Politics for energy security or a geopolitical struggle for power?
A thematic text analysis of EU policy making of critical metals for renewable energy

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Abstract

This thesis analyses EU policy making on critical metals for renewable energy technologies, with a focus on Rare Earth Elements (REEs) and cobalt. A thematic text analysis on EU documents published between 2010-2018 was conducted to identify themes and patterns in the EU debate and policy-making. The results showed that the EU has a clear objective to secure access to critical metals, to reduce import dependency and increase competitiveness on the market for critical metals. The key strategies to secure access to metals are to increase primary supply by increased domestic mining and by investing in countries with large reserves of critical metals; to improve recycling rates of these metals; to find substitution metals to replace the critical ones; and to focus on resource diplomacy. Environmental and social risks from an increased demand for REEs and cobalt gain little attention in the studied documents. Geopolitical risks are concluded as linked to the dependency on import from a few producing countries, China for REEs and DR Congo for cobalt, and are mainly focused on risks affecting the EU access to the metals. The struggle over resources and related geopolitical interactions are concluded to be affected by historical and existing global power structures. Further, the thesis concludes that EU resource diplomacy aims at facilitating for the EU to remain a powerful and competitive actor on the global market for trade of critical metal.

Keywords: Critical metals, cobalt, European Union, Rare Earth Elements, Renewable Energy

List of abbreviations

CRM - Critical Raw Materials
DR Congo – The Democratic Republic of the Congo
EU – European Union
IPCC - Intergovernmental Panel on Climate Change
GATT - The General Agreement on Tariffs and Trade
REE - Rare Earth Elements
WTO - World Trade Organisation

1. Introduction

In the Paris agreement from 2015 the world has agreed on a common target of staying well below an increase of two degrees centigrade compared to pre-industrial levels. To be able to meet this goal there is a need for worldwide immediate action and dramatic changes. The global primary energy demand is projected to vastly increase with the coming development, increasing world populations and a growing global middle class (Ozkan, 2018). This happens at the same time as we need to reduce the emissions from our energy use. A shift to zero- and low carbon energy sources in a near future is thereby on a wide scale argued as a crucial step forward to be able to achieve the 2-degree target (IPCC, 2014), let alone, to reach the more ambitious goal of the Paris Agreement.

In the last decade the world has seen a dramatic increase in adoption of renewable energy technologies as the costs for i.e. solar and wind power or alternative fuel vehicles have
decreased. This transition is estimated to continue, and many countries have set high goals for the share of renewables in the local energy mix. The Intergovernmental Panel for Climate Change (IPCC) has estimated that up to 80 percent of the world’s energy supply could be met by renewables by year 2050, if the right policies are implemented. The International Energy Agency has a global goal of 40 percent renewables by year 2020 (Cruciani, 2013; IPCC, 2014) and the European Union (EU) has an average objective of 21 percent of renewables in 2020 and 27% in 2030 within the EU (European Commission, 2018b).

An increased adoption of renewable energy does however not only come with decreased emissions of greenhouse gases, it also means an increased demand for materials needed for the production of renewable energy technologies (Hurd et al., 2012). Several different precious metals are needed for future energy technologies and those with supply shortage concerns are often referred to as critical metals or critical raw materials (Nansai et al., 2015). Many of these metals are mined in a limited number of countries with both environmental and social risks linked to them. The imbalance between demand and access to these metals has resulted in a global competition over resources that seem to accelerate with the transition to renewable energy (De Ridder, 2013). This situation has gained increased interest by nations and regions that rely on import and have low domestic production of the critical metals, such as the EU. To be able to understand future challenges with a transition to renewable energy, it is necessary to understand how these critical metals could affect complicated geopolitical relations and how countries and regions conduct policies in this global struggle for resources.

The traditional definition of geopolitics is “the influence of geography upon foreign relations of states” (O’Sullivan, Overland and Sandalow, 2017, p. 1). A more modern view is that geopolitics is a discourse about world politics and that it is socially bound to perceptions of the world and influenced by historical and current power structures (Tuathail, 2006). The globalisation has created a world where countries need to interact with each other and where trade between countries and regions has become crucial for development and welfare. The energy sector has for long been highly involved in this globalisation process and energy sources have made countries interact with each other at the same time as becoming dependent on each other. Our societies have for more than a century been dependent on oil, coal and natural gas for our use of energy and the geopolitics of energy has thereby been the same as the geopolitics of these raw materials. Paltsev (2016, p. 390) defines energy geopolitics as “the way countries influence one another through energy supply and demand”. The use of oil, coal and gas has shaped our societies, relations between nations and global development and a new energy mix will most likely result in new interactions with different challenges. Even though the energy use is still dominated by energy from fossil fuels it is clear that a transition in this sector has started to take place and already shows impacts on international relations and on the global market for raw materials (O’Sullivan, Overland and Sandalow, 2017). This development affects supply and demand of energy related resources and the impacts linked to these balances. The geopolitical power will likely shift from fossil fuel producing countries to countries rich on materials needed for renewable energy technologies and to countries with innovative and financial power to develop these technologies (O’Sullivan, Overland and Sandalow, 2017). Today’s geopolitics of energy can thereby be defined as implications for energy relations of a transition to renewable energy. Some argue that this change will provide diversification and energy security (De Ridder, 2013; Scholten and Bosman, 2016; O’Sullivan, Overland and Sandalow, 2017), while others raise risks of new conflicts over resources, increased environmental impacts (Månsson, 2015) and resource shortages resulting in geopolitical instability (Hurd et al., 2012; Paltsev, 2016; O’Sullivan, Overland and Sandalow, 2017).
As an effort to secure future supply of critical metals needed for renewable energy technologies, policy makers worldwide are formulating strategies on how to mitigate supply risks and how to handle challenges with the increasing demand. The EU has relatively little production locally and thereby rely heavily on import from other countries (Moss et al., 2013a; O’Sullivan, Overland and Sandalow, 2017). The EU has, like many other import dependent countries, identified a number of critical raw materials of high importance for the union’s economy and considered to be at risk when it comes to the supply. These materials are included in the so-called CRM list which includes 27 materials (European Commission, 2017a). For the complete CRM list see appendix 1.

1.1 Aim and research questions
The aim of this thesis is to analyse EU policy-making on critical metals needed for renewable energy technologies. The focus is set on metals within the group of Rare Earth Elements (REEs) and on cobalt. The European Commission has identified these as critical for renewable energy technologies and the production is highly concentrated to a limited number of countries, China and the Democratic Republic of the Congo (DR Congo). The European Commission considers the political risk in these countries as high and the risk for supply shortages is considered to be a future challenge for continued development of renewable energy technologies (Blagoeva et al., 2016; European Commission, 2017a).

The thesis aims to answer the following questions:

- How is the demand and supply of REEs and cobalt raised in EU policy making and other communication?
- What challenges, for importing and producing countries, in terms of environmental, social and geopolitical risks are discussed in the EU documents in relation to the supply and demand for REEs and cobalt?
- What strategies and actions are proposed as measures to address demand and secure supply of these metals and to mitigate the identified risks?

1.2 Previous research
According to O’Sullivan, Overland and Sandalow (2017) relatively little research has been done on the field of geopolitics of renewable energy and the research easily get outdated because of continuous development of renewable energy technologies. The most recent research found on geopolitics of renewable energy is by Criekmans (2011); De Ridder (2013); Sweijs et al. (2014); Paltsev (2016) and by Scholten and Bosman (2016). All these scientists have analysed the challenges with an increased demand for a wide range of critical metals. In 2017 Klinger J.M. published the book Rare Earth Frontiers, a work of human geography with a focus on global politics of REEs. This book presents research on the geopolitics of REEs and points specifically on how the global perception of a current supply risk has resulted in mining exploration of remote spaces that in history have been protected from centralized power. In a recent article by Månberger and Stenqvist (2018) it is concluded that reserves of many critical metals, including REEs and cobalt, are unlikely to constrain growth rates of renewable energy technologies. In this article it is further promoted that policy makers should focus on developing technologies that utilise alternative more abundant metals, improve metal intensity and increase recycling rates to reduce vulnerability to supply shortages.

In previous research little focus has been put on region or country specific consequences of a transition to renewable energy. O’Sullivan, Overland and Sandalow (2017) point at the need for this kind of focus in research and give examples of several countries and regions that would
be interesting to look more closely at. Among these are for example African oil producers, East Asia, Latin American oil producers or EU as an import dependent region. The policy view within existing research has mainly focused on international relations on a global scale. For example an article by Hurd et al. (2012) that highlights relevant market factors related to Energy Critical elements and reviews policy recommendations made by various countries.

Little focus in previous research is however put on regional or country specific politics related to critical metals from a geopolitical perspective, which is why this thesis could add something new to the field and open up for further research. By looking specifically at EU policy making related to critical metals, an improved understanding can be gained of how import dependent countries act in this new geopolitical landscape.

2. Background
This section will provide some background information considered as needed to understand the problem formulation and the aim of this thesis. The objective is to give the reader a basic knowledge to be able to more easily follow the thesis analysis.

2.1 Critical metals for renewable energy
Since the industrial revolution, technological advances have continued to increase, requiring an increased number of raw materials to produce ever more sophisticated technologies. Today we have several sectors that are critical for the economy, such as the automotive, chemical industries, electronics manufacturing and certainly also energy technologies. There is a wide range of raw materials needed in the production of renewable energy technologies and many of them are also considered as critical because of an increasing demand and a current production that is limited to a few countries, sometimes with low political stability (Hurd et al., 2012; Grandell et al., 2016). Many of these materials are precious metals vital for the performance of i.e. generators in wind turbines or batteries for electric vehicles (Pavel and Blagoeva, 2017). Critical metals have gained increased attention as strategic important for a continued development of low-carbon technologies and energy security (Grandell et al., 2016). Table 1 below summaries the most critical metals for different renewable energy technologies and is based on findings from several scientific studies. In this thesis the focus has however been set only on two of the identified metals; REEs and cobalt.

<table>
<thead>
<tr>
<th>Critical metal</th>
<th>Main technology</th>
<th>Component</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dysprosium (REE)</td>
<td>Wind</td>
<td>Generators</td>
</tr>
<tr>
<td></td>
<td>Electric vehicles</td>
<td>Motors</td>
</tr>
<tr>
<td>Neodymium (REE)</td>
<td>Solar Photovoltaic cells</td>
<td>Thin photovoltaic film</td>
</tr>
<tr>
<td>Gallium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tellurium</td>
<td>Electric and hybrid vehicles</td>
<td>Lithium-ion batteries</td>
</tr>
<tr>
<td>Silver</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cobalt</td>
<td></td>
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<tr>
<td>Lithium</td>
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<td>Copper</td>
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<tr>
<td>Platinum</td>
<td>Fuel cells</td>
<td>Catalysts and separators</td>
</tr>
</tbody>
</table>

Sources: (Fromer, Eggert and Lifton, 2011; Moss et al., 2013; Nansai et al., 2015; Grandell et al., 2016; O’Sullivan, Overland and Sandalow, 2017)
The REEs is a group of metals that has been identified as critical and with risk of supply shortage (De Ridder, 2013; Klossek, Kullik and van den Boogaart, 2016; O’Sullivan, Overland and Sandalow, 2017). The REEs are a set of seventeen chemical elements in the periodic table. Within this group of elements several are commonly used in clean energy technologies, often in nominal amounts, but critical to the unit’s performance. The U.S. Department of Energy has, in their critical material strategy (2011), identified five REEs as critical for the development of renewable energy technologies (Bauer et al., 2011; Hurd et al., 2012). Research done by the Resnick Institute (California Institute of Technology) conclude that some of the REEs demonstrate constraints to expansion of renewable energy technologies and points specifically at dysprosium as the most critical in short term because of an increased demand for magnets in wind turbines and electric and hybrid cars (Fromer, Eggert and Lifton, 2011). The demand for the REEs dysprosium and neodymium has increased disproportionately to the demand for other REEs (Alonso et al., 2012). These two are commonly used in permanent magnets in wind turbines. The magnets consist of alloys of these elements and can produce high magnetic fields which makes it possible to generate a high torque also for light and compact generators (Moss et al., 2013a; Grandell et al., 2016). The present technologies for large wind turbines thereby rely heavily on the REEs and an increased demand for these technologies would thereby mean an increased demand for these metals (Alonso et al., 2012).

