

Delivery no.: D6.4.1 – D6.4.4
**Results on consumer insights regarding Flexibility
product and use of Power tariffs**

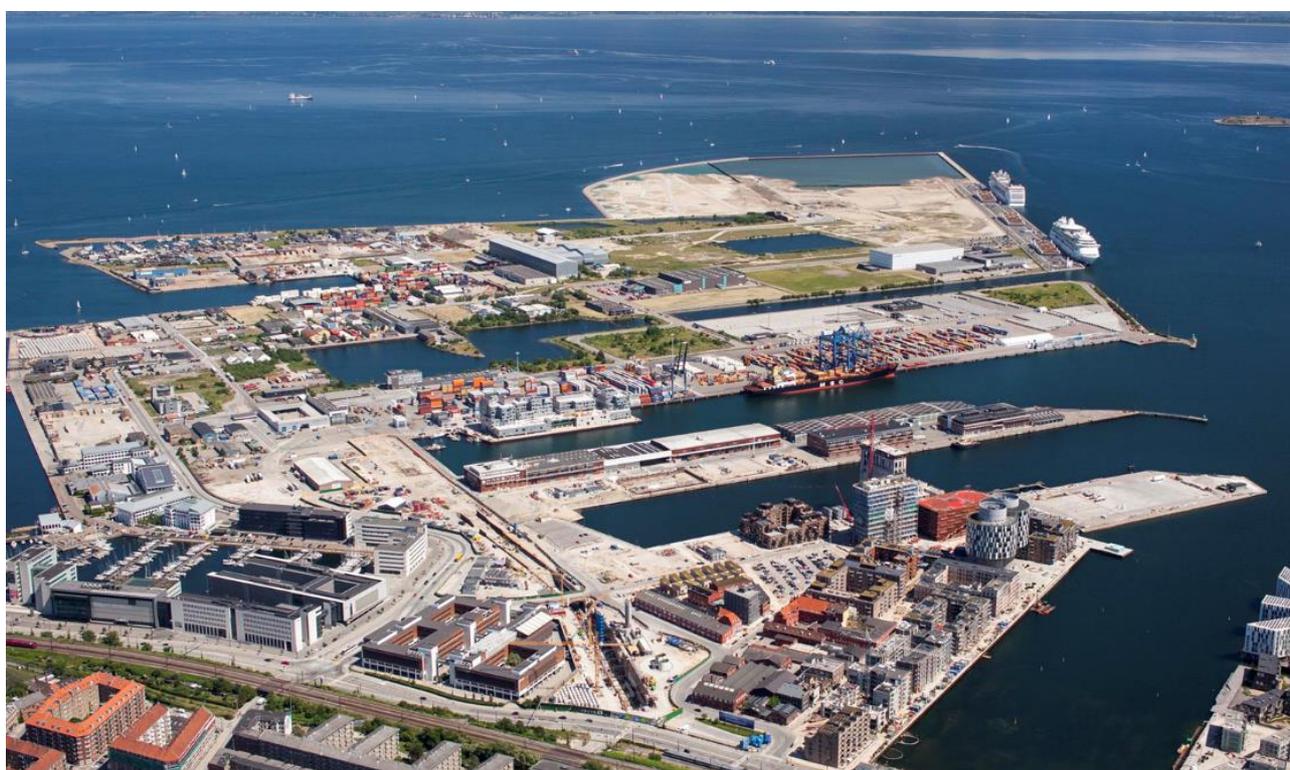


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Preface

EnergyLab Nordhavn – New Urban Energy Infrastructures is an exciting project which will continue until the year of 2019. The project will use Copenhagen's Nordhavn as a full-scale smart city energy lab, which main purpose is to do research and to develop and demonstrate future energy solutions of renewable energy.

The goal is to identify the most cost-effective smart energy system, which can contribute to the major climate challenges the world is facing.

Budget: The project has a total budget of DKK 143 m (€ 19 m), of this DKK84 m (€ 11 m) funded in two rounds by the Danish Energy Technology Development and Demonstration Programme (EUDP).

Forord

EnergyLab Nordhavn er et spændende projekt der løber til og med 2019. Projektet vil foregå i Københavns Nordhavn, og vil fungere som et fuldskala storbylaboratorium, der skal undersøge, udvikle og demonstrerer løsninger for fremtidens energisystem.

Målet er at finde fremtidens mest omkostningseffektive energisystem, der desuden kan bidrage til en løsning på de store klimaudfordringer verden står overfor nu og i fremtiden.

Budget: Projektets totale budget er DKK 143 mio. (EUR 19 mio.), hvoraf DKK 84 mio. (EUR 11 mio.) er blevet finansieret af Energiteknologisk Udviklings- og Demonstrationsprogram, EUDP.

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1. Introduction

1.1 Background

The green transition from fossil energy to renewable energy sources affects the Danish electricity system. Although Radius is not directly involved in the production of electricity, the conversion nevertheless indirectly affects our business with the transport of electricity, as it presents both new challenges and new opportunities. As the share of electricity from wind turbines increases, electricity prices will vary more, which will mean that customers might change their consumption patterns.

At the same time, there is an expectation that the Danish society will be more electrified. This means that a larger part of our energy consumption will draw on the electricity system, because both transport and heat will increasingly be based on electricity.

New remote power meters for all customers are also part of the conversion and enable hourly billing and new pricing principles. Radius has already introduced tariffs that vary according to when the customer consumes electricity during the day and during the year. The greater the load on the grid, the higher the tariff, and vice versa. In this way, we support an intelligent energy system where the tariffs reflect the costs incurred by the consumption.

The variable tariffs address the general problem of peak load in the network, but not specific challenges that can arise in the network. To address these challenges, Radius is considering introducing new products to large customers. Products that can reduce Radius' costs and which at the same time will be attractive to customers, because they can reduce customers' electricity bill.

In line with the increased demand for electricity, the load on the power grid increases. The traditional solution for this challenge is to reinforce the power grid. Reinforcements of the network increase Radius's costs, and customers will then experience higher prices for the transportation of electricity.

However, electricity consumption is not evenly distributed over the year and over the day. If the electricity consumption can be levelled out, this can mean that reinforcement can be avoided, which will mean less costs for the customers. The idea is therefore to develop products and services that reward customers who can move their consumption in relation to the load of the grid. This is what is referred to as 'peak load shaving'.

1.1.1 Focus on two tariffs

Radius is committed to ensure that customers can always consume electricity, provided that they pay according to the prevailing general prices. This right will remain. But we can provide customers with an extra offer, which means that the customers receive a payment to move the consumption in time or for a shorter period to refrain completely or partially from taking out the electricity they are otherwise entitled to.

In connection to task 6.4, it has been chosen to focus on two types of tariffs that Radius has considered in relation with a possible reform of the pricing. Neither of the two have yet been investigated among the power grid customers, and we are therefore interested in gaining knowledge about the customers' needs, wishes and perception of respectively tariff type and product.

1. Power [or load] tariff, which could be relevant to all customers. The purpose of the power tariff would be to achieve even more cost-oriented tariffs than the time differentiated tariffs do.
2. Flexibility products, which would only be relevant to high consumption companies. The purpose of the flexibility products would be to obtain bigger flexibility in connection with peak load situations.

As the grid companies sell capacity and not energy, a power tariff better reflects the real costs of operating the power grid. From an economic perspective we consider the power tariff as more cost-oriented than costs determined by energy consumption and several stakeholders are convinced that grid companies should use power tariffs instead of energy tariffs. We therefore have a desire to elucidate further what consumers think of this type of tariff.

Flexibility products are chosen as they represent a possible tool to ensure a more cost-effective operation of the grid. Flexibility products are also examined in other contexts and in other countries, and we consider it an option, which we should be able to offer when the new regulation from the EU is implemented (Clean Energy Package).

1.2 Purpose

The purpose of the study is to identify the customers' preferences and attitudes towards alternative terms, agreements and tariffs that can support a flexible consumption and placement of consumption in relation to the future challenges of the grid. We need more insights about our customers' wishes, needs and opportunities to change their energy consumption.

The survey is limited to the Nordhavn area and findings can therefore not be generalized to count for other types of companies or private persons with other demographic profiles. The overall expectation is to get indications of understanding, interest and accept of various grid tariffs and to gain input into what could be strengthened/changed, should we decide to conduct a bigger quantitative study.

The study is exploratory and is conducted to assess the customers' interest. The interviews are based on identifying how customers understand and experience the two types of charges (Power tariff and Flexibility products), including the following topics:

- Respondents' knowledge and attitudes towards tariffs for electricity distribution
- Attitudes and behavior in relation to the environment and sustainability
- Opportunities and limitations in relation to changing behavior
- Is it possible to make tariffs understandable to customers?
- What should be focused on in the communication to best support correct understanding?
- Do the customers understand the calculation models and the consequences?
- Do the customers experience the tariffs as acceptable / interesting?
- Are the tariffs expected to motivate changed behavior?
- Can large-scale business customers see opportunities and relevance in flexibility products (reservations, wishes, suggestions)?

1.3 Methodology and test set-up

1.3.1 A qualitative study

As the survey mainly has an explorative focus, a qualitative study is chosen. The in-depth interview method enables moderator to adjust topics, questions and explanation as the interview progresses. It makes it possible to follow the stream of consciousness of the respondent, to enclose knowledge and understanding and to ensure contextualization of the respondents' attitudes and reported behavior.

The complexity of the tariffs and flexibility products is a further reason to choose the qualitative method. The face-to-face dialogue makes it possible for the moderator consecutively to add explanatory details depending on the foreknowledge and understanding of the respondent. Through this iterative approach we also aim to understand what level and type of information is required for the target groups to understand and if possible to accept the concepts.

1.3.2 Semi structured face-to-face interviews

Each interview lasts 1 hour and takes place at the company respondents' workplace and in the household respondents' home. This location is chosen both to make it easier for respondents to participate and to strengthen the contextualization by giving the moderator an opportunity to view the facilities/home where the consumption take place, and thereby also to provide the respondents with a physical point of reference.

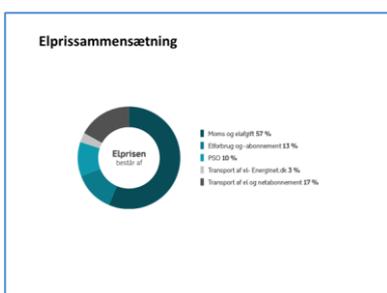
Some of the household respondents prefer for practical and privacy reasons to have the interview take place away from their home. Often because the partner and/or children are at home and therefore it is considered easier to be away from home. These interviews are conducted at a local café.

