

CLEEN

Cluster for Energy and Environment



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Smart Grids and Energy Markets

Consumers &
Demand Response
Consumer Survey Results

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31.5.2014

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Consumers' viewpoint on the Demand Response

What would be required in order to make the consumers willing to get involved in demand response?

- The focus purely on the household customers
- No emphasis on the technical issues, business models, roles of different market players, regulation etc.
- Methods: Literature review, expert interviews, consumer questionnaires
- The work is being done within Task 7.5 by the University of Vaasa

Key research questions

Identifying...

- What is the level of the consumers' awareness and interest towards saving electricity?
- What kind of electricity bill would the consumers prefer and why?
- Would the consumers be interested in participating Demand Response? What types of consumers might be interested? Why? How much money they should save in order to participate?
- What kind of DR would the consumers be interested in, manual DR (their own actions) or automatic load control?
- What are the prerequisites of the consumers for DR?
- What kinds of appliances do the consumers consider being suitable for DR?

Consumer questionnaire

- This presentation focuses on the consumer survey
- In total **231 consumers** answered the questionnaire online between May 2013 and February 2014. The responses were collected through Fortum's and Vattenfall's web sites.
- The main idea of the consumer survey was to understand the level of the consumers' awareness as well as their attitudes and interest towards Demand Response.
- *The outcomes of previous expert interviews helped to understand the concept and to ask the right questions in the consumer study. Based on these, we made some preliminary remarks.*
- *All the results in this presentation are based purely on the customer survey. The results of the other pieces of research are available separately.*



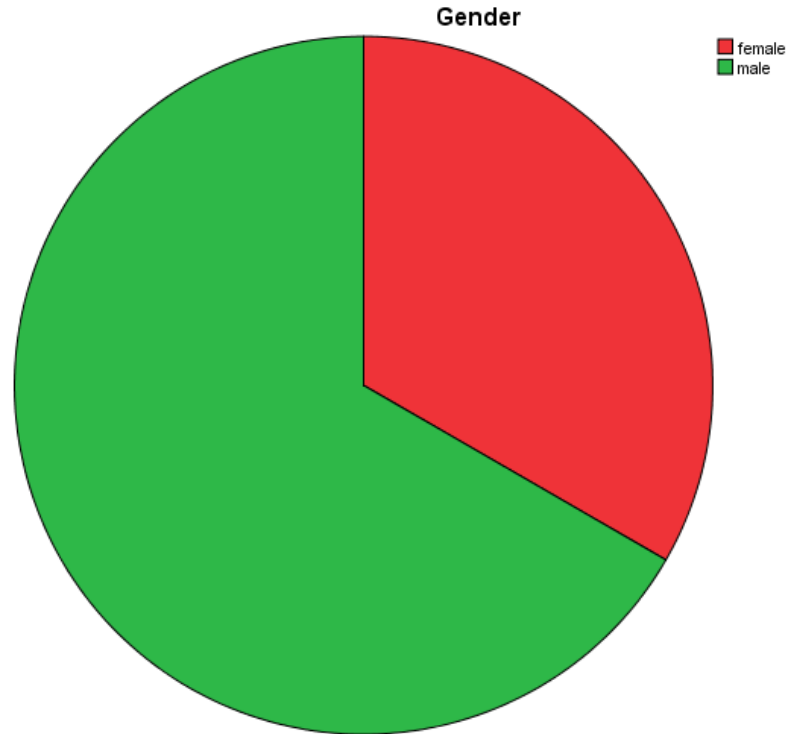
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Background information

Gender

67 % of the respondents were male and 33 % female.

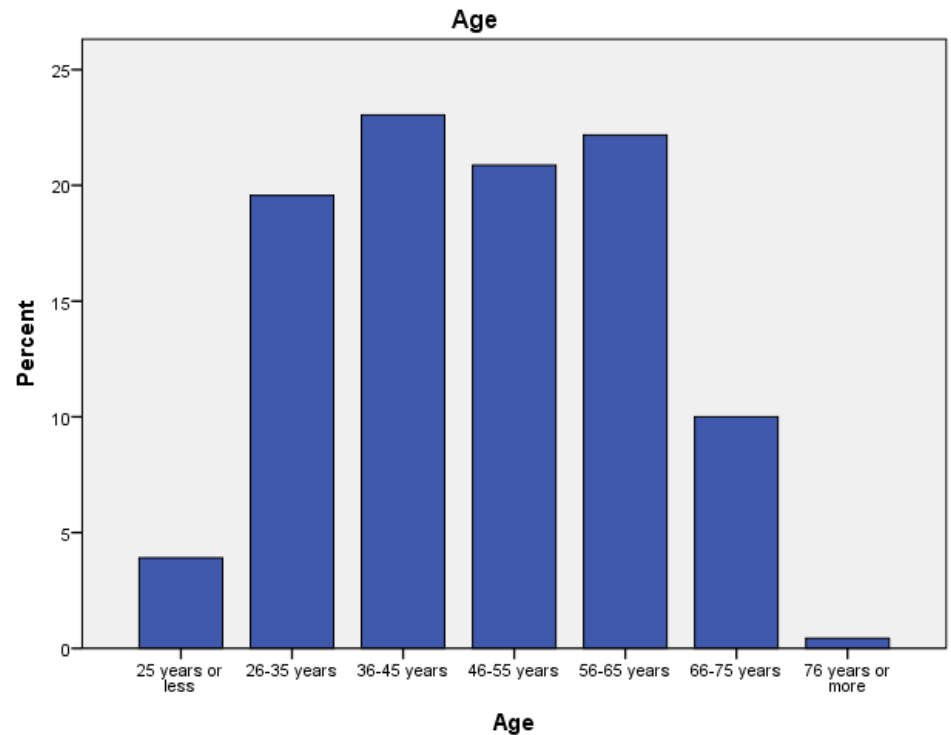


Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	female	76	32,9	33,3	33,3
	male	152	65,8	66,7	100,0
	Total	228	98,7	100,0	
Missing	System	3	1,3		
Total		231	100,0		

Age

The respondents were distributed quite evenly to different age categories, majority of them being 26-65 years old.

