HYPERSCALING THE POLDERS

A study on energy (in)just plans for the implementation of datacentres & wind farms internationally and local community perception in The Netherlands.

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Abstract

In recent years the usage of data in the cloud has increased astronomically which demands a lot of development from companies supplying cloud services. To keep up with the growing demands of data usage, datacentres are being built and developed on a global scale. Site-selection for these datacentres is an important component because the right conditions need to be met; not only on financial and legal terms but almost more importantly on a spatial and environmental level. The largest of these datacentres, called hyperscales, use a lot of power to operate. To keep in line with the Renewable Energy Transition (RET) it is necessary that these centres run on green, sustainable energy sources like wind energy. Green Cloud Computing (GCC) synergizes nicely with RET because it focuses on making cloud storage of data more sustainable. Most newly developed datacentres focus on sustainable solutions for cloud storage to save cost and to improve their brand image. This thesis investigates the impact of datacentres and accompanying wind farms on local communities and their living environment. A comparative case study on six different projects, of which five are located in Europe and one in Asia, gives an insight in site-selection and the difference it makes on community support. Subsequently, semi-structured interviews in one of the six project areas are conducted to find results on community involvement, -procedures and all around appreciation of the development. Results show a definitive difference in perceived energy justice based on the planning approach. Thereafter, recommendations are made to improve the development process of these projects. With an expected increase of this sector and decreasing physical space for development, rules need to be in place to protect the local community while still benefitting from the economic growth. This thesis only reviews a fraction of the complications of these developments and future research is needed on the impact of datacentres and wind farms on the national economy, on regional ecology, on health effects for local inhabitants and other aspects such as the governing aspect of these developments.

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1. Introduction

1.1. Background

We are currently transitioning into a “data decade”, where data – its collection, storage and usage – is key for every company. IT infrastructure has therefore become essential for all companies but especially for market leaders like Google, Amazon and Facebook (Haranas, 2020). To manage the data as safe and self-reliant as possible, these companies invest in large, private, datacentres, also called hyperscales. Datacentres are physical places where data gets stored and moved between platforms like public and private clouds. Everyone makes use of these clouds on a day to day basis by for example; checking into public transportation, browsing Instagram, listening to music through Spotify and sending a “Tikkie” - often simultaneously -. The COVID-19 pandemic contributes to the necessity of these datacentres working proficiently, since video calls and working from home require data-usage in the cloud. In a world where development is data-driven it is important that it works, always. There is no room for error, power outages or loss of data in the datacentres (Daim et al., 2014).

Downsides of these datacentres are that they require large amounts of energy to keep them running 24/7, which makes them not very environmental friendly (Daim et al., 2013). Besides keeping them running, energy is needed for UPS (Uninterruptable Power Supply), cooling and heating the systems. A hyperscale datacentre can use the equivalent of 200.000 households energy wise (Frederiks, 2020, cited in De Volkskrant, 2020). Instead of using fossil energy sources, the market leaders (and eventually all companies) are expected to use green energy to power their datacentres, to stick to the Renewable Energy Transition guidelines (IRINA, 2018). This is needed to combat climate change, but ultimately it improves the image of the companies and saves costs in the long run (Wang & Khan, 2013).

Smaller companies and datacentre suppliers picked Amsterdam to locate their datacentres because of its regional economical function. However, when the power usage of the “small” datacentres turned out to be extremely demanding on the energy supply network, the Amsterdam municipality limited the amount of datacentres allowed to locate there. Market leaders like Google and Microsoft therefore picked agricultural landscapes in The Netherlands to locate their hyperscales, primarily to benefit of the already existing infrastructure: large power cables and -supply (Reijn, 2020). Google opened their hyperscale in Eemshaven in 2016 and expanded it in 2018. Meanwhile Microsoft has picked an area in the Wieringermeer polder to develop their hyperscale and most recently an area of 166 hectares was selected in Zeewolde, Flevoland to house the biggest hyperscale datacentre in The Netherlands. Even though the local community is aware of these plans, the interested bidder has remained anonymous for the public.

1.2. Objective and Research Problem

This research investigates the impact of the earlier named developments on the living environment of the community. When thinking of the implementation of datacentres and wind farms a few questions come to mind involving the site-selection, the participation of the local inhabitants and the current availability and use of green energy for the maintenance of hyperscale datacentres. Determining the presence of energy (in)justice during implementation and more importantly, how the project development can improve in the future is the main objective of this thesis. For the companies and the datacentres the (siting)location is important; there need to be access to a large and stable power supply, water nearby for cooling is essential and proximity to the network providers is also important for network speeds (Daim et al, 2013).

For community members it is important to have clarity and certainty. People are not against the datacentres nor are they against green energy, but size and impact of the project on the living environment and cost and benefits need to be clear beforehand (Schwenkenbecher, 2017). It is important to know what promises are being made to the local community and what they can expect from the municipality in terms of benefits, from the developments in terms of local environmental impact and what their role in the process is. My expectations are that people would support the developments more if there is (financial) gain for them. Current involve the distribution of named financial gain. To give an example: if 10 farmers live down a road, only farmers 1, 3, 5, 7 and 9 will get financial compensation because the wind turbines are located on their land. Farmers 2, 4, 6 and 8 are left without compensation but with cast shadow, horizon- and noise pollution and devaluation of land. Meanwhile the power that is generated with these wind turbines is being sold off for low prices to multinationals and datacentres who in addition receive subsidies from the Dutch government.

Energy injustice seems in place more often than not, and this has recently lead to a lot of attention in media and in the society. Dutch television programs like “Zondag met Lubach” and “De Hofbar” devote entire shows, episodes or sections to the issue, which has led to more public awareness, even to those who do not have to deal with the issues. A variety of Dutch newspapers and -outlets, like “De Volkskrant” and “NRC” devote articles and podcasts to the societal issues on hand. The main question arising from these media outlets and transmitted to the viewer is “Why is the local community not benefitting from these datacentres and wind farms”?