Cobalt is another metal commonly raised as critical, primarily for the transition to a low-carbon transport sector (O’Sullivan, Overland and Sandalow, 2017). Cobalt is used in a number of industrial application, but the use in different types of batteries has the biggest share (Lebedeva, Di Persio and Boon-Brett, 2017). Cobalt thereby plays an important role for the increased production of hybrid and electric vehicles (Exner, Lauk and Zittel, 2015). Some scientists argue that the current cobalt deposits are not sufficient to meet the growing demand with the future penetration of electric vehicles, if we use the same technological solutions as we have today (Lebedeva, Di Persio and Boon-Brett, 2017).

2.2 Geographical distribution of reserves and production

Many of the metals that are needed for continued development of renewable energy technologies are in terms of both reserves1 and production distributed unevenly over the world. The future availability of REEs is for example of concern due to this reason. These elements are, despite the name, not rare and are relatively abundant in the Earth’s crust. Since they were unknown when they were first identified in 1794, they were presumed to be rare and got their name from that faulty thinking (Klinger, 2017). Resources of REEs are found in many countries in the world, but often in dilute concentrations and thereby difficult to extract efficiently and without serious environmental impacts (Fromer, Eggert and Lifton, 2011; O’Sullivan, Overland and Sandalow, 2017). Two countries together, China and Russia, hold 57 % of current known global reserves of REEs, the largest remaining country is Australia who holds 2,4 % of global reserves (O’Sullivan, Overland and Sandalow, 2017). In Europe, Sweden has a high proportion of so called heavy REEs, but no current production (Moss et al., 2013). As it is today, China control approximately 95 % of the current global production of REEs (European Commission, 2018a) and production that takes place elsewhere generally need to be exported to China for processing and then re-imported (O’Sullivan, Overland and Sandalow, 2017). China began to sell REEs to very low prices in the 1980s and mines in many other countries, i.e. in the United States, were forced to close because they could no longer make a profit (Turra, 2017). China’s near monopoly of the REE market gained considerable global

1 The definition of a reserve is where the resources are abundant enough to be economically recovered with existing techniques and knowledge for extraction. Remote places such as i.e. the ocean bed is thereby not included when talking about reserves (Interview, Official at the European Commission, 2018).
interest following China’s systematic tightening of export quotas in 2010 and 2011. As a result of these export restrictions the price for many REEs rose (Moss et al., 2013). This new political strategy pointed at many countries’ dependence on China’s REE-products (Hurd et al., 2012; Klossek, Kullik and van den Boogaart, 2016).

Cobalt is also a material with limited geographic distribution. The DR Congo holds the world’s largest known cobalt reserves (De Ridder, 2013) and provides approximately 51% of the global production of cobalt (O’Sullivan, Overland and Sandalow, 2017). China, Russia, Canada and Australia are other producing countries but their shares of the current production are much smaller (Lebedeva, Di Persio and Boon-Brett, 2017). The vast majority of cobalt import into the EU comes from Russia (91%) (European Commission, 2017a).

The size of the global reserves of certain metals and the production distribution between countries change over time. Investments in exploration and extraction, available technologies and the cost of extraction and processing are parameters that affect what reserves that are commercially viable to extract and where the production will take place. The demand for metals also change continually with innovation and new technologies, which makes it hard to foresee the future demand and supply of certain metals (O’Sullivan, Overland and Sandalow, 2017). Since the countries within EU has little production of both REEs and cobalt, as well as other critical metals needed for renewable energy technologies, the union is dependent on import from other countries and the supply risk is thereby argued to be highly relevant to handle if an energy transition to renewables should be possible (Moss et al., 2013).

2.3 Environmental and social impacts

“To figure out how to source rare earth elements in a stable, ethical, and sustainable way, we need to understand why they have been sourced in unstable, unethical, and unsustainable ways.” (Klinger, 2017, p. 236)

Mining is a physical process of removing the ores from rocks. The mining process comes with a wide range of environmental impacts and even if the negative impacts would be minimized, a mine will always have impacts on the surroundings (SGU, 2017). During the extraction process a significant amount of water is needed, resulting in large amounts of waste water. Also, acidic substances are used during this process, which can leach into the soil and the surrounding environment. This process is damaging for the environment and often lead to destabilised soil and water ecosystems (Chen, 2011; Turra, 2017). Both REEs and cobalt tend to form syndicates along with other metallic elements and the process to separate the individual ores is extremely complex and requires an intensive use of chemicals such as sulphates, ammonia and hydrochloric acids (Karamfilova, 2017). Another concern associated with the extraction and processing of REEs and cobalt is radioactivity. The minerals often co-occur with radioactive materials such as thorium and uranium which can lead to radioactive waste from the mining process (Turra, 2017). One of the most important environmental aspect of mining is the thereby waste management (Karamfilova, 2017). Mines are waste intensive and the handling of waste is thereby a key challenge with mineral mining, if not handled properly, polluting substances can leach into the environment and cause long term problems on plants, animals and humans (SGU, 2017).

China began mining REEs on a mass scale in the mid-1980s and during almost two decades the mining has been done under lax environmental regulations and it is not until recently more focus has been set at reducing environmental impacts. The mining and processing has thereby resulted in devastating damage to lives and the environment with consequences such as deaths, severe diseases, contamination of soil and water pollution, acidification and eutrophication.
according to Klinger (2017) and Lee and Wen (2017). The export restrictions on REEs introduced in 2010 was according to the Chinese government a strategy to curb environmental impacts by limiting the production (Lee and Wen, 2017). This effort was however short lived since these restrictions were found to be unlawful according to a WTO dispute settlement\(^2\) (WTO, 2014).

The mining for REEs and cobalt has not only resulted in severe environmental impacts but also led to serious consequences for people living nearby the mines and for the people working in the mines. Concerns of social aspects are for example raised by Lebedeva, Di Persio and Boon-Brett (2017) related to the production of cobalt in the DR Congo where forced labour, child labour and unsafe working condition are reoccurring problems. The marginalisation, deprivation and environmental impoverishment that have been the consequences of resource extraction in many African countries have also resulted in a series of conflicts, according to Janus (2012) and Ojakorotu (2017). Arguments have been put forward that conflicts in i.e. the DR Congo can be linked to resource control, since rebel groups are known to control resources as a mean to finance civil war. The conflicts have also been linked to the devastating effects of the extraction of natural resources, such as the mining of cobalt leading to environmental degradation and impoverishment.

3. Theoretical framework

Any theoretical framework comes with a number of assumptions about the nature of the data; what the data represents based on the selected theoretical framework (Braun and Clarke, 2006). To be able to analyse the empirical material selected for this research and to answer the research questions there is a need of a clarified standpoint within the geopolitical scientific fields as well as in relation to the concepts of security and the definition of risk. Therefore, a description of these fields and how they have been approached in the thesis analysis is explained in the following section.

3.1 An introduction to geopolitics

The area of geopolitics covers a broad variety of different approaches and the view of the concept has changed over time. The term geopolitics came with the modernist belief that it was possible to view the world in its totality. Among the early definitions of geopolitics was a form of geographical reasoning which stressed the capacity of states to act within a changing global arena (Dodds, 2000). The term geopolitics invokes many things simultaneously. The most obvious meaning of the term is according to Dalby (2013) the struggles for political dominance on a global scale. The ‘geo’ in the definition is both a matter of the world as well as of geographical borders that shape the contest for power. Concepts relevant to the area of geopolitics are the relationships between power, territory, conflict and location (Braden and Shelley, 2000). Geopolitics has been about how the world is organised politically, divided into states, blocs, alliances, territories and other administrative borders (Dalby, 2014). Parker (2008) identifies geopolitics as the study of geography as the political, societal, and historical shaping of a space. Geopolitics is, according to Cohen (2002), the interactions between dynamic geographical settings and political processes and the consequences of these interactions.

The contemporary literature of geopolitics commonly divides the field into traditional and critical approaches to geopolitics. The traditional definition of geopolitics has been focused on

\(^2\) One of the core activities of the WTO is to resolve international trade disputes. A dispute arises when a member government believes another member government is violating a WTO agreement or commitment (WTO, 2018a).
how geographical borders influence the relationship between states (Dodds, 2000; O’Sullivan, Overland and Sandalow, 2017). States are according to this definition considered as the principal actors in the international arena that always seek to maximise their own power. Tuathail (1999) argues that this former concept of geopolitics takes existing power structures for granted and works within these to provide advice for foreign policy decision-makers. In contrast to this, the critical approach also recognizes non-state actors and assume that geography is socially constructed. Critical geopolitics problematises the existing structures of power and knowledge when studying international relations and politics (Tuathail, 1999; Dodds, 2000). This view undertakes knowledge as situated, showing the perspective of certain cultures and subjects while marginalising that of others.

The formal analysis of geopolitics age back to the end of the Age of exploration in the late nineteenth century. This was the time when the colonisation of the non-European world had stagnated, and the European-centred world economy had reached its limits. Europe lost further power after two devastating world wars, which resulted in a shift in dominance of the world’s geopolitical stage to the U.S. and the Soviet Union (Braden and Shelley, 2000). Geopolitics has in history, according to Tuathail (1999), been Eurocentric, disregarding for example geopolitical thoughts of other nations, i.e. Russia and Japan. It has tended to ignore questions concerning the relationship between geopoliticians as intellectuals of powerful states and the power relationships characterising their state, its culture and its political economy. Critical geopolitics seeks to unravel these relationships and identify how they can affect political decision-making (Tuathail, 1999). Globalisation has played an important role for the area of geopolitics. It has been important because it has changed key aspects of international policy-making through its impacts on the role and purpose of states and territorial jurisdictions. Dodds (2005) argues that the divisions between the Global North and South is central to any understanding of geopolitics and that this way of categorising seeks to generalise and simplify a much more complex world. The capacity of people to influence the world around them depends on the availability of resources and knowledge and is thereby also linked to the geographical, societal and cultural background of people (Dodds, 2000; Power, 2010).

No one definition of geopolitics can be uncritically endorsed. Dodds (2000) points at the importance to specify what is excluded and included when defining geopolitics. There is clearly no neutral or objective way of looking at the world. How we decide to define an object will always carry different cultural and political predeterminations. “The theories on world politics are not detached from the world we seek to describe and explain,…” (Dodds, 2000, p. 34).

Geopolitics is a way of seeing and it has shaped the way in which global politics is represented. Geopolitical mapping refers both to the physical representation of the ‘global’ as well as to the way in which we represent the world imaginatively (Dodds, 2005).

“But, irrespectively of whether the word geopolitics is used or not, the conventional understanding today is that geopolitics is discourse about world politics, with particular emphasis on state competition and the geographical dimensions of power. Thus to study geopolitics we must study discourse, which can be defined as the representational practices by which cultures creatively constitute meaningful worlds.” (Tuathail, 2006, p. 1)

The definition of geopolitics used in this thesis is inspired by the critical geopolitics concept. Geopolitics is considered to originate partly from a geographical or state centred perspective but also include non-state actors. It is regarded as socially bound to perceptions of the world and influenced by historical and current power structures.
3.1.1 The dynamics of geopolitics, security and environmental change

The concept of security refers, according to Matthew et al. (2010), to freedom from the risk of loss or damage to a thing that is necessary for survival and well-being. Simultaneously with the changes of the geopolitical concept, the concept of security has undergone similar changes. Before the cold war, security analysis was focused on territorial sovereignty, balance of power and military dominance with the states as the main objects of security. The national security was thereby in the focus when discussing security politics. With the collapse of superpower rivalry and growing economic dependency, the field of security changed to look beyond national security. Within this field a more critical scholar has also originated from this development and resulted in a new approach on how to define the concept of security. This new approach identifies the object and meaning of security as non-military and instead raises risks such as mass migration and climate change (Dalby, 2013). Human security originates from this critical approach on security and offers an alternative way of looking at security focusing on people rather than on states or nations. It was recognised that national security not necessarily result in better lives for most people, and that the security of some people may be sacrificed for maintaining national security. The security concept was considered as vague and questions such as ‘security for whom’ were raised (Matthew et al., 2010). Human security is instead people-centred, multi-sectoral, inclusive, context specific, and oriented to prevent risks. It can be defined as “a condition that exists when people have the freedom and capacity to live with dignity” (Adger et al., 2014, p. 759).

The human security concept includes attention to power, interests, vulnerability, response capacities etc. It highlights that climate change is a social problem with environmental dimensions (O’Brien and Barnett, 2013). Climate security has seen a shift in focus from national security risks to human security risks related to climate change (Rüttinger et al., 2015; Mobjörk et al., 2016). Climate security has started to include social justice and human rights issues by focusing on the people affected and made insecure because of environmental degradation (Dalby, 2013; O’Brien and Barnett, 2013). Climate change has a long connection to geopolitics, the difference now is that humanity and political decisions will decide the future of the global climate. The previous focus on climate within geopolitics was often linked to for example weather and crop yields. The increasingly urgency in global politics in relation to human induced climate change has become an important ingredient in the current geopolitical landscape (Dalby, 2013). A broadened security approach is important to understand the dynamics of geopolitics of renewable energy and climate change.