The interviews are semi-structured as they all follow a pre-determined discussion guide¹, in which the main topics and key questions are outlined. Moderator ensures all main topics and key questions are covered and will otherwise follow the respondents' flow and prompt according to the overall objectives.

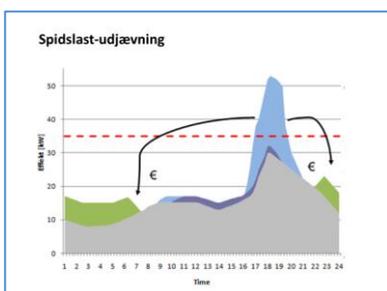
1.3.3 Test stimuli

During interviews respondents are presented to various illustrations to support introduction of the topics for discussion.

Company respondents are presented to:

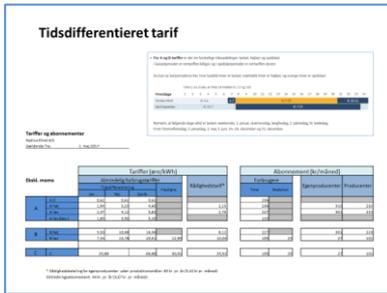


An explanation of how the cost for electricity is composed, focusing on the part that concerns distribution.

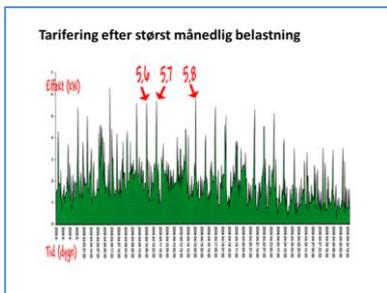


An illustration of the challenges in connection with peaks and how peak shaving can prevent having to reinforce the grid

¹ Discussion guides are attached in Appendix A

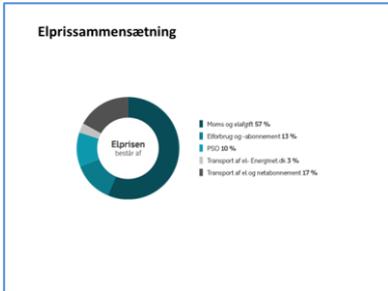


Presentation of the time differentiated tariffs, which currently applies to the company respondents



An illustration to explain the principles of the power tariff

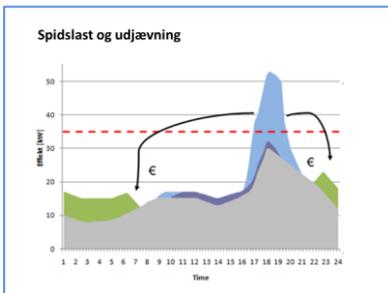
Household respondents are presented to:



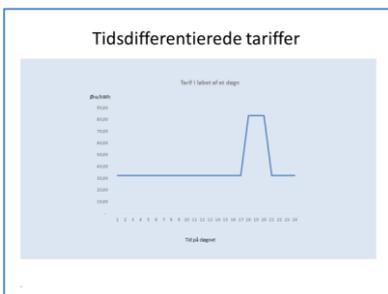
An explanation of how the cost for electricity is composed, focusing on the part that concerns distribution.



An introduction to the expected changes in our electricity consumption and production and the opportunities and challenges this presents to the power grid.

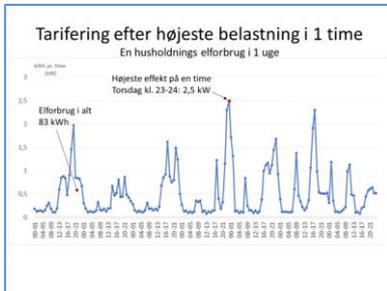


An illustration of the challenges in connection with peaks and how peak shaving can prevent having to reinforce the grid



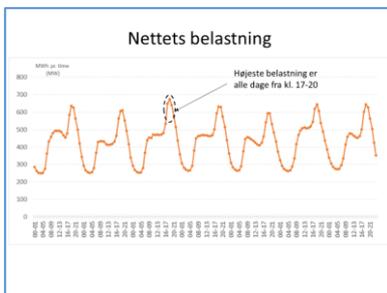
Presentation of the time differentiated tariffs, which successively with the installation of remote power meters will apply to all household customers.

The following are the 3-step explanation of the Power tariff according to the household's highest load during peak:



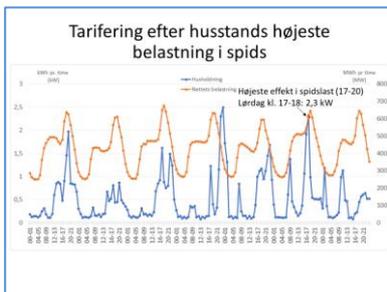
1st of 3 illustrations:

To introduce the concept of tariffing according to a household's highest load within an hour (in KW) (as opposed to the traditional way of measuring the total kWh).



2nd of 3 illustrations:

To show how the load on the power grid fluctuates over the day and how it peaks in periods.



3rd of 3 illustrations:

To illustrate how a tariff according to the household's highest load during peak is measured.

1.4 Recruitment and screening criteria²

1.4.1 Company respondents

As we did not know in advance, which person/job function in the companies would be responsible for matters regarding electricity consumption, we did the recruitment of the company respondents ourselves. It required a combination of explaining and questioning to find the right person to invite for the face to face interview. The screening criteria for the company respondents are:

- All are decision-makers regarding the company's electricity consumption
- All are from companies with a yearly electricity consumption of at least 400.000 kWh. This limit was chosen because customers with consumption above this limit has a potential to provide significant curtailment of consumption on its own possibly providing the certainty needed not to expand a 10 kV feeder.

In the Nordhavn area 9 companies have a yearly electricity consumption on 400.000+ kWh. Two of these are commercial office rentals, where the owners are only responsible for the part of the electricity consumption used for the outdoor and common areas (hallways, stairs, etc.), whereas the remaining electricity consumption is covered by the various companies renting office space in the buildings.

Decision-makers from 4 of the remaining 7 companies agree to participate. It is a high share within B2B survey recruitment, which is generally difficult and with a success rate of <1:10. Respondents respond positively to the survey being a part of the non-commercial EnergyLab Nordhavn and the topic concerning energy consumption and tariffs, both of which are perceived to of high relevance to the respondents.

1.4.2 Household respondents

The 16 household respondents are all recruited for interviews by DMA/Research A/S. Recruitment is based on random calls to registered residents in postal code 2150 Nordhavn. Screening criteria for the household respondents are:

- All have at least a 50% say in decisions regarding the household's consumption
- All have good insight in the household finances
- Spread in gender, age and family status

² Anonymized list of respondents is attached in Appendix B

2. Task 6.4.1: Findings from the company interviews

2.1 The companies

In all four participating companies, we are referred to a Facility Manager or a person of similar function, when we ask to talk to the person in charge of the company's electricity consumption.

The four participating companies are from different business categories and their facilities are very different in size; covering everything from older office buildings over a temporary warehouse to a state-of-the-art building covered with solar cells and equipped with a high-tech building management system (BMS). None of the facilities are manufacturing plants, but two of the companies have bigger machinery which run partly/entirely on electricity.

The four companies' electricity consumption is as follows:

Company	Electricity consumption for
1	Offices, canteen and meeting facilities
2	Offices, outdoor floodlights, big machines, storage
3	Offices, storage warehouses, robots, big machines
4	Offices, canteen and meeting facilities

Please note: Because of the small sample the survey is not applicable to generalization. Findings should therefore be understood and interpreted only in the context of the participating companies (their specific market conditions, company policies, facilities, etc.) and the specific respondents (knowledge, attitudes, job content, etc.). Any generalization in this report refers only to the four participating companies.

2.1.1 Decision making processes

All final decisions regarding electricity consumption lies with the Chief financial officer (CFO) or the Executive Management. CFO or Executive management is however only directly involved in changes, which require bigger investments, or which effect the operation.

In the daily operation, the companies' electricity consumption is monitored alongside all other costs. Since all participating companies have recently revised their electricity consumption and have implemented various electricity saving measures (LED lights, motion sensors to control the light, BMS to optimize energy consumption, solar cell panels, upgrades of electrical machinery), they do not pay much attention to the electricity consumption for the time being. It is mainly monitored to compare to previous years, and if the consumption is stable, no further actions are taken.

“I don’t believe there is much more to gain right now, since we have just gone through it all, thoroughly. But I am of course always interested in any suggestions about how we can save electricity.”

Responsibility for monitoring the electricity consumption lies with the Facility Manager, and all inquiries regarding this also go through him in the first place. The Facility Manager is responsible for ensuring the best solutions (quality and price) and is as such always interested in acquiring ideas and suggestions to improve the existing solutions. It seems that considering the company’s energy consumption only comes up with years apart or in relation with renovations or moving. This also means that the Facility Manager seldom has an up-to-date knowledge about the latest solutions and technologies available on the market.

2.1.2 Consumption behavior

Two of the companies mainly run in office hours (08:00–16:00). The other two companies place most of their administrative tasks during office hours, but their core operation cannot be planned. A substantial part of both operations is based on acute/unannounced demands and requires for them to be available for full operation at all hours 24/7/365.

All four participating companies rely on electricity to operate. They use electricity for building operation (light, ventilation, heating, kitchens), for IT which is crucial in both administration and the general operation, and two of the respondents also have big electrical machines (robots, big machines) in their production line.

According to the respondents, fast and stable operation, availability, high-level service and convenience for the customers are keys to a successful business for them. Here electricity plays an important part. Without stable electricity, none of these four companies can produce or provide the required services and keep up an acceptable service level.

“The high reliability of supply was an important reason why Denmark was chosen for our operation.”

The company respondents generally know and trust the electricity supply to be stable and well-functioning, and therefore they only have smaller standby generators to power their most vital machines (vital IT systems and electrical facility control systems) in case of power failures. Power failure is seldom, but when it happens, it results in lost working time,

lost production, lost opportunities/businesses/investments, delays for the respondents' clients and a critical drop in service level.

2.1.3 *Knowledge and understanding*

The four respondents are only focused on and aware of their customer relation with the electricity supplier. Perhaps as a natural consequence of the Engrosmodel, the business respondents don't seem to consider themselves as being in a customer relation with the distribution system operator (DSO), and only one of them seems beforehand to have any awareness about the distribution system as an independent part on the electricity market. The other three respondents neither seem to know nor care much about the distribution system.

The respondents perceive the DSO in line with taxes and charges: It represents a non-negotiable cost that can neither be influenced nor avoided, and therefore it is of little interest to the individual company and Facility Manager.