Above named observations have led to the following central question: How can the development and implementation of hyperscale datacentres and wind farms be improved to boost the support from the local community, making it beneficial for all parties? Secondary questions that help in answering my central question are:

- How are different parties involved in site-selection?
- How can the local community participate?
- What are the advantages and downsides for all parties?
- How to reach acceptance from the local stakeholders?

1.3. Reading Guide

This thesis is formed by different chapters delving deeper into the topic. Chapter two focuses on the theoretical relevance and concepts that are in place in the research. The following chapters describe the research steps and modes followed by their results in the shape of comparative case studies and semi-structured interviews. Chapter five discusses and reflects on the matter at hand and notes how further research adds value, while chapter six answers the central question of this thesis.

2. Theoretical Framework

Studying the existing literature clarifies that we are in a transition process from fossil fuel to green energy sources to reduce greenhouse gas emissions and that everyone has to contribute in some way, shape or form. For companies, institutes and governments sustainable ways of developing the economy is needed, while for the general public it often means they need to "sacrifice" something for "the greater good".

Reflecting on my research topic this has led to formulating a few concepts that will structure my research. Those concepts / definitions being:

- Energy Injustice
- Renewable Energy Transition
- Green Cloud Computing
- Emission outsourcing
- Resisting Injustice
- Not In My Backyard / Yes, In My Backyard
- Community Participation

2.1. Energy (In)justice

The main concept of this thesis is Energy Justice, or more fitting; Energy Injustice. The rise of energy justice and injustice as a concept has seen more attention since the transition from fossil fuel to green energy sources has gained importance. Bickerstaff et al. (2013) note how the production of injustice is linked to human-induced climate change which can be seen in a concrete example as lithium mining in Chile. Lithium is mined to serve as a green solution (e.g. batteries for electric cars) but the mining of the lithium has been environmentally costly (Early, 2020). Lithium gets extracted from open pit mines, leaving scars in the landscape. Besides the open pit mines, lithium gets extracted from underground reservoirs which relies on a lot of water usage. It therefore leaves indigenous communities in Chile wondering how those developments are sustainable (Early, 2020). Energy injustice takes place since the indigenous communities are not benefitting while a company (e.g. Tesla) reaps the benefits.

To provide a more scientific definition of Energy (In)justice I use the definition by Heffron et al. (2016): Energy justice seeks to apply justice principles to energy policy, energy production and systems, energy consumption, energy activism, energy security and climate change. This thesis focuses on the energy policy aspect of energy justice and more specifically on where injustice is experienced by the local community while datacentres and wind farms are developed.

The concepts and cases used in this thesis reflect on the presence of energy (in)justice in the described situation.

2.2. RET, GCC and Emission Outsourcing

Renewable Energy Transition is a concept where we shift from using fossil fuels to green energy to combat greenhouse emissions. Literature that shows pathways on how to differently distribute the costs and benefits from this transition to benefit the local community more (Chapman et al., 2018) gives a good starting point to analyse the situation in The Netherlands and more specifically in municipality Hollands Kroon. This is important because of the scale of the projects in The Netherlands. As mentioned before, hyperscale datacentres can use as much power as 200.000 households in some cases. The 100% sustainable green datacentres are supported in the bigger picture, because guidelines for the RET will be met that way (IRINA, 2018). Making these hyperscale datacentres green is what the literature calls Green Cloud Computing, and however it is not clear if making this industry green will be a solution to the issue of global warming, it is clear that it will help in lowering the CO2 emissions

while, in the same time, the consumption of energy increases (Radu, 2017). It is clear that the RET and GCC are needed, but unfortunately there are downsides too. Sovacool et al. (2017) describe the issue of mass deployment of wind turbines and the emission outsourcing it creates. Constructing, manufacturing and transporting the wind turbine components have a negative effect on the carbon footprint, which leads to a false sense of sustainable energy solutions: emission outsourcing. To provide a more concrete example of emission outsourcing; A wind farm that is developed portrays the image of providing green energy, which it does. What is not taken into consideration by the public is the manufacturing of the parts (e.g. blades and base) which costs a lot of energy. These components are made out of polyester and polyurethane which does not recycle well, resulting in some cases to the components being buried in massive landfills (image 1 & 2) (Griffith, 2020). The transport of the different parts of the turbines takes place by cargo-ship and heavy goods vehicles, which both increase carbon footprint. Sovacool et al. (2017) also express their concern with the resisting of injustice by the local public.

(Image 1 & 2: Mass burial of wind turbine blades in landfills by Benjamin Rasmussen, 2020)

2.3. Participation and Resisting Injustice

As far as I am aware of, there are no physical demonstrations conducted against the plans to implement a hyperscale in Zeewolde (see case 1), but it is important to involve local residents in development. Mueller (2020) describes how resident participation in Information and Participation Measures (IPMs) may lead to an increase in acceptance and a reduction in conflict. There is a clear role for the government here; hosting IPMs like oral presentations, information stands and citizen workshops are an informal way to increase the cooperation of the local inhabitants (Mueller, 2020). This leads to a main concept in my research; Not In My Backyard-ism and Yes, In My Backyard-ism. These terms describe negative and positive attitudes towards proposed developments (Brown & Glanz, 2018), and will help in my research to find out why people are positive about green energy projects, as long as it is not too close to their homes (Swofford & Slattery, 2010). Jenssen (2010) describes how there are different degrees of NIMBY in his research but points out how NIMBY occurs when residents come to the conclusion that local burdens exceed their local benefits. In line with those terms, I want to research how community participation affects the outcome of planned projects (Kluskens et al., 2019). I use these concepts and theories to analyse current or completed projects and reflect on the hyperscale project in Hollands Kroon.

2.4. Conceptual Model

In figure 1. you can see how the conceptual model will help with structuring the research and analysing the different cases. From top to bottom I pinpoint the need for sustainable datacentres. Subsequently I want to pay attention to hidden emissions that are linked to developing wind farms or datacentres, this also has an influence on the site-selection and injustice resisting by the local community. Finally, community participation need to be addressed, because acceptance from the community is crucial for the success of a project (Jenssen, 2010).

