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## APPENDIX 1. PERSUASIVE DESIGN

When technology is used to motivate users to change their behavior, it is called persuasive. (Costanza, Ramchurn, & Jennings, 2012). The term and probably most accepted model in this topic was developed by (Fogg, 2009). This framework includes three main factors: motivation, ability and triggers. A person with both high motivation and ability is more likely to perform the desired behavior, however those two factors can be traded off. In case of low motivation, high ability can still enable the behavior and the other way around. Additionally, to ability and motivation the behavior should be triggered, otherwise it might never happen. Each factor has different components that can be used as source of inspiration for the design of persuasive experiences or products.



(Fogg, 2003) proposed also some tools to tackle persuasiveness, which complement each other to strengthen the design:

- Reduction: simplification of a procedure, it makes the process easier by reducing a complex activity to a few simple steps (or ideally, to a single step).
- Tunneling: guidance through a procedure, it leads users through a predetermined sequence of actions or events, step by step
- Tailoring: individual customization, it provides information relevant to individuals to change their attitudes or behaviors or both.
- Suggestion: Intervention at the most opportune moment, it suggests a behavior at the most opportune moment, timing is critical for a suggestion to be effective.
- Self-monitoring: allow users to track their own behavior: allows people to monitor themselves to modify their attitudes or behaviors to achieve a predetermined goal or outcome.
- Surveillance: Allow others to track users' behaviors, it allows one party to monitor the behavior of another to modify behavior in a specific way. While surveillance technologies may use the threat of punishment to change behavior, they also can be designed to motivate people through the promise of rewards.
- Conditioning: reinforcement, it uses principles of operant conditioning to change behaviors.

## APPENDIX 2. ETHICS PRINCIPLES FOR PERSUASIVE DESIGN

Berdichevsky & Neuenschwander (1999) define a list of principles for the design of persuasive technology to be taken into account.

Table 4-9: Ethical principles of persuasive technology (Berdichevsky and Neuenschwander, 1999)

I.	The intended outcome of any persuasive technology should never be one that would be deemed unethical if the persuasion were undertaken without the technology or if the outcome occurred independently of persuasion.
II.	The motivations behind the creation of a persuasive technology should never be such that they would be deemed unethical if they led to a more traditional persuasion.
III.	The creators of a persuasive technology must consider, contend with, and assume responsibility for all reasonably predicted outcomes of its use.
IV.	The creators of a persuasive technology must ensure that it regards the privacy of users with at least as much respect as they regard their own privacy.
V.	Persuasive technologies relaying personal information about a user to a third party must be closely scrutinized for privacy concerns.
VI.	The creators of a persuasive technology should disclose their motivations, methods, and intended outcomes, except when such disclosure would significantly undermine an otherwise ethical goal.
VII.	Persuasive technologies must not misinform in order to achieve their persuasive end.
VIII.	<b>The Golden Rule of Persuasion.</b> The creators of a persuasive technology should never seek to persuade a person or persons of something they themselves would not consent to be persuaded to do.

## APPENDIX 3. BENCHMARKING DETAILED ANALYSIS

### *Washing machines*

#### ***Which devices and interaction channels are used?***

All the analyzed washing machines relies on the product interface and an app (smartphone, tablet) as the main interaction channels. The app is used in some cases, as in Berg design, as an extension of features available in the machine interface, this way equipping the interface with only the high value functions. For instance, in the app is possible to create new cycles, do recommendations, connect with service providers, activate notifications or other special features. The app also enables interoperability of multiple appliances if the brand or hub allows it.

#### ***What connected capabilities are these equipped with?***

##### ***// IoT framework***

Monitoring and control are the most common functions in connected washing machines and also the most advertised. Monitoring is done by providing information on cycle time and stage as well as notifications. Control features include start, pause and delay as well as the opportunity to activate other product specific features like FanFresh and eco-boost in Whirlpool machine. Optimization level is achieved by smart checking and preventive maintenance. Finally, both Samsung and Whirlpool machines includes autonomous functions when activated for doing so, the former has an automatic optimal cycle in which sensors determine the most optimal cycle for washing and Whirlpool has two features: one that communicates with nest to activate eco-boost washing if no one is at home and smart grid that runs the washing when the energy is cheaper.

#### ***Which strategies for sustainable behavior are considered in the product-service design and its interactions? // Sustainable behavior framework***

Multiple attempts to promote sustainable behavior during the use phase were found mostly in steering and clever design. Only Whirlpool design includes some sort of eco-feedback by informing the users on energy consumption along with a rate revealer.

Linear menus and shortcuts to favorite and recommended functions can be used as steering strategies if the app or interface is configured to propose less temperature

cycles. The cycles names might also influence user's decision making. According to Berg design, users prefer everyday personal tags like "sport clothe" while Whirlpool proposes type of soil, cloth or wash rather than the commonly use material (cotton, wool and so on).

Bundles also appears as a feature which add value to the service without being sustainable per se, nevertheless if the bundle is connected to a specific green producer detergent can be used as a steering function.

On eco-interactions level, both Samsung and Whirlpool provide detergent and softener auto-dispense that automatically regulate the dosage according to the given cycle. Samsung includes the already mentioned automatic optimal cycle which complemented with Eco bubble technology promises colder cycles with the same performance.

It is worth to mention than Whirlpool machine is he most equipped with autonomous function: Eco boost, connectivity with nest and smart delay, which can reduce energy consumption while facilitating the actions. Interestingly, smart delay is complemented with feedback and booking option this way compensating the lack of awareness that automatic functions can lead to.

#### ***Is there room for other strategies implementation?***

Most of the current strategies are in scripting and eco-interaction level, thus leaving aside eco-feedback strategies, which can also be complemented with social comparison and history of consumption. The use of smartphone open possibilities for doing proper recommendations to reduce consumptions or suggest eco-cycles insomuch there is access to users' patterns of use. As found in the literature research, if the eco-functions are not used as default the design would not ensure its use, hence defining eco-functions as the default can be an additional strategy to steer sustainable behavior

#### ***How is the product perceived by users? // User Experience analysis based on self-report***

Samsung design adversities multiple the technical features with potential to improve user's comfort. On the positive side, the design is perceived as easy to use and activate by using the preload detergent. Some convenient features are the remote control, the finish cycle notifications, the smart check and the vast number of programs However, problems are found in washing



machine connectivity with both wi-fi and the app, this intermittent connection limits the use of remote functions. Additionally, there is inconsistency between the design of the product interface and the app. It is also considered an expensive product for which the eco-mode is not actually economical and the soap dispenser can get clogged often.

For Whirlpool design, the app seems to be friendly a fast, energy saving options as delay to non-peak hours and plenty of washing cycles are appreciated. On the other hand, connection is unstable and the remote control must be manually activated in the washing machine what reduces its convenience. There is also skepticism about smart grid feature due to its high dependency on local current infrastructure.

To conclude, all the issues with connectivity negatively impact the user experience given that these constrain the promised smartness of the product. Moreover, as an expensive and luxury item users' expectations can be high in this matter.

Given that Berg design is a concept, not relevant information was found for UX analysis

#### **Other insights, about laundry:**

Besides the functions enable by connectivity, other technological features are commonly advertised as less noise, shorter cycles and in general less disturbing and more comfortable functions. These functions are assumed to address other potential concerns when doing laundry as:

Share spaces like student residences where different users use the same machine, for this issue booking calendars are available.

Leave laundry that finishes long ago remove the freshness of the clothe, different alternatives are proposed: delay of the complete cycle, delay of the rinsing or technological solutions as the FanFresh

Detergent dispenser that reduce the hassle of doing manually.

### **Energy monitoring**

#### **Which devices and interaction channels are used?**

Interaction relies almost completely in the smartphone and in just one case web. In all the analyzed cases the app or web are not an extension of the functionalities but the core interaction channel in which all features are enable.

#### **What connected capabilities are these equipped with? // IoT framework**

All energy monitors focus, as expected, in eco-feedback.

Real time monitoring of energy use as well as details of consumption by appliance are the most common functions. Each brand differs, though, in how is the information presented, the interaction with that data and the reliability of the technology. Only Smappee design has involved control level in the service, which is provided by connected plugs that can be programed or controlled remotely.

#### **Which strategies for sustainable behavior are considered in the product-service design and its interactions? // Sustainable behavior framework**

Eco-feedback strategies in energy monitoring help users to not only be more aware of the consumption but also to identify if there are energy leakages and motivate changes in energy use. Some found strategies include among others: real time notifications for turn on and off devices or peaks of energy, social comparison, visualization on consumption: Timeline (day, month, year), use trends, list of appliances use, bubbles (sense and Smappee), relation consumption-price. Regarding scripting, there are recommendations on how to save energy and goal setting.

It is worth to notice that in Sense design different visualizations of the same data are provided with deeper levels of detail, this allows users to interact, compare and reflect on the consumption rather than only visualize it.

#### **Is there room for other strategies implementation?**

Even though, there is a strong focus in feedback, Smappee has a limited interaction with the graphs so users can not explore in more detail the data. In a scripting level, some brands can explore the relation between consumption and price as well as personalized recommendations on energy saving. For clever design, the energy monitors might take advantage of connectivity and autonomy, as for example being connected to a smart home "hub" and other appliances directly.

