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# [THE ROLE OF DISTRIBUTION SYSTEM OPERATORS IN THE ENERGY TRANSITION]

Exploring the necessary strategies, resources and capabilities of the Distribution System Operators in the Netherlands to enable the Regional Energy Strategies

## Abstract

Regional Energy Strategies (RES) are conducted in the Netherlands in pursuit of the goals set by the Paris Agreement. Distribution System Operators (DSO) are important actors in the RESs, as they need to prepare the energy infrastructure based on the proposed changes in the strategies. Moreover, they are seen as essential stakeholders and are asked to support the conduction of the RESs. Therefore this research investigates what the necessary strategies, resources and capabilities of the DSOs are for enabling the RESs in the Netherlands. A conceptual model is designed combining the Resource-Based view and dynamic capabilities theory, to inventory the necessary strategies, resources and (dynamic) capabilities (Barney, 1991; Teece, Pisano & Shuen, 1997). A multiple case study design is used in which the five pilot RESs and the three DSOs operating in these pilot regions are studied. Document analysis is conducted on the RESs and the DSOs' strategies, in combination with interviewing RES professionals and DSO representatives. The outcomes of this research propose that the DSOs should better align their strategies with the position they want to take in the RESs. This will result in internal alignment, which enhances the enabling of the RESs. Moreover, it is found that knowledge and experience are crucial unique resources of DSOs in a changing environment. The complementary resources of the DSOs should include a subsidiary in the non-regulated domain, as well as strong lobby activities. By this Dutch law is influenced, and more freedom in the operating space for the DSOs can be achieved. For substitutable resources, it is crucial to acquire sufficient technical employees, as well as financial assets. In addition to resources, (dynamic) capabilities are required to enable the RESs. R&D activities, collaboration and knowledge creation are essential organisational processes that enhance the learning of an organisation. Learning on its turn is crucial to formulate the DSOs' dynamic capabilities to enable the RESs. The DSOs should specifically focus on increasing their internal learning ability to further develop and upscale solutions or innovations that can enable the RESs. Increasing the internal learning and strengthen the lobby activities will allow the DSOs to seize their opportunities and transform the organisation, which will eventually enable the RESs.

## Management summary

In pursuit of the Paris Agreement, the Dutch government, together with the association of municipalities (Vereniging Nederlandse Gemeente) set up a programme in which Regional Energy Strategies (RESs), are conducted. In this programme, the Netherlands is split up into 30 regions, which are entitled to compose a strategy in which their plans are described for making the region energy neutral by 2050. These RESs will have significant impacts on the Distribution System Operators (DSOs) in the Netherlands. The DSOs are responsible for operating the low and medium voltage networks and connecting their customers to the grid. Moreover, they are responsible for the regional natural gas network. The introduction of the RESs, as a part of the energy transition, has several impacts on the DSOs. First, the conduction of the RESs demands participation of the DSOs. As the DSOs traditionally are a demand-driven organisation, this requires a different approach and way of working. Moreover, proposed solutions by the RESs, such as solar panels, wind parks and electric cars, result in fluctuations in electricity demand and supply. As the DSOs are responsible for a stable supply of energy, changes in their operations are required. Furthermore, the phasing out of natural gas impacts the DSOs. Hence, for the DSOs to enable the RESs, several changes are needed. To research how the DSOs can enable the RESs, the following research question is conducted:

*What are the necessary strategies, resources and capabilities of the DSOs for enabling the RESs in the Netherlands?*

The required strategies, resources and capabilities are studied by using the theory of the Resource-Based View of the firm (Barney, 1991). This theory looks at how a company can gain competitive advantage by attaining the right resource base. As DSOs in the Netherlands are regulated and geographically determined, competitive advantage is not applicable. However, the authority consumer and market (Autoriteit Consument en Markt – ACM), monitors the price the DSOs charge, therefore, cost efficiency is required. Hence, this theory helps understanding how the DSOs should enable the RESs, while at the same time keeping the prices low. As the introduction of the RESs implies a changing environment for the DSOs, the dynamic capabilities theory (Teece, Pisano & Shuen, 1997) is also used to study how the DSOs can formulate capabilities that can change over time and can enable the RESs. A conceptual model is formulated, combining the Research-Based View and dynamic capabilities.

A multiple case study was conducted to inventory the necessary strategies, resources and capabilities as suggested in the conceptual model. Since the RESs are still being conducted, this research only studied five pilot regions that already submitted a first RESs in 2017. The multiple case study included these five pilot regions and their subsequent DSOs. These include Enexis in the operating area of Hart van Brabant and West-Brabant, Stedin in the operating area of Midden-Holland and Drechtsteden and Liander in the operating area of Friesland. Data for this research was collected in two different ways. Documents were collected on the RESs and the current DSO strategies. Moreover, interviews were conducted with DSO representatives, RES professionals and some other interviewees. In total, twelve documents were collected, and twenty-four interviews were conducted.

The analysis of these documents and interviews facilitated the answering of the research question. It can be concluded that the DSOs are already on their way to enable the RESs. The DSOs started specialised departments to support the conduction of the RESs. Moreover, subsidiaries of the DSOs facilitate the research and development of innovative solutions that can support the execution of the RESs. However, many things still need to be done by the DSOs to fully enable the RESs.

As a significant first finding, it is concluded that the DSOs' current strategy is not aligned with the enabling of the RESs. Although the strategies are grafted on the energy transition, they are not proposing the role and position of the DSOs in the RESs. This results in dissonance between DSO representatives in the role and position they take in the RESs process. Thus a clear vision is required by the DSOs on their role and contribution to RESs. Explicitly embedding the role and position of the DSOs in the RESs in the strategy allows a better enabling of the RESs.

Considering the resource base of the DSOs, a couple of things are noted. The knowledge base of the DSOs currently is the most significant unique resource and should support the enabling of the RESs. However, it cannot be said that this knowledge base will still suffice in the future. Therefore it is crucial for the DSOs to continuously renew and update their knowledge. Moreover, expertise should be gained on innovations like hydrogen to be able to enable the execution of the RESs. Another important category of resources is the firm's complementary resources, these resources support the commercialisation of innovations. Developing and commercialising innovations is crucial for DSOs to enable the conduction and execution of the RESs. There are two primary complementary resources currently present at the DSOs, namely lobby relations and activities and the subsidiaries in the non-regulated domain. Lobby activities are essential for DSOs to broaden their operating space and by this being able to commercialise innovations. Strengthening the lobby is required to expand the DSOs authorisations that will allow for innovations that can enable the RESs. Also, subsidiaries in the non-regulated domain allow the DSOs to find and test solutions outside their regulated working space. Moreover, literature argues that marketing and customer support are important complementary resources. Although this is less the case for DSOs as customers are tied to DSOs based on their location, customer support can still enhance the customer's willingness to adopt innovations that can eventually enable the RESs. A last category of resources is the firm's substitutable resources. Even though it is often argued that the firm's substitutable resources are unimportant, this research shows that they are crucial when there is a shortage of them. Three types of substitutable resources to enable the RESs are identified. First, human assets, in the form of technical employees and contractors are essential. Currently, there is a shortage of technical employees. Therefore the DSOs will need to invest in sufficient technical employees that can execute the solutions as proposed by the RESs. DSOs can recruit and educate at schools. Moreover, automation and increasing efficiency can decrease the demand for technical employees. Next to human assets, financial assets are crucial for enabling the RESs. Due to the complexity of the cost-determination system that is determined by the ACM, it cannot be said if current financial assets are sufficient. Nonetheless, it is indisputable that sufficient financial resources are crucial for any organisation facing changes in its environment. Lastly, analytical

tools that give insights into alternative energy systems should be further expanded to enable the RESs.

Finally, looking at the capabilities of the DSOs necessary for enabling the RESs a couple of things are noted. It is argued that DSOs should set up their dynamic capabilities to be able to adapt to changes in the environment. Dynamic capabilities are those capabilities that can change over time. Organisational processes are the root of those dynamic capabilities. When an organisational process is focused on learning, it can facilitate the formulation of dynamic capabilities. Dynamic capabilities and learning can facilitate the organisation to change over time and therefore are essential for enabling the RESs. As crucial organisational processes to enable the RESs, the DSOs research and development activities, collaboration and knowledge creation are identified. Research already takes place at the DSOs, however, the development of the found innovations still lags behind due to the restriction in the operating space of the DSOs imposed by Dutch law. A strong lobby should broaden the activities of the DSOs, which can enhance the development of innovations by the DSOs. Moreover, on the topic of knowledge creation, the DSOs are already able to create new knowledge and learn externally from the participation in pilot projects on various topics (e.g. energy storage in batteries). However, the DSOs are insufficiently able to translate this knowledge to their internal organisation, which is required to enable the RESs. Therefore the DSOs should focus on internal knowledge sharing and internal learning in order to develop solutions that enable the RESs.

Based on the previous, a chronological order is proposed in which the necessary strategies, capabilities and resources should be attained to enable the RESs. First, it is a prerequisite that the DSOs have sufficient human and financial assets. Without those, the enabling of the RESs is not possible. Therefore, the DSOs should ensure the sufficiency of those resources. Second, the DSOs' strategy should include a clear vision of their position and contribution to the RESs. This strategy should be aligned with the internal resources and capabilities of the firm in order to enable the RESs. Third, the firms should strengthen the lobby to broaden their operating space to be able to develop and upscale their discovered innovations. Lastly, the internal learning ability of the DSOs should be set up to develop dynamic capabilities that allow the DSOs to continuously adapt when changes in the environment occur. Although internal learning is perceived to become most crucial once the lobbying has effectively broadened the DSOs operating space, it is essential for the DSOs to continuously work on their internal learning capability. This allows the DSOs to constantly be prepared for changes happening in the environment that affect the DSOs and be able to adapt their resource and capability base rapidly.

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# 1. Introduction

As scientific evidence of the increase of greenhouse gasses, and specifically $CO_2$, is accumulating, the effects of human activities on our climate are becoming increasingly visible. Hence the international community is seeking to find a solution to diminish the effects of this profound climate change. For that reason, 195 countries signed the Climate Agreement of Paris that aims to keep global temperature rise below 2 degrees Celsius, compared to 1850; the pre-industrial era (The Paris Agreement UNFCCC, 2018). In pursuit of the Paris Agreement, the Dutch government initiated regional energy strategies (*regionale energiestrategie* – RES), as a part of their National Climate Agreement. In this programme, the Netherlands is split up into 30 sub-regions, which are individually responsible for developing an energy strategy (Klimaatakkoord, 2019). These strategies should be developed to reach the goal of the reduction of $CO_2$ with 95% by 2050, compared to 1990 (Klimaatbeleid, n.d.). The regions should reach this goal by changing from fossil to renewable electricity and by phasing out natural gas (Klimaatakkoord, 2018). So far, five pilot regions have submitted their RES. Therefore this research only focuses on these five strategies.

The RESs can have a significant impact on the energy system and specifically on Distribution System Operators (DSOs). DSOs are responsible for operating and ensuring the electricity and natural gas distribution system within a particular area (Van Werven & Scheepen, 2005). The transition towards renewable energy can lead to less stable supplies of energy due to variables like wind speed and solar radiation (Verbong & Geels, 2007). The inability of DSOs to adapt to the energy transition can jeopardise the stable supply of energy to consumers. Furthermore, phasing out natural gas can result in a higher demand for electricity, as a result of changing to electric heating (de Ronde, 2018). This can result in capacity issues on the DSOs' networks. Additionally, a two-way system is created by consumers producing their own electricity (Bayond-Rújula, 2009). All these changes require modifications by DSOs to fulfil the needs of their consumers and to enable the RESs. Moreover, the conduction of the RESs requires participation and input from the DSOs as well, to make plans that can successfully be executed. As DSOs traditionally do not participate in this kind of activities, this will require organisational changes too.

Next to the societal and company implications of the RESs, there is also an academic perspective on this issue. Various scientific research has been conducted on the future role of DSOs in the energy transition (Bayod-Rújula, 2009; Werven & Scheepers, 2005). It is acknowledged that DSOs will have to invest and innovate to be able to reliably deliver electricity in the future (Richter, 2011). Traditionally grid reinforcement is the DSO's first and often only response to keep the grid reliable. However, other solutions like charging different rates to stabilise demand (Palensky & Dietrich, 2010) and purchasing batteries to store energy at peak moments and use it for times with little supply (Wade et al., 2014) could postpone or even prevent grid reinforcement. Moreover, using electricity surplus at peak moments to produce hydrogen as an alternative for natural gas (Jones, Al-Mastry & Dunnil, 2018) and making use of district heating to store electricity in the form of heat (Berenschot, 2018) could be considered as solutions for various grid issues. However, these kinds of solutions require a strategy change and out-of-the-box thinking and working from DSOs. Currently, DSOs seem

to be focussed on solutions within their own reach and business. This phenomenon can be substantiated by the theory of strategic rigidity, which argues that successful companies are often the slowest to react to a changing market. These companies might be stuck in their way of doing business and are often too focussed on the performance they know (Matthyssens, Pauwels & Vandenbempt, 2005). To break out of this stiffness in strategy and to find a viable solution, a switch of focus might be necessary. Furthermore, the energy transition and RESs demand for a different way of working based on stakeholder relations and collaboration between different parties to find solutions. Therefore, this research focuses on a strategy shift, which enables DSOs to look at solutions outside their current paradigm and work together with different stakeholders, which will enable the energy transition initiated by the RESs.

## 1.1. Aim and research question

As exemplified, DSOs will need to change their strategy to be able to look for solutions outside the current business paradigm and to successfully participate in the RESs process, to support the enabling of the RESs. Current literature in this domain often tends to focus on the end-strategy, rather than on the necessary features of a company to reach this 'end-state'. The Resource-Based View (RBV) of the firm states that a company should have or gain the right resources and capabilities to gain competitive advantage and to form an appropriate strategy. This literature describes the importance of resources and capabilities in forming a strategy. In addition to the RBV, dynamic capabilities of a company tend to be valuable for a company that is facing changes in the environment (Teece, Pisano & Shuen, 1997). Most research on this topic is conducted for companies operating in the non-regulated market (Teece, Pisano & Shuen, 1997). As DSOs operate in a regulated market, strategies, resources and capabilities might differ from those operating in a non-regulated market. Therefore, this research aims to identify the strategies, resources and capabilities of the DSOs that are necessary to enable the RESs. The identification of the appropriate renewed strategies, resources and capabilities should guide DSOs through the enabling of the RESs and subsequently the energy transition in a feasible manner. Hence, the following research question is stated:

*What are the necessary strategies, resources and capabilities of the DSOs for enabling the RESs in the Netherlands?*

To answer this question, several sub-questions are formulated:

- *What does the RES entail?*
- *What is the current strategy of the DSOs?*
- *What are the current resources and capabilities of the DSOs?*
- *How do the current strategies, resources and capabilities restrict or enable the RES?*

The research question is answered by using strategic management literature to identify a framework which can facilitate the inventory of the current strategies, resources and capabilities of DSOs and how these enable or restrict the RESs. This research only assesses the RESs of the five pilot regions submitted in 2017. To study strategies, resources and capabilities of the DSOs that enable the RESs a multiple-case study is conducted at Enexis, Stedin and Liander, which are the companies operating in the areas of the five pilot RESs.

The next section discusses the theory that is used in this research to answer the research question. This is followed by a short section that provides some background on the issue at hand. After that, the methods to be used are discussed. This is followed by the presentation of the results, whereafter the implications are discussed in the discussion section. Finally, the conclusion provides the answer to the research question and the concluding notes of the research.

# 2. Theoretical Framework

## 2.1. Strategic management

As previously described, a shift in strategies of DSOs is required to enable the RESs and eventually, the energy transition. Whereas DSOs mainly focus on grid reinforcement, finding more affordable and effective solutions outside the current paradigm, such as batteries, influencing demand, hydrogen and heating networks, may require a more drastic change of the organisation and strategy. Moreover, the conduction of the RESs requires a different type of attitude of the DSOs in which they actively participate in the conduction of the RESs and share knowledge and information with external parties. Both these changes require a strategy change that subsequently will require a change in resources and capabilities of the organisation. To understand the basis of the strategies, resources and capabilities needed to facilitate the change, first, the mainstream strategy literature is discussed. This is followed by the introduction of the Resource-Based View that facilitates the exploration of necessary resources and capabilities by DSOs. As the last step, a conceptual model is developed as a starting point to inventory the current strategies, resources and capabilities that may implicate the constraints for the enabling of the RESs.

A popular definition of strategy is given by Chandler (1990, p. 13) as: "the determination of the basic long-term goals and objectives of an enterprise, and the adoption of courses of action and the allocation of resources for carrying out these goals". The main scope within the field of strategic management is about determining how firms can generate and sustain a competitive advantage. One of the oldest and best-known theories is Porter's (1979) five forces theory. This model describes five different forces that determine a companies' competitive advantage, and thus, its strategy (Porter, 1979). In the Netherlands, however, there is limited competition between DSOs as the market is regulated. The high cost of building and operating an energy network caused the Dutch government to assign each DSO with its own region. The Authority Consumer and Market (*Autoriteit consument en markt)* regulates this market to prevent unfair prices and to ensure quality (ACM, n.d.). The theory of Porter (1979) takes a market perspective on gaining competitive advantage by focussing on the competition and new entrants power. However, these forces are negligible in a regulated market. Therefore, the theory of Porter (1979) and other market-oriented strategy theories are less appropriate for this research.

In contrast to the market-oriented strategies, firm-internal oriented strategies focus more on the organisation itself. A major framework within internal strategic management is the Resource Based View (RBV). This theory looks at the resources a company owns, rather than at the products it produces (Wernerfelt, 1984). Translating this to a competitive advantage, the RBV

prioritises individual resources that can provide an advantage. In contrast, market-oriented strategy theories argue that competitive advantage is gained via market positioning. Although competitive advantage as such is not applicable for DSOs, firms in regulated markets are still concerned with costs and maximum prices, which requires cost-efficiency (Mahon & Murray, 1981). Therefore regulated companies still need to be competitive and cost-efficient to survive. A resource-based perspective can support these cost-efficiencies, for example, by diminishing costs through producing efficiently (Wernerfelt, 1984). Strategic management and cost-efficiency of DSOs is, therefore, best researched from an internal or resource-based perspective.

## 2.2. Resource Based View

The RBV argues that the resources and assets of a company can provide the unique basis of a company that, if used appropriately, will foster the success of a company, even if external factors change (Connor, 2002). The RBV argues that a firm is a collection of assets and resources that are tied to the firm semi-permanently (Wernerfelt, 1984). It is argued that the right combination of resources is required to support the enabling of the RESs. A major approach of RBV is the sustainable competitive advantage approach by Barney (1991). According to Barney (1991), firm-specific resources should be valuable, rare, inimitable and non-substitutable. Resources should have these characteristics to outsmart competitors and avoid competitors from gaining the same resource base. However, as the DSOs do not directly have to compete with other DSOs in the Netherlands, the characteristics of the resources for DSOs are slightly different. Therefore a distinction is made between three different kinds of resources that can be of value to DSOs and other regulated technology firms. The three types of resources that are distinct for this research are unique resources, complementary resources and substitutable resources.

