Under what conditions could centralized level planning be feasible for hyperscale data centers in the Netherlands

The case of the hyperscale from Meta in Zeewolde

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ABSTRACT

In a digitalizing world it becomes more important to store the large amounts of data the consumers use. To be as efficient as possible, the largest tech companies use hyperscale data centers to store their data. The Netherlands has certain factors, such as a suitable digital infrastructure and a suitable climate to facilitate these hyperscale data centers.

Decentralized planning causes inefficiency for the planning of hyperscale data center locations since there are different stakeholders involved on different levels. National, provincial and local governance are involved in data center planning, but also regional and national electricity operators. For the local government this many stakeholders with different wishes and ambitions, combined with knowledge required on hyperscale's, could make the planning of hyperscale data center locations a topic out of their league.

This study aims to determine under which conditions centralized level planning would be feasible for hyperscale data center planning. To study why hyperscale data centers failed in the Netherlands in 2023 and what can be improved for future cases, I use the potential hyperscale data center location in Zeewolde as a case study. This consists of a mixed-method approach, with expert interviews on hyper scales and the electricity grid in the Netherlands, combined with other relevant documents. This to investigate when it would be feasible to change from decentralized level planning to centralized level planning.

The results show that the national government only interferes with the decision by the municipality after the planning of the data center reaches national attention (due the impact data centers have on the electricity grid). The results suggest that centralized (ministry) level planning would be feasible when in the Netherlands there is congestion at the electricity grid. Hyper scales have too much impact on the electricity grid for municipalities to facilitate the planning. Another condition is if the Netherlands wants a more efficient and cheaper way of planning for hyperscale data center locations. Through an integrated planning process by the ministry, planning data centers combined with electricity planning would simplify the planning process. Fewer stakeholders are necessary and integrated approaches can reduce resistance because the planning would go simultaneously and you do not have to wait as long as a non-integrated planning process. These are two conditions during which centralized level planning would be feasible for the planning of hyperscale data center locations in the Netherlands.

Keywords: Hyper Scale, Data Centers, the Netherlands, Energy Grid, Centralized Level Planning.

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1 INTRODUCTION

1.1 Background

On 22 March 2022, the members of the Senate of the Dutch Parliament voted against the construction of the controversial hyperscale datacenter of Meta (Eerste Kamer, 2022). Meta is known as the parent company of Facebook. Only the CDA and VVD (Two Dutch parties) voted in favor of the construction of the hyperscale data center. One of the main reasons why the majority decided to vote against the data center is the disproportionately large demands on the available amount of sustainable energy in relation to the social and/or economic added value in the Netherlands (Eerste Kamer, 2022). The motion consists of a request to the parliament to use its public law powers in such a way that the implementation of the zoning plan, which is specified in the establishment of the Meta data center, will not be legally possible. This will last until it is determined, partly in the context of the National Environmental Vision, that such establishment is not contrary to national policy (Eerste Kamer, 2022).

The municipality of Zeewolde voted on the 16th of December 2021 in favor of the construction of Meta's datacenter (Zeewolde.nl, 2021). The vote was close, with 11 in favor and 8 against the change of the zoning plans in Zeewolde which allows Meta to build a datacenter. The problem is that Meta still must obtain various permits and buy some of the lands. Some of the land is in the hands of the State Property Agency (SPA), which has set various sustainability requirements before the land is sold (Zeewolde, 2021). Whilst this normally is possible, the motion of the Senate of Parliament can stop the construction of the datacenter. The parliament is requested to use their powers to stop the land owned by the state from being sold to Meta (Eerste Kamer, 2022). The State Property Agency cannot decide to sell the land independently. Whilst the SPA is part of the ministry of the Interior and Kingdom Relations, a decision is made by relevant policy departments. For this case: The Ministry of Economic Affairs and Climate Policy and the Ministry of Agriculture, Nature and Food Quality.

With many different actors, operating at different levels and all with different interests, this becomes a complex problem. The research problem arises because it is unusual for the Senate to interfere in municipalities' zoning plans. Normally, a municipality can decide for itself whether a zoning plan changes. Changing the zoning plan for a piece of land in the municipality of Zeewolde is typically not of national concern. If the government overlooks every zoning plan change, they would never get anything else done. For the case of the hyperscale data center in Zeewolde, there are certain conditions which make it necessary for the national government to interfere in this decision on a local level. In this research, I look at what conditions are important for central level planning of hyperscale data centers. Using theories such as the policy life cycle of Winsemius, centralized and decentralized level governance and transition theory, this research will explore how to address this complex problem and come up under which conditions planning by ministries on national level is more feasible for hyperscale data center planning.

Decentralized Government

It is not usual for the national government to intervene in decisions of changes in zoning plans. In the Netherlands we have a law called the 'Wet Ruimtelijke Ordening' (WRO). To simplify planning, it is normally not necessary for the national government to plan for decisions based on the lowest governmental level. That is why it is decided to decentralize where possible and only use central level planning when necessary (Infomil.nl, n.d). It is not necessary for the national government to help decide in a municipality if some agricultural land changes to a new business

area. This is decided on by a lower, local government by changing the zoning plans. In the past, the change of zoning plans regarding (hyperscale) data centers was decided on a governmental level such as the voting in Zeewolde. It is a new phenomenon that the national government interrupts the zoning plans for data centers. The reason why the hyperscale is postponed currently is because of 'a disproportionate amount of sustainable energy is being used' (Eerste Kamer, 2022). The interesting part is that the datacenter in Zeewolde is the 3rd location for a hyperscale datacenter in the Netherlands. Eemshaven (Province Groningen) and Hollands-Kroon (Province Noord-Holland) have already hyperscale data centers up and running, placed in 2016 and 2015 respectively (Nos.nl, 2020). The media attention for these data centers was relatively low compared to the datacenter in Zeewolde. A study done by the Rathenau Instituut in the Netherlands unraveled when the national attention for the hyperscale data centers started. It started when a series of articles were published by NRC in the first half of 2020 about the (hyperscale) data centers. When the Dutch program 'Zondag met Lubach' also made an episode in October 2020 about the drawbacks of data centers whilst referring to the articles by NRC, residents, local and national government in the Netherlands started the discussion on both how the future of hyperscale data centers could look like (Rathenau Instituut, 2022).

Previously the national government officially stated that the establishment of data centers must be regulated at a decentralized level (KCBR, 2019). To support the municipalities and provinces with the decision on the locations of data centers a number of national policy frameworks were created. The Spatial Strategy for Data Centers, the National Environmental Vision, the Dutch Digitization Strategy and the Action Plan Digital Connectivity (Rathenau Instituut, 2022). However, after the national unrest about the datacenter in Zeewolde, the cabinet decided to tighten up the rules around data centers on the 16th of February 2022 for new data centers. The national government decided that no new locations for hyperscale data centers are allowed (Rijksoverheid, 2022). The areas Zeewolde, Eemshaven and Hollands Kroon are excluded from this decision. This shows a shift from decentralized planning to a more centralized level planning action. Or in other words, hyperscale data centers ensure that spatial planning is getting important again at the national level for these one-function buildings.

Uncertainties

The load on the energy grid and the amount of sustainable energy is one of the biggest points of critique by the opponents of the hyperscale's (Weijer, 2020., Rijksoverheid, 2022). Their argument is that the Netherlands is trying to generate green energy, to reduce the amount of gray energy. Due to the high consumption of electricity by the data centers, the amount of gray energy will remain the same (Weijer, 2020). Because the amount of gray energy stays the same, the Netherlands keeps polluting and it will become harder to reach the Paris 2050 agreement. Currently there is an exponential increase of growth in data usage in the world (IEA, 2021). Another challenge in the Netherlands is the congestion on the electricity grid in the Netherlands (Voorhoeve, 2022). The increase in data usage, the amount of electricity it requires, and the congestion on the electricity grid makes it hard to plan these hyperscale data centers. As a result, there is a lot of uncertainty that increases political disagreement in the Netherlands about the data center planning. This will be further explained during methodology with Winsemius' policy life cycle. Uncertainty plays a key role in the energy sector and is becoming increasingly important in planning over both the long- and short-term planning horizons (Scott et al. 2020). The policymaker, energy system planner, and utility services are all faced with making or influencing

long-term decisions. These assets have around 30 plus years of lifetime, where significant uncertainty exists over several important dimensions (Scott et al. 2020).

Electricity used by the high-density computing facilities that power the Internet (i.e., data centers) has generated the most intense interest. This is: in part because of the importance of these facilities to the broader economy; in part because the power used by individual data centers can rival some industrial facilities; and in part because the total electricity used by these facilities has been growing rapidly (Koomey 2008a, Masanet et al. 2011). Until a few years ago, power grid network development could simply keep up with spatial activity (Voorhoeve, 2022). TenneT and the local electricity grid operators could simply supply the new demand. Now this is no longer the case (Voorhoeve, 2022), new questions are coming into play. Is there a need for a different type of planning for data centers? Does data infrastructure planning require the insights used from electricity planning? If so, could this be combined in an integrated system? And by whom on what scale?

The Dutch Datacenter Association (DDA) argues that locating of new data centers would benefit if it is planning on a national level (Nu.nl, 2021). As stated by the Dutch Datacenter Association Director Stijn Grove: "With central policy, everybody knows what he is up to. Ideally implemented by the minister of Digital Affairs. If you plan the growth of power networks together with the datacenter, the ministries can invest more efficiently. At the moment, the Netherlands is missing out on billions of euros by lack of policy because the action is taken at the last minute" (Nu.nl, 2021).

Currently the way the energy grid expands is that it follows demand, combined with a waiting list if there is a queue. If it is possible for data centers to be developed and planned combined with the energy grid it could remove the 'sudden' high impact on the energy grid.

After investigating the claims and submitting the research proposal on the 24th of January 2022 with the following research question:
Under what conditions is centralized level planning the most feasible way to plan hyperscale data centers in the Netherlands?

In this study often is centralized level planning written. This is defined as: the ministries on a national level (e.g. the ministry of Housing and Spatial Planning or the Ministry of the Interior and Kingdom Relations) are responsible for the planning.

The research proposal was accepted and the research could officially start. Two weeks later, on the 16th of February 2022, the cabinet decided to tighten up the rules around the data centers. No new plans for hyperscale datacenter locations are allowed until the national government figures out their exact rules. The allocation of new hyperscale data centers locations are decided on a centralized level. Because of the developments by the government on the planning of hyper scales in the Netherlands, I had to keep adjusting to the news and reports coming in and parts became irrelevant or outdated quickly.

Nevertheless, with a careful and systematic study, I will investigate under which conditions central planning is a more feasible way of planning hyperscale data centers.

1.2 The aim of this research & Research Questions

The aim of this research is to investigate under which conditions the planning of hyperscale data centers in the Netherlands should be done on a centralized level. Could centralized planning be the solution of the current inefficient way of planning? At the moment different levels of government keep interfering with each other instead of an integral planning approach (Eerste Kamer, 2022). Now it is unclear on how what the best policy is on hyperscale data center planning. But what could be a solution to the current inefficient way of planning? A solution could be to facilitate on a national level a certain amount of 'data center' locations, by pre-investing massive amounts of electricity to these locations. Another solution could be to ban the realization of new hyperscale locations. To find out why when the spatial planning of hyperscale data centers should be done on a centralized level the following research question is answered.

The primary research question is: *"Under what conditions is centralized level planning the most feasible way to plan hyperscale data centers in the Netherlands?"*

To answer the main research question, more clarity is needed. That is why I use answer the following sub-questions:

1) *What are the uncertainties regarding the rapidly evolving data and renewable energy networks in The Netherlands?*
   With this question I want to investigate what the uncertainties are what the DDA talks about during the planning of the electricity grid and the placement of Hyperscale Data centers.
2) *Is it possible for the Netherlands to achieve the climate goals with sustainable energy with an increase in data centers?*
   A big reason why opponents do not want a hyperscale data center is because of the large consumption of electricity. The world is becoming more sustainable and it looks like all the electricity from windmills goes to these data centers. With this sub-question, I want to investigate how the use of electricity is justified and how data centers actually get power.
3) *How is a suitable location of a data center defined?*
   With this sub-question I want to investigate why hyperscale data centers want to come to the Netherlands in the first place and specifically a location such as Zeewolde.
4) *Which actors are involved in the planning of a location of a hyperscale data center?*
   What are the problems from the different actors? The DDA says that there is inefficiency because actors work reactively on each other instead of integral planning. With this research question I want to investigate how the playfield looks like.
5) *Why is data infrastructure planning necessary at central level and not solvable at decentralized level?*
   With this sub-question I want to investigate what the difference is between planning at a national level or a governmental level. What is the reason why we could consider national level planning instead of the municipalities. What are the issues when municipalities decide?

1.3 The social and scientific relevance.

While investigating these research questions, I found out that one of the main problems is the overall consumption of electricity and that there is currently congestion on the electricity grid. After finding a suitable location for the data center, it is important that it be connected to the electricity grid. In the last several years this was never a problem and everyone could immediately connect to the grid. However, now there is net congestion, which makes it difficult to connect projects such as neighborhoods. Therefore, it is even more difficult to connect a building that has the same consumption as a large city. This makes the impact of installing a hyperscale important not only for the municipality (the amount of space, looks for residents) but also for the entire province and the electricity consumption of the whole country. In addition to congestion another disadvantage is that electricity planning is reactive. The grid operators may only start when a connection is necessary (and the building is ready). There is little academic research done on net congestion and hyperscale data centers in the Netherlands, which makes this study of scientific relevance. Electricity planning has hardly been discussed in planning literature. The current net congestion and wanting hyperscale data centers, electricity planning could make data center planning more feasible.

It seems that because of the combination of power usage and congestion on the grid, municipalities are no longer able to make the decision to plan a data center themselves. After all, this is where political unrest starts. Because if you make this decision from the municipality, the province and the government will still be able to intervene to stop this plan. TV-programs such as Zondag met Lubach made an episode about data centers and everybody (government, citizens) see a problem with data centers.

This happened for example in Zeewolde, where eventually the Senate through a vote forbade the sale of the land where the data center would be placed. The reason why these parties intervene is because connecting has a national impact because of the power consumption. Hyperscale's can be compared to a distribution center in terms of size, appearance and location. This is something a municipality can decide for itself, but because of national impact and political unrest, it might be better for the government to decide on the locations and placement of data centers.

Also on an international level the planning of hyperscale data centers is discussed. Bast et al. (2022) explain why data centers are necessary and the implications that are involved with data centers. These implications are for example the lack of clear input data because the data centers do not publish all of their data. This causes mystery around the data centers. Another implication is the large amount of electricity used, combined with the amount of water it requires for cooling (Bast et al., 2022). The second article is by Maas (2022), who investigated the influence of big tech companies on urban planning in Sweden. The research concludes that the tech companies do not directly influence Swedish planning, but indirectly they have a large influence on Swedish planning. These two academic papers, whilst not completely relevant for my study, were only published last year and show how new this topic is. (International) research on the planning of data centers is still new and limited, but not totally absent.

In the theoretical framework, the foundation will be laid for this study on hyperscale data centers. Three relevant theories which can be related to spatial planning are used in the theoretical framework, to investigate under what conditions centralized level planning would be the most feasible in the Netherlands. To explain why the political unrest happened in the Netherlands, I use the Policy Life Cycle of Winsemius. This will clarify that having a clear 'national' policy will remove the political unrest and why ‘national’ policies on data centers will lead to a decrease of political unrest. To further clarify what central level planning means and why for choosing hyperscale data centers the Dutch national level government would be better to use instead of at the municipal level, I use the theory of the Roo and Fleurke et al. Finally, because within hyperscale data center planning there are many spontaneous new changes, I use the transition theory from Loorbach and Van der Brugge.

2 THEORETICAL FRAMEWORK

This research uses three theories to investigate under what conditions centralized level planning is necessary for hyperscale data center planning. With these theories I also construct my conceptual model in order to study later the hyperscale data center planning case in Zeewolde.

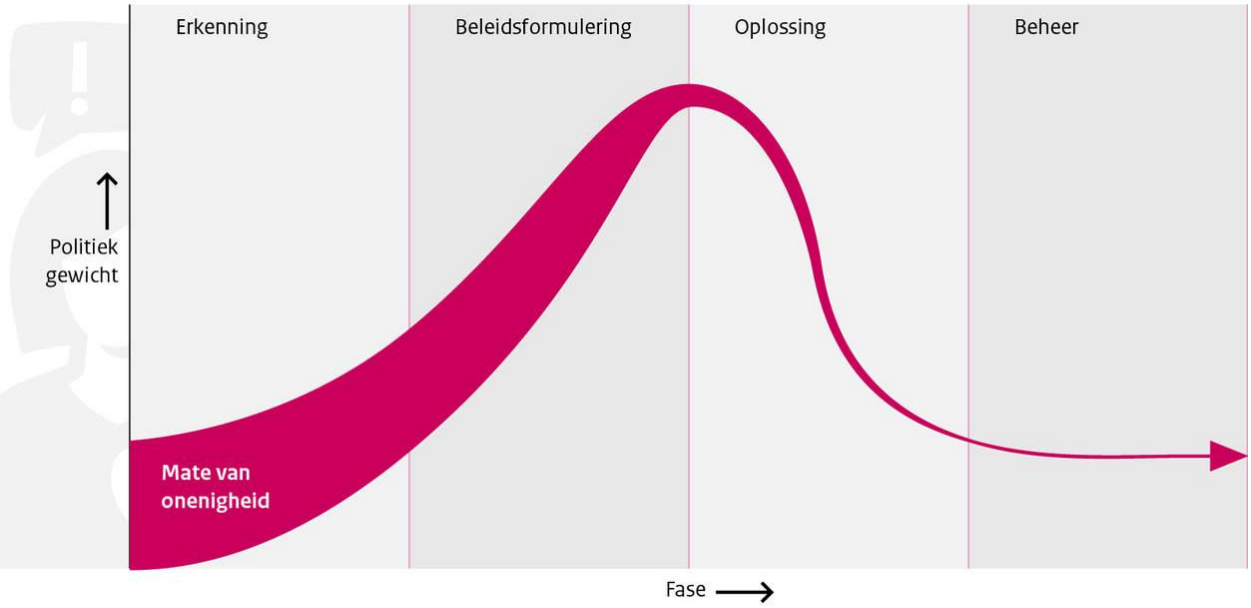
2.1 Policy Life Cycle of Winsemius

Winsemius was the Minister of Environment in the Netherlands from 1982 until 1986. He proposed a policy life cycle for environmental issues at that time as a part of the management on these environmental issues. These stages of policymaking can be indicated by the Policy Life Cycle of Winsemius (1986) as seen in Figure 1. The policy life cycle describes how the stages go through when environmental issues progress from the discovering phase until management. The four stages identified in this life cycle are: recognition, policy formulation, policy implementation, and control (Winsemius, 1986). It shows at which moments the political weight is greatest, and how the degree of disagreement develops. During initial phases, political importance increases, only to decrease again after determining the solution and in the management or implementation phase helps this thesis to explain what is currently going on, how to address it, and what happens to the future once the policy is changed. Van Daalen et al. (2002) explain that issues are often placed on the political agenda because events or even catastrophes take place. Thus, that actions often only take place after an event that has taken place, for example, to prevent new events from taking place or to prevent the situation from worsening.

Van Daalen et al. (2002) illustrate that the first phase of Winsemius (recognition) can be seen as ‘eye-openers’, which helps add new environmental issues (such as climate change, energy transition or now ‘hyperscale scale data centers’) on the political agenda. Hyperscale in Zeewolde was the eye-opener for the national government to investigate the case of hyperscale data centers. With the commotion around the hyperscale started, the level of disagreement increased. With many stakeholders involved, it becomes hard to find a designated place for the hyperscale and make all stakeholders involved agree to it. This will make the level of disagreement the highest in the policy formulation phase. If the national government comes up with the right policy on the policies on the hyperscale data center in Zeewolde and the locations of hyperscale in general, the disagreement will fade away.

Winsemius’ (1986) phases on the policy life cycle correspond to the datacenter case in Zeewolde. The lack of policy and vision in Zeewolde is recognized, and there was political unrest whilst looking for clear policy on hyperscale data centers (Rijksoverheid, 2022a). As a planner, the electricity grid has not been a problem for planning in the Netherlands in modern day time. Normally, connecting anything to the electricity grid would not have been a problem, whether it was about an office or a new neighborhood. Since at the moment it is no longer a certainty to connect something to the electricity grid (NOS, 2022c), this may be one of the reasons why such political disagreement has now emerged on planning issues due to net congestion. . However, after finding clear policy on hyperscale’s the unrest fades away and shall stay the same in the maintenance phase (Rijksoverheid 2022a).

Figure 1 The Policy Life Cycle of Winsemius



Source: Winsemius (1986)

2.2 Data- and Electricity Transition in the Netherlands

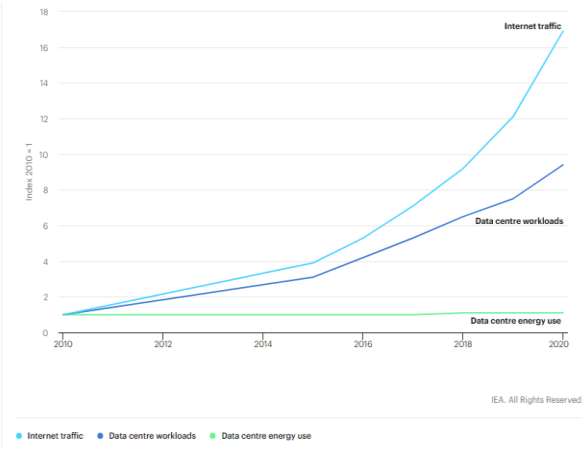
As you can see in Figure 2, the amount of internet traffic is exponentially increasing. With an exponentially large amount of internet used, (hyperscale) data centers are required to store and process the data used. A transition is often used as a nonlinear movement from one dynamic equilibrium state to another (Loorbach et al, 2017). According to Loorbach (2008) a transition can be recognized into four different phases. The phases are the predevelopment, the take-off, the acceleration and the stabilization phase. However, this visual representation of the different phases can also be seen by Rotmans et al., (2001) in Figure 3.