#### **How is the product perceived by users? // User Experience analysis based on self-report**

Sense has a good real time feedback that includes sound and alert, it can also drive money saving with energy use reduction and identification of leakages. Data is found to be useful with social and temporal comparatives and appliances use details. Some users acknowledge its potential for behavior change towards less and more optimal energy use. On the negative side, it seems that

the “smartness” does not fulfill user’s expectations because: it takes time to identify devices and accuracy can be low in some cases, this is supposed to improve through time but that is not always the case. Sometimes the system wrongly identifies devices and there is no option to correct those mistakes. It relies heavily in the intelligent system leaving aside the human interaction for appliances identification.

Some similar issues are faced by Snappee users who claim to go through a long training process with resulting low accuracy and reliability, especially when multiple appliances are connected. Besides, even though, the remote control of plugs is convenient its application is limited to one item and doing a complete house installation would be expensive. An appreciated aspect of the design is the opportunity actively participate in the training process which is easy and engaging.

Finally, Neuroio offers the appliance recognition as an extra package, this is not really clear in the webpage causing users dissatisfaction. The visual design is perceived as cheap with also limited data visualization.

To summarize, the appliances identification is promised in the value proposition as accurate and reliable, however the early development stage of the technology limits that “smartness”, hence affecting the value delivery and consequently the user experience. User’s expect to be able to interact and visualize data in a way that is meaningful to them and allow them to reflect upon it, thus the way data presented has an impact in the experience of use.

### *Circular PSS*

#### ***What is the service value proposition, how is that value created and captured?***

The findings on this matter are summarized in Figure 10 and 11. Flexibility, easiness, convenience, worry free, worthwhile alternative (to other options) and affordable are commonly mentioned values through the services.

#### ***Is there a relation between the value proposition and circular economy?***

The relation with circular economy was established based on the potential of extending or circulating resources according to the type of PSS, it is to say use or result oriented. The type of service was established based on the value capture model.

It was found that most of the analyzed services rely on subscription, hence becoming a use centered service. However, the consumption is measured in a specific unit generally used in result oriented services or Pay-Per-Use. According to the market, product and company requirements the structure of the service and revenue streams can be adapted to fit better user and company needs. Both SolarCity and Go bike have also flexible plans, including subscription, prepaid and Pay-Per-Use, this exemplify the value of flexibility.

Besides the extension of product-life span that theoretically use oriented PSS could provide, there are extended advantages according to the service, for example Go bike might help to the reduction of accidents and improvement of commuting time and SolarCity can revenue from tax reduction in going solar.

#### ***How is the value proposition translated to an interaction level? How is the service structured? What are the interaction channels and devices?***

For services with connected products it is common to rely on apps or web services as main or secondary interaction channel. Digital services have the advantage of providing an almost permanent touchpoint, where all the service registration, follow up, management and evaluation can happen. That is why these digital services are usually main touchpoint of the service, except in SolarCity due to its high complexity. All services have, however, multiple touchpoints from customer service to Whatsapp what facilitates contact with customers.

Furthermore, the offered product is also embedded with connectivity to track the use. For example, zipcar, greenwheels and Go bike keep track of distances and time, while SolarCity tracks energy. These products are equipped with other interaction channels, as for example greenwheels which has an unit to retrieve the keys once in the car.

#### ***Does the service convey an environmental message in the value proposition?***

Considering sustainable behavior as a potential strategy for extending use loops, this question addresses if there is a pre-set intention of the service to show the users the environmental advantages of the service as an strategy to increase adoption or awareness. These are the findings per service:

**Zipcar:** Highlights the benefits of disownership in terms of money and time, there is no clear intention of creating

environmental awareness of consumption.

**Go bike:** Green and healthy are mentioned in the value proposition for commuters, not to target tourist. No feedback on environmental matters is provided.

**Greenwheels:** Feature the benefits of disownership in terms of money and worry free. There is an underlying environmental message in the name, which is also advertised as a service value.

**SolarCity:** The process of going solar is itself and environmental message, however this is not deep shown in the value proposition. The service advantages strongly focus in the potential economic savings.

As can be seen, even though all the services promote more environmental friendly consumption and use, as car sharing, bike use, solar panels, there is not a clear pattern on conveying an environmental message in their value propositions, and if it is included it is not core part of the proposition for users. Economic saving potential seems to be have been more advertised than environmental benefits. For instance, no information was found on how sharing has potential to extend products lifespan or feedback on how much has been saved in resources while using this service instead of owning a product.

This analysis is done from a user's perspective, specifically when users are interacting with the webpage and service reviews online, so the abovementioned conclusion does not mean that the company is not taking advantage of the environmental advantages of the Circular Business Model, but more that this message might had not being transmitted to the users, and if it is, it can still be strengthened through more substantial information. In this regard Greenwheels is the only researched company with a rather more consistent consideration of sustainability.

#### ***Which strategies for sustainable behavior are considered in the product-service design and its interactions? // Sustainable behavior framework***

Continuing with the exploration of sustainable behavior in circular services, this question approach the service and interaction level of the service by searching for specific design strategies in this matter. See Figures 12 and 13 for more details.

**Zipcar:** Offers hybrid cars (limited), there is a filter to explicitly search those, this can be considered an eco-choice strategy. Finally, there is a use limit per day.

**Go bike:** Optimize the returning route to reduce consumption and offers carbon neutral bikes

**Greenwheels:** Green is a value of the service, the brand graphic design clearly conveys it. They steer users towards the more suitable plan for them, this strategy can enhance adoption.

**SolarCity:** As expected this service has a strong approach to eco-feedback like energy monitors. They also offer personalized designs what can be considered a steering approach.

With exception of SolarCity, most of the provided feedback is limited to eco-information and eco-choice, it has not achieved a level of personal eco-feedback that allow users to reflect on their consumption. No strategies were identified on an eco-interaction level with exception of the forced use of carbon neutral bikes in Go bike service.

#### ***Is there room for other strategies implementation?***

Zipcar and greenwheels can benefit for more detailed feedback on consumption of energy and CO2 production in comparison with car ownership also providing information on the most optimal speed for gasoline consumption. For steering, personalized offers with hybrid cards and use of defaults could potentially promote sustainability.

Regarding Go bike, the brand can strengthen the environmental message by structuring and showing the data that they already have on service adoption, this can be complemented with resources optimization. Suggestions and self-monitoring of routes and bike optimal use can also benefit product lifespan and finally use incentives to promote its use.

Finally, given that SolarCity has already tackle feedback level, it is recommended to enhance scripting and eco-interactions, for example by using personalized suggestions to optimize consumption or monetary incentives for using energy when is cheaper. And finally integrate the panels with smart home autonomous devices.

Due to the diversity on the analyzed services, it means, market, products, user, context, it is not easy to envision potential functions on eco-interaction level

#### ***How is the service perceived by users? // User Experience analysis based on self-report***

**Zipcar:** Is perceived as a convenient and worry free service for not frequent users that can definitely save money on

a long term while facilitates parking in crowded areas. It has also an easy and painless booking system that with the app can be used almost immediately. On the other hand, the cancellation, extension, late and insurance fee can be troublesome and can be complicated, some users also complain about the limited locations for picking up and returning the car.

**Go Bike** service offers smart functions for navigation, booking and notifications what is handy for the users, the interface is easy to use and the return is effortless. Nevertheless, those aspects are appreciated, users complain about the bike weight and limited adaptability and speed, as well as a high dependency on the tablet and motor technology, when those fail the service is completely blocked. Also, there is skeptics about the need of an electric bike in rather flat context. Finally, unbalance is found in the stations use, some are crowded while other underused.

**Greenwheels** was evaluated based on the app reviews due to the limited review information found online. App users appreciate the easy booking process and remote car opening, but mention that the app interface can be improved by showing real time car's availability and the map searching usability.

**SolarCity** provides a complex service that involves long term engagement and intervene customers houses in a deep way; this situation lead to multiple risks points in the installation and maintenance as broken roofs and short circuits. Additionally, users report the app to be unreliable for track consumption and billing forecast. There is lack of transparency on contract and billing process with hidden cost, this is also related with a complex estimation process that depends on multiple factors, the lack of clearness in that estimation leads to multiple user's dissatisfaction. Finally, 20 years of engagement can be discouraging for some users. On the positive side, according to the house conditions solar panels can save money, users also find useful the feature to keep track of energy use.