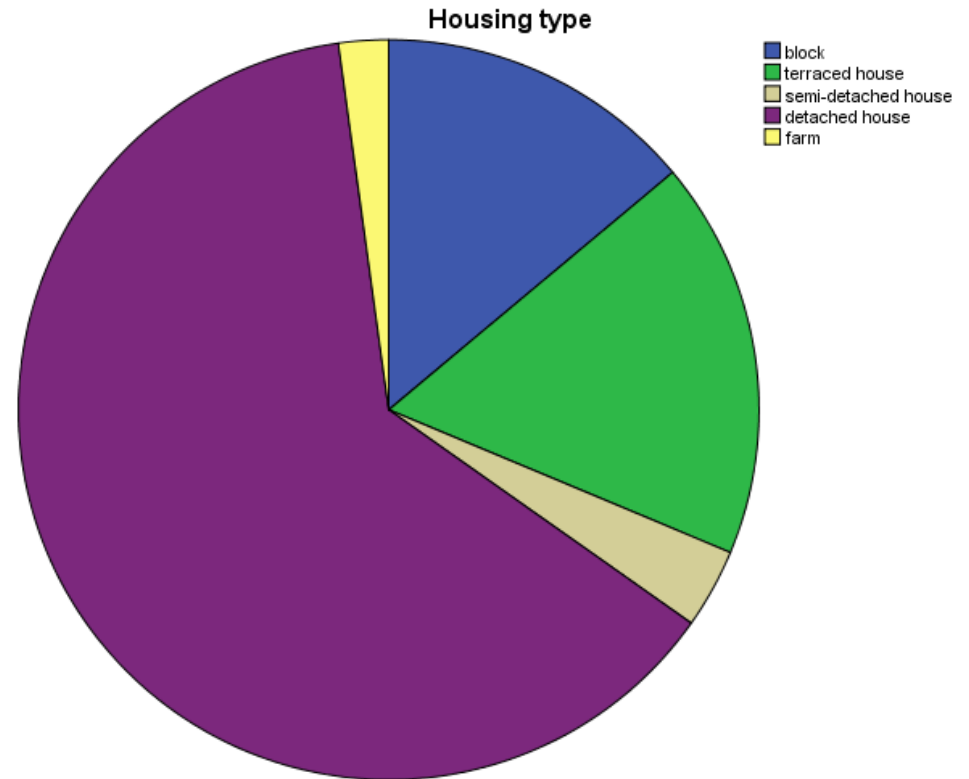


Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	25 years or less	9	3,9	3,9	3,9
	26-35 years	45	19,5	19,6	23,5
	36-45 years	53	22,9	23,0	46,5
	46-55 years	48	20,8	20,9	67,4
	56-65 years	51	22,1	22,2	89,6
	66-75 years	23	10,0	10,0	99,6
	76 years or more	1	,4	,4	100,0
	Total	230	99,6	100,0	
Missing	System	1	,4		
	Total	231	100,0		

House type

As many as 63 % of the respondents live in detached houses.

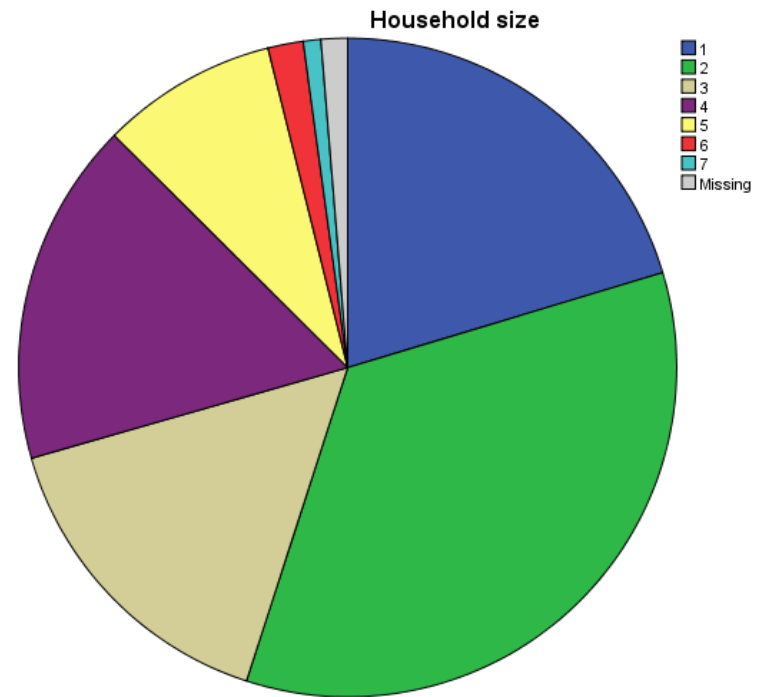


Housing type

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	block	32	13,9	13,9	13,9
	terraced house	40	17,3	17,4	31,3
	semi-detached house	8	3,5	3,5	34,8
	detached house	145	62,8	63,0	97,8
	farm	5	2,2	2,2	100,0
	Total		230	99,6	100,0
Missing	System	1	,4		
Total		231	100,0		

Size of household

Two persons was the most common household size.
40 % of the households had children.



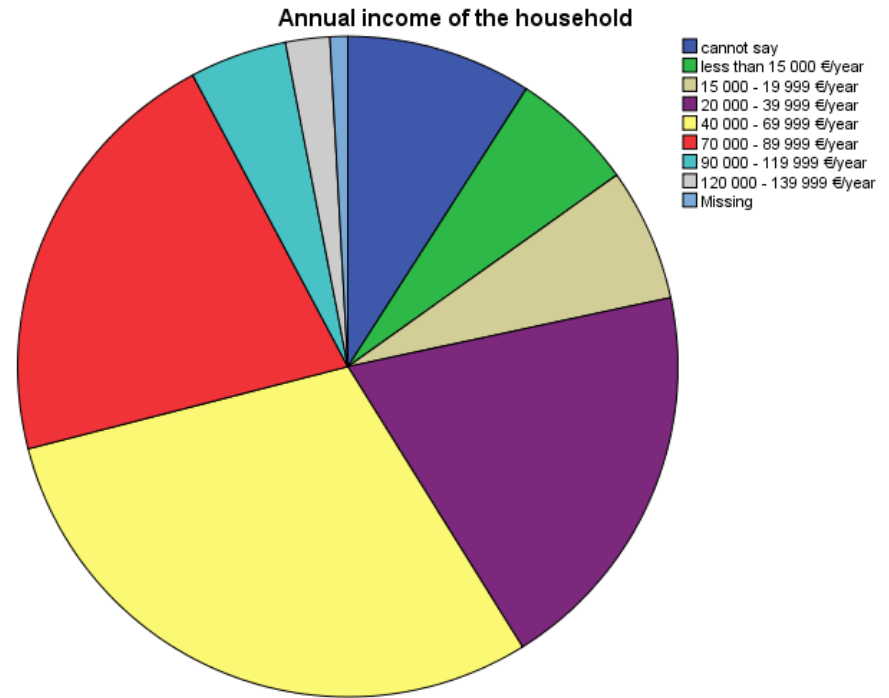
Household size

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	47	20,3	20,6	20,6
	2	80	34,6	35,1	55,7
	3	36	15,6	15,8	71,5
	4	39	16,9	17,1	88,6
	5	20	8,7	8,8	97,4
	6	4	1,7	1,8	99,1
	7	2	,9	,9	100,0
	Total	228	98,7	100,0	
Missing	System	3	1,3		
Total		231	100,0		

On average there were 1,86 adults and 0,81 children per household.

Household income

The respondents were distributed among all income levels. More than half of the households have income between 40 000 € and 90 000 €/year.

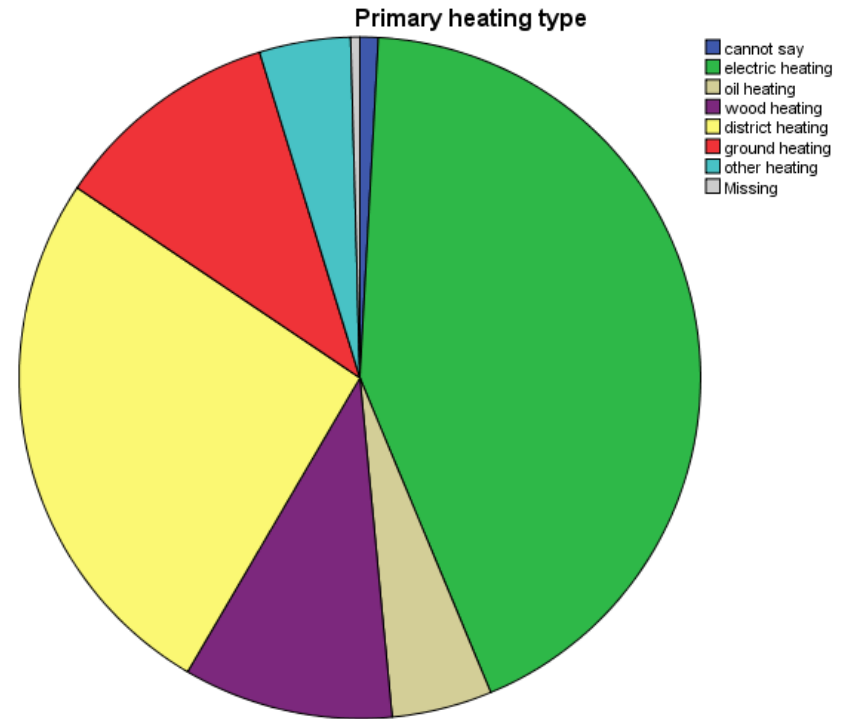


Annual income of the household

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	cannot say	21	9,1	9,2	9,2
	less than 15 000 €/year	14	6,1	6,1	15,3
	15 000 - 19 999 €/year	15	6,5	6,6	21,8
	20 000 - 39 999 €/year	45	19,5	19,7	41,5
	40 000 - 69 999 €/year	69	29,9	30,1	71,6
	70 000 - 89 999 €/year	49	21,2	21,4	93,0
	90 000 - 119 999 €/year	11	4,8	4,8	97,8
	120 000 - 139 999 €/year	5	2,2	2,2	100,0
	Total	229	99,1	100,0	
Missing	System	2	,9		
Total		231	100,0		

Primary heating type

The most common heating type among the consumers was electric heating, which was used by almost half of the respondents.