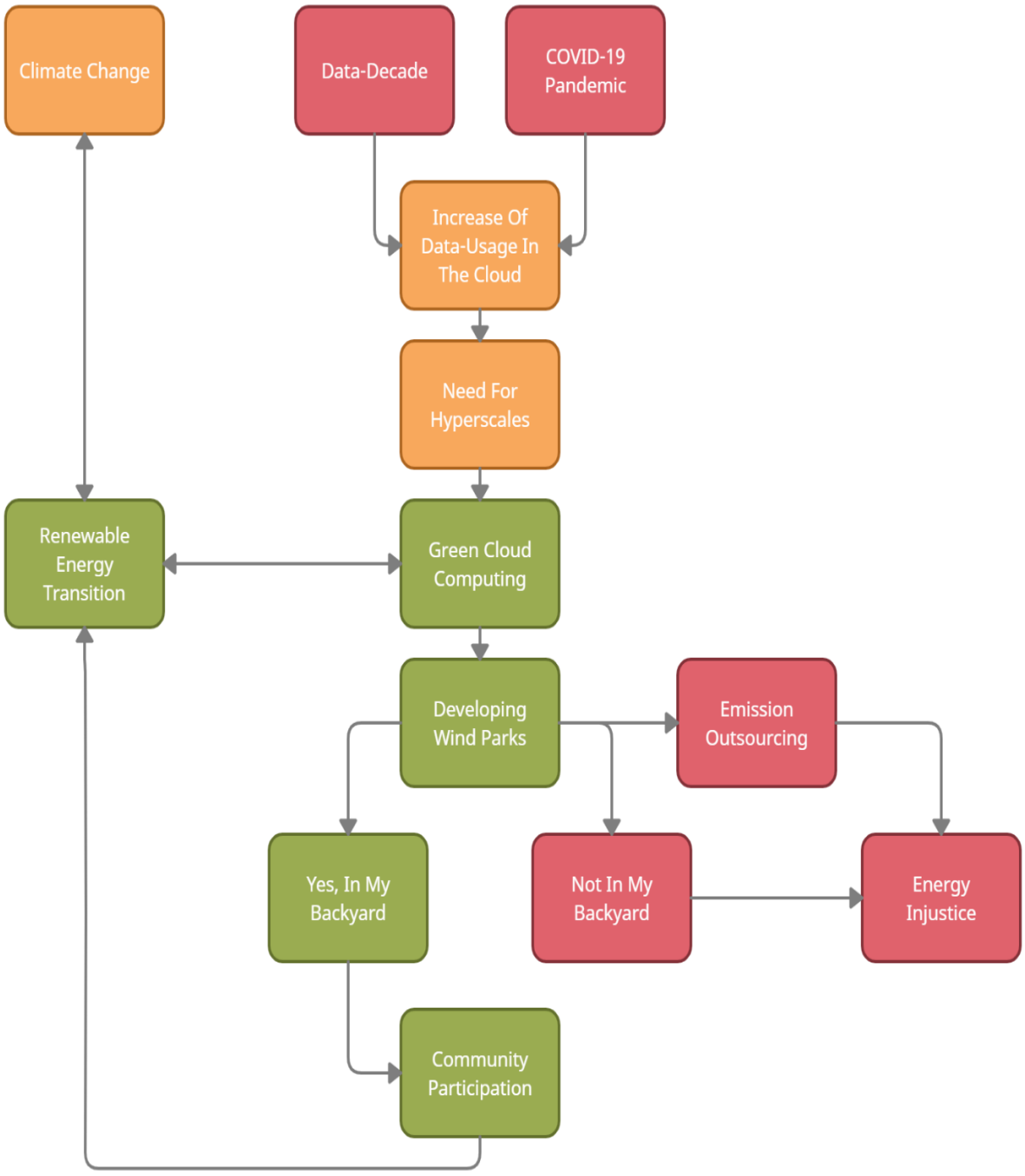

Figure 1. Conceptual model based on theoretical framework.

3. Methodology

The research topic has various dimensions on multiple scales which makes it interesting, yet intensive and complicated to research. Therefore this thesis does not aim to function as answer to all questions regarding datacentre and wind farm development, but to find out more about only a fraction of this topic. To find out more about site-selection I will make use of existing literature and secondary data collection. The first part of my research will focus on the site-selection and the roles that the different actors play in this process. Here I will analyse existing and planned projects to find out what went right and what went wrong and where there is room for improvement in the role for community members to work towards more energy just plans. The second part will focus on improvement in this site-selection and therefore primary data instruments will be used to gather information on perception and experiences of local stakeholders through qualitative, semi-structured, interviews. By combining the data sources and analysing the outcomes I strive to find a guideline for developing energy just plans for these type of cases.

For this thesis I consulted a variety of sources, which I have distinguished from each other in the reference list. The scientific sources are cited in this thesis while the multimedia sources are used for contextual references and are therefore not cited.

I developed a framework (table 2) to compare the previously named concepts to the chosen cases (Zeewolde, Hollands Kroon, Eemshaven, Hamina, Singapore, Fredericia) to see if they are all applicable. Under results you will find an overview of each case with a summary of its components and the framework filled in. The cases are selected because they reflect a diversity in planning approach and therefore a difference in resistance received from the local community. The instruments used to analyse the cases are:

- Need for Hyperscale Datacentres
- Green Cloud Computing
- Development of Wind Farms
- Emission Outsourcing
- Community Participation
- Energy Injustice

The first five instruments evaluate whether there is a need for a hyperscale datacentre, the option/availability to develop green datacentres with the Green Cloud Computing concept, the need for development of a new wind farm, the presence of emission outsourcing and the level of community participation. These concepts together decide the presence of the sixth concept, which is the level of energy injustice.