UX is a subjective evaluation of how an user experience all the service provided, all touchpoints might impact in an either positive or negative way user's perception. That is why the it is complex to evaluate UX and identify its pain-points. Overall, it seems that the payment after use is a high-risk part of the service steps, transparency and clarity in this matter is highly recommended. Interestingly, in user's comments there are no comments related with environmental benefits of the



Whirlpool, WFL98HEBU



Samsung, WW9000



Berg, design concept



Monitor

Control


Optimization

Autonomy



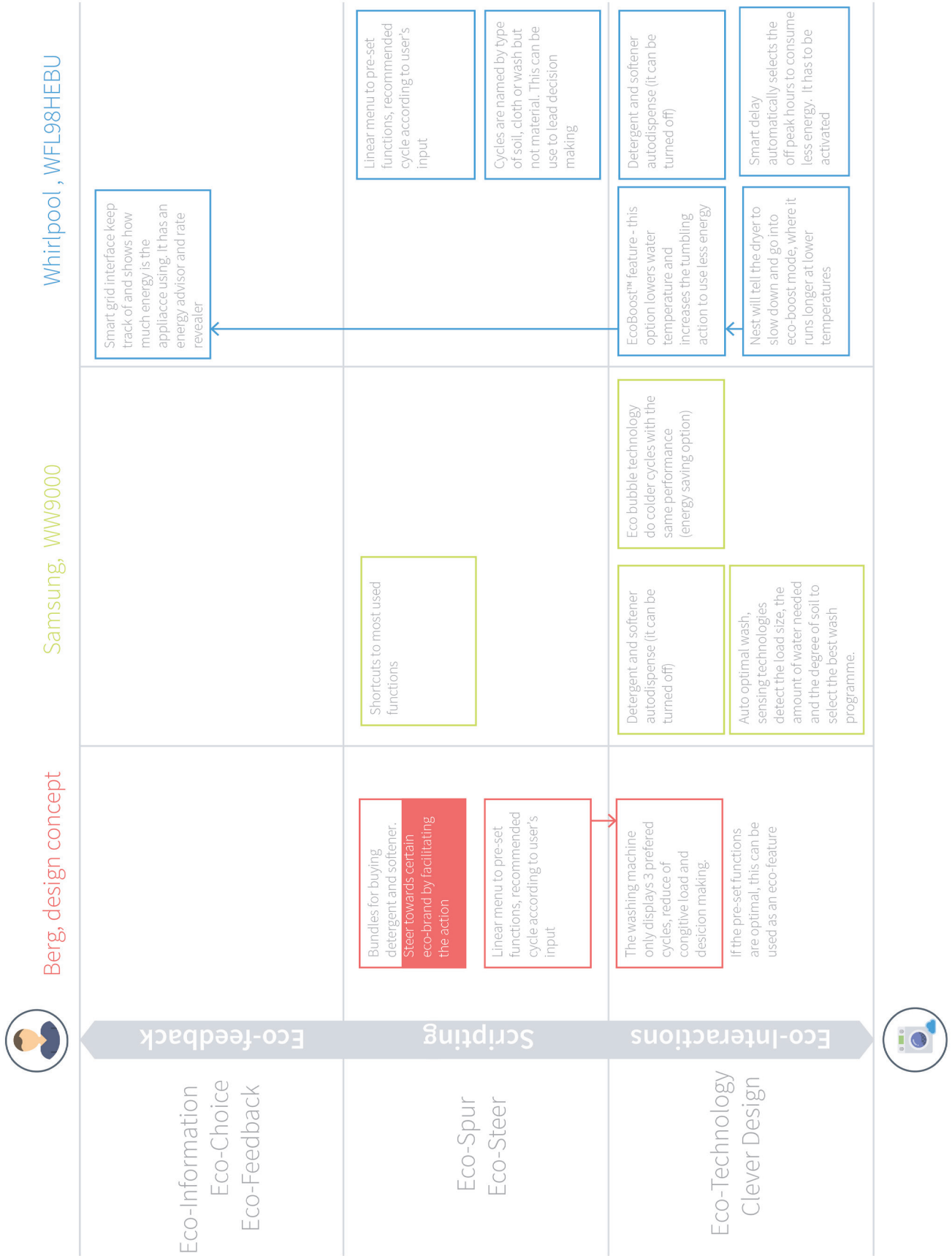
<p>Feedback on cycle time and stage. Notifications (before the rinse)</p>	<p>Smart washer app for feedback on cycle time and stage. Notifications.</p>	<p>6th sense live app for feedback on cycle time and stage. Notifications.</p>	
<p>It can be remotely controlled by the app: Delay feature, setting washing cycles</p>	<p>It can be remotely controlled by the app: start, delay and pause cycles. Choose the cycle. Eco-boost and freshair</p>	<p>It can be remotely controlled by the app: start, delay and pause cycles. Choose the cycle. Eco-boost and freshair</p>	
	<p>Smart check, an automatic error monitoring for detection and diagnosis of problems with troubleshooting solutions</p>	<p>Preventive maintenance notification</p>	<p>Autonomously connected with Nest to find an optimal time for washing in eco-boost. Smart grid runs the washing when energy is cheaper.</p>

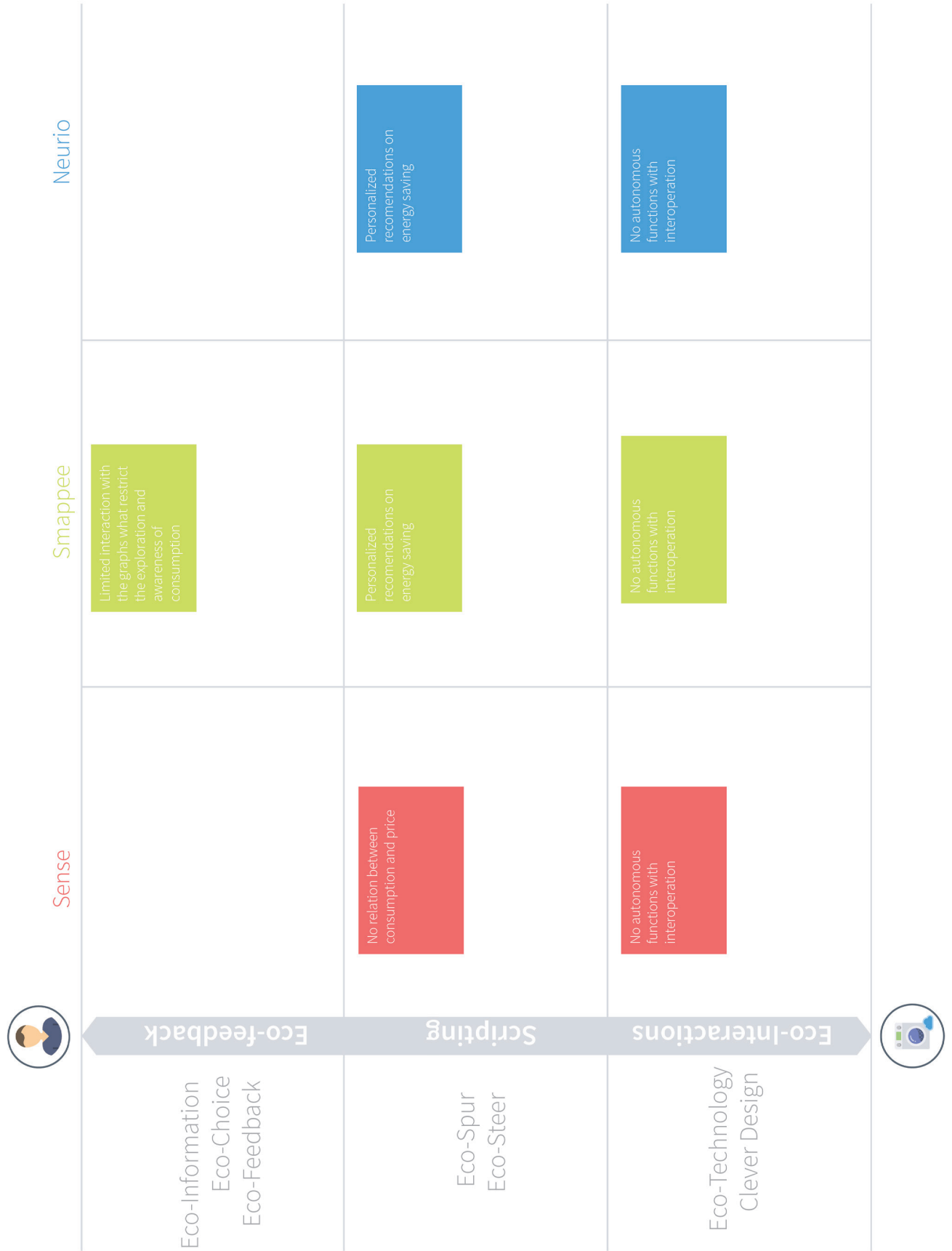


 Berg, design concept	Samsung, WW9000	Whirlpool, WFL98HEBU
Eco-Information Eco-Choice Eco-Feedback	<p>There is feedback on the cycle time but not on consumption of energy or water. Not feedback on auto-optimal wash</p> <p>Social comparison, set of default cycles, history of consumption</p>	<p>Includes feedback on energy but not water and soap</p>
Eco-Spur Eco-Steer	<p>Suggestions on eco-cycles. Use of the pre-set or default functions</p>	<p>No default or steering on eco-functions. Those can be easily activated or deactivated</p>
Eco-Technology Clever Design	<p>No autonomous functions with interoperation</p>	

Eco-feedback      Scripting      Eco-Interactions









Neurio



Smappee



Sense



Monitor

Control

Optimization

Autonomy




Real time energy use monitoring. Details by appliance if an extra plan is paid

Real time energy use monitoring. Details by appliance.  
Option for water and gas monitoring.  
Remote control of plugs

