

CLEEN

Cluster for Energy and Environment



sgem

Smart Grids and Energy Markets

Customer behaviour and expectations

Cleen Summit 12.6.2013

ABB

University of Vaasa

Presentation content:

- Consumers' interest towards DR
- Adjutant - a new concept of sustainable living
- Adjutant residents survey

Consumers' interest towards DR

How willing are the consumers to adopt Demand Response?

- The work was done within Task 7.5. by University of Vaasa
- Methods: Literature review, expert interviews, consumer questionnaire study
- Consumers' responses to the questionnaire study are still being received → no results yet from that part
- This presentation is based purely on the results of the **expert interviews**

Expert interviews

- In total **17 experts** were interviewed by phone
- A comprehensive selection of experts from electricity suppliers, DSO's, research organizations, energy associations & authorities and some other companies/organizations.
- **Main question areas** were:
 - The consumers' interest level towards DR
 - Consumer segments potentially interested
 - Consumers' motives, barriers and pre-requisites
 - Monetary savings required
 - Most suitable devices/equipment in households

Consumers' interest

Consumers' interest will depend highly on

- The benefits available
- The effort required
- How DR will be “packaged” for the consumers
(what products, services and automation will be included, how the idea will be presented)

→ There have to be clear **benefits**. DR has to be **easy** and require neither major investments nor a lot of effort. The message must **highlight the benefits** and explain things in **simple & easy-to-understand** way.

Consumers' interest

More than anything, consumers' interest will depend on the monetary savings. Small electricity consumption in practice means small possibility for savings.

- Households with **small electricity consumption**: There are no enough incentives available and therefore **less than 5 %** would be interested.
- Households with **relatively big consumption levels** should have significant interest towards DR. The proportion of the potentially interested consumers could be somewhere **between 25 % and 50 %**.

Form of DR

Two examples of DR were introduced

- DR based on **consumers' own activity** (consumer changes his behavior/consumption based on price signals)
- DR based on **external control or automation** (e.g. electricity company is controlling the consumers' loads automatically)

The experts saw these options having a very different potential:

- Consumers will not plan their life according to the electricity prices. Incentives are way too small to compensate the effort required in every-day life. Consumers' interest **0 – 5 %**.
- If the consumers do not have to do much and they do not have to sacrifice their convenience, they should be interested. **50 %** was quite common “educated guess” for the consumers' interest (but great variation).

Potential consumer segments

Anyone can be target group, and the less effort consumer has to do and the more benefits there are to be gained, the larger is the potential target group. However, some rough outlines for the most potential consumer groups:

- **Detached house owners**, especially those with significant flexible loads (e.g. accumulating electric heating)
- Perhaps **middle-aged** people
- People with **technical or commercial** education/experience
- **Pioneers**

Consumers' motives, barriers, pre-requisites

- **Easiness** is key: The idea and benefits should be easy to understand, possible installations should be very simple, the day-to-day usage should be effortless.
 - **Monetary benefits** have to exist, otherwise convincing the consumers is extremely difficult.
 - **Environmental and societal benefits** are important to some too, but this is a marginal group. Environmental effects are worth mentioning, but perhaps also economic issues from the society's point of view.
- If these requirements/motives are not fulfilled → Barriers

*Other barriers: Current electricity **prices are “too” low and stable to motivate consumers to change things. It is also easiest to change nothing. Also doubts: Does it work? Does it make any real impact? Do I lose control???***

Monetary savings required

Monetary saving is most powerful motive, but how much is enough?

- Depends on how DR is executed (how much knowledge and effort is required from the consumers, are some investments required etc...)
- At least **10 %** savings from the total bill (including supply, distribution and taxes) would sound “good enough”, but often impossible to be achieved
- Savings in euros are easier to understand and more concrete. **100 €** might to be enough for many.
- The above mentioned on the supposition that not much is required from the consumer.

Suitable equipment

The experts were quite unanimous that DR based on consumers' own activity does not have a future as a day-to-day action. Also, it is not likely that the consumers' will change their timetables according to electricity prices. The controllable load might also be insignificant.

→ **Least** appropriate devices for DR are: cooking devices, washing machines, tumble dryer, sauna stove...

The usable devices/equipment are something that do not require activity from the consumers on a daily basis and does not affect the consumers' life and convenience too much. Also, the controllable load needs to be significant enough.

→ **Most** appropriate devices/equipment for DR are: accumulating electric heating equipment, boiler, underfloor heating, automated ventilation, heat pump...

