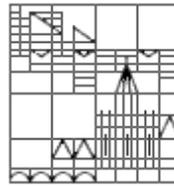




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# INNOVATION IN THE ENERGY SECTOR

EXPLORATION OF STIMULATING AND LIMITING FACTORS IN AN INNOVATION SYSTEM

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## Abstract

The purpose of this research is to identify factors that affect innovation and access to innovation funds in the energy sector. The research question is: *Which changes in the Dutch and European energy policy are needed to increase innovation and access to innovation funds?* The case under study is the Dutch Society for Renewable Energy (hereafter NVDE). Recommendations for the role of the NVDE are therefore also included in the research. This leads to an additional research question: *How can the NVDE contribute to the solutions?* The case consist of 53 members of the NVDE. Data is gathered via online-surveys and telephone interviews. Members perceive legal requirements and administrative procedures as the most pressing barriers. Mandatory collaboration and the duration of the application procedure are most often mentioned. Other problems encountered are the uncertainty of the Dutch innovation policy and the lack of innovation that reaching market implementation. An ideal energy policy has a long term strategy with prohibitions and obligations, facilitates equal competition between fossil fuel and renewable energy and has an innovation scheme that is adjusted to the energy policy. Suggested policy changes are the incorporation of prohibitions and obligations in the long term energy policy, facilitate equal competition and make innovation funds more realistic by the introduction of a follow-up subsidy scheme to avoid fade outs of innovations and replacing parts of the written application procedure by a pitch to avoid a skewed application procedure. The NVDE should influence national politics on the above mentioned topics. Furthermore it should inform and facilitate her members to alleviate some of the perceived barriers.

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## List of abbreviations

CO <sub>2</sub>	Carbon Dioxide
EREF	European Renewable Energies Federation
EU	European Union
ETS	Emission Trading System
NVDE	Dutch Society for Renewable Energy
IP	Intellectual property
QCA	Qualitative Content Analysis
RVO	Netherlands Enterprise Agency
SDE+	Stimulating renewable energy production
SME	Small and medium-sized enterprises
TKI	Top-consortium for knowledge and innovation

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## 1 Introduction

The European Union gathers forces to tackle climate change. Hereby a switch from fossil fuel energy to renewable energy is necessary. This transition is called the 'energy transition'. The aim of the European Commission is to increase the total share of renewable energy in the European Union (hereafter EU) to 20 percent of the gross final consumption of energy by 2020. To reach the 20 percent share the European Commission initiated national renewable energy targets. Based on the share in 2005, the European Commission determined how much each Member State needs to increase its share in order to contribute to the EU wide target (Rijksoverheid, 2018). The 2020-target for the Netherlands is 14 percent. In May 2018 the Dutch share was 6,6 percent<sup>1</sup>. Which indicates that the Netherlands is underachieving regarding the EU targets.

Innovation is seen as a driving force behind the energy transition (IRENA, 2017). Innovation leads to technological improvement which results in more efficient and cost-effective renewable solutions. To achieve the national and European targets, more innovation is needed. Therefore national and European governments have initiated innovation policies<sup>2</sup>. Policies aim at stimulating innovation by eliminating barriers to innovation and providing financial assistance via support schemes. Support schemes are needed because private financing is limited due to the risks of innovations.

The importance of innovation in the energy sector is well discussed in literature (Wüstenhagen et al (2007), Foxon et al (2005), Sagar et al (2006)). The same holds for barriers to innovation (Hadjimanolis, 1999), the role of SMEs in innovation (Hoffman, 1998) and the rationale behind subsidies (Brue et al, 2010). Even on the rationale behind subsidy schemes for innovation in the energy sector is academic literature available (Bronzini and Piselli, 2016 & Guiyang, 2007). The academic literature mainly focused on the governmental and economic rationale behind subsidies. Fewer researchers (Stewart and Fenn, 2006 and Abbot et al, 2006) however, have focused on company motives to apply for a subsidy and even less to

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<sup>1</sup> Centraal Bureau voor de Statistiek (2018). *Aandeel hernieuwbare energie naar 6,6 procent*. Retrieved on <https://www.cbs.nl/nl-nl/nieuws/2018/22/aandeel-hernieuwbare-energie-naar-6-6-procent> (29 June 2018)

<sup>2</sup> European Commission (2018). *Innovation policies*. Retrieved on [https://ec.europa.eu/growth/industry/innovation/policy\\_en](https://ec.europa.eu/growth/industry/innovation/policy_en) (29 June 2018)

the limiting factors of government policies to innovation. The same holds for access to innovation funds. Innovation funds are initiated to stimulate innovation since private funding is lacking. But do the innovations funds in practice have the desired effect? The factors will enrich the literature regarding effective subsidy schemes and its potential effect on innovation. Literature then becomes an effective tool to structure support schemes.

The research also contributes to the academic debate on the innovative capacity of SMEs. Hoffman et al (1998) discussed the state of academic literature on SMEs and innovation. Despite the article being less recent, some barriers still exist. Researchers perceive innovation among SMEs as important (Hoffman et al, 1998). The perspective of SMEs, and enterprises in general, on innovation is limited. This research will derive factors of effective innovation policies to SMEs, which contributes to the literature on innovation policy. Lastly academic literature argues that SMEs experience 'size-specific barriers' (Kaufmann and Tödtling, 2002 and Beck et al. 2006). Though this has been tested extensively, it has not been tested for innovative SMEs in the energy sector. This research will see if the barriers also exist in the case of renewable energy.

Based on the existing gaps in academic literature the goals of this research are to obtain evidence and insights into the drivers and barriers of innovation funding in the renewable energy sector. The second aim of the research is to identify solutions to these barriers. Hereby a critical side note needs to be made. The current political situation regarding the energy policy is in development. A month after this research began, negotiations on a new climate and energy policy started. Due to the uncertain outcome of the negotiations, the latest developments are not taken into account. Therefore the existing policy (from before the negotiations) is taken as the starting point. Bear this in mind whilst reading the policy suggestions.

The Dutch Society for Renewable Energy (hereafter NVDE) is the case under study. The NVDE is a special interest organisation that represents enterprises in the energy sector. The NVDE is exploring potential for incorporating innovation in their lobby activities. The outcomes of the research provide the NVDE with tailor-made recommendations regarding the role that the organisation can take to promote innovation and increase access to innovation funds. The population under study consists of members of the NVDE, making the outcomes relevant for the NVDE. The

NVDE has so far not pursued a research regarding innovation. The outcomes of the research will be a starting point for future activities. Furthermore the outcomes increase the knowledge of the NVDE regarding the innovative activities of her members.

Besides tailor-made recommendations, generalizable implications for society can be derived from the research. The research gathers feedback on the current national and European innovation policies. Feedback on the policy and available funds can be used to improve the innovation system. Continuous improvement of the innovation system is an important feature of the energy transition. Innovation is seen as a driving factor behind the energy transition. Without innovation, targets will not be reached. Enterprises need to do the innovations. Knowing the obstacles of companies regarding innovation and innovation funds, is valuable information to the government. This research thereby has the potential to improve innovation policy and accelerate the energy transition.

In order to achieve the research aims and have valuable implications for the NVDE, this research has two research questions. The first research question is: *Which changes in the innovation system and energy policy are needed to increase innovation and access to innovation funds?* The second question is: *How can the NVDE contribute to the solutions?* Sub questions structure answering the research question. The questions are related to the existing barriers in the energy sector, problems and solutions related to the innovation system and the role of the NVDE regarding these problems and solutions. The sub questions are described in more detail in section 2.

The structure of the research is as follows. Section 2 presents a selective literature review which is used to derive the research questions. Section 3 discusses relevant background information. The fourth section discusses the research setting and the methodology. Section 5 and 6 present and analyse the main findings. Section 7 summarises and concludes. The appendices contain information on the sources that were used for the analysis.

## 2 Literature review and research questions

### 2.1 Barriers to innovation

Innovation can be limited by various factors. Hadjimanolis (1999) sees barriers to innovation either as internal or external. Internal barriers to innovation are the lack of internal funds, absence of technical expertise, lack of management time and a non-

innovative culture. External barriers to innovation are difficulties in obtaining technical information, external finance, lack of customers demand, the perception of the risks and government regulation and policies (Hadjimanolis, 1999). The barriers decrease the rate of innovation. Enterprises are affected by these barriers to innovation, since it affects the competitive position of their enterprise, because fewer improvements of the products are made. Enterprises namely have less resources to dedicate to innovation. From a government perspective this is also undesirable as innovation is important for an economy to maintain and improve processes of economic growth.

The barriers that companies face can roughly be divided into four categories: administrative, financial, policy and legal. In this research this division will be used to test which barriers are present in the energy sector and how they affect innovation and access to innovation funds. Administrative barriers are related to time and personnel enterprises can dedicate to the administrative procedures concerned with innovation. The financial barriers consist of lack of internal resources and trouble with acquiring external financing. This hampers innovation. Government policy is the uncertainty about the policy, increasing the risks of innovation. The legal barriers are related to the existing regulations regarding innovation. Too strict requirements for innovation can hamper the innovative activities as well as additional legislation that interferes with the innovation.

## 2.2 Rationale behind support schemes

A government uses subsidies to achieve certain policy aims. This is done by *'supporting producers by direct or indirect means to reduce cost, increase income, generate employment or stimulate the national economy'* (Guiyang, 2007: p. 92). An indirect effect of a subsidy is that the cost price is reduced, potentially increasing the demand for the good. In other words, the government wants to stimulate the usage of a certain good, service, product or reach a certain policy aim (Brue et al, 2010). The effect of a support scheme is cost reduction for an enterprise, which reduces the costs for the producers, making production, investment or innovation cheaper. In the case of innovation a support scheme reduces the costs of the investment and/or innovation, in theory increasing the number of innovations (Brue et al, 2010).

The rationale behind support schemes for innovation is based in two market failures. When engaging in R&D and/or innovation technological spillovers may occur.

Firms do not include the spillovers in their cost-benefit analysis since it is hard to predict spillovers beforehand. The absence of the positive spillovers in the cost-benefit analysis, result in a sub optimal level of private investments from the perspective of society. Support schemes are used to increase R&D to the social optimum (Bronzini and Piselli, 2016). The second motive is related to the information asymmetries. Innovation can be uncertain and not without risks, making private investors reluctant to invest. Causing limited access to financing on the private market (Bronzini and Piselli, 2016). Subsidies and fiscal incentives are the most common support schemes. The aim of the support schemes is to stimulate innovation. Public funding compensates the lack of sufficient private funding (Bronzini and Piselli, 2016).

### 2.3 Limited resources of SMEs

SMEs represent 99 percent of the enterprises in the European Union<sup>3</sup>. Also an extensive part of the network of the NVDE are SMEs. Therefore the research pays special attention to the role of and barriers for SMEs regarding innovation. Central to this is, whether or not they experience the barriers more severe than non-SMEs.

Kaufmann and Tödttling (2002) describe barriers that SMEs experience as '*size-specific barriers*' (p. 149). In general SMEs perceive more barriers (Kaufmann and Tödttling, 2002). As seen above, barriers can either be financial, administrative or legal. Research shows that access to external funding is based on size, age and ownership (Beck et al., 2006). In the case of SMEs the own financial resources are limited, resulting in less private funding. Limited external financing lowers the innovative capacity of SMEs since the innovations cannot be financed.

Compared to non-SMEs, SMEs have less resources (financial, time and staff) to dedicate to acquisition of public funding. According to Bouwen (2002) this results in less access to public funding compared to non-SMEs. The rationale behind this is that SMEs have fewer personnel and thereby less time to devote to the acquisition (Kaufmann and Tödttling, 2016). Fewer resources to dedicate to the acquisition of funding in the first place, results in fewer SMEs acquiring innovation funds, especially compared to non-SMEs. Reducing the number of innovations done by SMEs.

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<sup>3</sup> Eurostat (2018). Statistics on small and medium sized enterprises. Retrieved on [http://ec.europa.eu/eurostat/statistics-explained/index.php/Statistics\\_on\\_small\\_and\\_medium-sized\\_enterprises](http://ec.europa.eu/eurostat/statistics-explained/index.php/Statistics_on_small_and_medium-sized_enterprises) (29 June 2018)

## 2.4 Government policy

Government policy affects the innovative abilities of enterprises. The nature of regulations and support schemes can either have a positive or negative influence on innovation. Pelkmans (2014) recommends an innovation policy '*that balances compliance, timing, flexibility and regulatory certainty*' (p.12). An ideal innovation policy consist of: (1) not too strict technological requirements, (2) sufficient time to comply with regulatory requirements, (3) where the regulation is more outcome based than based on strict technological requirements and (4) where the regulatory requirements do not change that often (Pelkmans, 2014, p.11-12).

Frenken and Hekkert (2017) see a fixed government policy also as an important factor for innovation. Innovation is more effective if the policy entails clear expectations regarding the role of different technologies. Clear expectations contribute to the creation of new markets and demands from consumers. This secures output for enterprises. Frenken and Hekkert (2017) wants the expectations to be reflected in the available innovation funds. The policy needs to indicate which technology will be important in the future and align the innovation funds according to that. In general one agrees that public funding is necessary in the case of innovation in the energy sector. Clausen (2009) argues that the private returns on investment do not exceed the societal benefits and public funding is therefore desirable. Private returns make investors reluctant to invest in the innovations.

## 2.5 Lobby strategies

Above the theory of access was briefly mentioned. Access to the lobby is, just as access to funding, dependable on available resources (Bouwen, 2002). He poses three questions related to lobbying: who to lobby? When to lobby? And how to lobby? (Bouwen, 2002). One need to know which of the actors are most important and/or most likely to be influenced. Related to timing, it is essential to know what the perfect moment is. According to theory, the earlier in the legislative process, the higher the chances of success.

