Stakeholders’ Perspectives on Carbon Capture and Storage in Indonesia

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"We do not inherit the Earth from our parents; we borrow it from our children".
~ Antoine de Saint Exupéry
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Acknowledgements

Doing a field research is a challenging task, but doing it as part of a thesis project makes it much more challenging. Yet, writing a good thesis report is not an easy one. That’s why I would like to say my proper thanks to the people who contributed to this work. I will try to make it as simple as possible.

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Andri
Delft, August 2010
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Executive Summary

Speaking at G-20 Summit at Pittsburgh in the USA, September 2009, the Indonesian President Susilo Bambang Yudhoyono has committed to reduce carbon emissions up to 26% by 2020 from business as usual scenario through an energy mix policy including LULUCF (Land Use, Land Use Change, and Forestry). In addition, the President is also confident that through International support this target can be increased to as much as 41% (Reuters, 2009). The strategy to reduce the carbon emissions, in particular from the energy sector is basically following Presidential Regulation No. 5/2006 (PERPRES) about National Energy Mix Target 2025 which consists of energy diversification and conservation. In fact, this target plan depicts that fossil fuels remain dominant, with the composition of 83% fossil fuels (oil, natural gas, and coal) and 17% renewables. In particular, coal is selected to be employed up to 33% of total National Energy Mix Target 2025 as to deal with energy demand growth (ESDM, 2006; ICSWG, 2009).

With the fact that fossil fuels will still dominate the source of energy until the coming few decades, Indonesian Government considers to implement carbon capture and storage (CCS) as an alternative way to reduce CO₂ emissions mainly from the energy (power) sector. In 2009, a preliminary study on understanding CCS potential in Indonesia has been carried out by Indonesia CCS Study Working Group. This preliminary study indicated that the main challenge of CCS implementation still remains in the non-technical aspects. Yet, public acceptance is one of the non-technical aspects of CCS that was still less addressed in the preliminary study of CCS in Indonesia. Meanwhile public acceptance on CCS is a big problem as CCS itself is a controversial issue. In different countries there are different reactions of the public regarding CCS where some of its projects have met severe local resistances (e.g. Barendrecht in the Netherlands).

At the moment, there is no CCS policy in Indonesia and very little is known about stakeholders’ perspectives on CCS. Whilst a policy is needed in order to guide the implementation of CCS so that it can achieve its objective in the right manner. And with respect to social acceptability, stakeholders play important role in the policy formation and decision making process. Their involvement is important as it can increase the legitimacy and accountability of the process and the outcome (a legitimate CCS policy). Furthermore it is also important to investigate stakeholders’ perspectives on CCS, and take these perspectives into account in developing policy on CCS for Indonesia. Gaining stakeholders’ perspectives can improve the understanding on the issue surrounding CCS. These all imply to an on-going intriguing question manifested as the problem statement of this study: “What are the perspectives of stakeholders regarding CCS and how could these perspectives be considered in developing policy on CCS for Indonesia?”

Therefore this study was aimed to gain insights and understanding on how different stakeholders perceive and define the problem surrounding the issue of CCS in Indonesia. It was also aimed to
inspire the policy makers in developing policy on CCS for Indonesia through stakeholder involvement.

In order to achieve these aims, this study attempted to answers the following research questions:

1. Who are the stakeholders and what resources do they have?
2. What do the stakeholders think about CCS and which aspects do they think should be considered most in the issue of CCS?
3. What kind of stakeholder involvement strategy is required to develop CCS policy in Indonesia?

To answer above research questions, literature study and field/empirical research had been performed. Literature study covered the relevant topics on CCS, and theoretical backgrounds of actor analysis, Q methodology, and network. It also involved study on the report of ‘Understanding CCS Potential in Indonesia’ conducted by Indonesia CCS Study Working Group. Meanwhile field/empirical research was conducted to investigate the perspectives of stakeholders on CCS. In this regard Q methodology was applied as the core method of the research.

First of all, actor analysis was used to identify the stakeholders and examine the network structure and the characteristics of stakeholders. This resulted in the overview of stakeholders’ interests, objectives, perceptions on the problem and solutions, resources, and relations in the network. From this overview, answer for the first research question was derived. Identified stakeholders were from different background and affiliation, such as national government, state-owned energy/power companies, private energy companies, academia and research institutes, NGOs, media, and international counterparts. Also their resources were identified, such as formal authority in formulation policy and regulations, technology, infrastructure, money, human capital, and international network.

Next, Q methodology was applied to investigate the perspectives of stakeholders with regard to CCS. Interviews as part of Q methodology were performed as to gather data and information from the stakeholders, and it was continued with data analysis. This resulted in the four stakeholders’ perspectives on CCS as follows: Perspective 1 (CO₂ emissions reduction through clean energy sources rather than CCS), Perspective 2 (CCS as one of the options in CO₂ emissions reduction portfolio), Perspective 3 (CCS is the only optimal solution to reduce CO₂ emissions), and Perspective 4 (CCS is only a tactic to keep burning coal forever). Further investigation on these perspectives lead to another finding: the cost of CCS and environment as the two aspects that were considered most by the stakeholders.

Furthermore, above findings then were articulated and led to a conclusion that conducting ‘an inclusive and balance’ stakeholder dialogue as the plausible stakeholder involvement strategy in order to enhance the participation of stakeholders in the policy formation of CCS in Indonesia. This strategy was elaborated in three subjects: which stakeholders should be involved, what issues should be put into agenda, and how this strategy could be conducted. Finally, this study came up with implications of the study and recommendations for further research.
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1

Introduction

Outline
This chapter is the introduction part of the study, it mainly presents the point of departure and the line of reasoning of the study. Section 1.1 is the background of the study. It starts with the discussion about climate change issue and Indonesia’s commitment to reduce CO₂ emissions up to 26% until 2020. It also highlights some key findings in the preliminary study of CCS in Indonesia. Section 1.2 elaborates the importance of stakeholder involvement and the challenges of the study. Then section 1.3 presents the aims and research questions of the study. Section 1.4 describes the research approach of the study. Finally, section 1.5 provides the structure of the study.
1.1 Research Background

Climate change has attracted the attention of the world global community mostly in the last decade. Studies show that some of the most adverse effects of climate change will be in developing countries, where populations are most vulnerable and least likely to easily adapt to climate change (Beg, et al., 2002; IPCC, 2001a, 2001b). Indonesia stands to experience significant impacts with climate change. Being an archipelago, Indonesia is very vulnerable to the impacts of climate change (PEACE, 2007). The increase in sea level and temperature, changes in rainfall and precipitation, higher intensity and frequency of tropical storm, all give bad impact to Indonesia. In a broader sense climate change is not just an environmental problem for Indonesia, moreover it is a problem which hinders social and economic development.

CO₂ (carbon dioxide) is recognized as a potent of GHG (greenhouse gas) that contributes to the global climate change. For Indonesia, the key emitting sectors are agriculture, energy, forestry, and waste. The energy sector (in particular from power generation) shows a very rapid growth of CO₂ emissions. In 2005, CO₂ emissions from the energy sector were about 293 million tones, having experienced an average growth of 6.6% per year from 1990 to 2005 (ICSWG, 2009). In line with the population growth and economic development, energy consumption will increase and therefore CO₂ emissions from the energy sector will also rise. As indicated in the National long term energy simulations that energy sector emissions in a business as usual scenario (BAU) will reach 1,150 million tones CO₂ emissions (MtCO₂e) in 2025 (ICSWG, 2009).

Speaking at G-20 Summit at Pittsburgh in the USA, September 2009, the Indonesian President Susilo Bambang Yudhoyono has committed to reduce carbon emissions up to 26% by 2020 from BAU scenario through an energy mix policy including LULUCF (Land Use, Land Use Change, and Forestry). In addition, the President is also confident that through International support this target can be increased to as much as 41% (Reuters, 2009). This commitment demonstrates Indonesia’s willingness in combating climate change at the leading edge. This has also been stipulated previously in The National Action Plan Addressing Climate Change (RAN-PI, Rencana Aksi Nasional Menghadapi Perubahan Iklim, 2007), according to which the country’s national commitment is to reduce greenhouse gas emissions from the energy sector, through LULUCF, while also increasing carbon sequestration as the national response to the climate change issue (ICSWG, 2009).

With regard to this commitment, three options are considered that would not hamper economic growth (Haug, 2004; Othman, Martunus, Zakaria, & Fernando, 2009). One is to use energy more efficiently, thereby reducing the energy consumption. The second option is to change to the consumption of renewable energy sources and the third option is to capture and store the CO₂ from fossil fuels instead of releasing it unto the atmosphere (Othman, et al., 2009). The last one is referred as ‘carbon capture and storage’ (CCS) (Gibbins & Chalmers, 2008; IPCC, 2005, 2006; Othman, et al., 2009; UNFCCC, 2008).
The first and the second option seem already embodied in the National Energy plan, where the strategy to reduce the carbon emissions, in particular from the energy sector is basically following Presidential Regulation No. 5/2006 (PERPRES) about National Energy Mix Target 2025 which consists of energy diversification and conservation. The pillars of this target plan are reducing oil dependency and employing more renewables. With this target plan, it is expected that the energy sector emissions can be reduced from 1,150 MtCO₂e (in BAU) to 950 MtCO₂e in 2025 (ESDM, 2006; ICSWG, 2009). Figure 1.1 depicts this target plan.

![Figure 1.1: Improvement of Indonesia National Energy Mix Target 2025](image)

**Figure 1.1: Improvement of Indonesia National Energy Mix Target 2025**

*CTL: Coal to Liquid*

*Source: ESDM (2006), ICSWG (2009)*

Some other policies and regulations that are in line with this target plan have been released later on, or even earlier, where some of them are summarized in Table 1.1.

The National Energy Mix Target 2025 depicts that fossil fuels remain dominant, with the composition of 83% fossil fuels (oil, natural gas, and coal) and 17% renewables. In particular, coal is selected to be employed up to 33% of total National Energy Mix Target 2025 as to deal with energy demand growth (ESDM, 2006; ICSWG, 2009). Coal demand grew at the fastest rate of 4.75% per year, followed by oil and natural gas at 2.8%, hydro at 2.6%, and renewables at 1.3% per year. For coal, the demand is mainly driven by electricity generation sector with the annual growth of 4.6% over 2002 (ESDM, 2006; ICSWG, 2009; Othman, et al., 2009). With the continuation of this profile and the absence of low carbon technologies in the national energy path, CO₂ emissions trend still grows (ICSWG, 2009).
Stakeholders’ Perspectives on Carbon Capture and Storage in Indonesia

Table 1.1: Overview of Indonesian policies and regulations on energy

<table>
<thead>
<tr>
<th>NO.</th>
<th>POLICY/REGULATION</th>
<th>BRIEF DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Energy Law</td>
<td>Give more attention on new and renewable energy development.</td>
</tr>
<tr>
<td></td>
<td>Energy Law - Law No. 30/2007</td>
<td></td>
</tr>
</tbody>
</table>
| 2.  | Geothermal Law and Regulation                                                     | - To regulate the management and development of geothermal energy sources for direct and indirect utilization  
- The price of electricity from geothermal PP by Public Utility (PLN)                                                                                                                                 |
|     | Geothermal Law and Regulation - Law No. 27/2003                                  |                                                                                                                                                                                                                     |
|     | - Government Regulation No. 59/2007                                               |                                                                                                                                                                                                                     |
|     | - Ministerial Regulation No. 14/2008                                              |                                                                                                                                                                                                                     |
| 3.  | Green Energy Policy                                                              | Renewable energy and energy conservation development policy:  
- Implementing the maximum utilization of renewable energy  
- Efficient utilization of energy  
- Public awareness in energy efficiency                                                                                                               |
|     | Green Energy Policy - Ministerial Decree No. 02/2004                             |                                                                                                                                                                                                                     |
| 4.  | Supply and Utilization of Biofuel                                                | - Accelerating biofuel utilization for fossil substitution  
- Instructions to 13 Ministers, Governors, and Mayors to take necessary initiatives and actions for biofuel development from supply (feedstock) side until consumption/commercialization side |
|     | Supply and Utilization of Biofuel - Presidential Instruction No. 1/2006          |                                                                                                                                                                                                                     |
|     | - Ministerial Regulation No. 32/2008                                              |                                                                                                                                                                                                                     |
| 5.  | Renewable Energy Utilization for Electricity                                      | - Regulating the supply and utilization of electricity  
- Prioritizing utilizing renewable energy for power generation  
- Renewable energy for power generation without bidding process                                                                                       |
|     | - Ministerial Decree No. 1122K/30/MEM/2006                                       |                                                                                                                                                                                                                     |
|     | - Ministerial Regulation No. 269-12/26/600.3/2008 on Electricity Production Cost |                                                                                                                                                                                                                     |
| 6.  | Regulation on Energy and Water Efficiency                                        | Instructions to Ministers, Governors and Mayors to implement energy and water efficiency in government offices.                                                                                                       |
|     | Regulation on Energy and Water Efficiency - Presidential Instruction No. 02/2008 |                                                                                                                                                                                                                     |


As forecasted by PLN (the State-Owned Electricity Company), in 2008 energy produced by coal power plants in Indonesia accounted for about 46% of total energy production, and will increase to about 63% in 2018. It is projected that the total CO₂ emissions from eight interconnected power systems in Indonesia will be 1,938.5 million tones of CO₂ accumulated from 2008–2018 as shown in Table 1.2. The power generation sector is expected to be the main contributor to the future CO₂ emissions in Indonesia (ICSWG, 2009).

Table 1.2: Total CO₂ accumulated emissions projection 2008–2018

<table>
<thead>
<tr>
<th>No.</th>
<th>Interconnection Power System</th>
<th>CO₂ Emissions (million ton)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Jawa – Bali</td>
<td>1,652.0</td>
</tr>
<tr>
<td>2</td>
<td>Sumatera</td>
<td>158.7</td>
</tr>
<tr>
<td>3</td>
<td>Kalimantan</td>
<td>93.0</td>
</tr>
<tr>
<td>4</td>
<td>Sulawesi</td>
<td>34.7</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>1,938.5</td>
</tr>
</tbody>
</table>

Source: ICSWG (2009)

Clearly, it will not be easy to fulfill the commitment to reduce CO₂ emissions up to 26% by 2020 as mentioned by the Indonesian President while the reliance on fossil fuels for energy supply to meet
demand is still high. There is a growing consensus amongst climate researchers that the greater use of energy impacts to the growth of CO\textsubscript{2} emissions, and therefore the link between energy use and climate change becomes stronger (Huntington & Brown, 2004; ICSWG, 2009). This implies that the way on how to secure energy supply without worsening climate change impacts appears as a dilemma. It is an uneasy thing for Indonesia to strike a balance between securing energy supply to meet demand and combating climate change on the other sides.

With the fact that fossil fuels will still dominate the source of energy until the coming few decades, Indonesian Government seems to consider the third option, implementing CCS as an alternative way to reduce CO\textsubscript{2} emissions mainly from the energy (power) sector (Hutapea, 2009; ICSWG, 2009; Simamora, 2008). An assessment on the impact of CCS in the national energy path has been conducted in mid 2007 through the simulations of four long-term national energy scenarios: BAU or base scenario, National Energy Mix Target 2025 (PERPRES), Hybrid scenario which is the National Energy Mix Target 2025 with more aggressive energy efficiency, and the last scenario is the use of CCS after 2023 as additional to Hybrid scenario. The results of these simulations as shown in Figure 1.2 indicate that CCS together with Hybrid scenario can reduce CO\textsubscript{2} emissions up to 13.4% from the BAU scenario (ICSWG, 2009).

![Figure 1.2: Impact of CCS implementation in the Long-term National Energy scenarios](image)

**Figure 1.2:** Impact of CCS implementation in the Long-term National Energy scenarios  
*Source: ICSWG (2009)*

However, many aspects of CCS still need to be further investigated. As part of this effort, in 2009 a preliminary study on understanding CCS potential in Indonesia has been carried out by Indonesia CCS Study Working Group (later on in this document, it will be called “CCS study group”). The aim was to provide fundamental principles and preliminary understanding of CCS potential (e.g. the value chain of CCS and its related key elements). This study group is a collaboration of Indonesian Government

Several potential and challenges on the technical and non-technical aspects of CCS have been investigated and presented in the preliminary study of CCS in Indonesia. The technical aspects consist of the value chain of CCS such as capture technology, transportation method, and subsurface geological storage. Meanwhile the non-technical aspects concern the regulatory framework and enabling policies. The regulatory framework addresses the issue of national/local regulation regarding capture, transport, and storage, while enabling policies addresses the issue of international financing, long-term liability, and public acceptance (ICSWG, 2009).

Furthermore, the implementation of CCS in Indonesia seems to have less major barriers on the technical aspects rather than on the non-technical aspects as indicated in the preliminary study of CCS in Indonesia. The main challenge of CCS implementation will still remains in the non-technical aspects. Public acceptance is one of the non-technical aspects of CCS that is still less addressed in the preliminary study of CCS in Indonesia. At the moment it is still unclear whether public will accept or reject CCS in Indonesia. Meanwhile for a technology to be successfully implemented it should be socially accepted. Public acceptance becomes important in an implementation of a technology (Johnsson, Reiner, Itaoka, & Herzog, 2010), including CCS. Therefore it is also important to investigate public views and opinions on CCS before it is implemented in Indonesia. And the findings from this investigation might be used as the input for developing CCS policy and the strategy to build public acceptance on CCS.

1.2 Stakeholder Involvement and the Challenges of the Study

Public acceptance on CCS is a big problem as CCS itself is a controversial issue. In different countries there are different reactions of the public regarding CCS where some of its projects have met severe local resistances. Barendrecht case in the Netherlands is an example where local politicians and the residents opposed the planning of storing CO2 in two depleted gas fields under the city. Shell as the project developer made strong claims that their research shows the storage of CO2 underground is safe. Meanwhile local politicians and the residents responded that Shell can not claim based on the previous experience of their research, they thought storing CO2 as a new and different think so there is no 100% guarantee that it will be safe. As a result, the project is now suspended (Shell, 2008; TheDailyCensored, 2009).

The similar case also happened in Brandenburg, Germany. Vattenfall, a Swedish energy company was targeting geological storage of CO2 in geological formation beneath the town. Though the local government gave support to Vattenfall, but the residents rejected the project. Politicians balked and
delayed passing a CO₂ storage law required by the European Union. The issue was too controversial, there was no consensus among stakeholders, which resulted in suspension of the project (Voosen, 2010).

A slightly different case but relevant with respect to public acceptance is what happened to Muria nuclear power plant project at the north of Central Jawa, Indonesia. The Government thought that Indonesia would be ready to utilize nuclear technology for power plant since its first preparation in 1979. There was no indication of government incapability. Also, the International Atomic Energy Agency (IAEA) considered Indonesia to be ready to have a nuclear power plant. However, the project plan raised resistance from various actors. Local residents and NGOs fiercely rejected the plan and made it postponed (ANTARA, 2010; Aprilianto, 2010a, 2010b). Richard Tanter, Arabella Imhoff and David von Hippel (2009) of Nautilus Institute argued that for Indonesia, a country that in the last decade shift to a new democracy era, the handling of the Indonesian nuclear power plan is a test of the power of public opinion in a new democracy, and of the capacity of government to assess risk appropriately and make large infrastructure decisions in a transparent way. This implies that public acceptance in Indonesia is also a critical important for the successful of a plan.

Above description has elucidated that it is not easy to overcome the problem surrounding non-technical aspects like public acceptance, even though the technical aspects have already been scientifically proven. Therefore, reconciling both technical and non-technical aspects, in particular for CCS case, can be regarded as a complex problem where various stakeholders with different interests, value structures and expertise are affected by the problem. Stakeholders can be defined as actors¹ that are involved in, having a vested interest in the policy being promoted and that can influence or be affected by a certain problem or action (Chevalier, 2008; Schmeer, 1999). Stakeholders in this respect may include locally affected residents or individuals and their formal or informal representatives, national or local government authorities, policy makers, academia, NGOs, interest groups, and business companies (IFC, 2007).

With respect to social acceptability, stakeholders play important role in the policy formation and decision making process. Their involvement is very important to the successful implementation of such policy. Since policy formation and implementation is a process, stakeholder involvement should be seen as an integral part of a stepwise process in decision making. Stakeholder involvement in this sense is a way to prevent and to reduce public resistance and non-cooperative behavior. Stakeholders should be involved in the decision making process. Because the risk will be high that if government gets no cooperation and no support from the stakeholders, which leads to no implementation and then nothing real happens. Another motives for stakeholder involvement are to improve the quality of decision making and to diminish the veto power of various actors participated in decision making process (Edelenbos & Klijn, 2006). Furthermore, there are three rationales for stakeholder involvement:

¹ Note that actor is an organized social unity (Graaf, Kroesen, Ravesteijn, & Guldenmund, 2009).
involvement that are commonly cited in the literatures: the substantive rationale, the normative rationale, and the instrumental rationale (Fiorino, 1990).

First, the substantive rationale is based on the idea that a technocratic orientation is too narrow for decision making on a complex societal issue (Fiorino, 1990, as cited in Cuppen, et al., 2010). This rationale argues that stakeholders can provide more insights and essential information and therefore relevant expertise is not limited to professionals and public officials (Bijlsma, Wolters, Kok, & Hoekstra, 2007; Fiorino, 1990). Stakeholder involvement is needed to improve the quality of knowledge in such issue. Refers to Funtowicz & Ravertz (1993) quality is defined as integrated or extended peer-reviewed knowledge, therefore through sharing ideas from different stakeholders can provide a better knowledge on the issue. Secondly, the normative rationale is based on the argument that citizens have a right to participate in a public decision as a prerequisite of democracy (Cuppen, Breukers, Hisschemöller, & Bergsma, 2010; McDaniels, Gregory, & Fields, 1999). And based on Rousseau, rather than being represented, citizens have a right to directly take a part on decision making (Cuppen, et al., 2010). This rationale regards the citizen involvement as a fair conduct of public decision making activities, and therefore it is desirable and necessary in a democracy (Shepherd & Bowler, 1997). And thirdly, the instrumental rationale is based on the argument that "effective lay participation in risk decisions makes them more legitimate and leads to better results" (Fiorino, 1990). This rationale argues that stakeholders' involvement can increase the legitimacy and accountability of decision making process and its outcomes. The focus of this rationale is how to make decision work. Therefore finding an acceptable outcome from the stakeholders is the key for this rationale (Cuppen, et al., 2010).

Tulder, Kaptein, Mil & Schilpzand (2004) also explained three reasons for involving stakeholders in the policy and decision making process: content, pragmatic, and moral. Firstly, based on reason concerning content, stakeholder involvement can result in more and better arguments to base policy on. It can render new insights and views that is hardly possible be provided in a technocratic environment. Stakeholder involvement can enable the incorporation of social and political elements into policy (Tulder, Kaptein, Mil, & Schilpzand, 2004). Secondly, based on pragmatic reason, stakeholder involvement can render policy become more effective. It can prevent decisions from being attacked or protested against in a later stage. And therefore this reason suggests incorporating the views of different stakeholders in the process. Through this way a decision can be supported by a broad spectrum of society (Tulder, et al., 2004). And thirdly, based on moral reason, stakeholder involvement is needed in order to increase the legitimacy of the policy, because of more democratic decision making process of the policy. Central to this reason are values, principles, and basic assumptions that stakeholders hold should be taken into account in the policy and decision making process. In this regard, stakeholder involvement stresses to the questions like: “what do we want, and why?” (Tulder, et al., 2004).
In line with aforementioned rationales, stakeholder involvement is also needed when it comes to a seeking for sustainable solution, e.g. in climate—energy issue. One prominent notion with regard to the sustainability can be found in the Brundtland Report (known as Our Common Future). This report introduced a key statement on sustainable development as “a development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (Brundtland, 1987). It also explained that sustainable development is a continued process of change in which the exploitation of resources, the orientation of technological development, and the direction of investments are made consistent with future as well as present needs. As the consequence, sustainable development strikes a bridge between development and environment, the needs of present and future generations (Kamp & Ravesteijn, 2008).