### 2.2.1. Unique, complementary and substitutable resources

An appropriate combination of the unique, complementary and substitutable resources is necessary for a regulated company to sustain. The first, unique resources, are hard to copy for competitors and enable a company to gain competitive advantage. This kind of resource corresponds with the description of Barney (1991). Despite the fact it was mentioned that unique resources are not necessary for DSOs to gain competitive advantage, it is perceived that these kinds of resources still will be present due to years of working experience and building up resources, usually in the form of knowledge and expertise. Unique resources include human capital, physical capital, intangible capital and experience (Mahoney & Pandian, 1992). The base of resources that a company builds over the years can provide a starting point to improve performance and decrease cost and can be hard to imitate for other companies. These kinds of resources can provide a DSO with the advantage to be the first to decrease cost or to adopt an innovation. Especially experienced and knowledgeable human assets are perceived to be a valuable unique resource for DSOs as experienced personnel can be scarce and hard to find and can help a DSO to decrease its costs, while still being able to seek for alternatives and enable the RESs.

The second type of resources included in this research are complementary resources. Complementary resources are perceived to be of great value in high-technology firms (Tidd, Bessant & Pavitt, 2005). Often firms manage to develop innovations but fail to commercialise

them. Complementary resources support the commercialisation of innovations. Examples of complementary resources are a customer support centre (after-sales), marketing and production departments. If firms fail to have or to make use of these kinds of resources, an innovation will most probably not succeed (Tidd, Bessant & Pavitt, 2005). Although DSOs in the Netherlands do not have a profit intention, it is still crucial for them to build a valid business case around innovations to prevent the increase of costs. For DSOs, these complementary resources can help to commercialise technical solutions, for example, the commercialisation of the use of hydrogen on the gas network.

Lastly, substitutable resources are resources that can be perfectly substituted by another resource. Although inimitability is often seen as a prerequisite of a resource that can provide a competitive advantage, in this research it is argued that substitutable resources are very valuable as they support the other types of resources and are a prerequisite for operating the organisation (Barney, 1991). Moreover, for this research, cost efficiency is more important than a competitive advantage. The service this type of resource provides is often vital for the organisation and could also decrease the costs if used appropriately. Examples of substitutable resources are financial resources and office space. Office space can be replaced by another space, but it is still necessary to resident the employees and therefore, an essential resource. Especially financial resources are presumed to be crucial for DSOs as the RESs and energy transition will involve enormous (future) investments.

The combination of these three resources builds the foundation of the essential resources for DSOs to sustain while enabling the RESs. Innovations and solutions derived from unique resources (e.g. human assets), should be commercialised by complementary resources and eventually be facilitated (e.g. financed) by substitutable resources. Having or acquiring the right resources will be the first step in facilitating a strategy change. In a changing environment, such as the introduction of the RES for the DSOs, the resources might be under pressure. Therefore it is important to inventory the current resource base and how this restricts or enables the RESs, to take appropriate steps to change or supplement the resources timely. As the resource base will differ per industry and even per company, extensive research is needed to identify the resources needed for DSOs.

## 2.3. Capabilities

Besides resources, it is often argued that it is not the resource itself that is most important. It is the functionality of the resource and how it is used that matters (Lockett, Thompson & Morgenstern, 2009). Some scholars even argue that resources by themselves cannot provide any competitive advantage at all. The resource must be used to do something in order to become valuable (Ray, Barney & Muhanna, 2004). The functionality of a resource should, therefore, be unravelled by capabilities. Capabilities are defined as: ‘the firm’s ability to undertake a productive activity, which is created through simultaneous deployment of resources and factors of production’ (Lockett, Thompson & Morgenstern, 2009, p. 14). Here, capabilities are the ability of a company to do something, whereas resources are assets a company owns. Although on the one hand, capabilities are needed to unravel the functionality of resources, on the other hand, capabilities are also based on the firms' resources. Hence, there is an interplay between the resources and the capabilities of a firm.

An interesting theory to further explore these capabilities is Teece, Pisano and Shuen's (1997) theory on dynamic capabilities. This theory focuses on the capabilities of a company to use resources when the company is facing a rapidly changing environment. This theory seems appropriate to study the necessary strategy change in this industry, as the RESs create a rapidly changing environment for DSOs. The introduced dynamic capabilities are defined as "the firm's ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments" (Teece, Pisano & Shuen, 1997, p. 516). Dynamics refer to the ability to renew competences to be able to conform to the changing business environment. Capabilities underline the importance of strategic management in the adaption of internal and external skills and competencies in a changing environment (Teece, Pisano & Shuen 1997, p. 515). The theory emphasises the importance for companies to be able to renew their firm-specific capabilities when changes in their environment occur. Dynamic capabilities seem of value for DSOs as they will have to identify how to react to and enable the RESs and the energy transition. The DSOs will need to respond to these changes by improving and adapting internal capabilities. Hence capabilities are only dynamic when they can change over time and can be used to react to changes in the environment. Below it is elaborated on how dynamic capabilities distinct themselves from other capabilities and of what components they are built of.

Understanding the different components of dynamic capabilities is required to find out how a company can benefit from them. A dynamic capability is the outcome of a firm's processes, positions and pathways. Capabilities, such as the ability to learn and the ability to create valuable alliances, are seen as outcomes of organisational processes. The firm's position is determined by its external relations with suppliers and complementors, intellectual property and its current technology (Teece, Pisano & Shuen, 1997). Together the processes and position of the firm form its dynamic capability. Furthermore, Teece, Pisano and Shuen (1997) argue that the competitive advantage of a company lies in its processes and positions, which are both determined by its path.

The firm's path depends on previously made decisions and steps, therefore path-dependencies will influence the organisational processes and shape its position. In regulated industries, such as the DSO market, those pathways are often predetermined by external bodies and regulations (Mahon & Murray, 1981). Pavitt (1984) identifies companies like the DSOs as supplier-dominated and argues that diversification of those firms may be weak. Therefore the pathways of different DSOs will be almost identical. Moreover, it can be argued that the pathways determined by governmental regulations may enhance strategy stiffness because it is hard for the DSOs to differentiate. Hence, so far, the pathways have similarly influenced the DSOs' processes. Future flexibility in regulations can provide opportunities for DSOs to differentiate and might diminish strategic rigidity. Lastly, the firm's position is determined by its endowments of technology, intellectual property and customer base (Teece, Pisano & Shuen, 1997). Since there is no direct competition between DSOs and they all have the aim to diminish (social) costs, they are often sharing insights on new technologies and intellectual property rights. Hence, also the DSO's position is negligible for forming a dynamic capability. Therefore, only the firm's processes determine its dynamic capabilities. Thus, it is crucial for a

DSO to get insights into these organisational processes to learn how they can be used or should be changed in order to react to rapid changes in the environment and enable the RESs.

### 2.3.1. Organisational processes

Hereafter the organisational processes are elaborated on. Examples are given of relevant processes and capabilities. However, it is only hypothesised that those exist in the same way for DSOs. This research tends to inventory the exact organisational processes present in the DSOs.

Ray, Barney and Muhanna (2004, p. 2) described organisational or business processes as: 'the actions that a firm engages in to accomplish some business purpose or objective.' These processes are thus routines and activities used by a company to reach its goals. The organisational processes realise the competitive potential of a firm, grounded in its resources and capabilities. Organisational processes are thus a subset of a firm's capabilities. Whereas capabilities are merely the firm's activity to undertake a productive activity, organisational processes are used to reach the goals of a company. Different empirical studies identified specific organisational processes that are needed for companies in changing environments.

For example, R&D activities can be an organisational process that aims at reaching the goals of a company to innovate. The importance of this process has been validated by Helfat (1997) while studying the US petroleum industry. R&D activities are an important process for almost every company in a rapidly changing, technology-intensive industry, such as the energy industry. Another relevant organisational process is the acquisition and alliance formation process (Karim & Mitchell, 2000). This process can be valuable for companies exploring new markets or technologies. By alliances or acquisitions, new knowledge or expertise could be gathered. For DSOs it might be relevant to ally with a company specialised in hydrogen, to explore relatively new technologies that can be used for the substitution of natural gas by hydrogen. Knowing how to set up such an alliance and being able to fully utilise the benefits of an alliance can be a valuable organisational process. Another trivial organisational process is the product development process. However, opinions on how to set up such a product development process vary. On the one hand, it is argued that effective product development requires cooperation between cross-functional teams (Eisenhardt & Martin, 2000). On the other hand, Christensen (1998) argues that experimentation and development units should be completely separated from daily operations. If this is not done, there is the chance that daily operations will outcompete new initiatives, due to cost-efficiency and the obligation to connect all citizens to the grid (VEMW, 2018). For DSOs, the latter might also be the case, as serving the customers will always be a top priority, and new initiatives may be declined based on short term cost perspectives. Therefore it might be valuable to form a separate business unit where long-term investments and business changes are researched. Lastly, the process of knowledge creation should be central to companies in high-tech environments. This includes the establishment of external relations with scientists, governments and professionals outside the firm (Eisenhardt & Martin, 2000). As DSOs operate in a complex system with a wide variety of stakeholders, this organisational process can be of high value to support the enabling of the RESs.

Recalling, organisational processes are actions that a firm engages in to reach its goals (Ray, Barney & Muhanna, 2004). The shared actions in the previously explained organisational processes are the exchange of knowledge collaborations and research activities in order to adapt to changes in the environment. The outcome of the actions of knowledge exchange, collaborations and research activities is the firm's ability to learn. To be able to adapt to changes it is crucial that the organisation can learn new practices and integrate them in the organisation. The ability to learn is further elaborated below.

### 2.3.2. Learning

Learning can thus be seen as an element of organisational processes. When an organisational process has the aim of learning, it can become a dynamic capability. Zollo and Winter (2002) even argue that learning is the base for dynamic capabilities. It is, however, crucial that organisational learning should aim at preparing the company for future insecurities in order to become a dynamic capability. When this aim is lacking there is merely learning as an organisational process instead of learning to acquire dynamic capabilities. Therefore learning can be seen as a subset of organisational processes that, if used appropriately, can become a dynamic capability that can benefit the firm in a changing environment. Teece, Pisano and Shuen (1997, p.12) identify learning as 'a process by which repetition and experimentation enable tasks to be performed better and quicker'. Organisational learning is commonly defined as a change in the organisation's knowledge that occurs as the organisation acquires experience (Argote & Miron-Spektor, 2011, p. 2). Knowledge should be interpreted broadly, both in terms of knowledge as a stock as well as in the form of a process (Argote & Miron-Spektor, 2011). Learning is argued to be formed by a combination of experience and knowledge and can build a company's dynamic capability if used to adapt to insecurities in the future. Below it is explained how dynamic capabilities can eventually lead to an appropriate adaption to the changing environment and a renewed strategy.

### 2.3.3. Dynamic capabilities

In the previous part, it is explained that dynamic capabilities are formed when a company is learning. Dynamic capabilities differ from the earlier defined capabilities in terms that they are meant to being able to change over time, based on changes in the environment. When a company is learning intending to change their capabilities over time in order to adapt to changes in the environment, we can speak of a dynamic capability. Recalling, dynamic capabilities are defined as "the firm's ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments" (Teece, Pisano & Shuen, 1997, p. 516). In a more recent paper, Teece (2007) specifies three distinct steps that are the outcome of dynamic capabilities and that enable the company to timely react to changes in the environment and eventually enable the company to renew their strategy. Having the right dynamic capabilities will allow a company to perform the steps of sensing and seizing opportunities and eventually transforming the organisation, and thus renew their strategy. Sensing, seizing and transforming are the outcomes from organisational processes that have the aim to learn and enable a strategy change by a company.

### 2.3.4. Sense, seize and transform

Here, the three steps of sensing, seizing and transforming are further explained. Examples of capabilities that could foster the three steps are described. However, there has not yet have been research on the dynamic capabilities at DSOs. Therefore, the defined dynamic capabilities that should result in the steps of sensing, seizing and transforming are merely examples that are hypothesised to be present at the DSOs. Further research should be conducted to inventory the capabilities required by DSOs to sense, seize and transform.

The first step of sensing is described as identifying opportunities or acknowledging external factors that potentially threaten the current business (Teece, 2007). Shifts in opportunities and threats should be noticed timely by a company to stay competitive, or in the case of DSOs, to stay cost-efficient under set prices. Schreyögg and Kliesch (2007) call this capability of constantly scanning the landscape for environmental change 'capability monitoring'. This dynamic capability to sense opportunities or threats is twofold. At the one hand, knowledge (resource) is required and on the other hand, earlier described (organisational) processes, such as research and especially development (R&D) activities are essential to unfold these capabilities. The opportunities can be identified by individuals in two ways: by entrepreneurs with access to existing information, or by new knowledge or information. Hence, processes, such as R&D activities, must be embedded in an organisation to stimulate the capabilities of individual entrepreneurs in the organisation to sense opportunities (Teece, 2007).

Once an opportunity is sensed, an accurate reaction of managers is crucial. In competitive markets, other players may also sense such an opportunity. In regulated markets, it is essential to determine to what extent opportunities can be seized based on restrictions set by regulations, laws and initiatives like the RESs. When the sensed opportunity concerns a new technology, this calls for improvement or revision of the companies' technological competencies. Again, well-developed R&D processes are thus crucial. Moreover, the company needs to identify an appropriate business model to seize the opportunity and identify the value proposition. The last concern is the creation of loyalty and commitment within the organisation. This is needed to internally incentivise employees to chase the opportunity (Teece, 2007).

The creation of loyalty and commitment is often also essential to reach the last step: transformation. Here, the new path must be adopted within the entire organisation. The culture should be realigned, and new routines and structures must emerge to support the change. Complex hierarchical organisations are likely to complicate this shift in routines and structures. Espejo (2011) argues that, based on the Viable System Model, autonomous business units can more adequately adapt to rapidly changing environments. Therefore, decentralised organisational structures can help with achieving a reconfiguration of business models and organisational structures. From a cognitive side, it is stated that top management can encourage transformation by supporting cooperation and lowering the resistance to change (Helfat & Peteraf, 2015). The latter might also help to create a culture shift and the right mindset in the internal organisation, that is required for reconfiguration (Teece, 2007).

Taking the previous steps of sensing, seizing and transforming together, dynamic capabilities of a company are thus the ability to identify and utilise an opportunity and embed this in the

organisation, with the ultimate goal to facilitate a new strategy. The organisation's ability to learn is the crucial component to form the dynamic capability and eventually transform the organisation and renew the strategy of the firm. On their turn, the three distinct steps of sensing, seizing and transforming are built from organisational processes that are embedded in the capabilities of an organisation that are influenced by its resources. Although many scholars agree on the appropriateness of the RBV and dynamic capabilities theories to research a firm's strategic advantage, there is also some criticism which is discussed below.

## 2.4. Criticism of RBV and dynamic capabilities

For a company to adapt and survive in a rapidly changing environment specific resources and dynamic capabilities are required. However, there is also critique of both the RBV as well as the dynamic capabilities theory. A major critique of the RBV is that it only tells what resources a company should have but does not tell how the company should acquire these resources. Therefore, the RBV is argued to have no managerial implications (Kraaijenbrink et al., 2010). This research tries to tackle this critique by combining the resources with capabilities and both describing the current resources and how this constraints the enabling of the RESs, to determine the steps that need to be made. Another often heard critique is that the term resource is either vague or too inclusive (Kraaijenbrink et al., 2010). This means that resources are often defined in such broad terms that everything from internal tangible resources to capabilities that enable firms to work with tangible resources is included in the definition of a resource. In this research, this is tackled by making a clear distinction between resources and capabilities. Moreover, resources are split up into unique, complementary and substitutable resources, which narrows the definition of resources. The last critique of the RBV is that unique resources are not sufficient to provide sustainable competitive advantage (Kraaijenbrink et al., 2010). To address this criticism this research argues that only resources are not enough, but capabilities need to unravel the value of resources to provide a strategic or competitive advantage. Although there is various critique on the RBV, most criticism is addressed in this research by specifying the theory or by combining RBV with (dynamic) capabilities to clarify the intentions of the RBV.

Although Teece, Pisano and Shuen (1997) propose an extensive framework and many studies support the theory, there is also criticism of the dynamic capabilities approach. Researchers argue that dynamic capabilities are often described in a vague manner, for example, 'routines to learn routines' (Winter, 2003). However, Eisenhardt and Martin (2000) state that dynamic capabilities mostly consist of identifiable and specific routines and thus are not vague. Another profound criticism of the theory of Teece (2007) is the low amount of empirical evidence on *how* firms can gain necessary capabilities, such as the ability to sense, seize and transform (Easterby-Smith, Lyles & Peteraf, 2009; Keil, 2004; Pablo et al., 2007). According to Ambrosini and Bowman (2009), this is not remarkable since the theory of Teece (2007) is relatively young. Moreover, several studies provide empirical evidence of dynamic capabilities. For example, Keil (2004) investigates empirically *how* big firms can use capital investments, alliances and acquisitions to learn how to develop ventures with external partners to gain dynamic capabilities. Furthermore, according to Eisenhardt and Martin (2000), the earlier discussed identifiable and specific routines are often based on extensive empirical research. Taking the previous into account, when formulating dynamic capabilities one must be aware of

not using any vague terms, but describing the capabilities in a clear and explicit manner, based on empirical evidence. If this is done, the theory of dynamic capabilities by Teece, Pisano and Shuen (1997) can be useful to support the strategy change of organisations in a rapidly changing environment.

## 2.5. Conceptual model

To summarise the previously discussed theory, both resources and capabilities should be changed in an organisation to be able to react to a changing environment and form a new strategy that could enable the RESs. This is visualised in a conceptual model in figure 1. In this model, there is a current strategy and renewed strategy that is build up from resources and capabilities. Based on the changing environment, in this case, the enabling of the RESs, the necessary strategies, resources and capabilities should be determined. The resource base is built from unique, complementary and substitutable resources that need to fit the renewed strategy. There is an interplay between resources and capabilities, where on the one hand the capabilities unravel the resources, and on the other hand, the capabilities are formed based on the resources. On the capability side, a capability is seen as dynamic when it manages to change over time based on changes in the environment. Dynamic capabilities are grounded in the organisational processes of a firm. When an organisational process aims at learning, and this learning is focussed on adapting to insecurities in the future, we can speak of a dynamic capability. Dynamic capabilities should eventually lead to the firm's ability to sense and seize opportunities and ultimately transform the organisation and renew the strategy, based on the demands from the environment. This conceptual model will be used to inventory how the strategy, resources and capabilities are currently enabling and restricting the RESs, in order to determine what strategies, resources and capabilities are needed in the future. The methodology section will further explain how this conceptual model will be investigated to find an answer to the research question.

