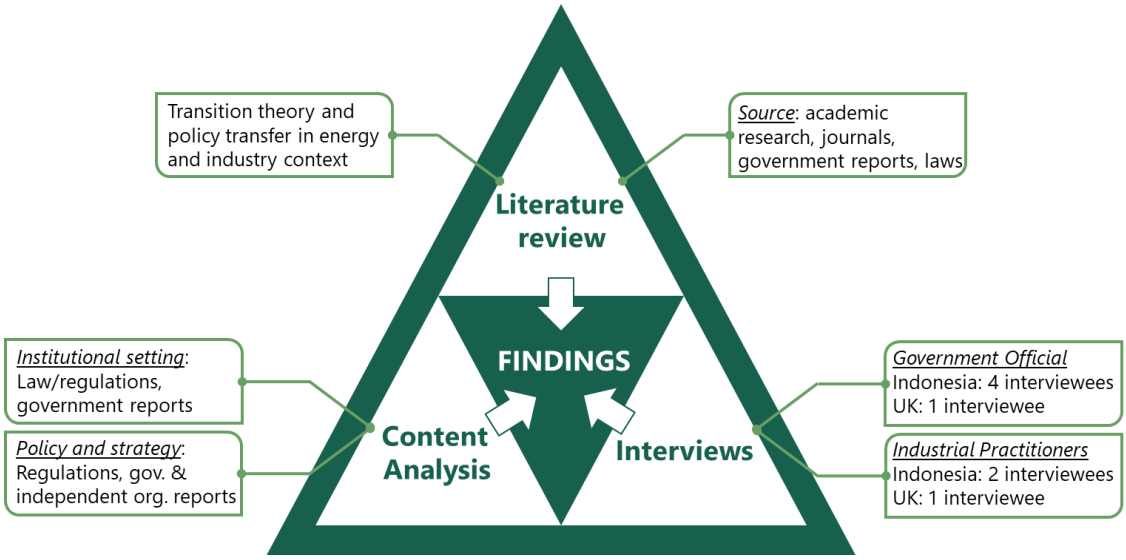


Figure 3.1. *Triangulation of data collection (source: Author)*

3.2.1 Literature review

Scientific literature has been previously reviewed and discussed in the theoretical framework section. The review process was started by determining relevant concepts in transition theory and policy transfer which could help to answer the research questions. The literature review is essential to understand the relevant concepts and theories and acknowledge controversies, inconsistencies, and unsolved research questions on previous research (Bryman, 2012). The main sources used for exploring these concepts are academic research, journals and information and explanations found in government reports, law, and other official reports available online.

3.2.2 Content analysis

Content analysis was conducted to analyse the policy document in order to gain more insight into how the regulations affect the EPIs transition energy. This analysis is useful as background information for the interviews. The content analysis consisted of two components: (1) policies and strategies; (2) information about the institutional setting. For the first component, policies and strategies were gathered through Indonesian and the UK governments' official websites. Meanwhile, for the second, most information regarding energy transition and the EPIs sector were gathered from Indonesian and the UK governments' official websites and some useful scientific articles as they gave a clear explanation about the context. Furthermore, I also checked websites of other independent organisations to gain insight into the policies effect on EPIs energy transition. Selected documents analysed are presented in **Table 3.2**.

Table 3.2. Document selection for content analysis

Document	Type	Relevant content
Indonesia Context		
Government Regulation Number 70 the Year 2009 on Energy Conservation	Regulation	Policy for energy efficiency, the requirements for energy-intensive industries to follow energy management

Document	Type	Relevant content
Presidential Regulation Number 61 the Year 2011 on National Action Plan for Reducing Green House Gases (RAN-GRK)	Regulation	Master plan for GHG reduction, including from energy and industrial processes
Ministry of Energy and Mineral Resources regulation Number 14 the Year 2012 on Energy Management	Regulation	Energy conservation program, energy management implementation guideline for energy-intensive industries
Government Regulation Number 79 the Year 2014 on National Energy Policy	Regulation	Overall outlook for Indonesian energy policy (supply and demand, energy security, energy development priority)
Government Regulation Number 14 the year 2015 on Industrial National Development Master Plan (2015 – 2035)	Regulation	Master plan for industrial development including managing the energy for industry
Presidential Regulation Number 22 the Year 2017 on National Energy General Plan (RUEN)	Regulation	Plan and program for achieving primary energy mix including renewable energy target, the calculation of energy demand include energy-intensive industry
UK Context		
Energy White Paper 2003: Our energy future - creating a low carbon economy	Policy paper	UK commitment to reducing GHG emissions, identified business opportunities to competitive market (including industry)
Energy White Paper 2007: Meeting the Energy Challenge	Policy paper	A new mandatory cap and trade scheme for organisations (including industries) consuming more than 6,000 MWh of electricity per year
Climate Change Act, 2008	Regulation	The legally binding framework for carbon-reduction target (including carbon trading scheme)
White Paper 2017: Industrial Strategy: building a Britain fit for the future	Policy paper	Strategies for energy-intensive industries competitiveness in the clean economy, how UK's industries adapt to carbon-reduction target
Energy Act 2013	Regulation	Updates regulation for financial incentives to reduce energy demand.

Source: Author

3.2.3 Interviews

In this study, semi-structured interviews were used to gain in-depth information, conforming to the data gathered from the literature review and content analysis. This type of interview allows the researcher to have more self-conscious conversations with people, but in a partially structured manner which needed to cover the scope of research (Longhurst, 2010; Flick, 2015). At the same time, semi-structured interviews allow participants to add important topics and subjects that the

researcher has not considered (Flick, 2015). Furthermore, the informal nature of this type of interview makes participants feel more comfortable, which allows them to respond freely (Longhurst, 2010).

A face-to-face meeting is considered the most proper method for conducting interviews because it offers immidiate interaction between study participants and the researcher, which helps the researcher observe non-verbal communication (Khan, 2014; Allen, 2017). However, an alternative of virtual meetings becomes more popular, especially in the COVID-19 pandemic, which excessively limits physical meetings. The synchronous communication found in face-to-face interviews also can be obtained in online interviews, i.e. through video calling.

For this study, I conducted all of the interviews through video calls. The main benefits of conducting interviews online are the meeting can be conducted anywhere, and the interview schedule can be more flexible (Longhurst, 2010; Allen, 2017). The geographical constraints no longer become a major concern, and researchers have access to a larger potential sample of participants around the world (Allen, 2017). Meanwhile, conflicted time constrain also can be overcome by this type of interview. Respondents can participate in the interview without limited to the working hour schedule, which allows more flexibility. Moreover, the researcher did not have to travel for the interviews, although in this study, the interviewees come from two different countries. This condition adds to the advantages of saving cost and time (Allen, 2017).

The interviews I conducted can be divided into two types: interviews with government officials and interviews with industrial practitioners. The former type is mainly for exploratory interviews conducted to gain more knowledge on the policymaking process for EPIs' energy transition. Meanwhile, interviews with industrial actors are conducted to gain insight into the implementation of the policies. Industrial experts are those who are or were involved in the energy policies development or implementation for industrial sectors. The list of interviewees contacted for this research is shown in **Table 3.3.**

Table 3.3. *List of relevant interviewees*

Code	Organisation	Title	Relevance	Date
	Policymaker: Government Official (GO)			
GO1	Ministry of Industry (Standardization and Industrial Services Policy Board)	Head of Green Industry Management and Facilitation	Responsible for energy management in energy-intensive industries	5-5-2021
GO2	Ministry of Industry (Directorate General Chemical, Pharmacy, and Textile Industry)	Director-General for Chemical, Pharmacy, and Textile Industry	Responsible for industrial development in energy-intensive industries (fertilizer, chemical, cement and glass industry)	23-5-2021
GO3	Ministry of Energy and Mineral Resources (Directorate Energy Conservation)	Staff - Policy Analyst	Responsible for formulation and implementation of policies for energy conservation	4-6-2021
GO4	Ministry of Energy and Mineral Resources	Staff - Policy Analyst	Responsible for formulation and	7-6-2021

Code	Organisation	Title	Relevance	Date
	(Directorate General of New Renewable Energy and Energy COnservation)		implementation of policies for new and renewable energies.	
GO5	Department for Business, Energy and Industrial Strategy (BEIS)	Head of Technologies - Industrial Decarbonisation Strategy	Responsible of industrial decarbonisation strategy in the UK	21-6-2021
	Industrial practitioner (IP)			
IP1	Indonesia Olefin, Aromatic, and Plastic Industry Association (Inaplas)	Secretary General for The Indonesia Olefin, Aromatic, and Plastic Industry Association (Inaplas)	Involved in development and implementation of Indonesia's energy policy in industrial sector	4-5-2021
IP2	Industrial Association - Responsible Care Indonesia	Responsible Care Indonesia - Energy Management Specialist	Involved in energy efficiency program in industrial sector	7-5-2021
IP3	The UK - Confederation of Paper Industries (CPI)	Director of Energy and Environmental Affairs	Member of Energy Intensive Users Group, involved in the development and implementation of energy and industrial policies in the UK	10-5-2021

Source: Author

3.3 Method of analysis

For the literature review and document analysis, I used a predefined set of codes that was drawn based on concepts from the theoretical framework. However, during the coding process, these codes were added or refined. For example, when there was repeated information from respondents in the interview process, this information is considered to be added as an important theme code. Allowing such flexibility in a predefined structure helps create a coding scheme that fits the data best to analyse the data more accurately (Cope, 2010). Furthermore, this set of codes also relates to the interview questions, helping to give ideas of what to expect in the interview results (see **Appendix 1**).

In order to analyse the interview data, all interviews were recorded as per permission from the interviewees. This allowed me to focus on the questions and the conversation during the interview. The set of predefined questions in this study can be seen in **Appendix 2**. The recorded interviews are transcribed and the transcriptions made are coded based on several relevant themes representing valuable findings. By coding the transcription data, it helps me identifying categories and patterns, and generating new connections between different subjects (Cope, 2010).

4. Analysis of Indonesian industry's energy transition

This section explains the existing condition of energy transition in Indonesia's industrial sector based on findings retrieved from policy documents and insights from interviews. The aim is to answer the first three secondary questions set in this research, which are (1) *"How do existing policies stimulate the energy transition process in the industrial sectors?"* (2) *"How does institutional setting influence energy transition policies in the industrial sectors?"*; and (3) *"What are the enabling factors and barriers for the energy transition in the industrial sector?"*

4.1 Policy towards renewable energy

Under Law No. 16/2016, Indonesia has committed to reducing greenhouse gas (GHG) emissions to 29% (unconditional scenario) and 41% (conditional scenario) below 2010 levels by 2030. In order to achieve the reduction goal, the Government of Indonesia set several actions in the Nationally Determined Contribution (NDC) in 2016. The measures include cutting the emissions from the energy sector, which contributes 33.9% of total 2010's GHG production in Indonesia. The main strategies are by improving new and renewable energy (NRE), energy efficiency, clean energy supply, and fuel switching (Government of Indonesia, 2016).