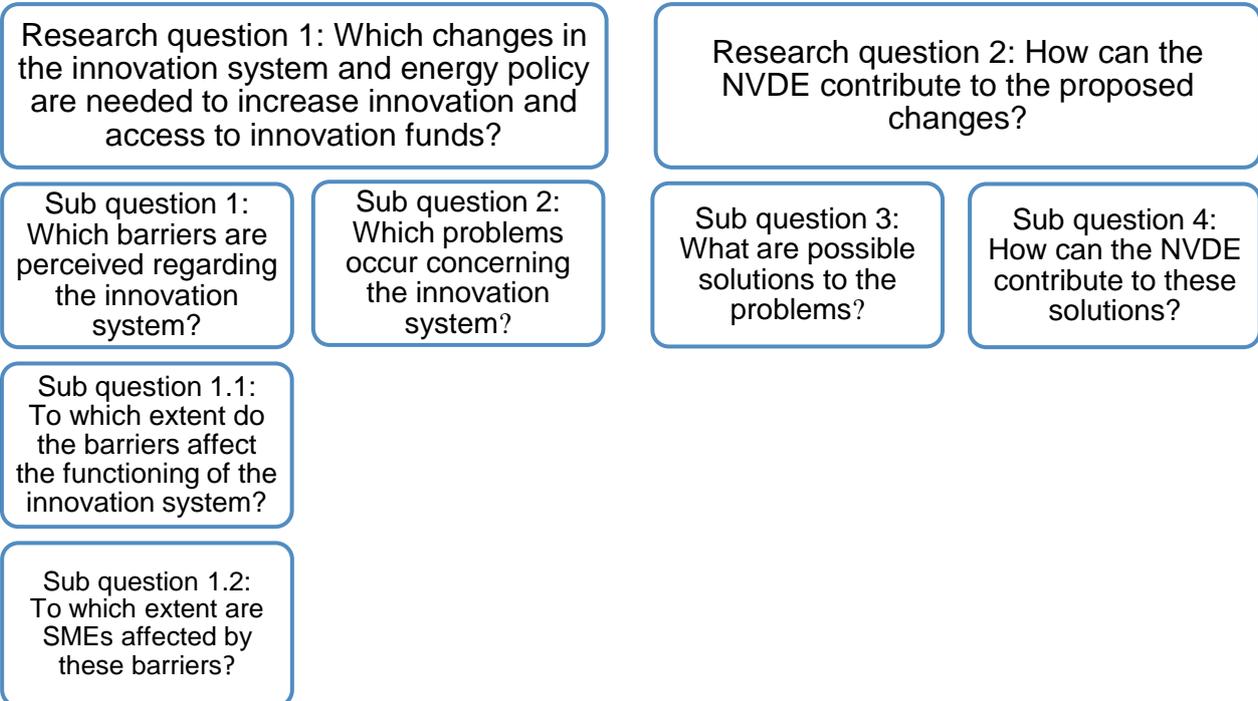
When lobbying 'the medium [...] is more important than the message' (Chalmers, 2013, p.39). Lobby organisations have to decide which medium they will use to lobby. Often used mediums are writing policy papers, arranging personal

meetings or regular phone contact (Chalmers, 2013). The core business of the NVDE is influencing national and European politics. The theory of access is therefore used to determine the best lobby strategy the NVDE can pursue.

### 2.6 Research questions

The literature review is used to generate guiding sub questions. These questions are used to structure the analysis and answer the main research questions. The figure below depicts the questions central to this research.

Figure 1: Research questions and support sub-questions



Guiding sub question 1 focuses on the different barriers perceived by enterprises. Barriers can be related to financial, administrative, policy or legal factors. Hereby it is important to determine how the barriers affect the functioning of the innovation system. The innovation system entails the innovation policies, the financial support scheme and the number of innovations pursued. The outcomes are used to substantiate the problems of the sub question 2. This sub question zooms in on the concrete problems arising from the barriers. Sub questions 3 gathers solutions to the problems. Regarding the problems, sub question 4 describes ways how the NVDE can contribute to the solutions. The outcomes of the sub questions are used to answer the research questions.

## 3 Background information

### 3.1 Innovation funds

At national and European level a total of 24 funds are available for renewable energy innovations (Appendix V). Some are open to all renewable energy technologies, others are for specific renewable energy sources<sup>4</sup>. The shared aim of the innovations funds is to advance the renewable energy technologies and realise a cost reduction. Innovation funds have several shared characteristics<sup>5</sup>. At national and European level the innovation funds are either subsidies or loans. The amount of subsidy depends on the phase of the innovation. Feasibility projects and demonstration projects have lower amount of subsidies than innovations in the commercialisation phase. The duration of an innovation fund is on average four years. The application procedure is either single- or two-staged. The single staged application procedure consist of several detailed plans (financial, project and development). The two staged procedure again consist of several written plans, differing in level of detail. The second staged procedure demands in the first round an introductory document on the project. Based on that proposal a fit with the fund is determined. The second written proposal includes all the required details on the project.

To increase (cross-border) collaboration between companies in the chain, collaboration is a mandatory requirement of the majority of innovation funds<sup>6</sup>. Collaboration can occur between different companies or with knowledge institutes, financial institutions and (local) government<sup>7</sup>. If an enterprise is granted a fund, it has the obligation to report the progress. Dependent on the duration of the fund, reporting in general has to be done on an annual basis. The reporting includes the progress made, the hours employees spent on the innovation and the financial accountability<sup>8</sup>.

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<sup>4</sup> Overheid.nl (2018). Regeling nationale EZ-subsidies. Retrieved on <http://wetten.overheid.nl/BWBR0035474/2018-05-24> (20 June 2018)

<sup>5</sup> Ibid. 4

<sup>6</sup> Ibid. 4

<sup>7</sup> Ibid. 4

<sup>8</sup> Ibid. 4

### 3.2 The NVDE (Dutch Society for Renewable Energy)

NVDE is a special interest organisation that directly and indirectly represent over 1000 companies in the energy sector. Quantified this counts up to a turnover of €17 billion per year and 60.000 full time jobs<sup>9</sup>. The main aim of the NVDE and its members is an energy provision only out of renewable sources. The network of the NVDE is composed of all kinds of enterprises in the energy sector. Among its members it has interest groups, renewable energy producers, network operators, suppliers of energy, heat and gas companies, firms that offer services and installations for energy saving, electric transport and heat pumps<sup>10</sup>.

The main activity of the NVDE is influencing national, regional and local policies. Via committees and working groups the NVDE gathers input from their members and convert this input into position papers, public statements and policy advises. Its department of Public Affairs is weekly in contact with policy advisors of political parties and ministries to discuss the position papers and influence the direction of the policies. The strategy of the NVDE can be considered successful. Whilst writing the negotiations for the renewed Dutch Climate Agreement are going on. Of the total of six round tables, the NVDE is represented in four<sup>11</sup>. The four tables are mobility, electricity, urban area and the overarching 'Klimaatberaad' (Climate Council). The participating parties develop the Dutch climate policy for the coming decades.

At European Level the NVDE joined the European Renewable Energies Federation (Hereafter EREF). EREF aims to 'defend the interests of independent power, fuel and heat production from renewable sources and to promote non-discriminatory access to the energy market.' They want to 'create, maintain and further develop stable and reliable framework conditions for renewable energy sources'<sup>12</sup>. In line with this they aim for more ambitious binding renewable energy sources than institutions like the European Council. Despite the fact that NVDE is member of EREF, influencing the European legislation is still underdeveloped. The past years the NVDE has been

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<sup>9</sup> NVDE (2018). *Over NVDE*. Retrieved on <http://www.nvde.nl/over-nvde/> (3 June 2018)

<sup>10</sup> NVDE (2018). *Leden*. Retrieved on <http://www.nvde.nl/leden/> (20 June 2018)

<sup>11</sup> Rijksoverheid (2018). *Kabinet geeft startschot voor Klimaatakkoord*. Retrieved on <https://www.rijksoverheid.nl/ministeries/ministerie-van-economische-zaken-en-klimaat/nieuws/2018/02/23/kabinet-geeft-startschot-voor-klimaatakkoord> (29 June 2018)

<sup>12</sup> European Federation on Renewable Energies (2018). *About us*. Retrieved on <http://www.eref-europe.org/about-us/> (29 June 2018)

occupied with establishing itself as a respected interest organisation in the Netherlands. The NVDE is currently well-established at national level and is considering expansion to European level. This research contributes to the decision to be made.

## 4 Research setting and methodology

This research has two goals. The first is to determine factors that limit innovation and access to innovation funds. Hereby the experience of respondents and the perceived barriers concerning innovation and innovation funds are described. The second part is of a more explanatory nature. In this section factors are turned into concrete problems and solutions to these problems are proposed. The solutions are linked to potential new roles of the NVDE.

The research adopts a case study approach. The case under study is the network of the NVDE. A case study approach is used when the study aims to generate, test or refine hypothesis and when internal validity is prioritised (Gerring, 2006). This research is an exploration of the factors that limit innovation and access to innovation funds in the energy sector. If possible, generalisations to wider population are made. The second aim of the case study is to list several recommendations for the NVDE. Therefore a balance between internal and external validity is needed. The case represents a synchronic single-case study. A single case study is most suitable if a topic is encountered for the first time (Gerring, 2006). Furthermore allows a case study an in-depth study of the case. Regarding the research question and the aim, in-depth analysis of the phenomenon is desired.

The research questions result in a description of problems, solutions and a recommendation for the NVDE. The focus in this research is therefore: 'the determination of hindering factors of the innovation system'. Hereby special emphasis is placed on a sub-population of the case under study, namely SMEs. A large part of the network of the NVDE are SMEs. The rationale is that non-SME have sufficient own resources to pursue innovative activities, where SMEs can experience more barriers. Therefore the NVDE is especially interested in the outcomes for SMEs.

The definition used for SMEs is that one of the European Commission, who specifies SMEs in three categories.

Table 1: Categories small and medium sized firms

<b>Categorie</b>	<b>Number of employees</b>	<b>Turnover</b>
<b>Micro firms</b>	≤10 employees	≤2 million
<b>Small firms</b>	≤50 employees	≤10 million
<b>Medium sized firms</b>	≤250 employees	≤50 million
<b>Non-SME</b>	≥250 employees	≥50 million

Source: European Commission (2018)

The research question is answered by mapping the demands and problems of the members regarding innovations. Problems are linked to potential solutions. The solutions are especially focussed on eliminating the problems for SMEs. In order to achieve this, an in-depth problem analysis is conducted. This is done via online surveys and semi-structured interviews.

A survey is chosen as a data collection method since surveys are an efficient method for data collection as well as data analysis (Bryman, 2012). Considering the limited amount of time and the absence of a research budget, surveys are a low-cost method (Bryman, 2012). Besides efficiency reasons, surveys are also chosen as a method to collect quantifiable data. This survey consists mostly of closed questions, resulting in perfect data for a quantitative analysis. The quantitative data is used to determine the general aspects of the research, such as perceived barriers and perception of the innovation policy. Examples of a closed question is:

1. Which barrier do you experience to be of most importance?
  - a. Financial
  - b. Administrative
  - c. Government policy
  - d. Legal
  - e. Consumer demand

And an example of an open question is:

2. What would you like to change about the application procedure?

The survey made use of pre-defined answering options. The options were based on theory, making theoretical inferences easier. To not exclude potential interesting

answers, questions were given the option 'other' and the survey also consisted of some open questions (see example above). As shown later the number of respondents is fairly low. This complicates drawing statistical inferences. In this research quantitative analysis is only used to draw up overviews of given answers.

The surveys were distributed among the members of the NVDE. At the time of writing the NVDE has a total of 53 direct members and 1000 indirect members (see appendix VII). The indirect members represent the members of interest organisation which are member of the NVDE. These interest organisations were asked to distribute the survey among their members.

Semi-structured interviews are used to collect more in-depth data. The semi-structured interviews had a pre-defined structure. This helped to ask similar questions during the different interviews. According to Thomas (2013) and Bryman (2012) semi-structured interviews should follow a similar structure and phrasing of the questions to get comparable results. The additional benefit of semi-structured interviews is that it allows to ask additional question. Examples of interview questions are:

- Could you give an example of a situation where you perceived that specific barrier?
- In an ideal world what would you like to change in the innovation system?
- What role could the NVDE take regarding innovation?

Questions were posed to gather clear examples of barriers and potential solutions to those barriers. In appendix VI a more extensive list of interview questions can be found. The data retrieved from the semi-structured interviews is coded according to the Qualitative Content Analysis (hereafter QCA) (Schreier, 2012). The goal of QCA is '*to describe the meaning of the material*' (Schreier, 2012: p. 3). QCA adopts a systematic approach to analysing the data. The questionnaire is used as a coding frame. The questionnaire represents the main categories of the research. According to Schreier (2012) are '*the main categories of your coding frame the aspects on which you want to focus your analysis on*' (p. 59). Data from the interviews that can be quantified according to the questionnaire is included in the quantitative analysis. More detailed information is maintained and used to substantiate the quantitative data. A good example of the application of the method is that all interviewees were asked if they had experience with applying for an innovation fund, and if answered with yes, the type of

innovation is asked. The questionnaire entails the same questions. If, for example, a respondent answered the question with 'yes' and with 'innovation credit'. Coding this into quantitative data results in 1 for 'yes' and 2 for 'innovation credit'.

Schreier (2012) advises to use multiple coders or pursue multiple coding sessions. This increases the quality of the coding. However due to unavailability of multiple coders, the interviews were coded by one person. However the interviews are coded twice, two weeks apart which increases the quality of coding since first time errors can be found.

The secondary data provides detailed information on the existing funds and the theoretical perceptions towards funding, subsidies and characteristics of SMEs. Secondary data consists of online sources of innovation funds, legal documentation on innovation funds and information on the network of the NVDE. Retrieved sources can be found in the bibliography. The online sources of innovation funds came from the Dutch Enterprise Agency (RVO), a governmental organisation that informs enterprises on entrepreneurial aspects in general and more specific on innovation<sup>13</sup>. The legal documents consisted of regulations from the Dutch and European institutions concerning innovation funds<sup>14</sup>.

#### 4.1 Data collection

Data was gathered in the spring of 2018. The survey was distributed among the members in the first week of the research period. Based on previous surveys, the expectation was that the response rate would be around 5 percent. To increase the response rate, a short introduction of the research was given in several committee meetings. These presentations indicated the importance of the research and the benefits of the research for the members. After the presentation all members received an email with a link to the survey (see appendix I to III). After the first launch of the survey, seven responses were received. This already exceeded the 5 percent response rate (13,2 percent). Dependent on the nature of the member (interest organisation or non-interest organisation) a different mail was sent. The only difference

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<sup>13</sup> Rijksdienst voor Ondernemend Nederland (2018). *Netherlands Enterprise Agency*. Retrieved on <https://english.rvo.nl/> (24 June 2018)

<sup>14</sup> Overheid.nl (2018). *Regeling nationale EZ-subsidies*. Retrieved on <http://wetten.overheid.nl/BWBR0035474/2018-05-24> (20 June 2018)

was that the interest organisation also received the request to forward the survey to their members (see appendix II).

