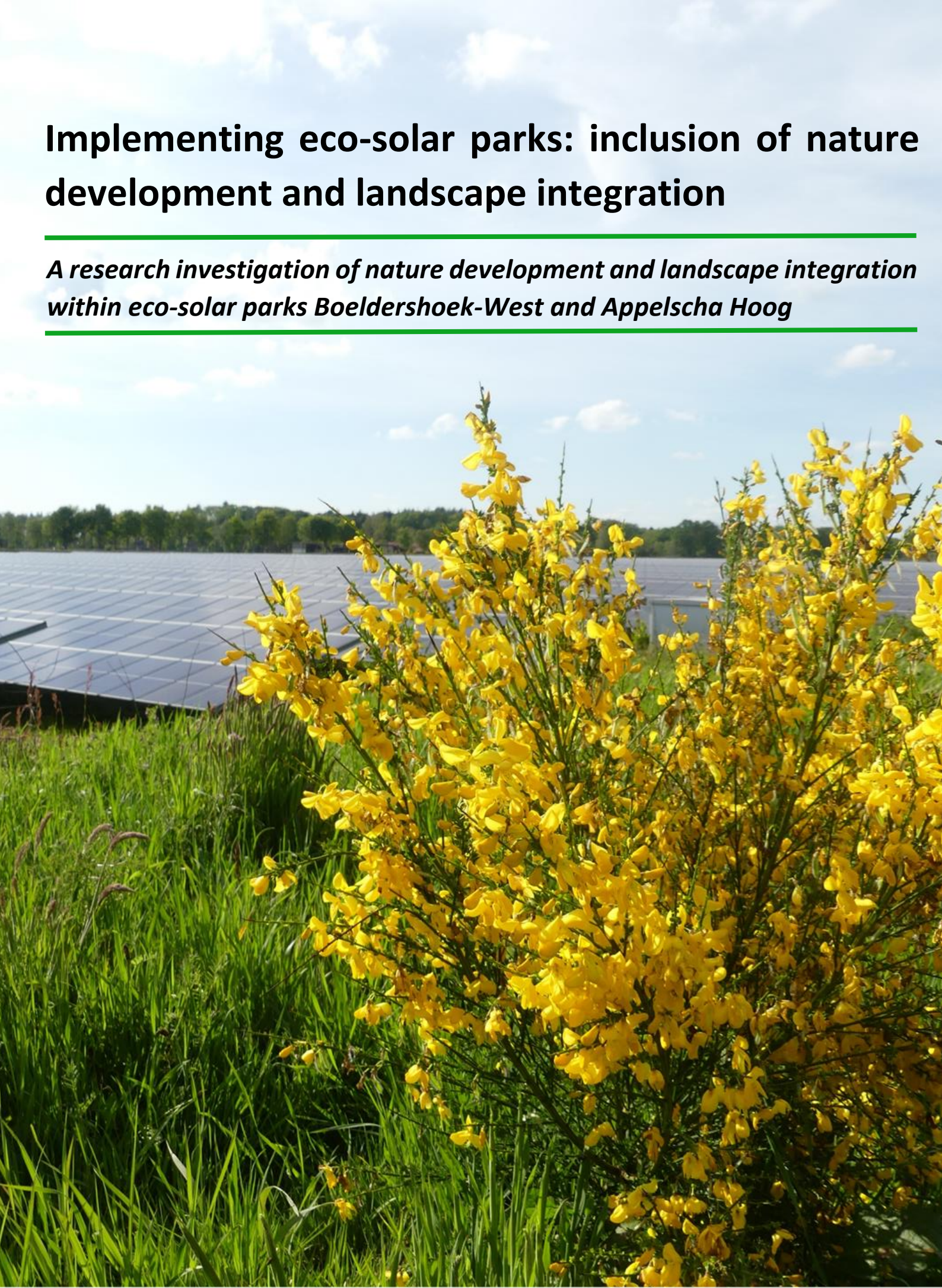
Implementing eco-solar parks: inclusion of nature development and landscape integration

A research investigation of nature development and landscape integration within eco-solar parks Boeldershoek-West and Appelscha Hoog



Damin Booiman | S3177912 | Spatial Planning & Design | Bachelor thesis

Colophon

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Abstract

In recent years, space has become increasingly scarce in the Netherlands. In contrast, two spatially demanding concepts became more prominent in the Dutch landscape: nature development and the energy transition. Moreover, policies address the increasing future importance of both concepts. A promising solution to future conflicts of space are eco-solar parks. Here, solar energy is generated while at the same time nature is developed. This research investigates the inclusion of nature development and landscape integration, which is vital for generating public support for solar parks, within the implementation processes of two implemented eco-solar parks: Boeldershoek-West and Appelscha Hoog. Extensive primary research was conducted by performing multiple interviews with actors involved in one of the implementation processes of the eco-solar parks. It is concluded that nature development is, despite forming an important objective in the development of both eco-solar parks, subordinate to financial feasibility. Sometimes, generating maximum profits was even at the cost of the ecological potential of the eco-solar parks. Landscape integration, on the other hand, was an important objective in the decision-making process and the design development phase of the parks. In Boeldershoek-West, nature development and landscape integration where combined by including strips of nature. In contrast, in Appelscha Hoog the ecological potential of the park declined because of concerns about visibility. Finally, it is argued that agreements between the initiator and operator of the eco-solar park about maintaining the natural values, are crucial for fulfilling future biodiversity objectives.

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1. Introduction

1.1 Background and relevance

'God created the earth, the Dutch created the Netherlands' is a famous Dutch saying. The Netherlands, once described as a planner's paradise (Faludi & Van der Valk, 1994, cited by Raus & De Roo, 2016), is known for its long planning history and well-developed planning systems (Gerrits et al., 2012, cited by Raus & De Roo, 2016). Today, Dutch planners face multiple challenges in their daily practices. These challenges are related to the increasing pressure on the public space in the Netherlands (van Dam et al., 2019). To illustrate, while the Netherlands contained just over 10 million people in 1950, the total population is now almost 17.3 million (CBS, 2019-1). Complementary, with this population increase more houses were needed to be built, industrial activities grew and the infrastructure network expanded. Consequently, space has become scarce in the Netherlands (van Dam et al., 2019).

After a long period of biodiversity decline in the Netherlands, a renewed focus on nature development started in the 1990's (Doevendans et al., 2007). With a focus on restoration and recreation of nature, this 'new nature' approach highly impacted the Dutch countryside (Doevendans et al., 2007; Bulkens et al., 2015; Jansen et al., 2017). In the meantime, the Netherlands became increasingly affected by climate change. Specific consequences were, and still are: sea level rise, increased precipitation patterns, and droughts (PBL & KNMI, 2015). To mitigate these effects, the transition from fossil fuels to renewable energy sources is crucial (IRENA, 2017). With spatial implementations like windmills and solar parks, the energy transition became increasingly visible in the Dutch landscape (de Boer et al., 2018).

The Dutch government has decided, in its climate agreement, to implement 80.000 hectares of new nature by the year 2027, of which 35.000 hectares were implemented in 2018 (MEZK, 2018). Formulated as well within the climate agreement, is the objective to produce 27% of the total energy production with renewable energy in 2030. Significant progression has to be made while the current share of renewable energy is 7.4% (MEZK, 2018; Rijksoverheid, 2019; CBS, 2019-2). So, both nature development and the energy transition will play an even more prominent role in the Dutch landscape in the upcoming years.

A promising solution to the conflict between scarcity of space with nature development and energy transition, are eco-solar parks. Eco-solar parks are parks where solar energy is generated while at the same time nature development is included (Dhar et al., 2019; EHVB, 2019). Even though a small number of eco-solar parks are identified in the Netherlands so far, a significant amount of future eco-solar parks are planned in the upcoming years. Moreover, eco solar-parks are starting to gain increasing awareness in Dutch policies as well (van Dam et al, 2019; Rijksoverheid, 2019).

In literature, research is available on design guidelines for eco-solar parks (Dhurry et al., 2019; Dhar et al., 2019; van der Zee et al., 2019). However, scientific literature lacks empirical research about how nature development and landscape integration are included in the implementation processes of realized eco-solar fields. While nature development is important to fulfill biodiversity objectives, landscape integration is vital for gaining public support for eco-solar parks (de Boer et al., 2018; van der Zee et al., 2019). Societal resistance against (eco-)solar parks namely, tends to be significantly high when parks are clearly visible in the landscape (de Boer et al., 2018).

This thesis plugs into prevailing gaps of the literature by reviewing eco-solar parks Boeldershoek-West and Appelscha Hoog, both located in the Netherlands and realized in 2018 (Eelerwoude, 2018; gemeente Ooststellingwerf, 2018). Through gaining a detailed understanding of the inclusion of nature development and landscape integration within these case-studies, key

practices for the implementation processes of future eco-solar parks can be defined. By doing so, the implementation processes of future eco-solar parks are more likely to enjoy public support, while at the same time biodiversity objectives have a higher potential to be fulfilled.

1.2 Research problem

This thesis investigates the inclusion of nature development and landscape integration within the implementation processes of eco-solar parks Boeldershoek-West and Appelscha Hoog. To study these specific case studies, and to ensure that the societal and theoretical relevance are fulfilled, the following research question is formulated:

"How are nature development and landscape integration included and potentially combined within the implementation processes of eco-solar parks Boeldershoek-West and Appelscha Hoog?"