The dynamic changes of energy policy in Indonesia start to favour renewable energy. Transformation energy policy has been made in the last decade through National Energy Policy (KEN). The latest, under Government Regulation No. 79/2014, replaces the previous regulation by increasing the target of NRE in the primary energy mix from 17% to 23% in 2025 and 31% in 2050. In line with this regulation, Indonesia's Ministry of Energy and Mineral Resources (MoEMR) aims to achieve this target mostly from bioenergy, hydro power, geothermal, and a small share from solar and wind energy (other NRE). **Figure 4.1** illustrate the policy changes and the implication to the latest energy goal.

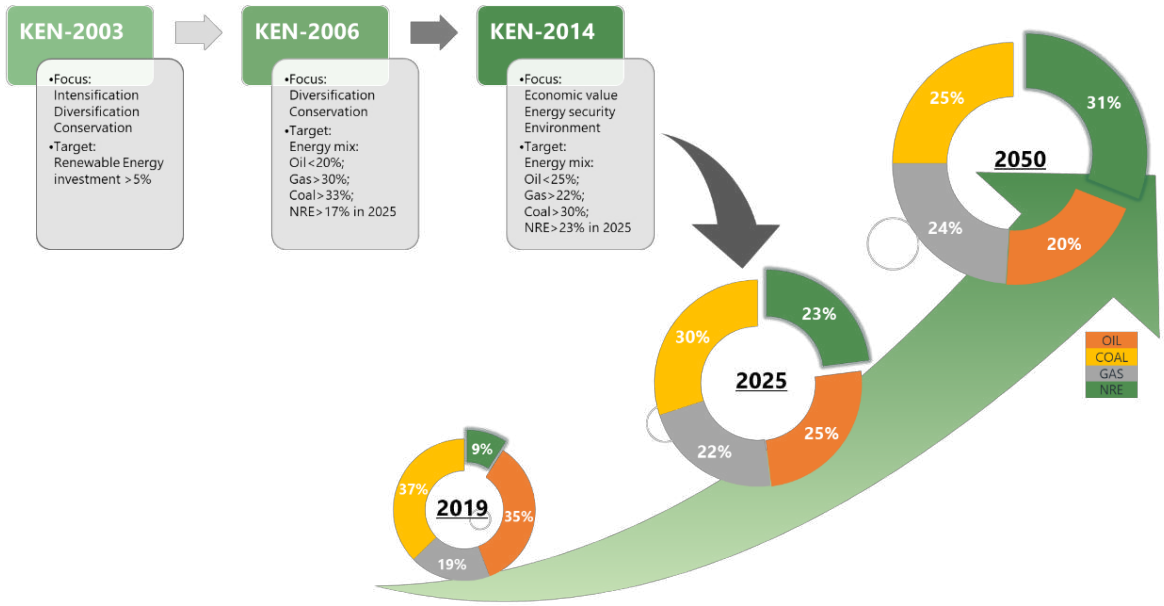
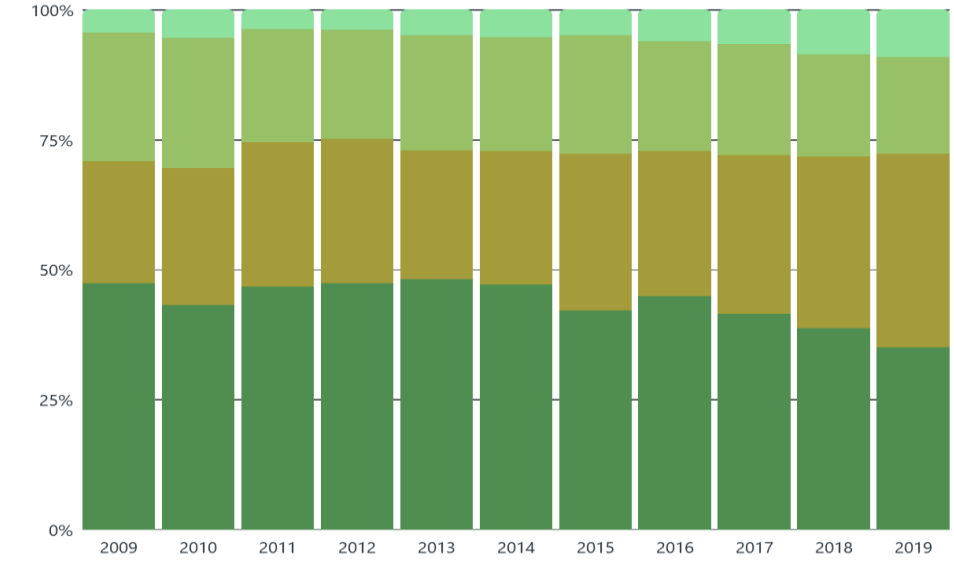


Figure 4.1. *Primary energy policy changes and the latest energy mix target from National Energy Policy (KEN) (Source: DEN, 2020 modified by Author)*

Although the policy begins to support renewable energy development, it should be noted that the share in the primary energy mix is still moderate. The NRE share's target is less than a third of the total energy supply in 2050. The current energy policy is still chosen fossil fuels to dominate the energy supply in the future (see **Figure 4.1**). Moreover, the trend of energy supply shows that energy consumers still depend on conventional resources: oil, gas, and coal (see **Figure 4.2**). In 2019, the portion of gas and oil in the energy mix declined while coal usage increases more than 50% above the 2009 share. It means that despite the decrease in oil share, the replacement options come back to coal, creating more carbon emissions. The main driver for this action is the price. Furthermore, the modification needed for swift from oil to coal is easier and cheaper than changing to NRE technology. In this sense, the infrastructure embedded in the existing system is hard to break. Thus, the energy supply becomes more difficult to be changed towards new renewable resources.



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
OIL	47.35%	43.24%	46.77%	47.43%	48.13%	47.06%	42.12%	44.90%	41.42%	38.71%	35.03%
COAL	23.43%	26.24%	27.74%	27.77%	24.79%	25.76%	30.14%	27.84%	30.53%	33.00%	37.28%
GAS	24.87%	25.11%	21.73%	20.88%	22.12%	21.85%	22.77%	21.12%	21.39%	19.68%	18.51%
NRE	4.35%	5.42%	3.77%	3.92%	4.96%	5.32%	4.97%	6.13%	6.66%	8.61%	9.18%

Figure 4.2. *Indonesian primary energy mix between 2009 – 2019 (source: MoEMR, 2020)*

To implement the policy, National Energy Policy (KEN) is supported by National Energy Plan (RUEN), which is regulated in Presidential Regulation Number 22 published in 2017. RUEN gives a general plan on how to meet the energy development goals set in KEN. Through the RUEN, the Government of Indonesia determines the direction of energy policy which contains energy mix targets, energy development priorities, and the responsibility of related sectors and stakeholders. Considering these things, the Government of Indonesia's energy policy directions in the RUEN include maximizing the use of new and renewable energies (NRE), minimizing the use of oil, and optimizing the use of natural gas. Several programs and actions are planned to maximise NRE usage, including power plant transformation, conversion to oil consumption to biofuel for industrial, transportation, and electricity sectors, and solar power utilisation for industry and commercial buildings. However, in the current condition, most NRE is utilised for power plant development, and only a small portion is used for transportation and industry. The industrial sector mostly uses biomass as an NRE source.

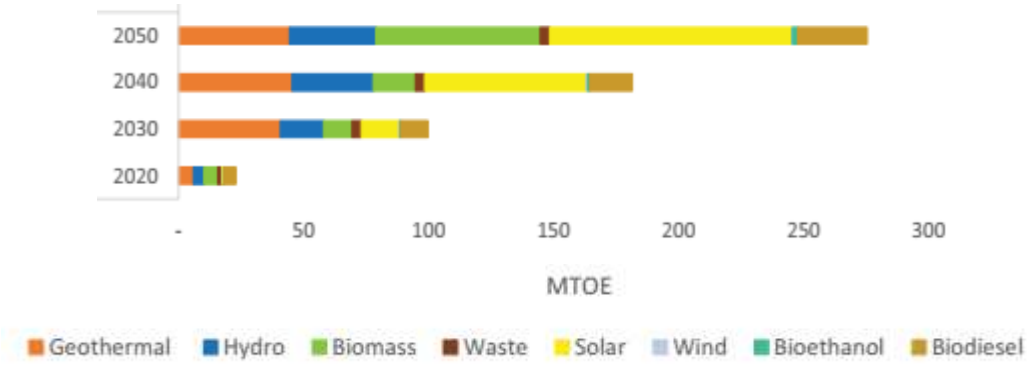
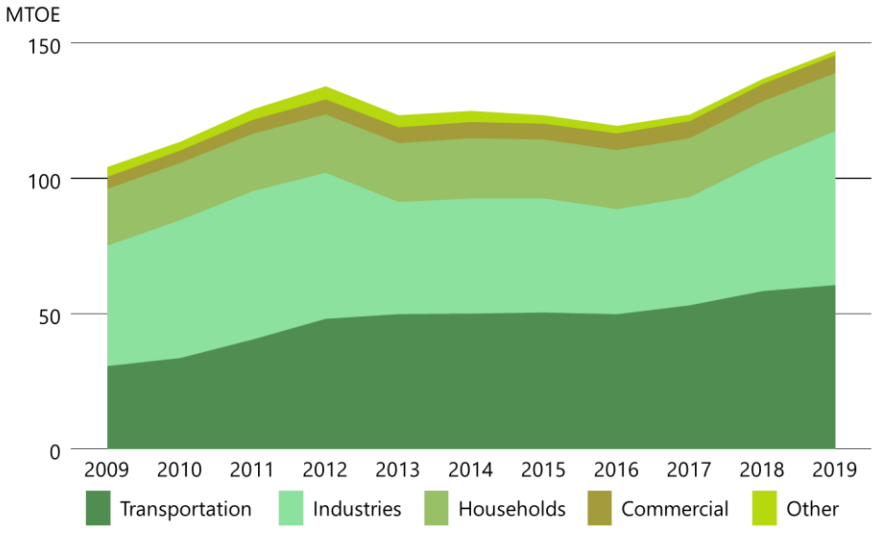


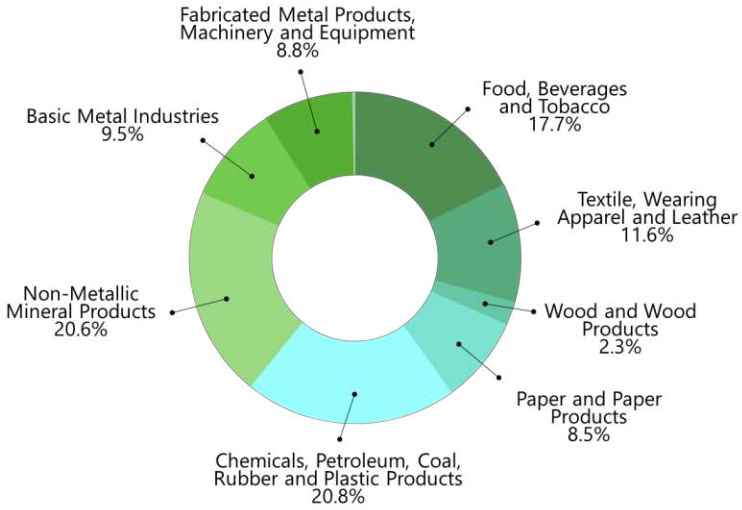
Figure 4.3. *New and renewable energy (NRE) supply plan (source: DEN, 2019)*

4.2 Industry role in the energy transition

One of the ways to reduce GHG emissions is done by cutting carbon emission from energy consumption which the industrial sector accounted for 38.7% of the energy final in 2019 (including biomass) (MoEMR, 2020) (see **Figure 4.4 (a)**). The energy consumption in the industrial sector is dominated by energy-intensive processing industries. Indonesia Statistics data on energy consumption in the industrial sector (see **Figure 4.4 (b)**) shows that the majority of this share of energy is consumed by energy-intensive processing industries (EPIs) such as chemical, non-metallic mineral products (cement, glass, and ceramic), food, paper, and metal (basic and fabricated) industry (ISB, 2016). These EPIs (cement, metal, food and beverage, fertilizer, ceramics, and paper industry) are also defined as high-energy consumer sectors by National Energy Council (DEN). This specific category is used to model the demand projection since these six industries contribute approximately 87% of industrial energy consumption (DEN, 2020).



