

# APPENDIX

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MSc Design for Interaction  
Master thesis report

Delft University of Technology  
Faculty of Industrial Design Engineering  
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## Surevy Questions

Do you have a smart meter at home?

Do you track your energy use? (For example: track your energy consumption at home and its costs)

Which energy provider are you using at home? (Please mention the name of the company)

Do you use an application or some form of display/dashboard/device to monitor your use?

If yes, what do you use to monitor your energy consumption and what information does it provide you? Please provide a short description.

How would you rank these goals based on your energy behavior ie. What factors are most important to you? (1 - highest priority , 5 - least priority)

Being comfortable (1-5)

Being sustainable (1-5)

Saving money (1-5)

Being privacy conscious (1-5)

Other (1-5)

If you ranked "Other" please mention the goal you had in mind. Type "none" if you don't have any.

Were there goals that you felt were equally important to you? (eg : I would give Being comfortable and Saving money the same ranking)

Contact information

## User interview questions

Would you like to share a little about your experience with the energy company?

What do you find most interesting about your energy bills? How often do you look at them?

What information do you think is valuable for you to have?

What recommendations do they currently give to help you become more sustainable?

what sort of an image or impression do you get from Vattenfall as a company? and are there some expectations that you have about those?

When you install or opt for an energy provider, do you have certain intentions associated with it?

What do you think is then the intention of the company when they interact with you?

Your first priority is saving money and then sustainability? So could you tell me a little about what saving money means to you? and what does being sustainable means to you?

What do you think about hyper-personalised recommendations for promoting sustainable behavior?

## User Interviews

(P1) - 40 years old

Family - 3 people - wife, child(8), himself

Type of house - Apartment(3 room)

Energy provider : Vattenfall

Profession : UX designer

Energy bill : about 80 euros/month

Survey responses - 1. Saving money=Being sustainable 2. Being comfortable 3. Being privacy conscious

P1 actively involves himself and his family in monitoring his energy use. He looks at his consumption overview ie. monthly bill and document provided by Vattenfall and participates in discussions with his wife and kid about their energy use. He finds the document provided by Vattenfall interesting as it provides comparisons, overviews and trends. Most recommendations and tips to save energy are provided to him through a newsletter . However, he rarely reads them and some of the tips are too obvious and not very relevant. Their family doesn't have a specific goal or intention when it comes to energy use although in general they consider themselves energy conscious/saving. They believe they have a small set up and already do everything they can to save as much energy as possible. From their perspective, they see Vattenfall as a company trying to fight climate change and trying to educate people about energy consumption.

"I think I already do enough to save as much energy as possible"

"My dream is to live in a tiny house with it's own grid and solar panels"

(P2)

57 years old, divorced, living alone, spend time with girlfriend in weekends

Family - 4 people - wife, 2 kids, lives by himself

Type of house - 2 floor apartment one of the canal houses, living room, open kitchen 3 bedroom

Energy provider : Energiedirect

Profession : Entrepreneur

Energy bill : about 180 euros/month(big bill from electric floor heating and

Survey responses - 1. Being comfortable 2. Being sustainable 3.Saving money 4.Being privacy conscious

P2 has had a couple of bad experiences paying very high additional dues at the end of the year from leaving his electrical floor and bathroom floor heating on . Since then he has become more careful about his energy use. He wants a lot of real time information on his actual usage. His energy provider only provides a monthly report with a basic total amount and comparisons and he still feels he has no idea what is driving it. He feels disappointed that the company's proposition of saving costs does not match the reality as much. Since he owns multiple apartments, tracking the usage is difficult with one application and he is forced to take different providers for each. He felt the company's intention was to provide efficiency linked to a low price point supported by digital technologies and automation. For him, comfort is being able to put on his floor heating without a worry, and he has ambitions to become sustainable by installing solar panels, however he hasn't found the most efficient way to do it.

"I would like to see my actual usage, my actual data, why am I not charged on the actuals? Why give me a surprise at the end of the year?"

(P3)

34 years old , Family - 3 people - wife, 1 baby (8 month)

Type of house - an average house 2 neighbors , quite large , 5 bedrooms, a garage , a bathroom and living room

Energy provider : Budgetenergie

Profession : coordinating advisor in the government

Energy bill : about 170/month

yes smart meter

Survey responses - 1. Being comfortable = Saving money 2. Being sustainable 3. Being privacy conscious

P3 believes they have an average electricity use but spends a lot on gas because of heating. Since he has an old house built in 1968, isolation is not ideal and they are still in the process of fixing this. He often switches between energy companies to get the best prices. For example, he switched from Vattenfall to Budget Energie a year back because it felt like overtime he ends up paying more when he stays with a company for too long. So he intends to switch providers in a couple of years again. He analyzes his energy consumption with an excel sheet comparing every month's data. He does not take any significant steps to reduce his energy although expects his smart thermostat to manage his heating expenses. He is into smart and connected devices and would like to have a clear overview of variable prices so that he can program his washing machine. He feels the recommendations and tips provided are quite generic. He sees his energy provider(Budget Energie) as a company that focuses on providing cheap electricity at low tariffs, their products and services are quite clear. He also expects shared technologies to be developed for residential heating.

"We cook on electricity so it's important we have a very reliable supplier, also with heating when it's cold, my priority is that it works especially with a baby, comfort becomes very important."

(P4) - 38 years old

Family - 2 people - wife

Type of house - own house , two houses combined front house back house really old - 1800 something big - living room, basement, 3 bedrooms, kitchen bathroom, small- living room, 2 bedrooms , bathroom, kitchen, big garden with the shed with power tools (consumes quite a bit of energy)

Energy provider : Eneco (previous vattenfall)

Profession : COO

Energy bill : about 150 bigger house 100 smaller house

yes smart meter no smart thermostat

Survey responses - 1. Being comfortable 2. Being sustainable 3. Saving money 4. Being privacy conscious

P4 lives in a combined house (2 houses joined together) built in the 1800s and requires that he be able to monitor the energy use in both houses which is currently not supported by their energy provider. He feels there are a lot of factors to optimize in this house because his energy bill is high. He believes in investing in better appliances/systems to make things more future proof. For instance, he changed to a more efficient heating system which cost about 2500 Euros. He finds monthly, yearly comparison data of his energy use interesting. He has the Eneco app but only uses it when he is sent his monthly energy report. He likes that the app is more interactive and gives information for e.g. about what appliances are on standby. Although he feels that recommendations are rather broad/generic, limiting and more focused on selling new services. He doesn't like the idea of installing solar panels as it affects the aesthetics of the house and would rather pay for it to be installed and maintained remotely. His goal is to strike a balance between comfort and saving money accompanied by not wasting energy in unwanted use that could affect the environment. As for comfort, reliability is his biggest need and he wouldn't mind paying a few extra euros per month if he knows his energy source is more sustainable.

" For me energy - it just needs to work, if it is cold then I should be able to turn on the heat and my wife likes using the sauna and I don't want to stop her."

(P5)

34 years old

Family - 3 people - wife, 1 4 yr old

Type of house - apartment 2BHK

Energy provider : BESCO (Indian)

Profession : Program manager

Energy bill : about 800/month- 9600 per year

No smart meter

Survey responses - 1. Being comfortable 2. Saving money 3. Being sustainable 4. Being privacy conscious

P5 monitors his energy bill every month, he tends to note his expenses carefully even more when he houses guests for a certain month. His comparison of usage is done primarily through his costs than through usage. For him comfort is the most important priority. He is aware of his excess use of air conditioner during the summers and instead compensates by reducing usage of other appliances. His energy consumption is informed through monthly bills and an app that usually provides updates about outages or power fluctuations. It is however not informative enough, they don't provide any recommendations or live readings. He is keen to understand his everyday usage so that he can understand what went right or wrong. He believes the company wants to provide uninterrupted power supply but often issues happen with peak loads during summers. He wants to have solar panels but the incentives are not too high at the moment since the provider does not

pay enough. His foremost priority is comfort, but he would like to save money as much as possible by being informed through data.

"I should be able to use whatever I use whenever I want to use it"

(P6)

23 years old

Family - live with gf in a house

Type of house - 100 sq meter living room kitchen connected, 3 bedrooms, a toilet and bathroom

Energy provider : Eneco yearly contract will switch to another one cause they have a better offer - Vandebron  
- they give energy from local resources wind and solar

Profession : student - bachelors electrical - masters embedded systems TUD

Energy bill : we pay the same amount every month - 110 euros ,

Survey responses - Being comfortable Saving money= being sustainable= almost same ranking Being privacy conscious

P6 is a data enthusiast when it comes to his energy information and likes to know the detailed information about his energy consumption. He uses the Eneco app currently to track his consumption and his happy that the smart meter is read often so he knows he get accurate data. Monitoring his consumption gives him a bit of context on their everyday activities, for instance it helps him understand if his energy consumption is still high when he is not home or is asleep. He takes simple steps like switching bulbs and buying appliances with high efficiency besides that he thinks energy is just something you use. However, he recently installed solar panels in the house that he lives in with his girlfriend and his excited about generating his own power. He feels that the intention of a company is to just stay in business and believes that smaller companies tend to have more idealistic views towards energy. Hence he soon plans to move from Eneco to Vandebron to ensure that all his power is generated through renewables. He wants to be sustainable but not at the cost of comfort as that can quickly reduce his motivation to remain sustainable. He is also not that concerned about privacy as he has a good understanding of how the smart meters work.

"i think the consumer has to choose by picking the right provider if they want to make an impact."

## Expert interview questions

Give intro over the project - mention multi-intentionality data driven systems - mention simplicity

What do you think being sustainable is - from a user perspective - what does it mean to be sustainable?

From an algorithmic perspective what is the level of understanding that you can learn about user behavior? By monitoring their power use? eg the smart meter

What are the most common activities that account for this waste? eg i know using a dishwasher with 3 plates or leaving light bulbs on.. - how do you detect specific activities as wastage as opposed to some not?

Is every optimisation and recommendation sent to a household explainable? or are there some. Sometimes in predictive algorithms you don't necessarily know why or how it predicted a certain result? Is there some way we

What the main parameters that decide this? like what parameters go into the algorithm and what aspects are generally optimised? So sort of like end - end of whats data is tracked and what goes out ? Data flow..

How are you currently incorporating human behavior and more social aspects of human behavior?

What information do you think an algorithm could actually learn from a user to influence the algorithm or change the way it behaves?

How would you describe the intention of an algorithm for an ai powered energy system? and for instance if you could say it has certain values or human like qualities would you be able to give any?