Primary heating type

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	cannot say	2	,9	,9	,9
	electric heating	99	42,9	43,0	43,9
	oil heating	11	4,8	4,8	48,7
	wood heating	23	10,0	10,0	58,7
	district heating	60	26,0	26,1	84,8
	ground heating	25	10,8	10,9	95,7
	other heating	10	4,3	4,3	100,0
	Total	230	99,6	100,0	
Missing	System	1	,4		
Total		231	100,0		

Some other heating types were also mentioned: heat pump (4) and pellets (5 respondents).

Notice! The data was collected through electricity companies' web portals. It is likely that consumers with big electricity consumption are more active visitors at those sites than those with small consumption.

Secondary heating type

In total 56 % of the respondents had one or more secondary heating types as well. Most common was wood heating, which was mentioned by 64 % of those with several heating types.

Also electric heating (19 %) was quite typical secondary heating type.

Oil heating and district heating were only mentioned by few respondents. Instead, heat pump was mentioned by 16 respondents, solar by 2 and pellets by 1 respondent.



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Electricity consumption

Electricity consumption

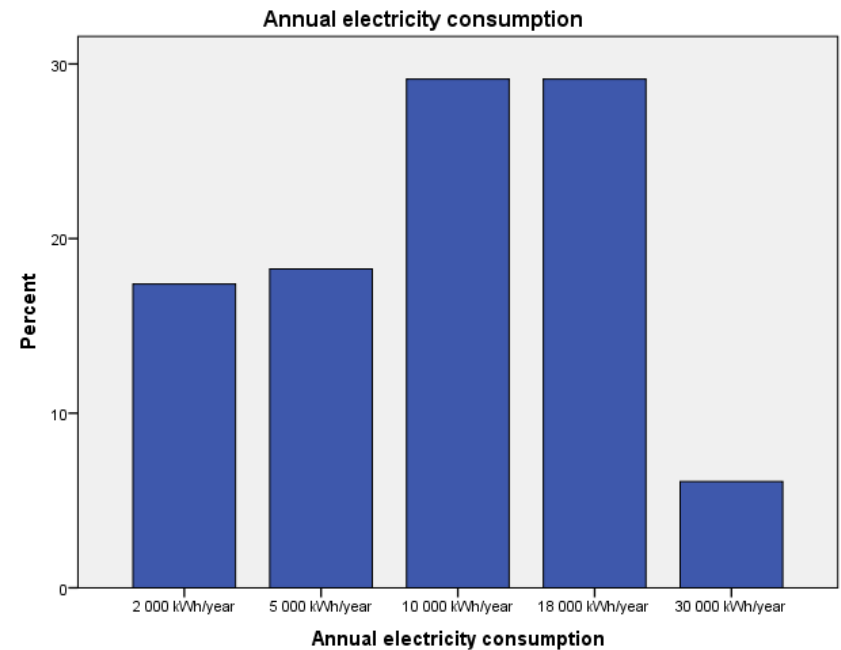
The household customers often fail to know their annual electricity consumption. Therefore, they were given some consumption category options in order to make it easier for them to estimate their consumption level. The categories are approximate but sufficient:

- 30 000 kWh/year (e.g. large electrically heated detached house)
 - 18 000 kWh/year (e.g. electrically heated detached house)
 - 10 000 kWh/year (e.g. detached house with a sauna stove but without electric heating)
 - 5 000 kWh/year (e.g. fairly large flat or terraced house with a sauna stove but without electric heating)
 - 2 000 kWh/year (e.g. rather small flat or terraced house without sauna stove or electric heating).

The respondents were asked to choose the *most suitable* option to describe the level of their electricity consumption.

Annual electricity consumption

10 000 and 18 000 kWh/year were the most common electricity consumption levels among the respondents.



Annual electricity consumption

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2 000 kWh/year	40	17,3	17,4	17,4
	5 000 kWh/year	42	18,2	18,3	35,7
	10 000 kWh/year	67	29,0	29,1	64,8
	18 000 kWh/year	67	29,0	29,1	93,9
	30 000 kWh/year	14	6,1	6,1	100,0
	Total	230	99,6	100,0	
Missing	System	1	,4		
	Total	231	100,0		

Significance of the electricity costs

The respondents were asked how significant they consider their electricity bill to be for their household (in relation to the income and other costs of their household).

The answers have been categorized according to the households' electricity consumption level as it is essential information to partially define the perception of the significance of the costs.

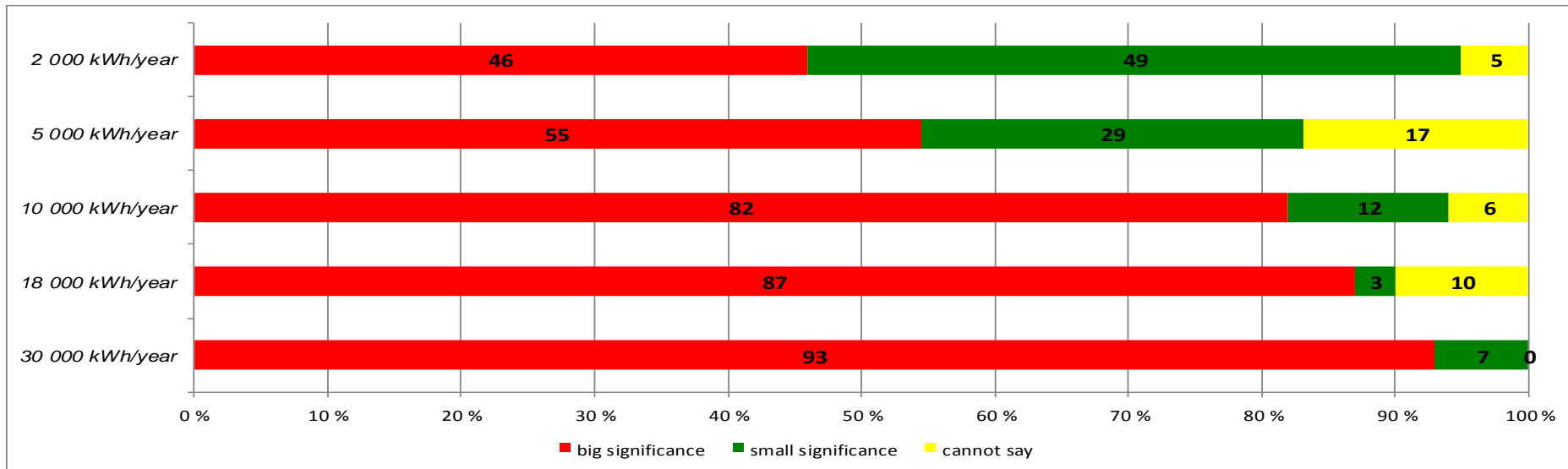
The results are presented on the next slide.