(a).



(b).

Figure 4.4. (a) *Total energy consumption by sector 2009 – 2019 (source: MoEMR, 2020)*
(b) *Industry's energy consumption shares by sub-sector in 2015 (source: ISB, 2016)*

As industrial development is still considered essential to contribute to Indonesia's GDP in the future, the projection of energy consumption in the industry indicates a significant increase (see **Figure 4.5**). The business as usual (BaU) scenario shows the demand from EPIs in 2050 will increase almost five folds the 2018's. However, since the industry still depends on fossil fuels as primary energy sources, the industrial sector might become the largest GHG emitter without extensive energy efficiency measures.

In 2018, energy efficiencies in the businesses consuming more than 6,000 TOE/year reached 10,321 GWh, and GHG emissions reduced up to 1.03 million ton CO_2eq (DJEBTKE, 2018). This figure shows that energy efficiency in the industrial sector is crucial to achieving the carbon reduction goal. Most energy efficiency actions in the industrial sector are done by improving the efficiency of the boiler, pump, and compressor systems since they are the standard equipment used in EPIs (DJEBTKE, 2018).

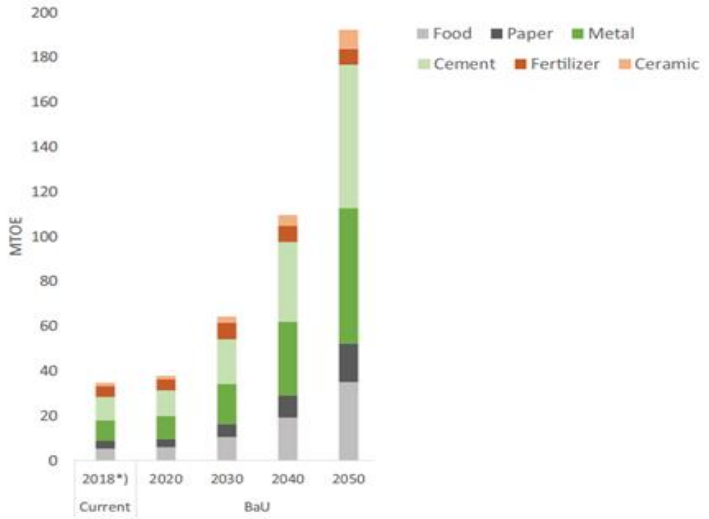


Figure 4.5. *Energy industrial demand from six energy-intensive industry groups (DEN, 2019)*

The large share of energy consumption from the industrial sector also means that transformation or changing fuel to low carbon resources will significantly reduce GHG emissions. The adjustment will need clear goals and a roadmap for industries because it involves long-term investment for such changes. However, there is a lack of concrete measures in the existing policy. NRE for the industry targeted in RUEN mainly emphasises replacing oil with biofuel, and 2050's target is only 12.9% for the industrial sector (RUEN, 2017). In RUEN, coal gasification becomes the alternatives for industrial energy and feedstocks.

Moreover, the Industrial National Development Master Plan (RIPIN) for 2015 – 2035 gives little attention to preparing industries to change to NRE. The same as in RUEN, RIPIN mostly focus coal-based industry development that can be used as 'new' energy sources, but lack of technical preparation to mitigate the emissions such as carbon-capture. Biomass and biofuel become other renewable energy options. However, there is no specific target stated in RIPIN and for which sub-sector needs to be prioritised for swift to NRE. Ministry of Industry (MoI) has a major concern on industrial competitiveness; thus, binding commitment could be a constraining factor for the industries to develop. For instance, as one of my respondents from the Ministry of Industry suggested:

> *"We (MoI) did not put specific target that could bind industry because we understand that our industries still have limitations. We do not want to stimulate the energy transition by straining them, but more by encouragement such as the Green Industry Award to appreciate the industries that give the effort to perform actions." (GO1, 5 May 2021)*

Meanwhile, MoEMR encourages energy re-structurisation in the industrial sector to reduce fossil fuel dependency by changing technology in the industries. This method is also one of the potentials of energy efficiency mitigation since the latest technology often offers lower energy intensity. This is confirmed by one of my respondents from MoEMR when she says:

> *"[...] industrial re-structurisation will have a major impact on the energy supply. For example, changing direct process heating equipment from gas/oil combustion to electricity-based equipment will make it easier to supply with NRE-based electricity… Thus, NRE utilisation in the industries will increase." (GO4, 7 June 2021)*

But this condition, again, affects the industry's competitiveness. It will need new investment and cost. Moreover, some types of the system could not be changed due to the nature of the production process. For example, cement clinker still needs carbon contact for the direct heating process. On the other hand, some industries have already initiated to use of NRE in their plants, but it is limited to non-essential activities. Chemical industries, as one of the EPIs (see **Figure 4.4 (b)**), generate their power to run their production plant, but for utilities requiring low energy like office and street lighting, they get the supply from PLN (National Power Company). Now, they try to replace the supply from their own NRE. As an example, one of my respondents from the industry explained:

> *"Our company (petrochemical industry) use the solar panel to substitute 40% electricity for lighting the plant that is currently coming from PLN (National Power Company) as part of the mitigation to reduce GHG emissions". (IP1, 4 May 2021)*

The current condition shows potential roles from the industries to contribute to energy efficiency and NRE utilisation. Since the mitigation is still limited, the current policies still could not

accelerate industries' participation. The following section will explain the existing key policies that stimulate energy transition in the industrial sector to understand the affecting policies.

4.3 Key policies for the industry's energy transition

From the existing policies in Indonesia, the key policies influencing the energy transition in the industrial sector mainly related to energy efficiency and environmental compliance. The energy efficiency policy drives the industries to perform energy management, while environmental compliance stimulates them to use clean energy. The latter also motivates industries not only to fulfil the environmental requirements but also in order to gain the highest level of appreciation from their market.

Energy Efficiency

Several regulations relate to energy efficiency in Indonesia's industrial sector. Before the latest national energy policy (KEN) was enacted in 2014, the energy efficiency policy was implemented through Government Regulation (GR) No. 70/2009 on Energy Conservation. When KEN/2014 and RUEN/2017 were legislated, some ministry regulations were updated to align with the energy policy goal, but some others remain the same since they are still relevant. The essential point of these regulations is about energy management policy. The set of policies is taken to make sure that energy-intensive industries reduce their energy intensity as efficiently as possible.

This set of regulations drives the industry to perform energy management programs. But, GR No 70/2009 is still the main regulation that sets up the energy management vision. In this regulation, industries consuming more than 6,000 TOE/year are required to execute energy management by assigning an energy manager; creating, and implementing an energy conservation program, regular energy audits; and submitting an annual report of the energy management programs through the Energy Management Online System (POME). The implementing directive for that regulation is supported by MoEMR Ministerial Regulation No. 12/2012 regarding Energy Management.

One of the effects of these regulations is the increased number of certified energy managers. In 2019, the total of certified energy managers was 795 (see **Figure 4.6**), increasing nearly 15 folds from the initial number in 2012 (DJEBTKE, 2020). This figure illustrates that energy efficiency practices implemented in the industries are growing as more energy managers available to perform energy efficiency protocols in the industrial flows and processes. Moreover, the number of energy auditors also expanded significantly, which means that the demand for energy audits for energy-intensive industries increased in the last decade.

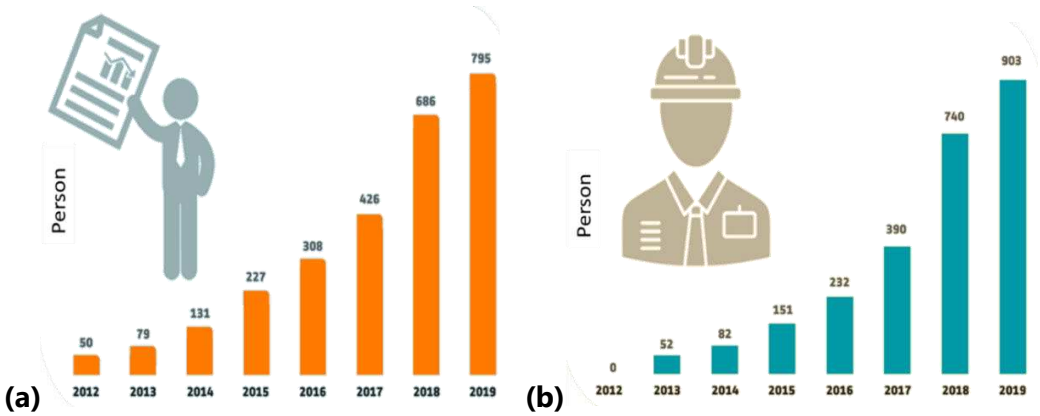


***Figure 4.6. (a)** Certified Energy Manager, **(b)** Certified Energy Auditor (Source: DJEBTKE, 2020)*

Even though GR No. 70/2009 stated that performing energy efficiency is mandatory for energy-intensive industries, in the implementation, the energy efficiency level that should be made is not set by the Government of Indonesia. The amount of energy efficiency that can be achieved comes from energy audit recommendations performed by an independent body. However, the action to perform all recommendations is voluntary basis, depending on the industry's capability.