Secondary questions that arise from this research question are:

- Which stakeholders were involved in the decision-making processes of eco-solar parks Boeldershoek-West and Appelscha Hoog and what was their influence?
- How were nature development and landscape integration represented within the decision-making phase of eco-solar parks Boeldershoek-West and Appelscha Hoog?
- How were nature development and landscape integration included and potentially combined in the design of eco-solar parks Boeldershoek-West and Appelscha Hoog?
- Do the eco-solar parks Boeldershoek-West and Appelscha Hoog contain a higher level of biodiversity than in their former function? How is this related to the landscape integration of the eco-solar parks?

1.3 Reading guide

The first chapter introduces the topic and addresses the societal and academic relevance. The second chapter discusses the most important concepts based on academic literature to eventually construct the conceptual model. The methodology in third chapter includes the data collection instrument to test this theoretical knowledge, and to broaden it with new insights. The fourth chapter discusses the results of the collected data with an explicit link to the theoretical framework and the conceptual model. Finally, the conclusion in the fifth chapter will answer the research question and includes a discussion of the results as well as the data collection process.


2

2. Theoretical Framework

2.1 Setting the agenda

After years of a declining quality of the Dutch ecology, nature development has, since the 1990's, become an important objective in Dutch landscape planning (Bulkens et al., 2015). The most prominent instrument in the nature development strategies is the concept of 'new nature'. The 'new nature' approach argues for 'a return to a natural environment largely exempt from human intervention' (Bulkens et al., 2015, p. 808). 'New Nature' is created and designed by humans and is therefore also referred as 'human-made nature' (Jansen et al., 2017). Even though 'new nature' can not be argued as wilderness, the concept has proven to be crucial for ecological restoration. (Hodder & Bullock, 2010; Bulkens et al., 2015;). It does so by creating more areas with a high degree of biodiversity and connecting nature areas to increase the overall ecology in the Netherlands (Bulkens et al., 2015).

Despite the positive contributions of 'new nature', the ecology of the Netherlands still faces a lot of challenges. Activities such as intensive farming, urban development and separation of nature areas are specifically threating to the quantity and quality of Dutch nature (CLO, 2018). To mitigate the effects of these developments, and to reach the ambitions in the climate agreement, the 'new nature' concept remains a crucial tool for fulfilling biodiversity objectives in the Netherlands in the upcoming years (Bulkens et al., 2015; MEZK, 2018; van Dam et al, 2019; Rijksoverheid, 2019). These biodiversity objects and the energy transition, as explained in the introduction, emphasize the importance of implementing eco-solar parks and are, therefore, on the agenda at a national scale (Peters, 2015).

2.2 Nature development and spatial design

There is no specific term for a solar park where nature development is included, however, in the Hague, the term 'eco-solar park' is generally used to describe this combination between solar fields and nature development (EHVB, 2019). In this thesis, an eco-solar park is defined as a specific area where solar energy is generated, in the form of a solar field, while at the same time biodiversity objectives are fulfilled.

Solar parks can create a higher quality and quantity of biodiversity if the parks are well designed for the inclusion of nature development (van der Zee et al., 2019). The area's former function is the baseline for future nature development. For example, if the project area used to be agricultural ground, the natural value used to be low, which is in contrast with a former natural area (van der Zee et al., 2019). Within the design of the park, flying routes for birds can be created by designing enough space between the panels. Space between the panels is also important for small mammals, just as situating the panels at least 60-centimeters above the ground (van der Zee et al., 2019). For vegetation development within the park, it is essential to have enough sunlight on the ground, therefore soil compaction needs to be avoided at all cost (Armstrong et al., 2014; van der Zee et al., 2019). By ensuring that the vegetation within or surrounding the park is diverse and herbal rich, solar parks are likely to function as a habitat for insects and other small animals (Liu et al., 2019; van der Zee et al., 2019). If solar fields take these aspects into account and are maintained in an extensive way, solar fields have a significant potential to function as an ecological connection with nature areas (van der Zee et al., 2019).

2.3 Landscape integration and societal support

Developing solar fields often takes place in close connection to spatial-physical and socio-economic conditions (Van Hoorn et al., 2010; de Boer et al., 2018). These conditions are related to the local context of a solar field, local base support networks and a participating municipality (de Boer et al., 2018). Because of these aspects, energy policies and academic literature increasingly

address the importance of including the local scale in solar energy projects (Pasqualetti, 2011; De Boer et al, 2018). As Batel et al. (2018) argues, taking into account the local conditions may help projects to avoid running into discussions about societal resistance.

The use of space and the visibility of a solar field are two crucial aspects in area based solar energy practices according to de Boer et al. (2018). If a solar field demands a high amount of space or is more visible in the landscape, a field tends to run into more societal resistance, depending on the specific area conditions. A crucial tool to cope with resistance because of visibility concerns is the landscape integration of a solar park (de Boer et al., 2018). By integrating a solar park within the surrounding landscape and, by making use of local conditions, a solar field becomes a significantly less visible spatial implementation. There is significant potential for nature to function as the instrument for realizing landscape integration whereas vegetation can 'cover' solar parks (de Boer et al., 2018). If vegetation is used for landscape integration, both biodiversity objectives and generating societal support can be combined (de Boer et al., 2018; van der Zee et al., 2019).

2.4 Implementation process

There is no clearly defined method on how renewable energy concepts with nature development initiatives should be implemented. However, scientific research is available where different phases exist during the implementation process of a spatial project (Kiker et al., 2005; Nilsson, 2007). Nilsson (2007), argues that the decision-making process is the crucial start in the implementation process.

A popular method in the decision-making of spatial concepts is multi criteria decision-making (MCDM). Spatial developments in MCDM are decided on various relevant criteria and compared with other alternatives to choose the best option, making it a favorable method of decision-making in spatial projects (Kiker et al., 2005; Kaya et al., 2018). Kiker et al. (2005) categorizes these criteria into: stakeholders, costs, and monitoring different options. As argued by de Boer et al. (2018), civilians are important stakeholders to gain public support. Governmental institutions also play a role because the government is responsible for designing the public space (MEZK, 2019). Following Peters (2015), permit processes also tend to have a significant influence on the decision-making process by providing legal instruments. For Dutch permit processes explicitly, a 'bestemmingsplan' (intend spatial development plan) is important. This document contains the future function of a specific area and consequently influences nature development and landscape integration (MEZK, 2019).

In the case of a spatial development a goal or objective, defined after the decision-making process, is translated into a design (Kiker et al., 2005). The principles argued by van der Zee et al. (2019) in section 2.2 are crucial for nature development within eco-solar parks and the spatial design of the parks. Visibility and local conditions function as vital parameters for the landscape integration of an eco-solar park (de Boer et al., 2018). After the design is agreed upon, the third phase of the implementation process, the realization, follows. Once the realization is done and the park is maintained, the project can be evaluated and the quality of nature can be monitored (Van der Zee et al., 2019). While nature development and landscape integration can be interconnected, it is important to investigate if and how the landscape integration influenced the realized biodiversity (van der Zee et al., 2019).

Once a spatial project is realized, the project will be operationalized (Nilsson, 2007). As the operationalization of solar parks is primarily focused on civil engineering, it is of less interest for this research. However, the maintenance of natural values within the eco-solar park is of great importance for nature development (van der Zee et al., 2019). Therefore, attention will be placed on how the natural values within the park are maintained once the realization is finished.

2.5 Conceptual model

Based on the scientific literature addressed in the theoretical framework, a conceptual model has been designed to create a schematic overview of the relevant concepts. The conceptual model is shown in figure 1. The red marked area will be investigated within this research.