How do you think more human elements like values and intentions can be captured in algorithms? How do you think it could be incorporated into energy systems? and what sort of data would you be interested in collecting to make your system behave better?

Do you think it'll create some form of overhead for the system?

also , there are a lot of groups that are anti-smart meter( also because from research you can actually learn about what people do throughout the day) , how do you think we could improve that? What paramets do you think we can optimise ?

What would the future of a company look like when you everybody is producing their own energy?

If you had speculate on a future smart energy home(lets say 10-20 years from now) with people participating .. what would you think it would look like? What would this participation look like?

What would be the most compelling thing that also encourages people to become more energy conscious?

Iteration 1

User interviews



40 years old  
Family - 3 people - wife, child(8), himself  
Type of house - Apartment(3 room)  
Energy provider : Vattenfall  
Profession : UX designer  
Energy bill : about 80 euros/month

Priorities

Saving money =  
Being sustainable  
Comfort  
Being privacy conscious

Energy activity

Looks at consumption overview - discusses at home - with kid and wife  
compare with previous period- finds the overview very interesting - email pdf  
eg 20% more gas than before  
Shows comparison against 3 people or 1 household etc also comparison of your current consumption with previous year same month.  
No disaggregations  
Recommendations are done via the newsletter, they get all tips what we can do to save energy  
he usually doesnt read those  
some of the tips are very obvious  
and not very relevant  
Goals/intentions : we had no specific goal but we are energy conscious and energy saving/consumption conscious.

Dont set goals but not consciously

Try to avoid spending too much based on the bills  
If there were goals it would be money wise to save. if it is a substantial amount  
Believes they have a small set up and they already do enough to save.

Goal of the company : thinks they are fighting climate change from their PR,  
i know they want to educate people about energy consumption.

Dreams to live in a tiny house with their own grid and solar panels

He would be interested in hyper-personalized

ret

User interviews



34 years old  
Family - 3 people - wife, 1 4 yr old  
Type of house - apartment 2BHK  
Energy provider : BESCOM  
Profession : Program manager  
Energy bill : about 800/month- 9600 per year  
No smart meter

Priorities

Comfort  
Saving money  
Being sustainable  
Being privacy conscious

Here, you have to confirm all electrical requirements while building the house and BESCOM just provides, they connect you to the grid and a meter measuring the energy.  
Starting to create facilities to give back to the grid you can give back some of the power and get paid currently very low pay. the power is designed for local consumption and you lose so much energy in transmitting it back

And also there is so much administrative effort in getting back the money, so it doesn't work as an incentive there  
Renewable energy for now is only partially supporting, the high energy appliances are still connected to the grid

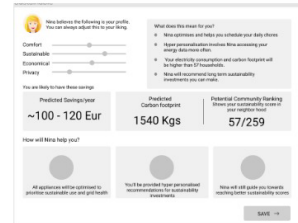
Every month I look at my energy bill. if there are additional guests then we tend to be more careful.  
We have slabs, so we look at how many units we can use for the month..0-100 units there is a price, 100-200 units is another

we compare in terms of money spent but not usage per say Comfort is most priority. we know we will use the ac during summers often and so we try to reduce usage of other things like water heaters or tv (maybe)  
BESCOM - monthly bills, when there is an outage, they contact us or inform on the newspaper  
they used to have an app - inform them during outage or power fluctuations or if a street light is on.. they immediately resolve the issue within 2 hrs

Doesnt understand what help here means  
Columns are ambiguous/ assumes 1, 2, 3, 4, 5, 6  
A lot of thinking and reading  
Would want to just click and go next

Not use "hyper-personalised"  
Not use "hyper-personalised"  
Doesnt want to add his own statement

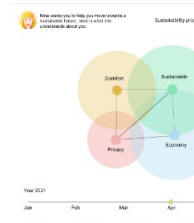
Priorities: 1. want to save as much energy as possible  
2. iam open to changing to help to contribute more  
Hyper-personalized statement feels redundant



Reference point for missing is missing  
Start-middle-end  
What does "help" mean for user?  
The numbers are clear  
Community setting is not clear, not all sustainability of people

Understands the category of what area is helping  
Understands that the category of what area is helping

Understands that the category of what area is helping



too vague  
need more specific words eg economy  
Wouldnt understand "helped" from this  
The line are not clear

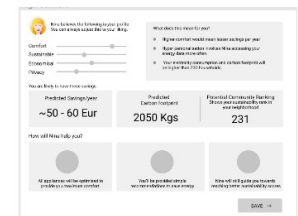
be doesnt worry about the energy bills

Prioritize comfort  
I am open to changing habits  
looks like I can have 2 priorities at the same time

Want to save as much as possible  
Hyperpersonalized recommendations

Want to contribute more to sustainable causes

Wont use  
I have already implemented I wouldnt mind some discomfort  
Data



Want to know how much iam contributing and how can i do.  
I wouldnt mind spending a bit more if that is more sustainable  
I understand what I need to do

Wouldnt mind spending a bit more if that is more sustainable  
I understand what I need to do

Wouldnt mind spending a bit more if that is more sustainable  
I understand what I need to do



be doesnt worry about the energy bills

be doesnt worry about the energy bills

be doesnt worry about the energy bills

not informative enough - no live readings or suggestions or the products they have .. acts as a basic complaint forum  
Interested to see every day usage, how much i am using what i did, what we did right/wrong so we can adjust to that.  
maybe other products that they are offering.  
people think solar power is expensive so if we know people in the neighborhood is doing it then people can learn from each other  
telecom companies already do something like this - who has the bandwidth highest, where it is coming from etc..

Intention - thought process behind app was uninterrupted power supply mainly because there are peak loads during summer and sometimes they shut down during these times.  
I dont see Eb taking any measures apart from trying more power from neighboring states.

Comfort - i should be able to use whatever i want to use whenever i want to use it  
Saving money - if i knew what i was consuming, would be helpful if i know there is a spike in daily consumption so i can take measures from my side to have more savings. eg you have consumed 50 % of your first slab limit. so we are informed.  
pr even compare to previous months.hyper personalisation - right now its very basic people dont care so if it is more people are more aware about how power is generated and what is the source  
or are more conscious about energy saving devices promoting sustainable and energy saving devices - then probably hyperpersonalisation will be effective





**Sustainable**

Nina tries to understand your values and goals related to sustainability based on your preferences and behavior. She gives you tailored recommendations to save energy and provide services so that you don't have to have to worry about your energy bills.

Your initial priorities

- I want to contribute more to sustainability causes.
- I am open to changing my habits to be more sustainable.
- I wouldn't mind some discomfort if it means saving on my energy bills.

Nina's understanding of your values

Past behaviors

Past behaviors	Nina's Recommendations
Electric vehicle charged from 18:00 - 23:30 Energy consumption: Very High Costs: -18.6€	Proposed EV charging time: 22:00 - 6:00 Date: 03.04.2020 <input checked="" type="checkbox"/> Accepted
Washing machine used from 9:00 - 10:00 Energy consumption: Very High Costs: -0.79€	Proposed laundry time: 12:00 - 1:00 Date: 03.04.2020 <input type="checkbox"/> Rejected

**What is very light?**

**Cost is clear**

**Find time and cost daily cost!**

**Nina needs to take into account the new column**

**Nina needs to take into account the new column**

**If you change your habits, you can save money on your energy bills.**

**Did the recommendation and cost of the new behavior?**

**Cost of this energy bill is... how much more expensive?**

**Try to simplify and make it as clear as possible - the values**

**probably not as clear as possible**

Your grid's health is low

Nina has negotiated to start doing your laundry at 20:05 today.

Save more: 2,5 Eur

25 others in your neighborhood have agreed to this

Agree No, do it now

See how the negotiation happened

What does healthy grid mean?

5 Apr - Internal budget of 20 KW per day

Connecting to WM - 77%

Connecting to Fridge - 193%

Reporting 30°C. Drawing 250 Watts from 12:00 - 13:00

Priority: Cooling Food freshness Risk: ■ ■ ■

Ana's Scheduled laundry 12: 00 - 13:00

Connecting Calendar - 167%

Reporting Ana's party from 18:00

Expected priority conflict

Prior behavior: High food quality

Ideal time - laundry activity - 20:05 - 23:00

Sending proposal to Ana

Needs to be more concrete

Not very intuitive

Does not understand it

Recognizes this is system information and log

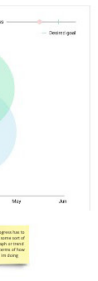
Connects idea to not letting it be more concrete

Nina should possibly appreciate me

General

Be clear to... the first... where... Be very concrete

miro



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Your initial priorities

- I want to contribute more to sustainability causes.
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Nina's understanding of your values

Past behaviors

Past behaviors	Nina's Recommendations
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Washing machine used from 9:00 - 10:00 Energy consumption: Very High Costs: -0.79€	Proposed laundry time: 12:00 - 1:00 Date: 03.04.2020 <input type="checkbox"/> Rejected

**Make the values feel good**

**Why would I get to add values?**

**Time of the logs is missing**

**Agree want to be able to change these recommendations**

**this is very useful**

**25 others have already agreed to this time**

**25 others have already agreed to this time**

**25 others have already agreed to this time**

Your grid's health is low

Nina has negotiated to start doing your laundry at 20:05 today.