In the second and third week of the data collecting period members who had not yet filled in the survey, were contacted via phone and email. During the phone call members were asked to yet participate with the research. Hereby they were given a choice: either fill out the survey or schedule an interview. In total 58 people were contacted. Out of these 58 people, 12 people were successfully contacted via phone. The other 46 received an email. The results of the reminder were promising. Out of the contacted 2 agreed to fill out the survey and 8 agreed to have an interview. Four members did not want to participate. The reasons for that were that they did outsource their business development department, they were not pursuing innovative activities and/or that they did not have control over the innovative activities. The other 32 did not respond. Due to privacy regulations the overview of individual contact moments are not included in the appendices. The document is held by the researcher.

The survey ended the fifth week of the data collection period. In total 9 responses were gathered via the survey. This results in a response rate of 17% percent. Compared to the earlier response rates, the number of responses are considered to be a success. However in order to make reliable and valid conclusions, the response rate is too low. The low response rate is somehow compensated via the interviews. A total of 7 interviews were held (13,2%). The interviews were conducted via phone or face-to-face and often lasted for 30 minutes. The interviewees are representative for the network of the NVDE as they represent the diversity of the network (see appendix VIII).

The interviews were not literally transcribed. The rationale is that the research does not focus on the word use, but on the content. Therefore the interviews are transcribed in a way that the content and meaning of the interviews is kept. All participants were asked if they had any objections for recording the interview. The interview was recorded in order to speak more freely. To avoid any conflicts of interest, the interviews were transcribed in an anonymous way. The results are therefore also anonymous. The transcripts of the interviews are held by the researcher.

## 4.2 Reliability and validity

Research ideally is able to generate value findings and derive implications from those findings. Reliability and validity are concepts to test the quality of the methodology. Research with minor reliability and validity is not suitable to make theoretical implications. To determine the value of this research, the next paragraph will touch upon reliability, validity and critiques on the methodology.

### 4.2.1 Reliability

Kirk and Miller (1986) see reliability in three forms: (1) *the degree to which measurement, given repeatedly, remains the same*, (2) *the stability of a measurement over time* and (3) *the similarity of measurements within a given period* (p. 41-42). To assure reliability, reliable indicators, clear questions and a proper description of how the research is pursued, is needed.

Efforts have been made to make this research reliable. The research used both quantitative data as well as qualitative data. A questionnaire is a reliable instrument. Questions are formulated in a clear manner and can be used at different points in time. The most common method of assuring reliability is the 'test-retest method' (Golofshani, 2003). Due to limited time to conduct the research, a retest is not possible. To increase reliability posed questions were asked in a clear and unambiguous manner. The questions posed are also included in the appendices. Furthermore the way the survey is conducted is described in detail. In the appendices the survey and the mail to the study population are provided.

The qualitative data is less reliable. As Patton (2001) wrote 'the researcher is the instrument' (p.14). Subjectivity of both researcher and respondent affects reliability. The semi-structured interviews follow a predefined pattern, however there is room to deviate. The deviations may result in answers for which no indicators are present. This affects the stability of measurement over time and even within a given period of time (Kirk and Miller, 1986).

Reliability is furthermore complicated in the coding process. The transcripts of the interviews are used to abstract data. This data is coded following the procedure of qualitative content analysis. To increase reliability the coding process should be done

by different coders (Schreier, 2012). Due to lack of available coders and lack of time, the data is coded by one researcher at two points in time. Coding the interviews at different points in time, increases the reliability. Missed indicators or double coded items can be discovered and corrected.

In short, this research has moderate reliability. The potential risk of subjectivity and the semi-structured interviews affect reliability. Though efforts have been made to increase the reliability. The questions were posed clear and unambiguous and a detailed description of the used methods, posed questions and the coding frame are included in the appendices.

#### 4.2.2 Validity

Joppe (2000) sees validity as that the research 'truly measures what it was intended to measure' (p.1). Other wording for this type of validity is construct validity: *the construct is the initial concept, notion, question or hypothesis that determines which data is to be gathered and how it is gathered* (Wainer and Braun, 1998). In other words whether the data gathered in the research answers the research question. The construct validity of the research is high for the national level. The data gathered enables the researcher to answer the posed questions. However due to a limited sample size and little experience on European funding, the data on European innovation funds and policy is too little to draw conclusions, resulting in a lower construct validity.

Another form of validity is external validity. External validity is that results are correct with respect to the population of an inference (Gerring, 2006). In other words the results are generalizable to a wider population. The external validity of this case study is low since the number of cases in this research is limited and detailed information is gathered. The detailed information is hard to generalise. The population under study are enterprises in the energy sector. The respondents are the members of the NVDE. The population consist of 53 direct members. The total (combined) number of respondents is 16, resulting in a response rate of 30%. This response rate is fairly low which complicates making generalisations.

However efforts have been made to increase the external validity. According to Przeworski and Teune (1970) external validity is increased when questions are posed

in a general way. In this research the questionnaire and the interviews all consisted of theoretical based general questions. The only question specific to the case under study was the question regarding the role of the NVDE. General posed questions generate outcomes that are suitable to make theoretical inferences.

In general the external validity is low. This is mainly due to the small sample size and the fairly low response rate. Therefore the inferences do not hold for a larger population. At most the findings apply to all members of the NVDE. In general, it is recommendable to repeat this research with a larger sample. To make the results replicable in a larger setting, several adjustments have been made to increase future external validity.

Internal validity is the fact that the posed expectations are correct with respect to the sample (Gerring, 2006). In other words, to which extent the results are free from bias. With respect to qualitative research, researchers bias is a common risk. Since qualitative research is less structured than quantitative research. This can lead to biased observations, selective recording of information and subjective interpretation of the results (Johnson, 1997). Researcher bias can be attenuated via 'reflexivity' (Johnson, 1997). Researchers reflect on their research behaviour and try to control the bias. Furthermore triangulation is advised to increase the validity. Triangulation is '*combining dissimilar sources of information to enhance validity of measurement*' (Marks, 2007, p.3).

This research aimed to increase the internal validity via triangulation. Triangulation is effectuated via the usage of different sources of data. The research uses surveys, interviews and secondary data. Especially the combination of a quantitative and qualitative data is beneficial to internal validity. The outcomes of the survey do not require subjective interpretation of a researcher. Reducing the chance of bias. The trouble with validity is related to the semi-structured interviews. The researcher decides which information to use out of the interviews. To check whether or not the data used in the research is existing, transcripts are often added to the appendix. In this research the results needed to be used in an anonymous way. To ensure that the transcripts exist, the transcripts are shown to the supervisor of the researcher.

The validity of the researcher is thereby also debatable. The construct validity hold for the Dutch innovation system. However the sample size and the response rate are

so low that making generalisations and inferences is impossible. This immediately affects the external validity. However the questions are posed in a general way, increasing the potential for generalisations. Therefore replication of the research is desirable. The internal validity is increased by using quantitative and qualitative data. The semi-structured interviews increase the chance of researchers bias.

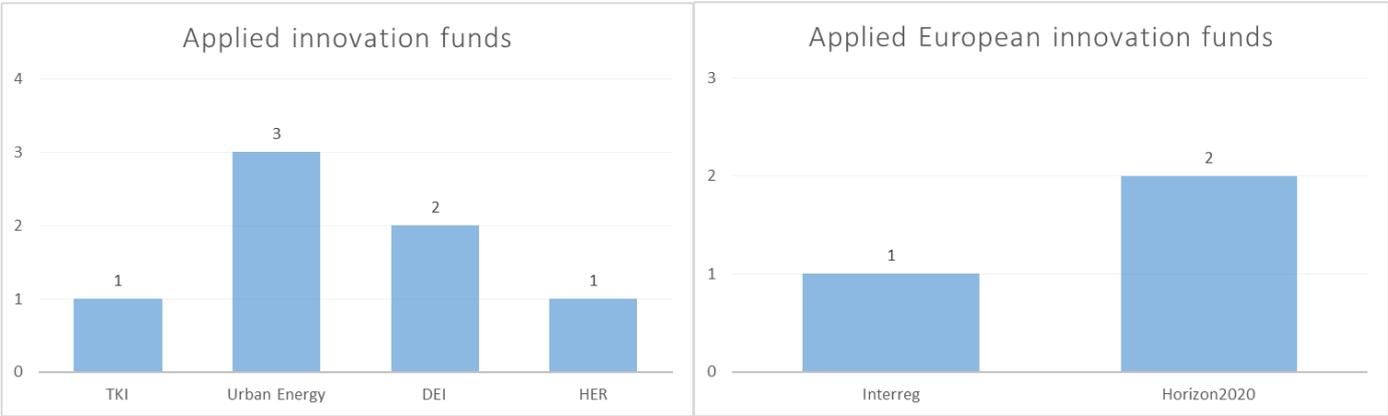
## 5 Results

### 5.1 Experience with innovation funds

At national level 17 innovation funds exist, at European level this number is 16 (Appendix V). Each innovation fund has specific characteristics and requirements. In order to define which innovation fund to apply for, a decent level of knowledge is necessary. Little knowledge can lead to a rejection of the application. The respondents indicate to have knowledge of a few innovation funds. There is no difference in knowledge level between national and European funds.

Seven out of the 15 respondents have applied for a national innovation fund (see figure 2). Only three of the 15 respondents applied for an European fund. The low experience on European funds complicates the process of making recommendations for European level. Therefore the number of recommendations for European policy will be limited. Two applications were unsuccessful. Both times the project did not fit within the requirements of the fund. This could be explained based on the lack of knowledge.

Figure 2: Innovation funds at national and European level applied for



## 5.2 Barriers to innovation

Literature defines financial, administrative, governmental and legal barriers to innovation and access to innovation funds. The survey tested if the barriers existed in the energy sector. Respondents were asked which barrier they perceived as most hindering. The legal barrier was most often perceived as hindering. Furthermore the research desired to know which of the other barriers were present. Therefore the survey contained questions specified to each barrier, including the option that they did not perceive the barrier. The questions listed several answering options per barrier. The results are depicted in figure 3 and explained afterwards.

Figure 3: Perceived barrier per category

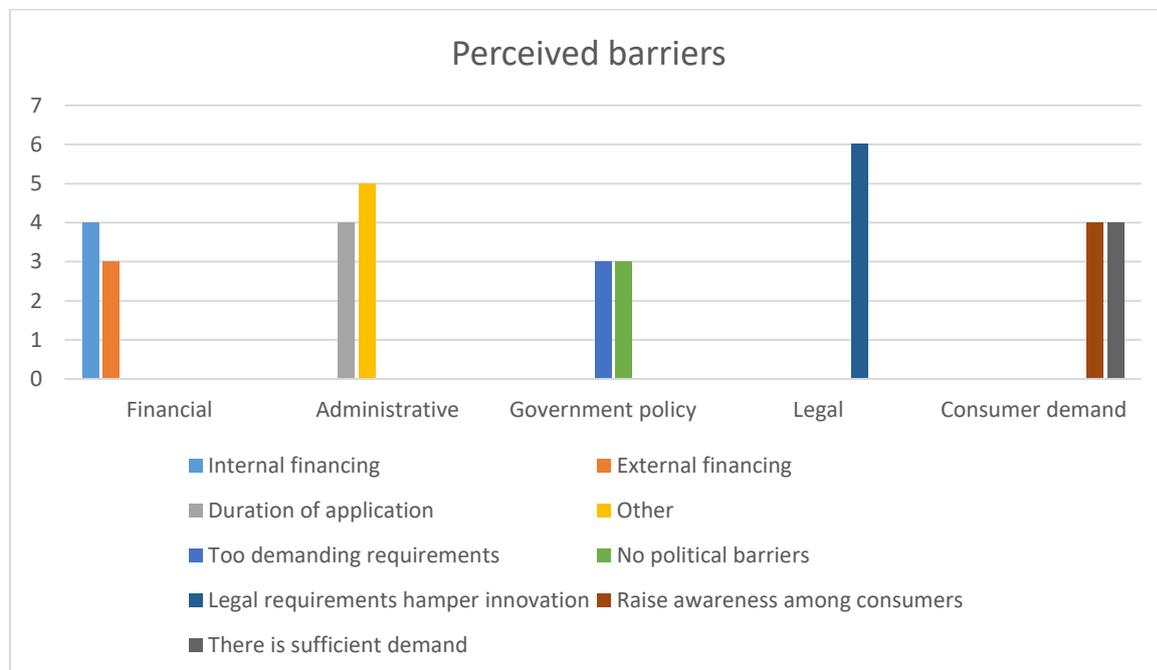


Figure 3 shows a more detailed picture of the perceived barrier. Per barrier the two main limiting factors are depicted. Figure 3 shows that the legal barrier is perceived as most hindering. Furthermore it shows that the financial barrier has the two limiting factors 'lack of internal funding' and 'lack of external funding'. The following paragraphs will go into more detail on these specific limiting factors.

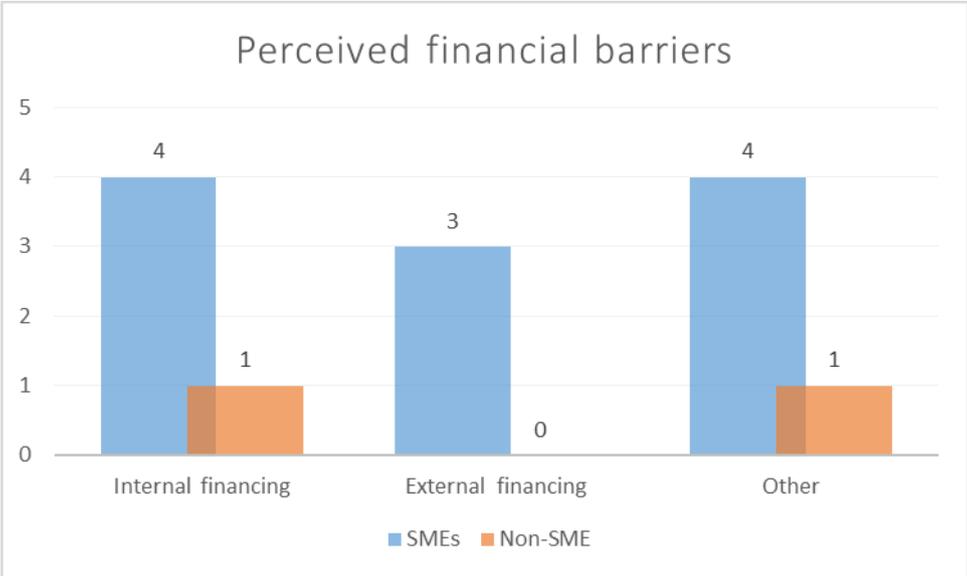
### Financial barrier

The findings indicate that financial limitations act as a barrier to innovation. As figure 3 shows, internal and external financing are the most pressing financial barriers. Internal financing hampers innovation in two ways. First since the enterprise itself does not

have sufficient internal resources to finance the innovation. Secondly limited internal resources hamper acquisition of external funding. This is in line with the theory of Hadjimanolis (1999). Internal resources are used as a guarantee for external financing. Financial institutions demand sufficient internal resources to assure payback of the loan in the future. Limited internal resources therefore affect the access to private funding.