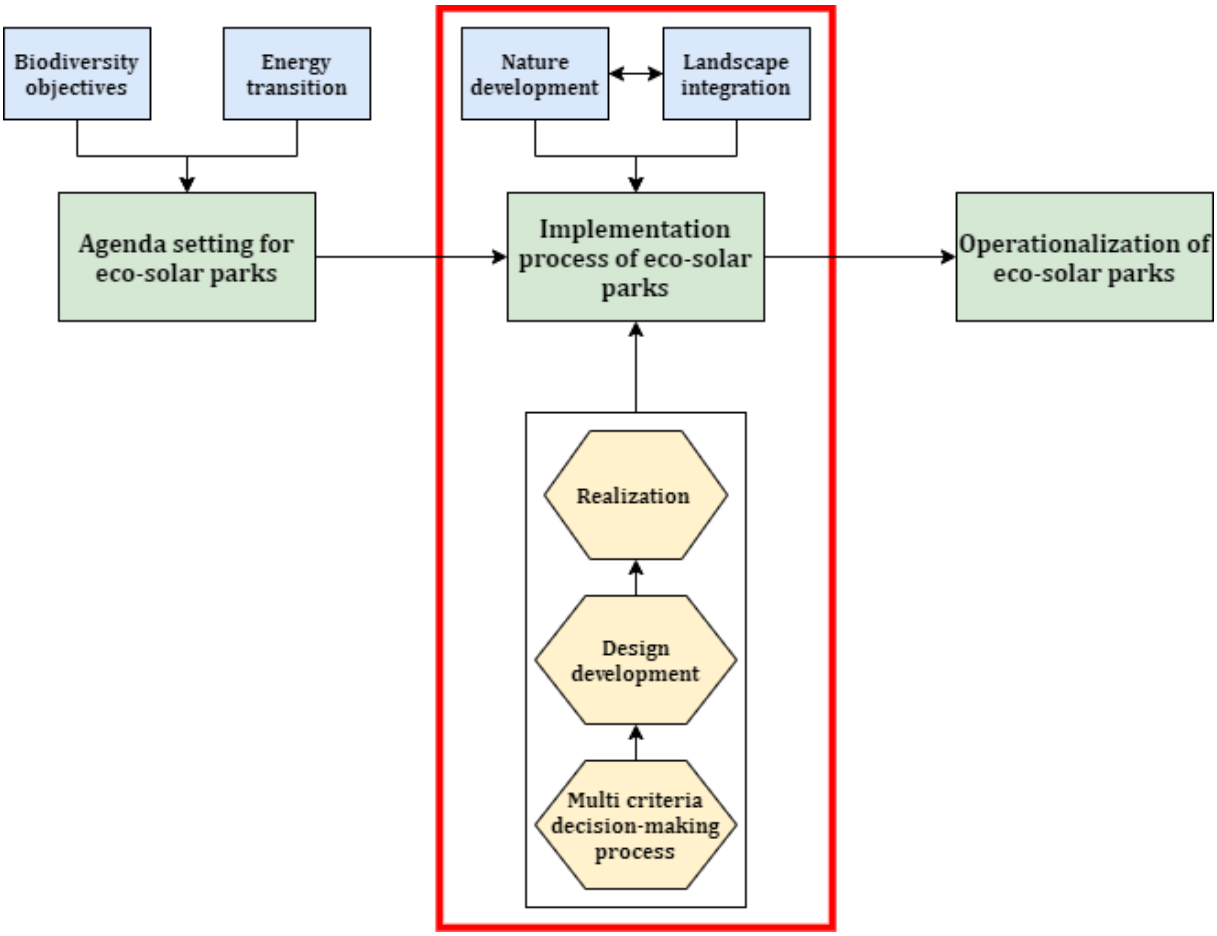


Figure 1: Conceptual model (Author, 2020).

3

3. Methodology

3.1 Case study approach and selection

A case study approach is particularly helpful to gain specific information about a certain topic which is put into practice (Cliford et al., 2016). These specific details are necessary to gain an in-depth insight into the structure and content of the implementation processes of the eco-solar parks. However, a disadvantage of the case study approach can be that the collected data is too small/detailed to draw general lessons from the defined practices (Clifford et al., 2016). This is an important aspect to keep in mind while collecting secondary and, especially primary data.

3.2 Case studies

3.2.1 Boeldershoek-West

Boeldershoek-West is situated in the municipality of Enschede, in the Dutch province of Overijssel. The area is in possession by the waste processor & energy producent Twence B.V, which initiated the development of Boeldershoek-West. The eco-solar park itself is situated between an industrial area on the north side, a highway on the southside, agriculture on the westside, and the waste processor installation of Twence on the eastside. The park covers more than 20 hectares and includes 60.000 solar panels (Twence, 2020). The surrounding countryside is characterized by a parcel structure of agriculture and nature areas. The nearest Natura 2000 area is located 5.5 kilometers away (Eelerwoude, 2018). Figure 2 contains a map of the project area of Boeldershoek-West. A larger version of the map is provided in appendix 1.

Figure 2: Boeldershoek-West (Author, 2020).

3.2.2 Appelscha Hoog

Solar park Appelscha Hoog, which is operated by the company of Groenleven, is situated in the municipality of Ooststellingwerf (Friesland). The development of Appelscha Hoog is initiated by the owner of the area: the municipality of Ooststellingwerf. The park covers 12 hectares, includes

36.000 solar panels (Groenleven, 2020), and is located south of the town of Appelscha. Directly south of the park, the Drents-Friesche Wold is situated, a Natura 2000 area. On the westside of the park there is a recreation park and on the eastside there is agriculture. Figure 3 contains a map of the project area of Appelscha Hoog. A larger version of this map is included in appendix 2.

Figure 3: Appelscha Hoog (Author, 2020).

3.3 Data collection instrument

3.3.1 Secondary Data

Policy documents were reviewed to gain information about the legal frameworks relevant for the implementation processes of Boeldershoek-West and Appelscha Hoog. In the first contact with the defined actors, named in the next paragraph, the actors were asked which documents were, according to them, relevant in developing the parks. By letting the actors suggesting the documents, it was ensured that the reviewed documents were truly relevant for the implementation processes of Boeldershoek-West and Appelscha Hoog.

The derived information from the secondary data functioned as important background information for conducting the interviews. Secondly, a basic understanding about the implementation processes of both eco-solar parks was generated by critically reading the documents. Moreover, the questions formulated for the semi-structured interviews are partly based on the information derived from the secondary data research. By making this link, a deeper insight is created about relevant aspects defined in the policy documents (Longhurst, 2016).

After contacting the defined actors, the documents in table 1 were reviewed:

Table 1: Overview of the investigated policy documents (Author, 2020).

Document	Source
Bestemmingsplan Boeldershoek 2018	gemeente Enschede (2016)
Development solar park Boeldershoek-West. Correct spatial establishment.	Witteveen+Bos (2017)
Landscape integration Boeldershoek-West	Eelerwoude (2016)
Quickscan protected species Boeldershoek-West	Eelerwoude (2016)
Facetbestemminsplan solar parks Ooststellingwerf	BügelHajema (2016)
Paragraph ecology solar park municipality of Ooststellingwerf	BügelHajema (2016)
Landscape integration Appelscha Hoog	gemeente Ooststellingwerf (2016)

3.3.2 Primary Data

Semi-structured interviews were considered most applicable to gain specific insight into the implementation processes of Boeldershoek-West and Appelscha Hoog. Semi-structured interviews consist of a scheme of predetermined questions, but with space for the interviewees to address issues they consider important as well. Flexibility is offered to the interviewer to go more in depth into the relevant new information which is not addressed in scientific literature (Longhurst, 2016; van Lanen, 2018). Local experts have space to address information they consider as relevant while the interview remains structured to collect as much detailed information as considered necessary (Longhurst, 2016).

Table 2: Overview of the interviewees (Author, 2020).

Date	Participant
April 8, 2020	***Huub Olde Loohuis*** Employee landscape and greenery – Twence B.V. Huub Olde Loohuis was part of the project team for Boeldershoek-West in the function of landscape and greenery.
April 8, 2020	***Sijtse Jan Roeters*** Landscape architect – Eelerwoude. Sijtse Jan Roeters was, together with Twence B.V, responsible for designing Boeldershoek-West.
April 15, 2020	***Jeroen Busscher*** Environmental manager – municipality of Enschede. Jeroen Busscher was involved in the permit process of Boeldershoek-West.
April 21, 2020	***Tinka Wuite*** Policy officer spatial planning – municipality of Ooststellingwerf. Tinka Wuite was involved in the permit process of Appelscha Hoog.
April 24, 2020	***Gerwin Strieks*** Project manager solar field Boeldershoek-West – Twence B.V. Gerwin Strieks was the project manager of solar field Boeldershoek-West.
April 28, 2020	***Pina Dekker*** Policy officer nature and landscape – municipality of Ooststellingwerf. Pina Dekker gave advise about nature development in Appelscha Hoog and was actively involved in the development of the former plan for Appelscha Hoog.
May 18, 2020	***Fin Jilderda*** Policy advisor spatial plans – province of Friesland. Fin Jilderda was partly involved in ensuring the inclusion of the interest of the province of Friesland in the development of Appelscha Hoog.

It is vital to select relevant participants for the semi-structured interviews (Longhurst, 2016; van Lanen, 2018). Both Boeldershoek-West and Appelscha-Hoog were identified as eco-solar parks after conducting online research. While performing this online research, the first relevant institutes were identified. In the next step, the institutes were contacted and by doing so the first persons who were involved in the development of one of the eco-solar parks were identified. These actors were asked which other actors were involved in the implementation process and so forth. A critical selection of the proposed actors was made to create a balance between actors involved in the permit processes and actors involved in landscape/nature aspect of the implementation processes. By applying this strategy in recruiting participants, relevant actors were contacted in an efficient way (Valentine 2005, cited by Longhurst, 2016). Table 2 provides an overview of the participants.

3.4 Reflection on the data collection process

The general interview guide used for the interviews can be found in Appendix 3. The Dutch version can be found in appendix 4. Specific follow up questions are not included in this guide, but were asked to specific actors based on previous interviews or secondary data. By using the same interview guide, it was possible to compare the outcomes of the interview and, by doing so, to draw valid conclusions from the results (Longhurst, 2016). The questions in the interview guide are based on the literature described in the theoretical framework and the information derived from the secondary data research.

