The design of a process approach to adjust the tariff system of the electricity network

A case study to determine the input for the process for adjusting the tariff system in the Netherlands using Q methodology

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TNO innovation for life

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Master of Science Thesis

For the degree of Master of Science in System Engineering, Policy Analysis and management at Delft University of Technology

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June 30, 2016

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“Wicked problems can’t be solved, but they can be tamed”

- John C. Camillus (2008)

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Summary

The energy transition puts pressure on the current tariff system design of the electricity network in the Netherlands. The tariff system is defined in this research as the calculation to establish the network costs, the allocation of these costs to the network users and the regulation of system operators who invest in, maintain and operate the electricity network. The pressure on the tariff system design is caused by the following three effects of the energy transition:

- Increasing share of renewable energy sources: Renewable energy sources, like wind and solar PV, are intermittent and hard to predict. Electricity demand and supply always have to be matches, leading to more balancing efforts of the system operator. Renewable energy sources are often located at more remote areas, thus requiring network capacity investments to transport the produced electricity to the electricity consumers.
- Increasing share of decentralized electricity generation: decentralized electricity generation is electricity generated and fed on the low voltage levels of the electricity network, like solar PV and CHP plants. This is against the nature of the cascading principle, the current network cost allocation method, which assumes electricity is fed-in on the high voltage level.
- Electrification: Electrification is the increasing demand for electricity as a result of new technologies, like heat pumps and electric vehicles.

In total, it is estimated that in the Netherlands alone €20 - €70 billion network investments are needed until 2020 to facilitate the energy transition, next to the 2 billion of required annual investments, with additional network investments after this year (Netbeheer Nederland, 2011; van der Schoot, 2013). Demand response, influencing the electricity consumption of electricity consumers, has the potential to decrease the abovementioned effects and network investments. However, incentives need to be given to stimulate demand response. Adjustments in the tariff system design can be made to provide these incentives.

The adjustment of the tariff system design is a wicked problem due to the following characteristics.

- There does not exist a definite solution in the sense of a mathematical equation, as electricity can't be steered and therefore the exact costs of an individual consumer engenders on the network are very hard to determine.
- The goals and principles behind the tariff system design are interdependent, meaning that trade-offs between them need to be made.
- Different stakeholders are involved, operating in different markets, leading to different and sometimes conflicting interest and values.
- Large design space, relentless aspects with big uncertainties, where developments, as mentioned regarding the energy transition, influence the tariff system design and vice versa.

Wicked problems often result in a "dialogue of the deaf" or a "deadlock": These are discussions that are stuck as actors can't agree with each other, as the problem and/or solutions are not completely clear and the arguments validity is based on the perception of the actors. Two bodies of literature are often used to deal with the wicked problems: Process management and Q methodology. Both share the same core approach: gaining insights in the perspectives of stakeholders and sharing them leads to new

insights, understanding between actors, resulting in richer solutions. However, both bodies of literature are often applied when a decision making process is already a “dialogue of the deaf” or a “deadlock”.

Q methodology, a systematic study of subjectivity, can identify dominant discourses of support and rejection and therefore has the capacity to allow more effective form of policy making and implementation. Process management is focussed on how content is developed and implemented, by letting the parties agree on how the decision process is made and give all involved parties the opportunity to serve their own interest. Process management and the design of a decision-making process is a rather abstract theory. This research uses the Q methodology to design a process approach for the adjustment of the tariff system. Thereby contributing to the scientific literature in two ways: Q methodology is applied in the first step of the decision-making process, i.e. the design of a process approach, and Q methodology is proposed which address several design principles that help achieving the elements of a good process design following de Bruijn et al. (2010). Thereby aiming to identify topics of discussion and structure the wicked problem of adjusting the tariff system design.

The Q-methodology in this case study contained 55 statement, which represent all that is being said regarding the adjustment of the tariff system design. 24 participants, working in sectors strongly affiliated with the tariff system, sorted the statements on a 11 point scale from most agree to most disagree, which is called the Q-sort. Subsequently the Q-sorts were clustered with the use of a factor extraction and factor rotation with the computer programme PQmethod, identifying four factors. The factors are interpreted, defining the following four discourses:

Traditional power to the market perspective: cost engender principle, high quality network and certainty for market parties.

The first discourse strongly focuses on the energy market and general economy: based on this perspective the tariff system should follow the cost engender principle, is stable and predictable, thereby reducing uncertainty for market parties and resulting in a high quality electricity network. Adjustments in the tariff system are primarily based on better applying the cost engender principle: a producer tariff and possibilities for reimbursement to network users for offering flexibility. More harmonization between European tariff systems is needed to create a level playing field.

Regional system sustainability optimization by collaboration, transparency of system operator and an adaptive tariff system.

This second discourse emphasizes the differences in regions and unique solutions to make them efficiently more sustainable. A top-down approach is therefore not feasible: the tariff system should be adaptable to comply with local conditions and solutions for optimization. The system operator should function as facilitator, giving more transparency about its network problems and planning, and collaborate with both public and private actors from different sectors to optimize the region to become more sustainable in an efficient manner.

The tariff system as a means to an end: achieving goals more important than following principles.

The third discourse is quite similar to factor one in respect to the principles and goals underlying the tariff system to facilitate the market. The main difference is that these principles are more regarded as

guidelines and therefore exemptions can be made. The tariff system is seen as a mean to directly influence clearly formulated public goals, but the goals could not be uniformly formulated. The communality in this discourse is that the tariff system should be used to directly help reaching a public goal and therefore exemptions can be made in respect with the principles behind the tariff system design.

Tariff system as a mean to facilitate the energy transition; more transparency and fair distribution of network costs.

The fourth discourse also sees the tariff system as a means to an end, but focused on the facilitation of the energy transition as the public goal. The goals and principles behind the tariff system are regarded as guidelines, but don´t have to be strictly followed. More important is that the tariff system gives the right incentives to facilitate the energy transition. They have a high urgency to become more sustainable and argue that the costs for becoming more sustainable only increase the longer it takes. The system operator should become more transparent regarding the network planning and problems, to give market parties the opportunity to find solutions. However, the system operator may also perform market activities to facilitate the energy transition, but only if he thereby prevent higher network costs in the future.

The four discourses and substantive knowledge gathered during the discussions with participants while performing the Q-sort are used to design a process approach following de Bruijn et al. (2010). Several design principles of elements for a good process design could be addressed and several topics of discussion are identified, structuring the wickedness for the decision making process to adjust the tariff system of the electricity network (see chapter 6 for visualization and detailed description). The process approach:

- Builds on the common ground with the formulation of a public goal for the process: minimization of the increase in network costs
- Deals with different perspectives and structures the process with the identification of three (non-exhaustive) negotiation round directions: Voltage level rounds, network cost allocation rounds and system perspective rounds
- Uses the results of the Q methodology to structure the start of the process, by providing an overview of potential adjustments in the tariff system, with the perceived risks, drawbacks and benefits
- Proposes several process agreements that help making decisions and aimed at preventing a “dialogue of the deaf” or “deadlock”
- Identifies a core value: protection of vulnerable network users

This research shows thereby the value of Q methodology, applied on a wicked problem which is not already highly polarized or high on the political agenda and uses it on the first step of a decision making process with the design of a process approach. It thereby gives a practical methodology to address several of the process managerial aspects and design principles of elements for a good process. As it is a single case study, more research is recommended to verify the applicability of Q methodology to design a process approach and identify potential ‘best practices’ how to apply Q methodology for a process design.

Preface

The thesis presented before you is the final step to receive my masters degree. The first time performing my own research was challenging and exciting, putting my knowledge and skills obtained in my bachelor and masters into practise. During the last year I've further developed myself by, among others, learning a new methodology that analyzes subjectivity. I've always been interested in analyzing and discussing problems without a clear solution, which I could put into practise with this thesis.

First of all, I want to thank all the people that participated in this research. I've really enjoyed the interviews, where several times scheduled appointments of an hour led to really interesting discussions of several hours. Additional gratitude goes to those participants that suggested or introduced me to other participants, they really helped me gather all the relevant data needed for this research. I've learned a lot from all of you and the research could not be performed without your input.

I want to thank my gradation committee for their feedback and comments on my thesis. I especially want to thank Mark de Bruijne. He helped me a lot in the beginning by defining my research, when I had a hard time finding a research topic. I really appreciate you and the personal way you supervised me over the last year, giving me the opportunity to be myself. You gave me advise and confidence when I dealt with struggles regarding the direction or approach I had to go in my thesis.

I also want to thank TNO for giving me the opportunity to research this interesting topic. I felt very welcome and I enjoyed the time spent in The Hague and Delft. Special thanks to Jasper Donker, who showed me around and helped me find my place in such a large organization. I really liked our discussions of my findings, where you helped me further develop the different perspectives on my research topic.

Furthermore, I would like to thank those people who helped me learn and apply the Q methodology. Eefje Cuppen, thank you for the time you made for me on short notice when I had doubts about the choices I had to make. Also thanks to the online Q community set up by Kent State University. I was pleasantly surprised by the activity on the forum and the discussions really helped me make deliberate choices for the application of the Q methodology. The active community responded fast on my posted questions and the subsequently following discussions made me better understand the issues I dealt with at that time.

I hope you enjoy reading the thesis,

Wouter van Mechelen

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1. Introduction

The energy transition affects the network operation and network management. Therefore the Ministry of Economic affairs started the STROOM project to adjust the electricity and gas law (VEMW, 2016). STROOM stands for streamlining, optimizing and modernizing (stroomlijnen, optimaliseren en moderniseren). In the summer of 2014 the concept law was published online for people to react on it. Over 30 actors from the electricity and gas sector reacted on the internet consultation (Overheid.nl, 2014). More reactions came via several other media, which led to quite some revisions, but the proposed law was eventually rejected at the end of 2015 by Parliament. From the consultation to the decision to reject the amendments there was critique that the proposed law didn't deal with future developments resulting from the energy transition (Meijburg & Schalij, 2016).

The energy transition has currently three main developments that influence the network operation and network management: the increasing share of intermittent energy sources, decentralized electricity generation and electrification (Netbeheer Nederland, 2011). Renewable energy sources often have an intermittent characteristic; the electricity production from these sources is hard to predict and can be limited influenced. The electricity network always has to be balanced, meaning that the efforts to match demand and supply increase. Decentralized generation, e.g. solar PV, CHP and windmill, increase the share of electricity generation on the low voltage level, while the electricity network was historically designed for electricity generation on the high voltage level. Electrification results in increasing demand for electricity as a result of new techniques, e.g. electric vehicles, heat pumps etc..

Investments in the network need to be made to deal with these developments. Capacity of the network needs to increase to deal with the increasing electricity demand and transport generated electricity from new, often more remote, electricity production locations to the consumers. Additionally, investments in facilities to balance the network are needed in the low voltage network to deal with decentralized generation. New techniques can also be used to reduce these investments, such as smart grids, storage and incentives for demand response (Netbeheer Nederland, 2011). But these also come at a price. In total, it is estimated that in the Netherlands alone €20 - €70 billion investments are needed until 2020, next to the 2 billion of required regular annual investments, with additional investments after this year (Netbeheer Nederland, 2011; van der Schoot, 2013).

These developments also put pressure on the current tariff system design of the Netherlands and increases the need to adjust it to the new conditions in the energy sector. The tariff system design is defined in this thesis as the regulation regarding network costs, network cost allocation and the activities of the system operator. This research focuses on the process to adjust the tariff system in the Netherlands to deal with the developments of energy transition.

1.1. Tariff system design: a wicked problem

The energy transition puts pressure on the current tariff system design and leads to uncertainty for system operators. The system operators are in dilemma regarding the network investments: there is a need for proactive network investments to facilitate the developments of the energy transition while current regulation incentives them to postpone investments (Steenhuisen & de Bruijne, 2014). The

cascading method, the current network cost allocation method to divide the network costs over the different voltage levels, is based on the principle of electricity generation on the high voltage level which is transported to the low voltage level (Hakvoort et al., 2013). The increasing share of decentralized electricity generation violates this principle, as electricity is generated on the low voltage level and with significant penetration levels of decentralized generation electricity will be transported to higher voltage levels, resulting in discussions for alternative cost allocation methods. Finally, there is a need for more demand response, i.e. influencing the electricity demand of consumers, for which in the current tariff system design are only limited incentives (Hakvoort & Huygen, 2012; Netbeheer Nederland, 2011). These issues are all in an uncertain and interdependent context; it is unclear how fast these issues develop in the upcoming years and they are strongly dependent on the policy choices, e.g. environmental policies or renewable energy policies. This creates the need to design a tariff system that can deal with the abovementioned issues and uncertainty resulting from the energy transition.

The design of the tariff system is addressed as a 'wicked problem'. Wicked problems often require a different approach than traditional policy approaches as technical, expert driven or routine administrative solutions: "Understanding the perspectives of key stakeholders, the knowledge bases available, the extent of agreement on broad goals, and the prospects for developing shared expectations, can provide a sound basis for considering how further engagement should occur and how future decisions should be made" (Head, 2008, p106). In other words, there is no definite and final answer to a wicked problem that can't be contested based on objective criteria. The solutions for a wicked problem are valued based on the perspectives of different stakeholders and how they perceive the problem and impact of the solution.

Chapter 2 addresses the wicked characteristics of the tariff system design in detail, for now the characteristics of the electricity network and multiple actors involved are addressed to identify why there is no definite and final solution for the tariff system design. Firstly, electricity can't be steered over the network and follows the route of least resistance (Pérez-Arriaga, 2013). Therefore the individual costs a electricity consumer engenders on the network are hard to determine exactly. The network costs are therefore partly socialized and allocated following the cascading method. There are several goals and principles behind the network cost allocation, of which some are conflicting and lead to making trade-offs between them. The different actors involved value the goals and principles differently based on their interest, perception of the problem and expected outcome. This means that there is therefore no definite and final solution, as they depend on the interests of the actors.

Wicked problems often lead to ´dialogues of the deaf´ or ´deadlocks´(Daams, 2011; van Eeten, 1999). These are discussions that are stuck as actors can't agree with each other, as the problem and/or solutions are not completely clear and the arguments validity is based on the perception of the actors. This hampers the process to actually deal with the wicked problem and come to a solution to the problem. The problem statement is therefore: how can the decision making process of the tariff system design be approached especially given the wicked character of the problem?

1.2. Knowledgyge gap and relevance of the research

To deal with the wickedness of the tariff system this research uses the Q-methodology. Q methodology is a method to study subjectivity and is increasingly applied in various fields of social sciences to structure wicked problems (Cuppen, 2013). It can identify dominant discourses of support and rejection (Ellis et al., 2007) and therefore "has the capacity to allow more effective form of policy making and implementation" (Barry & Proops, 1999, p337). Thereby it can be used to select stakeholders for a decision making processes (Cuppen et al., 2010) and structure political agendas (van Eeten, 1999).

This research applies Q-methodology on the tariff system design of the electricity network in the Netherlands, a field in which limited research is done to determine the different perspectives regarding the involved topics. There are several studies performed regarding certain aspects of the tariff system, for example regarding the large energy consumer exemption and smart grids (Hakvoort & Huygen, 2012; Hakvoort et al., 2013), however these are 'technical experts driven solutions'. These are studies based on economic principles and criteria, which don't take into account to full perspective of stakeholders and how they value the possible solutions: i.e. the solutions are not solely valued by economic principles and the criteria are valued differently by the involved stakeholders. There is so far, by the authors knowledge, limited insight in what the role of the tariff system should be in the Netherlands, what the design possibilities are and how the stakeholders value the possibilities with respect to the energy transition.

Process management and Q methodology are often applied when the discussion regarding a topic is in a deadlock. Van Eeten (1999) used the Q methodology in a "dialogue of the deaf" regarding the future of civil aviation to recast policy arguments. Other examples are the biomass debate (Cuppen et al., 2010), acceptance of wind farms (Ellis et al., 2007), renewable energy (Barry, Ellis, & Robinson, 2008). These are all issues that have featured on the political agenda at that time, often with wicked nature and where the actors are very polarized, hampering the progress of the process. The tariff system design is not highly on the political agenda and the limited discussion about certain aspects of the tariff system design is not yet polarized. This gives the opportunity to structure and analyse the problem in more detail before the discussion reaches a "deadlock" or (drifts into) a "dialogue of the deaf" by an ex-ante exploration of the discourses regarding the process of designing a new tariff system. Furthermore, this research might therefore also contribute to the development of a process that might result in the smooth adjustment of the tariff system design that deals with the developments of the energy transition

The thesis thereby contributes to the scientific literature in three ways. Firstly, Q methodology is applied on the tariff system design, a case study that is not high on the political agenda and therefore not highly polarized, using it on an ex-ante issue instead of an issue that is already in a deadlock, showing that Q-methodology can also be applied on not yet polarized issues. Secondly, the applicability of Q-methodology in process design is shown. It addresses the remark of Steven Brown in 2011 during the 2011 Annual Meeting of the International society for the scientific study of subjectivity: "So if you aspire to doing more than just analysing problems, I recommend the policy sciences and also using the leveraging advantage that Q methodology provides in other steps and other phases of the policy process."(Wolf et al., 2011, p47). This thesis applies it on the start of the policy process and thereby

directly linking it to process design aspects. Finally, the value of Q methodology is shown to address several design principles from the abstract theory of process management.

1.3. Research questions

Following the previous paragraph the research question of the thesis is:

What can Q methodology contribute to a process approach for adjusting the tariff system design of the Dutch electricity network

To answer the research question, the following sub-questions need to be answered.

1. *What is the context of the tariff system design?*
2. *Which aspects of the tariff system are under discussion for potential adjustments?*
3. *What are the most important discourses with respect to adjusting the tariff system?*

The first research question is addressed by a desk research. The tariff system design is discussed from a socio-technical perspective to identify the wickedness of the issue. The second sub question is a literature study mainly focussed on non-scientific literature, as these contain more opinions and perspectives. Additionally, several interviews are performed to firstly verify the leading topics and secondly to find additional topics that have not been addressed before. The leading topics are used in the Q-methodology as statements. The third research question is answered with a case-study. People strongly related to the tariff system participate in the sorting of statements related to the tariff system design identified in the second research question, which are analyzed to determine the discourses. The Q methodological results are subsequently linked to process design elements to show what Q-methodology can contribute to a process approach for adjusting the tariff system design of the Dutch electricity network.

1.4. Structure thesis

For this research the following structure is used. In chapter two the pressure on the tariff system design is further elaborated upon by describing the tariff system and its context based on a socio-technical perspective. Chapter three addresses the theory and methodology used in this research: Q-methodology and process management. The application of Q methodology on the case study is described in chapter four and the results are discussed in chapter five. Chapter six uses the results of the case study to design a process approach and links them to the design principles of a good process design. Chapter seven draws subsequently conclusions by answering the research questions and making recommendation for further research. Finally, chapter eight reflects on this research, firstly on the application of Q methodology and subsequently on the results of this thesis to improve further research activities.

2. Tariff system design: system description and context

This chapter describes the tariff system design from a socio-technical perspective to better understand the issues and pressure that the energy transition puts on the current tariff system. By describing the system and context the tariff system is part of, the various aspects are addressed that lead to the conclusion that the adjustment of the tariff system is a wicked problem. Paragraph 2.1 discusses the physical properties of the electricity network with its most important actors and paragraph 2.2 the goals and principles behind the tariff system design. These paragraph address the reasons why a tariff system is needed to allocate the network costs to the different consumers. Paragraph 2.3 describes in detail how the tariff system allocates the network costs to the electricity consumers in the Netherlands. Paragraph 2.4 gives an overview of the developments that in the energy sector in respect with the energy transition. The final paragraph recaps this chapter and concludes that the adjustment of the tariff system is has the characteristics of a wicked problem.

2.1. The electricity network: physical properties and important actors

The electricity network is used to transport electricity from producers to consumers. The electricity network can be separated in two different networks: transmission network and distribution network. Transmission network is historically used to feed in produced electricity and transport it over longer distances to the different distribution networks. The distribution networks transport the electricity further to the different consumers. Figure 1 shows the traditional system diagram from electricity generation to consumption and the most important actors in the system.

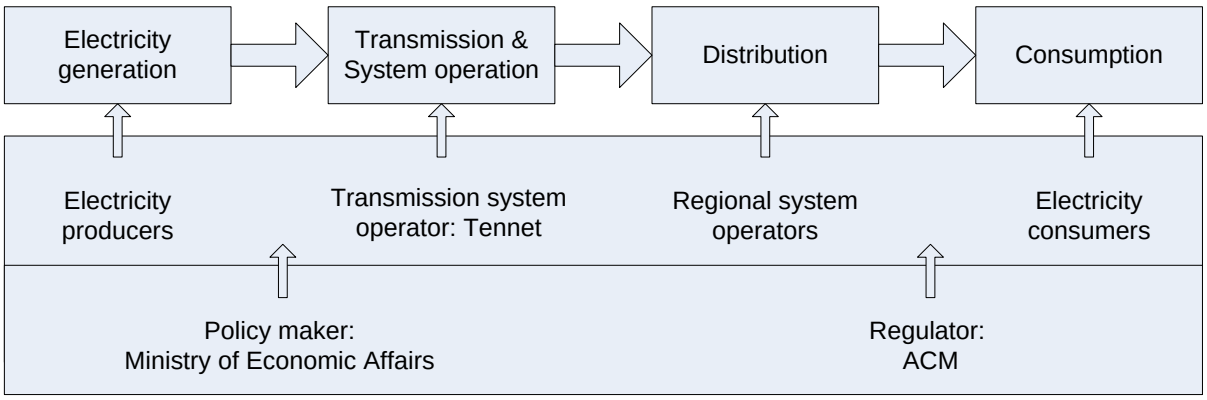

Figure 1: System diagram electricity transport with its most important actors

Electricity is generated by electricity producers who fed it into the transmission network. The system operator is TenneT, who operates, maintains and invests in the transmission network. The transmission network transports the electricity to the different distribution networks, owned by the regional system operators. The distribution network finally distributes it to the electricity consumers where it is consumed. The responsible policy maker is the Ministry of Economic affairs, who appointed the ACM as regulator to monitor the energy system.

The transmission network and distribution network consist of several voltage levels. The different voltage levels have two reasons: reduce transmission losses and to accommodate to the different load profiles. The transmission network has the highest voltage levels to have the minimum amount of transportation losses over the long distances. The distribution network consists of several voltage levels to which consumers are connected with different load profiles. Large energy consumers, such as steel and paper producer, are therefore connected to the high voltage network and small energy consumers, like households, are connected to the low voltage level.

Electricity transportation has some differences with other commodities which makes transport a bit more complicated (Pérez-Arriaga, 2013). First of all, electricity can't be stored on a large scale and definitely not within the gridlines of the network something which is possible in a gas network. This means that supply and demand of electricity always have to be matched at a certain moment in time. Secondly, electricity can't be steered, but follows the route of least resistance, also known as Kirchhoff's law (Pérez-Arriaga, 2013). This means that the transmission system operator has the task to balance demand and supply, working with tight margins for the value and frequency of voltages and currents as well as waveform of these signals.

2.2. The design of the tariff system: goals and principles

The network and transmission of electricity result in costs made by the system operators. Network investments are for the majority sunk costs: investments in the electricity network cannot be used for other applications or another purpose (Pérez-Arriaga, 2013). In the previous paragraph is mentioned that electricity can't be steered in a network, but follows the route of least resistance. Therefore it is hard to determine which network costs are caused by an individual consumers. A tariff system is needed to reimburse the system operators for the costs they made for the operation of the network. The tariff system allocates the network costs to different network users by means of transmission pricing; each consumer has a tariff for their use of the electricity network.

Goals and principles behind tariff system[1]

The main goal of transmission pricing is allocating the network costs to different consumers to recover the costs system operators have made. The network costs consist of the capital costs of the physical network and the operational costs for maintaining and operating the network, which are discussed in more detail in the next paragraph. These costs are made by the system operator and the sum of the income from all the transmission prices should be equal to these costs. Next to recovering the network costs, the transmission prices should also give an incentive to consumers for efficient use of the network; the more costs you engender on the network the higher your transmission costs should be.

[1] Based on (Hakvoort et al. 2013, p.11-28)

However, as mentioned in the previous paragraph, electricity can't be steered over the network and therefore makes it hard to determine the exact costs you engender on the network. Subsequently, electricity flows are netted, meaning that market transactions between several parties can results in opposing flows which are neutralized by each other; The impact of an individual consumer on the network is dependent on all the other market transactions. This means that individual 'flows' of electricity can't be assigned to individual network users and therefore the exact individual costs can't be determined.

The system operator and electricity consumer perceive network use differently. The system operator reasons from a capacity perspective, he invests in the network to have sufficient network capacity to transport the electricity on peak hours: the moment when the most electricity is consumed. Meaning that the costs you engender on the network depend on your peak demand, as the system operator invests in network capacity to be able to transport this peak capacity to its consumers. The consumers, on the other hand, often reason from the pay-as use principle: only pay transmission costs when you consume electricity and thus uses the network. Therefore the transmission costs are mainly determined by the peak demand(in kW) and not on the consumption(in kWh) of consumers.

Next to recovering the network costs there are two other important goals behind the tariff system design: the non-discriminatory principle and transparency, which are derived from European legislation[2]. The non-discriminatory principle means that consumers with a similar network demand should have similar transmission costs. Transparency is related to the method for determining the transmission prices and allocation to the consumer; consumers must know how their transmission costs are determined. In addition there are several principles, which should be applied as best as possible. These are:

- Cost engender principle**;** individuals pay the cost they impose on the network.
- Economic efficiency, both short- and long-term; tariffs should give incentives for efficient network use, but in such a way that in the long-term efficiency is achieved as well.
- Simplicity of tariff system; tariff system should be understandable.
- Stability/predictability of tariffs; adjustments in the tariff system should be preferably small or communicated sufficient time in advance.
- Flexibility for different market conditions; the electricity system is in transition and the tariff system should deal with changing or different market conditions.

The goals and principles are interdependent and can conflict with each other. They need to be fulfilled the best they can, for which trade-offs need to be made between the goals and principles. Hakvoort et al. (2013) identified six trade-offs, which further explains the secondary goals while discussing the trade-offs briefly in Table 1.

Therefore is concluded that the tariff system design is an institutional design question. The allocation of network costs can't follow a mathematical or economic principle and therefore is based on goals and principles.

[2] EU regulation 714/2009

Table 1: Conflicting goals of cost allocation in the electricity network (Hakvoort et al., 2013, p.11-13)

Trade-offs between principles	Explanation
Cost engender principle vs cost recovery	Cost engender means that efficient consumers pay less than inefficient consumers for the network they use. However, this doesn't automatically mean that these paid tariffs recover the total network cost.
Cost-engender principle vs competition	Cost engender would mean that consumers nearby generation plants would pay less than those consumer further away as they need "less network". This would for instance mean that imported electricity would have an competitive disadvantage over national produced electricity.
Cost engender principle vs simplicity	applying cost engender is quite complex due to the market model and physical properties of the electricity network as earlier discussed. Simplifying increases often the level of socialized cost, reducing the cost-causality.
Simplicity vs efficiency	Simplifying the tariff system often increases the level of socialized cost. This reduces the incentives to increase efficiency, as the different benefits that consumers have are not acknowledged.
Short-term vs long-term	On the short-term the network cost need to be recovered. Long-term the network should be efficient developed, for example with location depended tariffs. The optimal tariffs for the short- and long-term can therefore deviate from each other.
International level playing field (non-discriminatory)	As discussed in the introduction, the tariffs should be in proportion to the international market. Otherwise the Dutch (energy intensive) industry would have an international competitive disadvantage due to a higher electricity bill.

2.3. Determining transmission tariffs in the Netherlands: From network costs to transmission prices

The electricity network is a natural monopoly and therefore the allocation of the network cost is regulated. The ACM, the Dutch regulating organization of the electricity network, approves each year the height of the transmission tariffs per voltage level and system operator. The allocation of network cost is described in the tariff code (ACM, 2015a) and can be separated in 5 steps (Hakvoort et al., 2013; Ministerie van Binnenlandse Zaken, 2014; Ministerie van Economische Zaken, 2014):

1. Total network costs = total revenue transmission tariffs
2. Total income per system operator
3. Total income per voltage level
4. Total income per consumer groups
5. Transmission tariffs per consumer

1. Total network cost

The first step is to determine the total network costs, which directly determines the total revenue income from the transmission tariffs. The network costs consists of three categories: network costs of the current infrastructure, upcoming network investments and incentive factors for system operator to operate and invest efficiently in the network. The costs of the current infrastructure can be split in two: transport related network costs and transport unrelated network costs.

The transport related network costs are directly related and increase as the amount of electricity transported increases. These costs are mostly related to the physical infrastructure, such as depreciation of the network and its components or costs of building or maintaining the network. The exact details can be found in article 3.2.2.a of the tariff code (ACM, 2015b). These investments benefits

the whole network and are therefore allocated to all consumers. Since 2015 these costs also include the system services: costs related to safe and expedient transport, e.g. preventing congestion, black-start facilities and balancing demand and supply of electricity (TenneT, 2014). Previously to this date, these costs were reimbursed by a separate tariff.

The transport unrelated network costs are related to mainly overhead costs of the system operator, e.g. billing, customer service. The exact details can be found in article 3.2.2.b of the tariff code (ACM, 2015b). These costs are not related to the transport of electricity and are therefore reimbursed by a fixed tariff (See step 5.).

2. Total income per system operator (efficiency and expediency)

Not all the cost of a system operator are allocated to the consumers, first the regulator determines the efficient costs. The efficient costs are the total transmission revenues after regulations mimics a competition in a monopolistic market. The regulation should have them work efficient and expedient: there is checked if the costs made by the system operators are needed and if the activities are performed in a efficient way. Regional system operators have in addition a quality regulation to stimulate them to optimize the transmission service. The total revenue for the system operator are determined by the ACM, who determines the efficient cost, which includes a reasonable return on investment. The efficient costs are the actual costs the system operator has made, minus the efficient, expedient and quality regulation. This way the monopolistic position of the system operators is monitored and excessive profits are prevented.

3. Total income per voltage level

Subsequently the efficient costs are divided over the different voltage levels operated by a system operator. This means that all consumers connected to a voltage level from a specific system operator have the same transmission tariffs, however, differences can exist for consumers on the same voltage level which is operated by a different system operator. The allocation of the cost per voltage level is based on the cascading principle, which follows the hierarchical structure of electricity transmission discussed in paragraph 2.1**.**

The cascading method allocates the network costs to each voltage level, where the network costs are cascaded to lower voltage levels in ratio with the amount of power transported to that voltage level; The transmission incomes of a low voltage level are more than the total network costs of that voltage level, the additional income is used to reimburse the network costs of higher voltage levels. This follows the hierarchical structure of the electricity network where electricity is generated on high voltage levels and subsequently transported to the consumers on lower voltage levels. The electricity consumed at the low voltage levels is transported over the higher voltage levels and therefore the consumers also contribute to the network costs of these higher voltage levels.

4. Total income per consumer group

The total network costs per voltage level are allocated over the different network users connected to a voltage level. These are called network users, as it is possible that electricity producers also have transmission tariff for the electricity they fed into the network. Currently there is a producer tariff in the

legislation, but this is set on zero and therefore only consumers in the Netherlands have a transmission tariff.

Another distinction that can be made in groups of network users is based on their location. Generally this means that those network users who are located further from the feed-in point of the voltage level have a higher transmission price. This is currently not possible, as this is forbidden by European legislation (see paragraph 2.2). The reason for this restriction is based on the non-discriminatory principle: network users with similar load on the network should have similar transmission costs. Transmission prices based on the location of a network user would violate this principle, as a network user with a similar load but located at a different place would have a different transmission price. Network users have limited influence how far they are from a feed-in point and this strongly depends on the historical development of the network.

In the Netherlands two consumers groups are identified who would have too high transmission costs with the regular tariff system and therefore exemptions are made. These are the <600 hour exemption and a volume correction for large energy consumers exemption (VEMW, 2015b). The <600 hours exemption lowers the tariff components for network users who have a operating time of less than 600 hours. The volume correction applies for consumers with a operating time of >5700 hours and a consumption of >50GWh. These large consumers support the stability of the network and can therefore apply by the ACM for a reduction of transmission costs up to 90%.

5. Transmission tariff per consumer

The network cost allocated to the consumers groups on a voltage level are now specified to individual consumers with transmission tariffs. The transmission tariff can be based on the consumption or capacity of a consumer. A capacity based tariff means that the transmission tariff is based on the connection capacity to the grid; a physical limit of the maximum consumption a consumer has in kW or MW. With a transmission tariff based on consumption the consumer pays for every unit of electricity he consumes, in kWh or MWh. Table 2 shows an overview of the pros and cons of the two types of transmission tariffs which is subsequently elaborated upon.

Table 2: Comparison capacity and consumption based transmission tariffs (based on Hakvoort et al., (2013, p.35))

	Capacity based transmission tariff(kW)	Consumption based transmission tariff(kWh)
Pros	Reflects required network capacity and contribution to system peak	Reflects the use of the network, in both peak and off-peak hours
Cons	Tariff only based on small period of time	Fixed network costs are reimbursed with variable tariffs
	Contribution to system peak is charged, even if peak is not equal to system peak.	No distinction between peak and off-peak hours
	No charge for network use outside system peak time.	Inefficient incentives as consumers are not charged for their impact during system peak.
	Consumers with different loads profiles can be over/under charged	

A capacity based transmission tariffs reflects best the cost a consumer inflicts on the network, as the consumer pays for the contracted capacity of his connection. A capacity transmission tariff can be based

on the contribution to the system peak or the individual peak of the consumer. The system peak is the peak of the network; the highest load in the network in a specific time period. The system peak load is determine, where after the consumer is charged for their respectively load during the system. This means that consumers who demand less electricity during the system peak have lower transmission costs.

The transmission tariff based on the individual peak of a consumer doesn't take into account the system peak. The maximum load of a consumer is determined and the consumer is subsequently charged the transmission tariff based on his individual load. This method is easy to apply, because only the individual consumer peak loads need to be known. However, the system peak is overestimated as not every consumers' peak load is at the same moment. This means that a consumer whose peak demand is during off-peak hours are overcharged and consumers with a peak load during the system peak are undercharged. Another inefficiency of the capacity based transmission tariff is that it is only based on the peak load of a consumer, but the consumer isn't charged electricity consumption consumed at other moment then their peak load.

A consumption based transmission tariff does better reflect the use of the network instead of the system peak and network capacity. Those consumers who use more electricity have higher transmission costs regardless of the moment when it is consumed. A similar effect can occur as described for the capacity tariff; consumers who demand a lot of electricity during the system peak are undercharged and those who consume a lot during off-peak hours are overcharged. In addition the consumption based tariff can lead to inefficiency as the fixed network costs are charged based on variable transmission tariffs.

In the Netherlands, and also in other countries, a combination is used, where consumers are charged based on their capacity and their consumption. In the Netherlands consumers connected to voltage levels lower than middle voltage level have a consumption and capacity tariff. There is an exemption for households, they are charged a fixed yearly tariff and a single capacity tariff. The other consumers are charged for their capacity of their connection and for their actual peak load in the year. In addition, a fixed yearly tariff is charged, called vastrecht, that covers the transport independent costs of the system operators as discussed in step 1. For small consumers as households there is only a single fixed tariff.

In the transmission tariffs a time component can be incorporated, meaning that the transmission tariffs become variable instead of fixed in a year. Several time periods can be used, seasonal, daily, hourly or even dynamic prices: at any moment a different transmission tariff is applied. Time dependent transmission prices can be used to give additional incentives to consumers for efficient use of the network, i.e. demand response. The most common example is higher transmission prices during peak-hours than off-peak hours.

2.4. Energy transition: Historical changes and future developments in energy sector

The energy transition is broadly defined as "a radical, systemic and managed change towards 'more sustainable' or 'more effective' patterns of provision and use of energy" (Rutherford & Coutard, 2014, p.1353). Verbong & Geels (2007) argue that energy transition already started in 1960s and 1970s with the introduction of natural gas. Currently the energy sector is in transition to become more sustainable, as discussed in the introduction of the thesis.

At the end of the 1990s the liberalization and privatisation of the electricity sector started (van Damme, 2005). The change in the electricity law in 1998 started this process by separating production and distribution into different entities. A regulator of the energysector, the Directie Toezicht Energie which is now the ACM, was created and TenneT became the TSO of the high voltage grid (Verbong & Geels, 2007). The unbundling of production and distribution also meant the unbundling of electricity price and transmission prices (van Damme, 2005), which led the introduction of the tariff system that is still the basis of the current tariff system.

The core driver of the energy transition is the environment. This means for electricity production a shift from using fossil fuels to renewable energy sources. However, new technologies, such as electric vehicles, heat pumps etc., also change the demand side. In Paragraph 2.4.1 the impact of the energy transition on the electricity network and network management is discussed. Paragraph 2.4.2 focuses on the development of the tariff system since the liberalization of the electricity sector.