“Yes, I have noticed it (the cost for distribution). This is also a part of the costs that we can't effect.”

This means that none of the respondents have any detailed knowledge about the distribution tariffs, neither generally nor their own specifically.

(About already having time differentiated tariffs) *“We do? I wasn't aware.”*

Even though all four respondents, as part of their job responsibilities, approve the company's electricity bills, none of them seems to be particularly attentive to the specific entries on the bill. They are aware that a big part covers taxes and charges, and only a smaller part covers the costs for the consumed electricity. Their focus is on how the usage in kWh has developed and on the total amount to be paid.

2.1.4 *Attitude towards the green transition*

All four companies work actively with Corporate social responsibility (CSR) goals, which also cover environmental aspects. Three of the companies have a specifically appointed

Environment Manager and they all have facility managers, who among their responsibilities have a continuous focus on the company's electricity consumption³

“We have a green profile. Københavns Kommune who owns the buildings have had their Environment Department to go through all buildings and the factory and have assessed it as some of the best they have seen.”

Within the last 5 years all participating companies have been through a thorough revision of their energy consumption and have invested in various improvements and saving measures. One has recently moved into completely new buildings and two other companies have as part of their environmental profile installed solar cells to cover part of their electricity consumption.

“We consider expanding the number of solar cell panels on the other roof, to increase our own sustainable electricity production.”

In regards of purchase of electricity two of the companies have chosen their supplier based on lowest price, one company has chosen a company because of its green profile and one has just kept the retailer they were assigned in the first place (going back to the days were there was a retailer with an obligation to provide a universal service in a specific geographic area).

As they have all recently reviewed their energy consumption and have implemented new energy saving solutions, for now the respondents feel they have covered all feasible improvements. All four respondents agree that introduction of further initiatives will (in prioritized order) require that:

- Daily operation is either unaffected or improved
- Employees work life is either unaffected or more convenience is achieved
- Costs for initiatives will either break even with savings or ensure a long-term profit

³ The strong environmental focus of the participating companies is likely to be biased, as companies with a strong environmental profile and focus might be more inclined to participate in a survey regarding electricity consumption. This study can neither confirm nor deny that large-scale companies generally have a strong environmental focus.

Especially the two companies with no planned facility or plant changes do not expect to be able to make more savings related to their electricity consumption in the nearest future. The two other respondents, both of whom are facing bigger changes in their facilities, see more opportunities. One will move and build new facilities and operation area with all new machinery. The other will renovate existing buildings to create a more contemporary office environment.

(Talking about hybrid machines that return electricity production to the grid):

"I believe the more fancy and profitable things they can come up with, the more of that we will invest in."

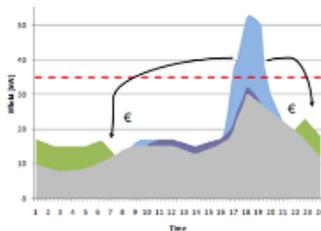
These two respondents see it as an opportunity to invest in future sustainable solutions which can be both environmentally friendly and cost reducing at the same time. Since it is rare to make big scale investments in sustainable solutions, all respondents are highly interested in getting the best possible counselling about contemporary energy friendly solutions. None of them knew where to best get qualified and independent advice.

2.2 Evaluation of Flexibility product

The flexibility product is introduced to the respondents with the following wording:

Along with the increased demand for electricity, the load of the power grid also increases. Without further action, it may call for the grid being expanded, which is the traditional way to solve this kind of challenge. Amplifications in the power grid is however expensive and along with the increase in Radius's costs, the customers will experience higher prices for the distribution of electricity.

The diagram of a “Peak shaving” is presented:



However, electricity consumption does not spread evenly over the year and over the day. If electricity consumption can be leveled out, expansions can be avoided, and this will ultimately mean less costs to customers. We call it peak shaving.

To spread the electricity consumption it is considered to offer products where high consumption customers receive a compensation for moving their consumption in time or for a shorter period refraining from receiving the power they are otherwise entitled to.

2.2.1 Immediate reception

Respondents generally welcome the concept, and the idea of being a part of the collective solution is appealing, as social responsibility and conscious consumption is in line with the general CSR policies of these four companies. Furthermore, they see it as another possibility of saving electricity. The main requirement is that their core businesses are not interrupted.

While the two companies with bigger machines and robots immediately express doubts about being able to miss power for even shorter periods of time, the two with mainly office facilities immediately come up with suggestions (e.g. shutting of electricity in part of the buildings or shutting of air circulation cooling). How much load it would be possible to shave by these measures is not clear, since none of the respondents have specific knowledge about how much electricity they use for different machines, technology, buildings, etc. They do however assess that ventilation and cooling only can be cut off for

a limited period (depending on season ½-1 hour), before the indoor climate will be affected.

2.2.2 Understanding

As the company respondents have relatively low knowledge of how the power grid works a basic introduction is crucial for them to understand and accept the motives for the Flexibility concept. Key points to inform them about to obtain their understanding and their acceptance are:

- The grid has limited capacity and when the capacity is exceeded it requires amplification
- The increased electrification in society leads to peaks which consequently challenge the capacity of the grid
- The financial consequences for the community (the consumers) connected with reinforcement/expansion of the grid

Once these messages are conveyed to these company customers, they understand Radius' motivations to introduce flexibility products, but do not have a strong notion about their own motivations. They primarily see it as an occasional possibility to save the electricity that they refrain from using.

2.2.3 Perceived relevance and interest

None of the companies assess that they will voluntarily be completely without power for even shorter periods. They consider it most likely that if they should agree to a Flexibility product, they would only be able to offer shaving part of their consumption, and only for a short period. And this idea is deemed highly interesting as the combination of saving electricity consumption along with helping to solve a collective community challenge is very well in line with the participating companies CSR goals.

Thus, the positive interest in being a part of a Flexibility solution is high, but the respondents generally find it very difficult to come up with ideas for the practical execution. There seems to be few obvious ways of finding flexibility in their power consumption. Every suggestion they come up with, they end up rejecting, because they foresee that it might affect the operation of the core business.

“Our students pay high fees to attend this school. They expect facilities and equipment to work perfectly. And most of our equipment, lights, IT,

heating, etcetera is state of the art, low energy products and automated to only run when required.”

“When we have an acute shipment, we need all robots to be fully functioning, no matter what time of the day it is.”

“It doesn’t appear to me that we can disconnect anything. We must be here during office hours where the peak of the grid also is. And the office runs in a very classic way: People come in, dock their PCs, get coffee, light is switched on, the elevator runs, ventilation runs, etcetera. All of these things are required to run the office.”

“It is very difficult. If for instance a ship is in the middle of being handled, we cannot stop everything. We have lots of people on work, and it would be incredibly expensive to have them sitting around. And time is of the essence for these ships. The faster it can be loaded or unloaded the bigger the earnings.

When prompted on various areas within each company’s electricity consumption respondents most often end up concluding that it will not be possible to cut power with the current equipment.

(Considering a suggestion to heat up an electrically heated warehouse a little extra in the morning and then turn of the heat for a couple of hours):

“I think it has to keep a certain temperature level, and we only have a manual way of turning up the heat extra in the morning. That would be too much hassle.”

But if new equipment opens for opportunities to cut power, the respondents are absolutely interested in taking that into account.

“Our current UPS plant is insignificant. Especially the latest power outage hit us hard. It lasted 40 minutes, but we were hit by the aftermath all day.

Some of the technical equipment would not restart, and for the rest of the day we were without network. Therefore, we have been discussing what needs to be UPS'ed in the future and we have also discussed the need for an emergency power generator. [...] If we get an emergency power generator we would definitely consider using that as a power source to be able to disconnect from the grid during peak."

Whereas it is difficult for the respondents to find areas where they today can make the Flexibility product work, they all see perspectives in having future machinery and technology with smart, automated flexibility solutions build in. Intelligent automation is an important factor to truly make the flexibility concept appealing. Ideally the automation should both make the disconnection and should also be able to assess whether/for how long a disconnection is possible.

(For this company's new location, they will invest in new machines and equipment – preferably intelligent and environment friendly solutions)
"Nowadays you can get the small machines as electrical robots that don't need operation by humans. They can run at all hours, which would most likely make it possible for them to stand still for a couple of hours during the peak."

All respondents suggest that Radius should offer the expertise to come up with substantiated ideas for how to (partly) disconnect the power without affecting the daily operation. If Radius (or anybody else for that matter) could help them find a good solution, they would gladly participate.

"If you from Radius can come up with any suggestion on how we can move our consumption without affecting our operation, I can only see advantages."

2.2.4 Preferred Flexibility concept

The respondents are presented to two different concepts and asked which of them, if any, seems most appealing and relevant to them:

- Concept A:
The company receives a lump sum of 30.000 DKK. They can be disconnected up till

four times a year with a duration of 4 hours. They will be warned an hour in advance. Each warned disconnection is compensated with 35.000 DKK.

- Concept B:
The company is compensated with 25 DKK per not-delivered kWh, which the company has reduced the consumption with, compared to what they over the last years have used on average at the same time.

Generally, the matter of a financial compensation is interesting, but of less importance to the participating companies. They are generally only interested in participating, if it has a minimum of impact on their business. And with a minimum of impact on their core business a compensation is not necessarily required.

Should there however be costs connected with participating, the respondents expect these costs covered, either by a direct compensation or as they all suggest; by access to professional energy counselling which can help the company save at least the same amount as they invest. To these four companies the latter seems more appealing than a financial compensation.

If refraining from power would affect their core business or would require a big effort, a compensation would have to be very big, and in some cases the respondents deem it impossible to set a value on the missing power. To some because their loss (undelivered products/service, unsatisfied customers) cannot be measured in money, to others because the financial loss would be much greater than any of the concepts include.

“I don’t want to sound arrogant on behalf of my company. However, those amounts are completely indifferent to running this business. We wouldn’t even notice them. We have a department [anonymized], if we asked them how many seconds they could do without the power to get a compensation like this ... it would maybe be one second, but they would hardly run the risk.”

Concept A is easier for the respondents to envision. With this concept they expect that they would in advance have decided which exact area should be without power. As such it seems like a calculated risk, where consequences and costs are possible to assess for them.

The respondents find it illogical to have a fixed amount for the compensation. They find it reasonable that the compensation should match the actual costs of the individual company in connection with flexibility in their consumption. But they also appreciate that to have an impact and make it worth the while for Radius/the community, the amount of power supply they refrain from must be relatively high. Therefore, it seems illogical, bordering to unfair to have a fixed compensation.