Due to the Covid-19 virus, it was not possible to conduct interviews face to face, therefore all the interviews were conducted by online video-calls. Originally, the objective was to have an interview with Groenleven as well. However, the relevant person was not working at the company anymore, therefore the interview with the operator of Appelscha Hoog did not take place. Next to performing the interviews, site visits to both eco-solar parks were conducted as well on May 17, 2020. Unfortunately, due to the Covid-19 virus, the site visits had to be performed by the author himself and could not be combined with a guided tour by one of the interviewees. However, the site visits gave a good impression about Boeldershoek-West and Appelscha Hoog.

The transcripts of the conducted interviews were analyzed by making use of deductive and inductive codes in Atlas.ti. By making use of this online program, it was possible to create a schematic overview of relevant aspects within the transcripts. This schematic overview was then compared with notes of the transcripts made by the author before using Atlas.ti to create a deeper understanding of the collected data. The deductive codes were based on information derived out of the theoretical framework, making it possible to link the results with the scientific literature. With inductive coding, relevant aspects of the implementation processes which were mentioned in the interviews but not in the scientific literature, were labeled as well (Cope & Kurtz, 2016). The combination of both inductive and deductive coding therefore connects the theory with the collected data while it is broadened by relevant new insights (Cope & Kurtz, 2016). The code tree in appendix 5 provides a schematic overview of the codes used in the data-analysis. The code book in appendix 6 shows whether the code is deductive or inductive and provides the source of the specific code.

3.5 Validity and reliability

By formulating the interview questions based on scientific literature and secondary data, multiple methods were mixed with the aim to collect valid primary data. Generally, triangulation, the use of mixed methods, strengthens the validity of the results (Clifford et al., 2016). However, a margin of uncertainty remains present because of possible misinterpretations of the interview questions by the interviewee or misinterpretations of the researcher in analyzing the data. Despite the fact that personal interests can influence semi-structured interviews, the results are seen as reliable.

This is because it was possible to make a critical comparison between the results by making use of a general interview guide.

Participants, especially those contacted first, had a significant influence on the selection of subsequent actors contacted for the primary data. Therefore, there is a possibility of a bias in the recruited participants, especially since the author is not an insider in the implementation processes of both eco-solar parks. Attempts to minimalize this bias were conducted by performing a critical selection of the contacted participants to create the balance as described in section 3.3.2.

3.6 Ethical considerations

Before conducting the interviews, the educational purpose and aim of the research were explained to the participants. It was also made clear that the research did not serve any commercial or political interest and that the researcher is completely objective. Participants voluntarily participated in the semi-structured interviews and were asked whether they wanted to stay anonymous in the thesis. Only with the agreement of the participants on the transcript, sometimes with some adjustments, the transcripts were used for the data-analyzing process. The transcripts were only used between the researcher and the supervisors and are not included in this thesis due to privacy concerns. This thesis may only be used for educational purposes and sharing this thesis requires agreement from both the researcher and the supervisor.


4

4. Results

4.1 Multi criteria decision-making process

4.1.1 Stakeholders

Civilians

A resonance group of inhabitants was constructed to primarily give feedback on the design of Boeldershoek-West. Other inhabitants were informed and able to give feedback during walk-in evenings. As in line with Pasqualetti (2011), it was argued by Huub Olde Loohuis that civilians were involved because the park would significantly impact their view on the surrounding landscape. Involving civilians was also an important objective set by the municipality of Enschede in developing the park: *"We aim for citizen participation and involving the inhabitants as much as possible. By doing so, inhabitants know what it is expected from them and which developments are planned"* (Jeroen Busscher).

Walk-in evenings were organized for Appelscha Hoog as well. Citizens mainly influenced the design of the park, whereas residents were concerned about visibility aspects of the park. Integrating the park in the surrounding landscape therefore became an important objective in developing Appelscha Hoog, Tinka Wuite explained, which is strengthened by de Boer et al. (2018). Moreover, the province of Friesland strongly advised to involve citizens in the decision-making to create public support for the implementation of the park.

Government

The municipality of Enschede reviewed the plans for Boeldershoek-West in order to provide the relevant permits. To gain the relevant permits, two important pre-requests needed to be met: landscape integration and citizen involvement, which were in line with the objectives set by the province of Overijssel.

The municipality of Ooststellingwerf, the owner of Appelscha Hoog, initiated the development of the solar park and conducted the permit process. Especially the council of the municipality of Ooststellingwerf was important, whereas: "*the council makes the final decision whether the park will be implemented or not"*, Tinka Wuite explained. The province of Friesland was particularly involved in the inclusion of the ecological zone in the park, before the provincial permission for the park was given.

Other relevant parties

Landscape architects were actively involved in developing Boeldershoek-West. Eelerwoude made the landscape integration plan for the park and, consequently gave advise about the design of the park. Particular attention was focused on the ecological connection of the park, which has high potential for nature development according to van der Zee et al. (2019). In Appelscha Hoog, landscape architects played a less prominent role, only giving a small amount of non-binding advise. Pina Dekker argued that it would be in favor of nature development if a landscape architect/advisory group would be involved standardly in developing solar parks.

Finally, the operator was a relevant stakeholder. In the case of Boeldershoek-West this was Twence itself. Twence appointed a diverse project team to develop the solar park in which specific attention was payed for the landscape integration and nature development of the park. For Appelscha Hoog, the company of Groenleven was the operator of the solar field and responsible for maintaining the solar panels. In the interviews it was not mentioned that the operator was involved in the landscape integration or maintaining the natural values in the park.

4.1.2 Costs

"*If it would not have been a viable investment, we would not have done it*" (Gerwin Strieks). This quote, which is in line with Kiker et al. (2005), emphasizes the great importance of the financial feasibility of both parks. Within the financial feasibility, the profits of solar energy are vital and influence other aspects of the implementation process. To illustrate, the spatial design of Boeldershoek-West, specifically the location of the solar panels, was constructed to gain maximal profits. Nature development was not allowed to be at the cost of potential locations for the solar panels since that was the revenue model of the park, Huub Olde Loohuis and Sijtse Jan Roeters explained. However, the other way around, this was at the cost for potential nature development and landscape integration.

In an earlier plan for the location of Appelscha Hoog, there used to be a nature strip of 40 meters. To gain enough profits, the strip was reduced to 25 meters and the solar park was even extended on the north side. Due to the focus on profits, the attention for nature development declined significantly, Pina Dekker mentioned. The profits gained by the municipality of Ooststellingwerf, were used for other sustainable initiatives within the municipality.

4.1.3 Monitoring

No other plans were developed for Boeldershoek-West. Other options were looked at, but a solar field turned out to be the most applicable because of the sustainability objectives of Twence, Huub Olde Loohuis argued. Also, there was already experience with implementing a solar field, since a relatively small park was developed earlier on the terrain of Twence. The initiative, which was in line with its sustainability objectives, was stimulated by the municipality of Enschede. In monitoring the plan, the ambition to create nature development was an important aspect, as argued by Huub Olde Loohuis and Sijtse Jan Roeters. This is in contrast however with Jeroen Busscher, who mentioned that nature quality was not that prominent in the plan for Boeldershoek-West. Finally, as addressed in section 4.1.1, the landscape integration of the park was an important aspect in generating public support.

Originally, the intention for Appelscha Hoog was to create a recreative area with a natural swimming pool. However, due to financial concerns this plan was not implemented. In the recreation plan, a nature strip of 40 meters was designed and agreed upon with the province. Because of this contract, the province insisted on the inclusion of the nature strip in the design of the solar field. To address the importance of the recreational plan, Pina Dekker mentioned: *"That the park is a nature inclusive park is quite a coincidence. It is really because of the original recreation plan. If that plan would not have been there, I think it would never have been a case on this location."*

However, the quality of nature was quite subordinate to gaining profits in the solar field. *"The idea of combining solar fields with nature values was relatively new. There was no assessment framework for it. Our policies prioritize that no nature value will be lost, but it does not look at the potential to develop new nature. However, this is particularly interesting for developing solar fields",* Pina Dekker argued. Therefore, the operator was not forced to create a higher value of nature in the agreements made for developing the solar park. Finally, to generate public support as in line with de Boer et al. (2018), it was of vital importance that the generated energy in the solar field was only meant for the town of Appelscha itself. The amount of generated energy was not allowed to exceed the energy consumption of Appelscha, as explained by Fin Jilderda: *"You should look at the required energy of the centrum, what does Appelscha need?. You are not allowed to generate more energy than the town needs. That is a requirement too."*

4.1.4 Permit process

The permit process of Boeldershoek-West was constructed with an environmental decision of 10 years. This was done because developing a solar field did not fit in the 'Bestemmingsplan' of the

project area. The environmental decision started with concept drawings and ended with a principle decision to develop the park. Within the process, a spatial establishment and ecological assessment were necessary to receive relevant permits. The ecological assessment looked at the current quality and quantity of nature in the area and the potential of the area to develop nature. Thirdly, a landscape integration plan was an important requirement of the municipality of Enschede.

The development of Appelscha Hoog was part of a 'facet-Bestemmingsplan' for multiple solar parks in the municipality of Ooststellingwerf. After involvement of citizens, certain potential locations remained including Appelscha Hoog. After the choice of location the spatial establishment, landscape integration, and ecological assessment were made up and shown to the province of Friesland. In contrast with Boeldershoek-West, no specific attention was payed to the potential to develop nature in the park, next to the strip of nature, Pina Dekker mentioned. Furthermore, it is important to mention that the decision-making process of Appelscha Hoog was part of the Crisis and Recovery Law. Because Appelscha Hoog was part of this law, there was no specific permit necessary for the realization phase, Tinka Wuite argued.