2.4.1. Impact of energy transition on the electricity network and network management: increasing network investments and balancing efforts

The energy transition results in a changing demand and supply of electricity (Blokhuis et al., 2011). On the demand side there are two developments: electrification and increasing share of distributed generation. Electrification is the increasing demand of electricity, as a result of for example the increasing share of heat pump and electric vehicles. Distributed generation is defined by Ackermann et al., (2001, p. 195) as "an electric power source connected directly to the distribution network or on the consumer site of the meter"). Solar PV or a windmill are often used as examples for distributed generation, but this also includes other generation technologies such as small CHP plants (Verbong & Geels, 2007). This changes the load profile of consumers, as they don't only consume but also produce electricity.

Distributed generation is one of the changes on the supply side: electricity is generated on low voltage networks. In addition renewable energy sources, e.g. large wind parks, are installed on land and off-shore. Solar PV and wind parks are likely to increase in the upcoming years to make the energy sector more sustainable. This is against the cascading approach, where electricity is assumed to be fed in on the high voltage levels of the electricity network.

Renewable energy sources are often intermittent and hard to predict how much electricity they produce at a certain moment. This increases the balancing efforts of the system operator to match demand and supply. With high penetration levels of energy sources connected to other voltage levels than the high voltage level, the electricity flow can change direction at certain moments. Electricity is

then transported from the low voltage level to higher voltage levels. This requires investments in transformation facilities and puts pressure on the cost allocation method of cascading, which assumes that electricity flows from high voltage to low voltage levels.

The energy transition has a lot of uncertainty that has to be dealt with (Netbeheer Nederland, 2011). External factors influence the direction and speed of the energy transition. For example policy for the use of renewable energy sources influences the penetration level of solar PV and wind power. System operators make investments for 40-80 years and base their investments on expected peak loads, which become harder to predict with above mentioned developments and uncertainties (Blokhuis et al., 2011). System operators have the dilemma between investing in capacity with the risk of overcapacity or wait for more certainty with a risk of under capacity, known as the system operator dilemma (Steenhuisen & de Bruijne, 2014). Either way, both risks result in increasing network costs.

To conclude, in the upcoming years network investments are most likely to increase (Netbeheer Nederland, 2011; Tennet, 2016). The capacity of the network needs to increase to transport produced electricity from new feed-in points to the consumers. The balancing efforts of the system operator increase as a result of more variability in demand and supply. Several alternatives are often mentioned to deal with these developments, as storage facilities, smart metering and smart grids. However, these developments are currently still in experimenting phase.

2.4.2. Changes in the tariff system

This paragraph briefly addresses three adjustments in the tariff system in respect to the cost allocation of network costs. The three changes are found using the website www.overheid.nl[3]. In 2009 there was a change for households, which led to determination of transmission costs based on a capacity tariff. Before 2009 the transmission costs were mainly determined by their consumption (Overheid.nl, 2009). Since 2014 large energy consumers can request a volume correction if they have a flat load profile and large electricity consumption (Overheid.nl, 2013). In the same law modification there was set that the tariff for system services is abolished (TenneT, 2014). The costs of system services are now included in the transmission tariff.

The other findings were often adjustments that weren't directly related to the cost allocation method, for example regarding electricity production or the unbundling and privatization. Quite a lot of changes are modifications of definitions or reformulations in the law, that result in small adjustments with little practical impact. Therefore can be concluded that since the tariff system is introduced in 1998, there have been only made small adjustments.

[3] There was searched for changes in the elektriciteitwet 1998 on the webpage www.overheid.nl in "het staatsblad" for "elektriciteitswet" posted by the ministery. This showed 78 results until 2000, of which 3 directly relate to the cost allocation of network costs.

2.5. Adjustment of the tariff system: a wicked problem

Given the abovementioned trends and issues regarding the current tariff system, the design of a tariff system design is addressed as a wicked problem. A wicked problem is a problem that cannot be "definitely described" and there are "no solutions in the sense of definitive and objective answers" (Rittel & Webber, 1973, p. 155). Weber & Khademian (2008) defined three dimensions of wicked problems: the level in which they are unstructured, the measure in which they are cross-cutting and their relative relentlessness. Unstructured means the causes and effects are difficult to identify, resulting in a highly complex and uncertain problem where a solution also changes the understanding of the problem. The cross-cutting dimension addresses the multiple stakeholders with diverse perspectives and interdependencies with each other. The relentless dimension addresses that there is no "final" optimal solution. The system changes or uncertainties that become more certain change the dynamics of the system. Also "ripples" occur, where efforts to solve the problem also haves consequences in other policy areas or markets.

The goals and principles discussed in paragraph 2.2 contribute to the unstructured dimension: the exact impact of a adjustment in the tariff system on the goals is unknown, but trade-offs between the goals have to be made. This is increased by the large design space of the tariff system, as could be seen in paragraph 2.3, resulting in a large amount of possible solutions. The cross-cutting dimension is identified by the several stakeholders and market parties that are addressed, who have their own perspective on how the tariff system should be designed and which goals are most important. The relentless aspect can be found in the institutional design question; the allocation of network costs over the network users is not an exact science; applying mathematical or economical principles or formulas won't result in an exact solution that should be accepted by all involved actors, this strongly depends how the goals and principles are valued by the different actors. The example regarding renewable energy policy and forthcoming uncertainty for system operators regarding their network investments are examples of the ripples that can occur. Given the above mentioned issues that have been identified in the current tariff system and the wicked nature of the problem, the question is what in what direction could the tariff system be designed.

3. Theory and methodology: Process management and Q methodology

The previous chapter argued that the adjustment of the tariff system design is a wicked problem. This chapter discusses two bodies of literature, Q methodology and process management, that deal with wicked problems and come to a design for a process approach to adjust the tariff system. Therefore Q methodology and process management literature are briefly introduced in respectively paragraph 3.1 and 3.2. Both Q methodology and process design are based on a similar core approach: gaining insights in the perspectives of stakeholders and sharing them leads to new insights, understanding between actors, resulting in richer solutions. Process managerial theory is fairly abstract, thereby making is hard to come to a concrete solution. Therefore paragraph 3.3 discusses the approach how the results of a Q methodology can support the design of a decision making process.

3.1. Q methodology

Q methodology is used to determine the discourse in the discussion about the tariff system. In this chapter the method is discussed briefly and its applicability on the discussion for adjusting the tariff system. Subsequently there is discussed how a Q methodological research is set up and are the degrees of freedom identified.

3.1.1. Introduction to Q

Q methodology is a study of subjectivity regarding a specific topic. Subjectivity are the points of view, meanings, perspectives, perceptions, opinions etc. of persons in respect to a specific topic. The emphasizes is on the subjectivity and not on the persons itself; The method is concerned with the shared perceptions rather than individual perceptions (Barry & Proops, 1999), or as Watts & Stenner (2005, p.86) phrase it: "what is decisive from a Q methodological perspective is less 'who said what about X?' than 'what is currently being said about X?' ". The Q method thereby has the capability to identify shared points of view, also known as discourses, regarding a specific topic.

Q methodology originates from the psychology domain, but is now also used in social sciences (see text block). It is a study that provides a foundation

Background on Q methodology

The Q-methodology was developed by William Stephenson in 1935 (See Stephenson, 1935a, 1935b), a physicist-physiologist from Britain. The method was first developed for and mainly used in psychology, challenging the Newtonian logic of 'testing' that continues to predominate in psychology (Stephenson, 1953).

Later the method is also used in other disciplines, mainly social studies (Barry & Proops, 1999). In the 1980s the Q-mythology was used in the USA in political science, with a major publication by Steven brown of his book Political subjectivity (S. R. Brown, 1980). Since the 1990s the amount of published studies using Q-methodology is increasing in a variety of sciences; life sciences, health sciences, physical sciences, and social sciences and humanities (S. R. Brown, Danielson, & van Exel, 2014).

Since 1977 there is a journal dedicated to Q-methodology and is in its 37th volume.(Website: http://www.operantsubjectivity.org/). In the beginning of the 1990s the ISSSS, International Society for the Scientific Study of Subjectivity, started with yearly conferences that are still organized and created an electronic discussion list(www.qmethod.org) which has now over 800 participants (S. R. Brown et al., 2014).

for the systematically study of subjectivity (Brown, 1993). It is often deployed to explore highly complex and socially contested issues, whereby the perspective of the participant is of great importance (Watts & Stenner, 2005). The Q method can be used to structure a discussion regarding the perspectives on a topic. It does not make use of predefined categories imposed by a researcher, but is uniquely capable of uncovering the discourse as revealed by the participants, revealing positions unanticipated by the researcher (Brown, 1980 in: van Eeten, 1999).

The Q method makes use of both qualitative and quantitative methods, therefore defined by Stenner & Rogers (2004) as a qualiquantological method. The researcher derives statements (the Q-set) from the concourse: all the different opinions, comments, value beliefs etc. regarding the topic. The participants (P-set) sort these statements on a scale, e.g. most agree to most disagree, called the Q-sort. This represents the perspective of the participant on the topic. The Q-sorts are compared using statistical techniques to find factors: commonalities between the Q-sorts. A factor consist of aggregated sorting of statements of a group of participants that have commonalities. Analyzing and interpretation of the factor leads to the a description of the discourse.

The factors together show the different discourses or positions of the participants regarding the topic. This can be used to find common ground on aspects of the issue and indicate where agreements can be found. The other way around, it indicates where disagreement about aspects of the topic are. A more extensive description for using the Q methodology, applied to the discussion of the tariff system design, can be found in chapter 4.

3.1.2. The Q methodology for the adjustment the tariff system

The Q methodology has several characteristics that make it very suitable to use in this thesis and with regards to the tariff system design. First, the Q methodology is exploratory by determining the discourses of a topic and does not strive to generalize this to a population(Watts & Stenner, 2012). This research also strives to explore the discourse around the tariff system design and is interested in what plays in the discussion around it. Therefore it wants to determine the different discourses. There is not strived to design a new tariff system in the thesis, but to facilitate the process to adjust the tariff system. Generalization to a population is thus not needed, as it wants to show the different perspectives on the issue to subsequently deal with the wickedness of the issue

The factors that result from the Q methodology contain an aggregated ordering of statements and are interpreted together to form perspectives regarding the tariff system design. These factors are used to structure the process as they identify on which topics there is agreement or disagreement. In addition, the sorting of statements and knowing the different discourses helps the participants better understand their own and other participants their perspective regarding the topic. Cuppen et al., (2010) stated that this contributes to an open and constructive atmosphere in her specific process and the participants associated identification of the different discourses that they were ‘allowed’ to disagree with each other. This can subsequently lead to new insights, learning from each other and eventually might result in richer solutions that consider the different perspectives leading to more support for the chosen solution.

Also Barry & Proops (1999, p.337) state regarding the use of Q methodology in environmental issues: “Q methodology has the capacity to allow a more effective form of policy making and implementation process”. Environmental issues are also often characterized with a wicked nature.

Stenner, Watts & Worrel, (2008) addresses that the general strength of Q lies in structuring the complexity of issues by studying and by communicating what the discourses in complex and social contestable issues are. The tariff system design with its wicked nature also doesn't have a single right answer, but the preferred design depends on the underlying perspectives regarding the issue, see chapter 2.

Q methodology is based on 'finite diversity of perspectives' (Thomas & Baas, 1992). Generally the method results in 2-6 factors (Cuppen et al., 2010), meaning that there are only few general viewpoints on the topic. This means that the group of participants can be relatively small, as long as all the different perspectives of the stakeholders are represented. This reduces the total time needed to perform the sorting of statements by participants, which makes the method very suitable in respect the time constraint and limited resources for the thesis.

3.1.3. Setting up Q methodological research

The Q-methodology is generally separated in six steps, which are described by several researchers (Barry & Proops, 1999; S. R. Brown, 1993; Cuppen et al., 2010; McKeown & Thomas., 2013; van Eeten, 1999; Watts & Stenner, 2005). Watts & Stenner (2012) is used as 'guidebook' for the design of the Q methodology in this thesis, as they give a clear overview of the choices and argumentation when Q methodology is used. For those who are interested in a more detailed but comprehensive introduction to the Q methodology, there is referred to Exel (2005)[4]. For each step the design variables are identified at the end of the step. The six steps are:

1. Define concourse (Watts & Stenner, 2012, p.53-56): The goal of the first step is to define the concourse and subsequently draw statements from it that are used in the second step. This means that the different opinions regarding the topic need to be defined. This can be done with (academic) literature research, analysing literary and popular mediums(magazines, television programmes etc.) and/ or interviews.

   Design variables: Choice of concourse sources

2. Define statements (Q set) (Watts & Stenner, 2012, p.56-65): From the concourse statements are derived, that are later sorted by the participants. All the statements must ideally answer one (research) question and should be as closely to the original statement from the concourse, to prevent that the researcher generates his own items. The statements together form the Q-set which cover the concourse, all that is being said regarding a topic, in a balanced way. This can be explained by the metaphor of laying carpet in a room: the carpet tiles are the statements, which should cover the complete floor (concourse) without too much overlap and without leaving spaces open. This can be achieved with an structured or unstructured approach, which will be later explained in chapter 4. The number of statements in the Q-set is mostly dictated by how many statements are needed to cover and balance the topic. Therefore a check by experts is often very useful. In general this results between the 40-80 statements, but lower or higher Q-sets are also possible.

   Design variables: structured versus unstructured Q-set definition.

[4] http://qmethod.org/articles/vanExel.pdf

3. Create a set of participants (P Set) (Watts & Stenner, 2012, p.69-73): The third step is to select participants who will sort the statements. It is important to have a heterogeneous group of participants in respect to their view regarding the topic. Therefore strategic sampling is often used, where participants are selected that have likely a specific point of view that is different from others. Also here the group of participants should be balanced and cover the perspectives regarding the topic. This also dictates for a large extent the number of participants, but in general the rule of thumb is that you use less participants than statements.. Demographic representation doesn't play a direct role, as generalization to the population is not the aim of the Q-method.

   Design variables: Selection method for participants

4. Sorting of statements by participants (Q sort) (Watts & Stenner, 2012, p.74-87): In this step the participants sort the statements according to some distribution, also known as the grid design. This is typically done based on a (quasi-) normal distribution with phrases as most agree to most disagree, see Figure 2 for an example. A free distribution or other forced distribution types are also possible, but the influence of the distribution type generally doesn't affect the outcome of your factors. It can however upset the participants, as the distribution doesn't match their distribution of statements. The Q-sort can be executed by post, internet or by a physical interview. Physical interviews are mostly recommended, due to the post-sort questions; After the Q-sort the participants are ask to explain their Q-sort, with a specific focus on the extremes. This is used in the interpretation of the factors in a later stage.

   Design variables: Grid design. Q-sort execution.

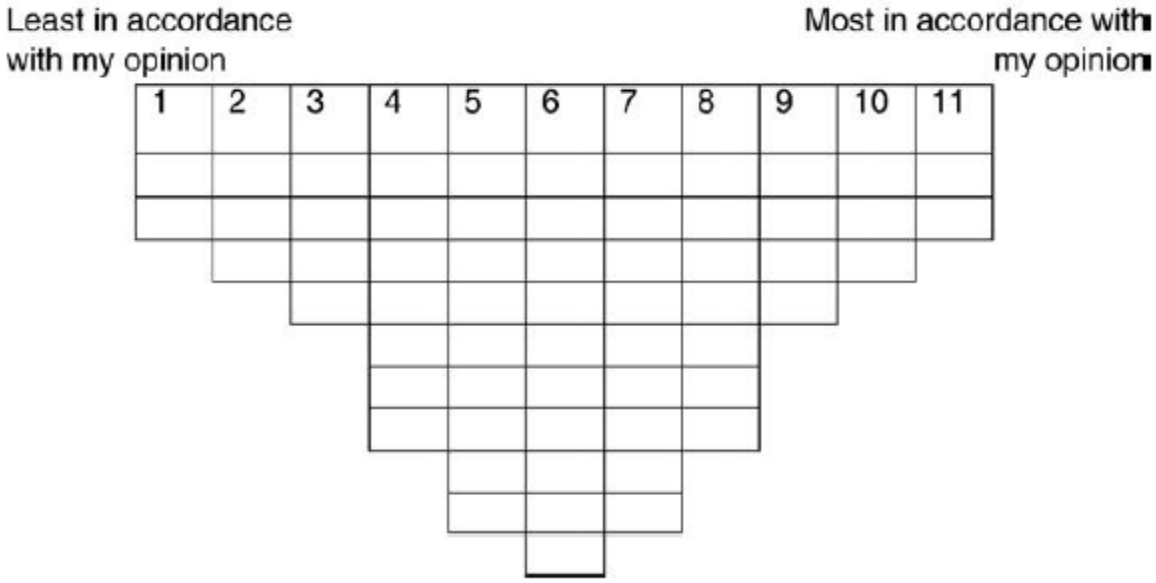

Figure 2: Possible Q-sort distribution (CUPPEN,2010). In each box the participant places a statement according their perspective.

5. Analysis (Factor rotation) (Watts & Stenner, 2012, p.91-144): The next step is to statistically analyse the Q-sorts and determine factors: cluster of statements. Several statistical choices and decisions have to be made, which will be elaborated in detail in during the application of the Q- methdology**,** as they are now not directly relevant in explaining the steps in the Q method. For now this step consist of factor extraction, clustering of statements, and factor rotation; mapping the relative positions of all the Q-sorts. The analysis will be executed with the PQ method software, as this is used in Watts & Stenner (2012) and is free of charge available[5].

   Design variables: Statistical choices

6. Interpretation (Watts & Stenner, 2012, p.145-168): The last step is to interpret the factors. This is done by analysing the statements that are ranked at the begin and end of the distribution(e.g. most agree, most disagree) and secondly which statements score higher/lower in that factor is relation to other factors. Here the post Q-sort interview with the participants from step 4 are very helpful to interpreter the factors.

The steps are described in more detail in chapter 4, where it is applied on the case study for the tariff system design.

3.2. Process management

Apart from Q methodology, another body of literature that deals with wicked problems and is applied on change in complex issues, where multiple actors are involved in a network and interact with each other in a series of negotiations, is process management. The process approach is focussed on how content is developed and implemented, by letting the parties agree on how the decision process is made and give all involved parties the opportunity to serve their own interest (de Bruijn et al., 2010). The focus is initially not on the issue at hand, as all choices regarding potential solutions for a wicked problem are debatable, and therefore the focus is how the decision making process will be formed, leaving the discussion open for all possible solutions. Thereby the process managerial approach improves the chances of finding a solution to the issue. the Therefore the six main reasons to apply process management are briefly discussed and the general goal of the process managerial approach. Subsequently the four core elements for a good process design addressed.

3.2.1. Six main arguments for process management and the goal of a process design

De Bruijn et al., (2010, p.20-23) provides six main arguments for process management for change in complex issues:

- Reducing substantive uncertainty: the different stakeholders all have relevant information. When all relevant stakeholders participate in the process this information can be obtained and the different sources can be tested against each other.
- Enriching problem definitions and solutions: The different perspectives on the problem definition and solution enriches the participants; an individual participant may develop a richer view for itself by learning from the other participants perspective and collective enrichment by understanding and appreciating each other's perspective in respect with the problem definition and solution.

[5] Available from: http://schmolck.userweb.mwn.de/qmethod/

- Incorporating dynamics: the problem definition and solution can become obsolete, as new information becomes available. This information usually comes from actors and by incorporating them this information becomes available within the process, rather than outside the process where it can be used by the actors to distance themselves from the solution. Having all relevant actors involved within the process, the new information can be used within the process to gain new insights and reflect on the current view of involved actors.
- Transparency in decision making: The involved actors can inquire where they stand during the process and influence the decision making process and influence the process over time by actively taking part in it.
- De-politicizing decision making: Change often results in resistance, as actors are steered into a direction or solution which they don't agree with. The process approach can reduce this resistance, as it doesn't focus on the substance of change but on the potential of a change.
- Support: Actors often have obstructive power, meaning they can block or deliberately stall the decision making process. They are more likely to have support when they are involved in the decision making process, where they can influence the problem definition and solution.

The six arguments don't guarantee that the process results in a solution, but address the problems that often result in a 'deadlock' or ' dialogue of the deaf' as discussed in chapter 1**.** Instead of focussing on possible solutions, actors are involved in defining the problem definition and potential solutions. This influence creates a better understanding in other actors perspective on the issue at hand. In the end, this should lead to more support for the final decision or at least a better understanding for the decision. Therefore it is important to have all relevant actors involved in the decision making process. Note that the final decision is not per definition a implementation or adjustment, but can also result in the decision to do nothing.

The process is thus not focussed on finding a solution to a predefined problem formulation by addressing several means. It is focussed on a goal that the process aims to achieve. Goals can be achieved by a variety of 'solutions', giving the involved actors the opportunity to address and argue for their preferred solutions and reflect on each other's solutions. The goal should therefore be formulated in an abstract manner, leaving the potential solution space as wide as possible. Ideally the goal should be formulated as a public goal, i.e. creating a win-win situation for the involved actors. This stimulates actors to take part in the process, as they have something to gain by participating and progressing the process.

3.2.2. Four core elements of a good process design and their design principles

De Bruijn et al., (2010, p.43) identified 4 core elements and design principles to achieve them, see Table 3. The principles are abstractly formulated and therefore need to be specified for each process design. For quite some design principles this can be achieved by formulating them process agreements. In paragraph 1.3.2 some of the elements and design principles are further elaborated upon in relation to the Q methodology.

Table 3: Four elements of a good process design and design principles.

Openess
• All relevant parties are involved in the decision-making process
• Substantive choices are transformed into process-type agreements
• Both process and process management are transparent
Protection of core values
• The core values of parties are protected
• Parties commit to the process rather than to the results
• Parties may postpone their commitments
• The process has exit rules
Progress
• Stimulate 'early participation'
• The process carriers a prospect of gain
• There are quick wins
• The process is heavily staffed
• Conflicts are addressed in the periphery of the process
• Tolerance towards ambiguity
• Command and control are used to maintain momentum
Substance
• Substantive insights are used for facilitation. The role of experts and stakeholders are both bundled & unbundled
• The process proceeds from substantive variety to selection

3.2.3. Process agreements

The process agreements precede the actual negotiation process and are defined as "agreements about the rules that the parties will use to reach a decision" (de Bruijn et al., 2010, p.3). The rules are established to come eventually to a decision, but also get the actors to participate in the process. The rules should give sufficient opportunity to the potential actors to serve their interests, as they are less likely to join the process if the process is steered towards a direction that they don't prefer, especially if they are required to come to a decision.

3.2.4. Negotiation rounds: interaction in a process

Decision making in a process is not linear, as the issue is too complex to come directly to a conclusion, meaning actors have several moments of interaction. Multiple negotiations will be needed to eventually make a final decision. During negotiations actors interact with each other and discuss a topic, which ends with a provisional result. De Bruijn et al. (2010, p.17) refer to this as a round. Bekkering & Walter (2013, p.21) refer to this as a "wyber": An idea is discussed based on facts and perspectives of stakeholders to gain information (diverge), subsequently from this information conclusions are drawn (converge) and finally the wyber is finished by formalizing the conclusions (consolidate).

At the end of the round or wyber there are often "winners and losers" (De Bruijn et al. 2010, p.18), stakeholders who did get out of the negotiation what they wanted and stakeholders who didn't. In following negotiations the 'losers' will try to make up for their losses. The losers can be compensated to create progress in the process, or coupling can be applied, where 'winners' deliberately give in on other issues to compensate the 'losers'. The multiple negotiations can be used to exchange wins, where at the end of the process everybody has gain something from the process. It is therefore important to have a wide scope for the process to be able to address several issues.

3.2.5. Process manager

The process is managed by the process manager, which has an "independent, disinterested role in the decision-making process, an derives much of his authority from this principle"(de Bruijn et al., 2010, p.93). An independent process manager creates trust in the process and the manager itself; when the outcome disinterests the manager, the stakeholders can trust the process manager to steer the process in an objective manner. The process manager should additionally be knowledgeable regarding the issue to understand the perspectives and be taken seriously by the actors. With the knowledge the process manager should at least be able to ask the right questions during the negotiations and preferably to be able to evaluate the answers.

3.3. Using Q-methodology as input for the process design

Both bodies of literature for Q methodology and process management are discussed. In paragraph 3.1 Q methodology is discussed, which shows the value for applying it on wicked problems. Subsequently paragraph 3.2 discussed process management, an abstract approach for the design of a decision making process to deal with wicked problems. This paragraph links the two bodies of literature and shows where the value of Q methodology is in the design of a process for a wicked problem. First an overview of existing literature is presented where Q methodology is applied on a wicked problem. Subsequently, the value of Q methodology is discussed for the design of a process approach.

3.3.1. Applications of Q-methodology for process aspects

This paragraph gives an overview of the application of Q methodology in processes regarding wicked problems. A search with Scopus results in 33 articles that addressed wicked problems with the Q-methodology[6]. Most of the found literature are case-studies to determine preferences, perspectives, collaborative viewpoints etc. for a specific topic. The topics various a lot, but often relate to public policy. This is no coincidence, as wicked problems are often found in public policy (Head, 2008) and strongly relate to the change in complex issues described by de Bruijn et al., (2010), see paragraph 3.2. They both have as a core approach that gaining insights in the perspectives of stakeholders and sharing them leads to new insights, understanding between actors, resulting in progress in the process.

Several studies have used Q-methodology to identify common ground and differences in the perspectives of stakeholders and subsequently gain new insights on or structuring the wicked problem. Thereby Q-methodology can offer a solution to a wicked problem. So has Signal et al., (2013) used Q methodology for the policy regarding health promotion problems in New Zealand and Frantzi, et al. (2009) to determine how the effectiveness of international environmental regimes are perceived.

Cuppen et al., (2010) applied Q-methodology to select stakeholders in the biomass debate. In Cuppen (2013) in shown how Q methodology can be used to support the design and evaluation of stakeholder dialogues. Based on Stirling (1998) definition of dimensions of diversity (variety, balance, disparity) “a balanced representation of the variety of perspectives, making sure that disparate (marginal) perspectives were included” Cuppen (2013, p145). Here Q methodology is applied to execute the first design principle for an open process: “All relevant parties are involved in the decision making process” (see Table 3). Although there can be debated what the relevant parties for a process are, Q methodology can be used to support the decision when stakeholders are selected for a process design

3.3.2. Potential applications for Q methodology in a process design

The previous paragraph mentioned several Q methodological researches that address specific aspects of a process design. This paragraph argues that Q methodology has the potential to address more elements of a good process design, resulting in process approach for adjusting the tariff system of the Dutch electricity network. Note that every wicked problem is unique therefore the use of Q methodology won’t per definition directly result in aspects of a process design. Therefore the four elements of a good process design are discussed and how Q methodology potentially can address several design principles of these elements. Thereby showing that the insights obtained by Q methodology can help structure and give direction to the a decision making process and how the identification of common ground and potential conflicts can be dealt with at the start of the process. The following sections discuss the four elements of a good process design and address those design principles where Q methodological results have the potential to contribute to.

[6] Search terms: (ALL("Q-method*")) AND (ALL(wicked)). Date:01-04-2016

Openess

Openness refers the character of the process, the option to join the process and transparency regarding the process(de Bruijn et al., 2010, p.43-46). As already discussed the Q methodology can be used to select stakeholders for a process based on the different perspectives identified with Q-methodology. During the process different rounds will be determined and a similar approach can be applied to have every discourse represented in the different rounds. The second design principle to have an open process is that substantive choices are formulated in process agreements. Q methodology gives a wide variety of perspectives and thereby might reveal unanticipated perspectives. With the help of post-sort questions, the argumentation behind the perspective becomes more clear. This can help the process manager formulated the process agreements as the substantive choices becomes more clear to the process manager and the process manager knows the argumentation behind the substantive choices. The third process design principle is more a precondition in a process: "both process and process management are transparent". However, as Q methodology can identify potential conflicts in perspectives, there can be taken measures at the start of the process. This makes the process from the beginning more transparent then measures are taken after conflicts between actors arise.

Protection of core values

The protection of core values, although might suggest, don't relate to an individual actor or participant position, but has a more generic nature(de Bruijn et al., 2010, p.46-48). The protection of core values should encourage the stakeholders to join the process and prevent them feeling trapped into a direction which they disapprove of. Q methodology can help identify the core values of stakeholders, for example based on a identified perspective, a shared core value could be identified based on the identified discourses.

Progress

A process can show little process, as the stakeholders commit to the decision making process rather than the result or sub decisions(de Bruijn et al., 2010, p.48-53). A prospect of gain can stimulate the stakeholders to actively work towards a decision and result in progress, as the actors know that the process and the final decision will gain them something. The identified perspectives may identify potential gains, or ideally, result in identifying a public goal that is shared by all parties. This could also be the case for identifying potential quick wins for (a groups of) stakeholders. The design principle "Conflicts are addressed in the periphery of the process" could partly be addressed. Before conflicts can be dealt with, they have to be identified, which Q methodology has to potential to do.

Substance

Wicked problems often lack substance, as the there is little objective information and actual decisions and execution of them comes late in the process(de Bruijn et al., 2010, p.53-56). Q methodology can results in substantive insights with the identified discourses and by discussing them in the process, facilitating more substantive insights as actors learn from each other and better understand each other's perspective.

4. Case study: Q methodology applied on tariff system design

Q methodology is used for the design of the process approach to address the design principles of a good process design, as discussed in the previous chapter. This chapter describes the Q methodology and applies it on the case study of adjusting the tariff system design. Each step, as discussed in chapter 3.1.3, is extensively described in the following paragraphs, with specific focus on the goal the each step and the choices in the design variables. Appendix A contains additional details for several of the steps.

4.1. Defining the concourse

The goal of the first step is to determine the concourse, of which subsequently statements are drawn. Brown (1993) refers to the concourse as all communicability surrounding a specific topic. The concourse consist of a very wide sample of topic, value beliefs, opinions etc. regarding the topic of study. From these communications statements are drawn as a sample; "in other words, the concourse is to Q set what population is to person sample" (Watts & Stenner, 2012, p.54).

Research question concourse

To define the concourse, a research question has to be formulated, which sets the boundaries of the research. The statements drawn from the concourse should answer this research question. For the this study the following research question was formulated:

How should the electricity tariff system in the Netherlands develop in the upcoming 10 years?

The time span of 10 years is chosen for practical reasons and to give the participants the feeling that the time span is sufficient to realize actual changes. The method for the tariff regulation, "het methodebesluit", is adapted every 3-5 years (VEMW, 2015a). This means that in 10 years the tariff regulation can be changed at least 2 times. This ways the participant gets the feeling that real changes can be realized and is less restricted to what is possible to realize in the time span. This would most likely result in the actual perspective of the participants instead of what their opinion is on what is possible to change in the time span.

Secondly, in this time span of 10 years there are two renewable targets: 14% renewable generation in 2020 en 16% in 2023 (SER, 2013b). The Energie akkoord mentions investments which are needed in the network, to deal the increasing share of (off-shore) wind parks and decentral electricity generation (SER, 2013a). These renewable targets indicate the change that is happening with the energy transition and give a sense of urgency. Assumed is that most people have a future scenario equal to the Energieakkoord; windpower and decentralized increases and therefore investments are needed in the network. The time span is not set higher, to prevent large variations in the perceptions of the participants how future electricity generation will develop. The clear renewable targets for 2023 are expected to be achieved by mostly already existing technologies (wind and decentralized generation) and a general perception on the impact of the network. Prolonging the time span would increase the differences in perspectives on future electricity generation and what the impact can be on development

of the network. This can result in differences regarding the context, leading to differences in discourses as a result from a different perspective of future energy scenarios instead of the tariff system design. This could mean that people agree on a certain tariff system design in similar a context, but disagree about the context and therefore about the tariff system design. As this study focuses on the tariff system design, the discussion about future energy sector scenarios should be kept to a minimum and therefore a longer time span is assumed not feasible. This assumption will be verified in the post-sort interviews., see paragraph 4.4.

Lastly, the time span was preferred to be a round number to prevent questions about the time span. The combination 10 and 2025 was, in combination with the above two arguments, therefore a suitable time span. This keeps the participant focused on the topic of the tariff system design and prevents discussion about the time span en energy sector context. A question was asked to the participant after the sorting of statements to check if this was achieved (See step 4).

Approach concourse

Two general types of sources can be used to determine the concourse: naturalistic and quasi-naturalistic (Robbins & Krueger, 2000). A naturalistic concourse is based on interviews with participants of which statements are directly drawn; the concourse is directly related to the study where the participants that sort the statements are the same as those interviewed . A quasi-naturalistic concourse is based on a variety of external sources that are not directly related to the study, such as literature, magazines, blogs and interviews.

For this study a hybrid version is used: A literature study(google search) and interviews with participants are conducted. The google search consisted of two parts: identification of web pages/newsfeeds related to the subject and the finding of articles/blogs of which directly statements could be drawn. Additional interviews are done to check the completeness of the concourse, derive a deeper level of understanding behind the argumentation of certain concourse material and gain additional information that is used in the google search. The google search often resulted in articles with varying context and therefore statements weren't always directly suitable for this study. The concourse definition is conducted iteratively: where new information from the interviews was used in the google search and vice versa (see Figure 3). A more detailed approach of the google search and concourse interviews can be found in respectively appendix A.1

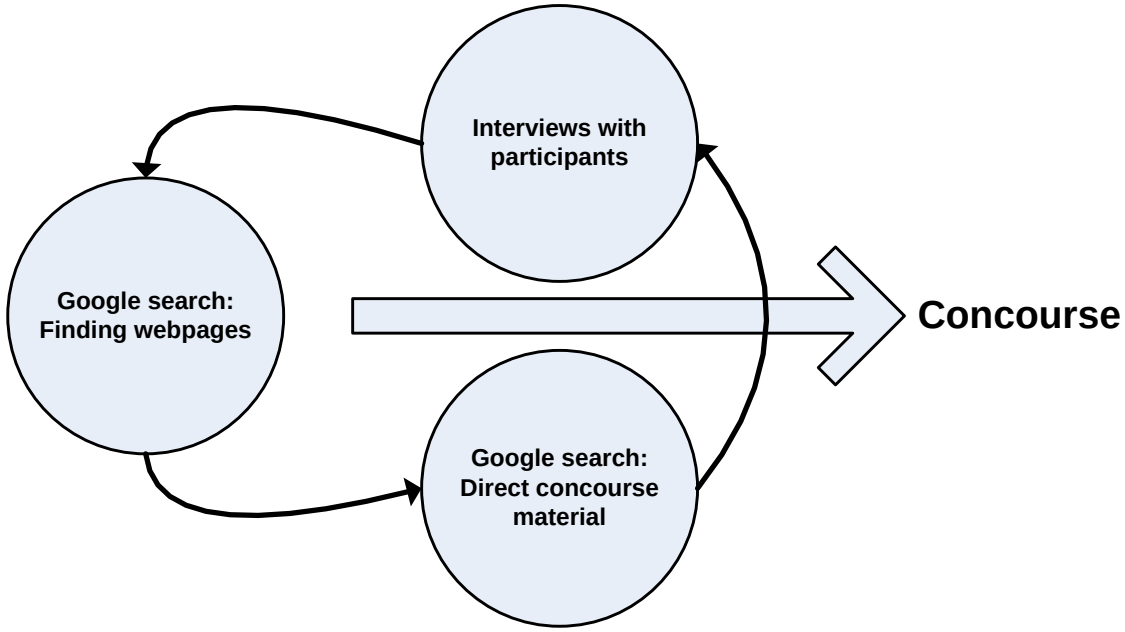

Figure 3: Approach concourse definition

4.2. Step 2: Define statements (Q set)

The goal of the second step is to draw statements from the concourse, which together from the Q set. The Q set should be representative for the concourse: each statements should be a samples of the concourse. The approach of Watts & Stenner (2012) advocates to create an overly large number of statements which can later be refined and reduced. Therefore, initially the only selection criteria of statement is that they relate to the research question formulated in step 1. This resulted in over 250 statements drawn from the concourse, which obviously contained replicas and redundancies among the statements.

These statements need to be refined to get a comprehensive Q set. Watts & Stenner (2012) mention that there is no single or correct way to generate a Q set and mention that a "perfect Q set" is fantasy or fiction. Brown (1980) also calls the design of a Q set 'more art than a science'. However, the main characteristics of an effective Q set is coverage and balance (Watts & Stenner, 2012, p.58): "a Q-set should be able to represent the different perspectives on the topics and should not be value-laden or biased towards a certain perspective".

Watts & Stenner (2012) mention varying sources about the amount of statements in a Q-set. They give as rule of thumb that a Q-set should contain between 40 and 60 statements. The lower boundary is set as smaller Q sets might have the risk of adequate coverage of the concourse. The upper boundary is more pragmatic; more items can make the sorting of statements 'demanding and unwieldy'. Depending on the goal of the research and research question, there can be chosen for Q-sets with more or less statements. Therefore the author has chosen the coverage and balance as main criteria and if possible to stay within the boundaries given by Watts & Stenner (2012) with the rule of thumb of 40-60 statements.

Watts & Stenner (2012) give two general processes for the Q-set design: a structured or unstructured process. A structured Q set process is constructed based on categories based on some

theory. The subject is broken down into different components and for each component some, often 5-6, statements are selected. This prevents bias of the researcher and helps balance the Q-set. However, there is a risk of overlap between components which can lead to unnecessary repetition or redundancy. The unstructured Q-set process still often starts by identifying components, but selects statements by understanding the subject as a whole. The advantage is that the statements are representative of the whole concourse, instead of components in the concourse. However, this process is more time consuming and requires deep understanding of the topic.