Concept B seems too uncertain to the respondents. The concept is perceived to be a flexibility which Radius can tap into at any given point in time. Thereby making it uncontrollable to the company.

"I will never get my boss to approve of this, where we are stand by 24/7. It would at least require that we agreed on a maximum times per year."

Without having any specific solution in mind, and therefore not knowing exactly what measures would be required from them to participate, the respondents suggest 4-7 days of notice as necessary. They imagine that this time should be used to (manually) set up the BMS, uninterruptible power supply (UPS), heating system, machinery, etcetera to the upcoming cut of power.

Finally, a couple of respondents are also interested in knowing if there would be any consequences/penalties if they do not comply with the agreement, for instance in a situation where Radius request them to cut power, but they cannot/will not refrain from it.

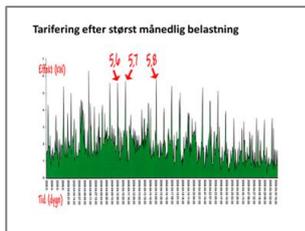
2.3 Company respondents' evaluation of Power tariffs

The Power tariff is briefly introduced to the respondents with the following wording:

Today, the cost of using the power grid is based on a fixed network subscription and of your consumption measured in kWh. As we talked about earlier, a large part of the costs of the power grid comes from peak load that requires reinforcement of the grid. If we take this knowledge into account, then you could conclude that it is not the amount of energy which drives most of the costs to the grid, moreover it is the load in relation to when it takes place. One can say that the power grid is less challenged by a constant low consumption over the year than by a huge consumption (even for a shorter period) during the peak load period. Therefore, it could be argued, that a price that follows the kWh consumption

("energy-dependent costs") is not entirely fair. It is, however, the load in the network compared to when it takes place.

(The graph with "3 highest peaks" is presented to the respondent)



Instead of a regular kWh-based price for transporting your electricity, you could then base your payment (tariffs) on when you use the grid most during a month. Since there is the greatest load on the grid in the weekdays between 7am-7pm, the tariff will depend solely on consumption within this period. You would then be charged monthly based on an average of the three hours (!) between 7am and 7pm, where you have had the highest consumption.

2.3.1 Immediate reception

Respondents have difficulties understanding the concept. The concept description to the company respondents is made on the assumption that, compared to the household respondents, these professionals would have more insight into how the power grid and supply works and would have a more detailed and specific knowledge about the power consumption in their company.

Their immediate reactions show that three of them have a hard time really understanding the Power tariff. They think they understand it, but based on their comments it is clear, that the complexity of the Power tariff makes more of them confuse tariff for the distribution with the costs for the supply.

"I see what you want with the communication: A division between grid and cost for the electricity (supply)."

"I am from Serbia, and now I finally understand why you in Serbia have two power meters: One cheap and one expensive. When the cheap runs a lamp is switched on in the electrical switchboard. After 8 o'clock at night

you can wash, turn on the water heater, etc., because there you use the cheaper power. If you use it during the day, it is the expensive tariff.”

2.3.2 Understanding

Even with extra explanations a couple of the respondents struggle to really comprehend the principles behind the tariff. They seem to keep forgetting or mix up what is electricity and what is distribution. Which means that when trying to understand the Power tariff, they apply the principles they know from pricing of electricity, i.e. ‘demand-supply’ means that when the windmills produce less power the costs are higher and ‘you pay per unit’ and the more you buy the more you pay.

Most likely this happens, because the respondents try to create cognitive consonance by filling in the blanks/incomprehensible parts. Thereby making it clear that these respondents would clearly have benefitted from a more thorough explanation (in line with the 3-steps explanation offered to the household customers).

2.3.3 Relevance and interest

Since the tariff is difficult to understand and the respondents have little or none specific knowledge about the details of their companies’ electricity consumption (how much, when, from what electrical machinery, are there peaks in the consumption, etc.), the respondents also have a hard time assessing, whether a Power tariff would affect their electricity costs.

Most of them end up concluding that the Power tariff would not make them change behavior in the companies. It is basically too complex to understand and act on: They do not know when they have peak in their consumption, and even if they knew, it would not be possible for them to change anything fast enough to avoid making a peak.

2.4 Conclusions companies

In the participating companies the respondents (facility managers) take care of the daily operation of plants, buildings, areas and machinery, which also includes monitoring the electricity consumption. This is mainly a matter of registering the monthly consumption and checking the invoices. If the consumption and costs do not vary markedly from the average or from the same month last year, they do not take any further action. Electricity is vital for running the operation and therefor an inevitable cost. The companies have very limited knowledge about specific details concerning their consumption; what time of day/week/year, from which buildings/areas/machines/installations, etc.

The respondents have limited knowledge about the electricity market in general, and even less about how the distribution works, but they all come from CSR-aware companies and

are as such interested in being a part of solutions which benefit both environment and society. Once the facts about peak load and peak shaving are known and understood, the respondents are open towards the idea of helping. All participation in helping solve the challenges of the power grid is however provided, that it does not inflict with the core business (production and service level), and if it leads to expenses, it will have to be approved from level 1 management.

The readiness is high, whereas the ability to come up with suggestions to how it could be executed is low.

Of the presented concepts (Flexibility product and Power tariff) respondents find it the easiest to relate to the Flexibility product. If a solution can be found that will not affect the core operation and cause loss of productivity or service level, they are all interested. They would however need help to find such a solution and suggest Radius to be the one to encompass this competence.

The Power tariff is rejected by the company respondents. It is difficult to understand the principles and none of them can see how they in the everyday operation would be able to suddenly move consumption because a peak is about to be reached. For the fairness principles behind this tariff to be better conveyed it is crucial that it is introduced much more thoroughly, and it should be considered that company consumers might have little or no willingness to move consumption on an hourly basis "just" to save money.

3. Task 6.4.2: Findings from the household interviews

3.1 The household respondents⁴

Most of the 16 household customers from the Nordhavn area live in newly build or renovated apartments or town houses. One lives in an older building and one in a house boat.

There is a pre-determined even spread in gender, age and family/non-family.

3.1.1 Consumption behavior

All the household respondents consider themselves to be at least somewhat environmentally conscious. They turn off the lights when they leave a room, they do not let the water run and they take various other measures to make as responsible choices as possible. Especially the ones who live in new constructions find it reassuring to have low energy installations and equipment.

They all depend on electricity and consider it an inevitable part of living expenses. The drivers for the participating respondents' behavior in connection with electricity consumption do however differ, and can be characterized by four different types:

- Convenience: Approximately 1/3 of the respondents, mainly families
 - They perceive everyday life to be busy and with a tight schedule, and their household chores should run as smoothly as possible
 - Small savings/extra costs are irrelevant compared to obtaining flexibility or ease
 - Environmental and social considerations are low on the priority list

- Consciousness: Approximately 1/3 of the respondents, mainly older/post families
 - They feel they have flexibility in their everyday life, but convenience is important to them
 - Saving money is not a driver
 - Environmental and social considerations can influence behavior if it does not affect convenience too much

- Economy: Approximately 1/6 of the respondents, across demographics
 - Saving money is a strong driver
 - To have an overview of consumption and costs is considered responsible and smart
 - Environmental and social considerations are of less importance

⁴ Anonymized list of respondents in appendix A

- Idealism: Approximately 1/6 of the respondents, younger females'
 - Are very aware of environmental considerations in all sorts of consumption (save energy/water/heat, buy organic/local, buy green energy, minimize consumption and trash, no perfume and artificial components in food and products for household and personal care)
 - Are glad to make the extra effort it sometimes requires
 - Saving money is of less importance

Across the types mentioned above there are some (primarily among the male) respondents, who are more technology-interested than the rest. They have invested in local ways to monitor consumption (digital energy meters, apps) and they typically know a little more about the electricity market than the rest of the respondents. They often refer to digital and user-friendly solutions as the best way to support more intelligent consumption.

The respondents' electricity consumption often collides with the period where the load is highest in the grid. It's in the morning before going to work/school/daycare and in the late afternoon and early evening, where everybody gets back home. Here the household chores are done, dinner is cooked, and various electronic devices are turned on for work, homework and entertainment.

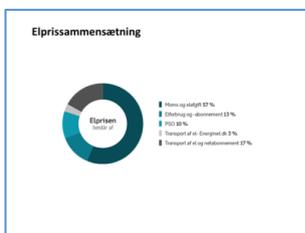
Electricity is not considered a good with its own inherent qualities. It is merely a mean to make it possible for the respondents to do the household chores and to use the entertainment devices they enjoy. Therefore, it is not obvious to the respondents to move their electricity consumption alone based due to a consideration of the grid. They are not as such not inclined to move neither household chores nor entertainment to other times of the day. Most of the household chores must happen, when the respondents are home (e.g. homework, cooking and cleaning) and the time to use entertainment also depends on when they are home and have spare time.

3.1.2 Knowledge and attitudes

Most of the respondents have no or very limited knowledge about the electricity market with suppliers and power distributions company. It is an absolute low interest area. If the supply is reliable, most of the respondents do not give it many thoughts in their everyday life. They know they must send in meter readings, but seldom know when they did it the last time or when they are expected to do it again. They know they get bills, but less than half of them have an actual idea about how much they pay.

“We live in a low energy building and all our electrical apparatus are new. Our consumption is so small that I don’t pay much attention to it. But I am certain that I would notice if the bill suddenly got much bigger. [...] I don’t know what we paid last time. Maybe three... no... I don’t have any clue.”

Most are only aware of the supplier, not of the distribution. When talking about if they know what posts their electricity bill consist of, all know that a big part covers “taxes and charges”. Only three of the respondents spontaneously mention distribution as part of the costs, and a couple more recognize it, ones they see the illustration of the components of the electricity bill.



“This is one of the reasons why we do not choose a new company (supplier). Most of the costs have nothing to do with the company and their price. You can only save marginals, and it is not worth the fuss.”

In line with the lacking awareness of the distribution, the household respondents generally do not know the name Radius. Those respondents who seem to have most recognition/knowledge of Radius before the interview have all had a special personal connection (e.g. one has worked with software for the Nordic electricity exchange, one works with the district heating grid, one has in other connection met a Radius employee).