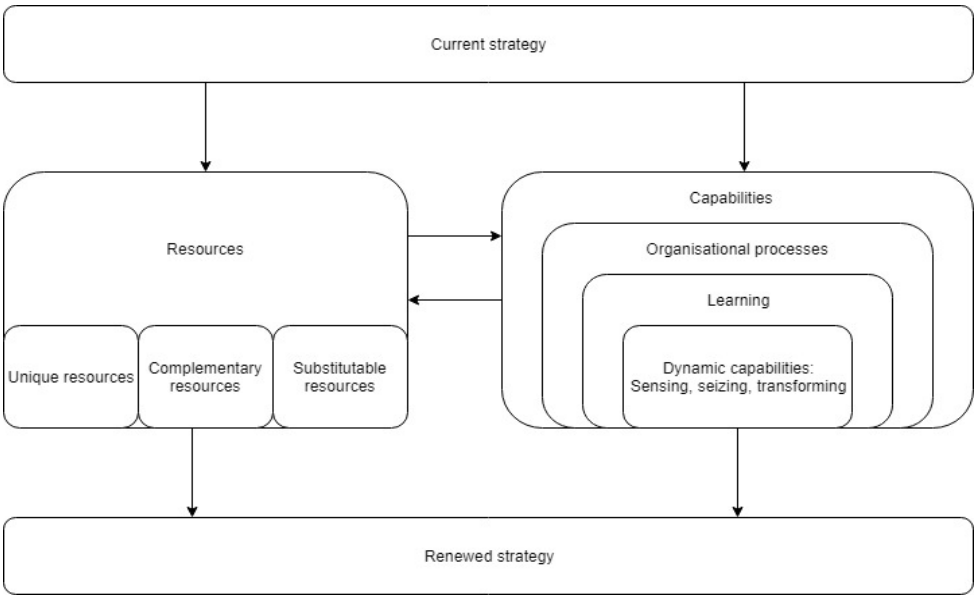


*Figure 1: Conceptual model of resources and (dynamic) capabilities*

In addition to the described theoretical framework, the next chapter will provide some context on the main variables: the DSOs in the energy system and the RESs. The background chapter thereby sets the starting point for the analysis of the research question and provides some general understanding needed for the analysis of both variables.

# 3. Background

This section will briefly describe the value chain of the energy system to facilitate an understanding of the different actors operating in the system. Moreover, it will provide an introduction to the Regional Energy Strategies.

## 3.1. The energy system and the different actors within this system

Figure 2 displays the four main actors in the energy system and their connections with each other. The primary responsibilities and tasks of the actors are described below.

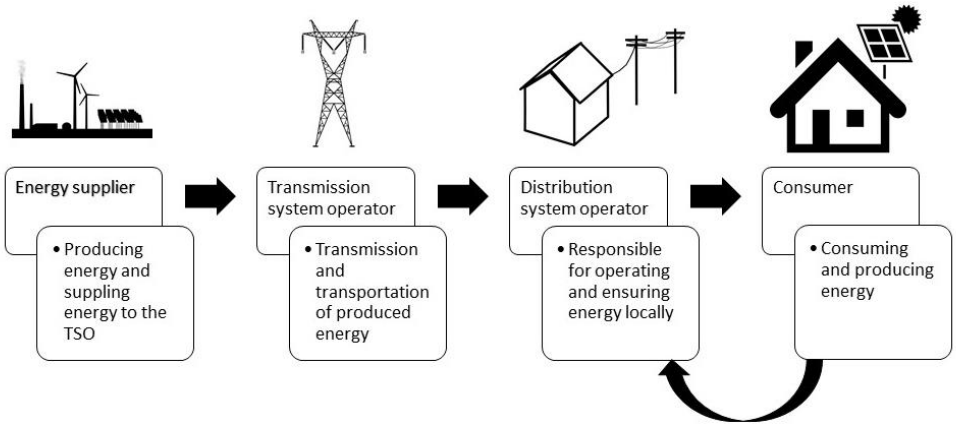


*Figure 2: The roles and responsibilities of the actors in the energy system*

**Energy producer**

The first actor in the chain is the energy producer. The energy producer is responsible for the production of energy; in this research, this can be both electricity and natural gas. Traditional energy producers extract the energy from fossil sources, such as coal, natural gas and oil. Next, to using fossil fuels, renewable sources are more and more used for generating energy. Renewable energy sources include hydropower, biomass, geothermal, solar, wind, wave and tidal energy (Panwar, Kaushik & Kothari, 2011). The energy producer is responsible for producing sufficient energy and supplying it to the Transmission System Operator.

**Transmission System Operator**

The Transmission System Operator (TSO) has the task to transport the energy produced by the energy producer to the DSOs. The TSO operates the high voltage grid (Tennet in the Netherlands) and/or the long distance natural gas transportation network (GasUnie in the Netherlands). Often the role of the TSO is executed by the same party as the DSO. However, this is not the case in the Netherlands. The TSO supervises and ensures the right balance between the demand and the supply of the network. The TSO has the insights in the actual balance of the energy system and is therefore responsible for taking actions when imbalances between demand and supply in the network occur (Van Werven & Scheepers, 2005).

**Distribution System Operator**
The Distribution System Operator (DSO) operates the local low voltage grid and/or the regional natural gas transportation network and is responsible for distributing the energy to the consumer by operating and ensuring the distribution network of a particular area. By the increase of consumers producing their own energy, the DSO is not only responsible for supplying energy, but also absorbing back the surplus of energy that consumers produce.

**Consumer**
The last actor in the energy chain is the consumer. This is the actor that consumes the produced energy. Moreover, a minor part of these consumers are also producing their own energy and delivering it back to the grid. The consumer has the right to choose their own energy producer, however, they are assigned to the DSO based on their geographical location.

## 3.2. Regional Energy Strategies

This section will give a glimpse of the aims of the five pilot RESs and their described action plans to reach these aims. The Regional Energy Strategies is a national programme that is set up by governmental institutions in the Netherlands. The RESs facilitate and offer a cross-sectoral regional cooperation structure to reach the goals of the National Climate agreement. In 2016 five pilot regions were set up that were entitled to develop a Regional Energy Strategy. The results from these pilots were used to form a consistent national approach to formulate a RES in each region in the Netherlands. After the results from this pilot project, it was decided that the content of the delivered strategies was slightly adapted. The five pilots were asked to make a strategy based on the five 'sector tables' of the Climate Agreement, namely: electricity, build environment, industry, agriculture and agricultural ground and mobility. After evaluation of the five pilot RES, it was decided that including electricity and build environment in the RES was mandatory and the other domains were optional. The pilot RES regions will also adapt their strategies based on this change. Moreover, the renewed RESs will have more rules and guidelines to follow, where the pilot RESs were not bounded to many rules to test and validate what worked best (Handreiking regionale energie strategie, 2018).

To form the RES, a 'steering group' (stuurgroep) should be formed, in which the governmental institutions, DSOs, energy Nederland (trade organisation energy companies) and societal representatives should be present. Within each region, working groups should be formed in which decentralised governments, DSOs, businesses and social organisations formulate the content of the RES (Ontwerp van het klimaatakkoord, 2018). In a document varying from 22 to 78 pages, the pilot regions state how they want to reach the goal to be (almost) climate neutral by 2050 (Regionale Energiestrategie Midden Holland, 2016). The strategies follow more or less the same structure, with an explanation of the aim of the strategy and defining the current situation in the region (Regionale Energiestrategie Fryslân, 2017). This is followed by the definition of the core of the strategy and the steps that need to be taken to get there. Some strategies take a next step in specifying a way to communicate (Drechtsteden, Midden-Holland, West-Brabant) and describing foreseeable difficulties and challenges (West-Brabant). The strategies mostly exist of smaller scale short-term plans that together should reach the goal of $CO_2$ neutrality. West-Brabant is very specific in its short-term plans, by for example identifying the number and percentage of homes that need to be renovated per year. Other regions, on the

other hand, take an approach in which they provide more general goals that can still be split up by specific bodies (Regionale Energiestrategie Drechtsteden, 2017). The result section will further elaborate on the RESs and compare the content process of the conduction of the RESs.

# 4. Methodology

This section introduces the methods that were used in this research. Strategic management is often studied in a quantitative manner, however, qualitative research methods are found to be more pertinent for understanding organisational resource creation and regeneration processes (Ambrosini & Bowman, 2009). As this study aimed to explore and inventory the current strategies, resources and capabilities and the necessary changes needed to enable the RESs by DSOs in the Netherlands; a qualitative research design was used.

## 4.1. Multiple case study

The introduction of the RESs is an important development for society, providing an interesting starting point for answering the research question (Bryman, 2016). The RESs are still in the introduction phase, and therefore it has not yet been assessed how the DSOs' strategies, resources and capabilities can enable them. Only five pilot RESs have been conducted so far. Based on the findings of these five pilots the Association of Dutch Municipalities (VNG) designed a guide on which the other 25 regions will formulate their RES strategy in the upcoming year (end 2019/start 2020). Also, the pilot regions will use this guide to update and renew their RES strategy in the forthcoming year. This research only focused on the five pilot RESs as these were the only complete documents at the moment of writing and thus suitable for analysis. It must be noted that the final format of the RESs deviates slightly from the pilot RESs, as the pilot process aimed to facilitate the formulation of the best RES format. However, the pilots were still seen as a starting point from where the other 25 regions build up their strategy.

This research aimed to inventory the necessary strategies, resources and capabilities of the DSOs to enable the RESs. A multiple case study was conducted to collect empirical data to answer the research question. A case study is the intensive and detailed analysis of a case (Bryman, 2016). The studied cases are the five combinations of the RESs and the three different DSOs that serve in the pilot RESs regions (Drechtsteden and Midden Holland by Stedin, Hart van Brabant and West Brabant by Enexis and Fryslân by Liander). A multiple case study can identify similarities and differences between the cases and will help to detect the necessary strategies, resources and capabilities for the DSOs to enable the RESs.

This research took the approach in which it first identified a conceptual model from the theory. The research then collected empirical data to inventory the different categories of the conceptual model for the DSOs. Data was gathered from different sources and pathways resulting in data triangulation, which enhances the validity of the research. Documents were collected and interviews were conducted to gather the different data needed. Then a twofold approach was taken to answer the research question. First, it was researched what the RES entails. Secondly, the current strategies, resources and capabilities of the DSOs were inventoried based on the conceptual model. Comparing the RES to the current strategies,

resources and capabilities gave insights in how the DSOs currently restrict or enable the RES. The restrictors and enablers eventually implied what the necessary strategies, resources and capabilities should be to enable the RESs.

## 4.2. Data collection

This research used two different categories of data in order to be able to answer the research question. The first category was written documents of different types. The second category were interviews with different persons. Below the data collection of both categories is specified.

### 4.2.1. Collection of documents

Different types of documents were collected to answer the research question. The RES documents of the five pilot regions were collected in order to support answering the first sub-question on what the RES entails. The second type of documents collected were the DSOs' strategy documents. The most recent strategy documents of the DSOs and their most recent (2017) annual report were collected to answer the second and third sub-questions about the DSOs strategies, resources and capabilities. In addition, some additional documents were collected to give some context to the research, for example, the manual for the new RES. Table 1 provides an overview of the documents used in this research.

*Table 1: documents used in the research*

| **RES** | **Type / name of document** |
|---|---|
| Drechtsteden | Energiestrategie Drechtsteden, 2017 |
| Friesland | Friese energiestrategie: de bouwstenen, 2017 |
| Hart van Brabant | Regionale energiestrategie Hart van Brabant, 2017 |
| Midden Holland | Verkenning energiestrategie Midden-Holland, 2017 |
| West-Brabant | Ons 2050, Regionale energiestrategie West-Brabant, 2017 |
| **DSO** | |
| Enexis | Strategy document, 2017 |
| Enexis | Annual report Enexis Holding N.V., 2017 |
| Stedin | Strategy document Stedin group 2018 - 2022 |
| Stedin | Annual report Stedin group, 2017 |
| Liander | Strategy document, n.d. |
| Liander | Annual report Alliander, 2017 |
| **Context** | |
| VNG manual | Handreiking Regionale Energie Strategieën |

### 4.2.2. Collection of interviews

In addition to the document collection, interviews were conducted to gather data. Interviews can provide deeper insights into the interviewees' opinions, and thus a better understanding of the issue at hand. The interviews were conducted in a semi-structured manner. An interview guide was set up to provide consistency, but there also was freedom to dive deeper into specific subjects or to change the order of the questions, when found appropriate (Bryman, 2016). The interview guide consists of standard questions that provided answers suitable for comparison and open-ended questions that helped identifying motives of the interviewees (Bryman, 2016). The interview guides can be found in appendix 10.1. In principle, all interviews were recorded and transcribed. Because of the semi-structured interviews and explorative nature of the study,

the interview data analysis happened alongside data collection. This iterative process can help to explore new directions. In this way, outcomes from earlier conducted interviews were used to go further into detail with interviews that still needed to be conducted (Galletta, 2013). This flexibility is valuable in an explorative context as new insights obtained during the research can be further explored.

The first type of interviews was with the employees of the three DSOs, hereafter called 'DSO representatives'. At these companies, the employees participating in the pilot RESs were interviewed. Moreover, two other DSO representatives were interviewed. The other DSO representatives were people involved in, or knowledgeable on the energy transition, asset management and/or the strategy of the DSO. The aim of the interviews with the DSO representatives was to determine their perspective on the strategy, capabilities and resources used to enable the RESs and the energy transition. Moreover, the DSO representatives involved in the RESs were asked about their perspective on the RES process and content.

The second type of interviews was with people involved in the RESs from outside the DSOs. In this research, these people are called 'RES professionals' and are people from municipalities, consultancies, ministries and other parties involved in the RES process. Interviewing this variety of professionals gave a broad insight into each RES and increased the external validity of the research. Per RES, it was aimed to interview two RES professionals. The interviews were used in addition to RES documents to answer the first sub-question. The objective of these interviews was merely to identify underlying reasons and to identify what considerations were taken into account while conducting the RES. Moreover, the RES professionals were also asked about the DSO and their strategies, resources and capabilities. However, as strategies, resources and capabilities are more internal practices of DSOs, the statements on these topics from the RES professionals only were used to give some gradation to the outcomes from the DSO representatives.

Lastly, a couple of interviews were conducted that provided some more context for the research. An additional interview was conducted with a DSO representative that is currently involved in the new RESs. This interview was conducted to determine how the new RESs differs from the pilot RESs. Moreover, an interview was conducted with an employee at one of the DSO's subsidiaries, to get insights into their innovation process and how they relate to the DSOs. Lastly, an interview was conducted with an employee of an energy storage company. With this interview, it was aimed to get an understanding of how such solutions can enable the RESs, and what the role is of DSOs in such solutions. Since these interviews are not part of the interview sample, no conclusions can be drawn from them. Therefore, these interviews were added as a nuance or addition. Table 2 provides an overview of the conducted interviews.

*Table 2: interviewees*

| **DSO** | **Function** | **RES region (if applicable)** | **Date of the interview (2019)** |
|---|---|---|---|
| Stedin | Senior consultant strategy | | 10th of April |
| Stedin | Strategy & Innovation employee | | 12th of April |
| Stedin | Area director energy transition | Drechtsteden | 4th of April |
| Stedin | Area director energy transition | Midden-Holland | 7th of May |
| Enexis | Manager Energy transition | | 22nd of April |
| Enexis | Manager Strategy | | 17th of April |
| Enexis | Strategic advisor | Hart van Brabant | 28th of March |
| Enexis | Strategic advisor energy | West-Brabant | 3rd of April |
| Liander | Strategic environment manager | Friesland | 24th of April |
| Liander | Relationship manager | | 24th of May |
| Liander | Public affairs / Advisor energy transition | | 24th of May |
| **Case (RES region)** | **Function** | **Kind of organisation** | |
| Friesland | Policy advisor | Ministry of infrastructure and environment | 24th of April |
| Friesland | Advisor sustainability and environmental issues | Municipality / Province | 1st of April |
| Drechtsteden | policy advisor sustainability | Municipality | 11th of April |
| Drechtsteden | Councillor | Municipality | 29th of March |
| Hart van Brabant | Policy advisor | Municipality | 13th of May |
| Midden-Holland | Policy advisor sustainability | Environmental Service Centre | 24th of April |
| Midden-Holland | Process manager, advisor energy transition | Consultancy company | 19th of April |
| West-Brabant | Entrepreneurial citizen | Energy corporation | 12th of April |
| West-Brabant | Communication advisor | Region office | 28th of March |
| West-Brabant | Process manager, advisor energy transition | Consultancy company | 27th of March |
| **Field of expertise (other)** | **Function** | **Kind of organisation** | |
| Energy storage | Research and Development engineer | Company specialised in energy storage | 27th of March |
| Renewable energy | Programme manager renewable energy | Subsidiary of a DSO in the non-regulated domain | 18th of April |
| New/ current RES | Project manager stakeholder engagement – involved in new RESs | DSO | 6th of June |

## 4.3. Data analysis

When all the data was gathered, it was systematically analysed to answer the research question. To answer what the RESs entail (sub-question 1) documents were analysed by using open coding to identify the main categories of content. The different codes were compared to identify similarities and differences between the RESs contents. The aim of the analysis of these documents was to gain a solid understanding of the content and objectives of the RES. The second part of answering the question of what the RES entails was looking at the process of the RESs. This includes the organisation and the different parties involved in the conduction process. The process was discussed per RES instead of per category, as this gives a better understanding of the differences in processes. As it was assumed that the RES process is not all written down in the RES documents, the interviews with the RES professionals and DSO representatives involved in the RES process were analysed as an addition to this topic.

For answering the second and third sub-questions about the strategies, resources and capabilities of the RES, a different approach to analyse the data was taken. First, the DSO interviews were analysed using open coding. Using open coding can help to identify identical codes and provide different categories of codes to structure the data. Thereafter, axial coding, based on the conceptual model, was used to structure different categories (Bryman, 2016). As the last step, selective coding was used to identify the theoretical concepts and relationships between the concepts in the conceptual model (Mills, Durepos & Wiebe, 2009). The RES interviews and strategy documents were analysed using the codes and categories already identified with the open coding of the DSO interviews. The codes and categories identified from the DSO interviews were used as the base for the other data, as it was perceived that the DSO representatives are most aware of the DSOs' strategies, resources and capabilities. After all the interviews and strategy documents were coded, the data were compared to see whether there was consistency. First, a comparison was made between the DSO representatives from within the same DSO. This indicates whether the DSO representatives within one DSO have the same perspective of the strategies, resources and capabilities of their organisation. Secondly, a comparison was made between the different DSOs to detect consistency. Comparing the interviews within and between the DSOs enhanced the internal validity of the research. Moreover, data triangulation was applied by comparing the strategy documents of the DSOs to the DSO interviews to validate whether the written documents correspond with the statements of the DSO representatives. In the last step, the statements of the DSO representatives were compared with the statements of RES professionals, to see whether external interviewees have the same perception of the DSOs as the internal interviewees. It must be noted, however, that the comparison with the RES professionals could only be used as a gradation of the results, as it is hard for externals to determine the strategies, resources and capabilities of a firm. In order to determine the current strategy as stated by the official strategy documents, a slightly different approach was taken compared to the other categories. For this part of the strategy analysis, first, the strategy document(s) were analysed, whereafter they were compared to the interviews of the DSO representatives. The written strategies were not compared to the RES professionals as it is hard for them to know the strategy of the DSO.

To answer the last sub-question and subsequently the research question, the outcome of the first sub-question was compared to the outcome of the second and third sub-questions. Comparing the content and process of the RESs to the current DSOs strategies, resources and capabilities resulted in identifying how the DSOs currently restrict or enable the RESs. The detection of the restrictions and enablers finally facilitated the answering of the research question of what the strategies, resources and capabilities are necessary to enable the RES.