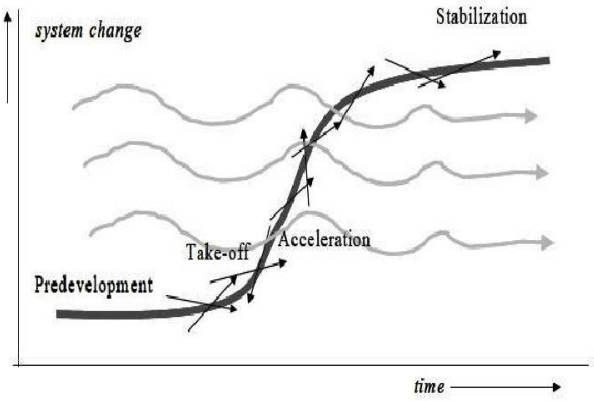
10 years ago, nobody knew something about hyperscale data centers and now they are popping up in the Netherlands and all over the world (REOS, 2019). With the rise of internet usage as you can see in Figure 2, hyperscale data centers are becoming more and more important. The use of Youtube, Google, and iCloud storage must be stored somewhere, and in the Netherlands. The use of hyperscale data centers is going through a fast transition.

The hyperscale data center in Zeewolde went through the phases described in Figure 3 rather quickly. After the take-off by the NRC and Arjan Lubach which is later discussed in the methodology, the Senate interfered and the minister for Housing and Spatial Planning put a hold for all new upcoming hyperscale data center locations. This shows the relationship why data centers can be related to a data infrastructure transition.

Figure 2 Global trends in data traffic internet traffic, data centers workloads and data center energy use

Figure 3 (Right) Visual representation of phases in a transition





Source: IEA (2021)

Source: (*Rotmans et al., 2001)*

The use of hyper scales is as discussed before in a transition. First, we are consuming and storing exponentially more internet. This all must be stored somewhere. That is why data centers are necessary. To make this happen efficiently, more and more hyperscale data centers are needed. And because of the amount of data, they are not able to fit in office buildings anymore. They require a large amount of space, and Meta asked for 166 hectares (Rijksoverheid, 2022b, DDA, 2022). These data centers consume a relatively large amount of electricity compared to other industries (DDA, 2022). The Netherlands is currently in an energy transition where the government wants to get rid of dependance gas completely in 2050 (Rvo, 2018). The Netherlands is trying to get rid of gas and use electric power. The problem is that because of the rapid, high-impact changes, the electricity grid cannot keep up with the electricity consumption. Besides having an increasing demand for electricity, the electricity grid cannot physically expand with more cables (NOS, 2022b). This is because the manpower for expansion is currently lacking, as well as it takes decades for all the permits (NOS, 2022b). In fact, the policy is still based on a flawless electricity grid where every request could be dealt with quickly.

Loorbach (2007) mentioned that there are different types in transition management, with each of them a different kind of focus, as can be seen in Table 1. Table 1 has been modified to show what the focus could be at operational, tactical and strategic levels. With this table, it is shown how centralized level planning would help with hyperscale data center planning in the Netherlands. In the short term, national government look at future sites for hyperscale data centers. This analysis can be based on space, close to nearby green electricity or other factors. At midterm level (5 to 15 years), the government has enough time to get the policies and regulations in place, for example, for the electricity grid. Currently the frame for the electricity is not appropriate for hyperscale data centers, because of the relatively long time waiting for permits. Getting cables to the future locations and enlarging the grid can make it attractive for hyperscale's to easily settle in these locations without waiting there for a long time. Integrating

the data-infrastructure with the electricity infrastructure could make the planning the hyperscale's more efficient. On a long-term strategic picture, the (local) government can think about how to develop this area. That is in contrast with the operational choices that have to be made earlier. Perhaps looking at opportunities to connect a heat grid at the location, but also other area development (nature, houses or recreation). With this table, I show how a data infrastructure can be used with the transition management.

Tabel 1 Transition Management Types and their Focus

Transition Management Types	Focus	Problem Scope	Time Scale	Level of Activities
Strategic	Area development for future hyperscale data center locations.	Abstract	Long term (30 years)	System
Tactical	Adjust the electricity grid to possible locations.	Institutions/Regimes	Mid term (5-15 years)	Subsystem
Operational	Possible future locations for hyperscale data centers	Concrete / Project	Short term (0-5 years)	Concrete

Source: Loorbach (2007), adjusted by author

The power of the central government to develop and implement policies in a top-down manner has decreased. This coincides with increasingly diffuse policy making structures and processes stratified across multi-level government (Loorbach, 2010). Generally referred to with the term "'governance" (Loorbach, 2010), the current practice of governments in Western European countries is to develop policies in interaction with a diversity of societal actors. In other words, interaction between all sorts of actors in networks often produces (temporary) societal consensus and support upon which policy decisions are based. This development is far from trivial in light of the many complex, persistent problems that face Western societies, and for which sustainable development can neither be planned nor emerge spontaneously.

Over the last decades, we have witnessed a shift from the centralized government-based nation-state toward liberalized, market–based, and decentralized decision-making structures in modernized European democracies (Loorbach, 2010). A view which relates to this is by Fleurke et al., (1997), who see that decentralization is a way of improving the organizational framework for dealing with certain policy issues. Not all policies are necessary to be decided on a ministry level. They state that two aspects are important in evaluating the effects and thus the success of decentralization. These are the characteristics of the process and the conditions in which it takes place. Fleurke et al., (1997) state that a number of characteristics determine the nature of the decentralization process. These are the scope of the devolved responsibilities and powers, the extent of central programming and the scale of policy instruments. The extent for in which way

these characteristics shape the decentralization process also depend on a number of factors, namely the complexity of the policy and the nature of these policy accomplishments, the expertise required to carry out the new responsibilities and to what extent the complexity of those responsibilities fit in the nature and scope of existing policy.

This decentralization process for the hyperscale data centers could be seen as an ineffective way of organizing the locations for hyperscale data centers. Planning issues were becoming more complex. It could be more convenient to solve planning problems on a decentralized level. The national government doesn't have a clue on local planning problems. As a result, it may be better to let local governments decide on planning cases. Yet it seems that for hyperscale data centers, is becomes counterproductive. Choosing and allowing a location for hyperscales requires knowledge on different topics such as water, electricity, policies and more. This seems to become too much for the local municipality. As a result, the planning of hyperscale locations could be more benificial if it was planning by national government.

De Roo (2015) states that the resistance between the higher and lower layers of the government is on why decentralization is important. With the data centers, there is a lot of friction between the national, provincial and local government. A ministry can have different wishes compared to a province or a municipality. Maybe the municipality wants a hyperscale, whilst the province favors the nature in that specific area and the ministry would for example prefer a large industry area. With decentralization, this makes it harder to achieve certain policies, because the higher level of governance can interrupt certain decisions. In the case of Zeewolde, the Senate interrupted the change of zoning plan destinations of the local government of Zeewolde by not selling the ground (Eerstekamer, 2022). Next to this, the complexity of the policy has influence as stated by Fleurke et al., (1997). With the national impact these hyperscale data centers have on the electricity grid, the complexity of the policies can be seen as big. This also makes sure that decentralization can be ineffective for when there is congestion on the electricity grid.

De Roo (2017) explains that sometimes the national government does not have the resources to control the physical environment in such a way that it satisfies all the different stakeholders. Different local context cases favor a local or regional level decision, hence the desire for a decentralized or area-specific policy. This transformation can be seen as a response to the growing dynamics, complexity and uncertainties of our societies (De Roo, 2017). However, for the hyperscale data centers in the Netherlands it seems that decentralization is not preferred. Whilst it seems that most cases could be solved in local and regional context, the demand on the electricity grid is in a national context. That is why maybe the hyperscale data centers planning could be improved it is planned on a centralized level.

2.3 Transition management in the Netherlands.

Within the transition theory, there are several multiple structures of activities throughout the transition which can be visualized in the multi-level concept model. This structure arrays from Micro-level to meso-level and to macro-level. The multi-level perspective supports that the transition emerges by the interaction between the different levels (Geels and Schot, 2007). Van de Brugge et al., (2005) explain that the activities on the micro-level are relating to the new technologies, individual actors and the emergence of new ideas. The hyperscale data centers are on this micro-scale the 'new' technology in the Netherlands. The rules, laws and norms performed by the dominant actors are on a meso-level (Van der Brugge et al, 2005). At the

meso-level, most of the problems came. There were no clear policies on data centers and the lack of rules caused a lot of political unrest. Political unrest because of no clear policies is a phenomenon mentioned earlier by Winsemius (1986). Winsemius (1986) explained that because the new 'environmental' issues had no policies yet, there was room for discussion. Without rules and regulation, there was no right or wrong and this caused political unrest. The hyperscale data centers are experiencing the same, and thus maybe with more central policies from the cabinet on data centers, the political unrest will fade away. It looks like that the data center planning is going through the same phases as the environmental issues discussed by Winsemius.

The societal context of slow, large-scale changes over time are on a macro-level (Van der Brugge et al, 2005). The energy transition can be seen as a possible slow societal change. The energy transition did not come out of nowhere; however it still came on an explosive scale (Loorbach et al, 2008). The current energy system is currently deeply embedded in our Dutch economy, consumption patterns, regulations and infrastructure. However, transitions to radically different energy systems are inevitable. Without clear policies on data centers and the current electricity grid congestion, it is hard to find correct locations for hyper scales. This is why different actors make different assessments regarding the urgency of the problem and the desired direction (Loorbach et al, 2008).

Uncertainties

Because it is hard to predict the winning options and major societal trends, Dutch context on policies in the industry changed in the 1970s from the 'backing losers' philosophy (giving state support to bad-performing large industrial companies) towards picking winners (Loorbach et al, 2008). A transition is a multi-actor problem-solving process. Transitions and the increase of importance in sustainability are inherently social factors, and therefore governance strategies involve a wide range of actors. Planned or unplanned change results from the interaction between actors. The transition process thus has an emergent character, both regarding how a transition is formulated in society as well as to what direction it goes. Governance strategies in this context has to include structuring and coordinating activities as well as allowing for and creating room for spontaneous and surprising activities. Government should play an active role in this process as a facilitating party, but still as one party among many (Eising and Kohler-Koch, 1999).

The government needs to formulate its necessary actions at the strategic level and become an integral part of the reflective discussions. When this reflective process is inadequate, it leads to a lack of coordination between levels of transition management, both in terms of substance and procedure (Loorbach, 2008). In relation to the hyperscale data centers, a decentralized approach could lead to the lack of cooperation, vision, and objectives-based view. A centralized level structured process could make sure that there is more structure in how to coordinate the data- and electricity transition.

The ministry as an actor has before encountered difficulty in breaking free from established routines, structures, and culture, and it has been hard to succeed changing this (Loorbach et al., 2008). Because of the bottom-up perspective and limited governmental involvement, we stay in a market- and technology-driven world (Loorbach et al., 2008). While this flexible facilitating approach can adapt to changes in network compositions, new initiatives, and actions, it remains close to conventional policies and approaches. However, it is noteworthy that through the

implementation of transition management, the ministry has gradually gained insight, adapted, and innovated its practices, thereby influencing its own policy culture (Loorbach et al., 2008).
It is important to see how the government reacts to the lack of strategic governance activities. The government is currently reacting to the issues which arise, such as the data centers. Relating to the transition management, only reacting isn't the best way of solving these issues. However, with learning-by-doing and doing-by learning problems such as finding locations for hyperscale data centers in the future will be resolved before it becomes a 'national' problem.
On the one hand, it's not weird that you don't know how to handle hyperscale data centers as they are a new topic in planning. Therefore, learn-by-doing and doing-by learning is fine. However, in the future, it is better to avoid this and address it beforehand.
The electricity transition, what is a major factor for the data centers, gained much speed, much attention and involved many stakeholders. Loorbach et at., (2008) state, it will be crucial to build further on achieved successes, claim and it is important to build room for innovating and learning and to be able to maintain a reflective approach. This reflexive approach can be seen in change in how data is stored. More data must be stored than ever. Will the Netherlands contribute to this data storage or ban the upcoming hyperscale data centers? Planning the locations beforehand on a national level could solve the responsive approach and make sure that there is more control in the whole process of finding a location for hyperscale data centers in the Netherlands.

Dynamics will necessarily shift more towards harvesting concrete successes, realizing fundamental changes in the regime and diffusing the process on a wider scale, at least to involve consumers. This will evidently require new and adapted strategies, approaches and instruments, which in part need to be discovered, developed and tested (Loorbach et al., 2008). It could be logical to think that a decentralized approach is how new locations of hyperscale data centers shall be planned. You could just compare them to distribution centers and that is also possible on a decentralized level. However, due to certain conditions it is more feasible to do it on a centralized level. This is because of the national impact the data centers have on the energy network. The electricity grid already has congestion and a hyperscale data center uses the power of a city, which makes it harder to find a correct location for a data center. This is why the national government could adapt and shift from a decentralized approach to a more centralized level planning approach. They could find a location, use their power to facilitate higher priority on the electricity connection.

With Winsemius' theory, it is discussed that political disagreement may arise due to new environmental issues. A current environmental issue is for example the hyperscale data centers combined with the electricity congestion. In addition, transition management by Van der Brugge et al,. (2005), Loorbach (2008) and Rotmans et al., (2001) among others is discussed and how the sudden rise of data centers and the increase in electricity usage is a transition that should be managed. With the use of De Roo (2015, 2017), Loorbach (2007,2008,2010) and Fleurke et al., (1997), the decentralization is explained and why hyperscale data centers could favor a centralized level for the decision on hyperscale data center locations also to help in the data- and electricity transition. Through this theoretical framework on spatial planning, a foundation has been laid on why hyperscale data centers are getting national discussion and that getting rid of the lack of policy and uncertainties on the electricity grid could make the unrest fade away. It is important to address that at the time of writing, there were no relevant academic papers based on hyperscale data center planning. To give more background on the hyperscale data centers in the Netherlands, news articles and reports on data centers in the Netherlands will be discussed in the

next chapter. What exactly does a hyperscale data center entail? Why can these be found in the Netherlands? What does the electricity grid and the electricity transition in the Netherlands have to do with hyperscale data centers? Finally, a conceptual model offers a perspective to study the case of hyperscale data centers in the Netherlands.

3 LITERATURE REVIEW

The structure of this chapter consists of the following elements. First, I will give an introduction on what exactly is a hyperscale data center. This is to construct a basis and gain knowledge and background on hyperscale data centers in the Netherlands. Through a literature review, I lay a foundation of knowledge to further understand the study. I clarify on what exactly is a hyperscale data center and why they are coming to the Netherlands. Also the net congestion on the electricity grid in the Netherlands is discussed. Because of the enormous use of power, this is one of the main reasons why problems arise from placing them in the Netherlands. Why can't the electricity grid just be expanded for example?

3.1 Hyperscale Data Centers

According to World Bank estimates, internet traffic in the year 2020 was about 1 gigabyte (GB) per person per day (The World Bank, 2021). The expectation then was that in two years, this traffic would increase by 50%. ING assumes that the growth will get stronger and stronger over time (ING, 2019). Internet usage will only increase in the future. This is partly due to the expansion of data-intensive practices and phenomena, such as big data analytics (the search for patterns in large amounts of unstructured data, including using self-learning algorithms), blockchain applications (such as cryptocurrency, a digital currency) and 'Better Deciding on Data Centers, the rise of the Internet of Things' (a network of digital devices connected via the internet) (CERRE, 2021). All these applications depend on data centers. But especially the biggest tech companies like Google, Microsoft, Facebook and Apple need to store so much data that it no longer fits in an office.

Data centers are an important part of our digital infrastructure, which enables the use of the internet. Citizens use it to store pictures in the cloud, look up pictures on Facebook and read the online news and stream videos on Youtube. Governments and businesses use data centers for example to store, process and share operational data or control data-driven devices. This data-driven technology innovations in the agriculture sectors enables us to make food production, farming and horticulture more efficient (WUR.nl, n.d).

There are different kinds of data centers. The Dutch Data Center Association describes three different types of data centers (DDA, 2022). Data centers are categorized as:

Colocation data centers, or also called multi-tenant data centers due to serving a hosting location for multiple customers. These commercially built data centers are built specifically to host servers for external customers. Hosting and/or cloud providers, schools, banks, hospitals, governmental organizations and more can purchase servers in these data centers. The goal of the colocation data centers is to make sure that everything keeps running for the customers and the connectivity is at its best.

*Company data centers***,** also known as single-tenant data centers due to serving a single client. The datacenter is solely responsible for the data storage of the company itself. These are mostly

older, inefficient server spaces built by (at the time) big companies to facilitate their own IT-environment. Since the complexity and efficiency of data is constantly growing, the trend is that most of the single-tenant centers migrate towards multi-tenant servers.

Hyperscale data centers are the most known data centers and are also the focus of this study. The definition of a hyperscale datacenter is at least 10 hectares and has an energy connection of 70 Megawatt or more (Rijksoverheid.nl, 2022b).
These data centers are owned by the biggest tech companies such as Google, Microsoft and Meta. Hyperscale data centers are specifically built for the servers for one of these companies and are the only user of the datacenter. Due to the scaling of the size of the data centers, they become more efficient in terms of energy consumption, work processes and more. However, whilst they consume energy more efficiently still means that they consume huge amounts of energy compared to the other two categories of data centers. This is why they are a controversial topic. In the Netherlands there are three hyperscale data centers. In Eemshaven there is a hyperscale from Google and in the municipality of Hollands-kroon there are two hyper scales from Google and Microsoft (DDA, 2022). A third location for a data center from Meta in Zeewolde is currently postponed until further research is done by different actors.

There are a couple of reasons why big multinational companies such as Meta, Google and Microsoft want to place their hyperscale data centers in the Netherlands. The Netherlands is a first world country, and one of the first countries in the world to have had access to the internet. The Netherlands has a strong motivation to be the leader of the digital world, with various ideas (such as the Spatial Strategy Data Centers Roadmap 2030) to make it a realistic plan. With this analysis, I describe why these tech companies want to locate their hyperscale data centers in the Netherlands. Whilst being one of the first countries to have access to the internet is not a main reason to build a data center in The Netherlands, there are 6 factors why for example Meta wants to build a data center in Zeewolde, the Netherlands.

1) **Suitable internet connection and sea cables**
   The Netherlands plays a key role in the European part of the internet. Important internet connections are coming ashore from the United States and the UK. All these cables come together in the internet hubs AMS-ix in Amsterdam and NL-ix (DDA, 2022). The AMS-ix is a large hub where all end-users meet. Consumers are not directly connected to the hub, but they are connected by internet providers. All the Dutch internet providers are connected to the AMS-ix, but also hosting companies and big content providers such as Microsoft, Google, Facebook and RTL are connected for example. The AMS-ix infrastructure is spread over different locations in Noord-Holland and new locations are added regularly, which makes it a robust infrastructure cluster (DDA, 2022). The AMS-ix the second largest hub in the world in the number of customers connected. Because of this connection, it is attractive for companies to place a data center in the Netherlands.

2) **Suitable digital infrastructure**
   The internet consists of over 50000 different networks. It is not possible to connect all of them directly together, that's why there are internet exchanges. In Amsterdam, there is the

AMS-IX, one of the biggest internet exchanges in the world (Eurofiber.com, n.d). It is extremely attractive for hyperscale data centers to be in a country with a suitable digital infrastructure. After all, this only improves their services. Nevertheless, besides being dependent on digital infrastructure, data centers are also part of it. The physical components, people and everyone who uses the products and services together form, and broaden, the digital ecosystem (Rathenau, 2022). It is a combination of all these elements that ensures that our digital infrastructure remains one of the best in the world.

3) **Suitable climate for cooling**

The cool climate in the Netherlands is perfect for the data centers. The machines in a datacenter consume a lot of energy and will heat up. Due to the huge size of a hyperscale datacenter, a lot of heat will be released. A colder climate will provide automatic cooling. Some hyper scales produce cooling for the equipment on hot days, when the temperature exceeds on average 25 degrees. They use drinking and/or surface water to cool equipment on these hot days. It is feared that this could occur periodically. Opponents of hyperscale data centers use water cooling as an argument for stopping the realization of hyper scales. The water used for cooling could periodically cause problems for the security of supply (Rathenau Instituut, 2022). However, the DDA elaborates that only 0.075% of the tap water in the Netherlands is used by Information & Communication Sector (where data centers are part of).

4) **Low risk of disasters & politically stable**

The risk of disasters is relatively low in the Netherlands. Risk is defined by the probability times the damage (Rathenau, 2022). Hurricanes, floods and earthquakes all have relatively low probability. The Netherlands is a politically stable country (Rathenau, 2022).