This policy shows that on one side, the Indonesian government wants to push energy efficiency, but, in the implementation, the Indonesian government could not control how much energy can be saved. This condition comes back to the consideration of industry competitiveness and their limitation to perform the mitigation, as both respondents from government and industry confirmed this circumstance. The MoEMR representative said that:

> *"[…] energy efficiency for businesses that consume more than 6,000 BOE is mandatory… We understand not all industries have the same capability, but at least we want to see that they (industries) have made an effort to do so." (GO4, 7 June 2021)*

Moreover, one industrial practitioner mentioned that:

> *"Every company has different resources; maybe for multi-national companies, they have the network and the capital to change their equipment to the latest (clean) technology. But, it would be different for other smaller industries and would affect their competitiveness[…]" (IP1, 4 May 2021)*

Despite the energy efficiency policy that drives the industry to start energy efficiency, the implementation of this policy still does not show optimal results. Based on the energy conservation report from DJEBTKE (2020), there were 308 energy-intensive customers identified to be subject to perform energy management, but only 40% of energy-intensive industries reporting their energy management program to the government. The major hurdles to this issue are no significant benefits seen by the companies to report their programs and no real sanctions imposed for entities failing to submit their reports (IESR, 2019). One of my respondents from the industry also confirm this condition by stating:

> *"The regulation is clear, industries consuming energy more than 6,000 TOE are required to monitor and report their energy management to the authority. However, in reality, companies have not felt the impact in doing so or the consequences if it is not implemented" (IP2, 7 May 2021)*

Meanwhile, in order to attract industries applying energy management and report, the Indonesian government offers support by inviting free energy audits for industries. However, the support did not indicate a significant effect on the energy management implementation. Industries need more than just energy audit, but also the support to implement the improvement, as one of my respondents suggested:

> *"…reporting the energy is one thing. But the important is how to make sure industries are able to implement the recommendation to improve their energy efficiency despite all the challenges." (IP2, 7 May 2021)*

Therefore, in the implementation, the existing energy efficiency regulations alone are still not optimum to stimulate industries to conduct energy management.

Environmental compliance

As one of the goals in RUEN is to maximise the use of NRE, several action plans are made to achieve this goal. However, it is interesting to find that policy creating more influences to NRE utilisation in the industry come from the policy of environmental compliance. Two key compliance policies identified are PROPER and Green Industry Award.

Indonesia's government has environmental compliance called The Program for Pollution Control, Evaluation, and Rating (PROPER). It is regulated through Minister of Environment Regulation No. 3/2014 regarding Programme on Corporate Performance Rating in Environmental Management. PROPER is a performance rating policy in environmental management that is given to companies based on their performance in energy efficiency, waste management, reducing air pollution, and GHG emissions. At first, the main goal of PROPER is to tackle industrial emissions control, but then it expands to enhance continuous improvement in the form of resource efficiency, development of independent community empowerment, and encourage the internalisation of environmental and social cost factors into business (MoEF, 2019).

PROPER has five ranks of compliance marked in a colour-coded rating scheme – Black, Red, Blue, Green, and Gold, which correspond to the different performance levels in terms of pollution control. Black rank is given to businesses/activities that intentionally made no pollution control effort. Red is for facilities that made some efforts, but they failed to meet legal standards. Blue is awarded to facilities that meet national regulatory standards and had reasonably frequent reporting. Green rank implies that the companies manage environment management beyond the expected compliance level. This green rank is intended for the proactive companies and is granted if they can also perform good equipment maintenance, reporting, and environmental work (Lopez, Sterner, & Afsah, 2009). Meanwhile, the highest rank, Gold, is rewarded to firms that demonstrate environmental excellence, which in addition to the Green requirements, involved the use of clean production technology, pollution prevention actions, and waste minimisation (Lopez, Sterner, & Afsah, 2009).

The PROPER impact can be seen in the compliance rate from 2002 to 2019, which showed a significant improvement, and the companies achieving rank green and gold overall showed a positive trend (see **Figure 4.7**). This figure illustrates that PROPER has given contribution to voluntary involvement by industries in conducting environmental management beyond compliance. Specific for Gold rank, clean production technology is one of the criteria that need to be fulfilled, including the use of NRE.

One of the reasons PROPER can manage to encourage industry involvement is the position of PROPER as a public disclosure program. This public recognition has encouraged industries to bring outperformance beyond the regulatory standards and allowed them to assess the costs of abatement against the advantages gained through environmental compliance (Torres & Kanungo, 2003). The program is claimed to enable companies with a high rating to publicise their achievement and earn market benefits (Torres & Kanungo, 2003; MoEF, 2019). This strong role of PROPER to stimulate industries in NRE utilisation is backup with statements from an industrial practitioner, as they said:

> *"For us, the main driver (for renewable energy and energy efficiency) is fulfilling PROPER compliance to achieve the Gold rank…Our market appreciates this effort." (IP1, 4 May 2021); and*

"I think an existing policy like PROPER still has the major influence stimulating industries to innovate in renewable energy[…]" (IP2,7 May 2021)

Both of my respondents still considered PROPER as the main driver for NRE usage in the industrial sector.

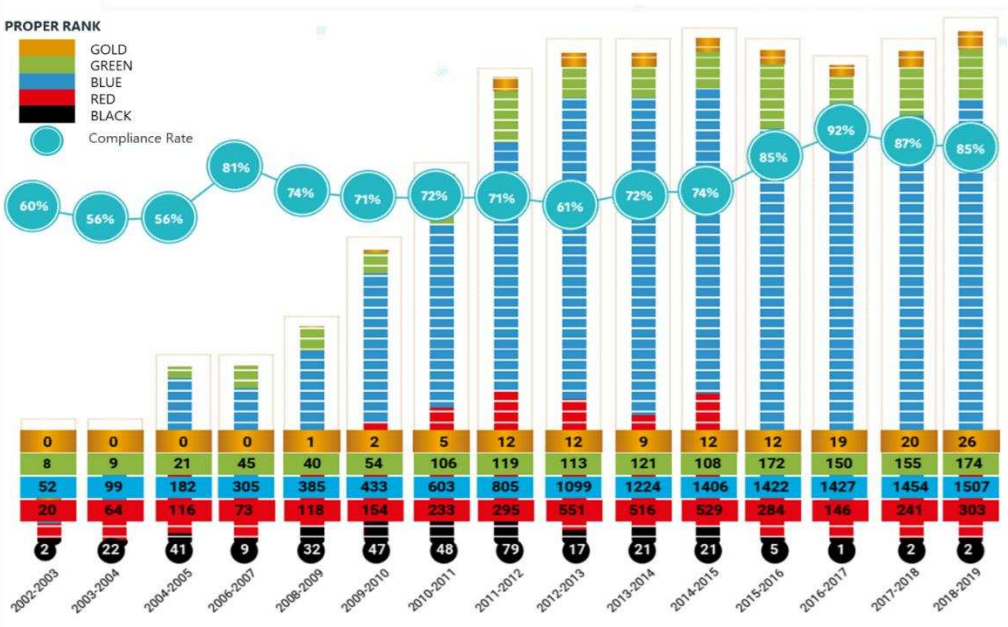


Figure 4.7. *PROPER Compliance Trend: 2002 – 2019 (Source: MoEF, 2019)*

Moreover, PROPER also affects financial credit. As a result, PROPER becomes one of the mandatory requirements for companies to apply for a loan in Indonesia. Firms that did not comply with the environmental management stated in PROPER (Black and Red rank) can apply for bank loans but will get higher interest than the higher PROPER's rank. This condition influences businesses to pay more attention to their environmental management.

Overall, PROPER has significant "consequences" that industries can take. Meanwhile, existing energy policies, such as energy management mandatory, still rely on the market to self-develop their effort, as previously explained in the energy efficiency section.

In addition to PROPER, the Indonesian government, through the Ministry of Industry (MoI), promotes industries to implement green industry standards and participate in green industry awards. This green industry policy is designed to improve the saving of industrial resources such as raw materials and energy.

Green Industry Standard (SIH) is an instrument to create a clean production model for industries. Until 2020, there are 28 SIHs that have been set to promote green industry implementation. Some of them are designed for energy-intensive industries such as cement, ceramic, glass, and fertilizer (urea). These standards have limit criteria on the maximum energy intensity that can be utilised in each industry set by consensus process of benchmarking the best available technology considered "green process".

In the early stages, green industry standards are enforced voluntarily. Incentives that can be given to industries that have implemented SIH are in the form of increasing the capacity of human resources, promotional support, as well as providing audit experts on energy, water, and raw

materials. However, in the future, SIH is planned to be mandatory for selected industries, as one of my respondents explained:

> *"[…] right now, SIH is still voluntary, but we want this standard to be a mandatory reference for new industry development… Later on, companies that cannot meet green industry standards will, of course, be subject to sanctions." (GO2, 25 May 2021)*

Meanwhile, Green Industry Award was introduced in 2010 as a form of non-fiscal incentive for manufacturing industries that have made significant efforts in the efficient use of raw material, energy, and water resources. The updated regulation for this policy is legalised in Minister of Industrial Regulation No. 18/2016 on Green Industry Award. One of the criteria in the award evaluation is the efforts to use renewable energy. The highest score will be given to facilities that utilise NRE more than 3% of total energy usage. From the government's perspective, this award can be used as an instrument to promote the use of renewable energy in the industrial sector, as my respondents stated:

> *"[…] one of the policies to encourage industries to use renewable energy is Green Industry Award… to appreciate the industries that give the effort to perform [mitigations] actions." (GO1, 5 May 2021); and*

> *"We (MoI) have Green Industry Award to stimulate the energy efficiency and encourage the use of renewable energy in the industrial sector." (GO2, 23 May 2021)*

Industries' interest in participating in the Green Industry Award increased since it was first launched. In 2019, the number of participants was 154, more than doubled compared to the number of applicants in 2010. This trend implies that industries' awareness of environmental compliance has improved. Industries use the award's recognition to gain market appreciation which could benefit their business. However, some industries see this award as a repetition to PROPER rating, and some of the evaluation criteria have already stated in the energy management report as one of the respondents from industries explained:

> *"Our company follows PROPER and Green Industry Award every year, but we find that the administrative (reporting) is overlapping. Some of the evaluation criteria are the same with other reports." (IP1, 4 May 2021)*

This condition indicates that the more compliance policies exist does not always mean the more positive impact will be generated.

4.4 Institutional and stakeholder mapping

Institutional and stakeholders mapping in this section is used to find out how the rules and regulations influence the relationship between stakeholders and the implication of this relation to energy transition in the industrial sector. Since the umbrella of energy transition policy is KEN and RUEN, I analysed the important stakeholders and their impact on the industrial sector based on those policies.

RUEN determines the priority of energy development, stakeholder relations, and the instrument needed to achieve the energy policy goal. Strategy-Program-Action matrix (see **Appendix 3**) relating to policies affecting the industrial sector in KEN and RUEN shows that MoEMR and MoI are stakeholders that have a great influence on energy transition in the industrial sector as they lead most of the program and action plan for achieving the RUEN target. Moreover, most of the

action plans that they run are directly dedicated to the industries. Thus, the level of stakeholders' influence on the industrial sector is assessed by the number of actions and the direct/indirect impact of those actions summarised in **Table 4.1**.

Table 4.1. *Stakeholders influence on industrial sector's energy transition*

Stakeholders	Actions	Influence on the industrial sector	Policy description
Ministry of Energy and Mineral Resources (MoEMR)	58	High	Energy efficiency, NRE utilisation, Incentives/ disincentives
Ministry of Industry (MoI)	30	High	Incentives/ disincentives, preparing industry ready for NRE
Ministry of Research and Technology (MoRT)	14	Moderate	Innovation for NRE and energy efficiency
Ministry of Finance (MoF)	8	Moderate	Incentives/ disincentives (coordination with MoEMR & MoI)
Ministry of National Development Planning / National Development Planning Agency (Bappenas)	3	Low	Government budget allocation for energy transition action plan
Ministry of Environment and Forestry (MoEF)	2	Low	GHG reduction

Source: Author, analysed from KEN and RUEN

However, MoEMR and MoI couldn't implement the action without support from other stakeholders. For example, the (fiscal) incentives/disincentives set out by MoEMR and MoI will not work without MoF approval. One of my respondents expressed the difficulties in getting approval from MoF by stating:

> *"[…] set up new (fiscal) incentives (for energy management) is not easy, let alone MoF approval is needed. The current budget priority is set more to (physical) infrastructure development (rather than stimulus)" (GO4, 7 June 2021)*

Moreover, the program and action plan will also need to be aligned with the National Development Plan coordinated by the Ministry of National Development Planning (Bappenas). Budget priority to run the programs and actions in the Ministries will be based on this development plan. This multi-stakeholder relationship adds the complexity of setting up new policies for the energy transition.