Lack of external financing hampers innovation, since it lacks financing for the entire project. Support schemes can dissolve this barrier by catering to private investors and enterprises. Catering to private investors takes entails the government providing financial institutions with earmarked funding. In the case of renewable energy the funding can only be used for renewable energy. The support scheme provides the private institutions with the guarantee that the risk potential of the investment is covered or to cover up the unprofitable part of the investment. By covering the risks of private investors, investments become less risky for the investors. Furthermore governments have support schemes for enterprises. Public funding alleviates the burden of limited external funding.

Figure 4: Perceived financial barriers sorted by SME and non-SME



Interesting to see is that the financial barriers are mainly perceived by SMEs. Forty percent of the SMEs indicate that they lack internal funding and 30 percent of the SMEs experience problems in acquiring external funding (see figure 4). Non-SMEs did not perceive these financial barriers to this extent. The figure below depicts this situation.

SMEs however stay realistic. One respondent indicated that: *'In the end, we all need money'*.

#### Administrative barrier

The findings also show that administrative factors hamper innovation and especially access to innovation funds. The hindering factors are the duration of the application procedure and the lack of time and staff. Figure 3 depicts 'other' as the most frequent ticked box, however most of the answers were related to the 'duration of the application procedure' and others differed too much to categorise as one barrier. The lack of time and staff is the second concrete barrier. Regarding the duration of the procedure, respondents indicated that this is especially hindering at European level. An application procedure can last for 1,5 years. At national level the application procedure is shorter. However at both levels the administrative procedure is perceived as too demanding. The explanation for this is the required level of detail of the project proposal. Enterprises have to devote considerable time and staff to writing the proposal. A lack of staff and time is thereby a crucial barrier. One respondent indicated that they have *'employees who are constantly writing proposals for the acquisition of funds'*. The findings show that SMEs are affected the most by the administrative procedure. All respondents who indicated the administrative procedure as a barrier, were SMEs. This makes sense, since SMEs have fewer time and personnel to write the proposals. In general the demanding administrative procedure hinders the access to innovation funds. Thereby indirect affecting innovation.

#### Legal and governmental barrier

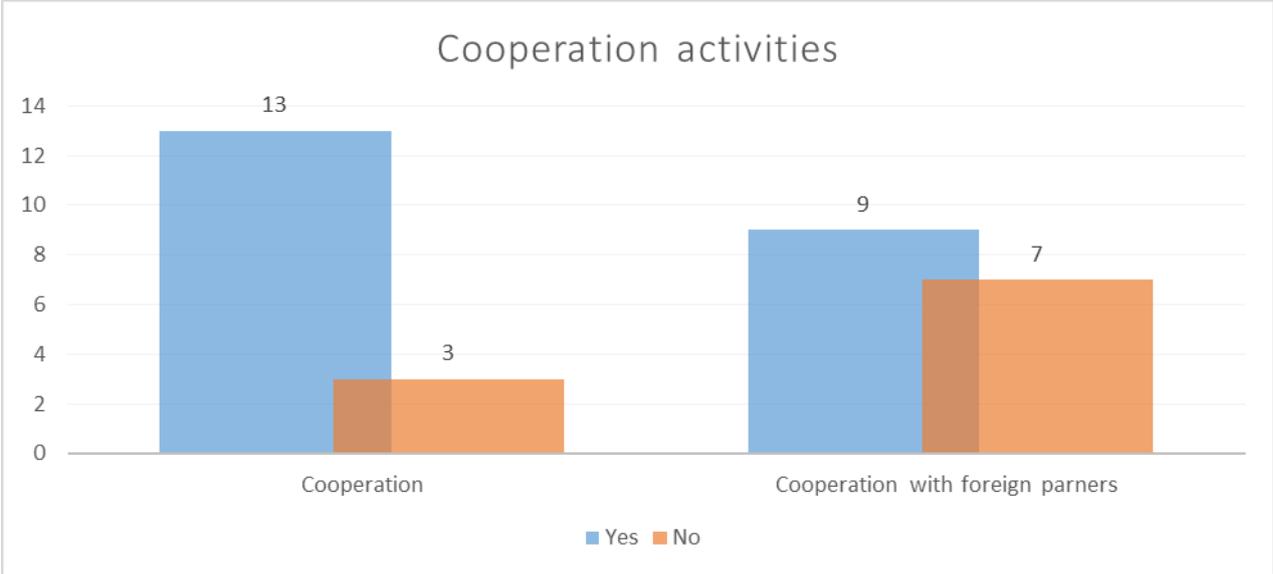
The legal barrier is perceived as the most limiting factor. Hereby the number of mandatory requirements is unanimously chosen as most limiting. This is related to the policy barrier labelled as 'too demanding requirements'. In general one can say that respondents perceive the requirements, written down in the law, are the most limiting to innovation. Examples of requirements are the mandatory collaboration, co-financing, future demand prospect, fitting within the hourly accounting and contributing to the national economy. Applicants need to fulfil all the requirements in order to be eligible for funding. However some aspects are not known beforehand. Especially for early development innovations a lot of things are uncertain. Future demand or future investors are often unknown. Respondents indicate that they desire less or more

flexible requirements. The current amount of recommendations demotivate enterprises to apply for funding. It does not necessary means that innovations are not pursued. It only limits access to public funding.

### 5.3 Corporation between companies

Thirteen out of the sixteen respondents cooperate with other companies, of which 60 percent also cooperates with foreign parties. This is graphically depicted below.

Figure 5: Cooperative activities of respondents



Frequent cooperation partners are knowledge institutes, other SMEs, national governments and non-profit organisations. Size of the firm and revenue do not matter for cooperation. Exchange of information and expertise is the main reason to cooperate with partners. Joint development of techniques is an equally important reason to cooperate. The majority of the respondents do not see cooperation as a barrier. However one negative aspect of cooperation is worth mentioning.

Many innovation funds demand cooperation between parties. Intellectual property is generated during the collaboration. But the division of the intellectual property (hereafter IP) is a topic of debate. One of the interviewees indicated that *'if a partner co-finances the innovation, they often want part of the IP. Which is understandable, we want the same if we co-finance. However this complicates the process because if we do not want to give away part of the IP, we have no investors.'* The interviewee also indicates that *'a lot of innovation funds demand a co-investor.'*

*Since investors often want part of the IP and we are not keen on that, we cannot apply for 80 percent of the innovation funds.* Less stringent collaboration requirements would be desirable.

Established companies experience no problem regarding intellectual property. They indicate that with partnerships they beforehand discuss the potential of the collaboration: *'we seek for complementarity and if all partners have enough personal takeaways ... therefore it sometimes happens that partners exit the collaboration'*. Potential explanation that collaboration is not perceived as a barrier is that the enterprises are not dependent on the other partner for the innovation. The companies have sufficient financial resources and knowledge to innovate, however see an added value in collaborating. Smaller companies are more dependent on collaboration. Not only in a financial manner, but also regarding expertise, pilot facilities or advice. Dependency increases the chance on problems.

#### 5.4 Preferential innovation funds

Respondents see subsidies and tax policies as the most preferential innovation funds. Respondents feel discomfort when it comes to the technological neutral or technological specific discussion. On the one hand do respondents not want technological boundaries: *'I prefer general regulations .. and test on commercial feasibility and impact [...] the Top sector Wind for example only has funds for offshore wind. Making it impossible for us to apply for such a fund.'* As shown, a technological focus narrows down the scope of eligible projects, which hampers innovation. However a danger of technological freedom is the problem of *'plant a lot of seeds and do not harvest'*. Various kinds of projects are granted subsidy, some of which have no future in the Dutch energy mix. Respondents therefore indicate that some guidance is necessary. This can either be in the existence of some technological specific funds or via narrowing down the future policy trajectory. Respondents see this in the form of more binding targets on the energy efficiency of residential buildings, clarity from municipalities on alternatives for natural gas and regarding the future of transport. One interviewee indicated that an exploration period for certain technologies helps eliminate inefficient solutions. A technology is granted a limited period of time to show its potential. For example within a period of five years, it should be clear whether or not an electric lorry is feasible in the near future.

To guarantee technological freedom, respondents also suggested to create outcome based innovation funds. Rather than asking a specific technology or a specific outcome. An innovation fund could for example demand a saving or cost reduction of certain percent. This increases the competitive nature of innovations and guarantees technological freedom.

This research sees a balance between technology specific and outcome based innovation funds as the desired solution. The technology specific funds give direction to the energy system of the future. Technologies, like solar and wind power, that will take on a large share of the renewable production need to be stimulated via tenders to increase the competitiveness between technologies. Technologies where the potential is uncertain, need to be supported via a defined trajectory. The technology will be supported for a given period of time to discover the potential. Conjoined projects are necessary in order to keep track of the developments. For the other technologies technology neutral/outcome based innovation funds need to be available. Via this manner potentials are discovered and no technologies are excluded. This is in line with the wishes of the respondents: funds available for their technologies, but at the same steering the technological development in to a certain direction.

## 6 Analysis

The findings uncovered factors that hinder innovation or access to innovation funds. This section analyses these limitations. Thereby a division is made between factors that limit innovation in general and factors limit access to innovation funds.

### 6.1 Factors that limit innovation

#### 6.1.1. Insecurity of Dutch innovation policy

A factor that hampers innovative activities of enterprises is the insecure Dutch energy policy. There is little certainty on the future energy system. Enterprises do not know whether or not their innovation will fit in the future energy mix. This hampers their innovative ambitions, since there is no guarantee that there will be return on the investment. The lack of certainty also affects the behaviour of consumers. Consumers know that there will be an end to 'gas based living', however what and when is unclear. The transition to 'gas free living' is a costly process. As long as consumers do not know

when and how they have to make the transition to 'gas free living', they do not demand renewable solutions.

In other words, the absence of a long term strategy, affect innovation. Enterprises are in need of a long term strategy to pursue innovations. The current policy do not exclude technologies, which *'leaves everything open and unprofitable, resulting in no changes'*. Enterprises want to know which technologies will be used in the future, especially regarding energy production and heating and cooling. Furthermore they miss targets, obligations and prohibitions for consumers as well as for enterprises. They desire the government to obligate consumers and enterprises to save energy and transition to renewable sources. Without targets, obligations and prohibitions, there is no incentive for the actors to demand renewable solution, making investments unprofitable. Absence of a guaranteed return on investment hinders innovations.

#### 6.1.2. Unfair competition between energy sources

Another factor that hinders innovation is the unfair competition between renewable and fossil fuel energy. Fossil fuel energy generates negative externalities in the form of CO<sub>2</sub> emissions. According to economic theory, negative externalities need to be incorporated in the price. When incorporated, the price will increase. At the moment the negative externalities are not incorporated in the price of fossil fuel energy, resulting in a price that does not reflect the actual costs to society. Despite the subsidy, renewable energy alternatives cannot compete against well-developed and cheaper fossil fuel energy. The difference in price affect demand for renewable energy. Enterprises therefore have uncertainty on the demand for their product. Lack of demand affects the return on investment, again limiting innovation. Producers of renewable energy therefore demand a more equal competition. So far the government has been reluctant for change. Increasing the price of energy fuels resistance among industry and consumers, potentially leading to evasion of energy intensive industries.

### 6.2 Factors that limit functioning of innovation funds

#### 6.2.1. Death valley of innovations

In an ideal innovative environment every innovation is brought onto the market. However respondents indicate that innovations often strand before market

implementation. The innovations are in between the demonstration phase and a marketable product. This is also called the 'death valley'. Companies have a hard time finding sufficient private funding to scale up. Since innovations are risky, private enterprises remain hesitant in investing large sums of money. This makes companies dependent on public financing. However respondents have the perception that the desire of the Dutch government is to constantly seek for ground-breaking innovations. When competing against a ground breaking innovation for an innovation fund, the chance of success decreases. *'I always have the feeling that the ground-breaking projects have more chances to get an innovation fund .. however there is a saying: better is the enemy of good. A good innovation that is developed incrementally can in the end have more impact than the ground-breaking innovation'*. The desire of the government for ground breaking innovation hampers access of other potential innovations. Innovations 'bleed to death'.

The death valley does not only limits access to public funding in general, but more specifically also after a subsidy period ended. As sketched out in the paragraph above, private funding is not sufficient to finance the innovation. Public funding is needed for a longer period of time. The current situation provides a subsidy for a certain period. After a funding period ended, enterprises need to enter the application period again if they desire additional public funding. During the application period, the innovation is paused. Innovation funds demand that the project, as described in the proposal, has not started before the decision is taken. Paused innovations have a higher chance of termination, leading to fewer innovations entering the market. Which, depending on the technology, slows down the energy transition. Public funding is therefore necessary for the continuation of innovation. Absence of sufficient access public funding hampers innovation.

### 6.2.2. Demonstration projects

Innovation funds for demonstration projects are aimed to scale up the innovation and increase the efficiency of the innovation. Enterprises receive funding to test the innovation in a realistic setting. Feedback from the demonstration project are used to realise cost-reduction and increase efficiency. Funding is provided for one demonstration project. Results show that in order to reach optimisation, multiple demonstration projects are needed. The innovation need to be tested in multiple

situations and on different scales to improve its functioning. Testing in various situations results in different points of improvement, making the product better and likely more efficient. Although government desires innovations to become more efficient and cost-effective after a demonstration project, the current subsidy schemes do not support this need. This affects the quality of innovations and pace of market implementation.