Real time energy use monitoring. Details by appliance



	Sense	Smappee	Neurio
Eco-Information Eco-Choice Eco-Feedback	<div data-bbox="331 1480 443 1704">Real time notifications when turning on and off devices and lights</div> <div data-bbox="451 1480 667 1704">Feedback on energy consumption with various visualizations - Timeline: days, months, years - Trends - Bubbles by appliance - List of appliances use</div> <div data-bbox="331 1234 443 1458">Social comparison based on consumption</div>	<div data-bbox="331 913 491 1137">Feedback on energy consumption. - History - Granularity by appliance</div> <div data-bbox="499 913 667 1137">Relation consumption-price</div>	<div data-bbox="331 584 491 808">Feedback on energy consumption. - History - Granularity by appliance</div> <div data-bbox="499 584 667 808">Notifications on peaks of consumption</div> <div data-bbox="331 338 491 562">Social comparison based on consumption</div>
Eco-Spur Eco-Steer	<div data-bbox="691 1480 850 1704">Recommendations for energy saving</div>		<div data-bbox="691 584 850 808">Goal setting</div>
Eco-Technology Clever Design		<div data-bbox="1054 913 1214 1137">Remote plugs turn on-off Option to set up automatic turn on-off. Limited to the amount of plugs</div>	





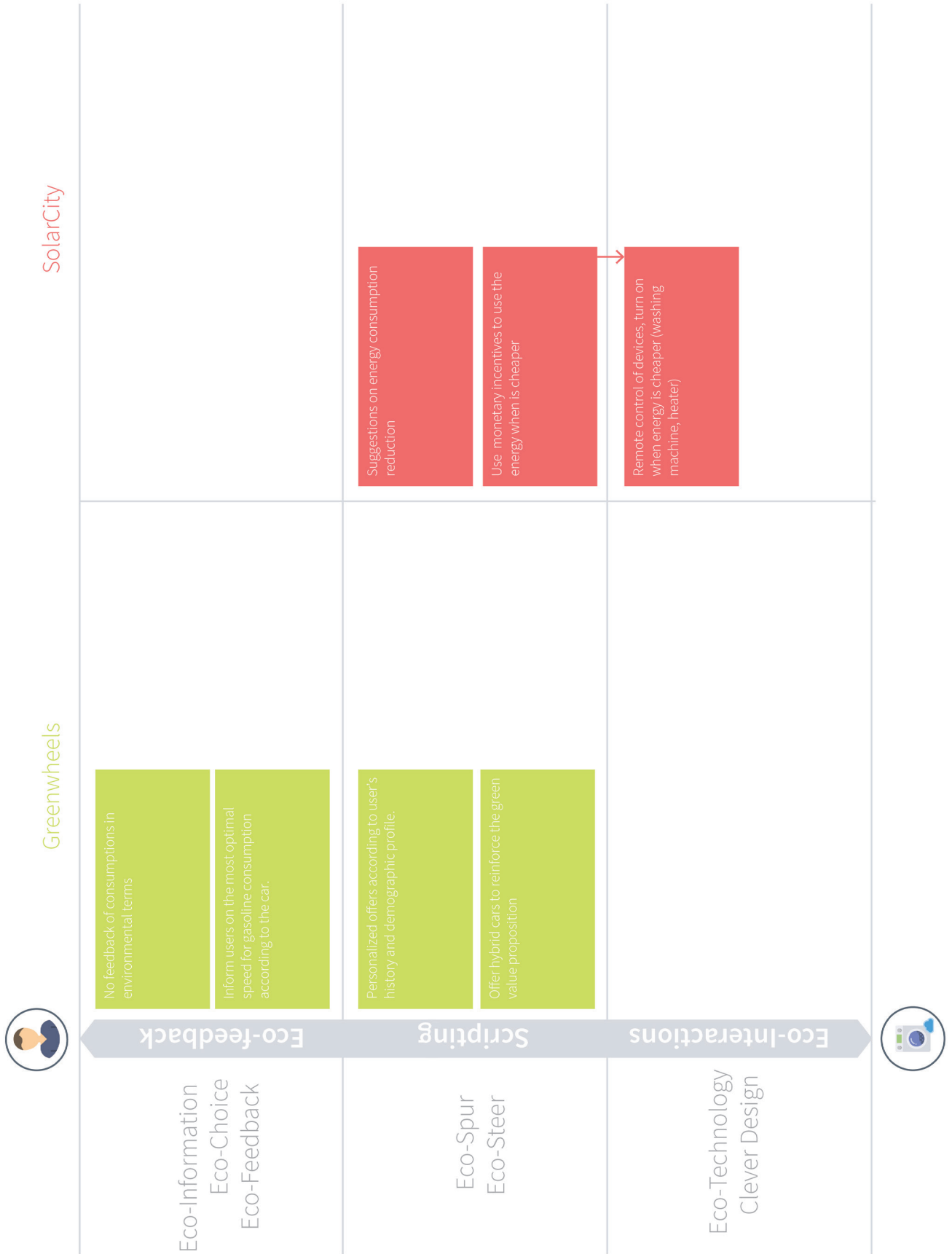


Greenwheels



SolarCity

<p>Value proposition</p>	<p>Green alternative for car ownership, <b>affordable, worry free and trustworthy</b>. They have two main targets: general users and business</p>	<p>Emphasis in saving money and flexibility in up front cost with the options for buy, lease and pay per use. Affordable, high quality, saves money and can even create revenue. Independence from the grid.</p>
<p>Value creation</p>	<p><b>Affordable:</b> Low price in comparison with ownership  <b>Worry free:</b> It includes gas and insurance. No need to pay taxes  <b>Green:</b> 20 years of experience in car sharing with emphasis in environmental                  There is also a partnership with OV chipcard targeting business users.</p>	<p>SolarCity offers all the support to go solar, from the evaluation of the house conditions to the continuous monitoring of solar energy. Along that process they have different partners for both installation and maintenance.</p>
<p>Value capture</p>	<p>There are three plans for monthly payment that fit user needs: occasional, regular and frequent. Additionally, car use is pay by hour plus km.                  Similarly, there are 3 more plans for business users which have different fees.                  Finally, there are plans per day, weekend and week as well.</p>	<p>Flexible plans, loan, lease, complete payment and pay per use. Each one has advantages and drawbacks that limit its adoption, as for example the 20 years commitment.                  A key part of the value capture is the taxes compensation for using solar energy.</p>
<p>Relation with CE</p>	<p>Similarly to zip car, greenwheels is an <b>use oriented service</b> that offers functionality rather than ownership. It can be framed as sharing/renting service due to the monthly fee, however the consumption is measured in hours and/or km, as <b>pay per use</b>.</p>	<p><b>Use oriented and result oriented service.</b> For both lease and pay per use, the service includes maintenance and installation for 20 years. However, solar panels are in constant development so probably in 20 years those will be obsolete. Pay per use is not the most popular option.                  The app includes real time monitoring of energy production and use, with data granularity by equipment or device, as well as social comparison, what can create awareness on consumption, however there is no goal setting or recommendations on how to reduce the use.</p>
<p>Environmental message</p>	<p>The value proposition emphasizes the <b>benefits of disownership in terms of money and worry free</b>.                  There is an <b>underlying environmental message in the name and it is highlighted as a value of the service</b>. Apparently, the feedback does not show any specific positive impact on the impact of sharing car instead of owning more than money saving. There is a lack of eco-feedback. Finally, hybrid cars offer is not included</p>	<p>Support the process to going solar <b>is itself an environmental message</b>, it is also seen by the users as a plus to the economic savings, the feeling of green energy and positive environmental impact of using solar panels is an incentive to use solar city. Interestingly, there is not a strong focus on that.                  There are limitations in the feedback and billing forecast. The UX analysis pointed out to a <b>lack of features and multiple glitches into the app design</b>, what reduces service trustability.</p>




Eco-Feedback

Scripting

Eco-Interactions





	Greenwheels	SolarCity
Eco-Feedback	Green as a value of the service, the brand design points toward the environmental advantages of car sharing	Real time feedback on consumption and generation of energy
Eco-Information Eco-Choice Eco-Feedback	Suggestion on the most suitable plan according to user's needs	Consumption detail by equipment or device
Eco-Spur Eco-Steer		Personalized design per house
Eco-Interactions		
Eco-Technology Clever Design		





Go bike (Copenhagen)