3.2 An introduction to risk

The thesis aims to study risks raised in the EU publications, for example environmental, social and geopolitical risks, thereby an understanding of risk as a concept and a clear definition of risk is needed.

The definition of risk can vary within different fields and in relation to different topics. When it comes to risk there is often a distinction between reality and the probability. Risk is also generally put in relation to a certain event or activity and are usually prospective. A risk can be seen as an accident or crisis before the actual happening of it and the risk or crisis does not have to happen for the risk to exist (Olofsson and Öhman, 2009). The technical narrow concept of risk focuses on the probability of events and the magnitude of specific consequences. The avoidance of risk has costs too and the issue of ‘acceptable risk’ or ‘how safe is safe enough’ cannot be ignored (Skott, 2000).

How the risk concept is defined and analysed play an important role for societies and for political decision-making. Kasperson et al. (1988) argue that the dilemma for society is the need to use risk assessment for public policies on the one hand, and the inability of the current
risk concept to explain and include the public response to risk on the other. They point at a need for a new comprehensive risk theory that is capable of not only capturing the technical analysis of risk but also the cultural, social, and individual responses that shape the public experiences of risk.

Giddens (1990) defines different types of risks as external and manufactured risks, where the latter can be recognised as highly shaped by humans, both in the production of the risk as well as in the mitigation of it. Some scientists argue that before the industrialisation there were no risks, only threats or hazards. According to this definition risks originate from actions or events coming from scientific or technological development, for example climate change as an effect of emissions of fossil fuels (Olofsson and Öhman, 2009). Beck (1992) argues that a risk society arises through the modernisation processes which are unaware of consequences and danger. He argues that production of wealth and modernisation is accompanied by the social production of risk and points at the importance to limit risks and hazards in a way that neither hampers the modernisation process nor exceeds the limits of which is ecologically, medically, psychologically and socially tolerable. However, the consequences of a risk society are seen as impossible to adequately address or overcome in a system of an industrial society (Beck, 1996). Beck also recognises that risks, just like wealth and knowledge, are distributed unevenly in a population or a society and will thereby influence the quality of life unequally. A person unaware of a risk will, regardless of wealth, not try to avert it. It is important to remember that risk is not bias and can affect everybody, it can be mitigated and averted to some point, but nobody is free from risk. In the risk society according to Becks theory there is a constant conflict in society over so called ‘bads’ (hazards and danger etc.). These conflicts over ‘bads’ are put on top of other conflicts over ‘goods’ (income, jobs, social security etc.) and thereby become dominant in modernisation of society through for example innovation and technical development. As part of the risk society is the relationship of society to the hazards and problems produced by it. This relationship can be seen to challenge the basis for societal security. In other words the awareness of risks is likely to upset the assumptions of the previously existing social order. Beck (1996) argues that this dilemma becomes problematic in political activity and decision-making.

Kasperson et al. (1988) raised the need to take social amplification into account to be able to more completely determine the amplitude of a certain risk. This way of understanding risk includes effects such as individual responses and risk behaviour, which in turn can lead to secondary effects. Individual or society behaviour will naturally vary depending on various reasons. Risk assessment thereby needs to address questions such as ‘what cultural resources this particular individual or group have that might affect how the risk will be interpreted and handled?’. The reasoning ‘we are all in the same boat’ distracts attention to differences when it comes to exposure and perception of risk. As an effect of this, caution is needed when applying grid and group risk categories for entire societies (Skott, 2000).

In this thesis the definition of risk is inspired by many of the above-mentioned aspects. Risk is seen as the probability, or the experience of probability, that human actions or other events will lead to consequences that individuals, or group of individuals, value (Olofsson and Öhman, 2009). From this definition there is a connection between an event and the result of such event, or the perception that such connection exists. The risk does thereby not occur randomly, it originates from human actions or natural events and can thereby also be prevented or mitigated by certain actions or events. The risks identified in this thesis are regarded as manufactured risks, where the production of the risk as well as the mitigation of it are shaped by human. Risks are here also considered to have secondary effects originating from a social context and
the perception and handling of risks are regarded as socially constructed, which is in line with the reasoning by Kaspersion et al. (1988), Giddens (1990) and Beck (1992, 1996).

4. Materials and methods
This section provides a description of what materials and what methods that have been used to realise the study and obtain the results. The choice of method, the operationalisation and a description of the empirical material will be presented. Finally, the reliability and validity of the methods and materials will be discussed.

4.1 Method introduction
To be able to understand politics related to a certain topic it is necessary to understand what political actors are communicating and how this information can be interpreted. The fact that language is central in the study of politics is not new and scholars have long recognized and studied how politics are expressed in both written and spoken words. Language is a medium for politics and is regularly used by political parties, policy makers and nations to negotiate and communicate motivations and relative power (Grimmer and Stewart, 2013). One way to study the political language is the use of written texts to make inferences about politics and political communication. A major part of communication from the EU is in the form of written texts. These texts can be strategy or policy documents, research documents, law text and other publications from the EU institutions and other EU bodies. Since the objective of this thesis is to study EU policy-making on critical metals for renewable energy, the use of written texts as the main empirical material has been considered as the most appropriate alternative.

The qualitative approach to study texts is to bring out the essential concepts of the text through carefully reading the content and the context in which it is included (Esaiasson et al., 2017). Qualitative approaches are according to Braun and Clarke (2006) diverse, complex and nuanced and are thereby suitable to use for rigorous text analysis. Qualitative analytic methods can roughly be divided into two main categories with different applications linked to them (Braun and Clarke, 2006; Esaiasson et al., 2017). The first category covers methods tied to, or originating from, a particular theoretical or epistemological position. Within the first category one finds for example grounded theory or discourse analysis (Braun and Clarke, 2006; Esaiasson et al., 2017). The second category include methods that seek to systematize the content. These methods are different descriptive analysis and are essentially independent of epistemology and can be applied across a range of approaches (Braun and Clarke, 2006). Within this category one finds different kinds of content analysis and methods categorising the content under specific labels, i.e. themes and subthemes, such as the thematic analysis.

4.2 Choice of method
Both content analysis and thematic analysis share the same aim of analytically examining narrative materials by breaking the text into smaller units of content. They can be suitable for the same kinds of research questions and they are both appropriate for qualitative analysis of data. Content analysis uses a descriptive approach in both the coding of the data and the interpretation of it while the thematic analysis provides a purely qualitative, detailed, and nuanced account of data when searching for identification of common threads that extend across the whole data-set (Braun and Clarke, 2006; Vaismoradi, Turunen and Bondas, 2013). Both content analysis and the thematic analysis are flexible methods suited to a wide range of research interests and theoretical perspectives. These methods also work well with both large and small data-sets and can be applied to produce data-driven or theory driven analysis (Clarke and Braun, 2013).
Both content analysis and the thematic analysis would be suited for the aim of this research and for the selected research questions, but the thematic analysis has been considered as more suited to investigate the geopolitical perspective in the data-set. By identifying themes and patterns in the communication from the EU it can be possible to more deeply analyse the content in the documents and draw more analytical conclusions than those that would come out from a strictly descriptive approach. The theme identification process makes it possible to see threads and nuances in the dataset, that most likely would be harder to trace with a traditional content analysis. It also allows for systematic analysis of meanings of the findings and thereby pays greater attention to the qualitative aspects of the material analysed, which would be more difficult with a strictly descriptive approach.

4.3 Qualitative thematic text analysis
The qualitative thematic text analysis applied for this study was approached in an inductive way with open-ended, explorative research questions. The thematic analysis is a widely used qualitative research approach, sometimes as a tool to use across different methods and sometimes as a method in its own right (Vaismoradi, Turunen and Bondas, 2013). The thematic analysis does not only analyse and report patterns (themes) within data but frequently goes further than this, and interprets various aspects of the research topic (Braun and Clarke, 2006).

For this thesis the thematic approach has been considered as a method by itself and the main argument for this is linked to how themes are created. If themes would emerge from or just be discovered in the text, this would mean that the role of the researcher would be passive. In the thematic analysis the researcher does instead play an active role in identifying patterns/themes, selecting which ones that are of interest and bases the analysis on these (Braun and Clarke, 2006). The active role of the researcher makes it important that it is clearly described what is done in the analysis and why and how it has been done.

4.3.1 Theme identification
The theme identification process can be done with several different techniques with different advantages and disadvantages depending on the characteristics of the textual data. Identifying themes as part of the analysis is according to Ryan and Bernard (2003) a basis in social science research. “Without thematic categories, investigators have nothing to describe, nothing to compare, and nothing to explain” (Ryan and Bernard, 2003, p. 86).

The idea of the thematic analysis in this thesis is to code important features and concepts found in the textual data and of relevance for the research questions guiding the analysis. For the analysis the whole data-set has been coded and the items relevant for the thesis topic have been included for the selection of themes. The identification of a theme has been based on the definition by Clarke and Braun (2013), in which a theme is a coherent, repeated and meaningful pattern in the data relevant to the research question.

For the analysis the theme identification was made through a qualitative approach based on open reading, identification of repetitions, similarities, differences and patterns and by identifying missing data. The textual data used for this analysis consist of texts of rich narratives. Ryan and Bernard (2003) argue that theme identification by searching for repetitions, similarities, differences and patterns is easy applicable to texts with rich narratives.

Besides searching for data that is present in the texts the focus has also been to look for data that is not mentioned and create themes from these findings. This way of theme identification can be valuable, but it is important to avoid finding only what you as a researcher is looking for (Ryan and Bernard, 2003). Searching for missing data can be challenging since there can be several reasons why data is left out. Here it is important to distinguish between data that is
left out because the author is unwilling to discuss it and data that is left out because the author assume the reader already knows about it. To be able to distinguish between these two it is necessary to be familiar with the subject and here also to be familiar with reading political texts.

The themes used in this thesis have been identified and coded according to the following categories: 1) definition of the problems addressed in the texts; 2) diagnoses of the key objectives; 3) proposed strategies and 4) suggested actors and 5) missing data.

4.4 Empirical material
The analysis covered a selection of 18 policy and strategy documents published by the EU Commission, the EU Parliament and the Council of the EU during the period 2010-2018, with a few exceptions for a few strategy and policy documents published earlier. The earlier publications were included since they were considered important policy frameworks for the research field and because no newer versions exist. Also 21 documents published for policy preparation from the years after the Paris agreement, 2015-2018 were included in the empirical material. These documents are published by the European Commission and by researchers representing the Commission. In total 39 documents have been used for the analysis, whereof 30 have been cited in this thesis.

A list of all documents used as empirical data can be found in appendix 2.

The documents have been collected from the European Commission database, from the EU online bookshop and from the EU open data portal. When searching for documents combinations of keywords according to table 1 were applied to the search engines. Only publications in English were included. The selection from the search results in the databases was made based on the relevance for the research questions which was decided after reading the abstract of each publication. Some documents that were included in the search result were deselected. Such documents were for example yearly monitoring reports, reports published by a specific EU member state, appendices to other publications and documents with only a minor focus on critical materials.

Table 2. Combinations of keywords used for search in the EU databases

<table>
<thead>
<tr>
<th>Keywords</th>
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<tbody>
<tr>
<td>‘Renewable Energy AND Raw Materials’</td>
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<tr>
<td>‘Renewable Energy AND Critical Raw Materials’</td>
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<tr>
<td>‘Renewable Energy AND Critical Metals’</td>
</tr>
<tr>
<td>‘Renewable Energy AND Rare Earth Elements’</td>
</tr>
<tr>
<td>‘Renewable Energy AND Rare Earth Metals’</td>
</tr>
<tr>
<td>‘Renewable Energy AND cobalt’</td>
</tr>
<tr>
<td>‘Geopolitics AND Raw Materials’</td>
</tr>
<tr>
<td>‘Geopolitics AND Critical Raw Materials’</td>
</tr>
<tr>
<td>‘Geopolitics AND Critical Metals’</td>
</tr>
<tr>
<td>‘Geopolitics AND Rare Earth Elements’</td>
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<tr>
<td>‘Geopolitics AND Rare Earth Metals’</td>
</tr>
<tr>
<td>‘Geopolitics AND cobalt’</td>
</tr>
</tbody>
</table>

4.5 Operationalization
The thematic text analysis was conducted using the NVivo software, which is a commercial tool suitable for analysis of textual data. The thematic analysis process was conducted in sex phases based on Braun and Clarke (2006) and Vaismoradi, Turunen and Bondas (2013). The
process should not be viewed as linear where the phases follow in a strict order. It is rather a recursive process where many of the phases reoccur and relieve each other.