Adjutant a new concept of sustainable living

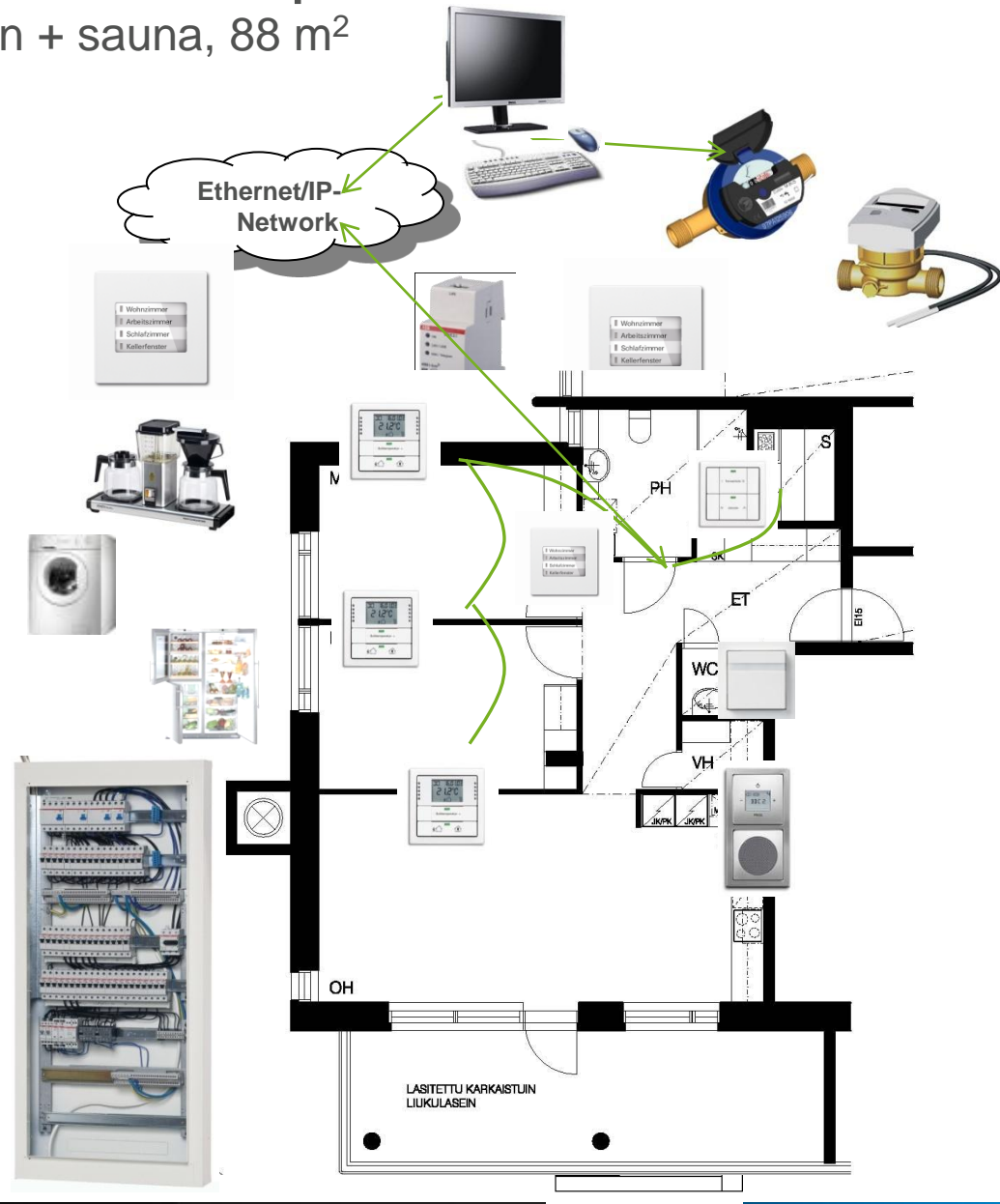
- 42 apartments
 - Measuring and visualisation of water consumption
 - Measuring and visualization of heat and electricity energy consumption
 - Possibility of consumption decrease
 - Room-specific heating control and decrease
 - At home / away / long time away -controls
- Solar electricity production
- Electric car charging
- Construction began January 2011
- Completed April 2012



Basic solution for apartments

3 room + kitchen + sauna, 88 m²

- IP-Gateway
 - Two way control possibility for BaseN data management
 - Energy monitoring Touch Display
 - Energy control switch
- 14 control circuit 16A with energy measurement
 - 6 lighting groups
 - 8 Controllable electrical loads
 - Washing machine
 - Oven
 - Fridge
 - etc
- Heating control
 - Room thermostat/room
 - Valve control/room
 - At home/away/long away switch
- Time switch 2 channels
 - Normal/decreased temperature of living room and bedroom thermostat
- Näpsä panel board with IT
- Wiring accessories +
 - Digital radio
 - Movement detector



The real-time measurement of energy, water and heating consumption at Espoon Adjutantti

- Residents are, for example, able to monitor electricity, heating energy and water consumption in real time from minute to minute using an apartment-specific monitoring system supplied by BaseN.
- Using ABB's KNX intelligent building control, residents can influence their own consumption. An 'At home – Away - Long Away' switch controls the lighting and the electrical equipment connected to the system. The system also controls heating for apartments.
- Adjutantti produces energy using solar panels on its roof. Solar electricity is used in the lighting for the building's stairwells and for charging the electric car that is at the general disposal of the residents.
- KONE has supplied Adjutantti with an energy-saving lift solution. The building's lift stores braking energy, and consumes considerably less electricity than traditional lifts used in apartment blocks. Energy is, for example, saved by turning off the lift's lighting and motor control when it is not in use.