5) **Trustworthy energy supply with sustainably electricity**

The Netherlands currently has one of the most trustworthy electricity grids in the world (Netbeheer Nederland, n.d.). In the Netherlands, the guaranteed electricity equals 99.99%, where the biggest cause of malfunctions is during excavations. On average, both private and business customers had in 2020 on average only 21 minutes of power failure per year (Netbeheer Nederland, n.d.). Data centers have a constant need for power, because the internet and data transmission do not stop overnight. Not only the guaranteed energy supply, yet also the possibility of renewable energy makes the Netherlands an attractive place for a datacenter. The datacenter sector is leading in sustainable innovation (DDA, 2022). Both in energy efficiency, power usage effectiveness, (PUE's) and the use of sustainable energy supplies are data centers leading the way and will continue to do so in the future (DDA, 2022). Whilst the hyperscale data centers in the Netherlands do use renewable energy, the renewable energy is not generated on their own land. Hyperscales use the most electricity of all the data centers, use power purchase agreements (PPA) to pay for their renewable energy.

Hyper scales, the data centers with the highest energy consumption, typically do not use subsidized power. Instead, they enter long-term contracts (power purchase agreements) for renewable energy generation with start-up projects, allowing them to operate subsidy-free (CERRE 2021). In this way, they thus actively contribute to the greening of the power

supply. Still these projects also require physical space. And citizens increasingly wonder where all the wind turbines, solar parks and other infrastructures needed for the energy generation and distribution required by the energy transition could be located (e.g. Rengers and Houtekamer 2020b). Other areas where there are many data centers and where such problems currently arise are the regions around Dublin (CERRE 2021) and Stockholm (Libertson et al. 2021). That is not to say, that this is always electricity that has been generated sustainably. Electricity that is not self-generated and comes from the grid is a mix from both fossil and renewable (or otherwise designated as sustainable) sources. Parties wishing to buy green power therefore buy certificates (so-called Guarantees of Origin, GvO) issued for each MWh generated sustainably. These companies can also buy such certificates for electricity generated and consumed abroad. By doing so, they do not contribute to the greening of Dutch power generation. If companies buy these certificates from neighboring countries, the Netherlands still must produce nonrenewable electricity. This again raises the question of how best to balance the costs and benefits of different (but related) infrastructures.

6) Cheap sustainable energy

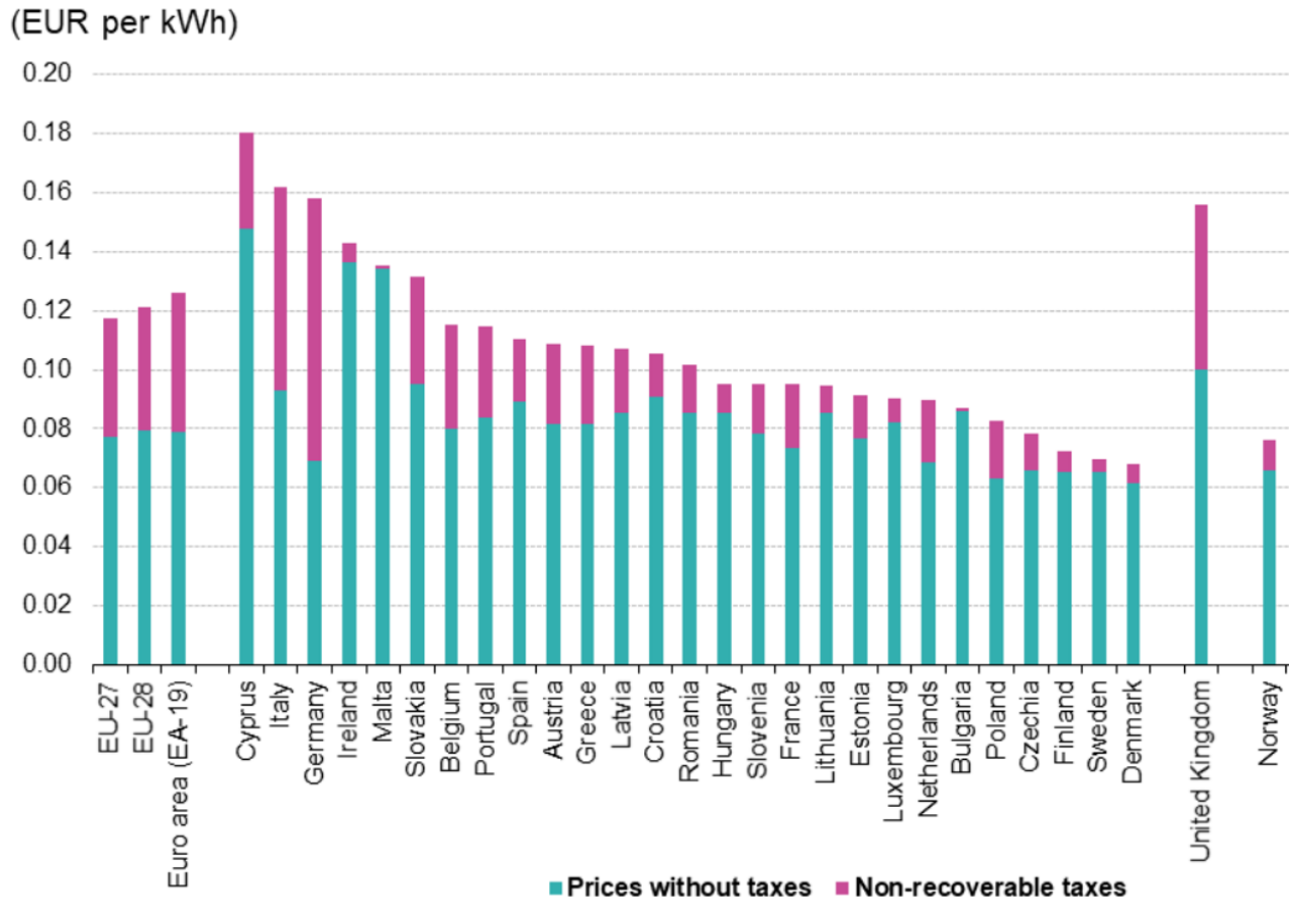
In the tv-show Zondag with Lubach, the relationship between sustainable green energy and hyperscale data centers was discussed. Among other things, it is said that the subsidy for sustainable energy leads to cheaper electricity, which brings even more data centers to the Netherlands. Rangers & Houtekamer (2021) follow this up by saying that these companies like to be close to the sources of green energy. That this saves costs and is useful for their image. However, those companies that so beautifully proclaim green power that Dutch citizens subsidies are bad for the overall energy transition, as stated by 'Zondag met Lubach'.

Not everyone completely agreed to the episode on data centers by Zondag met Lubach. An article published on Energeia, a platform for discussion in the energy sector, argued that the arguments by Lubach were clear, but not accurate. The writer of the article, Alex Kaat, states that the citizens of the Netherlands do not 'pay' for cheaper electricity prices for the data centers get (Energeia.nl, 2022). The data centers buy electricity. The price of the electricity is determined by the most expensive marginal producer, now mostly gas power plants. That is the same for every other industry that buys electricity. And if the data centers also buy sustainable Guarantees of Origin (GVOs) in addition to this for their image as a green company, does not cost the taxpayer anything extra (Energeia, 2022). Why Arjan Lubach can start the discussion on hyperscales and cause political unrest can explained be looking back at the policy life cycle created by Winsemius in 1986 and later discussed by Van Daalen en al., (2002). The first phase of the first phase of the life cycle (recognition) are 'eye-openers', which helps place new environmental issues on the political agenda. And just as this academic literature describes, the episode of Arjan Lubach can be seen as an eye-opener which starts the discussion of hyperscale data centers. The episode was an eye-opener for a lot of people and the first piece of knowledge on data centers for them.

Hyperscale data centers operate particularly in corporate renewable energy procurement, mainly through power purchase agreements (PPAs). This to purchase or generate enough renewable electricity to match 100% of their operational consumption (IEA, 2021). The Netherlands has low tax on electricity and even extra lower network costs for big electricity users (Kaat, 2022). As you

can see in Figure 3, the Netherlands is one of the cheapest countries for industrial electricity price, with taxes included. Kaat explains in an article (Energeia, 2022) that the numbers in Figure 3 mask the fact that small- to middle sized electricity users pay almost three times as much tax compared to the big users.

Figure 4 Electricity prices for non-household consumers, second half 2019



Source: Eurostat (2019).

In addition to low taxes for the electricity prices, large electricity consumers in the Netherlands have low network costs. Back in the day, all customers used to pay a calculated share of the costs of the network (Kaat, 2022). In 2013, to prevent a massive electricity user from going bankrupt, the national government voted for an emergency law to reward large-scale consumers with low network tariffs (Tweede Kamer.nl, 2013). Large scale electricity consumers with low network tariffs is a reason why for example Meta is interested in having a hyperscale data center in the Netherlands. If they are ensured by national policies that because of their large amount of electricity used, they can have a reduced fee and they are more likely to stay in the Netherlands.

Companies with a consumption of more than 50 GWh per year have since received a discount on transport tariffs of up to 90%. While this scheme was meant for other sectors, data centers are also included. The Zeewolde datacenter would use about 1380 GWh a year (Ekker & Kasteleijn, 2021). The difference with other data centers is that most other sectors are usually more energy inefficient and contribute less to the energy transition. If politicians have trouble with that

- and they have every reason to - then they will have to cut back on the favorable taxes and discounts for power guzzlers," says Kaat (Energeia.nl, 2022). If not, then don't complain about data centers either".

The percentage of green electricity in the Netherlands is increasing. By the summer of 2022, the percentage of renewable electricity used was at almost 50% per month (Klimaatakkoord.nl, 2022). The production of green electricity continues to rise rapidly. In 5 out of 7 months in 2022 (January to July) was the share of green electricity above 45%. The climate agreement aims for 70% sustainably generated power by 2030. The Netherlands Environmental Assessment Agency (in Dutch Plan Bureau voor de Leefomgeving) considers 75% sustainably generated electricity feasible (Klimaatakkoord.nl, 2022).

This nearly 50% generated electricity accounts for a total of 17% of Dutch energy use (Klimaatakkoord.nl, 2022). The difference here is that renewable electricity is only part of the total renewable energy in the Netherlands. In fact, total energy consumption in the Netherlands consists of 3 components. Heat (from mainly buildings and industry) accounts for 55% of total energy consumption. Transport accounts for around 25% (road and air traffic). Electricity use is 'only' 20% of total energy consumption. With electrification (e.g. cars from diesel to electric), electricity consumption will eventually be around 25% of total energy in the Netherlands (Klimaatakkoord.nl, 2022).

The data center in Zeewolde would use 1380 GWh a year (Solarmagazine.nl, 2022). Of this, 3.7% of energy consumption could be generated by solar panels in their area (Solarmagazine.nl, 2022). The total consumption would correspond to 460,000 households. The whole of the Netherlands consumes 111.2 billion kilowatts of power. Converted to TWh, that's 1.38TWh and 111.2TWh (about 1.2%). Central government's ambition was to aim for 70 gigawatts by 2050 (Rijksoverheid.nl, 2022b).

The datacenter infrastructure and the processing power that comes with it require a lot of energy. When the datacenter works inefficiently, the energy usage increases. Power usage effectiveness (PUE) is a tool to measure the energy efficiency in a datacenter. PUE is calculated by dividing the total amount of power entering a datacenter by the amount of power which is used to run the IT equipment with it. Because it is a ratio, a perfect energy efficiency uses a PUE of 1.0. The Hyperscale datacenter in Eemshaven has a PUE of 1.09 (Google, 2022), which is highly efficient. A suitable location, combined with up-to-date technology will contribute to the lowest PUE possible. Furthermore, electricity efficiency is the data of the IEA. Their calculations show that whilst the amount of internet traffic and datacenter workloads increase, the amount of data the data center uses stays consistent (Figure 2 in Chapter 2).

There are ambitious plans to go for even better and cheaper electricity efficiency. Google and Microsoft announced to source and match zero-carbon electricity on a 24/7 basis. With new digital technologies, combined with machine learning they can help for a carbon-free procurement by actively shifting computing tasks to times and regions for which low-carbon sources are plentiful (IEA, 2021). These are however long-term aspirational ways.

3.2 What are the pros and cons of hyperscale data centers in the Netherlands.

By giving pros and cons we can give a slightly clearer picture of why data centers could come to the Netherlands. Also, what are important elements of an exact location such as Zeewolde? What are generic factors on what makes the Netherlands an attractive host location? The real value of the Digital Infrastructure sector lies in its significant impact on the much larger Internet economy

and broader digital society. The picture emerges that Digital Infrastructure cannot be separated from a successful digital society, placing the Dutch in a favorable position to profit from digital growth. (Deloitte, 2013).

The Netherlands has remained a leader in networks, digital infrastructure and connectivity (DDA., n.d). Due to its central location, the Netherlands is an ideal connection to the rest of Europe as Digital Gateway to Europe. This is also known as the Digital Mainport, as a logistics hub alongside Schiphol Airport and the Port of Rotterdam.

This digital infrastructure is attractive for international tech companies. This creates an excellent investment climate and economic growth, in the form of investments and jobs (DDA, n.d). The datacenter and cloud industry has become an important part of our economy. The total digital sector accounts for around 25% of GDP. The datacenter industry also is responsible for around 20% of all foreign direct investments in the Netherlands. With an average growth of almost 10% a year, an ever-increasing amount of people have jobs (in)directly related to this sector. An obvious example is the creation of the (hyperscale) data centers, but also other tech companies have their headquarters in the Netherlands, for example Netflix and Booking.com (DDA, n.d). However, that does not have to be due only to the digital infrastructure; it can also be due to fiscal rules.

There are several generic arguments why the hyperscale data centers shouldn't be based in the Netherlands (Obbink, 2022). First is the size of the data centers. The three hyper scales combined are 164 hectares big. The hyperscale in Zeewolde would be 100+ hectares. The Netherlands is a small and dense country. The minister of Housing and Spatial Planning, Hugo de Jonge, mentioned that the Netherlands is relatively small compared to other countries and the scarcity of space and renewable electricity is too great to be careless with space and energy (Kasteleijn, 2022). The locals around the data centers actually prefer not to see the construction come near them due to the size and the ugliness of the data centers (Rengers & Houtekamer, 2021). Here, other factors are especially important. Often the zoning for that area is a meadow or other natural areas. When this is changed to a location for the data industry this piece of nature will change to a large box and locals prefer not to look at this.

For the case in Zeewolde, the inhabitants were against the construction of the data center due to the size (Zeewolde.nl, 2021). Meta would have had a size larger as 100 hectares, which is close to the size of the current 3 hyper scales combined (167 hectares, DDA, 2021). The local political party Leefbaar Zeewolde has anticipated this. After the elections they became the largest party, partly because of being strongly against the datacenter (Zeewolde.nl, 2021). The locals favor not having a data center by voting for the party Leefbaar Zwolle.

By analyzing the previous chapters, a couple of factors can be concluded on what exactly is a suitable location for a hyperscale data center.

The location should have:

1. A connection to the electricity grid with much power security *(99.9% uptime)*
2. Enough space and the suitable place for a zoning plan allowing construction and the use of a data center. *This is for example in Hollands-Kroon Umbrella-Zoning Plan*
3. Supply of a large amount of renewable energy nearby. *For instance, offshore wind energy close by.*

3.3 Electricity Use, Sustainable energy & the electricity grid

One of the main issues regarding the construction of a datacenter in the Netherlands is the electricity grid congestion. There are multiple reasons why there are problems with the energy usage now. First, the amount of energy a datacenter requires. You cannot simply plug-in a datacenter into the energy grid currently with the grid congestion now. As discussed in the theoretical framework, the electricity grid therefore the discussed concepts in chapter 2, especially dealing with uncertainties and understanding multilevel governance is useful here as well.

To meet such a growing demand, the electricity grid will have to be enlarged by the local grid operators. The power grid's capacity is not designed to cope with a sharp increase in demand (Stil, 2019). Not only hyperscale data centers, but also other large-scale consumers of energy are waiting to be connected in the Netherlands (Van Gils and Olsthoorn, 2020). And with the electrification of transport, heat and industry, the demand for electricity will increase even more (Rathenau, 2022). The energy transition will also require large-scale expansions, because of the integration of equipment for electricity generation from variable energy sources, such as solar panels and wind turbines. Also in residential areas, the number of solar panels, heat pumps and use of electric vehicles are increasing. Stakeholders are waiting in the queue to be connected to the grid. Now there is a first-come first served principle for connection to the grid. Electricity suppliers requested the government to change this to make prioritizing a possibility. The Minister of Climate and Energy ruled out this possibility because of the non-discrimination principle in the European energy legislation (Rathenau, 2022).

However, municipalities and provinces can prioritize certain functions through their zoning plans, which is then reflected in their connection to the grid (Van Gastel 2022). The province of Friesland was the first to do this (Verhoeve, 2022). The province of Friesland prioritizes various grid upgrades (and not individual connections) based on their social added value. For example, the supply of electricity is regarded as more urgent than the introduction of electricity from renewable sources, and grid reinforcement projects with the greatest positive social impact are given priority. The social impact is assessed based on the consequences for homes, businesses, economic added value and solving acute transport problems (Vemw, 2022). On a national level, the government also wants a prioritization guideline. The guideline would enable the network operators to prioritize network reinforcement investments more efficiently than currently is the case.

The VEMW, which is a knowledge center designed to advocate for corporate energy and water users in the Netherlands, endorses the potential of such a guideline. However, it needs to be carefully considered, and it should not make the network users dependent on political arbitrariness for access to the electricity market (Voorhoeve, 2022). You don't want a politician that can take a whole new path compared to the last one. It would be useful to have a main vision, guidelines and/or policies on how the future should look like. VEMW explains: "The shortage of employees and equipment, as well as long lead times of permits hinder the rapid realization of grid upgrades. A sustainable solution to the shortage of network capacity requires alignment with a legal basis in the realization of network investments" (Voorhoeve, 2022).

In many places, grid managers are already unable to meet the large demand for transmission capacity (Markt, 2022). A problem is that years pass by before the necessary enforcements are carried out. The *Autoriteit Consument & Markt (ACM)* is responsible for making sure everyone in the Netherlands gets electricity and gas. The energy market for electricity and gas consists of energy suppliers and network operators. The grid operator is the owner of the cables,

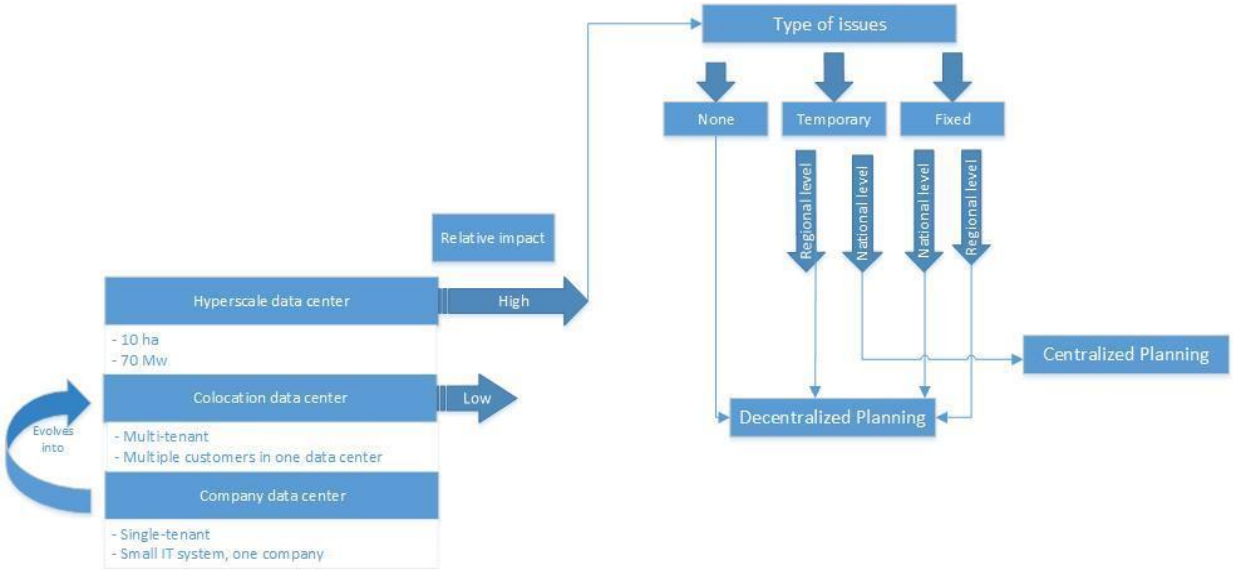
gas pipelines and connections. The energy supplier sells the energy. Because the grid operators are not allowed by the ACM to pre-invest in the electricity grid, it takes a long time with regulations to transport to a certain place (Markt, 2022). It is hard for net operators to build new connections, because net operators go over many different types and owners of land and they must get a permit for each slot of land. All these conversations with different stakeholders take a lot of time. It would be more beneficial to get these permits beforehand instead of for example a data center being constructed. This would save time, be more efficient and make it more attractive for data centers to come because they know that a connection to the grid wouldn't take a lot of time.

3.4 Conceptual framework

Figure 5 shows the conceptual framework based on the theoretical framework and the literature review. The Netherlands has as principle to govern the country as decentral as possible in relation to spatial planning. As of 2015, the tasks and responsibilities of municipalities have increased significantly (Tempelman et al., 2015). With this conceptual framework I want to show the difference on how different factors influence the decision if something could be more feasible on a central or decentral level. In this model, hyperscale data centers if central level or decentral level would be more feasible. On the left side the three different kinds of data centers are shown, as described in chapter 3.1 In this model, we only investigate the hyperscale data centers due to the relatively high impact on national level.