A fully structured approach didn't seemed feasible, as limited research was done on the topic as a whole, but research often focused on certain aspects of the tariff system, as shown in chapter 1. This would mean that components based on theory and literature would lead to a lot of overlap between components and therefore redundancy in statements. Therefore a more unstructured process was followed to determine the Q-set. However, the different levels of detail in statements led to the conclusion that selection of statements based on only one categorization wasn't satisfactory. Therefore the statements were categorized based on two groups of categories, where after the two 'draft Q sets' were compared and made into a single Q-set.

The first categorization was based on Hakvoort et al. (2013)**,** who determined 4 steps when designing a tariff system. These 4 steps systematically covered the aspects of the tariff system design and therefore seemed a good categorization of the physical aspects of the tariff system design. The four components are:

1. Determining the total network cost
2. Allocating cost to producers and consumers
3. Allocation to different categories of consumers
4. Allocation to specific users.

However, a lot of the statements from the concourse are more value laden, derived goals to achieve, values or other more soft aspects that don't fit the categorization of Hakvoort et al. (2013). Therefore the author created another categorization based on the concourse to cover the goals, values and beliefs of the tariff system. This categorization was constructed fluently, meaning that new categories were made when a statement didn't fit a previous defined categories. Iteratively components were adapted to fit with the subsequent statements, which resulted in the following categorization. Environmental

A. Task System Operators
B. European aspects
C. Allocation aspects
D. Incentives to network users
E. Cost recovery
F. Level playing field
G. Affordability
H. Simplicity
I. Participation/consultation
J. Quality of network

Two "draft Q-sets" were made based on the two categorization types, but used a similar approach to come to the a draft Q-set. Per category statements were reviewed for replicas and redundancies. Then a selection of statements was made to cover the concourse based on the categories. This resulted in two "draft Q sets" based on the two categorization containing respectively 45 and 50 statements, which can be found in appendix A.3.

The two draft Q sets reduced the amount of statements to sample from, which made it easier to select statements based on the whole concourse in the unstructured process. The two "draft Q-sets" are reviewed in respect to each other and combined to a single Q-set. This Q-set was reviewed by two

experts from the field: Rudi Hakvoort (TU Delft- TPM faculty) and Tim Lucas (TNO). The experts checked beside the coverage and balance of the Q-set also if statements weren't double-barrelled, clearly formulated and straightforward. After a final revision based on the expert check a definitive Q set was constructed of 55 statements (see next page). To reduce the length of the statements and therefore the size of the grid on which the statements are sorted on, the statements are a follow-up of the sentence: in 10 years I'd like to see a tariff system that…. (translated to English). The construction of statements is visualized in the Figure 4.

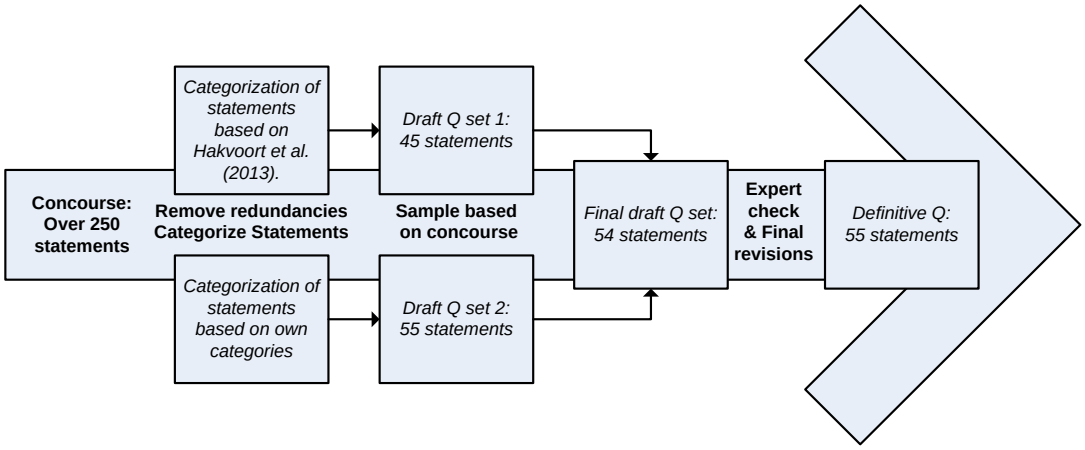

Figure 4: Approach Q-set definition

Final Q-set: 55 statements answering the research question:

Over 10 jaar zie ik graag een tariefsystematiek waarbij...

1. Investeringen in het netwerk zoveel mogelijk worden uitgesteld tot er meer zekerheid is over de toekomstige energievraag voor het netwerk.
2. Investeringen in het netwerk dusdanig ruim worden uitgevoerd, dat er in de afschrijvingstermijn van de investering geen capaciteitstekort kan worden verwacht.
3. Het netwerk op een gegeven moment als 'definitief' wordt beschouwd; uitbreiding van het netwerk (nieuw stuk netwerk) wordt (gedeeltelijk) bekostigd door de aangeslotenen aan dit nieuwe stuk netwerk.
4. De interconnectie capaciteit volledige marktkoppeling mogelijk maakt.
5. De interconnectie capaciteit afhankelijk is van de import en export met onze buurlanden.
6. Producenten een transporttarief hebben.
7. Producenten alleen een transporttarief hebben, wanneer we netto elektriciteit exporteren.
8. Producenten alleen een transporttarief hebben, wanneer dit door Europa voor alle landen verplicht wordt gesteld.
9. De hoeveelheid elektriciteit die geproduceerd wordt op een netvlak (gedeeltelijk) invloed heeft op de toedeling van netwerkkosten aan een netvlak
10. Het aantal netvlakken tussen producent en afnemer (gedeeltelijk) bepalen hoe hoog de transportkosten zijn [niveaustelsel principe].
11. Verliezen (gedeeltelijk) in het transporttarief worden verwerkt.
12. Congestie in het netwerk (gedeeltelijk) invloed heeft op de hoogte van het transporttarief.
13. De cascademethodiek wordt toegepast.
14. Het belangrijker is dat aangeslotene de juiste prikkels krijgen dan dat de tarieven de kosten van het netwerk dekken; eventuele tekorten worden aangevuld vanuit algemene middelen van de overheid.
15. Iedereen meebetaalt aan het netwerk, ook als je er niet op bent aangesloten.
16. De transporttarieven variabel zijn in de tijd; op elk moment kan er een ander transporttarief zijn
17. De transporttarieven verschillen in de tijd; op vooraf gedefinieerde momenten zijn er prijsverschillen in het tarief [uren, dagen, seizoen etc.].
18. Decentrale opwekking moet een apart transporttarief heeft.

19. Er meer soorten contracttypen zijn voor de transporttarieven van kleinverbruikers.
20. Er contractvormen zijn waarbij je niet altijd zoveel kan afnemen als je wilt; wanneer het nodig is kan je aansluiting worden gereduceerd tot een minimale “baseload”.
21. Het een optie is om te kiezen voor een transporttarief met vaste tarieven of variabele tarieven.
22. De netbeheerder flexibiliteit vraagt van een aangeslotene, tegen een vergoeding, wanneer hij hier behoefte aan heeft.
23. Het netbeheer ondergeschikt is aan een goed werkende energiemarkt.
24. Er wordt gezorgd voor minimale barrières voor marktwerking.
25. Transportkosten in Nederland voor aangeslotene niet (significant) hoger zijn dan omringende landen.
26. Er wordt gestreefd naar een zo zuiver mogelijk kostenveroorzakings-principe.
27. Het transporttarief hoofdzakelijk gebaseerd is op capaciteit(kW) van de aangeslotene.
28. Een verbruikscomponent (kWh) in het transporttarief zit.
29. Het transporttarief hoofdzakelijk gebaseerd is op verbruik (kWh) van elektriciteit
30. De tariefsystematiek flexibel wordt ingericht, zodat er gemakkelijk en snel aanpassingen kunnen worden gedaan wanneer er (onvoorziene) ontwikkelingen plaatsvinden.
31. De tariefsystematiek geleidelijk over de jaren wordt aangepast.
32. De hoogte van het capaciteitstarief gekoppeld is aan de hoogte van de systeempiek die er is op het moment van de maximale capaciteitsvraag van netgebruiker.
33. De netwerkkosten (gedeeltelijk) gedekt worden door algemene middelen van de overheid.
34. De tariefsystematiek prikkels betreffende netwerkinvesteringen geeft aan de netbeheerder.
35. Decentrale opwekking en duurzame technieken moeten gestimuleerd worden met transporttarieven.
36. De tariefsystematiek zoveel mogelijk hetzelfde is gebleven; veranderingen leiden tot een onzeker investeringsklimaat en zullen tot suboptimale prikkels en kostenverdelingen leiden.
37. De netbeheerder zich ook op de markt mag begeven, indien hij hierdoor de netwerkkosten kan verlagen.
38. De netbeheerder alleen rollen vervult die niet door de markt vervuld worden, maar waar hij wel behoefte aan heeft.
39. Regionale netbeheerders opslag mogen toepassen in het netwerk, zolang ze geen elektriciteit verkopen.
40. Investeringen in het netwerk worden gebaseerd op regelgeving en normen van de kwaliteit van het netwerk
41. Er in Europa naar een uniforme tariefsystematiek wordt gestreefd; bijvoorbeeld dezelfde tariefdragers, tariefhoogtes of kortingen.
42. Er mogelijkheden zijn voor kortingen(bijvoorbeeld grootverbruikers regeling, 600 uurs regeling o.i.d.) indien dit maatschappelijk gewenst is.
43. Veranderingen in de tariefsystematiek niet moet leiden tot teveel complexiteit voor aangeslotene; iedereen moet overzichtelijke en overwogen besluiten kunnen maken.
44. De kwaliteit van het netwerk niet achteruit gaat.
45. De tariefsystematiek zoveel mogelijk in één keer wordt aangepast.
46. Veranderingen in de tariefsystematiek gepaard gaan met zekerheid; het moet duidelijk zijn hoe de tariefsystematiek zich gaat ontwikkelingen in de aankomende jaren.
47. De tariefsystematiek wordt gebruikt om op bepaalde marktuitkomsten of doelen te sturen.
48. De huidige tariefsystematiek zo lang mogelijk wordt behouden.
49. De netbeheerder prikkels en/of transparantie geeft aan aangeslotene om zijn netwerkproblemen op te lossen.
50. De netbeheerder geen taken uitvoert die ook door een marktpartij kunnen worden gedaan.
51. De transporttarieven prikkels geven voor investeringen in het netwerk.
52. Er meer inspraak is voor aangeslotene of investeringen in het netwerk nodig zijn.
53. De overheid/minister geen invloed heeft in netwerkinvesteringen, maar dit door de netbeheerder wordt besloten die gecontroleerd wordt door de ACM.
54. De regels soepeler zijn, zodat er meer ruimte is voor onderlinge afspraken en onderhandelingen tussen afnemers, producenten, netbeheerders en marktpartijen.
55. Er wordt gekeken naar de verschillende type netwerken en netbeheerders prikkels kunnen geven voor het gebruik van andere netten (gas, elektra, warmtenetten).

4.3. Creation of a set of participants (P Set)

The next step is to select the group of participants who are sorting the statements according to their preferences. The group of participants is called the P-set in Q-methodological research. The goal of this step is to get a heterogeneous group of participants, which have different perspectives regarding the topic. This means that the P set is not a representative sample from a population as is more common in other statistical methods. In addition, the participants should have basic knowledge about the tariff system to perform the sorting of statements. This makes finding the right sample size and mix of participants not very straightforward.

Number of participants

First the size of the P-set, which has several rules of thumb suggested for the amount of participants. In principle, the Q-methodology doesn't need a large number of participants, as the method is based on the assumption of "finite diversity" (Watts & Stenner, 2012). Finite diversity means that there are not as many discourses about the topic, as there are participants. This led to the basic rule that the number of participants should not exceed the number of statements (Watts & Stenner, 2012). A minimum size for the P-set is defined by Barry & Proops (1999), which performed a valid Q methodology with 12 participants and a Q-set of 36 statements. Kline (1994) gives a ratio of 1 Participant: 2 statements, but Watts & Stenner (2012) give examples of valid studies with a larger ratio.

Another minimum rule for the participants is given by (Brown, 2010). This rule states that at least two participants should share a perspective to make a valid conclusion about this perspective. This would mean that a minimum of 1 perspective: 2 participants. However, the perspectives can only be determined after the analysis of the sort. Cuppen et al., (2010) mentions that normally 2-6 perspectives on a topic are determined with a Q methodology. This would mean that a minimum of 12 participants should be included in the P-set, assuming that the perspectives are all shared by two participants.

The rule of thumb of Watts & Stenner (2012) that no more participants than statements should be included will be followed, as well as the minimum rule. This means that the P-set in this study should contain between 12 and 55 participants. The timeframe of this thesis wouldn't allow to let 55 participant take part in the study. Secondly, as the Q-methodology doesn't require large numbers of participants, but focuses on the different perspectives. 25[7] participants are selected for this study (see Table 4). Arranging appointments and performing the Q-sorts took more time than expected, which led that not all approached candidates took part in the study.

[7] The participants sorted the Q-set based on their personal perspective, with their company perspective as background. The company names are stated to indicate the participants relevance towards the subject and therefore the sorts are not the official perspective of the company.

Table 4: Participants that sorted Q-set(P-set)

#	Name	Company
1	Alliander / Stichting E-laad	Auke Hoekstra
2	AWTI / TU Delft	Hamilcar Knops
3	Cofely	Leon Straathof
4	Consumentenbond	Michiel Karskens
5	De Duurzame Koepel	Monique Eijkelenburg
6	Eneco	Alex Ouwens
7		Ruud Vrolijk
8	Energie Nederland	Ruud Otter
9	Enexis / Stichting E-Laad	Lennard Verheijen
10	FME	Charlie Droste
11		Hans van der Spek
12		Eric Velthuizen
13	LTO glaskracht	Rob van de Valk
14	Ministerie van Economische zaken	Ermin Kloppenburg
15	Netbeheer Nederland	Hans Peter Oskam
16		Edwin Edelenbos
17	NWEA	Hilbert Klok
18	PAWEX	Nick Waltmans
19	TU Delft	Theo Fens
20	TU Delft	Laurens de Vries
21	TU Delft	Cherelle EID
22	C-Result / TU Delft	Paul Hermans
23	VEMW	Frits van de Velde
24	Vereniging Eigen Huis	Claudia Umlaud
25	Westland Infra	Arno van Scheijndel

Selection of participants

Two criteria of participants for the selection were already mentioned: Knowledge about the subject and a relevant perspective on the subject. Watts & Stenner (2012, p.71) call this strategic sampling: “select a participant if you think they are likely to express a particularly interesting or pivotal point of view. However this is hard to determine ex ante. They give as rule that the “right” participant always be a function of the research question you’re trying to answer. Cuppen et al. (2010, p.581) mentions this technique as purposive sampling: “the fact that there is a person who is assumed to have a different point of view is enough reason to include him or her in the sample”.

Another technique that can be used is opportunity sampling. Opportunity sampling is rarely the best strategy to construct the P-set, as the participants in Q methodology are the variable and the Q-set is the sample in contrast with other statically methods (Watts & Stenner, 2012). Random sampling, often used for statistical research, is not recommended as this has the assumption that expertise is eventually distributed over the whole population (Cuppen et al., 2010). This is clearly not the case for this study and secondly, not all persons will have a clear perspective on the subject or sufficient knowledge.

Purposive sampling is initially used for selecting participants. Firstly, actors are approached that are mentioned in chapter 2**.** There is assumed the different actors would have different perspectives on the topic. The supervisors could recommend some potential participants that are approached for the study. Additional potential participants were approached through contact details found at the internet

consultation about the new electricity and gas law (Overheid.nl, 2014). Besides the actors identified in chapter 2, scholars from the TPM faculty were approached who were also working in a related sector.

Secondly, a snowballing technique was used, where potential participants were asked to suggest a person who might be interested to take part in the study and has a different perspective on the topic than the participant himself. This is asked at participants after the sorting of statements and after the concourse interviews. Persons who declined the invitation to take part in the study are nonetheless asked if they could recommend a person to take part in the study.

The complete P-set contains participants from different fields and relations with the electricity sector. All the participants are related to the tariff system with their work; system operators, different electricity consumers (or interest group), different electricity producers (or interest group), academia or consultancy agencies. The participants have different backgrounds and assumed is that they therefore also have different perspectives. Two actors, ACM and TenneT, who were identified in the Chapter 2 could unfortunately not take part in this study.

Due to the use of the snowballing technique, there might be too much people from within the same network of people. Three times a participant proposed to contact an already included participant. However, this was at the end of the study and with amount of effort that is put into the construction of the P-set, there is assumed that the number of people actively taken part in the tariff system design discussion is very limited. In addition, after the Q sort and there was time left, the list of participants[8] so far was shown to the participant. The last participants that saw the (almost) complete P-set couldn't suggest more persons or companies to include, which indicates that the P-set is at least diverse and probably a lot of the directly involved persons are included in the P-set.

4.4. Sorting of statements by participants (Q sorts)

The strength of the Q-methodology is the combination of both qualitative and quantitative research. The quantitative research is the analysis of the different sorts of statements by the participants, known as Q-sorts in Q methodological research. However, Q methodological research is builds on effort after meaning and therefore an individual Q-sort or factor from the analysis doesn't mean anything, after it can be interpreted. Therefore qualitative research is needed to know the motivation behind the sorting. The Q sort consists of three parts: pre-sort instructions, the actual sorting of statements (Q sort) and the post-sort questions.

Invitation for Q sort

The interviews took place between the 9th of November and 5th of January. Interviewees were invited by email to schedule an appointment with the author to perform the Q sort, see appendix A.4. A brief introduction of the author and the subject of the thesis was given to the potential participant. In case the potential participant was referred to by another participant, he or she was mentioned in the email.

There is aimed to have as little barriers for participation as possible . First of all, the email mentioned that the research could be done with complete anonymity, so the participant could talk and sort the statements freely to later better understand the narrative of the discourses. During the

[8] This list consisted of participants that gave consent on mentioning their name and company, and companies that I was in contact with or wanted to include in the research.

interview is asked if name and company could be mentioned for the validity reasons of the thesis, but the sorts and post-sort answers remain anonymous. Secondly, the time for the appointment was scheduled in a hour, asking the minimal time in the schedule of the participants. The expert check showed that the interview could be performed within a hour, although the majority of the interviews took longer as a result of interesting discussions following the Q sort. Additional information about the research was given on request of the potential participant.

Pre-sorting instructions

The pre-sorting instructions start with introducing the participant, the researcher and the research topic. The participant was briefly asked to tell something about their role within their organization. The definition of tariff system is briefly recapped, although this was also explained earlier by email. Then the Q-methodology is explained, where the participant is explained that 55 statements that follow the research question should be sorted into the grid.

Subsequently the grid where the statements should be sorted was elaborated upon. The grid has a horizontal axis, of which the extremes show most agree to most disagree. Furthermore the columns are all equally regarding the agreement and the rows don't have any meaning. An example was given to further elaborate this to the participant mentioning that the researcher can only say that statements left of a referred column the participant more agrees with and right of the column you more disagree with[9]. Following up, there is mentioned that this also means that the centre column of the grid is therefore not per definition the middle point of the participants perspective and therefore more than half of the statements could be sorted as agree or disagree.

Thereafter the participant was asked to start sorting the statements. There was suggested to start by making a rough sort of three piles of statements before placing them into the grid: agree, disagree and neutral/ambiguous statements. This improves the sorting process, as the statements are compared in smaller piles and therefore the relative (dis)agreement between statements can be made easier (Watts & Stenner, 2012). Here was also mentioned the focus of the participant should be on the essence of the statements and that potential preconditions or remarks can be mentioned. Furthermore the participant was encouraged to ask questions about the statements if they weren't clear to him or give additional information about the place of a statement.

Grid design and Q-sort

After the pre-sorting instructions the participant start with the process of sorting the statements to eventually fill the grid. In Q-methodology the grid is of course dependent on the amount of statements, but the researcher has several choices to make while designing the grid. These are the range of the scale and the distribution form that is chosen, also known as the kurtosis (Brown, 1980). The grid design can be found in Figure 5 and the choices are elaborated upon below the figure.

[9] The design of the grid had "most agree" on the left and "most disagree" on the right. This is counter intuitive and should have done the other way around.

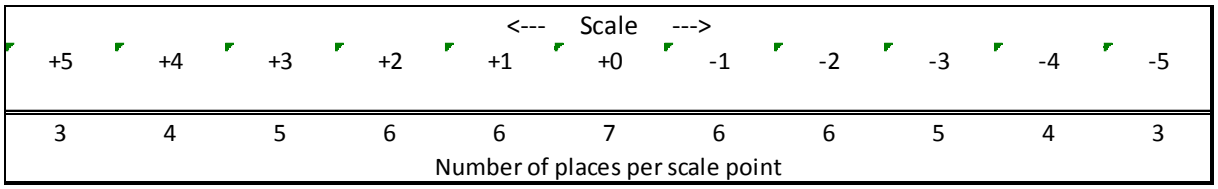

Figure 5: Grid design

First choice of the grid design is a fixed or free distribution. For this study there is chosen for a fixed grid with a almost quasi-normal distribution. The fixed distribution is the standard for doing Q-methodology, as it gives the most convenience for both the researcher and participants (Watts & Stenner, 2012). Brown (1980) research' showed that the differences between the use of a forced or free distribution result in negligible differences in the outcome of factors.

A fixed distribution is easier to analyze for the researcher and gives the participant some structure in sorting their statements. The structure gives also convenience for the participant, as statements are clustered in a column and therefore the participant doesn't need to value each individual statement, but can value them in respect with the cluster of statement. As it is the standard and gives more convenience, without losing value of the sort, a fixed distribution is chosen.

Secondly, the kurtosis is determined for the distribution, which is a 11 point scale from +5 to -5, see Figure 5**.** This is the guideline scale for a Q set with 40-60 statements (Brown, 1980; Watts & Stenner, 2012). Subsequently the slope of the grid needs to be determined; the number of statements under each point in the scale. A (quasi)-normal distribution is standard to use, as a participant is most likely to feel very strong about some statements, with most of the statement less strong feelings (Watts & Stenner, 2012).

The actual slope is influenced by the subject in relation to the P-set. Complex subjects and a P set with less knowledgeable participants have often a steeper slope, as this allows the participants to sort more statements in centre of the grid. If the P set are experts and/or the subject is less complex, a flatter slope is recommended. This study is quite complex, as it contains quite some components of the tariff system, which are all related to each other as they are derivatives of the concourse which contains quite some components (see chapter 2).

The participants are all experts from the field or academia related to this subject. As multiple components of the tariff system are discussed, there need to be some room at the extremes to address several topics. On the other hand, the P-set contains quite some interest groups, who are expected to have some focal points and are more indifferent about other statements. In addition, having a relatively small amount of statements at the extremes, forces the participant to make choices between options. Therefore a combination is used, where the slope is not real steep, so that participants have room to address several components of the tariff system in the extremes. Three statements can be placed at the extremes and 4 at the +/- 4 column. This should give sufficient room to address several components, but still forces the participant to make deliberate choices. At the same time, participants with specific focal points have sufficient room for statements they are indifferent about.

Post-sort questions

The Q-sort on its own doesn't say anything without an explanation of the participant why the statements are sorted the way they are. In Q-methodology this is called effort after meaning, where the statements get filled out as the study proceeds with the input of the participants (Watts & Stenner, 2012). Therefore the participant gets 6 questions after the sort, to elaborate on the Q-sort and validate some assumption made earlier in the research. Most of the Q-sorts are done individual, therefore the author asked the questions and reported their answers. This way the interviewer can ask for additional clarification. For the two group sessions that are organized for the Q-sorting, the participants got the form with questions to answer themselves, see appendix A.5.

The approach of the post-sort interview for the group sessions and the individual sorts was slightly different. In the individual sorts, as already mentioned, the interviewer reported remarks of the participants during the sort, encouraging them to elaborate on statements when he sorted them. The interviewer reported specific statements that were not logically sorted from his point of view or those which the participant had trouble sorting. After the sort was completed, the researcher referred to these statements with question three if they weren't mentioned by the participant. For the group sessions it was not possible to keep track of 3 sorting' at the same time. Therefore the sorts were after the questions compared with the interviewer and participants, where questions could be asked about each other's sorts. The interviewer reported these conversations.

The participants are asked to answer the following questions (translated from Dutch):

1. Can you elaborate on the 7 statements where you most agree with?
2. Can you elaborate on the 7 statements where you most disagree with?
3. Did you have trouble sorting specific statements? Please elaborate on those
4. Did you miss any statements or topics, which you do find important in this context?
5. Did you sort the statement with a future scenario of the energy sector in mind? If you did, briefly state this scenario. Do you think the sort will be very different if your scenario is different from the actual development in the energy sector?
6. Do you have remarks about specific statements or the sort in general?

The first four questions are asked to elaborate on the Q-sort of the participant. These questions are recommended by Watts & Stenner (2012), as they give additional information of the sort. Especially the extremes should be elaborated on, as these statements give the most information: All other statements in the sort are less/more agreement with. Statements that were hard to sort can also give additional information; the participant might have to make a trade-off, doesn't know the exact impact, has an specific opinion about it under certain conditions etcetera.

Question 4 is a validation of the Q set and is asked to check if the participant could give their perspective on the topic with the statements. Missing statements would mean that the Q-set is not representative for the concourse: apparently there is more said about the topic, but not included in the study. Question 5 is also a partly validation of the assumption that in 10 years there is expected that the main change is the increasing share electricity from wind and decentralized generation (See paragraph 2.4). At the same time, it shows the robustness of the sort: are there very different future energy scenarios and would other scenarios lead to different perspectives on the design of the tariff system? An

extremely hypothetical scenario was given, where CO2 was considered no problem. The participant was asked how this would influence their perspective on the development of the tariff system. Lastly, the participant was asked to briefly recap on the research and given the opportunity to give some last remarks. This question, although logically would be before the 5th question, is deliberately asked last. The participant could have taken some distance from the sort, answered a question on a higher level topic (regarding the energy transition) and therefore could possibly reflect one last time on a bit higher level on the research.

4.5. Data analysis

The data analysis takes all the Q-sorts of the participants to determine patterns between them and subsequently determine factors. A factor is a generalized Q-sort of a group of participants and represents the perspective of those participants. The factor extraction is done with the help of PQMethod, software specifically developed for doing Q methodology and available online without charge (Smolck, 2015). The data analysis consists of two steps: factor extraction and factor rotation. This chapter describes the three steps briefly and additional details can be found in Appendix B.6

Factor extraction

There are two ways to extract factors from the data: Principle Component Analysis (PCA) and Centroid Factor Extraction (CFA). The two methods often result in similar results, but the main difference is that a PCA results a single mathematical best solution that should be accepted (Watts & Stenner, 2012). As mentioned earlier Q methodology is a combination of qualitative and quantitative research and therefore the best mathematical solution is not always the best solution for the study. The statistical research can't interpreter the statements on their own, doesn't know the content of the post-sort interview or additional information that was gathered during the interviews. The PCA method is therefore recommended by Watts & Stenner (2012), as this gives more freedom to use this substantive knowledge in the statistical analysis and therefore used in this study.

The next step is to determine the amount of factors that are extracted from the dataset. There are several guidelines to determine the amount of factors to extract, but these are mainly based on the results following after the analysis. The first guideline is the based on the eigenvalues of the factors, also known as the Kaiser-Guttman criterion. The guideline is to keep those factors with an eigenvalue of >1(Guttman, 1954; Kaiser, 1960, 1970). Brown (1980) recommends to start with the 'magic number' 7 and keep those factors where two or more participants load significantly on (more on factor loadings is explained in next paragraph). Two more statistical methods are given by Watts & Stenner (2012): the scree test and parallel analysis. Both methods are based on the eigenvalues of the extracted factors, but take into account some drawbacks of the Kaiser-Guttman criterion. Watts & Stenner (2012) finally give a suggestion to just start with a factor for every 6-8 participants in your study.

All these methods are guidelines and there can be made use of more or less factors when the researcher can argue that this factor results in additional information about the data. Factors can be left out at a later stage and therefore Watts & Stenner (2012) suggest to rather start with more than less factors. This means that the researcher has quite some influence on the analysis and therefore the results. This should be kept in mind in the following steps of the data analysis to prevent a bias of the researcher on the results.

For this research there is started with the 'magic number' of 7 factors. A strict appliance of the Kaiser-Guttman criterion based on eigenvalues >1 would suggest to select 4 factors when the first results were available, which is kept in mind during for the factor rotation (see appendix B.6). This is also done with the criterion of two significant loadings per factor, as a single loading result into a factor that is equal to the Q-sort of the significantly loading participant. The scree test and parallel analysis are both methods that are relatively time consuming and based on statistical principles that are not always the best way to go for Q methodology, therefore these methods are not used.

Factor rotation

The factors have a relative position in regard to each other and by rotating them this position is changed. Watts & Stenner (2012) use the analogy of a lecture theatre for factor rotation: if you change your seat in the theatre, you have a different view on the stage. Each person has its own unique view on the stage (the subject at matter), but all the persons on the left have a different view on the subject than the people on the right in the theatre. A factor is a group of persons in the theatre, but these groups can be arbitrary chosen and slightly changed, however a person seated on the extreme left on the theatre will never see the subject the same as the person on the right of the theatre.

After the CFA the factors can be rotated in two ways: a varimax rotation or manual rotation. Varimax is automatic procedure of PQmethod and gives a rotation that leads to the maximum amount of study variance(Watts & Stenner, 2012). The two methods can also be used complementary, where the varimax solution is used and subsequently manually rotated. The choice of not using statistical criteria for determining factors are mentioned in the previous paragraph. This results therefore that only using a varimax leads to factors that are generally recognized, while hand-rotation is more likely to reveal perspectives in a more original or more surprising way (Watts & Stenner, 2012).

An issue for manual rotation is that it requires some skill and is therefore quite pertinent for beginners. Manual rotation is easier when there are clear markers. For example a participant whose opinion is very important within the organization of which the P-set consist of, or persons who share the same view based on substantive knowledge. Watts & Stenner (2012) therefore suggest a varimax rotation that is subsequently manually rotated. Freely interpreted, they suggest to optimize the varimax solution with substantive knowledge from the post-sort questions and interviews.

There are no clear markers to manually rotate on; the participant group is regarded as equals. There are some hunches of the researcher of participants that have a similar perspective, however based on these hunches the manual rotation would be very subjective and based too much on the researcher perspective. However, a lot of time is invested in gathering information with the sorting of statements and interviews, which would be neglected by using only the varimax rotation. The suggested methods by Watts and Stenner of using varimax and manual rotation is partly rejected based on this argumentation. This method was initially tried by the author, but didn't results is satisfactory results, as several rules of thumb weren´t met with the varimax rotation.

Therefore a manual rotation was used eventually. It is important that the researcher not reflects his view on the different perspectives and the following approach is used. First groups were identified based on the statistics: high correlations between Q-sorts, PCAs and CFAs with different amount of

factors were statistical optimized with a varimax rotation. See Appendix A.6 for more detailed information about the formation of groups. Based on the substantive knowledge of the author there was checked if the participants in these groups actually shared a similar perspective. Subsequently these groups were rotated in such a way that they would have a high loading on the factor, making them more representative for a single factor instead of two factors.

Significant factor loading for example study = 2.58(1/√# items in Q-set)*

➔ *2.58*(1/√55) ≈ 0.35*

Subsequently, the data is inspected for participants who load significantly (see textblock above) on more than one factor. Based on substantive knowledge a choice was made to rotate the factors in such a way that a participant would load on that factor which the participant had most similarities with. Subsequently the participants that didn´t load significantly were analyzed and tried to rotate on the factor where they had the highest loading on and fitted based on the substantive knowledge of the researcher. Note that rotating the factors changes the loading of each participant on the different factors. Therefore this process was repeated several times to try and reduce the number of non-significantly loading participants to a minimum. An schematic overview of the factor rotation as described above can be found in Figure 6 and the resulting factor matrix in Figure 7.

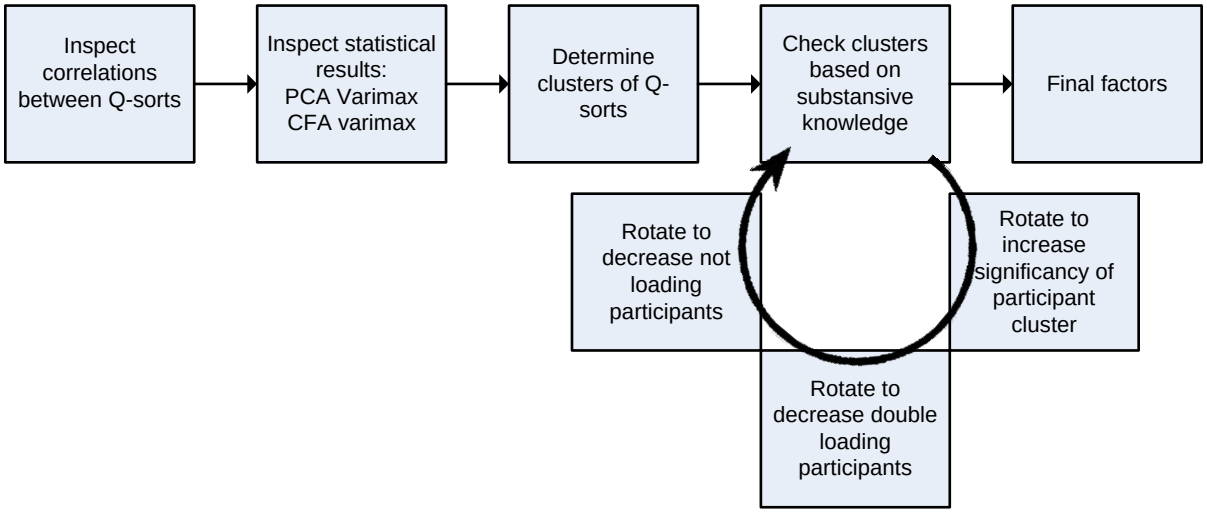

Figure 6: Process of factor rotation

Factor Matrix with an X Indicating a Defining Sort

	Loadings			
QSORT	1	2	3	4
1	0.1553	0.6346X	0.1280	-0.2140
2	0.4829X	-0.0416	0.0471	-0.2993
3	-0.2917	0.4646	0.4197	-0.0197
4	0.2621	0.0293	0.4457X	0.1270
5	0.5494	0.4265	-0.1259	0.1508
6	0.2450	0.4065X	0.1525	0.0383
7	0.5125X	0.2839	0.2871	0.1788
8	-0.1810	0.1519	-0.2043	0.4633X
9	0.6802X	-0.0017	0.1074	0.0974
10	0.5320	0.3812	0.1635	0.0832
11	0.1458	0.4733X	-0.0190	0.0485
12	0.0099	0.4867X	0.2751	0.2401
13	0.4105X	-0.0668	0.1279	-0.0155
14	0.6329X	0.1200	0.1218	-0.0643
15	0.3314	0.1267	0.5072X	-0.3453
16	0.1203	0.4743	0.5045	0.0354
17	0.1665	0.7467X	0.1875	0.1121
18	0.0240	0.5039X	0.2325	0.1572
19	0.0504	0.6035X	0.2742	-0.0666
20	0.6964X	0.2121	0.0048	-0.0858
21	-0.0526	0.7686X	-0.1830	-0.2082
22	0.0418	-0.0114	0.4972X	0.3380
23	-0.1384	0.2548	0.1961	0.6129X
24	0.1434	0.1636	0.4160X	0.0208
% expl.var.	13	16	8	5

Figure 7: Factor Matrix (left column Q sorts of participants, top row factors)

The manual rotation led to four factors that together have an explained variance of 42%. Kline (1994) and Watts & Stenner (2012) regard solutions with 35-40% or more as a sound solution. The q-sorts marked with an X represent significant loading Q-sorts. five participant load significantly on more than 1 factor and are therefore not marked. Briefly explained, the significantly loaded q-sorts their weighted average determines the factor array: the Q-sort of a factor. Weighting a double loading participant for two factors would mean that two factor arrays are influenced by a single participant, leading to too much communalities between the factors. This makes the different factors more distinctive for each other, as the goal is to identify the different perspectives.

In Figure 7 there can be seen that Factor 1 has six significant loading Q-sorts, Factor 2 has eight, factor 3 has three and factor 4 two. In total 19 participants load significantly on the factors, the remaining 5 participants load on more than one factor. A choice can be made to increase the significance level and thereby trying to get these participant load on a single factor. This is tested but one or several of the following reasons based on the substantive knowledge of the author[10] led to the decision not to increase the significancy.