Energy monitoring wall mounted display Front Page

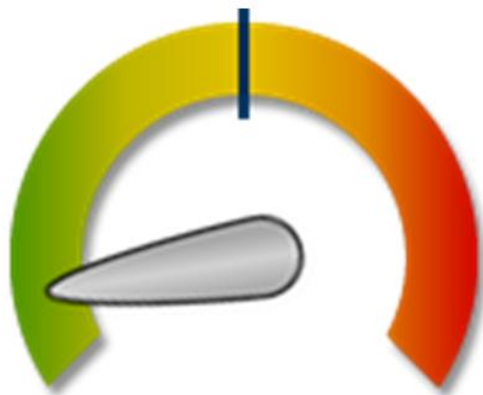


As. Oy

Espoon Adjutantti

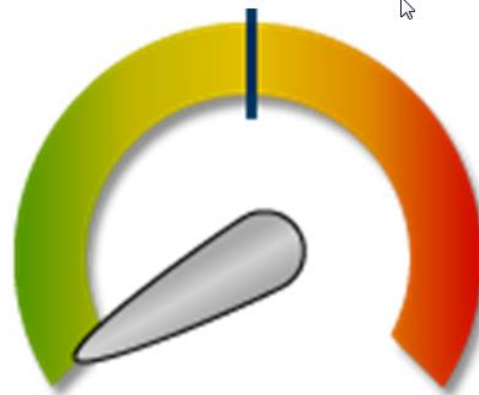


Sähkö



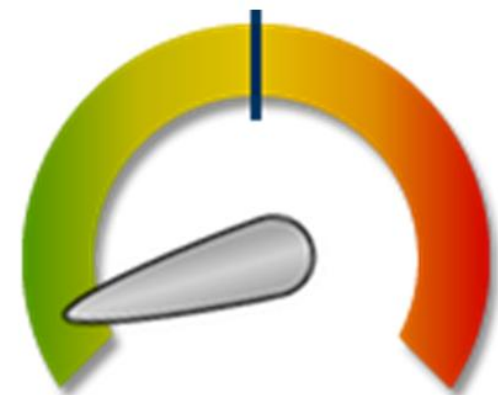
0.0601 kW

Vesi



0l/min

Lämpö



0.025kW

25.5.2012 9:15:24 (Europe/Helsinki)