There are different uncertainties for the planning of locations for these hyper scales. Electricity, space, water, air are different kinds of problems which are important factors for deciding on a location for hyper scales. The hyperscale data centers have a relatively high impact on the national level of governance, due to the size and amount of electricity needed. When a hyperscale data center is completely built, they must be 'plugged into' the electricity grid. Because there is a lot of electricity used, it will cause congestion on the grid. The net congestion is partly because we are currently undergoing an electricity transition in the Netherlands. In the future this will eventually fade away and net congestion will not be a problem anymore. If the amount of electricity consumed by the hyperscale data centers will not have an impact on the grid, it could mean that hyperscale data centers can be planned on a decentralized level without any problems. The types of issues are divided into none, temporary and fixed issues. None means the planning of a hyperscale data center has no problem. Temporary means that there currently is a problem, but in the future the problem goes away. An example for a temporary issue is electricity grid congestion. This is temporary because for data centers it limits the planning for data center locations now, but the grid congestion will go away in the future. A fixed issue is a problem with no (clear) solution or small odds. Lack of space for a hyperscale data center is a fixed issue. The odds are small that if there is already construction this will be taken away for space for a data center. Thus, why hyperscale data can't be planned in the middle of Amsterdam is a fixed regional issue and can be decided on a decentralized planning level.

Figure 5 Conceptual Framework



As discussed in the theoretical framework in chapter 2.2, we have witnessed a shift from the centralized government-based nation-state toward liberalized, market-based and decentralized decision-making structures (Loorbach, 2010). Fleurke et al., (1997) proceed to state that this could be due to the complexity of certain policies, the nature of the policy accomplishments and/or the expertise required to carry out the new responsibilities. With this model, I investigate if the reason that hyperscale data centers in the Netherlands can't be planned on a decentralized level is because of the national level issue (the electricity grid) and if it would be solved if the planning of locations for hyperscale data centers could be done on a central level such as the ministry.

In this literature review, I have described the generic basis of hyperscale data centers in the Netherlands with the use of articles and rapports. As mentioned in 3.2, there are four factors as to why they can be well located in the Netherlands (available connection to the electricity grid, enough space, suitable data infrastructure connection and sufficient supply of renewable energy close by). After that, an explanation on why the electricity grid in the Netherlands is currently an important factor for the placement of the hyperscale data centers is discussed, and why it caused resistance. With the conceptual framework I show that the problem lies in a national issue, the electricity grid congestion. How I further research this study is explained in the next chapter, the methodology.

In the methodology I will justify why I chose this type of research. In the theoretical framework and the literature review, there was still a gap due the fact that there were no relevant academic papers on hyperscale data centers. Therefore, I interviewed 2 stakeholders who are involved with data centers. One involved with the hyperscale data center in Hollands-Kroon and one member of the Dutch Data Center Association. In addition, 2 interviews are with people who work with the electricity grid. I want to investigate if hyperscale data centers are indeed better to plan on a central level due to the electricity grid problems (as can be seen in the conceptual model). One works as a regional net operator Stedin and the other for the national net operator TenneT. I chose two people in this topic to get a fairer and clearer image, and to be able to compare information between the stakeholders.

4 METHODOLOGY

A useful research design is the backbone of every research and helps to achieve valid and reproducible outcomes. Because it is a relatively new topic, there is no literature on why 'simple' spatial planning of these data centers causes political unrest during local level planning and why it could be better to plan the data centers on governmental level. Therefore, I personally spoke to 4 different stakeholders close to this topic. 2 of them were involved in hyper scale data centers, and 2 of them are involved in electricity planning on regional and national level. After that a content analysis of the documents shows websites, motions and journals used for this study. For At last the ethical considerations of the interviews are explained. After this chapter, the case of Zeewolde is discussed with the use of this methodology.

4.1 Research design & Strategy

To be able to answer the research question: *''Under what conditions is centralized level planning the most feasible way to plan hyperscale data centers in the Netherlands?*, multiple semi-structured interviews are conducted.

Hyperscale data centers planning is a relatively new topic in the Netherlands. Due to the lack of knowledge, I use an exploratory research method. The goal of exploratory research is to determine the nature of the problem and help to gain a better understanding of the problem. For an explorative study it is important to address that the direction can be changed subject to the revelation of new data or insight (Research Methodology, n.d). For example, the Rathenau Instituut (2022), the government (Rijksoverheid 2022a,2022b) and the Dutch Datacenter Association (2022) all publish articles and reports during the research phase and add new information on the topic. The problem of the planning of hyperscale data centers in the Netherlands is still in a preliminary stage and there is not enough knowledge available. Using the newly acquired information which will be explained in the data collection section, the study will be conducted.

During this research, new information on the subject is published. This means that during the research, information may change and the direction of the research may suddenly take a turn. For example, the national government stopped local governments from creating new locations for hyperscale data centers (Rijksoverheid, 2022a) This is why the strategy is exploratory research. The research analysis, combined with the literature review will all eventually come together in Chapter 5, in a case-study of the potential hyperscale data center of Meta in Zeewolde. Using a case study, an open observation makes sure you can investigate the different aspects and problems why the planning of data centers would benefit from centralized planning. Using a case study as strategy, all the new information on the Zeewolde case can be investigated and processed in this research.

To gain the information for this exploratory research new information and new documents are obtained in between the interviews. Also new information was published by the media on data centers during this study. That is why I chose to do a slightly modified semi-structured interview

each time. This means that the questions in subsequent interviews will change. Therefore, I chose to use a modified semi-structured interview approach. (Hyperscale) data centers remain a topic that is still being researched and where policies/information will change. Because I must complete the research, some parts may be time-barred. I gathered all the ins and outs about the data center in Zeewolde. I have reviewed the minutes of council meetings in Zeewolde. Everything in the case of the data center in Zeewolde is publicly available. As a result, I conducted 4 interviews, read the minutes of the municipality of Zeewolde on data centers, analyzed the academic articles on data centers, and read all the relevant documents on data centers. When I could no longer find new relevant information, I stopped collecting data. I had enough information about the data center in Zeewolde (and about data centers in general) to answer my questions.

As I mentioned earlier, this is an exceptionally current and new topic. First, I started reading all the documents I could find on data centers, combined with what I could find on data centers in the newspapers (NOS 2022a, 2022b, 2022c) and on the internet (KCBR, 2019; Stadzaken, 2020 ; Solarmagazine, 2022). Then I started looking at how I could incorporate this into a suitable study. From a question from the Dutch Datacenter Association whether hyperscales should not be planned in a more centralized way, I started researching this myself. I started adding useful academic papers (and found out that there is no relevant academic literature on the topic of data centers yet). Among these academic papers, the policy life cycle of Winsemius (1986), central level planning (Fleurke et al., 1997; De Roo, 2017) and transition management (Geels and Schot, 2007 ; Van de Brugge et al., 2005 ; Loorbach, 2008) emerged. As a result, I found that there is information missing in academic research and literature to answer the main question. At the moment, I could not yet say with certainty under what conditions centralized level planning is the most feasible way to plan hyperscale data centers in the Netherlands. That is why I chose to interview two people who are related to hyperscale data centers in the Netherlands and two people who are related to the electricity grid in the Netherlands. With this I want to show why, what the difference is for planning between an hyperscale data center and a distribution center in the Netherlands. They may be similar in size and appearance (large surface area and relatively ugly building style), however a hyperscale data center cannot be planned on a decentralized level, whilst a distribution center could. I can only find this out by investigating and interviewing certain people, because otherwise the information is yet unknown.

4.2 Data collection

This study includes two different types of data collection methods. Both primary and secondary data is collected. Primary data is collected by multiple expert interviews, whilst the secondary is collected by a document analysis. In an exploratory study, a combination of document analysis and multiple expert interviews can strengthen the research results and give more in-depth insights in the subject that is studied, as Shaoib & Mujaba (2016) argue.

4.2.1 Interviews

The primary data was collected by modified semi-structured interviews. During the interviews, the interview guide slightly changed. This is because new information on the hyperscale data

centers in the Netherlands was published. With guided semi-structured interviews, the interviewer relies on asking participants questions to collect data on a certain topic, whilst the questions do not have a complete set pattern and questions are not fully arranged in advance (George, 2022). A basic set of questions if structured specifically for the interviewee, whilst there is also space for a discussion which I did not prepare for. The structure Semi-structured interviews have the advantage of being flexible with room for spontaneity, combined with questions prepared during research. With a certain lack of structure the interview is open-ended, helping gather information on a topic whilst still allowing to observe patterns.

The decision for a semi-structured interview is because the research is exploratory in nature. With a semi-structured interview, new or shifting viewpoints can occur. Advantages of semi-structured interview is that the interview feels like a conversation where new topics and ideas can flow (George, 2022). The interviewee is more able to explain their knowledge on a topic, whilst not sticking to certain questions.

Another reason why a semi-structured interview is more appropriate is because experts from different fields were interviewed. The interviewees were chosen because they all have something to do with hyperscale data centers. Two of the interviewees have something to do directly with hyperscale, whilst the other two were chosen to explain the problems with the electricity grid. Because this study is exploratory by nature, knowledge from different sources are required to gain a better understanding of the topic. After the interview, new documents or information is shared which influence the questions for the future interviews.

Purposive sampling is used to select potential participants. According to Palinkas et al., (2013), the use of purposive sampling is only effective when a restricted number of participants from a population serves as a legitimate source. The participants in this study contacted by email, phone and contact pages from websites. Through the process of interviewing, additional participants are suggested, creating a so-called snowball sampling (Goodman, 1961). Snowball sampling can be used to find interviewees who are not in the foreground beforehand or are easier accessed through others.

Analyzing data

Table 2 shows the participants and their relation to the topic of this study. All the interviews were in Dutch and conducted through Google meet. The interviews are recorded, after having verbal consent and enabling the possibility to transcribe the interviews.

After acquiring the data, I want to analyze the data. This is why the interviews are transcribed and are used to code (based on appendix A) and gain results. I had a set of codes in advance, based on the conceptual framework. To compare the interviews, I compared the reasons why the hyperscale data center in the Netherlands was not coming. These national level problems are based on the ‘electricity grid’ code. Other reasons which are not structured around a national level are for ‘environment’ or ‘size’. By comparing this, I can find out through the codes which conditions are important so that hyperscale data centers can be planned better at a central level than a decentralized one.

The coding is both inductive and deductive. Starting the research as explained before, I deductively started with a set of codes on what issues arise whilst planning with hyperscale data centers. Afterwards whilst analyzing the results, a new code came forward. It turned out that after reading the data and finding the patterns, I had not found all the codes beforehand. Pure theory alone was insufficient to arrive at all the insights. 'Integral planning' (or the lack of integral planning) was a reason why hyperscale data centers had issues with local level planning of the locations of data centers. After this, by working inductively and deductively, I found all the data needed to use for a conclusion for hyperscale data center planning.

The interviews are recorded and transcribed in Dutch. The coded transcripts are analyzed. The transcriptions can be found in Appendix A. The interviews are analyzed with deductive and inductive coding. The deductive codes can be recognized by the blue color. These codes are from the literature review. These codes are used to create the scope and discussions for the results. Using the terms temporary and fixed problems (where fixed is about issues that are long-term), the codes are divided. The inductive codes (which can be seen by the color red) are new themes that came from the interviews. These codes gave new insights on the problem and will also be used in the coding tree. The theoretical framework is the base to help with the analysis of the interview.

The conceptual framework forms the basis on which the results will build. Irrelevant parts, such as off-topic parts of the stories of the interviewer are not transcribed. The raw recordings are still available at the time of the submission of this thesis for minimally a month. Coded data helps to extract relevant information by organizing the data and attaching values to this (Auerbach & Silverstein, 2003).

The interviews took from 30 to 60 minutes, depending on the relevance and knowledge of the participant in this study. The interviews are in a chronological order. This means that I first interviewed person A and at last interviewee D.

Tabel 2 Interviewees

Interviewee	Job + Sector	Function
A	Datacenter Hollands-kroon	Municipality - Project leader Hollands Kroon Data Center
B	Stedin (Energy)	Energy grid expansion
C	Dutch datacenter Association (data centers)	Marketeer
D	TenneT (Energy)	Energy System Planner

Interviewing these 4 people gives me additional data on hyperscale data centers and knowledge on the electricity grid. I analyzed the interviews to gain data to get the results to answer the research questions. The interviews are there partly to find out information that I cannot find in the literature or in documents.
Together with the document analysis, the literature review, these 4 interviews gave me enough information to get a clear picture of how exactly the case of hyperscale data centers in Zeewolde came about. Multiple interviews along these lines will only cause repetition and not add new value to this study. In a systematic way, I went through the material, giving me a clear and honest picture. By talking not just from 1 but 2 data center stakeholders, and not 1 but 2 stakeholders in the energy sector, you can see whether opinions may still differ between interviewees in some areas. I've listened to both sides of the arguments to get an appropriate overhead view of the discussion. After thinking about it, this was enough information altogether to complete this study.

4.2.2 Content analysis of documents

In addition to the interviews, documents are selected and analyzed through a content analysis. Content analysis is defined by Berelson (1952) as "a research technique for objective, systematic and quantitative description of the manifest content of communication" (Berselson, 1952, p.p 18). Prasad (2008) further elaborated that content analysis is more than a quantitative description, as it produces objective, systematic and generalizable results from qualitative data. Because the information about the centralization of data centers in the Netherlands is topical, new information is published throughout the research period. The secondary data is thus collected before, during and after the interviews. Interviewees also gave new documents which were not available beforehand. The secondary data collected consists of articles, rapports, websites and newspapers. The goal of this content analysis is to give depth to interviews, and to understand the discussion for hyperscale data centers. Table 3 shows the different kinds of documents used.

Tabel 3 List of websites, television shows, news articles, reports and documents

Document Type	Title	Source/Author	Accessed on	Published On
Journal	*Policy Life Cycle of Winsemius*	Winsemius	10-03-2022	1987
Report	*REOS (Spatial Strategy Data Centers Roadmap 2030 for the growth of data centers in the Netherlands)*	Rijksoverheid	06-05-2022	03-10-2019
News Article	*Broken promises: how the Wieringermeerpolder silted*	NRC	08-05-2022	05-06-2020

	up with wind turbines and data centers			
News Article	*Data centers use 2 times as much electricity as Amsterdam*	NRC	08-05-2022	21-06-2020
Television Program	*Netherlands as a hard drive*	Zondag met Lubach	12-12-2021	10-11-2020
News Article	*New data centers? The paperwork comes later*	NRC	08-05-2022	24-11-2020
News Article	*Data centers in the Netherlands use 66% more power as before.*	NRC	08-05-2022	14-12-2020
News Article	*Data center industry wants government to regulate where new data centers will be located*	Dutch Data Center Association	10-12-2021	27-10-2021
Motion	*Zeewolde City Council votes in favor of arrival of mega-datacenter*	Municipality of Zeewolde	05-01-2022	16-12-2021
News Article	*A data center, do we really need one? And here?*	Trouw	10-10-2022	07-01-2022
Motion	*Provisional halt on new mega data centers, no impact on Zeewolde*	Eerste Kamer	22-03-2022	16-02-2022
Television Program	*Data center in Zeewolde*	Zondag met Lubach	23-03-2022	21-03-2022
Report	*Making better decisions about data centers*	Rathenau Instituut	06-05-2022	14-04-2022
Website	*Political choice for low taxes and net grievances attracts data centers to the Netherlands*	Energeia	21-05-2022	14-05-2022
Motion	*Hyperscale data centers in the Netherlands only on two locations still welcome*	Eerste Kamer	10-06-2022	10-06-2022
News Alarm	*Grid operators ring alarm: electricity demand explodes*	NOS	10-10-2022	04-10-2022
News article	*Jetten (D66) takes over control of power grid licensing*	NOS	10-10-2022	05-10-2022

All the different authors and sources have been reviewed for authenticity and reliability. The different sources have knowledge from their field and ensure that this research is based on accuracy and facts. The documents above are listed by date of publication. They show how different news articles reacted to each other. This table lists the main developments that have relations to this study. Many more articles were used during the study, which can be found in the reference list.

4.3 Ethical Considerations

The interviews acquired for this study are handled with ethical considerations throughout this research process. Before conducting the interviews, the participants have been sent information about the thesis, why they are asked for information and the direction of the questions of the interview. The interviewees were asked before recording started if this was allowed for educational purposes. This was approved by all interviewees. Furthermore, the interviewees will be anonymized and are referred to as Interviewee A, B, C or D. To still understand which background the interviewee has, the company/sector is still visible. After the collection of data, it is stored both offline and online with two step authentications to ensure safety of the information. The content analysis consists of publicly open sources and are accordingly sourced.

In this chapter, I have explained how I collected and analyzed the information. The 4 interviews were processed and analyzed. In the next chapter, the findings, I elaborate on these results. The results are based on the potential hyperscale data center in Zeewolde. In the results, I want to look at why Meta (Facebook's parent company) decides to have a 3rd hyperscale location in the Netherlands in addition to Hollands-Kroon and Eemshaven. I want to look at why exactly they could end up in Zeewolde. In chapter 3.2, I found out 4 criteria as to why a hyperscale data center could come up in the Netherlands and I am going to see if it works in practice.

In addition to the final choice of location, I also want to be able to see in the results what impact this has had on the power grid. Is it even possible to place a hyperscale data center in Zeewolde with the electricity transition? When this all comes together, a zoning change is needed at the municipal level. The chapters beforehand showed that ultimately the Senate intervenes. It is rare that the Senate intervenes in zoning plan changes from local government.

I want to show why Meta chooses Zeewolde and I am going to analyze what issues are involved. Then I want to know whether the results would have been different than if planning had been done at a central level. From this analysis, I look at what the solutions might be, such as a possible integral planning approach on a centralized level.

5 ANALYSIS OF THE POTENTIAL HYPERSCALE DATA CENTER IN ZEEWOLDE

In the previous chapter, the findings of both the primary and secondary data are collected and discussed. In the literature review the following theories are discussed: the policy life cycle of Winsemius, centralized level planning and transition management. The literature review explores what generic factors were involved in placing a hyperscale data center in the Netherlands. This chapter also investigated why the congestion of the electricity grid in the Netherlands might work against planning a data center. With this perspective, I will look, through the interviews, at what causes the political unrest in Zeewolde and the national government. Why exactly did a data center want to come to Zeewolde specifically? Why is the electricity grid also a problem here? In addition, I look at the uncertainties at play in the municipality of Zeewolde. Because after the municipality's council decision, the national government eventually intervened. For a change in zoning plans, the Senate who interferes rarely happens in the Netherlands. Finally, I use the results to investigate under what conditions central level planning can work for hyperscale data centers. An integrated approach could provide the solution.

The interviews on hyperscale data centers and the interviews on the electricity grid are used to test under which conditions centralized level planning would be more feasible during the planning of hyperscale data centers. To test this, I use the case of the potential hyperscale data center in Zeewolde. First of all, it is important to investigate which problems arose during the decentralized planning process. As the interviews were conducted in Dutch, the quotes in this result section are the translated quotes. The original Dutch quotes can be found in Appendix B. In this chapter, we discuss the results of the interviews, what factors were talked about and what factors have influence to answer the research questions. The results and factors will be compared to the literature and used to interpret the results of the interviews.

5.1 Why does Meta decide for Zeewolde?

Starting off, we have to go back to the construction of the first hyper scales in the Netherlands in 2015. Interviewee A was involved in the further development of hyperscale data centers in Hollands Kroon. First, it is important to address the mystery around the data centers. Interviewee A: “Things that stand out, that you have a non-disclosure agreement. The atmosphere, the setting and the stakeholders are important. It’s clear what you need for a hyperscale data center. You need water, energy and permits (Interviewee A). Only other important factor is politics. With different interests by the different levels of government, it is more inimical than if you look at the aspects purely”. Interviewee A: “There is a lot of secrecy whilst constructing data centers. That is the reason why hyperscale data centers are not getting off the ground quickly”.

Figure 6 Timeline of possible locations of data centers

The first hyper scales ended up in Eemshaven and Hollands-Kroon. Part of the reason is that there is a large field of available space. However, the hyper scales do not choose the location themselves. Interviewee A explains that the owner of the Agri port complex looked into a transition from agriculture ground to something else. Microsoft is looking for hyperscale places all over the world. “Microsoft isn’t ringing the doorbell of the municipality of Hollands-Kroon to ask if there is space available”. The interviewee explains that how the project comes off the ground is quite obscure. Different kinds of parties come over from a mysterious company without going into much detail and especially asking for a lot of detail. The land is relatively cheap in these regions and the plot of Google was 75 acres for example. Interviewee A: ‘The issue was that we scared them away now. The hyper scales are not the villains. They don’t want any hassle. We want to feel welcome, and otherwise we investigate another region”.