<p>Value proposition</p>	<p>An <b>easy, quick, cheap and flexible</b> alternative for car rental and ownership. Target different groups with different plans: General, business, universities. <i>"It's a smarter way to get around the city."</i></p>	<p>The service target locals and tourists with a smart and easy to use system. Tourist: <b>See the city as local</b>, do not get lost with the navigation feature Commuters: <b>flexible, convenient (close to the station), healthy and green</b></p>
<p>Value creation</p>	<p><b>Flexibility:</b> various car types, sizes (vans, sedans), plans, rates per car, multiple locations (strategic), low price, no hidden fees <b>Cheap:</b> No hidden fees. It includes gas and insurance. In some cases miles as well. Saving money in comparison with ownership <b>Easy and quick:</b> Join, reserve, unlock and drive. If using the smartphone the process is almost immediate.</p>	<p><b>Carbon free motor.</b> <b>Smart features:</b> navigation, notifications, booking Both digital and physical connection with public transport system</p>
<p>Value capture</p>	<p>There is a monthly fee plus a payment each time a car is rented. The rates and plans are flexible targeting different customers preferences. The added value of the service is in unlocking value in the cars when the use is shared.</p>	<p><b>Flexible plans, subscription, pay as you go and pre-paid.</b> The project is sponsored by the government, which revenue from reducing pollution, accidents and optimizing commuters time.</p>
<p>Relation with CE</p>	<p><b>Use oriented</b> service that offers functionality rather than ownership. It can be framed as <b>sharing/renting</b> service due to the monthly fee, however the consumption is measured in hours and/or km, as <b>pay per use</b>.</p>	<p><b>Use oriented</b> service that offers functionality rather than ownership. The service is a government initiative to promote biking over car use, therefore reducing pollution, accidents and increasing users quality of life. The consumption revenue by km, as <b>pay per use</b>.</p>
<p>Conclusions and environmental message</p>	<ul style="list-style-type: none"> <li>- The value proposition have emphasized the <b>benefits of disownership in terms of money and time</b>. Features are offered accordingly, with high flexibility, multiple cars and plans.</li> <li>- On the other hand, <b>there is no clear intention of creating environmental awareness of consumption</b>. The feedback is limited to what is meaningful to the user in accordance to the value proposition (price, miles).</li> <li>- <b>Hybrid cars offer is limited</b> and there is no interface steering towards its use or benefits.</li> <li>- <b>Users appreciate the flexibility, easiness and worry free values of the service</b>. On the other hand, cancellation, late fee, time extension and insurance policies are not always clear and can be troublesome.</li> </ul>	<p>The value proposition for <b>the tourist does not incorporate any environmental message</b> while for commuters the value of healthy and green is somehow included. <b>Feedback on environmental benefits of bike use is not provided to any users.</b> There is information online on riding statistics but no relation with environmental impact is depicted. The service has had a considerable use rising in the last years. Apparently data is collected on the bikes's use but it is not translated in meaningful information for the users, more than cost. The smartness of the bike is brought up with different features, besides the bike is carbon neutral. However, there is still a <b>high dependency on the tablet</b>, which potential flaws inhibit the service. This have a high impact in the user experience.</p>

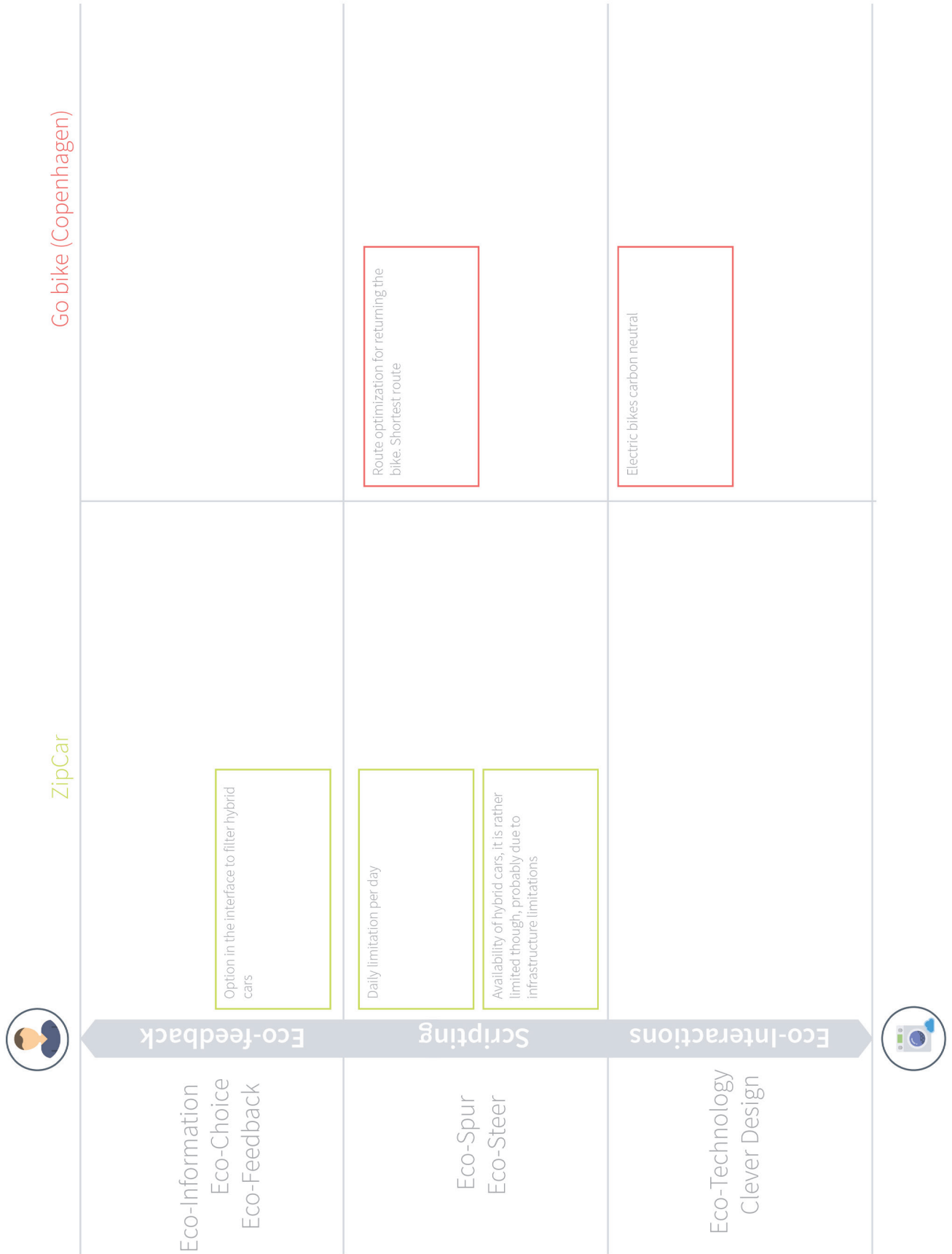
	ZipCar	Go bike (Copenhagen)
Eco-Information Eco-Choice Eco-Feedback	<p>No feedback of consumptions in environmental terms</p> <p>Inform users on the most optimal speed for gasoline consumption according to the car.</p>	<p>Even though the service provider is aware of environmental benefits of biking there is no feedback to users about it</p>
Eco-Spur Eco-Steer	<p>Personalized offers according to user's history and demographic profile.</p> <p>Steering towards use of hybrid cars with the use of defaults</p>	<p>Suggestions and self monitoring of the bike optimal environmental use</p> <p>Use of incentives to promote its use</p>
Eco-Technology Clever Design		
		

Eco-Feedback

Scripting

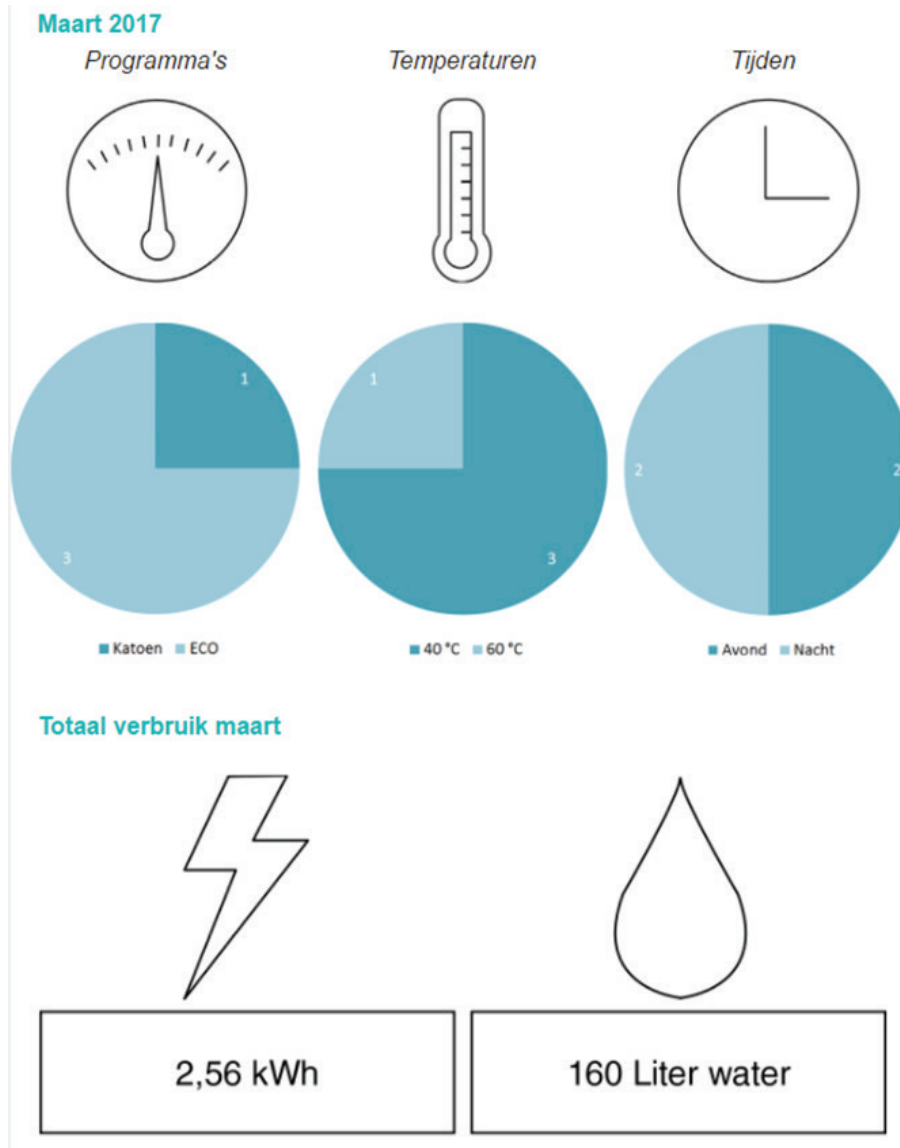
Eco-Interactions





## APPENDIX 4. HOMIE INTERVENTIONS DESIGN

First month:



