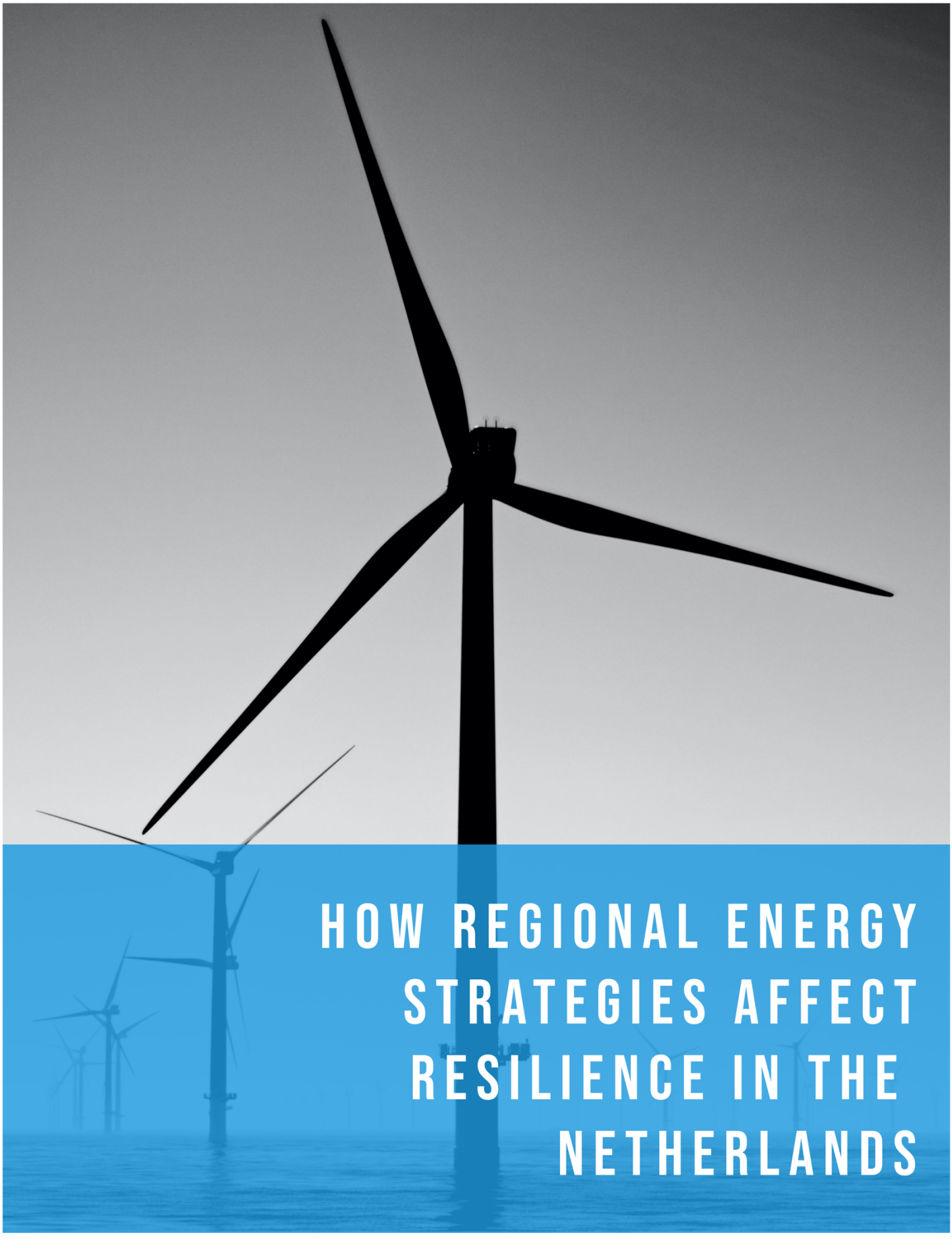
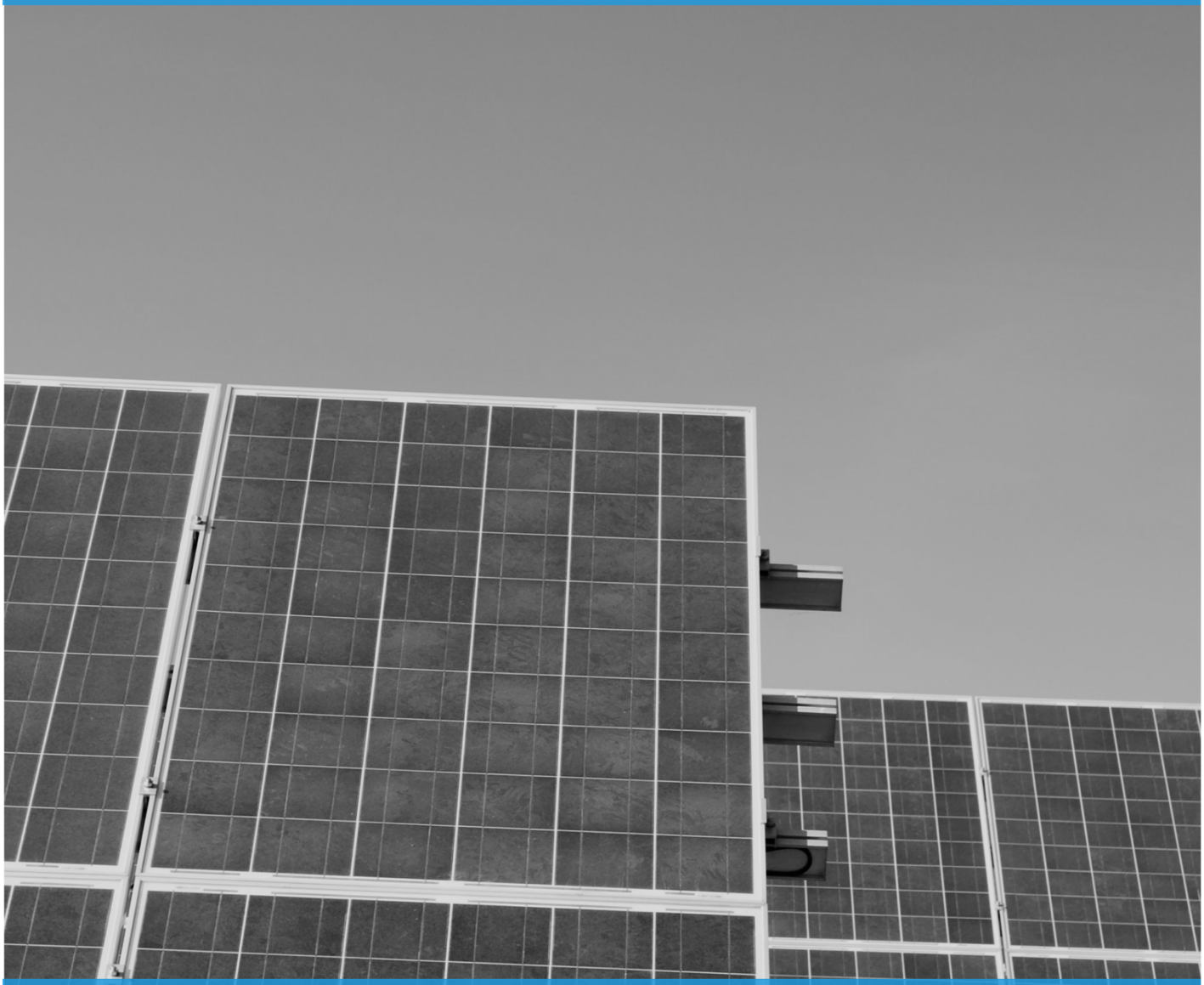
university of groningen

faculty of spatial sciences



HOW REGIONAL ENERGY STRATEGIES AFFECT RESILIENCE IN THE NETHERLANDS

A COMPARISON BETWEEN THE NORTHERN RES REGIONS: GRONINGEN, FRIESLAND, AND DRENTHE



Author: Madeleen Gaemers
M.S.K.Gaemers@student.rug.nl

Student number: S3332365

Programme: Bachelor Thesis Spatial Planning & Design
Rijksuniversiteit Groningen
Faculty of Spatial Sciences
Landleven 1
9747 AD Groningen

Supervisor: Prof. Dr. I. Horlings

Date: 28-01-2022

Abstract

This research investigates the level of resilience present in RES (Regional Energy Strategies) in the Netherlands by investigating 1.0 documents from the RES regions: Groningen, Friesland, and Drenthe. A comparative study was done of the three Northern RES regions. RES 1.0 is a national plan in the Netherlands to generate 35 TWh renewable electricity via solar panels and windmills, the transition of heat sources, and the required energy infrastructure and storage by 2030. Resilience refers to the ability of a system to maintain its functions after a shock of a stressor. Climate change is the shock or stressor of the energy system. The research question is: *How do RES regions Friesland, Groningen, and Drenthe increase resilience through their own RES 1.0 policy?* It is crucial to have a high level of resilience, as this goes hand in hand with climate change adaptation and efforts to enhance sustainability and urban development, energy systems lacking resilience will quickly become overloaded. The City Resilience Framework (CRF) is used to investigate the presence of resilience by looking for indicators of resilience for Aspects and Qualities. Data collection includes a literature review, policy documents, and semi-structured interviews. Data was analysed through a coding tree, scoring, stakeholder analysis, and gap analysis. Groningen and Drenthe tied in the total score of indicators for resilience in Aspects. However, Drenthe had more positive resilience indicators than Groningen, so Drenthe was deemed to have the highest level of resilience. In Qualities, Drenthe scored the highest in the total score of resilience indicators. All three regions had a total score in Aspects and Qualities that was positive: RES 1.0 showed an increase in resilience.
Recommendations are:
• Look for possible new adaptive measures, there are problems with electricity that will only continue to increase;
• Increase citizen participation and active involvement;
• Work with network operators to better communicate grid capacity and storage problems.

Investigating how RES policy can increase resilience could positively affect climate change adaptation and help create a new method for policymakers when writing future RES; it could entail a new decision process for the location and implementation of renewable energy sources, e.g., wind/solar farms and land use. This comparison offers RES regions opportunities to learn from each other and see how RES 1.0 increases resilience in the energy transition.

Keywords
Resilience; Regional Energy Strategies; Energy transition; City Resilience Framework; Climate change adaptation; Sustainability; The Netherlands Groningen; Friesland; Drenthe.

Abbreviations

BLA	Block Leader Approach
CO2	Carbon dioxide
CRF	City Resilience Framework
DET	Drentse Energie Tafel
ES	Energy systems
EU	European Union
FEA	Friese Energie Alliantie
GHG	Greenhouse gas
NPRES	National Programma RES
RES	Regional Energy Strategies
TWh	Terawatt-hour

Front page image source: Rampion offshore wind farm (Doherty, 2020).
Second page image source: Solar power plant (Burival, 2018).

Table of Contents

Appendixes

List of Figures

List of Tables

1. Introduction

1.1. Background

The 'Greenhouse Effect' is warming the earth's atmosphere due to GHG accumulation (Butler, 2018). An increase in temperature affects the climate on which environmental and human systems depend (Schneider et al., 2001). Reducing CO_2 emissions will stabilize the earth's temperature increase, thus stressors from climate change (Meinhausen et al., 2009; Plambeck, 2012). ES and infrastructure provide ways to decrease GHG emissions by transitioning to sustainable sources (Held et al., 2020; Li & Mahalec, 2021). Transitioning society to low CO_2 emissions will have consequences as sustainable ES's, e.g., solar and wind, require more space than fossil-based systems (Ministry of Economic Affairs and Climate Policy, 2019a). Responses or anticipation to climate change are in current Dutch policies and plans, e.g., National Climate Agreement (Government.nl, 2018).

National energy policies. The Netherlands is developing a sustainable ES for 2050 with nearly no CO_2 emissions and is working to the EU ambition of 50% less CO_2 emissions by 2030 relative to 1990. (Klimaat en Ministerie van Volkshuisvesting, 2017). The Dutch national government 'Het Rijk' establishes targets for GHG emissions in the Dutch Climate Act (Ministry of Economic Affairs and Climate Policy, 2019b). The Netherlands is strongly interconnected by import/export to other European countries through energy and logistics networks that are at risk of climate change effects (PBL Planbureau voor de Leefomgeving, 2015). The Netherlands does not want to depend on imports from other European countries for energy (Klimaat en Ministerie van Volkshuisvesting, 2017). EU directives and regulations set energy sector targets; the Netherlands is a member state and frames Dutch plans and measures to this (IEA, 2020).

Regional Energy Strategies (RES) is an instrument of the National Climate Agreement, updated biannually to investigate how to sustain electricity sustainably (Regionale Energie Strategie 1.0 Regio Drenthe, 2021). RES's ambition is to realize the generation of 35TWh renewable electricity, the transition of heat sources, and the required energy infrastructure and storage capacity by 2030 in cities and rural areas (The Hague, 2019). RES considers space and system efficiency (Regionale Energiestrategie, 2022). There are 30 RES regions where local governments, businesses, residents, network operators, and civil society work together (RES Regio's op de kaart, 2021). The RES process: regions investigate where and how they can best generate electricity on land from solar and wind, based on their regional conditions and makes a 'bid' on how many TWh's they can contribute to the national ambition (figure 1). Also, how, and where to use heat sources so that buildings can move away from natural gas use (Regionale Energiestrategie, 2022). Each region develops strategies to resolve barriers related to cost impacts, spatial planning, social acceptance, and integration of renewable energy to adapt to the changing conditions of climate change (IEA, 2020). RES allows collaboration to design plans that support the community (The Haag, 2019). Finally, NPRES facilitates, supports, and stimulates RES in the regions and allows the regions to learn from each other (The Haag, 2019). In 2019, the Netherlands consumed 113.1TWh of electricity, which is more than double the ambition of 35TWh (CBS.nl, 2020).

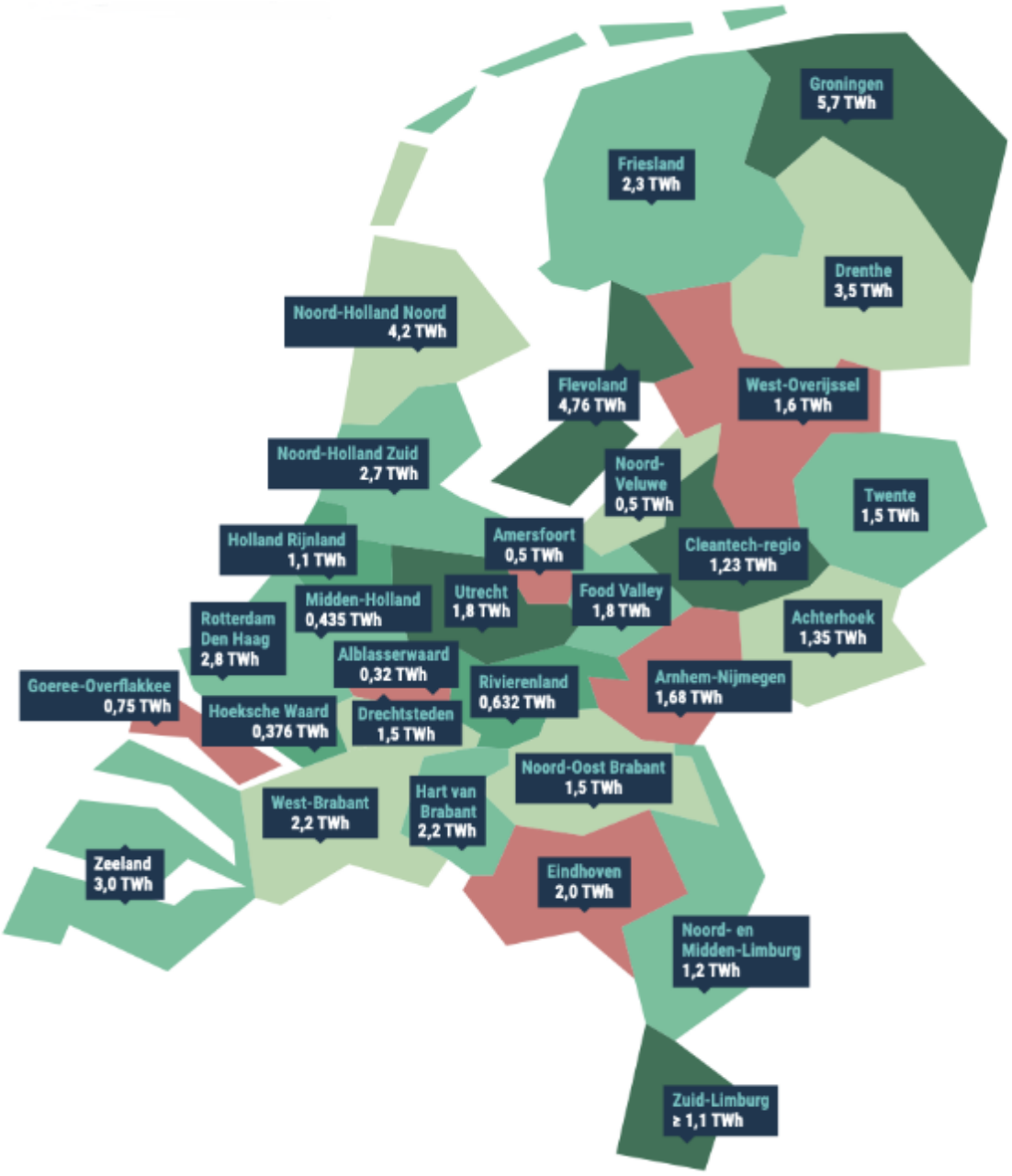


Figure 1: RES bids per region for 35TWh (RES 1.0 Groningen, p.11, 2021).