5.2 Why is the electricity grid a problem for Zeewolde

The electricity grid in the Netherlands faces many challenges. With the energy transition and in 2022 the Ukrainian war which speeded up the transition from gas to electricity the power grid faces the consequences. Anyone who wants to connect to the electricity grid currently waits in a queue (NOS, 2022b). Why is it hard to expand the electricity grid? Interviewee B explains that there are multiple problems. First is that there is a queue to connect to the grid and the waiting time for connecting to the grid is not known. The clients get annoyed because they have no clue how long they must wait. “We are very dependent on spatial planning and how long that takes, because we can only start working on connections after we are sure that a neighborhood or an industry area is ready. And because some permits take over 15 years to complete, it takes a while for us to keep up”. Combined with a scarcity of materials (a big transformer factory is in Ukraine which slows things down), too few mechanics and overall little manpower. Interviewee B explains that money isn’t the problem, but the planning with different levels of government with different wishes, combined with the lack of hands makes it very difficult to meet the required energy grid expansion. "Yes we have to expand and invest much more now. You just have to look in the investment plan. There is organic growth, the Netherlands is getting more inhabitants. There is also electrification happening because we are going off gas, heat pumps on electricity. So you see a huge upward trend and with staff shortages, we can't keep up with that."

For electricity planning, the problem is that the supply cannot keep up with the demand. Grid operators are only allowed to expand the electricity grid if they are certain that there is demand. They are not allowed to pre-invest in for example a big electricity outlet and ask companies to move to that area. This removes the flexibility of the operators. Interviewee B:
"Now we are only allowed to invest when there is a customer demand. You are not allowed to pre-invest. However, the government imposes all rules on us which prevents us from being flexible. This is because we are bound to the social costs. The customer pays so those costs should be as low as possible. Yet because of this, we are not allowed to pre-invest and as a result, we are now really on the edge of our capacity, or above. That is why we are now also looking at flex solutions. That you have wind farms, solar farms and, for example, a data center on a separate network with a battery in between".

At the end of 2022, reactions from grid operators are exploding. Multiple news articles (NOS, 2022a, 2022b,2022c) show the problems of the limitations the Dutch power grid has. Rob Jetten (D66) says he should have done more to expand the power grid (NOS, 2022a). With the explosion in demand for electricity, it is already full in many places. The strengthening of the electricity grid, after the Ukraine war and the ensuing energy crisis, is my main pain point. The problem is that people could have participated in this earlier. Indeed, government policies are clashing. The Netherlands knew that sustainability would be accompanied by a more heavily weighted electricity grid. The government encouraged households and companies with billions in subsidies altogether to switch to heat pumps, electric cars and gasless industry. And now that this is actually happening, the electricity grid remains the bottleneck.

So why is the electricity grid not prepared for the electricity transition? First, the energy transition has happened faster than expected. In 2014, there were 1 gigawatt of solar panels on Dutch rooftops. By 2021, there were 14.4 Gigawatts (NOS, 2022c) Netbeheer Nederland (NOS, 2022c) says the difficulty was that the problems were not yet visible. In the beginning, renewably generated power could still be handled just fine. Grid managers did already warn the ministry and the government. However, the real urgency was not there then, only hypothetical future problems. The most important thing for data centers is that investments cannot be made above all else. The energy system is set up for efficiency and low costs, so grid operators can hardly respond to upcoming changes (Nos, 2022c). This therefore makes it even for hyperscale data centers to develop plans hand in hand with grid operators. The advantage is that this keeps grid costs low. The downside, however, is that the grid operators have to work conservatively, and investments that were only demonstrably necessary are carried out.

PWC (2012) conducted research for the ACM, to investigate whether the way ACM currently sets tariffs is still appropriate for the future, in view of the energy transition. One of its conclusions was that grid operators currently have no incentive to respond to the expectation of future developments. This is a point confirmed by all interviewees (A, B, C and D), that not enabling the way the grid is connected is an extreme burden for hyperscale data centers. The response, however, was that they did not think it necessary to change the method yet (NOS, 2022c). Even now, the ACM is sticking to the way tariffs are set. Last year, the ACM set out in

their method decision how the tariffs for the period 2022-2026 will be calculated. And this will be almost the same as the way PwC's (2012) study warned it will inhibit rather than encourage grid operators to expand the electricity grid. The ACM sticks to the principle that no investments should be made that later prove unnecessary. And this therefore requires that it is clear exactly where the need for connections is.

Interviewee 4 confirmed: "From the market simulations different outcomes arise. There are many variables which we all must consider. With that many variables you have many different outcomes and that makes it hard to predict the future". During the interview, it became clear that one must make a lot of assumptions. TenneT has simulations for 2040, only how accurate are these? This is the same if you would've made a prediction in 2005 for 2020. The margins of these simulations are so huge that a clear conclusion is hard to give. Since the electricity grid has that many restrictions, permits and regulations there is almost to no flexibility. With a lack of changing policy, the consequences are an overfull energy grid with a hard time to expand. This is why it is hard to find potential locations for hyperscale data centers in the Netherlands, and especially on a local level. Municipalities have less influence on these decisions compared to the ministries. This is why the electricity grid with these policies and net congestion is in fact a condition when centralized planning would be more feasible. Ministries have more influence to change these policies compared to the municipalities.

5.3 Lack of clear governmental policy

What is an overarching topic across all interviews is uncertainty due to the lack of governmental vision. Even though there were many topics where the different interviewees talked about no clear policy on hyperscale data centers, it was a problem that came back during the interviews.

A central objective in the 'Spatial Strategy Data Centers (Ruimtelijke Strategie Data Centers)', as well as in decentralized policy documents, was to facilitate 'selective' growth in the data center sector (Rathenau, 2022). This ambition of selective growth has never become clearer and has always remained vague. These selective spots in decentralized policy are mainly the external, limiting factors in the Netherlands. This includes, for instance, the shortage of space and the limited capacity of facilities, e.g. due to electricity (Rathenau, 2022). The suggestion here is that more growth is actually the ideal scenario - even if it cannot be achieved within the boundaries of a specific municipality (Rathenau 2022; Overheid.nl, 2020). According to the Rathenau Instituut (2022), some economic views regarding the economy of the Ministry of Foreign Affairs conflict with the official position on hyper scales. Here, it is said that hyperscale data centers contribute little or nothing to maintaining or expanding the Netherlands' hyperconnectivity clusters, which is important for the Dutch digital infrastructure (Overheid.nl, 2020). In addition, the question which factors are decisive for selective growth of the data centers is not answered.

The digital infrastructure in the Netherlands now has characteristics similar to those of essential utilities. Like essential utilities, the digital infrastructure could also be democratically governable. Starting to think of data infrastructure as a utility, its importance increases. It

becomes an essential utility of public interest. And because of this, it will be important to have governance on this facility and come up with concrete plans instead of leaving it purely to the market. This will therefore mean that the cabinet and lower authorities should be able to set conditions on how the digital infrastructure should be implemented (Rathenau, 2022). Parliament, provincial and municipal councils must then oversee these conditions. From this, two challenges arise, namely the power of the company managing this infrastructure and the lack of openness in the current political debate. So this also strikes at the uncertainty mentioned earlier, as decision-making around data centers and other parts of digital infrastructure are not public (Rathenau, 2022).

For the case of Zeewolde, there was also uncertainty specifically. During the voting, a majority of the Zeewolde City Council voted in favor of the zoning change for the Meta data center in December 2021 (Omroep Flevoland, 2021). Eleven councilors voted in favor and eight against the arrival of the hyperscale data center in Zeewolde. A majority already emerged halfway through the meeting when Pvda/GroenLinks (Dutch political left parties) indicated they would vote in favor (Omroep Flevoland, 2021). It is interesting that these parties voted in favor, because it became clear that members of the parties were recommended to vote against the zoning plan change. GroenLinks in Provincial Council and four Flevoland municipal GroenLinks groups also called for the decision to be postponed. As did the national group of GroenLinks in the Lower House. A 'no' from the group in Zeewolde could have blocked the entire plan. Nevertheless, the local governmental parties still voted in favor (Omroep Flevoland, 2021). Related to this uncertainty is for example, the uncertainty of the electricity grid mentioned above. So once the data center comes, there need not be immediate certainty that it will be connected to the electricity grid.

Van Bruggen (PvdA/GroenLinks City Council Member of Zeewolde) during a city counselling (16-12-21) meeting about the data center of Meta in Zeewolde.

“"Onze landelijke fractie is ook kritisch. En dan is makkelijk gezegd. Daar hebben ze ook steken laten vallen. Er had al lang een landelijke visie op datacenters moeten liggen." Van Bruggen benadrukt nog maar een keer dat ze van mening is dat lokale politici prima kunnen beslissen over het onderwerp.

Van Bruggen richt haar pijlen op Erik van de Beld van de ChristenUnie die het besluit eigenlijk te groot vindt voor de lokale politiek. "Verlaat u straks bij de stemming dan ook de zaal en stemt u niet mee? Want u acht zich daar kennelijk niet toe in staat."”

Source: Zeewolde Council Meeting on Youtube (2021)

The quote shown above shows that there was a lot of political unrest at the local level of the government of Zeewolde about the hyperscale data centers. Van Bruggen, a member of the Zeewolde City Counsel for the PvdA/GroenLinks votes differently compared to the national vision of her party. She states that the Pvda/GroenLinks should’ve had a better vision on the

hyper scales. In her opinion, the local level government can decide themselves if a data center can be placed in Zeewolde. As described by Winsemius (1986), without clear policies on the subject there will be a higher level of political unrest. Thus, without a clear national policy on data centers, you get political unrest because there is not yet a framework on the vision on data centers. There is even a discussion if the decision on hyper scales is even a topic a municipality should vote for, which is exactly in line with this study.

A key challenge is the lack of transparency in the current public and political debate of data centers and how decision-making is about the siting of the components of this digital infrastructure (Rathenau, 2022). Democratic governance implies that citizens and their elected representatives can hold administrators accountable if it turns out that they are not complying with established policies. Currently, there is still a lot of ambiguity about the division of powers when implementing agreements made. Moreover, it often remains hidden from citizens and their representatives how the various (public) values are taken into account in the process and how the final verdict is ultimately reached. For appropriate democratic control, it must always be clear who takes what decision and that this can be verified. Just as interviewee A says: "Things that stand out, that you have a non-disclosure agreement". There is too much secrecy in this kind of business.

This opacity causes ambiguity at national, provincial and local governance. As explained by Interviewee A, the different parties have different interests and will not put all their cards on the table. The ministry of Economic Affairs can have different interests for the data center compared to the province or the municipality. For example, the ministry of Economic Affairs attracts hyperscale data centers due to their ambition of the Netherlands being a frontrunner on digital infrastructure. The province could favor the place being more nature driven, whilst the municipality wanted more neighborhoods. As a result, stakeholders and outsiders are always left guessing about correct information. They do not know what the ministry promised Meta during a meeting compared to the municipality of Zeewolde. An example of this can be seen from the literature and interviews. Here, at the municipality of Hollands Kroon and the province of North Holland, there are negotiations on licensing, and the consultation of the Ministry of Economic Affairs on whether the minister can/would intervene on behalf of a large technology company with the operator of the national energy grid TenneT (Rathenau, 2022). Interviewee A says in the interview, "How you picture it is very factual, you need water, energy and permits. The other important factor is politics. That makes it more inimitable than if you look purely at the aspects". The ambiguity causes different parties like the government, utilities, municipalities and companies to enter into different agreements with each other. Therefore, integration would be better.

Interviewee A: "Above all, you have to get the governments on board (and you have to do it as a municipality). The data centers themselves have nice programs in social investments. They want to be a good neighbor. Microsoft has already invested 5 million in the area, which you can't manage as a local government. The national government didn’t like Google coming to Hollands-

Kroon, because Google also had a hyperscale data center in Groningen. This would mean that Google would invest less in Groningen and have to spread investments in both regions. How the data center was built in Groningen in terms of bribes there is secrecy. You are not able to see exactly how it came about. Interviewee A for getting the data center in Hollands-Kroon: “It felt like fighting with one arm on your back. You try to get everyone to agree with each other and then it collapses. You can't put it down on paper what's happening because it's vague."

A solution to get less uncertainty in hyperscale data planning in Zeewolde and in the Netherlands could be a Sixth Note of Spatial Planning. A Sixth Note of Spatial Planning could make policies and locations of hyperscale data centers clearer. At the time there was no policy based around hyperscale data centers and it was market-based. With a Sixth Note of Spatial Planning, the government could explain what locations could be used for data centers. Theo Föllings, chairman of the SKBN (Knowledge Alliance Business parks Netherlands), says: "Various destinations desire a clear guidance for the coming years in the Netherlands. Not only business sites, but also housing sites, nature sites, agricultural sites and many other space claims' ' (Stadszaken.nl, 2020). Although there is no mention of hyperscale data centers here yet, it fits the picture exactly. According to Föllings, nobody is currently taking charge on how the Netherlands should be planned. As a result, consequences such as a lot of ambiguity are the fault of The Hague (Stadszaken.nl, 2020). This is because there are many municipalities with space where companies can locate, but there is no such overview, according to Föllings. This could also benefit hyper scales, if any locations are identified from The Hague. Because of the large impact on the energy grid, not only finding space is the problem. That is why a more structured plan is necessary. Föllings: "To make a congested and growing Netherlands function well, clearly more direction is needed from the government. Besides the space claims also the energy transition required space (Stadszaken.nl, 2020). One solution to this could be the Sixth Note Spatial Planning. For a small country to be well organized, there needs to be investment in clear policies. This will allow the different levels of governance plus businesses to know exactly where they stand.

The government has used different visions to plan the Netherlands. The NOVI (National Environmental Vision) did mention data centers, yet this was never defined in concrete terms. The vision on hyperscale data centers was even less clear. In the Data Centers Roadmap 2030 strategy (REOS, 2019) for the growth of data centers in the Netherlands, hyperscale data centers are named, however it also only states that they do see cluster formation. The strategy is to look to expand these sites, and little is told about other locations. There is no concrete plan for a 3rd location at all, while the government writes about getting a third location in the Road Map. Here again you see the wait-and-respond attitude of the government. In May 2022 the government explained: "The cabinet expects to finalize the tightening of the NOVI in 2024. Policy development and implementation do not stand still. The processes of the above-mentioned programs and the tightening of the NOVI run parallel and influence each other, as mentioned above. For example, the siting policy of new hyperscale data centers is already being tightened

this year" (Overheid, 2022). The government reacts only when a problem arises like the one at the data center in Zeewolde. Hyper scales had been in sight for much longer, as two are already built in Eemshaven and Hollands-Kroon. In the environmental visions, data centers were only mentioned generically, only they did not address how, for instance, hyper scales will be put in place. Whilst there were road maps and NOVI's about hyperscale data centers, there was still political unrest during the planning of the data center in Zeewolde. Relating this to Winsemius' (1986) explanation, this means that it is likely that there still is not a clear policy for the data centers. When there is clear policy on hyperscale data centers, the political unrest will fade away and it will be possible to apply integral planning. When there is still disagreement between different stakeholders, integral planning will not be beneficial.

5.4 Integral planning of data- and electricity infrastructure

The first article I read (and why I started this research) was by the director of the DDA. He called for central planning of hyperscale data centers, ideally by the Ministry of Digital Affairs (Nu.nl, 2021). Even though he did not say integral planning explicitly, he proposed a ministry which would execute the integral planning of data centers. During all the interviews, the term integral planning did explicitly come up. Interviewees A, B, C and D all explained in some way the benefits (and cons) of integral planning for data centers, which will be explained below. An overarching theme for hyperscale data center planning is that all systems work independently of each other which causes inefficiency (electricity planning & data center planning). The Rathenau Institute also advocates an integral policy framework. Currently, there are several policy domains that all need to be coordinated with each other. The Ministry of EZK, BZK and JeV all have requirements and wishes for data centers. The Rathenau Institute advises a ministry for Housing and Spatial Planning (Rathenau, 2022). The data center in Zeewolde has even the Ministry of Agriculture involved as a stakeholder. Since each department works from a different vantage point, an integrated national planning could provide the solution to bridge the differences. Integral planning could work with a Ministry of Digital Affairs which is explained by the interviewee C of the Dutch Data Center Association. The interviewee D of TenneT explained that it would be 'just' the next stakeholder in line asking for electricity. The main problem that interviewee D explains is that there is 'guidance' necessary on governmental level. The problem remains the way power is supplied in the Netherlands and especially the lack of opportunities for augmentation.

Interviewee A explains that there are also many differences between governments at different levels. The relationship between is an important factor. A province can punish municipalities if certain things aren't going the way they want. 'If you open your mouth as a municipality, the answer will be automatically no'. Interviewee explains that you must appease the various stakeholders with the money from the tech companies. For example, show that money can also be released for, say, a swimming pool for residents, or, say, something according to the province's wishes. With planning you don't want to rely on the 'relationship between

municipality and province'. Interviewee explains that not always a relationship between the municipality and the province is good, thus planning of a data center will not only be about the data centers, but also be about other topics where municipality and province clash. If you want to be a country with the biggest data infrastructure and multiple hyperscale data centers you have to provide policies to get these projects off the ground on a top-down level. Right now, from the bottom up, municipalities are fighting too many different regulations that prevent municipalities from getting this kind of complex problem off the ground (Interviewee A).

Interviewee A describes the data center planning suffers from procrastination. The interviewee explains that it is possible to do endless studies done to postpone a decisive yes or no answer. An example of these studies could be found in a study for Ministry of Interior and Kingdom Relations (2022). The study was a review of the modified plan of the municipality of Zeewolde for the construction of the data center Meta. A question from this research is: Will the waste heat from the data center actually be reused? You could argue these kinds of questions are less relevant for a decision and could be created to postpone a decisive yes or no answer. If this really is procrastination is hard to be factual and will only be data given by an interviewee.

Interviewee A explains that in Hollands-Kroon the province also threatened to stop the data centers because they didn't review the zoning plans. That is the same as what is happening in Zeewolde. The few people that lived there will lose the grassland close by thus the plan should stop. That was mitigated, by saying we are going to do it after. They went along with that, so the zoning plan was put up for inspection. Eventually people are sort of bribed by buying things off unofficially. Let a data center invest in a school or swimming pool. Paying them off directly is paid planning and is forbidden. Nonetheless what is happening in real life is close to bribing off'. Because these massive decisions of hyper scales are decided on municipality level, it is also important that the decision is a big political game. During election time, you don't want to claim that you will vote for the placement of a data center. That is why, if hyperscale data centers should be placed in the Netherlands it should not be decided on local governmental level. It is on a local level too big of a political game and less on the outcome. Governmental level is a better way to decide the locations for data centers, because they have more power and could have more influence on the electricity grid. To add to that problem, interviewee C explained: "If you see the Zeewolde alderman in front of the camera, you see that he has had too little media training for how big an impact such a decision has. And therefore, it takes on a life of its own". Interviewee further explains that the information which is communicated to the public is not completely wrong or bad but mostly inaccurate and negatively framed. Data centers are new and scary, and the Netherlands should be careful. "With clear policy and a national strategy, data centers wouldn't suffer as much" (Interviewee C).

One condition on how hyperscale data centers can be planned at a centralized level for example is if a ministry (such as the ministry for Digital Affairs) would have, besides having the power to choose the location of a data center, also has the power to directly plan the electricity cables. Planning data centers and-in-hand with the electricity infrastructure. This avoids the queue on the

power grid and reduces the long waiting line for regulations and permits. Of course, this integral approach has a major drawback. There is a reason to keep it fair and keep the authorities in check by not giving them all the power. With an integral approach, planning could be done more efficiently since there are less stakeholders dependent on each other.
Another condition is when planning of hyper scales at a national level is better when the electricity congestion is over. As mentioned in the conceptual model, the congestion on the electricity grid causes problems. It is hard to add something to the electricity grid. Especially a hyperscale data center, which uses the electricity of a big city, will not make the connection to the grid easier. If you take away the electricity use of the hyperscale, there was no planning of placing a hyperscale in Zeewolde probably. Possibly only local residents would complain, and this could potentially be solved with area development (paid by a tech company). Then the hyperscale would resemble a distribution center, for example, and you could still decide at a decentralized level to change your zoning plan to accommodate a data center. Then, in all likelihood, there would be no intervention at the national level. Thus, as explained in the conceptual framework, a central level planning-based approach is more feasible if realization of the hyperscale (or any other building) causes national impact.

6 CONCLUSION

Hyperscale data centers are owned by the biggest tech companies such as Google, Microsoft and Meta and are specifically built for the servers for one of these companies and are the only user of the datacenter. However, due to the large size (at least 10 hectares) and large energy consumption (at least 70 Megawatt) they become a spatial planning problem (Rijkswaterstaat, 2022b). Because normally a municipality can decide themselves if a building (in this case a hyperscale data center) can be placed in the area. However, For the case of the hyperscale data center in Zeewolde, there are certain conditions which made it necessary for the national government to interfere in this decision on a local level (Eerstekamer, 2022). In this research, I look at under which conditions centralized level planning would be more feasible for planning the location of hyperscale data centers in the Netherlands.

Based on analysis of the interviews with experts on hyperscale data centers in the Netherlands and the electricity grid in the Netherlands, combined with the information on hyperscale data centers and the electricity grid in the Netherlands, the research questions will be answered.

6.1 Answering the research questions:

The secondary research questions to give supporting information to answer the primary research question are:

1) What are the uncertainties regarding the rapidly evolving data and renewable energy networks in The Netherlands?
2) Is it possible for the Netherlands to achieve the climate goals with sustainable energy with an increase in data centers?
3) How is a suitable location of a datacenter defined?
4) Which actors are involved in the planning of a location of a hyperscale data center?
5) Why is data infrastructure planning necessary at central level over decentralized level?

Sub question 1: What are the uncertainties regarding the rapidly evolving data and renewable energy networks in The Netherlands?