### 6.2.3. Administrative burden

Respondents perceived that the application procedure limits access to innovation funds. The rationale behind the extensive administrative procedure is to demand a certain level of commitment from the enterprises. However many respondents indicate that the balance between the application procedure and the chance of success is too skewed. *'It is almost easier to acquire private funding'* responded one of the interviewees on the question about the perception of the application period. Another interviewee sketched out that the application procedure for European funds last for at least a year: *'The deadline for the application was in January. Four of five months before the deadline we started looking for relevant parties. In September we were informed whether or not we made it through the first round. The deadline for the second round was in January. In June we heard whether or not we made it through the cut'*. Regarding innovations, an application procedure of a year can be devastating. Competitors can overhaul the enterprise, making the innovation irrelevant. The costs of writing a proposal lies around €50.000 per application. Respondents indicated that they have several persons who are concerned with writing proposals.

At national level the application period is shorter. A decision is made 13 weeks after the deadline. However at national level it is the written proposal that hinders access to innovation funds. The written proposal demands a high level of detail. This requires a lot of preparation. The proposal can cover around 80 pages. A proposal demand financial prospect, hourly accounting, future demand, detailed description of technology, contributing partners and the way the innovation is financed.

The barrier was felt equally by SMEs and non-SMEs regarding European funds. At national level the application procedure was felt more as a barrier to SMEs. SMEs have limited financial resources and human capital. Dedicating one employee to write proposals is often not feasible. If €50.000 is invested in the application procedure, the

rate of success and financial return need to exceed the total costs. Respondents indicated that they are uncertain regarding the success of the applications and indicated that they only apply if *'we are convinced we have a shot'*. Otherwise the financial risk is too large.

In short the demanding application procedure affects the access to innovation funds, especially for SMEs. At European level the duration of the procedure is the biggest barrier, at national level it is the extensive proposal. Enterprises do not have the resources to dedicate to the application procedure or the costs of applying do not exceed the benefits. This affects the functioning of the innovation funds.

#### 6.2.4. Rigid collaboration demands

The number of mandatory requirements in general is perceived as a barrier. Innovation funds demand numerous things of applicants, such as future financing and demand, but also mandatory collaboration. Mandatory collaboration demands a company to pursue the innovation with others. A requirement of the collaboration is that partners also financially contribute. Co-financing an innovation is not without risks, therefore partners want something in return. In most cases partners demand intellectual property. Section 5.6 also described this. Respondents indicate that especially in the beginning, they are hesitant to share intellectual property. Mainly SMEs experience trouble with collaborating. An interviewee stated that because of the mandatory co-financing, they are not able to apply for 80 percent of the innovation funds. The respondent might over exaggerate, however it indicates that it is a serious issue. To avoid undesired sharing of intellectual property, SMEs prefer a more flexible system of collaborating. Up until now the innovative systems did not allow that.

### 6.3 Solutions to limiting factors

The research identified several problem areas based on experiences of the respondents. This section list potential solutions that might increase innovation and access to public funding.

#### 6.3.1. Increase number of targets, prohibitions and obligations

The uncertain government policy at national level limits innovation. Respondents desire a governmental policy that is fixed for a longer period of time. A fixed strategy

provides certainty to companies and gives them guidance regarding innovation decisions. According to Pelkmans (2014) and Frenken & Hekkert (2017) good innovation policy is fixed for a longer period of time and gives companies and consumers enough time to comply with the regulations. To solve the barrier a long term policy is needed. The policy need to consist of targets and prohibitions that lie in the near future and guide consumers and companies in the energy transition. The targets need to be set in the future, to give sufficient time to adjust to the policy (Frenken and Hekkert, 2017). The targets need to stimulate the usage of renewable energy. The target to reduce CO<sub>2</sub> emissions with 49 percent by 2030 and the decision to stop gas extractions by 2030 are examples of existing targets. These targets are a good start, but lack choices. The government needs to make choices regarding technologies used in the future (Rotmans, 2011 – Frenken and Hekkert, 2017). Enterprises also want this certainty, since it gives enterprises directions of which type of innovations it should pursue.

Obligations and prohibitions can provide this security. Respondents perceive sticks as an effective instrument. Prohibition of a gas connection in new build houses by 1 July 2018 is a perfect example<sup>15</sup>. The prohibition leads to an increase in demand for renewable alternatives. Prohibitions and obligations provide the desired certainty by respondents. Pelkmans (2014), Hekkert (2017) and Rotmans (2011) support this trend. Rotmans (2011) prescribes regional certainty as an important step in the transition. Respondents demand the same. In order to stimulate consumer demand, local governments need to indicate which renewable alternative will be suitable for their neighbourhoods. The obligation should include an ultimatum when the local governments need to provide clarity. Consumers can then adjust to this. The same would hold for the prohibition of gas heated boilers.

The main effect of a long term policy is that it provides certainty towards stakeholders. Securing that investments on innovations will have returns, will increase the number of investment. Positively affecting the innovations done. Rotmans (2011) and Frenken et al. (2017) state that the government should not only set out targets, but also needs to make choices regarding technologies and energy sources. Findings show that respondents are divided between an outcome based policy or a

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<sup>15</sup> Ondernemersplein (2018). *Verplichte gasaansluiting voor nieuwbouwwoning vervalt*. Retrieved on: <https://www.ondernemersplein.nl/wetswijziging/afschaffing-verplichte-gasaansluiting> (24 June 2018)

technological specific policy. On the one hand respondents desire certainty from the government by making choices regarding technologies. As one respondent stated: *'if no choices are made, than everything will stay inefficient and costly.'* On the other hand they want a more outcome based policy to avoid exclusion of their product. This research sees a mixture between a technological neutral and an outcome based innovation policy as described in section 5.3.

### 6.3.2. Increase CO<sub>2</sub> price

The actual price of fossil fuel energy is lower than the real price. The negative externalities of fossil fuel energy are not incorporated in the price, resulting in a non-realistic price. This results in unfair competition between fossil fuel energy and renewable energy. A higher price for renewable energy limits the demand for renewable energy, affecting the security of return on investment and thus limiting the number of investments in renewable innovations. Companies indicate that fairer competition is needed to guarantee investments in renewable energy.

The solution is that the negative externalities need to be incorporated in the price of fossil fuel energy. This can be done via increasing the CO<sub>2</sub> price. The current CO<sub>2</sub> price is €7.43 per tonne CO<sub>2</sub>. Experts indicate that the real price of CO<sub>2</sub> lies more around €90 to €100 euros per tonne (Moore & Diaz, 2015). An increase in the CO<sub>2</sub> price leads to a higher price of fossil fuel energy, since the production costs have risen. This makes competition between fossil fuel energy and renewable energy more equal. In the current situation fossil fuel based production is much more efficient than the renewable production process. In order to stimulate the usage of renewable energy despite the higher costs, subsidy is necessary. Subsidising the unprofitable part of production process results in a better competitive position. The effect of a higher price of fossil fuel energy is that the demand for renewable energy will increase. A higher demand leads to a higher production of renewable energy. Higher demand also leads to investments in renewable technologies, since demand is guaranteed. Increased demands and investments will in the end result in more efficient technologies.

The solution of increasing the price of fossil fuel energy is rather straightforward. However political parties are reluctant to increase the CO<sub>2</sub> since it affects the business climate in Europe and the Netherlands. At European level effort was made to increase the CO<sub>2</sub> price by introducing the Emission Trading System (ETS). However the policy

solution did not had the desired effect. Recent European proposals to increase the CO<sub>2</sub> price European wide has generated resistance by Member States and the industry. In the Netherlands the climate tables have come to an agreement that the tax on fossil fuel energy is gradually increased and the tax on renewable energy is decreased (Volkskrant, 21 juni 2018). In other words, the increase in tax means an incorporation of negative externalities of fossil fuel energy. A gradual increase is also needed since Europe and the Netherlands will still be dependable on fossil fuel energy. The production of renewable energy cannot be increased so quickly that it can cover the fossil fuel share. A gradual increase of the price of fossil fuel over time increase the demand for renewable energy. This makes investments profitable, which leads to an increase in innovations.

### 6.3.3. Follow-up subsidy scheme

Respondents described a situation where innovations are paused because of a lack of available financing. Innovations are either paused because a first round of public funding ended and one has to apply for additional public funding. This affects innovation since it extends the period before innovations are introduced on the market.

Projects in the death valley are still in need of funding. They cannot find sufficient private investors, thereby relying on public funding. Therefore respondents need to apply for a new round of subsidies. The application procedure, including writing the proposal, can take up to a year. A year of delay is disastrous for an innovation. The chance is that no public funding is granted or that competitors brought a similar product on to the market. Resulting in numerous innovations stranding before the market implementation. To increase the number of innovations that reach market implementation, a follow-up scheme need to be introduced. The follow-up scheme is a trajectory that, if innovation shows promising results, its subsidised from start to finish. In the beginning the project needs to compete with others in order to receive funding. But once funding is granted, targets are agreed on. If at the end of the subsidy a project reached the targets and still has considerable potential, the project can be granted a follow-up subsidy without writing an extensive proposal.

The benefit of follow-up subsidies is that innovative projects are certain of public funding, as long as they meet the conditions. By guaranteeing subsidy continuation of the innovation is guaranteed and innovations also reach market implementation faster

because enterprises only have to apply once. This improves the Dutch innovation climate, potentially resulting in more innovations entering the market. In other words innovation becomes more certain and access to funding is increased (Frenken and Hekkert, 2017). However the balance between follow-up schemes and one-time subsidies need to be maintained so that projects that only need public funding for one time, have an equal chance as the projects in need of multiple rounds of funding.

For SMEs a follow-up subsidy scheme alleviates the administrative burden. Although this also holds for non-SMEs, SMEs benefit more from it. Respondents indicated that writing proposals is time consuming and hindering innovative activities. For SMEs the administrative procedure is even a reason not to start the application procedure. A follow-up subsidy alleviate the burden on SMEs. The prospective of multiple funding schemes based on one extensive proposal, makes the cost-benefit analysis potentially positive (Kaufmann and Tödting, 2002). Making access to innovation funds at least more equal in the course of the innovation.

#### 6.3.4. Combine innovation and investment subsidies for demonstration projects

Regarding the nature of innovation funds, another limiting factor occurred. Projects in the demonstration phase, have access to demonstration funds. The aim of the funds is make projects more efficient and cost-effective. The funds subsidises one project. Respondents indicate that in order for an innovation to function in different environments, achieve the desired efficiency and become more cost-effective, multiple demonstration projects are needed. By testing the product or service in one situation, crucial shortcomings can be missed. Hekkert (2018) confirms this by stating that '*it is important that there are multiple entrepreneurs who experiment with the new technology*' (p.52). The demonstration subsidies therefore need to facilitate multiple demonstration projects. Combining a demonstration subsidy with an investment subsidy is a good solution. The combination facilitates improvement of the product and scale-up at the same time. The product improvement is financed via the demonstration subsidy. The various installations, products or services installed at different sights can be financed out of the investment subsidy. Due to this combination, cost-effectiveness and scale can be achieved at the same time. The products or installations are modified on the go, making early adopters not worse off than customers who buy the updated version. In the current Dutch system this is however not possible. Projects who have

been granted a subsidy out of the 'Top sector support scheme' are not eligible for the investment subsidy (Frenken and Hekkert, 2017). Frenken and Hekkert (2017) demand for a change. Combining the investment subsidy SDE+ and a demonstration innovation subsidy, multiple demonstration projects are feasible. The SDE+ is the investment subsidy that stimulates production of renewable energy<sup>16</sup>. The multiplicity of investments decreases the time innovations need to reach market implementation. Positively affecting the Dutch innovative climate.

### 6.3.5. Replace parts of the written proposal by a pitch

Concerning the application procedure the limiting factor is the skewed balance between effort and chance of success. This limits the access to innovation funds. Different administrative barriers are perceived between European and national level. At European level the application procedure is perceived as unreasonably. As mentioned above the application procedure includes several rounds of proposals, slowing down the innovation by at least a year. A proposed solution is to replace the second written proposal by a pitch. Initiators are invited to the committee present an demonstration the innovation and answer questions. The first written proposal is then used to see if there is a match between the aim of the fund and the innovation. The aim of the pitch is to go into detail on the innovation, ask in-depth questions on financing, feasibility and scalability. The personal aspect in the pitch also avoids malicious projects. Shortly after the first selection is made, the pitch should be scheduled. After the presentation the Committee has a few weeks to pose final questions, resulting in a final decision. The pitch has the potential to reduce the application procedure with at least six months up to a year. Benefit of the pitch is that developments in the sector and innovations remain aligned. In the current situation the time between the idea development and execution of the innovation can be two years. With technological developments, two years can be devastating for an innovation. With a shorter application procedure, time between idea development and execution is

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<sup>16</sup> Rijksdienst voor Ondernemend Nederland (2018). *Stimulering Duurzame Energieproductie*. Retrieved on: [https://www.rvo.nl/subsidies-regelingen/stimulering-duurzame-energieproductie?utm\\_campaign=275638724&utm\\_source=google&utm\\_medium=cpc&utm\\_content=262199724406&utm\\_term=sde%2B&adgroupid=20671505204&gclid=Cj0KCQjw6pLZBRCxARIsALaaY9bJJpLDkyKrVaR-Z4XYcJVQ1WYs5ibQQp9wz ruV6lt9sSFGDn629EaAjHqEALw wcb](https://www.rvo.nl/subsidies-regelingen/stimulering-duurzame-energieproductie?utm_campaign=275638724&utm_source=google&utm_medium=cpc&utm_content=262199724406&utm_term=sde%2B&adgroupid=20671505204&gclid=Cj0KCQjw6pLZBRCxARIsALaaY9bJJpLDkyKrVaR-Z4XYcJVQ1WYs5ibQQp9wz ruV6lt9sSFGDn629EaAjHqEALw wcb) (24 June 2018)

reduced, resulting in a better match between current technological demands and innovations.

A pitch does not only shorten the application procedure at European level. It can also replace parts of the written proposal both at European as at national level, alleviating the administrative burden on enterprises. This is especially beneficial for SMEs. SMEs compared to non-SMEs lack time and staff to involve in writing proposals, deteriorating the position of SMEs regarding innovation funds (Kaufmann and Tödting, 2002). A pitch equals the potential between SMEs and non-SMEs. In general a pitch would increase the access to innovation funds.

#### 6.2.6. Flexible collaboration

The last hindering factor to innovation is linked to the mandatory cooperation. Mandatory cooperation most of the time also demands co-financing. SMEs perceived the mandatory co-financing as a barrier to innovation. A way to resolve the stringent requirement is to allow a more flexible form of cooperation. Cooperation should not demand a financial contribution. Contributions could also consist of in-kind contributions such as providing staff, installations, material or services. The return for the contribution also does not need to be financial. Returns could also be material, related to human capital or based on marketing. An example of potential return is providing the investor with the first end product.