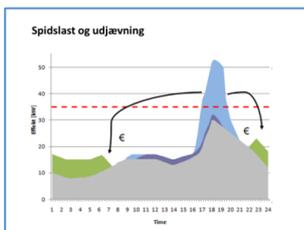
3.2 Introduction to the changes of the electricity market

As a mean of gradually building the respondents knowledge of the thoughts and intentions behind the Power tariff based on the highest load in peak, respondents are first introduced to the background:



In these years many changes happen, which also affect the electricity market:

- 1. There is an electrification of society, which means that the demand for electricity increases (more people get electric cars and heat pumps, more machines run on electricity)*
- 2. Increasingly more decentralized electricity production (solar cells and wind) - also from private households ('prosumers' or 'self-producers')*
- 3. Stronger batteries which can increase customers' share of self-produced consumption*
- 4. Remote power meters that can measure consumption on an hourly basis (as opposed to the existing yearly self-reported readings), thus making it possible to make more precise pricing*



The increased demand for electricity also increases the load on the electricity grid. This would traditionally lead to the power grid being reinforced. This does however increase the costs of the operation of the grid and lead to customers experiencing higher prices for transportation of the electricity, and because the electricity consumption is not evenly distributed over the year and day, an alternative to reinforcement could be to do what is called “peak load shaving”.

3.2.1 Reactions to the introduction to the change of the electricity market

With the introduction respondents understand the potential challenges and how peak load shaving can prevent costs for distribution to increase. Most of the introduced changes in the electricity market is common knowledge among the respondents, but none of them have ever considered how the combination of the different elements would affect the power grid. Mainly because many of them have never considered how the power grid works, let alone that there are limits to how much load it can take.

“It helps when you explain that there is a limit to how much the grid can transport at the time. I have actually never thought of that. I don’t think I have ever thought much about how the electricity gets here.”

The general idea of Peak shaving instead of reinforcement of the grid is received positively by all. The positive reception is especially based on the information that the load challenges appears in relatively few peaks and are not a general state, combined with the information that the costs of grid reinforcements are so big that it would affect the costs of the consumers.

3.3 Evaluation of the Time-differentiated tariff

The time-differentiated tariff is primarily used to illustrate to the respondents, how we already use differentiated tariffs based on peak load and is as such not meant as a test concept.



However, once the respondents are introduced to the more complex explanations about how the power grid works and learn about the intentions behind the time-differentiated tariffs (to motivate consumers to move consumption, where possible, away from peak load hours), they find this way of tariffing so meaningful that it ends up being the most preferred by all respondents. Therefore, the respondents' reception of the time-differentiated tariff is presented in the following.

3.3.1 Immediate reception

Only a few respondents have heard about the time-differentiated tariffs. Most of them live in new buildings, where remote power meters have been installed in connection with the construction. But at the time of the interviews the remote power meters are still not activated, and therefore the respondents are still not introduced to the time-differentiated tariffs.

“I don't think we've got a remote power meter. As I recall, it was not that long ago we had to read our power meter. I think my husband did it, I can't remember. [...] I don't know where our meter is.”

“It reminds me of the phone prices back in the days, where you could make calls at half the price after 8 o’clock. I didn’t know it was the same with electricity.”

Many of the respondents’ spontaneous reactions reflect an almost surprised interest in the newfound knowledge of how distribution tariffs work.

3.3.2 Understanding and interest

Most respondents find the time-differentiated tariff appealing. Once they understand the challenges with peak load situations they fully accept the differentiated tariffs. Another important factor is that the fixed daily period makes it is easy to act on. The ease is fundamental for the tariff to have any impact on the respondents’ behavior.

“It’s always better to nudge with reward instead of punishment.”

“It makes sense to differentiate according to the load situation across the day. And it’s logical that it is most expensive, when the load is highest.”

“It is easy to follow, and even though the savings are limited... if it is not essential for me to turn on the dishwasher or laundry machine between 17 and 20, I might as well do it at other times.”

The economic driven respondents are interested in getting more information about how much they can save by changing behavior. They would like to know how much electricity each device uses and how much money they can save by waiting/moving consumption. To them a list of examples could be a good idea, however if the savings are deemed insignificant it could have a dampening effect on their motivation to move consumption.

“How much are we talking about? It would be good to know what I can actually save by postponing tumble drying or charging of my iPad.”

The younger respondents and some of the more technology-interested respondents are looking for applications to help make this information accessible, preferable combined with a tool that day by day can tell them how much they have saved. It is also suggested to

make technological solutions that remind you of, when the tariff is higher or even prevent you from using certain machines or electrical outlets during peak. Some of the respondents predict that without reminders and/or specific numbers on the savings they might lose interest or forget about it.

Whereas many of the respondents find the time-differentiated tariff motivating, it does not motivate the 'convenient' respondents to change their behavior. If it does not have a major financial consequence, they will avoid taking any extra considerations into their daily household chores. The household chores are considered an obstacle that is preferably dealt with as fast and smooth as possible.

“It will not be many kroner saved per year and would not change anything for us. I don't want to rearrange my free time; it is worth more for me than a couple of 100 kroner.”

“When it is 8 o'clock I finally get some time to myself, and I don't want to have to start all the chores by then.”

Regardless of whether they expect to change behavior or not, many of the respondents spontaneously express doubt about how much their household can contribute with. Many of them live in new constructions with state-of-the-art electrical installations, heating and ventilation, LED lighting and low energy white goods, which makes their electricity consumption low to begin with.

“I am not sure how much more we can contribute with. We already remember to turn off the lights and we don't let the water run. All our machines are A+++ and we don't own a dryer. In this period (between 17-20 o'clock), we are all home. Everything is on: computers, TVs, iPads and we prepare dinner. We cannot change anything about that. We might occasionally do a laundry here, which we can postpone. But most laundries are done during the weekend.”

“I don't use much electricity. I only do 1 or 2 laundries a week. I don't have a dish washer or a computer, and I often eat cold meals at night, as I get warm food at work.”

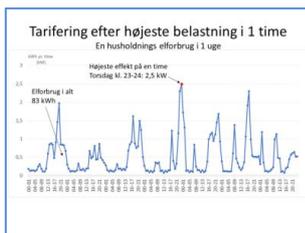
This study indicates that it can be essential to make consumers believe in the importance of even smaller changes in their consumption behavior. It is difficult to the respondents to find much consumption, which can be moved without interfering too much with their daily routines. Therefore, if they don't get the notion that even smaller changes can contribute in the bigger picture they might be inclined to completely dismiss making any changes. And this challenge seems particularly big among these respondents in their newly build low energy homes.

Maybe we could charge all our battery devices during the day, so that they can be disconnected during peak load hours. But other than this and postponing the laundry, I can't really see what difference we can make."

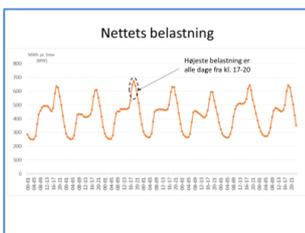
3.4 Private consumers' Evaluation of Power tariff (based on highest load in peak)

Having already understood how the grid is challenged by the general development in society and by the consumption patterns, the reasons for considering new tariffs are accepted. However, it requires further thorough explanations to understand the Power tariff.

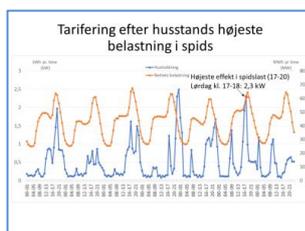
This is done by taking respondents through the principles of the Power tariff in a 3-step explanation:



Explaining how the tariff based on highest load in an hour (during a week) differs from the existing tariff measured as a total of kWh consumed in a week.



Then illustrating how the peak loads of the grid are placed during a week.



And finally overlaying the two curves to find the household's highest load during peak in the grid (and to illustrate how a household's highest load outside of peak is not being used for the tariff).

3.4.1 Immediate reception

Both during and after the 3-step explanation it is obvious that the complexity of the tariff makes it difficult to understand. And as a result, the presentation of the Power tariff seems to rise more questions and skepticism than clarity.

“So, I need to know how much electricity we have used, and if it is a ‘bad’ day, we cannot do laundry that day?”

“I think it seems very complicated. With the fixed time (time-differentiated tariff) I know when I should try to use less. With this one... I can use like crazy late at night... but what if other people do the same, then I am suddenly in trouble. And I have no way of knowing this?”

3.4.2 Understanding

Some of the respondents seem to stumble on the combination of different principles contained in this tariff: A well-known pricing principle: ‘you pay for what you use’ combined with a pricing principle which is known from train tickets and old phone prices: ‘it depends on *when* you use it’, and a completely new pricing principle: ‘most of your consumption you do *not* pay for’. And then it adds two elements of ‘coincidence’: 1) you do not know exactly when there is peak load in the grid, 2) it would require some effort to know exactly when you yourself have the highest load.

The combination of the pricing principles makes it difficult for the respondents to maintain exactly how the Power tariff works.

“I get it: It means that no matter how much I use here (at the household’s highest load during a week), I will pay the same, because it depends on how much electricity other people use at the same time. And if they use much, I will have to pay more.”

“It seems difficult to plan and understand, because how can I know when there is a peak in the grid?”

No matter whether the respondents are able or not able to distinguish between the different pricing principles, they agree that it seems unreasonably difficult to figure out, when your own highest load collides with the peak load of the grid. This makes them perceive the Power tariff as unfair and impossible to act on.

“I don’t think it is a good idea. We would need to be able to follow both the load in the grid and our own consumption. I think we would just give up. It requires too much effort.”

“I honestly wouldn’t know, when I should use less electricity.”

The extend of explanation it requires to get respondents to understand the Power tariff based on highest load in peak, also indicates how difficult it will be to inform/communicate about this tariff. Especially considering that most of the respondents are unlikely to read anything too long or complicated about their electricity supply or distribution. This, along with the difficulties of knowing *when* to use less electricity, will be the biggest challenges in getting a Power tariff to have any impact on household consumers’ behavior.

3.4.3 Relevance and interest

Even though respondents accept the circumstances that leads to the Power tariff, the complexity of the tariff makes them keep losing sight of how it all adds up and leaves them with a lot of doubts and skepticism, which ultimately make them reject the Power tariff.

“I would give up and just continue doing what I do today. But I keep on having the feeling, that it is a hidden way to make us pay more.”

“There is too much to consider. And if it is a matter of 20 kroner a week, I wouldn’t give a heck.”

“It seems very unfair. If you’ve been on vacation and come home Sunday and do your laundry here (peak load period), then you will have to pay a lot, even though it is the only time during the week that you use power.”

Some of the respondents even suggest that the Power tariff would make them more carefree about their consumption, since it appears that their consumption outside of peak load would not matter anymore. And for the respondents driven by economy it might even make them use more power at other times, to get fair value for their money.

“If I know, I will have guests Saturday night, and will have to pay a lot because of our consumption that one night: Then I should use as much as possible the rest of the week to ‘earn’ the big bill for my Saturday.”