Now the electricity grid congestion in the Netherlands is a cause for uncertainty for hyperscale data centers. In 2022, reactions from grid operators are exploding. Multiple news articles (Nos, 2022a, 2022b,2022c) show the problems of the limitations the Dutch power grid has. With the explosion in demand for electricity, there is grid congestion.Because the net operators are not allowed by regulations to pre-invest in infrastructure and are only allowed to follow the demand, the energy network continues to lag behind. The Netherlands is less adaptive to changes in the infrastructure planning, because the regulations and permits can take up to 20 years. This study shows that there was no clear policy on data centers, which makes it hard for municipalities, net operators and other stakeholders to make decisions. In the future it is important to have a clear policy for hyperscale data centers (similar projects) for all levels of government to reduce political unrest during planning. Currently the congestion on the electricity grid complicates the

planning for locations on hyperscale data centers. With central level planning, it could be easier to designate locations for hyperscale data centers and already plan electricity infrastructure in advance.

Relating the uncertainties to the conceptual framework, we can point out that the congestion on the electricity net could be seen as an uncertainty. The congestion is partly due to the rapidly evolving electricity usage (Nos, 2022a; Voorhoeve, 2022). If hyper scales could 'plug-in' the electricity grid without a problem, an important uncertainty disappears. This study shows that at the government levels studied, there is no clear vision on the (al)location of data centers. Local members of the party of for example GroenLinks vote in favor of the hyperscale data center, whilst the members of Groenlinks on provincial and governmental level asked them to vote against it (Omroep Flevoland, 2021). There is political unrest which causes confusion for the locations of hyper scales.

Sub question 2: Is it possible for the Netherlands to achieve the climate goals with sustainable energy with an increase in data centers?

With the Paris agreement in mind, many countries are working on becoming more sustainable, the Netherlands included. Various sectors are contributing, such as agriculture and construction. In an electrifying world, electricity consumption will continue to increase in the coming decades. Data centers are 'only' a 2 percent of the Netherlands' total energy consumption (DDA, 2022). The Netherlands does not immediately dismiss the idea of data centers because of their high energy consumption. This is because hyperscale data centers continue to become more and more efficient in the future (think of the PUEs) (DDA, 2022) and because of the fact that green energy can also be generated better in the future.

Sub question 3: How is a suitable location of a datacenter defined?
From the interviews, there are two responses that can demonstrate this. First, Project leader of the Hollands-Kroon Data Center says that a suitable location has several characteristics. The first thing hyperscale data centers look for is if there is space (a bit more remote because of the 'ugly' appearance of the data centers). In addition, they look to see if there is electricity, water and a data connection nearby. These are 3 inputs that ensure a data center can exist. This is all done in collaboration with various stakeholders. Municipality, province, ministries and more. Besides, TenneT does reconnaissance studies on the electricity grid. Different variants are analyzed on what the power grid in the Netherlands would be like in 2050. This also looked at how many data centers the Netherlands could have.

As stated in the theoretical framework, there are certain factors on why the hyperscale data centers are interesting for tech companies to place in the Netherlands. To repeat them:

The location should have:

1. A connection to the electricity grid with much power security *(99.9% uptime)*
2. Enough space and the suitable place for a zoning plan allowing construction and the use of a data center. *This is for example in Hollands-Kroon Umbrella-Zoning Plan*
3. Supply of a large amount of renewable energy nearby. *For instance, off-shore wind energy close by.*

Sub question 4: Which actors are involved in the planning of a location of a hyperscale data center?
The study revealed that many different stakeholders are affected by this planning problem. To make it clearer, they are shown in Table 4.

Tabel 4 Stakeholders hyperscale data centers

Data Center	**Energy**	**Extern**
Municipality (Zeewolde, Hollands-Kroon).	TenneT	Local residents
Provinces	Local net operators(e.g Stedin).	Regional Water Authorities
Executive: Ministries Administration: National government (Rijk)	Governments, ministries	Nature organizations
Data Center Owners (Meta, Google).		

Sub question 5: "Why is data infrastructure planning necessary at central level over decentralized level?"

Going back to the theoretical framework, Fleurke et al., (1997) see that decentralization is a way of improving the organizational framework for dealing with certain policy issues. De Roo (2015) adds that the resistance between the higher and lower layers of the government is why decentralization is important. Right now, it is important that the municipalities deciding on hyper scales are making decisions without having the complete view in mind. Thus, for people at a municipal level is it harder to consider the large additional factors that come into play when deciding on a hyperscale data center location. The congestion on the electricity grid, combined the different stakeholders involved and the political disagreement (Omroep Flevoland, 2021) makes it hard to decide for a location on a decentral level.

In 2022 there are no new locations for hyperscale data centers in the Netherlands allowed (Kastelijn, 2022). Why the centralized level planning approach affects a municipality level is that the power of the municipality level will decrease. Since the government, the province and the municipality all have different ambitions and wishes. A central level policy and decision ensures that there will be less political disagreement.

To answer the main research question:
"Under what conditions is centralized level planning the most feasible way to plan hyperscale data centers in the Netherlands?"

A carefully conducted study has researched how certain conditions came forward when centralized planning would be more feasible for planning hyperscale data centers in the Netherlands.
What came forward was that the hyperscale data centers are highly dependent on the electricity grid. However, with the electricity transition the grid currently struggles to keep up with the

demand. In 2022 net operators can't add all the customers to the electricity grid and there are many legislations and rules to expand and/or enlarge the grid. This ensures that even in the future it will be hard to connect for example a hyperscale data center on a remote location to the grid.

There is grid congestion in the Netherlands. Grid congestion limits local government in planning locations for hyperscale data centers due to the lack of power. Therefore, under the condition of grid congestion, it is more suitable for central planning to plan new locations for hyperscale data centers in the Netherlands.

Planning for this study is deciding what area could be used as a hyperscale data center location. In 2022, if a datacenter were to be realized, it wouldn't be able to connect to the grid (NOS 2022a). This is due to the amount of electricity used combined with the waiting list for connections to the electricity grid. Since it is difficult to connect a data center, it might be better if a ministry planned the location of data centers, because a ministry could use its power to create designated electricity hubs where companies (such as data centers) with high electricity usage can be realized. The electricity grid can already be prepared for the data centers and the planning of locations would be easier. Municipalities will not have the capability to make such a decision during net congestion, yet a ministry could. A ministry from Digital Affairs could be a designated ministry for this. This is why centralized level planning would be more feasible for planning a data center.

Another condition for when centralized level planning would be more feasible, is when you want cheaper and more efficient planning location of hyperscale data centers. Currently, there are too many stakeholders with their own interests interfering with the data centers which are holding back the planning. And because the planning of the data centers are currently getting delayed, adjusted or completely stopped, money is wasted. This could be solved using an integral approach by the ministry, where hyperscale data center planning and electricity planning go hand in hand. Less stakeholders could make the planning process go more efficiently.

Applying the theory of the policy life cycle of Winsemius (1986) to what happened in the case study of Zeewolde: After the policies by Huge de Jonge (banning new future locations of hyperscale data centers), the political unrest came to an end. The national government came with specialized policies regarding the hyperscale data centers. The degree of disagreement lowered, and the case is maintainable. The government has operated on a reaction basis. A problem suddenly arose and only then was it solved which did add to the political turmoil. It looks that for this case in Zeewolde, a centralized level of planning (or deciding) eventually stopped the unrest.

Loorbach (2008) explained that the electricity transition did not come completely out of the blue. If you had anticipated the electricity transition (and the congestion), you could have seen those hyper scales, because of their major impact on the electricity grid, had to be planned on a central level to avoid political unrest. As said before, integral planning (where data- and electricity planning would go hand-in-hand) would be a solution to plan the hyperscale data centers to reduce waiting times on permits. This integrated planning could be done in a ministry, such as a new ministry of Digital Affairs. More importantly, the route map, and especially choosing the specific grounds for the data centers are better defined. Because this is now left to decentralized levels, too many questions arise. By designating locations at a central level in the policy, it reduces the uncertainty that the various parties (such as grid operators, data centers and municipalities) struggle with. It is important at the national level to have people who understand the subject. Therefore, as a recommendation a Ministry of Digital Affairs should be created and it should employ in any case people with a background in planning, electricity infrastructure and/or digital infrastructure. With those backgrounds under the same ministry will central level

(integral) solution for hyperscale data center planning. It is not weird that hyperscale data center planning became an issue in the Netherlands, because 3 years ago nobody had the specific (combined) knowledge to prevent this.

6.2 Reflection

Problems such as hyperscale data centers that should be decided on a central level instead of a decentral level may become more frequent in the future. The Netherlands is a densely populated country and technology will also change in the future. In practice, there are currently no new locations for hyperscale data centers in the Netherlands allowed. Because hyperscale data center planning is a relatively new topic with different stakeholders, new issues, requirements and rules that everyone must comply with, it remains difficult to say how to solve similar cases in the future.

There are still some limitations that subsequent research can address. Firstly, the Netherlands in particular has been chosen here, yet other countries are also experiencing an increase in the use of data plus the infrastructure needed for this. Another follow-up research would be how people look at hyperscale data center planning in the future. Are the problems that exist now still relevant in the future? Is there still net congestion? Does the problem lie with the power grid? Is it lack of space that is a problem? And how much has data storage and usage grown?

Combined with the extreme relevance and the current studies on the subject, the outcome of this study can change. New articles / rapports are likely to occur and the future of hyper scales can change in the future. The study would have been even better if Hugo de Jonge, someone from the Senate of the Netherlands or from the municipality of Zeewolde could provide insight on the issue with an interview. For a subsequent study, this would be a great starting point. Due to certain unexpected obstacles that arose during this research, resulted in a postponement of the completion of this thesis. However, this experience taught me valuable lessons which can be used for future projects.

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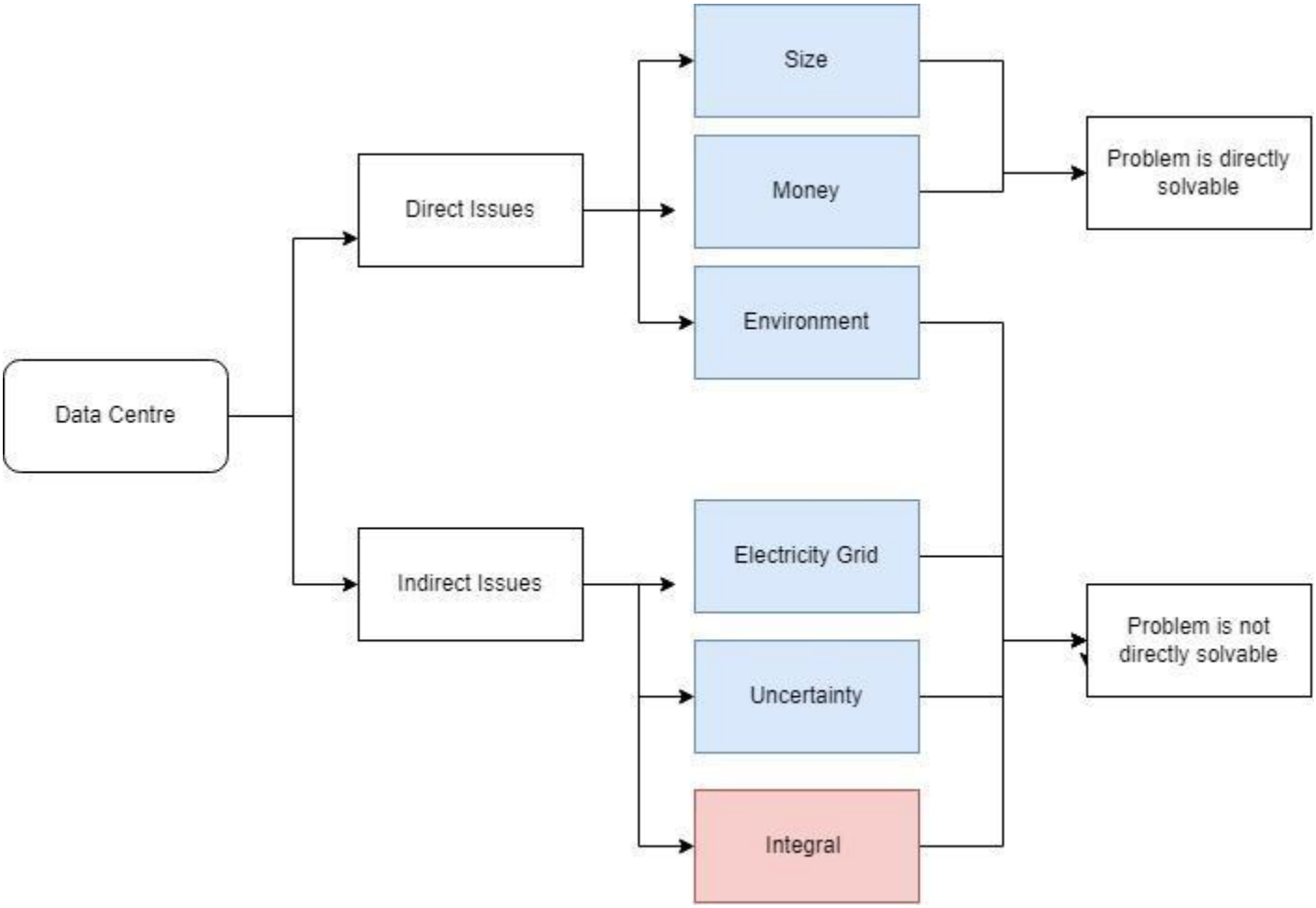
APPENDICES

Appendix A Coding scheme



Appendix B Interviews

Interviewee 1: Hollands Kroon

Natuurlijk aangegeven dat ik betrokken bij geweest bij het doorontwikkelen van data center in hollands-kroon. Zaken die daar opvallen en lopen, je hebt ook een non-disclosure agreement. Sfeer, settings en spelers is belangrijk. Zo ik je hoor is het vrij feitelijk. Je hebt water, energie en vergunning nodig. Er zit een schil omheen, dat is politiek bedrijven. Straks nader toelichten, maar dat is belangen, wisselgeld en spelletjes. Dat maakt het onnavolgbaar der dan als je puur naar aspecten kijkt. In hollands-kroon heb je veel definities van hyperscales. Het is een hele anderes schaal dan een gebouw.

Microsoft was al geland, en die heeft al 5 hyperscales neergezet. Allemaal bij elkaar, maar zijn indivividuele hyperscales. We zagen bij hollands-kroon een voordeel. De huizenmarktcrisis,

werkgelegenheid. Dit is een plek die qua schaal en omgeving (relatief weinig woning) dus kan je veel kwijt. En is er veel ruimte. Dit lijkt ons een goed idee qua werkgelegenheid en er is een transitie in schaalvergroting. Er verdwijnen meer boeren, dus er meer werkgelegenheid nodig. Op zoek naar een bron naar meer werkgelegenheid. Dit is een oneindige discussie "Ja erg werken alleen maar beveiligers in een hyperscale". Uh ja, er werken relatief weinig mensen per vierkante meter. Maar wat je ziet, ik heb een hele expeditie gedaan over de hele wereld. En bij orde van grote. Ik heb alle hyperscale locaties zover je kan vinden en duiden. Ik heb ze geïnventariseerd qua grootte. Plot die we ten noorden hebben ontwikkeld t.o.v microsoft, daar past 2x een dorp in. De werkgelegenheid is primair heel erg bij de orde aan de bouw. Ja daar heb je niet zoveel aan zeggen veel mensen. Maar daar komt meer bij kijken. Het draagt enorm bij aan het bruto nationaal product, die hyperscales. Er worden mensen ingevlogen voor werkgelegenheid. Als je Hollands-kroon vergelijkt met ierland, dan zijn het een soort tweelingen. Alleen is het jonger vergeleken met Ierland. En wat je daar ziet is dat er spin-off bestaat om te zorgen dat de hyperscales in stand blijven. De spin-off genereert ook veel werkgelegenheid. Dat is heel interessant om te zien. SWaar wij tegenaan lopen, is een van de belangrijkste (op dit moment omgevingswet komt er aan, maar nu nog de andere dingen) is het planologische regime. Dus wij moeten een procedure doorlopen, er is nu agrarisch grasland en er komt nu een ander gebouw. Dat betekend dat er personen aanschieten die helaas, persoonlijk, wettelijk geregeld er wat van mogen vinden maar ook partijen die vinden dat ze wat mogen vinden. Vooral de province vind dit en dat en zus en zo. En daar ontstond een krachtenspel dat ook het rijk er iets van vindt. En het rijk vind, die vond op dat moment, want in de afgelopen jaren is er een enorme negatieve kanteling (verdozing). Maar op dat moment wilde Nederland het keihard. En daar kwam het rijk een datacenter strategie opgesteld.

Met die data strategie was voor ons heel belangrijk en daar probeerde ik als kleine gemeente, want voor hun ben je niemand. Via kanalen hebben wij geprobeerd om te laten doorschemeren dat ze voor data centers in hollands-kroon moeten zijn. En uiteindelijk is dat er best lekker ingekomen. Daar hebben wij ook met DDA contact gehad. Het ontwikkelingsbedrijf in hollands-kroon hebben beste goede banden met, een groep binnen het rijk en die doen alle relaties en binnenhalen van grote partijen. Daar is microsoft binnen gehaald. Die zijn samen met wethouder naar amerika gegaan.

W: Wilde hollands-kroon zelf dat er datacenters kwamen?

Nee wij waren niet creatief. De eigenaar van agripoortcomplex, die bedacht dat er een transitie kon komen. Van agriculture naar glastuinbouw. Deze bedrijven zoeken door de hele wereld locaties. Dat doen ze niet zelf door aan te bellen bij gemeentes, joh hier is ruimte. Dat gaat allemaal vrij duister. Er komt dan een partij X, komen bij een bedrijf/ontwikkelingsbedrijf/ om te flirten en te kijken of er ruimte is, plek leuk. Is er electra, water, data beschikbaar? Dat was voor mij bijzonder vaag omdat het een hele andere tak van sport. Ik zat in gesprekken die

intresse hadden. Je mocht niet weten wie het was, maar in de vergadering hadden ze alleen een voornaam en ook eens zonder hele naam. Er is een waas van geheimzinnigheid. Ik probeerde er achter te komen wat het belang was waarom. Ik wilde zelf de big 5 krijgen, microsoft apple, amazon etc. Het is heel moeilijk om vanuit de gemeente om dit voor elkaar te krijgen. Het rijk wilde wel graag het doen. Het is goed dat bedrijven naar Nederland komen. De provincie vond het helemaal niks. Dat had minder te maken met maatschappelijke inpassing? Maar soms meer te maken met de relatie tussen bepaalde gemeente en provincie. Als een provincie bepaalde gemeentes aanrekend dat het niet gaat zoals de provincie wilt, dan worden ze afgestraft. Als jij je mond open doet is het antwoord nee. Dus je moet als gemeente ze opfluffen en in het standje krijgen wat ze willen. Dus als we er een heel groot arcitectenbureau doen. Of een beeld/kwaliteitsplan. Je gaat allemaal trucken gebruiken, los van de inhoud. Om het ik wil hierover praten standje te krijgen. Wat ook belangirjk is op het moment dat dit speelde, wist je niet wie de nieuwe ploteigenaar werd. Er was alleen een lijstje met zoveel hectare en 40 meter hoog. Ik ben van huis uit architect en RO specialist. Ik ben een blij ei, ik vind dat gaaf. Jezus dit is zo bijzonder dat je dit mag doen. Bij het horen van 40 meter schrikt iedereen. Ik met een collega in een bubbel geplaatst. Nice to know is dat hoeft nite iedereen te weten. Need to know moet iedereen weten. Wat meteen duidelijk werd is dat bepaalde mensen wisten welke paritjen het was. Je zou denken dat is niet relevant. Het gaat over data. Hyperscale, op een plek met voorwaardes. Of het plek a b of c is maakt dus wel uit.Waarom maakt dat wat uit. Er werd heel veel gespeculeerd, wij zaten in de bubbel dus wisten meer. Degene die speculeerde was de gemeente, provincie, opwonenden. Het zijn die die die. Wij wisten met een lead wie het wel was. Toen er uitonderhald was en het bekend mocht gemaakt, zijn we eerst bij de gemeente geweest.En toen was de reactie: Nee want ze hebben gezegd dat het apple is. Maarja dat kunnen ze wel zeggen, maar dat was niet. Alle plots hadden codenamen. Maar dat wist alleen iedereen binnen de bubble. Google is uiteindelijk geland. Wat daar speelde was dat het rijk toch een beetje begon te draaien toen ze wisten welke partij het was. Van kom maar, naar fuck zijn zei het. En waarom dan? Onze eindconclusie was Google zit al in Groningen. Voordeel, water genoeg, ruimte genoeg, energie genoeg. En dat label politiek en krachten → Google is er heen gelokt als compensatie t.o.v gaswinning. Want die bedrijven pompen vrij veel in de omgeving. Denk aan half miljoen per jaar voor initiatieven. Voor de scouting of wat dergelijke.