Resilience is the ability of a system to maintain its functions or positive adaptation and transformation after a shock of a stressor (Wald et al., 2006; Hermann et al., 2011). Various factors and systems contribute to an interactive and dynamic process to increase resilience and are context and time-specific (Hermann et al., 2011). Resilience is the power to recover and preserve the current state due to buffer capacity (Folke et al., 2010; Davoudi et al., 2012). This research investigates how RES 1.0 increases resilience, allowing regions' ES's to carry on after stressors from climate change.

1.2. Problem statement

Energy infrastructure in many countries is changing via the implementation of renewable energy sources (Bridge, Özkaynak & Turhan, 2018). Including resilience in development helps better manage unexpected events and vulnerability from progressing climate change. Increasing resilience is vital for climate change; it goes together with efforts to enhance sustainability and urban development (Leichenko, 2011). ES's lacking resilience will quickly become overloaded, so it is crucial to develop spatial plans that increase resilience.

Het Rijk sets governance conditions for CO2 emission goals, provides supportive policy instruments. Policies and programs are tailored to local conditions (Hoppe & Miedema, 2020). Each RES region has its ambitions for sustainable energy saving and production in line with EU ambitions and legislation. Regions are often too ambitious with poorly implemented policy plans (de Vries et al., 2019). May lead to perceived resilience in the region's ES's; they can keep functioning but not for long. If a system is less resilient, its ability to cope with stressors is lower (Folke et al., 2002). When a system decreases in resilience, it becomes vulnerable to shocks and stresses that could have previously been absorbed (Kasperson & Kasperson 2001a, Folke et al., 2002). Therefore, it is vital to remain or become more resilient.

1.3. Case Description

This research uses the three RES regions: Groningen, Friesland, and Drenthe, and together are known as the 'North' of the Netherlands, and locations are shown in figure 2.

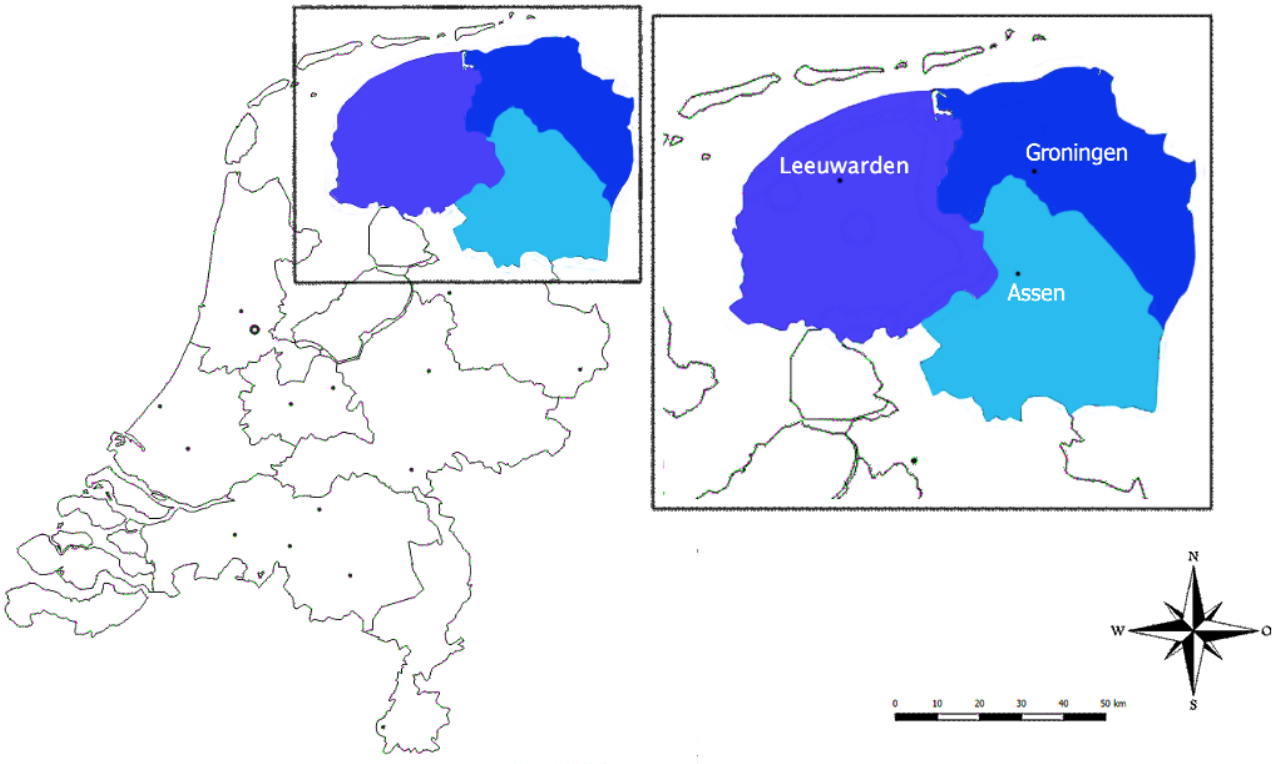


Figure 2: Case study areas, adapted from Blank World Map (2021).

Earthquakes occur in Groningen due to natural gas extraction, but in 2022, extraction is to halt (Reed, 2019). So has put pressure on policymakers to increase policies for renewable ES's. Groningen has the most ambitious target of all RES regions to generate 5.7TWh (RES 1.0 Groningen, 2021). Friesland bid to generate 2.3TWh of sustainable energy by 2030 (RES FRYSLÂN 1.0, 2021). Drenthe's bid to produce 3.5TWh from wind and sun-on-roof is ¼ of energy consumed in Drenthe (Energie voor Drenthe, 2022).

1.4. Research purpose and questions

This research investigates how RES 1.0 from Groningen, Friesland, and Drenthe aims to increase resilience through RES and differences in resilience. In addition, investigating the characteristics and meaning of RES policies are vital elements of determining resilience.

This research relates to spatial planning as RES 1.0 aims to create a healthy environment for humans to live in by regulating emissions from industry and other sources (Ministry of Infrastructure and Water Management, 2021). RES also considers spatial quality, impact, and community support during the energy transition (The Haag, 2019). RES proposes implementing measures for renewable energy generation in the spatial environment, so spatial planning plays a crucial role.

This research's central research question: *How do RES regions Friesland, Groningen, and Drenthe increase resilience through their own RES 1.0 policy reports?*

Sub-research questions to help research the main question:

1. *What are the stakeholders in the energy transition and their effects and influences of energy policies in the RES regions?*
2. *How and to what level do RES 1.0 reports increase and provide resilience for the regions?*
3. *What are the differences in resilience between regions from RES policies?*
4. *What lessons can the RES regions learn from each other?*

1.5. Academic and societal relevance

It is essential to understand the drivers for change and resilience; therefore, vital that policies related to energy are required to continue the supply of energy and is reliable and economical (Owen, 2009). For example, investigating how RES policy can increase resilience could positively affect climate change adaptation and help create new methods for policymakers for future RES. It could entail a new decision process for the location and implementation of renewable energy sources and land use. This study provides steps stakeholders may take to increase resilience. Also, able to make recommendations on increasing resilience through future RES and lessons for regions by investigating resilience strengths and weaknesses in RES 1.0.

1.6. Reading guide

Theoretical background explains the theories and framework used in this research. Then, section 3 shows the research design for data collection and analysis. Section 4 shows the results. Finally, section 5 discusses the results along with recommendations. Concluding remarks answering the research question, reflection, and ideas for future research are given in section 6.

2. Theoretical framework

2.1. Resilience and sustainability

The concept of resilience is most relevant for this research as it describes systems' capacity to function and survive from measures in place to deal with shocks and is a positive adaptation. Some functions of resilience:

'Delivers basic needs; safeguards human life; protects, maintains and enhances assets; facilitates human relationships and identity; promotes knowledge; defends the rule of law, justice, and equity; supports livelihoods; stimulates economic prosperity.' (The Rockefeller Foundation, 2015, p.4).

There is a discussion on how resilience and sustainability do and do not relate. Resilience has become a well-accepted term in spatial planning and seems to be replacing sustainability in academic discourse and as a reference frame (Davoudi, 2012). A required critical approach to defining resilience is due to the similarities in concepts and comprehension as it is context-specific (Rega & Bonifazi, 2020). Sustainability increases the quality of social, economic, and environmental systems, and resilience is a system's capability to respond and absorb stressors, the quality, and effects (Marchese et al., 2018). On the other hand, resilience focuses on adapting to new conditions and improving using creative innovations that positively impact the quality of life (Lew et al., 2016; Marchese et al.,2008). Sustainability and resilience link to political trends, so both terms develop in spatial planning (Folke et al., 2002).

Resilience prioritizes the change of planning processes and the capacity of territorial systems to transition due to vulnerabilities and shocks, so a better fit for this research (Park et al., 2012). Resilience in this research relates to the ability of RES to adapt ES due to the new conditions leading to vulnerabilities from climate uncertainties. A resilient system is dynamic but keeps its identity (Thompson et al., 2009). Resilience is a descriptor of a situation rather than a distinct entity (Marchese et al., 2018). Thus, can account for different situations and area sizes. Resilience provides a new way of framing and responding to uncertainties, offering an alternative paradigm for planning strategies (Lu & Stead, 2013). This research explicitly investigates resilience but keeps in mind the similarities with sustainability.

2.2. Energy systems

ES's encompass all energy activities and processes of using and acquiring energy to satisfy an area's inhabitants' energy needs (Keirstead, Jennings & Sivakumar, 2012). ES's are heating, transporting, electricity, and industrial activities. In addition, significant changes are made to ES's to reduce CO_2 emissions and mitigate climate change (Cronin, Anandarajah, & Dessens, 2018). Characterizing ES's as socio-technical systems is essential as they are increasingly changing due to global problems (Sovacool et al., 2020). Strong interrelations of the social-technical systems are social and cultural values, institutions, regulations, stakeholder relationships, and expectations (Rohracher, 2008).

2.3. City Resilience Framework

Cities draw people due to opportunities, economic activity, and innovation, but are also places where stresses and shocks occur as risk is present and becoming more unpredictable due to the increased complexity of systems and hazards like climate change (The Rockefeller Foundation, 2015). Enhancing adaptive capacity in systems can reduce vulnerability from climate change and shift the threshold for capacity of negative impacts to higher magnitudes (Smith et al., 2001). Resilience shifts policies from those that aim to control change in assumed stable systems to managing the capacity of systems to cope, adapt, and transition (Folke et al., 2002). Zuidema & de Boer (2017) state that resilience can be used as a viewpoint to analyse, describe, and as a framework for policy ambitions.

The Rockefeller Foundation (2015) has developed the 'City Resilience Framework' to investigate complex situations, what drivers contribute to resilience, and help understand resilience better and what matters most to increase resilience. CRF investigates and analyses how RES 1.0 increases resilience. As resilience is a descriptor, CRF can investigate RES 1.0. Investigating drivers helps identify the extent of resilience present and critical areas of weakness and strengths (The Rockefeller Foundation, 2015). Due to regional conditions, every RES is distinct and unique, meaning resilience may differ per region. Development strategies and policies enhance the resilience of a system (The Rockefeller Foundation, 2015).

CRF has been successfully used to investigate resilience in other cases, proving it is a practical framework (the Rockefeller Foundation, 2015). CRF uses four Aspects and seven Qualities to measure resilience. The Aspects: Governance, Society, Economy, and Environment, contain the ambitions for resilience, and the Qualities: Reflective, Resourceful, Robust, Inclusive, Redundant, Integrated, and Flexible, complement these ambitions. These Aspects and Qualities have indicators to assess resilience and are interconnected but assessed separately to broaden the scope, shown in figure 3 how they interrelate.

CRF identifies for Groningen, Friesland, and Drenthe, where RES 1.0 is weak and strong in resilience leading to recommendations. This research uses CRF, with adaptations by the author to fit the context of this research.

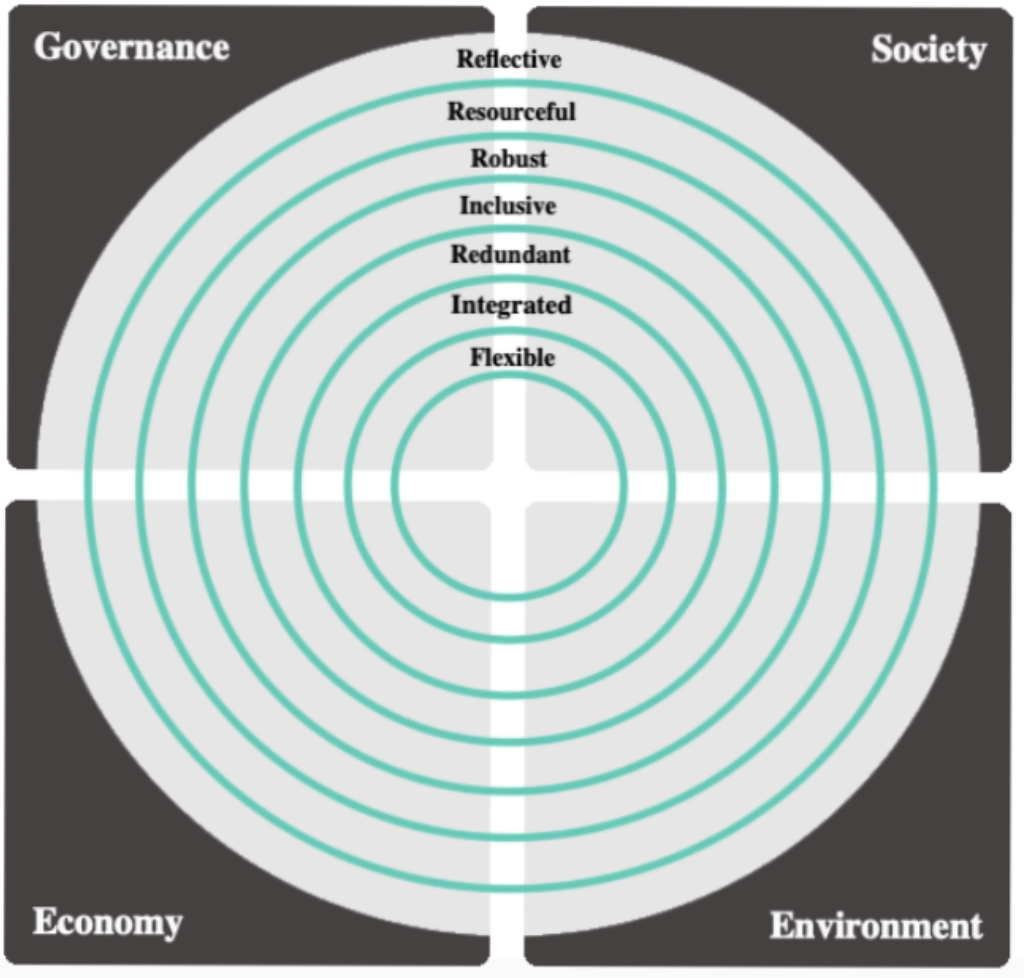


Figure 3: Aspects and Qualities relations from CRF (Author, 2022).

2.3.1. Aspects

Four Aspects and indicators (table 1) are taken from the Rockefeller Foundation (2015) and adapted by the Author to fit this research's scope better and used to assess resilience.