Other key notion that is also important with regard to sustainability is the 3P’s philosophy (People, Planet, Profit). People are about social well-being, Planet is about ecological quality, and Profit is about economic prosperity (Bergmans, 2006). The 3P’s should be balanced in order to get sustainable solution, and balancing the 3P’s means making choices and setting priorities. And the idea of balancing the 3P’s means one P should not profit at the expense of another. Therefore sustainable solution is not a top down solution, but it is a consensus solution where stakeholders are getting involved in the decision making process (Bergmans, 2006).

The other reason why stakeholder involvement is important is that nowadays people live in a global society, where people from different countries know each other and give support. If governments do something bad with the population, the whole world will know about what they do. Moreover with the rapid development of communication technology like internet makes people live in a borderless environment where information on such issue can spread quickly. Early involvement of stakeholder may provide positive tone and prevent hidden resistance from being accumulated. On a positive sense, stakeholders’ ideas and suggestions can be insightful and useful for the development of a plan. Therefore, stakeholder involvement can increase the chance of the successful of policy formation and policy implementation, moreover when there is support from the global community.

Furthermore stakeholder involvement can take many forms. With regard to the forms of involvement, Arnstein (1969) introduced a typology of eight levels of participation which also known as ‘a ladder of citizen participation’. According to Arnstein (1969), each level corresponds to the extent of citizens’ power in determining the end product. The first level is called as manipulation, and the second level is therapy. These two levels describe the levels of ‘non-participation’. The objective of non-participation is to enable powerholders to cure or educate the citizens. Powerholders have no intention to enable people to participate in planning or conducting programs. The third level is informing, the fourth is consultation, and the fifth is placation. These three types progress to the levels of ‘tokenism’ which allows people to hear and to have voice. Informing and consultation is the level of tokenism where people still lack the power to ensure that their views will be acknowledged by the powerholders. Hence, there is no assurance of changing the status quo at these levels of ‘tokenism’. Placation is a higher level of ‘tokenism’ where people are allowed to advise, but still the
powerholders have right to decide. The sixth level is partnership, the seventh is delegated, and the eight is citizen control. These three levels represent the levels of ‘citizen power’ with increasing degrees of decision-making clout. Partnership is the level where people can negotiate and engage in trade-offs with the powerholders. Delegated power and citizen control are the level where people finally obtain the full managerial power or the majority of decision-makings seats.

With regard to the importance of stakeholder involvement, it is important to understand the perspectives of stakeholders. Understanding stakeholders’ perspectives means understanding the whole of beliefs, values and presumptions that stakeholders use to cope with a particular problem (Cuppen, et al., 2010). A perspective shapes a stakeholder’s perceptions on a particular problem and its solution (Cuppen, et al., 2010; Enserink, Hermans, Koppenjan, Kwakkel, & Thiesen, 2009). Depending on the specific situation, perspectives are dynamics and therefore stakeholders may have multiple perspectives. And as people might hold new information and new experiences, perspectives can change over time (Cuppen, et al., 2010). Furthermore, understanding perspectives means to understand ‘what we are looking at’ (Cuppen, et al., 2010). These all imply that by understanding perspectives, stakeholders can have a better insight on what should they do to move forward.

Barendrecht and Brandenburg cases (as mentioned earlier) show that CCS is a controversial issue, and to get consensus on CCS is not an easy one. It also happened with Muria nuclear power plant. These three cases give a lesson that sometimes public rejection on such implementation of technology is inevitable, even though government and some others might support it. And regarding CCS, this might also happen if this technology is implemented in Indonesia. At the moment there is no CCS policy in Indonesia. Whilst a policy is needed in order to guide the implementation of CCS so that it can achieve its objective in the right manner. Another important lesson from the cases above is that it is important to take into account different views and interests of stakeholders with regard to CCS in developing policy on CCS for Indonesia. In this regard, stakeholder involvement is required in the policy formation of CCS as it can increase the legitimacy and accountability of the process and the outcome (a legitimate CCS policy). It clarifies that the moral and instrumental rationales as the basis for involving stakeholders in the policy formation of CCS in Indonesia.

Meanwhile very little is known about the perspectives of stakeholders on CCS. Also the preliminary study report of the Indonesia CCS Study Working Group does not shed light on this. Even more, it also seems that most public is not familiar with CCS technology and may only have a limited understanding of climate change and its mitigation options. Whilst it is obviously common that if different stakeholders will have different views and opinions on CCS. And since stakeholder involvement is important, it is also important to investigate stakeholders’ perspectives on CCS. And take these perspectives into account in developing policy on CCS for Indonesia. Furthermore gaining stakeholders’ perspectives on CCS is also important as it can improve the understanding on the issue surrounding CCS. It explains that content and substantive rationales as another reasons for involving stakeholders in the policy making process of CCS in Indonesia.
Above elucidation implies to a challenge of this study; to know what and how stakeholders think and want about CCS. Also to gain an overview of which stakeholders those hold the same or different perspectives on CCS. In addition, this overview can provide insights on what kind of stakeholder involvement strategy could be carried out (e.g. stakeholder dialogue) to develop CCS policy in Indonesia. Which stakeholders should be involved, what issues should be put into agenda, and how this strategy could be conducted. Therefore another important challenge for this study is to serve as a preparation for stakeholder dialogue. And stakeholder dialogue can serve as an alternative way to enhance the engagement of stakeholders in the policy formation of CCS in Indonesia. Finally these challenges lead to the intriguing on-going question manifested as the problem statement of this study as follows:

What are the perspectives of stakeholders regarding CCS and how could these perspectives be considered in developing policy on CCS for Indonesia?

1.3 The Aims and Research Questions

With respect to the importance of stakeholder involvement and to take the challenges indicated in the previous section, the aims of this study are as follows:

1. To gain insights and understanding on how different stakeholders perceive and define the problem surrounding the issue of CCS in Indonesia.
2. To inspire the policy makers in developing policy on CCS for Indonesia through stakeholder involvement.

Finally, in order to reach the aims of this study, the research questions are formulated as follows:

1. Who are the stakeholders and what resources do they have?
   This question is addressed to identify the stakeholders for the purpose of investigating their perspectives on CCS. Stakeholders will be examined for their network structure, interests, objectives, perceptions, and resources.

2. What do the stakeholders think about CCS, and which aspects do the stakeholders think should be considered most in the issue of CCS?
   This question reflects the focus point of this study. The identified stakeholders as the result of the first research questions will be investigated for their perspectives on CCS.

3. What kind of stakeholder involvement strategy is required to develop CCS policy in Indonesia?
   The findings from the previous two research questions will be used to articulate a kind of stakeholder involvement strategy. It shall elaborate three subjects: which stakeholders should be involved, what issues should be put in the agenda, and how this kind of strategy could be conducted.
1.4 Research Approach

The approach of this research is constructed into three phases; literature study, theory application, and research conclusions. Figure 1.4 depicts the schematic steps of this approach.

**Figure 1.4:** Research approach of the study

The first phase involves literature study on some relevant theories related to CCS (i.e. climate change and its mitigation options, sustainable development), literature study on preliminary study report of understanding CCS potential in Indonesia conducted by CCS study group, and literature study on actor analysis, Q methodology, and network.

The second phase is application of the theories. First, actor analysis will be used to identify the stakeholders and examine the network structure and the characteristics of stakeholders with regard to the issue of CO₂ emissions reduction in Indonesia. The purpose is to provide insights of how stakeholders relate one to another in the network and also their characteristics: interests, objectives, perceptions, and resources. The result is the overview of stakeholders’ interests, objectives, perceptions on the problem and solutions, resources, and relations in the network. Then, Q methodology will be applied to investigate more specific issue: CCS as part of the issue in CO₂ emissions reduction in Indonesia. This stage serves as a continuation of actor analysis in the first stage. Q methodology will be used to investigate the perspectives of stakeholders with regard to CCS. Interviews as part of Q methodology are performed as to gather data and information from the stakeholders. In this phase various interests and opinions regarding CCS are articulated and mapped out, and the points of agreement and disagreement are assessed. The result is the overview of stakeholders’ perspectives on CCS in Indonesia.

Finally, the third phase draws the research conclusions. This phase presents and discusses the answers of the research questions. This phase summarizes the integration between stakeholders,
perspectives, and network. Furthermore this phase also concludes of what kind of stakeholder involvement strategy (e.g. stakeholder dialogue) could be carried out to develop CCS policy. This strategy is elaborated in three subjects: which stakeholders should be involved, what issues should be put into agenda, and how this strategy could be conducted.

1.5 Structure of the Study
This study is structured as follows: chapter 2 gives an overview of CCS technology, the current state of CCS, and discusses some debates on CCS. Chapter 3 is about theoretical backgrounds of actor analysis, Q methodology, and network. Actor analysis and network are the basis tools for analyzing stakeholders’ characteristics and their relations in the network. This chapter also presents and discusses the key concepts and key steps of Q methodology as the method to investigate stakeholders’ perspectives. And then chapter 4 concerns with the analysis of stakeholders and their relations in the network with regard to the issue of CO₂ emission reduction in Indonesia. It also provides a comparative insight of the characteristics of stakeholders: interests, objectives, perceptions, and important resources. Chapter 5 explains how Q methodology was conducted to investigate stakeholders’ perspectives on CCS. This chapter discusses each step in Q methodology; concourse definition and the selection of Q statement, identification of P sample, Q sorts, and analysis of Q sorts. Chapter 6 presents and discusses the overview of stakeholders’ perspectives on CCS as the results of Q methodology. It also examines the similarities and differences between perspectives and discusses the distribution of perspectives among stakeholders. And finally chapter 7 presents the conclusions of the study. This chapter summarizes the integration between stakeholders, perspectives, and network. Furthermore it presents and discusses the answers of the research questions and also the implications of this study and recommendations for further research.
Chapter 2

Carbon Capture and Storage

Outline

Review of literature study on Carbon Capture and Storage (CCS) is presented in this chapter. The discussion of CCS in this chapter is addressed to give principle understanding on CCS technology before going further to answer the research questions. Section 2.1 starts with an explanation of CCS and its fundamental value chain; capture, transport, and storage. It also discusses an overview of the current status of CCS in the world. And then section 2.2 presents briefly six issues that play a role in the public debates on CCS; the risk of storing CO₂ underground, the energy used in CCS, the cost of CCS, time of readiness, CCS vis-à-vis renewables, and CCS and the Clean Development Mechanism (CDM).
2.1 Overview of CCS Technology

Carbon Capture and Storage (CCS) is a system of technologies that integrates three main processes: CO₂ capture, CO₂ transport, and CO₂ storage. CCS is a process whereby CO₂ is captured from gases produced by fossil fuel combustion, compressed, transported, and then injected into deep geologic formations for permanent storage (IEA, 2004, 2009a, 2010). Figure 2.1 shows the CCS process.

McKinsey (2008) has mapped out the stage of CCS component technologies that used differently in CCS value chain as illustrated in Figure 2.2. This figure describes the stage of CCS development from concept, lab testing, demonstration, commercial refinements needed, until commercial scale. Each component from different value chain (capture, transport, and storage) lies in different stage of development. From technological standpoint, the components of CCS technology are not relatively new and have been applied widely for decades such as in chemical and refining industries, and oil and gas industries.

CCS projects have been taking place throughout the world and moving toward commercial status as shown in Figure 2.3. In line with McKinsey (2008), IEA (2009) reported there are four fully-integrated, large scale CCS projects are in commercial operation today. Three of them, Sleipner (Norway), Snøhvit (Norway), and In Salah (Algeria), operate in natural gas production where CO₂ is injected into geologic formation after separated from natural gas. Meanwhile the fourth project operates in coal gasification plants in Weyburn-Midale (USA & Canada) where CO₂ is captured, transported and then injected into depleting oil fields that is used for Enhanced Oil Recovery (EOR). However, none of these large scale CCS projects are operated in power plants (CCSNetwork, 2009).
And with the absence of CCS application in the power generation, CCS is considered still in the early stage of development to be implemented in the power generation (Hansson & Bryngelsson, 2009).

**Figure 2.2:** Stage of CCS component technologies
*Source: McKinsey (2008)*

**Figure 2.3:** Existing and Planned CCS Project
*Source: IEA (2010)*
2.1.1 CO₂ Capture

CCS process starts from capturing CO₂ as shown in Figure 2.1. In practice, three areas are currently considered suitable for CO₂ capture; electricity generation (including district heating and industrial combined heat and power generation), industrial processes, and fuels processing. Other emissions sources such as the transport, agriculture, residential, and service sectors are least viable for capture process (ICSWG, 2009; IEA, 2004, 2008; Vattenfall, 2010a).

Capture technologies are designed to produce a concentrated stream of CO₂ that can be transported to a viable storage site for injection underground. CO₂ represents only a small portion of the flue gas (other constituents are nitrogen, oxygen, and water vapor) in fossil fired power plants. The content of CO₂ in the flue gas varies from 3% - 15% of total flue gas volume which depends on the fuel type and power plant process (Vattenfall, 2010a). Three broad technological methods are currently proposed in the capture stage; pre-combustion capture, post-combustion capture, and oxy-fuel combustion (Gibbins & Chalmers, 2008; ICSWG, 2009; Othman, et al., 2009; Vattenfall, 2010a). Recently, as depicted in Figure 2.2, all these three options are still under research and development efforts, as well as design work for both pilot and demonstration plants (Christie, 2009; McKinsey, 2008).

![Figure 2.4: Principles of three CO₂ capture methods](Source: Gibbins & Chalmers (2008))

In principle, the three capture methods as shown in Figure 2.4 are possible to be implemented in power generations that use coal, natural gas, biomass, or other fossil fuels. Each capture technology has advantages and disadvantages depending on which plant type that should be integrated as well as to other factors. From technical standpoint, capture is known as the most complex to develop among CCS components (IEA, 2004).

Pre-combustion capture works by extracting carbon from the fuel before it is burnt. At the first stage, the fuel is gasified by heating it in small amounts of oxygen which then produces synthesis gas (syngas) that is primarily a mixture of carbon monoxide and hydrogen. To convert carbon monoxide...
to CO₂, steam is then added which results in CO₂ and hydrogen (H₂). The CO₂ is then captured for storage and the remaining hydrogen-rich gas is then combusted in a turbine to generate electricity (IEA, 2008; Postnote, 2009; Vattenfall, 2010a; WRI, 2008). In pre-combustion capture, a high-pressure gas mixture contains between 15% - 40% of CO₂ (IEA, 2008).

In practice, pre-combustion seems suitable when combined with Integrated Gasification Combined Cycle (IGCC) plants and the use of pre-combustion capture could be optimized for generating electricity. However this advantage still impose a challenge for the development of the gas turbine and the gasifier (Christie, 2009; Vattenfall, 2010a). When CO₂ is separated from syngas, a hydrogen-fired turbine that can function with hydrogen-rich environment is highly needed. And this is important for pre-combustion capture in order to be commercially viable (Christie, 2009; WRI, 2008).

Post-combustion capture is a conventional process in capturing CO₂ and already used in a wide range of industrial manufacturing processes, refining and gas processing. The capture technologies used in industrial manufacturing process can also be applied to power plants. Post-combustion removes CO₂ after the fuel has been burnt, just before the combustion products are released to the atmosphere (IEA, 2008; Postnote, 2009). A chemical solvent such as mono-ethanol-amine is usually used to capture CO₂ from the flue gas in an absorption process. After absorption, the captured CO₂ is transported to a storage site. In the post-combustion process, the flue gas can contain 4% to 8% of CO₂ volume in natural gas-fired power plants, meanwhile for coal-fired power plants this is between 12% - 15% (IEA, 2008; Vattenfall, 2010a).

Because post-combustion enables retrofitting of existing plants, it is an interesting technology for current coal and gas fired power plants (IEA, 2004, 2008, 2009b; Vattenfall, 2010a). Apparently, the greatest challenge for post-combustion capture is how to meet the energy requirements needed to release CO₂ from the solvent. Post-combustion used a large amount of energy and therefore it reduces the overall power plant efficiency and of course adds cost. This aspect becomes the utmost consideration for commercial viability of post-combustion capture (IEA, 2008; Vattenfall, 2010a).

In oxy-fuel combustion, capture of CO₂ involves burning fossil fuels in nearly pure oxygen rather than air. Oxy-fuel combustion produces high concentration of CO₂ as the main component and a nitrogen free flue gas with water vapor. The concentration of CO₂ is between 70% - 85% of total cleaned flue gas and the rest is water vapor. This high concentration makes it relatively easy to separate CO₂ and to prepare it for transportation and storage (Christie, 2009; IEA, 2008; Postnote, 2009; Vattenfall, 2010a).

The key part in oxy-fuel combustion is the separation of nitrogen and oxygen in the air, whilst the air separation is highly energy demanding and reducing overall plant efficiency. However, oxy-fuel combustion gives the highest CO₂ captured concentration among other captures techniques. Therefore the challenge in oxy-fuel combustion to be commercially viable is the improvement of
necessary technology for air separation in order to produce oxygen (Gibbins & Chalmers, 2008; IEA, 2008; Vattenfall, 2010a). In conclusion, all CO₂ capture methods require large amount of energy to power the equipment, and this brings down the overall output of the power plant. Therefore, the capture method affects power plant efficiency in different ways. More fuel has to be used per unit of electricity in a CCS fitted power plant than in one without CCS. This energy need reduces the efficiency of power plants fitted with CCS technology (IEA-GHG, 2006; Postnote, 2009).

2.1.2 CO₂ Transport

CO₂ transport is the second stage in the value chain of CCS. Pipelines and shipping are known as two major options in transporting CO₂ produced from the power plants to the storage sites. Both options have different advantages and disadvantages with respect to the risk of leakage and investment cost. The choice of CO₂ transport infrastructure in most cases depends on the distance and volumes involved (IEA, 2004, 2008). Compared to the overall cost, transportation cost is considered to be small in general (IEA, 2004).

CO₂ can be transported as gas and liquid in pipelines. Transporting CO₂ via pipelines is an established technology as pipelines have been used widely for transporting natural gas. For the past 30 years CO₂ transport has been used in the United States where several thousands of miles of CO₂ pipelines have been built to transport CO₂ from industrial plants for Enhanced Oil Recovery (EOR) (IEA, 2009a). However, due to the characteristic differences between oil, natural gas and CO₂, CO₂ pipelines are not designed in the same way as gas and oil pipelines (IEA, 2008). Pipeline leakage is one of the most important things to be considered in transporting CO₂. As documented in International Panel on Climate Change (IPCC) report on CCS, the risk associated with CO₂ pipelines mostly evolve in potential leakage from damage, corrosion, the failure of valves or welds, and the seismic activity. External monitoring like visual inspection as well as the use of internal inspection devices and distributed fiber optic sensors along the pipelines is a must to be performed in order to mitigate corrosion-related risks (IEA, 2008; IPCC, 2005).

Besides pipelines, shipping CO₂ is considered a relevant mode of transport because the prime locations for underground CO₂ storage are unlikely to coincide with source locations, or in other words the storage location is very far away to reach by a pipeline (IEA, 2004). Shipping is also seen as more economical method for transporting smaller quantities of CO₂ (IEA, 2004, 2008; IPCC, 2005). Transporting CO₂ by ship has several similarities to liquefied petroleum gas (LPG) and liquefied natural gas (LNG) transportation by ship. Tankers are currently used for shipping LPG/LNG can be used for CO₂ shipping. The leakage of CO₂ during shipping may occur due to collision, foundering, stranding, and fire. This risk can be minimized through a careful planning of routes and high standards of ship configuration, training, and management (IPCC, 2005).
2.1.3 CO₂ Storage
The last stage of CCS value chain process is storing CO₂ into suitable sites after it has been captured and transported. Roughly, storage can take place either in geological formations or in ocean storage. Geological storage has received more attention and experience whilst ocean storage has not been deployed and thoroughly tested (IPCC, 2005). Depleted oil and gas fields, deep coal seams, and saline formations are all possible geological storage formations (IEA, 2004, 2008; IPCC, 2005). CO₂ storage is relatively in the maturity level. As shown in Figure 2.2, the current status of storage is in the demonstration and commercial refinements stage with few in the commercial stage. And as depicted in Figure 2.3, CO₂ geologic storage has operated at a number of sites worldwide (IEA, 2009a). EOR is an example of storing CO₂ underground for which experience exists. British Petroleum for example has been re-injecting 1.2 million tones of CO₂ per year from natural gas processing into a gas field at In Salah, Algeria since 2004 (Postnote, 2009). It should be noted however that in the origin of EOR principle was not addressed as the option for mitigating CO₂ emissions. Unless the idea of EOR seems can be applied and in line with CCS objective (IEA, 2008; IPCC, 2005).

Several key questions arise on CO₂ storage such as how safe is the storage site in preventing CO₂ from released to atmosphere? How much and where can CO₂ be stored in the underground? The risk of leakage of stored CO₂ from the underground storage can cause environmental damage such as underground water pollution (Christie, 2009; IPCC, 2005; Postnote, 2009). Moreover the risk of leakage will be paid more attention when the storage location is close to the residential population. CO₂ storage is a more controversial issue than CO₂ capture or transport (Christie, 2009).

2.2 Some Debates on CCS
Despite the relative maturity of CCS component technologies, many uncertainties and knowledge gaps surrounding CCS development are still exist, for example related to costs, life-cycle effects, storage capacity and permanence (Hansson & Bryngelsson, 2009; McKinsey, 2008). These uncertainties and knowledge gaps bring CCS into public debates nowadays. And since CCS is promoted for a variety of reasons, such as that CCS is a bridge to a sustainable energy system, it can remediate uncaring behavior of fossil fuels, and is compatible with fossil lock-in (Hansson & Bryngelsson, 2009). Various issues in the CCS debates are originated from people's different point of views based on their background and knowledge about CCS.

The debates concerning CCS are common things in the relatively new technology development and should be taken into account in the policy formation process. Furthermore, together with people awareness on climate – energy issues rise, the public debates on CCS have grown significantly in recent years. These debates can be found widely e.g. in media, internet, and discussion forum. Six issues that play a role in the public debate on CCS are the risk of storing CO₂ underground, the energy used in CCS, cost of CCS, time of readiness, CCS vis-à-vis renewables, and CCS and Clean Development Mechanism (CDM). These are described as follows.
The risk of storing CO₂ underground

This subject is mostly put forward by environmentalists to oppose the fundamental idea of CCS while the proponents of CCS like Vattenfall (2010b) argued that:

- The risks associated with CCS are well known and we have both the skills and the technology to handle them. These risks are, however, small in comparison to the risks we face without CCS: either to ignore the climate change issue or to try other paths to reduce the global CO₂ emissions within a reasonable time.

Also as CCS Network (2009) noted: “The risk of leakage is small in comparison to the risk when there is no CCS and let the CO₂ emissions grow up in the atmosphere”. Or by Praetorius and Schumaker (2009): “Even if leakage occurs, postponing the emission of CO₂ has a value in itself”.

Therefore the supporters of CCS think that storing CO₂ underground is the path should be carried out in reducing global CO₂ emissions within a reasonable time. The supporters of CCS also strengthen their argument from technical standpoint as argued by Vattenfall (2010b):

- We know that the three parts of the CCS chain, capture, transport and storage, work and that they can be performed safely – at the power plant, along transport routes, during injection and after sealing the storage facility. Smaller pipeline leakage can be easily detected due to sharp temperature falls near the fault. Larger ruptures can be quickly terminated by automatic shut-offs and safety devices. CO₂ that is expelled under strong cloud and dry ice formation will mix with the turbulent surrounding air and not gather invisibly on the ground. Storage will take place in the same kinds of formation in which oil and natural gas are found. CO₂ accumulation occurs in nature all around the world. Since these formations can hold natural gas and naturally occurring CO₂, they can also safely store injected CO₂.