Save more: 2,5 Eur

25 others in your neighborhood have agreed to this

Agree No, do it now

See how the negotiation happened

5 Apr - Internal budget of 20 KW per day

Connecting to WM - 77%

Connecting to Fridge - 193%

Reporting 30°C. Drawing 250 Watts from 12:00 - 13:00

Priority: Cooling Food freshness Risk: ■ ■ ■

Ana's Scheduled laundry 12: 00 - 13:00

Connecting Calendar - 167%

Reporting Ana's party from 18:00

Expected priority conflict

Prior behavior: High food quality

Ideal time - laundry activity - 20:05 - 23:00

Sending proposal to Ana

what is the risk based on this? No, doesn't see a conflict... when does this kind of decision get to you? who else can set this precedence

General

once I get my report from Nina... who else can set this precedence... who else can set this precedence

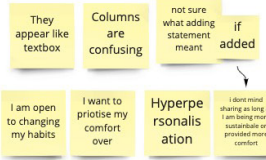
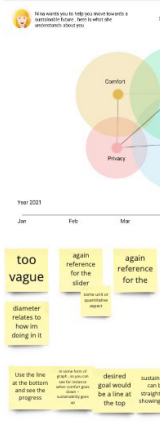
miro

## User interviews

23 years old  
student housing - 2  
Type of house - shared  
Energy provider : Duwo  
Profession : Student

### Priorities

Being comfortable  
Saving money  
Being sustainable  
Privacy

## User interviews

57 years old, divorced, living alone, spend time with girlfriend in weekends, Family - 4 people - wife, 2 kids, lives by himself  
Type of house - 2 floor apartment one of the canal houses, living room, open kitchen 3 bedroom  
Energy provider : Energiedirect  
Profession : Entrepreneur  
Energy bill : about 180 euros/month (big bill from electric floor heating and

**Priorities**  
Comfort  
Being sustainable

Being privacy conscious

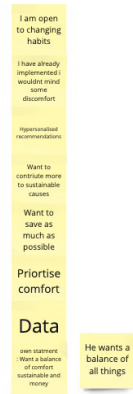
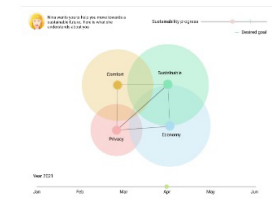
**Energy activity**  
Has often ended up paying a huge amount at the end of the year because of over use - (about 800-900 euros) from leaving the electric floor heating and bathroom floor heating on  
Wants information real time on what to do , not clear about actual usage  
energy direct has an app that - reports monthly, but only get a basic total amount used and still don't understand what's driving it  
Disappointed with company because their proposition is about saving costs and the reality doesn't match - had to pay huge penalties  
Has smart meter - Wonders why the usage is not made clear  
Had bad experience with customer experience trying to gain explanation for the high bills  
Reads emails - monthly usage of gas and electricity comparison of what your consumption vs other families  
APP - have two apartments app only works on one account and so difficult to know what its reporting on  
thinking of moving to another provider so he can get two different accounts for each house, you can use a monthly, give forecast of getting 525 euros back,

What it shows - monthly amount - day they deduct from account - 2100 euros from here , below that they split out what the costs are.. I would instead like to see my actual usage, want to see actual data,  
Why am not charge on the actuals and not a fixed amount and give me a surprise at the end of the year?  
Real time information is useful for me

They don't give you any recommendations

Intentions - price was important , liked their proposition and products like green energy, in the end their cost was still a bit high, so I went with the price point

Intention of company - Efficiency - linked to a lower price point - they claim they are direct and more digital, not too much promotion, use big data and automation and was hoping for that

**Comfort**  
Like the floor heating - being able to have the comfort you need  
**Sustainable** - is an ambition - thinking about solar panels, haven't done yet cause haven't found an efficient way to do it so low on priority now  
**Hyperpersonalisation** - very useful for me, make it easy for me, solutions and advice really tailored to my situation will be useful



**Sustainable**

Nina tries to understand your values and goals related to sustainability based on your preferences and behavior. She gives you tailored recommendations to save energy and provide services so that you don't have to have to worry about your energy bills.

Your initial priorities:

- I want to contribute more to sustainable choices.
- I am open to changing my habits to be more sustainable.
- I wouldn't mind some discomfort if it means saving on my energy bills.

Nina's understanding of your values:

Pro-ecological behavior, Altruism, Community, Competence

Previous recommendations logs:

Past behaviors	Nina's Recommendations
Electric vehicle charged from 18:00 - 20:00 Energy consumption: Very High Costs: 15 Eur	Proposed EV charging time: 22:00 - 0:00 Date: 03.04.2020 Accepted
Washing machine used from 9:00 - 10:00 Energy consumption: Very High Costs: 0.70 Eur	Proposed laundry time: 12:00 - 1:00 Date: 03.04.2020 Rejected

Too wordy, Competence feels creepy, I don't want to understand what you know about my values, I don't like recommendations, Changes proposed change also on the recommendation, We're allowed to integrate recommendations for saving energy and on the other hand, I don't like recommendations, Linear inequalities.

Time: 11:30

Your grid's health is low  
Nina has negotiated to start doing your laundry at 20:05 today.

Save more :2.5 Eur  
25 others in your neighborhood have agreed to this

Agree No, do it now

See how the negotiation happened

In kW "k" is small  
Time for each bar  
Looks like neighbors know your party

5 Apr - Internal budget of 20 KW per day

Connecting to WM - 77

Connecting to Fridge - 193

Reporting 30°C, Drawing 250 Watts from 12:00 - 13:00

Priority: Cooling Food freshness Risk: [Progress bar]

Aran's Scheduled laundry 12:00 - 13:00

Connecting Calendar - 167

Reporting Aran's party from 18:00

Expected priority conflict

Prior behavior: High food quantity

Ideal time - laundry activity - 20:05 - 23:00

Sending proposal to Aran

Looks like a "chat" - a sequence of events kind of like a log  
Risk is ambiguous  
Conflict is not clear  
I see the decision making process of it

General

Starts feel like it's too much information, but it's handy  
The pattern and energy and could be more useful  
The data seems to be a bit more complex than what I need  
The pattern and energy and could be more useful  
I don't have a reason to not feel, nothing too personal  
I feel have no reason by fear, no harm done

miro

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Previous recommendations logs:

Past behaviors	Nina's Recommendations
Electric vehicle charged from 18:00 - 20:00 Energy consumption: Very High Costs: 15 Eur	Proposed EV charging time: 22:00 - 0:00 Date: 03.04.2020 Accepted
Washing machine used from 9:00 - 10:00 Energy consumption: Very High Costs: 0.70 Eur	Proposed laundry time: 12:00 - 1:00 Date: 03.04.2020 Rejected

Things feel subjective and about change for the energy market  
Feels like a bit of information, which might be a bit personal  
I don't like recommendations, Changes proposed change also on the recommendation, We're allowed to integrate recommendations for saving energy and on the other hand, I don't like recommendations, Linear inequalities.

Time: 11:30

Your grid's health is low  
Nina has negotiated to start doing your laundry at 20:05 today.

Save more :2.5 Eur  
25 others in your neighborhood have agreed to this

Agree No, do it now

See how the negotiation happened

I like this, this is more what I want  
The world "health" is ambiguous  
Looks like how much you have paid for energy  
Don't want to look at negotiations

5 Apr - Internal budget of 20 KW per day

Connecting to WM - 77

Connecting to Fridge - 193

Reporting 30°C, Drawing 250 Watts from 12:00 - 13:00

Priority: Cooling Food freshness Risk: [Progress bar]

Aran's Scheduled laundry 12:00 - 13:00

Connecting Calendar - 167

Reporting Aran's party from 18:00

Expected priority conflict

Prior behavior: High food quantity

Ideal time - laundry activity - 20:05 - 23:00

Sending proposal to Aran

Looks like an energy grid management system  
I don't like recommendations, Changes proposed change also on the recommendation, We're allowed to integrate recommendations for saving energy and on the other hand, I don't like recommendations, Linear inequalities.

General

Not relevant, I don't like recommendations, Changes proposed change also on the recommendation, We're allowed to integrate recommendations for saving energy and on the other hand, I don't like recommendations, Linear inequalities.  
I don't like recommendations, Changes proposed change also on the recommendation, We're allowed to integrate recommendations for saving energy and on the other hand, I don't like recommendations, Linear inequalities.  
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I don't like recommendations, Changes proposed change also on the recommendation, We're allowed to integrate recommendations for saving energy and on the other hand, I don't like recommendations, Linear inequalities.

miro

34 years old  
 Family - 3 people - wife, 1 baby  
 Type of house - average house 2 neighbors, quite large, 5 bedrooms, a garage, a bathroom and living room  
 Energy provider : Budgetenergie  
 Profession : coordinating advisor in the government  
 Energy bill : about 170/month  
 yes smart meter

**Priorities**  
 Comfort  
 Saving money  
 Being sustainable  
 Being privacy conscious

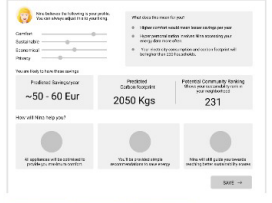
With respect to electricity we are quite average, but wrt gas we are quite high because of heating the house is from 1968, old isolation is not ideal , also quite large, 3 yrs ago we isolated the roof and that helped a bit still in the process of getting the best result switched to budget energie from vattenfall a year back, on comparison websites and thought they could save money and picked the cheapest.  
 Vattenfall - quite ok no problem, people are encouraged to switch energy companies here . So i shift between the cheapest  
 When you start with a company it feels like the cheapest but it often becomes more expensive overtime so i will probably shift again in a couple of years

Info - monthly email, with how much of gas and electricity, i started putting it into an excel file to get an oversight, vattenfall gave a nice graph from previous year, that doesnt work if you switch with the energy provider, because of that i started to keep track of it myself.  
 to see if isolating door or roof helps act on it? - not really, we have a smart thermostat , that helps to have a better schedule and can do remotely when travelling anticipate that we will pay different amounts because of different sources like energy and wind so i think it would have an impact on the price , so i would like to have a clear view of what the prices are so could use that to program your washing machine, right now its just average no dynamic pricing, there is day and night tariff , not sure if its for every provider  
 Recommendations - give tips on monthly bill, compare it to houses of same type and give a few tips ,eg switching off machines instead of using standby , quite generic  
 My expectations was that they would be cheap because they were called budget energie, i have used budget energie few years back as well, at that time they only did nuclear power.

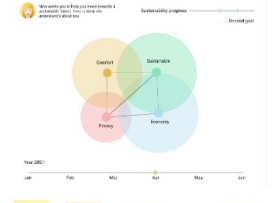
the rectangles are not clear  
 i wouldnt know what statement to add of my own  
 i am open to changing habits  
 want to contribute more to sustainable causes  
 fit existing schedules  
 hyperpersonal recommendations

The grid is independent here they dont take care of electricity comes to the house, they get green energy intention - i think their goal is just to give cheap electricity low tariffs and clear products

Comfort - for eg we cook on electricity so its important we have a very reliable supplier, also with heating when its cold for me priority is that it works espically with baby comfort becomes a priority.  
 Price is mostly because - we are on the high side and we are trying to see where we can win a little bit Sustainable - i think its important , doesnt like it that nuclea is called non-renewable hyper personalisation - we are trying a bit, i think most energy suppliers, every thing was green, looking at our house - electric heating would be too much work, heat pump would be too much effort, i dont see it happening  
 i soon expect to see some shared district heating or something like that for a residential region, a heat pump that doesnt use air but maybe water or something



i see it as a summary  
 i think its rather clear  
 she uses the initial practices to add me into a category  
 she used the initial practices to add me into a category



Feels a little bit vague  
 time is not clear  
 but looks different from what game flow  
 As the top can we set our desired goal?

**Sustainable**  
 How does it relate to your values?  
 How does it relate to your values?  
 How does it relate to your values?