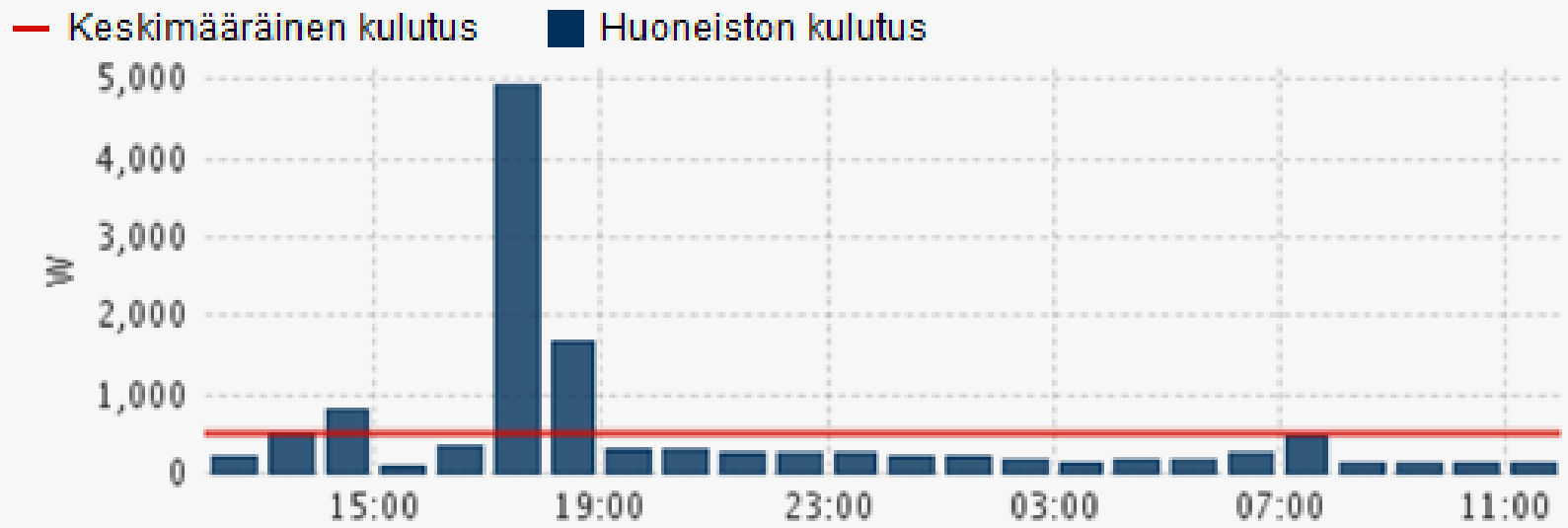
D34 Ulkolämpötila 14.4°C

Electricity consumption wall mounted display

Last 24 hours



Huoneiston sähkön kulutus 10.6.2013



Etusivu

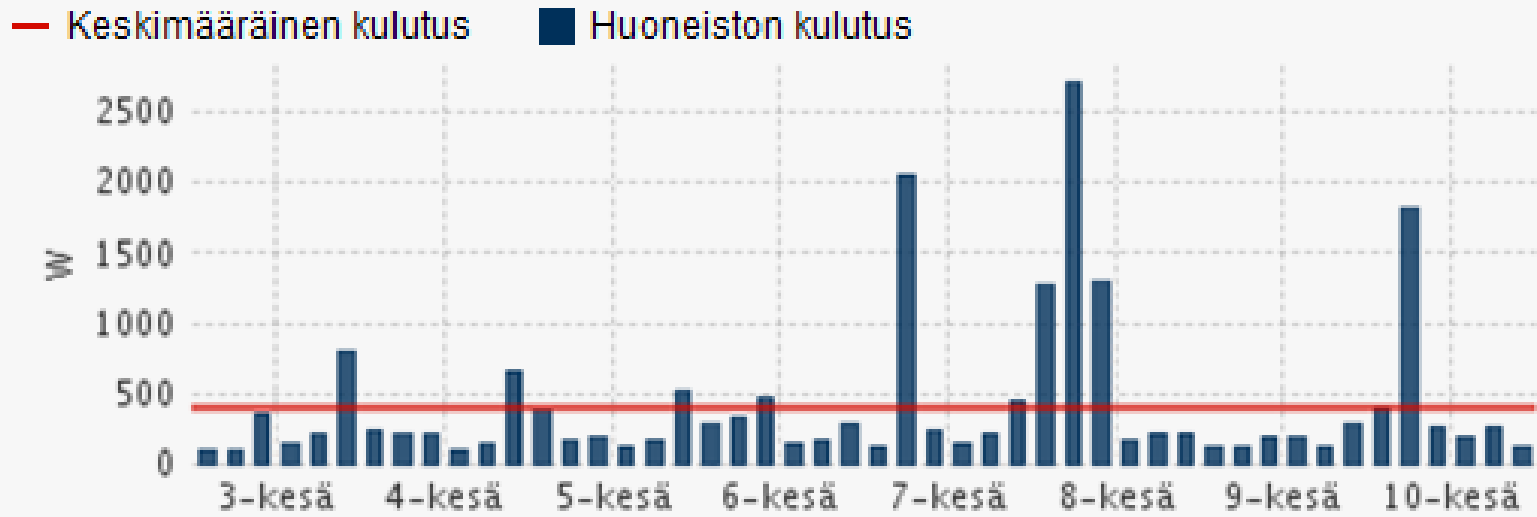
Viikonäkymä

Electricity consumption wall mounted display

Last week



Huoneiston sähkön kulutus, viikko

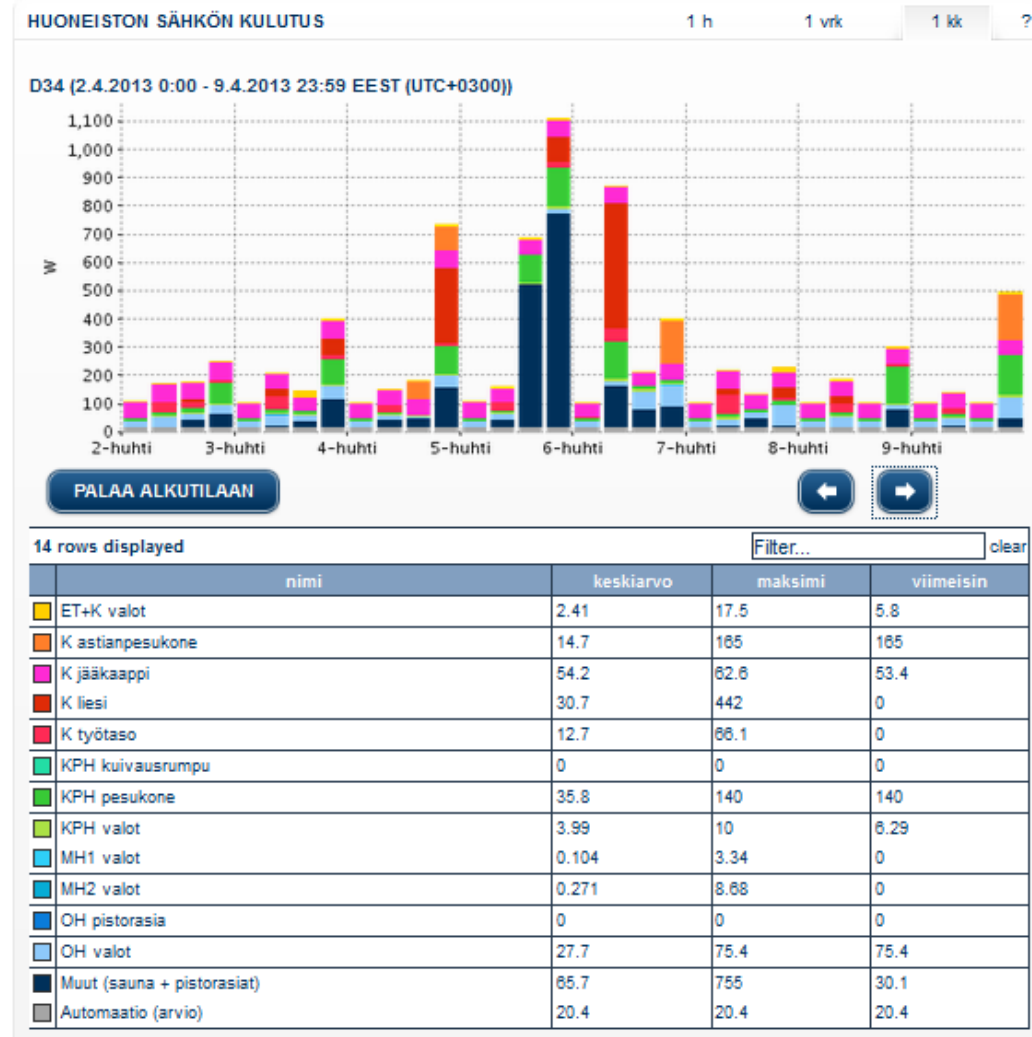


Etusivu

Päivänäkymä

Electricity consumption web-portal















Last week

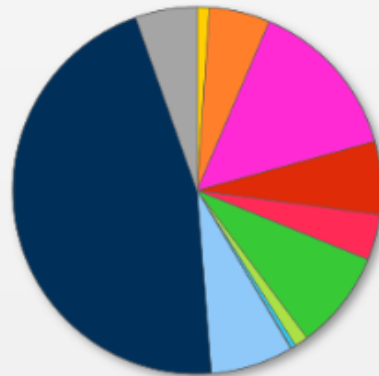


Electricity consumption web-portal

Breakdown of consumption among devices

14 rows displayed

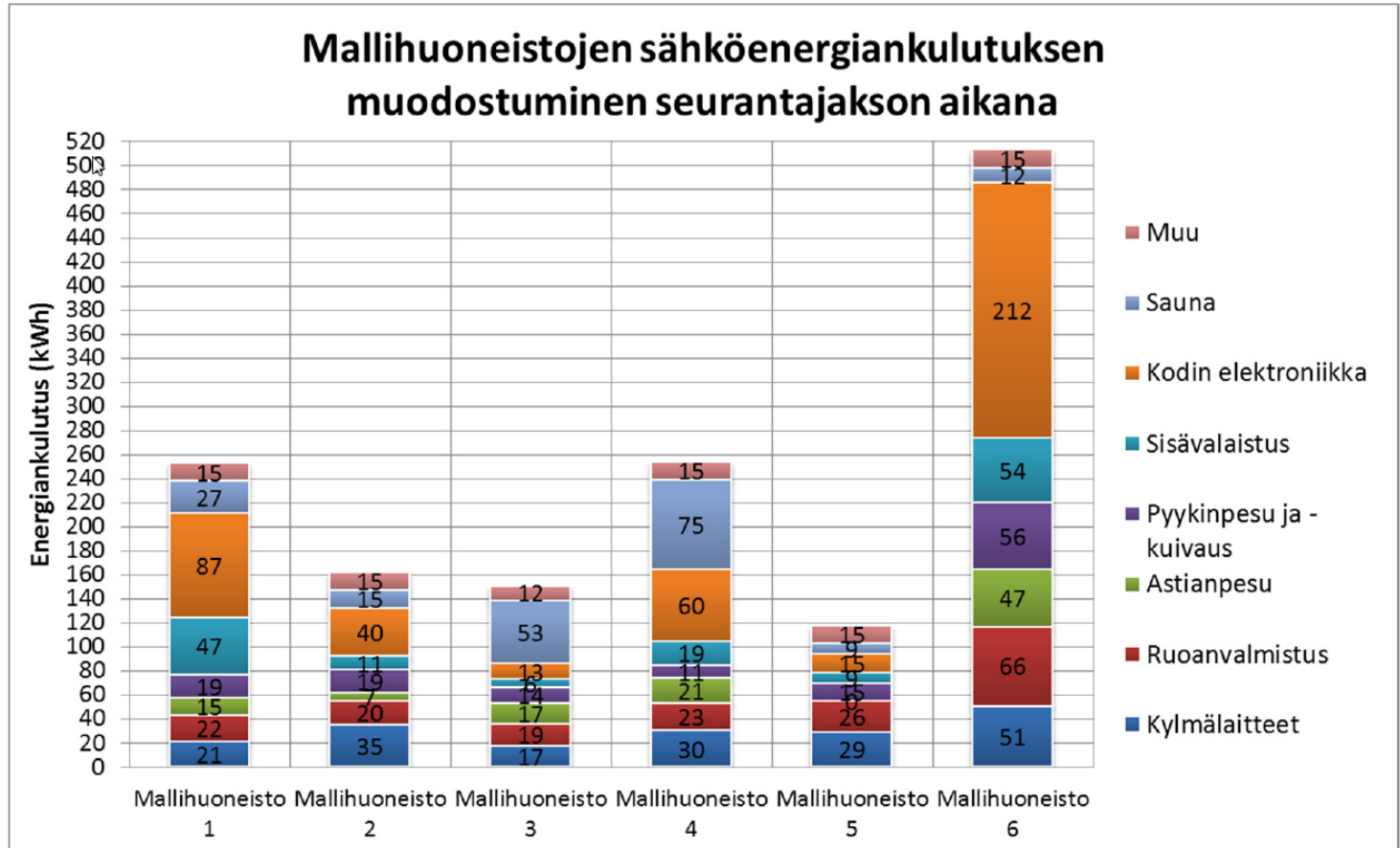
	nimi	keskiarvo	maksimi	viimeisin
	ET+K valot	4.14	26.2	0
	K astianpesukone	20.4	222	0
	K jääkaappi	54	61	57.1
	K liesi	24.4	338	0
	K työtaso	15.2	41.6	0.364
	KPH kuivausrumpu	0	0	0
	KPH pesukone	33.2	178	11.9
	KPH valot	4.57	11.4	5.16
	MH1 valot	1.54	54.9	0
	MH2 valot	0.373	11.8	0
	OH pistorasia	0	0	0
	OH valot	27.7	85.5	0
	Muut (sauna + pistorasiat)	175	1304	8.14
	Automaatio (arvio)	20.4	20.4	20.4



average ▼

Diagrammi kertoo huoneistossasi kulutetun sähkön jakautumisesta eri aikoina eri laitteiden kesken. Voit esimerkiksi seurata, minä tunteina tai viikonpäivinä huoneistossasi kulutetaan sähköä erityisen paljon sekä mikä laite kuluttaa eniten. Huomaa, että piirakkadiagrammi näyttää vain viimeisimmän jakauman valitulla ajanjaksolla.

Breakdown of electricity consumptions 6 apartments during one month



Kuva 6.27 Mallihuoneistojen sähköenergiankulutuksen muodostuminen 30 päivän seurantajakson aikana. Kulutus vaihtelee erikokoisissa asuntokunnissa. Yhden hengen asuntokunnissa kulutus on suhteessa suurempaa.