Meanwhile the opponents of CCS argue that “storing CO₂ underground is the same way of polluting activity. They refute the claim of the proponents of CCS with the argument that “many uncertainties remain when storing CO₂ underground” (Engelen, 2009; Greenpeace, 2008b). Also as Greenpeace (2008a) said:

- No meaningful impacts on climate change although there is sufficient suitable space underground to bury enough carbon, and there is no experience of safely storing any matter forever in the human history.” No matter how small the leakage is, it will just only undermine any climate benefit and CO₂ could disintegrate storage materials. The 1% of leakage, and then in the next 100 years people will see 63% evaporated of CO₂ in the atmosphere.

The Energy used in CCS

The opponents of CCS make claim that “CCS wastes energy and resources, based on the research that capturing and storing carbon dioxide would be a major energy consumer, gobbling up anything from 10% to 40% of a power plant’s electricity output” (Engelen, 2009). “....for power plants to be fitted
with CCS will require up to 25% more power and considerably more facility space" (Engelen, 2009; Greenpeace, 2008b). And furthermore by Greenpeace (2008a):

CCS causes more and more resources like coal needed for a power plant to generate the same amount energy as it without CCS. There is a dramatic increase of demands for cooling water, where approximately 90% freshwater is needed in CCS plant compared to that without CCS. Capture of CO₂ requires large amount of energy and it just decreases the power plant efficiency and increase resource consumption. Coal will be more and more burned.

The proponents defend this claim by explaining that using energy to prevent CO₂ from being released to the atmosphere is not a waste of energy, but it a good use of energy (Engelen, 2009; Vattenfall, 2010b). As noted by Vattenfall (2010b):

It is true that CCS plants use more energy rather than traditional plants, however the existing CCS plants are not in fully commercial state. The extra energy uses in CCS process could have been used to generate additional electricity and however some of the losses in electricity generation could be used for heat production.

Furthermore by CCS Network (2009) “...R&D in CCS is a process that produces improvement and promises great developmental potential in making great efficiency in CCS plants”.

The Cost of CCS

As the cost for power plant with CCS is higher than power plant without CCS, the opponents of CCS believe that CCS is not affordable to be developed. As claimed by Greenpeace (2008b) that

CCS could well mean electricity price rises of between 21 and 91%. Clean energy sources, such as wind power, provide electricity much more cheaply than coal-fired plants fitted with CCS will ever be able to. The funding to get CCS off the ground - including substantial sums of taxpayer's money - comes at the expense of real solutions. In countries it has been pursued, CCS has taken up an increasing share of energy research and development budgets whereas funding for renewable technologies and energy efficiency has stagnated or declined.

However the proponents of CCS object this argument, as Vattenfall (2010b) argued:

At present, several pilot and demonstration plants have been announced – plants that would cost much more than traditional, commercial plants. However, these plants are prototypes and prototypes are always costly. The costs of demonstration plants should not be mistaken for the costs of the fully-developed commercial CCS plants.

And by Praetorius and Schumacher (2009), “…it is to be expected that the costs of CCS will decline over time with more research and development and cumulative experience in applying the technology”.

Time of readiness

One of the most prominent arguments among the opponents of CCS with respect to time of readiness of CCS comes from Greenpeace (2008a):
Climate experts say the worst impacts of climate change can be averted by leveling off global warming pollution by 2015 and turning down the burner after that. But the earliest that CCS will be ready is 2030. The Nobel Peace Prize-winning Intergovernmental Panel on Climate Change is even less optimistic. The IPCC doesn't see CCS being commercially viable until even later - around 2050.

However, the proponents of CCS have strong reasons to believe that CCS could deliver in time since as noted by Vattenfall (2010b):

There are strong reasons to believe that CCS could deliver in time to become a powerful tool in the struggle to significantly reduce global CO₂ emissions and thereby combat global climate change. No other single measure has the same potential. Vattenfall strongly believes that CCS could become commercial under the emission-trading scheme in Europe by 2020. Thereby, it has commercial potential to become a powerful tool to reduce CO₂ emissions. Other measures, such as increased energy efficiency and renewables like wind power could deliver faster, but on a smaller scale. It is, however, important to remember that all measures are needed to handle the climate change issue.

**CCS vis-à-vis renewables**

The opponents of CCS see that CCS is dangerous, dirty, unpredictable, and cost-inefficient. Renewables on the other hands are safe, clean, predictable, and cost-effective in meeting energy needs, as noted by Greenpeace (2008a):

Renewable energy and energy saving have proven track records in meeting energy needs safely, cleanly, predictably and cost-effectively. The world has sufficient technically accessible renewable energy to meet global energy needs six times over.

In addition Greenpeace (2008a) also said “CCS is unproven, risky and expensive and investing in it threatens to undermine the range of clean energy solutions which are available right now”.

From the proponents’ standpoint, efforts to develop CCS do not reduce efforts to develop renewable, as noted by Vattenfall (2010b):

CCS is no silver bullet; it is an intermediate solution along the road to a global low-carbon of CO₂-neutral society. But, CCS does not have the potential to reduce all CO₂ emissions. It could be applied to large point sources but would be too costly for small, outspread sources. CCS is not seen as an option for the transport sector. Therefore, all the players in the energy sector are given high priority to the continued development of renewable and sustainable solutions.

Based on the information available today there is no hope that these technologies could become mature enough to replace the fossil fuels within a reasonable time.

**CCS and the Clean Development Mechanism (CDM)**

The inclusion of CCS as CDM is one of the most heavily debates of CCS in nowadays context. Based on Kyoto Protocol Article 12.2, CDM is aimed to help non-Annex I parties (developing countries) to
achieve sustainable development while contributing the ultimate objective of the Convention that is the reduction of global CO₂ emissions. The proponents of CCS argue that the inclusion of CCS in the CDM would strengthen the CDM itself. As the World Coal Institute, WCI (2009) stated:

The CDM is the only market based mechanism available under the Kyoto Protocol to finance CCS projects in developing countries and would play an important role in incentivizing the development of early opportunity, low-cost CCS projects. The opposition to the inclusion of CCS from a limited number of countries is a significant barrier to the global deployment of CCS, inhibits the transfer of this environmentally safe and sound technology to developing countries and denies developing countries access to the suite of mitigation technologies available to developed countries.

However above arguments are doubted by the opponents of CCS. As said by Greenpeace (2008a):

Projects under the CDM should focus on renewable energy and energy efficiency, increasing access to clean, reliable and affordable energy in developing countries on a regional as well as local scale. A CDM project should improve social, economic and environmental well being. CCS projects do not deliver this.

Furthermore as stated by Greenpeace (2008a):

CCS will not contribute to sustainable development. CCS is expensive making it unsuitable for small scale projects and few benefits are expected to come from large scale CCS. It will only provide employment to a limited number of people indirectly and directly during construction, operation and monitoring. Moreover, the technology is energy-intensive and increases consumption of coal by 30%. This increased demand would push up the price of coal and there would be an increase in the environmental damage related to coal mining. The costs of electricity could almost double, depending on the plant and capture type.
3

Theoretical Backgrounds of Actor Analysis, Q Methodology, and Network

Outline

This chapter concerns with the theoretical backgrounds that are used in this study to analyze stakeholders, perspectives, and network. Section 3.1 discusses about actor analysis and its roles in the policy analysis activity. It describes the different types of actor analysis methods based on four conceptual dimensions: values, resources, perceptions, and networks. This theory is used in this study in order to analyze stakeholders or actors involved in the issue, their interests, resources, perceptions (on the problem and solution), and relations in the network. Then section 3.2 introduces the key concepts of Q methodology as a method to uncover actor’s perspective. It explains the six major steps of Q methodology that are used as the guidelines in performing Q study. This method is interrelated with dimension ‘perceptions’ in actor analysis. Therefore this method is used in this study as the specific type of actor analysis that focuses on actor’s perceptions regarding the problem and its solution. And finally section 3.3 presents the concept of network. It describes the characteristics of network and strategies that actors used in the network to achieve their goals and interests.
3.1 Actor Analysis in the Policy Analysis Activity

Actor analysis is often used in the policy analysis activity. The purpose is to help a problem owner in gaining insight into the roles and positions of other actors, and providing an overview of an actor network (Enserink, et al., 2009; Mayer, Daalen, & Bots, 2004). Therefore a problem owner then can be more aware of the interests and objectives of other actors that are involved with the policy problem and that can influence or affected by the solution.

Furthermore, the insight from actor analysis can support various policy analysis activities (Enserink, et al., 2009; Hermans & Thissen, 2009). Mayer et al. (2004) described the different styles of policy analysis activity into the hexagon model as depicted in Figure 3.1. This figure shows the six analytical activities of policy analysis that are commonly used by policy analysts, these activities are: research and analysis, design and recommend, clarify values and arguments, advise strategically, democratize, and mediate.

![Figure 3.1: The hexagon model of policy analysis activity](image)

*Source: Mayer et al. (2004)*

Mayer et al. (2004) elaborated these six activities as follows: the first analytical activity is the research and analyze which focuses on gathering data. This activity emerges questions about facts, causes and effects. And therefore call for scientific research. To support data gathering for this activity, several techniques are used such as surveys, interviews, statistical analysis, simulation, and extrapolation. The second one is the design and recommend which focuses on solution. This activity translates the data and information gathered into a policy recommendation which commonly includes a set of alternatives and tactics. The third activity is the clarify values and arguments, based on the idea that there will always be implicit or normative issues and ethical dilemmas behind public policy issues. This activity seeks to improve the quality of debate through identification of the one-sided or limited nature of arguments, or showing where blind spots exist in the debate. The fourth
activity is the advice strategically which focuses on the issue of legitimacy and acceptance. This activity is client oriented and advises the client on the most effective strategy in order to achieve certain goals. Democratise is the fifth activity which does not have a value-free orientation, but more in normative and ethical objective: it should further equal access to, and influence on, the policy process for all stakeholders. The sixth activity is the mediate which focuses on solving conflicts. The main roles of this activity are about designing the rules of engagement, the negotiation procedures in a decision making process, and managing interaction and progress of the process.

Figure 3.1 also shows the six styles of policy analysis. These six styles are rational style, argumentative style, client advice style, process style, interactive style, and participatory style. Mayer et al. (2004) explained these six styles as follows: Firstly, the rational style assumes that the world is largely empirically knowable and often measurable. This style employs scientific methods in order to generate insight into causes, effects, nature, and as the result produces better policy. Secondly, the argumentative style assumes that policy is made, defended, and criticized through the medium of language. The objective is to provide recommendations and to avoid a dialogue between the deaf. The third style is the client advice style which assumes that policymaking process occurs in a complex and rather chaotic arena which comprises numerous players with different interests and strategies. Therefore this style stresses to gain insight in the various objectives, means and interests of the actors involved. Participatory is the fourth style. This style assumes that citizens should be involved in the policy-making process and decision making of major social issues. Fifth is the process style which based on the assumption that substantive aspects of a policy problem are, in fact, coordinate or perhaps even subordinate to the procedural aspects of a policy problem. This style emphasizes mediation and negotiation to reach the agreements. The last style is the interactive style which invites target groups and stakeholders to structure problems or devise solutions in structured working meetings. This is based on the assumption that individuals – experts, analyst, clients, stakeholders and target groups – have or may have differing views of the same policy problem. In line with above elucidation, several possible contributions as the roles of actor analysis in policy analysis activities are identified and summarized in Table 3.1.
Table 3.1: The roles of actor analysis in policy analysis activities

<table>
<thead>
<tr>
<th>Policy analysis activity</th>
<th>The role of actor analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research and analyze</td>
<td>Mobilize knowledge and information from a broad actor base, which is likely to improve the quality of the problem analysis.</td>
</tr>
<tr>
<td>Design and recommend</td>
<td>Create ideas for alternative strategies and tactics, by mapping options and interests of different actors. Identify common ground and shared fundamental values, to identify ways in which different actors can contribute to these shared values, and to identify needs and possibilities for compensation or mitigating measures to satisfy particular actors.</td>
</tr>
<tr>
<td>Clarify values and arguments</td>
<td>Include the full range of values and arguments in a problem analysis, which aids a problem analysis that is recognized and accepted by different parties, offering a better basis for agreement and cooperation concerning policy options.</td>
</tr>
<tr>
<td>Advice strategically</td>
<td>Assess the feasibility and implement ability of policy options, by mapping the positions, interests, resources, and relations of actors, providing insight into the opportunities and threats that actors offer for problem solving.</td>
</tr>
<tr>
<td>Democratize</td>
<td>Ensure that all the important actors are included in the policy process, and/or that their views and concerns are incorporated in the problem analysis. This supports from a normative point of views, more legitimate problem analysis.</td>
</tr>
<tr>
<td>Mediation</td>
<td>Map conflicts, identify (potential) coalitions of actors, and propose a roadmap for a negotiation process, including agenda items and participants in various stages of discussion.</td>
</tr>
</tbody>
</table>

Source: Enserink et al. (2009)

In a common crude simplification, the behaviours of actors in the policy processes can be described using four conceptual dimensions: networks, perceptions, values, and resources (Hermans & Thissen, 2009). Networks can be defined as the patterns of social relations between interdependent actors where the institutional context and rules limit and structure actors’ activities (Klijn, 1997; Ostrom, Gardener, & Walker, 1994). Perceptions are defined as the image that actors have of the world around them, the causal beliefs, cognitions, or frames of references (Bots, Twist, & Duinn, 2000; Hermans & Thissen, 2009; Scharpf, 1997). Values describe the internal motivations of actors; provide the directions to actors on how they would move. Values are also related to the concepts on a more abstract level such as norms, interests, and purposes, whereas objectives, goals, and targets express values in more specific terms (Bots, et al., 2000; Enserink, et al., 2009; Hermans & Thissen, 2009; Scharpf, 1997). Coleman (1990) expressed resources as the “things over which they have control and in which they have some interests” (p. 28). Resources are the instruments that enable actors to realize their objectives and influence the world around them, including other actors, relations and rules in the network. Resources are closely related to power and influence (Bots, et al., 2000; Enserink, et al., 2009; Hermans & Thissen, 2009; Scharpf, 1997).

Furthermore, several methods are available to support actor analysis. Where in some cases, a more focused and detailed actor analysis method is needed, depends on the concepts that are most of interest (Enserink, et al., 2009; Hermans & Thissen, 2009). Hermans & Thissen (2009) classified several methods in actor analysis based on four conceptual dimensions as explained earlier in above paragraph; networks, perceptions, values, and resources. Firstly, the network analysis methods focus on structural characteristics of actor’s networks, e.g. social network analysis. Secondly, the discourse analysis methods map actor’s perceptions, e.g. argumentative analysis, narrative policy analysis,
cognitive mapping, Q methodology (as used in this study). Thirdly, the preference elicitation methods focus on analyzing the values of actors, e.g. AHP, multi attribute assessment. Fourthly, the stakeholder analysis methods focus on resources and interdependencies among actors, e.g. conflict analysis & game theoretic models, transactional analysis.

However, actor analysis has some limitations. At least two limitations are identified, first is the trustworthy sources of information (Enserink, et al., 2009). The real actors’ networks can be characterized as messy, dynamics and ill-defined. Such information sources are not always easy to come by in order to assess actors’ characteristics and their formal and informal relations. To cope with this limitation, the reliability of information should be improved by comparing and cross-checking information from other sources (Hermans & Thissen, 2009). And when there is a lack of data, researcher should estimate carefully the analysis by using his/her logical reasoning. Therefore it is better to indicate at the beginning that if the information is lacking or only based on certain sources (Enserink, et al., 2009). The second limitation is that the findings of the actor analysis result in a snapshot and its validity is limited in time. In fact, actors’ characteristics change dynamically and therefore cause strategic and institutional uncertainty. To deal with this limitation, the analysis should be re-execute after a period of time (Enserink, et al., 2009).

3.2 Q Methodology as a Method to Uncover Actors’ Perspectives
One specific type of actor analysis methods that map actors’ views and opinions is known as Q methodology. This method was developed by William Stephenson, a British physicist-psychologist at Oxford University in 1930s as a new way to study individual’s belief and attitude. This method has been applied in various fields of social science, in attempts to uncover patterns of perspectives that are situated within people’s subjectivity (Clarke, 2002; Cuppen, et al., 2010; Ellis, Barry, & Robinson, 2007; Van Eeten, 2001; Webler, Tuler, & Krueger, 2001). Q methodology has also been used in environmental policy research, where analysis of conflicting knowledge claims might lead to more effective policy solutions (Ockwell, 2008; Reed, et al., 2009). Q has been used as a tool for facilitating stakeholder involvement in order to understand public perspectives in forest management (Steelman & Maguire, 1999).

Derived from the fact that the existing quantitative methods in the social science was felt as failed to take into account the standpoint of individual concerned, became the motivation for developing this methodology (Brown, 1996). Correspondingly, according to McKeown & Thomas (1988) that Q methodology typically employs small numbers of respondents and the in-depth study of single case is not uncommon. Q methodology integrates the strength of both quantitative and qualitative research method where anyone with a basic knowledge of research statistics can conduct Q research (McKeown & Thomas, 1988; Webler, Danielson, & Tuler, 2009). It is considered quantitative since factor analysis is used as a calculation method. And it is qualitative because discourse analysis or descriptive approach is applied to interpret the Q results. The key features of this method are the
'concourse' as the full range of discussion and range discourses on the particular issue under study; the 'Q set' as the set of statements that reflect the diversity of the concourse; and the 'P sample' as the group of respondents (Cuppen, et al., 2010; Davies & Hodge, 2007). The domain of Q is subjectivity (people’s point of views) and research is performed on small sample size (Valenta & Wigger, 1997). The sample needed for P sample is smaller compare to common random sampling which requires large sample size and this implies that the procedure for sampling respondents is usually different from that in R methodology (surveys and questionnaires) (Cuppen, et al., 2010).

In R methodology, questions are variables, respondents are subjects, and all possible respondents are population of the research. The goal is to find patterns in how respondents answered different questions, to see if the valuation of one variable is related to the valuation of a second variable in the same individual (Webler, et al., 2009). Q methodology behaves in the opposite way where Q statements are subjects, Q sorts (done by respondents) are variables, and concourse (all possible Q statements) is population of the research. The goal is to find patterns in where Q statements appear in different Q sorts, to see if the saliency of one variable is related to the saliency of another variable for the same Q statement (Webler, et al., 2009). Both methods, R and Q use factor analysis in order to find the patterns, but the difference is that the factor analysis in Q methodology is inverted. Table 3.2 summaries these differences.

<table>
<thead>
<tr>
<th>R methodology</th>
<th>Q methodology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>Concourse (all possible Q statements)</td>
</tr>
<tr>
<td>Subject</td>
<td>Q statement</td>
</tr>
<tr>
<td>Variable</td>
<td>Q sort (done by a respondent)</td>
</tr>
<tr>
<td>Factor analysis</td>
<td>Inverted</td>
</tr>
<tr>
<td>Goal</td>
<td>Find patterns in where Q statements appear in different Q sorts</td>
</tr>
<tr>
<td></td>
<td>Find patterns in how respondents answered different questions</td>
</tr>
</tbody>
</table>

*Source: Webler et al. (2009)*

Since the sample size is not large, Q methodology might not identify all possible discourses, only the ones exhibited by the interviewed stakeholders (Reed, et al., 2009) and this could be the drawback of this method. Q methodology relies on purposive sampling, based on the fact that there is a person who is assumed to have different point of view is enough reason to include him or her in the sample (Cuppen, et al., 2010). To reach the interpretation of perspectives, in general Q methodology is conducted under six major stages: concourse definition, selection of Q statements, P sample identification, Q interview, analysis of Q sorts, and interpretation of Q results. Following are the description of each stage.
Concourse definition
Concourse is the full range of discussion and range discourses on the particular issue under study (Cuppen, et al., 2010; Davies & Hodge, 2007). The concourse is defined by identifying sources, which contain ideas, opinions, values, preferences and knowledge claims on the issue, and this could be either written or spoken statements. Concourse can be defined from an interview with well-informed people (Webler, et al., 2009) or can be derived from a wide range of media such as article, journal, newspapers, book, report, web page, et cetera.

Selection of Q statements
The definition of concourse then is followed by selection of Q statements where a large set of statements are derived. On the other words, Q statements derived from different sources are representation of concourse. These statements should reflect the diversity of the concourse (Cuppen, et al., 2010), and to ensure this, strategic sampling is sometimes used. This can be done by dividing concourse into several categories and then the potential Q statements are listed into these categories. Categories of statements can be theoretically inspired or they can emerge inductively from a formal or informal analysis (Webler, et al., 2009). The Q set as the final set of Q statements is then selected by choosing a manageable number of statements from each category. It is strongly preferable that each statement in Q set is accurately represent what is said in the concourse (reflects the same meaning), thus the wording of each statement is keeping to be the same or stay as close as possible to the original wording as found in the concourse (Cuppen, et al., 2010; Webler, et al., 2009). Normally the number of Q statements to be selected is no more than sixty (Cuppen, et al., 2010).

Identification of the P sample
A group of respondents in Q research is referred to as P sample. In R research, the respondents are selected to be representative of a population, so does in Q research but in different manner. And since Q methodology uses purposive sampling, P sample needs to comprise as many different ideas, preferences, and opinions on the issue under study as possible (Cuppen, et al., 2010; Davies & Hodge, 2007). P sample is selected to represent the diversity of opinions within the target population, not the distribution of opinions across the population. P sample is also chosen because of their relevancy to the goal of the study. Furthermore, P sample is intentionally selected since the Q researcher feels they will provide interesting insights (Webler, et al., 2009).

The question arises, how to identify and select respondents for P sample? Several good ways are proposed, one is to involve people that knowledgeable about the concourse (the concerning issue). Policy and decision-makers and project initiators are often good respondents in this respect. Another way is through snowball-sampling technique (Cuppen, et al., 2010; Webler, et al., 2009). Start with person central to the subject and ask them to recommend other person who would be good respondents, either the pros or the cons supporters. The recommended respondents then are contacted and after interview they can be asked to recommend other potential respondents. People that have contribution to the concourse, for instance people with strong and well-formed
perspectives and have a written record of the concourse, can also be the criteria to be selected as respondents (Webler, et al., 2009). Lastly, combination of all techniques with classifying respondents based on their background and affiliation such as government, academia, NGOs, et cetera, can also be useful and helpful in the P sample selection process.

**Q interview**

At this stage, the Q statements are presented to the respondents in Q cards form. The respondents are asked to do the Q sort, where the statements (Q cards) are ranked, such as most agree to most disagree (Cuppen, et al., 2010), and put into a response chart that designed usually in normally distributed shape. The choice of sorting based on respondents’ beliefs and understandings about the issue. In addition to Q sort, during interview some open questions are asked to the respondents as to gather qualitative data for factor analysis in the next stage (Cuppen, et al., 2010; Webler, et al., 2009).

It is strongly recommended that Q sort is performed through on-site interview where respondent and researcher meet each other. This is to ensure researcher can understand how the respondent interprets the Q statements because the respondent can raise questions directly to the researcher about the background and meaning of Q statements and that makes Q sort yields in better quality. However, for such condition where on-site interview is hardly possible (e.g. respondent and researcher are located in far distance), Q sort can be performed through other alternatives. Researcher can send the Q set to the respondent and then the researcher guides him/her to do Q sort through phone interview as well as to gather qualitative data. One other alternative also available nowadays is Q sort through internet, but this must be done cautiously due to the absence of researcher when respondent doing the Q sort. Instruction must be clear and easy for respondent doing the Q sort. Early contact from researcher to respondent that explains about Q statements may prevent poor quality of internet-based Q sort.