ASPECTS	INDICATORS
GOVERNANCE	Showing clear and effective leadership and management strategic and integrated approaches by leaders and have the right skills, and are open and transparent (oecd.org, 2021). The Rockefeller Foundation (2015) states that Governance includes empowered and multiple stakeholders and integrated development planning if stakeholders can reach their goals.
SOCIETY	Society and the health and well-being of cities are essential for resilience. The Society aspect deals with minimal human vulnerability and basic needs, diverse livelihoods and employment, and adequate human activities and life safeguards through health services (The Rockefeller Foundation, 2015). Considers the extent to which residents can cope with climate change and its effects. Society is inclusive and cohesive, citizens' networks are active, the area is safe, and citizens enjoy healthy lives (oecd.org, 2021). The quality of shared services in the RES region and the inclusion of residential homes in energy system transitions.
ECONOMY	The Economy entails a sustainable economy, comprehensive security and the rule of law, and collective identity and community support (The Rockefeller Foundation, 2015). Drivers for resilience in the Economy are diverse industries, generating growth through a dynamic economy, conditions that allow innovation, and access for people to employment, education, and services (oecd.org, 2021). In addition, transparent investments and costs are made for energy systems in the region and increase employment opportunities.
ENVIRONMENT	The Environment includes a sound and diverse ecosystem in which local infrastructure meets basic needs and requirements, available natural resources, and a coherent policy towards land use (oecd.org, 2021). The Rockefeller Foundation (2015) adds that the Environment also entails infrastructure: reliable mobility and communications, adequate provision of critical services, and reduced exposure and fragility of infrastructure. How the Environment is considered in energy policies before implementation, for example, the placement of windmills on wildlife and landscape.

Table 1: Aspects for resilience (Author, 2021).

2.3.2. Qualities

Seven Qualities and indicators (table 2) are taken from the Rockefeller Foundation (2015) and adapted by Author to fit the scope of this research better and used to assess resilience.

QUALITIES	INDICATORS
REFLECTIVE	Systems are learning from past experiences and other systems for future decisions in RES. Uncertainty and change lead to mechanisms that constantly evolve and modify standards due to emerging evidence and available information, not seeking permanent solutions for the system.
RESOURCEFUL	Achieving goals by quickly finding new ways and measures to reach goals during stress and shocks. The system can anticipate changes and invest in anticipating changes to systems and the offer of new ambitions.
ROBUST	Able to withstand the impacts of shocks and stressors and keep functioning due to well-constructed, designed, and managed assets. Anticipation of potential hazards in systems.
INCLUSIVE	Shared ownership of the system by stakeholders' involvement on multiple levels, including vulnerable groups, and there is no exclusion of stakeholders, and participation is encouraged.
REDUNDANT	Purposely created spare capacity within a system by having extra or the same resources available. So, systems can accommodate changes in disruptions, pressures, or demand. Redundant reactions are diverse and should also be intentional, cost-effective, and prioritized.
INTEGRATED	Alignment between and within systems other than the energy system promotes consistency in decision-making and investments in systems that mutually support the same outcome across different scales and shared information between energy systems and RES.
FLEXIBLE	Systems can change, evolve, and adapt as a response to uncertain conditions. Systems respond through decentralized approaches, and new technologies and innovation allow flexibility. As a result, traditional knowledge and practices incorporate into new processes.

Table 2: Qualities for resilience, adapted from The Rockefeller Foundation (2015).

2.4. Conceptual model and hypothesis

Direction of arrows in the conceptual model (figure 4) represents the connections and operationalization of CRF to investigate resilience in RES 1.0 and creates research transparency. The dependent variable is resilience, and RES is the independent variable. The conceptual model is contained within climate change as shocks and stressors affect variables.

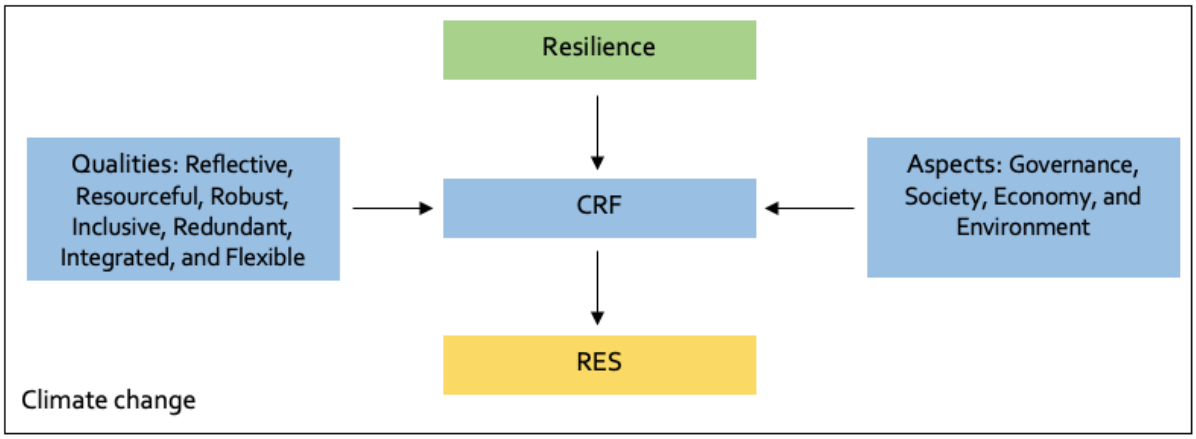


Figure 4: Conceptual model (Author, 2021).

It is expected that resilience was considered when RES 1.0 was developed or included goals in line with becoming resilient and are expected to deliver different RES 1.0 but still have the same overarching goal of transforming the ES. Resilience will differ per region, leading to recommendations.

3. Methodology

A qualitative comparative study was conducted and most suitable of the three RES regions, as it identified the characterizations and phenomena of each RES. However, identifying phenomena can only be done if recognized as different from other phenomena (Aarebrot & Bakka, 2003; Rihoux & Ragin, 2009). Statistical analysis would not be helpful due to a large amount of qualitative data.

3.1. Data collection

Data was collected from secondary sources: academic articles and policy report. Essential to realize that secondary data were produced for different purposes (Clifford et al., 2016). Only relevant data was used due to differences in research aims and questions in secondary sources. Primary data from semi-structured interviews were used for fact-checking, clarification, and insight into stakeholder relationships.

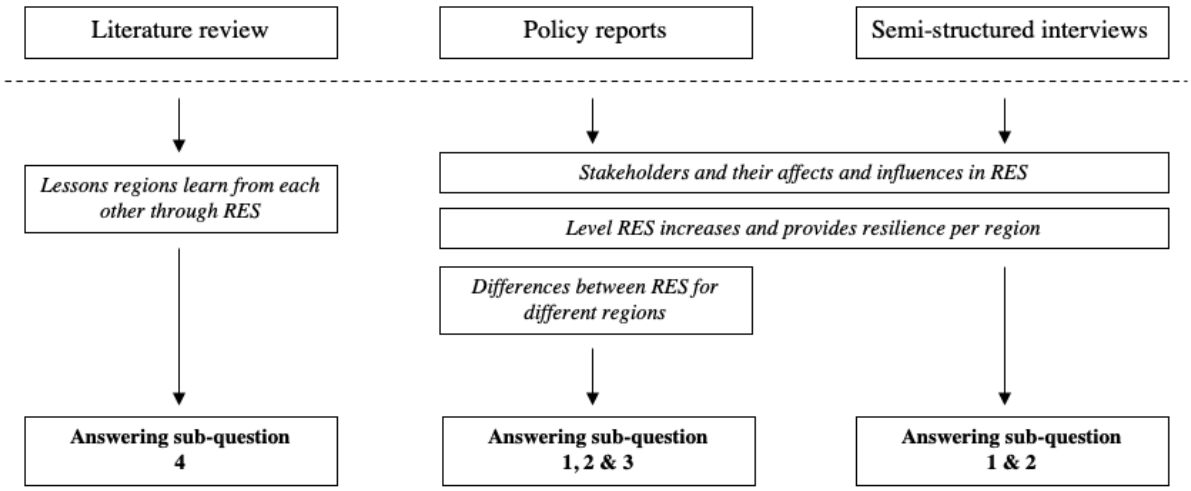


Figure 5: Overview of data collection methods (Author, 2022).

Different methods investigated are shown in figure 5. Mixed-method 'triangulation' was used to maximize understanding of the research problem (Clifford et al., 2016). Clarifying results by placing contrasting results into dialogue with one another allows for a more in-depth understanding (Mertens & Hesse-Biber, 2012).

3.1.1. Case study area selection

The Northern RES regions were used as case studies due to the Author's location being in Groningen, so more accessible resources, information, and preference to study these areas. Regions have similarities and overlap due to their proximity. Three regions enlarged the research scope, so there was enough data to determine gaps in resilience and more evidence of strengths and weaknesses in resilience. The regions have similar ambitions but different challenges due to each region's spatial setting, which is interesting to investigate. Finally, comparing three regions makes for more potent and specific recommendations.

3.1.2. Literature review and policy reports

Literature review of academic articles and government reports defined concepts and background information for this research. Academic articles with more than 20 citations were found with keywords (Appendix A) via 'Google Scholar', Elsevier 'Scopus', and 'Rijksoverheid' for reliability. Reading relevant academic articles and reports helps identify essential research and investigation (Clifford et al., 2016). Data collection from RES 1.0 reports published in 2021 is the most recent and relevant for this research and found on each region's provincial website detailing its ambitions, goals, and strategy.

3.1.3. Semi-structured interviews

Talking with people who have a role in making RES or have given input gave a broader and deeper understanding of specific policies, strategies, and methods chosen and checked facts. Semi-structured interviews are partially structured, informal, and have open answers (Clifford et al., 2016). Semi-structured interviews were conducted online due to Covid-19 measures.

PARTICIPANT	REPRESENTING	ROLE WITH RES 1.0	INTERVIEW IN MINUTES
PARTICIPANT D	RES 1.0 Drenthe, 2021	Works within Werkbureau, liaison and project leader for RES monitor	42:58
PARTICIPANT F	RES 1.0 Friesland, 2021	Policy officer within Province Friesland for climate and energy policy and part of Werkgroep for RES 1.0	39:20
PARTICIPANT NPRES	National Programme RES	Supports the development of RES in Groningen, Friesland, and Drenthe and acts as a link between Het Rijk and the Northern RES regions	40:16
PARTICIPANT T	TenneT	Senior advisor for public and political affairs and coordination of TenneT with RES	29:55

Table 3: Participants interviewed (Author, 2022).

Participants interviewed (table 3) were selected after reading all three RES 1.0. Unfortunately, after multiple attempts to reach a policymaker from Groningen, an interview was not possible. The interviews from NPRES and TenneT provided extra in-depth background information. Also, enough insight and specific information for Groningen. The interview questions (Appendix B) were made after data collection from RES 1.0 and transcribed non-verbatim.

3.2. Data analysis

Qualitative data collected from RES 1.0 was analysed via coding trees (Appendix C), then scored for resilience indicators, derived from Aspects and Qualities (Appendix D), and used for stakeholder analysis. Differences in resilience scores were analysed. Gap analysis is a tool to identify gaps presented in data and where differences exist and indicates weaknesses or strengths (Kim & Ji, 2018). Analysing phenomena is a way to analyse secondary academic data (Clifford et al., 2016). Figure 6 shows an overview of the steps and direction of the methodology.

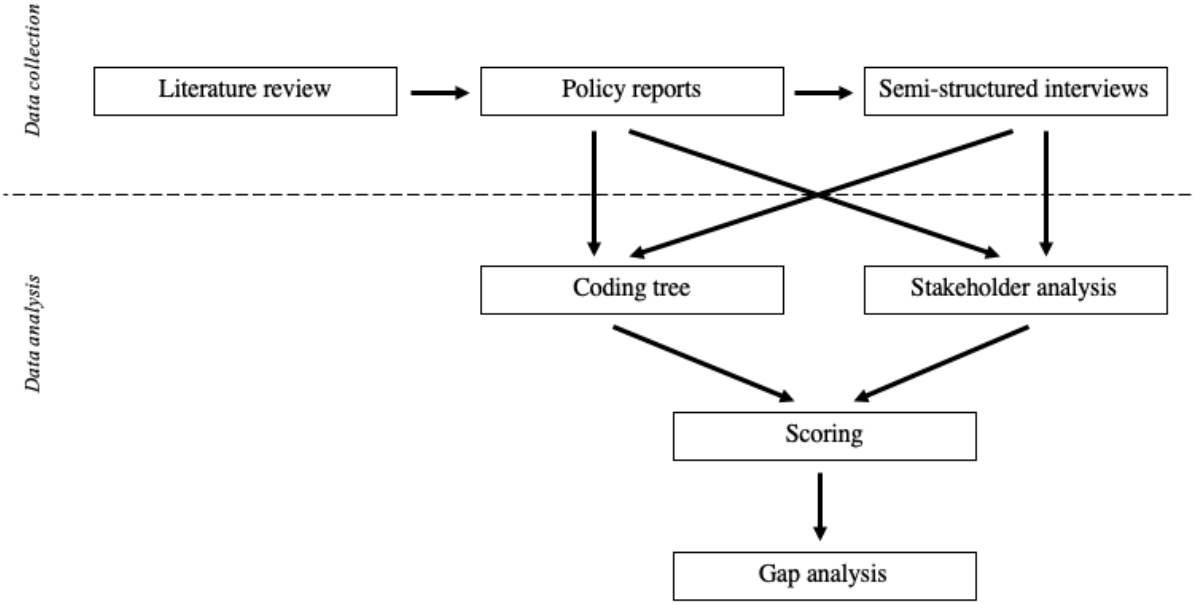


Figure 6: Overview of data collection and analysis (Author, 2022).

3.2.1 Stakeholder analysis

Stakeholder mapping is a tool to understand stakeholder support or opposition and power (Aligica, 2006). A stakeholder analysis was done by identifying and labelling stakeholders from RES 1.0 based on their characteristics (table 4), then mapped out in a decision matrix. A 'decision matrix' is a tool to organize information and analysis outside the matrix and was chosen to make the mapping of stakeholders clearer (Smith, 1996).

CHARACTERISTATION	DESCRIPTION
Influential or insignificant	The ability of stakeholders to *influence* and push changes in RES from their current position may be one of expected power, e.g., that of the provincial or municipalities in design making in RES. Alternatively, stakeholders may be *insignificant* in terms of influence in RES and not push changes.
Active or passive	The extent to which stakeholders are *active* or *passive* in decision-making in RES policies and their participation in the processes leading to RES. Suppose stakeholders provide input or are compliant with other stakeholders' ideas.

Table 4: Stakeholder characterisation adapted from Murry-Webster & Simon (2007).

Characterization led to labelling (table 5). Stakeholders were only labelled if there was enough evidence for characterization. Aligica (2006) states that mapping out stakeholders is vital for building legitimacy and policy ownership shows what power relations there are between decision-makers.

LABEL	CHARACTERISATION
Sleeping Giant	Influential & passive
Acquaintance	Insignificant & passive
Saviour	Influential & active
Friend	Insignificant & active

Table 5: Stakeholder labels after characterisation, adapted from Murry-Webster & Simon (2007).

3.2.2. Coding tree

The theoretical framework provides a lens for data collection and analysis (LeCompte & Schensul, 1999; Kawulich, 2004). Aspects and Qualities from the CRF are the topics for the two coding trees (Appendix C). The four Aspects and seven Qualities are the codes, which each have three subcodes based on indicators from tables 1 and 2. Codes are described and elaborated by sub-codes (Herce et al., 2014).

3.2.3. Scoring

Indicators from RES 1.0 were analysed via the coding tree and scored. Scoring indicators gave the quantitative data meaning for resilience. Scores are positive or negative. A negative score means an indicator for resilience but shows a setback or limitation that impacts resilience in an obstructive way and outweighs a positive indicator as setbacks weigh heavier and show where RES could improve. Scoring was between -3 to 3 (table 6) and shown in radar diagrams adapted from the spiderweb method by Bernstein (1986) show scores.

SCORE	INDICATORS
3	All 3 indicators for Aspect or Quality sub-codes were found in RES 1.0 for resilience positively, indicating a high level of resilience.
2	2 indicators for Aspect or Quality sub-codes were positively found in RES 1.0, indicating resilience
1	1 indicator for Aspect or Quality sub-codes were positively found in RES 1.0, indicating little resilience
0	No indicators for positive or negative resilience were found in RES 1.0 for Aspect of Quality
-1	1 indicator for Aspect or Quality sub-codes negatively found in RES 1.0, with minor limitations indicating setbacks for resilience
-2	2 indicators for Aspect or Quality sub-codes were found negatively in RES 1.0, with limitations indicating setbacks for resilience
-3	All 3 indicators for Aspect or Quality sub-codes were found negatively in RES 1.0, with solid limitations indicating setbacks for resilience

Table 6: Scoring definitions (Author, 2021).