Significance of the electricity costs

In total, 73 % of the respondents considered their electricity bill to have a big financial significance for their household.

As expected, the electricity costs were perceived most significant by households with high consumption levels.

However, also 46 % of the households with only 2 000 kWh annual consumption considered their electricity costs to be significant.





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Interest towards saving electricity

Energy consumer types

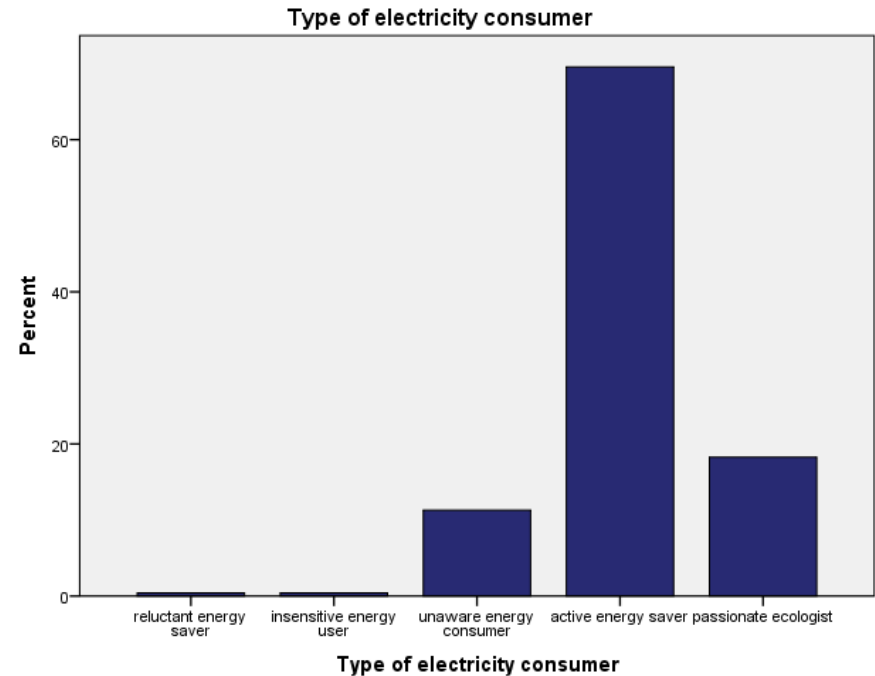
The respondents were categorized into different types of energy users based on their awareness, attitudes and interest towards energy saving. The category names were not shown to the respondents but are used to analysis purposes only to describe the consumers. The categories are:

- **Reluctant energy saver** (is not at all interested in saving energy or following the consumption, thinks that it is everybody's own business how much they use energy)
 - **Insensitive energy user** (thinks that energy will be always available and there is no real reason to try to save it)
 - **Unaware energy consumer** (thinks energy saving is good thing but needs more information about how to follow the consumption and what are the best ways to save energy at home)
- **Active energy saver** (knows a lot about own household's energy consumption and about energy efficiency, likes to follow the consumption, actively tries to save energy but is not willing to lower the standard of living)
- **Passionate ecologist** (always tries to save energy even if it requires a lot of effort and lowering the standard of living, thinks environmental reasons are the main driver for saving energy).

The respondents were asked to choose the *most suitable* option to describe the level of their electricity consumption.

Energy Consumer types

Most respondents consider themselves being active energy savers. Very few recognized themselves being reluctant energy savers or insensitive energy users



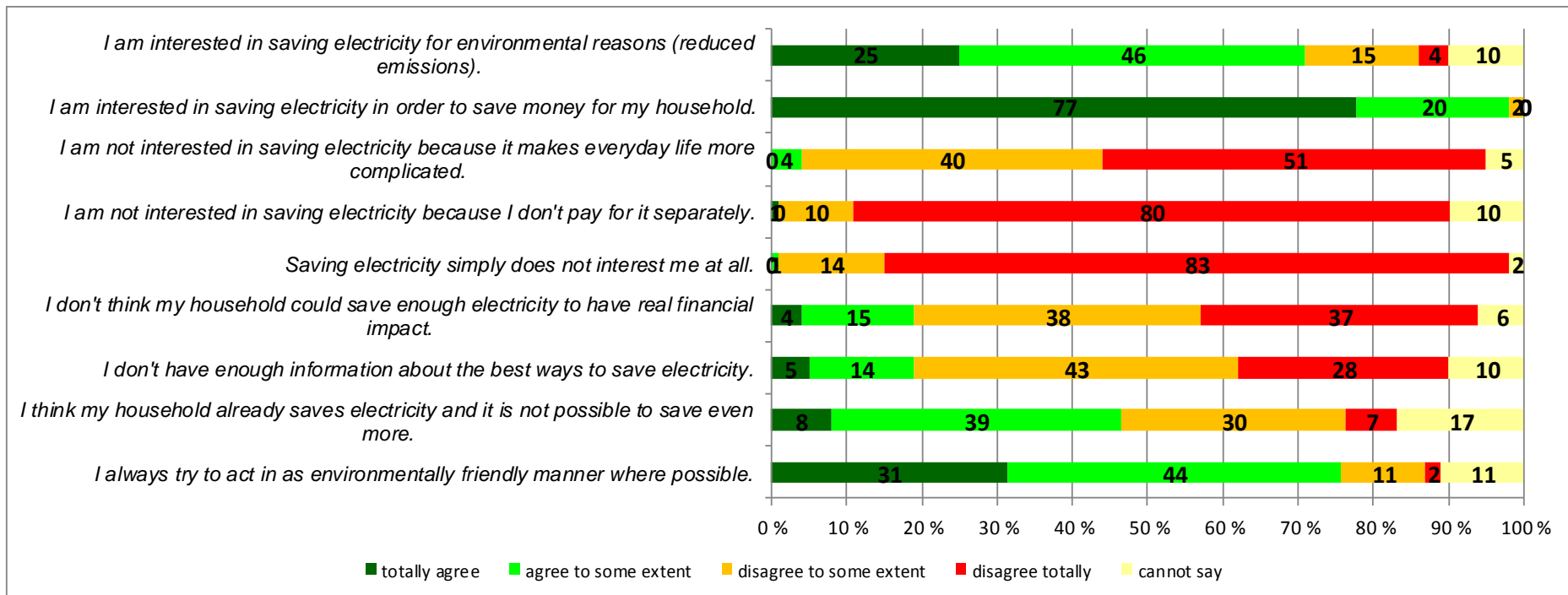
Type of electricity consumer

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	reluctant energy saver	1	,4	,4	,4
	insensitive energy user	1	,4	,4	,9
	unaware energy consumer	26	11,3	11,3	12,2
	active energy saver	160	69,3	69,6	81,7
	passionate ecologists	42	18,2	18,3	100,0
Total		230	99,6	100,0	
Missing	System	1	,4		
Total		231	100,0		

Notice! These figures are not likely to be comparable with average population. The respondents were visiting the electricity companies' web sites and by choice participated in the survey. They are likely to be more aware and interested towards energy issues than the average population.

Interest & awareness towards saving energy

The respondents were asked to comment on whether they agree or disagree with some specific statements regarding energy. It seems that the respondents in general are quite aware of the energy issues and willing to save energy.