**The six phases of the thematic analysis** (Clarke and Braun, 2013; Vaismoradi, Turunen and Bondas, 2013)

1. Getting familiar with the data: Reading and rereading the data and noting any initial analytic observations.
2. Coding the data: Generating labels for important features and concepts found in the data that are of relevance for the research questions.
3. Searching for themes: Coding the codes to identify similarities and differences in the data. An active process where the focus is to construct themes based on coherent and meaningful pattern in the data relevant to the research questions.
4. Reviewing the themes: Checking that the themes work in relation to both the data from the coding process and to the whole data-set. Reviewing whether the themes tell a convincing story about the data. In this phase the themes might be kept or discarded and possibly divided into subthemes and metathemes.
5. Defining and naming themes: Identifying the essence of each theme and constructing informative names for them.
6. Writing-up: Weaving together the analytic narrative and data extracts to tell the reader an informative, coherent and persuasive story about the data and contextualising it in relation to existing literature.

In phase 2 the first focus was to code and label the data for all information that could be linked to environmental, social and geopolitical challenges in relation to the critical metals. This coding was based on four top labels to facilitate the process: Core problem, objectives, strategies and actors. Secondly, sublabels where added to each top label based on information found in the textual data. This coding and labelling phase was conducted in NVivo by sorting the data into ‘nodes’ based on the content and was done in parallel with phase 1. The selected theme identification techniques (repetitions, patterns, similarities/differences and missing data) were applied when reading through the coded data.

To get a better understanding of the research field, create a clear context and map important information, two interviews with specialists were conducted. The interviews were with one researcher, who is author to literature used in background studies, and one official at the European Commission who also has been author and editor to several EU publications.

### 4.6 Reliability and Validity

The thematic analysis is a relatively straightforward method for handling textual data and it does not require the same detailed theoretical and technical knowledge as many other methods for text analysis, such as for example the discourse analysis (Braun and Clarke, 2006). There are however many things that can result in a poor analysis. There is always the risk that the researcher fails to analyse the data. The thematic analysis is based on themes constructed by the researcher and if these are poorly investigated and put together with little or no analytic narrative, then a weak analysis will most likely be the outcome. The analysis based on the identified themes should go beyond the specific content in the texts to make sense of the data and tell the reader what the presented information in the texts might mean. It is important to be aware of the researcher’s influence on the construction of themes and that preconceptions and opinions could affect what themes that are found in the texts. A qualitative analysis will always be shaped and influenced by the researcher and the only way to make it reliable is to maximize clarity. Making judgements explicit and clear makes it possible for the reader to argue with the researcher’s conclusions (Bernard and Ryan, 1999; Ryan and Bernard, 2003).
There is also a risk that the themes do not work because of too much overlap between themes or that the themes are not internally coherent and consistent (Braun and Clarke, 2006). All themes should cohere around a central idea or concept (Ryan and Bernard, 2003). To be able to succeed with this, the themes need to capture most of the data and provide a rich description or interpretation of the aspects in the data. When using a thematic analysis, it is important to ensure that the interpretations and analytic conclusions are consistent with the data-set and that the constructed themes really can be backed up by the data. To make the analysis convincing when presenting the results, it is thereby necessary to provide adequate examples from the data to demonstrate the themes (Braun and Clarke, 2006).

The use of official documents for analysing a certain topic, as done in this thesis, can however be criticized. Many of these publications are most likely a result after numerous debates and discussions and it can thereby be argued that they have been ‘watered down’. It could be argued that this have resulted in information missing in the final documents and that views and comments in the previous discussions have been left out. This can however also be seen as something positive since the content in the documents is an agreed content and thereby something that can be considered as the EU standpoint. Also, the addition of papers for policy preparation might capture these previous discussions that might be missing in policy or strategy documents. The two interviews that were conducted helped to map the background information to create a clear context for the text analysis. The interviews are few and the risk of becoming partial should thereby be regarded. The risk of becoming bias is however considered as handled since the interview responses are only used as background information or to back up the results and not as empirical material, and have thereby not affected the analysis or the results of this thesis.

5. Analysis and discussion

In this section the findings from the thematic text analysis are presented and analysed. The findings are divided according to the categories used as a framework for the thematic analysis; core problem, objectives, strategies and actors. The results from the documents on each theme are first presented, after each result section follows a summarising discussion in which the theoretical frameworks are applied and where interpretations of the results are made and linked to previous research.

5.1 Results - Core problem and identified challenges

For the EU to meet its climate and energy objectives, while at the same time securing energy access to all Europeans, low-carbon technologies is considered as necessary (European Commission, 2011a, 2015b, 2016a). The findings show that the access to critical metals and the risk for possible supply shortages are key challenges when aiming for energy security, continued economic development and competitiveness for the EU. These challenges are presented in most of the empirical material and a common view among both researchers and policy makers is that these need to be addressed in a near future to avoid supply shortages (e.g. European Commission, 2008, 2011b, 2017; The EU Parliament and the Council of the EU, 2009; Moss et al., 2013; Blagoeva et al., 2016). With the growing demand and the increasing strategic importance of certain critical metals, the focus on supply and demand has increased over time and the European Commission has, in e.g. the newly published ‘Raw Materials Scoreboard’ proposed a wide range of actions to handle this risk. (European Commission, 2016b).

The Raw Materials Scoreboard is an initiative of the European Innovation Partnership (EIP) on Raw Materials. The purpose of the initiative is to provide quantitative data for the raw materials policy context (European Commission, 2016b).
The supply situation of raw materials, including REEs and cobalt, and the dependency on imports was however already raised as a challenge in the Raw Material Initiative implemented in 2008. This initiative was set out as a strategy for tackling the issue of access to raw materials in the EU. The initiative is based on three main pillars: to ensure access to raw materials on the global market under the same conditions as other players and competitors; to set the right framework conditions within the EU to foster sustainable access to supply from European sources; and to reduce EU’s consumption of primary raw materials (European Commission, 2008).

The supply risk does not only occur in strategies or policy frameworks with a specific focus on critical metals, such as the Raw Material Scoreboard, but also in more general strategies and policy documents focusing on e.g. trade and a circular economy (The EU Parliament and the Council of the EU, 2009, European Commission, 2015a). The broad approach on these challenges indicates that the supply risk is a key theme in the documents. This risk has become a significant parameter in EU policy making in a number of different fields such as trade, production, innovation and energy security and also seems to have gained more attention in recent years in policy preparation which for example is shown in publication by Amighini et al. (2016); Pavel et al. (2016); Woertz et al. (2016) and the European Commission (2017c, 2017d).

The analysis show that policy and strategy documents commonly treat critical metals as a group. Supply and demand of REEs and cobalt separately, is mostly occurring in the documents for policy preparation. The concentration of production to a handful of non-EU countries as well as the low political stability of some of the suppliers are the main explanations for the criticality of metals. Blagoeva et al., (2016) argue that potential supply chain bottlenecks of REE and cobalt will reduce the EU resilience of the deployment of specific technologies that are vital for a transition to renewable energy. The increase in demand for these metals is generally expected to result in supply lagging behind demand and the risk of price fluctuations is thereby argued to become more present in the coming years (European Commission, 2011b; Pavel et al., 2016). The supply risk related to REEs is commonly mentioned by researchers, but also by the European Commission in e.g. the EU Trade Policy for Raw Materials (European Commission, 2012). The fact that the share of imports of REE to the EU reaches 100 % and that the production is limited almost only to China, are the core problems raised when identifying the high criticality of REEs (Moss et al., 2011; European Commission, 2012, 2017a; Blengini et al., 2017). The supply risk related to REEs is more frequently raised in the documents than the supply risk of cobalt. When the supply of cobalt is discussed, it is linked to the limited production to the DR Congo, which has been ranked with the lowest governance score because of internal conflicts and human rights abuses (European Commission, 2016b).

The European Commission has included both REEs and cobalt in the CRM-list (European Commission, 2018a). This list was created to prepare for policy making and prioritize in the field of resource security, the objective of this list has been to raise awareness of the criticality of materials (European Commission, 2018a). The definition of supply risk used in the CRM-list is again linked to the concentration of production to a limited number of countries and to the level political stability.

A reoccurring view among researchers is that the global supply of REEs may not be sufficient to meet the growing demand for renewable energy technologies (e.g. Mancini, De Camillis and Pennington, 2013; Blagoeva et al., 2016; Pavel et al., 2016; Blengini et al., 2017). Blagoeva et al. (2016) argue that the EU resilience to bottlenecks in the supply of primarily three REEs (dysprosium, neodymium and praseodymium), used in for example the permanent magnets in wind turbines, is low and state that a growing demand might result in an increased supply
shortage. This concern about if the supply is enough can however also be found in policy documents such as the Strategic Implementation Plan for the European Innovation Partnership (EIP) on Raw Materials⁴, in which EU oceans and remote places in Greenland are proposed as opportunities for future mining of REEs if other deposits are hard to find (European Commission, 2013a).

In the policy preparation documents it is frequently stressed that the risk of supply bottlenecks for both REEs and cobalt will decrease over time thanks to the potential diversification of supply sources and greater EU mine production (e.g. Moss et al., 2013; Blagoeva et al., 2016; Minpol and Partners, 2017). The EU resilience is, by the same researchers, also argued to improve if a high degree of substitution and significant recycling rates are achieved. With a growing demand of cobalt, Blagoeva et al. (2016) raise that substitution and recycling are the most influential strategies with a 2030 time frame. For REEs it is in the same research argued that these strategies should be combined with an increased domestic production, to be able to meet demand and reduce the risk for supply shortage.

The findings show that the concerns of potential supply bottlenecks of REEs have grown considerably since China imposed export restrictions on REEs in 2010. The increased use of these restrictive measures has according to Blagoeva et al. (2016) and the European Commission (2016) become an additional factor that has pushed prices up and increased the volatility on the market. The REE ‘crunch’ that followed the Chinese trade restrictions is commonly brought up as a cautionary example and a proof of the current supply risk (e.g. European Commission, 2012; Nansai et al., 2015; Mendez Parra and Schubert, 2016). Political factors, such as export restrictions, are by Moss et al. (2013) argued to exacerbate risks for future supply-chain bottlenecks. A situation when the structure of supply is monopolistic or dominated by only a few players is reasoned to create enough market power to affect global prices and export or output of a metal. When market access strategies are discussed in the EU Trade Policy for Raw Materials the Chinese export restrictions are highlighted as ”[o]ne of the most worrying developments.” (European Commission, 2012, p. 14). This concern is also raised by the researchers Mendez Parra and Schubert (2016, p. 21) who argue that these restrictions are used by the biggest trading partners to limit the access to their supply and that “[u]nless justified for security or environmental reasons, restrictions on access to resources should be removed.” The use of export taxes is generally allowed under the WTO but quantitative restrictions on exports are not allowed, unless justified for security or environmental reasons (WTO, 2014).

5.1.1 Summarising discussion
The core problem raised in the EU communication is clearly access to critical metals and the main challenges are linked to the risk of supply shortages. Increased dependency on other nations and reduced economic development and competitiveness are key aspects related to the supply risk. This risk can be interpreted with the definition of risk as the probability, or experience of probability, that actions or event will lead to. The risk is related to a concern of possible supply chain bottlenecks or shortages and the findings show a view that the probability of such events has increased over time. The risk originates from an increased use of critical metals, such as REEs and cobalt, needed for e.g. renewable energy technologies. The risk is further argued as reinforced when other nations are using export restrictions. Chinese trade restrictions did for example result in a change in the perception of the supply risk related to

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⁴ The European Innovation Partnership on Raw Materials was launched to focus on the technological advances and innovation for increasing the domestic supply of raw materials, improve substitutability and recycling. The Partnership is a stakeholder platform that brings together representatives from industry, public services, academia and NGO’s (European Commission, 2013a, 2017b).
REEs, which is argued as contradictory since previous research has stated at the actual consequences of these restrictions where small and temporary (Klinger, 2017). Kasperson et al. (1988) point at the public response to risk being shaped by cultural, social and individual aspects. The lack of tangible shortages suggests that the increased focus on supply risk in EU policy making was a result of an intricate mix of concerns for competitiveness, economic development, and transnational dependency aspects, rather than based on an increased actual threat to technology production or climate targets.