The gathering of information during the interviews could have some ethical issues due to the emotional involvement of the interviewees, therefore they remain anonymous. I expect people to be more willing to accept big projects when there are benefits for them, especially financial benefits. The way I present myself and approach the participants will be important in gathering the right information for my research. On the other hand I expect municipalities or companies to be reluctant on sharing information about site-selection, costs and benefits since this will be considered sensitive data. Hence, the decision was made to not conduct interviews with municipalities or multinationals (e.g. Microsoft) but to focus on the perception of the local community on the development of datacentres and wind farms in their living environment, and more so on their role in this development. It will have to be clear that I am researching a way of planning where everyone benefits, instead of “framing” any parties in a bad light. Table 2 shows an overview of the interviewees, date of interview, place of residence and occupation.

Interviewee	Date of Interview	Place of Residence	Occupation
Respondent #1	21-12-2020	Middenmeer	Tulip Farmer
Respondent #2	21-12-2020	Middenmeer	Logistics at Nationale Spoorwegen
Respondent #3	28-12-2020	Wieringerwerf	Tata Steel Employee
Respondent #4	03-01-2021	Slootdorp	Sales at Agrico
Respondent #5	07-01-2021	Wieringerwerf	Retired
Respondent #6	12-01-2021	Wieringerwerf	Greenhouse worker

Table 1. List of interviewees.

Due to the COVID-19 guidelines it became difficult to get in touch with the local community since people are staying in more and are reluctant to be approached on the street. To get in touch with the community in Hollands Kroon I contacted an acquaintance who resides in this municipality. She referred me to a local Facebook group called “Toekomst Wieringermeer” (Wieringermeers’ Future) where I posted on the discussion board to get in touch with local inhabitants. Hine (2017) describes this form of virtual ethnography as an embodied research instrument to the social spaces of the internet. The use of this cyberspace led me to building a direct connection with locals that were willing to be interviewed about their region and its development. The name of the group is important to me, because it shows that it is not just a group of people who are disagreeing with the current development, the name has no negative association. It does show however, that people want to be involved with - and actively participate in - the development of their living environment. These groups provide a sense of community (Hine, 2017) which cannot be provided physically currently due to the COVID-19 restrictions.

4. Results

To analyse the results, the six case studies are split up and summarized to give a clear overview of the different aspects and development of the plans. After the overview, the main outcomes of the cases and interviews will be presented. In an ideal research environment more interviews would have been conducted and more locations would have been visited, unfortunately due to the current COVID-19 pandemic the options were limited. This subsequently creates an opportunity for future, more in-depth, research.

The cases listed below in order are:

1. Datacentre + Wind farm Zeewolde (The Netherlands / Unknown party)
2. Datacentre + Wind farm Hollands Kroon (The Netherlands / Microsoft)
3. Datacentre + Wind farm Eemshaven (The Netherlands / Google)
4. Datacentre Hamina (Finland / Google)
5. Datacentre Singapore (Singapore / Google)
6. Datacentre Fredericia (Denmark / Google)

4.1. Case Study Overview.

Case 1: Zeewolde, The Netherlands.

Zeewolde is located in the south-east of the province of Flevoland. This households around 23.000 inhabitants. The region successfully ticks off multiple site-selection aspects like the central location (nationally), access to water sources and room for sustainable energy development (polders are known for their abundance of wind turbines). There currently is no developed wind farm so that needs to be developed which will lead to emission outsourcing and resistance from the majority of the local community. Only a fraction of the population will experience benefits from the developments, while the majority will experience negative aspects like horizon- and noise pollution. The promised green energy benefits will only benefit the datacentre, and not the local community (De Hofbar, 2020)

The building activities have not started yet, but the datacentre has already attracted attention from a variety of media like NRC, RTL Nieuws, Volkskrant and Zondag met Lubach. That is mostly caused by the predicted size of business park “Trekkersveld III”; 166 hectare. This would make it the largest datacentre in Europe. Besides the size, it is remarkable that, up till now, the multinational bidding for the site has remained anonymous for the public. The municipality refuses to announce what party is involved until all governing parties have agreed on terms and the permits are final (RTL Nieuws, 2020)

Issues that seem likely here are the development of a new wind farm, a lack of community informing and participation and therefore an expected resistance from the community. So far the only expected community involvement is the buy-out of four farmers living on the proposed datacentre location. The first turbine is expected to be built in April 2021 (Windpark Zeewolde, 2020)

No further, on-site, research has been done because there is no developed site yet (image 3).

(Image 3: Proposed datacentre location by Ons Zeewolde, 2020)

Case 2: Hollands Kroon, The Netherlands.

Hollands Kroon is located in the north of the province Noord-Holland and is a fairly new (2012) fusion of four existing municipalities (Wieringen, Wieringermeer, Anna Paulowna and Niedorp). The area is completely built up on poldered land and houses approximately 50.000 inhabitants. Much like the Flevopolder, this polder offers great conditions for the development of wind farms and datacentres. With plenty of open spaces and -water and a location close to Amsterdam it ticks off all the aspects that Daim et al. mention (2013). Historically, this area focuses primarily on agricultural functions like livestock- and arable farming, tulip growing and greenhouse farming.

To occupy the space in this polder the Dutch government gave the green light to build a new wind farm which was executed by Vattenfall in cooperation with ECN Wind Energy Facilities with the project name Windpark Wieringermeer. The distribution of the wind turbines was key for this process, because the provincial council wanted to cluster the wind turbines in even patterns opposed to the old situation, where wind turbines were located "randomly" across the land (NOS, 2020).

The issue that has received a lot of media attention in this case is the distribution of the generated energy. Research by the NRC and De Volkskrant show that promises were made for generated energy to be supplied to the local community on top of financial benefits. Since the development of large datacentres though, the energy seems to only be distributed to multinationals operating the datacentres. What makes this an even more pressing matter is the fact that the development of wind farms are partly funded by financial aid (subsidy) of the government, paid from tax payer money. The project developers did start a "neighbour policy" to distribute financial benefits to inhabitants living in a 1250 meter radius of a wind turbine (Windpark Wieringermeer, 2020) but there is only a select group of people benefitting from those measures. Another worry is that the amount of datacentres is increasing too rapidly (Trouw, 2020).