- Participant doesn't fit on either of the factors
- Participant fits on both factors
- Other participant(s) who better fits the factor would not load significantly anymore
- Author has insufficient substantive knowledge about the participant to place him on one of the two factors

The manual rotation follows the guidelines mentioned in the factor extraction: four factors had initially an eigenvalue of >1 (Kaiser-Guttman criterion) and every factor has two or more significantly loading Q-sorts. A fifth factor could also be added, but this would firstly violate the above mentioned guidelines, resulting in more Q-sorts who load on several factors and increased the correlation between factors, meaning that those factors have a partly shared perspective.

4.6. Factor interpretation

The last step is to analyze the factors that resulted from the factor matrix. A factor is simply put the weighted average of the significantly loading Q-sorts of that factor. Together with the substantive knowledge gained by the interviews the factor can be interpreted. For example, the placement of two statements is initially counter intuitive, however, with substantive knowledge there can be explained that the participants have preconditions that explain the place of the statement in the factor array. Therefore first the factor array needs to be determined, or in other words, a Q-sort of the factor. PQmethod determines for each statement in which column of the factor array it is placed. To interpret the factors the following steps are followed to prevent bias of the researcher, but also prevent losses of substansive knowledge of the researcher. Together this forms a cribsheet for each factor, which can be found is appendix B.1.

[10] The reasons are not made explicit due to confidentiality of the interview during the sorting of statements and post-sort questions.

1. Analyze factor array individual
    a. Analyze strongly agreed statements → +4/+5 columns
    b. Analyze strongly disagreed statement → -4/-5 columns
    c. Analyze remaining agreed statement → +2/+3 columns
    d. Analyze remaining disagreed statements → -2/-3 columns
    e. Analyze neutral/ambivalent statement → -1/0/+1 columns
2. Analyze factor array in respect with significant loading participants and substantive knowledge
3. Analyze factor array in respect with other factors
    a. Items ranked higher in factor array X than other factor arrays
    b. Items ranked lower in factor array X than other factor arrays
4. Formulate perspective of each factor

First the individual factor array is analysed to create an individual perspective irrespectively of the other factor arrays. The strongly (dis)agreed consist of the two most extreme columns, as a single most strongly (dis)agreed statements didn't give sufficient information to create a good first perspective of the factor. Subsequently the remaining (dis)agreed statements are analysed. There is strived to relate each statement to the so far established perspective. The neutral/ambivalent consist of two types of statements of which the first are the statements that are actually considered neutral in the factor. As the factor array is the roughly the weighted average<e of the individual Q-sorts of the participants, in this category are also statements that are ambivalent, e.g. (strongly) agreed and disagreed with by the participants significantly loading on that factor. Initially this column is only checked for statements that are counter intuitively and could be expected to have a higher/lower rank based on the place of other statements.

Statements that are considered counter intuitive based on the authors substantive knowledge are addressed in the second step. Based on the interviews additional information about the placement of statements in the individual Q-sorts is used to try and explain the placement of the statement in the factor array. Subsequently the neutral/ambivalent statements are addressed to identify which are indeed neutral and which statements are differently sorted by the participants of the factor.

The third step is to analyse the factors in respect to each other. This is done by identifying those statements that are ranked higher or lower than in the other factors. These statements distinguish that factor from the other factors and should be more emphasized in the formulation of the factor perspective. It also works the other way around, it shows on which statements is common ground. The final factor description in based mainly on the unique properties of the factor, differences between factors are subsequently mentioned as well as common ground between (several) factors.

5. Results

Q methodology has been applied on the case study of the adjustment of the tariff system. The results of the case study are discussed in this chapter. In paragraph 5.1 the four discourses regarding the tariff system design are described based on the factor interpretation as discussed in chapter 4.6. An additional analysis of the results based on the statements is performed to identify common ground, differences and ambiguousness in the different perspectives. The paragraph 0 concludes with additional findings and summarize the most important results from the case study that can be used in the process or are used in the design of the process approach. In Appendix B the data and a more extensive discussion of the results can be found.

5.1. Individual discourse description

In chapter 4 the steps of the Q methodology are discussed and applied on the case study for the tariff system design, resulting in the identification of four factors. This paragraph analyzes and interpreters each factor, based on the steps described in chapter 4.6. This paragraph discusses the results from the analysis and interpretation of the factors: the discourses. Each discourse is firstly briefly summarized, where after the discourse is first described based on the factor array and crib sheet. The factor array is a Q sort of statements, based on the participants that were flagged during the analysis, simply put a weighted average of the participants Q-sorts behind the discourse, see chapter 4.6. This means that the discourses description based on the factor array are only described based on the placement of statements in the factor array.

The discourse is subsequently further elaborated based on the substantive knowledge of the author gained during the sorting of statements by participants and the post-sort questions. This way a clear distinction can be made between the qualitative and quantitative interpretation of the factor by the author. For each discourse the most important statists are shown in the text block: The number of participants that are used to construct the factor array, number of double loading participants(participants that significantly loaded on the respective factor and another factor', and the variance the factor explains of the all the Q-sorts. Additional statistics can be found in appendix , the factors arrays and crib sheets can be found in appendix B.1

Discourse 1: Traditional power to the market perspective: cost engender principle, high quality network and certainty for market parties.

Statistics factor 1:
#of flagged participants: 6
double loading participants: 2
Explained variance: 13%

The first discourse strongly focuses on the energy market and general economy: based on this perspective the tariff system should follow the cost engender principle, is stable and predictable, thereby reducing uncertainty for market parties and resulting in a high quality electricity network. Adjustments in the tariff system are primarily based on better applying the cost engender principle: a producer tariff and possibilities for reimbursement to network users for offering flexibility. More harmonization between European tariff systems is needed to create a level playing field.

Perspective discourse 1 based on factor array

The first discourse has a traditional power to the market perspective on the development of the tariff system. The key principles are cost engender and good quality of the electricity network. Investments in the network should be based on regulation to maintain the quality of the network. The government shouldn't be involved with network investment at all, they lay down the rules which the system operator should follow and the ACM monitors the system operators. There is a preference for a top-down central regulation and opposes against arbitrariness in regulation or the possibility of negotiations between different parties. Also they strongly oppose against activities of the system operator which could be performed by market parties: system operator should manage the network and don't mix in with market activities.

Only when the system operator finds it necessary that demand response is needed, he can offer a reimbursement when network users offer him this flexibility. This principle is in the current tariff system already possible and relates to the cost engender principle: when you can offer demand response and therefore lower the network costs, you should be reimbursed. This can also be arranged in advance; a contract where the consumption can be capped, so that you can consume some electricity but not your whole contracted capacity.

This perspective wants a producer tariff that partly covers the network costs; this can be implemented European wide, but the statement of producer tariff without mentioning a European producer tariff is sorted higher. This perspective also strives to more harmonization within Europe besides a producers tariff, while regarding the differences in networks, uniformity about discount regulations or tariff components is desired.

Additional information discourse 1 based on substantive knowledge

The participants have a market oriented perspective, a monopolistic network disturbs a market and there should be strived to engender the costs of the network to those who cause them as best as possible. On the other hand, the network should not hamper the market; not the electricity market due to congestion in the network and not the economy due to disturbance of competition, by failure of the network(e.g. blackouts, congestion) or network costs that result in too high transmission tariffs.

This applies also for the tariff system regarding certainty; a volatile tariff system or too making often adjustments in the tariff system design leads to uncertainties and hampers market investments, while this perspectives generally considers the market as investor in renewable technologies and stimulator of the economy. Discounts/exemptions from the general tariff system are needed for two reasons: first, other countries apply similar exemptions and secondly they are needed to allocate the network costs better following the cost engender principle.

Therefore this perspective also strives to a more harmonization European tariff system. Not applying discounts/exemptions on transmission costs results in a disadvantage for the Dutch competition position on the international market. This also applies for the producer tariff; although this perspective agrees with the implementation of a producers tariff as producers also causes network costs, which follows the cost engender principle. However, this can result in damaging the international competition position of the Dutch electricity producers if only the Netherlands implements a producer tariff.

The cascade method is generally regarded as currently the best method of cost allocations. However, often mentioned in the post-sort questions is the principle of the cascade method or the reversed cascade method. This means that when electricity production on the lower voltage levels of the network increases and electricity is transported to higher levels, the network costs should also be allocated following this upwards electricity flow.

Less strongly agreed are some options that strive to a better cost engender principle, for example that transportation losses are incorporated in the tariffs and that that the capacity tariff(kW) is related to the peak capacity of the network. These options are nonetheless not strongly agreed with, as the second is prone to strategic behaviour and the transportation losses are (partly) due to historical development of the network and geological logical; i.e. you can't completely influence the transportation losses you induce on the network. This means that a level-playing field is important for this discourse.

Discourse 2: Regional system sustainability optimization by collaboration, transparency of system operator and an adaptive tariff system.

This second discourse emphasizes the differences in regions and unique solutions to make them efficiently more sustainable. A top-down approach is therefore not feasible: the tariff system should be adaptable to comply with local conditions and solutions for optimization. The system operator should function as facilitator, giving more transparency about its network problems and planning, and collaborate with both public and private actors from different sectors to optimize the region to become more sustainable in an efficient manner.

Statistics factor 2:
#of flagged participants: 8
double loading participants: 3
Explained variance: 16%

Perspective discourse 2 based on factor array

In this perspective the current tariff system should be made more flexible and adaptive to the developing energy sector. There is strongly disagreed with statements that the current tariff system should be maintained in the upcoming decade. The system operator should be transparent about its network problems and give incentives for demand response. The cost engender principle is also regarded very important and similar to discourse 1 is preferred that those who help reduce network problems for the system operator should be reimbursed. In contrast to the first perspective, the regulation regarding the tariff system should be more flexible to have more room for negotiations between different network users.

Investments in the network should be approached differently, investments in network should be made a bit tighter and not based completely on preventing congestion. In addition, regional system operators can make use of storage facilities, as long as they don't sell electricity. Congestion in the network should additionally also be incorporated in the transmission tariffs to stimulate demand response. Dynamic transmission tariffs, where at every moment a different transmission tariff applies, could also be used to stimulate demand response and reduce congestion.

Additional information discourse 2 based on substantive knowledge

The post-sort questions showed quite clearly that this perspective is mainly focussed on changes on a regional/local level. This perspective regards the impact of the energy transition to have to largest impact on a regional/local level and therefore the changes in the tariff system are mainly focussed on this voltage level. On this level collaboration should be realized between different public and private parties to optimize initiatives. The current tariff system is regarded too rigid and doesn't have enough adaptability for regional (network) conditions and specific local solutions. Therefore the tariff system should be changed in such a way that causing network costs results in a higher transport tariff and decreasing network costs is rewarded.

It is important that the system operators become more transparent and become facilitators for local initiatives between governments, market parties and network users. The system operator has a lot of knowledge according to this discourse to facilitate local initiatives and should use this knowledge to consult the initiatives and subsequently develop a network that facilitates these initiatives. In addition, the network user' preferences should be more central to facilitate its increasing complex wishes. This way future network capacity can be reduced in respect to current predictions and optimized to local preferences.

Often ICT facilities are mentioned to introduce dynamic tariffs that stimulate demand response, but also to create new business cases and give initiatives the possibility to deploy. The system operator is in principle a facilitator for these developments, only under strict conditions and in exceptional cases the system operator can participate in market activities, but rather in collaboration with public and/or private partners than on their own. The general perception is that if the system operator performs market activities, small initiatives can't compete and new initiatives have a system operator as a competitor which is regarded as a large barriers to enter the market.

Finally, this perspective regards a large interconnected European network as unnecessary and too expensive. Local optimization should reduce the demand for capacity on the transmission networks and regards its importance for the stability of the network to decrease. In addition they regard the current regulating agencies and governments to be in a ivory tower. They emphasize the unique local circumstances and possibilities for optimization, which can't be all included in general rules and regulation, but should be based on reciprocally agreements between public and private parties. The regulating agencies mainly focus on the non-discriminatory principle: everybody should have equal changes to start initiatives and take part in them.

Discourse 3: The tariff system as a means to an end: achieving goals more important than following principles.

The third discourse is quite similar to factor one in respect to the principles and goals underlying the tariff system to facilitate the market. The main difference is that these principles are more regarded as guidelines and therefore exemptions can be made. The tariff system is seen as a mean to directly influence clearly formulated public goals, but the goals could not be uniformly formulated. The communality in this discourse is that the tariff system should be used to directly help reaching a public goal and therefore exemptions can be made in respect with the principles behind the tariff system design.

Statistics factor 3:
#of flagged participants: 4
double loading participants: 2
Explained variance: 8%

Perspective discourse 3 based on factor array

Discourse three has quite some similarities with discourse 1: System operator shouldn't take part in market activities, cost engender principle should be applied in the tariff system, a good network quality where investments are based on norms and regulation and competition disturbance should be minimized. The differences seem in the interpretation and the effectuation of the above mentioned principles.

In contrast to the other discourses, the distinguishing characteristics can be found in the statements which are disagreed with. First of all, this perspective is strongly against dynamic tariffs: transmission tariffs that can vary at any moment in time or congestion in the network should not be priced in the transmission tariffs. This perspective also disagreed with the statement that network operation is subordinate to the energy market; this could means that they or find it equally important or find network management even more important.

Furthermore this perspective prefers that consumption(kWh) influences the transmission costs for consumers. Generally this is not regarded as cost engender, as the consumption doesn't influence the demanded network capacity, but this is based on peak consumption and therefore influences the network costs, see paragraph 2.3.

Additional information discourse 3 based on substantive knowledge

From the post-sort questions the difference becomes more clear between discourse 1 and 3. The main characteristic is that in this perspective sees the tariff system also as a mean to achieve certain goals. The principles, e.g. cost engender, non-discriminatory etc, are the basis for the tariff system, but exemptions several exemptions are mentioned during the post-sort interviews. The tariff system is regarded a mean to directly influence certain goals, instead of giving incentives to influence market mechanisms and steering towards goals. The goals should be clearly formulated and directly steered to achieving them.

The interesting thing about this perspective is that the preferred goals that should be achieved with the tariff system differ quite a bit. The different goals are disregarded as they differ for the different participants, but the characteristic that the tariff system should be used to achieve certain goals is important. In the previous discourses the electricity network and its characteristics is generally regarded as a necessity that should be financed by the tariff system. This discourse shares this perspective and therefore the system operator can still not perform market activities.

The highly agreed statement about a transmission tariff that is (partly) based on electricity consumption is a consequence of the above perspective on the tariff system. Although it doesn't directly follow the cost engender principle, it does influence a often mentioned goal: giving incentives to decrease the electricity consumption. Being charged for your electricity consumption gives a clear incentive to reduce your electricity consumption, a clear example of using the tariff system to directly influence a goal. There can be argued that this perspective doesn't follow the principles as strict as the perspective of discourse 1, but regards certain goals higher to make exemptions to achieve these goals.

Finally, this perspective is strongly against dynamic tariffs and incorporation of congestion in the transmission tariffs. This is because this perspective highly values the non-discriminatory principle. Network users shouldn't be charged for costs that they cause as a result of external factors. Congestion in the network is regarded as a problem of the network, e.g. the network has insufficient capacity. If the

network had more capacity or others in your region didn't consume a lot of electricity there was no congestion and the transmission tariff would be lower.

Discourse 4: Tariff system as a mean to facilitate the energy transition; more transparency and fair distribution of network costs.

Statistics factor 4:
#of flagged participants: 2
double loading participants: 0
Explained variance: 5%

The fourth discourse also sees the tariff system as a means to an end, but focused on the facilitation of the energy transition as the public goal. The goals and principles behind the tariff system are regarded as guidelines, but don´t have to be strictly followed. More important is that the tariff system gives the right incentives to facilitate the energy transition. They have a high urgency to become more sustainable and argue that the costs for becoming more sustainable only increase the longer it takes. The system operator should become more transparent regarding the network planning and problems, to give market parties the opportunity to find solutions. However, the system operator may also perform market activities to facilitate the energy transition, but only if he thereby prevent higher network costs in the future.

Perspective discourse 4 based on factor array

Discourse four also regards the tariff system as a mean for achieving a goal, however in this discourse the goal is also defined: stimulation of sustainable electricity production. Incentives for achieving this goal is regarded more important than recovering the network costs with the transmission tariffs; public funds can be used to recover the network costs when the total network costs aren't recovered by the transmission tariffs. The use of publics funds for recovering network costs can only be used for this reason and with the other statements is disagreed.

Demand response should be stimulated by reimbursing network users for the flexibility they offer based on the demand of the system operator. There is a strong disagreement with the introduction of dynamic pricing; transmission tariffs that can vary at every moment. However, transportation losses should be incorporated in the transmission tariffs. This can be related to a consumption component(kWh) in the transmission tariffs. Finally, the transmission tariffs should give an incentive to the system operator for making network investments. In addition, the government shouldn't have influence on the network investments.

Exemptions or discounts on transmission tariffs are not allowed, which seems counter intuitive in respect to the steering towards more sustainable growth. This could be due to the examples that are giving in this statement, which mostly address discounts for large energy consumers. Another option is that this perspective sees a tariff system where no discounts are needed. This would also be in line with the strong disagreement that the cost engender principle should be the basis of the tariff system.

Additional information discourse 4 based on substantive knowledge

In the post-sort questions the perspective of this discourse showed that it is strongly related to the perception of the energy transition. Something needs to happen to increase the pace towards a sustainable electricity sector. This perspective has a higher urgency for change and finds that enough time is giving to stimulate the market to realize this with insufficient results. The tariff system should be changed in such a way that the energy transition is stimulated. The philosophy is that short-term losses should be taken to realize benefits on the long-term.

The system operator plays an important part in realizing this goal and in preventing significantly increasing network costs. The system operator has knowledge and should be transparent, while keeping in mind the privacy of network users. Market activities should be kept to a minimum, but should only be used if significant reduction of network costs can be realized.

There is opposed to dynamic tariffs for two reasons; they are regarded as too sensitive for strategic behaviour and gaming. Subsequently, not everyone can significantly influence their consumption or have limited flexibility to offer. They are too volatile and therefore result in barriers for investments. The non-discriminatory principle should be applied; the network costs should not be only allocated to those who can't offer flexibility. This group is generally regarded as small-consumers with lower incomes, who can't afford sustainable techniques. In other words; those who benefit more from the electricity network should also contribute more to reimburse the network costs.

Finally, the independency of Netherlands in supplying their own electricity is important. The Netherlands shouldn't be dependent on import of electricity. Therefore the interconnection capacity shouldn't be directly increased. Uniformity in European tariff system is not needed; every electricity network is different and there can't be waited for European harmonization, this only slows down the energy transition towards more sustainability

5.2. Additional information gathered in Q methodological research

The identification of the factor are discussed on a high level to determine to formulate the discourses regarding the adjustment of the tariff system design. To get more insight in potential topics of discussion in the process approach, this paragraph identifies common ground, differences and ambiguous topics regarding the adjustment of the tariff system design. The discourse description can be used to identify this, but doesn't comprehend the level of detail regarding individual statements that are discussed during the post-sort interviews. Therefore the individual statements and their position in the factor array are analyzed as well. Related statements are clustered and analyzed based on their position in the factor arrays. This analysis can be found in appendix B.2 with an extensive elaboration. This paragraph shows the most important findings, regarding common ground that is found, differences in perspectives and topics that are regarded as ambiguous.

Common ground is determined if the statements are all ranked on a scale higher than +2. Exemptions can be made based if a statement is ranked neutral(rank between -1 and +1). Differences are identified if statements are ranked +2 or higher in one factor array and -2 or lower in another factor array. As several statements relate to a common topic, sometimes common ground or conflicts are based on a

group of statements, following the same procedure. Ambiguous findings are statements or group of statements ranked neutral(between -1 and +1) or (groups of statements) that were analyzed but didn't result in clear common ground or potential conflicts. Note that these are generalized findings and, although carefully formulated, there can be slight variations for individual participants or the defined discourses.

Common ground

- The tariff system should not remain the same for the upcoming 10 years.
- The role of the system operator is quite clear; they should manage the network and in principle don't perform market activities. Depending on the factor specific exemptions are mentioned.
- Cost engender principle should be the foundation of the tariff system.
- There is no specific support for the cascading method, however it is not definite the method should be abolished. Alternatives for the cascading method mentioned in the statements are generally disagreed with and regarded as neutral. When asked for alternatives, very few alternatives were mentioned besides sometime the option of the reversed cascade method, but also no cogent support was perceived for this allocation method.
- The transmission tariff component should not be mainly based on consumption(kWh) to allocate transmission costs (see also differences).
- The introduction of a producer tariff has common ground to be discussed. Introduction of a producer tariff is however often mentioned in collaboration with surrounding countries who also implement it. European wide producer tariff is generally regarded as too ambitious or unnecessary.
- More options to offer flexibility in demand and reimbursement for offering flexibility should be introduced.
- Physical network investments should be socialized through the tariff system and not directly assigned to those network users connected to the network.
- Using governmental funds to reimburse the system operators network costs should not be done; the tariff system should recover the network costs.
- Network quality is important; network quality should not reduce significantly.
- Improvements regarding transmission tariffs for small consumers; more differentiation is preferred; there are too little incentives for small consumers to change their load profile.

Differences in perspectives

- Not everybody wants a consumption component that partly influences the transmission costs of consumers. A difficult discussion can be expected regarding the ratio of the tariff components peak capacity(kW) and consumption(kWh). This can be explained by the voltage level a discourse is most affiliated with: Discourse 1 and 3 focus more on the high voltage levels and 2 and 4 more on the low voltage levels.
- There are quite some differences regarding creating demand response with variable or dynamics transmission tariffs. There is not that much disagreement regarding implementing demand response, but more regarding the side effects of creating demand response with variable or dynamic tariffs. Often the lack of predictability of transmission costs is mentioned, but also the risk for strategic behavior or gaming with dynami transmission costs.

- There is a difference where network management should focus on. On the one hand there is a perspective that mainly focuses on local optimization, while on the other hand there is a focus on a large European interconnected market. Although not conflicting directly, striving to achieve both is generally regarded as too expensive and inefficient.
- There is quite a difference in the preferred way to regulate the system operator. In the rank of statements this can be seen that some have a preference for network investments that are based on rules and regulation, while on the other hand the system operator should have more incentives for network investments, for example a penalty for decreasing network quality or a reward for good network management.
- There are quite some differences regarding flexibility in the tariff system design, some prefer a straightforward tariff design, while others prefer more flexibility and negotiations regarding certain topics. Depending on the topic the flexibility will also probably differ.

Ambiguousness:

- It is not completely clear what the investment approach of system operators should be. Important is that the network quality doesn't reduce. However, the current approach of investing in the network with over capacity is regarded unfeasible. The two statements regarding the investment approach are both not strongly (dis)agreed with: postponing investments until more there is more certainty for future demand of network capacity or installing overcapacity to prevent under capacity. This can be explained by the voltage level a discourse is most affiliated with: Discourse 1 and 3 focus more on the high voltage levels and 2 and 4 more on the low voltage levels.
- Several statements addressed options to give consumers more choices. It is not completely clear what these choices should be or how they should look like.
- The cost allocation method that should be used is ambiguous, the cascading method does not have a lot of support, but is regarded generally as the best method currently available. (see also common ground). Limited alternatives for the cascading method are mentioned.
- The approach to change the tariff system is not completely clear, a single large change or gradual change over the years. A single large change is considered as a large "shock" and can hamper investments until more certainty regarding the change is given. Gradual changes leads to uncertainty for the (energy) market as their transmission costs vary often over years.

5.3. Conclusions Q methodological research

The results of the Q methodology are now discussed with the definition of discourses and the identification of common ground, differences and ambiguous perspectives in respect with (groups of) statements. This chapter recaps the findings and makes conclusions that subsequently are addressed in the process approach, discussed in the following chapter. Again these are generalized results and slight differences can be expected in the individual perspective of the participants in the case study.

The four discourses discussed in paragraph 5.1 show differences that can be explained based on the voltage level they are most affiliated with. Discourse 1 and 3 both have a market oriented perspective, which is strongly focused on the high voltage level, while discourse 2 and 4 are more focused on the low voltage level. This means that the amount of differences identified in the previous paragraph is actually less, as the tariff system could only be adjusted for a specific voltage level. There has to be noted that most statements are indicative for the general direction an adjustment in the tariff system, this means that when the details are discussed, conflicts might arise that could not be defined based on this case study.

On the other hand, quite some common ground is found with the Q methodology. The theoretical determined wickedness of the problem is lower than expected, especially regarding topics only affecting a certain group of network users or for certain voltage levels. This suggests that certain aspects of the tariff system should be approached differently depending on the voltage level the adjustment affects. In addition, some of the differences that were identified are also explained by the potential negative consequences. Often the argumentation why a certain change was disagreed about, was because of the potential side effects. This was especially with the topic related to demand response; more demand response is generally received as positive, however, the lack of certainty and the sensitivity for gaming with variable transmission prices results in disagreement with the statements.

The use of Q methodology left certain topics as ambiguous; the placing of statements in the factor arrays didn't give a clear perspective how to approach this topic. Remarkable was the topic of cost allocation method. The cascading method is often mentioned as outdated and needs replacement in the future. Neither are there strong preferences to keep the cascading method the upcoming 10 years. However, other alternatives or foundations for cost allocations methods are stronger disagreed with.

Finally and most important for the argumentation of this study: there is general common ground that the tariff system should be changed with the energy transition. The exact directions can't yet be determined, but several topics for discussion are identified and quite a large variety of perspectives are determined. This could be facilitating during the propositions of changing aspects of the tariff system.

6. Process approach

This chapter uses the results from the case study, see chapter 5, to design a process approach based on the four elements of a good process design as described in chapter 3. Figure 6 shows an overview with a short description of the process approach. In the following paragraphs the process approach is further elaborated upon. Paragraph 6.1 describes the goal of the process: minimizing the increase in network costs. Subsequently the three directions for the rounds are discussed in paragraph 6.2: Voltage levels rounds, network cost allocation rounds and system perspective round. Paragraph 6.3 addresses the involvement of stakeholders for the process and interaction between them during the process. Paragraph 6.4 elaborates on the start of the process and paragraph 6.5 discusses the time line of the process with the most important events: a go/no-go moment for adjusting the network cost allocation method and some reoccurring events. Finally, in paragraph 6.6 the process approach is verified based on the four design elements of a good process design: openness, protection of core values, progress and substance. Specific focus is on the link between the results of the case study and how they contributed to the design principles of the elements of a good process design. Subsequently, this paragraph makes suggestions to address those design principles that couldn't be addressed based on the results of the case study to finalize the process approach.

The process approach identified three general directions where negotiations can take place: Voltage level rounds, network cost allocation rounds and system perspective rounds. They aim to contribute to the goal of the process: minimizing the increase of network costs. The voltage level rounds focus therefore on designing and experimenting for adjustments in the tariff system which only has impact on a (group of) voltage level(s). The system perspective tables focus on topics strongly related to other systems: The affect of the process on strongly related systems and vice versa. For example the introduction of a producers tariff in collaboration with surrounding countries or the protection of vulnerable network users. The network costs allocation rounds discuss the allocation of network costs and the network cost allocation method. Initially the focus is suggested to research alternative network cost allocation methods. With this input and the input from the other round directions there is worked towards a go/no-go where is decided if the network costs allocation method should be adjusted and if adjustment in needed, what the new network cost allocation method should be.

This decision should mainly be based on the process agreements that are made in the beginning of the process. These process agreements should support the decision eventually made; they are rules upon the decision will be based on. At the start of the process the results of the case study should be presented, verified and if needed further developed. This gives the involved stakeholders a better understanding of the different perspectives regarding the adjustment of the tariff system design, giving the opportunity to learn from each other, suggesting potential adjustments with a lot of common ground and an overview of benefits and drawbacks of adjustments. During the process stakeholders can further develop the potential adjustments and focus on the perceived drawbacks to create more support when the actual decision is made if a adjustment will be implemented. Ideally, a document is signed by all involved stakeholders at the end of the process, where they commit to the process and agree with the identification of adjustments with their drawbacks and benefits.

Although three directions are proposed, these are not separate processes and therefore annual meetings are proposed to celebrate success and share progress. The general approach during the process is to make high level agreements for the directions with all involved stakeholders, where after they are further specified in smaller groups of stakeholders. The stakeholders will be involved in multiple rounds, giving the opportunity to exchange: a stakeholder can give in during one round, as he will be reimbursed in another round.

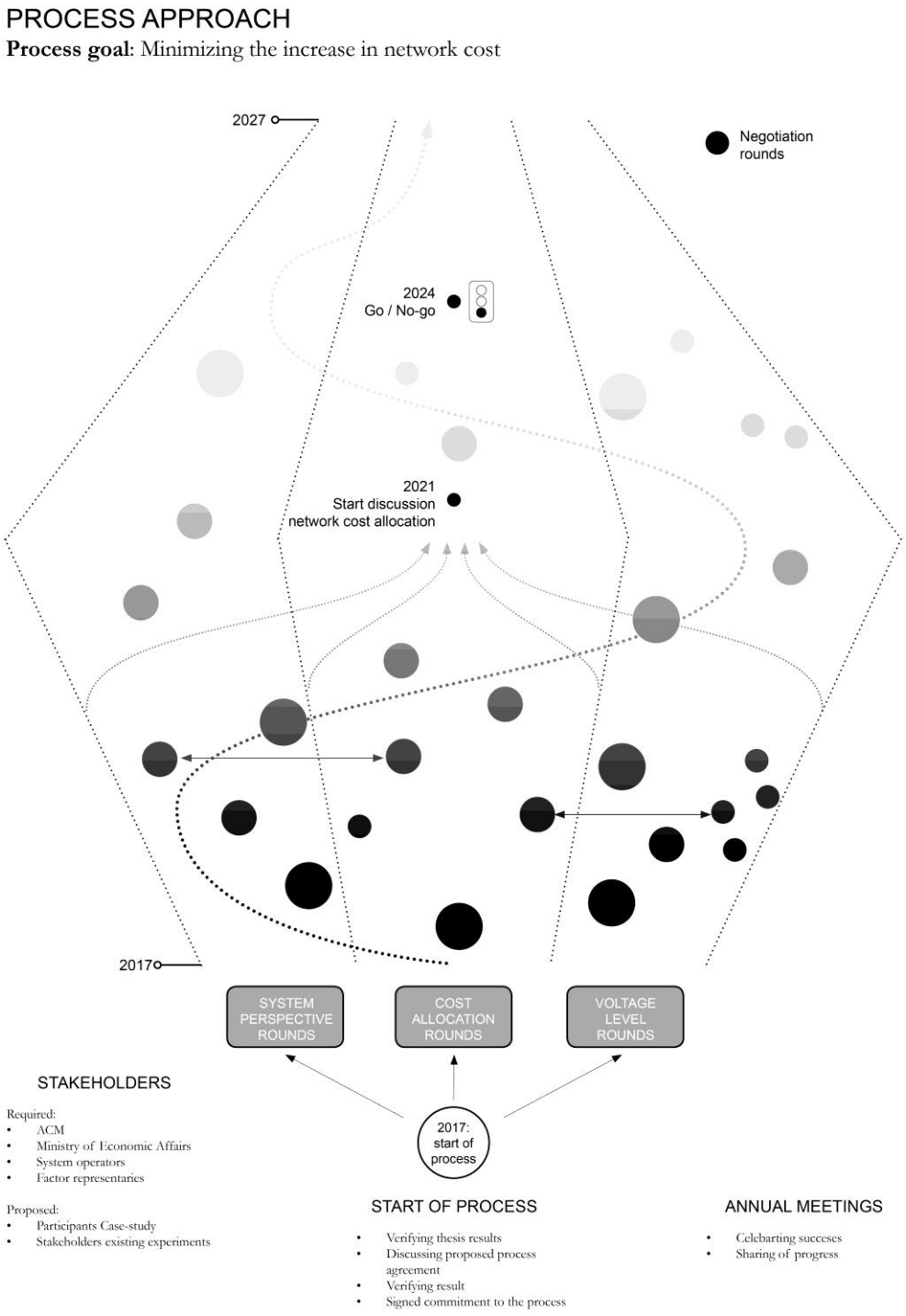

Figure 8: Overview of process approach

6.1. Process goal: Minimizing the increase of network costs for the energy transition

In chapter 3.2 there is argued that the process should be focused on achieving a goal and not on potential solutions. This facilitates to creation of a large solution space and prevent that certain solutions are excluded before the process starts. Ideally the goal should be a public goal which the actors perceive as ´something to gain´ when joining the process. Therefore the goal of the process is formulated as: minimizing the increase of network costs.

In the chapter 1 were several causes mentioned for the increasing network cost in the upcoming years. The results of the case study, see paragraph 5.3**,** show that a lot of the intended adjustments in the tariff system are aimed to reduce the needed network investments that occur if the current tariff system isn't adjusted. Investments in the network are needed and therefore the goal is formulated as minimizing the increase in network costs, as reduction of current network costs is most likely unfeasible with the trends of the energy transition.

The goal is a public goal as the increasing network costs result in higher transmission costs for all network users; all the transmission income together should be equal to the network costs, see chapter 2. Actors thus have something to gain by participating in the process: lower transmission costs. Additionally, nobody can really oppose to this goal, especially when additional process agreements are made regarding the other goals and principles of tariff system design discussed In paragraph 2.2, where most importantly the quality of the network shouldn't decrease (see chapter 5).

The goal of the process results in a wide solution space, far larger than only the tariff system design. This gives the opportunity to actors to suggest a large variety of solutions and gives the opportunity to exchange between values or different solutions during the process to create a 'win-win' situation, see paragraph 3.2.2. Setting the goal to adjust the tariff system design would result in a smaller solution space and could be perceived as reallocation of network costs; i.e. a process that leads to winners and losers and focused on a single mean: the tariff system.

Reallocation of the network cost should however not be excluded from the process approach. Paragraph 0 showed that there is common ground regarding several adjustments in the tariff system that intend a reallocation of network costs. A set of process agreements should be agreed upon that leads to the discussion if reallocation of network costs are needed. This is further addressed in paragraph 6.2.3.

6.2. Round directions in the process

The network costs can be reduced on three general aspects: reducing transport related network costs(less network investments), transport unrelated network costs (overhead, billing etc) and system services (less balancing efforts)(see paragraph 2.3). A large variety of solutions can be used to reduce the network costs for one or several of these aspects, however this paragraph focuses on the directions for the process to accommodate the findings in the case study: voltage level rounds, system perspective rounds and network cost allocation rounds. The suggested rounds are general directions for which the specific content should be determined during the process. The three round directions shouldn't be perceived as separate processes, but are interdependent and the round directions can generate input for other round directions. In the following paragraphs the round directions are further elaborated upon. In paragraph 6.3.2 the concept of rounds is further explained.

6.2.1. Voltage level rounds

The voltage level rounds focuses on solutions that reduce network costs for a specific voltage level or group of voltage levels. The results of the case study indicate that there are quite some differences in identified adjustments, values, principles and goals regarding the tariff system design that can be explained by the voltage level the participants are affiliated with(see paragraph 5.3).

The voltage level rounds thereby aim to build further on this identified common ground on a voltage level scale, giving progress to the process and increasing the prospect of gain for the participating stakeholders. Progress can be achieved by "transferring conflicts to the periphery of the process", see paragraph 3.2.2**.** By focusing on adjustments affecting only a single voltage level, or group of voltage level with common ground, reduces the chance of conflicts early on in the process. As the conducted research didn't focus specifically on differences within a specific voltage level, there can't be excluded that there would be no conflicts at all, most likely there will be some conflicts. However, there is some common ground as discussed above and it does prevent to directly deal with the large differences in perspectives, values and interests between the high and low voltage level.

This means that several rounds emerge, focused on different (groups of) voltage levels. Important is however, that these groups aren't separated completely, as a proposed solution for one voltage level might be also be an solution for another voltage level. Therefore the voltage level rounds should in the beginning of the process focus on a high level identification of possible solutiosn for specific voltage levels. Following the 'wyber' , see paragraph 3.2.4, this round should consolidate with identification of new rounds where the proposed solutions can be further developed.

Initially the negotiations in the rounds should be focused on designing experiments where the proposed solutions can be tested. Realizing experiments is easier than adjusting the tariff code or electricity law and most likely results in least resistance, as the solutions are first tested and not directly implemented in the regulation. The results of the experiments should be analyzed and determined how effective they are in respect with minimizing the network costs. Ideally, in the beginning of the process agreements should be made what a successful experiment is and when a successful experiment leads to an actual change in the tariff system design, see also 6.2.3.

Finally, the voltage level tables increase the prospect of gain for actors, as the experiments are focused on reducing network costs for a specific voltage level. Successful experiments that lead to lower network costs, means that the transmission costs for the network users connected to that voltage level also decrease. The experiments thus enable the possibility for 'quick wins', a design principle to stimulate progress in a process design, see paragraph 3.2.2. This is under the assumption that actors put most effort in designing and executing experiments for the voltage level they are most affiliated with.

Suggested is to increase the prospect of gain by determining process agreements that reward successful experiments. The reduction in network costs doesn't only benefits the specific voltage level, but is partly divided over other voltage level due to the use of cascading method and socialization, see paragraph 2.3. Two options are suggested: incentives by adjusting the network cost allocation to the relevant voltage level or direct incentives for successful experiment. Firstly, process agreements could be established that arrange that the voltage level with the most network costs reduction gets less network costs allocated. Secondly, the network users participating in the process receive an financial reimbursement, e.g. they are partly exempted for their network costs. Both options are further elaborated upon in paragraph 6.2.3.