User interviews



38 years old  
 Family - 2 people - wife  
 Type of house - own house, two houses combined front house back house really old - 1800 something big - living room, basement, 3 bedrooms, kitchen bathroom, small- living room, 2 bedrooms , bathroom, kitchen, big garden with shed with power tools (consumes quite a bit of energy)  
 Energy provider : Eneco (previous vattenfall)  
 Profession : COO Deus  
 Energy bill : about 150 bigger house 100 smaller house  
 yes smart meter no smart thermostat

**Priorities**  
 Comfort  
 Being sustainable  
 Saving money  
 Being privacy conscious

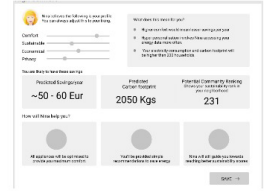
They do what they do as they say - everything works when i plug in . again problem with app does nt give overview of the two houses.  
 here loyalty doesnt seem to be benefit and its better to sometimes switch to other companies it was cheaper than Vattenfall and a bit balanced, and also the company seemed stable.

Energy bills- we combined houses so i try to look at the bill to see how thats working, and there are so many things to optimise, changed heating system recently to make more efficient (although quite expensive 2500 to get it installed ), but more future proof  
 whats interesting - the different graphs comparing with other months  
 he likes seeing previous years behavior app - he has it but uses only when i get the energy report, the app is more interactive than, like father used a lot of energy in the green house.  
 It also shows - devices that are on stand by - they say how much it is, but not what devices they are, would be nice to get hints on which these devices are eg you have been spending 25KW on sleeping devices

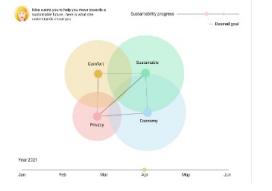
Recommendations - not really - tips are more generic and also more selling focused like do you like solar panels etc  
 Tips are broad and generic or too higher level - eg isolation or other things that i cant change.  
 solar panels would change the aesthetics of my house so find these tips limiting  
 Intention - it was striking a balance of wallet, saving environment and not wasting energy in unwanted things striking balance between comfort and paying for energy and what you dont use is not good for the environment company' intention - not sure

Comfort - it just needs to work, (reliability) , if it is cold then i should want to turn on the heat - my wife likes the sauna so i cannot stop her  
 Sustainability - how the energy was produced, dont mind paying a bit extra for that, i feel less guilty then for using a little extra power. im ok with paying 10-20 euros per month extra..if i can buy off my guilt solar panels - like the idea of self sustainable, but i dont like it on my house, like a big park where he can own few solar panels, easy for maintenance clean up etc. then i would consider why not

assumes 6 priorities  
 i wouldnt mind some discounts if it means saving  
 i dont mind data sharing  
 i am open to changing habits  
 Prioritise comfort  
 want to save as much as possible



sustainability should be almost equal as economy  
 the ranking to me - makes me feel a bit competitive  
 fun element  
 the money is very nice to see - it directly impacts me.  
 i dont know what it means  
 the second help tip is more useful  
 maybe i also want to compete with myself

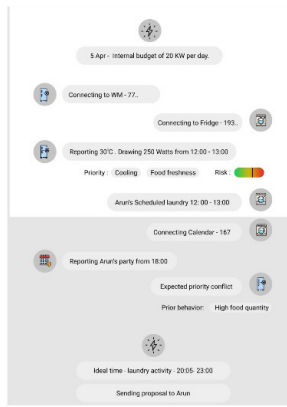


spun judge  
 doesnt tell me much  
 real numbers mean more to me then  
 for as this month is different from the other  
 maybe i also want to compete with myself

**Sustainable**  
 How does it relate to your values?  
 How does it relate to your values?  
 How does it relate to your values?



Not an actual...  
Do not...  
Get back on...  
Do like the...  
Sustainable resource



Something like this would be useful...  
I also see the fan in that...  
See it's...  
Understand the complete negotiation

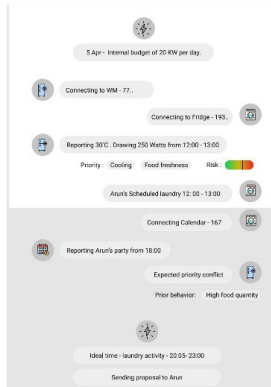
### General

Effort from an energy company...  
I think it's...  
I don't want to...  
I like it...  
I don't want to...  
I like it...  
I don't want to...  
I like it...

miro



Not an actual...  
Do not...  
Get back on...  
Do like the...  
Sustainable resource



did not want to...  
negotiation

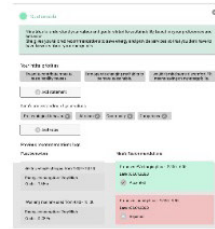
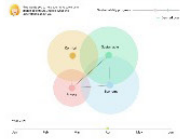
### General

Business need...  
Nice for Evs...  
I don't want to...  
I like it...  
I don't want to...  
I like it...  
I don't want to...  
I like it...

miro

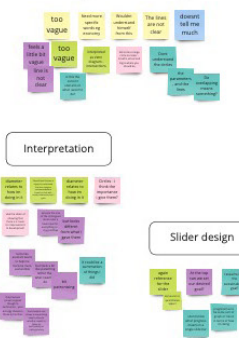
# Iteration 1 - Insights





Too abstract(nodes)

Timeline



Interpretation

Privacy

Expectation

Slider design



UI

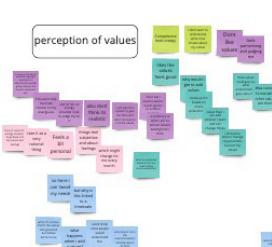
Interpretation

Feeling personal

perception of values

Expectation

Perception of recommendations



General

Transparency

Trust

Friendliness

Perception of intelligence

Having control

Expectation

perceived usefulness

intent

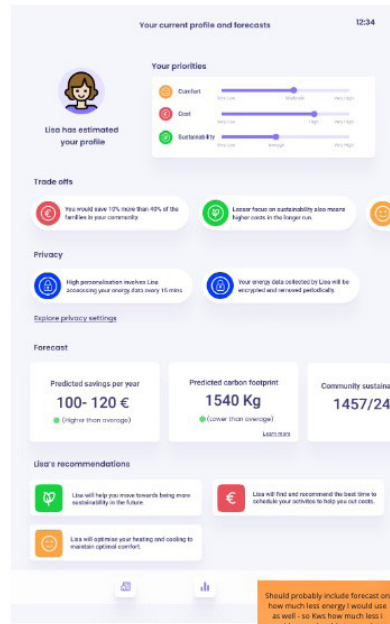
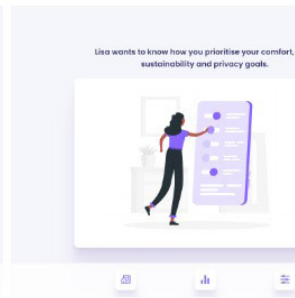
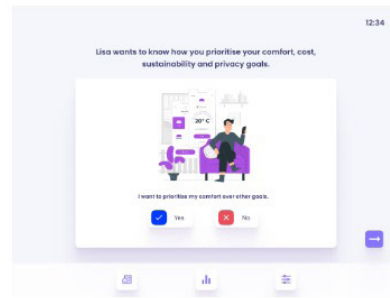
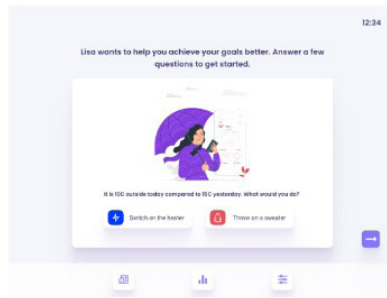
Expectation

Recognition of risk/conflict



# Iteration 2 - Insights

- Yujie
- Arun
- Chia-ling
- Anna



Should probably include forecast on how much less energy i would use as well. so that how much less i could use so be able to translate intentions into a number as well