A site visit made clear that the presence of a Microsoft hyperscale datacentre does change the image of the landscape (image 5 and 6) and interviews with community members gave an insight in perceived injustice.

(Image 4: Microsoft hyperscale in Hollands Kroon by Noordhollands Dagblad, 2020)

(Image 5 & 6: Grim looking borders of the Microsoft hyperscale in Hollands Kroon, changing the agricultural landscape by Author, 2020).

Case 3: Eemshaven, The Netherlands.

Eemshaven is located in the most northern part of The Netherlands in the province of Groningen. This port area (haven translates to port) is the largest port in the north of the country and solely serves an industrial / economic function opposed to the two prior analysed cases. Google established their first hyperscale in The Netherlands in 2016 at this location. Google describes the reasoning for their site-selection as: "Eemshaven has the right combination of energy infrastructure, construction site, and suitable manpower for the datacentre" (Google, 2020a).

A clear difference between this project and the previously named cases is the (negative) media attention received in the previous cases. The fact that there is almost no negative impact for local inhabitants is cause for a higher degree of acceptance. Another aspect that helps in accepting these types of development is that there was no need for new wind farm development. Google describes that they buy their energy from sustainable sources in neighbouring Delfzijl and more southern; Zeeland.

After this successful datacentre, which expanded in 2018, Google opened another datacentre in Hollands Kroon which instantly received a lot more negative feedback from the local community. This underlines the idea of how site-selection plays a very important role in community support and the perceived injustice.

(Image 7: Datacentre and wind turbines in Eemshaven by Google, 2020b)

Case 4: Hamina, Finland.

Hamina is located in the south-east of Finland near the Russian border. The region houses approximately 20.000 inhabitants but, like in most of Finland, the population density is rather low (33 inh./km). This region is mostly known for its port and the transit of cargo to Russia.

Google established one of their first hyperscales in Europe in this town because of the favourable site aspects. The facility is located in an old paper factory and by acquiring this facility Google did not need to develop a complete new site. The water used for cooling is extracted directly from the Gulf of Finland with twenty-year-old renovated pump from the old paper mill (Baxtel, 2020a). Google prides themselves for developing this datacentre, noting that it contributes to the local economic growth but also the sustainable energy systems (Google, 2020c).

There are no reports on local resistance for the developments. My conclusion is that that is because of the outsourcing of the energy supply. There are no wind farms built in the local area which is usually the main reason for resistance from the local community. For this project Google invested in Swedish wind energy. They signed a deal with Nordic wind farm operator Eolus VIND AB to purchase the needed electricity from their newly developed wind farms in Sweden (Datacenter Dynamics, 2014).

For this reason there is a clear case of emission outsourcing, but it does combat the resistance of the local community.

(Image 8: Google datacentre in Hamina by Google, 2020d)

Case 5: Singapore

In 2011, Google decided to establish their first datacentre facility in Southeast Asia, more specifically; in Singapore. Opposed to the other studied cases this facility is built in an urban environment which raises questions about local resistance. Singapore houses 5.7 million inhabitants and especially the population density is high (7.804 inh./km2). This project displays the ability for datacentres to be built vertically as well as horizontally, which of course requires less open space.

Google (2020e) explains that they located in Singapore to provide the large userbase of the cloud with a regional facility to benefit from. Besides that reason, Singapore offers the largest underseas cable network in the region, a highly educated workforce and an investor friendly policy. The datacentre has performed so well that an expansion took place in 2015 and a third one is expected to be finalized in 2021 (Baxtel, 2020b).

Unfortunately there is no remote information available on the energy supply that is being used. My expectation is that the energy is being bought at an attractive rate in a neighbouring area, without developing any new wind farms. There is however, a lot of attention for the sustainable use of energy and water inside the facility and the multifunctional use of the building. The first facility also houses apartments for low income residents and a primary school. The addition of these functions shows interest for working with the local community.

(Image 9: Datacentre with multiple levels in Singapore by Google, 2020f)

There are no reports on energy (in)justice for this case. A reason for this is the difference in planning policy in this part of the world. In Europe we have become accustomed to a bottom-up approach for planning practices, and when that does not occur it often results in community resistance. In more top-down organised societies, like the Singaporean culture, a more hierarchical structure is fulfilled (Kingdom of the Netherlands, 2020). This could very well lead to less resistance for these type of developments, at least to less expressed resistance.

Case 6: Fredericia, Denmark.

Fredericia is a city in the west of Denmark. Located, as nearly every city in Denmark, close to open water. This region houses around 41.000 inhabitants and is, like the other sites, very suited for datacentre and sustainable energy source development. Google has finalized the development of their most recent project and made the datacentre operative in November 2020 (Datacenter Forum, 2020). In Fredericia, Google found an industrial area with existing infrastructure with space for development leading to this site being selected.

The region is involved and supportive to developing sustainable energy sources (Google, 2020g). Unlike the other regions, this region opted for solar panels over the development of wind farms. Since the opening of the facility the energy is 100% from sustainable sources and Google pledged to keep investing in Danish renewable energy projects like onshore- and offshore wind farms(Google, 2020h) to maintain a 100% green coverage while their facility grows.

(Image 10: Datacentre development Fredericia by Author in Google Maps, 2020)

No signs of community resistance have been found. This is mostly because there is no wind farm development and a lot of jobs have been created for the local community. Copenhagen Economics (2019) has reported that Google contributed to 2600 new jobs in the region between 2018-2020.

4.2. Case Study Main Outcomes.

With all cases summarized, results can be logged in the framework (table 3). We can see that there is a need for datacentres at all locations, due to the increase in usage of the cloud by people worldwide. Without changes in consumer behaviour or innovative data storage techniques, this growth will continue over time which results in the need for more datacentres. The cases show that the development of new datacentres itself is not a problem for now, they often lead to investments in renewable energy sources and they contribute to the creation of new job opportunities for the community.