The findings show a broad focus on the supply risk since it is addressed in a wide range of different policy and strategy documents over time. This focus is an effect of EU being very import dependent but also of an increased interest in maintaining political power on the global market. The struggle over resources for competitiveness and the concerns of other countries ‘catching up’ indicate a struggle for political power on a global scale, which is also what defines the area of geopolitics according to Dalby (2013). This struggle is naturally affected by perceptions of the world and influenced by historical and current power structures, which define the critical view on geopolitics used in this thesis. Such perceptions of the world could for example be affected by the history in which Europe has been a powerful and wealthy region for a long time, while for example China is a newly developed country with a very different political history than the European.

The categorisation of the statements in the studied documents implies that the concept of security presented is rather focused on national security according to the definition by Dalby (2013), which focus on the state or nation as the object of security. The focus on securing the supply of critical metals to increase EU competitiveness and to maintain economic development gain more attention than e.g. energy security for all Europeans. On the other hand, human security can be argued as captured in the objectives to reduce climate change and improve energy security by an increased use of renewable energy technologies, which further could be jeopardised in a situation with supply shortage of for example REEs or cobalt.

The findings show a common concern if the supply of REEs is enough to cover the future demand. This viewpoint among policy makers in import dependent countries is also demonstrated in previous research by Klinger (2017), where it is stated that this faulty thinking has resulted in an increased interest for mining in remote place. This aspect will be discussed more in detail later.

5.2 Results - Environmental and social risks

A general view is that environmental and social risks need to be handled to fulfil a sustainable supply of raw materials (e.g. European Commission, 2008, 2011b, 2013a, 2018; Mancini, De Camillis and Pennington, 2013), but in most documents, there is little focus is put on describing the actual risks in detail, by what chain of events and mechanisms it poses a risk, and how they can be mitigated. Environmental and social risks in relation to the increasing demand of critical metals are more commonly found in the strategies from the European Commission. The Raw Material Scoreboard (European Commission, 2016b) is an example of a strategy where these risks get more attention compared to other documents. Here, the importance to handle environmental challenges related to extractive waste and water usage is demonstrated and the risks are argued to vary depending on the site, the mineral and on the techniques used when mining.

A common way of treating the environmental and social risks in other documents is to refer to other existing policy frameworks and rules that are in place, such as the Mining Waste Directive (The European Parliament and the Council of the EU, 2006). Karamfilova (2017) argues that this directive was launched after the occurrence of major accidents involving spill of hazardous
extractive waste in Europe in 1998 and 2000. These accidents raised concerns of the appropriateness of then available policies. The main objective of the Mining Waste Directive is to prevent, or reduce as far as possible, any adverse effects on the environment and any risks to human health resulting from the management of extractive waste (The European Parliament and the Council of the European Union, 2006). However, in the European Implementation Assessment of the Mining Waste directive, Karamfilova (2017) concludes that the practical implementation of the directive has been problematic and that levels of effectiveness and efficiency across the EU vary from one Member State to another.

“A key finding of this paper is therefore that all Member States (EU-27) faced transposition problems, for reasons related to late and/or wrong transposition. Consequently, proper implementation of the directive cannot be expected in practice for the time-being in all Member States.” (Karamfilova, 2017, p. 7)

Related to environmental risks with mining, the Raw Materials Initiative, the Implementation plan for the EIP on Raw Materials, and the Raw Material Scoreboard conclude that the overall potential for mining and quarrying in Europe is high but that access to land has become a key challenge for the extractive industry because of increased competition for different land uses and a highly regulated environment (European Commission, 2008, 2013a, 2016b). Despite this land use issue, one of the main strategies suggested by the European Commission and by researchers to secure supply of e.g. REEs and cobalt, is to increase the local production of these minerals (European Commission, 2008; Mancini, De Camillis and Pennington, 2013; Blagoeva et al., 2016; Pavel and Blagoeva, 2017). None of the studied documents raise any risks related to an increased production, not with increased domestic production nor with increased production in other countries. This missing risk analysis could be explained by that these risks are considered as addressed in the other existing policy frameworks for environmental protection in the mining sector, such as the Mining Waste Directive.

A public mistrust for extractive industries is a frequently raised aspect related to environmental and social risks.

“Public acceptance in the EU of extractive industries is low as compared with other economic sectors. The general public in the EU has little trust that extractive companies make efforts to behave responsibly. Trust in mining companies is generally higher in countries outside the EU.” (European Commission, 2016b, p. 61).

A long history of negative impacts on the environment and high environmental risks is argued as a reason behind this low public acceptance (European Commission, 2013a, 2013b). The low public acceptance demonstrated in the documents, is expressed to be connected to a low public awareness and trust in relation to the mining industry. It is for example stated in the Implementation Plan for the EIP of Raw Materials that the public mistrust towards the mining industry “…often derives just from prejudices and lack of awareness of the importance of raw materials for the society” (European Commission, 2013b, p. 30). This way of seeing the low public acceptance assumes that the public perception of risk is unjustified, and that people need to be more aware of why mining activities are important. On the other hand, it does not show an awareness of the history of environmental and social impacts from mining and that perceptions of risk might be based on previous experiences and actual negative impacts. Related to the low public acceptance to mining within the EU, the Raw Material Scoreboard raise that the EU raw material sector is a world leader in sustainability reporting which is argued to support transparency and corporate social responsibility (European Commission, 2016b).
Other measures that the Commission promote to reduce the public mistrust are, for example, advanced technologies to monitor environmental impacts arising from mining to mitigate possible environmental hazards and thereby reduce the actual risk (European Commission, 2013b).

The ‘Ecodesign Directive’\(^5\) states that energy-related products account for a large proportion of the consumption of natural resources and that they often also have important environmental impacts. The same document reasons that a continuous improvement in the mitigation of environmental impacts from different products needs to be encouraged within the EU (The European Parliament and the Council of the EU, 2009). At the same time, the focus on increased mining to improve energy efficiency with technological development is highly promoted in several documents and argued as needed to be able to reduce greenhouse gas emissions (e.g. The EU Parliament and the Council of the EU, 2009; European Commission, 2015b, 2016a).

The focus on environmental and social risks in producing countries is limited, but some documents mention the importance of a sustainable supply for imports. Several strategy documents argue that the EU promotes a sustainable supply from third countries as an important strategy when securing access to critical metals (e.g. European Commission, 2011b, 2012). In the report ‘EU Trade Policy for Raw Materials – Second Activity Report 2012’, it is for example stated that “it is important to ensure that the supply of raw materials to our economy is both sustainable and carried out under fair and undistorted conditions for all parties.” (European Commission, 2012, p. 7).

The DR Congo is considered as an increased-risk country in the EU Trade Policy for Raw Materials and in the Implementation Plan for the EIP on Raw Materials. These reports argue that trade of certain minerals has the potential to exacerbate regional conflicts (European Commission, 2012, 2013a). The reports were published a few years back, but this view seems to remain since the DR Congo and its neighbours in Central Africa are specifically targeted in the recently implemented ‘Conflict Mineral Regulation’ which calls for supply chain due diligence for Union importers of tin, tantalum and tungsten, their ores, and gold originating from conflict-affected and high risk areas (The European Parliament and the Council of the European Union, 2017). As of today, this regulation on conflict minerals does not include cobalt, even though the DR Congo holds the largest global reserves of cobalt.

5.2.1 Summarising discussion
The findings show that environmental and social risks gain little attention in the studied EU documents and when they are discussed it is often in relation to waste from mining activities within Europe with little attention to producing countries outside the union. Relatively little focus directed to the actual environmental and social consequences and on how the risks can be mitigated. The results show that the environmental goal to decrease greenhouse gas emission is prioritised before other environmental aspects from for example increased mining activities. When discussing renewable energy technologies the Ecodesign Directive argues that “[a]lthough a comprehensive approach to environmental performance is desirable, greenhouse gas mitigation through increased energy efficiency should be considered a priority environmental goal pending the adoption of a working plan.” (The EU Parliament and the Council of the EU, 2009, para. 14). This statement indicates that the main goal is to reduce greenhouse gas emissions through increased development of renewable energy technologies and that the unavoidable environmental impacts related to such development need to be

\(^5\) The Ecodesign Directive has an objective to provide EU rules for improving the environmental performance of products, such as energy technologies and other engineering products (The EU Parliament and the Council of the EU, 2009).
accepted. This view points at the urgency in politics related to human induced climate change that, according to Dalby (2013), has become an important ingredient in the geopolitical landscape. It can further be linked to the risk society concept presented by Beck (1992), who state that risk abatement has costs too and that the question ‘how safe is safe enough?’ needs to be considered.

Even though Europe has relatively strict environmental and social regulations related to mining, compared with many other countries, the results show a common view of a public mistrust towards this industry. A low public acceptance to extractive industries could demonstrate a perception of risk that is socially constructed based on knowledge and previous experiences of e.g. environmental and social impacts. As stated by Beck (1992), risks are just like wealth and knowledge, distributed unevenly in a population and between different countries and regions. The low public acceptance to extractive industries within the EU is claimed to be related to people being more aware of possible consequences from mining activities but also to what people see as an acceptable risk. The European Commission seem to think that this mistrust, to some extent, is unjustified and argues that increased transparency could result in increased acceptance. When discussing increased mining in non-EU countries, which often are developing countries, it is important to raise the issue of the ability to avoid risks. There are large differences in exposure and perceptions of risks and it can be argued as the luxury of wealthy countries to be able to avoid environmental and social risks related to mining.

The findings show that the European Commission promotes a sustainable supply of raw materials from third countries. This objective is however raised when the risk of supply shortages is discussed which implies that the focus on sustainability is also a measure to reduce the risk of supply shortages and not only to handle environmental or social risks.

The DR Congo is the largest producer of cobalt globally. Even though the country is highly affected by internal conflicts and political instability, which in previous research has been linked to extractive industries (Janus, 2012; Ojakoruto, 2017), cobalt has not been included in the regulation on conflict minerals. One reason behind this can be argued to be that the current import of cobalt to the EU originates mainly from Russia (European Commission, 2017a). On the other hand an increased demand of cobalt is expected (Blagoeva et al., 2016), which most likely would result in a need for imports also from the DR Congo.

5.3 Results - Geopolitical risks

In general, the word ‘geopolitics’ is rarely used in the policy- or strategy document but it does however occur in the documents for policy preparation. When supply chain analysis and the criticality of the materials included in the CRM list is discussed the following question is for example raised:

“Clearly, the crucial question to be addressed in assessing criticality is “to whom the resource is critical?” Indeed, if the shortage in the resource is critical to country, company, sectors, the socio economic implication should be taken into account and modelled (e.g. risk of supply, geopolitical risk etc.)” (Mancini, De Camillis and Pennington, 2013, p. 25).

In the same document the rapid global demand growth for e.g. REE and cobalt and the concentrations of supply and political risks associated with key suppliers are brought up as examples of geopolitical factors. When addressing materials and their potential impact on the competitiveness of the clean energy sector Pavel and Blagoeva (2017) argue that geopolitical
factors could have consequences for the EU and link these factors to the dependency on import from other nations.

“The EU is strongly reliant on supplies of raw materials from non-EU countries. For some materials near to monopoly supply situation is observed, often from politically unstable countries, sometimes having history of applying export quotas.” (Pavel and Blagoeva, 2017, p. 5)

In the same research it is further argued that the “…chosen specific technology will affect the EU security of supply in a different way due to different geopolitics related to the supply of the required materials.” (Pavel and Blagoeva, 2017, p. 6).

Based on the definitions of geopolitics found in recent policy preparing documents the common view seems to be that the high focus on securing access to critical metals and reducing dependency on other nations, are strategies to handle geopolitical risks to the EU, with little focus on geopolitical risks for producing countries, such as for example resource related conflicts in DR Congo. The risk for supply chain bottlenecks is for example commonly linked to that the production is limited to a few countries and sometimes to countries with low political stability and internal conflicts (e.g. European Commission, 2011b, 2016b, 2017a; Blagoeva et al., 2016; Pavel and Blagoeva, 2017). Related to this the following statement is made in a policy preparing document on trade and economic relations with Asia from the European Commission;

“China’s dominance of the rare earth sector and its ability to control the price such raw materials could be the source of geopolitical tensions (in which Europe and the EU are involved). Western dependency could encourage Beijing to use its market power in the sector as a means of existing political and geopolitical pressure” (Amighini et al., 2016)

Since the EU relies completely on imports for the access to REEs, China is brought up as a key partner and the EU-China relationship is highlighted in e.g. the EU Trade Policy for Raw Materials as crucial for the future access to REEs and other materials (European Commission, 2012). The findings show a growing concern related to export restrictive measures imposed by large producing countries and this concern seems to have grown considerably since 2010 when China imposed export restrictions on REEs (European Commission, 2011b, 2016b; Moss et al., 2013; Blagoeva et al., 2016). In the Raw Material Scoreboard it is for example stated that “…more than 50 % of all restrictions that were active in 2012 were introduced after 2009, and almost 25 % were introduced in 2012” (European Commission, 2016b, p. 32). This is also stated by researchers within the area of trade;

"The general picture suggests that the use of export restricting measures has increased in popularity over the last 10 years. This development coincides with the high prices for raw materials observed during the same period. As prices started to increase, we see that the main exporting countries implemented taxes and other restrictions.” (Mendez Parra and Schubert, 2016, p. 11).