**Analysis of Q sorts**

Statistical analysis is the fundamental part of Q methodology before arrive to describe the narratives of social perspectives. Statistical analysis in Q methodology typically involves the sequential application of the three sets of statistical procedures to the Q sorts’ data: correlation, factor analysis and the computation of factor scores (McKeown & Thomas, 1988). Van Exel & Graaf (2005) described a relatively concise explanation on Q sorts’ analysis as follows:

First, the correlation matrix of all Q sorts is calculated. This represents the level of (dis)agreement in points of view between the individual Q sorters. Next this correlation matrix is subject to factor analysis, with the objective to identify the number of natural groupings of Q sorts by virtue of being similar or dissimilar to one another, that is, to examine how many basically different Q sorts are in evidence (Brown, 1980, 1993). People with similar views on the topic will share the same factor. A Factor loading is determined for each factor. A factor loading is determined for each Q sort, expressing the extent to which Q sort is associated with each factor. The number of factors in the final set depends on the variability in the elicited Q
The original set of factors is then rotated to arrive at a final set of factors. Rotation may be either objective, according to some statistical principle (like varimax), or theoretical (or judgmental), driven by theoretical concerns, some prior knowledge or preconceived idea of the investigator, or an idea that came up during the study. (p. 8)

Rotation does not affect the consistency in sentiment throughout individual Q sorts or the relationships between Q sorts, it only shifts the perspective from which they are observed. Each resulting final factor represents a group of individual points of view that are highly correlated with each other and uncorrelated with others. The final step before describing and interpreting the factors is the calculation of factor scores and different scores. A statement's factor score is the normalized weighted average statement score (Z-score) of respondents that define that factor. (p. 9)

To help analyzing the Q sorts data, statistical software tailored for Q research is often used, such as PQMethod (Windows based), MQMethod (Mac based), et cetera.

**Interpretation of Q results**

The group of factors resulted from the factor analysis (or referred as clusters) at the analysis stage are interpreted contextually as perspectives or discourses (Cuppen, et al., 2010; McKeown & Thomas, 1988). Hence the researcher then obtains the map of respondents’ perspectives on the concerning issue. The clusters are actually idealized Q sorts since they are produced by analysis, not by respondents (Webler, et al., 2009). Interpretation of Q results is qualitative part of Q study and this is something an art of narrating the social perspectives. According to Webler, et al. (2009), what researcher has to do is “...to read the idealized Q sorts and write a narrative describing each one that is to compose the social perspectives” (p. 25). To have good quality of interpretation, comments made by respondent during Q sort are important to be taken into account and included in narrating the perspectives.

### 3.3 Conceptual Understanding of Multi Actor Network

Actors, organizations, or parties, all together form the network. The term ‘network’ is often used to describes a multi actor network, where in such a network, an actor, organization, or party want to influence the others (Bruijn & Heuvelhof, 2008). In the modern decision making, governance and network theories strongly focus on the changing nature of actors (Edelenbos & Klijn, 2006; Scharpf, 1997). Many actors are involved in decision making and they pose not only vital resources to realize goals and outcomes but also have different views and opinions on the problem. Each actor holds different information and ideas on solutions (Bruijn & Heuvelhof, 2008; Edelenbos & Klijn, 2006). In a complex decision making, actors’ interests often conflict. Decision making is often blocked by some actors since the decisions are not matching their interests (Bruijn & Heuvelhof, 2008; Edelenbos & Klijn, 2006). According to the network theory, policy is formed through interactions between actors with their perceptions and strategies. These actors are dependent and tied to each other (Edelenbos...
Policy shaping and formation are constructed by complex interaction between different actors which have to be managed in order to achieve actors’ interests and outcomes (Edelenbos & Klijn, 2006; Klijn, 1997; Koppenjan & Klijn, 2004). Therefore a better understanding of actors involved, their resources, interests, roles, positions, and perceptions on the problem in a multi actor network can increase the ability to manage the complexity of a decision making process. And this will help policy makers to define and build strategy in order to achieve their goals and objectives (Bruijn & Heuvelhof, 2008; Edelenbos & Klijn, 2006).

The activities on managing interactions between actors are commonly covered by the concept of network management (Edelenbos & Klijn, 2006; Klijn, 1997; Koppenjan & Klijn, 2004). Bruijn & Heuvelhof (2008) elaborated the common characteristics of networks and of decision making in networks where various actors are involved. According to Bruijn & Heuvelhof (2008), the characteristics of a network are different with those of a hierarchy as displayed in Table 3.3 below.

**Table 3.3: Differences between a hierarchy and a network**

<table>
<thead>
<tr>
<th>Hierarchy</th>
<th>Network</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uniformity</td>
<td>Variety</td>
</tr>
<tr>
<td>Unilateral dependencies</td>
<td>Mutual dependencies</td>
</tr>
<tr>
<td>Openness/repetitiveness to</td>
<td>Closedness to hierarchical signals</td>
</tr>
<tr>
<td>hierarchical signals</td>
<td></td>
</tr>
<tr>
<td>Stability</td>
<td>Dynamic</td>
</tr>
</tbody>
</table>

*Source: Bruijn & Heuvelhof (2008)*

Bruijn & Heuvelhof (2008) described each characteristic of a network as follows; the first characteristic is variety where different actors, products, interests, objectives, means, resources, etc., all together form the structure of the network. The second characteristic is mutual dependencies, which is set against unilateral dependencies. Actors in a network are dependent each other. They have dependencies on several resources such as funds, authority, information, and political connections. Actors’ dependency means that in some cases actors do not accept directives from another actor. An actor might be superior to another actor at one time, but in the next time another actor might be more superior to an adjacent subject. The next characteristic is closedness, which is set against openness. According to this characteristic, actors by definition are not sensitive to external interventions. They tend to be more resistance to such intervention since they have strong beliefs on their idea. The fourth characteristic is dynamic, which is set against stability. Actors’ positions in a network change constantly. Actor with an insignificant role in a network may suddenly occupy an important position in a network and becomes important to the others in the network. New actors may enter decision making process while others will leave. This dynamicity makes actors’ should monitor other actors positions and influence in the decision making process. Therefore their strategies should be adaptive.
Due to the characteristics of network, an actor employs his/her strategy to influence other actors. Or, a group of actors develop strategy to intervene other actors. Decision making in a network is a capricious process and unstructured, and therefore it has a major risk: one issue decision making. There is only one issue on the agenda. (Bruijn & Heuvelhof, 2008; van Bueren, Klijn, & Koppenjan, 2003). Deadlock will arise when different actors insist to take different views on one issue. One issue decision making left only little room for compromise. The strategies to cope with one issue decision making in a network are widely discussed in many literatures (e.g. Axelford, 1984; Kahan & Rapoport 1984; Teisman & Klijn, 1997). One alternative that is obviously clear is by setting multi issue in decision making. This implies that there are several issues appear on the agenda and there are sufficient interesting issues for each actor on the agenda. And these make multi issue is more attractive for actors to participate in the decision making process (Bruijn & Heuvelhof, 2008).

Multi issue decision making in a network gives several advantages and chances for actors to enhance their strategies and achieve their goals. The first advantage is a room for giving and taking. A room is created for actors to negotiate with other actors and therefore creates possibilities for avoiding deadlock (Bruijn & Heuvelhof, 2008; Teisman & Klijn, 1997). The second advantage is that multi issue provides incentives for cooperative behaviour which results in changing coalitions (Bruijn & Heuvelhof, 2008; Bruijn, Heuvelhof, & Veld, 2002; Kahan & Rapoport, 1984). Figure 3.2 illustrates this strategy.

As shown in figure 3.2, there are two coalition formations. First is one issue coalition (Figure 3.1a), and the second is multi issue coalition (Figure 3.1b). In one issue coalition there is one issue in one agenda. A1 (actor 1) and A2 (actor 2) are in the different coalitions with A3 (actor 3), A4 (actor 4), and A5 (actor 5). For example, A1 takes view that actor A4 dislikes with the issue, and this condition puts A4 in the position of resisting A1. In multi issue coalition, the constellation of actors is the same, but there is not only one issue, but multi issue. This implies that for each issue there are different coalitions of actors. Coalitions can change continuously depend on which issue is discussed on the table (Bruijn & Heuvelhof, 2008). A1 and A4 may opposite each other in the first issue, but when the second issue is discussed, they may support each other. And since they have mutual relations and

Figure 3.2: Changing coalitions of actors in multi issue decision making (A1: actor 1, A2: actor 2, A3: actor 3, A4: actor 4, A5: actor 5)

*Source: adopted from Bruijn & Heuvelhof (2008)*
understanding on the second issue, they will be aware that they have to manage this mutual relation. A1 and A3 then will behave moderately each other when dealing with the first since they do not want to harm their mutual relations. Therefore, these changing coalitions yield incentives for cooperative behaviours (Bruijn & Heuvelhof, 2008).

The third advantage is the chances of desired and unforeseen outcomes. Multi issue decision making bring many chances of foreseen events and therefore foreseen outcomes (Axelford, 1984; Bruijn & Heuvelhof, 2008; Kahan & Rapoport, 1984). Multi issue decision making allows for an infinite number of couplings between issues that different actors have different views on the issues. Multi issue decision making leads to the enrichment by negotiation where actors do not only exchange issue, but also use a large number of couplings to make a deal (Bruijn & Heuvelhof, 2008). Then fourth advantage is that multi issue makes actors learn how to make trade-offs. It is based on the idea that multi issue makes it attractive for actors to participate in the decision making process (Axelford, 1984; Bruijn & Heuvelhof, 2008). An incentive is created for actors to participate in decision making process when their wish lists placed on the agenda. And they will start to exchange information and ideas with other actors, and then it will also obvious that trade-offs between them have to be made (Axelford, 1984; Bruijn & Heuvelhof, 2008; Kahan & Rapoport, 1984).

Strategies used by actors in networks are different with strategies in hierarchy. Such strategy may produce successful decision making in a hierarchy but maybe counterproductive in a network (Bruijn & Heuvelhof, 2008; Bruijn, et al., 2002). However in the actual reality many networks also have hierarchical elements (Bruijn, et al., 2002). According to Bruijn & Heuvelhof (2008), at least there are four reasons for this. The first reason is that every organization, either government or private, has a formal structure, and this formal structure is often hierarchical. When an organization faces reality of the network, tension usually arises between the reality of network and formal hierarchy. Secondly, it is often difficult for a network organization to approach for external actors. Formal, hierarchical structures are needed by network organizations at least to let external actors know to whom they should communicate. The third reason is because of the issue of formal accountability (deLeon, 1994). Example for this is that shareholders of a company may ask the board of directors to account over the company’s performance. Or a parliament holds a minister to account for the performance of his ministry. These all need a formal hierarchical relation. The fourth reason is because the degree of hierarchy is perceived differently by different actors within organization. A manager may perceive his organization as hierarchy, while other managers perceive it as a network.

Furthermore Bruijn & Heuvelhof (2008) proposed several strategies for a hybrid, hierarchical networks. First strategy is accounting for the content, but also for the process. This strategy based on the idea that such an account will make actors sensitive to the decision making process. Therefore actors will then account not only for the results but also for the process. This implies that actors will have to maintain the relations with other actors. The second strategy is making procedural agreements with the actors in the networks about what to do. An actor can share his/her problem
with the other actors in the network. Therefore it will be wise for the actors in the network make a procedural agreement in case such problems occur between them. The third strategy is using formal authority/position to put pressure on the actors in the network. This is often for actors in the governance system to use their formal authority to influence other actors that do not have formal authority. When an actor in the governance system wants to use this strategy, he/she might coordinate with other actors in the governance system to support his/her authority. The fourth strategy is activating the actors in the networks. This strategy is strongly related to forming coalition among actors in the networks. An actor can use his/her connection to other actors that are on friendly terms in order to enhance his/her bargaining position in the networks.
4

Mapping the Stakeholders: Network Structure and Characteristics

Outline

This chapter concerns with the analysis of stakeholders: mapping the stakeholders and their relations in the network with regard to the issue of CO₂ emission reduction in Indonesia. The purpose is to gather and analyze qualitative information regarding stakeholders and to provide insights of the network structure of stakeholders and their characteristics: interests, objectives, perceptions, and resources. This chapter uses the term stakeholder as defined in chapter one; stakeholders are actors that are involved in, having a vested interest in the policy being promoted and that can influence or be affected by a certain problem or action (Chevalier, 2008; Schmeer, 1999). This implies that analyzing stakeholders means analyzing actors. Therefore this chapter follows the concept of actor analysis in chapter three as the tool for analyzing stakeholders. The sources of information of analysis in this chapter was obtained through text-analysis (except for academic and research institutes was obtained through interviews). Section 4.1 starts with identification of stakeholders based on their roles and position in the governance system. Section 4.2 deals with mapping the network structure of stakeholders. This gives an overview of formal and informal relations among stakeholders. Also which stakeholders that have strong or weak influence to the other stakeholders in the network. Section 4.3 elaborates the characteristics of stakeholders involved in the issue, which focuses on their interests, objectives, perceptions, and resources. A summary table is presented which serves to support the systematic comparison of stakeholders’ characteristics.
4.1 Identifying Stakeholders

The problem statement (and the research questions) defined in chapter one serve as the point of departure for the analysis of stakeholders. This point of departure then was followed by identifying stakeholders. It is important to identify stakeholders for the purpose of investigating the network structure and the characteristics of stakeholders. In order to ensure the clarity of the list of stakeholders, identification was performed iteratively by drawing up an initial list of stakeholders. It was then followed by dividing the stakeholders into categories. A common classification used was based on stakeholder’s role and position in the governance system (Enserink et al., 2009). Based on this classification, stakeholders were grouped into the following categories (as displayed in Table 4.1): National Government, State-Owned Energy/Power Companies, Private Energy Companies, Academia and Research Institutes, Non-Governmental Organizations (NGOs), and International Counterpart.

With regard to the issue of CO2 emission reduction in Indonesia, there could be more than one problem owners. However for the purpose of this study, it is assumed that the problem owner is the Ministry of Energy and Mineral Resources (ESDM). Since this ministry is mostly responsible for the energy (power) sector, and therefore responsible in reducing CO2 emissions from this sector.

Table 4.1: The list of identified stakeholders

<table>
<thead>
<tr>
<th>Stakeholders’ roles and position in the governance system</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>National Government</strong></td>
</tr>
<tr>
<td>Ministry of Energy and Mineral Resources (ESDM)</td>
</tr>
<tr>
<td>Ministry of Environment (KLH)</td>
</tr>
<tr>
<td>Ministry of Finance (KEMENKEU)</td>
</tr>
<tr>
<td>Ministry of Research and Technology (RISTEK)</td>
</tr>
<tr>
<td>Ministry of National Development Planning/National Development Planning Agency (BAPPENAS)</td>
</tr>
<tr>
<td>Investment Coordination Board (BKPM)</td>
</tr>
<tr>
<td><strong>State-Owned Energy/Power Companies</strong></td>
</tr>
<tr>
<td>State-Owned Electricity Company (PLN)</td>
</tr>
<tr>
<td>State-Owned Oil &amp; Gas Company (PERTAMINA)</td>
</tr>
<tr>
<td>State-Owned Gas Company (PGN)</td>
</tr>
<tr>
<td><strong>Private Energy Companies</strong></td>
</tr>
<tr>
<td>Medco Energi</td>
</tr>
<tr>
<td>Shell</td>
</tr>
<tr>
<td>Total</td>
</tr>
<tr>
<td><strong>Academia and Research Institutes</strong></td>
</tr>
<tr>
<td>Institute of Technology Bandung (ITB)</td>
</tr>
<tr>
<td>University of Indonesia (UI)</td>
</tr>
<tr>
<td><strong>Non-Governmental Organizations (NGOs)</strong></td>
</tr>
<tr>
<td>Greenpeace South East Asia (Greenpeace)</td>
</tr>
<tr>
<td>World Wildlife Fund Indonesia (WWF)</td>
</tr>
<tr>
<td><strong>International Counterpart</strong></td>
</tr>
<tr>
<td>British Foreign and Commonwealth Office – United Kingdom Embassy Jakarta (FCO UK)</td>
</tr>
</tbody>
</table>

In order to understand stakeholders and their environments, stakeholders identified in Table 4.1 then are further investigated for their characteristics and relations (formal and informal) in the next section. The analysis starts by mapping out the formal positions and relations of stakeholders into a
formal chart as to depict how they relate one to another in the network. And then it is continued with the specific assessment on stakeholders’ interests, objectives, perceptions, and resources. The overview result of this assessment then is presented into a summary table.

4.2 Mapping the Network Structure of Stakeholders

Stakeholders’ relations have a formal and an informal side (Enserink et al., 2009). A relation is formal when there is a specific arrangement in the relation that is established by law, regulation, or legislation, otherwise the relation is informal (Enserink, et al., 2009). This section covers the analysis of the formal network structure of stakeholders (actors involved) by mapping out their formal positions and relations as they form the basis to investigate informal relations. The ‘formal chart’ is used as the means of analysis. Note that although the formal positions and relations do not determine the informal relations between stakeholders, but they can limit the informal interaction and shape the influence (Enserink et al., 2009). Therefore this chart also provides the influential relations between stakeholders.

**Figure 4.1:** The formal chart for CO₂ emissions reduction issue in Indonesia

Figure 4.1 depicts the formal chart for CO₂ emissions reduction issue in Indonesia. This formal chart depicts only those relations deemed most important for the analysis. Note that all stakeholders...
mentioned in Figure 4.1 are organized and considered to be mainly concerned with Indonesia. The formal coordinative relationships exist between the ministries/agencies as they are part of the National Government. These relationships are indicated by the bold solid lines with single-sided arrows. Based on the authority level of policy instruments, each ministry and/or agency has different degrees of influences to the other stakeholders. These influences level could be authoritative (indicated by solid line with single-sided arrow), semi-authoritative (indicated by dashed line with single-sided arrow), and mutual influential (indicated by dashed line). Both authoritative and semi-authoritative influential relationships are formal since they are established through specific laws and regulations. Authoritative means that the policy instruments of a stakeholder have very strong influence and directive power to change the course of actions of such affected stakeholders. And semi-authoritative means that the policy instruments of a stakeholder have influence but do not have directive power to change the course of actions of such affected stakeholders. Meanwhile the mutual influential relationships in most cases are informal, but they could be formal when there are specific arrangements in the relationships.

It is obviously clear from Figure 4.1 that the Ministry of Energy and Mineral Resources and the Ministry of Finance both have authoritative influential relationships with the state-owned energy/power companies. And both ministries also have semi-authoritative influential relationships with the private energy companies. The Ministry of Energy and Mineral Resources has several policy instruments that are related to the effort on reducing CO\textsubscript{2} emissions from the energy (power) sector, e.g., Presidential Decree No. 5/2006 about National Energy Mix Target 2025, geothermal law and regulation, green energy policy, regulation on price of electricity, oil, and gas, etc. (as well as mentioned earlier in Table 1.1 in chapter one). Through these policy instruments, the Ministry of Energy and Mineral Resources has authority to employ possible alternatives for reducing CO\textsubscript{2} emissions from the energy sector, e.g. CCS as the alternative to reduce CO\textsubscript{2} in the power generations.

The Ministry of Finance regulates the fuel tax, and the subsidy for electricity and oil. As stipulated in the National Energy Mix Target 2025, the dependency on oil will be reduced. In line with this plan, some specific arrangements are made between the Ministry of Finance and the State-Owned Electricity Company (PLN) and the State-Owned Oil & Gas Company (PERTAMINA) where electricity and oil subsidies are planned to be reduced gradually and carbon tax is proposed to be applied. Correspondingly, the Investment Coordinating Board (BKPM) promotes investment incentive on the development of renewables and low carbon technologies to the state-owned energy/power companies and the private energy companies. However BKPM does not have strong influence since its authority does not have directive power to them.

The Ministry of Environment has semi-authoritative influential relationships with the state-owned energy/power companies and the private energy companies due to its authority to manage and monitor the National Action Plan Addressing Climate Change (RAN PI). This action plan stipulates the reduction of greenhouse gas emissions from the energy sector through LULUCF (Land Use, Land Use Change and Forestry) while also increasing carbon sequestration (ICSWG, 2009). In order to
strengthen and to get support for this action plan, the Ministry of Environment builds mutual influential relationships with environmental NGOs (e.g. joint campaign on the use of renewables and energy efficiency to the public). Also with the academia and research institutes (e.g. research of low carbon technology, develop education curriculum on climate change in universities, etc) and with an international counterpart like Foreign Commonwealth Office – United Kingdom (e.g. international funding, technology transfer on low carbon technology, etc).

The mutual influential relationships with the international counterpart are not limited only with the Ministry of Environment, but also with the Ministry of Energy and Mineral Resources, the state-owned energy/power companies, and the private energy companies. Considering the potential resources of international counterpart, the relationships between these stakeholders can strengthen the implementation of policy instruments of the Ministry of Energy and Mineral Resources with regard to CO2 emissions reduction, e.g. technology transfer, development of low carbon technology, and international financing. Another mutual influential relationship is between the Ministry of Research and Technology and the academia and research institutes. This ministry arranged the National Research Agenda that guides it to do joint research and development with the academia and research institutes in the development of green and environmentally friendly technology.

As depicted in Figure 4.1, the Ministry of National Development Planning/National Development Planning Agency (BAPPENAS) does not have any specific/direct relationships with any of the stakeholders, except only with the other ministries/agencies. However this ministry has formal authority to formulate long term national plan in many vital sectors (e.g. energy, environment), and therefore has direct influence to all ministries’ policy instruments. With this formal authority, BAPPENAS plays important role in embedding the agenda of CO2 emissions reduction into the long term national energy plan.

4.3 Analyzing the Characteristics of Stakeholders

In order to have a better understanding on stakeholders, it is important to systematically assess and to look further at their characteristics; interests, objectives, perceptions, and resources. This assessment is performed with the help of the examination on the formal chart discussed in section 4.2. The information used to specify stakeholders’ characteristics was obtained through text-analysis: websites, government or company reports, official statements, and media. Except the information about academia and research institutes, it was gathered through interviews with the respondents from universities. Interest is defined as the issue that matter most to an actor or a stakeholder. Interests usually have a clear direction, and by assessing stakeholders’ interests can help to estimate to what extent certain solutions will be acceptable (Enserink et al., 2009). Objectives indicate what an actor or a stakeholder wants to achieve in a certain situation, and uses these objectives as a measure to judge the situation (Enserink, et al., 2009). Assessing stakeholders’ perceptions means to know how different stakeholders define the problem and its possible solutions (Enserink et al., 2009). So
that this assessment tries to figure out the main causes of the issue and possible solutions should be taken according to the stakeholders. While assessing resources means to know the available resources or power that a stakeholder has and can use to influence the other stakeholders and to achieve their objectives (Enserink et al., 2009).

With regard to the issue of CO₂ emissions reduction in Indonesia, the Ministry of Energy and Mineral Resources (ESDM) as the problem owner sees the fact that the population growth and economic development increase the energy consumption, and thus increase the CO₂ emissions from the energy (power) sector. However, at the moment only fossil fuels that are seen by this ministry can supply large amounts of energy for the domestic demand since this ministry objective is to ensure the security of supply of energy. But fossil fuels have limitation, and therefore this ministry also notices that it is important to encourage the use of renewables, energy efficiency, and the use of low carbon technology. This ministry then considers to utilize CCS as it can be used (as the complement of National Energy Mix Target 2025 and more aggressive energy efficiency) to reduce large amounts of CO₂ emissions from the energy (power) sector based on the Long-term National Energy scenario simulation (ESDM, 2006; ICSWG, 2009; Simamora, 2008). However the way that the Ministry of Energy and Mineral Resources perceives the problem and its possible solution is not always the same with the other stakeholders. This can be seen by assessing different stakeholders’ interests, objectives, perceptions, and resources as will be discussed momentarily in the following paragraphs.