Vooral de medeoverheden moet je meekrijgen (en dat moet je zelf doen). De bedrijven hebben zelf mooie programmas in social investments. Ze willen een goede buur zijn. Microsoft heeft al 5 miljoen geinversteerd in het gebied, wat je niet lukt als lokale overheid. Omdat daar een uitwisselingsdeal was vond het rijk het niet fijn dat google ook kwam in hollands-kroon. Meer omdat ze dan minder zouden inversteren in Groningen. Dus meer politieke redenen waarom ze groningen niet wilde. Dat spreekt natuurlijk niemand uit. Hoe dat in Groningen is gegaan qua

steekpenningen zit er een waas van geheimzinnigheid. Maar ook een waas van belangen die je niet goed kan doorgrongen. Het voelde alsof je met 1 arm aan je rug aan het knokken bent. Je probeert iedereen goed te krijgen en dan zakt het in elkaar. Je kan het niet op papier zetten wat er allemaal gebeurd omdat het vaag is. Wat we vervolgens gedaan hebben is dat we op de inhoudt, we hebben een architectenbureau erbij gehaald. Dat vind iedereen fijn (gerenomeerd ieamdn). Beeld/kwaliteit gemaakt. Allemaal dingen opgenomen. Maar hollands-kroon wilt werken vanuit het goede gesprek en vertrouwen, in plaats van aan de voorkant. Maar de provincie wilt de regels. Dit is het bestemmingsplan, dit moet je doen qua kleur. Hollands-Kroon wilt meer ruitme geven. Dat is anemlijk het aantrekkelijkst voor ontwikkelaar/initiatief nemer. Dus uiteindelijk met heel veel energie is het gelukt om het bestemmingsplan in procedure te brengen. De provincie wilt een gezienswijze hebben en dat wil je nite hebben, wat dan is de provincie geoorloofd om een planalogisch regime te hebben. Maar het bleef in de lucht hangen, want de ARO is provincie. H-K moest daar langs en ze vonden eigenlijk dat het nite op plotniveau mocht bestemmen, maar er moest een hele visie komen voor het hele wieringemeer. Dus ze wilde niet de complexiteit van de plot maar van alles, en dat alles wordt opgelost dus. Dus die maakte het heel groot, ook huizen voor de bouwers en dergelijke.

Dit is de tactiek van treineren. Dus op het moment dat je het spannend vind als provincie/rijk/gemeente is het heel fijn om allerlei onderzoeken te doen en dan is de ja/nee uit te stellen. Dat is gemitrigeerd, door te zeggen we gaan het erna doen. Daar gingen ze in mee, dus het bestemmingsplan is ter inzage gelegd. De provincie dreigde, maar niet gebeurd om het bestemmingsplan te bekijken. En ondanks dat er weinig mensen woonde, woonde er wel mensen waar hun grasland weg gaat. Dan beoordelen wij of het gegrond is dat ze klagen. Ben je belanghebbend, zit je dichtbij genoeg. Dan zie je dat de initiatief nemer, de hyperscale, dat er geen belang is bij geen zienswijze. Dat daar dus weer geschaakt wordt en er gemediate wordt. Wat kan ik doen om jouw zorgen weg te nemen. Je mag niet zeggen als ik je een ton geef houdt je je waffel, dat is verboden in Nederland. Dat is betaald planelogie. Maar het schuurt er wel tegen aan .

Je kan wel aan beide partijen vragen of ze in gesprek komen. Soms zit je als overheid erbij. Je bent dan neutraal. Als het lastig wordt moet je als lokale overheid weg, want daar wil je niks van afweten als het over geld gaat. Er is een zienswijze overeindgebleven van alle 4. Daar zat slechts een kleine wijziging in, dus dat is prima. De man is nog wel in beroep gegaan toen H-K er niet mee akkoord is gegaan. En nog bij raad van state, maar H-K had het gewonnnen. Dus toen was er een planalogisch regime.

Rechter kan delen vernietigen, maar wij waren bang voor de 40 meter hoogte. Maar dat is dus ook niet gebeurt. Je denkt van alles lekker geregeld. Maar er gebeurt opeens heel lang niks. Je bent als overheid afhankelijk van de grondeigenaar die verschillende opties heeft. En die wilt

planalogisch regie, omdat een akkertje minder waard is. Van akkerbouw naar hyperscale kan factor 10, 20 verhogen qua verhogen qua verkoop prijs.

Toen kwam iemand uit de lucht die zei: wij willen wel gaan bouwen. Engels sprekende, kwamen langs bij Myra. Haar vraag: Van wie zijn jullie? Tijdens het eerste overleg was het anticlimax, mogen ze nog niet zeggen. Beetje kennismaken. Kom op met het ontwerp! Alleen was het een gebouw van 20 meter ipv 40. Het vreemde dat ze maar voor 40 meter gingen is dat je ziet dat ook hierin. Je hebt hyperscale eindgebruikers, (microsoft eigenaar/eindgebruiker). Enduser = ontwikkelaar. Maar je hebt nu ook een markt met inversteringsmaatschappijen die het bouwen voor Microsoft. Dat is dus gebeurt voor Google, maar er zit een partij tussen die het maakt. Google wilde 40 meter, maar die had dus ook haastt. Dus dat had misschien te maken met een platform dus ze hadden snel ruimte nodig. Dus voor het plot praatte we met meerdere met verschillende partijen. Op een deelplot. Ze wilden op een deel nog wel de hoogte in gaan, maar het was maar een idee en werd niet uitgevoerd. Als je het doorrekend naar de huidige stand van de data centers. Eerst was het Ooh wat leuk. En nu moeten we: Alles is ruk, de gebouwen zijn lelijk. Autonimiteit is weg. Wat ik daar bijzonder in vind. Microsoftplot is volledig onder welstand opgesteld. Weslstand regime, beeldkwaliteit plannen. Province en ARO. Gaan over architecteur. Zij waren het er allemaal mee eens. We deon een welstandsnota, we doen dit. En nu komen ze met: het is lelijk. Ze hadden maximaal de kans om er aan de voorkant iets aan te regelen. T.o.v was daar minimaal geregeld. Microsoft is helemaal groen. Vanuit de ontwerpfilosofie is alles groen, want het lijkt net kassen. En soms is alles een ander tintje groen. Ik vind zelf een hyperscale niet lelijk, maar daar kan ik zelf mee bezig zijn. We gaan deze (google) losknippen van dat achterlijke groen. Het was geen eis, maar wilde zelf. Het nieuwe hyperscale gebouw is licht wit met babyblauw. Aan de overkant komt nog een hyperscale van Microsoft met een andere architectuurschaal. (Grijs/oranje). Het zit vlakbij de monsterkabel van de AMS-IX. Ook daarvan is de ligging geheimzinnig. Dat komt voor terrorisme en dat soort zaken. Eigenlijk wil je niet in bestemmingsplannen zien waar dat soort kabels zitten. Wij hebben heel lang gezocht naar de kabel om te laten zien, hier kunnen jullie zitten. Energie is ook belangirjk, maar microsoft heeft alle energie van het windpark gekocht (groene nergie). Daar vind men van alles van, ik vind het leuk dat mensen wat vinden maar daar doe ik niet zoveel mee. Voor veel mensen is dit zuur, want het zou voor 40.000 huishoudens zorgen en nu linea recta de hyperscale in. Wat veel mensen vergeten is dat ze veel efficienter zijn dan als alles los waren in kleine deeltjes. **Pue GESPREK**.

Ik heb mij verdiept in wat ze doen. Ze willen de beste technieken om de PUE zo laag mogelijk te krijgen, dus zo efficient mogelijk.

De laatste hick-up was water. Dan kom je bij het HNK en PWN. HNK wilt het niet wat ze hebben veel water nodig. Partij vraagt, kan ik het niet uit de sloot halen, uit het meer halen. En eigenlijk willen ze het liefst het terug kunnen dumpen. Alleen door de techniek wordt het water

heel vaak opnieuw gebruikt en kan je dus daardoor niet opnieuw gebruiken. En dit kan je dan ook niet meer terug de grond in stoppen. Hier komen veel milieuaspecten bij kijken en was een oplossing om met een vrachtwagen het weg te rijden.

Het laatste aspect is geluid. Het zijn grote geluidsmakers. Ze hebben veel agrigraten ze hebben (R+3). Dus als de energie wegvalt schieten er accus aan. En als accus aan gaan gaan dieselgeneratoren aan om dit weer hierna weer op te vangen. Diesel is ook niet leuk door de olie (grijze stroom etc.) Het vervelende daarvan is dat het pas de 3e redudentie is. Om het half jaar doen ze een blackout om het te checken of alles werkt. ALleen sinds tot 2013 is hier nooit buiten testdingen gebruik van gemaakt. Dus daarom is het voor mileu laster (emmissie, geluid) terwijl dat niet gebruikt wordt. We hebben zelf bepaald dat we niet aan de EU richtlijn doen omdat deze nite worden gebruikt.

Wat heel intressant zou zijn is flow-energie. Dus hele grote bakken met water (batterijen) die snel kunnen opladen. Ze zijn heel groot, dus dat is lastig. Maar dat kan een alternatief zijn voor de diesselgeneratoren.

W: Waarom in Nederland?

Het is goedkoop, de faciliteiten. De grond is goedkoop. Plot van google is 75 hectare en dat is leuk betaalbaar hier. Ik weet niet of het goedkoper is dan Duitsland bijvoorbeeld, maar met het huidige klimaat gaan ze waarschijnlijk met een grote boog om Nederland heen, want ze willen geen gezeik. Zelfs we het accepteren willen ze misschien ergens anders zijn. Ze dneken: Of we willen welkom zijn of donder maar op.

Ze zeggen nu de groeten omdat ze maar 3 locaties hebben,

Ook de beeldvorming is belangrijk. Als dit in verkiezingstijd is. Als je in het afgelopen half jaar iets naar de gemeenteraad had gebracht. Willen ze het niet doen, want dan gaan ze niet meer op mijn stemmen. Dus er komt een grote politieke laag, waardoor het minder over de inhoud gaat.

Ik denk dat geluid, water en energie belangrijke proposities zijn. Dat zijn goede plekken voor Eemshaven & Hollandskroon. De AMS-IX loopt Noordelijk, dus ook goed voor Eemshaven.

W: Verdiend hollands kroon hier nog wat aan?

De WOZ, dus belastingen die betaalt moeten worden. De leesjes van de bouwkosten. Formeel zijn ze kostendekkend, maar je mag het wel verdelen. Dus als ze een duur gebouw zetten, dan kan je zeggen. Je maakt de dakpannen voor iedereen goedkoper of gratis. De WOZ, De belastingen. De social return, wat ze in de gemeente stoppen. De werkgelegenheid, de spinoff.

Microsoft heeft een onderwijs traject , ICT specifiek. Dat is goed voor de ROC en de scholen eroheen. Ze doen ook zaken voor technische dingen. Die zie je nu nite meer, maar die waren er wel.

W: Ik vroeg me ook af, ze kopen nu de groene stroom af van de windmolenparken. Kunnen ze dat niet zelf doen, eindeloos veel geld?

Doen ze ook, ze hebben ook een windmolenpark bij scandinavie neergeflikkerd. Als ze het zelf moeten faciliteren doen ze het ook. In Amerika hebben ze het ook zelf. Op de plekken zoals Tesla zie je mega zonneparken eromheen. Het nadeel is dat in Nederland dat de windparken in wierengenmeer op een bepaalde manier zijn ontworpen. Voor bepaalde rust en bla bla bla. Dat is dan voor een partij weer lastiger. Ik denk als ze hadden gezegd we willen een plot maar dan met zonnepanelen zeggen wi jweer: Dat vinden we niet mooi

W: Offshore windmolenparken?

Ik denk dat ze dat prima kunnen doen. Ik denk alleen dat het net het niet meer aankan. Wat het probleem is dat TenneT een periode heeft van 20 jaar. Wat TenneT heeft gezegd, je bent met een bestemmingsplan bezig. Wij gaan pas kijken als je echt gaat bouwen. Maar ze doen het er het langst over, terwijl ze pas op het laatste moment doen. Ze doen het pas als het zeker is. En nu wordt alles zeker, maar dan kunnen ze het nite meer doen. Ze hadden beter moeten anticiperen.

Het is gewoon het oude denken, het oude beestje. Het lijkt nu alsof de data centers eng zijn. Maar het is maar een paar procent, en de rest van de transitie zijn wij. Het is gewoon nooit geanticipeert, deze orde van schaal.

Een datacenter heeft Hoogspanning, dat wordt getransformeerd naar een exacte voltage. Dat is parralel ontwikkeld. Op dit moment zegt TenneT dat we nite meer mensen kunnen aansluiten. En ook het net kan het niet aan, want ze kunnen het niet terugleveren (de gewone burgers). Want dat kunnen ze ook niet aan.

Interviewee 2: Stedin

Wat beleid is is first come first serve.Alle aanvragen die je hebt moet je doen. Als netbeheerder heb je aansluitplicht en moeten we zorgen dat er capiciteit beschikbaar komt. Alleen zo’n hoogspanningsstation kan 10 jaar duren. Zoek maar eens grond voor zo’n hoogspanningsstation. Dan heb je allemaal vergunningstrajacten. Bestemmingsplan Plan wijziging. Grondaankoop. Omwonenden die een raad van state procedure aangaan. Dit kan dan 2 3 jaar duren, dus dat vertraagd het.

W: gaan ze first come first serve veranderen

Dat klopt volgens mij wel. Dat is iets van prioriteren, programeren. Dat is om te kijken of woningbouw voor mag gaan op bijvoorbeeld data centers. Maar daar is nog geen beslissing over genomen. Dus op dit moment mag dat nog niet, nu is er een wachtlijst en die moeten wij afwerken. Het data center in zeewolde had voorrang gekregen boven andere klanten, omdat de overheid daar een beetje had gelobbyed. Dus dat was niet helemaal goed gegaan.

Stel het past niet en er is congestie, maar je wilt een aansluiting. Bijvoorbeeld in utrecht. Dan kom je in een wachtrij en dan moet je wachten, staat niet bekend. Wij zijn heel erg afhanklelijk van de ruimtelijke ordening en hoe lang dat duurt. En waar we nu ook last van hebben is schaarste van matteriaal. Een grote transformator fabriek staat in Oekraïne, dat vertraagd het ook. En we hebben ook te weinig monteurs, te weinig mankracht. We hebben wel genoeg geld, maar te weinig handjes.

W: merken jullie iets van de energietransitie

Ja wij moeten nu veel meer uitbreiden en investeren. Je moet maar enes kijken in het inversteringsplan. Je hebt de autonome groei, nederland krijgt meer inwoners. Maar je hebt ook electrificatie omdat we van het gas af gaan, warmtepompen op electriciteit. Je ziet dus een enorme steigende lijn en met personeelstekort kunnen we dat niet bijhouden.

W: Waar zit de moeiljikheid in

Ja echt alles, de ruimte voor ondergronds, de ruimte bovengrens is lastig om te kijrgen. We hebben spanningsklachten, willen een transformatorhuisje maar niet in mijn achtertuin.

Het hele ruimtelijke stukje, gecombineerd met schaarste van mateiraal en mensen. En het nadeel van netbeheerders is dat wij nu het moeten investeren, maar dat krijg je pas na 40 jaar uit betaald. DE ACM bepaald onze tarieven. Wij moeten miljarden investeren en krijgen het pas veel later terug, waardoor je daardoor ook nog problemen krijgt. Materieel, financieel, ruimtelijk.

W: Is dit een probleme die er altijd is? Als energietransitie klaar is. Is het dan nog steeds lastig?

Nu mogen we alleen investeren als er een klantvraag is. Je mag niet voor-investeren. Maar de overheid legt ons allemaal regels op waardoor wij niet flexibel kunnen zijn. Dit komt omdat het maatschappelijke kosten zijn. De klant betaald dus die kosten moeten zo laag mogelijk zijn. Maar daardoor mogen wij niet voorinvesteren. Maar daardoor zitten wij nu wel echt op het randje van onze capititeit, of daarboven. Maar daarom kijken we nu ook naar flex oplossingen.

Dat je windmolenpark, zonnepark en bijvoorbeeld een data center op een apart netwerk doen met een batterij ertussen.

Onze taak is zorgen dat klanten aangesloten worden. Wij gaan als Stedin wel het gesprek aan met klanten om te vragen of ze kunnen ‘cable poolen’. Dan deel je dus een vrij veld met bijvoorbeeld 2 bedrijven. De ene laden dan om 3 uur smiddags en de andere om 3 uur snachts. Maar dan is de taak van Stedin om dat contractueel goed af te spreken. Dat zou je misschien ook met een datacenter kunnen doen, maar die zijn niet flexibel met een data afname. Het is dan ook wel makkelijk omdat het niet fluctueert.

TenneT is dus de landelijke netbeheerder. Wij hebben een koppeling met dat netwerk. Daar zit tussenspanning, hoogspanning, middenspanning en laagspanning. Zo’n hyperscale zit echt aan het veld van een distributiestation. Je hebt echt vrije velden nodig waar zo’n kabel zit. Naast een station heb je dus ook vrije velden nodig. Hierdoor zijn dus extra complicaties.

Online hebben wij capiciteitkaarten waar je kan kijken voor afname. Rood kan dan sowiso niet. Wij proberen dan met de gemeente af te spreken dat ze dan groene regios kiezen. Wij zitten al veel met provincies en gemeentes aan tafel om te zorgen hoe ze ons kunnen helpen, waar ze een zonnepark het beste kunnen neerzetten.

Het kan dus ervoor zorgen dat andere dingen niet aangesloten kunnen worden, die maatschappelijk belangrijker zijn.

Het stedelijke gebied is makkelijk dan het niet stedelijke gebied. In landelijk gebied heb je veel meer ruimte voor data centers / windmolen parken. Er is dus veel meer ruimte, dus krijg je congestie.

In zeeland heb je veel zon/windenergie. Maar omdat dat fluctueert is dat ook weer lastig omdat een data center stroom constant nodig heeft. Daarvoor zou je flex oplossingen voor kunnen gebruiken. Of bijvoorbeeld waterstof, grote batterijen en dat soort oplossingen.

Wij hebben als volk er niet zoveel aan, dus ik ben er zelf een beetje tegen. Maar we hoeven niet data centers voor het buitenland in onze weilanden te zetten. Ik hoop dat de overheid het gaat reguleren. Ik ben tegen onnodige data centers die niet voor Nederlanders zijn. Ik heb liever woningbouw dan datacenters.

Interviewee 3: Dutch Data Center Association

Voor jouw context, er was al een ingrijp. Er was al een bouwstop op het moment dat dit bericht was. Er was al een lokale bouwstop voor alle data centers rondom amsterdam. Dit bericht van nu is voor de hyperscales.

Het is goed om te kijken wat die bouwstop echt betekend hebben. Bij de eerste bouwstop mochten aanvragen die in behandeling waren nog doorgaan. Dus het was eigenlijk een stop voor nieuwe aanvragen. Hetzelfde met de huidige bouwstop. Er zitten een aantal voorwaarden aan, waardoor er eigenlijk geen bouwstop is.

Er valt dus een hoop voor te zeggen. Er wordt veel geroepen, maar er is weinig concreet (qua bouwstoppen).

Het is geen aangelegenheid van de landelijke politiek. In de realiteit is er wat er gebeurd met de grond wordt op een heel ander niveau besloten. De grond in Zeewolde is een nationaal probleem geworden.normaal gesproken gebeurt dat niet en daarom pleiten we als DDA voor nationale regie. Dit zijn grote beslissingen dus dat moet je niet door een kleine gemeente zoals Zeewolde laten beslissen. Dat zijn namelijk geen beroeppolitici maar mensen die door de weeks gewoon bakker en die doen dit erbij. En dit zijn wel grote beslissingen met landelijke impact. En daarom zeggen we als DDA dat het landelijk georganiseerd moeten worden, zodat het meer georganiseerd is.

W: Hoe zou dat precies moeten, ministerie van ruimtelijke ordening of iets anders?

Wij hebben een strategiedocument hiervan. Heb je trouwens naar onze cijferpagina gekeken. We hebben daar een mythes en feitenpagina. Wat je kan zien is dat stroom/energie helemaal niet veel is. Het is ongeveer 2% van het energie/stroom gebruik. Er zijn branches die daar hoger in zitten. En juist het plaatsten van hyperscale datacenters zorgt voor efficienty (PUE).

Het is gewoon het economie van schaal model, hoe groter de schaal hoe efficienter je dat kan doen. Dat geld ook voor data centers. De schaal helpt met stroom brengen naar, het koelen. En het koppelen van warmte. Dat is ook een deel van de nationale strategie. We willen van het gas af en we willen aan de warmtenet. Data centers kunnen hier een rol bij spelen, maar als je dan een gebied / bedrijventerrein gaan plannen. Zou je dan in je achterhoofd kunnen houden om te kijken of er ook een data center komt

W: Maar met de energietransitie is dat moeilijk. Duurt lang voor tennet/stedin. Zo’n data center kan 3 jaar start to finish en tennet reageert pas al s alles af is.

Ja tuurlijk. Als datacenter koop je natuurlijk ook in op schaal. Een datacenter heeft een potentiele capiciteit bijvoorbeeld 20 megawatt, die 20 mw staat er niet gelijk in. Maar in een paar jaar moet je wel het hebben.

W: Ik zou het liefst een kaart hebben met waar de data centers het best kunnnen komen. De voordelen waarom data centers in Nederland kan je wel makkelijk vinden, en de nadelen spreken ook wel voor zich. Helemaal omdat zo[‘n data center elektriciteit van 400.000 gebruikt

Over wat voor electriciteit heb je het dan. Want als je kijkt naar duurzame electriciteit kijk je ook naar PPA’s (Power purchase agreements). Als je daar kritisch naar kijkt en naar de windpark projecten worden die pas gerealiseerd als er een afnemer is. Dus een windpark wordt pas gebouwd als er een partij is die de stroom inkopen. Dit is specifiek in Nederland, maar ik weet niet hoe dat zit met off-shore/on-shore. Maar het is goed om er rekening mee te houden. Het vertekend de discussie. De stroom was er nog niet en een data center jat dat. Want ze komen er omdat er data centers zijn die het willen kopen.