Source: Juuso Mäki, 2013, Asuinkerrostalon energiankulutuksen hallinta älykkään asukasportaalin avulla

Electricity quality web-portal

Last 24 hours

SKANSKA ABB

 As. Oy
Espoon Adjutantti

Huoneiston kulutus

Ohjauspaneeli

Taloyhtiö

Ohjeet

Energiehokkuus

Kirjaudu ulos

Tavoiteseuranta

Sähkö

Yksityiskohtainen

Sähkön laatu

Vesi

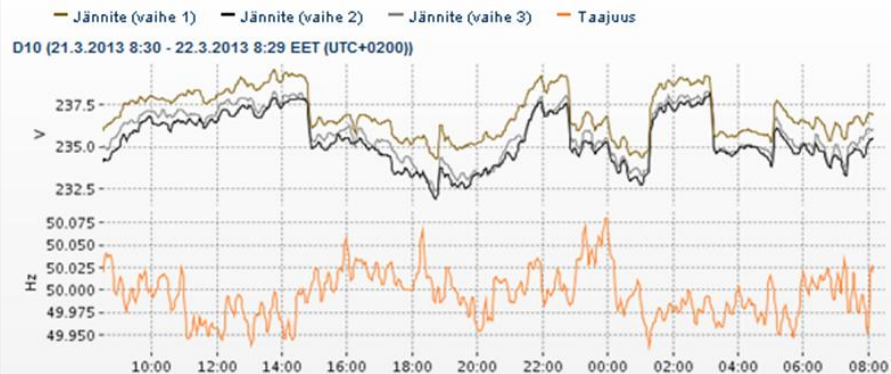
Lämpö

Sähkön laatu

SÄHKÖVERKON JÄNNITE JA TAAJUUS

1 vrk

1 kk



PALAA ALKUTILAAN



Diagrammi kertoo huoneistoosi tulevan kolmivaihesähkön jännitteen ja taajuuden. Suomessa jännitteen nimellisarvo on 230 voltia ja taajuus 50 hertsiä.

TEHOKERTOIMET (REAALIAIKAINEN)

Määräykset 4:

TALOYHTIÖN KUUKAUSI

 Kiinteistösähkö
4763 kWh

 Vesi
382367 litraa

 Lämpö
31986 kWh

Hetkellinen kulutus/luotto

> Aurinkopaneeli

> Sähköauto

> Hissi

ULKOLÄMPÖTILA

-13.5°C


Housing company web-portal



HUONEISTON KULUTUS ?

SÄHKÖ

Kuluvan vuorokauden kulutus: 1644 Wh
Keskimääräinen kulutus: 30 W

VESI

Kuluvan vuorokauden kulutus: 75.7 litraa
Keskimääräinen kulutus: 0.01 l/min

LÄMPÖ

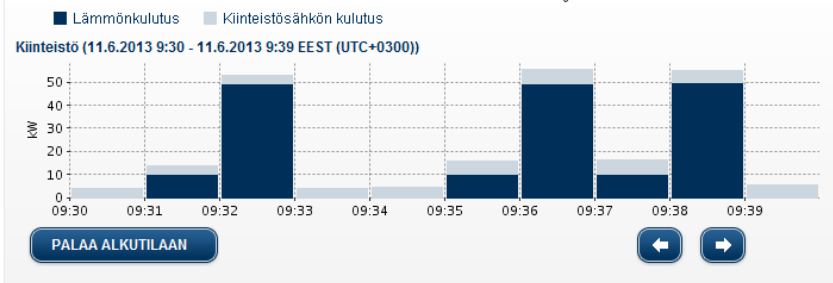
Kuluvan vuorokauden kulutus: 0 Wh
Keskimääräinen kulutus: - W

ULKOLÄMPÖTILA ?

13.8 °C



TALOYHTIÖN ENERGIAN KULUTUS



Diagrammista näet taloyhtiön kokonaiskulutuksen valitsemallasi aikavälillä. Taulukossa on esitetty kiinteistösähkö, lämmönkulutus (pl. huoneistojen lämmönkulutus) sekä veden kulutus. Hiiren vasemmalla näppäimellä voit maalata osan käyrästä, jolloin maalattu aikaväli suurentuu tarkasteltavaksi.

LÄMPÖ ?	VESI ?	KIINTEISTÖSÄHKÖ ?
30 kWh	621 litraa	4 kWh

HETKELLINEN KULUTUS/SITUOTTO

AURINKOPANEELIT ?	SÄHKÖAUTO ?	HISSI ?
Tuotto 3039 w	Kulutus 3 w	Kulutus 0 w



Photovoltaaige web-portal

Last day



Taloyhtiön aurinkopaneelit

AURINKOPANEELIEN TUOTTO

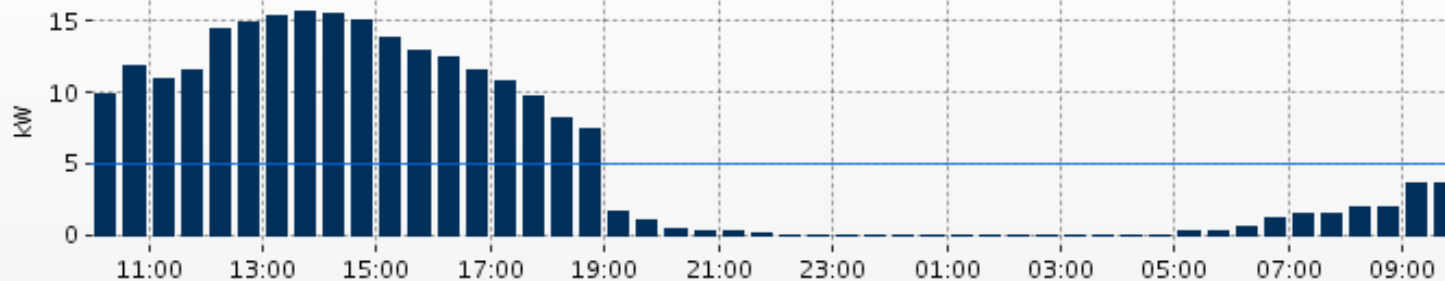
1 vrk

1 kk

?