### 4.4. Research quality indicators

Various research quality indicators should be considered when conducting a case study. According to Bryman (2016), the criteria for qualitative research are reliability, replicability and validity. Reliability and replicability were both ensured by providing interview guides and thoroughly describing the research process (Yin, 2003). Validity is split up in internal and external validity. The internal validity of the study was ensured by comparing the data between the cases. Cross-checking data from different cases can confirm causal relationships. The external validity of case studies is usually seen as rather low as generalising the outcomes is often not possible. Nevertheless, Dutch DSOs are highly regulated, which increases the similarity between them as many features of the companies are determined by governmental laws and rules. Moreover, the five pilot RESs provide the input for the other 25 RESs that are still under construction. Also, the three companies studied are operating the majority of the Dutch electricity and gas networks (Gaslicht, 2017). Taken the previous arguments together, the external validity and generalisability of this study were determined to be relatively high.

The next section provides the results based on data that is gathered and analysed as described in the methodology.

## 5. Results

This section provides the results of the analysis of the documents and interviews. Appendix 10.4. provides the transcripts of all the interviews. 42 People were approached to interview, aiming at three to four interviews at each DSO (depending on the number of RES regions in their operating area) and two interviews per RES region. In total, 24 interviews were conducted; eleven with DSO representatives, ten with RES professionals and another three interviews that provide some more context on the issue at hand. For the RES region Hart van Brabant there was only one RES representative interviewed, several others were contacted, but did not respond. Since data saturation arose after about six to seven RES interviews it might be argued that another interview with a RES professional at Hart van Brabant would not have given any new insights, however, this cannot be said with absolute certainty. The length of the interviews varied between thirty to sixty minutes, with an average of approximately fifty minutes. The result section first provides the results from the analysis of what the RES entail. Then, the results from the analysis of the DSOs' current strategies, resources and capabilities are presented, those will also be compared to the literature. After that, it is presented how the DSOs are currently enabling or restricting the RESs. This is followed by the necessary strategies, resources and capabilities for enabling the RESs.

The first part of the result section provides an overview of the pilot RESs and their content and processes. These results will answer the first sub-question about what the RES entail. These results are based on document analysis, accompanied by the RES professional interviews and the DSO representative interviews of those involved in the RES. After the analysis of the RES, the DSOs' strategy, resources and capabilities are analysed using the four steps described in the method section. These four steps answer the second and third sub-questions. Subsequently the last sub-question can be answered based on comparing the results of what the RES entails with the current strategies, resources and capabilities of the DSOs.

## 5.1. RES results

This part of the results will give an answer to the first sub-question: 'What does the RES entail?' Answering this sub-question contains two dimensions; the content of the RESs documents and the process of the RES conduction. Below the results of the content and process are discussed by combining documents and interviews. The content is discussed per subject. The process is discussed per region, as the processes vary per RES.

### 5.1.1. Content of the RES

Appendix 10.2.1. displays an overview of the content of the RESs based on the RES documents. Although each RES document has a different structure, there are seven main categories discussed, namely: the goals, heating/ phasing out natural gas, net balancing, education, electricity savings, agriculture and renewable energy generation (Regionale energiestrategie Drechtsteden, 2017; Regionale energiestrategie Fryslân, 2017; Regionale energiestrategie Hart van Brabant, 2017; Regionale energiestrategie Midden-Holland, 2016; Regionale energiestrategie West-Brabant, 2017). Below the main findings per category are discussed based on the document analysis; here it will also be indicated which of the content categories potentially have a (high) impact on the DSOs.

*Goals.* The overall goal of the RESs is to be energy neutral by 2050. To indicate how the RESs should reach this goal, a subgoal is set at a $CO_2$ reduction of 50% by 2030. The steps to achieve these goals vary from conducting pilots to bundling local initiatives and supporting regional plans. All RESs focus on small-scale initiatives that together have to contribute to the goals.

*Heating.* Electrical cooking, heat pumps, all-electric and heat networks are generally stated as future alternatives for natural gas. Especially geothermal heat is mentioned as a future source of heat. Although this sounds promising, technology on this still needs to further develop in order to make it more feasible. Moreover, all RESs acknowledge the issue of industrial heating, which needs to reach way higher temperatures than residential heating. The RESs do not come up with a solution to phase out natural gas in industries. The proposed plans of electric cooking, heat pumps and all-electric housing will have significant impacts on the DSOs, as the grid needs to be reinforced to facilitate the higher demands of electricity. One DSO representative said:

*'There is a factor four of electricity flows at peak moments when a house is all-electric, has a heat pump and an electric car, compared to the current grid load.'*

This indicates a massive impact of these RES plans on the operations of the DSOs. Another often heard alternative for natural gas is heat networks. There is an ongoing discussion of what

role the DSOs should take in heat networks. At the moment, DSOs are not entitled to operate a heat network, but there is an ongoing lobby for changing the role of the DSOs in heat networks. Many interviewees argue that heat networks are vital infrastructures, just like electricity and gas networks, and should, therefore, be under the control of the DSOs. Depending on the change in the regulations, heat networks can have a significant impact on the DSOs.

*Net balancing.* Most RESs acknowledge the responsibility of the DSOs in assuring a stable supply of energy. They propose grid reinforcement and smart grids to balance the network. Friesland proposes to add hydrogen to the gas network in order to balance the supply and Drechtsteden wants to buffer electricity in cars. As the DSOs, and on the high voltage level TSOs, are responsible for net balancing, fluctuations in electricity demand and supply will heavily impact the DSOs. Grid reinforcement, cable pooling, batteries, and lowering security buffers are currently mentioned solutions by DSO representatives to deal with peak fluctuations. Depending on the change in future regulations and laws, processes and techniques for DSOs might need to change in order to balance the net.

*Education.* All RESs acknowledge that there is a significant role in education in the energy transition. Education is a means to create awareness. Especially vocational education must be adjusted to the needs of the energy transition. Technical employees will need to learn how to install new techniques like heat pumps and smart meters. The change in education might also impact the human assets of the DSOs, as it can change the supply of employees.

*Electricity savings.* The energy savings are split up into three domains: housing, commercial buildings/ offices and logistics and transport. In the housing category, the RESs focus on increasing the energy labels of houses via isolation, better equipment and increasing the awareness. Drechtsteden acknowledges that the citizens in their region on average have a lower income than the average in the Netherlands. The region wants to support its citizens in transiting to heat pumps and private solar panels via campaigns and a local energy office. The energy saving measures for offices and commercial buildings are not specified by all RESs, it seems that the national government forces the energy saving projects in this sector. Drechtsteden is the only region that proposes specific measures, such as coupling energy labels to funding. For the last category of logistics and transport the RESs collectively state that all cars should be electric by 2050. Moreover, the public transport sector should be expanded, and all busses should become electric. A more efficient public transport network should be developed, and concepts like mobility as a service and cars sharing should be further expanded too. The savings on logistics can have an impact on the DSOs, especially when the number of electric vehicles increases. The increase in electric vehicles will mean a higher demand for electricity and peak demands at specific times of the day when most cars and buses are charged.

*Agriculture sector.* Depending on the region, three RESs made statements about the agricultural sector. West Brabant said that agriculture is outside the scope of the RESs. Also Drechtsteden did not mention anything about agriculture. The other three RESs come up with goals such as decreasing heating in greenhouses and using special growing techniques. Moreover, it is proposed to use biomass as a fuel. So far, it does not seem that these measures are heavily impacting DSOs.

*Renewable energy.* All regions focus on wind turbines and solar panels. Solar panels projects are proposed in different forms such as solar parks but also on rooftops. RES West-Brabant even proposes a floating solar park in a nature park. Also, biomass is proposed as a source of energy by most RESs. All RESs focus on local initiatives to reach the goals, rather than national initiatives. The construction of renewable energy projects can profoundly impact the RES. Especially projects in areas where the infrastructure is not built for peak loadings, it can be a challenge for DSOs to timely reinforce the grid.

Overall, the subjects of heating, net balancing and renewable energy generation will have the highest impact on the DSOs. These subjects imply that the DSOs will have to find solutions and alternatives to facilitate the goals proposed in the RESs. However, the pilot RESs do not yet specify the exact measures that they will take and also no concrete locations are assigned for renewable energy generation. This complicates the determination of the impacts by the DSOs, as no concrete plans are yet designed by the pilot RESs.

### 5.1.2. Process of the RES

To give a conclusive answer on what the RES entails, it is important to understand the process of the RES conduction, the different parties involved and their roles. Appendix 10.2.2. provides an overview of the different parties involved and the organisation, communication and monitoring practice, based on the RES documents. Below the process of the RES will be further elaborated per region based on the document analysis and the analysis of the interviews with the RES professionals and DSO representatives involved in a RES.

*Drechtsteden*

For the RES region of Drechtsteden, it is mentioned that they greatly benefit from the fact that the municipalities involved previously worked together on a regional scale on other subjects. Over twenty parties were participating in this pilot RES including banks, DSOs and citizens initiatives. Eventually, the pilot RES of Drechtsteden provides intentions, rather than concrete locations. The RES facilitated the exploration of potential locations for renewable energy generation and alternatives for natural gas per area.

*Friesland*

The RES region of Friesland is the only region that includes a whole province. All three interviewees that were involved in the RES process of this region state that eventually the region did not manage to deliver the expected strategy and therefore the delivered document was called: ‘Friese energiestrategie: de bouwstenen’ (Friese energy strategie: the building blocks). Especially for the DSO, this was quite a disappointment as it did not bring any concrete locations or projects on which they could start investing. The interviewees also mentioned that the RES of Friesland had relatively low support from the municipalities and the citizens in the region. One interviewee even states that it feels like Friesland has to start all over with the new RES process.

*Hart van Brabant*

The region Hart van Brabant used the pilot RES more as a process tool rather than focusing on the outcome. The aim of the RES of Hart van Brabant was setting up a clear network and involve every relevant party in this. Therefore Hart van Brabant never organised sessions in which concrete locations for renewable generation were appointed. The most significant benefit of focusing on the process and network of the RES organisation is the involvement of the municipalities, which is followed by the fast approval of the decisions by the 'Raad'. Besides the municipalities, province, DSOs and water authority, the region hired different professionals, such as landscape architects and communication offices to facilitate the whole process

*Midden Holland*

The RES region Midden Holland started strong according to the interviewees. However, there was quite some resistance from other parties, and eventually, a treaty was formulated instead of a real strategy document, which was supported by an exploration document of the different initiatives. The province, however, did not sign the treaty as it did not agree on wind farms in 'het Groene Hart'. This resulted in a generally low commitment of different parties to follow up on the treaty.

*West Brabant*

The region of West Brabant systematically started with interviewing approximately 40 institutions in the region to inventory the different incentives and initiatives of parties. The region hired a consultancy company to facilitate this process. The pilot RES West Brabant was focussing on exploring what the current demands are and what will be needed in the future to supply all these demands with renewable energy. The RES document eventually provided an overview of what is needed, however, specific locations were not appointed.

Overall the composition of the different RES teams where more or less the same, however in some regions, not all parties did participate equally. None of the pilot regions has succeeded in developing a RES document that answers the whole question of energy neutrality and appoints concrete locations for renewable energy generation. Also, many parties acknowledged that the period for the RES was too short, especially as most parties did not know each other beforehand. For the new RES 'round' it must be noted that agriculture, mobility and industry are no longer a mandatory part of the RES. Moreover, the 'new round' of the RES is more regulated and strict than the researched pilot RES and will therefore probably deliver more concrete RES documents, which can better support the plans for investments of the DSOs (Handreiking regionale energie strategie, 2018). For the DSOs, the conduction of the RESs implies that the region will propose different initiatives to become $CO_2$ neutral by 2050. Moreover, the DSOs are asked to join the RESs conduction and to provide input. As the DSOs will need to adapt their infrastructure and way of working, it is crucial that the DSOs can timely identify the necessary strategies, resources and capabilities in order to enable the RESs.

## 5.2. Current strategy of the DSO

The current strategy of the DSO to enable the RESs is envisioned to be build up from three things: the strategy document(s) with the primary statements and the strategic direction of the DSOs, the attitude the DSOs take in the RES process and lastly the contribution of the DSOs to the RES.

### 5.2.1. Strategic direction of the DSO from the strategy document(s)

All three DSOs have a strategy that emphasises the facilitation or acceleration of the energy transition. Besides facilitating the energy transition, the DSOs' strategies focus on excellent grid management (Enexis), better operating the grid (Stedin) and offering reliable and affordable energy (Liander). In addition, Stedin adds a third pillar to this strategy in which they state to focus on sustainable business management and Liander focuses on offering affordable and accessible energy. The most recent strategy statements of all three DSOs were updated at the end of 2017 (Alliander jaarverslag, 2017; Enexis groep strategisch plan, 2017; Strategie Stedin groep, n.d.). Based on the answers of the DSO representatives, it is concluded that the DSOs did not change their strategy based on the introduction of the RESs. According to them, the strategy is already facilitating the RESs because it focuses on the energy transition. As one DSO representative said:

*'I think the current strategy is already aligned with the RES. We have two pillars: excellent grid management and accelerating the energy transition. The RES is a part of the energy transition, but also has common grounds with excellent grid management.'*

### 5.2.2. Attitude of the DSO in the RES

The attitude of the DSO in the RES is the way the company acts in a RES process and in relation to other parties. This attitude for DSOs is perceived to be twofold. The first part is about the role that the DSOs take in the RESs. The role determines how the DSO acts in relation to other parties in the process and with regard to the decisions that are made. The second part is about the contribution of the DSO to the RES process. This concerns the input they provide in the RESs. Together the strategy documents and the attitude of the DSOs represent the current strategy of the DSOs as described in the conceptual model.

*Role of DSO in the RESs*

There is a shared vision within and between the DSOs that the companies should not take a directing role in the RES process. This is supported by the following quote:

*'We do not want to take control of decision making, that is the task of municipalities.'*

In addition, the DSOs representatives stated that they do not have the democratic legitimacy to make decisions in the RESs. Stedin is most convinced of their lack of democratic legitimacy and emphasised that the municipalities should make the decisions. Appendix 10.3.1. displays the different quotes related to the position of the DSO in the decision-making process. None of the written strategy documents by the DSOs mentioned whether or not the DSOs should take a directing role in the RESs or energy transition. In addition, the RES professionals are less clear about the role of the DSOs in the RES. Although six out of ten interviewees did mention

something about the role of the DSO in the RES, there seems little consensus of the perceived role. The only thing they have in common is that they mentioned that the DSO provides or should provide information, which corresponds with the statement of the DSO representatives of not taking a leading or directing role in the RESS process. Overall, it is unclear what the role of the DSOs is in the RES process is. The written strategies do not mention the role and contribution of the DSOs. Moreover, although the DSO representatives said not to take a directing role, the RES professionals are not aware of this position.

*Contribution of the DSO in the RESs*
Within each DSO, there seems to be a consensus that the DSO should advise and support decision making within the RESs. Besides advising, Enexis and Liander emphasise that they provide different options and its consequences. This is supported by the following quote:

*'I took an advising role and answered the questions that were asked'*

Within Stedin there is less consensus on this topic. Nonetheless, two out of four interviewees mentioned that they provide maps and technical analyses that show different opportunities. The strategy documents do not specifically discuss the contribution of the DSOs to the RESs. Enexis, however, does emphasise that they want to advise neighbourhoods to change to hybrid heat pumps (Enexis jaarverslag, 2017). Stedin states that they are asked to join the conversation and to advise on the costs and benefits of (new) energy infrastructures (Strategie Stedin groep, n.d.). Liander states in their strategy that they want to support their customers in making decisions (Alliander jaarverslag, 2017). All three statements can be seen as a form of advice, as mentioned by the interviewees. However, it does seem that the advising role taken by the DSOs towards the RESs, is not much embedded in the strategy documents. Comparing this to the statements of the RES professionals on this subject, there seems to be a similar thought. The shared vision of the contribution of the DSOs to the RES is that the DSOs think along with the ideas proposed in the RESs. Thinking along is envisioned to be vaguer and less concrete than the advising role that the DSO interviewees state to take. Appendix 10.3.1. shows quotes on the contribution of the DSOs in the RESs by both the DSO representatives as well as by RES professionals. Overall, the DSOs contribute to the RESs by advising and providing different options and consequences. Although not specified to the RESs, this is also embedded in the written strategies. Even though the RES professionals have a similar perspective on the contribution, it is not clear whether the contribution is sufficient to fully enable the RESs.

Another significant contribution by the DSOs is the creation of awareness of the role of DSOs in the energy system and subsequently, the energy transition. Within Liander all interviewees acknowledged that the knowledge, awareness and realisation of the importance of DSOs by external partners is rather low. At Enexis and Stedin this seems less evident. However, at all DSOs, it is mentioned that the DSOs contribute by creating insights, awareness and sharing knowledge. This is substantiated by a document conducted by Netbeheer Nederland, together with the DSOs. This document is called: 'basic information on the energy infrastructure' and aims at teaching the different participants in the RES about the basics of the energy infrastructure (Netbeheer Nederland, 2019). It must be noted, however, that this document was only published after the pilot RESs phase. The strategy documents of the different DSOs do not

discuss the importance of increasing the awareness of the role of DSOs. They did all mention, however, that they want to share their knowledge and data with other parties. With the latter, they emphasise that data security is also critical due to privacy regulations (Alliander jaarverslag, 2017; Enexis jaarverslag, 2017). The RES professionals seem to agree that there is a lack of awareness, but mainly knowledge of the role of the DSOs in the RESs. The following quote emphasises this lack of knowledge and awareness:

*'There is a lack of knowledge: what is a DSO, why does it exist, what can it do and what can't it do. This might sound harsh: but people have no clue of the difference between a supplier and a DSO'*

Thus, there is a consensus between the DSOs and the RES professionals on the importance of raising awareness and understanding of the role of DSOs. Appendix 10.3.1. displays a couple of statements concerning awareness of the different parties that indicate the consensus on this topic.

Overall, it seems that the current strategy is not yet adapted based on the impacts and demands of the RESs. To some extent, there is alignment in the way DSO representatives act in the RES processes. However, as the role and attitude that they should take is not yet embedded in the strategy documents, the way the DSO representatives act in the RESs is inconsistent. This results in different inputs from DSOs per RES, which subsequently leads to a diffused understanding of the strategy of the DSOs to enable the RESs by the RES professionals. Therefore a clear strategy is required for each DSO to communicate their contribution to and position in the RESs. Having a clear strategy will provide guidelines on how to act in the RESs and will provide similar inputs from DSOs in the RESs. This should enhance the enabling of the RESs.

Figure 3 provides a visualisation of the distribution of the statements about the role and contribution of the DSOs in the RESs. Each section of the results ends with a similar figure which visualises the distribution of the statements. For this visualisation only the statements of the DSO representatives (total of eleven interviewees) are counted as those are most aware of the internal strategies, resources and capabilities of their companies. As there are different numbers of interviewees at each DSO, namely four interviewees at Enexis, four interviewees at Stedin and three at Liander, percentages are used to visualise the distribution. Hence, 100% means that all interviewees mentioned it, and 0% means that none mentioned it. A statement is only counted when it corresponds with the majority of statements. When for example an interviewee mentions the role of the DSOs to be directing and the majority of the interviewees describe it as non-directing, the statement is not counted for in the visualisation.