For the Ministry of Environment (KLH), the environment conservation and protection is the major interest. Good environment quality and meeting the target of 26% of CO₂ emissions reduction are their objectives. KLH sees that the causes of the growth of CO₂ emissions are the increasing demand and the use of fossil fuels. KLH also sees that even though deforestation (due to fire) is the number one contributor of CO₂ emissions in Indonesia, but the energy sector shows the biggest rapid growth of CO₂ emissions. Furthermore KLH thinks that CO₂ emissions should be reduced through environmentally friendly ways, e.g. by using more renewables as the sources of energy. The important resource that KLH can use to achieve its objectives is the formal authority in national policy formulation, regulation, implementation and technical policies in the fields of environment and sustainable development (e.g. National Action Plan addressing Climate Change – RAN PI) (KLH, 2007).

The interests and perceptions of the Ministry of Environment have a close similarity with those of environmental NGOs like Greenpeace and WWF. Both NGOs have similar interest with regard to the prevention and adaptation to dangerous climate change. With the concept of ‘zero carbon pathway’, Greenpeace aims to achieve their objectives of deep emissions reduction in energy, industry, agriculture, and waste (Greenpeace, 2009). Similar with Greenpeace, WWF proposes the ‘climate-safe future’ as their objectives to achieve the sustainable use of renewables, deep reduction of pollution and wasteful consumption (WWF, 2010b). Greenpeace thinks that the only way to reduce CO₂ emissions is to get rid of using fossil fuels. Closely related with Greenpeace, WWF regards the most rapid and cost-effective way to reduce CO₂ emissions from the energy sector are by energy efficiency
and using renewable energy. Both NGOs have similar important resources; the international networks in over 40 countries and independent financial funding. And both NGOs use these as important resources to achieve their objectives (Greenpeace, 2009; WWF, 2010b).

Economic growth and development is the major interest of the Ministry of Finance. Sustained economic growth and good employment opportunities are the objectives of this ministry. This ministry notices that the climate change (caused by CO₂ emissions) can hamper economic development and investment, and therefore such alternative should be carried out to reduce CO₂ emissions. The important resource that this ministry has is the formal authority in the national policy formulation, regulation, implementation and technical policies in the fields of finance and national wealth (e.g. fiscal & tax policy). Through this formal authority, this ministry sees that carbon tax might be used as an alternative means to suppress CO₂ emissions from energy (power) and industrial sectors (KEMENKEU, 2010; Wardhana, 2009). The Investment Coordinating Board (BKPM) holds specific interest in the foreign and domestic investment. Good environment for business and investment, and high investments in three focus sectors: energy, infrastructure, agriculture are BKPM main objectives. BKPM sees that higher attractiveness of investment in fossil-based resources tends to lowering investment in the development of renewable energy technologies. Therefore BKPM sees that there should be more investment incentive in renewable energy technologies in order to encourage the development of renewable energy technologies. And for this, BKPM can use is its formal authority to boost domestic and foreign direct investment through creating conducive investment climate (BKPM, 2010).

The Ministry of Research and Technology (RISTEK) and the academia and research institutes (e.g. ITB, UI) have similar interests in the research and development of technology. Good policy on the research and development of technology and the creation of technologies that are environmentally friendly and energy efficient are the objectives of RISTEK. Research and development facilities and also formal authority in national policy formulation, regulation, implementation and technical policies in the fields of research and development of science and technology (e.g. National Research Agenda) are the important resources that RISTEK can use to achieve its objectives (RISTEK, 2010). While the academia and research institutes are aiming the research and development for creating the technologies that are sustainable; useful for society, environmentally friendly, and economically benefits. Human capital and knowledge and research facilities are the important resources that academia and research institutes can use to achieve their objectives. Furthermore RISTEK notices that most power generation technologies used are highly inefficient and emit large amounts of CO₂ emissions. And therefore this ministry thinks that the development of green, environmentally and energy efficient technology is the key to reduce CO₂ emissions (BeritaRistek, 2010; RISTEK, 2010). On the other sides, academia and research institutes see that the rapid growth of CO₂ emissions comes from the wrong policy and technology implementation. Therefore they see that the implementation of CO₂ reduction tools should assess not only technological side, but also their impact on environment, society, and economics. Correspondingly, the Ministry of National Development Planning/National
Stakeholders’ Perspectives on Carbon Capture and Storage in Indonesia

Development Planning Agency (BAPPENAS) which interests in the national and public policy on country’s development plan sees that the long term national energy plan should cover and meet the balance between security of supply, environment, and economic development. Formal authority in national policy formulation, regulation, implementation and technical policies in many vital sectors like natural resources and environment is the important resource for BAPPENAS to achieve its objective; good public policy on country’s development (BAPPENAS, 2010).

Domestic electricity supply is the major interest of the State-Owned Electricity Company (PLN). This interest is in line with that of the Ministry of Energy and Mineral Resources. For PLN, securing domestic electricity supply while preventing high losses in electricity supply are the main objectives. Monopoly on electricity and interconnected power system infrastructure are PLN important resources to achieve its objectives. On PLN views, economic growth leads to growth in electricity demand, every 1% of economic growth will need 1.5% to 2% growth in electricity (ICSWG, 2009). And therefore this electricity growth needs the increase of electricity capacity expansion which should be expanded through building more power plants. Furthermore PLN also sees that based on the least cost principle, the required electricity capacity expansion up to 2018 will be dominated by steam and coal power plants, thus produce considerable amount of CO₂ emissions (ICSWG, 2009).

From the other sides, for the State-Owned Oil & Gas Company (PERTAMINA) the domestic oil and gas supply is their main interest. Good domestic supply of oil and gas while getting high profit from oil and gas business are PERTAMINA main objectives. Offshore facilities, pipelines infrastructure, and oil and gas technology mastery are PERTAMINA important resources. PERTAMINA sees that the domestic energy demand is still dominated by fossil fuels. It is not easy to change to other alternatives in a short time, although oil reserves are near to its end. PERTAMINA notices that the cost for developing renewable technologies that can supply a large amount of energy (e.g. hydrothermal) is definitely high at this moment (PTPJB, 2010). Meanwhile the State-Owned Gas Company (PGN) Country’s holds interest in the utilization of natural gas for domestic supply. While supplying natural gas for domestic needs, PGN also seeks for high profit from natural gas business. Pipelines infrastructure 5881 km (3723 km of distribution pipelines & 2158 km of transmission pipelines) and experiences in utilizing these infrastructure are PGN important resources to achieve its objectives. But PGN sees that natural gas has not been utilized optimally for domestic use, whilst it is more environmentally friendly compared to oil and coal. And therefore it could be used as an alternative of clean energy sources (PGN, 2009).

In the views of most private energy companies like Medco Energi, Shell, and Total, fossil fuels will continue to play role in the large energy supply and to meet global energy demand for the foreseeable future (MedcoEnergi, 2009; Shell, 2010; Total, 2010). It is not surprising since their main interest is the profit and revenue from energy (oil and gas) business. They seek for high profit from high demand of oil and gas. Medco Energi sees that CO₂ emissions are inevitable as long as people use fossils, and therefore in order to ensure the security of supply and cope with CO₂ emissions, fossils and renewable resources should be utilized together (MedcoEnergi, 2009). And according to Shell
and Total, optimal solutions are needed in order to help limiting the footprint of global carbon emissions while keeping use fossil fuels for energy supply. Money and technology are the important resources that these companies can use to keep exist in the energy business. And with regard to the alternative solution to cope with CO₂ emissions, experiences in utilizing EOR (Enhanced Oil Recovery) and CCS are the important resources that Shell and Total have (RedOrbit, 2007; Shell, 2010; Total, 2010).

Meanwhile, the British Foreign and Commonwealth Office (FCO UK) as an international counterpart has interest to support Indonesia’s policy makers in order to manage Indonesia’s transition to a low-carbon and high growth economy. Its objective is the implementation of low carbon technology in Indonesia (FCO-UK, 2009). For FCO UK, a high economic growth in Indonesia benefits the UK investment. Furthermore FCO UK sees that the rapid economic development in Indonesia is highly dependent on the use of both coal and gas. And therefore this need for energy must be balanced with the international community’s commitment to avoiding dangerous climate change (FCO-UK, 2010). Funding and international networks are the important resources that FCO UK can use to achieve its objective.

Table 4.1 serves to support a systematic comparison of analysis of stakeholders’ characteristics as discussed above. This summary table helps to identify the similarities and differences, as well as shared interests, objectives, and perceptions between stakeholders.
Table 4.2: Overview of stakeholders’ interests, objectives, perceptions, and important resources with regard to the issue of CO₂ emissions reduction

<table>
<thead>
<tr>
<th>Stakeholders</th>
<th>Interests</th>
<th>Objectives</th>
<th>Perceptions</th>
<th>Important Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ministry of Energy and Mineral Resource²</td>
<td>Domestic energy supply&lt;br&gt;Development of sustainable energy system&lt;br&gt;Reduce CO₂ emissions from the energy sector</td>
<td>Good security of supply of energy&lt;br&gt;Effective and optimal alternatives to reduce CO₂ emissions&lt;br&gt;Low CO₂ emissions from energy (power) sector as to fulfill the target of reducing 26% of CO₂ in Indonesia by 2020</td>
<td>Population growth and economics development increase energy consumption, thus increases the CO₂ emissions from energy (power) sector.&lt;br&gt;To deal with the increasing energy demand, fossil fuels are still needed while encourage the use of renewables, energy efficiency, and the use of low carbon technology. CCS can be used to reduce large amounts of CO₂ emissions from the energy sector based on the Long-term National Energy scenario simulation.</td>
<td>Formal authority in national policy formulation, regulation, implementation and technical policies in the fields of energy and mineral resources.&lt;br&gt;(e.g. Presidential Decree No.5/2006 about National Energy Mix Target for 2025)</td>
</tr>
<tr>
<td>Ministry of Environment³</td>
<td>Environment conservation and protection&lt;br&gt;Reduce CO₂ emissions through environmentally friendly ways</td>
<td>Good environment quality&lt;br&gt;Low CO₂ emissions as to fulfill the target of reducing 26% of CO₂ emissions in Indonesia by 2020</td>
<td>The increase on demand and use of fossil fuels leads to higher CO₂ emissions.&lt;br&gt;Deforestation (due to fire) is still no.1 contributor of CO₂ emissions, but energy sector shows the biggest rapid grow.</td>
<td>Formal authority in national policy formulation, regulation, implementation and technical policies in the fields of environment and sustainable development.&lt;br&gt;(e.g. National Action Addressing Climate Change – RAN PI)</td>
</tr>
<tr>
<td>Ministry of Finance⁴</td>
<td>Economics growth and development</td>
<td>Sustained economic growth, good employment opportunities.&lt;br&gt;Effective fiscal policy instruments to suppress CO₂ emissions.</td>
<td>Climate change can hamper economics development and investments.&lt;br&gt;As an alternative, carbon tax can be the effective way to suppress the CO₂ emissions form energy, power, and industrial sectors.</td>
<td>Formal authority in national policy formulation, regulation, implementation and technical policies in the fields of finance and nation wealth.&lt;br&gt;(e.g. fiscal &amp; tax policy)</td>
</tr>
</tbody>
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<tr>
<th>Stakeholders</th>
<th>Interests</th>
<th>Objectives</th>
<th>Perceptions</th>
<th>Important Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ministry of Research and Technology5</td>
<td>Research and development of technology</td>
<td>Good policy on the research and development of technology</td>
<td>Most power technologies used are highly inefficient, polluting, and emit CO₂.</td>
<td>Formal authority in national policy formulation, regulation, implementation and technical policies in the fields of research and development of science and technology. (e.g. National Research Agenda – ARN) R&amp;D facilities.</td>
</tr>
<tr>
<td>Ministry of National Development Planning/National Development Planning Agency (BAPPENAS)6</td>
<td>Formulation of national and public policy on country’s development</td>
<td>Good public policy on country’s development.</td>
<td>Long term national energy plan should cover and meet the balance between supply security, environment, and economic development</td>
<td>Formal authority in national policy formulation, regulation, implementation and technical policies in the fields of: - human resources and culture - politics, security, and defense - local autonomy and regional development - economy - natural resources and environment - public facilities and infrastructure - development funding</td>
</tr>
<tr>
<td>Investment Coordinating Board7</td>
<td>Foreign and domestic investments that can improve social inequality and reduce unemployment (3 focus sectors: energy, infrastructure, agriculture)</td>
<td>Good environment for business and investment</td>
<td>Higher attractiveness (profit) of investment in fossil-based resources (e.g. coal) tends to lowering investment in development of renewable energy technologies. Incentive in renewable energy technologies is to address more investment on it.</td>
<td>Formal authority to boost domestic and foreign direct investment through creating conducive investment climate: coordination of policy implementation in investment, propose policy of investment services, define the standards and procedures for investment activities.</td>
</tr>
</tbody>
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5 RISTEK (2010), Berita Ristek (2010)
6 BAPPENAS (2010)
7 BKPM (2010), Wardhana (2009)
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<tr>
<th>Stakeholders</th>
<th>Interests</th>
<th>Objectives</th>
<th>Perceptions</th>
<th>Important Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>PLN (State-Owned Electricity Company)</td>
<td>Domestic electricity supply</td>
<td>Good supply of electricity (security of supply)</td>
<td>Economic growth leads to growth in electricity demand, thus needs increase in electricity capacity expansion. Based on the least cost principle, the required electricity capacity expansion up to 2018 will be dominated by steam and coal power plants, thus produce considerable amount of CO₂ emissions.</td>
<td>Monopoly on electricity Power system facilities (600 isolated, 8 interconnected)</td>
</tr>
<tr>
<td>PERTAMINA (State-Owned Oil &amp; Gas Company)</td>
<td>Domestic oil &amp; gas supply Profit and revenue</td>
<td>Good supply of oil (security of supply) High profit</td>
<td>Domestic energy demand is still dominated by fossil fuels. It is not easy to change to other alternatives in a short time, although oil reserves are near to its end. The cost is definitely high for developing renewable technologies that can supply a large amount of energy (e.g. hydrothermal).</td>
<td>Offshore facilities Pipelines infrastructure Technology</td>
</tr>
<tr>
<td>PGN (State-Owned Gas Company)</td>
<td>Utilizing natural gas for domestic supply Profit and revenue</td>
<td>High demand for natural gas High profit</td>
<td>Country’s natural gas has not been utilized optimally for domestic use, whilst it is more environmentally friendly compared to oil and coal.</td>
<td>Experiences in natural gas pipelines (transmission &amp; distribution) Pipelines infrastructure 5881 km (3723 km of distribution pipelines &amp; 2158 km of transmission pipelines)</td>
</tr>
</tbody>
</table>

8 CSWG (2010)  
9 PTIPB (2010)  
10 PGN (2009)
### Stakeholders

<table>
<thead>
<tr>
<th>Stakeholders</th>
<th>Interests</th>
<th>Objectives</th>
<th>Perceptions</th>
<th>Important Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>National: Medco Energi(^{11})</td>
<td>Support domestic oil &amp; gas supply</td>
<td>High demand for fossil fuels</td>
<td>Fossil fuels will continue to play role in for large energy supply. Meanwhile CO(_2) emissions are inevitable as long as we use fossils. To ensure the security of supply and cope with CO(_2) emissions, fossils and renewable resources should be utilized.</td>
<td>Money Technology Infrastructure for Enhance Oil Recovery (EOR)</td>
</tr>
<tr>
<td>Multi-national: - Shell(^{12}) - Total (^{13})</td>
<td>Profit and revenue</td>
<td>High demand for fossil fuels</td>
<td>Fossil fuels will continue to play a significant role to meet global energy demand for the foreseeable future. Optimal solution is needed to help limit the footprint of global carbon emissions while keeping use fossil fuels for energy supply.</td>
<td>Money/investment Technology CCS &amp; EOR experiences</td>
</tr>
<tr>
<td>- ITB (Institute of Technology Bandung)(^{14}) - UI (University of Indonesia)(^{15})</td>
<td>Research and development of knowledge and technology for the society</td>
<td>Technologies those are sustainable; useful for society, environmentally friendly, economically benefits.</td>
<td>The rapid growth of CO(_2) emissions comes from the wrong policy and technology implementation. Implementation of CO(_2) reduction tools should assess not only technological side, but also it impact on environment, society, and economics.</td>
<td>Human capital Knowledge &amp; research facilities e.g. ITB Sustainable Energy Research Centre (PPEB-ITB), UI Energy Centre (PE-UI)</td>
</tr>
<tr>
<td>Greenpeace (Greenpeace South East Asia)(^{16})</td>
<td>Prevention and adaptation to dangerous climate change</td>
<td>Zero carbon pathway; deep emissions reduction in energy, industry, agriculture, and waste.</td>
<td>The use of fossil fuels are the source of the climate problem (increasing CO(_2) emissions) The only way to reduce CO(_2) emissions is to get rid of using fossil fuels.</td>
<td>International networks in over 40 countries Independent financial donors</td>
</tr>
</tbody>
</table>

\(^{11}\) Medco Energi (2009)  
\(^{12}\) Shell (2010)  
\(^{13}\) Total (2010), RedOrbit (2007)  
\(^{14}\) Based on interviews  
\(^{15}\) Based on interviews  
\(^{16}\) Greenpeace (2008)
As described in above analysis and shown in Table 4.1, there are different interests, objectives, perceptions, and resources held by different stakeholders with regard to the issue of CO₂ emissions reduction. This analysis also indicates that stakeholders with their resources can play a role in CO₂ emissions reduction effort in Indonesia. As those who have similar interests and objectives, they might use their resources to cooperate together in order to achieve their objectives. This also implies that each of them can influence other stakeholders’ course of action. However it is unclear how they perceive CCS as an alternative for reducing CO₂ emissions. While CCS is considered by the Ministry of Energy and Mineral Resources as an alternative solution in order to reduce CO₂ emissions, particularly for the power sector. Therefore, to understand how different stakeholders perceive CCS will be further investigated in chapter five and six.
5

Q Methodology to Investigate Stakeholders’ Perspectives on CCS

Outline

Q methodology as the core method of this study was applied to investigate stakeholders’ perspectives on CCS. This chapter discusses the steps of Q methodology that were performed during study. Section 5.1 discusses the process on defining the concourse and selecting Q statements. This section presents the iterative process of Q statements selection. Followed by identification of the P sample in section 5.2 that explains how the respondents (the stakeholders) were identified and selected. Identification of the P sample was based on stakeholders’ identification in chapter four and also through snowball-sampling technique. Then section 5.3 describes the process of Q interview where the respondents doing the Q sorts. And finally section 5.4 comes up with the analysis of the Q sorts that was performed in Q interview.
5.1 Concourse Definition and the Selection of Q Statements

Around two hundred and fifty statements were collected in attempts to reflect the variety of ideas and opinions about CCS. Most statements were ready-made samples derived from the sources other than communications with respondents. Statements were taken from scientific articles/journals, cyber-news articles, reports (especially report from CCS study group), et cetera. Since the issue of CCS was (and is still) relatively new in Indonesia, concourse definition that were related with Indonesia case was not so easy. Fortunately, CCS has been discussed heavily with highly available sources in the global case, so this was so helpful in defining concourse that was still relevant with Indonesia case.

Concourse then was divided into several categories as to ensure the diversity of ideas and opinions were reflected in the Q statements. An intensive iterative approach was used to dividing these categories as the criteria to select the statements and as well as to reduce the Q set into manageable number. Two supervisors were involved in this iterative process through intensive discussion. And finally forty-five statements remained as the candidates for the final Q set that point the wide range of ideas and opinions exist regarding CCS which relevant with Indonesia case. The iterative process in identifying and selecting Q statements based on categories is illustrated in Table 5.1.

<table>
<thead>
<tr>
<th>Round</th>
<th>Categories</th>
<th>Number of categories</th>
<th>Number of selected statements</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CO₂ source, CO₂ capture, CO₂ transport, CO₂ storage, CCS enabling policies (international financing, long term liability, public acceptance), CCS in global context</td>
<td>7</td>
<td>250</td>
</tr>
<tr>
<td>2</td>
<td>CO₂ source, CO₂ capture, CO₂ transport, CO₂ storage, CCS enabling policies, CCS in global context, technology, coal, alternatives, ETS/CDM, CO₂ reduction, sustainable development (social, economics, environment)</td>
<td>11</td>
<td>150</td>
</tr>
<tr>
<td>3</td>
<td>CO₂ source, CO₂ capture, CO₂ transport, CO₂ storage, CCS enabling policies, CCS in global context, technology, coal, alternatives, ETS/CDM, CO₂ reduction, sustainable development, centralized power, need of tools &amp; knowledge, uncertainty, CCS project, cost</td>
<td>17</td>
<td>130</td>
</tr>
<tr>
<td>4</td>
<td>CO₂ source, CO₂ capture, CO₂ transport, CO₂ storage, CCS enabling policies, CCS in global context, technology, coal, alternatives, ETS/CDM, CO₂ reduction, sustainable development, centralized power, need of tools &amp; knowledge, uncertainty, CCS project, cost</td>
<td>17</td>
<td>92</td>
</tr>
<tr>
<td>5</td>
<td>CO₂ source, CO₂ capture, CO₂ transport, CO₂ storage, CCS enabling policies, CCS in global context, technology, coal, alternatives, ETS/CDM, CO₂ reduction, sustainable development, centralized power, need of tools &amp; knowledge, uncertainty, CCS project, cost</td>
<td>17</td>
<td>45</td>
</tr>
</tbody>
</table>

Wordings of the forty-five remained statements then were checked as to keep them stay as close as possible with the concourse. After that, those statements were piloted to three people with different backgrounds that have interest and enough knowledge about CCS and its related issue. This was to
ensure no relevant statements were missing and those statements can represent the variety of ideas and opinions on CCS. From the piloting process, the three people remarked that all the forty-five statements were relevant to the concerning issue, and this brought definitive forty-five statements as the final Q set. The list of the final Q statements can be seen in Appendix A. During interviews, respondents were also asked whether there were something missing from the statements or there were still perspectives that are not covered yet in the Q set. Most respondents thought most topics on CCS were already covered in the Q set and only few respondents gave some additional comments and suggestions for the Q set. However, in principle most of those comments and suggestions already covered by other statements.

5.2 Identification of the P sample

Identification of the P sample was based on the identification of stakeholders in chapter four. It was continued by making contact with those in the list of identified stakeholders. In order to do that, an early contact with the member of CCS study group was made. And in the further step, snowball-sampling technique was performed where each stakeholder was asked to give some names that could be involved in the study, either person who recognized as has similar or different opinions on CCS. This led into the P sample or a list of respondents which consists of some relevant stakeholders that knowledgeable with CCS issue. This P sample also consists of respondents with different organization background and affiliation, such as national government, practitioners from energy/power companies, academia and research institutes, NGOs, international counterparts, and media. In total there are thirty respondents including some members of CCS study group. CCS study group itself comprises people from different background and affiliation.

Due to privacy reasons, none of their names can be mentioned here. However, most of their organizations or institutions can be named here. From the national government there are the Ministry of Energy and Mineral Resource (ESDM), the Ministry of Environment (KLH), the Ministry of Research and Technology (RISTEK), and the Investment Coordinating Board (BKPM). Meanwhile from the energy/power companies there are State-Owned Electricity Company (PLN), the State-Owned Oil & Gas Company (PERTAMINA), the State-Owned Gas Company (PGN), Shell, and Medco Energi. In academia and research institutes there are people from Institute of Technology Bandung (ITB), University of Indonesia (UI), Institute of Technology Tenth November (ITS), and Indonesia Energy Institute (INDENI). And from NGOs there are Institute of Essential Service Reform (IESR), World Wildlife Fund Indonesia (WWF), and Greenpeace South East Asia (Greenpeace). International counterparts are represented by the Foreign and Commonwealth Office United Kingdom Embassy at Jakarta (FCO UK) and Indonesia National Committee-World Energy Council (KNEI-WEC). And the last there are two from the media (cannot be mentioned here).