New facilities contribute to another positive development: innovation. Newly developed datacentres should be equipped with the latest technologies to make use of residual heat to provide warmth for the local community (e.g. swimming pool, greenhouses & offices) (Weerwind & Steenbakkers, 2019). The implementation of Green Cloud Computing is important to make the datacentres green and ready to be upscaled when the need is there. We see that all studied facilities are making use of the latest innovations. The only location that might not be able to work with the latest technologies is the facility in Hamina. This facility is located in an old factory building, which means that modernizing the facility would require additional investments. With multinationals like Google and Microsoft wanting to contribute to the Renewable Energy Transit we can expect datacentres to be developed with the newest technologies and to continue innovating to remain fully covered by sustainable energy sources (Google, 2020h).

Whilst the need for hyperscales and additional innovative solutions like Green Cloud Computing do not negatively impact energy justice, the third component of the framework (Wind farm development) seems to correlate heavily with energy justice. Note that in those cases where new wind farm development is planned or implemented the local community expresses their perceived energy injustice. It raises the question why governments decide to develop wind farms in some regions and to decide to outsource the energy supply in others. What has to be mentioned is that the Hamina case there is new wind farm development, just not in the direct vicinity of the datacentre. Therefore the framework shows there is energy injustice experienced, but not locally. As long as there is new, on shore, wind farm development necessary, there is an increase in energy injustice. Components of wind turbines are notoriously difficult to recycle, whereas solar panels are more environmental friendly because components are recyclable (Zonneplan, 2021). So although the emission outsourcing does not directly influence energy injustice for the local community, it is something to keep in mind while considering these types of development.

Community participation should be seen as the biggest influencer of perceived energy injustice. It is important to break the cycle of NIMBYism to improve the acceptance of the local residents for large-scale projects (Devine-Wright, 2011). Devine-Wright also mentions how there is a widespread social consent to increase the use of renewable energy internationally, but it is fragile due to poor public engagement. By two way communication, hosting IPM's and distributing cost and benefits in a more fair manner the acceptance by the community can be improved. In the cases studied we see a variety of community participation varying from no- and very limited participation to a full on cooperation with local communities.

In the Zeewolde example we find that only a limited number of inhabitants will benefit from the developments: four farmers and one landowner need to be bought out by the unnamed multinational. The other inhabitants are not benefitting whatsoever which clearly indicates the presence of energy injustice. A similar case occurs in Hollands Kroon, where a few inhabitants receive financial compensation through the neighbour policy. In Eemshaven there was no new wind farm development but Google provided new jobs for the existing inhabitants, this combination results in energy justice

rather than injustice. In Hamina we find a different approach; an old factory building was brought back to life and there were no new local wind farm developments, therefore there is no energy injustice experienced by the local community. There is however, invested in wind farms in Sweden. The people living in those areas do experience injustice because there are no benefits for them whatsoever. Case 5, Singapore, illustrates a different situation. Unfortunately this case has unknown factors, like the energy distribution, but there is attention for the local community by providing multifunctional facilities which we do not find in other cases. It is likely however, that injustice is experienced by the local community due to the top-down approach that is common practise. Google's latest project, in Fredericia, has the most positive approach. The local community is engaged in the planning process, there are job opportunities created and investments in sustainable energy solutions are a priority. The governing parties opted for solar farms rather than wind farms which results in less waste of materials.

	Need for hyperscale DC	Green Cloud Computing	Development of Wind Farms	Emission Outsourcing	Community Participation	Energy Injustice
DC + WP Zeewolde	Yes	Necessary	Yes, in progress	Yes	Very limited	Yes
DC + WP Hollands Kroon	Yes	Yes	Yes, completed	Yes	Limited	Yes
DC + WP Eemshaven	Yes	Yes	No new development	No	Yes	No
DC Hamina	Yes	Likely	No local new development	Yes	None	Yes, but not locally
DC Singapore	Yes	Yes	Unknown	Unknown	Limited	Likely
DC Fredericia	Yes	Yes	No new development	Little	Yes	No

Table 2. Completed framework for concept and case comparison.

4.3. Interview Analysis and Main Outcomes.

The case studies presented an objective overview of how to reduce energy injustice in local communities in project areas. To get a better understanding of how the local community perceived datacentre and wind farm implementation I conducted six interviews with inhabitants of municipality Hollands Kroon. Below I answer the sub questions determined in the introduction, based on the answers of the interviewees.

1. **On the involvement of different parties in the site-selection process:**

The general consensus is that the local community plays little to no role in this process. All interviewees reported they were informed about the plans through flyers and pamphlets. Not in the planning phase, but only after the developments started. In no way were they being approached to partake in the site-selection process, they were only informed when those decisions were already made. Respondent #2, #3 and #6 were quick to note that they do not expect to partake in the decision making process but they expected more from the local government. Respondent #3 commented: *"We vote for people to protect our interests and well-being…but then I hear about plans like these afterwards. Do they not understand that this is not what I, what we, want?".* Respondent #4 was more worried about the new development: "*Now that one large datacentre is settled I am afraid that we can expect more. Did you*

hear about Google and their new datacentre that they started building without a permit?". It is good to note that the interviewees were not too unhappy with the site-selection because the industrial farm was already being developed, but they felt unheard by the municipality.