## Tradeoffs



## Forecast



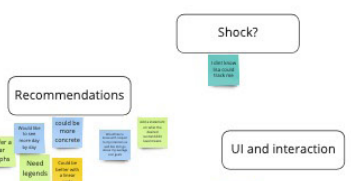
## Recommendations



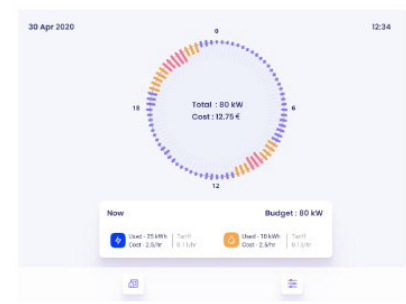
## UI and interaction



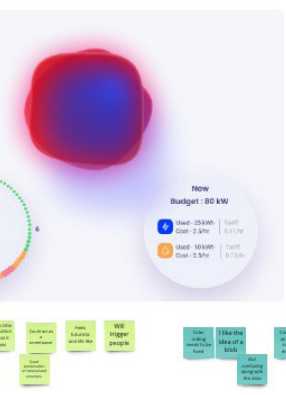
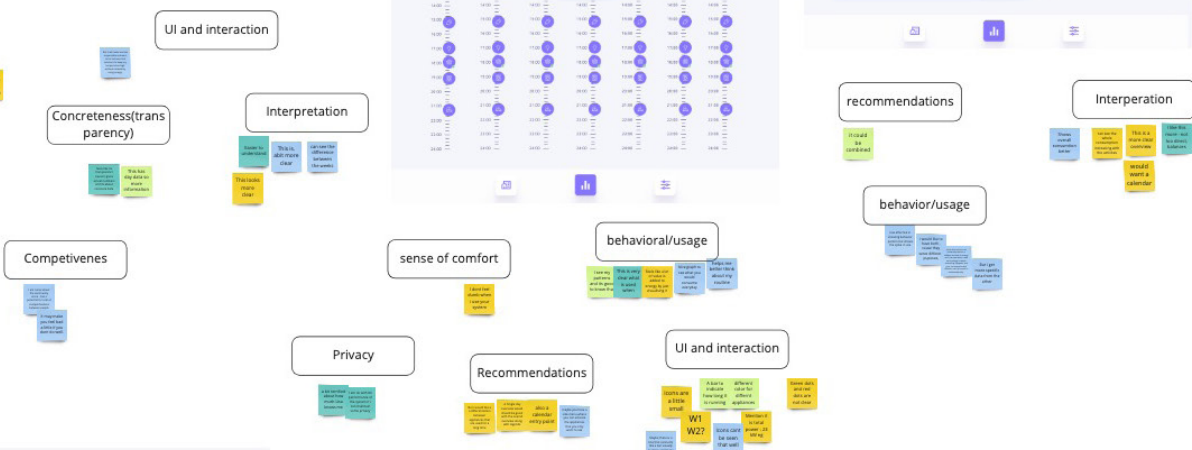
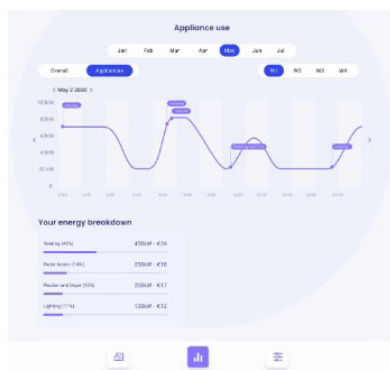
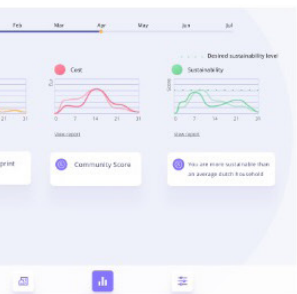
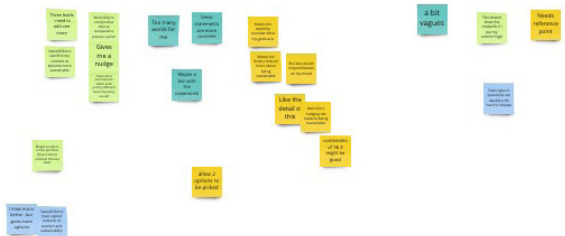
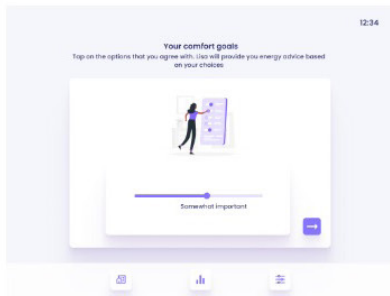
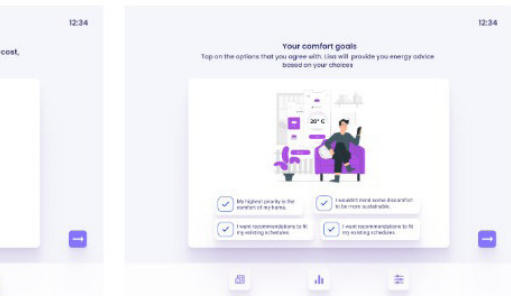
## Intention



## Dots







# Iteration 3



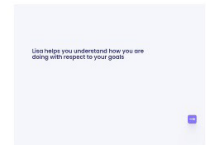
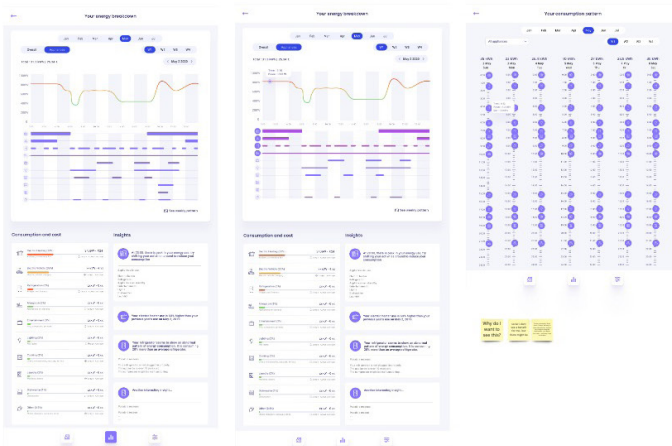
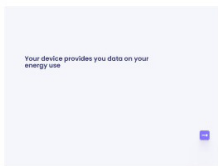
Use this to know how you would like to plan your comfort, cost, sustainability and privacy goals.

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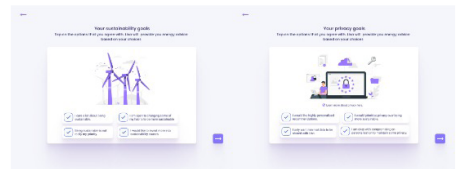
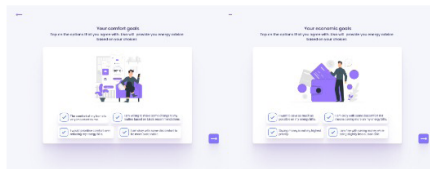
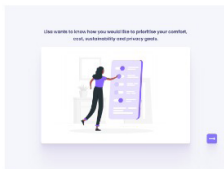
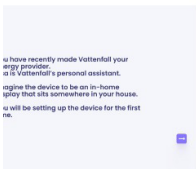
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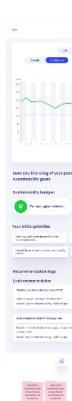
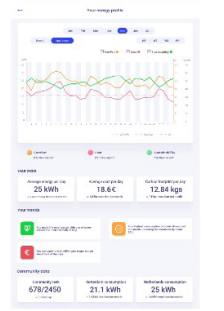
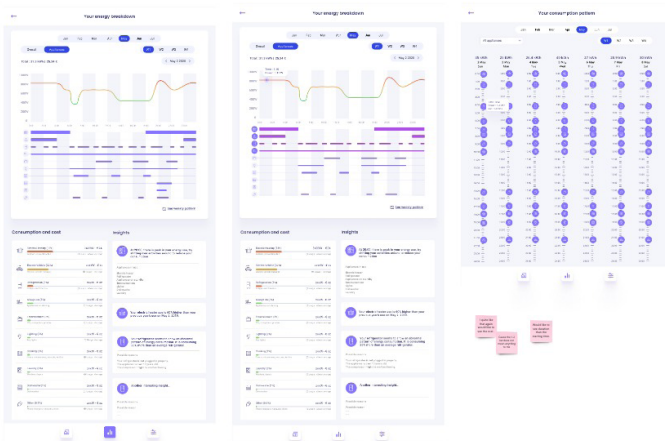
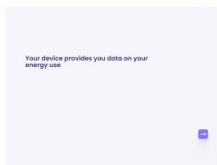
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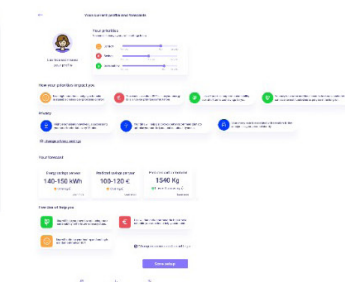
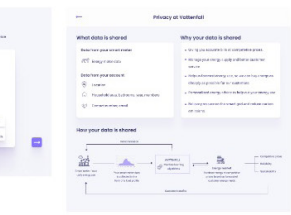
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General

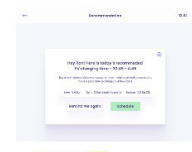
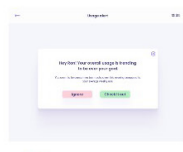
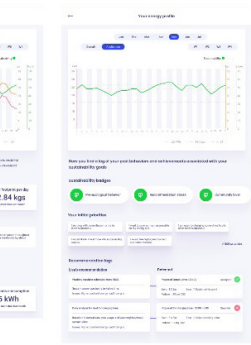
General



General



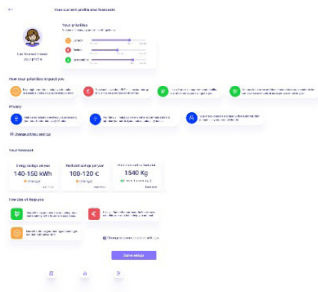
General



Survey



mic



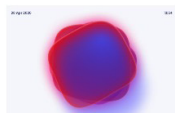
General



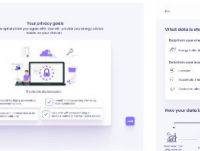
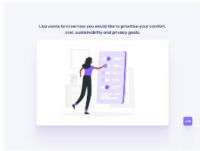
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Survey



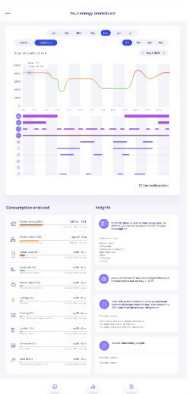
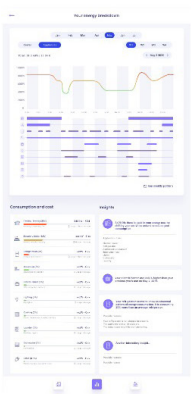
You have recently made Vattenfall your energy provider. Lisa is Vattenfall's personal assistant. Imagine the device to be an in-home display that sits somewhere in your house. You will be setting up the device for the first time.



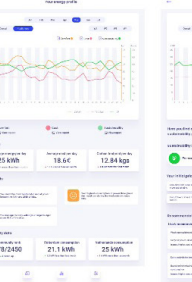
General



Your device provides you data on your energy use



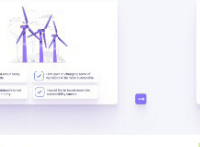
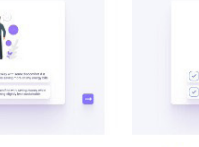
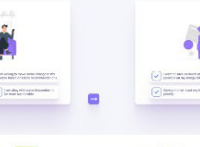
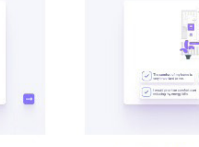
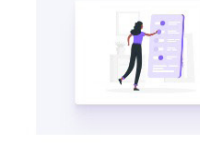
Use helps you understand how you are doing with respect to your goals



General



You have recently made Vattenfall your energy provider. Lisa is Vattenfall's personal assistant. Imagine the device to be an in-home display that sits somewhere in your house. You will be setting up the device for the first time.