4.5 Enabling factors and barriers for the energy transition in Indonesia industrial sector

From the explanation of existing policies and institutional settings, it can be identified that there are several factors affecting the energy transition in Indonesia's industrial sector. Some of those factors contribute as enablers and others as barriers which will be further described and summarised as follows.

4.5.1 Enabling factors

Enabling factors in this study refer to the factors making industries willing to play a part in the energy transition. Based on the findings, market and industrial networks play an important role in stimulating industries to improve their energy management and change their long-term vision to clean energy.

Market

The EPIs market is mainly distinguished in two types: a market-sensitive price for basic material products and a small market size for specialised products (Wesseling et al., 2017). Both markets imply that energy-intensive industries are vulnerable to lose market to competitors if companies could not show good credibility in terms of quality and compliance. This condition drives EPIs to gain market/customer appreciation by maintaining their trustworthiness through the recognizable practice of compliances.

As previously explained in the key policies section, in Indonesia, the efforts that industries made are basically to show their market/customers that they have complied with government regulations. This is one of the efforts to securing existing markets and gaining trust from new customers. In addition, more and more buyers are aware of clean energy; thus, the demand for low-carbon products will increase. Several statements from my respondents strengthen this finding, as they mentioned:

> *"Our customer appreciates this (PROPER compliance) effort… of course we take this as a motivation, that's why our company vision now is more sustainable oriented." (IP1, 4 May 2021);*
>
> *"The request for facilitating renewable energy certification in Indonesia increase in last five years, especially for industries having an export market" (GO4, 7 June 2021); and*
>
> *"[…] many industries improve their energy system because their customers request specific requirement on maximum energy usage per unit product." (IP2; 7 May 2021)*

These statements point out the influence of the market to enable industries to transform their energy system, both on energy efficiency and NRE utilisation. Moreover, in Indonesia's case, the international market has more significant effects than the domestic market. It means that the awareness of low-carbon products from the domestic market is still low.

Networks

Energy-intensive industries are recognised as an industry with a close network with their technology providers and markets (Wesseling et al., 2017). In Indonesia, this network also includes the relationship with the same industry sub-sectors. For example, one of the chemical industry associations, INAPLAS, has an active role in sharing best practices to their members, including technology benchmarking from the latest technology worldwide (INAPLAS, 2019).

> *"I believe we (chemical industries) can easily get what the latest technology can be used for improving energy efficiency. Industry association like FIKI and INAPLAS also share their best practices between their members." (IP2; 7 May 2021)*

This factor is the potential that benefits the industrial sector in Indonesia since implementing commercial or "mainstream" technology could reduce research and development costs. However, the market network still plays a crucial role in how industries will implement the available

technology. The drive to use clean production strongly relates to product competitiveness, as one of my respondents stated:

> *"If we (industries) want to secure our market, eventually, we will have to use the most efficient technology because it will affect final cost and product competitiveness" (IP1, 4 May 2021)*

Thus, in Indonesia case, networks potentially become an enabling factor when combines with the industry-market relationship. If industries do not include technology change in their long-term vision, their business is potentially threatened by their competitors.

4.5.2 Barriers

In this study, barriers refer to factors haltering the transition process or holding up the transition to move to the next phase. Based on findings and analysis in the key policies and institutional setting which previously explained, the main barriers for the energy transition in Indonesia industrial sector are policy and administrative barrier, technology and innovation barrier, and financial barrier.

Policy and administrative barriers

The energy efficiency as key policy section explains that the current policy's implementation does not indicate optimum energy efficiency output. Two major reasons are (1) the industry does not see any real impact from current incentives and disincentives scheme and (2) there are too many reports required when industries perform energy management.

The lack of stimulus also seen in the encouragement of NRE utilisation in the industrial sector. The policy that is felt to provide the most benefits in the implementation of renewable energy is PROPER. In addition, the existing institutional setting on how the electricity system is managed also influences the NRE utilisation. The existing rules mandated the National Electricity Company (PLN) to solely sold electricity in Indonesia. This setting hinders industries from generating their own electricity from NRE, i.e., solar panels. The respondent from industrial practitioner explained this situation by stating:

> *"The obligation to utilise electricity from PLN limits us (industries) to generating our own electricity from renewable sources...Our company has utilised solar panels but could not generate full capacity because we still have contracts to buy electricity from PLN" (IP1, 4 May 2021)*

Thus, industries' willingness to use NRE is low. This circumstance also can be seen as the primary energy mix for the industry. In 2019, renewable energy used in industry was only 11% and mostly contributed from biomass (MoEMR, 2020).

Those reasons detaining the energy transition process are closely related to path dependency of the existing institutional setting. The current policies are seen as rules and regulations in the dominant-regime level, which obstruct the implementation of the energy transition.

Innovations/technology barriers

The industrial structure of energy-intensive industries or EPIs influences industries' innovation strategies (Wesseling et al., 2017). The process of innovation in EPIs leans to follow predefined technology since new investment requires high cost; thus, the innovation mostly focused on improving productivity and efficiency. This situation also happens in Indonesia, as most of the energy-intensive industries depend on existing technology. For example, Indonesia's

petrochemical products mainly produce from naphtha/oil-based processes. To shift that raw material to lower-carbon sources, such as methane (gas), it means they need to change the whole process because the technology used is totally different. Thus, higher capital investment is needed, and this condition leads to holding up the energy transition process in the industrial sector. Some of my respondents support this condition as they mentioned:

> *"We (MoI) keep promoting new petrochemical investment to the new process. We have gas (methane) reserves that can be used while naphtha is imported. The naphtha-based chemical needs to shift to methane or methanol-based if we want to have lower GHG emissions." (GO2, 23 May 2021);*

> *"[…] energy efficiency has "saturated value", which means when industries using specific technology are able to reduce their energy intensity, there will be a phase where they hit the maximum efficiency value of that technology. Thus, if they want to improve more, they must change to different technology […]" (GO4, 7 June 2021)*

This circumstance entails technical path-dependency, which adds innovation/technology to the lock-in situation in Indonesia. The main reason is that most of the industries in Indonesia need to restructure their process system to move to the NRE system, and it involves high capital.

Financial barriers

The last barrier identified in this study is the financial barrier. In this context, financial barriers are about potential problems facing in financing the policy and financing the technology. This barrier might not be explained specifically in the energy transition theory for EIPs. However, it is closely related to the two previous impediments. As mentioned in the policy barriers section, current policies for stimulating NRE usage and energy efficiency are lack stimulus, especially fiscal incentives. One of the reasons is the limitation of the state budget; hence, there is a struggle in financing the policy. Meanwhile, changing technology in energy-intensive industries is also difficult because high costs and investments are needed. Thus, financing the implementation of technology becomes a hurdle.

Path-dependency of the existing institutional setting is one of the causes of this financial barrier. Once a specific policy is implemented, there are financial implications involved; for instance, budget plans and expenses are set up. In the section on institutional and stakeholders mapping, it is explained that the relationship complexity between stakeholders in the development of fiscal incentives influences the policy-making process. There are dominant stakeholders that influence the specific type of policy. For example, MoI sets up policies that are more likely to protect industry competitiveness. Meanwhile, MoF is more concerned about policies to maximise national revenue and minimise expenditure. Thus, it is often difficult to create a balanced policy accommodating related stakeholder interests.

Based on the enabling factors and barriers, current policies still cause dissatisfaction, which means that there are policies that need to be improved. The summary of both enabling factors and barriers can be seen in **Table 4.2.** These enablers and barriers will be used to the identified potential for policy transfer in the following section.

Table 4.2. *Enabling factors and barriers to energy transition in Indonesia's industrial sector.*

	Enabling factors		**Barriers**
Markets	+ Markets drive the industry's competitiveness. + Energy efficiency demanded by customers + Markets influence company to change long-term vision	Policy and administrative	- Lack of stimulus - Overlapping report - Unfavourable policy for electricity from NRE generation
Networks	+ Best practices can be easily obtained from the similar industrial sector + Close networks with technology providers, customers, and industry association	Innovation/ technology	- Restructurisation of the process is needed. - High cost and investment for new technology.
		Financial	- Incentives need funding, while state revenue is limited. - Financing the implementation of innovation & technology.

5. Policy transfer for Indonesia's energy transition in the industrial sector

The aim of this section is to answer, *"How can policy transfer help Indonesia to improve the energy transition in the industrial sector?"* and *"What are the constraining factors and the potentials of transferring the energy transition policies in the industrial sectors?"*. In this section, UK's experience on energy transition in the industrial sector will be used as a case to find a potential policy that can be transferred.

5.1 What can be transferred?

To determine what policy can be transferred to Indonesia, first, I took barriers from the previous section as a form of dissatisfaction coming from Indonesia as a recipient country. One of the policy transfer processes is searching for a solution for dissatisfaction. The presence of dissatisfaction with the current conditions means that there are things that need to be improved. Dissatisfaction arises when the current conditions are unable to handle the barriers. Indonesia's existing policy stimulating energy transition in the industrial sector is perceived to be insufficient; hence, there are still barriers hindering the transition process.

In this study, the UK's energy transition policy in the industrial sector is used as a case to look at the potentials of policy learning as a solution to dissatisfaction from some of the industry's actors. By using the policy transfer approach, the UK's energy policy is taken as an example case to see what potential synergies can be sought for policy learning between the UK and Indonesia with respect to energy transition in the industrial sector. One of the reasons for choosing the UK as a case for comparison is due to the recently renewed bilateral cooperation between the UK and Indonesia, which includes the renewable energy sector (MoFA, 2020; FCDO, 2021). This collaboration can be used as an opportunity for Indonesia to learn about the UK's energy transition policy. Moreover, as the host of the COP26 Climate Summit, the UK claims to have a strong commitment to reducing GHG emissions, including in the industrial sector, which can be seen in the latest strategic document for the industry's deep decarbonisation plan (BEIS, 2021).

The search of potential policy is based on the summary of identified barriers in Table 4.2.

Overcoming the policy and administrative barriers

For this policy barrier, I have identified that there is a lack of stimulus, making industries reluctant to play a part in the energy transition process. The potential measure to overcome this issue is by choosing a policy that offers reciprocal benefits. Since energy efficiency is one of the key policies in Indonesia, the policy searching process started from this policy.