6.2.2. System perspective rounds

The electricity network is literally and figuratively connected to other systems. Electricity is for example needed to perform market activities of network users, who can't perform the market activities without the electricity. Also the electricity network is part of the energy system and influenced by developments in, among others, the use of gas, heat and electricity, see paragraph 2.4. The case study identified that a group of participants strongly felt that a system perspective is lacking and the focus is too much on individual parts of the system, see paragraph 0**.** Therefore systems perspective rounds are proposed to deal with the influences from connected systems on the network costs and the influence of adjustments in the tariff system on other connected systems. The case study identified two important topics that should be discussed in these rounds: the protection of vulnerable network users and the introduction of a producer tariff.

The results identified that there are several groups of network users, connected to different voltage levels, whom require some sort protection. Two groups that are often mentioned are the large energy consumers and households with limited financial resources. Large energy consumers operate on the international market and high electricity prices or transmission costs harm their international competition position. Households with limited financial resources can't invest in new technologies that reduce their electricity related costs, e.g. solar PV to reduce electricity consumption, smart home systems that can be used for demand response or storage facilities that can reduce their peak load. There is proposed to start a round where process agreements are determined to identify vulnerable network users, how to monitor the influence of proposed adjustments and experiment on them and find potential measures when the vulnerable network users are un-equivalently harmed by the tariff system.

The case study also showed that there is common ground regarding the introduction of a producer tariff. However, the Dutch electricity producers also sell their produced electricity to surrounding countries of the Netherlands. The participants in the case study therefore often mentioned that a producer tariff should be implemented in collaboration with the surrounding countries of the Netherlands or in whole European. These rounds should be focused on possible methodologies for a

producer tariff, consult with surrounding countries on the possibilities and find strategies for the implementation.

These are two proposed directions for rounds based on the case study and therefore specified on the tariff system design. However, other systems could also influence the tariff system design. It is therefore suggested to try and identify systems that are related to the tariff system design. Options are for example subsidies from governmental agencies, that could be used to finance or incentivize the experiments as discussed in paragraph 6.2.1, already existing experiments regarding renewable energy, where the network costs could be influenced by or sustainability policies where more emphasized should come on the network costs or a systems perspective.

The above mentioned topics for the negotiations in the system perspective rounds strongly related to the design element of openness. The system perspective rounds can thereby stimulate "involvement or all relevant parties in the decision making process" , see paragraph 3.2.2, if actors from other systems related to the tariff system design are identified and tried to actively involve in the process of minimizing the increase in network costs.

6.2.3. Network cost allocation rounds

The research started by the pressure on the current cost allocation method: the cascading method (see chapter 2)**.** The results of the case study did not result in a clear conclusion regarding the adaption of the cost allocation method. The results don't show a strong preference for keeping nor changing the cost allocation method. The alternatives for the cascading method incorporated in this research are generally disagreed with. The research also didn't result in other alternatives mentioned by the participants. This leads to the conclusion that more research is needed regarding the cost allocation method and potential alternatives,

Therefore a direction of rounds is proposed that focuses on the network cost allocation method. This round direction will most likely result in the most conflict, as reallocation of network costs result in some (groups of) consumers with higher and other groups with lower transmission costs. This means that there are 'winners and losers' (see paragraph 3.2). This means that research alone won't lead to consensus about the adjustment of the cost allocation method: there is no definite solution to the tariff system design (see chapter 2)**.**

Initially, effort should be put in research as the case study showed that too little is known regarding alternatives for the network cost allocation method. This can be formulated in a concrete process agreements: participants in the process will allocate resources in researching network cost allocation methods. This process agreement address the design principle for openness: "substantive choices are transformed into process-type agreements" (see paragraph 3.2). The actors therefore don't have to commit to adjustment of the cost allocation method, but only into researching and analyzing the alternatives for the network cost allocation method in comparison to the current network cost allocation method.

There is proposed to formulate process agreements that are based on the results from experiments designed and executed in the voltage level rounds. An example is agreeing that the voltage level with the most effective experiments will get less network cost allocated, or will at least not get more network cost allocated. These type of process agreements prevents a negotiation about the 'best' cost allocation method, but the process will steer towards a (selection of) alternative network cost

allocation methods or might conclude that no new network cost allocation method is needed over the years. To stimulate progress, a go/no-go moment should be determined regarding the adjustment of the network cost allocation method. Otherwise the process will get stalled by proposing new experiments. The go/no-go moment is further discussed in paragraph 6.5.

Additionally, this incentives early participation, as those stakeholders have more time to experiment and have the chance to influence the formulation of process agreements that can eventually lead to adjusting the network cost allocation method in their benefit. During the process this gives additional incentives to perform experiments, as discussed in paragraph 6.2.1**.** This also emphasize the importance that the voltage level rounds shouldn't be independent of each other; successful experiments should be shared to give additional incentives to others to increase their efforts to experiment and reduce the network costs on their voltage level.

It might be hard to formulate and have the involved stakeholders commit to these process agreements that influence the potential adjustment of the cost allocation method; it might be a too large of a commitment if stakeholders expect that it will lead to a personal disadvantageous adjustment of the cost allocation method. Also the incentive to experiment on the different voltage levels might lag if the discussion regarding the process agreements takes too long or initially no experiments succeed in reducing the network costs. The prospect of gain is at the end of the process, which might be too far away and have too many uncertainties to become a strong incentive to experiment.

Therefore is another possibility is to determine process agreements that give a financial incentive to successful experiments. The most direct incentives is a process agreement where the involved network users in a successful experiment are (partly) exempted from their transmission costs based on the reduction of network costs. Other options for process agreements that all involved actors commit financial resources to rewards successful experiments or addressing governmental funds, e.g. subsidies, that are used to reward successful experiments or the network users participating in the experiments. This means that this round is not solely focused on method of network cost allocation, but also on the financial allocation for experiments.

6.3. Stakeholder involvement and exchange of values

Stakeholders have to participate in the process and during different rounds, where they interact with each other. Therefore paragraph 6.3.1 identifies required and proposes stakeholders for this process. Subsequently the rounds are further discussed based on the interaction between stakeholders in paragraph 6.3.2.

6.3.1. Required and proposed stakeholders in the process

In paragraph 3.3**Fout! Verwijzingsbron niet gevonden.** was mentioned that Q-methodology can be used for the selection of stakeholders. For this process approach this is not done for two reasons: the group of participants and to better achieve the design element of openness. Firstly, the participants are granted anonymity in this research, meaning that stakeholder identification and selection as Cuppen et al., (2010) did can only result in the ammonized participant codes and not the real stakeholders. Additionally, the participants cooperated in the research on their own behalf, meaning that their perspective might deviate from the companies. For the realization of the process a colleague of the involved participant might join the process and thereby making the stakeholder selection unfeasible for

this research. Secondly, the first design principle to have an open process is 'all relevant parties are involved in the decision-making process' (see paragraph 3.2.2). This research didn't aim to select the stakeholders for the process but to design a process approach, which is a different than Cuppen et al., (2010) aimed to achieve with her research. The group of participants is also most likely too small to select from and have all the relevant parties included. Therefore only required and proposed stakeholders are identified for this process approach, see Table 5**.**

Table 5: Required and proposed actors

Required stakeholders
ACM
Factor / voltage level representatives
System operators
Ministry of Economic Affairs
Proposed stakeholders
Participants Q methodology
stakeholders currently involved in experiments

Required actor

Four types of actors are required to start the process: ACM, factor and / or voltage representatives, system operators and the ministry of economic affairs. The ACM and Ministry of Economic Affairs are firstly required to stimulate progress following the design principle 'the process is heavily staffed', see paragraph 3.2.2. Both actor are beneficial for the image of the process, as their involvement shows the importance of the process and gives authority to the decisions and process agreements that are made, i.e. without these two actors giving commitment to the process has less value, because the commitment is given to actors with less authority. Additionally, both actors have knowledge regarding the regulation of the tariff system design and can play an advising role regarding how proposed adjustments in the tariff system design should be incorporated in the regulation, e.g. adjustment of the electricity law or tariff code. Their involvement in the process thereby prevents that the made decisions eventually cannot be carried out, as stakeholders withdraw their commitments to process agreements or regulation can't be changed.

The system operators are key to the success of the process: on the one hand they are the experts regarding potential network problems and secondly to give transparency regarding network costs. The system operators are crucial for the voltage level rounds: experiments can be identified based on the network problems system operators have. Also they are needed to determine if experiments are successful in respect with the achievement of actual network costs reduction. Without the system operators involved in the process the success of experiments becomes debatable as limited data regarding the network costs and network cost reduction can be obtained. The minimum requirement is therefore that TenneT and a regional system operator is included. TenneT has insight in the network costs for system services(network balancing efforts) and the network costs of the high voltage level and the regional system operator for the lower voltage levels. Although this is the minimum requirement, there is strongly emphasized to include all system operators as every network is unique and has different network problems. A wide variety of network problems gives more options to experiment and therefore more opportunities to reduce the network costs.

The last required stakeholder is a group of stakeholders, selected from the different discourses identified with Q methodology. Ideally, all the participants from the cases study would join the process, but at least every factor should be represent just as every voltage level. All the participants are experts in their field and together should give substance to the process: designing and experimenting in the voltage level rounds, researching the network cost allocation and finding connection with related systems and actors in the different system perspective rounds. Alternatively, a group of representatives for different voltage levels could also suffice, but these are harder to select, as there are different types of consumers on each voltage level and there are for example no interests groups that look after all the network users of a specific voltage level.

Proposed actors

The participants in the case study are proposed to involve in the process. These stakeholders are carefully selected to form a diverse group with different perspectives, see paragraph 4.3. These stakeholders, with a variety of backgrounds, are all knowledgeable about the tariff system and the issues resulting from the energy transition. Their participation results in a wide variety of perspectives and ideas regarding the adjustment of the tariff system design, resulting in open process and gives the process the potential for a lot of substance. Additionally, several of the participants in the case study are well-known in the sector, increasing the weight of the process, just as is argued for the Ministry of Economic Affairs and the ACM.

In the systems perspective rounds direction, see paragraph 6.2.2, was suggested to include stakeholder that already conduct already experiments related to network management or affiliated subjects in respect with the energy transition. These actors have experience setting up experiments and potentially have connections with other stakeholders that could be included in the process. Their participation has the potential to kick-start the process. When experiments are already designed or are just started and a network costs aspect could be incorporated in the experiment. If these experiments are successful in respect with reducing network costs and are rewarded, the other stakeholders receive early on incentives to start with more experiments, as is argued in paragraph 6.2.3 regarding the network cost allocation method.

6.3.2. Rounds configuration: stakeholder interaction

There are three rounds directions identified, where (a selection of) the stakeholders interact with each other. The exact configuration of stakeholders for the rounds can't be made at this point, there are too many uncertainties regarding the actual participation of the stakeholders, the process agreements and the participation dependents on the willingness of the involved stakeholders to participate in (multiple) rounds. Therefore some general suggestions are made regarding the participation of stakeholders in the different round directions. Additionally there are some suggestions made in respect with the interaction between the rounds.

At the start of the process the rounds should contain as many stakeholders as possible. In these first rounds the process agreements are made and it is important that all the stakeholders commit to these process agreements. In the beginning of the process the rounds should mainly focus on specifying the direction of the three identified round directions on a high level and consolidate about these directions, following the wyber of Bekkering et al. (2001), see paragraph 3.2.4**.** This gives insight in the

other stakeholders perspective, thereby stimulating learning from each other and creating understanding of the different perspective. The process loses speed when not all stakeholders are involved in the process: new information might arise, leading to new insights, stakeholders are against the formulated process agreements or want to change the general specification of the rounds direction.

When the process progresses over the time, the tables can become smaller. High level directions are set and a small group of stakeholders can define the specifics based on the general direction of the rounds. By decreasing the number of stakeholders, the progress of the process is stimulated: smaller groups negotiate about the details instead of large groups, meaning that potential conflicts can be discussed by a smaller group of actors, following the design principle ' conflicts are addressed in the periphery of the process', see paragraph 3.2.2

In paragraph 6.2 was already mentioned that although there are separate rounds directions, these are not separated processes. Stakeholders should be stimulated to join in multiple round directions and in several rounds, as they can learn from each other in each round and generate a wide variety of potential solutions. This also result in the potential of exchange of value or trade-offs between rounds; when negotiations become stuck, a stakeholder can decide to give in the one round and a different stakeholder in another round. This gives the potential to create a win-win situation or to 'compensate losers', see paragraph 3.2.4**.**

6.4. Start of the process

The start of the process is important as the process agreements are determined for the rest of the process. The statements used in the Q methodology and the responses of actors will be the basis to address several topics regarding the tariff system. The focus should be initially on the verification of the perspectives regarding specific topics and secondly develop and specify the perspectives further. The focus for potential adjustments in the tariff system design should be on argumentation why a certain aspect should be adjusted and what the potential drawbacks and benefits are. Additional topics that weren't in addressed in the case study can be proposed by the actors. At the end of the workshop an overview of potential changes with its drawbacks and benefits should be the result.

During this discussion, topics should not be discarded as unviable, as the goal of the start of the process is to identify as many potential adjustments in the tariff system. During this meeting the involved actors give their perspective regarding certain adjustments and argue why they find the changes beneficial or disadvantageous. Also the discourses are discussed, to have the involved stakeholders better understand each other. At the end of the start of the process, there should be a consolidation: an overview of the four discourses and overview of potential adjustments in the tariff system with its preliminary benefits and drawbacks. Later in the process this can be used to deal with the potential drawbacks regarding certain adjustments in the tariff system design; e.g. in paragraph 0 was concluded that quite some adjustments were disagreed upon because of certain risks or potential drawbacks the adjustment has, but the intention of the adjustment was agreed with. During the process there can be focused on preventing these drawbacks. This could also be formulated in a process agreement, e.g.: if the identified drawbacks or risks for a potential adjustment are sufficiently dealt with, there is decided to implement the adjustment. This prevents discussion regarding the adjustment itself, but focuses on how there is decided which adjustments are implemented.

Ideally the start of the process is ended by signing a document, committing to potential changes and their drawbacks and benefits. This prevents that at later stages new drawbacks are identified to slow down the process or hamper the implementation of adjustments in the tariff system. This has as drawback that actors who want to join at a later stage also need to agree with this document, who might have well founded additional drawbacks or unforeseen drawbacks for solutions that were not yet identified. A solution might be that the document can be revised on for example a annual basis, where all parties again have to sign the document.

Additionally to this document, several process agreements should be made at the beginning of the process. The process agreements in this and previous paragraphs could function as the basis for determining them. This document could also be refined during the process, however, important is that agreements are made that determine how the decisions during the process are made. This contributes to the openness of the process, following the design principle 'substantive choices are transformed into process-type agreements' (see paragraph 3.2.2).

6.5. Timeline of process and most important moments

This paragraph gives an overview of the timeline of the process and important moments during the process. The time span of the process will initially be set for 10 years. This time span is also used for the case study and the arguments for the 10 year time span can be found in paragraph 4.2. The key argument that applies for the time span is that it contains two regulating periods, giving the opportunity to adjust the tariff system at least twice before the end of the process[11]. A shorter time span would give insufficient time to perform experiments in the voltage level rounds direction, leading to limited input from the voltage level rounds direction to discuss the adjustment of the network cost allocation method. Finally, the results of the case study showed that in this time span quite some adjustments in the tariff system are preferred. Therefore the process should start as soon as possible to be able to negotiated, decide and implemented the potential adjustments.

A key moment is the go/no-go moment for the decision to adjust the network cost allocation method. There is proposed to set the go/no-go moment in 2025, after the second regulation period (Assumed is that the second regulation period will also be 4 years). This go/no-go moment should decide if the network cost allocation method should be adjusted and potentially a decision regarding the new network cost allocation method can be made. The negotiations regarding the decision to change the network costs allocation should start in 2021, the beginning of the second regulation period. This gives sufficient time to initially research alternative cost allocation methods and determine the process agreements that influence the decision regarding the adjustment, as discussed paragraph 6.2.3. In the period between 2021 and 2024 the network cost allocation methods should be designed in more detail.

The voltage level tables and system perspective table can try to achieve the same progress throughout the whole process. Initially, there should put quite some effort to generate ideas for experiments in the voltage level rounds direction. The voltage level rounds might focus more on smaller experiments in the beginning, which become larger during the process and even permanent changes in the tariff system more at the end of the process. The system perspective is more dependent on what

[11] The "methodebesluiten" are revised every 3-5 years. A new "methodebesluit" will start in 2017 and used until 2021.

happens in the other rounds and what develops outside of the process. Initially they should focus on finding connections with other systems, e.g. system operators of neighbouring countries to discuss a producer tariff(see paragraph 6.2.2)**.** Later they should monitor and discuss the results of the voltage level experiments and developments outside the process and how this influences the vulnerable network user. This means that after 2021 the general focus of the process narrows down and focuses more on realizing adjustments than widening the scope.

The time span of the process is long and could be perceived by the stakeholders as a large commitment. However, the start of the process requires the involvement of all stakeholders, but later the rounds can become smaller and not all stakeholders have to participate in all rounds, as discussed in the previous paragraph**.** To prevent that the rounds or round direction separate too much, an annual meeting is proposed where the different rounds and progress of the process are discussed. Proposed is to organize a yearly congress or related event which can be done publicly. This contributes to the transparency of the process and gives parties outside of the process the chance to learn from the results and potentially give new information that could be used within the process.

6.6. Recap: Elements of a good process design

This paragraph recaps the previous paragraphs to determine if this process has all the design elements for a good process design: Openness, protection of core values, progress and substance.

Therefore the design principles that lead to the elements of a good process design of de Bruijn et al., (2010), see chapter 3, are reviewed based on the proposed process design in Table 6. Additionally, those design principles that weren't addressed in the process approach are briefly discussed and a conclusion is a preliminary conclusion is drawn.

Table 6: Addressed design principles with results of case study

Design elements for a good process design and design principles	Input from case study	Paragraph
Openness		
• All relevant parties are involved in the decision-making process	*Q methodology can be used for actor selection. Not applied.*	§3.3.1
	P-set can also participate in process	§6.3.1
• Substantive choices are transformed into process-type agreements	Indirectly through Identification of process goal: minimization of increase in network costs	§6.1
	Indirectly: document signed at the end of the process with overview potential solutions	§6.1
• Both process and process management are transparent	*Not applied*	-
Protection of core values		
• The core values of parties are protected	Identification of core value: protection of vulnerable network users	§6.2.2
• Parties commit to the process rather than to the results	Indirectly through identification of process goal: minimization of increase in network costs	§6.1
	Several process agreements proposed	Various
• Parties may postpone their commitments	Indirectly: benefits and drawbacks of potential adjustments are identified at the start of the process, however, no preliminary selection is made.	§6.1
• The process has exit rules	*Not applied*	-
Progress		
• Stimulate 'early participation'	Indirectly in the various round directions	§6.2.1
• The process carriers a prospect of gain	Indirectly through Identification of process goal: minimization of increase in network costs	§6.1
	Voltage level rounds	§6.2.1
• There are quick wins	Potential quick wins are identified: voltage level rounds	§6.2.1
• The process is heavily staffed	Indirectly: P-set contained several 'heavy' stakeholders	§6.3.1
• Conflicts are addressed in the periphery of the process	Indirect: potential conflicts are identified in results of case study and discussed at the start of the process	CH. 5
	Identification of rounds	§6.1
		§6.2
• Tolerance towards ambiguity	*Not applied*	
• Command and control are used to maintain momentum	*Not applied*	
Substance		
• Substantive insights are used for facilitation. The role of experts and stakeholders are both bundled and unbundled	Indirectly: application of Q methodology to create substantive insights	Ch. 5
	Goal of process sets wide solution space	§6.1
	Large variety of stakeholders	§6.3.1
• The process proceeds from substantive variety to selection	Indirectly: results case study structure substantive variety	§6.1

In Table 6 there can be found that each element of a good process is at least once addressed directly and several times indirect based on the results of the case study. For most design principles the results of Q methodology had to be interpreted and reformulated into the design principles. Clearly, the Q methodology doesn't result in of the shelf design principles. Some results might be fortuitous, however, each element is directly and indirectly addressed based on the results of the Q methodology. This suggest that the Q methodology was successful for this case study to address the design principles to achieve the elements of a good process design.

Four design principles aren't addressed by the results of the case study, see Table 6, and are therefore briefly discussed. The first is "both process and process management are transparent". This design principles should be addressed during the process, by communicating during the start of the process (paragraph 6.1) the process, process managerial aspects (e.g. process agreements) and the role of the process manager. This design principle is considered an action during the process and can therefore not be addressed by the results of the case study.

The second design principle that is not addressed by the case study is "the process has exit rules". The exit rules create a safety and space and nourishes cooperation and decision making(de Bruijn et al., 2010, p.48). The exit rules lower the barrier to join the process, as stakeholders have the option to leave the process. When stakeholders feel the need to leave, they have to option to leave, thereby contributing to the protection of core values. Preferred is that no one leaves the process, the process should therefore be aimed to be appealing enough for the stakeholders. This design principle is regarded a precondition for every process design and is unlikely to be addressed by the results of the Q methodology.

"Tolerance towards ambiguity" is the third design principle not addressed by the case study. This is considered a also a design principle that is taken into account during the process. It refers to leaving terms vague and unclear, to keep the stakeholder "dreaming" that their preferences are still on the table (de Bruijn et al., 2010, p.52). In the process this can be found in for example the formulation at the voltage level table: "successful experiments".

The fourth and final design principle that is not addressed by the case study is "command and control are used to maintain momentum". This design principle should be used during the process to force a decision, e.g. threatening to make a decision if the stakeholders can't make a decision together. An option in the proposed process approach where this design principle can be applied is at the go/no-go moment regarding the network cost allocation method(see paragraph 6.2.3 and 6.5), where the ministry makes the decision regarding adjustment of the network cost allocation method when the involved stakeholders can't decide. Although applicable, this design principle should be kept in mind during the process, but doesn't result from the case study.

This suggests that all design elements for the process approach that could be addressed are addressed by the case study. Keep in mind though, that this list is not exhaustive. The design principles can be addressed in various ways, but are now only addressed based on the results of the case study. For example, one core value is identified, however, it is very likely that more core values need to be determined and protected in the process. Q methodology should therefore not be seen as a framework to design a process, but can identify several aspects of the design principles which can function as the basis of the process design. Note that the process has not yet begun, the topic of tariff system design is not high on the political agenda, but quite some aspects are already addressed and the issue is

structured, even without any negotiation between stakeholders. Without the case study these findings would probably identified during the start of the process, while the start of the process is now already structured, giving promise for the process to progress fast and make steps forward.

7. Conclusion & Recommendation

This research addressed the use of Q methodology to design a process for the adjustment of the tariff system of the electricity network. The tariff system design is a wicked problem and is used as a case study to show that Q methodology can be used to design a process approach to deal with a wicked problem and help structure it. The research thereby shows the application of Q methodology to fulfil several of the design principles that result in realizing the abstract design elements for a good process design of de Bruijn et al. (2010). It also demonstrates the practical value of Q methodology in the first step of a policy process as Steven Brown suggested in Wolf et al. (2011).

This chapter concludes the thesis by answering the research question of the thesis. Therefore first the sub-questions are answered that are used to answer the research question in paragraph 7.1- 1. Finally, paragraph 7.5 makes a recommendation for further research in respect with the use of Q methodology for a process design and some practical recommendations regarding the designed process approach.

7.1. What is the context of the tariff system design?

Paragraph 2.5 concluded that the adjustment of the tariff system is a wicked problem.. The physical properties of an electricity network make it very hard to determine the exact costs an individual network user engenders on the electricity network. The network costs can´t be allocated based on mathematical equation or economic principles and is partly socialized over all network users. Therefore the tariff system design has several goals and principles that should be achieved as best as possible. However, the goals and principles can conflict with each other, meaning trade-offs have to be made between them. This results in the conclusion that the tariff system design is an institutional design question: There is no single best solution, but the preferred solution depends on the perspective of a person and how they value the goals and principles.

The current tariff system is under pressure, which will increase in the upcoming years as a result of the energy transition towards a more sustainable energy sector. Electricity is increasingly generated on other voltage levels than the high voltage level, which is against the principle of cascading, the current network cost allocation method. With sufficient capacity installed on a voltage level, a voltage level could have a electricity surplus, resulting in a change of direction in electricity flow: electricity transported from a lower voltage level to a higher voltage level. The cascading method is based on the principles that electricity flows from the high to the low voltage level. These developments are most likely to increase, putting pressure on the current tariff system design to allocate the network costs to the different network users.

Additionally, in the upcoming years the network costs will increase to facilitate the energy transition. However, the exact direction of the energy transition is unknown, resulting in a lot of uncertainties, while decision have to be made by the system operator regarding the network investments. These uncertainties increase by interdependencies with other systems that also influence the demand for electricity and the use of the electricity network, e.g. stimulation of renewable electricity generation, electric vehicles, heat pumps etc.

On the other hand are there developments that could decrease the currently estimated investments. However, these techniques often need to be developed further or are limited applied. The tariff system can be used to stimulate these techniques and developments, but therefore the current tariff system design has to be adjusted.

7.2. Which topics of the tariff system are under discussion for potential adjustments?

The previous sub-question addressed the context of the tariff system design and concluded that the tariff system is under pressure and adjustments should be made to facilitate the energy transition. A literature study is performed to identify topics of the tariff system that are under discussion for adjustment . In addition interviews are held with people working in sectors strongly affiliated with the tariff system, creating a iterative process for new search terms in the literature study and topics to discuss in the interviews. The identified topics under discussion from the literature research and interviews are formulated into statements so that they can be used in the Q methodology. Following the methodology, the statements are categorized to achieve coverage and balance of all that is being said about the tariff system design. This resulted in 55 statements that can be found on page 29.

7.3. What are the most important discourses with respect to changing the tariff system?

The 55 statements are used in the Q methodology and 24 people working in sectors strongly affiliated with the tariff system sorted them on a scale from most agree to most disagree. The analysis of the sorts identified four factors, a Q sort from the weighted average of a group of participants that have communalities in their sorts. These four factors are described in dept in paragraph 5.1**.** The summarized description can be found below.

1. Traditional power to the market perspective: cost engender principle, high quality network and certainty for market parties.

The first discourse strongly focuses on the energy market and general economy: based on this perspective the tariff system should follow the cost engender principle, is stable and predictable, thereby reducing uncertainty for market parties and resulting in a high quality electricity network. Adjustments in the tariff system are primarily based on better applying the cost engender principle: a producer tariff and possibilities for reimbursement to network users for offering flexibility. More harmonization between European tariff systems is needed to create a level playing field.

2. Regional system sustainability optimization by collaboration, transparency of system operator and an adaptive tariff system.

This second discourse emphasizes the differences in regions and unique solutions to make them efficiently more sustainable. A top-down approach is therefore not feasible: the tariff system should be adaptable to comply with local conditions and solutions for optimization. The system operator should function as facilitator, giving more transparency about its network problems and planning, and collaborate with both public and private actors from different sectors to optimize the region to become more sustainable in an efficient manner.

3. The tariff system as a means to an end: achieving goals more important than following principles.

The third discourse is quite similar to factor one in respect to the principles and goals underlying the tariff system to facilitate the market. The main difference is that these principles are more regarded as guidelines and therefore exemptions can be made. The tariff system is seen as a mean to directly influence clearly formulated public goals, but the goals could not be uniformly formulated. The communality in this discourse is that the tariff system should be used to directly help reaching a public goal and therefore exemptions can be made in respect with the principles behind the tariff system design.

4. Tariff system as a mean to facilitate the energy transition; more transparency and fair distribution of network costs.

The fourth discourse also sees the tariff system as a means to an end, but focused on the facilitation of the energy transition as the public goal. The goals and principles behind the tariff system are regarded as guidelines, but don´t have to be strictly followed. More important is that the tariff system gives the right incentives to facilitate the energy transition. They have a high urgency to become more sustainable and argue that the costs for becoming more sustainable only increase the longer it takes. The system operator should become more transparent regarding the network planning and problems, to give market parties the opportunity to find solutions. However, the system operator may also perform market activities to facilitate the energy transition, but only if he thereby prevent higher network costs in the future.

7.4. What can Q methodology contribute to a process approach for adjusting the tariff system design of the Dutch electricity network?

In chapter three the basic theory of process management and process design are discussed. Subsequently this theory is used to design a process approach based on the findings in the case study of the tariff system design. Q methodology results in discourses which represent the perspectives regarding a certain topic. These discourses can subsequently be used to have stakeholders better understand each other. Process management is based on a similar principle, where negotiations and sharing of knowledge results in a better solutions and understanding of other stakeholders perspective. Table 6 gives an overview of the results that are used in the design of a process approach and which design principles they address. A general answer to the research question is given below.

On the basis of the four discourses three general round directions are proposed for the process approach. The three directions are chosen too address to core issues and differences of the discourses: a lacking system perspective (based on discourse 2), differences between network users connect to different voltage levels (based on differences between discourses 1 & 3 versus 2 & 4) and a network cost allocation round direction based on the missing preference for a specific cost allocation method (based on all factors). Q methodology usually identifies 2 – 6 discourses, which can be analyzed to identified the main directions for the rounds in a process approach

Mainly based on the reactions of the participants in the case study to various statements the goal of the process was identified: minimizing the increase in network costs. Quite some suggested aspects of the tariff system that are under discussion of adjustment are derived from the expected increase of the network costs. The granted anonymity and structured approach to address several topics of discussion with the Q methodology led to interesting discussions, granting the author the substantive knowledge to identify a public goal that aimed to create a win-win situation for all stakeholders involved in the process.

The results of the case study are used to address several of the design principles of the elements of a good process design. Several process agreements could be identified related to these design principle: a core value was identified, prospects of gain and potential quick wins. Additionally, the identified potential conflicts are dealt with in the process by addressing them in the periphery of the process. Finally, the identification of discourses facilitates substantive insights and can be used to create a substantive variety. Not all design principles could be addressed based on the result of the Q methodology, however, some strongly relate to the developments during the process or are more general rules or preconditions of a process design. The results don't directly result in clear design principles, but often have to be formulated in clear process agreements and need to be agreed upon by the stakeholders at the start of the process. With this side note in mind, there can be concluded that Q methodology has the capability to design a process approach for adjustment of the tariff system design of the electricity network.

The process approach gives confidence in a smooth adjustment of the tariff system design in the upcoming years. The process approach already structured the problem for a large degree, which facilitates the start of the process and potentially speed up the definition of process agreements and

identification of possible solutions direction. The already identified potential conflicts are dealt with as far as possible at this stage, reducing the chance that unexpected conflicts arise and slow down the progress. The combination of experiments in the voltage level rounds that function as input for the decision to adjust the network cost allocation method follows the process management theory and gives confidence that this leads to a decision which is generally supported by the involved stakeholders. This shows that the wickedness of the problem is reduced, or at last dealt with, reducing the chance that the process will result in a ´deadlock´ or a dialogue of the deaf´

7.5. Recommendations

The conducted research is based on a single case study specified on the adjustment of the tariff system of the electricity network. It showed how Q methodology can be used to design a process approach following the elements of a good process design. The results of the Q methodology are not clear and concise design principles to fulfill the elements of a good process design; they need to be interpreted and reformulated for a process approach. This paragraph therefore makes recommendations regarding further research to strengthen the link between the results of a Q methodology to design a process approach.

Firstly, The research resulted in a theoretical process approach, which is not actually realized. Although the theoretical design elements are met to a large degree, actually realizing the process based on this process approach is the best validation to determine the value of Q methodology in the process design. The process can verify the identified discourses, show to which extend to all common ground and differences are identified and if aspects are missing.

Secondly, this is a single case study and thus don't not prove that each design principle addressed in this case study, could also be addressed in another case study based on the Q methodological results. Additionally, Q methodology has quite some degrees of freedom in its design, meaning that fulfilling the design principles can also strongly depend on how the Q methodology is applied on the case study. Therefore is recommended that Q methodology should be applied in more case studies to design a process approach. This could strengthen the link between Q methodology and the design of a process approach.

Thirdly, there is recommended to research the influence of the design of the Q methodology on the results and applicability for a process approach. This case study contained quite some statements regarding the solutions space of the tariff system design, as the topic isn't high on the political agenda and therefore not (yet) highly polarized. This resulted that the statements were not really subjective, in sense that they were actual quotes derived from stakeholders. Multiple Q methodological researches on the same topic and on different moments could result in suggestions for the design of Q methodology how and when to apply to design a process approach.

Finally, process architects and process mangers should be involved in the above mentioned recommended research. This way process architects, those who design a process, can get familiar with the methodology and with their experience might even gather more valuable information from the Q methodological results. For example, asking the right questions during the sorting of statements by participants or during the analysis of results. For process managers the knowledge gain about the topic

at stake is very useful and a gives very good overview of the different perspectives regarding the topic and potential solutions, an important aspect of the process manager(see paragraph 3.2.5**.** When Q methodology is executed before the process the process manager has a starting point at the beginning the discussion regarding the process design and process agreements, instead of initially analyzing the negotiations during the process. This could improve the speed of the process. Therefore experiments with experienced process managers and architect should show the actual value of Q methodology for them in the process.

Finally, some recommendations are made regarding the process approach itself. There is deliberately chosen for the term process approach, to show the link between Q methodology and process design. This means that it is not a complete process design yet and should be further developed. Especially since the goal of the process is formulated as: minimizing the increase in network costs. This research focussed on the adjustment of the tariff system design, which contains a large part of the solution space to minimize network costs. However, the solution space to minimize the increase in network costs is far larger and therefore the process approach should become larger than only the adjustment of the tariff system design. The process is therefore recommended to further develop to increase the solution space and focus more on minimizing the increase in network costs.

8. Reflection

This thesis is definitely the most exciting task for obtaining my masters degree at the TU Delft, with many highlight and some low points. Although the TPM BSc and MSc prepares you for this final project, executing a research project individually was challenging; finding a topic, scoping the project and keeping up to speed even if the direction to go is not completely clear was harder than expected. The use of a new methodology which was foreseen as executing 'six steps' had more degrees of freedom, which had to be dealt with. As inexperienced 'Q researcher' much attention is paid to why certain choices have been made and to systematically interpreter the results from the Q methodology when existing literature couldn't give sufficient structure. In this reflection is thus explicit attention given to these choices in paragraph 8.1. In paragraph 8.2 a general reflection is given upon the results of the Q methodology and the process approach

8.1. Reflection on Q methodology: lessons learned

This paragraph reflects on the application of the Q methodology on the tariff system design. Therefore the each step is individually addressed with a specific focus on the choices that are made in these steps.

8.1.1. Defining the concourse

The research question formulated in the concourse was: *"How should the electricity tariff system in the Netherlands develop in the upcoming 10 years?"*. Quite some effort has been put into the argumentation behind the 10 year time span. Several arguments are mentioned in paragraph 4.1, but during the Q-sorts no questions were asked regarding the chosen time span. There is assumed that the round number and middle long term is accepted by the participants and regarded as a logical.

The concourse approach, an iterative process with a google search and interviews led to a large variety of statements. In the post-sort questions only a few suggestions were given when asked if the participant missed any statements (see paragraph 8.1.4). The use of naturalistic and quasi-naturalistic sources led to a large variety of potential statements. Some older sources could be used from previously discussions about specific topics and the STROOM internet consultation also resulted in a large amount of statements. However, the large amount of quasi-naturalistic sources made it harder to address the right level of detail on the statements, as the context of the sources differed quite a bit. The use of interviews helped a lot, the interviewees could further explain already found statements, but also address alternatives or potential drawbacks.

The sources lacked often opinions or quotes and this resulted that the amount of real "subjective" statements were lacking, but are more borderline subjective(Stephenson, 2016**)**. The lack of real opinions and quotes can also be expected, as the tariff system is currently not very high on the political agenda. Additionally, the context of the statement is subjective, time span of 10 years, creating a uncertain future. In the end, as (Watts & Stenner, 2012, p.66) state: "even a less than ideal Q set, because of it invites active configuration by the participants(effort after meaning), may still produce useful results".

8.1.2. Step 2: Define statements

The use of two different categorizations to select statements and expert checks led to a final Q-set of 55 statements. The amount of 55 statements follows the rule of thumb that a Q-set should contain between the 40 and 60 statements. In the post-sort questions is asked if the participants missed any statements. Besides a few topics that are strongly related to the tariff system design, but outside the scope of this research, no statements were missing according to the participants. However, during the Q-sorts became clear that there was some redundancy in the statements. A couple of statements contained small differences, but were based on the same principle. During the Q-sorts became clear that not all participants could make a deliberate choice between these statements.

This was especially with various statements that were related to creating more demand response. Quite some statements were related to this subject, but no clear conclusion could be made about demand response. This is assumed the result of the sorting process, where the best statement regarding demand response is sorted on the extremes of the scales and therefore the other statements more in the middle of the scale, as the participant has expressed the preference for demand response with a single statement. When analyzing the data, PQ method can´t see the relation of this group of 'demand response statements', although the participants might share this viewpoints. Reflecting on the Q-set a more specific statement addressing demand response in general might have solved this problem. On the other hand, quite some valuable information was found with the multiple "demand response statements". Both approaches could suffice for the Q-methodology, but in this case the statistical analysis doesn't give hard evidence of people who want more demand response. A specific participant had a strong perspective regarding variable tariffs and ICT to stimulate demand response, however, this perspective doesn't come forth in the four discourses.