3.2.4 Gap analysis

Gap analysis determines and investigates differences in the scores of resilience indicators in RES 1.0. Gaps between results show a policy's substantial resilience or lack thereof. Gap analysis forms the basis for the discussion and helps prioritize resource allocation and recommendations (Balm, 1996).

3.3 Ethical considerations

Positionality with this research is that of an outside observer. Referencing secondary data is obligatory. RES reports red twice to determine an average resilience score and minimize bias. The reading order of RES is random and highlighted in Appendix E. The objective of this research, its data collection, and analysis are transparent, and there are no hidden intentions and no right or wrong. Individual names are not mentioned to prevent interview answers from leading back to participants. The rights within the specific local contexts are considered and understood. For online interviews, participants were asked to sign a letter of consent (Appendix F) to know their rights and understand the use of their information in this research. Data was stored during the writing process and deleted after.

4. Results

All stakeholders support RES through their actions and contributions; there was no indication of counteraction. Due to changing relationships, residents for all three regions were difficult to label. Trends in strengths and weaknesses shown in graphs show gaps in resilience.

4.1 Shared stakeholder: Het Rijk

'Sleeping Giant' is Het Rijk's label for all three regions due to having influence and power; they control the time range to complete RES but take a step back and do not partake alongside stakeholders. Het Rijk only sets the conditions for RES stated in the National Climate Agreement. *'Het Rijk makes the final decisions and sets the national plans, the province is still dependent on help and funding' RES 1.0 Drenthe (p.56).*

4. 2 Groningen

4.2.1. Stakeholders Groningen

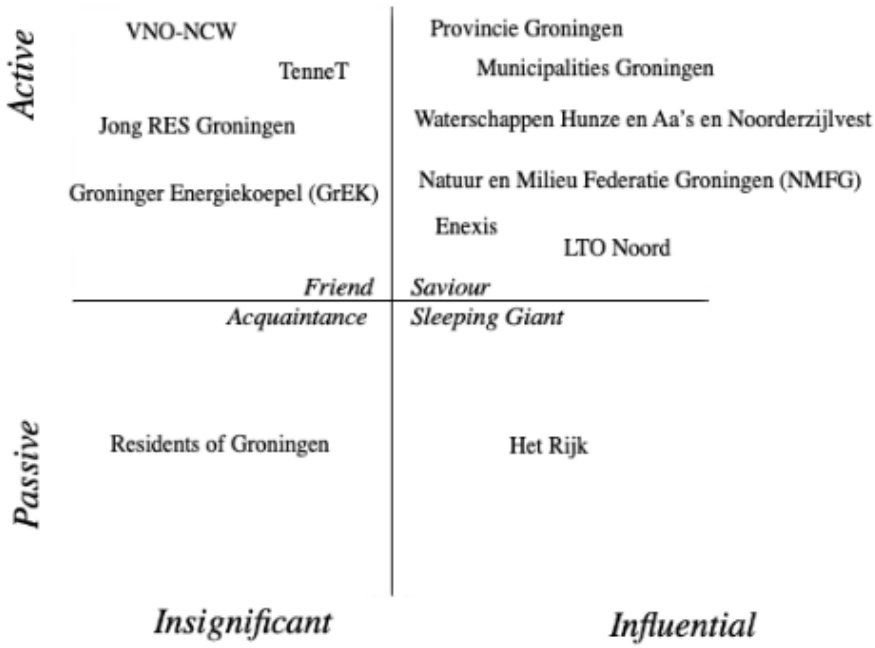


Table 7: Stakeholders Groningen (Author, 2022).

Groningen stakeholders and labels show in table 7. Stakeholders labelled 'Saviour' are influential, the leading decision-makers, and work the most on RES in Groningen: *'the province of Groningen, the Hunze en Aa's and Noorderzijlvest water boards and ten municipalities are working together.' RES 1.0 Groningen (p.4).* These stakeholders allow Enexis and LTO Noord to be in the RES decision-making process, thus their label. Stakeholders labelled 'Friend' are in action for RES Groningen, but there was no evidence that they led any decision-making in Groningen.

Residents had different opinions on involving themselves with RES. However, as RES Groningen describes, involvement is welcomed; this indicates that residents are currently passive in participation in RES and do not show real influence in decision-making in Groningen.

4.2.2. Results Groningen

Society scored highest with 2 (figure 7); Groningen clearly states it is vital to consider the local community in RES, support local initiatives, and closely monitor the effects and profits for society for future RES. *'local environment should always be involved in the development of sustainable energy projects and the local environment should always benefit from renewable energy projects' RES 1.0 Groningen (p.23).*

Governance is not at its optimum and seems disorganized due to the lack of transparency and clear leadership in Groningen from policymakers in RES; there still is shuffling within the governing committees, thus scored -1. *'The municipality is busy with each other, maintenance and seeking cooperation from the province but finding it difficult to deal with stakeholders. First worked together with a steering group and a broad steering group. That again separated into a social table and a board table. There was also a variant that only a limited number of stakeholders were present.' Participant T.*

Economy and Environment scored 1. Groningen shows ambitions to create new jobs through the renewable energy sector and innovation but currently lacks this capacity and does not show a clear investment plan. Groningen needs significant adaptation to its energy infrastructure. Shows ambitions for improving nature and biodiversity through RES. Appendix G gives a further overview of the results.

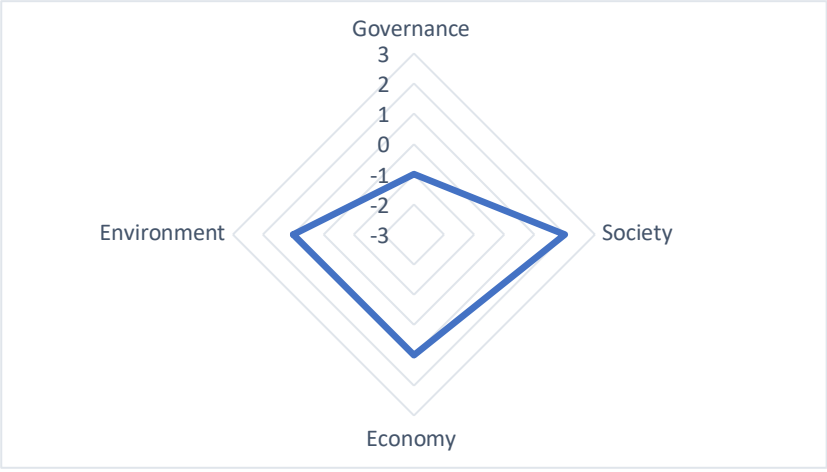


Figure 7: Aspects Groningen (Author, 2022).

Reflective, Inclusive, and Integrated scored the highest with 2 (figure 8). Groningen shows to learn from experiences with renewable energy and monitors the progression of RES. Is keen on participation from stakeholders and shows strong integration from aligned goals, crucial for RES. *'RES partners will continue to work together…to develop further the joint regional vision and policy on the regional energy transition…movement moving from local agreements to regional agreements.' RES 1.0 Groningen (p.5).*

Robust and Redundant scored the lowest with -1 due to grid capacity problems at play. ES cannot cope and keep functioning to full potential with the changes from RES due to lacking grid connections and storage capacity. Innovative reactions and human resources are currently lacking. '*There is a desire to realize more sun-on-roof…there is a roof area for the generation of potentially more than 1TWh. Due to various causes (unsuitable roof construction, problems with insurance, lack of grid connection, or high construction costs), potential cannot be fully utilized'. RES 1.0 Groningen (p. 11).* Appendix H gives a further overview of the results.

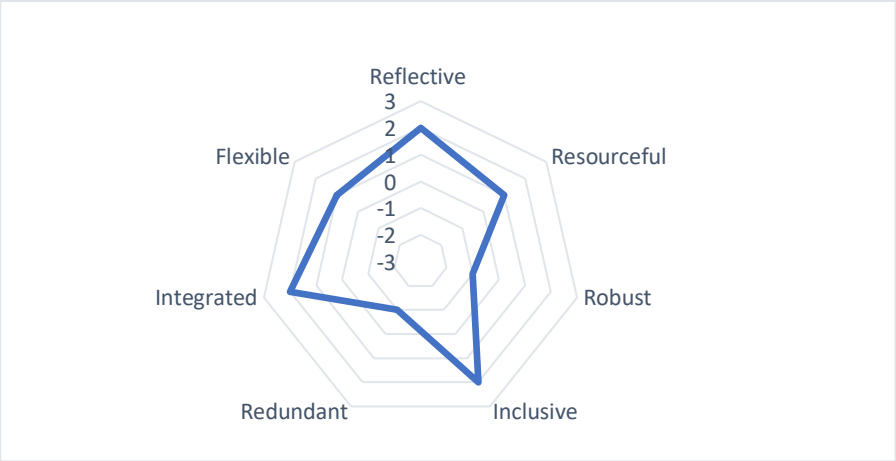


Figure 8: Qualities Groningen (Author, 2022).

4.3 Friesland

4.3.1 Stakeholders Friesland

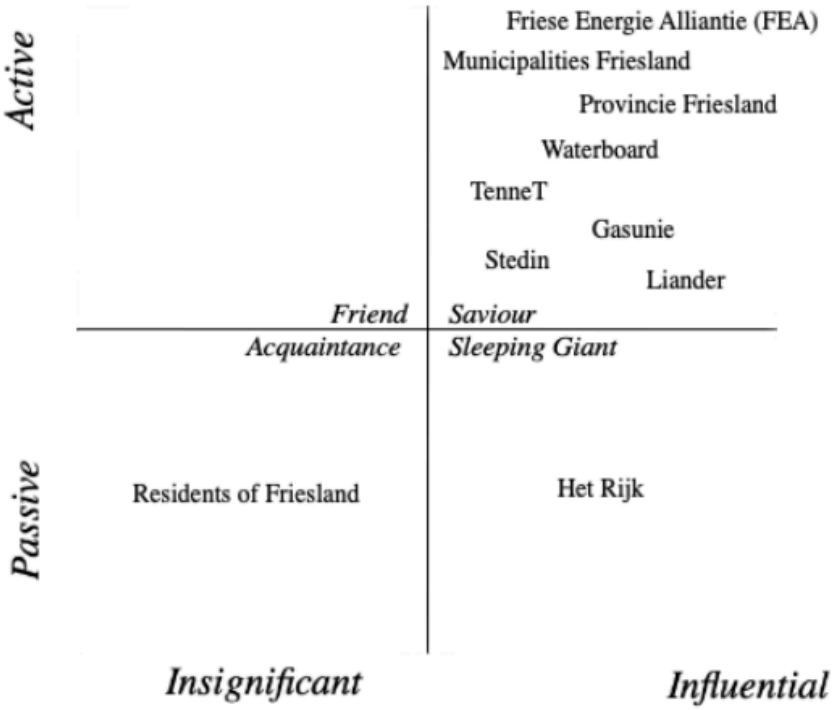


Table 8: Stakeholders Friesland (Author, 2022).

Stakeholders in Friesland are shown in table 8. Stakeholders labelled 'Saviour': *'All Frisian governments and social organizations work together on the energy transition.' RES 1.0 Friesland (p.22).* Indicates they have influence and are working actively on RES. FEA organizes RES in Friesland: *'FEA comprises 11 collaborative civil society organizations and its collaborative partners in RES, who participated in working groups and steering groups.' Participant F.*

There is no participation of residents due to Friesland using existing projects for their bid of 2.3TWh. However, there has previously been a citizen participation process for these projects, just not for RES. *'They say you have not properly involved your residents, but that is the result of choice not to designate new locations for RES…is mainly an administrative decision where residents are not specifically involved.' Participant F.* Residents labelled 'Acquaintance', no evidence of active participation, and were not invited to participate in RES decision-making.

4.3.2. Results Friesland

Governance scored highest with 2 and Environment scores 1 (figure 9). Friesland developed the tool 'Fryske Waaier' and FEA, showing effective leadership to increase transparency about RES. Friesland experiences grid capacity problems but strives to consider a policy that benefits the environment. *'…urban fringes of the larger cities in Fryslân, where healthy and green areas, with an emphasis on biodiversity and sustainable energy, can be transformed into a diverse run-off area…spatial cohesion is safeguarded.' RES 1.0 Friesland (p.21).*

No indicators of resilience from Economy, so 0. Society scored -2, due to lack of inclusiveness for citizens by their choice to only use existing projects, which does not regard citizens vulnerability to climate change. Appendix I gives a further overview of the results.

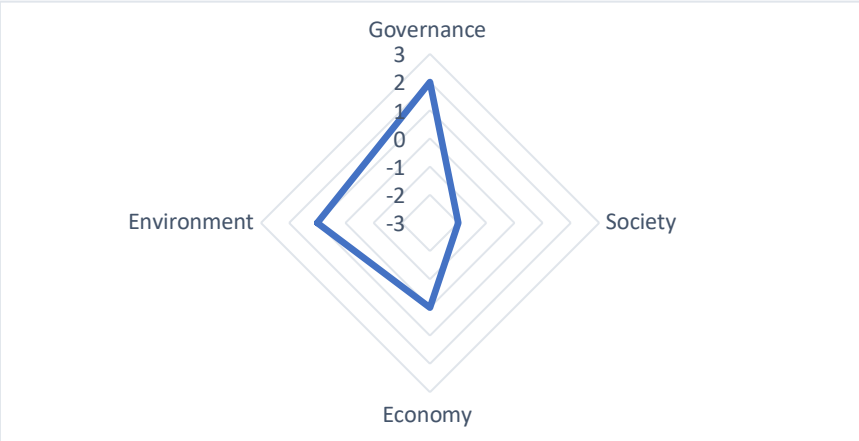


Figure 9: Aspects Friesland (Author, 2022).

Integrated, Reflective, and Resourceful scored 2 (figure 10). Governmental RES stakeholders show strong alignment, ambitions, and investments to increase integration; however, residents' lack of active involvement due to only existing projects being used halts this integration progress between stakeholders. *'Residents are not actively involved in drawing up RES, but if we are going to designate*

new locations, you have to involve people, that is absolute, you cannot impose that from above' Participant F.

Inclusive and Redundant scored lowest with -1 as there is no spare grid capacity: the system cannot currently accommodate changes. Involvement and integration of governmental stakeholders, but citizens are not invited to participate in RES, so only inclusive for governmental stakeholders. Friesland does realize an executable bid for RES but shows no diversity in the method. Appendix J gives a further overview of the results.

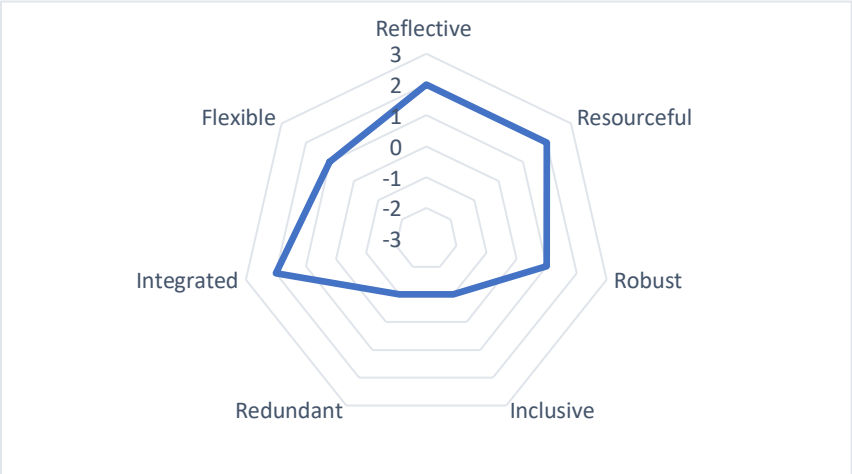


Figure 10: Qualities Friesland (Author, 2022).