2. **On how the local community can participate:**

Again the interviewees are clear in their perception of the governing parties, they feel let down. The general idea was for them to benefit financially or would be provided with energy from the wind turbines in the municipality at a lower rate. Respondent #2 felt deceived: *"The wind turbines were supposed to generate power for the households here, that is how we were tempted. In reality Microsoft and others showed up as soon as the wind turbines were there…".*

The community does confirm that there is a rule for people to receive a financial compensation if they live near enough the turbines. However, the number of people receiving this compensation is small and does not make up for those not living "close enough". Respondent #1 added: *"Some of the farmers in our municipality can take it easy now, they will live of the profits from the wind turbines. For me it is not the same because I don't live close enough. I don't think it is fair because I still see the turbines every day while working and when the wind is blowing in our direction I can even hear them!".*

Other participation opportunities are not in place. The interviewees are represented in the city council but are not happy with how they are represented. Unfortunately they will have to wait until 2022 to vote again for a new council. Respondent #6 thinks voting will not make a difference: *"There is no participation at all.. It is just about politicians being egotistical and attracting big companies. We as a fairly small community cannot stop these type of developments".*

3. **On the down- and upsides of the developments for all parties:**

The responses to the questions regarding this sub question were less like-minded. While some of the respondents were completely against the developments in their region, others saw possibilities for positive influences. Respondent #5 for example showed interest in the growth of the municipality. *"I am not happy with the visual pollution that the wind farm brings, but I am not bothered by the datacentres. I have heard that a new town will be created to house employees of the datacentres. Now, I would like to see Microsoft or Google or any other of the new companies hire locals, but housing new people in our municipality should improve the economic situation".*

A big issue is still the exact location of your house. Some of the inhabitants become millionaire overnight, while others just have to deal with the negatives. Some of the interviewees just do not see any upsides at all, indicating a clear sense of energy injustice. On question 17 (see appendix 8.3) I received heartfelt replies. Respondent #1: *I am afraid that the entire polder will serve as an energy plant if nothing changes. I am not going to court and I do not see myself relocating either (because of my company), but it is a depressing idea to think of our polder filled up with metal blocks (datacentres) and wind turbines".* While Respondent #6 is more open to leaving the place he was born in: *"As I mentioned earlier, I don't trust the politicians or even the voting system. It really depends on the benefits that will be presented to me if I stay here. If they put some turbines close to me then I can receive money for doing nothing… who doesn't like that… haha. If I only experience hinder and no actual benefits, I could see myself leaving this region. I can move a bit more south or north while working the same job".*

4. On how to reach / improve acceptance from the local community:

The community wants to be heard. Multiple interviewees mentioned that "a general presentation from a big American company" does not make them feel involved in the process. *"What bothers a lot of people in this region is the fact that everything happens in a shady manner. We do get to hear some information about projects, but then we are met with false promises or half explaining stories. A politician can tell me that there will not be more datacentres locating in our region, but that could be completely different a month later",* respondent #2 answered to question 16.

Another solution for some of the energy related issues was mentioned by respondent #4: *"I want a real compensation… Wouldn't it be a good idea if the municipality, province, national government or whoever provides us all with solar panels on our roofs? That way we can provide our own energy.. it would feel a lot fairer".* A clear answer that shows that a materialistic, sustainable solution can cause a big change in perception of the local community. It is unrealistic to expect everyone to be happy with large-scale projects in their area, but I do not think it is sustainable for municipalities accept such tensions among their inhabitants.

5. Discussion and Reflection

The case studies and the interviews make clear that there is room for improvement in the planning of datacentre and wind farm projects. The most remarkable aspect is the way that the municipalities and governmental branches are not being transparent about the plans and the decision making process. This view was already established after seeing the items by “Zondag met Lubach” and “De Hofbar” on these cases, but were only underlined by the responses from the local community.

There is an obvious need for datacentres as well as there is a clear need for sustainable energy solutions. We can agree that in general it is rather positive that multinationals and municipalities develop datacentres by Green Cloud Computing and other sustainable energy solutions to focus on the Renewable Energy Transition. Site-selection will be the most important aspect of these developments, with open space becoming more scarce and population becoming more vocal. A fair distribution of costs and benefits is therefore paramount for the success of new plans. An issue in my research is that I am more likely to find reports on resistance from the local community in the Dutch cases that I studied. Reason being that these news outlets report in my native language and are more accessible. To illustrate an example: the information I received through “Zondag met Lubach” or through one of the NRC podcasts is easily comprehensible and gives me an opening for further research. I have not been able to find that type of material for the Singapore case , while there is a possibility that it does exist. I therefore had to base most of my research on the foreign cases from official Google sources which, I assume, portrays their initiatives slightly biased.

This creates an opening for essential research to be done. This thesis only comprises research into basic site-selection matters and local stakeholder perception of developments which is only an elementary component. There were plenty of implications mostly involving accessibility to sources due to COVID-19 guidelines and plans not being fully developed yet. To really get an understanding of how similar, future developments locally can receive more support there need to be clarity about a wide range of topics. The effects of wind farms and wind turbines on health (complications by low frequency noise), nature (effect on biodiversity), power distribution (fair distribution amongst local communities) and horizon pollution (day and night(light pollution issues)) need to be studied extensively. Also the role of the government need to be more clear. Interviews by media outlets with minister Wiebes (Economic Affairs and Climate Policy), provincial council and municipalities show that fingers are pointed at each other rather than teamwork being displayed. Goals and plans need to be aligned between these parties to contribute to a more accepted way of development. Without improved transparency (in the decision making process for site-selection and cost and benefit distribution of developments) it is expected that the resistance from the local community will increase because the trust in the government decreases. As more cases develop, information can be shared between local communities to support each other and to ”resist” the governing parties.

Another take that can be researched regards the actual usage of the cloud. With current growth of the cloud usage worldwide there will be a constant need for upscaling existing datacentres and developing new ones. New research in the technical aspects of storage could lead to new solutions that require less storage of data and/or less usage of data and subsequently, less of a need for datacentre development.

6. Conclusion

To answer the central question of this thesis, “How can the development and implementation of hyperscale datacentres and wind farms be improved to boost the support from the local community, making it beneficial for all parties?” we can be clear.