8.1.3. Step 3: Creation of participant set

24 participants are included in the research, following all the rule of thumbs for the P-set. The combination of purposive sampling and snowballing technique worked well and it seems that the group is diverse. There is a small chance that the use of the snowballing technique resulted in quite some people out of the same network; it happened three times that a person suggested another person that was already included in the P-set. On the other hand, 3 general starting points were used for the snowballing technique: network of TNO colleagues, personal TU Delft network and general contact information from the internet. Additionally, Netbeheer Nederland were surprised regarding the amount of participants in my research, suggesting that the network of people strongly related to tariff system design is not very large.

Two important actors in the tariff system design are missing in the P-set: TenneT and the ACM. Both were contacted but could not participate in the research. However, Netbeheer Nederland is included, who also represents TenneT as system operator. The ACM as regulator is very knowledgeable, however, can't be involved in making regulation. Therefore more in-depth information about the tariff system design might not be gathered, but the value of the perspective of ACMegarding the tariff system design can be doubted.

8.1.4. Step 4: Sorting of statements

There is not much to reflect on the actual sorting process by participants, the sorting instructions were clear and the participants could all place the statements in the grid. The grid design was in general well received, although some persons did mention that they would have more room at the extremes. An even flatter distribution could be used, however, these participants often or strongly agreed or strongly disagreed with a statement. The forced distributed stimulated to make a deliberate choice and at the end of the Q-sort additional questions could be asked why certain statements didn't make it to the extremes and others did. In the grid design was however an small inconvenience, the agree side of the scale was on the left and disagree on the right, which was counter intuitive for some participants.

The ratio between statements in the pre-sort of statements seemed well. There were no significant differences in the ratio between agreed statements and disagreed statements. With exemption of a single participant, the agreed statements never passed the 0 column or vice versa. Quite some participants found it hard to categorize statements as neutral, valuating every statement either as agree or disagree, even with the instructions that the middle of the scale is less valuable for this type research. Other participants were well willing to categorize statements as neutral, and thereby paying almost no attention in which of the middle columns the statements was sorted. This combination led that the statements sorted between the +2 and -2 column were hard to objectively analyse, as several participants made a deliberate choice to put the statement in the +1 or -1 column, while others didn't. However, Q-methodology mainly focuses on the extremes for discourse formulation and these columns could were not affected by this.

Finally, the post-sort questions served its purpose. The first three questions to elaborate upon the Q-sort led to quite some substantive knowledge and very interesting talks. As already mentioned, no very important statements were missing according to the participants. However, after an hour sorting the statements some participants did mention that they found is hard to take some distance and analyze the complete set of statements for missing statements. The fifth question regarding the development of energy sector verified the assumption of the author: electricification, wind energy, decentralized generation were generally mentioned as main developments. Sometimes storage was mentioned, but on a very small scale. Sometimes the smart-grid and smart-metering was mentioned, however this is regarded as a pre-condition, e.g. dynamic transmission tariffs or congestion pricing can only be applied with a smart grid. It is a technique that facilitates demand response.

8.1.5. Step 5: data analysis

It is hard to reflect on the data analysis, as it is the first time the Q-methodology was used. There is quite some effort put into systematically extracting factors and rotating them. In the end, the researcher has quite some influence during the manual rotation. The use of the varimax function of PQmethod could also been done, but as already discussed in chapter 4, this results rarely in the best rotation. Eventually there was chosen a strategy similar to previous work of Watts & Stenner (2012), to have as many of the participant load significantly and try to reduce the amount of double loading participants. In the end, the best reflection on the data analysis is if the results make sense and the factor arrays don't have unexplained counter-intuitive placement of statements. This was not the case and it discussed in more detail in the following paragraph.

8.1.6. Step 6: Factor interpretation

The interpretation of the factors, but especially the argumentation how the discourses are formulated is quite hard. This can mainly be explained by the anonymity that is granted to the participants regarding their individual Q-sort and post-sort questions. This results that the argumentation is a bit vague, as it is based on the substantive knowledge of the author and can't be directly related to remarks of participants or individual Q-sorts. The crib-sheet gave some structure, but this is purely statistical and can't deal with counter intuitive findings in the factors array, that can be easily explained by the participants perspective whom significantly load on the factor. The anonymity would however again be given, as the participants talked freely and several times especially mentioned that certain quotes can't be used in the thesis. This was very valuable in getting to know the perspective of the participant for factor interpretation, however, leads to less substantiation of the discourse description.

The identified factors led to four discourses, based on factor array interpretation and substantive knowledge. The identified discourses aren't that exciting in the sense that they revealed completely new perspectives for the tariff system design. The value is according to the author in the level of detail. For example, there is quite some support for the introduction of a producer tariff, which lately was under discussion to be removed as option in the regulation. Additionally, there were quite some aspects found that could be used in the process approach, which is discussed in the next chapter. In the end, the discourses make sense, although no large surprises were identified, which seems the best indicator for the execution of a good Q-methodology.

8.2. General reflection on results

This paragraph makes some final reflections on the complete research.

Q methodology for process design

The recommendation already mentioned that further research is required to establish an explicit link between the use of Q methodology and addressing design principles to achieve the elements of a good process design. This might be hard, as de Bruijn et al. (2010, p.63) facilitated abstract guidelines, which help to design a process, but doesn't necessarily result in a good process: "It should be pointed out that going through these activities, in combination with a correct application of the designing principles, does not necessarily result in a good process design. Designing a process is not a mechanistic activity." The actual execution of the process is the only way to find out if the process was good.

Therefore deliberately was chosen to design a process approach, focussed on the main design principles that could be identified with the Q methodology. This means that the process is not completely finished. On the other hand, following the process approach, the stakeholders have to commit to and agree with the process design. Even though a process is well designed, if the stakeholders are not willing to join the process or commit to the process agreements, the process should be adjusted or can't be executed. Therefore the process approach contains examples and propositions and should be seen as recommendation on which the stakeholders and process manager should come to definite process design.

All relevant stakeholders are involved in the decision making process

A final reflection is on the specific design principle of de Bruijn et al. (2010, p.67) regarding all relevant stakeholders are involved in the decision making process. Q methodology can be used for a stakeholder selection, as Cuppen (2013) has shown. However, this might be less suitable for process approach,, as 'all relevant stakeholders' don't necessarily mean a selection from the identified discourses. The Q methodology doesn't take into account other aspects of stakeholders e.g. power or if they have are interested in the decision making.

Case study results versus actual behaviour of stakeholders in a process

This also relates to the results derived from the Q methodology. The participants in the case study are granted anonymity, are interviewed in a somewhat informal setting by a student, which may have led to opening up more than they normally would in an actual process. This has been very valuable regarding the formulation of discourses and the identification benefits and drawbacks on a very detailed level to determine common ground and differences, see appendix B.2 / paragraph 5.2. However, some participants explicitly said that certain remarks could not be mentioned in the thesis. This could mean that participants would behave or argue differently than they did during this research. Therefore the relevance of a stakeholder selection with Q methodology as Cuppen (2013) did has several reasons not to apply to this case.

This might also apply for the conclusion that the wickedness of the problem was less(see paragraph 0) than theoretical wickedness identified in chapter 2.5. The time span in the Q methodology was set for 10 years and the problem was during the research not very high on the political agenda. This might have reduced the perceived urgency by the participants regarding the problem. The less than anticipated wickedness could therefore result from the fact that the participant are willing to consider certain aspects of adjustments in the tariff system or are not completely informed and want to know more about the impact of a adjustment. When actual decisions are made or more information is available, the participants might have a stronger opinion regarding an adjustment. Also there should be kept in mind that the participants personally engaged in the research and the statements are not officially sorted by the company.

On the other hand, the statements are indicative and are not explicitly formulated as adjustments that could directly be implemented. This could mean that there are differences regarding the details of an adjustment addressed in the statements, but these differences could not be identified with this case study. However, as proposed in the process approach, the general direction of adjustments should be agreed upon by all stakeholders, where smaller groups work out the details. Therefore these potential differences are "in the periphery of the process" and already indirectly dealt with.

In the end, the research question of the thesis is answered, based on the use of Q methodology and the theory of process management. The process approach addresses several aspect of the wickedness of the issue and general direction of the process are identified. As recommended, more research is required to establish a more solid link between design a process approach with Q methodology. For this case study this is achieved, keeping the above mentioned notations in mind, and giving chances for further research to develop and verify the application of Q methodology for designing a process approach.

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A. Q-methodology

A.1 Google search approach concourse

The google search led to finding several web pages strongly connected to the energy sector, such as news sites and blog pages. Especially the web pages with blogs or columns were very useful, as it gave the personal view of authors who work or are strongly related to the subject and contained good statements. Secondly, supervisors suggested some web pages and subscriptions for newsfeeds by email. With the recently launched internet consultation[12] by the Dutch Government about the new Electricity and Gas law the newsfeed subscriptions are very useful to keep informed about the current discussion. The combination has led to both recent topics of discussion as well as older ones. An overview of the energy related news pages and newsfeeds can be found in Table 7. Besides these web pages the google search also led to finding directly pages with reports, articles, blogs or other information that were used to draw statements from.

Table 7: overview of webpages and newsfeed used in the concourse google search

Webpage name	webpage
Energie actueel	www.energieactueel.nl
Energie+	www.energieplus.nl
Energeia	www.energeia.nl
Energiebusiness	www.energiebusiness.nl
Energienieuws	www.energienieuws.info
Ensoc	www.ensoc.nl/nieuws
Netbeheer Nederland newsfeed	
Energeia Newsfeed	

The (combination of) search terms that are used to find the above web pages, search the news pages and find additional information directly from google can be found in Table 8. The search terms are iteratively established, as more information became known during the search and after the interviews. The search terms are in Dutch as the Dutch concourse needed to be determined.

[12] https://www.internetconsultatie.nl/stroom

Table 8: search terms used for google search [in Dutch]

List of search terms	
Generic search terms	Subject specific search terms
Cascade methodiek	Producententarief
Energie transitie	Rol netbeheerder
Netwerk	Decentrale productie/opwekking
Netwerkinvesteringen	Opslag netwerk
Netwerkkosten	(Offshore) windpark
Netwerk uitbreiding	Zonnepanelen
Regulering	WKK
Tariefsystematiek	Grootverbruikerregeling
Transporttarief	600 uur regeling
	Europa/EU
	Flexibele/dynamische transporttarieven
	Interconnectiecapaciteit

A.2 Concourse interviews

Several interviews are conducted to verify if the defined concourse from the google search was complete and gain additional statements on a more detailed level. The participants are selected with the goal to define the concourse and gather more concourse material on the development of the tariff system. A extensive description of the selection of participants can be found in paragraph 4.3.

The group of participants who are interviewed are working in a sector that is strongly related to the tariff system: large energy consumers (VEMW), system operators (Netbeheer Nederland & Enexis), producers (Energie Nederland) and regulator(ACM). Secondly, a group of participants is selected based on their scientific knowledge of the subject, who don't need to represent a company and are therefore assumed to be less biased in their perspective to a certain goal, but can give general remarks about the development of the tariff system. On the other hand, the scientific group is diverse in their background and therefore are assumed to analyze the tariff system design from another perspective.

The complete group consists of field experts, scientific experts or participants with both backgrounds. In total 12 persons were approached, of which 4 were non-responses due to time issues in their schedule. The interviews gave indeed more detailed information about the concourse and were quite useful to draw statements from, but very few new subjects were addressed, which led to the conclusion that the google search in addition with the interviews had defined the concourse. Therefore no additional participants were approached to replace the non-responses. Table 9 shows an overview of the 8 participants which took part in the concourse interviews.

Table 9: Participants concourse interviews

Name Participant	Company
Annelies Huygen	TNO UVA
Frits van der Velde	VEMW
Hamilcar Knops	AWTI TU Delft
Hans Peter Oskam Edwin Edelenbos	Netbeheer Nederland
Hilbert Klok[13]	ACM NWEA
Lennart Verheijen	Enexis Stichting E-Laad
Ruud Otter	Energie Nederland

Approach concourse interviews

The concourse interviews are first of all used to check the defined concourse based on the google search and gather more detailed statements. However, the defined concourse might not be complete and therefore the participant should not be steered by the defined concourse based on the google search. Steering the participant could lead to losing new concourse material as the participant only focuses on the so far defined concourse. Therefore a semi-structured interview with open questions are used.

The semi-structured interview allows the participant to engage in a wide ranging discussion (Aberbach & Rockman, 2002) and provides details, depth and a insider's perspective(Leech, 2002). The open questions allows the participant to answer in their own framework and is often preferred by higher educated people (Aberbach & Rockman, 2002). This suits the goal of the concourse interviews, as the focus is on the participants perspective, but also allows to address specific topics. The participants are all high educated people; scientist from universities or field experts.

Some disadvantages of a semi-structured interview with open questions are; coding is harder, harder to perform statistical analysis with the data and therefore time (and money) intensive in comparison to a structured interview (with closed questions) (Aberbach & Rockman, 2002). However, the goal of the interview is obtaining specific concourse materials in the form of statements. Therefore the coding for statistical purposes is not relevant, as a statistical analysis is performed based on the sorting of the statements in a later stage. The different perspectives on the tariff system are in this research more important than slight variations on those perspectives, therefore a limited amount of semi-structured interviews could be conducted in the time available for this research.

[13] Participant switched jobs during the research. At the moment of the concourse interview he was working at the ACM. During the concourse he switched to NWEA. Note that the participants were interviewed on personal basis and the companies are only mentioned as validation of their knowledge about the subject.

The interview had the following structure:

A. Introduction to graduation topic and mention goal of the interview [5 min]
    1) Topic tariff system: Network costs, costs allocation and role of system operator
    2) Goal: gather different perspectives on the development of the tariff system
    3) Ask permission for recording, mention anonymity of the interview
B. Ask the four questions, emphasize that the focus is on question 3 and 4. [40 min]
    1) Which network related developments will occur as a result of the energy transition?
    2) What is the impact of these developments on the network and the network costs?
    3) Can the current tariff system deal with these developments?
    4) What should be changed in the tariff system to deal with these developments
C. Adress topics from google search/earlier interviews that weren't addressed yet. [15 min]
D. Finish interview: ask for participation further research.

The interview started with introducing the graduation topic and the goal of the interview. The goal of finding different perspectives was mentioned to give the participant the opportunity to also mention perspectives that he knows about, but not necessarily agrees with. The participant is asked if the interview could be recorded for analytical purposes. However, the anonymity of the content of the interview is emphasized; the recording would only be used by the author and the content would be anonymous. This should put the participant at ease and encourage him to talk freely about the subject.

Secondly, the four questions that were going to be discussed are mentioned and that the emphasis of the interview is on the last question. Question 1 and 2 are asked to determine briefly the participants definition of energy transition, the context in which he evaluates the tariff system and what this has for an impact on the network and network costs. There is emphasized that these questions should be discussed in general and that the focus in on question 3 and 4. These questions give the participant the opportunity to address issues and secondly address solutions to these issues.

The questions are open and give the participant the time to formulate his perspective about the subject, within the boundaries of the interview. The interviewer is silent and makes notes about subjects he wants to get back to later. New subjects or new perspectives that weren´t included in the concourse already are asked to elaborate upon and the interviewer can use contrasting statements to trigger the participant to explain the perspective in more detail. These statements are formulated in a neutral way to prevent that the participant is feels attacked by the interviewer. There is strived create a open setting as in a normal conversation.

When the participant has answered the four questions, subjects from the concourse that weren't discussed yet are brought up by the interviewer to verify the so far established concourse and possibly gain additional information. The interview is ended by asking if the participant want to take part in the sorting of statements and if the participant can give suggestions for possible participants for the Q-sort.

Invitation to concourse interview

The participants are invited for the interview by email which can be found in the text block below. The invitation is written in Dutch, as all the participants for the interviews are from Dutch origin. The author is introduced through the supervisor from TNO, where he is introduced as a graduate student from TNO who wants to talk about the electricity tariff system. If no direct contacts are available, the author contacts the participants himself. Some examples are included in the letter to check if the addressee is the right person in the organization to talk to and has the required knowledge about this subject. There is specifically chosen to use the term talk and not interview, to reduce barriers of participation. Finally, there is explicitly mentioned that the interview can be conducted with complete anonymity if the participant this prefers.

Onderwerp: Uitnodiging deelname thesis onderzoek tariefsystematiek elektriciteitsnetwerk.

Geachte **Geadresseerde,**
Mijn naam is Wouter van Mechelen, master student Systems Engineering, Policy Analysis and Management aan de faculteit Technische Bestuurskunde van de TU Delft. Voor de afronding van mijn studie voer ik een afstudeeropdracht uit bij TNO met betrekking tot de netwerkkosten van het elektriciteitsnetwerk en de verdeling van de kosten over netwerkgebruikers, kortweg de tariefsystematiek van het elektriciteitsnetwerk. Hiervoor wil ik de verschillende visies op de ontwikkeling van de tariefsystematiek in relatie tot de energietransitie in kaart brengen.
Jasper Donker, mijn begeleider vanuit TNO, heeft voorgesteld u te betrekken in mijn onderzoek. Als werknemer bij **Bedrijf/Organisatie** zou ik graag uw mening horen over de huidige tariefsystematiek en de ontwikkeling hiervan in de komende jaren. Hiervoor zou ik uw visie willen bespreken over de invloed van de energietransitie op de netwerkontwikkeling; o.a. de (stijgende) netwerkkosten, verdeling hiervan over verschillende netwerkgebruikers en regulering van netwerkbeheerders. In mijn onderzoek staan de verschillende visies centraal, waardoor het interview anoniem(qua persoon en bedrijf/organisatie) kan worden uitgevoerd indien dit is gewenst. Ik zou graag op korte termijn een afspraak met u maken om hierover te spreken.
Ik wil u alvast bedanken voor de tijd die u voor mij neemt en hoor graag of u wilt deelnemen aan mijn onderzoek. Indien u nog vragen heeft met betrekking tot het interview, mijn onderzoek of een afspraak wilt maken, kunt u mij bereiken op onderstaand e-mail adres of telefoonnummer.

Met vriendelijke groet,
Wouter van Mechelen
E-mail adress
Phone number

A.3 Draft Q-sets

Draft Q-set based on the categorisation from Hakvoort et al. (2013).

1. Investeringen in het netwerk zoveel mogelijk worden uitgesteld, tot er meer zekerheid is naar de toekomstige vraag van het netwerk.
2. Investeringen in het netwerk dusdanig ruim worden uitgevoerd, zodat er voor de afschrijvingstermijn van de investering geen capaciteitstekort wordt verwacht
3. Het netwerk vrije vestiging en economische activiteiten faciliteert en geen beperking is voor de markt .
4. Worden uitbreidingsinvesteringen (nieuwe netten) bekostigd door de aangeslotene van dit netwerk of die hiervan gebruik maken
5. met een interconnectie capaciteit die volledige marktkoppeling mogelijk maakt.
6. Met een interconnectie capaciteit afhankelijk van de import en export met onze buurlanden
7. Producten een transporttarief hebben
8. Producenten alleen meebetalen aan het netwerk wanneer we netto elektriciteit produceren
9. Producenten alleen meebetalen aan het netwerk indien dit voor iedereen in Europa gelijk is
10. De hoeveelheid die geproduceerd wordt op een netvlak (gedeeltelijk) invloed heeft op de toedeling van netwerkkosten aan netvlakken
11. Het aantal netvlakken tussen producent en afnemer (gedeeltelijk) bepalen hoe hoog de transportkosten zijn [niveaustelsel]
12. Congestie in het netwerk en verliezen als gevolg van de locatie (gedeeltelijk) worden toegepast [nodal/zonal pricing]
13. De cascademethodiek wordt toegepast zolang de betrouwbaarheid van het netwerk van het hoogspanningsnet komt
14. Het transporttarief van aangeslotenen op hogere netvlakken hoofdzakelijk gebaseerd is op capaciteit(kW).
15. Waarbij een verbruikscomponent (kWh) in het transporttarief zit.
16. Waarbij het transporttarief voor grootverbruikers hoofdzakelijk gebaseerd is op verbruik (kWh)
17. Waarbij de hoogte van het capaciteitstarief sterk gekoppeld is de aan de bijdrage van de systeempiek
18. De netwerkkosten (gedeeltelijk) gedekt worden door algemene middelen
19. De transporttarieven variabel zijn in de tijd; op elk moment kan er een ander transporttarief zijn.
20. De transporttarieven verschillen in de tijd; op vooraf gedefinieerde momenten zijn er prijsverschillen in het tarief [uren, dagen, seizoen etc.]
21. Contractvormen zijn met een gegarandeerde capaciteit en optionele capaciteit, waarbij er tot de gegarandeerde capaciteit kan worden gereduceerd wanneer dit nodig is
22. Het een optie is om te kiezen voor een transporttarief met of zonder variabiliteit
23. De netbeheerder service vraagt van een aangeslotene, tegen een vergoeding, wanneer dit nodig is.
24. Het netbeheer ondergeschikt is aan een goed werkende energiemarkt
25. Waarbij er wordt gezorgd voor minimale barrières voor marktwerking
26. Betaalbaarheid een gereguleerde kwaliteit van het netwerk tegen efficiënte kosten betekent
27. Transportkosten niet (significant) hoger zijn dan andere Europese landen
28. Wordt gestreefd naar een zo zuiver mogelijk kostenveroorzakingsprincipe
29. De tariefsystematiek geleidelijk over de jaren wordt aangepast
30. De tariefsystematiek zoveel mogelijk in één keer wordt aangepast
31. Veranderingen in de tariefsystematiek gepaard gaan met zekerheid, men moet weten wat men kan verwachten in de aankomende jaren
32. De overheid moet de energiemarkt meer sturen om overinvesteringen in het netwerk te voorkomen en meer zekerheid te geven aan nieuwe technologieën
33. De tariefsystematiek wordt gebruikt om bepaalde marktuitkomsten te sturen
34. De huidige tariefsystematiek zo lang mogelijk wordt behouden
35. De netbeheerder zijn rol duidelijk is afgebakend en zoveel mogelijk wordt beperkt
36. De netbeheerder zich ook op de markt mag begeven, indien hij hierdoor de netwerkkosten kan verlagen
37. De netbeheerder prikkels transparantie geeft aan de markt om zijn netwerkproblemen op te lossen
38. De netbeheerder alleen rollen vervuld die niet door de markt vervuld worden, maar waar hij wel behoefte aan heeft
39. De netbeheerder geen taken uitvoert die ook door een marktpartij zouden kunnen worden gedaan
40. De transporttarieven prikkels geven voor investeringen in het netwerk
41. Er meer inspraak is voor aangeslotene of investeringen nodig zijn
42. Er in Europa zoveel mogelijk op dezelfde manier word getarifeerd en zelfde regels gelden
43. De overheid/minister geen invloed heeft in netwerkinvesteringen, maar dit door de netbeheerder wordt besloten die gecontroleerd wordt door de ACM.
44. Kortingen (bijvoorbeeld grootverbruikers regeling) op transportkosten aanwezig zijn indien dit nodig is
45. Waarbij de regels soepeler zijn, zodat er meer ruimte is voor onderlinge afspraken en onderhandelingen tussen afnemers, producenten, netbeheerders en marktpartijen

Draft Q-set based on the categorisation of goals/values/believes.

1. Decentrale opwekking en nieuwe duurzame technologieën moet gestimuleerd worden met transporttarieven
2. Terug levering van decentrale productie moet in principe altijd kunnen, wanneer een netbeheerder dit wil beperken moet hij hiervoor een vergoeding geven
3. Autarkie/private netten moeten zoveel mogelijk worden voorkomen
4. Het net kan beter te ruim worden uitgelegd dan te krap
5. Nieuwe technologieën moeten geen beperkingen ondervinden vanuit het net of netbeheer
6. Op laagspanning moet vraag en aanbod beter op elkaar worden aangepast
7. Korting wordt gegeven aan grootverbruikers indien zij dit nodig hebben
8. Grootverbruikers worden niet gesubsidieerd door de maatschappij
9. Transporttarieven niet significant hoger zijn dan andere Europese landen.
10. de tarifering van transport van elektriciteit steeds meer op dezelfde manier gebeurd in Europa
11. De koppeling (interconnectie capaciteit) met onze buurlanden maximaal wordt uitgebreid
12. Er alleen een producententarief wordt gebruikt indien dit Europees bepaald is
13. De tariefsystematiek stuurt op specifieke marktuitkomsten
14. De netbeheerder alleen gereguleerde taken uitvoert, waarbij er zoveel mogelijk aan de markt wordt overgelaten
15. De netbeheerder gereguleerde taken erbij krijgt, wanneer deze niet door de markt worden opgepakt.
16. De netbeheerder meer vrijheden krijgt om het netwerk zo efficiënt mogelijk te beheren
17. De netbeheerder ook activiteiten uitvoert die door de markt kunnen worden gedaan, wanneer deze (onvoldoende) plaatsvinden.
18. Regionale netbeheerders opslag mogen toepassen, zolang ze geen elektriciteit verkopen
19. Netbeheerders moeten meer informatie vrijgeven over het netwerk en tegen welke problemen ze aan lopen, zodat de markt tegen een vergoeding kan helpen
20. Producententarief afhankelijk is van de netto import en export van Nederland
21. Netbeheer en netwerkkosten ondergeschikt zijn aan een goed werkende vrije elektriciteitsmarkt
22. Tariefsystematiek voor langere tijd wordt vastgelegd om te zorgen voor zekerheid voor nieuwe investeringen en nieuwe initiatieven
23. Tariefsystematiek flexibel wordt ingericht, zodat er gemakkelijk en snel aanpassingen kunnen worden gedaan wanneer er (onvoorziene) ontwikkelingen plaatsvinden
24. Wijzigingen in de tariefsystematiek zoveel mogelijk op één moment zijn gebeurd.
25. Wijzingen in de tariefsystematiek geleidelijk gebeuren en opeens volledig wordt omgegooid
26. Ik het belangrijker vind dat er duidelijkheid wordt gegeven over wat we willen met de tariefsystematiek dan wat er daadwerkelijk veranderd.
27. De tariefsystematiek prikkels betreffende netwerkinvesteringen geeft aan de netbeheerder
28. Nieuwe investeringen in het netwerk worden gebaseerd op regelgeving en normen van het netwerk
29. De tariefsystematiek zoveel mogelijk hetzelfde is gebleven; veranderingen leiden tot een onzeker investeringsklimaat en leveren nooit optimale prikkels
30. Totale (efficiënte) kosten van het netwerken de kosten van de netbeheerder
31. Het prikkelen van aangeslotene belangrijker is dan de kosten dekken van het netwerk; tekorten bij de netbeheerder kunnen eventueel vanuit algemene middelen van de overheid worden gedekt
32. Iedereen profiteert (indirect) van het elektriciteitsnetwerk; ook als je geen aansluiting op het netwerk hebt moet je meebetalen.
33. Het netwerk bekostigd wordt vanuit algemene middelen van de overheid
34. Er locatieprikkels zijn voor aangeslotene op hogere netvlakken
35. Er geen locatieprikkels zijn
36. Er geen locatieprikkels worden toegepast; dit levert teveel barrières en beperkt de marktwerking van de elektriciteitssector
37. Vrije vestiging en economische productiviteit belangrijker zijn dan de toerekening van kosten die je in het netwerk veroorzaakt
38. Er locatieprikkels zijn voor elektriciteitsproducenten op hogere netvlakken
39. Er locatieprikkels zijn voor afnemers op hogere netvlakken
40. Er waar mogelijk (gedeeltelijk) diepe investeringskosten worden toegerekend
41. Het aantal netvlakken tussen afnemer en producent invloed heeft op het transporttarief [niveaustelsel principe]
42. Het huidige netwerk als 'klaar' wordt beschouwd; uitbreiding van het netwerk wordt (gedeeltelijk) bekostigd door de aangeslotene
43. Er meer diversiteit moet komen in contracttypen voor kleinverbruikers
44. Veranderingen in de tariefsystematiek niet moet leiden tot teveel complexiteit voor aangeslotene; iedereen moet overzichtelijke en overwogen besluiten kunnen maken
45. Er moet bij het netwerk worden gekeken naar verschillende energievormen, waarbij netbeheerders prikkels kunnen geven voor het gebruik van andere netten(gas, elektra, warmtenetten)
46. Er meer inspraak is door aangeslotene en/of politiek welke investeringen er in het netwerk worden gedaan
47. Iedereen moet dezelfde kwaliteit van het netwerk krijgen
48. Er meer keuze is in de kwaliteit van je aansluiting; aangeslotene moeten de opties krijgen om service te bieden aan de netbeheerder

49. De kwaliteit van het netwerk gelijk blijft
50. De kwaliteit van het netwerk aan vast gestelde normen voldoet

A.4 Invitation Q-sort

Onderwerp: Onderzoek ontwikkeling tariefsystematiek van het elektriciteitsnetwerk

Geachte [*Geadresseerde]*,

Mijn naam is Wouter van Mechelen, master student Systems Engineering, Policy Analysis and Management aan de faculteit Technische Bestuurskunde van de TU Delft. Voor de afronding van mijn studie voer ik een afstudeeropdracht uit bij TNO met betrekking tot de netwerkkosten van het elektriciteitsnetwerk, de verdeling van de kosten over netwerkgebruikers en de rol van de netbeheerder, kortweg de tariefsystematiek van het elektriciteitsnetwerk. Hierbij is het doel het onderkennen van de verschillende visies over de ontwikkeling van de tariefsystematiek in relatie tot de energietransitie.

[Via referentiepersoon, bedrijf, heeft voorgesteld u te betrekken in mijn onderzoek]. Om de verschillende visies in kaart te brengen gebruik ik een methode waarbij 55 stellingen gesorteerd worden in een normale verdeling op een schaal eens-oneens, waarna de sortering wordt besproken. In mijn onderzoek staan de verschillende visies centraal, waardoor het interview anoniem(qua persoon en bedrijf) kan worden uitgevoerd indien dit gewenst is. Het uitvoeren van het onderzoek zal ongeveer een uur duren.

Ik wil u alvast bedanken voor de tijd die u voor mij neemt en hoor graag of u wilt deelnemen aan mijn onderzoek. Indien u nog vragen heeft met betrekking tot de sortering, mijn onderzoek of een afspraak wilt maken, kunt u mij bereiken op via de mail of onderstaand telefoonnummer.

Met vriendelijke groet,
Wouter van Mechelen
[*telefoonnummer*]
[*email adres*]

A.5 Post-sort questions

Vragen voor na de sortering:

Deze vragen geven de ruimte om extra toelichting te geven op uw sortering. Wanneer u naar stellingen verwijst, vermeld dan het nummer wat op het kaartje van de stelling staat. U kunt nog steeds uw sortering aanpassen indien gewenst.

Kunt u kort toelichting geven op uw keuze van de 7 stellingen waarmee u het meest mee eens bent:

Kunt u kort toelichting geven op uw keuze van de 7 stellingen waarmee u het meest mee oneens bent:

Had u moeite om bepaalde stellingen te sorteren? Zo ja, welke en waarom?

Miste u stellingen of zijn er onderwerpen niet meegenomen, die u wel belangrijk acht in deze context?

Heeft u de sortering gebaseerd op basis van verwachte ontwikkelingen in de energiesector? Zo ja, kunt u deze verwachte ontwikkeling kort beschrijven? Zou de sortering veranderen als deze ontwikkelingen niet plaatsvinden? Licht kort toe

Heeft u verder nog opmerkingen over de sortering of specifieke stellingen die u verder wilt toelichten?

A.6 Factor extraction and rotation

Factor extraction

Factor extraction is done by using the CFA option in PQ method. The analysis is started by using the 'magic number' of 7 factors. Figure 9 shows the unrotated factor matrix of the analysis.

Unrotated Factor Matrix

	Factors						
	1	2	3	4	5	6	7
SORTS							
1	0.5582	0.1839	0.2648	-0.2177	0.0816	-0.0809	0.4265
2	0.2230	-0.4736	0.0969	-0.1701	0.1302	-0.2540	0.1001
3	0.3227	0.5230	-0.1648	-0.2226	0.1876	-0.2941	-0.0216
4	0.3867	-0.1153	-0.3472	0.0442	0.0610	-0.1704	-0.3444
5	0.5318	-0.1691	0.3376	0.2934	0.0857	-0.0390	0.1199
6	0.5001	0.0550	0.0855	0.0315	0.0031	0.0646	0.0137
7	0.6329	-0.1759	-0.0823	0.1890	0.0221	-0.1023	-0.0584
8	-0.0472	0.3201	0.0750	0.4367	-0.1679	0.0914	0.2383
9	0.4072	-0.5017	-0.0180	0.2232	0.1261	0.0861	0.0691
10	0.6560	-0.1705	0.0974	0.1364	0.0166	0.2564	-0.2224
11	0.4040	0.1600	0.2441	0.0665	0.0362	-0.2792	-0.1022
12	0.4740	0.3467	-0.0696	0.1265	0.0598	-0.1067	0.0894
13	0.2284	-0.3542	-0.0749	0.0501	0.0564	0.2337	0.1587
14	0.4755	-0.4379	0.0632	0.0524	0.0856	0.0624	0.1377
15	0.4696	-0.2343	-0.2178	-0.3898	0.1435	0.1322	0.2738
16	0.6339	0.2207	-0.1922	-0.1052	0.0525	0.2687	0.1032
17	0.7008	0.3284	0.1829	0.0601	0.0640	0.2096	0.0221
18	0.4783	0.3217	0.0010	0.0633	0.0471	0.2559	-0.0501
19	0.5751	0.3048	0.0816	-0.1542	0.0666	-0.1803	-0.1508
20	0.5166	-0.4506	0.2204	0.0785	0.1118	-0.1198	0.0161
21	0.3639	0.4088	0.5701	-0.1732	0.2735	0.1309	-0.3555
22	0.2350	0.0908	-0.5049	0.1808	0.1330	-0.1300	0.0631
23	0.1671	0.4250	-0.2345	0.4750	0.2008	-0.2222	0.0771
24	0.3974	0.0215	-0.2504	-0.0780	0.0373	0.3929	-0.2018
Eigenvalues	5.1266	2.4212	1.3154	1.0304	0.3109	0.9158	0.7912
% expl.var.	21	10	5	4	1	4	3

Figure 9: Principle Component analysis with 7 factors - Unrotated factor matrix

The unrotated factor matrix shows the correlation of each sort on a factor and for each factor the Eigenvalue and explained variance. In total 48% of the variance is explained by the 7 unrotated factors . The Kaiser-Guttman criterion (see chapter 4.5) would result in keeping factor 1-4 that have an Eigenvalue of larger than 1.

Factor Rotation

Identifying markers

The factor is chosen to be rotated manually, therefore some markers needed to be identified (see paragraph 4.5). To prevent too much influence of the researcher, markers were identified by using statistics. Potential groups were firstly identified by using the correlation matrix, see Figure 10.

Correlation Matrix Between Sorts

SORTS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	100	22	37	-5	36	47	19	5	13	23	41	29	3	22	36	38	43	14	41	29	38	7	7	13
2	22	100	-9	8	25	7	22	-30	13	14	4	2	30	34	27	1	-11	-4	5	43	-6	-6	-22	-4
3	37	-9	100	21	2	20	14	0	-15	0	27	47	-17	-13	8	38	29	16	44	-7	29	16	21	18
4	-5	8	21	100	17	10	35	-23	19	27	11	22	11	20	16	20	11	19	23	25	-4	27	9	23
5	36	25	2	17	100	33	34	9	39	42	25	27	20	39	18	10	43	21	26	46	20	7	-5	7
6	47	7	20	10	33	100	42	9	4	43	14	14	31	11	11	33	42	28	19	28	21	4	12	28
7	19	22	14	35	34	42	100	-8	23	43	29	25	25	36	29	29	39	17	22	53	5	15	21	33
8	5	-30	0	-23	9	9	-8	100	-20	-6	1	16	2	-11	-30	-2	10	14	-9	-7	0	13	21	-3
9	13	13	-15	19	39	4	23	-20	100	47	11	5	28	55	38	13	18	7	2	46	-6	16	4	6
10	23	14	0	27	42	43	43	-6	47	100	35	13	29	44	25	36	41	31	34	36	25	4	2	38
11	41	4	27	11	25	14	29	1	11	35	100	32	-15	22	-7	21	34	15	29	18	40	2	22	-6
12	29	2	47	22	27	14	25	16	5	13	32	100	-10	19	22	36	54	42	29	-3	19	16	40	7
13	3	30	-17	11	20	31	25	2	28	29	-15	-10	100	19	25	19	-5	12	-8	29	-21	21	-18	26
14	22	34	-13	20	39	11	36	-11	55	44	22	19	19	100	36	30	35	2	8	41	5	-6	-7	9
15	36	27	8	16	18	11	29	-30	38	25	-7	22	25	36	100	39	29	11	22	26	0	2	-11	33
16	38	1	38	20	10	33	29	-2	13	36	21	36	19	30	39	100	54	42	31	18	28	24	18	39
17	43	-11	29	11	43	42	39	10	18	41	34	54	-5	35	29	54	100	50	53	24	52	-1	23	32
18	14	-4	16	19	21	28	17	14	7	31	15	42	12	2	11	42	50	100	42	13	49	14	18	30
19	41	5	44	23	26	19	22	-9	2	34	29	29	-8	8	22	31	53	42	100	20	49	19	26	18
20	29	43	-7	25	46	28	53	-7	46	36	18	-3	29	41	26	18	24	13	20	100	17	9	-11	1
21	38	-6	29	-4	20	21	5	0	-6	25	40	19	-21	5	0	28	52	49	49	17	100	-11	-5	20
22	7	-6	16	27	7	4	15	13	16	4	2	16	21	-6	2	24	-1	14	19	9	-11	100	46	26
23	7	-22	21	9	-5	12	21	21	4	2	22	40	-18	-7	-11	18	23	18	26	-11	-5	46	100	0
24	13	-4	18	23	7	28	33	-3	6	38	-6	7	26	9	33	39	32	30	18	1	20	26	0	100

Figure 10: Correlation matrix between individual sorts

Sorts with a correlation higher than 0.40 are underlined in this figure. The significance level is the same as determined in paragraph 4.5**,** which is 0.35, but this resulted is too much significant correlations and therefore the significance level was increased by 0.05, thereby marking those participants with a higher correlation with each other. Based on the correlation matrix between the individual sorts, groups larger than 2 were identified that all significantly correlated with each other. In total 9 potential groups are identified, which can be found in Table 10.