It is suggested that before introducing a Power tariff it should be possible for the consumer to know both when there is peak load in the grid and when the household exceeds the average level of consumption. Until this is made possible, they find the Power tariff unreasonable.

3.5 Conclusions household consumers

The household respondents have little knowledge and little interest in the electricity supply and distribution. They rely on electricity in their everyday life, and most perceive it to be an inevitable part of the household costs, which they seldom take an active stand on.

The respondents generally perceive themselves as conscious consumers and most of them are not prone to make major changes in their consumption. The exception is the respondents driven by economy, who will always be interested in opportunities to save money. For the rest of the respondents, the possible savings are perceived to be too small for them to bother with it.

To obtain acceptance and motivate a change in behavior, it is crucial for all respondents to receive thorough information about the reasons behind and the intentions with new tariffs for the distribution. They often have little or no basic knowledge in this matter, and their interest is low, which means catching their attention long enough to tell the story, will be the first task to overcome.

If one succeeds in catching their attention long enough to tell the story, most of the respondents feel motivated and inclined to change behavior (to different extents). Motivation can be reinforced by access to specific knowledge about how much can be saved (economic driven respondents) and by knowledge about the challenges of the power grid in the future (conscious and idealistic respondents). The convenience driven respondents either require substantial financial benefits and/or intelligent solutions that

minimizes any effort from their side, and even if such solutions were available, they are still unlikely to make changes.

The time-differentiated tariff is preferred by all respondents. Once they understand the benefits of peak load shaving they fully accept the tariff. It is easy to understand and to act on, and with exception of the convenience driven respondents they all state that it motivates them to change behavior.

The Power tariff is rejected by the respondents. It is very difficult to understand and too complex to act on. It makes most respondents give up in advance, which makes it without any effect on their behavior. The Power tariff also seems unfair, because you can be “punished” for one odd case of high consumption. This leaves some of the respondents with a feeling of being cheated. And the economic driven respondents feel inclined to increase their consumption to “level out” the peak consumption they will be tarified for.

4. Cancellation of Task 6.4.3 – Survey with electricity suppliers

We originally planned for this survey to also cover interviews with suppliers. The purpose was to gain qualitative insights about the suppliers' attitudes towards and wishes for possible future tariff structures. In the meantime, a Dansk Energi and Energinet has conducted a survey regarding the future tariff design⁵. This survey covers, among others, the suppliers' attitudes towards future tariff structures. It has therefore been decided to cancel the planned survey, which would have covered the same topics.

The survey from Dansk Energi and Energinet concludes overall that the suppliers wish for and predict (translation of the paper below):

- A better reflection of real costs by introducing higher fixed payments and lower marginal rates
- Incentives for more self-production can be socially unbalanced (unfair), as it is the more prosperous who can afford it
- Tariff design should be easy to understand (electricity is low-interest for all customer categories) and transparent
- The weakness of time-differentiated tariffs are they affect widely
- Instead, specific capacity problems in the grid should be solved by geographically delimited purchases of flexibility via suppliers
- It is important that disconnection (by flexibility) takes place through the electricity supplier, while the grid companies will not have the direct customer contact
- Ideally, there should be one overall price signal that ensures an efficient balance between transport price and energy price
- Electricity suppliers are expected to continuously forward tariffs unchanged to end customers
- Tariffs for distribution of production must be well thought out because they can destroy price signals in the market

⁵ https://www.danskeenergi.dk/sites/danskeenergi.dk/files/media/dokumenter/2019-01/Konsultationspapir_fokusomraader_faelles_tarifprojekt.pdf

5. Task 6.4.4: Executive Summary

In this qualitative survey we talk to household consumer and high consumption companies about time-differentiated tariffs, power tariffs and flexibility products to gain insights about their evaluation of and interest in more cost-oriented tariffs and peak load shaving measures.

Neither of the respondent groups (company and household) have interest in or knowledge about the power distribution operator. They also have very limited knowledge about specific details concerning their electricity consumption; what time of day/week/year and from which buildings/areas/machines/installation the consumption originate. Nor are the companies not aware they have a time-differentiated tariff.

Across the different company types and household consumer profiles there is an overall perception of electricity as an indispensable mean of operating the businesses and households. Electricity consumption is not limited by the related costs, which are perceived as an inevitable evil.

It is crucial that the respondents understand the challenges with peak load situations and the costs connected with reinforcement of the grid. Once they understand that these challenges and related costs affect all consumers, they accept new tariffs and products that can help prevent costs for grid reinforcement.

The companies are overall positive towards being a part of peak load shaving through a flexibility product. They are however only interested in participating, if it has a minimum of impact on their business. No financial compensation can make up for lost production and loss of service level. There is no obvious way to (partly) refrain from power for longer or shorter periods, and it would therefore require help to find a solution that does not impact the core business. If this can be found financial compensation only has to match investment cost.

With exception of the household respondents driven by convenience, all other are positive toward moving consumption when it is possible to help peak load shaving. They clearly prefer the time-differentiated tariff to a power tariff. The time-differentiated tariff is perceived to be easy to understand and remember, and it still leaves them with the perception of a free choice of when they will move consumption and when not.

The power tariff is too complex to understand and to act upon. Both to household respondents and to the company respondents (who are only briefly presented to the concept). The confusion derives from the combination of pricing principles: A well-known pricing principle: 'you pay for what you use' combined with a pricing principle which is known from train tickets and old phone prices: 'it depends on when you use it', and a completely new pricing principle: 'most of your consumption you do not pay for'. And then it adds two elements of 'coincidence': 1) you do not know exactly when there is peak load in the grid, 2) it would require some effort to know exactly when you yourself have the highest load.

The household respondents also find the power tariff unfair in the sense that they can have a lot of days with very low consumption during peak and then be "punished" for just one day with high consumption. This makes some of them suggest that the Power tariff would make them more carefree about their consumption in general, since they would try to "even out" their unfair extra costs by using more on the other days.

Appendix A1:

**Discussion guide for household
respondents**

Introduktion (7 min / 00:07)

Moderators introduktion

- Tak for deltagelse
- Kort præsentation af moderator (+ evt. medlyttere)
- 60 minutter og lydoptagelse
- Anonymitet – ingen navnespecifikke data formidles til tredjepart
- Formål: Undersøgelsen er en del af ELN, som har til formål at udvikle fremtidens energiløsninger. Undersøgelse omfatter både private og erhverv i Nordhavn.
- Radius er et elnetsselskab. Dvs. vi står for drift og vedligehold af elnettet, som transporterer strøm til dit hjem. Desuden ejer vi de elmålere, som alle husstande og virksomheder har, og vi har ansvaret for, at aflæsningerne kommer korrekt til den elleverandør, som leverer den strøm, som kunden bruger. Vi står ikke for salg af selve strømmen.
- I den næste time har fokus på to ting: At blive klogere på, hvordan du/din husstand forholder sig til elforbrug og at undersøge, hvad du tænker om forskellige måder, man overvejer fremover at prissætte transporten af strømmen (elnettet)

Respondents præsentation

- Navn, alder, job, brutto husstandsindkomst?
- Hvem bor i din husstand?
- Hvor længe har du/l boet her i Nordhavn?
- Noget I er særligt glade for ved jeres bolig?
- Noget I er mindre glade for ved jeres bolig?

Forbrug og kendskab (8 min / 00:15)

1. Hvordan foregår det, når du/l skal aflæse forbrug på el, vand og varme? Fortæl gerne med egne ord, hvad der sker fra start til slut.
 - a. Bliver du gjort opmærksom på, at du skal foretage jer noget? Eller foregår det per automatik?
 - b. Hvem gør hvad? Er det altid sådan?
 - c. Er der noget du/l taler om eller tjekker op på i forbindelse med dette?
2. Så på en skala fra 0-10, hvor meget går du op i jeres elforbrug?
 - a. Hvordan vil man kunne se det hos dig?
 - b. Er der noget, som du er særligt opmærksom på? Er der noget du er fuldstændigt ligeglade med?
 - c. Hvad gør du/gør du ikke? (Hvorfor/hvorfor ikke)
 - d. Er det det samme for andre i din husstand?
3. Er der andre områder, hvor du går mere/mindre op i dit forbrug? Er din holdning/tilgang til elforbrug på nogen måde anderledes end hovedparten af dit øvrige forbrug? Hvordan?
(Fx 'jeg går meget op i miljø/spare penge, men el skal bare være der, og jeg gider ikke rende rundt og slukke for apparater hele tiden' eller modsat)
4. Hvor meget konkret viden har du om husstandens elforbrug?



- Ved du, hvor stort dit/jeres elforbrug er? Enten i kWh eller i kroner/lører?
(Hvad vil du skyde på?)
- Ved du, hvor du/l køber jeres strøm?
- Ved du, hvilke elementer prisen på den samlede elregning består af?
[VIS: prissammensætningsmodel (forklar/bekræft) og understreg Radius' område – drift, vedligehold og udbygning af nettet]



Tidsdifferentieret tarifiering (10 min / 00:25)

SIG: Hidtil har Radius og andre netelskaber prissat transporten af strøm med en fast pris per forbrugt kWh. Dvs. jo mere strøm du forbruger, desto mere har du også skulle betale for transporten.

Omkostningerne skal bruges til at drift og vedligeholde af elnettet (groft sagt: kabler, ledninger, stationer og skabe).

VIS: "Ændringer i omverden"



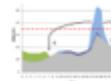
SIG: I disse år sker der imidlertid mange forandringer i disse år. Det betyder, at elmarkedet ændrer sig.

- Der sker en såkaldt elektrificering af samfundet hvilket betyder at flere får elbiler og varmepumper og efterspørgslen efter el således øges
- Der kommer mere decentral elproduktion, flere solceller og mere vind – også hos private husstande (man kalder som prosumere eller egenproducenter)
- Der kommer måske batterier som f.eks. kan øge kundernes andel af egenproduceret forbrug
- Fjernafmålte målere som kan forbedre markedet fordi forbruget kan gøres op på timebasis
- Målere gør det også muligt for Radius at lave en mere præcis prissætning.

•

SIG: I takt med den øgede efterspørgsel efter el, øges belastningen af elnettet. Uden yderligere tiltag fra Radius' side, kan det medføre, at elnettet skal forstærkes (=udbygges), hvilket er den traditionelle måde at løse udfordringen på. Forstærkninger i nettet øger Radius' omkostninger til elnettet og kunderne vil derefter opleve højere priser på transporten af el.