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Electricity contract

Electricity contract types

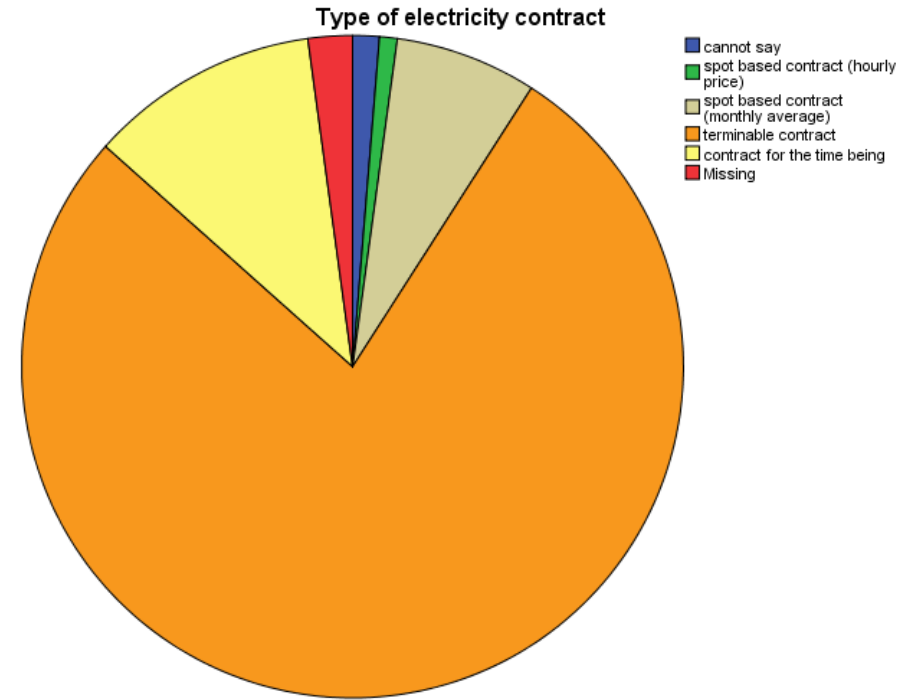
Demand Response requires a contract that is based on hourly pricing, due to the fact that otherwise flexible prices according to the consumption are not possible. However, this might be a significant barrier for DR because it is expected that many consumers don't want to change their contract from a familiar to an unknown (and more risky) option. The consumers were asked what type of contract they have now and what type they would prefer.

The options were explained to the consumers:

- Contract for time being, where the price stays the same for long periods of time and will change according to a notification from the supplier. Different prices for e.g. day/night-rate electricity could still be included.
- Terminable contract, where the price is fixed for the whole contract period (usually 1 or 2 years). Different prices for e.g. day/night-rate electricity could still be included.
- Contract based on monthly average price, where price is defined on hourly basis in NordPool and billed from the household according to monthly average price (commission added).
- Contract based on hourly price, where the price is defined on hourly basis in NordPool and billed from the household according to how much it has actually used electricity during each hour (commission added).

Type of electricity contract

Most of the respondents (79%) have terminable contract. 12 % of them have contract for the time being and 8 % have some kind of spot based contract.

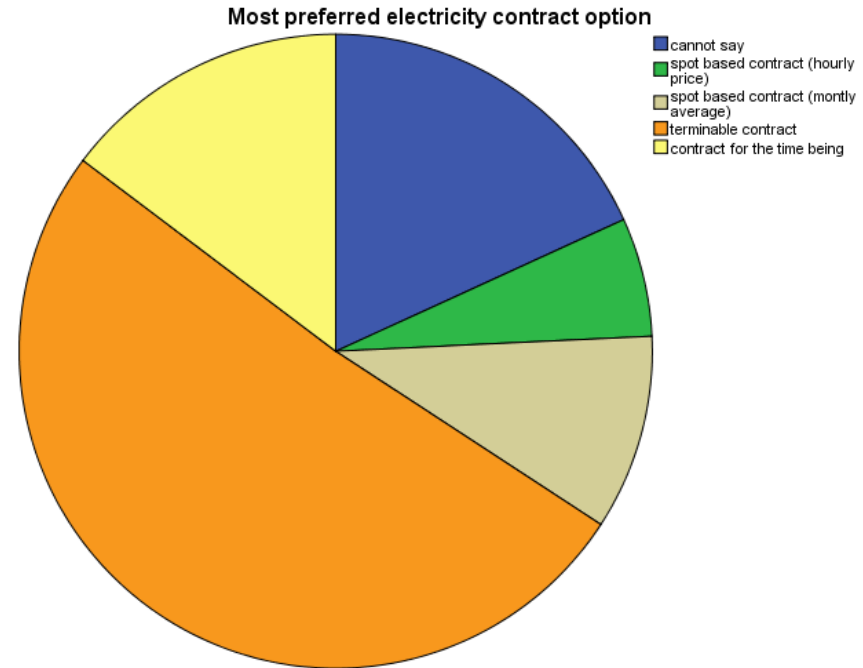


Type of electricity contract

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	cannot say	3	1,3	1,3	1,3
	spot based contract (hourly price)	2	,9	,9	2,2
	spot based contract (monthly average)	16	6,9	7,1	9,3
	terminable contract	179	77,5	79,2	88,5
	contract for the time being	26	11,3	11,5	100,0
	Total	226	97,8	100,0	
Missing	System	5	2,2		
	Total	231	100,0		

Most preferred electricity contract option

Half of the respondents prefer terminable contract. Almost one fifth of the respondents cannot say which contract type they would prefer, which is likely to describe the unawareness of the different types.



Most preferred electricity contract option

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid cannot say	42	18,2	18,2	18,2
spot based contract (hourly price)	14	6,1	6,1	24,2
spot based contract (monthly average)	23	10,0	10,0	34,2
terminable contract	118	51,1	51,1	85,3
contract for the time being	34	14,7	14,7	100,0
Total	231	100,0	100,0	

However, it is interesting to see that as many as 16 % of the respondents would like to have a spot based contract.

Why Spot based contract?

Those consumers who chose Spot based contract to be their preferred option, were asked to provide arguments for their choice. The main reasons were:

- **Cheapest price / Monetary savings (long-term)**

"In the long run it's the cheapest option, despite of possible significant fluctuation in price in the short-run."

- **Willingness to try**

"I would like to try. If e.g. after one year it seems that terminable contract is cheaper, I would like to switch back. The current practice ties one's own decisions too much."

- Some other arguments: short cancellation time (a month), possibility to observe the price development, possibility to influence more in the electricity bill by using electricity during cheap hours...

Why NOT Spot based contract?

- Price volatility causes **too much uncertainty** (consumers want to be able to predict their costs)
"Rough price increases frighten me. Financially, I live on a razor edge all the time and I cannot afford unexpected costs."
"Spot prices are highest when it would be most natural to use electricity (8-14). One adult at home during daytime, so vacuuming, cooking and washing laundry & dishes has to be done during expensive hours. When the prices are low the usage is lower as well. At night we want to sleep, not to listen to the noise from the laundry machine."
- Fear of **price peaks during winter-time** when electricity is used the most
"Electricity price is likely to be highest when we need it the most – in winter."
- **Too much time/effort required**
"Terminable contract does not require constant care. Believe it or not, in my life I don't think about electricity issues almost at all... and that is good."
- Also: Unawareness, doubts about saving opportunities...



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Demand Response

Interest towards Demand Response

It is not worth asking the respondents' interest towards Demand Response without simplifying and explaining the concept, due to the fact that it is very difficult for the consumers to evaluate something they are not familiar with and don't understand.

Therefore, two simplified examples of DR were given to the respondents and they were asked to state their interest towards them.

First the respondents were provided with an explanation of the basic idea and benefits of DR:

"The households' need for electricity is not the same all the time, but it varies during the day and week. In most households electricity is most needed in weekday mornings and evenings, whereas in the daytime on weekdays and during nights the need is usually lower.

If the use of electricity could be distributed more evenly in future that would decrease the costs as well as the environmental impacts of electricity consumption.