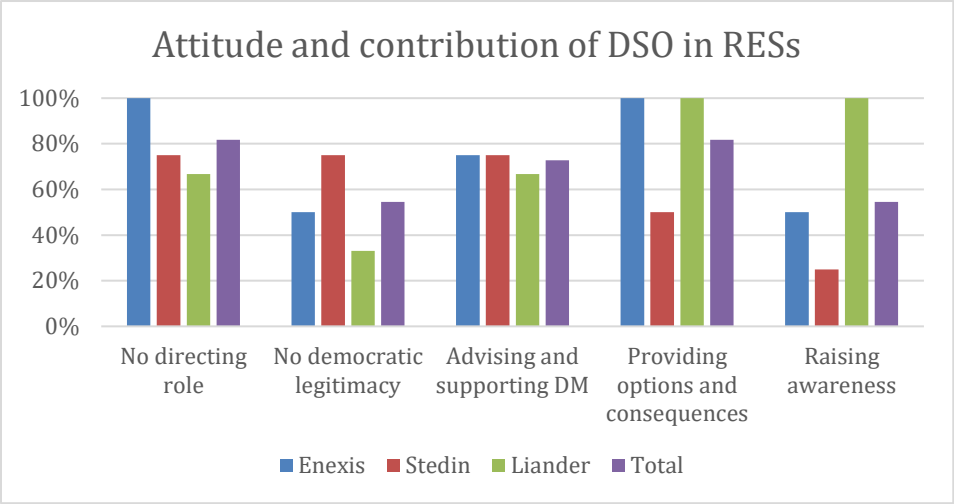


*Figure 3: Distribution of statements on the role and contribution of the DSOs*

## 5.3. Current resources

Referring back to the theoretical framework, the Resource-Based View argues that a company's competitive advantage is rooted in its resources. As described in the theory the resources can be split into three categories. The first group are unique resources, such as experience and intangible assets. The second group are complementary resources that can help to commercialise products or innovations. The last group are substitutable resources, such as financial resources. In the section below the results of the three different categories are presented. Appendix 10.3.2. provides an overview of the quotes that indicate resources.

### 5.3.1. Unique resources

There is one primary unique resource derived from the analysis of the interviews: the current knowledge base of the employees and the organisation. This knowledge base mainly revolves around the existing energy infrastructure and operations. It is unclear if the DSOs have sufficient knowledge on techniques like energy storage or hydrogen as an alternative for natural gas. Especially Liander and Stedin are very confident about the current knowledge levels and both state that they have enough knowledge within the organisation, an example of a quote emphasising this is shown below:

*'Overall, I think we have enough knowledge within our company'*

Enexis is a bit more reserved on this topic. Only two out of four people stated that they have enough knowledge within the organisation. Moreover, they emphasised that knowledge is available in the organisation, but some people still will need to gain this knowledge. Comparing the perception of the DSO representatives to the strategies of the DSOs results in consensus. All three strategies state that they have a lot of knowledge and expertise that can support the energy transition. Comparing these statements to the interviews with the RES professionals, it is mentioned that the DSOs have a lot of knowledge. However, it is not specified if this knowledge is sufficient. Overall DSOs have a broad knowledge base, but it is unclear whether they share enough of this knowledge with the RESs parties. Moreover, it is also not mentioned if this knowledge will still be sufficient in the future. The unique resource of human assets and their knowledge corresponds to unique resources as mentioned in the theoretical framework.

Next to the knowledge of human capital, also experience is envisioned to be a valuable unique resource. Although the DSOs have plenty of experience in the current way of doing business, there is not much experience yet with operating in the new situation of the RESs and the energy transition. The lack of experience to act in this new situation might restrict the companies in enabling the RESs.

### 5.3.2. Complementary resources

This category focuses on resources that can complement an innovation in order to support the commercialisation of it. However, as the DSOs operate mainly in a regulated domain, it is not always possible for them to commercialise their innovations. Nonetheless, all three companies stated that they actively lobby for more flexible regulations for DSOs. This is supported by the following quote:

*'There are many things we want to consider but that are not allowed at the moment. That is why we actively participate in the lobby'*

Lobbying in this research is seen as a resource, rather than a capability since lobby connections are assets a company owns that are tied to the firm semi-permanently (Wernerfelt, 1984). At Stedin, however, not all interviewees mentioned lobbying activities, which indicates a more reserved position. Liander and Enexis both discuss lobbying in their written strategy; in contrast, Stedin does not suggests lobbying in its strategy at all. Enexis mentions the importance of lobbying to create more flexibility for the DSOs. Liander only mentions the importance of a strong lobby for managing risks, such as the shortage of personnel in the market space. The statements in the strategy documents align with the statements of the DSO representatives. Overall, lobbying and good lobby connections are often used as a way to support the commercial activities of the DSO. Comparing this to the RES professionals, only one interviewee mentioned the lobby of the DSOs. Although the DSO representatives seem to be convinced of the role and importance of their lobbying, it is unclear how this currently affects Dutch policy.

Another resource that is perceived to be able to commercialise innovations is owning a company, by the group of the DSO, that operates in the non-regulated domain. All Enexis respondents mentioned that the Enexis group owns the company Enpuls that supports and executes sustainable energy projects, innovations and solutions outside the regulated domain. Also, the strategy document of Enexis emphasises that Enpuls can look for solutions or alternatives outside the regulated domain that will eventually go to the market or can complement the DSO (Enexis jaarverslag, 2017). Alliander (group name of Liander) owns six companies in the non-regulated domain, which are used to commercialise innovations. This is also confirmed by the group strategy document and the DSO representatives. Contradictory, the Stedin group decided at the beginning of this year to sell Joulz, which was their company in the non-regulated domain. None of the DSO respondents mentioned this. After the selling of Joulz, the Stedin group very recently announced the foundation of a new company: NetVerder. This company operates in the non-regulated domain, but will only focus on energy-infrastructures other than gas and electricity, and thus not on solutions like batteries (Duijnmayer, 2019). In the official press release, it is stated that Stedin only wants to focus on

excellent and future grid management (Stedin Groep, 2019). The strategy document published in 2017 by Stedin confirms this. Three out of the four RES professionals in the operating area of Enexis mentioned Enpuls, the non-regulated company. For Stedin and Liander, none mentioned a non-regulated company owned by a DSO. Thus, there seems to be dissonance on the added value of owning (a) company(ies) in the non-regulated domain between on the one hand Enexis and Liander and on the other hand, Stedin.

Considering this, it is concluded that Enexis and Liander share a similar resource base for commercialising innovations. Stedin, on the other hand, has a weaker complementary resource base, that only focuses on energy infrastructures. However, this seems to be a deliberate choice. This is supported by Stedin's strategy, which states: 'Independent grid operation is very important. That is why we are reserved in developing activities outside the regulated domain. Stedin does not want to compete with parties in the market sphere when the activities can also be done by commercial parties.' (Stedin groep strategy, n.d., p. 24). This choice, however, leads to a lower ability of Stedin to commercialise innovations.

The earlier discussed theories do not mention lobbying or subsidiaries as complementary resources, this can be explained by the fact that complementary resources are usually described in non-regulated markets in which there are no restrictions on commercialising innovations in terms of laws or regulations. Therefore lobbying and non-regulated subsidiaries are only a valuable complementary resource in a regulated market. In addition to the previously discussed resources, the theoretical framework suggests that a good customer support centre or a marketing department can be valuable complementary assets for a firm to commercialise their innovations (Tidd, Bessant & Pavitt, 2005). These complementary resources are less crucial for DSOs. The relative unimportance of marketing can be explained by the fact that the consumers are related to the DSO based on their geographical location. However, this does not mean that consumer engagement is unimportant and marketing or a strong customer support centre can enhance the acceptance of innovations by consumers. These complementary resources are however, not perceived to be present at the DSOs. This might make it more difficult for the DSOs to commercialise their innovations.

### 5.3.3. Substitutable resources

The last kind of resources are the ones that can be substituted, yet they are crucial for a company to operate successfully. Three important categories are identified as substitutable resources for DSOs based on the results of this research.

The first substitutable resource identified is human assets. Human assets are usually categorised under unique resources, for example, when it comes to the knowledge and expertise by managers. However, the type of human assets described here is best classified under substitutable resources, as it concerns the number of vocationally (skilled) personal. Vocationally skilled personnel is not per se a unique resource, but sufficiency in it is necessary for a company to operate. Within each DSO, there is consensus on the lack of human resources, specifically technical employees and contractors. This is supported by the following quote:

*'There is a big shortage of technical personnel. We have many vacancies for those jobs'*

According to the DSO representatives, this is caused by a shortage on the market. The main cause of this shortage is that the increase of renewables and grid reinforcement outgrows the supply of personnel. Different recruitment campaigns are started by companies to recruit technical employees and contractors. Besides the lack of technical employees, Enexis is the only DSO acknowledging a second kind of human assets that is not sufficiently present. Two out of four Enexis representatives mentioned that they need more people that can go 'outside' and talk to the stakeholders. The issue of the shortage of technical employees is also acknowledged in the DSOs strategy documents. Stedin states that they invest in strategic personnel planning to make sure they will continuously have the right kind of personnel (Strategie Stedin Groep, n.d.). Also, Liander actively recruits technical personnel to combat the shortage (Alliander jaarverslag, 2017). Enexis also acknowledges this shortage, but on the other hand, also detects the development of IT, which may decrease vacancies over time (Enexis jaarverslag, 2017). It seems that the RES representatives are less aware of the shortage of technical personnel and contractors. Only three out of ten RES professionals mentioned the scarcity, all of them working in the operating area of Stedin. It is unclear why only the RES professionals in this particular operating area are aware of this shortage. Considering the previous, it can be concluded that although this kind of human assets is substitutable, it can still be hard to obtain them due to scarcity in the market.

The second type of substitutable resource identified are the tools that are used by the DSOs. Many different kinds of tools are available and present at the DSOs. In this research, the tools mentioned explicitly refer to the tools that are built and used to give insights in and alternatives on the future energy system for the RES. The tools can be seen as substitutable resources because similar tools could substitute them. At Enexis, half of the DSO representatives mentioned tools, on the neighbourhood level, that support the RESs. At Stedin, three out of four representatives indicated the development and use of scenario- and mathematical tools that support decision making in the RES. Two out of three respondents at Liander described tools which are used to provide options and alternatives on the neighbourhood level. All three DSOs thus mentioned the use of tools, having more or less the same goal. Liander mentions the use of tools in their strategy document; however, they only mentioned the use of tools in the context of operations (e.g. solving a shut-down), it does not discuss the use of tools in relation to providing insights for the energy transition. Enexis states to provide 'energy maps' for local governments and other parties, to support decision making. Moreover, the usage of the tools seems to be a more recent development as it can be seen from the following quote from a RES professional:

*'They did not do that during the pilot, but they (DSOs) now also provide tools so they can visualise. For example interactive atlases or potentials with a visualisation: this is what it will need to be done if you put a cable here and a substation there, and this will be the cost'*

This quote also corresponds with the earlier described attitude of the DSOs in which they provide options and consequences on alternatives for the RESs. Moreover, this indicates that the tools are not all yet in place or used and might get a more prominent role in the future.

A last substitutable resource identified is the firm's financial resources. At Enexis, it is mentioned that the financial assets are currently still sufficient to carry out all the planned investments. However, it is emphasised that ratios will probably decrease and that grid reinforcement is very costly. At Stedin it is stated that money should never be the reason not to invest and that eventually, they can always charge the customer. At those two companies, it is also mentioned that the transition will cost a lot of money. However, they mentioned that the lead times would more likely be the bottleneck than money will be, referring to the (lack of) human assets. Lastly, DSO representatives at Liander are not able to oversee whether the current financial resources are sufficient. Overall, there does not seem clarity on the current financial assets, neither on the lack of them in the future. The strategy documents do not specifically discuss the impact of the RES on the financial assets, but they do emphasise the importance of a stable financial position. The financial situation, charged prices and investments of the DSOs are also monitored by the ACM (authority consumer market). This authority ensures that the DSOs only make appropriate investments and prevent unfair prices for consumers (ACM, n.d.). Only two out of ten RES professionals mentioned the financial assets of the DSOs. They acknowledge the potential difficulties of financing future investments of DSOs. This low number corresponds with the statement that the other parties have low awareness and knowledge of the DSO and the cost that come with operating the grid.

As substitutable assets are usually not perceived to be valuable for organisations as they can be replaced anyway, there is little literature on it (Barney, 1991). However, from the results of this research, it proves that substitutable resources can become crucial, especially when there is a lack of them. It appears that the lack of human assets, in the form of technical employees and contractors, can restrict the enabling of the RESs. The same goes for financial assets. Although it is unclear whether the financial assets will be sufficient, it can become the bottleneck if there is a deficiency.

Figure 4, 5 and 6 visualise the distribution of the different statements by the DSOs on the subject of resources. Taken all the resource categories together, it seems that the resource base is slightly changing towards a resource base that can enable the RESs. Especially the tools, lobbying and non-regulated subsidiaries will support the enabling of the RESs. However, these changes are not yet fully embedded in the strategy documents, and this might also be the reason why the RES professionals overall have a low understanding of the position of the DSOs. Moreover, the lack of experience in the new situation as a unique resource can induce difficulties for the enabling of the RESs. Furthermore, the knowledge base seems sufficient for now, but it is unclear if it still will be in the future. The lack of customer support and marketing on the topic of innovation can moreover result in a low understanding of innovations by customers and subsequently, a low adoption rate. Lastly, the substitutable resource of human assets appears to be crucial for the DSOs in the changing environment. The shortage of technical employees and contractors can restrict the DSOs in enabling of the RESs.

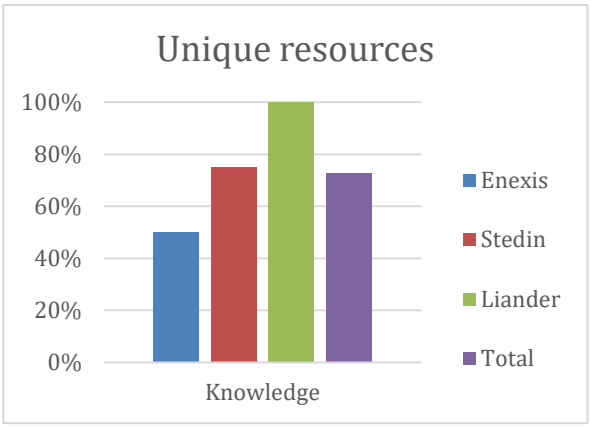


*Figure 4: Distribution of statements concerning unique resources*

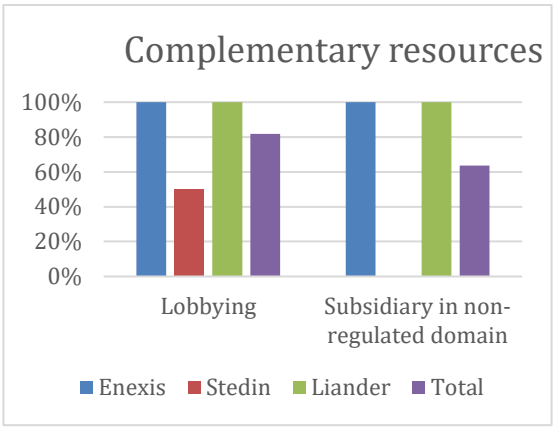


*Figure 5: Distribution of statements concerning complementary resources*

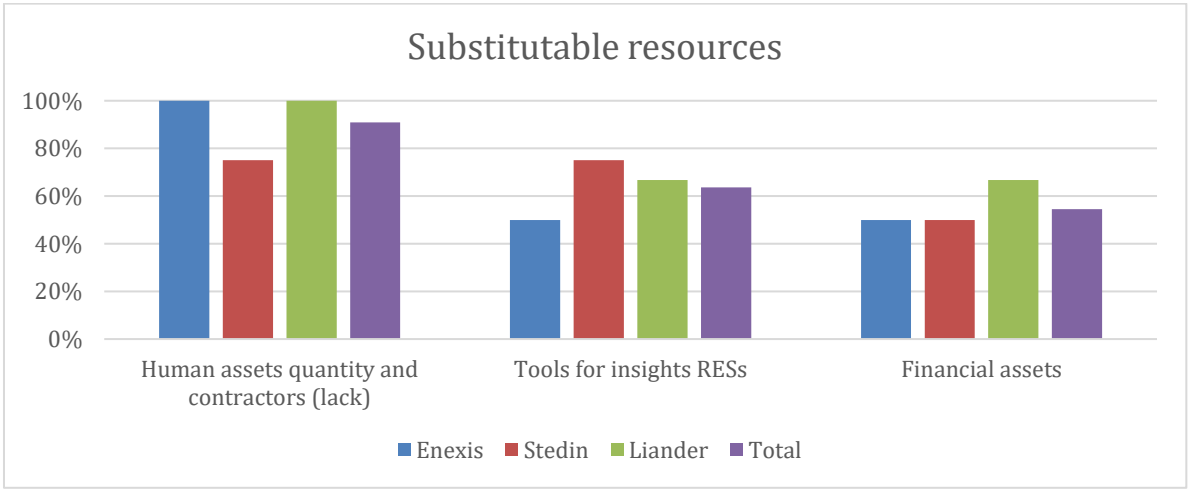


*Figure 6: Distribution of statements concerning substitutable resources*

## 5.4. Current capabilities

As discussed in the theoretical framework, a resource itself does not provide an advantage. The functionality of the resource and how the resource is used determine the advantage of the resource (Lockett, Thompson & Morgenstern, 2009). On the one hand, the capabilities should therefore unravel the functionality of the resources. On the other hand, the capabilities of a firm also built from the resources. Capabilities that can change over time based on changes in the environment are called dynamic capabilities. Capabilities that are used to reach the companies aims are called organisational processes. If the organisational processes have the intention to learn, it can eventually form a dynamic capability. Dynamic capabilities can, on their turn, eventually lead to the sensing and seizing of opportunities, which should be followed by the transformation of the organisation and a renewed strategy based on changes in the environment. In this section, the (dynamic) capabilities, organisational processes and the sensing, seizing and transforming capabilities of the DSOs are presented. Quotes relating to the capabilities and sub-categories are found in Appendix 10.3.3.