VIS: "Spidslast og udjævning" diagram



SIG: Nu forholder det sig sådan, at elforbruget ikke fordeler sig jævnt over året og døgnet. Hvis elforbruget kan udjævnnes kan det betyde, at forstærkninger kan undgås, og det vil betyde færre omkostninger til kunderne. Vi kalder det for spidslast-udjævning.

Det betyder også, at en stor del af omkostningerne til elnettet, skyldes netop de spidsbelastningsperioder, som kræver udbygning af elnettet. Også selvom disse kan være relativt få og korte. Hvis vi tager afsæt i den viden, at det altså ikke er energimængden i sig selv, der driver omkostningerne til elnettet (fordi det kan det meste af tiden bære et langt højere forbrug, end der er), men derimod belastningen ift., hvornår den finder sted. Så kan man sige, at elnettet faktisk bliver mindre udfordret af et konstant lavt forbrug hen over året end af et kæmpe forbrug (selv i en kortere periode) i spidslastperioden. Derfor kan man også sige, at en pris, som følger kWh forbruget ("energifafhængige omkostninger"), ikke er helt retvisende. Det er derimod belastningen i nettet ift. hvornår den finder sted.

Dette er en af årsageme bag, at man i Radius (og andre elnetsekskaber) i disse år begynder at indføre "Tidsdifferentierede tariffer"

VIS: "Tidsdifferentierede tariffer"



SIG: Princippet er, at man betaler relativt mere for transport af strømmen i det tidsrum, hvor der er mest belastning af elnettet (fx mellem 17-20, hvor de fleste kommer hjem, tænder for forskellige apparater, og er i fuld gang med huslige gøremål).

5. Har du hørt om tidsdifferentierede tariffer før?
6. Hvad tænker du umiddelbart om dette?
 - a. Positivt/negativt?
 - b. Er det til at forstå, hvad det går ud på? Hvis du skulle forklare det til en, som ikke forstår det, hvad ville du så sige?
 - c. Rimeligt/urimeligt? Hvis du skulle overbevise en af modsat holdning, hvad ville du så slå på?
7. Tror du, at en tidsdifferentieret tarif ville påvirke din husstand?
 - a. Hvordan? (INST: OBS på, om resp. har fokus er på omkostninger, adfærd og/eller følelser – og om det opfattes positivt/negativt)

SIG: De tidsdifferentierede tariffer bliver indført hos alle i Radius' område inden for de næste par år.

8. Hvad tænker du umiddelbart om dette? (Klage, undersøge nærmere, trække på skulderne, knap nok opdage det?)
 - a. Ville det ændre noget i dig/jeres forbrug? På hvilken måde tror du umiddelbart? Hvorfor tror du umiddelbart ikke?

Effektarif efter højeste belastning i 1 time (15 min / 00:40)

PEG PÅ: Spidslast slide

SIG: Som vi talte om før, så kommer en stor del af omkostningerne til elnettet fra de spidsbelastningsperioder, som kræver udbygning af elnettet. Og det betyder, at det ikke er energimængden i sig selv, der driver de største omkostninger til elnettet, men derimod belastningen ift., hvornår den finder sted (altså, hvis forbruget finder sted på tidspunkter, hvor der er god plads i nettet, så er det forbundet med relativt lave omkostninger, men finder det sted, når nettet er belastet, så kan det blive forbundet med høje omkostninger). Lige nu tarifferer vi altså efter energiforbrug (kWh). Men man overvejer fremover at tarifferer efter "Effekt" (kW).



VIS: "Speedometer"

SIG: Et speedometer kan bruges til at forstå forskellen mellem tarifieringen efter energiforbrug (kWh) eller efter effekt (kW). Hastighed kan sammenlignes med "effekt", og kørte kilometer kan sammenlignes med "energiforbrug": "Kører du hurtigt" betaler du mere end, når du "kører langsomt" selvom du kører der samme antal kilometer i alt (kWh forbrug). Det samme med effekt. Jo mere du bruger på samme tid, jo højere effekt, og jo mere betaler du.



VIS: "Tarifiering efter højeste belastning i 1 time"

SIG: *Så i stedet for en almindelig kWh-baseret pris for transport af jeres el, kunne man fx basere betalingen (tarifiering) på, hvornår en husstand belaster nettet mest i løbet af en uge. Så ville betalingen ikke længere afhænge af husstandens samlede forbrug målt i kWh, men derimod på den ene time i løbet af ugen med højest effekt (her torsdag kl. 23-24).*



9. Hvad tænker du umiddelbart om dette?
10. Er det til at forstå, hvad det går ud på?
 - a. Hvis du med egne ord skulle fortælle det til en anden, hvad denne "Tarifiering efter højeste belastning i en time" går ud på, hvordan ville du så forklare det?
11. Rimeligt/urimeligt?
 - a. Hvis du skulle overbevise en af modsat holdning, hvad ville du så slå på?
12. Tror du, at en "Tarifiering efter højeste belastning i en time" ville påvirke din husstand?
 - a. Hvordan? (INST: OBS på, om **resp.** har fokus er på omkostninger, adfærd og/eller følelser – og om det opfattes positivt/negativt)
13. Hvad ville du gøre, hvis du blev gjort bekendt med, at) sådan en tarifieringsmodel blev indført hos dig? (Klage, undersøge nærmere, trække på skulderne, knap nok opdage det?)
 - a. Ville det ændre noget i dig/jeres forbrug? På hvilken måde tror du umiddelbart? Hvorfor tror du umiddelbart ikke?

INST: Såfremt respondenterne er optaget af, at Radius bare vil tjene flere penge: *Vores samlede indtægter er reguleret. Så uanset hvordan vi tilrettelægger prissætningen så kommer vi til at opkræve det samme beløb. Men fordelingen mellem kunderne kan være forskellig.*



Effektarif efter højeste belastning i spids (15 min / 00:55)

SIG: *Da det tidspunkt, hvor en husholdning belaster nettet mest, falder ikke nødvendigvis sammen med det tidspunkt, hvor nettet samlet set er mest belastet (det vi kalder "spidslast"/"spids"). Det tidspunkt, hvor nettet samlet set bliver mest belastet ligger alle dage i tidsrummet 17-20. vil, kan den model vi lige har talt om godt.*

VIS: "Nettets belastning" (Sikr, at respondent forstår illustration)

PEG PÅ: "Tarifiering efter højeste belastning i 1 time"

SIG: *... Og det vil sige, at det tidspunkt, hvor denne husstand belaster nettet mest (torsdag kl. 23-24), ikke falder sammen med tidspunktet, hvor nettet er mest belastet – og dermed risikerer at skulle udbygges.*



VIS: "Tarifiering efter husstands højeste belastning i spids"

SIG: *Hvis vi kører de to grafer ind over hinanden, kommer det til at se cirka sådan ud, og det viser os grundlaget for en helt tredje form for prissætning af transport af strøm: Her kigger man stadig på husstandens forbrug over en uge. I løbet af ugen betaler husstanden ikke for sit samlede forbrug, men kun for effekten (kW) i den time i løbet af "spids" (som ligger hver dag mellem 17-20), hvor husstanden belaster nettet mest. Så hvis vi kigger på husstandens forbrug i tidsrummene 17-20, så er det højeste forbrug*



(husstandens største belastning af nettet) lørdag kl. 17-18. Derfor bliver husstanden betaling i denne uge sat ud fra de 2,3 kW, som man forbruger her.

1. Hvad tænker du umiddelbart om dette?
2. Er det til at forstå, hvad det går ud på?
 - a. Hvis du med egne ord skulle fortælle det til en anden, hvad denne "Tarifiering efter højeste belastning i en time" går ud på, hvordan ville du så forklare det?
 - b. Kan du regne ud, hvad der ville ske med husstandens pris for **transport af strømmen**, hvis den havde det samme samlede forbrug over ugen (83 kWh), men det fordelte sig helt jævnt (illustrer lige flad streg henover graf)?
 - c. Kan du regne ud, hvad der ville ske med husstandens pris for **transport af strømmen**, hvis den havde det samme samlede forbrug over ugen (83 kWh), men den kun forbrugte strømmen i tidsrummet 17-20 hver dag?
3. Rimeligt/urimeligt?
 - a. Hvis du skulle overbevise en af modsat holdning, hvad ville du så slå på?
4. Tror du, at en "Tarifiering efter højeste belastning i en time" ville påvirke din husstand?
 - a. Hvordan?
(INST: OBS på, om **resp.** har fokus er på omkostninger, adfærd og/eller følelser – og om det opfattes positivt/negativt)
5. Hvad ville du gøre, hvis du blev gjort bekendt med, at) sådan en tarifieringsmodel blev indført hos dig? (Klage, undersøge nærmere, trække på skulderne, knap nok opdage det?)
 - a. Ville det ændre noget i dig/jeres forbrug? På hvilken måde tror du umiddelbart? Hvorfor tror du umiddelbart ikke?

Afslutning (5 min / 00:60)

6. På en skala fra 0-10, hvor 0=Ingen ændring og 10=meget stor ændring, i hvor høj grad ville sådan en "Tarifiering efter højeste belastning i en time" påvirke, hvornår du/l lægger jeres forbrug?
 - a. Hvorfor/hvorfor ikke?
 - b. Hvis vi holder os til ønsket om at få jer til at flytte jeres forbrug fra spidslast perioder, kunne der så være noget, der (i endnu højere grad) ville påvirke jeres forbrug?
 - c. Kunne du forestille dig andre, hvor dette produkt i (endnu) højere grad kunne motivere til ændret forbrug?
 7. Er der noget, som vi ikke har fået spurgt til, som du tænker kunne være vigtigt for os at vide?
 8. Har du nogen afsluttende spørgsmål til mig?
- Tak for deltagelse
 - Må jeg vende tilbage med afklarende spørgsmål?

Appendix A2:

**Discussion guide for company
respondents**

Introduktion (5 min / 00:05)

Moderators introduktion

- Tak for deltagelse
- Kort præsentation af moderator (+ evt. medlyttere)
- 45-60 minutter og lydoptagelse
- Anonymitet – ingen navnespecifikke data (hverken firma eller person) formidles ud af huset
- Formål: Undersøgelsen er en del af ELN, som har til formål at udvikle fremtidens energiløsninger. Vi har fokus på at undersøge pris/tariferingsmodeller på elnettet.
- Omfatter både private og erhverv i Nordhavn

Respondents præsentation

- Navn, stilling/funktion (hvad dækker det over)?
- Hvor længe har du arbejdet i din nuværende stilling?