Overall, the P sample covers almost all stakeholders as identified in chapter four with additions in academia and research institute (ITS), NGO (IESR), international counterpart (KNEI-WEC), and media.
But since some contacts could not be made, some of identified stakeholders in chapter four are not included in the P sample; they are the Ministry of Finance, the Ministry of National Development Planning/National Development Planning Agency, and Total (a private oil and gas company). However on top of that, it was expected that above sample of respondents from different background and affiliations can reflect the variety of knowledge, interest, values, experience, and expertise, as well as to ensure various insight of perspectives emerge in the study.

5.3 Q Interview

The focus of this stage is the Q sort for gathering the quantitative data as well as qualitative data for interpreting factors by asking few open questions to the respondents. Note that the answers of the respondents (especially from the national government) were not merely representing official statement of their organization. But their answers were reflecting as close as possible to what their organization thinks about the issue. For doing a Q sort, each respondent was invited for an interview. The interviews were held between April 2010 and May 2010 where some of them took place at Jakarta and the rest through phone interviews. Mostly it takes forty-five to ninety minutes for an interview. Opening questions were asked to the respondents such as: “Could you tell briefly about your organization/company and what do you do in the organization/company?” and “Could you tell a bit about your ideas on CCS are in relation to CO2 emissions reduction target for Indonesia?”.

After that respondents were asked to do the Q sort where forty-five statements were presented to them. In this study, there were two alternatives ways for respondents in doing the Q sort: first by using printed-out paper cards and distribution chart/score sheet, and the second by using FlashQ application (Braehler & Hackert, 2010) in a computer/laptop. The procedure of Q sort started with the respondents were asked to read the statements and then to sort them into three piles of indeterminate scores – “Agree” pile, “Neutral” pile, and “Disagree” pile. Next, respondents were asked to rank those statements and put the cards into a forced normal distribution score sheet as shown in Figure 5.1. The rank of scores is from one to eleven, with position one as “most disagree” or ‘least like how I think’ and position eleven as “most agree” or ‘most like how I think’. After ranking the statements into score sheet, respondents were given a chance to change the rank of the statements. Of this stage, the respondents were emphasized that there is no “right” or “wrong” answer, but it is purely subjective based on their beliefs and understandings.

After finishing the Q sorting task, respondents then were asked with several questions such as “Why do you “most agree” with this statement?” , “Why do you “most disagree” with this statement?” , “Do you miss specific statement, if yes please explain why?”, and a reflection statement that wraps up the Q sort process “So, as concluding remarks, what do you think about the idea of CCS?”.
5.4 Analysis of Q Sorts

Analysis of Q sorts was performed with the help of PQMethod 2.11 (Schmolck, 2002). The Q sorts obtained from the interviews were correlated in a 30 x 30 matrix (see Appendix B) and then factor-analyzed using Centroid\(^{19}\) in order to find associations among the different Q sorts. And by default, Centroid analysis produced unrotated factor matrix with seven factors extracted (see Appendix C). The unrotated factors then were rotated by using Varimax rotation as the common rotation method in Q study in order to identify significant factors so that individuals tend to be associated with just one factor (Webler, et al., 2009). Although, when performing factor analysis, the question emerged: in order to be able to identify the meaningful factors, what is the right number of factors to extract and to keep for rotation? Or in the other words, how to decide the optimal number of perspectives that a researcher wish to extract from the analysis? To answer these questions, an iterative approach was followed based on statistical criteria and analysis of qualitative interviews data.

On the basis of statistical criteria, three criteria as “the rule of thumb” were followed. First was by looking at the common rule in statistical research, the Kaiser’s criterion or eigenvalue criterion. Factors with eigenvalue greater than one were selected for extraction (Brown, 1980; Heijnen, 2008). For this case, the eigenvalue criterion was satisfied by three factors: Factor 1, Factor 2, and Factor 3.

Next, the second criteria introduced was to accept factors that have at least two significant loadings (Brown, 1980). As noted by Brown (1980), “Factor loadings are the correlation coefficients representing the degree to which a Q sort correlates with a factor” (p. 222). Loading is calculated as 2.58 * standard error (SE) where SE = 1/√N with N equals the number of statements (Brown, 1980; McKeown & Thomas, 1988). In this case, with 45 statements, SE = 1/√45 = 0.149. Loading is accepted as statistically significant at 0.01 level when it is exceeding 2.58(SE), and at 0.05 level when it is exceeding 1.96(SE) (Brown, 1980; McKeown & Thomas, 1988). At 0.01 level, only loadings above

\(^{19}\) PQMethod offers two extraction methods of factor analysis: Centroid and Principal Component Analysis (PCA). Centroid was chosen since this method is the standard procedure and commonly used in Q methodology.
0.3846 were accepted as statistically significant, and hence three factors can be included for extraction based on this criterion: Factor 1, Factor 2, and Factor 3. However, by using a relaxed standard at 0.05 level, loadings exceeding 0.2922 were significant and therefore four factors were capable for extraction: Factor 1, Factor 2, Factor 3, and Factor 5.

The last “rule of thumb” was by following Humphrey’s rule. A factor is significant if the cross-product of two highest loadings exceeds 2(SE) (Brown, 1980). Based on this criterion there were only two factors can be included for extraction: Factor 1, and Factor 2. However, Brown (1980) also introduced a less stringent use of Humphreys’ rule, that is: the cross-products exceed at least 1(SE), in this case 1(SE) = 0.149. Based on this latter criterion, there were three factors can be included for extraction: Factor 1, Factor 2, and Factor 3.

Apparently, on the basis of statistical criteria, the range of factors can be extracted was from two to four factors, and hence were kept for Varimax rotation. However, besides statistical criteria, theoretical significance by looking at qualitative interviews data was also justified in determining the number of factors should be extracted since the factor size is affected by the variables (respondents) which are included in the study (Brown, 1980). Therefore, application to both criteria, statistical and theoretical, led to identification of three factors those were significant for extraction and subjected to Varimax rotation: Factor 1, Factor 2, and Factor 3.

Appendix D shows the distribution of Q sorts in the factor matrix after Varimax rotation. The sorts which load significantly on a factor are marked by an X. This table shows the factor loadings as the correlation coefficients indicating the degree to which each Q sort corresponds to each factor. With significant loadings to be equal to or greater than ±0.3846, of thirty respondents twelve respondents loaded significantly on more than one factor; sixteen respondents loaded significantly only in one factor, and two respondents did not load in any of the factors. Respondents who loaded in more than one factor were identified as confounders and considered to be eliminated from subsequent analysis (Webler, et al, 2009). But the elimination of confounders from the final analysis can yield in the loss of valuable perspectives. In order to counter this occurrence, the strategy was to consider raising the level at which a loading is significant (which will only make the statistical criteria more stringent) (Watts & Stenner, 2005). In this case, in order to define the significant sorts, the significant loadings were set to be equal to or exceed ±0.500 and also by considering the qualitative interviews data. The result was that thirteen respondents loaded significantly on one factor and not on others.

Of these thirteen respondents, two respondents loaded significantly on Factor 1, five on Factor 2, six on Factor 3. Factor 3 had positive and negative significant loadings, where four respondents were in

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20 On the basis of statistical criteria, two factors extracted (Factor 1 & Factor 2) were resulting three perspectives, and four factors extracted (Factor 1, Factor2, Factor3, and Factor 5) were resulting five perspectives. However, after looking at qualitative interviews data there were respondents whose opinions did not correspond or represent the same perspective with others in the same factor group.
positive loadings, and two respondents are in negative loadings. Therefore Factor 3 is identified as bipolar factor. Five respondents did not load significantly on any of the factors, and the remaining twelve respondents loaded significantly on more than one factor. The total variance explained of the three factors was 48% which is relatively low. This shows that the variation of ideas, opinions, and viewpoints regarding CCS is quite high. However in Q methodology the total variance explained is not considered as the relevant measure (Cuppen, et al., 2010). Q methodology emphasizes the number of factors exist which shows the existence of different perspectives, not as the percentage of a perspective in the population. Therefore, Q methodology interprets and maps out the revealed factors in a more nuanced way (Cuppen, et al., 2010; Webler, et al., 2009). Next, chapter six will discuss the interpretation of these three resulted factors in order to arrive at the social perspectives of the concerning issue.
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Q Results: Stakeholders' Perspectives on CCS

Outline

Stakeholders’ perspectives on CCS are presented and discussed in this chapter. These perspectives are based on factors identified through analysis of Q sorts in the previous chapter. These perspectives represent idealized forms of social perspectives which were latent within the Q sorts’ data and indicate shared ideas, opinions, viewpoints and also differences among the stakeholders with regard to the issue of CCS. Section 6.1 discusses the interpretation of Q results. It shows the actual construction of the perspectives. Next, section 6.2 presents the similarities and differences between perspectives in order to see the relation between those perspectives. And section 6.3 discusses the distribution of perspectives among stakeholders. It shows which stakeholders those homogeneous or heterogeneous with regard to perspectives.
6.1 Interpretation of Q Results

Three factors with one factor identified as bipolar had been obtained through factor analysis. In order to help interpreting these factors into perspectives, the calculated factor scores were assessed. Factor scores (see Appendix E) on the basis of defining sorts for each factor shows the scores obtained by each statement for each factor. In subsequent interpretation, the normalized factors scores (see Appendix F) were also assessed. The statements with the highest and the lowest scores, and also the most distinguishing statements on each factor were listed and used to help interpreting the factors. Furthermore, some relevant quotes from interviews as qualitative data were used to describe the meaning of each factor.

The following sections discuss the interpretation of each factor on the basis of quantitative and qualitative data analysis. Factor 1 represents Perspective 1, and Factor 2 represents Perspective 2. Meanwhile Factor 3 (see Appendix D) is clearly bipolar since it has statistically significant positive loadings (respondent no. 2, 7, 13, and 20) and negative loadings (respondent no. 22 and 30). Thereby Factor 3 represents two opposing perspectives; Perspective 3 and 4. Perspective 3 is the representation of the positive significant loadings, and Perspective 4 is the representation of the negative significant loadings. Both, Perspective 3 and Perspective 4 are two different perspectives in the same factor. They are in the different sides of the same coin.

In addition, eight statements with the highest positive and negative scores are shown in a table respectively for each factor. Each table also contains the most distinguishing statements and some relevant quotes from the interviews.

6.1.1 Perspective 1: CO₂ emissions reduction through clean energy sources rather than CCS

This perspective emphasizes the use of clean energy sources in order to reduce CO₂ emissions. The core belief of this perspective is that the use of dirty fossil fuels is the root of climate change itself, as expressed by one who holds this perspective, “...the truth is that using dirty fossil fuels is the root of climate change problem, therefore using clean energy sources is inevitable choice if we want to significantly reduce CO₂ emissions and fight against climate change”. Coal utilization is not believed can boost economic growth. Most CO₂ emission sources come from energy sectors, therefore the effort on cutting CO₂ emissions must be focused on these sectors.

This perspective sees that even if CCS could significantly reduce CO₂ emissions, it is not able to deal with other harmful emissions of fossil fuels. With respect to this argument, one who holds this perspective expressed, “Not only CO₂ are released from burning dirty fuels like coal, but it also releases sulfur oxide and nitrogen oxide. Both can retain incoming solar radiation and cause acid rain which damages infrastructure and environment”. This perspective is not in favour of the notion that
storing CO₂ in sedimentary basins can be regarded as mimicking the natural system. In fact it is artificial and therefore its environmental safety can not be guaranteed.

CCS is seen as a very high cost technology. A good financial performance and the incentives from government are needed. Interestingly this perspective is in a bit favour of the notion that CCS could be a cost-effective answer to a high carbon tax. As can be seen in the quotes from one who holds this perspective, “…but if there is a possible benefit of CCS maybe it can be a good deal for a high carbon tax, since Indonesia is still dominated by the use of fossil fuels”. Overall, this perspective does not support or consider CCS as an option neither extremely opposes CCS. Table 6.1 presents the statements that characterized this perspective from statements with highest positive and negative scores, the most distinguishing statements, and some relevant quotes from interviews.

**Table 6.1: Statements that characterized Perspective 1**

<table>
<thead>
<tr>
<th>Rank of Statement</th>
<th>Q Statements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agree (11)</td>
<td>9. A reduction of CO₂ emissions from the energy sector should be implemented by using clean energy sources. *</td>
</tr>
<tr>
<td>Agree (10)</td>
<td>26. Even if CCS could significantly reduce CO₂ emissions, it would not solve other problems which are inherent to the combustion of dirty fuels. *</td>
</tr>
<tr>
<td></td>
<td>29. Installing a pipeline for CO₂ transport in Indonesia should take into account seismic risk and potential leakage over the long term.</td>
</tr>
<tr>
<td></td>
<td>35. Commitment of and cooperation between different stakeholders is a crucial condition for the successful implementation of CCS.</td>
</tr>
<tr>
<td>Agree:</td>
<td></td>
</tr>
<tr>
<td>Other distinguishing statements</td>
<td>45. CCS could be a cost-effective answer to a high carbon tax. *</td>
</tr>
<tr>
<td>Disagree (1)</td>
<td>31. Storing CO₂ in sedimentary basins can be regarded as mimicking the natural system. *</td>
</tr>
<tr>
<td>Disagree (2)</td>
<td>1. Coal utilization is very essential for developing countries in order to boost their economic growth. *</td>
</tr>
<tr>
<td></td>
<td>11. CCS can be a major element of low carbon energy economy for Indonesia.</td>
</tr>
<tr>
<td></td>
<td>13. CCS is the only way forward for the developing world to have sustainable growth.</td>
</tr>
</tbody>
</table>

**Relevant quotes from interviews**

“...the truth is that using dirty fossil fuels is the root of climate change problem, therefore using clean energy sources is inevitable choice if we want to significantly reduce CO₂ emissions and fight against climate change”.

“As long as we only rely on CCS which is the used of fossil fuels, we will not be able to solve climate change problem. The use of fossil fuels is the root of climate change itself”.

“Most of the sources of CO₂ come from energy sectors, significant effects should come from reducing the biggest sources.”

“CCS will cost quite an amount of capital. To materialize it, we need good financial performance, i.e. IRR, NPV. The cost of the technology is considerably high, thus, we need incentives from the government”.

“...but if there is a possible benefit of CCS maybe it can be a good deal

---

21 A carbon tax is an environmental tax that is levied on the carbon content of fuels (Hoeller & Wallin, 1991).
"Not only CO2 released from burning dirty fuels like coal, but it also releases sulfur oxide and nitrogen oxide. Both can retain incoming solar radiation and cause acid rain which damages infrastructure and environment."

"WWF & Ecofys study on energy development argues that the world can be supplied with renewables until 100%. The use of clean energy sources in large energy sector is not a utopia, it is real and feasible to be done."

"Storing CO2 either underground or in sedimentary basins is very risky, moreover in vulnerable seismic area like Indonesia. And we see that the storing system is not similar with natural system. It is artificial, and since it is developed in artificial way, its environmental safety can not be guaranteed."

6.1.2 Perspective 2: CCS as one of the options in CO2 emissions reduction portfolio

The core belief of this perspective is that climate and energy policies must not rely on one single option in order to cut CO2 emissions level. This perspective considers CCS as an option but not as the number one solution since other options may be more suited. Those who hold this view said, "There are many other options, so don’t stick only to CCS. If we rely only to CCS, we will not be able to go forward to sustainable energy way", also "...Many things can be done to reduce CO2 emissions from technology side and also policy side. CCS can not be regarded as the only means. Many options can be utilized to fight climate change."

This perspective tends to favour on renewable energy and energy efficiency. Reason for this favour is that renewable energy and energy efficiency would promote local employment and a new economic opportunity, meanwhile CCS does not benefit local communities in the long term. Therefore this perspective also stresses that concerns about CCS from local communities are legitimate and that they should be addressed.

Those who hold this perspective argued that the cost of CCS is still high for developing countries to adopt. It will not be easy for financing CCS, and a reliance only on CCS will hamper the economic growth itself. This perspective is in disfavour with carbon market or emissions trading schemes as financing mechanism for CCS. The reason for this is as expressed by one who holds this perspective, "Carbon market is based on mechanism set by CDM principles, while CCS is not yet approved methodology in CDM. Therefore it will be very difficult and complicated to make CCS works under this scheme."

This perspective is especially positive about CCS for Enhanced Oil Recovery (EOR). However, other applications, such as CCS for biomass or gas processing plants, are not favoured that much. Table 6.2 shows the statements with the highest positive and negative scores, the most distinguishing statements, and the relevant quotes from interviews that characterized this perspective.
### Table 6.2: Statements that characterized Perspective 2

Statements with the highest positive (agree score (11) and (10)) and highest negative scores (disagree score (1) and (2)) for Perspective 2. Most distinguishing statements are indicated with *.

<table>
<thead>
<tr>
<th>Rank of Statement</th>
<th>Q Statements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agree (11)</td>
<td>12: In order to achieve substantial global emission reduction, we need all options.</td>
</tr>
<tr>
<td>Agree (10)</td>
<td>18. All climate and energy policies must be focused to achieve emission cuts level without reliance on CCS.*</td>
</tr>
<tr>
<td></td>
<td>22. Concerns about CCS, e.g. from local communities, are legitimate and need to be addressed.*</td>
</tr>
<tr>
<td></td>
<td>35. Commitment of and cooperation between different stakeholders is a crucial condition for the successful implementation of CCS.</td>
</tr>
<tr>
<td>Agree: Other distinguishing statements</td>
<td>15. CCS does not provide long-term benefits to local communities, whereas a shift to renewable energy and energy efficiency would promote employment and new economic opportunities.*</td>
</tr>
<tr>
<td>Disagree (1)</td>
<td>13. CCS is the only way forward for the developing world to have sustainable growth.</td>
</tr>
<tr>
<td>Disagree (2)</td>
<td>2. CCS is only a tactic to keep burning coal forever.</td>
</tr>
<tr>
<td></td>
<td>11. CCS can be a major element of low carbon energy economy for Indonesia.</td>
</tr>
<tr>
<td></td>
<td>25. CCS is complex enough in itself, it should not be linked to other possible advantages such as Enhanced Oil Recovery.*</td>
</tr>
<tr>
<td>Disagree: Other distinguishing statements</td>
<td>33. The most promising financing mechanism for CCS is the one that utilizes the carbon market or emissions trading schemes.*</td>
</tr>
<tr>
<td></td>
<td>14. CCS must also be adopted by other industries, e.g. biomass and gas power plants and in the fuel transformation and gas processing sectors.*</td>
</tr>
<tr>
<td>Relevant quotes from interviews</td>
<td>“The cost of CCS is still high for developing countries to adopt, therefore it will not be easy for financing CCS, and reliance only on CCS will hamper the economic growth itself”.</td>
</tr>
<tr>
<td></td>
<td>“CCS is also very specific in term of site selection. The understanding on CCS is also low among public, therefore we should inform public about CCS. The decision on site selection of CCS must consider public interests”.</td>
</tr>
<tr>
<td></td>
<td>“CCS is used in extractive industries that usually owned by big corporations and operated in remote and enclave areas with minimal contact, and thus does not benefit the local communities”.</td>
</tr>
<tr>
<td></td>
<td>“Carbon market is based on mechanism set by CDM principles, while CCS is not yet approved methodology in CDM. Therefore it will be very difficult and complicated to make CCS works under this scheme”.</td>
</tr>
<tr>
<td></td>
<td>“There are many other options, so don’t stick only to CCS. If we rely only to CCS, we will not be able to go forward to sustainable energy way”.</td>
</tr>
<tr>
<td></td>
<td>“CCS will face many disagree to settle this as a requirement in such related industry”.</td>
</tr>
<tr>
<td></td>
<td>“CCS should be considered as a contingency measure to forcefully downgrade the level of CO2 emissions using current energy source of fossil fuels. Meanwhile the proactive approach in the long term should be to find alternative energy”.</td>
</tr>
<tr>
<td></td>
<td>“CCS for EOR has been used by oil &amp; gas companies, and this seems as one of the advantage of this technology. However CCS is only a tool among tools. Many things can be done to reduce CO2 emissions from technology side and also policy side. CCS can not be regarded as the only means. Many options can be utilized to fight climate change”.</td>
</tr>
<tr>
<td></td>
<td>“Cost benefit analysis needs to be taken into account in policy decision making, not only in technological side but also economy whether it can generate real economy for public or not”.</td>
</tr>
</tbody>
</table>
6.1.3 Perspective 3: CCS is the only optimal solution to reduce CO₂ emissions

This perspective is in favour of CCS. On the basis that it is hardly possible for the world to be independent from fossil fuels within a reasonable time, CCS is seen as the only effective way to remediate the uncaring behavior in using fossil fuels. CCS is the solution to the climate change and therefore it must be used for long time and not temporarily. This perspective strongly believes that CCS can be delivered on time based on the facts that the components of this technology have been used many years by many industries. No matter how difficult and expensive the technology is, but soon or later CCS will come to the affordable cost. CCS can be the powerful complement for the development of renewable technologies, and therefore it will speed up the penetration of renewables. The reason behind this is that CCS will be supported by the price of carbon when the costs of CCS are lowered and carbon prices rise as caps on CO₂ emissions become tighter. The money from carbon trading then can be used to invest more in renewables.

This perspective stresses the notion that government should develop a CCS roadmap and embody it in the national energy plan. And since it is impossible for developing countries like Indonesia to implement CCS by their self, there should be understand voluntary efforts from developed countries to support developing countries, such as technology transfer and financing. The statements with the highest positive and negative scores, the most distinguishing statements and the relevant quotes from interviews that characterized this perspective can be seen in Table 6.3.

Table 6.3: Statements that characterized Perspective 3
Statements with the highest positive (agree score (11) and (10)) and highest negative scores (disagree score (1) and (2)) for Perspective 3. Most distinguishing statements are indicated with *.