### 5.4.1. Organisational processes

The first and most identified capability by the DSO representatives is the capability of collaboration. When collaboration is focused on reaching the company's goals, it can be

perceived as an organisational process. Collaboration is perceived to be crucial to form dynamic capabilities as it can support the renewal of a firms competences and resources. There are different kinds of collaborations that can be distinguished. Within Enexis, the most heard type of collaborations is with external (commercial) parties to find different types of solutions. One interviewee at Enexis suggested that the DSOs should also collaborate more with each other. Also at Stedin the primary type of collaborations is with external parties aiming at seeking solutions. Moreover, one interviewee proposed that there should be more collaborations internally; within and between teams. At Liander there is less consensus on the type of collaborations, one interviewee mentioned the collaborations with external parties for solutions. Another interviewee mentions collaborations with municipalities and regions, based on external demands. The low(er) level of collaborations to seek alternative solutions at Liander, might be explained by the fact that Alliander owns most subsidiaries outside the regulated domains and those are not seen as external collaborations by the interviewees. All three strategy documents mentioned the intention to collaborate with different parties. They all extensively mentioned the importance of collaborations to enhance the energy transition and to identify alternatives and solutions. Three out of ten RES professionals mentioned the collaborations of DSOs. Those interviewees acknowledged the importance of broader collaborations, not only with DSOs, to facilitate the energy transition. In the theoretical framework, the organisational processes of alliances and acquisitions are mentioned, to gather new knowledge and expertise. Although the DSOs collaborate a lot, they do not formally ally with companies that for example specialise in hydrogen. Alliances with specialised companies on topics like hydrogen or energy storage could benefit the enabling of the RESs by providing alternatives for grid reinforcement. At the moment the DSOs do not have such strong alliances with these kinds of companies, which can restrict the RESs. Moreover, no acquisitions are made. This could be explained by the fact that the DSOs are bounded by law, and thus, they could not purchase a company that operates outside this regulated domain.

Another organisational process is R&D activities. R&D activities ought to be crucial for companies in a technology-intensive and rapidly changing environment (Helfat, 1997). All three DSOs seem to have an R&D department, although not called as such. However, as those departments focus on innovations and research, they are labelled as R&D departments. However, not all interviewees acknowledged such a department. Within both Enexis and Stedin, only one person mentions the use of their R&D department to search for innovations. At Liander, all three interviewees identified the R&D department. The strategy documents do not specifically mention an R&D department, but they do discuss being innovation-driven, which could indicate strong R&D activities. As having an R&D department is an internal organisational structural matter, it is not surprising that none of the RES professionals mentioned such a department. R&D activities can be a good indicator of the firm's ability to innovate and adapt to a changing environment. For the DSOs, however, it is unclear what the exact role of the R&D department and its activities is and how they relate to the firm's ability to adapt to changes in the environment and enable the RESs. The distribution of the visualisation of the organisational processes of collaborations and R&D activities can be found in figure 7.

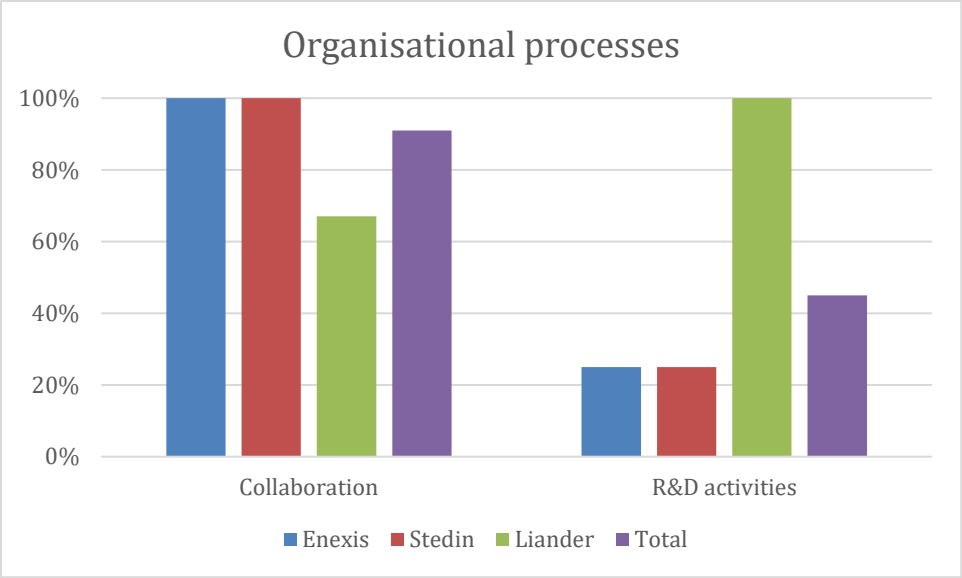


*Figure 7: Distribution of statements on collaboration and R&D activities*

Another discussed organisational process from the theoretical framework is the product development process. After identifying innovations, they should be further developed and scaled up to contribute to the renewal of the organisation based on the external changes. The theory distinguishes two different pathways to develop new products. The first argues that product development requires cooperation between cross-functional teams (Eisenhardt & Martin, 2000). The second argues that product development should be completely separated from daily operations (Christensen, 1998). For the DSOs the latter seems to be the case. By forming subsidiaries that operate outside the regulated domain and mainly focus on sustainable innovations, it is prevented that daily operations outcompete new initiatives. Moreover, Espejo's (2011) Viable System Model argues that autonomous business units can more adequately adapt to rapidly changing environments. Therefore the founding of subsidiaries can enhance the quick adaption to the changing environment. However, it must be prevented that this structure results in the inability of the rest of the organisation to adapt. Another restriction to the development process is, again, Dutch law. Although the DSOs are allowed to test, validate and pilot their innovations, upscaling is often not possible due to the restrictions on the activities that the DSOs are allowed to execute. All DSO representatives acknowledge this. Therefore, the development process of the DSOs is assumed to be rather weak, resulting in a limited ability to upscale innovations.

As a last organisational process that is presumed to be important to develop dynamic capabilities is the process of knowledge creation. Eisenhardt and Martin (2000) state that this can be done by creating external relations with scientists, governments and professionals outside the firm. From the results of this research, it appeared that not only the creation of knowledge based on external relations is important, but knowledge creation should be perceived broader. The results from this research identified three categories of knowledge exchange: external knowledge gathering, external knowledge sharing and internal knowledge sharing. First, external knowledge gathering can be split up into external knowledge gathering and external information gathering. The second type of knowledge exchange is knowledge sharing,

mainly in the form of input for the RESs. Lastly, internal knowledge exchange concerns information and knowledge exchange between employees of the organisation. The different knowledge exchange categories are discussed below.

As mentioned, external knowledge gathering for DSOs is twofold. On the one hand, there is the gathering of information on investments plans from municipalities. This category is categorised as external information gathering. On the other hand, there is the gathering of knowledge from external parties like research institutes and consultancies. The statements of the DSO representatives mainly revolve around getting informed on the location plans of regions and municipalities to make investments. Both Enexis and Liander mentioned this process as very valuable for their investment planning. Within Stedin, only one interviewee mentioned external knowledge gathering. This information gathering is supported by the following quote of one of the DSO interviewees:

'*With those RES we can get insights in the long term plans and where we can expect production'*

Enexis is the only DSO that mentioned gathering external knowledge from, for example, consultancies or research institutes. The strategy documents of the DSOs do not discuss the process of external information or knowledge gathering. Three RES professionals mentioned that the DSOs try to gather knowledge or information from the RESs, municipalities or region (in this case external parties). The kind of knowledge or information that the DSOs try to gather is primary about location decisions for renewable energy projects by municipalities on which the DSOs can start investing. Although the DSOs try to gather new information and knowledge, they mainly focus on information gathering from municipalities, rather than knowledge gathering from a variety of stakeholders. Especially the knowledge gathering from consultancies, research institutes and other knowledgeable actors may enhance knowledge creation and support the DSO to enable the RESs. At the moment, the DSOs are rather weak on this part of knowledge creation.

As discussed, the DSOs perceive to have a very good knowledge base (unique resources). Consequently, they all stated that they want to share their knowledge and expertise with external parties with the aim to help to accelerate the energy transition. At Enexis and Stedin two out of four interviewees state that they share knowledge with external parties. At Liander all three interviewees stated to do so. This deviance can be explained by the fact that not all interviewees have conversations in the RESs and might not be aware of the external knowledge sharing that is taking place. All three DSOs' strategy document focus on external knowledge sharing. They specify that the knowledge and information they share aim to serve the 'social goal', referring to their social nature as a utility company. The RES professionals very well acknowledge the processes of knowledge sharing with external parties (municipalities, RES etc.). The RES professionals also emphasised the importance of knowledge sharing, as the DSOs are overall way more knowledgeable on the technical part of the energy transition, compared to the municipalities. The process of external knowledge sharing was not included in the original conceptual model, but can be a great enabler of the RESs. By sharing knowledge, information and expertise, the RESs will be able to make more accurate plans, which will eventually also benefit the DSOs in terms of investment planning.

The last category of knowledge exchange is internal knowledge sharing. The RES representatives least mentioned this type of knowledge exchange. Two people at Enexis mentioned internal knowledge sharing and focus on the importance of sharing experience and clustering knowledge that is scattered all over the organisation. At Stedin one interviewee states that there should be more collaboration internally to share knowledge. A Liander representative describes a new value system that is being built, in which a more customer focus approach should also lead to better knowledge sharing internally. The following quote by one of the DSO representatives shows the internal knowledge sharing in the DSOs:

*'So we all hear about different ideas and initiatives in the regions, and we share those experiences internally'*

The strategy documents do not mention the process of internal knowledge sharing. None of the RES professionals mentioned internal knowledge sharing, which can be explained by the internal nature of this process. Internal knowledge sharing can be an excellent means to create new or extend existing knowledge. However, at the DSOs, internal knowledge sharing does not seem to be an embedded process. Insufficient internal knowledge sharing can result in different knowledge bases of employees, which can eventually restrict the enabling of the RESs since the input in the RESs will not be the same. Therefore, internal knowledge sharing is crucial to enhance knowledge creation and provide new opportunities for the RESs.

Figure 8 visualises the distribution of the different knowledge creation categories. From the quantification of the quotes, it appears that gathering and sharing information and knowledge is at the moment a better embedded process for the companies than the internal knowledge sharing process. This can be explained by the importance of the DSOs to know where investments should be made. However, the creation of new knowledge via, for example, research institutes or consultancies is not much present in the DSOs. At the moment, the knowledge base of the DSOs still seems to be sufficient. However, in the future, the inability of the DSOs to create new knowledge from these kinds of external parties can restrict the enabling of the RESs. Moreover, internal knowledge sharing is not much present at the moment. Enhancing the practice of internal knowledge sharing can create new knowledge and facilitate the translation from pilots to internal process and by this support the enabling of the RESs.

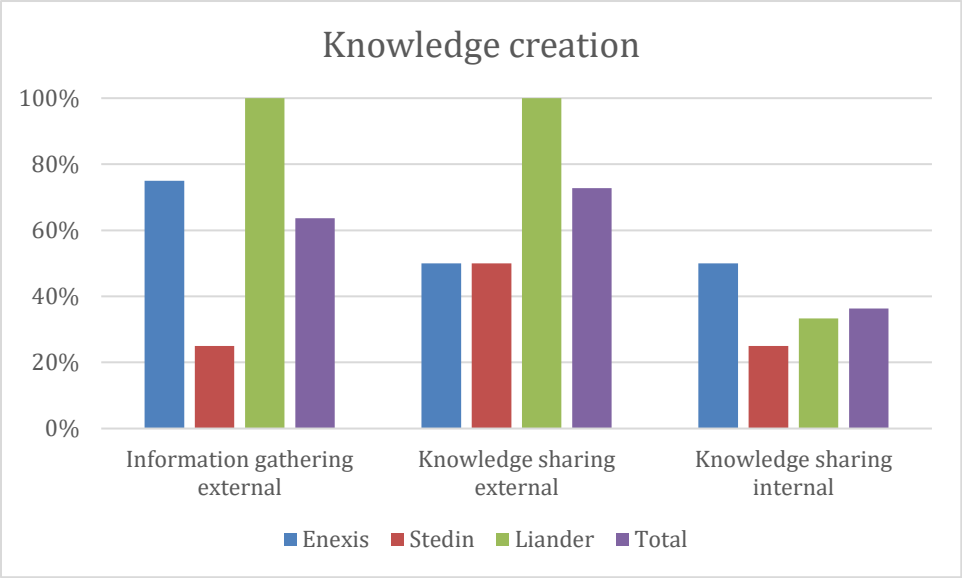


*Figure 8: Distribution of statements on knowledge creation*

### 5.4.2. Learning

As described in the theoretical framework, the intention of organisational processes should be to learn in order to achieve a dynamic capability. More specifically, learning should be focused on future insecurities in order to develop dynamic capabilities. Within both Enexis and Stedin three out of four DSO representatives mentioned this capability of learning. At Liander only one interviewee mentioned the capability of learning. Learning mainly originates from participating in pilots. The main objective of the pilots is learning and testing, this is supported by the following quote by one of the DSO representatives:

'*With the pilot projects, we aim to learn how those things work'*

Only one interviewee, at Enexis, mentioned that internal learning (between colleagues) is important too. In all three strategy documents, the capability of learning is mentioned in the context of pilot projects, which can be seen as external learning. More specifically, Stedin mentions piloting in heat networks in order to learn and to build up expertise, intending to be prepared for the future, in case the DSOs get a more prominent role in heat networks. Only one RES professional mentioned that the DSOs are learning or try to learn. Figure 9 displays how the statements on external learning are distributed.

Although learning is only mentioned explicitly in the context of conducting pilots, the other previously described organisational processes can also result in learning. For example, collaborations, R&D and knowledge exchange all can result in learning. However, it is important that these organisational processes have the intention to learn to adapt to insecurities in the future in order to form the dynamic capabilities of a company. For example, when collaboration is merely focused on achieving cost-benefits in the short term, the organisational processes will never become a dynamic capability. For the current organisational processes of the DSOs as described before, especially R&D activities and collaborations focus on the learning component to be able to adapt to (future) changes. The knowledge creation process seems to mainly focus on the gathering and sharing of information for investment planning,

rather than aiming to create new knowledge and to learn. Therefore the knowledge exchange processes are perceived not to be dynamic capabilities. Moreover, as the development process cannot expand due to restrictions in law, this process cannot be focussed on learning and thus is not a dynamic capability.

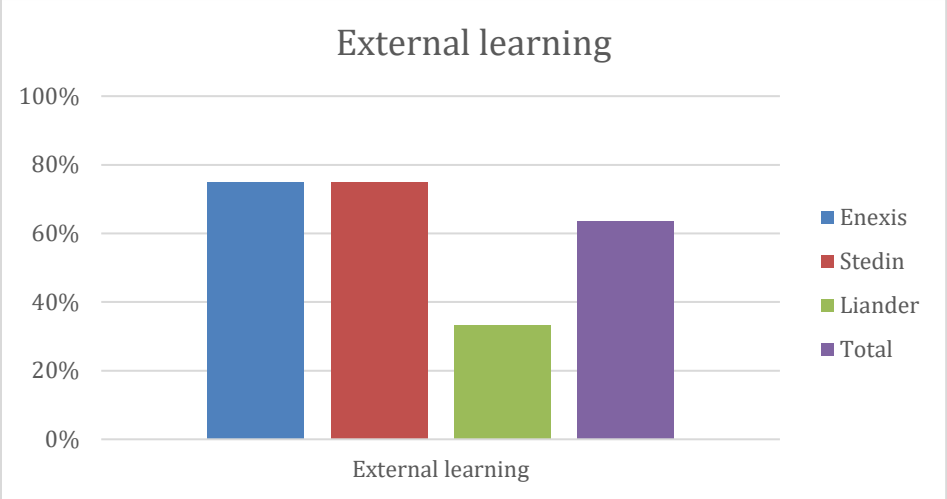


*Figure 9: Distribution of statements on external learning*

### 5.4.3. Dynamic capabilities: sensing, seizing and transforming

The organisational processes described in the theoretical framework form the basis of the firms' dynamic capabilities. The organisational processes that have the aim to learn in order to adapt to insecurities and changes in the future environment result in the firm's dynamic capabilities. When a company has the right dynamic capabilities it will eventually be able to sense and seize opportunities and transform the organisation and renew its strategy, which in this case can enable the RESs (Teece, 2010). Below the organisational activities within the DSO that form the basis of the three steps are described. Figure 10 displays the visualisation of the distribution of the statements on sensing, seizing and transforming.

#### 5.4.3.1. Sense

The first step of sensing is described as identifying opportunities. For DSOs, it can be argued that sensing threats is more important than sensing opportunities, as in the current environment they are facing the threat of not being able to connect all the incoming demands from customers timely. Therefore seeking alternatives is seen as a crucial step to take for DSOs. Within and between all three DSOs there is a strong acknowledgement of the need of seeking for alternatives, for example, to postpone grid reinforcement, or to balance the grid. Also, the strategy documents emphasise the need to develop new solutions. Only one of the RES professionals identified that the DSOs are seeking for alternatives. A possible explanation for this low number could be that the search for alternatives by DSOs is not externally visible. Moreover, the DSOs have the earlier described R&D activities that can help to identify opportunities. The R&D activities and the seeking of alternatives lead to the so-called 'capability monitoring' (Schreyögg & Kliesch, 2007). Moreover, collaborations with external partners, non-regulated subsidiaries and entrepreneurial employees can support the seeking for alternatives (Teece, 2007). Overall, the DSO representatives are aware of the changes in the

environment and are constantly seeking for opportunities, threats and subsequently alternative solutions. Therefore it is argued that the DSOs successfully execute the sensing step.

#### 5.4.3.2. Seize

Once an opportunity is sensed or a solution is detected, an accurate response is essential, usually in the way of seizing. In regulated markets, as explained in the theory, this also means that the DSO should determine to what extent the opportunity can be seized under current regulations and laws. All DSO representatives mentioned the restrictions on the DSOs by the law. However, piloting solutions are allowed under Dutch law. Therefore, almost all DSO representatives mentioned that they pilot to test solutions and to be able to learn from them. The subjects of the mentioned pilots vary from the phasing out of natural gas, to the use of batteries and even the use of hydrogen as an addition to natural gas. Also, the strategy documents mention pilot projects as a mean to learn and test assumptions. Some RES professionals identify that the DSOs pilot as a way to seize alternatives. Although it is commonly stated by DSO representatives that the DSOs pilot new opportunities and innovations, they are restricted by regulations to further develop such solutions. Therefore pilots are not followed up upon, and no feasible business cases are developed to further seize the solutions. Another inhibitor for fully seizing opportunities can be the DSOs' inability to translate the lessoned learned externally from pilots, towards internal organisational processes. Hence, internal learning should be strengthened to facilitate this translation and support seizing innovations. Consequently, it is envisioned that the DSOs are currently not able to fully seize opportunities needed to transform the organisations and enable the RESs.