Table 10: Potential groups of sorts that significantly correlate with each other.

Group 1	1	6	17	
Group 2	1	17	19	
Group 3	3	12	19	
Group 4	6	7	10	
Group 5	9	10	14	20
Group 6	10	17	6	7
Group 7	12	17	18	
Group 8	16	17	18	
Group 9	17	18	19	21

Subsequently different amount of factors were extracted by using PCA or CFA option in PQMethod and was rotated by using the varimax rotation. The idea behind this approach that PQMethod optimizes the explained variance and the groups that load significantly on a factor should have at least their sort in common. In addition, the author could gain some experience using PQmethod and the different options that it offers. The groups of participants loading significantly on a factor can be found Table 11.

Table 11: Groups of sorts loading significantly on a factor by using various amounts of extracted factors.

Analysis	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
PCF 7 factors	3, 11, 19	9, 14, 15	4, 22, 23	16, 18, 24	2, 7, 13
PCF 4 factors	1, 3, 6, 11, 17,18,19,21	2, 5, 7 ,9 ,14 ,20	4, 24		
CFA 7 factoren	16, 18, 24	2, 7, 9, 13, 14, 20	4, 22,23	1, 11, 12, 19, 21	
CFA 4 factoren	1, 3, 6, 11, 12, 17, 18, 19, 21	2, 7, 9, 13, 14, 20	4, 15, 22, 24	8, 23	

In the left column the analysis method is mentioned with the amount of extracted factors. The remaining columns shows the factors after varimax rotation and the factors with the significantly loading sorts. The analysis are shown with the extraction of 7 and 4 factors, as extraction with 5 and 6 factors led to almost identical results as extraction of 7 factors. Starting with an extraction of less than 4 factors led to too large groups of sorts significantly loading on a factor.

In total now 25 potential groups of sorts that could function as a marker are identified. A selection of groups is made that was formed several times. These groups were analyzed based on the substantive knowledge of the author, to check if they also were related besides the statistical results. This resulted in 4 groups which functioned as a marker during the hand rotation, see Table 12.

Table 12: Marker groups: Sorts that are grouped together several times and share similar post-sort information.

Marker group 1	Marker group 2	Marker group 3	Marker group 4
2, 7	11, 19	9, 14	4, 22

Now the marker groups are rotated in such a way, that they have a high loading on a factor. Marker group 1 and 3 shared quite some similarities, both statistical and based on substantive knowledge, and could not be rotated in such a way that they would load on an individual factor; they had too much in common. Therefore these marker groups were later combined.

By rotating the factors that the marker groups had a high significant loading, other sorts loaded also significantly on the factor. Each sort that loaded significantly on the factor was checked by the substantive knowledge of the author if they were similar to the marker group. Subsequently double loading sorts were analyzed and factor were rotated subsequently to load them on the single factor. This was an iterative process, as rotating the factor rotates also the position of the other sorts, and eventually every sort loaded significantly on at least one factor.

B. Data from case study

B.1 Data for individual factor interpretation

The rotated factors are analyzed by using the PQMethod software. This results in a document where the factor arrays for each factor can be constructed. The factor array is the Q-sort for a factor. Subsequently the factor array is elaborated by showing the statements and their columns, first the extremes columns of the factor array and following towards the middle of the grid. On the following pages each factor´ factor array can be found and subsequently the factor array is amplified with the actual statements. Subsequently the factor arrays are compared with the other factors to construct a crib sheet.

Factor array 1

Factor 1
Q-sorts: 2, 7, 9, 13, 14, 20

-5	-4	-3	-2	-1	0	1	2	3	4	5
15	3	7	1	12	2	5	8	4	6	26
33	14	29	9	19	17	16	11	27	22	40
37	39	35	10	36	21	18	13	34	25	44
	47	38	28	43	30	23	20	41	50	
		54	51	45	31	46	24	53		
			55	48	42	49	32			
					52					

+5	+4
26Er wordt gestreefd naar een zo zuiver mogelijk kosten veroorzaking principe	6Producenten een transporttarief hebben
40Investeringen in het netwerk worden gebaseerd op regelgeving en normen van de kwaliteit van het netwerk	22De netbeheerder flexibiliteit vraagt van een aangeslotene, tegen een vergoeding, wanneer hij hier behoefte aan heeft
44De kwaliteit van het netwerk niet achteruit gaat	25Transportkosten in Nederland voor aangeslotene niet (significant) hoger zijn dan omringende landen
	50De netbeheerder geen taken uitvoert die ook door een marktpartij kunnen worden gedaan

-5	-4
15iedereen meebetaalt aan het netwerk, ook als je er niet op bent aangesloten	3Het netwerk op een gegeven moment als 'definitief' wordt beschouwd; uitbreiding van het netwerk (nieuw stuk netwerk) wordt (gedeeltelijk) bekostigd door de aangeslotenen aan dit nieuwe stuk netwerk
33De netwerkkosten (gedeeltelijk) gedekt worden door algemene middelen van de overheid.	14Het belangrijker is dat aangeslotene de juiste prikkels krijgen dan dat de tarieven de kosten van het netwerk dekken; eventuele tekorten worden aangevuld vanuit algemene middelen van de overheid.
37De netbeheerder zich ook op de markt mag begeven, indien hij hierdoor de netwerkkosten kan verlagen	39Regionale netbeheerders opslag mogen toepassen in het netwerk, zolang ze geen elektriciteit verkopen.
	47De tariefsystematiek wordt gebruikt om op bepaalde marktuitkomsten of doelen te sturen.

+3	+2
4De interconnectie capaciteit volledige marktkoppeling mogelijk maakt	8Producenten alleen een transporttarief hebben, wanneer dit door Europa voor alle landen verplicht wordt gesteld.
27Het transporttarief hoofdzakelijk gebaseerd is op capaciteit(kW) van de aangeslotene	11Verliezen (gedeeltelijk) in het transporttarief worden verwerkt.
34De tariefsystematiek prikkels betreffende netwerkinvesteringen geeft aan de netbeheerder.	13De cascademethodiek wordt toegepast.
41Er in Europa naar een uniforme tariefsystematiek wordt gestreefd; bijvoorbeeld dezelfde tariefdragers, tariefhoogtes of kortingen.	20Er contractvormen zijn waarbij je niet altijd zoveel kan afnemen als je wilt; wanneer het nodig is kan je aansluiting worden gereduceerd tot een minimale “baseload”.
53De overheid/minister geen invloed heeft in netwerkinvesteringen, maar dit door de netbeheerder wordt besloten die gecontroleerd wordt door de ACM	24Er wordt gezorgd voor minimale barrières voor marktwerking.
	32De hoogte van het capaciteitstarief gekoppeld is aan de hoogte van de systeempiek die er is op het moment van de maximale capaciteitsvraag van netgebruiker.

-3	-2
7Producenten alleen een transporttarief hebben, wanneer we netto elektriciteit exporteren.	1Investeringen in het netwerk zoveel mogelijk worden uitgesteld tot er meer zekerheid is over de toekomstige energievraag voor het netwerk.
29Het transporttarief hoofdzakelijk gebaseerd is op verbruik (kWh) van elektriciteit	9De hoeveelheid elektriciteit die geproduceerd wordt op een netvlak (gedeeltelijk) invloed heeft op de toedeling van netwerkkosten aan een netvlak
35Decentrale opwekking en duurzame technieken moeten gestimuleerd worden met transporttarieven.	10Het aantal netvlakken tussen producent en afnemer (gedeeltelijk) bepalen hoe hoog de transportkosten zijn [niveaustelsel principe].
38De netbeheerder alleen rollen vervult die niet door de markt vervuld worden, maar waar hij wel behoefte aan heeft.	28Een verbruikscomponent (kWh) in het transporttarief zit.
54De regels soepeler zijn, zodat er meer ruimte is voor onderlinge afspraken en onderhandelingen tussen afnemers, producenten, netbeheerders en marktpartijen	51De transporttarieven prikkels geven voor investeringen in het netwerk.
	55Er wordt gekeken naar de verschillende type netwerken en netbeheerders prikkels kunnen geven voor het gebruik van andere netten (gas, elektra, warmtenetten).

+1	0	-1
5De interconnectie capaciteit afhankelijk is van de import en export met onze buurlanden.	17De transporttarieven verschillen in de tijd; op vooraf gedefinieerde momenten zijn er prijsverschillen in het tarief [uren, dagen, seizoen etc.].	12Congestie in het netwerk (gedeeltelijk) invloed heeft op de hoogte van het transporttarief.
16De transporttarieven variabel zijn in de tijd; op elk moment kan er een ander transporttarief zijn	21Het een optie is om te kiezen voor een transporttarief met vaste tarieven of variabele tarieven.	19Er meer soorten contracttypen zijn voor de transporttarieven van kleinverbruikers.
18Decentrale opwekking moet een apart transporttarief heeft.	30De tariefsystematiek flexibel wordt ingericht, zodat er gemakkelijk en snel aanpassingen kunnen worden gedaan wanneer er (onvoorziene) ontwikkelingen plaatsvinden.	36De tariefsystematiek zoveel mogelijk hetzelfde is gebleven; veranderingen leiden tot een onzeker investeringsklimaat en zullen tot suboptimale prikkels en kostenverdelingen leiden.
23Het netbeheer ondergeschikt is aan een goed werkende energiemarkt.	31De tariefsystematiek geleidelijk over de jaren wordt aangepast.	43Veranderingen in de tariefsystematiek niet moet leiden tot teveel complexiteit voor aangeslotene; iedereen moet overzichtelijke en overwogen besluiten kunnen maken.
46Veranderingen in de tariefsystematiek gepaard gaan met zekerheid; het moet duidelijk zijn hoe de tariefsystematiek zich gaat ontwikkelingen in de aankomende jaren	2Investeringen in het netwerk dusdanig ruim worden uitgevoerd, dat er in de afschrijvingstermijn van de investering geen capaciteitstekort kan worden verwacht	45De tariefsystematiek zoveel mogelijk in één keer wordt aangepast.
49De netbeheerder prikkels en/of transparantie geeft aan aangeslotene om zijn netwerkproblemen op te lossen.	42Er mogelijkheden zijn voor kortingen(bijvoorbeeld grootverbruikers regeling, 600 uur regeling o.i.d.) indien dit maatschappelijk gewenst is.	48De huidige tariefsystematiek zo lang mogelijk wordt behouden.
	52Er meer inspraak is voor aangeslotene of investeringen in het netwerk nodig zijn.	

Crib sheet factor 1		Ranking
# statement	**Items ranked at +5**	
26	Er wordt gestreefd naar een zo zuiver mogelijk kostenveroorzakings-principe.	+5
40	Investeringen in het netwerk worden gebaseerd op regelgeving en normen van de kwaliteit van het netwerk	+5
44	De kwaliteit van het netwerk niet achteruit gaat.	+5
	Items ranked higher in factor 1 array than other factor arrays	
6	Producenten een transporttarief hebben.	+4
8	Producenten alleen een transporttarief hebben, wanneer dit door Europa voor alle landen verplicht wordt gesteld.	+2
23	Het netbeheer ondergeschikt is aan een goed werkende energiemarkt.	+1
25	Transportkosten in Nederland voor aangeslotene niet (significant) hoger zijn dan omringende landen.	+4
27	Het transporttarief hoofdzakelijk gebaseerd is op capaciteit(kW) van de aangeslotene.	+3
41	Er in Europa naar een uniforme tariefsystematiek wordt gestreefd; bijvoorbeeld dezelfde tariefdragers, tariefhoogtes of kortingen.	+3
50	De netbeheerder geen taken uitvoert die ook door een marktpartij kunnen worden gedaan.	+4
	Items ranked lower in factor 1 array than other factor arrays	
10	Het aantal netvlakken tussen producent en afnemer (gedeeltelijk) bepalen hoe hoog de transportkosten zijn [niveaustelsel principe].	-2
14	Het belangrijker is dat aangeslotene de juiste prikkels krijgen dan dat de tarieven de kosten van het netwerk dekken; eventuele tekorten worden aangevuld vanuit algemene middelen van de overheid.	-4
19	Er meer soorten contracttypen zijn voor de transporttarieven van kleinverbruikers.	-1
28	Een verbruikscomponent (kWh) in het transporttarief zit.	-2
35	Decentrale opwekking en duurzame technieken moeten gestimuleerd worden met transporttarieven.	-3
39	Regionale netbeheerders opslag mogen toepassen in het netwerk, zolang ze geen elektriciteit verkopen.	-4
47	De tariefsystematiek wordt gebruikt om op bepaalde marktuitkomsten of doelen te sturen.	-4
54	De regels soepeler zijn, zodat er meer ruimte is voor onderlinge afspraken en onderhandelingen tussen afnemers, producenten, netbeheerders en marktpartijen.	-3
	Items ranked at +5	
15	iedereen meebetaalt aan het netwerk, ook als je er niet op bent aangesloten.	-5
33	De netwerkkosten (gedeeltelijk) gedekt worden door algemene middelen van de overheid.	-5
37	De netbeheerder zich ook op de markt mag begeven, indien hij hierdoor de netwerkkosten kan verlagen.	-5

Factor array 2

Factor 2 Q-sorts: 1, 6, 11, 12, 17, 18, 19, 21										
-5	-4	-3	-2	-1	0	1	2	3	4	5
2	7	1	4	9	5	10	6	16	12	22
36	15	3	8	23	14	11	17	19	20	49
48	29	38	13	40	27	21	32	24	26	54
	33	41	18	43	28	37	35	30	39	
		45	25	46	31	44	51	34		
			47	53	42	50	55			
					52					

+5	+4
22De netbeheerder flexibiliteit vraagt van een aangeslotene, tegen een vergoeding, wanneer hij hier behoefte aan heeft.	12Congestie in het netwerk (gedeeltelijk) invloed heeft op de hoogte van het transporttarief.
49De netbeheerder prikkels en/of transparantie geeft aan aangeslotene om zijn netwerkproblemen op te lossen	20Er contractvormen zijn waarbij je niet altijd zoveel kan afnemen als je wilt; wanneer het nodig is kan je aansluiting worden gereduceerd tot een minimale “baseload”.
54De regels soepeler zijn, zodat er meer ruimte is voor onderlinge afspraken en onderhandelingen tussen afnemers, producenten, netbeheerders en marktpartijen.	26Er wordt gestreefd naar een zo zuiver mogelijk kostenveroorzakings-principe.
	39Regionale netbeheerders opslag mogen toepassen in het netwerk, zolang ze geen elektriciteit verkopen.

-5	-4
2Investeringen in het netwerk dusdanig ruim worden uitgevoerd, dat er in de afschrijvingstermijn van de investering geen capaciteitstekort kan worden verwacht.	7Producenten alleen een transporttarief hebben, wanneer we netto elektriciteit exporteren.
36De tariefsystematiek zoveel mogelijk hetzelfde is gebleven; veranderingen leiden tot een onzeker investeringsklimaat en zullen tot suboptimale prikkels en kostenverdelingen leiden	15iedereen meebetaalt aan het netwerk, ook als je er niet op bent aangesloten.
48De huidige tariefsystematiek zo lang mogelijk wordt behouden.	29Het transporttarief hoofdzakelijk gebaseerd is op verbruik (kWh) van elektriciteit
	33De netwerkkosten (gedeeltelijk) gedekt worden door algemene middelen van de overheid.

+3	+2
16De transporttarieven variabel zijn in de tijd; op elk moment kan er een ander transporttarief zijn	6Producenten een transporttarief hebben.
19Er meer soorten contracttypen zijn voor de transporttarieven van kleinverbruikers	17De transporttarieven verschillen in de tijd; op vooraf gedefinieerde momenten zijn er prijsverschillen in het tarief [uren, dagen, seizoen etc.].
24Er wordt gezorgd voor minimale barrières voor marktwerking.	32De hoogte van het capaciteitstarief gekoppeld is aan de hoogte van de systeempiek die er is op het moment van de maximale capaciteitsvraag van netgebruiker.
30De tariefsystematiek flexibel wordt ingericht, zodat er gemakkelijk en snel aanpassingen kunnen worden gedaan wanneer er (onvoorziene) ontwikkelingen plaatsvinden.	35Decentrale opwekking en duurzame technieken moeten gestimuleerd worden met transporttarieven.
34De tariefsystematiek prikkels betreffende netwerkinvesteringen geeft aan de netbeheerder. .	51De transporttarieven prikkels geven voor investeringen in het netwerk.
	55Er wordt gekeken naar de verschillende type netwerken en netbeheerders prikkels kunnen geven voor het gebruik van andere netten (gas, elektra, warmtenetten

-3	-2
1Investeringen in het netwerk zoveel mogelijk worden uitgesteld tot er meer zekerheid is over de toekomstige energievraag voor het netwerk.	4De interconnectie capaciteit volledige marktkoppeling mogelijk maakt.
3Het netwerk op een gegeven moment als 'definitief' wordt beschouwd; uitbreiding van het netwerk (nieuw stuk netwerk) wordt (gedeeltelijk) bekostigd door de aangeslotenen aan dit nieuwe stuk netwerk.	8Producenten alleen een transporttarief hebben, wanneer dit door Europa voor alle landen verplicht wordt gesteld.
38De netbeheerder alleen rollen vervult die niet door de markt vervuld worden, maar waar hij wel behoefte aan heeft.	13De cascademethodiek wordt toegepast.
41Er in Europa naar een uniforme tariefsystematiek wordt gestreefd; bijvoorbeeld dezelfde tariefdragers, tariefhoogtes of kortingen	18Decentrale opwekking moet een apart transporttarief heeft
45De tariefsystematiek zoveel mogelijk in één keer wordt aangepast.	25Transportkosten in Nederland voor aangeslotene niet (significant) hoger zijn dan omringende landen.
	47De tariefsystematiek wordt gebruikt om op bepaalde marktuitkomsten of doelen te sturen.

+1	0	-1
10Het aantal netvlakken tussen producent en afnemer (gedeeltelijk) bepalen hoe hoog de transportkosten zijn [niveaustelsel principe	5De interconnectie capaciteit afhankelijk is van de import en export met onze buurlanden.	9De hoeveelheid elektriciteit die geproduceerd wordt op een netvlak (gedeeltelijk) invloed heeft op de toedeling van netwerkkosten aan een netvlak
11Verliezen (gedeeltelijk) in het transporttarief worden verwerkt.	14Het belangrijker is dat aangeslotene de juiste prikkels krijgen dan dat de tarieven de kosten van het netwerk dekken; eventuele tekorten worden aangevuld vanuit algemene middelen van de overheid	23Het netbeheer ondergeschikt is aan een goed werkende energiemarkt
21Het een optie is om te kiezen voor een transporttarief met vaste tarieven of variabele tarieven.	27Het transporttarief hoofdzakelijk gebaseerd is op capaciteit(kW) van de aangeslotene.	40Investeringen in het netwerk worden gebaseerd op regelgeving en normen van de kwaliteit van het netwerk
37De netbeheerder zich ook op de markt mag begeven, indien hij hierdoor de netwerkkosten kan verlagen.	28Een verbruikscomponent (kWh) in het transporttarief zit.	43Veranderingen in de tariefsystematiek niet moet leiden tot teveel complexiteit voor aangeslotene; iedereen moet overzichtelijke en overwogen besluiten kunnen maken
44De kwaliteit van het netwerk niet achteruit gaat.	31De tariefsystematiek geleidelijk over de jaren wordt aangepast.	46Veranderingen in de tariefsystematiek gepaard gaan met zekerheid; het moet duidelijk zijn hoe de tariefsystematiek zich gaat ontwikkelingen in de aankomende jaren.
50De netbeheerder geen taken uitvoert die ook door een marktpartij kunnen worden gedaan.	42Er mogelijkheden zijn voor kortingen(bijvoorbeeld grootverbruikers regeling, 600 uurs regeling o.i.d.) indien dit maatschappelijk gewenst is.	53De overheid/minister geen invloed heeft in netwerkinvesteringen, maar dit door de netbeheerder wordt besloten die gecontroleerd wordt door de ACM.
	52Er meer inspraak is voor aangeslotene of investeringen in het netwerk nodig zijn.	

Crib sheet factor 2		Ranking
# statement	**Items ranked at +5**	
22	De netbeheerder flexibiliteit vraagt van een aangeslotene, tegen een vergoeding, wanneer hij hier behoefte aan heeft	+5
49	De netbeheerder prikkels en/of transparantie geeft aan aangeslotene om zijn netwerkproblemen op te lossen.	+5
54	De regels soepeler zijn, zodat er meer ruimte is voor onderlinge afspraken en onderhandelingen tussen afnemers, producenten, netbeheerders en marktpartijen.	+5
	Items ranked higher in factor 2 array than other factor arrays	
10	Het aantal netvlakken tussen producent en afnemer (gedeeltelijk) bepalen hoe hoog de transportkosten zijn [niveaustelsel principe].	+1
12	Congestie in het netwerk (gedeeltelijk) invloed heeft op de hoogte van het transporttarief.	+4
16	De transporttarieven variabel zijn in de tijd; op elk moment kan er een ander transporttarief zijn	+3
20	Er contractvormen zijn waarbij je niet altijd zoveel kan afnemen als je wilt; wanneer het nodig is kan je aansluiting worden gereduceerd tot een minimale “baseload”.	+4
21	Het een optie is om te kiezen voor een transporttarief met vaste tarieven of variabele tarieven.	+1
30	De tariefsystematiek flexibel wordt ingericht, zodat er gemakkelijk en snel aanpassingen kunnen worden gedaan wanneer er (onvoorziene) ontwikkelingen plaatsvinden.	+3
	Items ranked lower in factor 2 array than other factor arrays	
7	Producenten alleen een transporttarief hebben, wanneer we netto elektriciteit exporteren.	-4
13	De cascademethodiek wordt toegepast.	-2
25	Transportkosten in Nederland voor aangeslotene niet (significant) hoger zijn dan omringende landen	-2
29	Het transporttarief hoofdzakelijk gebaseerd is op verbruik (kWh) van elektriciteit	-4
40	Investeringen in het netwerk worden gebaseerd op regelgeving en normen van de kwaliteit van het netwerk	-1
45	De tariefsystematiek zoveel mogelijk in één keer wordt aangepast.	-3
46	Veranderingen in de tariefsystematiek gepaard gaan met zekerheid; het moet duidelijk zijn hoe de tariefsystematiek zich gaat ontwikkelingen in de aankomende jaren.	-1
	Items ranked at +5	
2	Investeringen in het netwerk dusdanig ruim worden uitgevoerd, dat er in de afschrijvingstermijn van de investering geen capaciteitstekort kan worden verwacht.	-5
36	De tariefsystematiek zoveel mogelijk hetzelfde is gebleven; veranderingen leiden tot een onzeker investeringsklimaat en zullen tot suboptimale prikkels en kostenverdelingen leiden	-5
48	De huidige tariefsystematiek zo lang mogelijk wordt behouden.	-5

Factor array 3

Factor 3: Q-sorts: 4, 15, 22										
-5	-4	-3	-2	-1	0	1	2	3	4	5
1	12	9	7	17	10	5	6	2	24	4
3	15	14	8	34	21	11	13	19	28	26
16	23	18	27	41	31	30	20	25	39	43
	51	29	33	42	32	38	22	46	40	
		36	37	48	35	49	44	50		
			55	53	45	52	54			
					47					

+5	+4
4De interconnectie capaciteit volledige marktkoppeling mogelijk maakt	24Er wordt gezorgd voor minimale barrières voor marktwerking.
26Er wordt gestreefd naar een zo zuiver mogelijk kostenveroorzakings-principe.	28Een verbruikscomponent (kWh) in het transporttarief zit.
43Veranderingen in de tariefsystematiek niet moet leiden tot teveel complexiteit voor aangeslotene; iedereen moet overzichtelijke en overwogen besluiten kunnen maken.	39Regionale netbeheerders opslag mogen toepassen in het netwerk, zolang ze geen elektriciteit verkopen
	40Investeringen in het netwerk worden gebaseerd op regelgeving en normen van de kwaliteit van het netwerk

-5	-4
1Investeringen in het netwerk zoveel mogelijk worden uitgesteld tot er meer zekerheid is over de toekomstige energievraag voor het netwerk	12Congestie in het netwerk (gedeeltelijk) invloed heeft op de hoogte van het transporttarief.
3Het netwerk op een gegeven moment als 'definitief' wordt beschouwd; uitbreiding van het netwerk (nieuw stuk netwerk) wordt (gedeeltelijk) bekostigd door de aangeslotenen aan dit nieuwe stuk netwerk.	15iedereen meebetaalt aan het netwerk, ook als je er niet op bent aangesloten.
16De transporttarieven variabel zijn in de tijd; op elk moment kan er een ander transporttarief zijn	23Het netbeheer ondergeschikt is aan een goed werkende energiemarkt.
	51De transporttarieven prikkels geven voor investeringen in het netwerk.

+3	+2
2Investeringen in het netwerk dusdanig ruim worden uitgevoerd, dat er in de afschrijvingstermijn van de investering geen capaciteitstekort kan worden verwacht.	6Producenten een transporttarief hebben.
19Er meer soorten contracttypen zijn voor de transporttarieven van kleinverbruikers	13De cascademethodiek wordt toegepast.
25Transportkosten in Nederland voor aangeslotene niet (significant) hoger zijn dan omringende landen.	20Er contractvormen zijn waarbij je niet altijd zoveel kan afnemen als je wilt; wanneer het nodig is kan je aansluiting worden gereduceerd tot een minimale "baseload".
46Veranderingen in de tariefsystematiek gepaard gaan met zekerheid; het moet duidelijk zijn hoe de tariefsystematiek zich gaat ontwikkelingen in de aankomende jaren.	22De netbeheerder flexibiliteit vraagt van een aangeslotene, tegen een vergoeding, wanneer hij hier behoefte aan heeft.
50De netbeheerder geen taken uitvoert die ook door een marktpartij kunnen worden gedaan.	44De kwaliteit van het netwerk niet achteruit gaat.
	54De regels soepeler zijn, zodat er meer ruimte is voor onderlinge afspraken en onderhandelingen tussen afnemers, producenten, netbeheerders en marktpartijen.

-3	-2
9De hoeveelheid elektriciteit die geproduceerd wordt op een netvlak (gedeeltelijk) invloed heeft op de toedeling van netwerkkosten aan een netvlak	7Producenten alleen een transporttarief hebben, wanneer we netto elektriciteit exporteren.
14Het belangrijker is dat aangeslotene de juiste prikkels krijgen dan dat de tarieven de kosten van het netwerk dekken; eventuele tekorten worden aangevuld vanuit algemene middelen van de overheid.	8Producenten alleen een transporttarief hebben, wanneer dit door Europa voor alle landen verplicht wordt gesteld.
18Decentrale opwekking moet een apart transporttarief heeft.	27Het transporttarief hoofdzakelijk gebaseerd is op capaciteit(kW) van de aangeslotene.
29Het transporttarief hoofdzakelijk gebaseerd is op verbruik (kWh) van elektriciteit	33De netwerkkosten (gedeeltelijk) gedekt worden door algemene middelen van de overheid.
36De tariefsystematiek zoveel mogelijk hetzelfde is gebleven; veranderingen leiden tot een onzeker investeringsklimaat en zullen tot suboptimale prikkels en kostenverdelingen leiden.	37De netbeheerder zich ook op de markt mag begeven, indien hij hierdoor de netwerkkosten kan verlagen
	55Er wordt gekeken naar de verschillende type netwerken en netbeheerders prikkels kunnen geven voor het gebruik van andere netten (gas, elektra, warmtenetten).

+1	0	-1
5De interconnectie capaciteit afhankelijk is van de import en export met onze buurlanden.	10Het aantal netvlakken tussen producent en afnemer (gedeeltelijk) bepalen hoe hoog de transportkosten zijn [niveaustelsel principe].	17De transporttarieven verschillen in de tijd; op vooraf gedefinieerde momenten zijn er prijsverschillen in het tarief [uren, dagen, seizoen etc.].
11Verliezen (gedeeltelijk) in het transporttarief worden verwerkt.	21Het een optie is om te kiezen voor een transporttarief met vaste tarieven of variabele tarieven.	34De tariefsystematiek prikkels betreffende netwerkinvesteringen geeft aan de netbeheerder
30De tariefsystematiek flexibel wordt ingericht, zodat er gemakkelijk en snel aanpassingen kunnen worden gedaan wanneer er (onvoorziene) ontwikkelingen plaatsvinden.	31De tariefsystematiek geleidelijk over de jaren wordt aangepast.	41Er in Europa naar een uniforme tariefsystematiek wordt gestreefd; bijvoorbeeld dezelfde tariefdragers, tariefhoogtes of kortingen.
38De netbeheerder alleen rollen vervult die niet door de markt vervuld worden, maar waar hij wel behoefte aan heeft.	32De hoogte van het capaciteitstarief gekoppeld is aan de hoogte van de systeempiek die er is op het moment van de maximale capaciteitsvraag van netgebruiker.	42Er mogelijkheden zijn voor kortingen(bijvoorbeeld grootverbruikers regeling, 600 uurs regeling o.i.d.) indien dit maatschappelijk gewenst is.
49De netbeheerder prikkels en/of transparantie geeft aan aangeslotene om zijn netwerkproblemen op te lossen.	35Decentrale opwekking en duurzame technieken moeten gestimuleerd worden met transporttarieven.	48De huidige tariefsystematiek zo lang mogelijk wordt behouden.
52Er meer inspraak is voor aangeslotene of investeringen in het netwerk nodig zijn.	45De tariefsystematiek zoveel mogelijk in één keer wordt aangepast.	53De overheid/minister geen invloed heeft in netwerkinvesteringen, maar dit door de netbeheerder wordt besloten die gecontroleerd wordt door de ACM.
	47De tariefsystematiek wordt gebruikt om op bepaalde marktuitkomsten of doelen te sturen.	

Crib sheet factor 3		Ranking
# statement	**Items ranked at +5**	
4	De interconnectie capaciteit volledige marktkoppeling mogelijk maakt.	+5
26	Er wordt gestreefd naar een zo zuiver mogelijk kostenveroorzakings-principe.	+5
43	Veranderingen in de tariefsystematiek niet moet leiden tot teveel complexiteit voor aangeslotene; iedereen moet overzichtelijke en overwogen besluiten kunnen maken.	+5
	Items ranked higher in factor 3 array than other factor arrays	
2	Investeringen in het netwerk dusdanig ruim worden uitgevoerd, dat er in de afschrijvingstermijn van de investering geen capaciteitstekort kan worden verwacht.	+3
7	Producenten alleen een transporttarief hebben, wanneer we netto elektriciteit exporteren.	-2
24	Er wordt gezorgd voor minimale barrières voor marktwerking.	+4
28	Een verbruikscomponent (kWh) in het transporttarief zit.	+4
33	De netwerkkosten (gedeeltelijk) gedekt worden door algemene middelen van de overheid.	-2
46	De netwerkkosten (gedeeltelijk) gedekt worden door algemene middelen van de overheid.	+3
	Items ranked lower in factor 3 array than other factor arrays	
12	Congestie in het netwerk (gedeeltelijk) invloed heeft op de hoogte van het transporttarief.	-4
17	De transporttarieven verschillen in de tijd; op vooraf gedefinieerde momenten zijn er prijsverschillen in het tarief [uren, dagen, seizoen etc.].	-1
18	Decentrale opwekking moet een apart transporttarief heeft.	-3
22	De netbeheerder flexibiliteit vraagt van een aangeslotene, tegen een vergoeding, wanneer hij hier behoefte aan heeft.	+2
23	Het netbeheer ondergeschikt is aan een goed werkende energiemarkt.	-4
27	Het transporttarief hoofdzakelijk gebaseerd is op capaciteit(kW) van de aangeslotene.	-2
34	De tariefsystematiek prikkels betreffende netwerkinvesteringen geeft aan de netbeheerder.	-1
51	De transporttarieven prikkels geven voor investeringen in het netwerk	-4
	Items ranked at +5	
1	Investeringen in het netwerk zoveel mogelijk worden uitgesteld tot er meer zekerheid is over de toekomstige energievraag voor het netwerk.	-5
3	Het netwerk op een gegeven moment als ‘definitief’ wordt beschouwd; uitbreiding van het netwerk (nieuw stuk netwerk) wordt (gedeeltelijk) bekostigd door de aangeslotenen aan dit nieuwe stuk netwerk	-5
16	De transporttarieven variabel zijn in de tijd; op elk moment kan er een ander transporttarief zijn	-5

Factor array 4:

Factor 1 Q-sorts: 8, 23										
-5	-4	-3	-2	-1	0	1	2	3	4	5
16	4	3	5	1	2	6	17	18	11	14
26	9	7	8	12	10	15	35	28	22	37
42	33	24	20	13	25	19	38	31	51	47
	41	36	23	21	27	40	43	34	53	
		48	29	30	32	52	44	49		
			39	50	45	54	55			
					46					

+5	+4
14Het belangrijker is dat aangeslotene de juiste prikkels krijgen dan dat de tarieven de kosten van het netwerk dekken; eventuele tekorten worden aangevuld vanuit algemene middelen van de overheid	11Verliezen (gedeeltelijk) in het transporttarief worden verwerkt.
37De netbeheerder zich ook op de markt mag begeven, indien hij hierdoor de netwerkkosten kan verlagen.	22De netbeheerder flexibiliteit vraagt van een aangeslotene, tegen een vergoeding, wanneer hij hier behoefte aan heeft
47De tariefsystematiek wordt gebruikt om op bepaalde marktuitkomsten of doelen te sturen	51De transporttarieven prikkels geven voor investeringen in het netwerk
	53De overheid/minister geen invloed heeft in netwerkinvesteringen, maar dit door de netbeheerder wordt besloten die gecontroleerd wordt door de ACM.

-5	-4
16De transporttarieven variabel zijn in de tijd; op elk moment kan er een ander transporttarief zijn	4De interconnectie capaciteit volledige marktkoppeling mogelijk maakt.
26Er wordt gestreefd naar een zo zuiver mogelijk kostenveroorzakings-principe.	9De hoeveelheid elektriciteit die geproduceerd wordt op een netvlak (gedeeltelijk) invloed heeft op de toedeling van netwerkkosten aan een netvlak
42Er mogelijkheden zijn voor kortingen(bijvoorbeeld grootverbruikers regeling, 600 uurs regeling o.i.d.) indien dit maatschappelijk gewenst is	33De netwerkkosten (gedeeltelijk) gedekt worden door algemene middelen van de overheid.
	41Er in Europa naar een uniforme tariefsystematiek wordt gestreefd; bijvoorbeeld dezelfde tariefdragers, tariefhoogtes of kortingen.

+3	+2
18Decentrale opwekking moet een apart transporttarief heeft.	17De transporttarieven verschillen in de tijd; op vooraf gedefinieerde momenten zijn er prijsverschillen in het tarief [uren, dagen, seizoen etc.].
28Een verbruikscomponent (kWh) in het transporttarief zit.	35Decentrale opwekking en duurzame technieken moeten gestimuleerd worden met transporttarieven.
31De tariefsystematiek geleidelijk over de jaren wordt aangepast.	38De netbeheerder alleen rollen vervult die niet door de markt vervuld worden, maar waar hij wel behoefte aan heeft.
34De tariefsystematiek prikkels betreffende netwerkinvesteringen geeft aan de netbeheerder.	43Veranderingen in de tariefsystematiek niet moet leiden tot teveel complexiteit voor aangeslotene; iedereen moet overzichtelijke en overwogen besluiten kunnen maken.
49De netbeheerder prikkels en/of transparantie geeft aan aangeslotene om zijn netwerkproblemen op te lossen.	44De kwaliteit van het netwerk niet achteruit gaat.
	55Er wordt gekeken naar de verschillende type netwerken en netbeheerders prikkels kunnen geven voor het gebruik van andere netten (gas, elektra, warmtenetten).