<table>
<thead>
<tr>
<th>Rank of Statement</th>
<th>Q Statements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agree (11)</td>
<td>21. The developed countries must lead the CCS effort and CCS should be spread rapidly to the developing countries.*</td>
</tr>
</tbody>
</table>
| Agree (10)        | 3. CCS is a measure to remediate previous uncaring behavior in burning fossil fuels.*  
|                   | 5. Increased adoption of CCS will encourage penetration of renewables.*  
|                   | 39. Indonesian government should develop a CCS roadmap that is embodied in the national energy plan.* |
| Disagree (1)      | 2. CCS is only a tactic to keep burning coal forever.* |
| Disagree (2)      | 17. CCS wastes energy: it uses between 10% and 40% of the energy produced by a power station.  
|                   | 18. All climate and energy policies must be focused to achieve emission cuts level without reliance on CCS.  
|                   | 19. CCS technology will not be ready in time to overcome climate change.* |
| Disagree: Other distinguishing statements | 4. The world can fight climate change only by reducing its dependency on fossil fuels.*  
|                   | 6. CCS should be used only temporarily and as a partial solution to the climate change problem.*  
|                   | 15. CCS does not provide long-term benefits to local communities, whereas a shift to renewable energy and energy efficiency would promote employment and new economic opportunities.*  
|                   | 20. The pursuit of CCS as a ‘solution’ is unwise given its lack of
Chapter 6 | Q Results: the Stakeholders’ Perspectives on CCS

| Relevant quotes from interviews | "CCS is not for temporarily, but it’s still significantly needed for longer period. Unless the level of CO₂ concentration in the atmosphere has been pressed below 350ppm".  
"CCS can be the powerful complement for renewables".  
"Technology transfer is important for CCS development. It is impossible for developing countries implement CCS by their self. There should understand voluntary efforts from developed countries to support developing countries".  
"It is too extreme to say CCS as just a tactic. In fact, we still need coal as source of energy and CCS is an option to deal with the emissions".  
"In fact CCS component technologies have been used many years in many industries, so no worries about its deliverability, it will be on time...".  
"With CCS we can be more care to the environment while using fossil fuels. No matter how difficult and expensive the technology, but soon or later, CCS will come to affordable cost".  
"The cost of CCS is still high since it is not yet deployed in the large scale. It is common for such technology in a demonstration phase, but it will reach affordable cost".  
"The responsibility of government is vital in order to support CCS development, and at the same time to increase public awareness on it".  
"Capture technology alone might increase energy inputs which would be reflected in energy costs to the consumer. But CCS gives significant impact in reducing CO₂ rather than other alternatives. Any significant implementation of carbon capture and storage, therefore, will require public support in order to create the political will to act. This might be one alternative to overcome one of the current environmental problem". |

### 6.1.4 Perspective 4: CCS is only a tactic to keep burning coal forever

The last perspective portrays the antithesis of Perspective 3. The core belief of this perspective is that CCS is only a tactic to keep burning coal forever. There are no benefits of CCS for Indonesia. It will only increase the dependency on fossil fuels. The adoption of CCS will be contra-productive to the development of renewables. CCS is even not a partial solution to the climate change neither will it be ready in time to overcome it. Therefore there are no reasons to rely on this unproven technology either temporarily or for the long time. The only effective way to fight climate change is by reducing dependency on fossil fuels. Furthermore, this perspective believes that a shift to renewable energy and energy efficiency can promote employment and new economic opportunities. Table 6.4 shows the statements with the highest positive and negative scores, the most distinguishing statements and the relevant quotes from interviews that characterized this perspective.

**Table 6.4:** Statements that characterized Perspective 4

<table>
<thead>
<tr>
<th>Rank of Statement</th>
<th>Q Statements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agree (11)</td>
<td>2. CCS is only a tactic to keep burning coal forever.*</td>
</tr>
<tr>
<td>Agree (10)</td>
<td>17. CCS wastes energy: it uses between 10% and 40% of the energy produced by a power station.</td>
</tr>
<tr>
<td></td>
<td>18. All climate and energy policies must be focused to achieve emission cuts level without reliance on CCS.</td>
</tr>
</tbody>
</table>
19. CCS technology will not be ready in time to overcome climate change.*

Agree:
Other distinguishing statements

4. The world can fight climate change only by reducing its dependency on fossil fuels.*

15. CCS does not provide long-term benefits to local communities, whereas a shift to renewable energy and energy efficiency would promote employment and new economic opportunities.*

20. The pursuit of CCS as a ‘solution’ is unwise given its lack of technological maturity and the absence of commercial viability.*

Disagree (1)

21. The developed countries must lead the CCS effort and CCS should be spread rapidly to the developing countries.*

Disagree (2)

3. CCS is a measure to remediate previous uncaring behavior in burning fossil fuels.*

5. Increased adoption of CCS will encourage penetration of renewables.*

39. Indonesian government should develop a CCS roadmap that is embodied in the national energy plan.*

Disagree:
Other distinguishing statements

6. CCS should be used only temporarily and as a partial solution to the climate change problem.*

Relevant quotes from interviews

“CCS is not the right way to cut global emission, it will not in line with renewables and energy efficiency”.
“The adoption of CCS will only make renewable energy technology development slow since people then will rely on using fossil fuels”. “CCS is only a tactic from coal power plants and mine industries to have justification in keep burning coal forever. With CCS they will have more justification that GHG emissions form burning coal will not be a problem any longer”.
“Increases adoption of CCS will be contra-productive to the development of renewables not only for Indonesia but also the whole world”.

6.2 Similarities and Differences between Perspectives

Four perspectives have been identified and interpreted in the previous section. In order to enhance comprehension on the perspectives, the similarities and differences between perspectives were examined. It is already known that a factor represents a perspective. How each perspective may look similar or differ can be investigated by looking at the correlation values between factors scores resulted in PQMethod, as displayed in Table 6.5. The higher the correlation value between two factor scores, the more the similarity between two perspectives and vice versa the lower the correlation value between two factor scores, the more the difference between two perspectives. Besides looking at these correlation values, the relevant quotes from the interviews were also examined.

<table>
<thead>
<tr>
<th>Factor 1</th>
<th>Factor 2</th>
<th>Factor 3 (bipolar factor)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor 1</td>
<td>1.0000</td>
<td>0.4346</td>
</tr>
<tr>
<td>Factor 2</td>
<td>0.4346</td>
<td>1.0000</td>
</tr>
<tr>
<td>Factor 3</td>
<td>0.2190</td>
<td>0.1983</td>
</tr>
</tbody>
</table>
Based on Table 6.5, the correlation value between Factor 1 and 2 is 0.4346, between Factor 1 and 3 is 0.2190, and between Factor 2 and 3 is 0.1983. Factor 3 has low correlation values with both Factor 1 and 2. But since Factor 3 is bipolar factor with two different perspectives; Perspective 3 (CCS is the only optimal solution to reduce CO2 emissions) and 4 (CCS is only a tactic to keep burning coal forever), each perspective correlates differently with Perspective 1 (CO2 emissions reduction through clean energy sources rather than CCS) and 2 (CCS as one of the options in CO2 emissions reduction portfolio)²².

Above correlation values show that Perspective 1 and 2 are correlated. Both perspectives are in the similar tendency in choosing CO2 emissions reduction portfolio, but Perspective 1 is more practical-oriented, and Perspective 2 is more policy-oriented. Perspective 1 focuses mainly on the use of clean energy sources (e.g. renewables) in the energy sector, since this sector is the biggest CO2 emitter. Perspective 2 sees not only renewable energy but also energy efficiency as the option. Perspective 1 does not consider CCS as an option neither extremely opposes CCS. Meanwhile Perspective 2 sees CCS as one of the options but not as the number one solution. However both perspectives see CCS as the high cost technology for developing countries to adopt.

Both perspectives also correlate with Perspective 4 particularly in their preference to reduce CO2 emissions. Perspective 4 is however more extreme as it sees renewable energy and energy efficiency as the only effective ways. Another similarity is that both Perspective 2 and 4 believe a shift to renewable energy and energy efficiency would promote employment and new economic opportunities. The difference is that Perspective 4 is strongly negative on CCS and sees it is only a tactic to keep burning coal forever.

Both Perspective 1 and 2 have low correlations with Perspective 3. Perspective 1 and 3 are different in that they see fossil fuels. Perspective 1 believes that the world can be supplied with renewables until 100%, and it is not utopia since it is based on scientific study. Perspective 3 sees that it is hardly possible for the world to be independent from fossil fuels within a reasonable time. These three perspectives are also different in that they see CCS as CO2 emissions reduction portfolio. Perspective 3 is strongly positive on CCS and believes that although CCS is a high cost technology, but soon or later CCS can come to the affordable cost for developing countries to adopt. In addition, Perspective 3 stresses the embodiment of CCS in the national energy plan; this does not seem to play very urgent for Perspective 2. However all Perspective 1, 2 and 3 agree with the role of developed countries to support developing countries on CCS.

²²The correlations between Factor 3 and both Factor 1 and 2 can be seen in the opposite way. First, with regards to the positive significant loadings in Factor 3 (Perspective 3), the correlations are low between the positive part of Factor 3 with both Factor 1 and 2. Secondly, with regard to the negative significant loadings in Factor 3 (Perspective 4), the correlations are high between the negative part of Factor 3 with both Factor 1 and 2.
Perspective 3 and 4 reflect the opposite perspectives. What seems positive on CCS in Perspective 3 seems as negative in Perspective 4, and vice versa. Both perspectives reflect the believers and the disbelievers of CCS. Perspective 3 is technological-oriented and takes more pragmatic on CCS as CO₂ emissions reduction tool. Meanwhile Perspective 4 is environmental-oriented and takes more idealistic on the use of renewables and energy efficiency as the solution for the climate problem.

However, from the findings above, basically no perspectives are conflicting one to another with regard to renewables. Perspective 3, for example, no matter how strong it attitudes to support CCS, but it does not behave negatively on renewables. The difference lies on the ‘time dimension’. Perspective 3 sees that renewables will not enough to replace fossil fuels as the main energy supply in a reasonable time. But this perspective does not give a definite explanation on “what does a reasonable time” mean? Meanwhile those who believe that renewables can replace fossil fuels up to 100% can not give a definite answer to “when will renewables be ready to take over fossil fuels as the source of energy?” This implies that the option on using renewables is accepted by all perspectives. Therefore this can be the point of agreement of all perspectives.

6.3 Distribution of Perspectives among Stakeholders

In order to gain a better view on which stakeholders those hold the perspectives, a table of distribution of perspectives among stakeholders was constructed. Table 6.6 provides the distribution of respondents with a defining sort (significant loading) based on type of organization/affiliation and perspective. Only respondent loads significantly on one perspective and not to other perspectives are put into table. The respondents are grouped based on general actor type: organization background and affiliation as mentioned in chapter five (see section 5.2: identification of the P sample). This type of actor comprises: national government, practitioners from energy/power companies, academia and research institutes, NGOs, international counterparts, and media.

<table>
<thead>
<tr>
<th>Perspective 1</th>
<th>Perspective 2</th>
<th>Perspective 3</th>
<th>Perspective 4</th>
<th>Total per</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO₂ emissions</td>
<td>CCS as one of</td>
<td>CCS is the</td>
<td>CCS is only</td>
<td>per type</td>
</tr>
<tr>
<td>reduction</td>
<td>the options</td>
<td>the only</td>
<td>a tactic to</td>
<td>of actor</td>
</tr>
<tr>
<td>through clean</td>
<td>in CO₂</td>
<td>optimal</td>
<td>keep burning</td>
<td>per</td>
</tr>
<tr>
<td>energy sources</td>
<td>emissions</td>
<td>solution to</td>
<td>coal forever</td>
<td>perspective</td>
</tr>
<tr>
<td>rather than CCS</td>
<td>reduction</td>
<td>reduce CO₂</td>
<td></td>
<td></td>
</tr>
<tr>
<td>National</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Government</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy/power</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>companies</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Academia and</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>research</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>institutes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NGOs</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Total per</td>
<td>2</td>
<td>5</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>perspective</td>
<td></td>
<td></td>
<td></td>
<td>13</td>
</tr>
</tbody>
</table>

23 International counterparts and media are not listed in this table since there are no respondents from these actor types with defining sort.
Apparently, different perspectives occur within one actor type in Table 6.6 above. For instance, respondents from energy/power companies load on Perspective 1, 2 and 3. Correspondingly, on each perspective respondents from different types of actors also appear. For example, on Perspective 2 there are respondents from national government, energy/power companies, and academia and research institutes. It shows heterogeneity of actor types regarding perspectives.

Table 6.6 however provides only respondents with defining sorts. Whilst factor loading shows a larger number of respondents without defining sorts (17 respondents). These respondents should be considered for their potential to support particular perspective. To what extent each perspective is represented within actor types can be further investigated by calculating the average factor loadings per actor type on each perspective (Cuppen, et al., 2010). The reason for this is that factor loadings can be interpreted as a measure of agreement. The higher the factor loading, the more a respondent agrees with particular perspective (Cuppen, et al., 2010). In doing so, all thirty factor loadings on four perspectives were analyzed and the results are depicted in Figure 6.1. This picture gives a more comprehensive view than the analysis summarized in Table 6.6 which is based only on defining sorts.

![Average Loadings](image)

**Figure 6.1**: Distribution of average factor loadings per actor type across the four perspectives; P1: CO₂ emissions reduction through clean energy sources rather than CCS, P2: CCS as one of the options in CO₂ emissions reduction portfolio, P3: CCS is the only optimal solution to reduce CO₂ emissions, P4: CCS is only a tactic to keep burning coal forever.

Figure 6.1 depicts four clustered columns along X axis which represent four perspectives. The Y axis represents the value of average loadings. Each bar within clustered columns represents an actor type. The longer the bar column (along positive Y axis) from the baseline, the higher the average factor loading on that factor for that actor type is. And since Perspective 3 and 4 are the opposite perspectives, their bar columns show opposite behaviours. Both perspectives have bar columns with two different directions: moving along positive and negative Y axis.
Figure 6.1 underlines the findings shown in Table 6.6 that stakeholders (actors involved) are heterogeneous in perspectives though they are in the same actor type. It shows that respondents in the same type of organization/affiliation can have different perspectives to one another. This figure gives some observation clues to which perspectives each actor type holds relatively the most. For instance, in Table 6.6 international counterparts did not load in any of the perspectives. But in Figure 6.1 it is obviously clear that international counterparts have high average loading on Perspective 3 (CCS is the only optimal solution to reduce CO₂ emissions) and the lowest on Perspective 4 (CCS is only a tactic to keep burning coal forever). It is not surprising since they hold the agenda to encourage the implementation of CCS in developing countries like Indonesia. In conclusion, international counterparts are relatively homogeneous to their perspectives as they are dominated by Perspective 3.

Another finding is that national government has high average loading on Perspective 2, similarly low on Perspective 1 and 3, and very low (negative) on Perspective 4. It is reasonable for national government since Perspective 2 is more policy-oriented, and therefore calls for considering not only one single option. For instance, Perspective 2 also emphasizes the use of renewables and energy efficiency. National government is not in favour of Perspective 4 since this perspective is too extreme and can be contra-productive with their policy orientation (consider not only one single option). As to conclude, national government is relatively homogeneous regarding their perspectives since this actor type is dominated by Perspective 2.

A surprising finding is that energy/power companies have low average loadings on Perspective 1, 2, and 3, and very low (negative) on Perspective 4. It was expected that this actor type would be dominated by Perspective 3 but in fact they have heterogeneous perspectives. They are not dominated by one single perspective. It is probably because that those in this actor type also consider other options in reducing CO₂ emissions, not only CCS. Three respondents from this actor type put a strong attention on the development of renewable energy technologies which is a reflection of Perspective 2. In addition, two sorts from this actor type reflect Perspective 1 that emphasizes the use of clean energy sources. Whereas they see the natural gas as clean energy source since it burns more cleanly and has fewer CO₂ emissions than other fossil fuels like oil or coal. What obviously clear is that they are not in favour with Perspective 4, as this perspective extremely sees no benefits on CCS.

Next, for academia and research institutes, their distribution average loadings seem similar with that in the energy/power companies. Notably they load low on Perspective 1, 2, and 3 and the lowest on Perspective 4. This actor type is heterogeneous with regard to their perspectives. There is no single perspective dominates this actor type. But it is not surprising since academia and research institutes

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24 As stated by respondent from this actor type in the interview regarding statement no. 39 (see Appendix A), “…this is absolutely crucial if CCS is to become viable, and accepted, in Indonesia as well as helping to make Indonesia a leader in the developing world on CCS. It also links very closely to what study group undertake”.

25 Except for the Ministry of Energy and Mineral Resource (the problem owner), which has high loading on Perspective 3 (CCS is the only optimal solution to reduce CO₂).
tend to be open to all options and more research-oriented. Their interests lie on the seeking of solutions that are good for science, technology, and society. Many options are better rather than only one single option.

Then, for NGOs, they have high average loading on Perspective 1 and low on Perspective 2. It is understandable since they are in favour of the use of clean energy sources as the core belief of Perspective 1. Among other actor types, NGOs load the only negative loading on Perspective 3 and the only positive loading on Perspective 4. But both of these loadings are low. There was one respondent from this actor type that has consistent attitude on both Perspective 3 and 4. As he agreed with Perspective 4 that strongly oppose CCS, he also disagreed with Perspective 3 that in favour of CCS. In overall, NGOs are relatively homogeneous with regard to their perspectives as this actor type is dominated by Perspective 1.

Lastly, the results for media show heterogeneous perspective. Average loadings are high for Perspective 1, 2, 3 and very low (negative) for Perspective 4. But no single perspective dominates this actor type. Several possibilities exist for this occurrence. First, it is probably because CCS issue in Indonesia is new and far from mature for media to make opinion. CCS issue is difficult to be disseminated at this time since there is high knowledge gap in the public about CCS. Secondly, it is also possible that CCS is not an interesting issue for media at the moment. And therefore not many information about CCS are known by public. The third possibility is because media tend to be accommodated to all perspectives. And it is not surprising since media serves as the public opinion maker. They can be the supporter or the opponent of such perspective depends on which perspective that is dominant or having less resistance from other actors. Their existence is very critical to those who want to build public acceptance on such agenda, i.e. CCS.

In conclusion, with regard to the perspectives, three actor types are heterogeneous and the other three are rather homogeneous. Energy/power companies, academia and research institutes, and media are heterogeneous with regard to their perspectives. Meanwhile national government is homogeneous on Perspective 2 (CCS as one of the options in CO2 emissions reduction portfolio). Then international counterparts are homogeneous on Perspective 3 (CCS is the only optimal solution to reduce CO2 emissions) and finally NGOs are homogeneous on Perspective 1 (CO2 emissions reduction through clean energy sources rather than CCS). And none of the actor types are homogeneous on Perspective 4 (CCS is only a tactic to keep burning coal forever). It also indicates that most stakeholders do not extremely oppose CCS, but tend to be moderate and see whether CCS is more beneficial or not for Indonesia as CO2 emissions reduction portfolio. Finally Table 6.7 summarizes these findings.
Table 6.7: Distribution of heterogeneity/homogeneity of actor types with regard to perspectives

<table>
<thead>
<tr>
<th>No.</th>
<th>Actor Type</th>
<th>Heterogeneous/Homogeneous (with regard to perspectives)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>National government(^{26})</td>
<td>Homogeneous on Perspective 2 (CCS as one of the options in CO(_2) emissions reduction portfolio)</td>
</tr>
<tr>
<td>2</td>
<td>Energy/power companies</td>
<td>Heterogeneous</td>
</tr>
<tr>
<td>3</td>
<td>Academia and research institutes</td>
<td>Heterogeneous</td>
</tr>
<tr>
<td>4</td>
<td>NGOs(^{27})</td>
<td>Homogeneous on Perspective 1 (CO(_2) emissions reduction through clean energy sources rather than CCS)</td>
</tr>
<tr>
<td>5</td>
<td>International counterparts</td>
<td>Homogeneous on Perspective 3 (CCS is the only optimal solution to reduce CO(_2) emissions)</td>
</tr>
<tr>
<td>6</td>
<td>Media</td>
<td>Heterogeneous</td>
</tr>
</tbody>
</table>

\(^{26}\) Except for the Ministry of Energy and Mineral Resource (the problem owner).

\(^{27}\) Except for Greenpeace.
Conclusion and Discussion

Outline

This chapter presents and discusses the conclusions and summary findings of this study. Section 7.1 discusses the integration between stakeholders, perspectives, and network. It reflects the summary findings of this study. Section 7.2 draws and discusses the conclusions with regard to the research questions based on the findings of this study. And finally section 7.3 presents the implications of this study and also comes up with recommendations for further research.
7.1 Stakeholders, Perspectives, and Network in the Issue of CCS

This study shows that different stakeholders hold different interests, objectives, perceptions, and resources. Yet, they might also hold similar interests, objectives, perceptions, and resources. In the network, stakeholders are tied each others with different kinds of relationships. Their relationships could be formed through sharing the common interests and objectives. Yet, a stakeholder uses its resources to influence other stakeholders in order to achieve its objectives. This study indicates that the way that stakeholders define the problem and its solutions is shaped by perspectives. This implies that different stakeholders with different background or affiliation hold different perspectives. Or within the same organization people may have different perspectives. Stakeholders within the same network organization, like the ministries in the national government, can have different perspectives. Though, their organization political interests are relatively similar.

This study also elucidates that different stakeholders with different background and organization can hold similar perspectives. And therefore they can be connected by sharing perspectives, though their organization political interests are different. Overall, this study clarifies that there exist similarities and differences between perspectives among stakeholders. They can be homogeneous or heterogeneous with regard to perspectives. Furthermore by combining the information in Figure 6.1 and Table 6.7 in chapter six, these findings can be visualized into a distribution chart as illustrated in Figure 7.1.

Figure 7.1: Distribution of favorability and determination with regard to CCS

Figure 7.1 maps out the perspectives on CCS in two dimensions: favorability and determination. This figure illustrates the distribution of favorability and determination of stakeholders with regard to CCS. Favorability measures the level of preference of a stakeholder with regard to CCS, and determination
measures the level of sense of urgency of a stakeholder with regard to CCS. Figure 7.1 also elucidates in details about the distribution of heterogeneity and homogeneity of stakeholders with regard to perspectives. For example, international counterparts are homogeneous on Perspective 3 (CCS is the only optimal solution to reduce CO₂ emissions). In above figure it is clear that the two international counterparts; the FCO UK and WEC-KNEI, are located in the same area. They both have high favorability and determination to CCS. So that it clarifies that Perspective 3 is the perspective with high favorability and determination to CCS. In the other way, Greenpeace which holds Perspective 4 (CCS is only a tactic to keep burning coal forever) is located in the far different area with FCO UK and WEC-KNEI. And it also clarifies that Perspective 4 is the perspective with low favorability to CCS, but high determination to CCS. Note that since Perspective 4 is the opposite of Perspective 3, the determination to CCS for Greenpeace means as the sense of urgency to oppose the idea of CCS.

The findings of this study shed light that the four perspectives on CCS might be interpreted as multi issue in the same agenda of CO₂ emissions reduction. They reflect various interests of stakeholders in regarding CCS as a CO₂ emissions reduction tool. Some stakeholders agree, some others are neutral or even disagree. Most importantly, there exist similarities between perspectives that indicate the intersection between the interests of stakeholders. And when the stakeholders look at this intersection, they might share a common interest which in turns can increase the chance for building mutual collaboration. As in the network of actors, multi issue decision making allows for different actors to share their ideas, gain insights and put their wish lists on the agenda, which in turns gives chance for mutual relations between actors (Bruijn & Heuvelhof, 2008). Furthermore mutual relations can enhance the participation of stakeholders in the policy making process which may make such a policy product becomes more legitimate.

### 7.2 Conclusions with regard to the Research Questions

The first research question is posed as “Who are the stakeholders and what resources do they have?” This research question emphasizes that it is important to know the stakeholders for the purpose of investigating their perspectives. Also by knowing their resources, it could be known that why they should be involved in developing policy on CCS for Indonesia.

Chapter four and five of this study are aimed to answer this research question. The identified stakeholders are from different background and affiliation (as shown in Table 4.1 and Table 4.2 of chapter four, and mentioned in section 5.2 of chapter five): national government, state-owned energy/power companies, private energy companies, academia and research institutes, NGOs, media, and international counterparts. The resources that stakeholders have are vary, based on their background and organization (as displayed in Table 4.2 of chapter four). Formal authority in formulation policy and regulations are important resources of national government like the ministries. Technology, infrastructure, money, human capital, international network are important resources for non-government stakeholders like the state-owned energy/power companies, NGOs.
The second research question is addressed at "What do the stakeholders think about CCS, and what aspects do the stakeholders think should be considered most in the issue of CCS?" The analysis and results of Q methodology discussed in chapter five and six are the answers for this question.

Four stakeholders’ perspectives on CCS are the reflection on what and how the stakeholders think about CCS. These four perspectives are as follows: Perspective 1 “CO₂ emissions reduction through clean energy sources rather than CCS”, Perspective 2 “CCS as one of the options of CO₂ emissions reduction portfolio”, Perspective 3 “CCS is the only optimal solution to reduce CO₂ emissions”, and Perspective 4 “CCS is only a tactic to keep burning coal forever”.