4.3. Drenthe

4.3.1. Stakeholders Drenthe

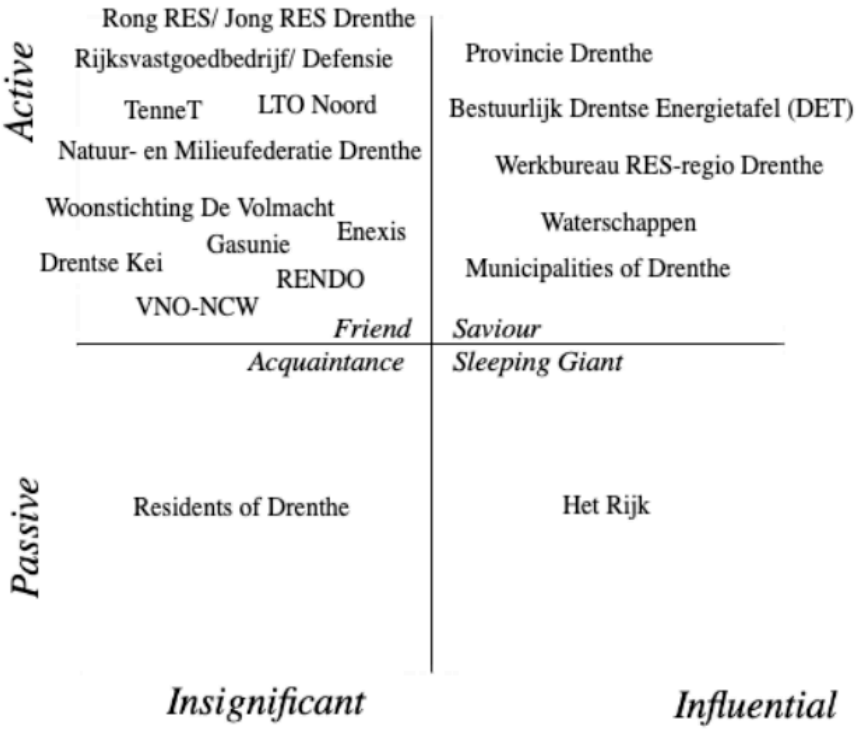


Table 9: Stakeholders Drenthe (Author, 2022).

Stakeholders for Drenthe are shown in table 10. DET is a specific committee for RES Drenthe made up of numerous active and influential stakeholders who give advice, make significant decisions, and are jointly responsible for RES. *'DET is the connection to Het Rijk, and is specially set up within RES and is something specific within Drenthe'. Participant D. Stakeholders labelled 'Friend': 'The other partners have an advisory role.' RES 1.0 Drenthe (p.13).* They did not show power in the final decisions but are active in RES.

Drenthe expressed that residents can be influential in RES but do not respond or show interest when asked for their opinions and advice; participation is an issue, so 'Acquaintance'. *'RES is trying to reach people and hear people say, 'involve us' but where are they?' 'Residents have much influence, but they do not use it enough.' Participant D.*

4.3.2. Results Drenthe

Governance scored the highest with 3, followed by Society with 2 (figure 11). Drenthe shows effective management in RES by transparent decision-making and expressing their desire to include citizens and founding the DET. *'We divide the Drenthe approach into several methods: involvement; to tell; to steer; collaborate; support and innovate.' RES 1.0 Drenthe (p. 20).* Drenthe pays attention to stakeholder participation and how to get other stakeholders enthusiastic about RES. It also discusses that the energy transition of heat sources will affect residential homes but provides no real solution.

Economy and Environment both scored -1; plans for a sustainable economy are not a focus, but support exists for small businesses transitioning to sun-on-roof or small turbines. *'About energy generation and employment, we are looking for a connection, and are also working on innovation in sustainable energy generation…but is not actively picked up within RES' Participant D.* Experiences lack of grid capacity as a limiting factor, and environmental impacts are not currently considered but will be in 2.0. Barriers to spatial planning of the environment should be considered in RES now. Appendix K gives a further overview of the results.

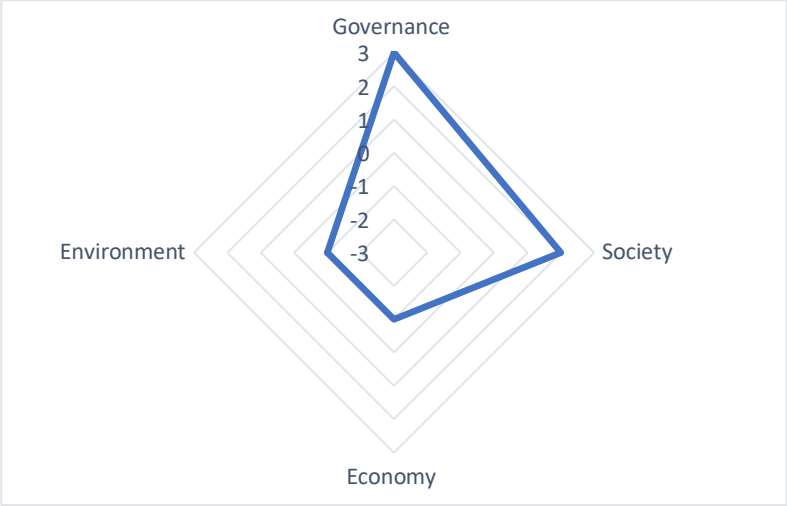


Figure 11: Aspects Drenthe (Author, 2022).

Integrated scored the highest with 3 (figure 12). Drenthe shows solid and dynamic alignment between stakeholders and is enthusiastic about sharing and communicating findings. *'…Working together as a region…we learn from each other, and we look for common principles.' RES 1.0 Drenthe (p.13).*

Reflective, Resourceful, Inclusive, and Flexible scored 2. Drenthe shows to plan for future RES and includes citizens constantly. *'In consultation with our society; we must ensure that our society is also sufficiently informed and joins us and wants to join in.' Participant D.* Drenthe can conduct pilot projects for new techniques that reflect for Resourceful and Flexible.

Redundant and Robust scored -1. The network lagging behind capacity is a limiting factor for RES to continue at full potential, but the grid can only be expanded from concrete plans from RES and hits harder in Drenthe due to the low building density, making it challenging to connect projects. *'…the heat transition is subject to many uncertainties, e.g., the availability of sources, the development of new technologies, and affordability…still many technical, economic, and social questions to be solved; the coming years will be dominated by 'learning in practice'.' RES 1.0 Drenthe (p.48).* So evaluates the anticipation of hazards and the limited availability. Appendix L gives a further overview of the results.

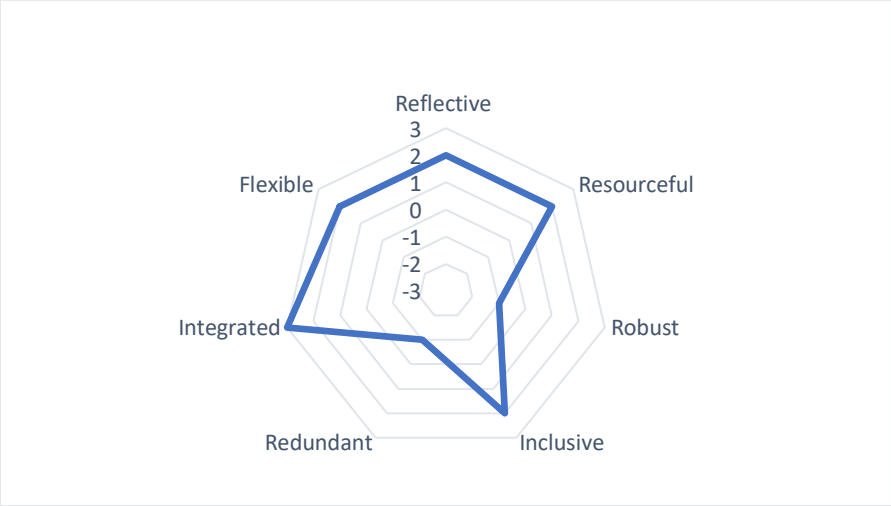


Figure 12: Qualities Drenthe (Author, 2022).

4.4. Comparison of the three provinces

Groningen and Drenthe scored a total of 3 in resilience for Aspects (figure 13). Drenthe has higher resilience due to higher score of positive resilience indicators. However, Groningen has 3 Aspects with positive resilience indicators, whereas Drenthe has 2 but scored overall higher in these 2 Aspects. Total scores for all three regions are positive: RES 1.0 increases resilience through the Aspects.

Friesland and Drenthe had 2 or more positive indicators for Governance due to FEA and DET, respectively, consisting of a collection of stakeholders from government and societal organizations showing strategic, creative, and effective leadership in producing RES 1.0., which Groningen does not have.

Only Friesland scored negative for Society, due to lack of citizen participation, by currently using existing and implemented projects; Friesland still needs citizen participation due to use change.

Groningen and Drenthe considered how residential homes are impacted and are inclusive for citizens in the RES process.

Only Groningen considered a plan to involve industry for a sustainable economy and how the energy transition could create jobs. Friesland and Drenthe indicated that the economy would become a focus for future RES. Drenthe was the only region to show a transparent estimation of financial investments needed for RES but did not discuss plans for how the economy would be positively affected.

Noticeable is that the grid capacity and storage problem hit all three regions and no plans exist to solve this. Drenthe scores negatively due to not including plans for biodiversity and the local environment but indicate they will participate in RES 2.0. Groningen and Friesland do include these plans leading to a positive resilience indicator.

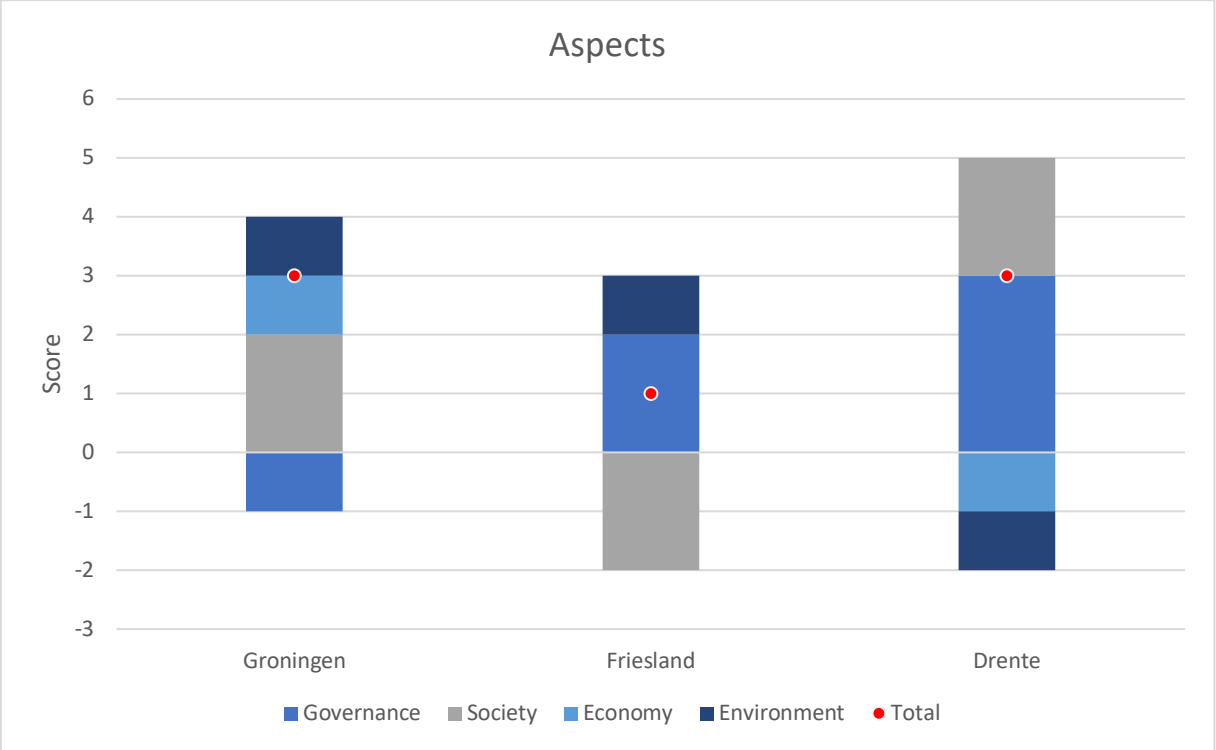


Figure 13: Overall resilience for Aspects (Author, 2022).

Drenthe scored highest for positive indicators for resilience and in total score in Qualities (figure 14). Drenthe scored 3 for Integrated, they show dedication to involving all stakeholders to give input and strong alignment between governmental stakeholders in common ambitions for RES, while Groningen does not seem to have complete alignment and Friesland forgone a citizen participation process in RES 1.0.

All scored positive indicators for Reflective, Resourceful, Integrated, and Flexible; they show learning from past experiences and other regions. RES is not permanent and open to new mechanisms and techniques in future RES. All regions show the capacity to anticipate hazards (the effects of grid capacity problem) and are investing to increase this capacity to prevent further problems. Regions

scored positive in Flexible due to adapting and evolving in uncertain conditions through new technologies.

All showed negative indicators for resilience in Redundant, which could be improved the most as all three regions could not currently accommodate changes in disruptions, pressures, or demand due to the grid capacity and storage problem. The regions do not show diverse reactions due to focusing on electricity generation and no other possible innovative methods. Robust had negative indicators for Groningen and Drenthe due to a lack of human resources for adapting the grid, limiting capacity to implement sun-on-roof and wind projects. Friesland did not mention they were affected by a lack of human resources; no negative indication was found.

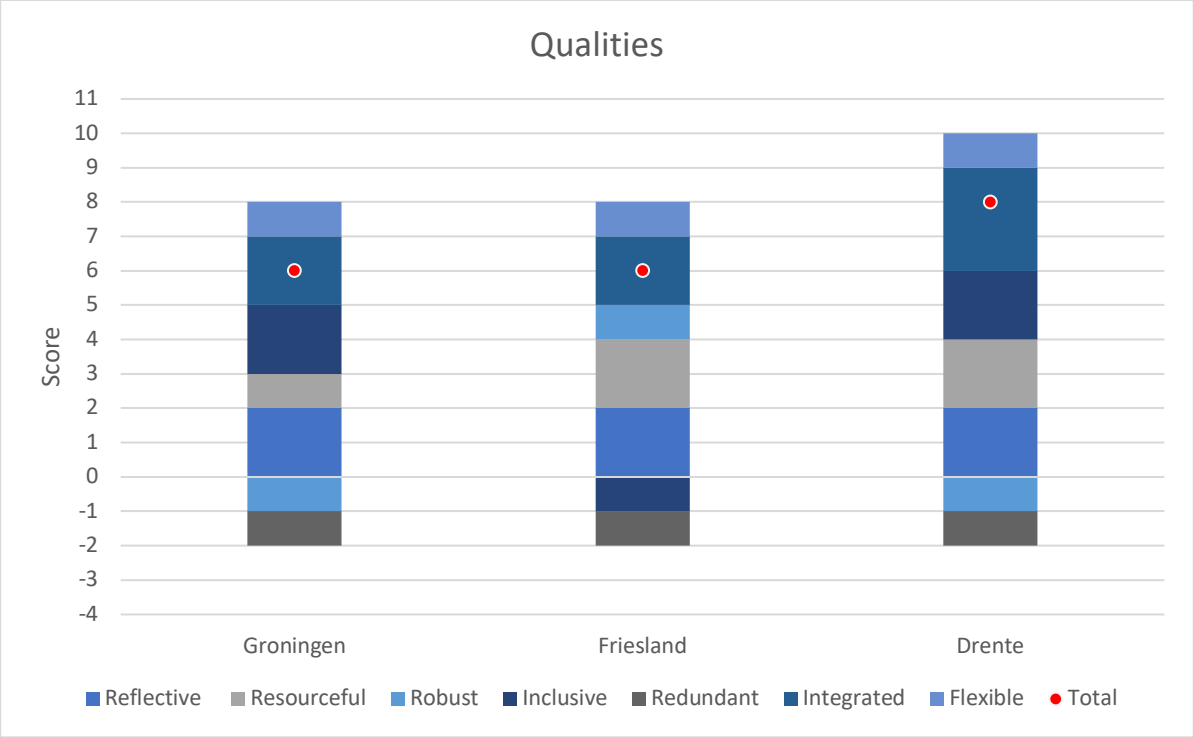


Figure 14: Overall resilience per region for Qualities (Author, 2022).

5. Discussion

All three regions showed a total score of more positive than negative indicators; this is a good outcome as RES 1.0 does help to increase resilience in the changing circumstances and context.

All three regions are affected by the grid capacity and storage problem, affecting the implementation of solar and wind farms, limiting RES 1.0. They are resulting in a mismatch between the supply of electricity and demand, leading to more capacity and storage being required (Weck, van Hoof & van Sark, 2016). A renewable energy future with solar and wind is unavoidable, so this major problem needs to be solved (Abbott, 2010). Sun-on-roof and wind come with spatial problems; all three regions expressed difficulties finding suitable locations due to grid problems. RES regions working together and sharing information are the first steps to finding a solution.

Friesland and Drenthe show creative governance in organizing and leading RES by collaborating with various stakeholders in FEA and DET to reach a consensus. The energy transition and resilience are social issues, so an extensive range of actors should be involved in governance (Loorbach, van der Brugge & Taanman, 2008). There is a governance shift as the formal structure was unsuitable for the energy transition discussion, stimulating new collaborations. RES is currently moving from the pre-development phase where governance is stable but increasing bottom-up innovation, to the take-off phase, where the state of the system and governance begins to shift under the process of change (Rotmans et al., 2001; Loorbach, van der Brugge & Taanman, 2008). Groningen showed that their organization of responsibility and decision-making in RES 1.0 was not transparent; Groningen could be inspired by FEA and DET and set up a similar collaboration.