-3	-2
3Het netwerk op een gegeven moment als 'definitief' wordt beschouwd; uitbreiding van het netwerk (nieuw stuk netwerk) wordt (gedeeltelijk) bekostigd door de aangeslotenen aan dit nieuwe stuk netwerk.	5De interconnectie capaciteit afhankelijk is van de import en export met onze buurlanden.
7Producenten alleen een transporttarief hebben, wanneer we netto elektriciteit exporteren.	8Producenten alleen een transporttarief hebben, wanneer dit door Europa voor alle landen verplicht wordt gesteld.
24Er wordt gezorgd voor minimale barrières voor marktwerking.	20Er contractvormen zijn waarbij je niet altijd zoveel kan afnemen als je wilt; wanneer het nodig is kan je aansluiting worden gereduceerd tot een minimale "baseload".
36De tariefsystematiek zoveel mogelijk hetzelfde is gebleven; veranderingen leiden tot een onzeker investeringsklimaat en zullen tot suboptimale prikkels en kostenverdelingen leiden.	23Het netbeheer ondergeschikt is aan een goed werkende energiemarkt.
48De huidige tariefsystematiek zo lang mogelijk wordt behouden.	29Het transporttarief hoofdzakelijk gebaseerd is op verbruik (kWh) van elektriciteit
	39Regionale netbeheerders opslag mogen toepassen in het netwerk, zolang ze geen elektriciteit verkopen.

+1	0	-1
6Producenten een transporttarief hebben.	2Investeringen in het netwerk dusdanig ruim worden uitgevoerd, dat er in de afschrijvingstermijn van de investering geen capaciteitstekort kan worden verwacht.	1Investeringen in het netwerk zoveel mogelijk worden uitgesteld tot er meer zekerheid is over de toekomstige energievraag voor het netwerk.
15iedereen meebetaalt aan het netwerk, ook als je er niet op bent aangesloten.	10Het aantal netvlakken tussen producent en afnemer (gedeeltelijk) bepalen hoe hoog de transportkosten zijn [niveaustelsel principe].	12Congestie in het netwerk (gedeeltelijk) invloed heeft op de hoogte van het transporttarief.
19Er meer soorten contracttypen zijn voor de transporttarieven van kleinverbruikers.	25Transportkosten in Nederland voor aangeslotene niet (significant) hoger zijn dan omringende landen.	13De cascademethodiek wordt toegepast
40Investeringen in het netwerk worden gebaseerd op regelgeving en normen van de kwaliteit van het netwerk	27Het transporttarief hoofdzakelijk gebaseerd is op capaciteit(kW) van de aangeslotene.	21Het een optie is om te kiezen voor een transporttarief met vaste tarieven of variabele tarieven.
52Er meer inspraak is voor aangeslotene of investeringen in het netwerk nodig zijn.	32De hoogte van het capaciteitstarief gekoppeld is aan de hoogte van de systeempiek die er is op het moment van de maximale capaciteitsvraag van netgebruiker.	30De tariefsystematiek flexibel wordt ingericht, zodat er gemakkelijk en snel aanpassingen kunnen worden gedaan wanneer er (onvoorziene) ontwikkelingen plaatsvinden.
54De regels soepeler zijn, zodat er meer ruimte is voor onderlinge afspraken en onderhandelingen tussen afnemers, producenten, netbeheerders en marktpartijen.	45De tariefsystematiek zoveel mogelijk in één keer wordt aangepast.	50De netbeheerder geen taken uitvoert die ook door een marktpartij kunnen worden gedaan.
	46Veranderingen in de tariefsystematiek gepaard gaan met zekerheid; het moet duidelijk zijn hoe de tariefsystematiek zich gaat ontwikkelingen in de aankomende jaren.	

Crib sheet factor 4		Ranking
# statement	**Items ranked at +5**	
14	Het belangrijker is dat aangeslotene de juiste prikkels krijgen dan dat de tarieven de kosten van het netwerk dekken; eventuele tekorten worden aangevuld vanuit algemene middelen van de overheid.	+5
37	De netbeheerder zich ook op de markt mag begeven, indien hij hierdoor de netwerkkosten kan verlagen.	+5
47	De tariefsystematiek wordt gebruikt om op bepaalde marktuitkomsten of doelen te sturen.	+5
	Items ranked higher in factor 4 array than other factor arrays	
1	Investeringen in het netwerk zoveel mogelijk worden uitgesteld tot er meer zekerheid is over de toekomstige energievraag voor het netwerk.	-1
11	Verliezen (gedeeltelijk) in het transporttarief worden verwerkt.	+4
15	iedereen meebetaalt aan het netwerk, ook als je er niet op bent aangesloten.	+1
18	Decentrale opwekking moet een apart transporttarief heeft.	+3
29	Het transporttarief hoofdzakelijk gebaseerd is op verbruik (kWh) van elektriciteit	-2
31	De tariefsystematiek geleidelijk over de jaren wordt aangepast.	+3
38	De netbeheerder alleen rollen vervult die niet door de markt vervuld worden, maar waar hij wel behoefte aan heeft.	+2
51	De transporttarieven prikkels geven voor investeringen in het netwerk.	+4
53	De overheid/minister geen invloed heeft in netwerkinvesteringen, maar dit door de netbeheerder wordt besloten die gecontroleerd wordt door de ACM.	+4
	Items ranked lower in factor 4 array than other factor arrays	
4	4De interconnectie capaciteit volledige marktkoppeling mogelijk maakt.	-4
5	5De interconnectie capaciteit afhankelijk is van de import en export met onze buurlanden.	-2
6	6Producenten een transporttarief hebben.	1
9	9De hoeveelheid elektriciteit die geproduceerd wordt op een netvlak (gedeeltelijk) invloed heeft op de toedeling van netwerkkosten aan een netvlak	-4
20	20Er contractvormen zijn waarbij je niet altijd zoveel kan afnemen als je wilt; wanneer het nodig is kan je aansluiting worden gereduceerd tot een minimale “baseload”.	-2
21	21Het een optie is om te kiezen voor een transporttarief met vaste tarieven of variabele tarieven.	-1
24	24Er wordt gezorgd voor minimale barrières voor marktwerking.	-3
30	30De tariefsystematiek flexibel wordt ingericht, zodat er gemakkelijk en snel aanpassingen kunnen worden gedaan wanneer er (onvoorziene) ontwikkelingen plaatsvinden.	-1
41	41Er in Europa naar een uniforme tariefsystematiek wordt gestreefd; bijvoorbeeld dezelfde tariefdragers, tariefhoogtes of kortingen.	-4
50	50De netbeheerder geen taken uitvoert die ook door een marktpartij kunnen worden gedaan.	-1
	Items ranked at +5	
16	16De transporttarieven variabel zijn in de tijd; op elk moment kan er een ander transporttarief zijn	-5
26	26Er wordt gestreefd naar een zo zuiver mogelijk kostenveroorzakings-principe.	-5
42	42Er mogelijkheden zijn voor kortingen(bijvoorbeeld grootverbruikers regeling, 600 uurs regeling o.i.d.) indien dit maatschappelijk gewenst is.	-5

B.2 Additional data analysis based on individual statements

This appendix clustered the statements in general topics and addressed them in respect of this topic. For each topic consensus and disagreements are discussed. Figure 11 shows the output file of the PQ method, where statements are sorted from most consensus to least consensus over the different factors. Note that the Q-sort of each participant and each factor array should be individually perceived and absolute comparison based on the place of the statement is therefore not possible. However, statements that are more at the extremes of the scale in different Q-sorts or factor arrays can be interpreted as common ground between factors. The more the statements are in the middle of the factor array, the harder they are to interpreter in respect to each other. In addition to the factor arrays, additional substantive knowledge from the interviews are added.

			Factor Arrays			
No.	Statement	No.	1	2	3	4
21	21Het een optie is om te kiezen voor een transporttarief met	21	0	1	0	-1
10	10Het aantal netvlakken tussen producent en afnemer (gedeelt	10	-2	1	0	0
52	52Er meer inspraak is voor aangeslotene of investeringen in	52	0	0	1	1
29	29Het transporttarief hoofdzakelijk gebaseerd is op verbruik	29	-3	-4	-3	-2
32	32De hoogte van het capaciteitstarief gekoppeld is aan de ho	32	2	2	0	0
45	45De tariefsystematiek zoveel mogelijk in één keer wordt aan	45	-1	-3	0	0
33	33De netwerkkosten (gedeeltelijk) gedekt worden door algemen	33	-5	-4	-2	-4
7	7Producenten alleen een transporttarief hebben, wanneer we n	7	-3	-4	-2	-3
5	5De interconnectie capaciteit afhankelijk is van de import e	5	1	0	1	-2
6	6Producenten een transporttarief hebben.	6	4	2	2	1
17	17De transporttarieven verschillen in de tijd; op vooraf ged	17	0	2	-1	2
9	9De hoeveelheid elektriciteit die geproduceerd wordt op een	9	-2	-1	-3	-4
44	44De kwaliteit van het netwerk niet achteruit gaat.	44	5	1	2	2
3	3Het netwerk op een gegeven moment als 'definitief' wordt be	3	-4	-3	-5	-3
30	30De tariefsystematiek flexibel wordt ingericht, zodat er ge	30	0	3	1	-1
11	11Verliezen (gedeeltelijk) in het transporttarief worden ver	11	2	1	1	4
31	31De tariefsystematiek geleidelijk over de jaren wordt aange	31	0	0	0	3
8	8Producenten alleen een transporttarief hebben, wanneer dit	8	2	-2	-2	-2
22	22De netbeheerder flexibiliteit vraagt van een aangeslotene,	22	4	5	2	4
42	42Er mogelijkheden zijn voor kortingen(bijvoorbeeld grootver	42	0	0	-1	-5
13	13De cascademethodiek wordt toegepast.	13	2	-2	2	-1
49	49De netbeheerder prikkels en/of transparantie geeft aan aan	49	1	5	1	3
19	19Er meer soorten contracttypen zijn voor de transporttariev	19	-1	3	3	1
46	46Veranderingen in de tariefsystematiek gepaard gaan met zek	46	1	-1	3	0
36	36De tariefsystematiek zoveel mogelijk hetzelfde is gebleven	36	-1	-5	-3	-3
55	55Er wordt gekeken naar de verschillende type netwerken en n	55	-2	2	-2	2
27	27Het transporttarief hoofdzakelijk gebaseerd is op capacite	27	3	0	-2	0
34	34De tariefsystematiek prikkels betreffende netwerkinvesteri	34	3	3	-1	3
20	20Er contractvormen zijn waarbij je niet altijd zoveel kan a	20	2	4	2	-2
40	40Investeringen in het netwerk worden gebaseerd op regelgevi	40	5	-1	4	1
35	35Decentrale opwekking en duurzame technieken moeten gestimu	35	-3	2	0	2
38	38De netbeheerder alleen rollen vervult die niet door de mar	38	-3	-3	1	2
23	23Het netbeheer ondergeschikt is aan een goed werkende energ	23	1	-1	-4	-2
18	18Decentrale opwekking moet een apart transporttarief heeft.	18	1	-2	-3	3
50	50De netbeheerder geen taken uitvoert die ook door een markt	50	4	1	3	-1
1	1Investeringen in het netwerk zoveel mogelijk worden uitges	1	-2	-3	-5	-1
53	53De overheid/minister geen invloed heeft in netwerkinvester	53	3	-1	-1	4
15	15iedereen meebetaalt aan het netwerk, ook als je er niet op	15	-5	-4	-4	1
28	28Een verbruikscomponent (kWh) in het transporttarief zit.	28	-2	0	4	3
41	41Er in Europa naar een uniforme tariefsystematiek wordt ges	41	3	-3	-1	-4
25	25Transportkosten in Nederland voor aangeslotene niet (signi	25	4	-2	3	0
48	48De huidige tariefsystematiek zo lang mogelijk wordt behoud	48	-1	-5	-1	-3
2	2Investeringen in het netwerk dusdanig ruim worden uitgevoer	2	0	-5	3	0
54	54De regels soepeler zijn, zodat er meer ruimte is voor onde	54	-3	5	2	1
43	43Veranderingen in de tariefsystematiek niet moet leiden tot	43	-1	-1	5	2
24	24Er wordt gezorgd voor minimale barrières voor marktwerking	24	2	3	4	-3
51	51De transporttarieven prikkels geven voor investeringen in	51	-2	2	-4	4
47	47De tariefsystematiek wordt gebruikt om op bepaalde marktui	47	-4	-2	0	5
12	12Congestie in het netwerk (gedeeltelijk) invloed heeft op d	12	-1	4	-4	-1
4	4De interconnectie capaciteit volledige marktkoppeling moge	4	3	-2	5	-4
39	39Regionale netbeheerders opslag mogen toepassen in het netw	39	-4	4	4	-2
16	16De transporttarieven variabel zijn in de tijd; op elk mome	16	1	3	-5	-5
14	14Het belangrijker is dat aangeslotene de juiste prikkels kr	14	-4	0	-3	5
37	37De netbeheerder zich ook op de markt mag begeven, indien h	37	-5	1	-2	5
26	26Er wordt gestreefd naar een zo zuiver mogelijk kostenveroo	26	5	4	5	-5

Figure 11: Statements sorted from consensus to differences for factor arrays (output file PQmethod).

Activities system operator

There is quite some common ground about the role of the system operator. In principle he can´t perform market activities, but there is quite some disagreement when the system operator can perform market activities. Factor 1 is most strict and doesn´t want the system operator to perform any market activities at all. Factor 4 only allows market activities of the TSO when he can significantly reduce the network costs, otherwise these are activities that should be performed by market parties. Factor 2 is less strict in which activities are performed by the system operator: Storage in distribution grids is allowed, as long as they don´t sell electricity. However, as there is shown in paragraph 5.1, the system operator should have a facilitating role for market parties and collaboration between different actors should be stimulated. Factor 3 is somewhere between factor 1 and 4; the system operator performs no market activities, but exemptions are made easier, for example the storage facilities operated by regional system operators.

Table 13: Activities system operator

#	statement	Rank F1	Rank F2	Rank F3	Rank F4
37	De netbeheerder zich ook op de markt mag begeven, indien hij hierdoor de netwerkkosten kan verlagen.	-5	1	-2	5
38	38De netbeheerder alleen rollen vervult die niet door de markt vervuld worden, maar waar hij wel behoefte aan heeft.	1	-1	-4	-2
39	Regionale netbeheerders opslag mogen toepassen in het netwerk, zolang ze geen elektriciteit verkopen.	-4	4	4	-2
50	De netbeheerder geen taken uitvoert die ook door een marktpartij kunnen worden gedaan.	4	1	3	-1

Cost allocation, transmission tariffs, and demand response

Cost allocation following the cost engender principle was clearly formulated in statement 26 and is highly ranked for factor 1-3. Factor 4 ranked it on -5, which seems that they strongly oppose to the cost engender principle, however in the post-sort questions this is nuanced. The cost engender principle is something that should be the basis, but not strictly followed as this is firstly not possible due to technical properties of electricity transmission, as discussed in paragraph 2.1**,** and secondly exemptions can be allowed in the cost engender principles should be possible to strive to give better incentives to network users. Participants from other factors also mentioned that following the cost engender principle to the extremes is not realistic, as the effort to better allocate the cost following this principle will not weight against the results (institutional cost of tariff system, always suboptimal thus not completely 'fair' cost allocation, increasing complexity of tariff system etc.). Therefore there is quite some common ground about the principle of cost engender as the basis for cost allocation in the tariff system. This common ground is reinforced by the statements that public funds are used to reimburse the system operators network costs; all four factors disagree with statement 33.

Currently the cascade method is used to allocate the network costs to different voltage levels. Statement 13 regarding the use of the cascade method is not ranked in the extremes, factor 1 and 3 slightly agree with it(+2 column) and factor 2 and 4 slightly disagree (respectively -2 and -1 column). In

the interviews there were quite some people mentioning that the cascade method is outdated and that it doesn't deal with the increasing share of electricity generation on the lower voltage levels. Statement 9 and 10 mention other methods or foundations on which cost allocation to different voltage levels can be based on. However, statement 9 is disagreed by all factors and statement 10 is mostly regarded neutral, except factor 1 who slightly disagrees with the statement. There is not really common ground regarding the allocation method, however, there is certainly not a strong disagreement; several times there is mentioned that the cascade method is thus far the best allocation method(cost allocation and relative simple application) and should therefore be used until something betters comes along.

The individual transmission costs consist of a peak consumption(kW), fixed tariff and on lower voltage levels a consumption(kWh) component. A transmission tariff based on peak consumption is generally accepted as following the cost ender principle, as the capacity of the electricity network is based on the peak consumption of the network users. However, factor 2 and 4 have regarded the statement that peak consumption should be leading for the transmission costs as neutral, factor 3 slightly disagrees with this statement and only factor 1 ranks this statement in the +3 column. On the other hand, all factors disagree with the statement that consumption(kWh) should be leading for the transmission costs. Factor three and four strongly agree that there should at least a consumption component that influences the total transmission costs of a consumer, while factor 1 rather not sees a kWh component and factor 2 is neutral about this statement. Often mentioned is that the consumption component is more tangible for consumers; for the amount of electricity you use, you pay.

Based on substantive knowledge it can be interpreted as following: there is common round that the kW component is leading, but this aspect is in respect to the other statements not considered directly most important: other issues should be changed and therefore this statement is not sorted in the extremes. This is reinforced by the disagreement that kWh should be leading. There can be a debate about the ratio between kW and kWh, but generally the kW part will be larger than the kWh. A larger kWh component is generally regarded as stimulating decentralized generation, as these network users don't use a lot of electricity. Also it is easier to reduce your electricity consumption then your peak consumption, which can be regarded as more fair. At the same time, large energy consumers who currently don't have a kWh component in their transmission costs, will oppose as this would lead to increasing transmission cost for them. The differences are therefore assumed to be related to the interest of the participant represent: kW for larger electricity consumers and a preference for a larger kWh component for small electricity consumers.

Currently only consumers have a transmission tariff, but electricity producers also use the network and gain their profits from it. Three statements about the introduction of a producer tariff were in the Q-set(statement 6-8). No factor strongly opposes against the implementation of a producer tariff. The other two statements are preconditions under which a producer tariff should be implemented. Opposed is against the precondition that a producer tariff is implemented when net electricity is transported abroad. This is an arbitrary rule and leads to uncertainty and should not be the basis for implementation of a producer tariff. The precondition that a producer tariff should be implemented as a European standard is also generally opposed to (factor 2-4 all in -2 column), only factor 1 agrees with this statement. However, simply implementing a producer tariff in the Netherlands is not without consequences, this would harm the international competition position of the Dutch electricity producers. The reason there is opposed against a European producer tariff is that it is regarded

infeasible to achieve this. However, introducing it in combination with our neighbouring countries is often suggested. Implementing it would however not be as straightforward as now suggested, the height of the producer tariff, tariff components etc still all need to be discussed. The conclusion regarding the producer tariff is that there common ground to discuss the implementation of a producer tariff.

Strongly related to the transmission tariff is creating demand response with tariffs that are dynamic. Currently the transmission tariffs are static: the tariffs components are fixed in a year. Making them dynamic, increasing tariffs at certain moments in time, gives incentives to consumers to use less electricity at such a moment and therefore reducing congestion in the network. Two statements (12 and 16) are related to dynamic pricing, where the tariff height can change at any moment in time. Factor two advocates for dynamic pricing, although they mention that a smarter network is needed, e.g. more ICT connected to the network. The other factors oppose against dynamic pricing for several reasons, which are not directly bound to specific factors. First of all, uncertainty is often mentioned with dynamic pricing. Volatile tariffs make it harder for electricity consumers to predict their transmission tariffs and therefore lead to uncertainty for businesses. In addition, there is a risk for gaming or hatching, where people use changes in tariff heights to make profits.

Secondly, changing tariffs to decrease congestion is also regard as a perverse incentive for system operators. Congestion is regarded as insufficient network capacity, while the system operator gets more income from not creating sufficient capacity. This would mean that profits of system operators will increase if congestion in the network increases. Thirdly, the ICT that is required to monitor congestion also have additional cost and system operators need to operate these ICT. Several times doubts about the capability of system operators to manage such an ICT infrastructure are mentioned. In addition, there are doubt if such a large ICT facilities would actually decrease congestion (and therefore network capacity) enough to have lower costs than simply increasing the network capacity.

Factor four is the only factor that agrees with incorporating transmission losses in the tariffs. The other factors don't oppose against this statement, but generally interpreted it differently. Factor four prefers that if lower transmission losses occur, the transmission prices for those are lower. Transmission losses correlate with the distance that need to be covered from producer to consumer. Lower distance means less losses and therefore lower network costs(system operator buys additional electricity to cover transmission losses). They prefer more decentralized generation and this way decentralized electricity generation is stimulated. Therefore they also don't strongly oppose against congestion pricing. Congestion pricing on local level can be applied, however, congestion on higher network levels shouldn't be implemented.

Congestion and transmission losses pricing are regarded as locational signals: depending on your location the transmission tariffs can vary. Often this is regarded as unfair due to the limited influence you have on your location. Historical development of the network could have led that you are at the end of a network and therefore have more transmission losses. Similarly, people who leave in the centre of a city have to cope with an old network that often has lower capacity that newer districts. These issues relate to the non-discriminatory principle.

Instead of transmission tariffs that can very at any moment of time, a statement also mentioned varying transmission tariffs at fixed moments (statement 17). Factor 2 and 4 slightly agree with this

option, while factor 1 and 3 are neutral about this option. Often mentioned is that changing the tariffs at fixed hours a day results in strategic behaviour; those consumers that can change their peak consumption shift it a couple of hours. This is often regarded as violating the non-discriminatory principle, as not everyone can shift their peak. This issue also applies for statement 32, where the transmission tariff is related to when you consume your energy in relation to network peak; if your peak is not at the system peak you have lower transmission costs.

Generally strongly agreed are the optional choice to offer for flexibility (statement 20 and 22). Here system operators can offer reimbursement for flexibility or people can take contracts where the system operator can lower their consumption against a reimbursement. Often mentioned is that strict rules about these contracts are needed to prevent that the system operator decreases their maximum that they can't consume enough electricity.

To summarize and conclude about the cost allocation, transmission tariffs and demand response. There is generally common ground about the core principle: cost engender principle. The transmission costs should be mostly determined by the peak consumption. The peak consumption(kW) should be the core component of the transmission costs. The system operator should offer reimbursements if he demands flexibility of consumers. This is quite similar to the current tariff system. However, there is quite some common ground about the introduction of a producer tariff. Implementation would definitely lead to resistance and quite some discussion will be about the height of the tariff and the tariff component, but there is definitely common ground to discuss the implementation, especially when a producer tariff will also be implemented in neighbouring countries.

Ambiguously is the cascade method, however, alternatives in this research are not more agreed with. The main reason to oppose against the cascade method is that it doesn't deal with the increasing share of electricity generation on lower voltage levels. However, as no real alternatives are offered, the perception is that the cascade method can be applied as long as no better alternatives is proposed. The core of this alternative is the cost allocation to lower voltage levels, as those consumers currently carry a lot of the total network costs.

A general consumption component in the transmission tariffs can result in quite some resistance. However, currently there is already a kWh component at lower levels. The assumption is that the discussion between a consumption and peak consumption component is not directly related to the tariff components, but more strongly related to the cost allocation. A consumption component on all voltage levels would mean that those who consume more electricity, also have higher transmission costs. However, the cascade method determines for a large part which voltage level reimburses which part of the network costs. Therefore it would make more sense to discuss the cost allocation over the voltage level than changing the tariff components and their height.

The introduction of more demand response has most common ground if the system operator offers reimbursement for offering flexibility. However, a lot of consumers have only a limited amount of flexibility to offer and therefore would not qualify. To implement dynamic pricing several issues need to be addressed. First of all, the costs of ICT and the potential network costs reduction. Subsequently the risk for gaming and how there will be dealt with this. Locational signals are generally opposed against, however, often there is mentioned that new locations should take the network in consideration. The core topic if variable pricing is discussed is how to prevent that consumers that can't significantly

influence their electricity consumption don't have significantly higher transmission costs and prevention of strategic behaviour.

Table 14: Cost allocation, transmission tariffs, and demand response

#	statement	Rank F1	Rank F2	Rank F3	Rank F4
6	Producenten een transporttarief hebben.	4	2	2	1
7	Producenten alleen een transporttarief hebben, wanneer we netto elektriciteit exporteren.	-3	-4	-2	-3
8	Producenten alleen een transporttarief hebben, wanneer dit door Europa voor alle landen verplicht wordt gesteld.	2	-2	-2	2
9	De hoeveelheid elektriciteit die geproduceerd wordt op een netvlak (gedeeltelijk) invloed heeft op de toedeling van netwerkkosten aan een netvlak	-2	-1	-3	-4
10	Het aantal netvlakken tussen producent en afnemer (gedeeltelijk) bepalen hoe hoog de transportkosten zijn [niveaustelsel principe].	-2	1	0	0
11	Verliezen (gedeeltelijk) in het transporttarief worden verwerkt.	2	1	1	4
12	Congestie in het netwerk (gedeeltelijk) invloed heeft op de hoogte van het transporttarief.				
13	De cascademethodiek wordt toegepast.	2	-2	2	-1
14	Het belangrijker is dat aangeslotene de juiste prikkels krijgen dan dat de tarieven de kosten van het netwerk dekken; eventuele tekorten worden aangevuld vanuit algemene middelen van de overheid.	-4	0	-3	5
15	iedereen meebetaalt aan het netwerk, ook als je er niet op bent aangesloten.	-5	-4	-4	1
16	De transporttarieven variabel zijn in de tijd; op elk moment kan er een ander transporttarief zijn	1	3	-5	-5
17	De transporttarieven verschillen in de tijd; op vooraf gedefinieerde momenten zijn er prijsverschillen in het tarief [uren, dagen, seizoen etc.].	0	2	-1	2
18	Decentrale opwekking moet een apart transporttarief heeft.	1	-2	-3	3
20	Er contractvormen zijn waarbij je niet altijd zoveel kan afnemen als je wilt; wanneer het nodig is kan je aansluiting worden gereduceerd tot een minimale "baseload".	2	4	2	-2
22	De netbeheerder flexibiliteit vraagt van een aangeslotene, tegen een vergoeding, wanneer hij hier behoefte aan heeft.	4	5	2	4
26	Er wordt gestreefd naar een zo zuiver mogelijk kostenveroorzakings-principe	5	4	5	-5
27	Het transporttarief hoofdzakelijk gebaseerd is op capaciteit(kW) van de aangeslotene.	3	0	-2	0
28	Een verbruikscomponent (kWh) in het transporttarief zit.	-2	0	4	3
29	Het transporttarief hoofdzakelijk gebaseerd is op verbruik (kWh) van elektriciteit	-3	-4	-3	-2
32	De hoogte van het capaciteitstarief gekoppeld is aan de hoogte van de systeempiek die er is op het moment van de maximale capaciteitsvraag van netgebruiker.	2	2	0	0
49	49De netbeheerder prikkels en/of transparantie geeft aan aangeslotene om zijn netwerkproblemen op te lossen.	1	5	1	3

Network investments

Network investments are separated in two high level subjects: General network investments and investments in interconnection capacity. General network investments are capacity expansion of existing network or building new network parts(statement 1-3). There is common ground that the current approach of socializing new network parts should be maintained; every factor disagrees with the statement that new network parts should be financed by those who are connected to the new network. This also applies for the statement(33) regarding the use of governmental funds to fund the network costs, every factor disagrees.

There is also common ground about that the quality of the network should be kept at the same level(statement 44). This result is reinforced by statement 1, which shows that every factor disagrees with the statement that investments should be postponed until more certainty about the future demand of capacity of the network; this could lead to a decreasing the network quality. The contrasting statement(2) is however not generally agreed: network investments that are made have such a large capacity that no capacity shortage can be expected in the lifetime of the network part. Factor three agrees with this statement, factor 2 strongly disagrees with this statement and factor 1 and two are neutral. These statements are the extremes and therefore quite some people put this more in the middle of their sort.

Regarding the interconnection capacity similar statements(4 and 5) were introduced: interconnection capacity to theoretical import all electricity from neighbouring countries or interconnection capacity based on import and export(interconnection capacity determined based on demand). Factor 1 and 3 are for more interconnection capacity, while factor 2 and 4 oppose. Several participants in factor 1 and 3 also mentioned the idea of a “koperen plaat”, a European network that is fully interconnected. Several participants in factor 2 and 4 oppose against this idea. They regard this as unnecessary and have more a focus on the increase of decentralized generation and therefore find interconnection too expensive and unnecessary. Several times is also mentioned that the Netherlands should not depend (too much) on import of electricity, but should be (largely) self-sufficient in their electricity generation.

Besides statements regarding the network capacity investments, several statements were implemented regarding who and how there should be decided if network investments are needed(statements 34, 40, 44, 51, 52. 53). A general statement that the tariff system should cover this is agreed with by factor 1,2 and 4, while factor 3 is neutral. Two statement specify the previous statement more and show differences between factors. Factor 1 and 3 find that this should be primarily based on rules and regulation, while factor 2 and 4 agree more with transmission prices giving incentives for network investments(e.g. network tariffs decrease when insufficient investments are made or quality of network is too low and therefore the system operator has a lower income). In addition statements are introduced to see who should have influence on the network investments. Factor 1 and 4 find that the government can have (to some extend) influence on the network investments, while factor 2 and 3 are neutral. Influence of network users is regarded by all factor neutral.

In respect to these issues it is hard to determine common ground besides the fact that the quality of the network should not decrease. However, this statement remains vague and therefore discussion on details can be expected. Regarding interconnection capacity there is common ground between factor 1 and 3 and factor 2 and 4. Respectively there is a more “koperen plaat” perspective

versus a more decentral perspective. The same separation can be found regarding on where investments should be based on: regulation or transmission tariffs.

Table 15: Network investments

# statement Rank F1		Rank F1	Rank F2	Rank F3	Rank F4
1	Investeringen in het netwerk zoveel mogelijk worden uitgesteld tot er meer zekerheid is over de toekomstige energievraag voor het netwerk.	-2	-3	-5	-1
2	Investeringen in het netwerk dusdanig ruim worden uitgevoerd, dat er in de afschrijvingstermijn van de investering geen capaciteitstekort kan worden verwacht.	0	-5	3	0
3	Het netwerk op een gegeven moment als 'definitief' wordt beschouwd; uitbreiding van het netwerk (nieuw stuk netwerk) wordt (gedeeltelijk) bekostigd door de aangeslotenen aan dit nieuwe stuk netwerk.	-4	-3	-5	-3
4	De interconnectie capaciteit volledige marktkoppeling mogelijk maakt.	3	-2	5	-4
5	De interconnectie capaciteit afhankelijk is van de import en export met onze buurlanden.	1	0	1	-2
33	De netwerkkosten (gedeeltelijk) gedekt worden door algemene middelen van de overheid.	-5	-4	-2	-4
34	De tariefsystematiek prikkels betreffende netwerkinvesteringen geeft aan de netbeheerder	3	3	-1	3
40	Investeringen in het netwerk worden gebaseerd op regelgeving en normen van de kwaliteit van het netwerk	5	-1	4	1
44	De kwaliteit van het netwerk niet achteruit gaat	5	1	2	2
51	De transporttarieven prikkels geven voor investeringen in het netwerk.	-2	2	-4	4
52	Er meer inspraak is voor aangeslotene of investeringen in het netwerk nodig zijn.	0	0	1	1
53	De overheid/minister geen invloed heeft in netwerkinvesteringen, maar dit door de netbeheerder wordt besloten die gecontroleerd wordt door de ACM.	3	-1	-1	4

Residuary statements.

The remaining statements are the more indicative statements and are discussed together. First statement 23, 24 and 55 compare give an indication of the network in relation to the (energy) market. Factor 1-3 prefer minimum barriers for competition on other markets. However, only factor three regards disagrees with the statement that network management is subservient to energy market. Statement 55 is generally disagreed upon, except by factor 2, but helped understand the position towards network management.

Generally, the (energy) market should be facilitated by the network and network management. Although the network is a monopoly, there should be strived that this affects the market as little as possible. The differences between the factors are based on one side in how far they have a systems perspective and how subservient network management is to the (energy) market). This could also be a result of how outspoken they are regarding this topic. The three statements emphasize the differences between the factors, but don't really result in conflicting perspectives nor ambiguousness.

Statements 19, 21, 30, 43, 46 and 54 all address statements regarding adaptability certainty and choices in respect to the tariff system. These statements confirm the focus of the factors, but don't show any conflicts as some factors either agree or disagree and the other factors are relatively neutral regarding the statements. Only statement 54 shows some conflict regarding the option of negotiations between different actors. Factor 2 strongly agrees with this statement, while factor 1 strongly opposes. This can again be explained by the focus of the two factors, where factor 2 focusses more on low voltage network and factor one more on the high voltage network. Arbitrary rules lead to uncertainty which is less desirable for large energy consumers. In addition, factor one has a more top-down central regulation perspective. Factor two focusses on regional system optimization, where a generic tariff system would be too restrictive.

Common ground can be found in statement 31 and 45, where a slight preference is showed for a gradual change in the tariff system or at least there is some opposition against making a single large change. The side-note is often made that these statements are two extremes. Every year making significant changes in the tariff system leads to too much uncertainty. More common ground can be found regarding that the tariff system needs to be changed in the upcoming 10 years with statement 36 and 48. The factor explains the difference regarding harmonization tariffs system within Europe. Regarding factor specific contents this might be wanted, however, generally the networks are regarded as having too many difference to harmonize.

The last statements address some exemptions and the use of the tariff system as an incentive for renewable stimulation. There is quite some common ground regarding exemptions; they should not be applied. Factor 4 is strongly opposed with this statement, as the examples are disregarding their interest. Exemptions or incentives for renewable energy should be stimulated is the perspective of factor 4. The other factors oppose to this perspective, except for factor 2. According to the factor array they have a slight preference, but with substantive knowledge this can be interpreted with their locational optimization perspective: renewable energy fits the locational optimization.

Table 16: Residuary statements

# statement		Rank F1	Rank F2	Rank F3	Rank F4
19	Er meer soorten contracttypen zijn voor de transporttarieven van kleinverbruikers.	-1	3	3	1
21	Het een optie is om te kiezen voor een transporttarief met vaste tarieven of variabele tarieven.	0	1	0	-1
23	Het netbeheer ondergeschikt is aan een goed werkende energiemarkt.	1	-1	-4	-2
24	Er wordt gezorgd voor minimale barrières voor marktwerking.	2	3	4	-3
25	Transportkosten in Nederland voor aangeslotene niet (significant) hoger zijn dan omringende landen.	4	-2	3	0
30	De tariefsystematiek flexibel wordt ingericht, zodat er gemakkelijk en snel aanpassingen kunnen worden gedaan wanneer er (onvoorziene) ontwikkelingen plaatsvinden.	0	3	1	-1
31	De tariefsystematiek geleidelijk over de jaren wordt aangepast.	0	0	0	3
35	Decentrale opwekking en duurzame technieken moeten gestimuleerd worden met transporttarieven.	-3	2	0	2
36	De tariefsystematiek zoveel mogelijk hetzelfde is gebleven; veranderingen leiden tot een onzeker investeringsklimaat en zullen tot suboptimale prikkels en kostenverdelingen leiden.	-1	-5	-3	-3
41	Er in Europa naar een uniforme tariefsystematiek wordt gestreefd; bijvoorbeeld dezelfde tariefdragers, tariefhoogtes of kortingen.	3	-3	-1	-4
42	Er mogelijkheden zijn voor kortingen(bijvoorbeeld grootverbruikers regeling, 600 uurs regeling o.i.d.) indien dit maatschappelijk gewenst is	0	0	-1	-5
43	Veranderingen in de tariefsystematiek niet moet leiden tot teveel complexiteit voor aangeslotene; iedereen moet overzichtelijke en overwogen besluiten kunnen maken.	-1	-1	5	2
45	De tariefsystematiek zoveel mogelijk in één keer wordt aangepast.	-1	-3	0	0
46	Veranderingen in de tariefsystematiek gepaard gaan met zekerheid; het moet duidelijk zijn hoe de tariefsystematiek zich gaat ontwikkelingen in de aankomende jaren.	1	-1	3	0
47	De tariefsystematiek wordt gebruikt om op bepaalde marktuitkomsten of doelen te sturen.	-4	-2	0	5
48	De huidige tariefsystematiek zo lang mogelijk wordt behouden.	-1	-5	-1	-3
54	De regels soepeler zijn, zodat er meer ruimte is voor onderlinge afspraken en onderhandelingen tussen afnemers, producenten, netbeheerders en marktpartijen.	-3	5	2	1
55	Er wordt gekeken naar de verschillende type netwerken en netbeheerders prikkels kunnen geven voor het gebruik van andere netten (gas, elektra, warmtenetten).	-2	2	-2	-2