### 2. Efficiënt wassen

We zien dat je al gebruik gemaakt hebt van het ECO-wasprogramma, goed bezig! *Het ECO programma kan namelijk tot 23% van de gebruikte energie besparen bij een 40 °C was.* Dit komt doordat het ECO-programma niet gebruik maakt van hogere temperaturen, maar van langere inwerktijden om een effectieve wassessie te garanderen. Hierdoor kan de machine energie besparen bij het opwarmen van het water.

Wassen op koudere temperaturen kan aanzienlijk schelen in het energieverbruik van de wasmachine. Wist je dat je met ons koude wasprogramma nog eens *25% kan besparen ten opzichte van een 30 °C was?*

Second month

## 1. Wasgedrag van afgelopen maand

De volgende informatie is gebaseerd op onze data van de 4 wassen die je gedraaid hebt in de maand maart. Ter vergelijking staat je wasdata van de voorgaande maand eronder:

### Maart 2017

Programma's



■ Synthetics ■ Wol ■ ECO

Temperaturen



■ 30°C ■ 40°C ■ 60°C

Tijden



■ Ochtend ■ Middag ■ Avond ■ Nacht

### Februari 2017

Programma's



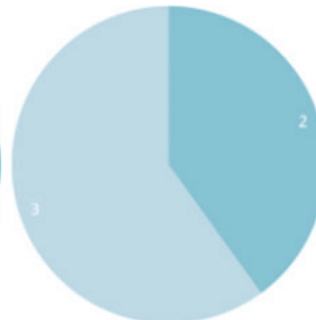
■ Synthetics ■ ECO ■ Katoen

Temperaturen



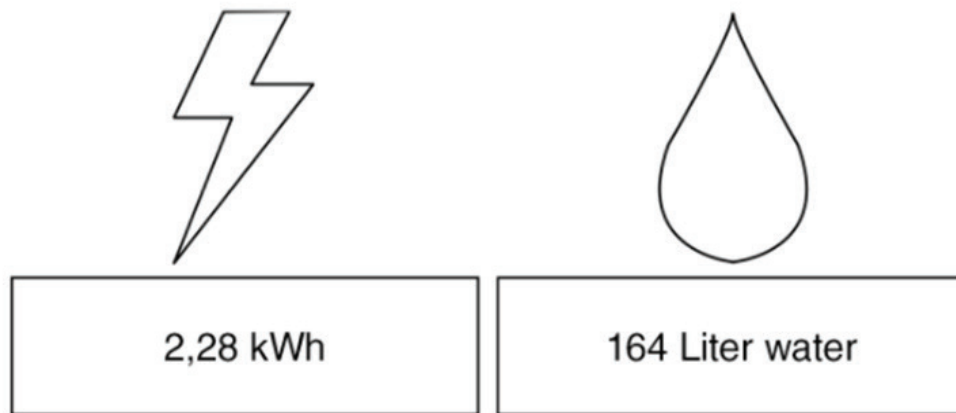
■ 30°C ■ 40°C ■ 60°C

Tijden



■ Ochtend ■ Middag ■ Avond ■ Nacht

### Totaal verbruik maart



## 2. Efficiënt wassen

We zien dat je al gebruik hebt gemaakt van het ECO-wasprogramma, goed bezig! *Het ECO programma kan namelijk tot 23% van de gebruikte energie besparen bij een 40 °C was.* Dit komt doordat het ECO-programma niet gebruik maakt van hogere temperaturen, maar van langere inwerktijden om een effectieve wassessie te garanderen. Hierdoor kan de machine energie besparen bij het opwarmen van het water.

Wassen op koudere temperaturen kan aanzienlijk schelen in het energieverbruik van de wasmachine. Wist je dat een 30 °C was al 25% goedkoper is in energieverbruik dan een 40 °C was, en dat je *met ons koude wasprogramma nog eens 25% kan besparen ten opzichte van een 30 °C was?*

Third month

### A. Gemiddelde gebruiker

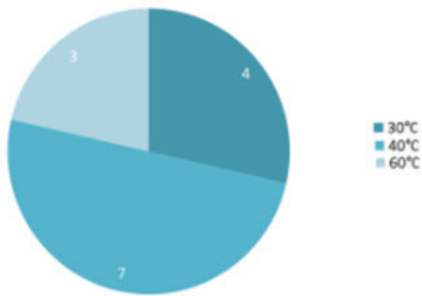
Hieronder tonen we een kort overzicht van jouw waardes, én de waardes die gelden voor een gemiddeld Nederlands gezin van vier personen, gevolgd door een uitgebreider overzicht van jouw wasinformatie:

#### Jouw data

14 wasbeurten/maand

7,17 kWh energie

475 Liter water

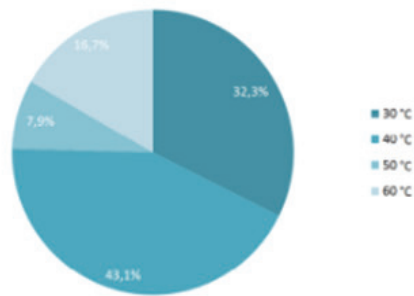


#### Gemiddeld 4-persoonsgezin

31 wasbeurten/maand

14,5 kWh energie

1548 Liter water



### B. Programma



Vaker het ECO-programma gebruikt

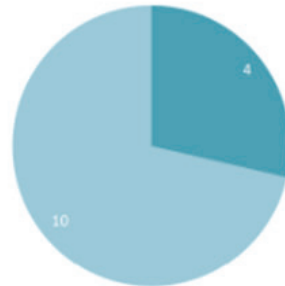
#### Vorige maand

>

#### Deze maand



■ 30 min ■ ECO ■ Katoen



■ 30 min. ■ ECO



### C. Temperatuur



warme wassen gestegen

Vorige maand

>

Deze maand

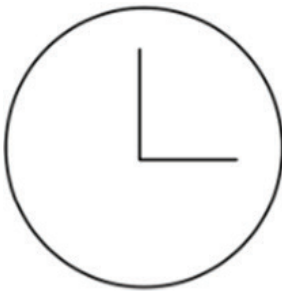


■ 30°C ■ 40°C



■ 30°C ■ 40°C ■ 60°C

### D. Tijden



niet 's nachts gewassen

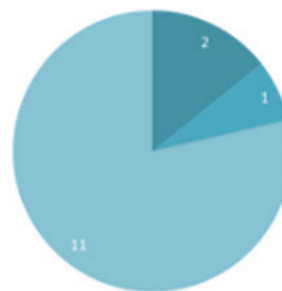
Vorige maand

>

Deze maand



■ Ochtend ■ Middag ■ Avond ■ Nacht



■ Ochtend ■ Middag ■ Avond ■ Nacht

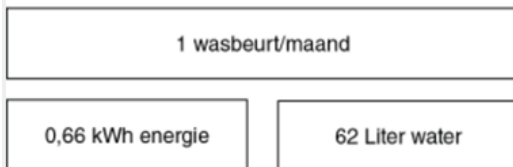
Fourth month

## 2. Wasgedrag van afgelopen maand

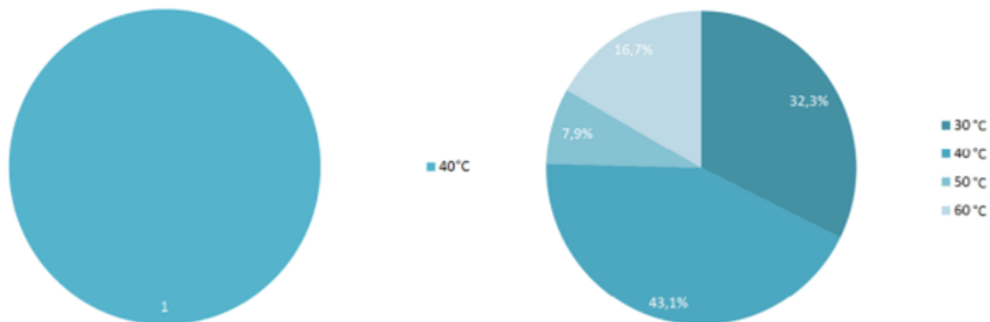
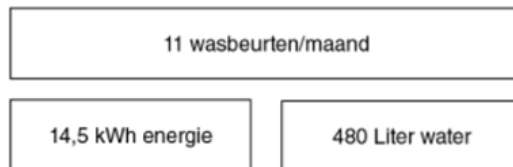
De volgende informatie is gebaseerd op onze data van de was die je gedraaid hebt in maart.