Just like in Indonesia, energy efficiency policy is important to play a part in the energy transition process in the UK. Several policies & strategic documents, such as Energy White Paper 2003 and 2007, mentioning one of the UK's national energy goals is to reduce energy consumption by energy efficiency, especially in the energy-intensive industries. One of the success factors of GHG reduction in the UK is the success of energy saving in energy-intensive industries stimulated by energy efficiency policy. This finding is supported by a statement of one of my interviewees from the UK government when he mentioned:

> *"[…] energy efficiency is an important strategy to complement the deep decarbonisation plan in the industries. We still have to keep this 'easy wins' to maximise GHG emissions reduction." (GO5, 21 June 2021)*

Energy efficiency is considered easier to be implemented than decarbonisation technology strategies such as carbon capture storage mainly because the cost is much cheaper in the former option. The UK considers its Climate Change Agreement (CCA) and Climate Change Levy (CCL) programs as the key policies towards energy efficiency. On the one hand, CCL promotes voluntary contracts between the UK industry and the Environment Agency to reduce the industry's energy consumption and GHG emissions. In return, industries will receive a discount on the CCL, which is similar to a carbon tax, a tax added to electricity and fuel bills (Environment Agency, 2020).

CCA scheme, on the other hand, has a timeline, which industry that has a CCS must conduct measurement of its energy use and carbon emissions and report them against the agreed target to the UK's Environment Agency. The facility or group facilities included in a CCA are referred to as a target unit. These facilities continue to be eligible for the CCL discount if the industry's target unit meets the agreed commitment at the end of each reporting period.

Based on the CCA evaluation report from Department for Business, Energy and Industrial Strategy/BEIS (2020), the CCA program has succeeded in stimulating energy saving and reducing GHG emissions. It can be seen by the number of CCA participants, which is joined by around 2,600 firms covering an estimated 114 TWh of energy use in 2018 (BEIS, 2020). The participation rate is reported to be 80-100% for most sectors (BEIS, 2020).

As a voluntary scheme, CCA is considered very popular in UK's industrial sector. One of the main drives is the tax reduction incentives. This condition is supported by one of my respondents from the UK industrial sector, as he stated:

> *"One of the policies stimulating energy transition in the industries is Climate Change Agreement (CCA)… we get the benefit of tax (CCL) discount if we meet the targeted energy efficiency […]" (IP3, 10 May 2021)*

The positive feedback for CCL and CCA show that this type of stimulus plan is working in the UK, enabling industries to take part in the energy transition. Learning from this set of policies, Indonesia is able to choose these program schemes to be policy objects that can be transferred.

However, the degree of policy transfer also needs to be determined. The selection influences how much Indonesia can implement the policy program. Direct copying the whole program will be difficult to be applied since there are context differences between the UK and Indonesia, for instance, the emission reduction goal and financial factor. Thus, in this case, CCL and CCA are preferable to be used as an inspiration or hybridisation with existing policy.

As an illustration, choosing CCL and CCA, a hybridisation means the Government of Indonesia combines these programs with existing policy in Indonesia. Since Indonesia already has an energy management policy, a policy program like CCA can be used as additional leverage to stimulate industries to give a commitment on how much energy efficiency is targeted to be achieved. Meanwhile, since currently, Indonesia does not have a fuel/carbon tax like CCL, this program can be used as an inspiration. Indonesia can use other tax schemes as a substitute, for example, company income tax discounts.

The goal of these programs is to push the transition stage by driving initiatives from the niches (private sectors). When these initiatives are accumulated into mainstream behaviour, new rules may be set in the dominant regime (Loorbach, 2010). For instance, a minimum level of specific energy efficiency could be set as a mandatory requirement for new facility investments.

Lessening the innovation and financial barriers

The main reason for innovation and financial barriers is that there is a limited budget to cover the incentives and the implementation of innovation. The potential actions that can ease this issue are by providing a new financial scheme that could gain revenue and at the same time allocate that national income for industries' incentive programs, including stimulus for innovation.

Since the UK have a different issue with Indonesia regarding the financial context, gaining new revenue is not really the focus for the UK government. The UK has CCL that was introduced in 2001 as an environmental tax on commercial energy use. The aim is to promote energy efficiency across the industry. However, from Indonesia's learning perspective, other than being used as a disincentive for fuel usage, the CCL program can be seen as an inspiration to set policy of a new source of revenue. To balance the cost of business caused by this tax, the revenue coming from this scheme needs to be allocated for stimulating energy transition initiatives in the industries.

The UK's Industrial Energy Transformation Fund (IETF) is one of the programs designed to help energy-intensive businesses to reduce their energy costs and carbon emissions through energy efficiency and low-carbon technologies investments supported by the UK's government (BEIS, 2021b). IETF is intended to support technologies improving energy efficiency and those reducing energy demand across a system of industrial processes. This scheme provides funding that will be awarded as grants through a competitive process. The aid intensity will differ on each depending on the activity and technology support.

Since IETF is a new program that is officially set out in 2021, the impact of this scheme is not yet available. However, the promising is there since the feedback from the consultation report elaborated the industries' interests in this program (BEIS, 2021b). Indonesia can use this policy program as an inspiration to set up innovation stimulus. Since Indonesia's financial fund is limited, the environmental tax initiative could be set up as one of the fund's income resources.

Another perspective from the UK's experience that can serve as a policy learning opportunity for Indonesia is to overcome financial barriers via the principle of sharing risk and cost of the energy transition process between taxpayers, industries, and consumers (BEIS, 2021). The taxpayer contributes through the share of the national budget on energy transition programs and industries by investing in high energy-efficient and low-carbon technology. Meanwhile, consumers play a part in pay the cost of products caused by carbon emissions. In the latest UK's industrial strategic document (2021), consumers become important actors in the decarbonisation process; thus, demand-side measures are designed to support consumers to make low carbon choices. This vision is confirmed by my respondent from the UK government as he stated:

> *"Yes, there are financial differences (between developing and developed countries), but in the future, government intervention (for funding) will not be dominant. The costs and risks of the energy transition will be shared between taxpayers, industries, and consumers… developing low-carbon product standards will involve customers contributing in the low-carbon market […]" (GO5, 21 June 2021)*

The search for potential policy is considered to be the easiest step. The main concern of the successful policy transfer is the implementation. After selecting some of the potential objects to be transferred, an assessment of the barriers and potential factors to the implementation process is required. The following section will elaborate more about the barriers and the opportunities for implementing the policy learned.

5.2 Constraining factors and opportunities to implement policy transfer

Assessing the constraining factors and opportunities to implement the potential policy found in the previous section was done by analysing the statement from respondents which support the findings. Constraining factors in this study are identified as factors restricting the transferability process or the barriers that could hinder the selected transferred object policy from being implemented. Meanwhile, opportunities imply factors that have the potential to ease the transferability process or making the policy transfer easy to be implemented.

To overcome the policy and administrative barriers, a hybridisation of CCA and CCL is chosen as the object to be transferred. CCA has the potentials to be transferred as it is considered a simple program that has attractive stimulus. This policy program allows industries to set their own commitment, which means it can be adjusted to the industry's capability. CCA also offers a more clear target on energy saving since committed energy reduction from the industries will help to determine the industries' capability to perform energy efficiency.

However, in the implementation, transferring this policy program will need a new regulatory framework. Changing an established institutional setting is not easy and often complex (Alexander, 2005), which also happens in Indonesia. The following statements from my respondents support the fact that designing new regulations, especially for energy policy, is a challenging process.

> *"[…] changing existing regulation is difficult […]" (GO3, 4 June 2021);*
>
> *"[…] Multi interest on carbon tax makes it (policy design) a complex process." (GO1, 5 May 2021);*
>
> *"[…] The draft of carbon market policy changing very fast especially at Ministerial level.. external factor (like politics) is often involved […]" (GO4, 7 June 2021)*

These findings indicate the barriers that could happen in implementing CCA and CCL programs are institutional change and high politicisation for the new energy regulation. The latter means that the multi-political interests might halter the transferability of the policy program because the more differences in political interest involved, the more difficult new policy to be approved.

Meanwhile, to minimise the innovation and financial barriers, I identified that there is no specific policy in the UK that closely relevant to solve the root cause of these barriers. The reason is because of the difference in financial resources. Thus, the lowest degree of policy transfer, which is inspiration, is chosen. The policy program that can be used as inspiration is the combination of CCL and IETF. The opportunities for implementing this new policy can be driven based on the demand side, which means the demand for such policies will make the transfer process easier (Benson, 2009). In the case of lack of funding as innovation and financial barriers, the need for a solution/policy to lessening this issue is high. Some statements from my respondents are backing this condition by saying:

"[…] We (Government of Indonesia) need financial support for providing innovation incentives […]" (GO4, 7 June 2021)

"Industrial restructurisation couldn't be done alone by the industry… government support is needed" (GO2, 23 May 2021)

However, similar constraining factors as CCL's case could also be found in this setup since new rules and regulations are needed. The summary of this whole process is illustrated in **Figure 5.1.**

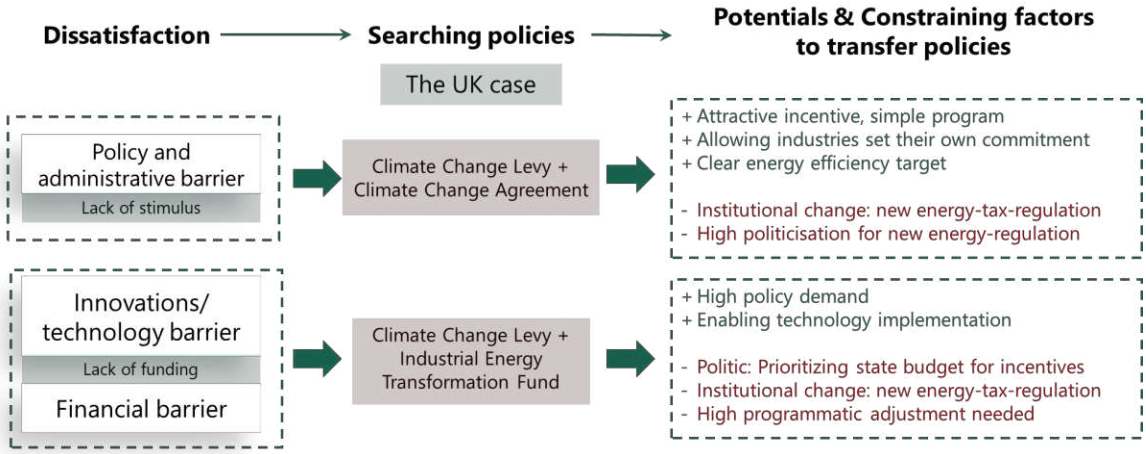


Figure 5.1. *The summary of the policy transfer process in this study using the UK case as an example (Source: Author)*

Furthermore, there is a considerable need to be made before deciding to implement policy transfer. Since policy transfer is influenced by similarities and differences between donor and recipient country, the failure of policy to be transferred can be caused by different contexts (Rose, 1991; Dolowitz & Marsh, 2000). In this case, policies from developed countries may not necessarily be implemented in developing countries, especially considering the difference in economic structure. One of my respondents from the Indonesian government suggested:

"For us (Indonesia), the small changes of GDP have a great impact on the economy. It would be different for developed countries. That's why, we (Government of Indonesia) really concern about putting policies that could possibly disrupt business competitiveness […]" (GO2, 23 May 2021)

Moreover, different contexts in this study were also found in the long vision target. For example, the UK's emission target is far more ambitious than Indonesia's. Thus, a policy designed for achieving the target is considered to have different motivations. This situation is described by one of my respondents from the UK when he stated:

"[…] the UK's commitment on the climate change affecting the policy… considering the industrial sector is no longer dominate the UK's GDP, the UK government might have less attention for industrial sector […]" (IP3, 10 May 2021)

These last two statements indicate that the concerns when designing policy in a developed country will be different from the developing country. Thus, the adjustment to the local context needs to be considered (Rose, 1991).