Forbrug og kendskab (15 min / 00:20)

1. På hvilken måde er du involveret i beslutninger om virksomhedens energiforbrug?
Og specifikt elforbrug?
 - a. Er der andre involverede?
 - b. Hvem tager sig af hvad?
[INST: Evt. organisationsdiagram]
 - c. Hvordan samarbejder I om det?
2. Hvor meget fylder energiforbrug i virksomheden?
(Probe: Varme, vand, brændstof, el, flyrejser, andet)
 - a. På hvilke måder/hvorfor mon ikke?
 - b. PROBE: Har virksomheden en grøn agenda? Hvad handler den om / fokuserer på?
 - c. Hvem tager sig af dette/de forskellige områder hos jer?
3. Tager virksomheden aktivt stilling til, hvor I køber jeres energi?
 - a. Hvordan vælges? Hvilke kriterier? Hvordan orienterer I jer?
 - b. Hvem tager sig af dette hos jer?
 - c. Gælder dette også specifikt for jeres el?
4. Hvor meget viden har du om virksomhedens elforbrug?
 - a. Ved du, hvor stort virksomhedens elforbrug er?
 - b. Ved du, hvor I køber jeres strøm?
 - c. Ved du, om det er til fastpris eller variabel pris?
 - d. Kender du hvilke elementer prisen på den samlede elregning består af?
[INST: Vis prissammensætningsmodel (forklar/bekræft) og understreg Radius' område – drift, vedligehold og udbygning af nettet]
 - e. Ved I at prisen varierer over døgnet? [Vis pristabeller: B lav]
Hvilke overvejelser gør I jer omkring dette?




- f. SIG: Man forventer, at prisvariationer bliver større med tiden. Hvis priserne bliver endnu mere differentierede, er det så noget, der ville blive mere relevant for jer at gå ind i?
5. Har I nogensinde overvejet egenproduktion (solceller)?
- a. Har I UPS anlæg (nødstrøm – dieselgenerator eller batteri?) Størrelse?

Fleksibilitetsprodukt (20 min / 00:40)

Jeg vil gerne præsentere dig for et konceptforslag. Det betyder, at det er nogle indledende tanker om et muligt nyt produkt. Derfor er det endnu ikke udtænkt ned i detaljer eller har været igennem en professionel tekstforfatter. Det er udelukkende lavet for at give dig en overordnet ide om, hvilke overvejelser man gør sig.

INST: Vis "Spidslast-udjævning" diagram og forklar

SIG: I takt med den øgede efterspørgsel efter el, øges belastningen af elnettet. Uden yderligere tiltag fra Radius' side, kan det medføre, at elnettet skal forstærkes, hvilket er den traditionelle måde at løse udfordringen på. Forstærkninger i nettet øger Radius' omkostninger til elnettet, og kunderne vil derefter opleve højere priser på transporten af el.



Elforbruget fordeler sig imidlertid ikke jævnt over året og døgnet. Hvis elforbruget kan udjævnes kan det betyde, at forstærkninger kan undgås, og det vil betyde færre omkostninger til kunderne. Vi kalder det for spidslast-udjævning.

Man overvejer derfor at tilbyde produkter, hvor store kunder får en betaling for at flytte forbruget i tid eller for at afstå helt eller delvist fra at aftage den strøm de ellers er berettigede til i en kortere periode.

6. Hvad tænker du umiddelbart om dette?
- a. Er det til at forstå, hvad det går ud på?
7. Hvad synes du umiddelbart om ideen?
- a. Fordele/ulemper?
- b. Forbehold?
8. Ville der være noget af jeres forbrug, som I faktisk kunne undvære i kortere eller længere perioder – om formiddagen og om eftermiddagen? Hvilket? Hvor meget udgør dette cirka?
9. På en skala fra 0-10, hvor 0=overhovedet ikke relevant og 10=overmåde relevant, hvordan ville du så bedømme dette produkt ift. jeres virksomhed?
- a. Hvorfor?
- b. Er der noget i beskrivelsen, i særligt er medvirkende til, at du vurderer sådan?
- c. Hvad skulle der til for at gøre det (endnu) mere relevant for jeres virksomhed?
- d. Kunne du forestille dig andre, som dette produkt ville passe (endnu) bedre til?
10. Hvilke forudsætninger tænker I umiddelbart, at I ville (have brug for at) sætte?
11. PROBER:

- a. Varsling/ikke varslet? Hvor længe i forvejen?
- b. Længde af ude-periode? (10 min. vs. ½ time vs. 2 timer vs. længere?)

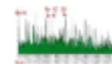
SIG: Et eksempel på, hvordan sådan en aftale kunne se ud, kunne være:

12. KONCEPT A: Engangsbeløb på 30.000 kr. Afbrydelse op til 4 gange per år. Varighed op til 4 timer, varsel på 1 time. 35.000 kr. pr varslet afbrydelse
 - a. Hvad tænker du umiddelbart om dette?
 - b. Er det realistisk?
 - c. Er det interessant?
13. KONCEPT B: Få 25 kr. per ikke leveret kWh, som kunden har reduceret forbruget med – i forhold hvad de gennemsnitligt har brugt det seneste år på samme tidspunkt
 - a. Hvad tænker du umiddelbart om dette?
 - b. Er det realistisk?
 - c. Er det interessant?

Effekttarif (15 min / 00:55)

Jeg har et andet konceptforslag, som jeg gerne vil præsentere dig for. Ligesom før er det først og fremmest beskrevet for at give dig en overordnet ide, og der er ikke arbejdet med detaljer eller finish.

SIG: I dag baseres omkostningen for brugen af elnettet på et fast netabonnement og af ens forbrug i kWh. Som vi talte om før, så kommer en stor del af omkostningerne til elnettet fra spidsbelastningsperioder, som kræver udbygning af elnettet. Hvis vi forfølger den viden, at det altså ikke er energimængden i sig selv, der driver omkostningerne til elnettet, men derimod belastningen ift., hvornår den finder sted. Så kan man sige, at elnettet faktisk bliver mindre udfordret af et konstant lavt forbrug hen over året end af et kæmpe forbrug (selv i en kortere periode) i spidslastperioden. Derfor kan man godt sige, at en pris, som følger kWh forbruget ('energafhængige omkostninger'), ikke er helt retvisende. Det er derimod belastningen i nettet ift. hvornår den finder sted.



VIS: Graf med 3 højeste peaks.

SIG: Så i stedet for en almindelig kWh-baseret pris for transport af jeres el, kunne man basere jeres betaling (tarifiering) på, hvornår I belaster nettet mest i løbet af en måned. Da der er størst belastning af nettet i hverdage mellem kl. 7-19, vil tarifieringen udelukkende afhænge af forbruget inden for dette tidsrum. I ville blive tariferet månedligt efter et gennemsnit af de tre timer (!) mellem 7 og 19, hvor I har været mest belastet.

14. Hvad tænker du umiddelbart om dette?
15. Er det til at forstå?
 - Hvis du med egne ord skulle fortælle en kollega, hvad effekttariffen går ud på, hvordan ville du så forklare det?
16. Hvad synes du om den måde at tarifiere på?
 - (INST: Forstår resp. forskellen fra eksisterende)
 - a. Fordele/ulemper?

b. Fairness?

17. På en skala fra 0-10, hvor 0=Ingen ændring og 10=meget stor ændring, i hvor høj grad ville sådan en effekttarifering påvirke, hvornår I lægger jeres forbrug?
- Hvorfor/hvorfor ikke?
 - Hvis vi holder os til ønsket om at få jer til at flytte jeres forbrug fra spidslast perioder, kunne der så været noget, der (i endnu højere grad) ville påvirke jeres forbrug?
 - Kunne du forestille dig andre, hvor dette produkt i (endnu) højere grad kunne motivere til ændret forbrug?

Afslutning (5 min / 00:60)

18. Er der noget, som vi ikke har fået spurgt til, som du tænker kunne være vigtigt for os at vide?
19. Har du nogen afsluttende spørgsmål til mig?

- Tak for deltagelse
- Må jeg vende tilbage med afklarende spørgsmål?

Add on: Investeringer (5 min / 00:65)

Radius bliver af myndighederne målt på leveringssikkerhed. Målingen går på to ting: 1) hvor mange afbrud den enkelte kunde i gennemsnit har om året og 2) på hvor lang tid den enkelte kunde i gennemsnit er uden strøm om året. Under gennemsnittet gemmer sig naturligvis en række afbrud. Vi kan i vores strategi for nettet godt ændre på karakteren af de typiske afbrud uden at ændre gennemsnittet. Det kan primært gøres ved en ændret investeringsstrategi suppleret med et tilpasset beredskab. Populært sagt kan man sige der er to arketyper af de typiske afbrud. Det kan enten være at de typiske afbrud sker dagligt, hvor 100-3000 kunder er berørt i et par timer. De daglige afbrud sker typisk i forskellige geografiske områder, så det er ikke de samme kunder der rammes dagligt. Den anden arketype er at der er færre fejl – fx et hvert femte år eller sjældnere – men til gengæld vil det være 10.000-40.000 kunder, der rammes ad gangen og det vil ofte tage flere timer.

I dialogen med en virksomhed placeret inden for et afgrænset geografisk område, kan ovenstående formuleres i to spørgsmål:

Hvilken type afbrud foretrækker I/du for jeres virksomhed:

- En fejl hvert 2. – 5. år af en gennemsnitlig varighed på 45 – 60 minutter?
- En fejl hvert 10. – 20. år af en gennemsnitlig varighed på 2 timer eller mere?

Bemærk det vil ikke have en betydning for deres betaling for ~~aflydelsen~~.

Appendix B:

Respondent lists

Household respondents

Gender	Age	To what extent are you involved in decisions regarding the household's energy consumption? <i>I take care of....</i>	Persons in the household	Children in the household
F	30-39	all	2	Yes
F	30-39	more than half	3	Yes
F	30-39	half	4	Yes
F	40-49	all	1	No
F	40-49	half	4	Yes
F	40-49	all	5	Yes
F	50-59	all	2	No
M	20-29	more than half	2	No
M	30-39	more than half	2	No
M	40-49	all	5	Yes
M	50-59	all	2	No
M	50-59	all	3	Yes
M	50-59	all	4	Yes
M	60-69	all	1	No
M	60-69	all	1	No
M	70+	more than half	2	No

Company respondents

Work title	Approximately yearly consumption	Electricity consumption for
Facility Manager	500.000 kWh	Offices, canteen and meeting facilities
Chief Technology Officer	1.000.000 kWh	Offices, floodlights, big machines, storage
Facility Manager	1.700.000 kWh	Offices, storage warehouses, robots, big machines
Physical Plant Manager	1.100.000 kWh	Offices, canteen and meeting facilities