Het zijn niet alleen de data centers die alle groene stroom inkopen. Het zijn alle bedrijven die dit soort projecten financieren. Een vastgoedbedrijf kan dat ook financieren bij het bouwen van een woonwijk. Maar waar zit dan het gewin van een woonwijk.

Data centers hebben natuurlijk veel geld en een grote behoefte aan stroom. Ze hebben 24/7 stroom nodig. Die consistentie van stroom maakt het aantrekkelijk, je kan er op bouwen voor warmtenetwerken en groene stroom netwerken. Ze staan er 10/20 of meer jaar. Ze hebben heel lang warmte die ze kunnen geven. Ze staan er dus wel even

W: Wat doet de DDA nou precies?

Onze activiteiten zijn vrij breed. Nu veel rapporten omdat er op politiek vlak veel dingen zijn waar wij willen inhaken. We brengen de branche bij elkaar. Nodigen vaak de politiek uit bij congressen om ze te laten zien waar ze een waardevolle rol kunnen spelen. Ik zelf ben beleidsmedewerken bij onderwijs en werkgelegenheid. Veel in contact met scholen om opleidingen te realiseren voor datacenters. Wij hebben te weinig (technische) mensen zoals elke branche, dus proberen we mensen die daar in te krijgen. Er zijn veel kansen dus het is wel een hele intressante branche. En dat proberne we ook naar biuten te brengen. De kern van het bestaan is het vertegenwoordigen van de branche. Het is ook een hele jonge branche > internet bestaat nog niet zo lang. Als jonge branche hebben ze het nodig om vertegenwoordigd te zijn, iedereen moet de juiste informatie krijgen. Ik wil niet zeggen misinformatie, maar wel wel veel halve informatie waardoor het plaatje verkeerd is.

W: Arjan lubach achtig

Wat er gecommuniceerd wordt is niet geheel fout of slecht, maar het is niet volledig juiste informatie en het is heel negatief geframed. Er is een negatief frame onstaan, wij weten ook niet precies waarom en hoe. Het is natuurlijk nieuw en eng. We moeten als land zorgne maken, maar het is niet dat maar een kleine groep mensen die profeit hebben. Of dat er veel vervuiling is. De infrastructuur werkt beter en iederene gebruikt de cloud dus dat verhaal moet ook verteld worden. We zijn niet per se een lobby organisatie die zegt hoe de wetgeving moet zijn. Maar het moet wel realistisch blijven en we pleiten voor een nationale strategie. Omdat nu data center de dupe worden terwijl de partijen met de beste intenties een stuk land aanbieden. Maar dat komt niet goed in de media tot z'n recht / gecommuniceerd wordt waardoor het een eigen leven gaat leiden. Als je de wethouder van Zeewolde ziet voor de camera zie je dat hij te weinig mediatraining heeft gehad voor hoe groote impact zo'n beslissing is. En daardoor gaat het een eigen leven leiden

W: Nederland te klein voor dit

Logische reactie, maar het is ook goed om te kijken naar de cijfers te kijken. Hoeveel procent van de oppervlakte is nou eigeljk een data center. Dat valt dan wel weer mee namelijk. Datacenters zijn distributiecenters voor data. Distributiecentra zijn voor fysieke producten. Van bedrijf naar bedrijf zal het gros zijn, maar door online shoppen gaan er enorm veel pakketjes naar huizen. En ook daarvoor zijn distributiecentra. Onze maatschappij digitaliseerd, betekent meer online shoppen, dus meer online. Daar hebben we meer infrastructuur nodig. We zitten in een fase die snel groeit, snel ontwikkeld. Maar we zien nu ongecontroleerde groei wat niet goed is.

Wat ook wel grappig is om te zien is dat wereldwijd gezien energiegebruik data ceneters gelijk is gebleven. Hoe kan dat komen. Computerapperatuur wordt efficienter, gaat heter draaien maar dat bespaar ik je. Maar in de realitteit is dat partijen vroeger hun ICT in een bezemkast hadden, nu in een data center komt. Nu wordt dat dus met groene stroom, en veel efficienter naar de ICT temperatuur. Het gaat er efficienter naartoe, wordt efficienter gekoeld. Maar de groei: 1) de schaal wordt groter van data centers in zijn algemeenheid. Dus meer ICT apparatuur 2) Maar het wordt ook efficienter, dus het blijft gelijk.

W: Komen in Nederland ook data centers waar de info naartoe gaat

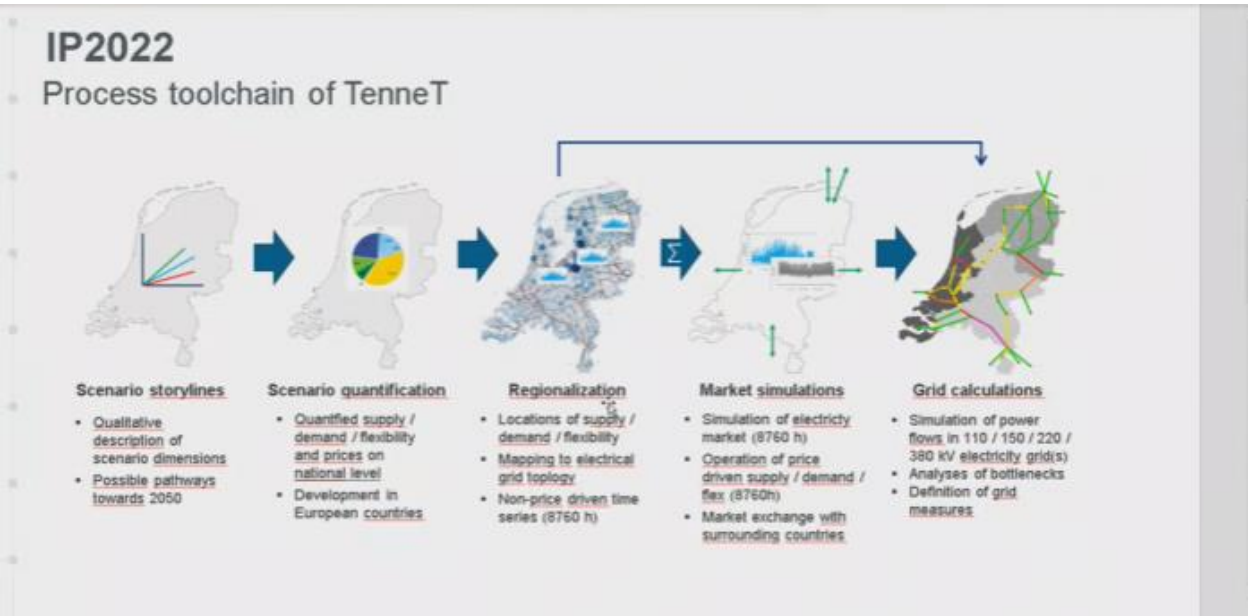
Je weet nooit wat er met de data gebeurd. Het zou gewoon puur zakelijk efficiëntie technisch gezien. Hoe minder afstand data hoeft af te leggen, hoe efficienter het is. Nederland moet ook niet vanuit de UK worden bestuurd.

W: Het kost veel moeite om energiegrid te vergroten, en liever een woonwijk dan een data center (aldus stedin). Het is namelijk wie het eerst komt wie het eerst maalt.

Ja ik vind het een hele moeilijke kwestie, want er wordt sowisoe te weinig gebouwd. En dat heeft niet alleen met de electriciteit te maken. We hebben een huizencrisis en dat wordt soms ook deels op data centers gegooid. En dat is niet de realiteit. Er mag gewoon kritiek zijn tegen data centers, maar de discussie moet wel feitelijk blijven. Maar de discussie tussen woonwijken / data centers is veel breder dan alleen stroom. En de problemen met stroomtekorten zijn eigenlijk vooral in de provincies met weinig data centers (gelderland, overijssel).

Interviewee 4: TenneT

Het is een interresant ding als je het hebt over de ontwikkeling van data centers.



In het midden zie je een stuk regionalisatie. Uit markt simulatie komen tijdsreeksens over brandstoftype, of belasting per uur in een bepaald jaar. Maar dat moet je vervolgens verdelen. Waar zit dat dan allemaal. Dat is vaak best wel natte vinger werk zeg maar. Wij hadden bijvoorbeeld in de vorige (IT opleiding)?? Met een batterij in de buurt van Amsterdam. Dat was een batterij van 1 GW geregionaliseerd.We wilden zoveel batterij hebben, en dan was het daar komt 1 Gigawatt daar. Vervolgens zag je in sommige uren dat de batterij helemaal niet zo fijn gedroeg en dat er gigantische knelpunten en overbelasting in lijnen daar in de buurt had. Maar daar gaan wij achter de oren krabben van. Ja dat was best een toevallige keuze om hem daar neer te zetten. Dat was niet echt vanuit een analyse of iets dergelijks. Ga je dan investeren omdat daar een knelpunt ontstaat. Toen waren er een aantal mensen die zeiden: we dan pas investeren als er echt een concrete aanvraagt ligt om die batterij te plaatsen. Maar aan de andere kant, er ligt wel een X hoeveelheid aan gigawatt in zo'n scenario. Dat moet ergens komen en dat heeft helemaal

geen concrete aanvraag.Je moet ook oppassen dat het geen wishfull thinking wordt. Met dat soort dillemas zitten we veel.

We weten van heel veel dingen niet zo goed waar die komen. We gaan in de meeste toekomstscenarios uit van significantie hoeveelheden batterijopslag. Maar wie dan dan komen en hoe die precies gaan gedragen kunnnen we wel verkennen. Varianten uitrekenenn. Maar we weten het niet, daar is nog geen ervaring mee.

W: Decentraal/centraal uitleg van scriptie. Vanuit tennet kunnen anticiperen.

Volgens mij komt uit die systeem verkenning studies, uit IP 2030/50. De varianten analyseren we, van verschillende locaties van datacenters. Ook het gedrag en hoeveelheid van data centers. En dan kunnen tenminste tonen wat de implicaties daarvan zijn om het infrastructuur. En daarmee gaan we op gesprek met partijen als EZK of andere stakeholders. Want dan kan je het gesprek voeren daarover, wat nuttige locaties zijn of minder. En dan gaat het verder, dan heb je het programma energie hoofd infrastructuur, dat is van het EZK. Dan kijken ze naar ruimtelijke aspecten. Wat er in de toekomst komt. Daar komen ook gesprekken uit. En dat nemen wij weer mee in vervolgstudies. De ruimtelijke beperkingen die er zijn.

Wij vrezen dat je er sowieso niet aan ontkomt. Met grootverbruik. Niet alleen data centers maar ook grote industrie. Dat moet veel meer gecoördineerd worden. Want je ziet dat het al kanteld. Bijvoorbeeld de grote off-shore windmolen parken. Je kan zien dat dat centraal wordt aangewezen, die moeten daar komen en die daar. Ze zijn zoveel gigawatt. En daar en daar aan land komen en op het net aansluiten. Dat moet je dan ook aan de vraagkant ook gaan doen. Anders sluit dat niet op elkaar aan. Voor een deel is dat ph-66, clusterenergie strategie gebeurt dat ook wel.

W: Dat is nu nieuw, vanzelf gebeuren

Ja ik zie dat wel gebeuren. Ik zie niet dat er in de toekomst over 5 jaar bijvoorbeeld .Als je dan een 2 gigawattt electrolizer neerzetten. Dat je daar overal een vergunning daarvoor krijgt.

Ik denk dat dat besturing sowieso moet komen, linksom of rechtsom. Dat je dat doet door de overheid, dat ze iets aanwijzen. Of door marktprikkels. Dat je zegt dat data centers/beheerders een voordeel krijgen als ze daar vestigen boven een andere plek.

Ik denk dat productie en vraag op elkaar afgesteld moeten worden.Die hebben een behoefte aan infrastructuur triggeren. Als je die op elkaar afgestemd kan je uitkomen met misschien minder infrastructuur. Het is sowieso al superveel, dus je wilt het wel beperken. Wij kunnen niet onbeperkt koperen platen maken.

W: Zijn clusters beter of verspreid beter?

Ligt puur aan de schaal. De hyperscale data of co-locaties. Hyperscales moet je dichtbij de grote productielocaties zetten. Dus bijvoorbeeld waar de wind op zee aan land komt. Zodat je zoveel mogelijk van de waardevolle groene elektriciteit kwijt kunnen. Zonder dat je eerst een *doorgangsboord?* moet faciliteren naar een andere plek.

W: Hoe zit dat met hollandskroon/eemshavens qua locaties?

Ja dat heeft meer te maken met de opbouw van het net. Tot nu toe is daar geen 380 kv Verbinding naar boven (Noord-Holland). Daar wordt wel over gesproken. Het is allemaal gecompliceerder dan puur de kabel.

Het ideale van zo'n data centers is dat het baseload heeft. Die heeft 24/7 stroom nodig. Het stomme is, je hebyt veel afhankelijkheden.

Productie in de toekomst is geen baseproductie. Dat is een onderwerp waar ik nu mee bezig ben. Hoe flexibel kunnen die data centers in de toekomst worden. Qua gedrag. Ik ga er ook van uit dat ze niet super flexibel kunnen worden. Maar als ze bijvoorbeeld al 20% flexibel kunnen zijn, zou dat ook helpen in bepaalde situaties.

Het gemengde is dat je met baseload en een het gebruik van zo'n windmolenpark is dat als er wind waait het ideaal is, maar als de wind niet waait trek je opeens veel elektriciteit uit het netwerk. Het stomme is dat je ook locaties hebt waar het juist wel goed is als er veel baseload is. Omdat je dan veel van je knelpunten kan oplossen. Maar dat hangt af van de locaties, van de andere productie in de omgeving. Hangt af van de scenarios. Dus je kan er niet echt een zwart/wit uitspraak over doen.

We doen ook veel gevoeligheidsanalysis
Hier hadden we onderzocht wat het verschil is tussen veel data centers en weinig data centers. En wat voor invloed dat heeft op het net. En wat gebeurt er wat er gebeurd als je data centers op bepaalde plekken neerzet. Dat is gebaseerd op een MRA studie van 1 of 2 jaar geleden. Daar hebben ze verschillende scenarios gemaakt met locaties. Dat hebben we onderzocht en dan rekenen we het door, vergeleken we het. Met de verschillende scenarios. Wat is het verschil tussen de het basis scenario met weinig data centers en met veel data centers. Daar kan je nog spelen met locaties en een van die conclusies was, zoals je wel kan verwachten. Dat de je de grote data centers dicht bij de energieproductie moet plaatsen.Want anders krijg je helemaal overbelasting op het net. Dat kan je zo zien op de foto.

De grote industrie clusters, die locaties. Die voorkeurslocaties voor windopzee zijn meegerekend. Data centers zitten daar ook bij. Dus vooral aan de kust.

W: Hebben data centers te maken met tennet/stedin/beide

Beide. Ligt er aan hoe groot het is. Hyperscales zit meer richting onze kant. Met co-locaties doen we onderzoek met Liander, ik kan je daar nog het contact van sturen. Ergens bestaat een bestand met voor hoeveel vermogen je welke aansluiting krijgt met elektriciteit. 110 kv is TenneT net.

W: komt er voor hyperscales een onderstation op het terrein?

Ja dat ligt aan TenneT om dat op te lossen. Wij moeten gaan kijken hoe we dat regelen. Dat kan zijn door een onderstation daar bouwen. Of een kabel trekken naar een onderstation in de buurt. Ik weet ook niet of het voorbeeld midden-meer actueel is. Daar was een data center gepland, en daar moest een nieuwe verbinding voor worden gemaakt.

Ja daar was microsoft moeilijk aan het doen of ze nog wel wilden komen. Dus dat is nog een politiek spelletje op zich voordat we daar weer verder mee gaan. Ja en in het publieke ogen zijn data centers echt de boeman geworden. Echt in twee jaar ofzo. Ik herinner me nog dat een interne meeting. Dat het voor communicatie naar externe was bedoeld. Dat er een lijstje was met afnemers en dat data centers helemaal onderaan het lijstje staan. Dat we daar helemaal niet voor gaan hardlopen.

W: De eerste hyperscales waren 2015/2016. En toen arjan lubach in 2021 met iedereen een mening.

Ja precies, dat is vrij hard gegaan.

W: Ja ze hebben er wel vrij weinig last van, ja missachien van de windmolen parken zie je direct last.

Ja elektronen hebben geen kleur. Ze zijn niet aangemerkt dat dat speciaal voor huizen moet zijn. Ja elektrificatie, de vraagkant is heel efficiënt en steeds meer elektriciteit. Maar daardoor komt het doelstelling van duurzame energie dus ook steeds lastiger. Dat is wellicht ook moeilijk te communiceren. Door te zeggen dat de klimaatdoelen lastiger zijn omdat je data centers hebt.

Vergeet niet dat het ruimtelijk een dingetje is. Je hebt naast de data centers zelf ook een enorme bak elktrische infrastruur nodig. Je hebt transformatoren, je hebt schakelinstalaties. Dat zijn wel een paar voetbalvelden aan ruimte. Dat is niet gewoon even een stekker in het stopcontact voor 2.4 GW.

W: Dus dat is moeilijk voor vergunningen?

Precies.

W: Is jullie focus de komende 10/20/30 jaar?

Ja het IP kijkt 10 jaar voorruit, dat was 8 jaar. Het wordt nu weer 15 jaar. Maar je hebt ook studies die verder kijken, zoals 30 jaar voorruit. Maar hoe verder je voorruit kijkt, hoe meer koffiedik het kijken wordt. Dus daar kan je dan minder beslissingen op doen. Het heeft dus meer een verkennend karakter, die lange termijn studies.

Dus daar pas je ook minder detail toe in het modelleren. Daarnaast zijn we bezig met het bouwen van veel modellen. Maar het moet ook passen bij de onderzoeksvraag. Het hoeft niet super optimale marktonderzoeken te zijn voor 2050, want dat kan je niet bepalen. Dat is teveel onzekerheid.

W: Dat kaartje met de data centers, hoe zat dat qua specifieke plekken. Dichtbij productie en water. Zijn dit nieuwe plekken of al bestaande

Ja je kunt van alles onderzoeken, maar wat we nu hebben gedaan. Ja we keken wat er stond in de studies. Dus daar werden concreet locaties benoemd bij het MRA. Bij noord-holland/noord nederland regio informatie gevraagd bij collegas, en die informatie samen gevoegd. En dat dan gaan doorekenen. Maar we zijn niet uitgekomen, en dat was ook niet het doel. Om bij een optimum te komen. Het was puur verkennend, wat doen de verschillende varianten op het stroomnet.

W: Ook niet echt jullie verantwoordelijkheid

Ja het is puur voor de discussie bij gesprekken. “Als jullie het optimaal willen inpassen in het systeem, dan kan je wellicht deze locaties kiezen”. Ik weet niet of dat wenselijk is, maar die communicatie zou wel kunnen komen.

W: Digital Affairs, digitale en elektriciteit samen doen

Ja de vraag is wat is ideaal. Wat is je doel? Wil je optimale systeemkosten, maximale net ontlasting. Ja voor TenneT is het gewoon de zoveelste stroomgebruiker. Je kan niet alles tegelijk optimaliseren. Je komt altijd ergens in de knel. Een ministerie van digitale zaken zal de 7e of 27e stakeholder zijn die bij ons komt aankloppen met geef ons stroom. Wij moeten al die dingen op elkaar afstemmen. Beide dingen zijn onzeker op de lange termijn (grote elektriciteit

productie/afname). Maar daar moet sturing komen (bijvoorbeeld de overheid) die zegt we gaan het zo doen.

W: Nu is er gewoon maximale onzekerheid, weinig verstand van alle kanten. Iedere stakeholders heeft eigen eisen. Probleem over 20 jaar wat minder omdat er dan meer kennis is.

Ja maar dat hoeft niet eens 20 jaar lang te wachten, dat is precies wat er gebeurd. Nu hebben alle stakeholders gesprekken gevoerd met scenarios. met sectorale stakeholders met hun visie op het systeem, om het dan toe te passen om een beeld te krijgen van het hele systeem. Dat kost veel moeite en tijd, maar hopelijk levert het wat op. Als er coördinatie ook komt (centraal). Dat zijn niet wij maar het EZK of andere overheid.

Je ziet dat veel stakeholders allemaal verschillende studies/scenarios sturen. Dus het maakt heel uit wat voor aannames je gebruikt voor je optimalisatie. Je krijgt dus allemaal verschillende dingen. Dat maakt het voor ons ook lastig, want je kan als gemotiveerde stakeholder andere scenario's maken die misschien helemaal niet zo zijn. Dus je moet goed filteren of het echt is en er een neutrale inschatting is gemaakt.

Mijn persoonlijke mening is dat we moeten kijken wat er nou allemaal in zo'n data center gebeurt. Ik vind dat bitcoin mining wel zonde is van de energie. Kijk of apps zuiniger met data kunnen omgaan. Maar dat is allemaal wel erg ver weg.

W: Beetje praten over hypocriet. We zitten wel op microsoft teams

Klopt, even kijken wat voor gebruik er nou echt is in zo'n data center. Maar daar zitten zoveel en bedrijven tussen dat het moeilijk is om te kijken. Ze zijn nu ook aan het kijken om te zien of er datacenters naar noorwegen komen. Ik kan je die studie nog wel even doorsturen.