This gives collaborating partners more freedom regarding collaboration. Flexible collaboration also reduces the risks. Investors do not have the risk of lost investments and the enterprise is not facing interest or sharing the IP. This is especially beneficial for SMEs, who saw collaboration in the form of co-financing as an issue. If this collaborating requirement is stretched, the complicating factor is reduced, increasing the access to funding for SMEs (as well as non-SMEs). Furthermore is flexible collaboration a proper example of how respondents prefer 'outcome-based requirements' to be filled in. Collaboration is demanded, but how collaboration is filled in is up to the partners.

### 6.3 Role NVDE regarding innovation

Previous sections sketched out the problems and solutions concerning innovation and access to innovation funds. This section will focus on the role the NVDE could take on

to contribute to the solutions. The problems are foremost related to the design of the energy and innovation policies. Policies come into existence via the legislative power. The political aspect of innovation policy, complicates the role of the NVDE. Although the main aim of the NVDE is to influence politics, they have no guaranteed and direct influence. The influence is depending on the willingness of policymakers and politicians. This complicates the role of the NVDE in solving the problems. However the question posed is *'How can the NVDE contribute to the solutions?'* Although immediate change of the policy is not possible since of the legislative system, the NVDE can still take on some roles to contribute to improve the innovation system.

Based on the previous paragraphs four roles are identified: informative role, lobby role, role of connector and advisory role. Each role helps members of the NVDE in getting better access to innovation funds and improving the conditions for innovation. For each is also indicated if it should be taken up in the short, mediate or long term.

### 6.3.1. Information

This is the first time that the NVDE approached members concerning innovation. The initial reaction of members was surprised. The second reaction was positive, seeing potential for the NVDE taking up innovation in her portfolio. The first conclusion is therefore that the NVDE should include innovation policy in her portfolio. The expansion demands informative action of the NVDE. Members need to be informed on the services the NVDE offers regarding innovation. The informative role should also include providing information regarding innovation. The NVDE has valuable documents with all relevant innovation funds available at national and European level. The publication of these documents to its members positively affects the knowledge of the members. Providing members with informative documents on existing innovation funds, limits the efforts members have to put into the search for funding. The documents are updated each year according to the revisions of the innovation funds. The NVDE is also working on the development of the information document into an interactive decision tree. By answering several questions, members end up with the most suitable fund for their innovation and information how to apply.

Furthermore the NVDE should make use of other partners in her network to inform her members. The NVDE stays in close contact with the 'top consortia' (hereafter TKI) which are responsible for part of the available innovation funds.

Collaboration with them on providing information could be beneficial. The same hold for the Netherlands Enterprise Agency (RVO)<sup>17</sup>. The Netherlands Enterprise Agency is responsible for the application procedure and granting the subsidy. Both institutions should be invited to inform the members of the NVDE on the application procedure. Especially RVO could provide tips and tricks and offer help during the application procedure.

Provision of information increases access to innovation funds by eliminating some of the perceived barriers. Information on the existing innovation funds and application procedure contributes to the level of knowledge of the members. Increased knowledge and with additional tools to apply, the administrative barrier is less hindering. If members know what the requirements entail and what is expected, complying to the requirements is easier. Reducing search- and application time. As a result fewer applications are rejected because of not fitting in the fund description. Better information increases the access to innovation funds, since applicants know what is expected.

### 6.3.2. Lobby

Although the NVDE is not directly involved in the legislative procedure, it can influence the policymakers and politicians. Therefore lobbying is the most effective role to adjust innovation policy and innovation funds according to this research. The NVDE is a renowned interest organisation in the energy sector. Politicians and policy makers value their input and expertise. Providing input regarding innovation complements the current activities.

Bouwen (2002) posed three questions in his theory of access. The question related to when to lobby is essential in this case. The current political situation provides a window of opportunity for the NVDE to effectuate the innovation lobby immediately. The NVDE is member of 4 of the 6 tables of the climate agreement. The NVDE thereby has the opportunity to plug in the problems and solutions regarding innovation in order to improve the innovation policy. Since the tables discuss the general strategy, the NVDE should use these tables to lobby for a long term strategy. Hereby it should steer for more targets, obligations and prohibitions. Good points to lobby are the obligation

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<sup>17</sup> Rijksdienst voor Ondernemend Nederland, *Netherlands Enterprise Agency*, retrieved on: <https://english.rvo.nl/> (24 June 2018)

for municipalities to make known which 'gas free' options are going to be available in which neighbourhoods, the obligation to increase the energy label of house when it is transferred from owners and prohibition of central heating boilers. Addressing the issue and demanding more policy certainty at the climate tables, is the most the NVDE can do to improve the energy policy. The above mentioned points answers the 'what to lobby' of Bouwen (2002). Since a higher price for fossil fuel energy is already part of the national climate agreement, additional lobby for a higher CO<sub>2</sub> price is not necessary.

After the negotiations for the new climate agreement the NVDE should expand her lobby activities to the problems related to innovation funds. Innovation funds are created in collaboration. The ministry of economic affairs and climate cooperates with RVO and TKI's to determine which innovation funds will be available for the coming year and how much money each fund will get. This makes these three actors the most relevant to lobby (Bouwen, 2002). The NVDE works in the same building with some of the TKI's and stands in good contact with RVO. The TKI's have already indicated that they want to discuss the outcomes of the research, to see if changes can be made. The NVDE should definitely use these meetings to influence the structure of innovation funds. Furthermore is the chairman of the NVDE also part of the overarching board of the TKI's. They need to use his double position to advocate for changes in innovation policies. During these sessions the problems and solutions related to the demonstration projects, the death valley and the administrative procedure should be addressed.

The above mentioned strategy is concerned with influencing the Dutch policy. The NVDE should first start at national level before pursuing European lobbying. The rationale behind this is that the network at European level is not as well-established as at national level. Much time and effort need to be invested in order to get the desired return. In general effective European lobby demands multiple staff members who reside in Brussels to lobby. The organisational structure of the NVDE is not designed for permanent expansion to Brussels.

### 6.3.3. Connector

As mentioned above, educating members regarding innovation policy is a tool to overcome parts of the sketched problems. The NVDE should not only inform her

members, but also make use of her network. The NVDE had a unique variety of members. It represents big and small players in the whole energy sector. The diversity of the network is a valuable asset that the NVDE should employ regarding innovation. A role as connector between members would have added value. Members with innovative projects can approach the NVDE for help in finding potential partners and even financing. The NVDE knows better than anyone what members are involved with, thereby knowing which members might be a good match. For the members it means a reduction in searching time. The NVDE can help in finding funding since some members are financial institutions who invest only in sustainable initiatives. Linking financial members with innovative members can help finding private funding. Reducing the financial barrier.

The members itself also have valuable knowledge. In the role of connector, the NVDE should also make use of the knowledge of her members. The results show that members have experience with the application of innovation funds on national and European level. Members indicate that after writing several proposals, it becomes easier. Smaller and less experienced members struggle with the application procedure. This also resulted in rejected proposals. The NVDE can turn the mixture between experienced and unexperienced into something positive. The NVDE should collect best practices regarding the acquisition of innovation funds. The best practices are made available to her members and those interested can consult the information. The best practices increase access to innovation since it alleviates the administrative procedure.

A more effective way of sharing best practices is by connecting experienced members with unexperienced members. Members make known to the NVDE that they are considering an application for a specific fund. The NVDE will connect the unexperienced member to an available and experienced member. The nature of help is flexible. Members can give substance to the assistance themselves. In the ideal situation members help with writing proposals, reading proposals and providing tips on formulation.

As a connector the NVDE contributes to increasing the access to innovation funds. By providing assistance during the application procedure, the problems related to the administrative procedure are decreased. Best practices or help by experienced members, lead to better informed applicants. Knowing what and how to write the

proposal, reducing the actual writing time. This limits the costs of the application procedure. Furthermore the NVDE can help with the search for relevant partners in the case of mandatory collaboration. Reducing the actual search time for the enterprises. Although it does not change the actual application procedure, it positively influences the time spent on preparation and writing the proposal, making applying for a fund more attractive. The services will have the greatest effect for SMEs. This group struggles the most with available resources. Easing the application procedure, applying for an innovation fund is more attractive. Rotmans (2011) confirms the essence of (new) cooperation between different partners. A role as connector is therefore in line with the latest perception on effective transitions.

#### 6.3.4. Member of advisory board

The diversity of the members could also be put to another use. Few other interest organisations have such a diverse network of companies involved in the energy sector. Innovation programmes are revised on an annual basis by an independent advisory board. The representation of the whole energy sector, the expertise of her members and the valuable contacts with policy makers and political parties makes the NVDE a suitable member of such an advisory board. In the role of advisor the NVDE annually gathers feedback from her members on the existing innovation funds and the barriers. In other words, they execute a smaller version of this research. With those results the NVDE has useful information for the policy makers on how to improve the innovation funds. The updated version of the innovation fund is again tested among relevant members. Having a broad interest organisation as an advisor, it helps determining if all technologies have sufficient options for funding. Board members are valued based on their expert opinion. Increasing the likelihood that suggestions are incorporated. Incorporation of the suggestions leads to improved access to innovation and if successful solving problems as discussed in 6.1.3. to 6.1.6.

#### 6.3.5. Other suggestions

Respondents indicate that the NVDE would benefit from more staff. The NVDE supports additional staff. However in order for the NVDE to hire more staff, a raise of contribution is necessary. However, members do not support a raise of contribution. In that sense the results of a membership has not benefited the members enough to

support a raise. At the moment the NVDE is represented at multiple negotiation tables of the new climate agreement. SMEs and non-SMEs can provide input via the NVDE. Members highly value this opportunity. Depending on the outcomes of the climate agreement, the value of the NVDE can rise. Risen value can lead to more members and increase willingness of members to pay more contributions. Both result in more financial means, making additional staff possible.

Furthermore did respondents suggest that the NVDE also should start their own innovation programmes, either by making financial resources available or by gathering cases and pursuing the innovation in collaboration with their members. Considering the nature and internal resources of the NVDE both suggestions are not feasible. The NVDE is a non-profit organisation with limited means. The financial resources are collected via contributions. Innovation programmes would also be financed out of the contributions. The respondents did not desire a raise of the contribution, making the existence of innovation programmes even more unlikely.

Gathering cases and being the initiator behind innovation programmes and applying for financing is also not suitable for the NVDE. The NVDE has zero experience regarding pursuing an innovation project and writing a proposal. Fulfilling the leaderships role will not contribute to the quality of the project. Furthermore the NVDE does not have the level of expertise required for innovation projects. Making this role not suitable for the NVDE.

#### 6.3.6. Trajectory

The executing of the roles should follow a time path. The NVDE can immediately start with providing information. The NVDE has documents on the available national and European innovation funds. The information could be put into factsheets and a decision tree. The information provision can be extended with organising informative sessions with partner institutions. Besides that the NVDE can also start immediately with the lobby on innovation. The determined problems and solutions provide sufficient input for lobby. Especially with the current negotiations on the climate agreement, lobby is desirable. Since the tables do not decide on the precise funding, the NVDE should focus here on the long term strategy of the energy transition and the role of innovations.

The role of connector should be pursued on a mid-short term. A period of six to eight months is desired. Within these months the NVDE finishes the negotiations and has time to collect the necessary information: the innovative activities of all members and the best practices of experienced members. With the information the NVDE is equipped with the necessary tools to be a connector.

In the near future the NVDE needs to consider become an independent advisory board member. In the current situation the expertise of the NVDE on innovation is too scarce. A permanent member of staff needs to be involved with innovation. Once the information level of the staff and the members has increased and the role as a coordinator is operational, the NVDE contributions regarding innovation policy become more valuable.

Although the NVDE has the ambition to expand the lobby activities to European level, reality shows that these ambitions are too big. The conditions are far from ideal. The NVDE is not an active member of the European interest organisation on renewable energy, resulting in standpoints of the interest organisation which are not favourable for the Dutch situation. So to become more effective at European level, a first step is to become more active in the European interest organisation. However the European organisation does not have an effective lobby on European innovation policy and funds. In order to have both a successful lobby on European energy and innovation policy, a more permanent representation in Brussels is necessary. However the financial means and staff are limited, which according to Bowens (2002) theory of access, hampers effective lobby. The lack of European potential, also makes it hard to change the European application procedure for innovation funds. Therefore the NVDE cannot contribute to eliminating the existing mismatches at European level.

At national level however, the NVDE is a well-established interest organisation. It should exert its status to solve the mismatches at national level. The most effective way to solve the mismatches is to influence policy makers, members of parliament and directors of the innovation programmes. The medium (Bouwen, 2002) the NVDE should use to influence policy is by regularly visiting the members of Parliament and by writing position papers regarding relevant topics related to innovation.

## 7 Conclusion

### 7.1 Answering the research question

After analysing the data, this section will provide some concluding remarks. The aim of the thesis was to determine barriers to innovation and the identification of factors that obstruct access to funding. Hereby several sub questions were posed to structure answering the main research questions. This section will first answer the sub questions posed in section 2.6. The answers will cumulate into the main answers to the research questions. The section will be concluded by some critical remarks and suggestions for future research.

#### 7.1.1. Answering the sub questions

Academic literature described factors that obstruct innovative capacities of enterprises. In general financial, administrative, legal and policy barriers exist. The sub question 1 aimed to test the existence of the barriers to innovation in the energy sector. The posed questions thereby were:

- Sub question 1: Which barriers are perceived regarding the innovation system?
  - Sub question 1.1: To which extent do the barriers affect the functioning of the innovation system?
  - Sub question 1.2: To which extent are SMEs affected by these barriers?

Findings showed that the legal barrier is perceived as most hindering to innovation. The number of requirements an enterprise needs to adhere to before being eligible to an innovation fund is extensive. The number of requirements and uncertain aspects in projects, discourage enterprises to pursue the acquisition of public funding. In other words, the numerous requirements of the innovation funds affect the functioning of the funds. This is especially true for small and medium sized firms, who are often dependent on public funding but have limited resources to devote to the acquisition.

This was also reflected in the administrative barrier. The duration of the application procedure is hereby the most hindering. At European level the application procedure takes approximately a year, excluding the months of preparation. All respondents indicated that only if they were hundred percent certain of their success, they considered applying. At national level the duration of the application procedure is

shorter. However, the requested size of the proposal is still around 80 pages. This especially limits access to innovation funds for SMEs. Small and medium sized firms have fewer resources to devote to the application procedure, resulting in less access to the innovation funding. And since innovation schemes often aim to target SMEs, the innovation fund does not achieve its goal.