47 years old  
 Family: 4 people: me and daughter  
 Type of house: Apartment(3 room)  
 Energy provider: Vattenfall  
 Profession: Project manager  
 Energy bill: They send an email every month and I read that, feels this is good enough. Concerned cause the numbers are going up cause they are staying/working at home because of corona.  
 Doesn't use an app, not been curious about it, I have tried the Nest smart thermostat, but its not too into technology so it does not work for me, I never used it.  
 Steps she takes: I am extra aware when to use washing machine for my clothes, in general I am an average user for the apartment I live in but with corona it is out of my hand

Use helps you understand how you are doing with respect to your goals

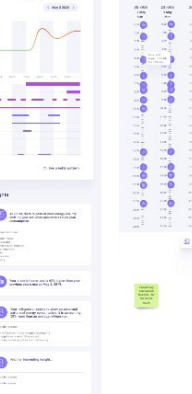
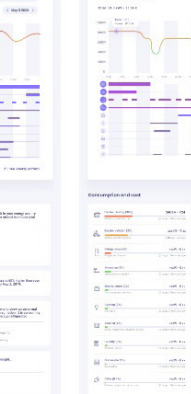
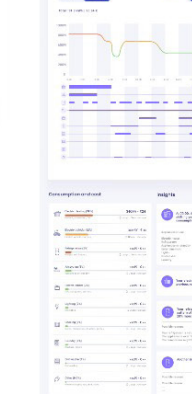
Use helps you understand how you are doing with respect to your goals

Use helps you understand how you are doing with respect to your goals

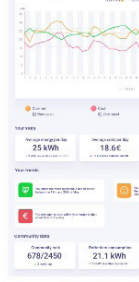
Use helps you understand how you are doing with respect to your goals

Use helps you understand how you are doing with respect to your goals

Your device provides you data on your energy use

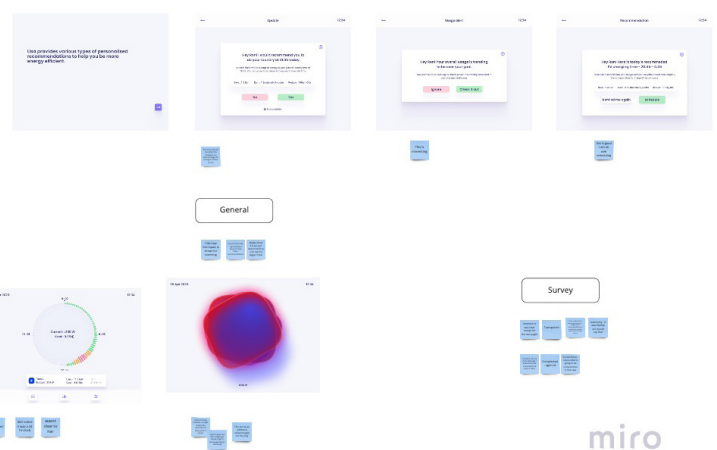
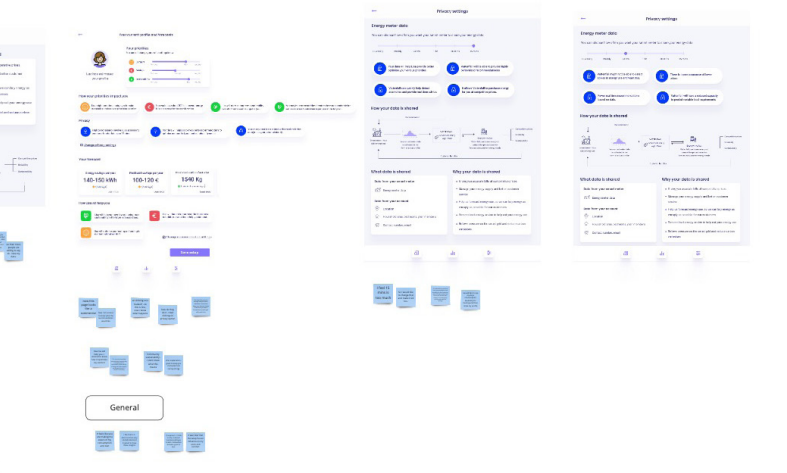


Use helps you understand how you are doing with respect to your goals

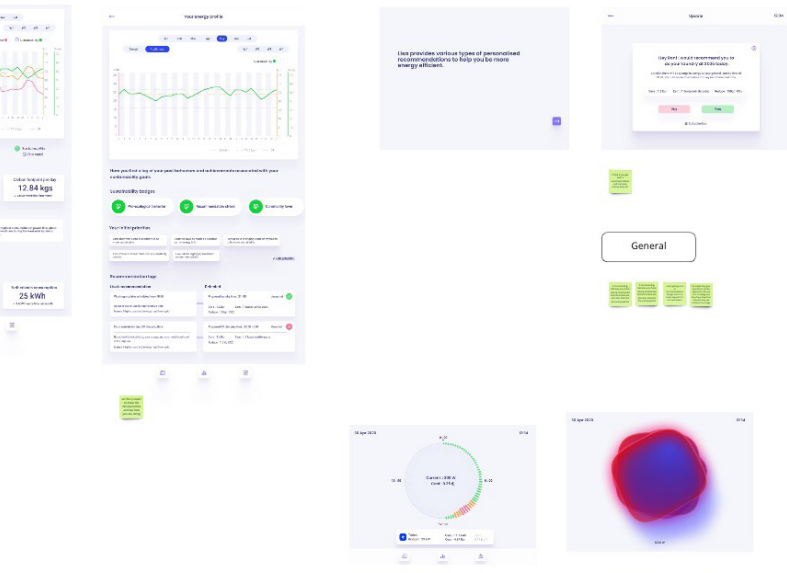
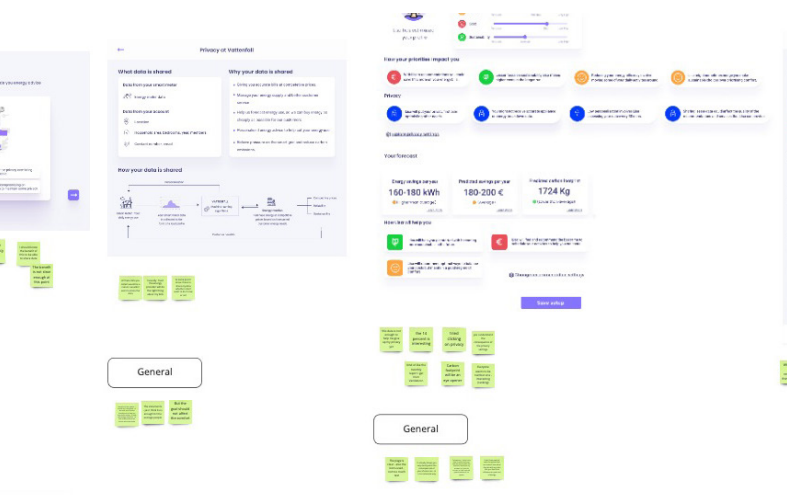


General





miro



23 years old  
Family - live with gf in a house  
Type of house - 100 sq meter living room kitchen connected, 3 bedrooms, a toilet and bathroom  
Energy provider - Eneco yearly contract will switch to another one cause they have a better offer - Vandebron - they give energy from local resources wind and solar

Profession - student - bachelors electrical - masters embedded systems TUD  
Energy bill - we pay the same amount every month - 110 euros

Finished installing solar panels recently  
In winter we consume a lot more and in the summer a lot less - on an average it comes down to 110 euros

Currently we are quite well on track, extension is quite  
we paid about 1200 for the whole year  
since we now have solar panels we are expected to half our expense

we might save 50-60 euros a month

things you like - simple basic stuff like switching bulbs, changing an old fridge, buy new electronics, i prefer to buy something with high efficiency rating. Besides that energy is just something you use.

His parents had solar panels 16 yrs back,  
now for you pocket and gives a nice feeling to generate your own electricity  
in the last few hrs - we generated more energy than we consumed yesterday

4 months ago - smart meter was installed.  
for me to see that they read the smart meter often - cause i can see what i consume clearly and for them they can use it to manage the grid.

we put a sensor over the analog meter previously to monitor use  
i am interested in this data, but my gf doesn't care so much about this, it gives me a bit of context.

It helps you think why am i consuming when nothing is active when i am sleeping for instance, so i can see standby devices -  
Planning to make a home project where i can connect an empty port and use that the actively monitor my use, so i can see how much i have generated  
and see when to for instance a great time to turn on laundry

right now there is no financial incentive. From 2023  
when we use energy we pay 20 cents and when we deliver it will 20 cents - but in the future it will be 10cents, so then you are motivated to consume it yourself.

intention of company stay in business, stay in business, have revenue and some view companies from a strategic viewpoint, like  
vandebron - energy from renewable resources  
energy use

i think the consumer has to choose by picking the right provider they want to make an impact  
i don't think the companies really care that much

Priorities - Being comfortable  
Saving money  
being sustainable - almost same ranking  
being privacy conscious

at home you want to be comfortable but your motivation to be sustainable quickly decreases when you are not comfortable  
money and sustainable be equal but for more money bit higher because you are not that easily motivated to be sustainable if you have to pay more  
you sometimes don't have luxury to pay more for the climate

sustainability is expensive price of solar panels and stuff is going down with government subsidies which is nice  
Privacy - as long as there are no microphones or camera i don't think its that big a deal, its not that special - not that concerned

List wants to know how you would like to profile your comfort, energy sustainability and energy goals



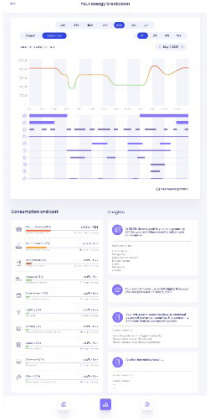
Your comfort goals  
How comfortable do you agree with your provider's energy goals?



Your energy goals  
How comfortable do you agree with your provider's energy goals?



Your sustainability goals  
How comfortable do you agree with your provider's energy goals?



List helps you understand how you are doing with respect to your goals

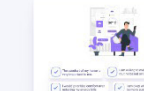
General

You have recently made Vattenfall your energy provider. Lisa is Vattenfall's personal assistant. Imagine the device to be on in-home display that sits somewhere in your house. You will be setting up the device for the first time.

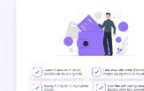
List wants to know how you would like to profile your comfort, energy sustainability and energy goals



Your comfort goals  
How comfortable do you agree with your provider's energy goals?



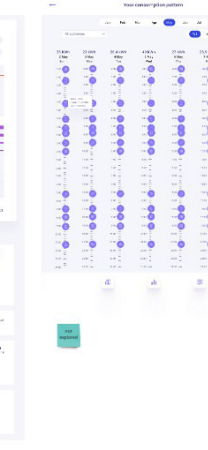
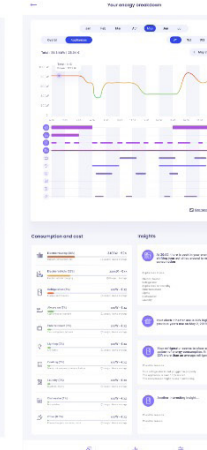
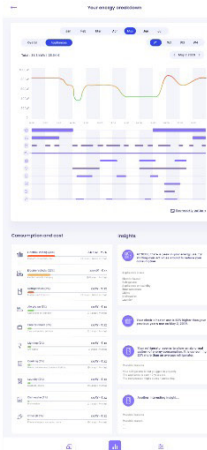
Your energy goals  
How comfortable do you agree with your provider's energy goals?