A common view is that these measures are strategies to promote domestic downstream industries and to provide additional revenue, but that they create distortions in the global markets and uncertainties in the regular flow of metals (European Commission, 2011b; Mendez Parra and Schubert, 2016). When discussing trade restrictions in policy preparation it is also stated that “Importing countries are the immediate losers from export restricting measures on raw materials.” (Schubert, Brutschin and Pollak, 2015, p. 23).
Tightened trade regulations within GATT/WTO are promoted by both the EU Commission and by researchers, as needed to limit the use of export restrictions (European Commission, 2012; Mendez Parra and Schubert, 2016; Blengini et al., 2017). In relation to this Mendez Parra and Schubert (2016) state that there have been WTO disputes related to trade restrictions and point specifically at the Chinese restrictions on REEs. The search for dialogues and outreach activities towards third countries to intensify cooperation are also suggested as important actions to secure a future access of critical metals (European Commission, 2008, 2012).

5.3.1 Summarising discussion
The use of the geopolitical term in the document implies that it is mainly the traditional definition of geopolitics that is present. The geopolitical factors that are mentioned in the documents are linked to the security of supply of critical metals for the EU. There is a clear focus on Europe as region and on the development of the union which can be argued to be in line with the focus on states and nations with clear geographic borders according to the traditional definition of geopolitics by (O’Sullivan, Overland and Sandalow, 2017).

The clear focus against trade restrictions is in line with the EU strategy for free trade. It could however also imply that the EU willingness to provide advice for foreign policy decision-makers, as in the case with the Chinese restrictions on REEs, is a result of existing power structures. The EU has through history been an important player on the global market with the ability to shape rules for trading. Tuathail (1999) argues that geopolitics is highly influenced by existing and historical power structures and that it in history has been Eurocentric, disregarding thoughts of other nations. The Chinese government has argued that the objective of the trade restrictions on REEs was to reduce the domestic environmental pressure from many years of unsustainable mining. This has however not been accepted as the real motive by the WTO and the motivations from the Chinese side were thereby disregarded. To what extent the increased demand for e.g. REEs is shaping new power structures that the EU is not willing to accept, remains to be studied.

Various previous scholars argue that the transition to renewable energy poses numerous geopolitical risks (Dodds, 2000, 2014; Paltsev, 2016; O’Sullivan, Overland and Sandalow, 2017). Paltsev (2016) argues that supply and demand for energy will remain an important factor influencing the global balance for power in the future. O’Sullivan, Overland and Sandalow (2017) argue that renewable energy will result in new geopolitical winners and losers. Countries rich on resources or with financial power to invest in new technologies are the winners, while the losers are countries of the developing world with limited access to resources. The EU is highly import dependent when it comes to REEs and cobalt, but also have the financial resources to handle this vulnerability by for example increased domestic production and by technological development, which indicate that the union is a geopolitical winner.

5.4 Results - Objectives
Securing access to critical metals, such as REEs and cobalt, is a reoccurring key objective in the studied documents to handle the risk with the increasing demand and possible supply shortages (e.g. Mancini, De Camillis and Pennington, 2013; Moss et al., 2013; Schubert; Brutschin; Pollak, 2015; Blagoeva et al., 2016; European Commission, 2016b). Other objectives that are raised but that gain limited attention is to reduce the actual demand for critical metals or redistributing the demand (European Commission, 2013a, 2015a).

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6 The World Trade Organization (WTO) deals with the global rules of trade between nations. Its main responsibility is to ensure that trade flows as smoothly, predictably and freely as possible. The General Agreement on Tariffs and Trade (GATT) covers international trade in goods. The work related to the GATT agreement is the responsibility of the Council for Trade in Goods which is made up of representatives from all WTO member countries (WTO, 2018b).
A secure access to critical metals is by the EU argued as crucial to ensure the EU competitiveness and, hence, crucial to the success of implementing renewable energy (European Commission, 2008, 2016a, 2016c; Moss et al., 2013). This is further linked to the aspect of maintaining jobs and economic development within the union. The CRM list is raised as a key instrument for policy making and is aimed to serve as a tool to secure supply of the included materials (European Commission, 2015c, 2017a; Blengini et al., 2017).

The Raw Material Initiative has set out the strategy on how the EU should tackle the challenges related to access to raw materials (European Commission, 2008). Both researchers and policy makers frequently point at the first and the second pillars of this initiative; to secure access to raw materials and to increase access to supply from European sources. The results show that these two pillars gain more attention than the third pillar, which focus on reduction of EU’s consumption of primary raw materials.

The secure access to critical metals is highly linked to the EU dependency on other nations because of the large share of imports of for example REEs. The dependency on other nations can, as stated in several documents (e.g. Schubert; Brutschin; Pollak, 2015; Pavel and Blagoeva, 2017), lead to increased risks for supply shortages. In the same documents a reduction of the dependency on other nations is argued as a subset objective when aiming for a secured access to raw materials.

Another view related to the objectives is the interest in staying as an important actor on the global market for trade of raw materials and to ensure European competitiveness. In the Raw Material Initiative, it is for example states that;

“There is need for a decisive European response in order to ensure European competitiveness. Therefore, the issue of raw materials requires high level political attention and should be addressed in an integrated EU strategy that ties together various EU policies and promotes further cooperation between the Member States where appropriate.”(European Commission, 2008, p. 12).

Related to the competitiveness and the EU role on the global market the European Commission (2013a, p.13) states that a sustainable supply of raw materials should be achieved by “Putting Europe at the forefront in raw materials sectors…”.

5.4.1 Summarising discussion
The key objective that reoccur in the documents is to secure the future access to critical metals. This objective is further directly linked to the aim at reducing dependency on other nations and increase the European competitiveness. There is a clear focus on becoming a leading actor in the renewable energy sector and to make this possible the need for critical metals has become a key issue. The objective to secure the supply of e.g. REEs and cobalt, is concluded a measure to reach energy security and to reduce greenhouse gas emission by an increased use of renewable energy, but also as an objective to maintain power on the global market for critical metals.

5.5 Results - Strategies for goal fulfilment and risk mitigation
The findings show that the strategies proposed are mainly focused on fulfilling the objectives to secure supply of critical metals, improve competitiveness and reduce dependency on other nations. To boost the EU’s competitiveness by protecting the union against scarcity of resources and volatile prices, creating new business opportunities and innovative and more efficient ways of producing and consuming critical metals, are proposed as important actions (e.g. European Commission, 2013a, 2016b). Strategies aimed at fulfilling the objective to ensure a stable supply of e.g. REEs are to a large extent focused on reducing import dependency
by increasing the local production of REEs, improving resource efficiency and recycling and at finding substitutes. In the following four sections, the strategies that gain most attention in the studied EU documents will be presented.

5.5.1 Increase of primary supply

With an increasing demand for critical metals, an increased production is frequently raised as a one important strategy to be able to secure future access and reduce dependency on other countries (e.g. European Commission, 2008, 2013a, 2016b; Moss et al., 2013). The CRM list is, for example, considered a tool to help incentivise the European production by facilitating the launching of new mining activities (European Commission, 2017a). Both in the Raw Materials initiative and in the EIP of Raw Materials it is argued that increasing the exploration within the EU of certain critical metals is a key strategy to secure supply (European Commission, 2008, 2017b). One action area proposed in the Strategic Implementation Plan on Raw Materials is to promote investments activities to support increased mining in both Europe and abroad.

“The actions shall (1) support, through specific policy tools, the European mining, research and geological companies in exploration and development of mining projects abroad, (2) promote mining investment in Europe, and (3) foster cooperation with some countries on promoting the positive impacts of mining (economic, social and environmental), including exchange of best practices in raw materials policy and social acceptance of mining.”

(European Commission, 2013a, p. 23)

The focus on increased production of minerals both within the EU but also outside is by Blagoeva et al. (2016) explained by that current supply from mining activities are not sufficient to meet the future demand for minerals. A connected reoccurring view is also that domestically produced raw materials would be less vulnerable to trade restrictions that otherwise could increase the likelihood for supply disruptions (e.g. European Commission, 2012, 2016b; Pavel and Blagoeva, 2017). The REEs are, in policy preparation, brought up as an example where the supply situation is likely to stabilise in the coming ten years thanks to, inter alia, expansion of EU mine capacity (Blagoeva et al., 2016). When it comes to the development of REE mines within Europe, the Norra Kärr deposit in Sweden and south west Greenland are brought up as attractive potential future mines because of a high proportion of REEs (Moss et al., 2013; European Commission, 2015c; Pavel and Blagoeva, 2017). Researchers argue that these mines could potentially secure a large part of the European needs for REEs in the coming decades and with adequate funding and permits the mining could begin before 2020 (Pavel and Blagoeva, 2017). In the Implementation Plan for the EIP of raw materials it is further stated that;

”Major opportunities of access to raw materials exist within the EU today, especially for mining operations at greater depths, in non-conventional surface deposits or in small deposits. The ocean bed could also contain valuable raw materials, such as copper, zinc, gold, silver and rare metals, leading to growing world-wide competition for marine mineral deposits.”

(European Commission, 2013a, p. 8)

Related to investments in supplying countries the challenges of lacking mining policies in many countries with large metal reserves are by the European Commission further linked to the perception of risk;
“Several of the major suppliers of raw materials of high importance to the EU economy are located in countries that lack attractive mining policies to encourage exploration. Even though the geological attractiveness of these countries results in a higher overall attractiveness for companies to invest, companies' perception of risk has played an increasing role in determining the allocation of exploration budgets.” (European Commission, 2016b, p. 58)

Competition from other land use activities and a low public acceptance to extractive industries are brought up as challenges that complicates the strategy to increase the domestic mining production (European Commission, 2008, 2013a, 2016b). Another concern raised as a possible hinder for increased mining production, both within EU and outside, is how the national institutional framework conditions are formed. As stated by the European Commission (2008, p. 3-4); “Although there are examples of new mining initiatives being taken within Europe, there are still constraints in implementing the current EU and national regulatory framework that jeopardise the future development of the EU extractive industry.” A reoccurring view in policy and strategy documents is that the structure of natural mineral policies and environmental regulations could both impede or expedite the development of mining production. If environmental restrictions are too strict this could for example make it hard for mining companies to fulfil all these and to be economically profitable (e.g. European Commission, 2008, 2013a, 2016b). This argument was also brought up by one of the interviewees who stated that the mining industry in Europe have complained on being constraint by too strict environmental regulations (Interview, Official at the European Commission, 2018).

Long lead times between exploration of a deposit and development of a mine is also raised as aggravating circumstances, since it means that supply cannot be increased in a short term (Blagoeva et al., 2016; European Commission, 2016b; Pavel et al., 2016). Increasing the availability of raw materials sourced within the EU is part of the strategy ‘Tackling the challenges in commodity markets and on raw materials’ (European Commission, 2011b). In this strategy it is stated that the European Commission needs “[t]o ensure that the right framework conditions are in place to prevent unnecessary administrative burdens from limiting the use of locally available raw materials.” (European Commission, 2012, p. 7).

5.5.2 Recycling
In a world of increasing demand for critical metals, the use of secondary materials is considered another key strategy to improve EU’s security of supply at the same time as promoting a circular economy.