SMEs also experienced the financial barrier more than non-SMEs. The financial barrier consisted of lack of internal funding and lack of external (private) funding. In order to acquire private funding, considerable internal funding is necessary to repay the investment. Innovation funds both demand investment of as many of the own financial resources as co-investors. For SMEs the amount of own resources and the number of co-investors is limited. Affecting the innovative capacities of SMEs. Making them more reliant on public funding. However the requirement of innovation funds is to have co-investors, limits the access to innovation funds for SMEs. Making it harder for SMEs to compete with non-SMEs in the acquisition of innovation funds, since non-SMEs did not perceive this as a barrier.

In short, legal, administrative and financial barriers exist in the energy sector. The barriers affect the innovative capacity as well as access to funding. This especially holds for small and medium sized firms. The barriers uncovered several concrete problems that affect innovation and the access to innovation funds. This leads us to sub question 2:

- Sub question 2: Which problems occur in the innovation system?

Based on the data six problems were defined. All problems are related to the policy design of the innovation system. Respondents were unanimous regarding the current uncertain government policy. The government policy does not have a concrete long term prospect. Enterprises do not know which technologies will be included in the energy system of the future. For example one does not know to which extent energy storage or hydrogen transport will be part of the energy system of the future. Same holds for consumers who do not know when they have to change to 'gas free' living. The uncertain policy affects the demand of consumers for renewable technologies and the security of innovations. Enterprises therefore demand a certain long term energy policy.

Unfair competition between energy sources is also a problem that affects innovative capacities of enterprises. Renewable energy is not able to compete with fossil fuel energy since the price of fossil fuel energy is too low. The negative externalities of fossil fuel energy are not incorporated in the energy price. The unfair energy price of fossil fuel makes it hard for renewable energy to compete with it. Reducing the likelihood of return on investment, making innovations less profitable.

The third problem is related to the number of innovations that are slowed down or ended because of residing in the death valley. In the current innovation system innovations are subsidised for a period of four years. After the four years enterprises have to apply for an additional round of funding. Which pauses the innovation for at least a few months. Applicants still have the chance of rejection. Making continuation of the innovation uncertain. Often non ground-breaking innovations reside in the death valley. Although having the prospect of considerable impact, government desires ground-breaking innovations. Limiting the access of 'average' innovations to innovation funds. Increasing the number of innovations which do not reach market implementation.

Projects in the demonstration phase which are granted a demonstration subsidy, experience the problem of executing the demonstration project and achieving the desired efficiency and cost-reduction. The aim of demonstration subsidies is to make product or services more cost-effective and efficient to make market introduction more likely. Respondents indicate that in order to reach the desired efficiency, multiple demonstration projects are needed. The current innovation system does not provide for this, affecting potential market implementation.

The fifth problem arises from the administrative barrier. The duration and the required level of detail of the application procedure is skewed compared to the level of success. Enterprises indicate that the cost of applying sometimes do not exceed the benefits of the subsidy. This hampers access to innovation funds. This especially holds for SMEs since they have limited resources.

The last problem is related to the rigid requirements. Especially mandatory collaboration is perceived as a hurdle. Innovation funds demand collaboration with mandatory co-financing. This is in particular perceived a barrier to SMEs. Investors demand a return for the investment. In the starting phase this is often intellectual

property. Companies are hesitant to share that, resulting in less financing. The co-financing requirement of collaboration hampers access to innovation funding.

The problems provide a good input for potential solutions. The sub question 3 led the research into that direction:

- Sub question 3: What are possible solutions to the problems?

The government needs to adjust its innovation system in order to improve the innovative capacities of enterprises and the access to innovation funds. The first step is to make a long term energy policy. This policy needs to include obligations and prohibitions providing guidance for enterprises and consumers. Furthermore the technological future of the energy policy needs to be clear. A good example is the obligation for municipalities to make decisions on the renewable future of neighbourhoods and the prohibition of a gas heated boiler. Consumer demand increases, assuring return on investment in innovations.

To make renewable energy more competitive with fossil fuel energy, the price of fossil fuel energy needs to be increased. A good solution is to incorporate the negative externalities into the price of fossil fuel energy. This can be done by incorporating the price of CO<sub>2</sub> into the energy price. However the current CO<sub>2</sub> price does not reflect the actual price of the CO<sub>2</sub> emissions. Because of the dependency on fossil fuel, the price of CO<sub>2</sub> gradually needs to be increased. This results in a higher energy price of fossil fuel energy, making it more equal to renewable energy. This results in a potential higher demand for renewable energy, making innovations in renewable energy technologies more profitable.

The problem of the death valley needs to be solved with a follow-up subsidy scheme. If an innovative project has been granted a subsidy one time, it has a chance on a follow-up subsidy if showing progress and potential. A follow-up schemes eliminates the continuous process of applying for funding. Reducing the number of projects in the death valley and increasing the chance on market implementation. However a balance need to be found between follow-up schemes and subsidies for one-time appliers.

Demonstration projects demanded additional funding to pursue multiple demonstration projects. Respondent suggested that linking demonstration subsidies to investment subsidies is a desirable solution. Frenken and Hekkert (2017) support this

solution. However the current policy does not allow that. Projects that have been granted an innovation subsidy are not eligible for the investment subsidy. This needs to be changed in order to stimulate innovation. Linking the investment and demonstration subsidy makes multiple demonstration projects possible, leading to more cost effective and efficient market products.

The duration and level of detail of the application procedure limited the access to innovation funds. To reduce the burden of the administrative procedure, a pitch should replace part of the written procedure. A pitch equals the competition between SMEs and non-SMEs, since the preparation time of a pitch is less demanding than a proposal of 80 pages. Less time needs to be devoted to the application procedure, increasing access to funding. The same holds for shortening the application procedure at European level. A shorter application procedure is more in line with reality and increases access to funds, thereby indirectly affecting innovation.

The last solution was related to mandatory collaboration and especially co-financing. Respondents proposed a more flexible cooperation where co-financing is not mandatory. Partners are free to fill in the content of their collaboration. This reduces the barrier experienced by especially SMEs.

The case under study was the NVDE, an interest organisation. Up until now, the NVDE did not have innovation in their portfolio. This is also the reason that they were interested in the innovative activities of their member. Based on the outcomes, the NVDE wanted to know which role they could fulfil. Therefore sub question 4 was:

- Sub question 4: How can the NVDE contribute to these solutions?

Based on the findings, four potential roles were defined. The majority of the problems stem from the innovation policy. Since the NVDE has no legislative power, changing the policies directly is ruled out. However the NVDE is a renowned interest organisation and stands in good contact with politicians and policy makers. The roles chosen give the NVDE the best tools to at least have some positive impact on the existing barriers.

Informing members with relevant information should provide members with knowledge on all available innovation funds and the application procedure. An interactive decision tree is the most suitable instrument to do this. Informative session on the application procedure with institutions should also be organised. This role can

be immediately pursued and increases the level of knowledge of her members. A higher knowledge level decreases potential failures in the application procedure, since members know which funds are most suitable and what the requirements are.

The informative role should be complemented with the role as connector. The NVDE should make use of the expertise available in their network. Gathering best practices regarding the application procedures, again increases the available information. Besides gathering best practices from experienced members, the NVDE should link these experienced members to first-time appliers and help them with writing their proposals. The NVDE should also connect members with a project to potential collaborating partners. Exchanging best practices and connecting members contributes to the reduction of the administrative barrier. This increases the access to innovation funds and the innovative capacity.

Influencing the legislative and executive power is the main task of the NVDE. The role as lobbyist is also suitable in the case of innovation. The NVDE should lobby employees of the Ministry, RVO and TKI's to change existing innovation funds. To position at the climate tables should be used to steer for a long term energy policy. Which can result in an improved innovation policy. In the future lobby activities should be extended to providing input regarding relevant political debates on innovation. Lobby activities should be pursued at national level, since the NVDE lacks the network, expertise and capacity to lobby at European level. The current political situation allows the NVDE to incorporate innovation immediately in their portfolio.

The last role is a role for the near future. The diversity of the network of the NVDE makes them a good member of an advisory board. The NVDE could then advise the government regarding innovation funds. However the current level of expertise of the NVDE is too low to pursue this role. The NVDE need to increase the knowledge via calendaring the innovative activities of all members and existing innovation policies. With the proper level of knowledge and cooperating members, the NVDE can take on the role of advisor.

### 7.1.2. Answering the research questions

The research question central to this thesis was twofold. The first part focused on necessary steps to align the demands of the enterprises with the innovation policy. The

second part focused on how the NVDE could help aligning the factors. Both parts will be answered separately.

- Which changes in the innovation system and energy policy are needed to increase innovation and access to innovation funds?

The described problems indicated three necessary policy changes to stimulate innovations, and improve the access to and functioning of innovation funds.

- (1) The first change is to create a clear and fixed energy policy with targets, obligations and prohibitions that effectuate in the near future.
  - (2) Furthermore does the competition between fossil fuel and renewable energy need to become more equal. Therefore the policy need to incorporate a gradual increase of the price of fossil fuel energy via a CO<sub>2</sub> price or tax. Both policy changes provide certainty on future demand for renewables, thereby making innovations more attractive.
  - (3) To increase access to public funding, realistic innovation funds are needed. More realistic schemes have more flexible requirements, a well-balanced application procedure and room for multiple demonstration projects.
- How can the NVDE contribute to the proposed changes?

The research defined four roles that the NVDE could take one to contribute to a better innovation system. To improve innovation the NVDE should:

- (1) Pursue an active lobby to influence policy makers and politicians. The focus of the lobby need to be on the improving the energy policy and advocating equal competition.
- (2) Become an advisor in the independent advisory boards of the innovation funds. Hereby it can contribute to the annually revision of the innovation funds. Improving the current innovation systems.

To improve access to innovation funds, the NVDE should

- (3) Inform her members on the existing innovation funds and application procedures, to increase the level of knowledge.
- (4) Connect members with each other to ease the application procedure via exchange of best practices, finding collaborating partners or funding.

Hereby the focus should be on national policy. Influencing the European policy will not be effective due to absence of expertise and sufficient staff.

## 7.2 Critical Remarks

Although the researcher is convinced that the prescribed solutions and recommendations hold for the entire energy sector, some critical elements need to be taken into consideration. The sample of this research is small, only 53 potential respondents. Thereby the response rate was 30 percent which increases the probability of error. A low response rate and small sample size makes it harder to generalise to a wider population. The same holds for making theoretical implications. A low response rate hampers the possibility of drawing statistical conclusions. Complicating the process of contributing to theory and the validity of the results.

Data was gathered via an online survey and telephone interviews. In retrospect, the process of gathering data via the online survey can be improved. The length of the online survey should be decreased. The survey consisted of a considerable amount of questions. The researcher debated the trade-off between gathering the necessary information and a shorter, less extensive survey. In the end the researcher chose for the more extensive survey which took respondents 15 minutes to fill in. This could have been a contributing factor to the low response rate. In the future research surveys should either be shorter or conducted via telephone, increasing the willingness to participate.

The research also desired to incorporate the European dimension into the outcomes. However the data did not have sufficient findings to make valuable conclusions. This is mainly due to the low response rate and the size of the sample. Members of the NVDE lack experience with European innovation policy. This attenuates the scope of the research.

## 7.3 Future research

Future research should replicate the research in a larger sample. Preferable studying multiple cases at the same time. To see if the perceived barriers to innovation are not specific to the energy sector, a case not related to the energy sector should be incorporated. A larger sample increases the value of the findings. Thereby future

research should focus on increasing the response rate. This can be done by shorter surveys or conducting the survey via phone. The findings of the replicated research should be used to validate the findings of this research. And based on the combined findings make theoretical implications.

Another suggestion for future research is to conduct a similar research only focusing on the European innovation policy. Hereby the sample should consist of enterprises from different Member States. The current research was not able to draw inferences on European policy since data provided to little findings. Future research should take the existing theoretical and methodological framework as a starting point. This results in findings that can be compared not only between Member States, but also between European level and national level.

The last suggestion for future research is to incorporate the government perspective more into the research. This research aimed to interview actors who determine the innovation funds and policy. However due to the climate agreements, the agenda of the actors were too full to plan an interview. Future research should also focus on the perception of policy makers on the functioning of the policy and the funding scheme and how they react to barriers and problems mentioned by enterprises. This provides valuable insights on the motives and choices for the innovation funds.

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# Appendices

## Appendix I Survey Innovation funds NVDE

Dear participant,

Innovation is seen as one of the most important factors to stimulate the energy transition. The government stimulates innovation by supporting enterprises via subsidies and credits. The Dutch Society for Renewable Energy is interested in the needs of her members regarding innovation and innovation subsidies. The aim is to plot the needs, the barriers and the experiences with innovation and innovation subsidies. Lastly you will be asked to think about a potential role for the NVDE in this process.

Thank you in advance for filling in this survey.

Kind regards,

Evelien Haaksman

### **Company characteristics**

- What is the name of your company?
- How many employees are working in your company?
  - Less than 10 employees
  - Between 11 and 50 employees
  - Between 51 and 250 employees
  - More than 250 employees
- What is the annual revenue of the company?
  - Two million or less
  - Between 3 and 10 million
  - Between 11 and 50 million
  - More than 50 million
- With what type of renewable energy is your company involved in?
- Is your company involved in innovation?
  - Yes
  - No

### **Reason for innovation**

- Which reason for innovation is applicable to your company?
  - To stay competitive
  - To maintain and further develop special technologies
  - To do research
  - To contribute to the protection of the environment

- To save energy
- To develop new and/or improved renewable energy techniques
- To prepare for economic, social and environmental issues
- To generate a cost reduction
- Other..