Your sustainability goals  
How comfortable do you agree with your provider's energy goals?



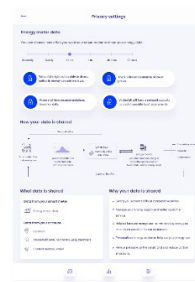
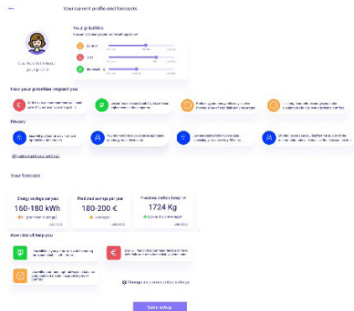
Your device provides you data on your energy use



List helps you understand how you are doing with respect to your goals

General

General

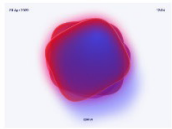


General

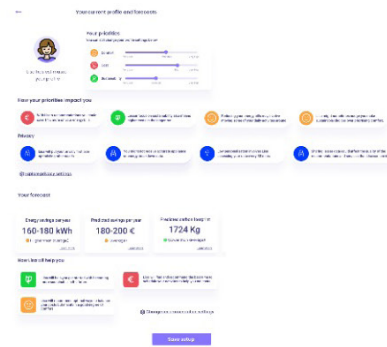
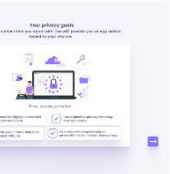
General



General

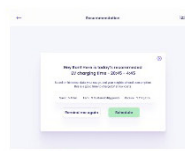
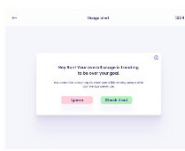


miro



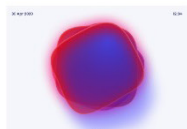
General

General



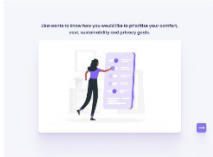
General

Survey



miro

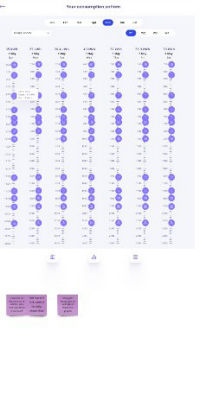
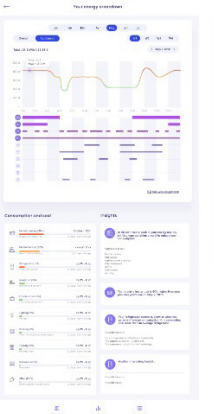
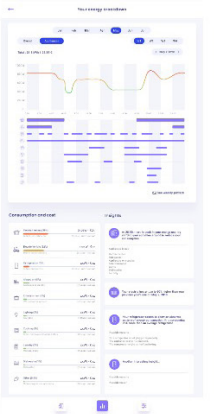
You have recently made Voltanfall your energy provider. Like a Voltanfall's personal assistant, imagine the device to be an in-home display that sits somewhere in your house. You will be setting up the device for the first time.



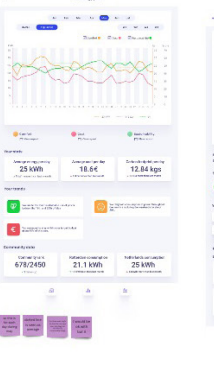
What does it show?  
How can you use it?  
How can you interact with it?  
How can you interact with it?

General

Your device provides you data on your energy use.



Use helps you understand how you are using with regard to your goals.



Energy usage overview

General

General



Privacy of Voltmeter

Why your data is shared

How your data is shared

Your benefits

How to help you

Energy settings

Energy control data

How your data is shared

Why your data is shared

Why your data is shared

General

Energy price

Energy price

Energy price

Energy price

Energy price

General

Survey

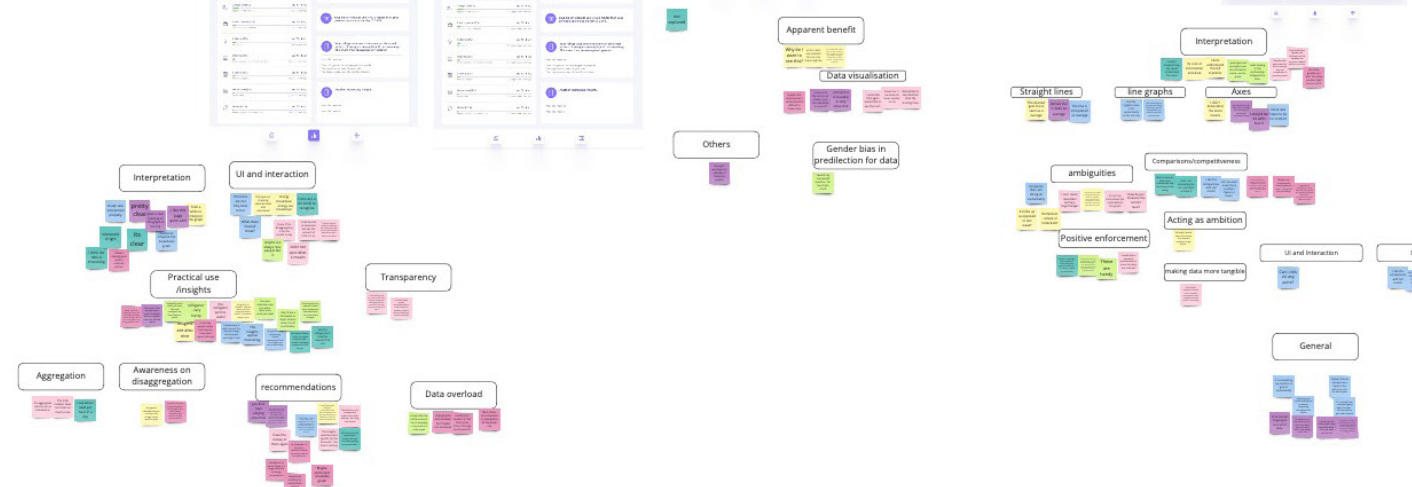
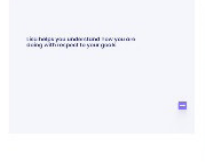
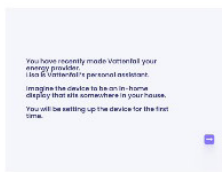
Energy price

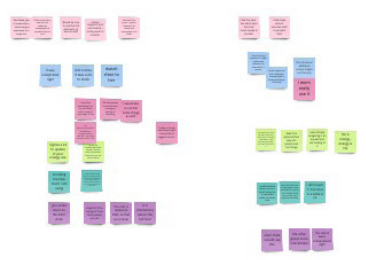
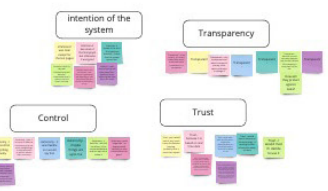
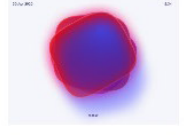
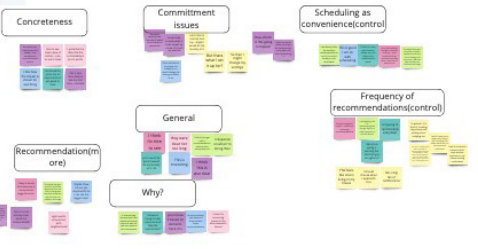
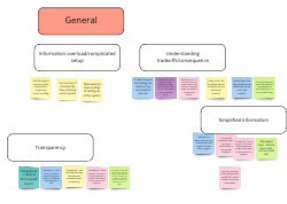
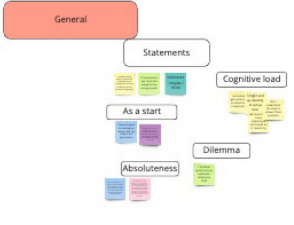
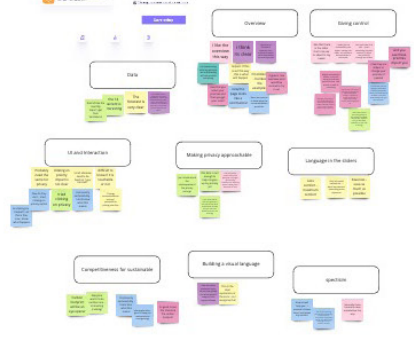
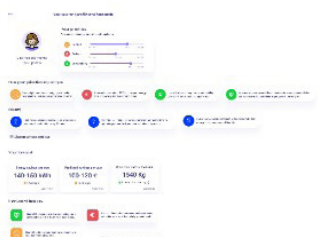
Energy price

Survey

miro

# Iteration 3 - insights





# IDE Master Graduation

## Project team, Procedural checks and personal Project brief

This document contains the agreements made between student and supervisory team about the student's IDE Master Graduation Project. This document can also include the involvement of an external organisation, however, it does not cover any legal employment relationship that the student and the client (might) agree upon. Next to that, this document facilitates the required procedural checks. In this document:

- The student defines the team, what he/she is going to do/deliver and how that will come about.
- SSC E&SA (Shared Service Center, Education & Student Affairs) reports on the student's registration and study progress.
- IDE's Board of Examiners confirms if the student is allowed to start the Graduation Project.

**! USE ADOBE ACROBAT READER TO OPEN, EDIT AND SAVE THIS DOCUMENT**

Download again and reopen in case you tried other software, such as Preview (Mac) or a webbrowser.

### STUDENT DATA & MASTER PROGRAMME

Save this form according the format "IDE Master Graduation Project Brief\_familyname\_firstname\_studentnumber\_dd-mm-yyyy". Complete all blue parts of the form and include the approved Project Brief in your Graduation Report as Appendix 1!



<p>family name <b>Reji</b></p> <p>initials _____ given name <b>Meenu Sara Mathai</b></p> <p>student number <b>5048370</b></p> <p>street &amp; no. _____</p> <p>zipcode &amp; city _____ <b>lft</b></p> <p>country <b>Netherlands</b></p> <p>_____ <b>R</b></p> <p>_____ <b>ft nl</b></p>	<p>Your master programme (only select the options that apply to you):</p> <p>IDE master(s): <input type="radio"/> IPD <input checked="" type="radio"/> Dfl <input type="radio"/> SPD</p> <p>2<sup>nd</sup> non-IDE master: _____</p> <p>individual programme: _____ (give date of approval)</p> <p>honours programme: <input type="radio"/> Honours Programme Master</p> <p>specialisation / annotation: <input type="radio"/> Medis gn</p> <p><input type="radio"/> Tech. in Sustainable Design</p> <p><input type="radio"/> Entrepreneurship</p>
--	--

### SUPERVISORY TEAM \*\*

Fill in the required data for the supervisory team members. Please check the instructions on the right!