Though there are stakeholders that are strongly agree and disagree with CCS, but in overall most stakeholders are moderate to CCS. Stakeholders tend to figure out the cost and benefit of CCS compare to the other options. And regarding renewables, basically there are no conflicting attitudes among stakeholders. Either to those who strongly support CCS or disagree with CCS. The difference lies in the ‘time dimension’. Those who agree with CCS basically agree with the use of renewables. However there is no clear answer from them about when to replace fossil fuels and move to renewables. And for those who disagree with CCS and have strong belief that renewables can replace fossil fuels by 100%, none of them can give definite answer to when renewables will be ready to take over fossil fuels as the source of energy. Without clear answer on this question, those who strongly agree with CCS will keep on see that there are no optimal solutions to reduce CO₂ emissions without CCS.

Economic and environment are the two aspects that stakeholders think should be considered most for CCS, while social aspect follows after that. Economic consideration underpins mostly to two major points: the cost of CCS and economic benefits of CCS (e.g. for local communities). Most stakeholders see that CCS is a very high cost technology that requires a large amount of money. This can be the drawback for economic development itself. Therefore they also think that CCS implementation needs international financing for developing countries. Environment consideration underpins to the storage of CO₂ and the risk of leakage. These are the roots of environmental consideration on CCS. If storage of CO₂ cannot be guaranteed on its safety and long term liability, then CCS will not give impact to CO₂ emissions reduction. It is just shifting the trash from one garbage to garbage.

The third research question is addressed at "What kind of stakeholder involvement strategy is required to develop CCS policy in Indonesia?” Answers for this research question can be derived from the findings of the map of stakeholders in chapter four and stakeholders’ perspectives in chapter five and six.
This study concludes that the most logical and plausible stakeholder involvement strategy that is required to develop CCS policy in Indonesia at the moment could be through conducting an ‘inclusive and balance’ stakeholder dialogue. Stakeholder dialogue in the context of this study is a form of organized meeting aimed to enhance the participation of stakeholders in the policy formation of CCS in Indonesia. Inclusive and balance means that the dialogue should include a wide range of stakeholders from different background, affiliations, and also heterogeneous perspectives. This implies that stakeholder dialogue should also ensure the process of gaining insights and sharing knowledge, ideas, views, and opinions from various stakeholders (Cuppen, et al., 2010). Stakeholder dialogue is a basis for creating mutual collaboration of stakeholders in order to develop CCS policy in Indonesia. And on top of that, it is expected that not only a legitimate CCS policy, but also a good CCS policy can be developed through stakeholder dialogue. Furthermore, there are three subjects need to be elaborated for the purpose of conducting stakeholder dialogue. The first is ‘which stakeholders should be involved’. This subject serves as the guideline for selecting participants. The second is ‘what issues should be put in the agenda of dialogue’. This subject aims to define the issue for the agenda of dialogue. And the third is ‘how the dialogue could be conducted’. This subject aims to define the stages of the dialogue which consists of performing focus groups dialogue, synthesis, and disseminating the results. Figure 7.2 displays the schematic steps for an ‘inclusive and balance’ stakeholder dialogue.

![Figure 7.2: Steps for an ‘inclusive and balance’ stakeholder dialogue](image)

**Which stakeholders should be involved?**

First of all, stakeholder dialogue should have a balance of participation of stakeholders from different background and affiliation, interest, objectives, resources, and perspectives with regard to CCS. It should ensure that all participants respect each other’s contribution in the dialogue and seek for collective objectives. With regard to perspectives, stakeholder dialogue should comprise participants with different perspectives on CCS. So that it is not only limited to those who hold Perspective 3 (CCS is the optimal solution to reduce CO₂ emissions) and 2 (CCS as one of the options in CO₂ emissions reduction portfolio), but also Perspective 1 (CO₂ emissions reduction through clean energy sources rather CCS) and 4 (CCS is only a tactic to keep burning coal forever). This implies that the dialogue is
not limited the participation of only national government, but also involves the state-owned energy/power companies, private energy companies, academia and research institutes, NGOs, international counterpart, and also media.

What issues should be put in the agenda of dialogue?
Principally, stakeholder dialogue is used to clarify values and arguments that different stakeholders hold. Clarifying values and arguments is the important part of stakeholder dialogue as the basis for building mutual understanding concerning the issue (Enserink, et al., 2009). The four stakeholders’ perspectives on CCS represent the values and argument that different stakeholders hold regarding CCS. These might be interpreted as multi issue in the agenda of CO₂ emissions reduction. So it is quite clear that the four stakeholders’ perspectives can be put as the issues in the agenda of dialogue, where stakeholders can clarify to each other about the claim and reason that why they hold such perspective. Following are the four major issues and its possible derivatives that can be put in the agenda of dialogue:

1. CO₂ emissions reduction through clean energy sources rather than CCS.
   (Why clean energy sources?, what kind of clean energy sources?, etc.)
2. CCS as one of the options in CO₂ emissions reduction portfolio.
   (What options are more suited than CCS?, does CCS benefit local communities?, how to include CCS into CDM?, etc.)
3. CCS is the only optimal solution to reduce CO₂ emissions.
   (Why CCS?, how CCS can be delivered within reasonable time?, how to finance CCS, how to advance the role of developed country in technology transfer of CCS?, etc.)
4. CCS is only a tactic to keep burning coal forever.
   (Why CCS is risky and unsafe, how renewables can replace fossil fuels within reasonable time, etc.)

How the dialogue could be conducted?
After selecting participants and determine the issues, stakeholder dialogue could be conducted in three stages. The first stage is performing focus groups dialogue, the second is performing synthesis, and the third stage is disseminating the results.

The first stage is to perform the dialogue into two focus groups for the effectiveness of the dialogue. Each group focuses on two issues that are different one to another. And each group should have balance participants. It is to ensure the balance of the dialogue where different stakeholders can have an equal opportunity to clarify and understand the values and arguments of each of the four perspectives. Following is the example of the composition of the issues in each focus group:

1. Focus group 1, with the topic issues:
   a. CO₂ emissions reduction through clean energy sources
Chapter 7 | Conclusion and Discussion

2. Focus group 2, with the topic issues:
   a. CCS as one of the options in CO₂ emissions reduction portfolio
   b. CCS is only a tactic to keep burning coal forever

The second stage is to perform the synthesis. The synthesis means to meet the results of the two focus groups. So that in this stage the similarities and differences of the issues are evaluated, and conclusions are drawn.

The third stage is to disseminate the results of synthesis to the public or wider stakeholders for getting feedback. The feedback then can be used to evaluate the results and the process of stakeholder dialogue, and also as the input material for the focus groups.

7.3 Implications of the Study and Recommendations for Further Research

This study shows that stakeholders vary in their perspectives on CCS. It is reflected by the four stakeholders' perspectives on CCS. In this regard, Q methodology shows its usefulness in uncovering these perspectives. Doing Q research gives more chance to understand people perspectives in more nuanced way, rather than only to see at the pro and contra points of views. This method gives more rooms to interact with the respondents' emotions. Different respondents have different perspectives. And how the respondents 'react and respond' to the Q statements were influenced not only by their knowledge on CCS, but sometimes it was much more by their interests and beliefs.

Two activities are identified as very crucial in Q methodology: concourse definition/selection of Q statements and Q interview. Yet, when performing these two activities, some limitations are identified as follows:

- Even though the source of information about CCS was highly available, but only limited that was related with Indonesia case. It was not so easy to select the Q statements that represent in specific the case of CCS in Indonesia. This implies that statements were selected for their similarities and as close as possible with the current situation in Indonesia, even though they were not actually the case for Indonesia.

- There were a lot of statements about CCS, but sometimes they looked similar, not only in the wordings but also in the meanings. Defining concourse iteratively with the help of two or more researchers could give the clarity of the meanings of the selected words/statements. Yet, defining concourse with two people or more, sometimes time consuming. Since each researcher has his/her own perspectives on the statements, long discussions occurred. This could be the disadvantage of this methodology in term of time framing. If such a research needs to be performed in a very limited time, Q might not give a good result. Because the concourse definition is done in a short time which might yield poor quality of Q statements.

- Based on the experience during the Q interview, sometimes respondents need some explanations about the meanings of the words/statements. When they misunderstood the meanings, the Q
sort might result in improper manner. For example a respondent because he did not know the meaning then gave a high score for a statement. But after the researcher explained the meaning, he gave a low score for that statement. Moreover the number of the statements was quite a lot for some respondents to deal with (forty five statements). Because of this some respondents need more time and sometimes need to redo the Q sort from the beginning. This was something quite problematic for both researcher and respondent. Yet, conducting Q sort was much more effective to those who have well knowledge about the issue.

Another activity that is also important in Q methodology is interpreting the results. This is the part where a researcher plays with social narrative. And narrating social perspectives is something of art. The names of the four perspectives were derived by the researcher ‘sense of wordings’. This is the room where a researcher can express what they think about respondents’ perspectives. It is also the process of transforming quantitative data into the meaningful insights about people subjectivity. And therefore this step is also important in term of how then people understand the results of the study by looking at the researcher’s report. Whether it is meaningful and describing the true findings or just contains narratives without meanings.

This study also shows that Q methodology might also be used to select participants for a stakeholder dialogue. And therefore this also implies that this study could also be regarded as the preparation for a stakeholder dialogue (as mentioned earlier in the introduction chapter). Commonly, selecting participants for a dialogue is performed based on background of organization or affiliation. But this study shows that selecting participants could also be based on perspectives, which could result in a different group composition than a selection based on background of organization or affiliation. So that by selection based on perspectives, a dialogue could be more inclusive and balance in the composition of the participants.

Furthermore, this study indicates that in overall most stakeholders tend to be moderate on CCS. It has two meanings with regard to the future of CCS in Indonesia. The first is that there is a chance for CCS to be implemented without significant barriers from stakeholders, and the second is that stakeholders tend to wait and see whether CCS will be more beneficial or not for Indonesia. And for the second reason it also means that stakeholders will not take the risk to implement CCS if such requirements are not fulfilled. This implies that stakeholders tend to raise such question like ‘what’s in CCS for Indonesia?’ Issues that have nothing to do with CCS but concern with the interests of stakeholders are therefore particularly important.

Based on the findings of this study, the risk of storage CO₂ underground and the risk of leakage are the central of the environment issue of CCS. Most stakeholders regarded these issues as the controversial part of CCS. Also by looking at the cases of public debates on CCS, e.g. Barendrecht in the Netherlands and Brandenburg in Germany, it can be concluded that the risk of storage CO₂ underground issue is a common thing in CCS debates. Public acceptance on CCS seems very much
dependent on how the storage of CO2 underground can be safe in the long term, for environment and as well as for the people.

This study also envisages an important lesson that sometimes involving stakeholders is not enough by only informing or conducting some meetings. As shown for example in the case of Barendrecht, there existed the communication between opposing parties. Project developer informed the public about CCS and meetings between parties were made. Yet, the government and project developer paid lip service to the importance of public acceptance. Public saw little seriousness of the purpose in addressing public acceptance from the government. Information deemed insufficient and unreliable for the public (Reiner, 2010). This indicates that government or policy makers should take an active role for building a more meaningful interaction with the public. In this regard, this study suggests that an inclusive and balance stakeholder dialogue might play a role in building a mutual interaction between government/policy makers and public/stakeholders in Indonesia about CCS.

Finally, after above explication, following are the recommendations for further research:

1. Stakeholders’ perspectives are dynamics and can change over time. This implies that the validity of the current findings is limited in time. So it is recommended to re-execute the study after period of time, for example after a stakeholder dialogue is conducted. This also applies for mapping the stakeholders’ characteristics such as their objectives, resources and relationships in the network. And it is also recommended to re-execute stakeholder analysis not only based on text-analysis but also with a deep interview.

2. Because of lack of contacts, there was no respondent from the Ministry of National Development Planning/Agency of National Development Planning (BAPPENAS). While as indicated in this study, this ministry plays important role in the formulation of long term national plan in many vital sectors (e.g. energy, environment). So it is highly recommended for further research to include the respondent from this ministry for the purpose of investigating the perspective on CCS.

3. This study has not yet investigated the perspectives of local government and local community about CCS. Whilst the actual implementation of CCS seemingly possible affect the local government and local community. Where for example the storage area might be located under the authority of local government and near to the residents living hood. In this regard, it is highly recommended for further research to investigate local government and local community opinions on CCS.

4. A comparison with other cases might give a better understanding on the issue of CCS. In this regard, it is recommended for further research in making comparison about the perspectives of stakeholders in the other developing countries that also have plan with CCS, e.g. China, India.

5. This study provides only a snapshot design of stakeholder dialogue. It did not make a detail design, just an overview of how a dialogue would look like. So it is highly recommended for further research to design the detail of the dialogue, e.g. about when and where the dialogue might be conducted.
References


Appendix A: Q Statements

1. Coal utilization is very essential for developing countries in order to boost their economic growth.
2. CCS is only a tactic to keep burning coal forever.
3. CCS is a measure to remediate previous uncaring behavior in burning fossil fuels.
4. The world can fight climate change only by reducing its dependency on fossil fuels.
5. Increased adoption of CCS will encourage penetration of renewables.
6. CCS should be used only temporarily and as a partial solution to the climate change problem.
7. Given the uncertain future of renewable energy technologies, investment in CCS is necessary.
8. Cost reductions in renewable energies and a reasonable price for CO₂ will make them competitive with coal and CCS.
9. A reduction of CO₂ emissions from the energy sector should be implemented by using clean energy sources.
10. Rather than increasing dependency on fossil fuels, efforts should be focused on energy efficiency and renewable energy.
11. CCS can be a major element of low carbon energy economy for Indonesia.
12. In order to achieve substantial global emission reduction, we need all options.
13. CCS is the only way forward for the developing world to have sustainable growth.
14. CCS must also be adopted by other industries, e.g. biomass and gas power plants and in the fuel transformation and gas processing sectors.
15. CCS does not provide long-term benefits to local communities, whereas a shift to renewable energy and energy efficiency would promote employment and new economic opportunities.
16. CCS should be approved in the Clean Development Mechanism (CDM) in order to provide funding for CCS in developing countries.
17. CCS wastes energy: it uses between 10% and 40% of the energy produced by a power station.
18. All climate and energy policies must be focused to achieve emission cuts level without reliance on CCS.
19. CCS technology will not be ready in time to overcome climate change.
20. The pursuit of CCS as a ‘solution’ is unwise given its lack of technological maturity and the absence of commercial viability.
21. The developed countries must lead the CCS effort and CCS should be spread rapidly to the developing countries.
22. Concerns about CCS, e.g. from local communities, are legitimate and need to be addressed.
23. CCS gives hope since it has potential to be affordable also to economies in transition.
24. CCS should be safe on the short term as well as on the long term, both for humans as well as for the environment in general.
25. CCS is complex enough in itself, it should not be linked to other possible advantages such as Enhanced Oil Recovery.
26. Even if CCS could significantly reduce CO₂ emissions, it would not solve other problems which are inherent to the combustion of dirty fuels.

27. To generate public confidence in CCS, health and safety regulations for capture, transport and storage should be guaranteed.

28. Governments must secure land for CO₂ pipeline infrastructure where that is deemed to be in the public interest.

29. Installing a pipeline for CO₂ transport in Indonesia should take into account seismic risk and potential leakage over the long term.

30. Pipelines are the most appropriate CO₂ transportation option for Indonesia.

31. Storing CO₂ in sedimentary basins can be regarded as mimicking the natural system.

32. CCS may reconcile fossil-fuel use with climate targets, but this presumes storage capacity to be available, and safety to be guaranteed.

33. The most promising financing mechanism for CCS is the one that utilizes the carbon market or emissions trading schemes.

34. Governments should take the lead on developing community-tailored CCS public engagement strategies.

35. Commitment of and cooperation between different stakeholders is a crucial condition for the successful implementation of CCS.

36. Acceptance of CCS begins with building awareness of the need and the feasibility of CCS deployment through public discussions and media coverage.

37. A greater understanding of the urgency and severity of the climate change problem will make CCS more acceptable.

38. Financial incentives are necessary for industry to invest in CCS.

39. Indonesian government should develop a CCS roadmap that is embodied in the national energy plan.

40. CCS is only feasible for large point sources of emissions and therefore at odds with a more decentralized energy system.

41. To take economic advantage of CCS, storage locations should be near to the large and centralized power plants.

42. Selection of storage sites needs to be backed up by demonstrative models that identify potential migration and seepage paths within the defined site boundaries.

43. We simply do not know enough about how stored CO₂ will behave - safe and permanent CO₂ cannot be guaranteed.

44. Even if CCS becomes feasible, capable of long-term storage, safe, and commercially viable, its impact would be limited and come at a high cost.

45. CCS could be a cost-effective answer to a high carbon tax.
Appendix B: Correlation Matrix between Q Sorts
### Appendix C: Unrotated Factor Matrix

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| Eigenvalue | 9.9466 | 3.2430 | 1.0555 | 0.3768 | 0.9682 | 0.9015 | 0.8730 |
| % expl. Var. | 33 | 11 | 4 | 1 | 3 | 3 | 3 |
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### Appendix D: Q Factor Loading

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% expl. Var. | 13 | 17 | 18

X indicating a defining sort.
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### Appendix E: Q Factor Scores

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<th>No.</th>
<th>Q statement</th>
<th>Factor Arrays</th>
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<td>1</td>
<td>Coal utilization is very essential for developing countries in order to boost their economic growth.</td>
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<tr>
<td>2</td>
<td>CCS is only a tactic to keep burning coal forever.</td>
<td>-3 -4 -5</td>
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<tr>
<td>3</td>
<td>CCS is a measure to remediate previous uncaring behavior in burning fossil fuels.</td>
<td>-1 1 4</td>
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<td>4</td>
<td>The world can fight climate change only by reducing its dependency on fossil fuels.</td>
<td>1 0 -3</td>
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<td>5</td>
<td>Increased adoption of CCS will encourage penetration of renewables.</td>
<td>-3 -1 -4</td>
</tr>
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<td>6</td>
<td>CCS should be used only temporarily and as a partial solution to the climate change problem.</td>
<td>-1 2 -3</td>
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<tr>
<td>7</td>
<td>Given the uncertain future of renewable energy technologies, investment in CCS is necessary.</td>
<td>1 -2 -3</td>
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<td>8</td>
<td>Cost reductions in renewable energies and a reasonable price for CO2 will make them competitive with coal and CCS.</td>
<td>5 1 -2</td>
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<td>9</td>
<td>A reduction of CO2 emissions from the energy sector should be implemented by using clean energy sources.</td>
<td>3 2 -1</td>
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<td>10</td>
<td>Rather than increasing dependency on fossil fuels, efforts should be focused on using energy efficiency and renewable energy.</td>
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<td>11</td>
<td>CCS can be a major element of low carbon energy economy for Indonesia.</td>
<td>-4 -5 -2</td>
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<tr>
<td>12</td>
<td>In order to achieve substantial global emission reduction, we need all options.</td>
<td>2 -3 1</td>
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<tr>
<td>13</td>
<td>CCS is the only way forward for the developing world to have sustainable growth.</td>
<td>1 5 3</td>
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<tr>
<td>14</td>
<td>CCS must also be adopted by other industries, e.g. biomass and gas power plants and in the fuel transformation and gas processing sectors.</td>
<td>-1 3 -3</td>
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<tr>
<td>15</td>
<td>CCS does not provide long-term benefits to local communities, whereas a shift to renewable energy and energy efficiency would promote employment and new economic opportunities.</td>
<td>-3 2 -1</td>
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<td>16</td>
<td>CCS should be approved in the Clean Development Mechanism (CDM) in order to provide funding for CCS in developing countries.</td>
<td>-3 -2 -1</td>
</tr>
<tr>
<td>17</td>
<td>CCS wastes energy: it uses between 10% and 40% of the energy produced by a power station.</td>
<td>-2 -3 -4</td>
</tr>
<tr>
<td>18</td>
<td>All climate and energy policies must be focused to achieve emission cuts level without reliance on CCS.</td>
<td>-3 4 -4</td>
</tr>
<tr>
<td>19</td>
<td>CCS technology will not be ready in time to overcome climate change.</td>
<td>-2 -2 -4</td>
</tr>
<tr>
<td>20</td>
<td>The pursuit of CCS as a 'solution' is unwise given its lack of technological maturity and the absence of commercial viability.</td>
<td>0 0 -3</td>
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<tr>
<td>21</td>
<td>The developed countries must lead the CCS effort and CCS should be spread rapidly to the developing countries.</td>
<td>-1 -1 -5</td>
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<tr>
<td>22</td>
<td>Concerns about CCS, e.g. from local communities, are legitimate and need to be addressed.</td>
<td>-2 4 1</td>
</tr>
<tr>
<td>23</td>
<td>CCS gives hope since it has potential to be affordable also to economies in transition.</td>
<td>-1 -2 2</td>
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<tr>
<td>24</td>
<td>CCS should be safe on the short term as well as on the long term, both for humans as well as for the environment in general.</td>
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<tr>
<td>25</td>
<td>CCS is complex enough in itself, it should not be linked to other possible advantages such as Enhanced Oil Recovery.</td>
<td>-1 -4 -2</td>
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<td>26</td>
<td>Even if CCS could significantly reduce CO2 emissions, it would not solve other problems which are inherent to the combustion of dirty fuels.</td>
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<tr>
<td>27</td>
<td>To generate public confidence in CCS, health and safety regulations for capture, transport and storage should be guaranteed.</td>
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<td>28</td>
<td>Governments must secure land for CO2 pipeline infrastructure where that is deemed to be in the public interest.</td>
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<tr>
<td>29</td>
<td>Installing a pipeline for CO2 transport in Indonesia should take into account seismic risk and potential leakage over the long term.</td>
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<td>30</td>
<td>Pipelines are the most appropriate CO2 transportation option for Indonesia.</td>
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</tr>
<tr>
<td>31</td>
<td>Storing CO2 in sedimentary basins can be regarded as mimicking the natural system.</td>
<td>-5 -1 -1</td>
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<tr>
<td>32</td>
<td>CCS may reconcile fossil-fuel use with climate targets, but this presumes storage capacity to be available, and safety to be guaranteed.</td>
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## Appendix E: Q Factor Scores (cont’)

<table>
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<tr>
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<td>33</td>
<td>The most promising financing mechanism for CCS is the one that utilizes the</td>
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<td>carbon market or emissions trading schemes.</td>
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<td>34</td>
<td>Governments should take the lead on developing community-tailored CCS</td>
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<td>public engagement strategies.</td>
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<td>35</td>
<td>Commitment of and cooperation between different stakeholders is a crucial</td>
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<td></td>
<td>condition for the successful implementation of CCS.</td>
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<td>Acceptance of CCS begins with building awareness of the need and the</td>
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<tr>
<td></td>
<td>feasibility of CCS deployment through public discussions and media coverage.</td>
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<tr>
<td>37</td>
<td>A greater understanding of the urgency and severity of the climate change</td>
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<tr>
<td></td>
<td>problem will make CCS more acceptable.</td>
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<td>Financial incentives are necessary for industry to invest in CCS.</td>
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<td>Indonesian government should develop a CCS roadmap that is embodied in the</td>
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<td>national energy plan.</td>
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<td>40</td>
<td>CCS is only feasible for large point sources of emissions and therefore at</td>
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<td>odds with a more decentralized energy system.</td>
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<td>To take economic advantage of CCS, storage locations should be near to the</td>
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<td>large and centralized power plants.</td>
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<td>Selection of storage sites needs to be backed up by demonstrative models</td>
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<td>that identify potential migration and seepage paths within the defined site</td>
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<td>boundaries.</td>
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<td>We simply do not know enough about how stored CO₂ will behave - safe and</td>
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<td>permanent CO₂ cannot be guaranteed.</td>
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<td>Even if CCS becomes feasible, capable of long-term storage, safe, and</td>
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<td>commercially viable, its impact would be limited and come at a high cost.</td>
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<td>CCS could be a cost-effective answer to a high carbon tax.</td>
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