“Acting on the EU’s consumption of primary raw materials: the first step in ensuring a sustainable supply of raw materials is to increase the efficiency in the use of scarce resources and to promote the recycling of these materials. This aim is all the more relevant in the context of limited supply growth facing increasing global demand.” (European Commission, 2012, p. 7)

Recycling and reuse of materials are widely proposed in both policy preparation as well as in policies and strategies as solutions to EU’s combined challenges of resource security, business competitiveness and environmental protection (e.g. European Commission, 2011b, 2013a, 2013b, 2015a, 2017a). Measures to boost the market for secondary raw materials and to improve resource efficiency policies and product and waste regulatory frameworks are promoted as needed to be able to increase the amount of recycled materials (European Commission, 2013a, 2016b, 2018).
A common view is that an improved recycling would generate a reduced need for imports of critical metals, and thereby reduce the dependency on other nations (European Commission, 2011b, 2013a, 2013b, 2017a). The findings show that the strategy of improved recycling is aimed specifically at the materials included in the CRM list, and when it comes to the REEs, recycling is argued to be one of the most effective measures to enhance the EU resilience to supply and improve EU competitiveness (Blagoeva et al., 2016; European Commission, 2017a).

"The objective of this action area is to boost the quality and quantity of collected waste/end-of-life products, in particular those containing technology/critical metals and minerals in significant quantities – and improve the life-cycle management of products, thereby preventing losses of valuable raw materials and to then ensure their high quality treatment and recycling. This would in turn help further develop recycling activities, promote increased access to secondary raw materials and reduce the EU dependency on imports of many of these metals, including critical metals, in the EU, thereby contributing to increasing the share of industry in Europe’s GDP.” (European Commission, 2013b, p. 34)

Even though the environmental benefits from recycling are promoted in some documents, the analysis indicate that the increased access to the materials, reduced dependency on imports and improved competitiveness gain the primary attention when it comes to benefits from recycling (European Commission, 2013a, 2016b; Blagoeva et al., 2016).

5.5.3 Substitution

Even though recycling rates for many critical metals would be optimized to the highest possible extent, a common view raised in the EU communication, is that the increasing demand for certain metals calls for Europe to also introduce substitution based solutions to handle the critical supply situation (e.g. European Commission, 2013a, 2016b, 2017a; Mancini, De Camillis and Pennington, 2013; Moss et al., 2013a). An improved resilience situation for REEs is for example argued to be possible if both the degree of substitution and the recycling rates are improved in the coming decade, in combination with an increased local production of minerals within the EU (Blagoeva et al., 2016; European Commission, 2016b). It is further stated that substitution needs to be considered carefully on a case-by-case basis and rather targeted at special applications than on a specific metal. For some applications it might be possible to replace a particular metal with another without losing in the performance (Blagoeva et al., 2016; Pavel et al., 2016; Pavel and Blagoeva, 2017). However, the use of the same metal in another application may not be replaceable which justify the associated supply risk and possible additional costs (European Commission, 2013a).

When looking at the EU resilience to supply chain bottlenecks of REEs in wind turbines, Blagoeva et al. (2016) argue that substitution is the most effective measure to improve the resilience and secure material supply for this technology. It is further stated that "Substitution is a sustainable strategy to moderate the demand of some critical materials and thus reduce the pressure on their supply.” (Blagoeva et al., 2016, p. 22). Even though substitution is commonly mentioned as a key strategy and stated as the most effective measure to reduce the supply risk, it still gains limited attention in the documents compared with other strategies. Substitution is in general mentioned together with recycling and increased local production, and thereby rarely in conjunction with any explanations on the course of action for employment. The only document that mention substitution on its own is the article for policy preparation focusing specifically on substitution of critical raw materials in low-carbon technologies (Pavel et al., 2016). The findings show that a focus on possible environmental or social sides of the
substitution is missing in the EU policy making. A material that for example could replace a REE, and thereby reduce the supply risk and dependency on China, could come with both improved and worsened environmental or social impacts depending on e.g. how and where it is mined. This risk is not treated in the documents.

5.5.4  Diplomacy and trade politics

Other proposed strategies in both policy preparation as well as in policy and strategy documents, commonly circulate around diplomacy and trade politics (e.g. European Commission, 2012, 2016b; Schubert; Brutschin; Pollak, 2015; Amighini et al., 2016). The European Commission argues that the EU strives to be an active actor in trade negotiations and it is frequently stated that the aim is to remove all kinds of trade barriers to promote free trade (European Commission, 2012, 2016a, 2017c; Directorate General for Research and Innovation, 2017). In 2011 the European Commission published a new strategy on raw materials that emphasises the importance of resource diplomacy. In this strategy the focus is put on securing access to raw materials, in particular the critical ones, through partnerships and policy dialogues (European Commission, 2011b). In the Raw Material Initiative, the following statement explain how trade and regulatory policy can improve access to raw materials;

“The EU should work towards the elimination of trade distorting measures taken by third countries in all areas relevant to access to raw materials. The EU will take vigorous action to challenge measures which violate WTO or bilateral rules, using all mechanisms and instruments available, including enforcement through the use of dispute settlement. More generally, the EU will act against the protectionist use of export restrictions by third countries. In determining its actions, the EU will take as priority those export restrictions that pose the greatest problems for EU user industries or give their domestic downstream industries an unfair competitive advantage on international markets.” (European Commission, 2008, p. 7)

A common view, stated by both researchers and the European Commission, is that the EU should intensify bilateral dialogues with major EU trading partners to reduce the risk of sudden supply shortage of important raw materials (European Commission, 2012, 2016a; Schubert; Brutschin; Pollak, 2015). In the policy preparation document ‘Trade and Economic Relations with Asia’, Amighini et al. (2016) claim that China is a key partner for the EU because of its major production of several important raw materials. In the EU Trade Policy for Raw materials (European Commission, 2012) it is further stated that the EU-China relationship is characterized by several differences on raw material matters. The following statement indicate that there is a will to improve cooperation with China related to other raw materials, but that the REEs are excluded from this cooperation, because of the WTO dispute settlement following the trade restrictions on REEs introduced by China in 2010.

"Beyond these obvious differences, the EU has reaffirmed its will to exchange ideas on raw materials. These exchanges concerned materials of bilateral relevance not subject to the first WTO Dispute settlement case (see section 2.2.3), such as rare earths, in order to attain a better understanding of the policy objectives pursued and to find amicable solutions.” (European Commission, 2012, p. 18)

The REEs seem to be a sensitive policy matter also in more recent documents, where the relationship to China has become complicated. As stated earlier, both researchers and the European Commission use the China case with REEs as an example of how trade restrictions
can cause problems on the global market (e.g. European Commission, 2012, 2017c; Nansai et al., 2015; Mendez Parra and Schubert, 2016).

The EU trade politics are further regarded as linked to the EU development policy. In the ‘EU Trade Policy on Raw Materials’ it is reasoned that win-win situations can be created by investments and knowledge sharing to developing countries with large deposits of critical metals (European Commission, 2012). A common view is that such cooperation could be beneficial for both the producing country’s development and for EU’s access to raw materials (e.g. European Commission, 2008; Directorate General for Research and Innovation, 2017).

Several import dependent countries, such as the US, Japan and Russia, are known to have active programmes for stockpiling materials, especially the ones considered as critical. The US has for example stockpiled materials necessary for the defence industry (European Commission, 2008, 2015c). In one of the documents for policy preparation it is stated that stockpiling materials could have the same effect on prices as trade restrictions (Pavel et al., 2016). Despite this, the European Commission intends to explore the added value and feasibility of a possible stockpiling programme of critical raw materials (European Commission, 2011b; Schubert, Brutschin and Pollak, 2015).

Another part of the EU diplomacy related to critical metals is directed towards other import dependent countries. A trilateral initiative between the EU, Japan and the USA was launched by the EU in 2011 (European Commission, 2012). The initiative was aimed to create a platform for cooperation on how science, technology and innovation can help to secure a stable supply of critical metals. The first workshop treated the future access to REEs (European Commission, 2012).

### 5.5.5 Summarising discussion of all strategies

The key strategies presented in the studied documents to reduce the risk of supply shortage of REEs and cobalt are; increased primary production, both within the EU but also in non-EU countries; increased recycling; finding alternative materials through substitution; and improved diplomacy. All the proposed strategies are aimed at securing access to supply of critical metals, reducing the EU dependency on a few producing nations and at improving the EU competitiveness.

The strategy to increase the primary production of metals has resulted in an interest in exploration for new mining opportunities, both within Europe but also in other countries that could be potential suppliers. Sweden, Greenland and the European ocean bed are examples brought up in the documents as potential future places for mining of REEs. Greenland and the ocean bed are typical examples of remote places that so far have been protected from human exploration. In the book ‘Rare Earth Frontier’ by Klinger (2017), this dilemma is raised related to REEs and she argues that the increased interest in mining in remote places is based on faulty thinking that REEs would be ‘rare’ in reality, which is not the case. This reasoning is backed up by an article by Månberger and Stenqvist (2018) in which it is concluded that reserves of metals, such as REEs and cobalt, are unlikely to constrain growth rates of renewable energy technologies.

Norra Kärr, outside the Swedish city Gränna is an example of an REE enriched deposit that has gained increased interest in recent years as a potential European production place. International mining companies have shown interest in mining here, but public voices and environmental associations have highlighted the environmental impacts for the closely related lake Vättern (Nyteknik, 2014). In the Swedish Mineral Strategy from 2013 it is clearly stated that Sweden is open for increased domestic mining and that this should be done to meet the demand for certain metals within the EU (Regeringskansliet, 2013). This enlarged focus on
mining within Europe underline the concern over increased dependency on other nations and the importance of competitiveness on the trade market. Advocates for increased mining in Sweden argue that it is better to mine where the environmental regulations are stricter and where there is enough knowledge on how to minimise consequences (Mining for Generations, 2018). In contrast to this the European Commission raises that the strict environmental regulations in many Member States and the low public acceptance to extractive industries makes it hard to introduce new mines within Europe. One interesting question related to a deposit like the one in Norra Kärr, is whether the common interest of the Union to increase domestic production would be prioritised before the interest of single countries, like Sweden, and thereby push countries to open new mines against the national will. Another related question is if the increased interest in domestic production would weaken EU environmental regulations related to mining activities or prevent reinforcement of existing regulations. The question whether mines should be implemented within Europe or abroad could be described by the risk concept introduced by Beck (1992), in which there is an ongoing conflict over so called ‘bads’. With this definition the environmental and social impacts from mining could be argued as the ‘bads’ and the EU thereby decides whether to increase production domestically or in other countries, based on whether the ‘bads’ can be accepted or not.

The strategy to increase recycling of critical metals is another way of securing supply. The will to become less dependent on imports at the same time as the demand for metals such as REEs and cobalt increases, makes the EU locked to what can be done on a local level to handle the supply challenge. This argument was also brought up in one of the interviews, where the interviewee stated that countries and regions with access to large deposits of critical metals, naturally also have a lower interest to improve the recycling of materials (Interview, Researcher, 2018). When discussing the benefits from recycling in the documents the main benefits raised are the ones from a secure supply to metals and reduced dependency on imports, little focus is put on any environmental benefits from recycling as a result of for example reduced mining activities. This again highlights the geopolitical background where a key focus for the EU seem to be to remain a powerful actor on the market for critical metals, if not with a primary supply, then with secondary resources. In contrast to this, previous research by Månberger and Stenqvist (2018) concludes that recycling will only play a marginal role when securing supply, since existing reserves of the majority of critical metals, including REEs and cobalt, are enough to meet the growing demand for renewable energy technologies.

Substitution is considered a key strategy in EU policy making and also as the most effective one according to (Blagoeva et al., 2016). Despite this it gains relatively little attention in the documents compared to increased primary production and recycling. This can be argued as explained by the difficulties in finding alternative materials that could give the same performance in renewable energy technologies as REEs and cobalt. An argument that is also raised in previous research by O’Sullivan, Overland and Sandalow (2017) and in one of the expert interviews (Interview, Researcher, 2018). Research to find possible substitutions can be time consuming and need capital investments, which might also explain the choice to focus on other strategies before this one. The struggle over specific resources, such as the REEs, will most likely remain if no better options exist. This further implies that the strategies to improve access to these materials will be prioritised before substitution if a strong demand still remains, and as long economies of scale can be gained from a secure access to supply. Recent research by Månberger and Stenqvist (2018) concludes that most technologies can be substituted by back-stop technologies with slightly lower performance or higher cost, but including alternative metals than the critical ones facing a lower demand.
The fourth key strategy proposed in the studied documents is diplomacy and increased cooperation with important trading partners. The trilateral initiative of Europe, the USA and Japan, is a cooperation between three highly import dependent nations where the aim has been to secure access to supply. When looking at an initiative like this from a geopolitical perspective it can be argued that it supports existing power structure when including nations commonly stated as part of ‘the global north’ or ‘developed countries’ and excluding countries in the so called ‘global south’ or ‘developing countries’. This implies that the already wealthy countries seek to cooperate to secure their continued wealth and to secure their own power on the global market.