This would benefit both the households, electricity companies and the environment.

The households can, if they want to, agree on different ways to balance their electricity consumption with their electricity company in the future.

We will describe you two different ways. Do you think your household could be interested in balancing your electricity consumption?"

Example 1 (DR based on consumers' own activity)

The price of electricity is defined on hourly basis for the household and the valid prices can be checked easily for the next 24 hours e.g. from the computer, smart phone or separate display. If one wants it is also possible to get notices through these devices, for example, "Tomorrow after 18 o'clock the electricity price will be high, avoid the unnecessary use".

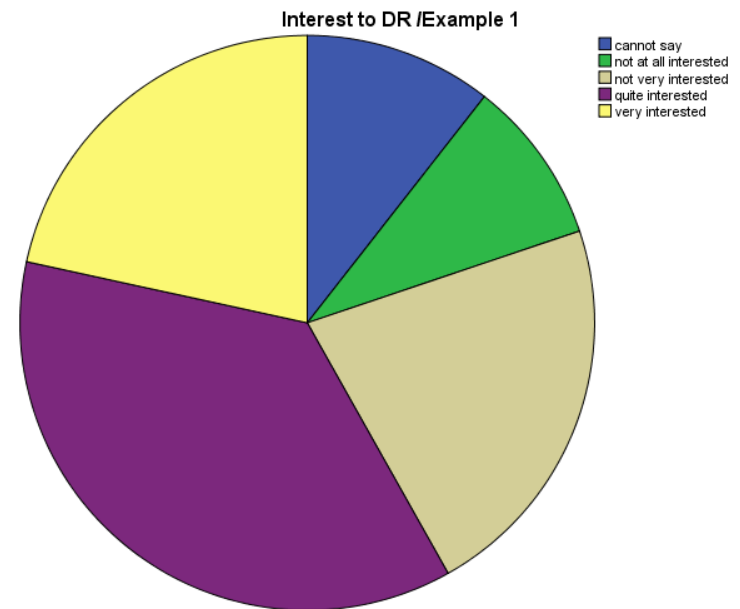
If the household so wishes, it can avoid using electricity while the prices are high, e.g. by heating up the sauna stove or using laundry machine only when the prices are low. Thus the household can save in the electricity bill during the year but can also use electricity when ever needed.

Interest towards DR, Example 1

The households seem to be interested in the manual DR, where they control their electricity use according to the prices. As many as 58 % of the respondents are interested.

Interest to DR /Example 1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	cannot say	24	10,4	10,6	10,6
	not at all interested	21	9,1	9,3	19,8
	not very interested	50	21,6	22,0	41,9
	quite interested	83	35,9	36,6	78,4
	very interested	49	21,2	21,6	100,0
	Total	227	98,3	100,0	
Missing	System	4	1,7		
	Total	231	100,0		



Reasons for being/not being interested for DR (E1)

Interested respondents

The main reasons for the households' interest towards DR/1 were possibility to save money as well as the fact that one's own life rhythm is quite flexible and enables using electricity when the price is lowest. Some respondents also commented that they have a lot of suitable electricity consumption and that they like the idea that they can keep the control for themselves (decide whether they use electricity or not when the price is high).

“In a family with children the laundry machine is used frequently, so it should be used when the price of electricity is low”.

Not interested respondents

By far the most common reason for the respondents to not to be interested in DR/1 was the fact that they do not want or can not live according to the electricity prices; they want to plan their timetables freely, or their find it otherwise too complicated.

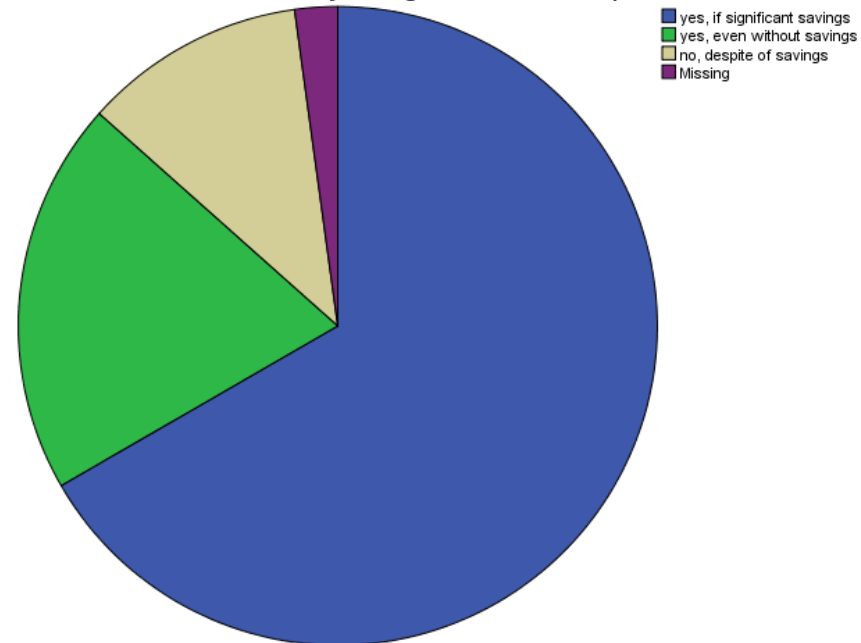
“Food needs to be prepared when we are hungry, home entertainment electronics we use when we are at home. Heating probably consumes the most and that needs to be on all the time when it is cold. Lightning is needed when it is dark. Only laundry machine and dish washer can wait for lower electricity prices. I don't see any economical sense in establishing this kind of system, the possible savings are marginal for the consumers”.

Impact of financial savings, Example 1

In case there were significant savings involved, as many as 68 % of the respondents would be interested in DR (Example 1) and 20 % would be interested anyway.

However, 12 % of the respondents would not be interested, despite of savings.

If monetary savings /Interest to Example 1



If monetary savings /Interest to Example 1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes, if significant savings	154	66,7	68,1	68,1
	yes, even without savings	46	19,9	20,4	88,5
	no, despite of savings	26	11,3	11,5	100,0
	Total	226	97,8	100,0	
Missing	System	5	2,2		
Total		231	100,0		

Required savings, Example 1

Those respondents who stated that they would be interested in the DR described in the Example 1 in case the saving would be big enough, were asked how much the annual saving should be. There is a huge variation between the answers, from 20 to 2000 euros.

On average the required saving is 314 euros, varying between 85 €/year (households with 2 000 kWh annual consumption) and 629 €/year (30 000 kWh).

Electricity consumption of the respondents household	Number of respondents	Required savings potential (average)	Required savings potential (variation)
2 000 kWh/year	17	85 €/year	20 – 200 €
5 000 kWh/year	22	133 €/year	50 – 300 €
10 000 kWh/year	38	244 €/year	20 – 1 000 €
18 000 kWh/year	48	469 €/year	50 – 2 000 €
30 000 kWh/year	10	629 €/year	120 - 1 000 €
All respondents	135	314 €/year	20 – 2 000 €

Example 2 (DR based on automatic load control)

*The price of electricity is defined on hourly basis for the household and **the electricity supplier can control the households' electricity use to times when electricity is cheaper.** In that case the operation of e.g. boiler and electric heating could be directed to the cheap hours of the day in future. The household could decide which appliances (and how) it will let the electricity supplier to control. This would **not require any actions from the occupants and they would notice practically no differences in their everyday life**, because there would always be enough heat and warm water available. During the year the household would gain savings in their electricity costs.*