### **Motivation for no pursuing innovation**

- What is the motivation not to engage in innovation?
- Does your company consider to engage in innovation in the future?
  - Yes
  - No

### **Barriers to innovation**

3. Which financial barriers regarding innovation do you experience?
  - a. Our innovative activities are hampered due to a lack of internal financial resources
  - b. The acquisition of external financial resources at financial institutions is difficult
  - c. Finding sufficient private investors is difficult
  - d. The risks of innovation are too big
  - e. We do not encounter any barriers regarding financing our innovations
  - f. Other....
4. Which of the following administrative barriers do you experience?
  - g. Our innovations are hampered by a lack of staff
  - h. Our innovations are hampered due to a lack of time
  - i. The administrative procedure of innovation funds is unclear
  - j. The duration of an application for subsidy hampers innovations
  - k. We do not experience any administrative barriers
  - l. Other ....
5. Which of the following political barriers do you experience?
  - m. The government offers too little assistance regarding application for an innovation fund
  - n. Government policy is uncertain, which makes innovations more difficult
  - o. The conditions for innovation funds are too demanding
  - p. There are no political barriers
  - q. Other ...
6. Which legal barriers does your company experience regarding innovations
  - r. Dealing with ownership of innovations are complex
  - s. The legal requirements hamper cooperation
  - t. The legal requirements hamper innovation in general
  - u. There are no legal barriers
  - v. Other ...
7. Which barriers concerning consumer demand do you experience
  - w. The government needs to focus more on consumer awareness
  - x. Consumers needs to be subsidised when buying our product
  - y. The demand from consumers is too limited to pursue innovations

- z. There is sufficient consumer demand
- aa. Other ...
- 8. Which other barriers do you experience?
- 9. Which barrier do you experience to be of most importance?
  - bb. Financial
  - cc. Administrative
  - dd. Political
  - ee. Legal
  - ff. Consumer demand
- 10. What are adequate solutions to dissolve these barriers?
- 11. To which extent do innovation funds dissolve these barriers?
  - gg. To great extent
  - hh. Partly
  - ii. To lesser extent

### **Experiences with innovation funds**

- How would you rank your knowledge regarding the available national innovation funds?
  - I am aware of all available innovation funds
  - I am aware of the specific funds for my sector
  - I only have knowledge of a few funds
  - I do not have knowledge of the available funds
- Does your company have experience with applying for national innovation funds?
  - Yes, our company handed in an application
  - No, our company did not apply for a fund
  - We are planning to hand in an application

### **Experience innovation funds**

- For which of the following innovation funds have you handed in an application? Or for which do you consider to apply for?
  - Early phase financing (Vroegfasefinanciering)
  - Innovation credit (Innovatiekrediet)
  - PPS-‘toeslag’
  - Demonstration energy innovation (DEI)
  - Renewable energy (HER)
  - System integration (systeemintegratie)
  - Grow facility (Groei faciliteit)
  - Guarantee Entrepreneurs financing (Garantie ondernemingsfinanciering)
  - Guarantee facility SME credits (Borgstelling MKB kredieten)
  - Seed capital
  - Qredits
  - Offshore wind – R&D Projects
  - System integration in the North Sea
  - Urban Energy

- Joint Industry Programme
- Early adaptors programme
- CCUS (Capture and storage of CO2)
- Hydrogen (waterstof)
- Other ....
- Which of the following statements applies to your company?
  - Without the subsidy the innovation could not be pursued
  - The subsidy was needed to start additional innovations
  - The subsidy is requested to secure more innovations in renewable energy
  - The subsidy is requested to limit CO2 emissions
  - Other
- Was the application successful?
  - Yes
  - No
  - De application process is ongoing

### **Successful applications**

- When is the application submitted?
- What was the reason for the application ?
- What was the innovation about?
- What was the amount of subsidy?
- To which extent has the subsidy made a difference in the executing of the project?
  - To great extent
  - To some extent
  - Neutral
  - To lesser extent
  - Hardly
- How did you experience the application procedure?
  - Simple
  - Neutral
  - Complex
  - Other
- What you change in the application procedure?

### **Unsuccessful application**

- Why was your application 'rejected'?
  - Project did not fit within the project requirements
  - Too little own financial resources
  - Feasibility of the project was insecure
  - Not well elaborated project proposals
  - No correct collaboration
  - Other
- What would you do different next time round?
- What would you like to see change in the application procedure?

## European innovation funds

- How would you rate your own knowledge of the existing European innovation funds?
  - I am aware of all the available innovation funds
  - I am aware of the specific funds for my sector
  - I only know a few
  - I have no knowledge of innovation funds
- Do you have any experience with applying for European innovation funds?
  - Yes we handed in an application
  - No, we never applied for an European fund
  - We are planning to apply

## Application European Innovation funds

- For which innovation fund did your company apply? Or are you planning to apply for?
  - SME instrument
  - Joint technology initiative
  - European fund for strategic investments
  - EUREKA
  - LIFE
  - NER300
  - Dutch Growth CO-invest Programme
  - INTERREG North-West Europe
  - INTERREG North-Sea
  - COSME
  - Risk-sharing financing facility
  - RSI
  - EREM Loans
  - DVI-1
  - DVI-2
  - INNOVFAN
  - Horizon 2020
- Has the application been approved?
  - Yes
  - No
  - Application is still going

## Successful applications

12. When did you apply for the application period?
13. What was the reason to apply for an application?
14. What was the innovation about?
15. What was the amount of the subsidy?
16. Did the funding make a considerable difference in the executing of the project?
  - a. To great extent
  - b. Considerably
  - c. Neutral

- d. A little
- e. No difference

17. What would you like to change about the application procedure?

### Unsuccessful applications

- What was the reason your proposal was rejected?
  - The project did not fit within the requirements
  - Lack of own financial resources
  - Feasibility of the project was unclear
  - Not well developed proposal
  - No collaboration
  - Other ..
- What would you do different next time ?
- What would you like to change in the procedure?

### Collaboration

- Do you collaborate with other organisations regarding innovation?
  - Yes
  - No

### No collaboration

- What is the reason for no collaboration?
  - No need
  - Found no suitable partner
  - The requirements for cooperation are too strict
  - The cooperation has failed
  - Not enough partners
  - Other ...

### Collaboration

- What kind of organisation do you collaborate with?
  - Knowledge institute
  - SME
  - Non-profit organisation
  - National government
  - Public institution
  - Decentral government
  - System operator
- What is the reason for the collaboration?
  - Exchange of information
  - Further development and producing new techniques
  - Collaborate with someone to generate more system integration
  - Collaborate with company from a different sector to achieve the system integration
- Which obstacles did you experience?
- Do you collaborate with parties within or outside the Netherlands?

- Within the Netherlands
- Within the European Union
- Outside the European Union
- Within the Netherlands as well as outside

### **Cross-border collaboration**

- What was the main reason to engage in cross-border collaboration?
- Which obstacles did you experience within the partnership?
- How do you feel about the European requirements for cross-border collaboration?

### **Additional innovation funds**

18. Which form of innovation funds do you see as most preferable?

- jj. Loans
- kk. Subsidies
- ll. Artificial prices
- mm. Cover-up the operation loss
- nn. In-kind benefits
- oo. Cancelling of losses
- pp. Tax measures
- qq. Other ....

### **Government policy**

19. With which of the following statements regarding government policy do you agree?

- rr. The government policy should not entail too much technological requirements
- ss. The time to fulfil the legal requirements is too short
- tt. The government policy should be more outcome focused than technology focus
- uu. The government policy should be fixed for a longer period of time
- vv. The government should stimulate innovation with financial instruments

20. In what way does the current government policy has a positive or negative effect on innovation?

### **Role of the NVDE**

- What could the NVDE do to improve access to innovation funds?
- Would you be open for an interview to talk more in-depth about the topic?
- On which email address could we contact you to schedule an interview?

## Appendix II Email to members which are a non-interest organisation

Dear <Firstname><Secondname>,

Innovation is an essential part of the energy transition. Without innovation the 2030 targets are out of reach. Due to this fact the NVDE became interested in the innovative activities from her members. Therefore we started a research to map the needs of our members regarding innovation. The aim of the research is to explore the obstacles regarding innovation, which experiences our members have with innovation and innovation funds and which role the NVDE could take to increase access to these innovation funds.

The outcomes of the research result in an overview of the activities of our members, potential to cooperate and a chart with the most relevant innovation funds. In order to get as much reliable answers as possible, we need your help! Therefore we would like to ask you if you (or a colleague) is willing to fill out this survey. In less than 20 minutes you can contribute to this result. Despite the hectic time we would really appreciate if you can fill out the survey within two weeks. The survey asks some company specific characteristics. This is only for internal use, the outcomes of the survey is only used for this purpose and not distributed. We would like to thank you in advance for your collaboration. The anonymised and general outcomes of the survey will be distributed among the respondents.

If you have any questions regarding the survey, do not hesitate to send an email address in the closing.

Kind regards,

Evelien Haaksman

*Research Intern*

[evelienhaaksman@nvde.nl](mailto:evelienhaaksman@nvde.nl)

06-18729172

## Appendix III Email to interest organisations

Dear <Firstname><Secondname>,

Innovation is an essential part of the energy transition. Without innovation the 2030 targets are out of reach. Due to this fact the NVDE became interested in the innovative activities from her members. Therefore we started a research to map the needs of our members regarding innovation. The aim of the research is to explore the obstacles regarding innovation, which experiences our members have with innovation and innovation funds and which role the NVDE could take to increase access to these innovation funds.

The outcomes of the research result in an overview of the activities of our members, potential to cooperate and a chart with the most relevant innovation funds. In order to get as much reliable answers as possible, we need your help! Therefore we would not only like to ask you if you (or a colleague) is willing to fill out this survey, but also to forward this among your members. By doing this, the research will gain relevance. Besides that you will also automatically gain insight in the needs and perceived barriers of your members.

In less than 20 minutes you can contribute to this result. Despite the hectic time we would really appreciate if you can fill out the survey within two weeks. The survey asks some company specific characteristics. This is only for internal use, the outcomes of the survey is only used for this purpose and not distributed. We would like to thank you in advance for your collaboration. The anonymised and general outcomes of the survey will be distributed among the respondents.

If you have any questions regarding the survey, do not hesitate to send an email address in the closing.

Kind regards,

Evelien Haaksman

*Research Intern*

[evelienhaaksman@nvde.nl](mailto:evelienhaaksman@nvde.nl)

06-18729172

## Appendix IV Email to members of interest organisations

Dear <Firstname><Secondname>,

You receive this email because your interest organisation is member of the Dutch Society of Renewable Energy. NVDE sees innovation as an essential part of the energy transition. Innovation is an essential part of the energy transition. Without innovation the 2030 targets are out of reach. Due to this fact the NVDE became interested in the innovative activities from her members. Therefore we started a research to map the needs of our members regarding innovation. The aim of the research is to explore the obstacles regarding innovation, which experiences our members have with innovation and innovation funds and which role the NVDE could take to increase access to these innovation funds.

The outcomes of the research result in an overview of the activities of our members, potential to cooperate and a chart with the most relevant innovation funds. In order to get as much reliable answers as possible, we need your help! Therefore we would like to ask you if you (or a colleague) is willing to fill out this survey.

In less than 20 minutes you can contribute to this result. Despite the hectic time we would really appreciate if you can fill out the survey within two weeks. The survey asks some company specific characteristics. This is only for internal use, the outcomes of the survey is only used for this purpose and not distributed. We would like to thank you in advance for your collaboration. The anonymised and general outcomes of the survey will be distributed among the respondents.

If you have any questions regarding the survey, do not hesitate to send an email address in the closing.

Kind regards,

Evelien Haaksman

*Research Intern*

[evelienhaaksman@nvde.nl](mailto:evelienhaaksman@nvde.nl)

06-18729172

## Appendix V Overview of innovation funds

<b>Dutch Innovation funds</b>	<b>European innovation funds</b>
Vroegfasefinanciering	SME instrument
Innovatiekrediet	Joint technology initiative
PPS-toeslag	European fund for strategic investments
Demonstratie energie innovatie	EUREKA
Hernieuwbare energie	LIFE
Groei faciliteit	NER300
Garantie ondernemingsfinanciering	Dutch growth co-invest programme
Borgstelling MKB kredieten	INTERREG North-West Europe
Seed capital	INTERREG North-Sea
Qredits	COSME
Wind op zee – R&D projecten	Risk-sharing financing facility
Systeemintegratie op de Noordzee	RSI
Urban Energy	EREM loans
Joint Industry Programme	DVI I & II
Early Adaptors Programme	INNOVFIN
CCUS (Capture and storage of CO <sub>2</sub> )	Horizon2020
Waterstof	

## Appendix VI Semi-structured interviews

General structure of interview:

1. Do you agree with me recording this interview? The results will be anonymised.
2. Could you tell me more on the main activity of your enterprise?
3. What is the reason to innovate?
4. Do you experience any barriers related to innovation?
5. Did you apply for national or European funding? If yes, for which? No, why not?
6. How did you perceive the application procedure?
7. What is your opinion regarding technological neutral funds?
8. Do you experience any trouble regarding collaboration?
9. In an utopian world, what would you like to change in the innovation system?
10. Which role can the NVDE play?

## Appendix VII Members of the NVDE

1. 54 Events
2. Alliander
3. ASN Bank
4. Bodemenergie.nl
5. CE Delft
6. Delta
7. Den Ouden
8. Dutch Heat Pump Association
9. E-kite
10. EBN
11. ECN
12. ElaadNL
13. Eneco
14. EWA
15. Energy2Go
16. Enexis Groep
17. Ennatuurlijk
18. Essent
19. EWT
20. Fakton
21. Fastned
22. Gasunie
23. Greenchoice
24. Groengas Nederland
25. Holland Solar
26. HVC
27. Inventum
28. Ithodaalderop
29. NBKL
30. NBPI
31. Nederland Isoleert
32. Netbeheer Nederland
33. NUON
34. NWEA
35. ODE decentraal
36. OM – nieuwe energie
37. Particuliere windturbine exploitanten
38. Platform bioenergie
39. Platform geothermie
40. Pluimers isolatie
41. PWC
42. PZEM
43. Qurrent
44. Siemens
45. Squarewise
46. Stadverwarming Purmerend
47. Stedin
48. Tennet
49. Tesla
50. TNO
51. Triodos Bank
52. UNETO VNI
53. Warmtenetwerk

## Appendix VIII Overview of interviewed and survey respondents

Table 3: Overview of interviewed and function

<b>Company</b>	<b>Function</b>
1. Current	Innovation & business development manager
2. TNO	Business Development Sustainable Energy
3. HoSt	Project Developer
4. BTG World	Head Consultancy Division
5. RenewabLAW	Founder
6. E-kite	Commercial director
7. Straathof Advies – Energie in transitie	Consultant

Table 4: Overview of survey respondents

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<b>Company</b>
1. Straathof Advies – Energie in transitie
2. Platform Geothermie
3. Greenchioce
4. ElaadNL
5. HVC
6. NWEA
7. OM energie
8. Ennatuurlijk BV
9. C-Trade BV

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