— Keskimääräinen tuotto ■ Aurinkopaneelien tuotto

Kiinteistön aurinkopaneelit (10.6.2013 10:00 - 11.6.2013 9:59 EEST (UTC+0300))



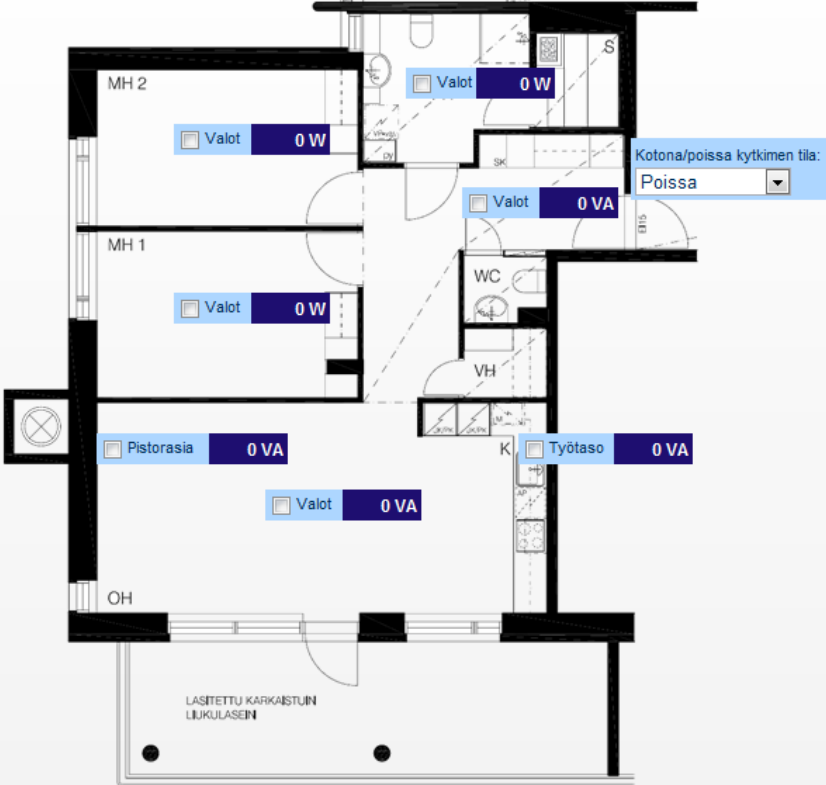
PALAA ALKUTILAAN



Diagrammista voit seurata taloyhtiön aurinkopaneelien tuottamaa sähköä tietyllä aikavälillä kilowatteina (kW).

Control panel of apartment web-portal

Asunnon ohjauspaneeli



Tällä sivulla voit ohjata huoneistosi valoja ja pistorasioita päälle ja pois. Lisäksi voit muuttaa kotona/poissa -kytkimen tilaa. Kytkimien vieressä oleva lukuarvo kertoo kyseisen pisteen sähkönkulutuksen reaaliajassa. Joissakin pisteissä on ilmoitettu kulutus näennäistehona (VA, voltiampeeri), pätötehon (W, watti) sijaan, teknisten rajoitusten vuoksi.

APARTMENT DISPLAY VS. WEB



70% OF USERS
PRIMARILY USE
THE
APARTMENT
DISPLAY

- Almost half use the display daily
- The rest, once or twice per week

19% OF USERS
PRIMARILY
FAVOUR THE
WEB

- Using the Web is clearly more rare, once per week or once or twice per month

11% HAVE
NOT USED THE
ENERGY
MONITORING
SYSTEM

- No time to get familiar with it, or the apartment is a second one

Source: Kopla asiakasymmärrystoimisto, 2012 , Experiences of the residents of Adjutantti of eco-efficient solutions

THE MONITORING SYSTEM'S EFFECT ON CONSUMPTION

POSITIVE

- A few had noticed a lower electricity bill
- A few found that the system had affected their consumption habits, particularly water consumption, and made them turn off lights and the TV more often

NO EFFECT

- But, for many, there is no discernible effect, as their consumption has always been moderate (detached houses in particular)
- "When you have to do the laundry, you have to do it"

"My energy consumption was already minimal, so there hasn't been that much of an impact. My wife doesn't leave the tap running any more, though." (Male, 60+)

Source: Kopla asiakasymmärrystoimisto, 2012 , Experiences of the residents of Adjutantti of eco-efficient solutions

RESIDENT COMMENTS ON THE ENERGY MONITORING SYSTEM

"I must admit that when it comes to the display, I haven't figured out what it compares against. Maybe if you could develop it a bit, so that it shows totals or something, I could understand it a little better." Female, around 35.

"The Web thing is just fine, as it shows the daily, monthly, and all those different consumptions, and the cumulative consumption from the period." Male, around 65.

"Sometimes, when walking past it, you check that OK, I've got the computer on, and naturally the fridge-freezer. I'm pretty interested in finding out, let's say, how much my desktop computer consumes. It's a perfectly fine motivator to steer your consumption." Male, around 27.

"When you see the meter rising close to red, you'll check what's using up all that electricity." Female, around 60.