Previous research by e.g. De Ridder (2013); Sweijis et al. (2014) and Klinger (2017) point at countries and regions becoming more nationalistic and self-centred as a geopolitical effect of the increased struggle over resources for renewable energy technologies.

“Import dependent states have formulated policy responses aimed at securing a stable and affordable supply of minerals. Producing countries have also become more active in formulating mineral policy, as they want to benefit from high prices. This has resulted in a trend towards more government interference, mercantilism and protectionism. The increased role of governments and state owned enterprises is also related to the rise of state capitalism. Trends in mineral policy have both positive and negative implications for the balance of conflict and cooperation in international relations. The risk of international tension, however, is increased by the transition to a multipolar world, in which countries are focusing more on their national interests and international relations are becoming more uncertain and instable.” De Ridder (2013, p. 2)

This increased focus on the national interests is shown to be present in EU policy making since many strategy and policy documents indicate an increased focus on securing access of raw materials for the union. Increased domestic production of e.g. REEs and improved recycling are strategies to move the supply back ‘home’ instead of being dependent on import from other nations, which further indicate some sort of protectionism. Trade restrictions can also be argued as measures to keep the supply to the domestic market, which has been the key critique against China for the trade restrictions on REEs.

At the same time as the EU promotes free trade and opposes most trade restrictions, diplomacy strategies raised in the documents suggest increased investments in countries with large reserves of e.g. REEs and cobalt and possible stockpiling of metals. These are methods to ‘block’ metals for own use since the investments are made to secure access to metals for EU consumption. By investing in these places, the EU reduces the risk of supply shortages that exist when the import is limited to a few countries. The findings also indicate an increased interest for stockpiling materials which further indicates a strategy to secure access for the own supply. The question how these strategies are different from the trade restrictions implemented by China, when it comes to the impact on the market and prices, and why some ‘blocking’ methods are accepted and other not, remains to be answered.

The results show that the urgency to secure the supply of critical metals is pushing policy makers and other actors to promote increased technological development rather than on reducing the actual consumption of the materials. The strategies proposed for securing supply are to some extent all dependent on improved technological development; increased mining activities by more efficient mining techniques; recycling through improved technologies to handle waste; and substitution by for example new backstop technologies to enable more
efficient mining. The missing focus on a reduced consumption of metals in EU policy making implies that other strategies are prioritised before trying to reduce the consumption.

5.6 Results - Actors
In general, the documents for policy preparation put relatively little focus on whom should realise the promoted strategies. When actors are mentioned a common view seem to be that companies and industries play the most important role for the realisation of increased local production, recycling and substitution and that policy makers need to make sure that the right frameworks are in place to make this possible. In the strategy ‘Tackling the Challenges in Commodity Markets and on Raw Materials’ the following statement is for example found:

"Securing supplies of raw materials is essentially the task of companies and the role of public authorities is to ensure the right framework conditions to allow companies to carry out this task. The Commission intends to explore with the extractive, recycling and user industries the potential for targeted actions, notably with regard to recycling.” (European Commission, 2011b, p. 14)

In the Implementation Plan for the EIP of Raw Materials it is on the other hand stated that a cooperation between the European Commission, the EU Member States, industry and academia is needed to secure access to raw materials and to realise the proposed strategies (European Commission, 2013b). The whole idea with this network is to involve many different stakeholders in the work to fulfil the objective of a secure access to raw materials, especially the critical ones.

This wide view on key actors is also present in the newly published report on ‘Critical Raw Materials and the Circular Economy’. In this report the European Commission points at key actors and projects within the EU that are working towards the objective of securing access to supply. These actors are the European Innovation Partnership (EIP) of Raw Materials, the Ad hoc working group on CRMs, the European Institute of Innovation and Technology, SCREEN (the European Expert Network on CRMs), the ERECON (the European Rare Earths Competency Network). All these actors are argued to play an important role in the work of securing access to critical metals, such as REE and cobalt, reducing dependency on other nations and at improving the EU competitiveness on the global market for raw materials (European Commission, 2018).

5.6.1 Summarising discussion
The findings show a broad focus and an involvement of a wide range of different actors in the work to secure the access to critical metals. The work on securing access to supply is in the documents stated to include policy makers, industry, civil society and academia. The broad approach on dealing with the supply situation and related challenges and the inclusion of a wide range of actors indicate that the EU has taken the concern of supply shortage seriously and is working on a wide front to deal with it.

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7 A composition of different stakeholders (Member States, industry, research and civil society) that contributes with expertise related to the CRM-list (European Commission, 2018).
9 A network of experts on critical Raw Materials with stakeholders, public authorities and civil society representatives (European Commission, 2018).
10 A network active 2013-2015 with representatives from industry, academia and policy making with the aim of looking on how to improve the REE supply within the EU (European Commission, 2018).
6. Conclusions

The aim of this thesis was to analyse EU policy making and debate on critical metals needed for renewable energy. The focus was primarily set on the metals within the group REEs and on cobalt. Below follows a summary of the findings and answers to the research questions.

My first research question addressed how the demand and supply of REEs and cobalt is raised in the EU documents. I concluded that an increased demand in relation to supply of critical metals, including REEs and cobalt, is addressed widely in EU policy making and considered a key challenge for future development of renewable energy. These materials are mainly seen as critical because of the concentration of supply to a limited number of countries with a high political risk. Securing the access of critical metals, including REEs and cobalt, is a key objective for the EU to maintain a stable economic development, increased competitiveness and to reduce the import dependency on other nations, such as China for the REEs. The supply risk is related to a concern of possible supply chain bottlenecks or shortages and the findings indicate a common concern within the EU that the probability of such events has increased in recent years. The increased focus on the supply risk is however argued to be affected by a perception of risk that is socially constructed and thereby not necessarily reflects an increased actual probability of a supply shortage. The struggle over resources is further argued to be affected by perceptions of the world and influenced by historical and current power structures. The urgency to secure the supply of critical metals is claimed to push policy makers and other actors to promote for example increased mining activities and technological development, rather than reducing the actual consumption of the materials.

My second research question addressed what challenges in terms of environmental, social and geopolitical risks, for importing and producing countries respectively, are discussed in the EU policy making and other communication in relation to the supply and demand for REEs and cobalt. I concluded that environmental and social risks gain little attention related to REEs, cobalt and other critical metals. The common view is that the EU should work for a sustainable access to critical metals. To handle the social risks related to metals mined in conflict affected areas the EU has implemented a conflict mineral regulation. Cobalt is however not included in this regulation, even though the main producer DR Congo is considered a conflict affected area when it comes to other minerals included in this regulation. The main environmental risks raised in the documents are related to extractive waste from the mining industry. Relatively little focus is put on the actual consequences and on how the risks can be mitigated. A common way to deal with the risks is to refer to existing policy frameworks, such as for example the Mining Waste Directive. A low public acceptance to extractive industries as well as strict environmental regulations are argued to complicate for the mining sector within the EU. I conclude that the low public acceptance to extractive industries within the EU is related to people being more aware of possible consequences from mining activities but also to what people see as an acceptable risk.

The main geopolitical risks are linked to the dependency on other nations because of the high need for import for REEs and cobalt. The EU Commission viewpoint is that an increased dependency also increases the risk for supply shortages and could thereby affect the economic development in the union as well as the EU competitiveness. This again implies a struggle over political power where EU as an import dependent region tries to regain power on the market by reducing the dependency on e.g. China. Even though EU is import dependent when it comes to REEs and cobalt, I conclude that EU is a geopolitical winner with the development of renewable energy thanks to its political power and financial strength necessary to handle such vulnerability.
The third research question focused on what strategies and actions that are proposed as measures to address demand and secure supply of these metals and to mitigate the identified risks. The four main strategies presented by the EU to secure its access to REEs, cobalt and other critical metals, to improve the EU competitiveness and to maintain the power on the global market are to; (1) increase primary supply, both within the EU and in other countries, (2) improve the secondary use of materials by more recycling and (3) redistribution of demand by finding alternative materials through substitution and (4) diplomacy and increased cooperation with important trading partners. All the proposed strategies are aimed at securing access to supply of critical metals.

The strategy to increase primary production has resulted in an increased interest in exploration for new mining opportunities, both in Europe and abroad. The enlarged focus on mining within Europe is mainly aimed at reducing the dependency on imports from other nations and at improving the EU competitiveness. These are also the key objectives when aiming at increasing the recycling rates within the union. The strategies to secure access to critical metals, such as increased primary production and recycling, are considered as prioritised before substitution if a strong demand remains and if economies of scale can be gained from a secure access to supply.

The EU takes a clear position against all kinds of trade restrictions and many diplomacy actions thereby focus on promoting a free trade. Resource diplomacy is also part of EU strategies on critical metals. China is considered an important trade partner, but the trade relation related to REEs has become complicated after previous trade restriction introduced by China. The focus against trade restrictions is a strategy for free trade, but it also implies an EU willingness to advice foreign policy making which is argues to be a result of existing power structures. This was for example shown in the case with the Chinese trade restrictions on REEs when the EU and other import dependent countries did not accept the Chinese environmental explanation behind the restrictions and instead raised a WTO dispute settlement against China. The European Commission also shows an interest in investing in countries with large reserves of critical metals to secure access to meet the domestic demand for metals. This strategy is a way of ‘blocking’ access to metals for the own consumption.

An increased focus on the national interests is concluded to be present in EU policy making and debate since the studied documents demonstrated an increased focus on securing access of critical metals to meet the own demand. The strategies to increase domestic production of e.g. REEs and improved recycling are strategies to move the supply back ‘home’ instead of being dependent on import from other nations, which indicates a geopolitical protectionism. Diplomacy actions are also related to the strategy to increase the number of suppliers globally by for example investments in countries with large reserves of e.g. REEs and cobalt. The EU shows an increased interest for stockpiling materials which further indicates a strategy to secure access for the own supply.

This thesis has analysed EU policy making on critical metals for renewable energy technologies with a specific focus on environmental, social and geopolitical risks. The results from this thesis gives an increased understanding of the focus in EU communication and policy making when it comes to critical metals for renewable energy. The thesis provides a viewpoint to the transition to renewable energy that normally gain little attention in the public debate, but that might be of great importance for the future development of renewable energy. The thesis poses questions for further research such as to what extent the increased demand for REEs and cobalt is shaping new global power structures and if the increased focus on domestic production is putting pressure on single nations to open new mines or resulting in weaker environmental regulations to facilitate for new mines.
The findings from this thesis would gain from being supplemented by further research looking at EU policy making over a longer period, to see if there has been a change in focus over time. Other interesting research related to the topic would be to look on policy making on critical metals in other import dependant countries, but also from the perspective of large producers, such as China and the DR Congo.

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8. Bibliography


Regeringskansliet (2013) ‘Sveriges mineralstrategi - För ett hållbart nyttjande av Sveriges mineralillgångar som skapar tillväxt i hela landet.’, (N2013.02).


**Online sources**


**Interviews**


## Appendix 1

### Table 3. The EU list of Critical Raw Materials from 2017

<table>
<thead>
<tr>
<th>Critical Raw Materials (CRMs) 2017</th>
<th>Antimony</th>
<th>Fluorspar</th>
<th>Indium</th>
<th>Phosphorus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baryte</td>
<td>Gallium</td>
<td>Magnesium</td>
<td>Scandium</td>
<td></td>
</tr>
<tr>
<td>Beryllium</td>
<td>Germanium</td>
<td>Natural graphite</td>
<td>Silicon metal</td>
<td></td>
</tr>
<tr>
<td>Bismuth</td>
<td>Hafnium</td>
<td>Natural rubber</td>
<td>Tantalum</td>
<td></td>
</tr>
<tr>
<td>Borate</td>
<td>Helium</td>
<td>Niobium</td>
<td>Tungsten</td>
<td></td>
</tr>
<tr>
<td>Cobalt</td>
<td>Heavy Rare Earth Elements (REEs)</td>
<td>Platinum Group Metals (PGMs)</td>
<td>Vanadium</td>
<td></td>
</tr>
<tr>
<td>Coking coal</td>
<td>Light Rare Earth Elements (REEs)</td>
<td>Phosphate rock</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: European Commission (2017a)
Appendix 2

Table 4. Empirical material used for the text analysis

<table>
<thead>
<tr>
<th>Directives, Initiatives and Communications</th>
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<table>
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<th>Strategy Documents</th>
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<th>Papers and reports for policy preparation</th>
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<tr>
<td>Reference</td>
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*References that have not been referred to or cited in the analysis