Hieronder tonen we een kort overzicht van jouw waarden, én de waarden die gelden voor een gemiddeld Nederlands huishouden van 1 persoon. We zien hier dat je vergeleken met een gemiddeld 1-persoons huishouden minder wassen hebt gedraaid, en vaker op een lage temperatuur wast. Heel goed!

### Jouw data



### Gemiddeld 1-persoonshuishouden



### E. Totaal verbruik

Ook hebben we een overzicht gemaakt van jouw totale water- en energieverbruik:



**7,17 kWh**  
(meer dan 2x zoveel  
als vorige maand)



**475 Liter water**  
(32% meer dan  
vorige maand)

## APPENDIX 5. HOMIE DATA ANALYSIS DETAILS

### QUALITATIVE ANALYSIS

#### *About washing behavior:*

Insights	Figure
There is a relation between the amount of people at home, and the amount of washings. Families tend to wash more.	1, 5
The average washing per person per month is 14 washes (among 13 users) what is increased by users with high consumption.	-
Even though single users wash less than families, there is still a difference among them, between 2 (user10, 25) and 7 washes a month (User 06).	1, 5
Even though, families tend to wash more, there is still a considerable difference between similar composition families like user 21 with 44 washes and user 13 with 19.	
The most used programs are in order, Cotton (31%), 30 min (21%) and Cotton Eco (18%) and spin (16%).	2
Name detailed programs as easy iron, synthetics, wool hand wash and drain are barely used.	2
40° is the preferred temperature with 39% of the washes, followed by 30° (26%) and 60° (12%)	3
92% of the 40° washes are done in cotton programs (including eco), while 30° washes are mostly done in 30-30 program	3
Cotton (eco or not) as is used in almost 50% of the washes. For this the preferred temperature is 40°. There is a relation between the cotton program and either 40 or 60 degrees wash.	2-3
30-30 degrees is the second most popular temperature and cycle. It is a fast choice with pre-set temperature and time.	2-3
90° and cold wash (rinse) are barely used.	3
75 % of households use 3 or less type or programs (considering spinning as a wash program)	6
Eco mode is only available for 40 or 60 degrees, which is used in 18% of the washes. It is to say that in the 82% left eco was not considered in the selection process.	4
There is no relation between the amount of washings and the number of used programs. Some users use multiple programs with rather low washes (User 13) while others wash more with only one cycle (User 21).	7
The selection of temperature per user does not present a specific pattern, some users wash with one specific temperature (37%), while others prefer two (26%) or three (21%).	8

#### *About Interest and knowledge on sustainability*

Data analysis	Figure
Users reports about interest in sustainability does not clearly increased through time, in most of the cases it kept steady	9
Even though, some users report that using HOMIE service could had been someway influenced their interest in sustainability that is not reflected in their report on interest (Figure 9).	11, 9
It is interesting that in any case the interest in sustainability caused by HOMIE increased through time, most users report the same influence through time.	11
Regarding, knowledge about sustainability user's opinion keeps steady or even decrease through time	10

*Qualitative analysis:*

- **Users decide when to wash based on different concerns: whenever it suits the schedule, when the basket is full, weekends or according to other events (performance) are the most common patterns.**
- Current users are mostly tenants
- Machine location, Hallway, Bathroom, Laundry room, Storage, Kitchen, In the attic
- **Short programs are liked, as well as the spin (delicate) program and delay function**
- Display is desired (in case it is not included) to check how long the program takes and how long the program takes (helps in decision making)
- **Along with display the most common requirement is shorter cycles with the same quality.**
- The problem with eco is that is longer than a normal cotton cycle. This reduce the willingness of use, a shorter eco would be nice.
- There are outlier users who ask for specialized programs. Family with a baby ask for delicate wool wash program
- **It is common to sort cloth in white (clear), black (dark), color, bedsheets, delicate and towels. Or everything together. Other categories are uniforms.**
- Towels and bedsheets are commonly washed in high temperature cycles (60-90); some users do it occasionally (once a month) instead of all times.
- High temperatures for general cloth (not towels) can be related to changes in the shape
- The most mentioned temperature for common laundry is 40 degrees, higher if the cloth is dirty or smelly.
- There is a tendency to use higher temperature for white items as well
- Doing laundry is not an enjoyable process, hanging specially.
- It is not common to reflect on the price of each laundry, however the moment of buying the machine characteristics on energy and water consumption might be important. An user with low income is more aware of energy consumption
- Some users opt for laundry service in case of not having a machine at home, this can be quite expensive
- Most important factors when buying a washing machine, in order of mention: Price, brand, washing programs (spin, short programs), energy efficient (ECO), delivery (installation), insurance, size. One user prefers second hand
- **The most appreciated characteristics of homie are: saving the upfront cost of the machine, good low price, better overview of the costs (fair and all included), trustable quality and economic machine, it is a startup, it is nice to receive suggestions, sustainable, easy and quick installation, maintenance included.**
- Some users see Pay-Per-Use as a temporal solution while wait to buy their own one.

*Follow up survey:*

Insights	Quote
There are more cycles available than what the users actually use.	5, 15
Users would like to have feedback on the program length and notifications (not to email, it is easy to look over mails so it's not handy).	12
<b>Time is really important factor when selecting the cycle.</b> There is a common request for shorter programs.	2, 10
Choosing the program might be troublesome, multiple variables as time of the cycle, personal, kind of wash might clash	10, 14
The higher the temperature the better the cleaning. Higher temperature for white as well.	3, 4
Eco wash or shorten are limited to some programs only, in the former users are not able to use eco in lower temperatures, and the latter limits washing to user's time availability.	9, 11, 13
Some users appreciate and are willing to receive suggestions	6, 9, 36
<b>The service might have created awareness to some users when selecting the cycle and temperature, lower temperature, more use of eco as well as water consumption. For some user's suggestions matters, as well as to economize when they know (aware) which is the most economic cycle. This can be due to a combination of suggestions and price incentive. Some users are not affected by the suggestions and price.</b>	1, 16, 17, 18, 19,20, 31, 26

When not paying, the attention paid to the price might be reduced, therefore in this stage suggestions might be more impactful than price incentive.	22
Most users would recommend HOMIE to friends, it is easy and cheap	23, 24
There might be a general interest in understanding washing consumption, knowing it is not possible to know how much water and energy does the machine consumes.	24
The service seems to be acknowledged for users with low income, or not interested in paying full price, for big families Pay-Per-Use can be disadvantageous.	25
Ideal payment would be nice.	30-38
Some users would like to have more statistics, graphs and background information on the webpage	31, 33, 37
The web page offers products that are not available yet	27, 28
The list used to present the washes seems too much and does not clearly communicate the consumption. It is not possible to export the list for printing	29, 34
Users would like to have automatic debit, automatic top up, pay all the washes in one time	39
The relation between temperature and sustainability is not always clear	39

### *Conclusions, insights and information triangulation:*

#### **About HOMIE service**

- The most appreciated characteristics of homie are: saving the upfront cost of the machine, good low price, better overview of the costs (fair and all included), trustable quality and economic machine, it is a startup, provide nice suggestions, sustainable, easy and quick installation, maintenance included.
- According to qualitative data, the service might have created awareness to some users when selecting the cycle and temperature, lower temperature, more use of eco. For some user's suggestions matters, as well as to economize when they know (are aware) which is the most economic cycle. This can be due to a combination of suggestions and price incentive. Some users are not affected by the suggestions and price.
- Even though some users report that HOMIE has influenced their interest in sustainability in the metrics, that is not reflected in the overall interest scale. It is interesting though, that the qualitative analysis reports that some users are more aware of the program and temperature use as well as water consumption.
- It is not common to reflect in the price of each laundry, especially during the free month. In this stage suggestions might be more impactful.
- Users appreciate suggestions on how to wash better and are willing to receive more detailed ones.
- Most users would recommend HOMIE to friends, it is easy and cheap.
- Users would like to have more statistics, graphs and background information on the webpage
- The relation between temperature and sustainability is not always clear.

#### **About washing behavior**

##### **Consumption:**

The quantitative analysis shows that the consumption can varies according to household composition, but there is still a considerable difference among similar compositions. There is room for reducing and steering towards more sustainable programs and temperature selection.

##### **Habits**

- There is a common understanding that the higher temperature the cleaner the laundry. This applies specially for towels, bedsheets and white cloth.
- Towels and bedsheets are commonly washed in high temperature cycles (60-90); some users do it occasionally (once a month) instead of all times.
- Users decide when to wash based on different concerns: whenever it suits the schedule, when the basket is full, weekends or according to other events (performance) are the most common patterns.