Friesland did not do a citizen participation process for RES 1.0 by using existing projects. Instead, it may affect future RES that citizens become opposed to RES due to the non-communicative approach. For example, undergoing a citizen participation process may make citizens more sympathetic evaluators of hard decisions like the location of new projects in RES and improve the support, thus creating less divisive and combative residents to govern (Irvin & Stansbury, 2004).

Drenthe scored overall the highest in Aspects and Qualities and showed strong integration of stakeholders and a passion for including citizens in RES. However, Drenthe realizes the cost to transition residential homes is high but needs to brainstorm how this will be funded and by who. Drenthe does not include environmental quality ambitions, e.g., biodiversity through RES; more integration is required between RES and the environment through clear spatial plans.

5.1 Recommendations

Recommendations (table 10) are based on over-arching weaknesses and drawbacks that, if continued, may decrease resilience, the lagging grid capacity and storage, and difficulties with starting or conducting citizen participation to increase awareness and input.

1	*Look for possible new adaptive measures; there are problems with electricity that will only continue to increase.* The demand and pressure for electricity from renewable sources increases to remain at the same consumption level. Viewing the energy transition from another perspective: do not focus only on solar and wind but also on new and innovative ways to create and reduce energy use. Solar does not appear to scale up for a global solution (Abbott, 2010). Other options can be investigated through RES. Investigate if biofuels could be used as a renewable source in the regions to diversify the energy portfolio (Langeveld, Sanders & Meeusen-Van Onna, 2010). Waste and residues are feedstock for Biofuels and combined with carbon capture and storage of CO_2 emissions, could lead to negative emissions but requires storage-area to be feasible (Khandelwal & van Dril, 2020).
2	*Increase citizen participation and active involvement.* Lack of citizen participation and interest was a recurring topic. Transformative adaptation methods need to be considered more often in policy plans (Fedele et al., 2019) and can be behaviour responses (Kates, Travis & Wilbanks, 2012). An exciting approach to increase participation, awareness, and response is the BLA (Burn, 1991) (Appendix M). BLA creates long-term behaviour changes and effectively builds communication and trust between governmental bodies and citizens.
3	*Work with the network operators to better communicate the grid capacity and storage problem.* The network capacity and storage problem lead to congestion in the Netherlands. Move away from investing first but inform and communicate to raise awareness and support to reduce the problem. Create opportunities for more stakeholders to understand and work on creative and innovative solutions on multiple levels.

Table 10: Recommendations for regions (Author, 2022).

6. Conclusion

The main research question: *How do RES regions Friesland, Groningen, and Drenthe increase resilience through their own RES 1.0 policy reports?* All three regions show resilience is increased through RES 1.0 by showing new and robust collaborations of stakeholders working together. Regions show constant planning, an eye towards future RES, consider the spatial impacts of implementing solar and wind farms, and minimize possible adverse effects. Regions show resilience because they can realise their bid for the ambition of 35TWh for ES transition: the ES is able to cope with shocks and stressors from climate change. RES 1.0 provides an alternative way for planning in the uncertainty of the energy transition. There are differences in resilience between regions in strength, but it is essential to say that RES is not a competition but a tool to help the energy transition in the Netherlands.

What are the stakeholders in the energy transition and their effects and influences of energy policies in the RES regions? Governmental stakeholders have the most power in RES, but stakeholders per region differ and influence. There is a wide variety of stakeholders, not just provincial or municipal, but grid operators and waterboards. Participation of citizens is lacking in Friesland. In Groningen and Drenthe, citizens do not involve themselves.

How and to what level do RES 1.0 reports increase and provide resilience for the regions? Regions show RES increases resilience: total score in Aspects and Qualities is all positive. RES 1.0 contains various characteristics leading to space and system efficiency, making RES a dynamic process. RES 1.0 preserves the output and function of ES's while transitioning: electricity is produced, and there are no shortages.

What are the differences in resilience between regions from RES policies? Drenthe shows they have the most resilience, followed by Groningen and Friesland, due to Drenthe showing a strong organisation of stakeholders and decision-making in RES 1.0. Groningen and Friesland indicate lower resilience due to a lack of organized collaboration of stakeholders and citizen participation, respectively.

What lessons can the RES regions learn from each other? Regions can learn how the stakeholder's process is going and apply this to make RES assessable to everyone and how each region is coping with the grid capacity problem to minimize possible shortages or increases in energy prices. The regions need to keep up to date with what each region is doing, exchange information, and pool ideas to work together but specifying RES to each region's conditions. Regions could provide feedback to each other's RES. To conclude, the energy transition affects everyone, and the transition to a sustainable ES requires the cooperation and collaboration of stakeholders, techniques, and systems.

6.1 Reflection and future research

The research framework can investigate resilience in other RES regions for further empirical studies of resilience and governance arrangements for climate adaptation and how RES could include solutions for the grid capacity problem. This research investigated if RES 1.0 had positive or negative resilience indicators, further research could also look at the number of times an indicator found in RES, not only if an indicator is present or not.

It was difficult to be critical, as information changes as RES are updated and adapted by policymakers. The length of documents impacted analysis, sometimes going too much into detail or not enough. Investigating three regions may have been too much for the time available this research and affected the ability to be entirely critical.

References

Abbott, D. (2010). Keeping the Energy Debate Clean: How Do We Supply the World's Energy Needs? *Proceedings of the IEEE*, *98*(1), 42–66. https://doi.org/10.1109/jproc.2009.2035162

Aligica, P.D. (2006). Institutional and Stakeholder Mapping: Frameworks for Policy Analysis and Institutional Change. *Public Organization Review*, 6(1), pp.79–90.

Balm, G. (1996). Benchmarking and gap analysis: what is the next milestone?. *Benchmarking for Quality Management & Technology*, 3(4), pp.28-33.

Bernstein, D. (1986), Company Image & Reality. A Critique of Corporate Communications, Holt, Rinehart and Winston, Eastbourne, UK.

Blank World Map. (2021). *Blank Map of the Netherlands*. Available at: https://blankworldmap.net/blank-netherlands-map/ [Accessed 18 Nov. 2021].

Bridge, G., Özkaynak, B. and Turhan, E. (2018). Energy infrastructure and the fate of the nation: Introduction to special issue. *Energy Research & Social Science*, 41, pp.1–11.

Butler, C. (2018). Climate Change, Health and Existential Risks to Civilization: A Comprehensive Review (1989–2013). *International Journal of Environmental Research and Public Health*, 15(10), p.2266.

Burn, S. (1991). Social Psychology and the Stimulation of Recycling Behaviors: The Block Leader Approach. *Journal of Applied Social Psychology*, 21(8), pp.611-629.

CBS.nl. (2020.) *Electricity production at record high*. [online] Available at: <https://www.cbs.nl/en-gb/news/2020/12/electricity-production-at-record-high> [Accessed 5 January 2022].

Clifford, N., Cope, M., Gillespie, T., & French, S. (2016). *Key methods in geography*. Thousand Oaks, Ca: Sage Publications.

Cronin, J., Anandarajah, G. and Dessens, O. (2018). Climate change impacts on the energy system: a review of trends and gaps. *Climatic Change*, [online] 151(2), pp.79–93. Available at: https://link.springer.com/content/pdf/10.1007%2Fs10584-018-2265-4.pdf.

Davoudi, S. (2012). Climate risk and security: New meanings of 'the environment' in the English planning system, European Planning Studies, 20(1), pp. 49–69.

Davoudi, S., Shaw, K., Haider, L., Quinlan, A., Peterson, G., Wilkinson, C., Fünfgeld, H., McEvoy, D., Porter, L. and Davoudi, S. (2012). Resilience: A Bridging Concept or a Dead End? "Reframing" Resilience: Challenges for Planning Theory and Practice Interacting Traps: Resilience Assessment of a Pasture Management System in Northern Afghanistan Urban Resilience: What Does it Mean in Planning Practice? Resilience as a Useful Concept for Climate Change Adaptation? The Politics of Resilience for Planning: A Cautionary Note. *Planning Theory & Practice*, 13(2), pp.299-333.

Energie voor Drenthe. (2022). *Samen voor schone energie voor Drenthe*. [online] Available at: https://www.energievoordrenthe.nl/default.aspx [Accessed 17 Jan. 2022].

Fedele, G., Donatti, C., Harvey, C., Hannah, L. & Hole, D. (2019). Transformative adaptation to climate change for sustainable social-ecological systems. *Environmental Science & Policy*, 101, pp.116-125.

Government.nl. (2018). *Climate policy*. [online] Available at: https://www.government.nl/topics/climate-change/climate-policy.

The Hague. (2019). Climate Agreement [online] Available at: https://www.klimaatakkoord.nl/binaries/klimaatakkoord/documenten/publicaties/2019/06/28/national-climate-agreement-the-netherlands/20190628+National+Climate+Agreement+The+Netherlands.pdf.

Herce, M.E., Elmore, S.N., Kalanga, N., Keck, J.W., Wroe, E.B., Phiri, A., Mayfield, A., Chingoli, F., Beste, J.A., Tengatenga, L., Bazile, J., Krakauer, E.L. and Rigodon, J. (2014). Assessing and Responding to Palliative Care Needs in Rural Sub-Saharan Africa: Results from a Model Intervention and Situation Analysis in Malawi. *PLoS ONE*, 9(10), p.e110457.

Hermann, H., Stewart, D., Diaz-Granados, N., Berger, E., Jackson, B. and Yuen, T. (2011). What is Resilience?. *The Canadian Journal of Psychiatry*, 56(5), pp.258-265.

Hoppe, T. & Miedema, M. (2020). A Governance Approach to Regional Energy Transition: Meaning, Conceptualization and Practice. *Sustainability*, 12(3), p.915.

IEA. (2020). *The Netherlands 2020*, International Energy Agency, Paris. https://www.iea.org/reports/the-netherlands-2020.

Irvin, R. A., & Stansbury, J. (2004). Citizen Participation in Decision Making: Is It Worth the Effort? *Public Administration Review*, *64*(1), 55–65. http://www.jstor.org/stable/3542626

Kates, R. W., Travis, W. R., & Wilbanks, T. J. (2012). Transformational adaptation when incremental adaptations to climate change are insufficient. *Proceedings of the National Academy of Sciences*, *109*(19), 7156–7161. https://doi.org/10.1073/pnas.1115521109

Kawulich, B. B. (2004). Data Analysis Techniques in Qualitative Research. In Darla Twale (Ed.), Journal of Research in Education, 14(1) p. 96-113.

Keirstead, J., Jennings, M. and Sivakumar, A. (2012). A review of urban energy system models: Approaches, challenges and opportunities. *Renewable and Sustainable Energy Reviews*, 16(6), pp.3847–3866.

Khandelwal, M., & van Dril, T. (2020). *DECARBONISATION OPTIONS FOR THE DUTCH BIOFUELS INDUSTRY*. PBL. https://www.pbl.nl/sites/default/files/downloads/pbl-2020-decarbonisation-options-for-the-dutch-biofuels-industry_3887.pdf

Kim, S. and Ji, Y. (2018). Gap Analysis. *The International Encyclopedia of Strategic Communication*, pp.1–6.

Klimaat en Ministerie van Volkshuisvesting. (2017). *Rijksoverheid stimuleert duurzame energie - Duurzame energie - Rijksoverheid.nl*. [online] www.rijksoverheid.nl. Available at: https://www.rijksoverheid.nl/onderwerpen/duurzame-energie/meer-duurzame-energie-in-de-toekomst.

Langeveld, J. W. A., Sanders, J. P. M., & Meeusen-Van Onna, M. J. G. (2010). *The biobased economy: biofuels, materials and chemicals in the post-oil era*. Earthscan. https://books.google.nl/books?hl=en&lr=&id=jQPFDwAAQBAJ&oi=fnd&pg=PR1&dq=agriculture+in+the+netherlands+biofuels&ots=50AXOvByyu&sig=gKRGBreht-x9eG4_5OdaS2tWhxk&redir_esc=y#v=onepage&q=agriculture%20in%20the%20netherlands%20biofuels&f=false

Leichenko, R. (2011). Climate change and urban resilience. *Current Opinion in Environmental Sustainability*, [online] 3(3), pp.164–168. Available at: https://www.sciencedirect.com/science/article/pii/S1877343510001533.

Li, R. & Mahalec, V. (2021). Greenhouse gas emissions reduction by cross-sector integration of energy systems: Optimal sizing of integrated entities. *Energy Conversion and Management*, 248, p.114788.

Loorbach, D., Brugge, R.V.D. and Taanman, M. (2008). Governance in the energy transition: Practice of transition management in the Netherlands. *International Journal of Environmental Technology and Management*, 9(2/3), p.294.

Lu, P. and Stead, D. (2013). Understanding the notion of resilience in spatial planning: A case study of Rotterdam, The Netherlands. *Cities*, 35, pp.200-212.

Marchese, D., Reynolds, E., Bates, M.E., Morgan, H., Clark, S.S. and Linkov, I. (2018). Resilience and sustainability: Similarities and differences in environmental management applications. *Science of The Total Environment*, 613-614, pp.1275–1283.

Mertens, D. M. & Hesse-Biber, S. (2012). Triangulation and Mixed Methods Research. *Journal of Mixed Methods Research*, 6(2), pp.75-79.

Ministry of Economic Affairs and Climate Policy. (2019a). Integrated National Energy and Climate Plan, The Netherlands. [online] Available at: https://ec.europa.eu/energy/sites/default/files/documents/nl_final_necp_main_en.pdf. [Accessed 12 Oct. 2021].

Ministry of Economic Affairs and Climate Policy. (2019b). Long term strategy on climate mitigation, The Netherlands. [online] Available at: https://ec.europa.eu/clima/sites/lts/lts_nl_en.pdf. [Accessed 1 Nov. 2021].

Ministry of Infrastructure and Water Management. (2021). *Roles and responsibilities of provincial government, municipal governments and water authorities - Environment - Government.nl*. [online] www.government.nl. Available at: https://www.government.nl/topics/environment/roles-and-responsibilities-of-provincial-government-municipal-governments-and-water-authorities.

Murry-Webster, R. and Simon, P. (2007). Making sense of stakeholder mapping. *Project management practice*, (2): 12-13 *https://skat.ihmc.us/rid=1JGD4CJZ4-F9CF0Y-1KM6/SEMINAL%20stakeholder%20mapping%20in%203d.pdf.*

Oecd.org. (2021). *Resilient Cities - OECD*. [online] Available at: https://www.oecd.org/cfe/resilient-cities.htm.

Owen, A.D. (2009). *Energy Policy*. [online] Oxford: Eolss Publishers Co Ltd. Available at: https://www.eolss.net/sample-chapters/C08/E3-21.pdf [Accessed 6 Oct. 2021].

Park, J., Seager, T.P., Rao, P.S.C., Convertino, M. and Linkov, I. (2012). Integrating Risk and Resilience Approaches to Catastrophe Management in Engineering Systems. *Risk Analysis*, 33(3), pp.356–367.

PBL Planbureau voor de Leefomgeving. (2015). *Worldwide climate effects - Risks and opportunities for the Netherlands*. [online] PBL Netherlands Environmental Assessment Agency. Available at: https://www.pbl.nl/en/publications/worldwide-climate-effects-risks-and-opportunities-for-the-netherlands [Accessed 6 Oct. 2021].

Plambeck, E.L. (2012). Reducing greenhouse gas emissions through operations and supply chain management. *Energy Economics*, 34, pp.S64–S74.

Reed, S. (2019). Earthquakes Are Jolting the Netherlands. Gas Drilling Is to Blame. *The New York Times*. [online] 24 Oct. Available at: https://www.nytimes.com/2019/10/24/business/energy-environment/netherlands-gas-earthquakes.html.

Rega, C. & Bonifazi, A. (2020). The Rise of Resilience in Spatial Planning: A Journey through Disciplinary Boundaries and Contested Practices. *Sustainability*, 12(18), p.7277. Available at: http://dx.doi.org/10.3390/su12187277.

Regionale Energiestrategie. (2022). *Nationaal Programma Regionale Energiestrategie*. [online] Available at: https://www.regionale-energiestrategie.nl/home/default.aspx [Accessed 17 Jan. 2022].

Regionale Energie Strategie (RES) 1.0 Regio Drenthe. (2021). [online] Available at: https://www.wdodelta.nl/_flysystem/media/res-1.0-regio-drenthe-01-04-2021.pdf. [Accessed 8 Oct. 2021].