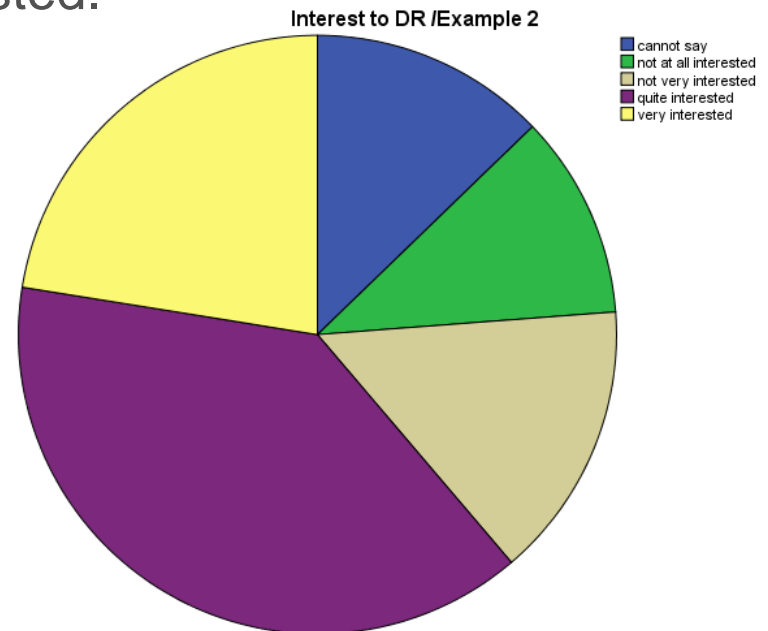
If the household so wishes, it can also save electricity by it's own actions, like described in the first example.

Interest towards DR, Example 2

The households seem to be interested in the automatic DR as well, where the electricity company controls their load according to the prices. As many as 61 % of the respondents are interested.

Interest to DR /Example 2

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
cannot say	29	12,6	12,8	12,8
not at all interested	25	10,8	11,0	23,8
not very interested	34	14,7	15,0	38,8
quite interested	88	38,1	38,8	77,5
very interested	51	22,1	22,5	100,0
Total	227	98,3	100,0	
Missing				
System	4	1,7		
Total	231	100,0		



Reasons for being/not being interested for DR (E2)

Interested respondents

The main reason for the households' interest towards DR/2 was the possibility to save money, but definitely also the fact that the DR described in Example 2 was seen as a very easy option for the consumers. The impact on their everyday life was considered small. However, some of the respondents mentioned that even if their loads would be controlled automatically, they should always have the option of overriding the controlling actions.

“This example is more independent from what hobbies the household members have or what is being done at home during daytime”. Therefore, this option is nicer because the consumers' actions are not being controlled by electricity pricing”.

Not interested respondents

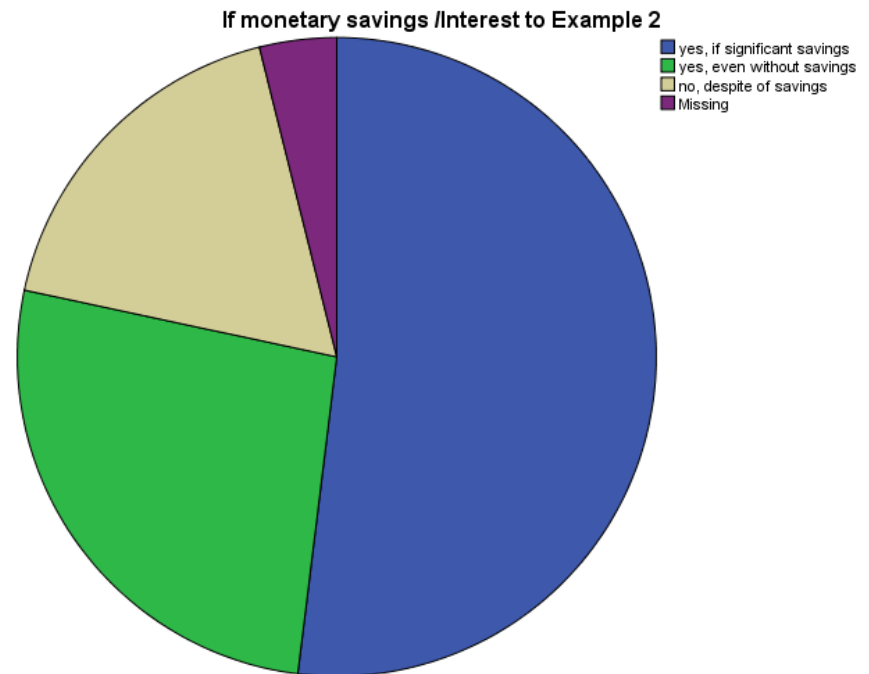
The most common reason for the respondents to not to be interested in DR/2 was the fact that they do not want anyone else to control their use of energy. Another major reason was that the respondents felt they don't have enough controllable loads in order to have significant savings.

“I want to influence on things myself, and I definitely don't want some external quarter to influence in how I live my life in my own home. I will not sell my privacy. I would rather buy an aggregate”.

Impact of financial savings, Example 2

In case there were significant savings involved, 54 % of the respondents would be interested in DR (Example 2) and 28 % would be interested anyway (even without savings).

However, 19 % of the respondents would not be interested, despite of savings.



If monetary savings Interest to Example 2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes, if significant savings	120	51,9	54,1	54,1
	yes, even without savings	61	26,4	27,5	81,5
	no, despite of savings	41	17,7	18,5	100,0
	Total	222	96,1	100,0	
Missing	System	9	3,9		
Total		231	100,0		

Required savings, Example 2

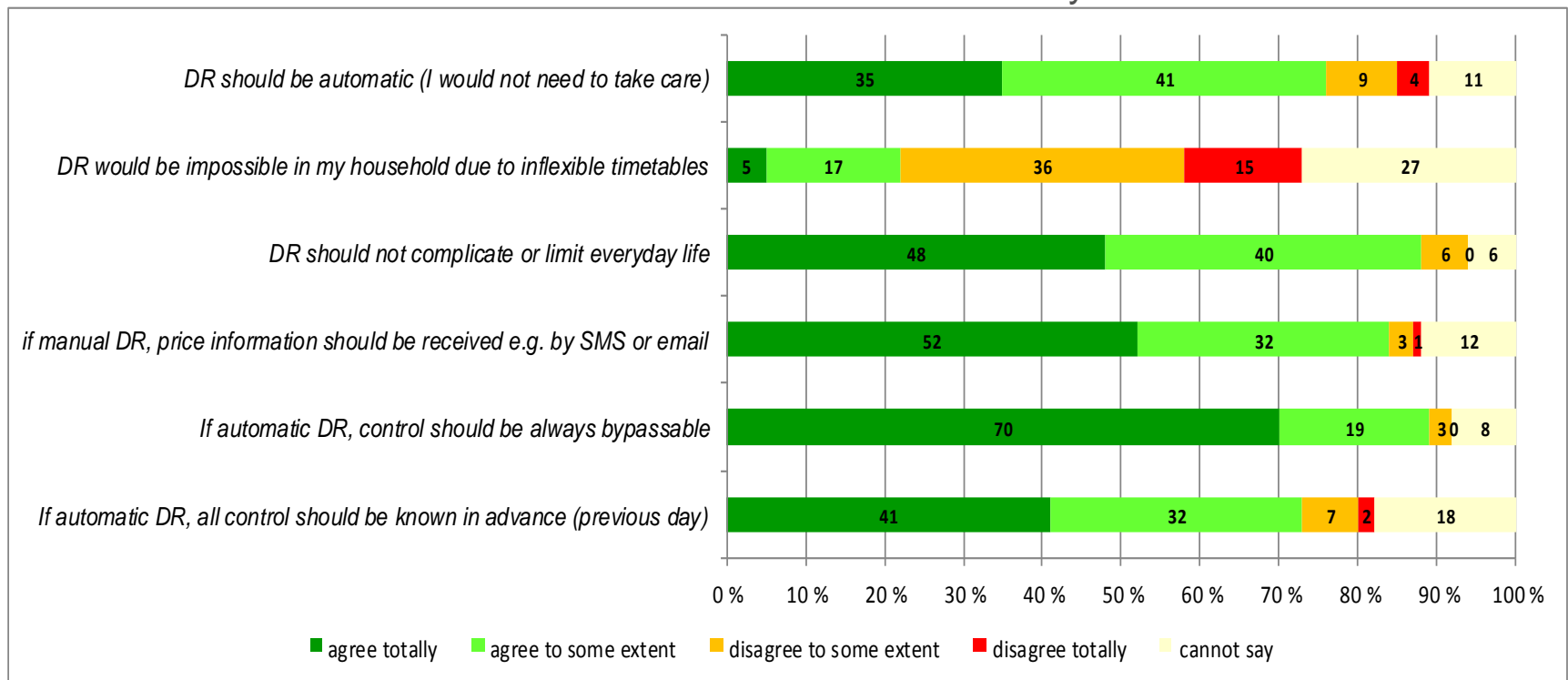
Those respondents who stated that they would be interested in the DR described in the Example 2 in case the saving would be big enough, were asked how much the annual saving should be. There is a huge variation between the answers, from 20 to 2000 euros.