The case study overview demonstrates how different approaches play different into the energy justice aspect of large-scale projects as datacentre and wind farm implementation. The development of wind farms and the community participation play the biggest role in shaping an energy just or unjust situation. The best way to plan these projects is to inform all parties in the planning phase of the project, well before an actual site is selected, in line with Muellers’ statements (2020). To cooperate during the site-selection process would be a great start for a beneficial partnership. A site needs to adhere to certain standards and with the cooperation of the local community it should not be an issue to select an appropriate site. The interviews show that the local community is generally willing to participate, as long as they are treated with respect and as long as they all benefit, whether it is financially, materialistic or energy-wise. This participation is needed to break the NIMBY-cycle for large-scale projects, as Devine-Wright mentioned (2011).

When a site is selected, a set of rules needs to be developed about job perspective for the local community and the distribution of sustainable energy. This research shows that it is not the datacentre that causes the problems in most cases, but rather the wind farm attached to it. A solution like in Fredericia or Eemshaven amounts to the least amount of energy injustice perceived by the local community. These solutions also produce the lowest amount of emission outsourcing and thus these cases show the current most sustainable solution. Making use of solar power or existing wind farms cancels out new wind farm development and subsequently reduces the energy injustice perceived by the local community and therefore reduces the amount of resistance.

To summarize: Implementation of hyperscale datacentres and wind farm can be improved by actively engaging in two-way communication with the local community and by providing solutions for the community rather than breaking promises or neglecting them. Compensation in the shape of energy-solutions or financial means change the degree of acceptance by the community, but cooperation in the planning process would be more sustainable in the long term.

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8. Appendices

8.1. Consent Form

DECLARATION OF INFORMED CONSENT

Research project name: Spatial Planning & Design Bachelor Thesis: A study on local stakeholder perception of energy (in)just plans for the development of datacentres and wind farms in The Netherlands.

Student's name: Pelle L. R. Moen

This bachelor thesis research investigates: The development of datacentres and wind farms in The Netherlands with a special focus on the developments in municipality Hollands Kroon. The perception of the local community on developments in their living environment and their participation in the process is being researched.

You have been invited to participate in this research as an interviewee.

Please provide your consent that

1. You have been informed about the purpose of the research;
2. You have spontaneously and in complete freedom accepted to be interviewed;
3. You consent the use of anonymized interview data for the research aims of the project, including its publication.

I declare that I am aware that:

- The research includes the collection of individual responses, opinions, evaluations
- each participant is free to ask for clarifications on the data collection procedure and about every other aspect of the project;
- each participant is free to leave the session in every moment;
- the eventual refusal to participate or the renunciation during the session will not involve any negative consequence for the participant;
- personal data collected for research purpose will not be transmitted to third parties;
- the collected personal data will be elaborated anonymously
- the research is conducted in the light of the RUG ethical policy (https://www.rug.nl/about-ug/policy-and-strategy/research-ethics/?lang=en)

Name _____

Signature_____

Date_____

In case you believe you have been mistreated during this interview or for any
more information you may wish to have regarding the research, please contact the thesis supervisor, Dr. Ethemcan Turhan (e.turhan@rug.nl)

8.2. Interview Guide Inhabitants Hollands Kroon – Dutch Version

Vraag	Betrekking op subvraag
1. Kan je mij wat over jezelf en je dagelijkse bezigheden vertellen?	Introductie
2. Ben je hier opgegroeid?	Introductie
3. Wat kan je zeggen over de ontwikkelingen in je leefomgeving?	Introductie
4. In hoeverre was je op de hoogte van de genoemde ontwikkelingen?	1
5. Wie zijn er, voor zover je weet, betrokken geweest bij deze ontwikkelingen?	1
6. Vind je dat dit soort ontwikkelingen nodig zijn? (Datacenters / Wind Parken)	1
7. Vind je deze gemeente een geschikte locatie voor dit soort projecten? Waarom wel / niet?	1
8. Nu de projecten er toch zijn, op welke manieren heb je deel kunnen nemen?	2
9. Voel je je een deelnemer of een toeschouwer?	2
10. Had je dat graag anders gezien? Zo ja, heb je suggesties?	2
11. Zijn er voordelen die je ervaart door de ontwikkelingen? (Bijv. Financieel / Energie)	3
12. Zijn er nadelen die je ervaart door de ontwikkelingen?	3
13. Denk je dat de voordelen en nadelen eerlijk zijn verdeeld onder de deelnemende partijen?	3
14. Hoe zouden de verdelingen eerlijker kunnen zijn of aanvoelen?	3
15. Wat kan er anders gedaan worden om meer support te krijgen voor dit soort plannen?	4
16. Heb je nog vertrouwen in de overheden die betrokken zijn in dit soort plannen?	4
17. Zijn er drastische stappen die je overweegt te nemen? (Bijv. Rechtszaak / Verhuizing)	4
18. Toevoegingen?	Slot

8.3. Interview Guide Inhabitants Hollands Kroon – English Version

Question	Related to sub question
1. Can you tell me something about yourself and your daily activities?	Introducton
2. Did you grow up in this region?	Introduction
3. Is there anything you can tell me about recent developments in this area?	Introduction
4. To what extend were you up to date (informed) about these developments?	1
5. What parties are, to your knowledge, involved with these developments?	1
6. Do you think these types of developments are necessary? (Datacentres / Wind Farms)	1
7. Do you think this municipality is a suited location for these kind of developments? Why / Why not?	1
8. Now that the projects are here (and finalized), in which way have you been a part of the developments?	2
9. Do you feel like you are participating or do you feel left out?	2
10. Would you have liked that to be different? If so, in what way?	2
11. Are there any personal benefits for you as a part of these developments? (Financial / Energy etc.)	3
12. Are there any personal downsides as a result of the developments?	3
13. Do you feel like there is a fair distribution of positives and negatives between the different parties?	3
14. How could this distribution be or feel more equally distributed?	3
15. What could there been done differently by the parties to get more support from the local community?	4
16. Do you still trust the governmental parties involved in cases like this?	4
17. Are there any serious steps you are considering to take in the near future? (Going to court / moving to a different municipality)	4
18. Any additional remarks?	Conclusion