RES FRYSLÂN 1.0. (2021). *REGIONALE ENERGIE STRATEGIE FRYSLÂN*. [online] Available at: https://www.resfryslan.frl/wp-content/uploads/2021/04/RES-1.0_RES-FRYSLÂN_NL_DEF_digitaal.pdf. [Accessed 19 November 2021].

RES 1.0 Groningen. (2021). *Groningen RES Regionale Energie Strategie*. [online] Available at: https://www.provinciegroningen.nl/fileadmin/user_upload/Documenten/Downloads/Downloads_2021/RES_1.0_Groningen__versie_08-04-2021_.pdf. [Accessed 19 November 2021].

RES Regio's op de kaart. (2021). Regionale Energiestrategie. https://www.regionale-energiestrategie.nl/resregios/default.aspx.

Rihoux, B., and Ragin, C.C. (2009). Configurational comparative methods : qualitative comparative analysis (QCA) and related techniques. Thousand Oaks, Calif.: Sage

The Rockefeller Foundation. (2015). *City Resilience Framework*. [online] Available at: https://www.rockefellerfoundation.org/report/city-resilience-framework/.

Rohracher, H. (2008). Energy systems in transition: contributions from social sciences. *International Journal of Environmental Technology and Management*, 9(2/3), p.144.

Schneider, S., Sarukhan, J., Adejuwon, J., Azar, C., Baethgen, W., Hope, C., Moss, R., Leary, N., Richels, R. and van Ypersele, J.P. (2001). Overview of impacts, adaptation, and vulnerability to climate change. [online] Available at:

http://documentacion.ideam.gov.co/openbiblio/bvirtual/005614/content/wg2/pdf/wg2TARchap1.pdf.

Smith J.B. (1996). Using a Decision Matrix to Assess Climate Change Adaptation Options. In: Smith J.B. et al. (eds) Adapting to Climate Change. Springer, New York, NY. https://doi.org/10.1007/978-1-4613-8471-7_7.

Smith, J.B, Schellnhuber, H.J., Mirza, M.M., Fankhauser, S., Leemans, R., Erda, L., Ogallo, L.A., Pittock, B., Richels, R.G., Rosenzweig, C., Safriel, U., Tol, R.S., Weyant, J.P., & Yohe, G.W. (2001). Vulnerability to climate change and reasons for concern: a synthesis. https://archive.ipcc.ch/ipccreports/tar/wg2/pdf/wg2TARchap19.pdf.

Sovacool, B.K., Hess, D.J., Amir, S., Geels, F.W., Hirsh, R., Rodriguez Medina, L., Miller, C., Alvial Palavicino, C., Phadke, R., Ryghaug, M., Schot, J., Silvast, A., Stephens, J., Stirling, A., Turnheim, B., van der Vleuten, E., van Lente, H. and Yearley, S. (2020). Sociotechnical agendas: Reviewing future directions for energy and climate research. *Energy Research & Social Science*, 70, p.101617.

Thompson, I., Mackey, B., McNulty, S., Mosseler, A. (2009). Forest Resilience, Biodiversity, and Climate Change. A synthesis of the biodiversity/resilience/stability relationship in forest ecosystems. Secretariat of the Convention on Biological Diversity, Montreal. Technical Series no. 43, 67 pages.

De Vries, R., Vringer, K., Wentink, C., Visser, H. (2019). *Gemeentelijke bestuurskracht en de energietransitie*. Den Haag: PBL.

Weck, M.H.J., van Hooff, J. and van Sark, W.G.J.H.M. (2016). Review of barriers to the introduction of residential demand response: a case study in the Netherlands. *International Journal of Energy Research*, 41(6), pp.790–816.

Zuidema, C., J. de Boer. (2017). Resilient Energy Landscapes, in: E.M. Trell, B. Restemeyer, M. Bakema, B. van Hoven (eds.) Governing for resilience in vulnerable place. Abingdon: Routledge.

Appendixes

Appendix A: Keywords used to find academic articles

Keyword	Academic articles
Resilience	Davoudi et al., 2012. Folke et al., 2002. Hermann et al, 2011. Leichenko, 2011. Lu & Stead, 2013. Marchese et al., 2018. Park et al., 2012. Rega & Bonifazi, 2020. Thompson et al., 2009. Zuidema & de Boer, 2017.
Stakeholder	Aligica, 2006. Murry-Webster & Simon, 2007.
Climate change	Butler, 2018. Cronin, Anandarajah, & Dessens, 2018. Davoudi, 2012. Smith *et al.*, 2001. Schneider *et al*., 2001. Smith, 1996.
Transformative adaptation	Fedele et al., 2019. Kates, Travis & Wilbanks, 2012.
Energy	Abbott, 2010. Bridge, Özkaynak & Turhan, 2018. Hoppe & Miedema, 2020. Khandelwal & van Dril, 2020. Keirstead, Jennings & Sivakumar, 2012. Langeveld, Sanders & Meeusen-Van Onna, 2010. Reed, 2019. Rohracher, 2008. Sovacool et al., 2020. de Vries *et al.*, 2019. Weck, van Hooff & van Sark, 2016.
Energy transition	Loorbach, Brugge & Taanman, 2008.
Methods	Clifford et al., 2016. Herce *et al.*, 2014. Kawulich, 2004. Kim & Ji, 2018. Mertens & Hesse-Biber, 2012. Rihoux & Ragin, 2009.
Carbon dioxide	Li & Mahalec, 2021. Plambeck, 2012. Andres et al., 1999
Energy policies	Owen, 2009.
Radar diagram	Bernstein, 1986.
Block Leader Approach	Burn, 1991
Citizen participation	Irvin & Stansbury, 2004.

Appendix B: Interview questions

Friesland:

Stakeholders

- Who is responsible for RES? The province or other stakeholders?
    - Friese Energie Alliantie (FEA), how do they lead and organise RES in Friesland?
- Can you please talk more about 'de Fryske Energie Waaier'?
    - Is this applicable to Groningen or Drenthe?
    - Is this organised through the Werkgroep?
- How would you say residents are influential or not, active or passive in decision making, supporters or blockers of RES?
    - How would you say citizen participation leads to a decentralised approach in RES?
    - How are residents considered if they can cope (financially) with the adaptations made due to RES?
    - Will residents be included more in RES 2.0?
- Why are no new locations chosen for RES 1.0 in Friesland?
- In what ways has the Rijksoverheid responded to Friesland's points for attention and preconditions (chapter 1.5)?
    - In what ways is Friesland dependent on het Rijk for RES?
    - Has Het Rijk shifted responsibility to the RES regions?
- 'Gedurende het proces geeft Liander gevraagd en ongevraagd advies'. What is meant by this? Is this meant in a positive or negative manner?
    - Could you tell me about 'NULelie' where Liandier is working on for RES?
- Are there any stakeholders mentioned in RES who were not supportive/block RES?

Overall

- What are the problems encountered with RES?
    - e.g., citizen participation, funding, infrastructure?
- How was the goal for 35TWh finalised after regions had comminated how much TWh they could bid?
- Bids are above 35 TWh, will this be adapted to possibly 50 TWh?
- The Netherlands has agreed to 55% CO_2 reduction for 2030, but why do the provinces still work towards 49%?
- Could you please talk more about the Zonnelader?
    - How is this used to discover suitable places for RES projects?
- How are ideas exchanged between RES regions?
- How do you think RES 1.0 Friesland uses an integrated approach?

Drenthe

Stakeholders

- Who is responsible for RES? The province or other stakeholders?
    - The Bestuurlijk Drentse Energietafel (DET), how do they lead and organise RES in Drenthe?
    - Could you talk more about this stakeholder and the relationship with Werkbureau RES Drenthe?
- How would you say residents are influential or not, active or passive in decision making, supporters or blockers of RES?
    - How would you say citizen participation leads to a decentralised approach in RES?
      How are residents considered if they can cope (financially) with the adaptations made due to RES?
- In what ways has the Rijksoverheid responded to Drenthes points for attention and preconditions (chapter 5)?
    - In what ways is Drenthe dependent on het Rijk for RES?

- Are these stakeholders supportive of RES? Enexis, TenneT, Natuur- en Miniluefederatie Drenthe, LTO Noord, VNO-NCW, Drentse kei, Jong RES/ JongRES Drenthe and Woonstiching De Volmacht?
    - If no for a stakeholder, why are they not supportive or block RES?

Overall

- The national target is 35 TWh, how is this divided amongst provinces?
    - If the province can't realise enough TWh to reach the required national target of 35TWh, what happens?
- If 35 TWh is already reached, won't this then be adjusted to a higher ambition of say 40TWh for 2030?
- What are the problems encountered with RES? e.g., citizen participation, costs, infrastructure?
- Does Drenthe have enough of its own natural resources for the energy transition, or does Drenthe require resources from outside the province?
- How does RES 1.0 include industry and creating jobs for a sustainable Drenthe?
- Why are there exchanges between Germany and the Netherlands (Drenthe) in energy?
    - Is this due to Drethe not having enough of its own natural energy sources, or also producing for Germany?
- It is mentioned that a 'warmtenet' is not economically viable, why is this?
- Which 'warmtebronnen' do you think is the most efficient for drenthe? Geothermal, 'warmte-koude opslag' (WKO), 'thermische energie uit oppervlaktewater '(TEO) or 'industriele restwarmte'?
    - Is this a national requirement from Het Rijk that you need to investigate warmtebronnen as a province?

TenneT

- How is TenneT involved/active in RES 1.0 for Groningen, Friesland, and Drenthe?
    a. How can TenneT influence RES 1.0?
    b. Does TenneT's role as a stakeholder change/differ per RES region in the North?
- TenneT is the national network operator, does TenneT have more say in RES than regional network operators e.g., Liander because of this?
- Could you please explain the network capacity problem?
    a. How does this affect RES?
    b. When was it clear that the capacity of the network is a major issue for the energy transition?
    c. What is TenneT doing/can do to solve the network capacity problem?
- RES is focused on the generation of electricity via Zon and Wind. It seems there is not much investment into other possible means, do you have any suggestions for other means of electricity generation that could also be included in RES?
- Is Het Rijk (NP RES) the commissioner or do RES regions approach TenneT for input?
- What do you think of the role of Friesland, Groningen, and Drenthe in RES?

Nationaal Programme RES

- What is the role of the Nationaal Programma RES?
- What is the link between Het Rijk, RES Regions and NP RES?
- How does NP RES organise contact between the RES regions?
    - Is it NP RES responsibility to answer to the points of attention in the RES documents?
    - Who is responsible for RES? The province or other stakeholders?
- What are the problems encountered with RES? e.g. citizen participation, costs, infrastructure?
- What do you think of the role of Friesland, Groningen and Drenthe in RES?
    - Do you have any possible recommendations for them?

Appendix C: Table of codes for Qualities and Aspects to collect qualitative data

Aspects

Topic	Parent codes	Child codes	Child codes definition
		Leadership	Effective leadership and management by strategic and integrated approaches from policy makers.
	Governance	Transparency	Province is open and transparent in decision making and empowers multiple stakeholders.
		Integration	Integrated development planning.
		Human vulnerability	Vulnerability of humans is kept to a minimum, by considering the extent to which citizens can cope with climate change
	Society	Inclusive	Policy makers are inclusive and cohesive for citizens
		Shared services and residential homes	Quality of the shared services and if residential homes are considered in energy transition policies
Aspects			
		Sustainable economy	Policy plans for a sustainable economy, which includes a diverse number of industries
	Economy	Investments and costs	Clear investments and costs made for the energy system are shown
		Innovation	Conditions that allow for innovation and creates job opportunities, but entails a comprehensive security and rule of law
		Use of land	Policy considers a diverse and sound ecosystem towards uses of land that benefits the environment
	Environment	Local infrastructure	Local infrastructure meets basic needs and requirements; reliable and effective provision of critical services
		Natural resources	Enough natural energy resources are available in the province for energy system transition e.g. does not require resources from another province

Qualities

Topic	Parent codes	Child codes	Child codes definition
		Learning	Learning from past experiences or other systems e.g. provinces
	Reflective	New information and evidence	Mechanisms in place that constantly evolve and modify standards of the energy systems based on the emergence of new information and evidence

		Permanency	Solutions suggested in policy reports are not permanent
		Capacity to anticipate	System has the capacity to anticipate changes to the energy system
	Resourceful	Goals achieved and ambitions	New ways and measures are produced to reach these goals, and goals are achieved under stress and shocks and new ambitions are offered
		Investments to anticipate	Investments made to increase capacity to anticipate
		Withstand impacts	Able to withstand the impacts of shocks and stressors
	Robust	Keep functioning	Systems can keep functioning due to being well-constructed, designed, and managed assets.
		Anticipation	Anticipation of potential hazards in systems
		Stakeholders	Involvement of stakeholders on multiple scales
Qualities	Inclusive	Shared ownership	Vulnerable groups are also included as stakeholders, leading to shared ownership of the system.
		No exclusion	There is no exclusion of stakeholders and participation is encouraged.
		Spare capacity	Purposely created spare capacity within a system, by having extra or the same resources available in a system.
	Redundant	Accommodating changes	Systems can accommodate changes in disruptions, pressures, or in demand.
		Diverse reactions	Redundant reactions are diverse and should also be intentional, cost effective and a priority.
		Alignment	Alignment between and within systems other than the energy system, to promote consistency in decision making.
	Integrated	Mutually supportive	Investments in systems are mutually supportive of the same outcome across different scales.
		Shared information	Information is shared between energy systems.
		Response	Systems can change, evolve, and adapt as a response to uncertain conditions.
	Flexible	Decentralised	Systems respond through decentralised approaches.
		New technologies	New technologies and innovation allow flexibility, traditional knowledge and practices are incorporated into new processes.

Appendix D: Tables used for recording scores of the quantified, qualitative data found from policy reports

ASPECT	SCORE
Governance	
Society	
Economy	
Environment	

Aspects table to assess level of resilience present

QUALITY	SCORE
Reflective	
Resourceful	
Robust	
Inclusive	
Redundant	
Integrated	
Flexible	

Qualities table to assess level of resilience present

Appendix E: Table to show in which order the policies have been read for data collection.

1	RES 1.0 Friesland, 2021.
2	RES 1.0 Drenthe, 2021.
3	RES 1.0 Groningen, 2021.
4	RES 1.0 Drenthe, 2021.
5	RES 1.0 Friesland, 2021.
6	RES 1.0 Groningen, 2021.

Appendix F: Consent form for participants for semi-structured interviews

Dear participant,

Below you find the consent form for my bachelors' thesis at the University of Groningen. The aim of this thesis is to identify the resilience in RES 1.0 reports for Groningen, Friesland and Drenthe and compare the results from each province to form a basis for recommendations and further research.

Participation is voluntary. Withdrawal from the research is always possible and no reason must be provided. The data will be treated anonymously and will only be used for university-related purposes.

If there are further questions you can reach me through M.S.K.Gaemers@student.rug.nl

What is your name? (This will only be used for the consent form and will not be linked to your interview)

[*form to fill in name*]

I have read the information (above) about the research project. I was able to ask questions and my questions were answered satisfactorily. I allow the interview data to be used for the following purposes: a written thesis.

The interviews will be recorded. The recording will then be transcribed for a detailed analysis. The recordings are only related to data collection. Any remarks which could lead to identification will be removed from the text. In the thesis anonymous quotes will be used. I allow a voice recording of the phone call. [*option to select yes or no*]

Thanks in advance for your participation.