On average the required saving is 322 euros, varying between 60 €/year (households with 2 000 kWh annual consumption) and 767 €/year (30 000 kWh).

Electricity consumption of the respondents household	Number of respondents	Required savings potential (average)	Required savings potential (variation)
2 000 kWh/year	7	60 €/year	20 – 100 €
5 000 kWh/year	14	127 €/year	50 – 300 €
10 000 kWh/year	32	217 €/year	20 – 500 €
18 000 kWh/year	38	448 €/year	50 – 2 000 €
30 000 kWh/year	7	767 €/year	370 - 1 500 €
All respondents	98	322 €/year	20 – 2 000 €

Attitudes and pre-requisites towards DR

The respondents strongly feel that DR should not complicate their everyday life. At the same time, only a small proportion of them feel that DR would be impossible in their household due to inflexible timetables. As one could expect, most respondents feel that the ultimate control should stay with them also in cases where the electricity company controls their loads automatically.





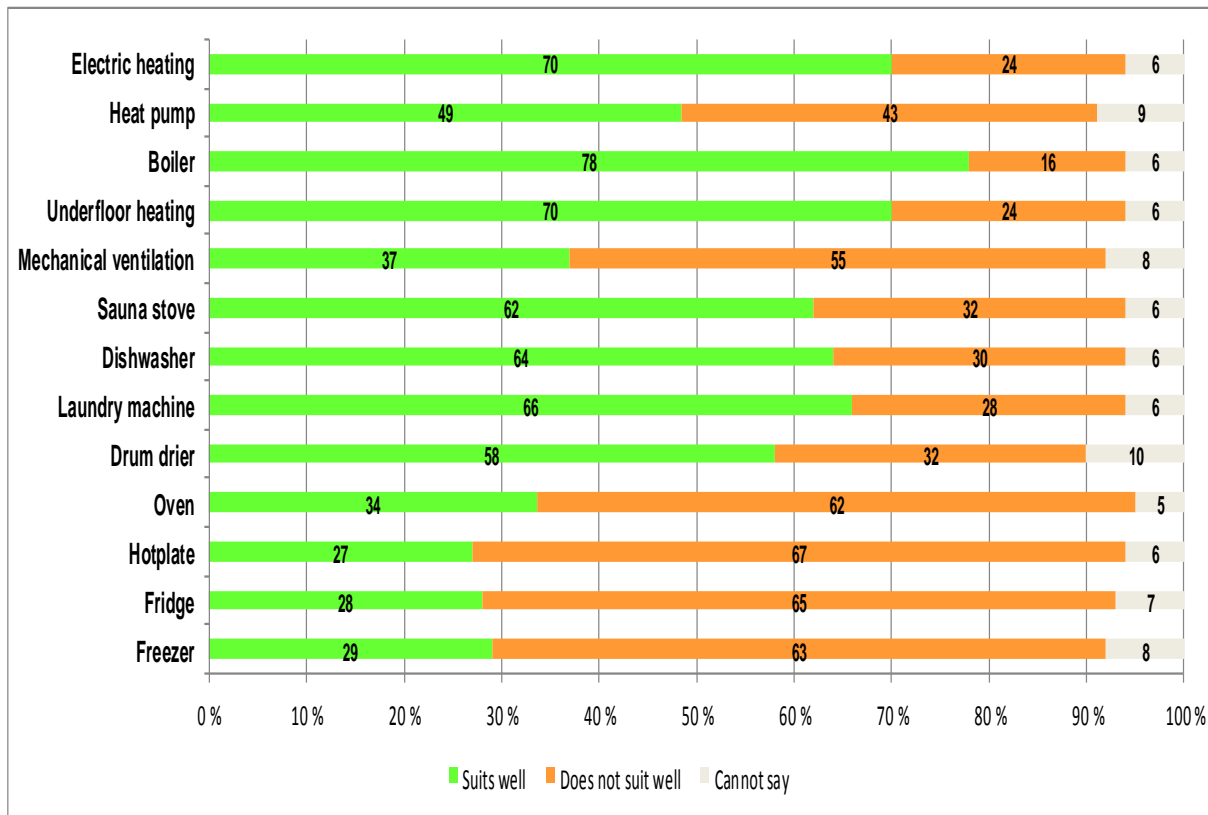
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Suitable appliances for DR

Suitable appliances for DR

Taking into account only households who have certain appliance/equipment, it seems that the respondents consider boiler, underfloor heating and electric heating the most suitable appliances for DR. The least preferred ones are hotplate, fridge and freezer.



Households who don't have...	...this appliance / equipment
42 %	Electric heating
55 %	Heat pump
34 %	Boiler
33 %	Underfloor heating
41 %	Mechanical ventilation
36 %	Sauna stove
15 %	Dishwasher
4 %	Laundry machine
59 %	Drum drier
5 %	Oven
1 %	Hotplate
0 %	Fridge
3 %	Freezer

Other suitable appliances/equipment

The respondents were asked whether some other appliances or equipment come to their mind that could also be suitable for DR purposes.

The most common answers were:

- Entertainment electronics (especially TV, computer)
 - Lightning (both indoor and outdoor)
 - Car heaters (especially motor heater)



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Summary

Summary

- It is very common that the electricity costs are being considered significant for the household's budget, especially by those with high electricity consumption.
 - The respondents in general are very interested in energy issues and energy saving, but it must be noticed that the sample is very likely to have higher (than within average population) percentage of people who are "energy active", which also has to be taken into account when analyzing the results.
 - Only 12 % of the respondents currently have a Spot based contract and most prefer terminable contract (without hourly pricing), which is a clear barrier for DR.
 - Electric heating, boiler and underfloor heating are considered best appliances/equipment for DR, whereas freezer, fridge and hotplate are considered least suitable for the purpose.

- 58 % of the respondents are interested in DR based on the household members' own activity. Many consumers find it as an easy way to influence in their electricity bill, but many also think it would complicate their everyday life too much. Also, there should be a clear financial incentive involved, and sometimes the households' expectations on the savings potential might be unrealistic. Required saving should be on average 469 euros per year e.g. in a house with approximately 18 000 kWh annual electricity consumption.
- Similar (61 %) share of respondents would be interested in automatic load control (done by an external quarter). There are pros and cons related to this type of DR as well: It is easy for the consumers but on the other hand, they feel they give the control of their house to someone else. Required savings potential for a house with approximately 18 000 kWh annual consumption, would be 448 €/year.

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Thank you!