Completing the permit processes of both eco-solar parks was crucial to receive the SDE subsidy, provided by the national government (RVO, 2020). *"The project stands or falls with the provision of the subsidy. One of the requirements is that all permits need to be extracted by the local government, the municipality, to continue with the subsidy".* This quote of Jeroen Busscher emphasizes the great importance of the subsidy. The SDE subsidy demands a finished permit process of the local municipality before the subsidy is provided. The inclusion of nature development and landscape integration therefore depends on the specific permit process of the relevant municipality.

4.2 Design development

4.2.1 Nature development

In its former function, Boeldershoek-West used to be an agricultural area which included a conifers nursery and contained almost no natural quality. Within the design of the eco-solar park, an explicit link was made with the surrounding natural area of water retention, afforestation and meandering streams. "*All vegetation is situated outside the grid. By doing so you connect to the surrounding landscape and maintain corridors for wildlife. Even parts within the park have an extra connection with the zone of greenery outside"*, Huub Olde Loohuis argued. This is in line with van der Zee et al. (2019), who argued that solar parks can have significant potential to function as ecological corridors. However, a discussion remains about the extra connection from inside the park to the outside greenery. Namely, Sijtse Jan Roeters and Gerwin Strieks argued that the nature value is situated in the strip surrounding the solar panels, which is visualized in photo 1. The vegetation within the strip and the park was designed with native plant materials, including herbal rich flowers to create a habitat for insects, as in line with van der Zee et al. (2019).

Appelscha Hoog also used to be an agricultural area before the implementation of the solar panels. In the former recreative plan, an ecological connection was designed specifically for migration of animals coming from the nearby Nature 2000 area, the Drents-Friesche Wold. This strip of nature was, as argued, included in the design of Appelscha Hoog as well, but contained less natural value. This was partly because the strip was reduced by 15 meters, but also because the design of the strip changed to a 'natural dike', Pina Dekker addressed. This 'natural dike' was designed with some native plant material, including herbal rich flowers. However, this 'natural' dike did not include the variety of plants and trees as designed in the previous strip of nature. As a result, the 'natural' dike had significantly less potential for nature development than in the recreational plan.

Photo 1: The strip of nature surrounding Boeldershoek-West (Author, 2020).

4.2.2 Spatial design solar field

The solar panels in Boeldershoek-West were designed in strips of 6 meters, with 3 meters of space between them and the panels situated 1.2 to 1.4 meters above the ground. By doing so, soil compaction was avoided and enough light would be able to reach the ground. The aim was, as in line with van der Zee et al. (2019), to develop vegetation under the solar panels which would create a habitat for insects, birds and small mammals, Huub Olde Loohuis and Sijtse Jan Roeters argued. The space between the panels, which were designed in a north-south construction, was designed for flying routes of birds. Originally, the space between the strips of panels, designed by Eelerwoude, was bigger for flying routes of predator birds. However, as argued, this was not done because it would negatively affect the generated amount of profits.

Little was mentioned about the spatial design of Appelscha Hoog. Within the park itself, it was argued that no attention was payed to natural values. The panels were not designed in such a way that it could create a habitat for either birds or insects. This is backed up with information derived from the 'bestemmingsplan'. In this document it was argued that the natural value was situated within this natural strip and that there were no natural values included in the spatial design of the solar park itself (gemeente Ooststellingwerf, 2016).

4.2.3 Integration in landscape

Visibility was the key variable for landscape integration of both eco-solar parks, as in line with Pasqualleti (2011) and de Boer et al. (2018). For Boeldershoek-West, the vegetation at the fences is mainly designed for shielding off the solar field. Despite this vegetation, local residents did get financial compensation for horizon pollution. Furthermore, the landscape integration of Boeldershoek-West was done by designing natural elements which were common in the area to fit the park in the identity of the surrounding landscape (gemeente Enschede, 2016). By doing so, nature development became an instrument for landscape integration to generate public support, as addressed in de Boer et al. (2018) and van der Zee et al. (2019). Finally, the slope of the park was preserved because of water retention and natural values, Gerwin Strieks emphasized.

Appelscha Hoog was designed with a 'natural dike', visualized in photo 2, which reduced the ecological potential significantly compared to the former natural strip, Pina Dekker argued. She continued that this 'dike' however, was designed because of visibility concerns from the local residents. The function of the strip therefore shifted to a natural barrier to place the solar field out of sight. Even though the 'dike' contains some natural values, no explicit combination was made between nature development and landscape integration. Finally, the park was situated at the edge of the town of Appelscha to avoid fragmentation of the rural area, Tinka Wuite addressed.

Photo 2: The 'natural dike' surrounding Appelscha Hoog (Author, 2020).

4.3 Realization

4.3.1 Natural value

"We made an inventory of the nature quality before and after the realization of the park. We now see a clearly visible increase of breeding birds, insects, mammals". This quote from Huub Olde Loohuis addresses the developed quality of nature in Boeldershoek-West. This is strengthened by Sijtse Jan Roeters, who argued that the herbal rich vegetation is good for insects and for birds. The natural value of the park is mainly concentrated within the natural strip surrounding the park designed both for nature development and landscape integration. On the other hand, Sijtse Jan Roeters argued that: "*the park is realized not that long ago. So we have not conducted a multi-year research. That is however necessary to investigate if the park improves the biodiversity.*"

The quality of nature is not monitored in Appelscha Hoog, or Tinka Wuite and Pina Dekker are not aware of it, they mentioned. Therefore it is difficult to say if the solar field contains a higher level of biodiversity than before the implementation of the park. Pina Dekker however, thinks that the park does not contain a higher level of biodiversity now compared to the area's former function. The biodiversity within the strip needs time to develop, but will be significantly lower than the foreseen strip of nature in the recreative plan, or when there was an explicit combination made between landscape integration and nature development.

4.3.2 Maintenance

Agreements were made within Twence to maintain the natural values within the park. Differentiated extensive maintenance by making use of grazing sheep, which was agreed upon in the design development phase, is applied in Boeldershoek-West. Huub Olde Loohuis mentioned

that he is satisfied to a certain amount with the realized nature quality. However, he addressed that a higher level of nature quality was possible with a more nuanced grazing regime and planting more herbal rich flowers within the park. Regarding the future plans for Boeldershoek-West, there is currently a process going on to change the permit for the solar park from 10 to 25 years, Jeroen Busscher addressed.

There is no legal instrument forcing the operator of Appelscha Hoog to maintain the natural values in the park, as previously addressed. Maintaining the natural values is completely voluntary, and depends on the willingness of the operator to do so. The natural values within the park, or the 'natural dike' would have been more ensured if explicit agreements were made about the maintenance, Pina Dekker argued. Both in the primary and secondary research no information was given about the future plans for Appelscha Hoog.


5

5. Conclusion and discussion

5.1 Conclusion

A qualitative data research has been executed to answer the following research question: *"How are nature development and landscape integration included and potentially combined within the implementation processes of eco-solar parks Boeldershoek-West and Appelscha Hoog?"*

Citizens were actively involved in the decision-making processes of Boeldershoek-West and Appelscha Hoog. Because of visibility concerns, as in line with Pasqualleti (2011) and de Boer et al. (2018), local residents significantly influenced the landscape integration of both eco-solar parks. Municipalities were important stakeholders because they provided the relevant permits for implementing the parks. Relevant provincial policies were also included within the permit process, because of the integration of the two governmental layers (Peters, 2015). Finally, the operator was of explicit importance to maintaining the natural values within the eco-solar parks.

Despite the fact that it was an important objective, nature quality was subordinate to financial feasibility within the decision-making processes of Boeldershoek-West and Appelscha-Hoog. Gaining maximum profits, as in line with Kiker et al. (2005), was even sometimes at the cost of potential nature development within both eco-solar parks. Therefore, it was crucial to receive the SDE subsidy, of which a finished permit process of the local government was an important condition. However, there was a difference between the legal frameworks of both parks regarding improvement of the ecological potential of the project area. In Boeldershoek-West opportunities to improve nature quality were looked at, while in Appelscha Hoog the objective was that no natural value should be lost.

Attention was payed to the spatial design of Boeldershoek-West to create a habitat for flora and fauna to improve the biodiversity of the area (van der Zee et al., 2019). Moreover, the strips of nature surrounding the solar field, which were designed with herbal rich vegetation, were designed for combining landscape integration and nature development. For Appelscha Hoog, the former recreational plan was designed with a strip of nature which would function as an ecological connection between two Natura 2000 areas. However, shielding off the park, because of visibility concerns, became an important objective within the landscape integration (Pasqualleti, 2011; de Boer et al., 2019). This was at the cost of the ecological potential of Appelscha Hoog: the strip of nature changed to a 'natural' dike containing less biodiversity.

Both parks were realized recently, therefore long-term ecological inventories, which are necessary to determine potential improvement in biodiversity (van der Zee et al., 2019) were yet not possible. Even so, the first signs of nature development are positive in Boeldershoek-West. It is important to continue with the extensive maintenance in the park to maintain the natural values as addressed by van der Zee et al. (2019). For Appelscha Hoog, maintenance of the natural values within the park is done on a voluntary basis. The future ecological potential of the park therefore depends on the willingness of the operator, addressing the importance of making agreements about maintaining natural values for future eco-solar parks.