#### 5.4.3.3. Transform

When the opportunity or solution is seized it is important that the new path is adopted within the whole organisation. Although the DSOs are currently not able to seize the opportunities they sense, they do try to transform their organisation. The most critical step that is made by the DSOs in the transformation are newly created functions or departments that focus on external stakeholder relationships regarding the RESs and energy transition. At all three organisations, a new type of function or department is introduced. At Stedin and Liander the explained functions already seem to be in full operation. At Enexis, however, only two out of four interviewees mentioned the new type of function and team, and the department is still underdeveloped according to the following quote:

*'So we are developing the new department that will be the expertise centre for the energy transition'*

At both Stedin and Liander, there are new function profiles in the department Customer and Market (Klant en Markt). This new function is called relationship manager or area director. The responsibilities of these relationship managers and area directors are to get involved with the different RESs and other energy transition-related initiatives throughout the regions and provinces. At Enexis the new functions are part of the Asset Management department and are called strategic advisor energy transition or partner energy transition. Besides the employees that are directly involved in the RESs, there is also a selected team at Enexis that will focus more on the calculations on the grid and the development of tools to support the strategic

advisors and partners energy transition. The new type of functions also requires new kinds of knowledge. An interviewee describes this as:

*'So now you are talking to not only one client but with the whole region, and the answers are often ambiguous, and you still have to search for alternatives and answers. And also in those conversations, there is no clear role description. So these kinds of conversations are totally different than our traditional account managers used to have'*

Although the DSOs stated that they have a solid knowledge base, they are seeking new kinds of knowledge and skills. From the strategy documents, it is not clear that they were and are developing those new skills, departments and functions. Only one RES professional mentioned a transformation step by the DSOs. The interviewee noticed that only from last year on (2018) the DSO sent a dedicated account manager to facilitate and support the RES. As the transformation of such a department is usually internally, RES professionals are probably not aware of the change. Although the DSOs try to transform their organisation, they are holding back by the regulations that prevent the shift from seizing to transforming. Furthermore, setting up a new team or department that is focussed on the energy transition and the RESs does not imply that the whole organisation is also changing. In the theory section it was described that transforming the organisation also requires support by top management in order to lower the resistance to change (Helfat & Peteraf, 2015). As the strategy is not yet aligned with the changes implied by the introduction of the RESs, it is also assumed that the top management is not yet supporting the transforming of the organisation. This can restrict the transformation that is necessary for enabling the RESs.

Concluding, although the DSOs are sensing opportunities and they try to seize them by piloting and transform the organisation by forming a new department, they are restricted by the law and regulations to fully do this.

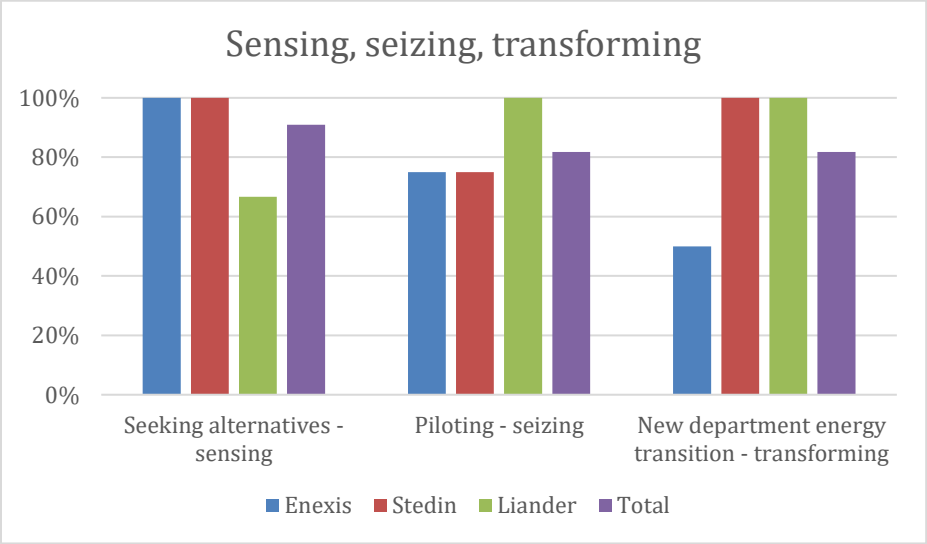


*Figure 10: Distribution of statements on sensing, seizing and transforming*

## 5.5. Additional results

Three other interviews were conducted with interviewees that could provide some context and extra insights into the issue at hand in addition to the regular interviews. The additional interviews were conducted with an employee of a company that stores energy, an employee at one of the subsidiaries of the DSOs, and an employee at a DSO that is involved in the new RESs. The results of these interviews are not coded in the way the other interviews are. Only the relevant parts of the interviews are analysed and added to this section of the results. As the number of interviews of this type is limited, no absolute conclusions can be drawn from them.

The first interviewee works at a company that stores surpluses of electricity at peak moments of renewable energy generation in the form of heat. This heat can, later on, be used to supply houses with heat. According to the interviewee, these kinds of solutions could be used to prevent grid reinforcement. However, the interviewee acknowledged the restrictions in regulations of the DSOs to acquire such solutions. The interviewee argued that regulations and laws should be changed in order to give more possibilities to the DSOs. Furthermore, the interviewee expects a complete change of the energy system, in which central electricity generation is replaced by decentral generation. This results in more local transport and exchange of electricity and storage could play a significant role in this. The interviewee stated that this change will greatly influence the DSOs. It is emphasised that this change can be challenging for DSOs as they will need to modify the current grid, instead of the more easy solution of a new local network to be built from scratch. To conclude, the interviewee sees a great role for heat storage in the energy system, but the role of DSOs in this still dramatically depends on changes in law and regulations. This corresponds with the outcome of the other interviews that indicate that Dutch law should change to enable the RESs.

The second interviewee works at a subsidiary of one of the DSOs. As stated before, the subsidiaries are operating in the non-regulated domain and aim to seek alternatives to accelerate the energy transition. One of such an alternative is flexibility solutions, for example, with different tariffs. As those kinds of solutions can have significant impacts on the grid, there is always a lot of collaboration between the DSO and the subsidiary. The subsidiary does perform different pilots that can support either the market or the DSOs. However, the interviewee stated that they aim to merely test and verify solutions; they do not aim at fully operating a solution or project for a longer term. Once a pilot is validated to be successful; they try to seek commercial parties that can buy the projects or ideas and proceed on the market. This is supported by the recent selling of a smart grid solution by Enexis' subsidiary Enpuls (McDonald, 2019). Also, this interviewee recognised that the energy system will change. In the future, the interviewee envisions a system in which each area has a system that fits best to its characteristics. Following the DSO representatives, the subsidiary interviewee also believes that the DSOs will have a great challenge in executing the energy transition, due to limitations in technical employees and contractors. Lastly, the subsidiary interviewee argued that the DSOs will need to change in the future and will have to take a critical look at themselves and the products they offer in order to stay relevant in the future.

The third interview was conducted with an employee of a DSO that is involved in the conduction of a 'new' RESs. This interview can give insights into the differences that might

exist between the pilot and the new RESs. Overall, the internal resources and capabilities of the DSO that should enable the RESs did not change much over time compared to the pilot RESs. For this specific DSO, the team that is responsible for the external communication with stakeholders, like the RESs, did slightly expand overtime to support the RESs. The role and attitude of the DSO are still to advise, to get information and to share knowledge. A new insight from this interview is that the interviewee mentioned that the team and employees dedicated to the energy transition quickly adapt to the changes in the environment. However, the rest of the organisation has more difficulties getting used to the new situation, and therefore, no culture shift has occurred yet. The interviewee stated that a shift is required from a more conservative attitude towards a more proactive attitude. The interviewee acknowledged that this behavioural change is very hard to achieve in the organisation. On the RESs side, the interviewee believes that the new RESs will be able to deliver more concrete plans on which the DSOs can start investing, in contrast to the pilot RESs which did not succeed in delivering specific strategies or plans. However, the interviewee sees difficulties for the RESs in terms of human capacity at the municipality side in order to fulfil the new demands of the RESs. Overall, there seem to be no significant changes at the DSOs compared to the pilot phase of the RESs. The RESs, however, are now more concrete.

## 5.6. Restricting or enabling the RESs by the DSOs strategies, resources and capabilities

Taken all the previous results into account a couple of important things can be noticed. It first must be said that the pilot RESs did not deliver the planned strategies. As discussed, most RES regions had difficulties with finding agreements on the decisions to be made. According to the interview with the DSO representative that is now involved in the new RESs, the new RESs will deliver more concrete results. Moreover, the whole process of getting to know each other took more time than expected, which complicated the delivery of the RESs in time. These difficulties indicate the importance of good collaborations and trust in the RES process. Furthermore, knowledgeable parties seem crucial in order to make accurate and well-informed decisions. Below it is discussed how the strategies, resources and capabilities of the DSOs either enable or restrict the RES process. The way in which the DSOs can enable or restrict the RESs is twofold. On the one hand, the DSOs can enable or restrict the RESs during the conduction phase of the written document. On the other hand, the DSOs can also enable or restrict the execution of the plans of the RESs, for example, when there is a lack of resources. Looking back at the RES results (5.1), the content part of the RESs mainly indicates what is needed by the DSOs to enable the execution of the RESs. The process of the RESs mainly indicates how the DSOs should enable the conduction of the RESs. It will be indicated per category on which level the DSO enables or restricts the RESs.

### 5.6.1. Restricting or enabling the RESs by the DSOs' strategies

The first thing that catches the eye when analysing how the DSOs' strategies might restrict the RESs is that although there seems to be consensus on the strategy by DSO representatives, many things are not documented in written strategy documents. This has two different consequences. First, DSO representatives provide different input to stakeholders and RES professionals, since the contribution of the DSOs in the RESs is not embedded in the strategy.

Second, because of the lack of specific statements on the attitude of the DSOs in the strategy documents, confusion among RES professionals can occur on the role of the DSO in the RESs. Since the role of the DSO in the RES process is not clearly described, the RES process might be restricted due to the confusion about the role of the DSOs. Subsequently, when the role of the DSOs is not clear, the input they give for the conduction of the RES is also unclear, which can restrict the enabling of the RESs.

Moreover, DSOs take an advising approach and show the consequences of different decisions. When this is done correctly, this can significantly benefit the conduction of the RESs by supporting decision making. However, since the DSOs tend to have a more conservative attitude, not all DSO representatives are confident enough to actively give advice on, for example, the best alternative for natural gas in a specific neighbourhood. The fact that the process of giving advice and providing consequences is not embedded in the strategy documents can restrict the conduction of the RES as not all the DSO representatives feel confident enough to take this role. As a last point for the strategy, the creation of awareness and knowledge of the DSOs is discussed. The lack of awareness and knowledge can restrict the conduction of the RESs, as it is hard to make decisions without the appropriate knowledge. Both the RES professionals and DSO representatives acknowledge this. A first step is taken to increase the knowledge base of the RES professionals by the conduction of an information document by Netbeheer Nederland (Netbeheer Nederland, 2019). The urge to increase knowledge and awareness of third parties is, however, not embedded in the strategy documents yet. The restrictions derived from the strategy of the DSOs mainly concern the conduction of the RESs.

Taken the previous together, the current strategy is grafted on the energy transition. However, it does not explicitly focus on the renewed role of the DSOs in this transition. This confuses both the DSO representatives and the RES professionals about the role the DSOs take in the RESs. However, the willingness to share knowledge and consequences can enable the RESs, but as long as this is not clearly embedded in the strategy, the lack of a clear vision on the role of the DSOs restricts the enabling of the RESs.

### 5.6.2. Restricting or enabling the RESs by the DSOs' resources

A crucial resource for the DSOs that can enable the RESs is their knowledge base. The knowledge base can both enable the conduction as well as the execution of the RESs. According to the DSO representatives and the RES professionals, the knowledge of the DSOs is sufficient. At the moment this resource thus does not restrict the enabling of the RESs. However, as innovations are quickly developing and changes in laws and regulations can enforce new responsibilities for DSOs, it is unclear if the knowledge will still be sufficient in the future. Moreover, the DSOs do not have experience with the new situation of the RESs, which can restrict the enabling of the conduction and execution of the RESs, as the DSOs still need to figure out what to do with the RESs.

The complementary resources such as subsidiaries and lobbying can both support the conduction and the execution of the RESs. If the DSOs can commercialise innovations, they can give perspectives for new solutions that could enable the conduction of the RESs.

Moreover, the commercialisation of innovations could enable the execution of the RESs. The non-regulated companies owned by Alliander and Enexis could be very good partners to enable the RESs. Stedin does also have a subsidiary, but its operating space is restricted to net applications, and this might restrict the execution of the RESs. However, it could be argued that the operations executed by the non-regulated parties, could also be picked up by other commercial market parties and thus the lack of a non-regulated company does not per se have to imply a restriction for the RESs. Nonetheless, a non-regulated party owned by the group structure of the DSO could make the communication with the RESs easier, as there are fewer parties involved. This could support the enabling of the RESs. Moreover, when lobbying leads to less strict regulations, this can support the enabling of the RESs. However, for now, it cannot be said if the lobby is strong enough to actually accomplish the desired changes in laws and regulations.

For the last group of resources, the substitutable resources, the lack of human assets can restrict the RESs on two levels. First, when there are insufficient employees from the DSO to participate in the RES process, this will restrict the conduction of the RES. At the moment, it seems that this is only the case for Enexis. The other side of the lack of human assets concerns all three DSOs. Because of the scarcity of technical employees and contractors, the execution of the plans made in the RESs will be restricted. Moreover, the tools that are developed by the DSOs and used to support the RESs can greatly support the RESs conduction. However, as not all tools are in full operation yet, this will restrict the decision making of the RES. It is crucial for the DSOs to further invest and expand the analytical tools that are provided to the RES to enable the RESs decision-making. As a last substitutable resource, the financial assets of the DSOs are mentioned. It is unclear whether this resource is sufficient at the moment. If the financial resources are insufficient, they can significantly restrict the execution of the plans made by the RESs. Although substitutable resources are usually not perceived to be very valuable, the lack of them can significantly restrict the enabling of the RESs. At the moment, only the human assets seem insufficient and restrict the enabling of the RESs. The other substitutable resources still seem to be sufficient and will enable the RESs.

Overall there are quite some resources in place that can enable the RESs. Nonetheless, there are also some resources that are still underdeveloped, and it is crucial for the DSOs to invest in these resources in order to enable the RESs and subsequently the energy transition.

### 5.6.3. Restricting or enabling the RESs by the DSOs' capabilities

Collaboration is a crucial organisational process for enabling the RESs. The DSOs highly emphasise their willingness to collaborate with municipalities to enable the conduction of the RESs. More formal collaborations or alliances with parties that could develop alternative solutions for grid reinforcement are less common among the DSOs. This might restrict the enabling of the RESs when insufficient alternatives are found. The R&D activities of the DSOs are another organisational process that can enable the RESs. As it is unclear what the role is of the R&D department and to what extent they try to innovate, it cannot be said to what extent the R&D activities are enabling the RESs. Following up on the R&D activities, the development of innovations is crucial to eventually enable the execution of the RESs. As regulations and

laws restrain the DSOs, they are restricted in developing and upscaling new solutions that could enable the execution of the RESs.

As a last organisational process knowledge creation is discussed. As discussed, knowledge is perceived as a precious resource of the DSOs. External information gathering, for example, to make investments, can benefit the execution of the RESs. When DSOs can timely invest in the connections for renewable energy, those will be not stagnated by long waiting times. Moreover, it can help the DSOs in advising the RESs based on the most accurate information. Enexis and Liander both actively gather knowledge and information and are therefore not likely to restrict the RESs on this subject. Stedin seems less active in information and knowledge gathering, and this could eventually lead to a restriction of the RESs due to inaccurate knowledge and information. Although the DSOs actively gather information and knowledge from municipalities, they do not actively state to gather new knowledge from external parties such as research institutes or consultancies. Gathering such knowledge is crucial to create new knowledge which can enable the RESs' conduction and execution. Thus, improving this process is vital for DSOs. Besides external knowledge gathering, external knowledge sharing can significantly enhance the enabling of the RESs. It seems that the DSOs actively share their knowledge and expertise, which can improve the conduction of the RESs. The last category of the knowledge exchange process is internal knowledge sharing. Internal knowledge sharing within DSOs can provide benefits for the conduction of the RESs as well, as best practices can be shared within the DSO and subsequently benefit the value of the advises that the DSOs give to the RESs. Compared to the external knowledge sharing and gathering, this capability does not seem to be present at all DSOs, which could restrict the enabling of the RESs. Overall, the current organisational processes are enabling the RESs, however an increase in knowledge creation, collaboration and development are required to prevent restricting the RESs in the future.

Based on the previous described organisational processes, the DSOs have the ability to learn, mainly externally, which can help provide feasible options for the RESs. Also, when DSOs have a strong capability to learn, they will be able to adapt according to the RESs' plans. Learning within the DSOs is mainly focused on preparing for future changes, for example, with piloting innovations. However, the lack of internal knowledge sharing and the inability of the DSOs to seize their opportunities implies that the internal learning of the DSOs is lagging behind. When the DSOs are not able to translate the knowledge and experience they gain from conducting pilots into internal processes, the enabling of the RESs will be restricted. Although the DSOs' ability to learn externally provides a good starting point, internal learning is crucial to fully make use of the firm's dynamic capabilities and be able to sense, seize and transform. Therefore, the weak internal learning ability can restrict the enabling of the RESs.

Looking at the sensing, seizing and transforming activities of the DSOs as an outcome of their organisational processes, a couple of things can be noted. Firstly, the sensing ability of the DSOs seems quite good. Sensing alternatives can contribute to the content of the RESs and provide new directions for the energy transition. In the next step of seizing DSOs pilot a lot. Although this sounds promising and can provide input for the conduction of the RESs, it must be said that after piloting the DSOs are usually not able to follow up on projects or to upscale

them, due to regulations and laws. Moreover, the inability of the firms to translate the lessons learned from pilots into an internal process (internal learning) restricts the seizing of opportunities. Although piloting by the DSOs can enable the conduction of the RESs as it can provide new options, for the execution of the RESs, this will not be enough. The fact that the DSOs cannot follow up on the pilots can restrict the enabling of the execution of the RESs in the future. Although the DSOs are not fully able to seize the opportunities, they are currently trying to transform the organisation. To transform the organisation, the DSOs set up a department and created new vacancies to support the RESs and energy transition, by participating in and contributing to the RESs processes. The new departments will enable RESs conduction. However, it must be noted that Enexis is still in the phase of setting up this department and might at the moment not be fully able to enable the RESs. Although these kinds of departments can be great enablers, it is unclear if the rest of the organisation and culture is changing too. According to the DSO representative of the new RES, changing the whole organisation into the direction of the energy transition is a great challenge. When the rest of the organisation does not change its culture and mindset towards the facilitation of the energy transition, this can also restrict the enabling of the RESs.

## 5.7. Necessary strategies, resources and capabilities for enabling the RESs

Taken all the previous together, it can be concluded that the DSOs are already on their way to enable the RESs and facilitate the energy transition. However, this does not go without any difficulties. Derived from the previous enablers and restrictors the necessary strategies, resources and capabilities by the DSOs for enabling the RESs can be formulated.

The lack of clear statements in the strategy documents of the DSOs about their role in the RESs resembles an unclear vision which is accompanied by diffused attitudes of employees. The written strategy of the DSOs, therefore, should clearly state what the role and position are of the DSOs in the RESs. By doing this, the DSO employees will get a better understanding of the role they should take in the RESs process. When this is done, the RESs can better be enabled since the expectations of the parties involved in the RES process will be better managed. The RESs moreover, will highly benefit from a strategy by the DSOs in which they proactively advise the RESs in order to create feasible options.

In the resource base, the lobbying activities and subsidiary companies in the non-regulated domain can be great enablers of the RESs, as they can support the development of innovations. However, the lack of human assets and the potential insufficiency of financial assets may highly restrict the RESs. Therefore, it is crucial for the DSOs that they attain sufficient technical employees or develop systems to make the work process more efficient. Moreover, minimising costs should ensure that the DSOs will have sufficient financial assets in the future. In addition, the DSOs should further develop their tools base to even better support the enabling of the RESs.