6. Discussion

In the discussion section, the result obtained in sections 4 and 5 will be reviewed in relation to the theory. The aim of this section is to reflect transition theory on energy transition in the industrial sector and the extent to which the concept of policy transfer is suitable for improving the energy transition process.

6.1 Energy transition in the industrial sector

The concept of multi-phase in transition theory helps to identify the current stage of energy transition in Indonesia's industrial sector, which is indicated by the change speed and the size of system change over time (Rotman et al., 2001). The system change scrutinised in this study is the shift of renewable energy share in the primary energy mix and the change of GHG emissions in the industrial sector. The findings in this study indicate that in the last decade, only slow changes of energy shifting and minor changes of NRE share and GHG emissions reduction happened in the industrial sector. Thus, Indonesia's energy transition in the industrial sector is considered at the predevelopment phase.

However, concerning the existing policies and institutional setting in the policymaking process in Indonesia, the energy transition process in the industrial sector is hard to be pushed to the take-off phase. The findings show that policies for energy efficiency and NRE utilisation as the key policies for the energy transition in the industrial sector insufficient to stimulate the transition process. This condition explains the perspective from transition theory that dominant regimes often act as a constraining factor because existing regulations and rules are maintained to support the current development path (de Boer & Zuidema, 2016; Rotmans et al., 2001; van der Brugge et al., 2005).

Linking this study's results with a multi-level perspective helps to understand strategies needed towards the transition goal (van der Brugge et al., 2005). The multi-level perspective on transition theory highlights that interaction within and between different socio-technical levels: the landscape, regime, and niches, influence the transition process, including for energy transition in the industrial sector (Geels, 2002; Wesseling et al., 2017). The bottom-up innovations from the industries (niches) are shown in the findings as Indonesia's industrial sectors have been voluntarily contributed to the energy transition goal in the form of changing technology for energy efficiency and utilizing renewable energy. However, the size of these initiatives is still limited because the existing policies do not give sufficient stimulation to promotes those initiatives to grow. This circumstance strengthens the claim from transitions scholars that innovation from the niches has to be supported by a broader socio-technical transition that involves mindset and behaviour changes (landscape level), as well as policies and infrastructure (regime) (Geels, 2002; Wesseling et al., 2017).

Moreover, in this study, several factors are identified as barriers and enabling factors for Indonesia's industrial sector to play a part in the energy transition. In this research, the energy-intensive processing industries (EIPs) characteristics of socio-technical and innovation (ST&I) system by Wesseling et al. (2017) and the Triple Embeddedness Framework (TEF) in industry regimes by Geels (2014) are used to give the understanding identifying those drivers and barriers to innovation, development, and diffusion in practice.

In this study's results, markets and networks are identified as the enablers because both have a positive influence on energy-intensive industries in Indonesia to participate in the energy

transition path. Geels (2014) takes this phenomenon in a more general sense of industry responses to external factors. Markets and networks act as external aspects of the economic environment. Both factors have impacts on the changes of industrial regime, which might contribute to path-dependency and lock-in situation (Geels, 2014; Kungl & Geels, 2018). Nevertheless, this study shows that markets and networks have the potential to push the industrial sector using low-carbon resources.

Meanwhile, Wesseling et al. (2017) mention more specifics about the nature of EPIs' market claimed that EPIs' customers would not significantly give pressure on the industries to become more sustainable sector. One of the main reasons is that their customers are intermediate industries that typically not willing to pay for a price for "cleaner" material (Wesseling & van der Vooren, 2016; Wesseling et al., 2017). However, in Indonesia's case, the appreciation from EPIs' buyers for industries with clean production gives the industries advantages to maintain their customers. The effort of doing low-carbon production add to the value of their product. Thus, Indonesia's EPIs indirectly have been pushed by the market to perform beyond compliance.

Furthermore, government policy is identified as one of the barriers to energy transition in Indonesia's industrial sector due to the lack of stimulus for the industries to encourage them to perform energy efficiency and to utilise NRE. Overlapping policies and reports in Indonesia are considered to threaten EPIs competitiveness. This policy barrier is aligned with what has been described in EPIs characteristic as a factor affecting EPIs competitiveness (Wesseling et al., 2017). The policy for the energy transition in EPIs contributes to enabling energy transition if it is creating stimulus and protecting economic competitiveness, but the policy could also become a barrier when regulations are constraining EPIs competitiveness (Wesseling et al., 2017).

In the meantime, a financial factor is found as the critical barrier for Indonesia's energy transition in the industrial sector since this issue influence both policy and innovation barriers. In the EPIs characteristic (Wesseling et al., 2017) and TEF for industry regime (Geels, 2014), this financial factor is not explicitly mentioned as an affecting factor to the energy transition. However, to some extent, this financial issue relates to the technology barriers, which obstruct the technology implementation when the innovation and technology need to be upscaled or commercialised, also, for the policy barriers where state budget limits the incentives scheme for stimulating industries participation.

The transition concept has been criticised for being centred in developed countries and less considered to the different contexts of social, behavioural, environmental, and political in developing countries (Chang et al., 2017). Moreover, most transition research fails to explicitly explain the context of the studied transition and the effect of the generalisation of the result (Markard et al., 2012). These critics are indicated in this study as not all transition concepts reflect in practice, even in a similar context of the industrial sector. For example, the financial barriers, especially in supporting incentives for industries, is considered not essential in developed countries. Meanwhile, this study shows that this barrier becomes an important factor in developing countries since they have limited financial support.

6.2 Policy transfer in the energy transition context

Policy transfer in the sense of searching for policy improvement helps to find the potential policy from other places. In this study, an example of how Indonesian policymakers might conduct a policy transfer process is shown to learn potential policies that could be transferred to improve energy transition in the industrial sector. However, as globalisation spreads widely, the line

between policy transfer and other types of policy learning becomes blurred. Policymakers often seek policy inspiration without explicitly referring to a specific place. Nevertheless, even this inspiration is considered as a form of policy transfer (Rose, 1991). Thus, it is difficult to determine whether the inspiration for a policy is taken based on policy transfer or the emerge of ideas during the policymaking process. This circumstance explains that in practice, the process of policy transfer is often messy (Dolowitz & Marsh, 1996).

Furthermore, policy transfer for energy transition is often used to pass on successful policy from developed countries to developing countries. The aim of policy transfer in the energy transition is mainly for stimulating renewable energy technology demand (Bößner et al., 2020), which can be seen in innovation policies, incentive frameworks, and market creation (Bhamidipati et al., 2019). In the case of policy transfer in Indonesia's energy transition for the industrial sector, the potential policy to be transferred is the type that has stimulus for the industries to innovate and implement energy efficiency and renewable energy technology. However, this incentive scheme is often in the form of fiscal support. Most policy transfer from developed countries lacks consideration on the countries' capability to fund this type of policy over a long period. Thus, in Indonesia's case, the policy implementation is hampered by financial issues.

Many developing countries face similar issues as Indonesia; the goal is to achieving the energy transition target and maintaining economic growth without sacrificing industrial competitiveness. This similarity of goal makes it relevant for government to look at policies and strategies of other countries to accomplish those goals. Despite the limitations, policy transfer still offers a way to learn potential measures for policymakers in the industries' energy transition context.

7. Conclusion and reflection

The conclusion section of this study revisits the results and discussion by answering the primary research question: "*What are the possible and adaptable policies to transfer for improving energy transition in the industrial sector in Indonesia*?" Following the conclusions, the reflections of challenges and opportunities are explained, including my learning process during this research. To wrap up, I will end my thesis with suggestions for further study.

7.1 Conclusions

Key policies stimulating energy transition in the industrial sector in Indonesia are energy efficiency and environmental compliance policy. Both policies have their own role; the former relates to energy use reduction while the latter refers to maximizing NRE utilisation. However, the existing policies did not significantly improve energy efficiency (through the number of energy management reports) and NRE usage. Thus, the energy transition stage in Indonesia is still considered at the pre-development phase.

The involvement of the industrial sector is important as their actions are considered initiatives from the niches. These initiatives could alter the dominant level to create new rules or settings that could accelerate the transition process (Loorbach, 2010).

Furthermore, the existing institutional setting for the energy transition in Indonesia's industrial sector influences the relationship between stakeholders. Based on KEN and RUEN, stakeholders at the National level have dominated the power to set up energy transition policy. MoEMR and MoI are the leading actors in driving programs and actions that are closely related to the industrial sector. Programs mandated to MoEMR and MoI are dominated by tactical and operational activities from the transition management perspective, which is represented by energy conservation programs. Since MoEMR and MoI have different roles, the long strategic vision for the energy transition in the industrial sector is mainly centred on KEN. This condition influences the exclusiveness of programs in each ministry, creating less synchronised actions. In the transition management perspective, the key principle is for all relevant stakeholders to simultaneously carry out their capacity. Thus, the existing institutional setting in Indonesia for the energy transition in the industrial sector is indicated contributing to the lock-in situation.

There are three barriers and two enabling factors identified in this study, which are analysed based on findings in key policies and institutional settings. *The barriers consist of policy and administrative barriers, innovation barriers, and financial barriers, while the enabling factor consists of market and industry networks.*

In the multi-level perspective theory of industrial regime, the push factors for the industry to accelerate the transition process can come from the support of government policy and the market (Geels, 2014). In Indonesia's case, government policy as the force in the socio-political environment (Geels, 2014) has a negative impact because it hinders the energy transition process in the industrial sector. The main findings are existing policies did not provide sufficient stimulus for the industry to perform energy efficiency and/or NRE utilisation.

Moreover, the innovation barriers indicate the condition of industry-specific institutions. Innovation strategy is influenced by the industrial structure of high cost and investment. Thus, there is a tendency of technical path dependency affecting the transition process. Meanwhile,

financial barrier refers to path dependency of existing institutional setting as the current relationship between stakeholder add to the complexity of policy-making.

On the other hand, markets and networks include the economic environment force (Geels, 2014). In Indonesia's case, these factors positively impact the transition process in the industrial sectors as they contribute to the industry's willingness to perform energy efficiency and NRE utilisation. The need to uphold market demand drives energy-intensive industries to gain market/customer appreciation by maintaining their trustworthiness through recognizable compliances. Meanwhile, since energy-intensive industries are recognised as an industry with a close network with their technology providers and markets (Wesseling et al., 2017), these networks have the potential to become an enabling factor when it combines with the industry-market relationship. If industries do not include technology change in their long-term vision, their business is potentially threatened by their competitors.