Madeleen Gaemers

Appendix G: Overview of results from Aspects, Groningen

ASPECTS	*DATA*	RESULTS
GOVERNANCE	*'The municipality is busy with each other and the maintenance and seeking of cooperation from the province but finding it difficult to deal with stakeholders. First worked together with a steering group and a broad steering group. However, that is again separated into a social table and a board table. Moreover, there was also a variant that only a limited number of stakeholders were present' Participant T.*	Groningen does not show clear leadership and currently seems disorganised due to the lack of a clear governing body in RES. However, many relevant stakeholders are involved in RES Groningen and shows transparency in what they need to be able to complete RES. Groningen shows integrated development planning.
SOCIETY	*"The local environment must always be involved in the development of sustainable energy projects; and that the local environment should always benefit from renewable energy projects" RES 1.0 Groningen (p.23). "The costs of making homes natural gas-free are still much higher than what can be saved with it... All municipalities in the region are therefore concerned about the development of energy poverty. This means that with a further increase in energy costs, more and more residents will have difficulty paying the energy bill. This also means that there will be no financial scope for them to carry out the necessary insulation measures." RES 1.0 Groningen (p.16)*	Groningen shows they keep human vulnerability in mind, and how the energy transition in Groningen will affect residential homes. The transition in home will be difficult for residents to comply with due to finances, but Groningen cannot control this, and a solution is needed from higher up.
ECONOMY	*"We have provided insight into how the implementation of the RES affects the economy and the labour market in the province. We have the ambition to maximize the positive impact of the energy transition on the Groningen economy and employment." RES 1.0 Groningen (p.16). "The sustainable energy sector in Groningen is also growing faster than the national average. However, a lack of qualified personnel threatens further growth and may well become the biggest limiting factor in the energy transition." RES 1.0 Groningen (p.18).*	RES allows for innovation and new jobs in Groningen which supports economy and resilience. However, trained personnel to support the energy transition is becoming a limiting factor for further growth of a sustainable economy.
ENVIRONMENT	*"In the coming year, together with stakeholders, we will arrive at a common approach to ecology at energy parks. The partners in the RES Groningen strive for each future energy park to add value to nature and biodiversity." RES 1.0 Groningen (p.18). "Firstly, it is currently difficult to give a guarantee about the connectivity of energy parks of which little or nothing is known now and of which this will only become known at a later stage. In other words: as the realization of our ambitions progresses in the coming years, it will become more difficult to connect currently unknown energy parks in time." RES 1.0 Groningen (p.12).*	Groningen is keen to strive for RES to improve biodiversity and add to the environment. The electricity grid capacity shows it is a problem in realising further stages in RES and needs to be adapted.

Appendix H: Overview of results from Qualities, Groningen

QUALITIES	*DATA*	RESULTS
REFLECTIVE	*"As a RES region, we work together to learn from each other's experiences and experiments. We will jointly develop a sustainability ladder for sources." RES 1.0 Groningen (p.5). "After establishing the RES 1.0, we will monitor whether the local environment benefits from renewable energy projects, and we will continue to talk to each other to exchange experiences." RES 1.0 Groningen (p.5)*	Groningen shows learning from experiences. Monitoring of the environment supports this and is used for further discussions in RES Groningen
RESOURCEFUL	*"The RES Groningen indicates as concretely as possible where and when developments in the production of sustainable electricity are expected, but there are also determined municipal ambitions that need to be worked out more concretely in order to properly estimate the impact on the network." RES 1.0 Groningen (p.5)*	Groningen has the capacity to anticipate changes to the energy system in the future, and the effects that RES may have.
ROBUST	*"It has been calculated for the province of Groningen that there is a roof area for the generation of potentially more than 1 TWh. Due to various causes (unsuitable roof construction, problems with insurance, lack of grid connection or excessive construction costs), this potential cannot be fully utilized, but the aim is to do this as much as possible. On the one hand, efforts are required from the roof owner, on the other hand RES partners can also play a role by properly informing and unburdening roof owners; by helping them with procedures and financing." RES 1.0 Groningen (p.11)*	The system does not have the assets and construction to fully keep functioning in the energy transition. However, this is anticipating and realising the potential hazards, which can be taken for RES 2.0.
INCLUSIVE	*"There has also been a lot of talk about participation and local ownership. It was established that there is a need for agreements on common principles and future cooperation." RES 1.0 Groningen (p.7)*	Groningen shows that inclusion and involvement of stakeholders, especially residents, is important for future RES.
REDUNDANT	*"The capacity of the electricity grid in the (Northern) Netherlands is under pressure. No one currently has control over this scarcity. Grid operators are obliged to connect, governments have insufficient resources to manage on quality. Cooperative projects and sun-on-roofs are being squeezed as a result." RES 1.0 Groningen (p.21)*	Groningen is currently unable to accommodate the changes in electricity demand and the effect this has on the system. However, Groningen is investigating alternative heat sources that later will be able to create space capacity.
INTEGRATED	*"In the coming years, the RES partners will continue to work together in a RES context for further development of the joint regional vision and policy on the regional energy transition. Where we make a movement moving from local agreements to regional agreements." RES 1.0 Groningen (p.5). "Together we develop a common spatial vision for new policy for future wind and solar parks." RES 1.0 Groningen (p.4)*	RES partners are mutually supportive of the same outcomes and show alignment.
FLEXIBLE	*"We have mapped out possible heat sources and are following the research into the regional sources (including the Eemsdelta heat route) and the developments surrounding geothermal energy and green gas." RES 1.0 Groningen (p.14)*	Groningen is investigating new technologies and methods that could be implemented in the future and shows the system has the capacity to evolve in uncertain circumstances

Appendix I: Overview of results from Aspects, Friesland

ASPECTS	*DATA*	RESULTS
GOVERNANCE	*"The Fryske Energie Waaier has been developed as a guideline for having a good conversation between residents, energy initiatives, governments and other stakeholders. It can serve as a tool for governments to discuss and further shape local ambitions, joint ambitions, and the relationship between them. The Waaier also offers a lot of inspiration."*	Friesland has developed a policy tool, the 'Waaier' to help support the FEA in RES as a basis for communicating about RES to other stakeholders. Due to this, resilience is shown for Governance as it is a way to increase transparency in RES and its shows and strategic and integrative approach from Friesland.
SOCIETY	*"Waaier is a policy instrument, but has not yet been officially adopted, and is a developed instrument that anyone could use. It is a guide, a booklet of ideas, it is an inspiration and how to start a conversation with residents when municipalities designate locations for RES" Respondent F*	Society scores lowest due to lack of citizen participation, as no new locations were used for RES, only existing. However, Friesland is aware of this and is planning to include more citizens. This shows that Friesland is planning for citizen participation through the implementation of the 'Waaier', however still scores low for society as this has not been implemented yet.
ECONOMY	*"There are, of course, always challenges in terms of financing, support and network capacity". RES 1.0 Friesland (p.21).*	Indicators of resilience for Economy was not mentioned in RES 1.0 Friesland so scores 0. Only this is mentioned in the RES that resembles an indicator for resilience in the economy but is not enough information to score on.
ENVIRONMENT	*"One of the most urgent and practical tasks concerns the reinforcement of the energy network. The energy transition will require integration of the visible part of the grid infrastructure. Integration of possible new substations/regulatory stations and switching stations requires thorough spatial integration, which requires intensive cooperation with municipalities regarding permit processes and social support." RES 1.0 Friesland (p.21).*	There is some resilience in Environment for Friesland. The local infrastructure is there but needs improvements and thoughtful integration into the landscape.

Appendix J: Overview of results from Qualities, Friesland

QUALITIES	*DATA*	RESULTS
REFLECTIVE	*"To keep the costs for the switch to sustainable heating as low as possible and to operate efficiently, it is important to learn from each other" RES 1.0 Friesland (p.19).*	Friesland shows they are reflective and adapt their RES from new emerging information, but also new information from other RES regions. Decisions made are not permanent
RESOURCEFUL	*"In addition, a spatial integration tool has been developed, the Fryske Energie Waaier, to further develop new ambitions for sustainable electricity." RES 1.0 Friesland (p.8).*	Friesland has developed the 'Waaier' as a new way to support RES and their bid.
ROBUST	*"The mix of different heat sources must also be robust, and the distribution of heat sources must be concrete and realistic. This provides clarity to residents and other stakeholders" RES 1.0 Friesland (p.19).* *"At the moment, more and more stations are already overloaded, despite the hard work being done to expand the energy infrastructure..." RES 1.0 Friesland (p.26).*	Friesland knows and keeps in mind their plan must be robust. However, the current electricity grid is not able to withstand shocks and stressors and is overloaded.
INCLUSIVE	*"If we are going to designate new locations, you have to involve people, that's absolute, you can't just impose that from above." Respondent F*	Inclusive scores low for Friesland. Currently there is integration of organisational stakeholders, but residents are let out. This is due to existing projects being used in RES 1.0. However, they intend to increase involvement and citizen participation when new locations for projects will be used for RES.
REDUNDANT	*"Elements that are important when making choices include the affordability, availability and reliability of heat sources. In addition, we attach importance to social support and the extent to which heat solutions use clean energy". RES 1.0 Friesland (p.19)*	Friesland does not show how the energy systems can accommodate changes in disruptions, pressures, or in demand. Friesland does realise diverse reactions are a requirement but have yet to expand on being redundant for resilience.
INTEGRATED	*"Are of course different collaborations, and forms, but there is coordination between the RES yes" Respondent F.* *"A good dynamic has been created in the administrative RES consultations to exchange ideas openly with each other. The administrative RES consultations of the past year have contributed to a good relationship. Despite the differing views, there is room to discuss this (more quickly). Thanks to the RES process, structural administrative consultations about the energy transition are taking place for the first time." RES 1.0 Friesland (p.22)*	Integrated is strong for Friesland. There is alignment between stakeholders for RES and other RES regions for the energy transition.
FLEXIBLE	*"The more electrical heat solutions that are realised, the more solar panels and wind turbines are needed in Fryslân. Despite the cost-saving measures, the RES 1.0 takes this growth up to 2030 into account." RES 1.0 Friesland (p.18)* *"The implementation strategy is aimed at collaborating on the energy transition between local and decentralized authorities, social organisations, companies and institutions in Fryslân." RES 1.0 Friesland (p.10)*	The FEA shows Flexibility for resilience in RES as new processes incorporate traditional practices. The Friesian energy system can change with the agreements made in the Climate Agreement. Friesland also uses a decentralised approach in RES.

Appendix K: Overview of results from Aspects, Drenthe

ASPECTS	*DATA*	RESULTS
GOVERNANCE	*"We divide the Drenthe approach into several methods: involvement; to tell; to steer; collaborate; support and innovate". RES 1.0 Drenthe (p. 20).*	Drenthe scores the highest for Governance and for society shown in figure c. This is since they express strong and integrated approaches in leadership and via the establishment of the DET to carry out RES.
SOCIETY	*"During this unique online event, visitors were taken into the world of electricity generation through solar and wind energy and the reduction of our natural gas consumption in the Drenthe region…. visitors could also talk to administrators from the RES region of Drenthe". RES 1.0 Drenthe (p. 22).*	Drenthe is also open and transparent in decision making, participation from society is encouraged by engaging stakeholders through interactive means. This is one of the ways Drenthe shows they are inclusive for citizens.
ECONOMY	*"About energy generation and employment, we are looking for a connection and they are also working on innovation in sustainable energy generation, but also the shift from fossil fuels, also the number of mechanics and how can we organize that within Drenthe… but this is not actively being picked up within RES" Participant D.* *"In addition, there is relatively little industry present, which means that the supply of residual heat for, for example, a heat network is limited". RES 1.0 Drenthe (p.50)*	There is not a lot of industry present in Drenthe, which removes the focus to other areas of the energy transition.
ENVIRONMENT	*"We are investigating smart solutions for grid capacity problems. In many places in Drenthe, the available grid capacity is a limiting factor in realizing sun-on-roofs". RES 1.0 Drenthe (p.31). "But what are our core tasks? Generation, network, and regional heat. Those are the core business things we must do, so we've limited RES 1.0 to that as well. Now we see, what about natural values and biodiversity, multiple use of space, mobility, agriculture? We have said how we can do something with this in the next RES". Participant D*	Environment scores negative due to the network not having the current network capacity for sustainable energy generation, but this is a known issue. Environment is currently not one of the main focuses for Drenthe, however for future RES, this will be more of a focus.

Appendix L: Overview of results from Qualities, Drenthe

QUALITIES	*DATA*	RESULTS
REFLECTIVE	*"RES 1.0 is not a final terminal. In the follow-up to RES 2.0, we will work out several matters, such as biodiversity, economy and employment, mobility, health and monitoring" RES 1.0 Drenthe (p.12)*	Reflective has scored high due to learning from past experiences in RES and other RES regions. Solutions suggested in RES 1.0 are not permanent, as the region is always working towards the next RES.
RESOURCEFUL	*"We have mapped the potential energy sources individually. In practice, a combination of sources and techniques, such as solar thermal and green electricity, will be used to provide a district with energy." RES 1.0 Drenthe (p.52). "The capacity of the future grid is an important point of attention. A good balance in generation with solar energy on the one hand and wind energy on the other helps with this. Research must also be conducted into the efficient use of the energy generated (direct and local) and into innovative storage options. Hydrogen may play a role in this." RES 1.0 Drenthe (p.55)*	Drenthe shows resilience in being resourceful via new (potential) methods for energy generation. Also, possible resourceful changes that need to be made to the energy system are highlighted.
ROBUST	*"In Drenthe, the available grid capacity is a limiting factor in realizing sun-on-roofs. By sharing knowledge and experiences about specific solutions that are already present in the market and by making expertise available, as many cases as possible are helped to realize sustainable generation" RES 1.0 Drenthe (p.31). "...the heat transition is subject to many uncertainties about, for example, the availability of sources, the development of new technologies and affordability. Because there are still many technological, economic, and social questions to be solved, the coming years will be dominated by 'learning in practice." RES 1.0 Drenthe (p.48)*	Drenthe does not show it is robust in being that it has not been well designed and continues to function on full capacity. However, Drenthe does realise potential hazards.
INCLUSION	*"We have a task and wind here, sun on the roof there, but if we would like to do it in consultation with our society, we must ensure that our society is also sufficiently informed and goes along and also wants to go along." Participant D*	Shows collaboration between stakeholders, thinking ahead for future RES and investigating new potential energy sources that fit into the region. Drenthe encourages participation, especially from residents, but they do not always get a response when invited to take part and give their opinion: which could be limiting to inclusion.
REDUNDANT	*"If you look at Drenthe and you look at the network, what is RES about? Generating renewable energy if you generate it you must put it somewhere on the grid. If you look at the map of Drenthe, more than ¾ is on red, we are locked, let's say, we can't lose generated energy, we can't deliver energy... that's a point of attention" Participant D. "We make sure that we keep room for the expansion of the electricity stations." RES 1.0 Drenthe (p.44)*	Redundant in Drenthe is low. Drenthe struggles to anticipate due to lacking network capacity but does try to plan for capacity on the network. The energy network and its capacity are a known issue and a problem.
INTEGRATED	*"We are proud of the way in which we work together on an equal basis at regional level as governments and social partners. Regional cooperation is a dynamic process." RES 1.0 Drenthe (p.13)* *"By working together as a region, we ensure a careful process, we learn from each other, and we look for common principles. We also work together to promote regional interests." RES 1.0 Drenthe (p.13)*	Drenthe shows strong integration due to alignment between different stakeholders in Drenthe. This promotes efficiency in decision making.
FLEXIBILITY	*"We are conducting pilots with new techniques, sources and innovations, and we mainly focus on existing buildings. "RES 1.0 Drenthe (p.48) "Give network operators the opportunity to decide, in consultation with local and regional authorities, whether connection capacity can be withdrawn" RES 1.0 Drenthe (p.56)*	Drenthe incorporates flexibility which increases resilience. Drenthe uses innovative methods to find new technologies that can be used for the future. Decentral approach to solving problems is taken in Drenthe.

Appendix M: Implementing Block Leader Approach plan (Burn, 1991)

BLA is used to help spread information and awareness about RES and is a way to try to get people involved to boost participation from the local community. Regional Energy Strategies and logo helps increase the project's recognisability and memorability, boosting the target group's emotional response.

1. **Recruitment process of Block Leaders:** Before the recruitment process, numerous workshops with the theme' energy transition' open to the public are held. RES details are conveyed to volunteer citizens who stand out in these workshops, show enthusiasm and strong opinions in the energy transition, and have strong interpersonal communication. For example, the person recruited could get a specific salary or volunteer work. The number of the Block Leaders that need to be recruited depends on the size of the neighbourhood and how many people aim to be communicated with about RES. These block leaders can be placed one for seven streets or so, but this is not based on scientific data that it should be this.

2. **Role and Responsibilities of the Block Leaders:** Block leaders are active and environmentalist residents primarily responsible for delivering persuasive messages to induce a neighbourhood norm aware and involved in the energy transition. Their mission is to work as an inspiring transition agent to unite the community to create awareness and a collective mindset on RES.

3. **General responsibilities of the block leaders:** A commitment of 15 - 25 hours per year, attending training and orientation programs and attending the quarterly meetings and filling out the 'Quarterly Report.' These quarterly meetings will allow to: share the experience and observations gained in the field; provide general input and feedback about the program from Block Leaders; learning points

4. **Tasks Block Leaders do to raise awareness and participation for RES:** Providing information about RES and the energy transition through presentations at neighbourhood associations; Face-to-face conversations with residents; Giving out flyers where the mains tasks, goals, and achievements of RES is highlighted

5. **Duration and Replacement of the Block Leaders:** there will be changes in the number of Block Leaders needed during this program. The recruitment of new block leaders should be continued, motivating existing block leaders to stay. Current Block Leaders are active in the recruitment process. The program should continue until enough citizen participation and input are required for RES.