Source: Kopla asiakasymmärrystoimisto, 2012 , Experiences of the residents of Adjutantti of eco-efficient solutions

RESIDENT COMMENTS ON THE ENERGY MONITORING SYSTEM

*"Kilowatt-hours are quite a lot more difficult to picture than Euros."
Male, around 45.*

"Naturally, money changes your motives in a completely different way." Female, around 35.

"This is definitely one of the best features in the apartment. Thanks to the home/away switch, you can be sure that you left nothing on."

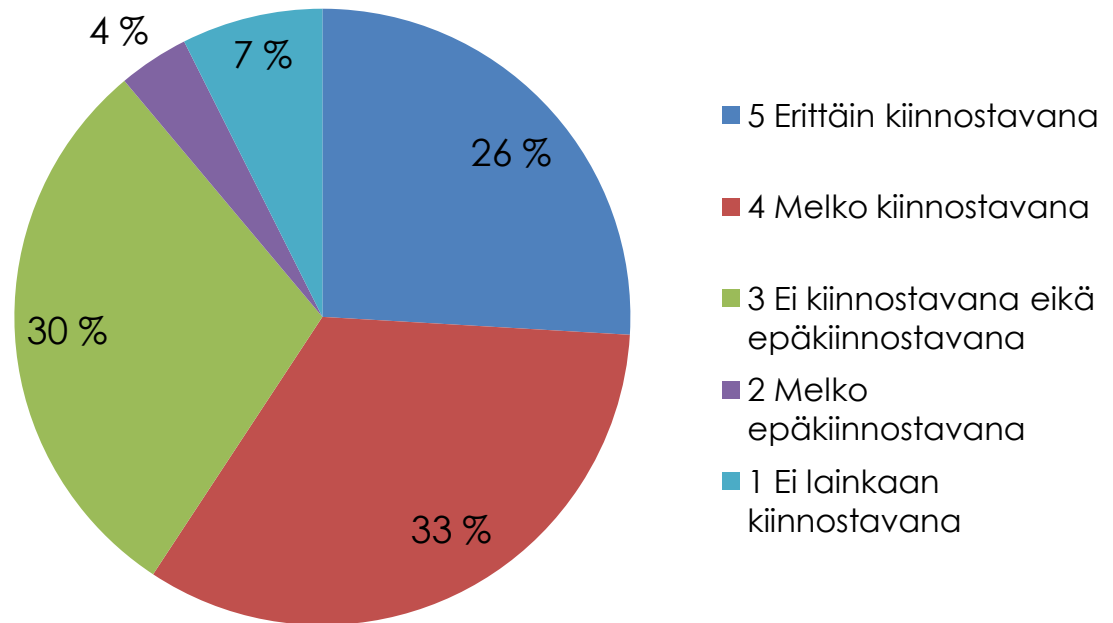
"I wonder how it would work if you have different electricity contracts with different prices from different companies...? I'd consider seeing what each appliance consumes more worthwhile." Male, around 60.

"To be frank, I doubt it would be very interesting; I don't think I would start fiddling around with, for example, when I go to sauna or when I turn on the coffee machine. That kind of thing would be more important in a detached house with electrical heating." Male, around 50.

Source: Kopla asiakasymmärrystoimisto, 2012 , Experiences of the residents of Adjutantti of eco-efficient solutions

INTEREST IN APPLIANCE-SPECIFIC CONSUMPTION MONITORING

- 59% finds appliance-specific monitoring very or fairly interesting
- 30% neutral
- 11% fairly uninteresting or not at all interesting



Source: Kopla asiakasymmärrystoimisto, 2012 , Experiences of the residents of Adjutantti of eco-efficient solutions

ECO-EFFICIENCY AS A SALES ARGUMENT

- Many feel that the most important and most effective eco-efficient solution in Adjutantti is **high-quality construction**
- Were the residents to move, many would prefer to move to an equivalent building
- Things they would miss were particularly the **real-time energy monitoring and the home/away switch**.
- For some, also the **electric car** (esp. those without a car) **and easier access system/lift** (the elderly) are important
- Many mentioned having become used to eco-efficient solutions and being prepared to pay a little extra during purchase
- Things they would recommend to others included, in particular, **the apartment displays**, as it allows one to **save** on living costs

"I'd prefer to pay a little bit more for higher-quality construction, as living becomes cheaper that way." Male, around 50.

"It's good that energy-efficiency has been taken into consideration using construction, with the added bonus of nice floor designs." Male, around 27.

"Maybe we should think about our way of life these days, which we are doing, and regulations have been made stricter." Male, around 50.

WHY WOULD I RECOMMEND LIVING IN ADJUTANTTI?

Possible cost savings. Whether the solar panels, for example, will ultimately produce costs savings, might not be seen until sometime in the future.

The building is future-proof and feels good with its structures and special features.

Because the eco-issues will likely increase the apartment's value in the future.

The eco-solutions are so functional. The simple nature of the technology and its ease of use. Details of modern living.

It is good to set an example, if you have the chance. A good solution from the perspective of the national economy as well.

I would recommend it because I would like to emphasise that it is possible to live comfortably while still saving energy.

The building has been constructed well. The possibility of monitoring your heat and electricity consumption teaches you to reduce unnecessary consumption. The electric car is a nice addition to living comfort.

The solar panels and the lift are an excellent example of how you can save energy in apartment buildings as well with the correct solutions. The room-specific displays are excellent, and the home/away switch helps you save energy in your everyday life. We are very pleased with the building with regard to the energy solutions.

CLEEN

Cluster for Energy and Environment



sgem

Smart Grids and Energy Markets

Thank you!