In conclusion, it is argued that despite its inclusion within the implementation processes of Boeldershoek-West and Appelscha Hoog, nature development was subordinate to landscape integration, both because of financial feasibility as well as concerns about visibility. However, as the case of Boeldershoek-West shows, there is significant potential to combine nature development and landscape integration to fulfill both biodiversity objects and to gain public support.

5.2 Discussion

Within the theoretical framework, the three main phases of the implementation process were clearly defined. However, while conducting the interviews, it turned out that the multi criteria decision-making phase and design development phase were closely connected with each other and often took place in a parallel timeframe. Moreover, the design sometimes tended to be part of the decision-making process. At times this made it challenging to follow the structure of the interview guide, which was based on the structure of the theoretical framework. It also made it more challenging to analyze the primary data based on the theoretical framework. For future research, it is important to include the interwovenness of these two phases within the theoretical framework and data collection process.

Within this research, no civilians were interviewed. This was not done due to time management issues and difficulties to contact relevant citizens. For future research, it is recommended to include civilians. As addressed, citizens are crucial stakeholders. Investigating their point of view and opinions about nature development, especially landscape integration within eco-solar parks could provide promising new insights which could strengthen the practices defined in this thesis.

Both eco-solar parks were realized recently. Therefore, as addressed, long term ecological inventories about biodiversity improvement within the parks were not available. This made it challenging to answer the fourth sub-question. For future research, it is important to investigate eco-solar parks which contain long term ecological inventories to create an in-depth understanding about the biodiversity development within the specific eco-solar park.

The key practices formulated within the conclusion are based on the implementation processes of two specific case studies. Therefore, the defined practices are not applicable to their full extent on the implementation processes of future eco-solar parks, because every spatial project is implemented in a specific context. The practices provide general guidance, but stakeholders involved in future eco-solar parks need to determine the applicableness of the practices themselves.

5.3 Recommendations

Boeldershoek-West and Appelscha Hoog were both realized in 2018. Even though that was still a relatively short time ago, developments in (eco)-solar parks and related policies went have rapidly developed since then. Specifically the policy documents ‘Omgevingsvisies’ are relevant for future implementations of eco-solar parks because they provide the legal framework for spatial developments within landscapes. Therefore a future study is recommended which investigates the opportunities for the integration of the defined practices in ‘Omgevingvisies’. By doing so, the defined practices have a higher potential to be implemented within future eco-solar parks.

6. References

Armstrong, A., Waldron, S., Whitaker, J. & Ostle, N. J. (2014). Wind Farm and Solar Park Effects on Plant-Soil Carbon Cycling: Uncertain Impacts of Changes in Ground-Level Microclimate. *Global Change Biology,* 20(6), pp. 1699–1706. doi: 10.1111/gcb.12437.

Batel, S., Devine-Wright, P. & Tangeland, T. (2013) Social acceptance of low carbon energy and associated infrastructures: a critical discussion. *Energy Policy,* 58, 1-5. http://dx.doi.org/10.1016/j.enpol.2013.03.018.

Boer, J. de, Zuidema, C., Hoorn, A. van & Roo, G. de (2019). The adaptation of Dutch energy policy to emerging area-based practices. *Energy Policy,* 117, 142-150. https://doi.org/10.1016/j.enpol.2018.02.008.

BügelHajema (2016). *Facetbestemmingsplan Zonnepaneelvelden Ooststellingwerf.* NL.IMRO.0085.BPZonnepaneelveld-OW01. Assen: BügelHajema Adviseurs.

BügelHajema (2016). *Paragraaf Ecologie – Zonnepaneelvelden gemeente Ooststellingwerf.* Appendix Facetbestemmingsplan Zonnepaneelvelden Ooststellingwerf. NL.IMRO.0085.BPZonnepaneelveld-OW01. Assen: BügelHajema Adviseurs.

Bulkens, M., Muzaini H. & Minca, C. (2016). Dutch new nature: (re)landscaping the Millingerwaard, *Journal of Environmental Planning and Management*, 59(5), pp 808-825. doi.org/10.1080/09640568.2015.1040872.

CBS (2019-1). *Statline, Bevolking; kerncijfers.* Retrieved on February 23, 2020 from https://opendata.cbs.nl/statline/#/CBS/nl/dataset/37296ned/table?fromstatweb. Centraal Bureau voor de Statistiek.

CBS (2019-2). *Aandeel hernieuwbare energie naar 7,4 %.* Retrieved on February 20, 2020 from https://www.cbs.nl/nl-nl/nieuws/2019/22/aandeel-hernieuwbare-energie-naar-7-4-procent. Centraal Bureau voor de Statistiek.

Clifford, N., Cope, M., Gillespie, T. & French, S. (Red.) (2016). *Key Methods in Geography.* 3th edition. London: SAGE.

CLO (2018). *Natuurbeleid en natuurbescherming: trends in kwaliteit van natuur, 1990-2017.* Retrieved on February 23, 2020 from https://www.clo.nl/indicatoren/nl2052-trend-kwaliteit-natuurtypen. Copendium voor de Leefomgeving.

Cope, M. & Kurtz, H. (2016). Organizing, Coding, and Analyzing Qualitative Data. *Key Methods in Geography,* pp. 647-665. London: SAGE.

Dam, F. van, Tisma, A. & Diederiks, J. (2018). *Transities, ruimteclaims en landschap.* 3013. Den Haag: Plan Bureau voor de Leefomgeving (PBL).

Dhar A, Naeth, M. A., Jennings, P. D. & Gamal El-Din, M. (2019). Perspectives on Environmental Impacts and a Land Reclamation Strategy for Solar and Wind Energy Systems. *The Science of Total Environment,* 718, pp. 1-13. doi: 10.1016/j.scitotenv.2019.134602.

Dhurry, A. Z., Allam, Z., Lobine, D. & Lollchund, M. R. (2019). Sustainable Renewable Energy Planning and Wind Farming Optimization from a Biodiversity Perspective. *Energy,* 185, pp. 1282–1297. doi: 10.1016/j.energy.2019.07.147.

Doevendans, K., Lörzing, H. & Schram, A. (2007). From Modernist Landscapes to New Nature: Planning of Rural Utopias in the Netherlands. *Landscape Research,* 32(3), pp. 333–354. doi: 10.1080/01426390701318270.

Eelerwoude (2016). *Landschappelijke inpassing Boeldershoek-West.* Goor: Eelerwoude.

Eelerwoude (2016). *Quickscan soortenbescherming Boeldershoek-West.* Goor: Eelerwoude.

Eelerwoude, 2018. *Grootste Zonnepark Overijssel: goed voor de biodiversiteit.* Retrieved on Februari 23, 2020 from https://www.eelerwoude.nl/project/grootste-zonnepark-van-overijssel-goed-voor-de-biodiversiteit/.

EHVB (2019). *T'Oor Den Haag.* Retrieved on February 20, 2020 from https://www.evhb.nl/projecten/t-oor-den-haag/. Energie van Hollandsche Bodem.

Gemeente Enschede, 2016. Toelichting bestemmingsplan Boeldershoek 2018. Retrieved on March 31, 2020 from https://www.ruimtelijkeplannen.enschede.nl/plannen/NL.IMRO.0153.BP00169/NL.IMRO.0153.BP00169-0002/t_NL.IMRO.0153.BP00169-0002.html.

Gemeente Ooststellingwerf, 2016. *Appelscha Hoog. Voorstel landschappelijke inpassing.* Retrieved on April 4, 2020 from https://www.ooststellingwerf.nl/mgd/files/facetbestemmingsplan_zonnevelden.pdf.

Gemeente Ooststellingwerf, 2018. *Zonnevelden.* Retrieved on May 15, 2020 from https://www.ooststellingwerf.nl/zonnevelden.

Groenleven, 2020. *Zonneparken: Gemeente Ooststellingwerf.* Retrieved on May 24, 2020 from https://groenleven.nl/projecten/zonneparken-ooststellingwerf.

Hodder, K. & Bullock, J. (2010). Really Wild? Naturalistic Grazing in Modern Landscapes. *British Wildlife,* 20 (5), 37-43.

Hoorn, A., van, Tennekes, J. & Wijngaart, van den, R. (2010). *Quickscan energie en ruimte.* Raakvlakken tussen energiebeleid en de ruimtelijke ordening.

IRENA (2017). *Untapped potential for climate action: renewable energy in nationally determined contributions.* Abu Dhabi: International Renewable Energy Agency (IRENA).

Jansen, P., Stoep, J. van der, Jochemsen, H. & Keulartz, J. (2017). Wistful Wilderness: Communication About 'new' Nature in the Netherlands. *Journal of Environmental Policy and Planning,* 19(2), pp. 197–213. doi: 10.1080/1523908X.2016.1198254.

Lanen, S. van (2018). Qualitative data collection & ethical considerations. *Methods of Academic Research.* Groningen: University of Groningen.