As a last category, the necessary capabilities to enable the RESs are discussed. As the RESs introduce a changing environment for the DSOs, this indicates that the DSOs should set up their dynamic capabilities. As a part of the dynamic capabilities, there should be organisational

processes embedded in the organisation that benefit learning. The DSOs should have a very strong ability to collaborate and, if appropriate, form alliances that can benefit the learning ability of the firm. Currently for the DSOs, they seem to have good collaborations skills, but still have to improve their ability to form alliances to enable the RESs. Moreover, the DSO should have strong R&D activities, in which it is even more important to be able to develop the innovations discovered. The development process, however, is currently restricted by Dutch law. Lastly, the creation of knowledge is crucial. In the knowledge creation process, the DSOs should enhance their external knowledge gathering on future energy solutions. Moreover, internal learning within the DSOs should become stronger to enable the RESs. The DSOs can learn from pilot projects. However, they do not seem to be able to share this knowledge internally. Thus, the internal learning ability of the DSOs needs to improve to better benefit from the firm's dynamic capabilities.

As a result of the firm's dynamic capabilities, the companies are already able to search for threats and opportunities. These opportunities are seized by piloting different projects, which is a decent starting place for enabling the RESs. However, fully seizing opportunities to enable the RESs is restricted by two issues. On the one hand, Dutch law restricts the upscaling of pilots and thus the seizing of the opportunities. On the other hand, the weak ability of the firm to learn internally restricts the full seizing of the opportunities. There are two necessary steps to make to solve this problem. First, although the complementary resources are already indicating an ongoing lobby, the lobby should be even stronger to change laws and enable the seizing. Second, once the laws allow for seizing; the internal learning of the organisation should also become stronger to allow the seizing. As a last step, the DSOs started their transformation by forming new departments and functions to enable the RESs. However, since this is just a single department, the full transformation of the organisation did not yet take place. Nonetheless, first, the seizing step needs to be overcome, before the rest of the organisation, its structure and culture can change with it.

# 6. Discussion

In the introduction, it is argued that the DSOs need to change their strategies, resources and capabilities to enable the RESs. Although the DSOs are already well on their way in enabling the RESs, they will need to invest in a couple of crucial points. First, they will need to form a (written) strategy in which they explicitly state what their role is in the RESs and how they want to contribute. This strategy should be implemented internally. Moreover, the DSOs will actively need to use their complementary resources of lobbying and subsidiaries to commercialise innovations. Furthermore, customer support can strengthen the relationship with customers, who can enhance the commercialisation. Lastly, the DSOs will need to have stable and sufficient human assets and financial assets to enable the RESs. In addition to the resources, (dynamic) capabilities by the DSOs are required to enable the RESs. DSOs are already actively collaborating to find alternatives that could enable the RESs. Also, formal alliances could provide more knowledge and expertise to the RESs which could be used to enhance the enabling of the RESs. Another crucial process is the R&D activities of the DSOs to innovate. Research is already taking place at the DSOs. However, development is currently restricted by the Dutch

law. Also, the DSOs will constantly need to create new knowledge to keep up to the demands of the RESs. Accordingly, DSOs should be able to learn, both internally, as well as externally. Externally the DSOs are already learning from their participation in pilots. Internally, however, the learning process should be enhanced for the DSOs to actually move from sensing and seizing opportunities towards actually transforming the organisation, and by this fully enabling the RESs.

Now that the research question is answered, this section will discuss the appropriateness of the used theory to answer the research question and suggest alternative theories. Moreover, additions to the current literature base are considered, as well as the managerial implications of this research. Lastly, this is followed by the limitations of this research, which also provide some suggestions for further research.

## 6.1. Appropriateness of used and alternative theories

The conceptual model, based on the Resource-Based View and dynamic capabilities, was used to inventory the necessary strategies, resources and capabilities of DSOs. This theory is argued to be adequate for finding the results as the Resource-Based View is primarily focussing on resources that can provide a company with a competitive advantage, or in this case, cost-efficiency (Wernerfelt, 1984). The addition of dynamic capability theory (Teece, Pisano & Shuen, 1997) supported the identification of appropriate capabilities in a changing environment. Specifying the resources in unique, complementary and substitutable resources helped to identify how each type of resource could add to the enabling of the RESs. Overall, the theories used are found appropriate to identify the necessary strategies, resources and capabilities for the DSOs to enable the RESs.

There are also other theories that could be considered appropriate for researching this topic. In the theoretical framework, it was already discussed that the external oriented five forces theory by Porter (1979) was found less appropriated. It was argued that powers such as the forces of new entrants and buyers were assumed to be negligible, because of the regulated nature of this part of the energy system. However, in the changing environment in which Dutch law could also change, these forces might become more critical. For example, the increasing number of heat networks can be seen as a substitutable product for the current natural gas network (Porter, 2008). Also, rivalry among DSOs (competitors) could be seen as a possible force that applies to DSOs. Although the DSOs cannot compete in the sense of trying to get each other customers, due to the geographical locations of the grid, they are benchmarked and tested by the ACM on their prices, and therefore competition can appear based on prices and costs (Porter, 2008). However, the appropriateness of the theory of Porter mainly relies on possible changes in the energy system and laws and therefore, at the moment, it is not seen as a fitting theory to research the issue at hand.

Besides looking at strategic management literature, it could also be argued that innovation system theories can be appropriate for researching how the DSOs can innovate to enable the RESs. The majority of the research in this strand focuses solely on innovation systems. This, however, has proven to be insufficient for researching a technological change. The theory of Hekkert et al., (2007) therefore expands the innovation system theory by proposing processes

of an organisation that are highly important in innovation systems. This is called Technology Innovation Systems (TIS) theory and suggests seven functions that should be applied for mapping the key activities in an innovation system. These functions include knowledge development and resource mobilisations, which are concepts that were also found to be crucial in the conducted research (Hekker et al., 2007). However, the theory of Hekkert et al. (2007) only focuses on processes that need to take place in innovation systems to lead to technology development. Identifying these processes in an innovation system can be very valuable, yet, it does not provide any implications on the decision-making level of a company. As TIS takes a system perspective, the theory is found less appropriate to study the issue at hand, since this research demanded firm-specific implications.

Overall, various theories could have been used for studying the issue at hand. However, the RBV and dynamic capabilities theory are argued to be most appropriate for this research, as they focus on both the strategies, resources and the capabilities required for a company operating in a changing environment.

## 6.2. Additions to current literature

In comparison to the majority of the previous research in the strategic management literature, this research focused on companies in regulated environments. Therefore a couple of additions to the current literature are identified. The theory of Tidd, Bessant and Pavitt (2005) identified several complementary resources, such as strong marketing and customer support departments. For the regulated domain, however, these resources seem less vital. This research identified that the resource of lobbying and owning a subsidiary in the non-regulated field are great complementary resources for DSOs. These complementary resources could also be valuable for other regulated companies. However, it depends on the legal context whether these resources would also be valuable for other non-regulated companies. Moreover, substitutable resources are commonly argued not to be essential for organisations. This research shows that substitutable resources can be very crucial for organisations to have, especially when there is a shortage of them (e.g. personnel and financial assets).

Another addition to the literature is on the capabilities side. The process of knowledge creation is mentioned in the conceptual model as an organisational process that enhances learning and can form dynamic capabilities. Eisenhardt and Martin (2000) however, only mention the importance of the creation of external relations to create knowledge. This research also identified the importance of internal knowledge sharing as a process that enhances knowledge creation and can subsequently form a dynamic capability. Subsequently, the ability of an organisation to learn should be divided into external and internal learning. External learning in the sense of learning from other parties or pilots, and internal learning by translating the new knowledge and expertise into new processes within the organisation. The last contribution to the current literature base again relates to the regulated character of the DSOs. In this case, Dutch law highly restricts the DSOs to seize their opportunities. Therefore, it can be added to the literature that dynamic capabilities are not just formed if the organisation can learn and renew its capabilities, it is also essential that the firm's environment, or in this case the legal context, allow dynamic capabilities to flourish.

## 6.3. Managerial implications of the research

The outcomes of this research also result in some managerial implications. It has come clear that, although the DSOs are moving in the right direction, many improvements still can be made. A significant managerial implication is derived from the lack of human assets. The lack of technical employees and contractors can highly restrict the enabling of the RESs. Therefore it is crucial for the DSOs to actively search and recruit technical employees. This can, for example, be done by recruitment campaigns at schools or providing more attractive working conditions than competitors. Moreover, making use of digitalisation and making work more efficient may decrease the demand for technical employees. Another managerial implication is derived from the result that the DSOs can learn externally. However, they are not able to translate the lessons learned from outside pilots and thus lack the ability to learn internally. This is one of the reasons, next to the restrictions caused by the law, why they are not able to seize their opportunities. Therefore, the DSOs should invest in the internal alignment of the learning process, to enhance internal learning and improve their ability to seize opportunities and by that eventually, enable the RESs. Internal learning can be enhanced by, for example, feedback and knowledge acquisition and coaching and information acquisition (Kyndt, Dochy & Nijs, 2009). Moreover, the dynamic capabilities as proposed by Teece, Pisano and Shuen (1997) imply that an organisation should be able to continuously renew their capabilities, based on changes in the environment. Even though the DSOs have the ability to learn, to some extent, it is crucial for DSOs to move from a strict organisation towards a more adaptive organisation. Whereas the DSOs traditionally acted more reactive based on demands, a change towards a more proactive approach is required to enhance the dynamic capabilities and become an adaptive organisation that can enable the RESs. For the top management, this implies that they should carry out those proactive and adaptive values. Moreover, it is argued that the change of the organisation should be embedded in by the DSOs' strategy (documents). The strategy of the DSOs should have a normative character in which it focuses on the DSO's future role and values in addition to their focus on operational management. By focussing more on the normative values, a clearer vision of the DSOs will be formed. This will result in a more consistent and more transparent attitude of the DSO representatives in the RESs, which will eventually enhance the enabling of the RESs. Taken together, having sufficient human assets, the internal learning capability and a normative strategy should eventually enable the RESs and consequently, the energy transition.

## 6.4. Limitations of the research

A couple of limitations are identified that apply to this research. A distinction is made between the limitations of the results of this research and the limitations in the methods used for this research.

### 6.4.1. Limitations of the results

As a first limitation of the results, this research only studied the pilot RESs. Those RESs were conducted at the end of 2017 with the aim to validate and test the concepts in order to formulate a manual on which all the regions can build their RESs. As the pilot RESs were conducted at the end of 2017 and did not follow strict guidelines yet, there is a difference between the pilot RESs and the new RESs. Therefore, it could be argued that the relevance of this research is reduced, as it only applies to the pilot regions, and the new regions did not complete their RES

yet. However, the additional interview conducted with the DSO representative involved in the new RESs indicated a similar process of the new RESs, in which the different parties have to get to know each other and collaborate. The content slightly deviates for the new RESs, as agriculture, industry and mobility are no longer mandatory topics to address in the RESs, but can be added voluntarily. Moreover, the new RESs will need to deliver more concrete plans than the pilot RESs did. As the outcomes of these RESs will only be more specific than the pilot RESs, the proposed dynamic capabilities and renewal of the strategy will become even more crucial for the DSOs. Therefore, this research is still highly relevant for the DSOs to adapt their strategies, resources and (dynamic) capabilities to enable the RESs.

A second limitation of the results from this research is concerned with the statements on the financial assets of the DSOs. As already indicated, not many interviewees could oversee whether the DSOs have sufficient financial assets. The ACM sets maximum tariffs, benchmarks between the other DSOs and tests the investments of the DSOs based on expediency (ACM, n.d.). Therefore the DSOs are obligated to operate in the most efficient way. However, since Dutch government aims at making the energy transition a success, it would not be logical if the ACM would not agree on the increase of tariffs resulting from the investments that the DSOs have to make based on the energy transition. Thus, it is assumed that eventually, the DSOs will always be able to charge their customers and raise sufficient money for their investments. However, this does not guarantee that the money will be available when needed. Since this whole process of determining the sufficiency of the financial assets of DSOs is fairly complicated and outside the scope of this research, it is for now assumed that the DSOs have sufficient financial assets. However, the results on the financial assets must be interpreted with caution, and no absolute conclusions can be drawn from these results. Nonetheless, it is indisputable that sufficient financial resources are crucial for any organisation facing changes in its environment.

As a last limitation of the results, the complementary resource of lobbying is discussed. Lobby connections and lobby activities are resources and processes that are often hard to identify from outside the organisation. Moreover, it is almost impossible to determine whether the current lobby is ‘enough’ since law and regulations are not per se adjusted based on certain levels of lobbying. Although it is hard to identify if the current lobby of the DSOs is strong enough, it is stated that lobbying is crucial for DSOs to be able to seize their opportunities and therefore the lobby is seen as an important resource for enabling the RESs.

### 6.4.2. Limitations of the methods

There are also a couple of limitations derived from the chosen research methods. A first limitation relates to the sampling of the DSO representatives. Although it was aimed at speaking to the same function type at each organisation, this was complicated by the fact that the DSOs have different organisational structures and types of teams and functions that address the RESs and the energy transition. Because of this, the internal validity of the research is lowered, as the comparison between the cases might not always be accurate. However, all the DSO representatives interviewed were knowledgeable about the energy transition and the firm’s strategy and vision on how the DSO is facilitating the energy transition and the RESs.

Nonetheless, the outcomes of the different DSOs must be compared with caution to prevent drawing any inaccurate conclusions.

Also, the external validity of the research should be discussed. This research only studied DSOs in the Netherlands. As energy systems differ per country, based on the country's legal system, this research cannot be generalised outside the Netherlands. Moreover, interviews were only conducted with the three biggest DSOs, responsible for the majority of grid connections in the Netherlands. Next to those three big companies, four other DSOs are operating in the Netherlands. As those DSOs are all smaller than the DSOs studied for this research, the organisational structures, resources and capabilities could be different. However, as all the DSOs in the Netherlands are highly regulated, it is assumed there is a certain level of similarity between the bigger and smaller DSOs. Nonetheless, generalising the outcomes of the researched DSOs should be done with caution. Overall, the external validity of this research is moderate. Although generalising results to outside the Netherlands is not possible, generalising results to other DSOs in the Netherlands is possible to some extent, as long as this is done with caution to the potential differences.

As a last limitation to the chosen methods, it could be argued that the questions asked in the interviews provided space for the interviewees to answer in a broad manner. Questions such as: 'What processes are used to stimulate the search for alternatives', can be answered in a varied and very broad way. This has the benefit of not steering answers and not suggesting processes which enables the interviewees to respond without the impact of the preconception of the interviewer. However, this also leads to a broad range of answers that can sometimes be hard to compare. Moreover, this can also lead to interviewees not mentioning certain strategies, resources or capabilities, although present within the organisation. As an alternative, this research could have first interviewed a couple of interviewees to make a pool of strategies, resources and capabilities, whereafter the other interviewees were interviewed based on this pool to identify if the other interviewees answered the same. Although this was not done in this research, the research used an iterative approach in which certain questions or directions were added or adjusted after the first rounds of interviews. By doing this, it was aimed to be able to go into new directions, when indicated by the interviewees.

## 6.5. Further research

This research also implies a couple of paths for further research. As the research concludes that the current Dutch law is highly limiting the dynamic capabilities of the DSOs and thus their ability to enable the RESs, it would be a very interesting direction to research how regulations and laws should change in order for the DSOs to better enable the RESs. A second path for further research is derived from the fact that new RESs are currently conducted. Further research could be conducted on how the new RESs are evolving and impacting the DSOs. Since the new RESs are bound to more strict guidelines, the RESs need to deliver more concrete plans and strategies. These guidelines are provided by the Association of the Dutch Municipalities (Vereniging Nederlandse Gemeentes – VNG), based on the command of the Dutch government to form RESs. Since the Dutch government initiated the RESs, it is assumed that the Dutch government will also adapt the law and regulations to facilitate the RESs. This could enhance the seizing process by the DSOs, as laws and regulations will restrict them less. From this,

another further research step is derived. Once the laws and regulations change and provide possibilities for the DSOs to seize their opportunities, the next step is the transformation of the organisation. As the DSO representative in the new RES indicates, there is currently only a small group within the DSO that is transforming towards the more outside-oriented way of working, which the RESs and the energy transition are demanding. When the DSOs are able to seize their opportunities fully, it can be assumed that there will be resistance to change the organisational culture from the traditional, reactive, internal-focused perspective towards the more proactive, outside-oriented approach. Further research should be conducted on this resistance and how this resistance should be tackled. Researching the previously mentioned topics would give more insights in the change of the DSOs overtime and how they would eventually need to adapt, after the change in laws and regulations, in order to enable the RESs and the energy transition.

# 7. Conclusion

This research aimed at answering the question:

*What are the strategies, resources and capabilities necessary of the DSOs for enabling the RESs in the Netherlands?*

This research question is answered by using the Resource-Based View of the firm, with the addition of the dynamic capabilities theory. A multiple case study was conducted in which five RESs were researched in combination with the three DSOs that operate in the five RESs regions. In addition to the RESs documents and DSO strategy documents, interviews were conducted with RESs professionals and DSOs representatives. After analysing all these data, it can be concluded that the DSOs have several resources and capabilities that are already enabling the RESs. The DSO strategies, however, are not aligned with all the resources and capabilities. Also, no clear vision could be derived from the DSOs' strategies on the role and contribution of the DSOs in the RESs. Therefore, to fully enable the RESs it is essential that the DSOs form a strategy in which they explicitly state their role in and contribution to the RESs. Moreover, regarding the resource base, it is necessary that the DSOs keep a good knowledge base and continuously adapt it, based on new technologies. Also, the DSOs complementary resources of lobbying and owning subsidiaries need to be maintained, and their lobby activities might even need to be strengthened to be able to seize the solutions and alternatives identified. The substitutable resources on their turn are crucial to enable the RESs. Therefore, the DSOs need to further develop supportive analytical tools and assure the sufficiency of human and financial assets. The current capabilities and organisational processes of collaborating, R&D activities and external information gathering and sharing already support the enabling of the RESs. In addition, internal knowledge sharing and external knowledge gathering should be stimulated to enhance knowledge creation by the firm. External learning is already taking place by the participation in pilots. However, internal learning should be enhanced to be able to translate the knowledge gained from pilots into organisational processes that can support the development of innovations.

The dynamic capabilities of the firm are currently enabling the DSOs to sense opportunities. Dutch law, however, restricts the seizing of the opportunities and the transformation of the organisation. Referring back to the complementary resources, an influential lobby is crucial to impact Dutch law and by this contribute to the conduction of laws that can enable the DSOs to seize their opportunities. In addition to lobbying, the notion of internal learning is crucial to be able to translate the knowledge they attain into processes and actions that support the seizing of opportunities and facilitate the step towards the transformation of the organisation. Lastly, in the transformation phase, it is again essential that there is a clear vision and statement from the top management, in the form of a written strategy, to transform the whole organisation according to the changes in the environment. When the previous strategies, resources and capabilities are applied, the DSOs will enable the RESs.

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# 10. Appendices

The appendices of this research can be found in a separated document and can be retrieved upon request.