<p>** chair <b>Elisa Giaccardi</b> dept. / section: <b>HICD</b></p> <p>** mentor <b>Dave Murray-Rust</b> dept. / section: <b>HICD</b></p> <p>2<sup>nd</sup> mentor <b>Nick Mueller</b></p> <p>organisation: <b>Deus</b></p> <p>city: <b>Amsterdam</b> country: <b>Netherlands</b></p> <p>comments (optional) <b>The thesis is connected to the new research area of "multi-intentional interaction" which is a topic in Dcode project for which the mentor and chair are working on together. Hence they belong to the same dept.</b></p>
---

- Chair should request the IDE Board of Examiners for approval of a non-IDE mentor, including a motivation letter and c.v.
- !** Second mentor only applies in case the assignment is hosted by an external organisation.
- !** Ensure a heterogeneous team. In case you wish to include two team members from the same section, please explain why.

## Procedural Checks - IDE Master Graduation

### APPROVAL PROJECT BRIEF

To be filled in by the chair of the supervisory team.

chair Elisa Giaccardi date - - signature \_\_\_\_\_

### CHECK STUDY PROGRESS

To be filled in by the SSC E&SA (Shared Service Center, Education & Student Affairs), after approval of the project brief by the Chair. The study progress will be checked for a 2nd time just before the green light meeting.

Master electives no. of EC accumulated in total: \_\_\_\_\_ EC

Of which, taking the conditional requirements into account, can be part of the exam programme \_\_\_\_\_ EC

List of electives obtained before the third semester without approval of the BoE

YES all 1<sup>st</sup> year master courses passed

NO missing 1<sup>st</sup> year master courses are:

name \_\_\_\_\_ date - - signature \_\_\_\_\_

### FORMAL APPROVAL GRADUATION PROJECT

To be filled in by the Board of Examiners of IDE TU Delft. Please check the supervisory team and study the parts of the brief marked \*\*. Next, please assess, (dis)approve and sign this Project Brief, by using the criteria below.

- Does the project fit within the (MSc)-programme of the student (taking into account, if described, the activities done next to the obligatory MSc specific courses)?
- Is the level of the project challenging enough for a MSc IDE graduating student?
- Is the project expected to be doable within 100 working days/20 weeks ?
- Does the composition of the supervisory team comply with the regulations and fit the assignment ?

Content:  APPROVED  NOT APPROVED

Procedure:  APPROVED  NOT APPROVED

comments

name \_\_\_\_\_ date - - signature \_\_\_\_\_

Designing for transparent intentions in AI powered energy systems project title

Please state the title of your graduation project (above) and the start date and end date (below). Keep the title compact and simple. Do not use abbreviations. The remainder of this document allows you to define and clarify your graduation project.

start date 15 - 02 - 2020 20 - 07 - 2021 end date

**INTRODUCTION \*\***

Please describe, the context of your project, and address the main stakeholders (interests) within this context in a concise yet complete manner. Who are involved, what do they value and how do they currently operate within the given context? What are the main opportunities and limitations you are currently aware of (cultural- and social norms, resources (time, money,...), technology, ...).

The development of intelligent systems has created enormous opportunities to improve and change human lives. Such systems are heavily reliant and driven by data and algorithms to achieve optimal user experiences for myriad users. However, in recent times there have been controversial debates on what systems should learn about the users and how the accompanying data collected is used. There has also been a significant increase in end users being better aware of the issues and ethics concerning data collection and privacy; which in turn has affected their trust in such systems. This calls for a better understanding of how different stakeholders (owners and end consumers) of a data-driven product/service perceive, interpret and use the system. In addition to this, it is also important to understand how the use of such services/products are framed with different intentions in terms of gain/use.

Such data-driven and intelligent systems are gaining popularity in nearly every industry. One such industry is the sustainable/renewable energy domain where automation is being used to effectively optimise and control energy consumption. This sector will be the context of focus in the thesis.

This project is in association with "[Deus](http://deus.ai)" and the "Connected Everyday Lab (CEL)" at TU Delft. Deus is a company/design organization that focuses on human(ity) centered AI. Deus will be providing support by providing a client to apply the problem and solution to. This can help ground the problem statement in a real-world context and additionally provide a sound business perspective to the project. CEL is focused on researching and designing thoughtful interventions for modern complex technologies.

space available for images / figures on next page

**Personal Project Brief** - IDE Master Graduation

introduction (continued): space for images

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image / figure 1: \_\_\_\_\_

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image / figure 2: \_\_\_\_\_

**PROBLEM DEFINITION \*\***

Limit and define the scope and solution space of your project to one that is manageable within one Master Graduation Project of 30 EC (= 20 full time weeks or 100 working days) and clearly indicate what issue(s) should be addressed in this project.

Most data-driven products/services are multi-dimensional and multifaceted and do not necessarily have the same meaning and value to all its users. Different users could use it with different intentions and assign their own purpose of use. For example, an end-user could use a product/service as a tool to accomplish a task, whereas the same tool could be used by a developer to understand and track a user's interests/behavior and in turn optimise services further. This creates a scenario where multiple users (end users, developers, analysts, owners) have conflicting needs and the product/service is used with different intentions. Additionally, what goals the organization have for the users might not align with what the end users want for themselves. In such scenarios, traditional design enforces the idea of simplifying interfaces that frame or dictate certain intentions of use for people. But this can be considered a sensitive issue because the end-users are unaware of these other potentially conflicting intentions. This creates an increase in tension between intelligent systems and the needs of end-users but also a sense of mistrust. Hence, there is a need to create a sense of legibility to the users on the behavior of these systems and the other intentions of use in order to enable trust.

In this thesis, the above problem will be explored in the domain of sustainable energy. The client is an energy provider that wants to propose a carbon free future through a direct to customer proposition driven by artificial intelligence meant to automate the optimisation of renewable energy consumption. They also want to facilitate a more personal relationship for customers with their own energy consumption. This would create a need to visualise or add more meaning to why/how the automations or recommendations are performed by the system and how they fit the user's need. But this could also mean, giving users an opportunity to contribute to how their energy consumption is optimised.

This leads to the design question that can be formulated as (problem statement) :

\*How can we introduce a way to bring more transparency (in order to enable trust) on the amount of intent that customers have for them to contribute towards their energy needs?\*

The following questions will act as a starting point for research :

- What constitutes transparency in the context of AI? and to what level is it expected?
- What kind of a role/ level of involvement do customers want to have in contributing to their energy needs?
- How do we balance the business goals of the company and the energy needs of the end-user?
- How does shared autonomy play into enabling trust in AI systems?
- How can we communicate the transparency and intent of algorithms effectively in intelligent systems?
- How can we simplify the working of algorithms in order to make them more approachable and engaging?

**ASSIGNMENT \*\***

State in 2 or 3 sentences what you are going to research, design, create and / or generate, that will solve (part of) the issue(s) pointed out in "problem definition". Then illustrate this assignment by indicating what kind of solution you expect and / or aim to deliver, for instance: a product, a product-service combination, a strategy illustrated through product or product-service combination ideas, ... In case of a Specialisation and/or Annotation, make sure the assignment reflects this/these.

**The anticipated outcome would be a prototype that the end-users or customers can rely on to understand their renewable energy consumption and create an opportunity for them to contribute to this system.**

The initial research will be done to understand the energy system and its intelligence. This will then include understanding the client's customer needs w.r.t their energy needs. It is anticipated that creating awareness in the amount of intent that customers can have in modifying their personal system can enable trust and help them to be more involved in their energy consumption behavior.

The prototype could be in the form of an interface(digital or physical) that could best represent the interaction desired.



**PLANNING AND APPROACH \*\***

Include a Gantt Chart (replace the example below - more examples can be found in Manual 2) that shows the different phases of your project, deliverables you have in mind, meetings, and how you plan to spend your time. Please note that all activities should fit within the given net time of 30 EC = 20 full time weeks or 100 working days, and your planning should include a kick-off meeting, mid-term meeting, green light meeting and graduation ceremony. Illustrate your Gantt Chart by, for instance, explaining your approach, and please indicate periods of part-time activities and/or periods of not spending time on your graduation project, if any, for instance because of holidays or parallel activities.

start date 15 - 2 - 2020 20 - 7 - 2021 end date



Total weeks : 23  
 Public holidays are displayed in grey, blue are voluntary holidays. A break is also planned for week 26.  
 Kick off - 11/02/2021  
 Midterm - 13/04/2021  
 Expected Greenlight - 14/06/2021  
 Expected Graduation - 20/07/2021

Approach :  
 A research through design approach will taken with an initial exploration phase followed by 3 cycles of design.

**MOTIVATION AND PERSONAL AMBITIONS**

Explain why you set up this project, what competences you want to prove and learn. For example: acquired competences from your MSc programme, the elective semester, extra-curricular activities (etc.) and point out the competences you have yet developed. Optionally, describe which personal learning ambitions you explicitly want to address in this project, on top of the learning objectives of the Graduation Project, such as: in depth knowledge a on specific subject, broadening your competences or experimenting with a specific tool and/or methodology, .... Stick to no more than five ambitions.

The area of research in this project can be considered as part of designing for human-centred ai. I have been deeply inspired by data and intelligence and effect it can have on the world. Considering most product or services these days have some form of intelligence, it becomes imperative to know how to responsibly design for it. This project will be the start of me being able to involve myself in this field and create an area of expertise that I can start to focus on as a designer. From a career perspective, the project enables an introduction and an opportunity to research this to a small level and hopefully kick start a longer journey of designing for intelligence systems. This was also inspired by the research elective on more-than-human design that helped me explore on how systems are getting more complicated with time and how it brings unintended consequences with time when in use. The project is done with a company so that I can get some Dutch work experience, as most of my internships were canceled due to Covid. On a more personal level, I want to work on my productivity and self management skills, which has proven to be quite difficult during these times. Additionally, I want to be able to learn to better trust my intuition when it comes to design decisions .

To put it concisely:

1. Give myself an opportunity to explore human-centred ai.
2. Improve Self management skills (especially during Covid-19)
3. Opportunity to gain dutch work experience and solve real world case.
4. Be more confident about my design decisions

**FINAL COMMENTS**

In case your project brief needs final comments, please add any information you think is relevant.