Liu, Y., Zhang, R. Q., Huang, Z., Cheng, Z., López-Vicente, M., Ma, X. R. & Wu, G. L. (2019). Solar Photovoltaic Panels Significantly Promote Vegetation Recovery by Modifying the Soil Surface Microhabitats in an Arid Sandy Ecosystem. *Land Degradation & Development,* 30(18), pp. 2177–2186. doi: 10.1002/ldr.3408.

Longhurst, R. (2016). Semi-structured Interviews and Focus Groups. In Clifford, N., Cope, M., Gillespie, T. & French, S. *Key Methods in Geography,* pp. 143-156. London: SAGE.

Kaya, I., Çolak, M., & Terzi, F. (2018). Use of mcdm techniques for energy policy and decision-making problems: A review. *International Journal of Energy Research, 42*(7), 2344-2372. doi:10.1002/er.4016.

Kiker, G., Bridges, T., Varghese, A., Seager, T., & Linkov, I. (2005). Application of multicriteria decision analysis in environmental decision-making. *Integrated Environmental Assessment and Management, 1*(2), 95-108. doi:10.1897/IEAM_2004a-015.1.

MEZK (2018). *Klimaatakkoord.* Den Haag: Ministerie van Economische Zaken en Klimaat.

Nilsson, K., L. (2007). Managing Complex Spatial Planning Processes. *Planning Theorie and Practice,* 8(4), pp. 431–447. doi: 10.1080/14649350701664473.

Pasqualetti, M. J. (2011). Social barriers to renewable energy landscapes. *Geographical Review*, *101*(2), 201–223.

PBL & KNMI (2015). *Klimaatverandering – Samenvatting van het vijfde IPCC-assessment en een vertaling naar Nederland.* 1405. Den Haag & de Bilt: Plan Bureau voor de Leefomgeving and Koninklijk Nederland Meteorologisch Instituut.

Peters, G., B. (2015). *Advanced Introduction to Public Policy.* 1st Edition. Northampton, EdwardElgar Publishing.

Rauws, W. & Roo, de G. (2016). Adaptive Planning: Generating Conditions for Urban Adaptability. Lessons from Dutch Organic Development Strategies. *Planning and Design,* 43(6), pp. 1052–1074. doi: 10.1177/0265813516658886.

Rijksoverheid, 2019. *Rijksoverheid stimuleert duurzame energie.* Retrieved on February 23, 2020 from https://www.rijksoverheid.nl/onderwerpen/duurzame-energie/meer-duurzame-energie-in-de-toekomst.

RVO, 2020. *Stimulering Duurzame Energieproductie (SDE+).* Retrieved on May 24, 2020 from https://www.rvo.nl/subsidie-en-financieringswijzer/sde. Rijksdienst voor Ondernemend Nederland.

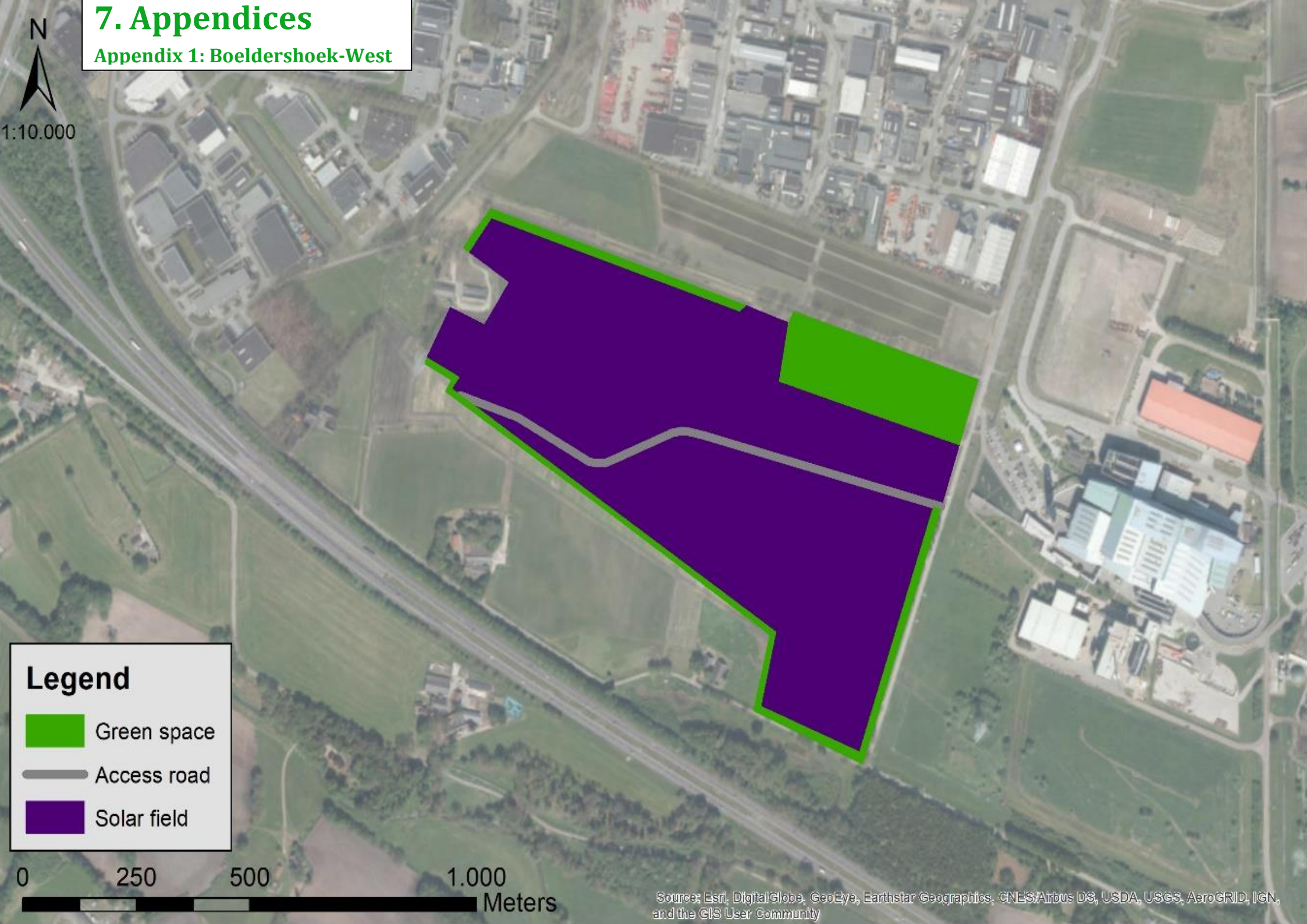
Twence, 2020. *Zonnestroom uit het groene hart van Overijssel.* Retrieved on May 18, 2020 from https://www.twence.nl/projecten/zon.html.

Witteveen+Bos (2017). *Ontwikkeling zonnepark Boeldershoek-West. Goede ruimtelijke onderbouwing.* HGL213-4/17-000.613. Deventer: Witteveen+Bos.

Zee, F. van der, Bloem, J., Galama, P., Gollenbeek, L., Os, J. van, Schotman A. & Vries, J. de (2019). *Zonnepark Natuur en Landbouw.* 2945. Wageningen: University of Wageningen.

7. Appendices

Appendix 1: Boeldershoek-West




Appendix 2: Appelscha Hoog
N
1:10.000
Legend
Green space
Access road
Solar field
0
250
500
1.000
Meters
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Appendix 3: General interview guide English

Introduction

Introducing story about my study and bachelor thesis. Also a short reflection will be given on earlier contact between me and the interviewee.

Role/function

1. How did you get involved in the development of Boeldershoek-West/Appelscha Hoog?
    a. In which period were you involved in the development?

2. What has been your role and function within the development of Boeldershoek-West/Appelscha Hoog?
    a. Which phase specifically? Decision-making, design, realization and/or maintenance?

3. What was the aim of developing Boeldershoek-West/Appelscha Hoog and with what aim did your instance take part in the development?

Decision-making

4. How was the decision-making about developing Boeldershoek-West/Appelscha Hoog constructed? Which criteria palyed a role?
    a. Why is there an explicit choice to develop a solar field on this location and not another renewable source of energy?
    b. Are there any alternative plans developed? Based on which criteria is decided for this specific plan?
    c. How where the estimated costs divided? Was there a possibility to make use of a subsidy?

5. How was the permit trajectory of Boeldershoek-West/Appelscha Hoog constructed? Which permit processes were fulfilled and why were these of specific importance?

6. Which other actors were according to you important in developing Boeldershoek-West/Appelscha Hoog? Why were these actors important?
    a. Which government layers were involved in the decision-making?
    b. How were civilians included in the decision-making process?
    c. Were there, according to you, actors missing in the decision-making process?

Design

7. Which criteria were according to you important in developing Boeldershoek-West/Appelscha Hoog? Why were these criteria important?
    a. What criteria determined the landscape integration?

8. How is it ensured that the generation of solar energy and nature development were combined in the design of Boeldershoek-West/Appelscha Hoog?
    a. Is the setup of the solar panels taken into account in relation to nature development?

Realization and maintenance

9. Do the solar parks Boeldershoek-West/Appelscha Hoog contain a higher level of nature than before the implementation of the park? How can this be seen and are you satisfied with the result?
    a. How is the natural value divided? Vegetation and animal species.