Based on findings and analysis in section five, I argue that *policy transfer has the potential to help to improve energy transition in the industrial sector by overcoming the barriers*. Looking at how the policy searching process can overcome the barriers, there are two different outputs followed. First, the potential of transferring policy programs from the UK is found to improving stimulus through hybridisation of Climate Change Levy (CCL) and Climate Change Agreement (CCA) program with the existing policy. Second, creating policy from the inspiration of the UK's case on environmental tax and industrial innovation funding scheme is considered can be used as inspiration. However, for the second output, the UK's case seems could not provide a potential policy that could be implemented. The reason is that there are different contexts found between the UK's Indonesia.

The constraining factors for both outputs are quite similar, namely the difficulty of new regulation approval and high politicisation for approving new energy policies. Meanwhile, the *potential for alleviating policy transfer* is the high demand of providing improvement in the policy.

In sum, my primary research question, "*What are the possible and adaptable policies to transfer for improving energy transition in the industrial sector in Indonesia*?" can be answered as follows:

The most possible and adaptable policy to transfer based on the UK example is taking the energy efficiency policy program, CCA, and CCL to stimulate industry to actively involved in the energy transition. There are nonetheless some constraining factors to transfer policy, mainly relating to the difficulty of new regulation approval. However, beyond that, the policy context must also put into consideration. In this study, the highlighted concern is that designing policy in developed countries differs from developing countries, for instance, different goal priorities and commitments. This difference could potentially lead to unsuccessful policy transfer. Thus, the adjustment to the local context needs to be carefully considered (Rose, 1991).

7.2 Lessons

This study contributes to understanding aspects that influence the energy transition in the industrial sector, especially in developing countries. The additional knowledge offered from this study is valuable for enhancing transition research in various contexts since most of the transition studies are home-grown in developed countries. Barriers and enabling factors captured in this study to some extent aligned with the analysis from transition theory, particularly in the condition where regime level adds to the lock-in situation. However, this study's result shows that the inclusion of local context contributes to a different response in the transition process. For example, markets of Indonesia's energy-intensive industries positively influence the energy transition, while

in another context, most markets in this segment did not stimulate industries for low-carbon shifting (Wesseling et al., 2017).

Another lesson that can be obtained from this study is for the Indonesian planners and policymakers to evaluate energy transition visions and strategies in the industrial sector. The barriers and enablers identified from the transition perspective show that policy improvement is needed. Policy transfer can be used as one of the means to find the potential measures to improve energy policy. Taking lessons from the UK's energy policy experience is an example of how policy transfer could be advantaged to find a potential strategic policy that may help to solve the transition issues. However, both planners and policymakers need to understand that barriers and limitations require to be anticipated.

7.3 Reflections

Starting with a reflection on the theoretical background of this research, I found that transition theory helps to identify the barriers and enabling factors for the energy transition in the industrial sector. The concept of multi-layer perspective contributes to most of the analysis since this study focus on the industrial regime. However, the transition management theory on how the actor's style manages energy transition does not contribute significantly to evaluating findings. Meanwhile, the policy transfer theory is helpful to conceptualise the process, although it is rather complex in practice this process of searching and implementing policy. Thus, simplifying the process might neglect the complexities that play a role in policy transfer.

In the beginning, this study was planned to have a balanced explanation between Indonesia and the UK context on energy transition in the industrial sector. However, due to limited interviewees who responded to interview requests from the UK, the comparison would be an imbalance. Therefore, in this research, the Indonesian industrial sector is used as the main focus to study the energy transition process. It allows for a deeper understanding of the situation in Indonesia. Then, the UK case has played a role as an example of how the process of searching for satisfaction can be done. However, the result of policy selection does not mean that the UK's policy is the best policy to be transferred. The policy learning example from the UK shows that such approaches have the potential to overcome barriers and strengthen enablers factor in Indonesian energy transition for the industrial sector. In order to strengthen the policy selection, comparisons with cases from other countries are strongly recommended for further study.

Regarding my empirical data collection, the interviews I conducted were very useful to the enriched explanation of the existing policy and future plans in Indonesia and the UK. One of the hurdles in the process was that the interviews did not proceed according to the scheduled plan. Since most of the respondents have an active occupation, it was not easy to set up the interviews fitting their schedule. Nevertheless, despite conducting all the interviews through video-calling, I believe it still gives valuable information and ideas to this study, especially to the context that I was not familiar with.

Furthermore, the analysis of the findings from the interview proved to be time-consuming. The recording for each interview was approximately one hour or more. Thus, processing the interview results took quite some time.

7.4 Recommendations

There are several recommendations that can be made for further research based on this study result. First, further research is needed to explore more about the market role, especially from developing countries, to drive energy transition in the industrial sector. As an enabler in this study, the market has a great potential to stimulate the industry to play an active role in the energy transition. However, I identified that this conscious consumer behaviour mostly comes from the export market (to developed countries). This kind of study will enrich the understanding of consumers' role as external pressure to the industrial regime.

Second, the role of policy transfer to energy transition needs to be explored further in the context of financial support. The leading countries in energy transition are mostly dominated by industrialised countries) and less-industrial countries need to follow them (Bhamidipati et al., 2019; Bößner et al., 2020). However, the basic difference between these global North and global South countries is that the former have much more financial resources to support the technology implementation to make the policy work. It will be interesting to explore how policy transfer in the industrial energy transition will work with or without financial support from the donor countries.

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Appendices

Appendix 1 – Code Book

No.	Research questions
Q1	How do existing policies stimulate the energy transition process in the industrial sector?
Q2	How does institutional setting influence energy transition policies in the industrial sector?
Q3	What are the enabling factors and barriers for the energy transition in the industrial sector?
Q4	How can policy transfer help Indonesia to improve the energy transition in the industrial sector?
Q5	What are the constraining factors and the potentials of transferring the energy transition policies in the industrial sector?

Link to	Category	Code	Definition
Q1	Influencing policies	Energy efficiency	Statement about policy to promote energy efficiency in the industrial sector
		Decarbonisation	Statement about policy to encourage zero carbon emission in the industrial sector
		Innovation and technology	Statement referring to policy supporting the innovation for energy transition in the industrial sector
		Environmental compliance	Statement about environmental protection policy
Q2	Institutional setting	Stakeholder involved	Statement about actors involved in the policymaking and its implementation
		Interaction	Rules affecting the interaction between stakeholders (government and business actors) to achieve energy transition
		Funding	Statements regarding the budget and funding for implementing rules, programs, or actions
Q3	Enabler or barriers for energy transition	Path dependency	Statement about the dependency of existing condition
		Innovation	Statement regarding the influence of innovation to energy transition in the industrial sector
		Incentives	Statement about the impact of incentives for energy transition in the industrial sector
		Markets	Statement regarding the influence of market to the industries
		Networks	Statement regarding the relationship between industries and their customers, suppliers, competitors
		Financial	Statement regarding financial support for energy transition in the industrial sector
Q4	Policy transfer	Best practices	Statement referring to successful policies
		Transferability	Statement about policy transfer adoption/implementation
		Object to transfer	Statement about potential policy object (policy content, policy program, etc)
Q5	Potentials or constraining factors for policy transfer	Local context	Statement regarding the influence of local context to policy transfer process
		Financial	Statement regarding the financial scheme for policy transfer

Link to	Category	Code	Definition
		Institutional arrangement	Statement about the influence of institutional arrangement on policymaking

Appendix 2 – Interview Guideline

No	Questions	Link to
Explorative questions (for policymakers)		
1	In your opinion, what policies have the most influence in the process of transition to renewable energy, in general and specifically for the industrial sector?	Q1, Q2
	a. How do they stimulate the energy transition process in industrial sector?	Q1
	b. Do the existing policies sufficient to drive energy transition in industrial sector?	Q1, Q2
	c. What kind of (new) rules, regulations that could push the energy transition process in the industrial sector?	Q1, Q2
2	Who are involved in the development and implementation of transition energy policies in industrial sector?	Q1, Q2
3	How do you think about the importance of technology innovations to accelerate energy transition in industrial sector?	Q1, Q2, Q3
	a. How the current policies help to stimulate the innovations?	Q1, Q2
4	What are the factors disabling the success of the energy transition process, in general and specifically for the industrial sector?	Q3
5	What are the most influential factors in determining the success of the energy transition process, in general and specifically for the industrial sector?	Q3
For recipient country (Indonesia)		
6	To what extent do you think Indonesia can learn transition energy in industrial sector from other countries?	Q4
	a. Do you know specific examples of (renewable) energy policies that are transferred to Indonesia? If so, could you elaborate one of the examples?	Q4
	b. How about from the UK's energy policy, especially in industrial sector?	Q4
7	In your opinion, will it be easy or difficult to transfer policy from other countries who have more experience in energy transition?	Q5
	a. If it is easy, what would be the enabling factors and the benefits for Indonesia?	Q5
	b. If it is difficult, what would be the barriers that inhibits the implementation?	Q5
For donor country (The UK)		
6	To what extent do you think the UK can transfer energy transition policies in industrial sector to other countries?	Q4
	a. Do you know specific examples of (renewable) energy policies that are transferred from the UK? If so, could you elaborate one of the examples?	Q4
	b. How do you think the UK's energy transition policies in the industrial sector can help the energy transition process in Indonesia?	Q4
7	In your opinion, will it be easy or difficult to transfer policy to other countries who have less experience in energy transition?	Q5
	a. If it is easy, what would be the enabling factors and the benefits?	Q5
	b. If it is difficult, what would be the barriers that inhibits the implementation?	Q5
Practical Questions (for industrial experts)		

No	Questions	Link to
1	To what extent does your organisation involved in the development or implementation of energy transition?	Q1, Q2
2	Does your organisation include energy transition in its long-term goals? What are they?	Q1, Q2
	a. What strategies do you use in order to achieve those goals?	Q1
3	In your opinion, how do existing policies (in your country) stimulate the energy transition in the industrial sector?	Q1
4	How do you think about the importance of technology innovations to accelerate energy transition in industrial sector?	Q1, Q2, Q3
	a. Does your organisation encourage the innovation for energy transition/renewable energy?	Q1,Q2
	b. How the current policies help to stimulate the innovations?	Q1, Q2
5	What are the factors disabling the success of the energy transition process, in the industrial sector?	Q3
6	What are the most influential factors in determining the success of the energy transition process in the industrial sector?	Q3
7	In your opinion, to what extent does your organisation search for best practices from other countries for energy transition context?	Q4
	a. Do industries share best practices and learn from each other? (especially from international experiences)	Q4
8	In your opinion, will it be easy or difficult to transfer policy from other countries who have more experience in energy transition?	Q5
	a. If it is easy, what would be the enabling factors and the benefits for the recipient country?	Q5
	b. If it is difficult, what would be the barriers that inhibits the implementation?	Q5

Appendix 3 –Stakeholder's Strategy-Program-Action Matrix based on KEN & RUEN

Stakeholders	Total Strategy	Total Programs	Total Action Plans	Direct/Indirect regulation to industrial sector	Influence on the industrial sector
MoEMR	31	31	58	Direct	High
MoI	17	20	30	Direct	High
MoF	6	6	8	Direct	Moderate
MoRT	5	6	14	Indirect	Moderate
MoEF	2	2	2	Direct	Low
Bappenas	2	2	3	Indirect	Low