10. Do you have any other questions/remarks?

Appendix 4: General interview guide Dutch

Introductie

Inleidend verhaal over mijn studie en mijn scriptieonderzoek. Hierin ook even korte reflectie op het eerdere contact tussen mij en de betreffende persoon.

Rol/functie

1. Hoe bent u betrokken geraakt bij de ontwikkeling van Boeldershoek-West/Appelscha Hoog?
    a. In welke periode was u betrokken bij de ontwikkeling?

2. Wat is uw rol en functie geweest binnen de ontwikkeling van Boeldershoek-West/Appelscha Hoog?
    b. Welke fase specifiek? Besluitvorming, ontwerp, realisatie en/of beheer.

3. Met welk doel is Boeldershoek-West/Appelscha Hoog ontwikkeld en met welk doel heeft uw instantie hieraan bijgedragen?

Besluitvorming

4. Hoe verliep de besluitvorming over het ontwikkelen van Boeldershoek-West/Appelscha Hoog? Welke criteria waren hierbij van belang?
    a. Waarom is er specifiek gekozen voor een zonnepark op deze locatie en niet voor een andere duurzame energiebron?
    b. Zijn er alternatieve plannen ontwikkeld? Op basis waarvan is dit specifieke plan gekozen?
    c. Hoe waren de begrote kosten verdeeld? Kon er aanspraak gedaan worden op subsidies?

5. Hoe verliep het vergunningstraject van Boeldershoek-West/Appelscha Hoog? Welke vergunningsprocedures zijn doorlopen en waarom waren deze van specifiek belang?

6. Welke andere actoren waren volgens u belangrijk in de besluitvorming over Boeldershoek-West/Appelscha Hoog? Waarom waren deze actoren van belang?
    a. Welke overheden op welke schaalniveaus waren betrokken bij de besluitvorming?
    b. Hoe zijn burgers en omwonenden meegenomen in het beslissingsproces?
    c. Vond u dat er iemand/bepaalde functie ontbrak bij de besluitvorming?

Ontwerp

7. Welke criteria waren volgens u belangrijk in het ontwerp over Boeldershoek-West/Appelscha Hoog? Waarom waren deze criteria van belang?
    a. Op basis van welke criteria is de landschappelijke inpassing bepaald?

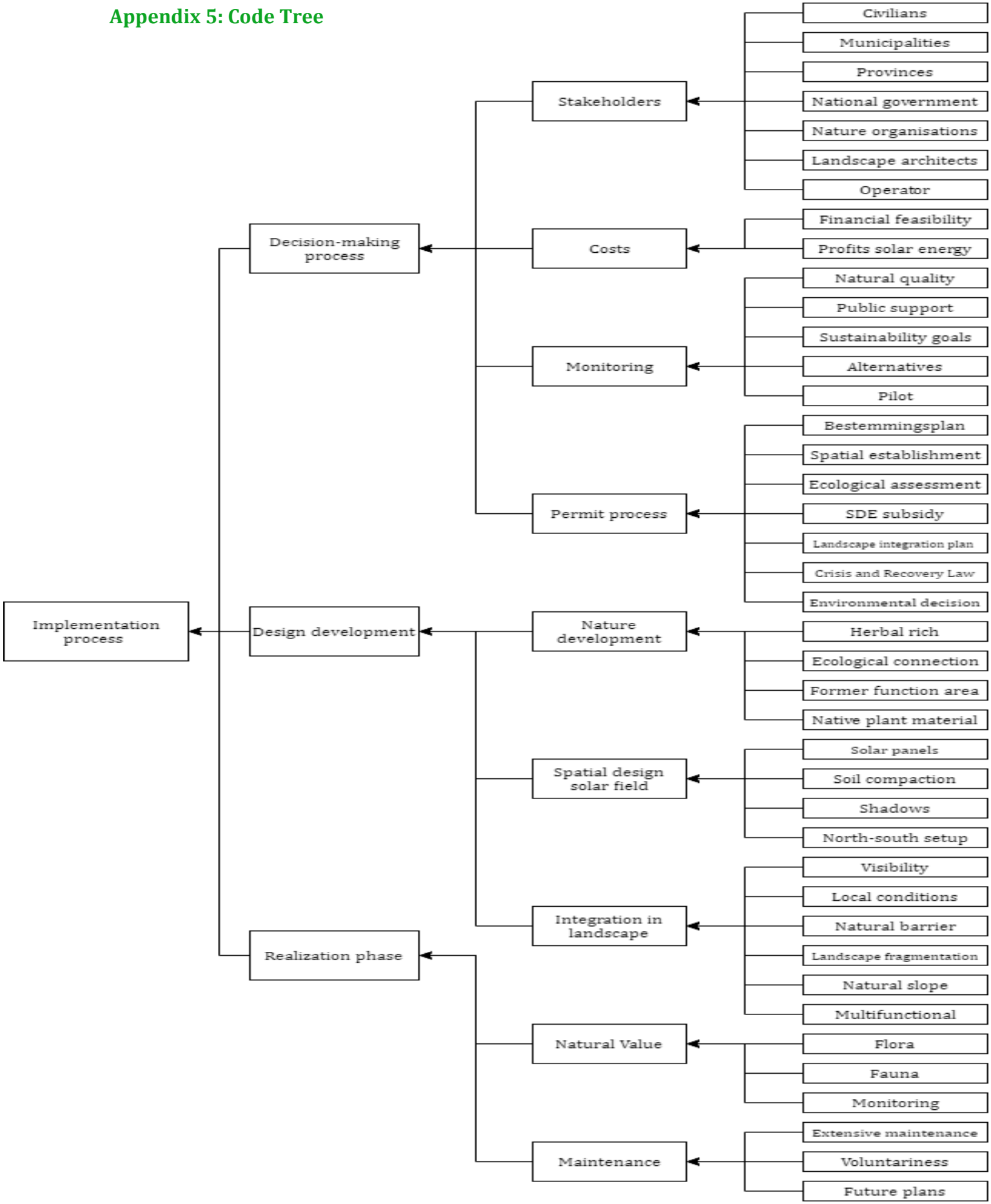
8. Hoe is er voor gezorgd dat het genereren van zonne-energie en het ontwikkelen van natuur gecombineerd waren in het ontwerp van Boeldershoek-West/Appelscha Hoog?
    a. Is er rekening gehouden met de opstelling van de zonnepanelen in betrekking tot natuurontwikkeling?

Realisatie en beheer

9. Bevat het zonnepark Boeldershoek-West/Appelscha Hoog een hogere natuurwaarde dan voor de realisatie van het plan? Hoe is dit terug te zien en bent u hier tevreden over?
    a. Hoe is de natuurwaarde onderverdeeld? Vegetatie en diersoorten.

10. Heeft u nog verdere vragen/opmerkingen?

Appendix 5: Code Tree



Appendix 6: Code book

Phases	Code	Sub-code	Deductive/ inductive	Source
Multi-criteria decision-making process	**Stakeholders**	Civilians	Deduct	Kiker et al. (2005) & de Boer et al. (2018)
		Municipalities	Deduct	MEZK (2019)
		Provinces		
		National government		
		Nature organizations	Deduct	van der Zee et al. (2019)
		Landscape architects		
		Operator	Deduct	Kiker et al. (2005)
	Costs	Financial feasibility	Induct	Interview SJ, JB, GS & PD
		Profits solar energy	Deduct	de Boer et al. (2019)
	Monitoring	Alternatives	Deduct	Kiker et al. (2005)
		Nature quality	Deduct	van der Zee et al. (2019)
		Public support	Deduct	Kiker et al. (2005), de Boer et al. (2018) & van der Zee et al. (2019)
		Sustainability goals	Induct	Interview HOL, SJ, JB, GS, TW & PD
		Pilot	Induct	Interview, HOL, JB, GS
	Permit process	'Bestemmingsplan'	Deduct	MEZK (2019)
		Spatial establishment	Induct	Interview JB, TW & PD
		Ecological assessment	Induct	Interview HOL & SJ
		SDE subsidy	Induct	Interview HOL, SJ, JB, GS, TW & PD
		Landscape integration plan		
		Environmental decision	Induct	Interview JB
		Crisis and Recovery Law	Induct	Interview TW
Design development	**Nature development**	Herbal rich	Deduct	van der Zee et al. (2019)
		Ecological connection		
		Former function area		
		Native plant material	Induct	Interview HOL, SJ & PD
	Spatial design solar field	Solar panels	Deduct	van der Zee et al. (2019)
		Soil compaction		
		Shadows	Induct	Interview HOL
		North-south set up	Induct	Interview HOL, SJ, GS & JB
	Integration in landscape	Visibility	Deduct	de Boer et al. (2018) & van der Zee et al. (2019)
		Local conditions		
		Natural barrier	Induct	Interview HOL, SJ, JB, GS, TW & PD
		Landscape fragmentation	Induct	Interview TW
		Natural slope	Induct	Interview GS
		Multifunctional	Induct	Interview HOL, TW & PD
Realization	**Natural value**	Flora	Deduct	van der Zee et al. (2019)
		Fauna		
		Monitoring		
	Maintenance	Extensive maintenance	Deduct	van der Zee et al. (2019)
		Voluntariness	Induct	Interview PD
		Future plans	Decuct	Kiker et al. (2005)