- It is common to sort cloth in white (clear), black (dark), color, bedsheets, delicate and towels. Or everything together.
- Time is a key factor considered when selecting the cycle (that is why display is required). There is a common request for shorter cycles.
- Selecting the cycle might be troublesome since users need to balance the personal available time along with the wished program and the time it takes.

### ***Programs and temperature***

- The selection of three or less temperatures per household indicated in the quantitative analysis is consistent with the classification of cloth, if cloth is classified different temperatures or programs might be used according to the clusters. This does not happen in all cases though
- It is interesting that even though the most common way to sort out the cloth is by color and type (general, bedsheets, towels) the cycles are named by material. It can be assumed therefore, that the programs' naming can facilitate the selection process and consequently work as a steering strategy.
- Most of the washes are done in cotton cycles and in either 40 or 60 temperature, 40 is the most common.
- The second most popular program is 30-30. Its wide use might reflect users need to balance time and cleanliness. Also shows that the name of the cycles by type of material is not necessarily required for the user's willingness to select a cycle.
- Both 90 degrees and cold program are barely used. The same is found for detailed name programs (synthetics wool, hand wash)
- Most households use 3 or less type of programs according to the quantitative analysis, this is consistent with reports in the qualitative analysis that point out to multiple unused functions or the habit of using just a few. Washing more does not relate to using more programs

**Why is the eco function used in only 18% of the washes?** The use of eco is only available for 40 and 60 degrees' temperature, this limit user's choice, who according to the qualitative analysis are willing to use it in less temperature. Other factor that influences the rather low use of this function is that it takes longer than a normal cycle and that time is mentioned as one of the main user's concerns when selecting the cycle.<sup>13</sup> Quantitative analysis highlighted extremes behavior, in this regard, users 21, 12 and 18 could be interviewed to gain insights into high consumption habits while users, 4, 10, 25 into less consumption.

Missing information?

Even though a relation between the laundry sort out and temperature/program was found, it is not clear yet which knowledge, habits and intentions are involved in the decision-making process. Additionally, some concerns were identified that could influence the selection process, as cleanliness, time, available personal time, type of cloth, social events, however the importance given to each one is not defined. It is essential to gain insights into a deeper layer of user's behavior to be able to design a solution that better fit their concerns.



## APPENDIX 6. QUOTES HOMIE INTERVIEWS

\*\*\*\*\*Pre-installment interview

“No, before that was not relevant” User 15 talking about thinking on the washing cost

“Most of the times Eco, but it takes a long time, so an extra short program would be good” User 8 about a desired feature

“The dirtier, the warmer.” User 8 about the selection of temperature

“Bed linen at 60 C, white wash at 40C, dark wash on cold.” User 21 about the temperature selection

“no, I am quite simple, it has more options than I need” User 6 about missing features

“Good price, it is nice to receive advice in how to wash better” User 6 about HOMIE service

“No cost beforehand, sustainability, fair paying for what you use, not expensive” User 21 about HOMIE service

\*\*\*\*\*After use

“No, what I am wondering about is why the wifi remains connected when you turn the washing machine off after finishing the laundry” User 10 about connectivity

“Curious about most economic program. Most eco-friendly programs last very long.”

“I sometimes have trouble choosing a program for the time I have and what kind of wash I want to run, but it's built into the machine.” User 5 about missing features

“Eco wash at 30 degrees” User 6 about missing features.

“The exact time when the machine would finish, the length of a washing round, a push notification (e.g pushbullet) or a telegram -bot message. Email notifications is practical but it is easy to look over it because there are many emails” User 15 about missing features

“Good machine, I only miss in the eco 40 program is the possibility is to enable the quick feature, but that is already included in the machine program” User 10 about missing features

“No not really. However, there are only a few programs that can shorten, so **I often concentrate the washing up to the days I'm home and then do everything at once**” User 5 about missing features

“No I actually always use the same” User 11 about missing features

“Now I wash less frequent and I filled every round more. I am more conscious about washing, I don't wash anymore small things or individual items, I think that I have become more conscious about my behavior and I do it better every week” User 03 about changing washing behavior with Pay-Per-Use

“I changed from 40 eco because according to you that is the most economic program but like I said above that takes an hour of washing time.” user 10 about changing washing programs with Pay-Per-Use

“Yes, we use the quick eco more frequent when it is optional in the program” User 17 about changing washing program

with Pay-Per-Use

“I tried intentionally lower temperature no more hot wash. I used to that” User 03 about changing washing temperature with Pay-Per-Use

“30/30 and much more eco” User 18 about changing washing programs with Pay-Per-Use

“I’m using the eco mode more” User 8 about changing washing programs with Pay-Per-Use

“Because we have not paid yet, I have not really paid much attention to the prices” User 18 about the prices

“Certainly, I am very satisfied! It’s easy and not expensive” User 08 about recommending HOMIE

“Yes absolutely. Already told some colleagues, they are very interested. Some also do not want an expensive purchase price, and some just seem interested in their washing behavior, and I did not expect that!” User 03 about recommending HOMIE

“Yes, for people who do not have the finances to buy a washing machine immediately” User 22 about recommending HOMIE

Yes, notifications are fine and you are more conscious (try to wash as cheaply as possible by running full wash and using ECO) User 07 about recommending HOMIE

Not always, it is not clear that no dryer can be delivered” User 15 about web page

“It’s fine, just crazy that there are options that are not yet available. (Such as dryer / dishwasher)” User 22 about web page

No need to see the complete list of washing time is fine to only see wash (spin, laundry). I cannot log in with enter.” User 06 about web page

“Ideal payments would be great.” User 04 about options in the webpage

Nice website, I just looked at it. Maybe a little more statistics and background information, I was quite shocked to see how many liters of water the washing machine users. User 06 about options in the webpage

A JSON / XML API to integrate it into other overview solutions (such as Home Assistant). User 15 about options in the webpage

“I am curious about more elaborated washing statistics than I can see right now”. User 06 about options in the webpage

Printable overview of costs: user 18 about options in the webpage

“The weekend washes as cost-effective” User 6 about options in the webpage

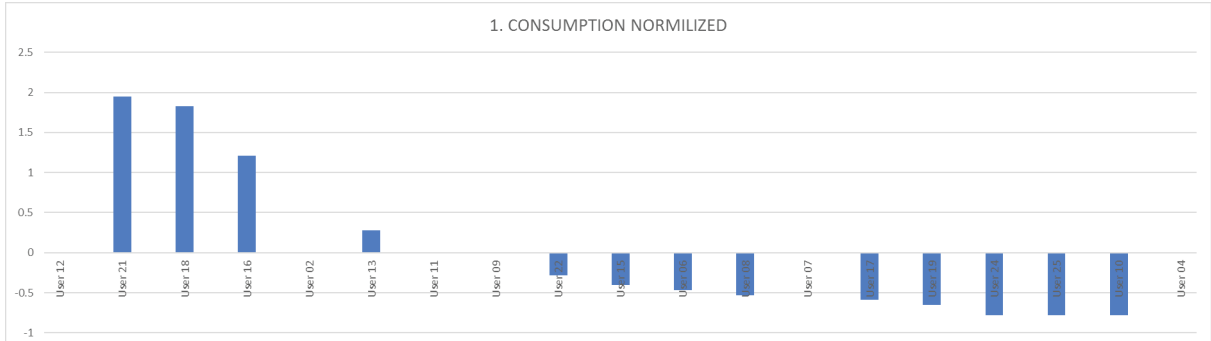
Advice on how to wash better” User 7 about options in the webpage

“No not really. Maybe some of your graphs were behavior or so” User 5 about options in the webpage

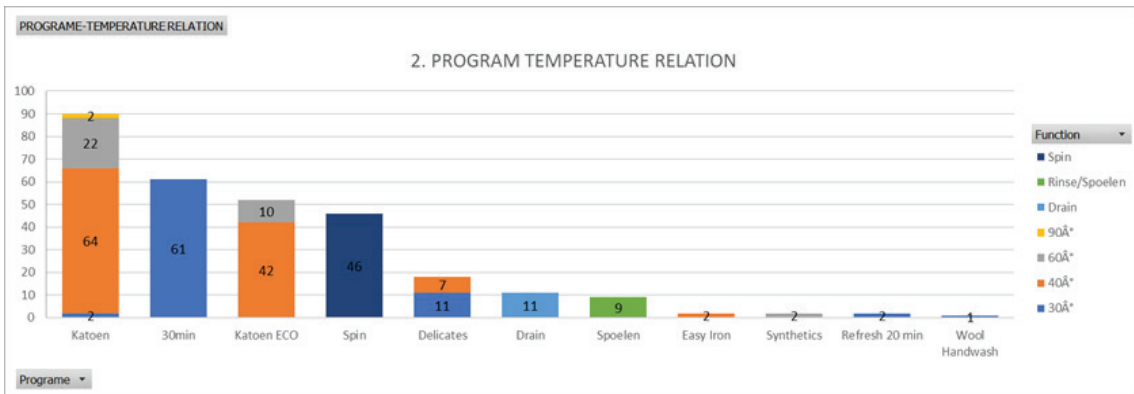
“Great that it goes automatically and I do not have to confirm anything again.” User 08 about payment

Figures quantitative analysis HOMIE data

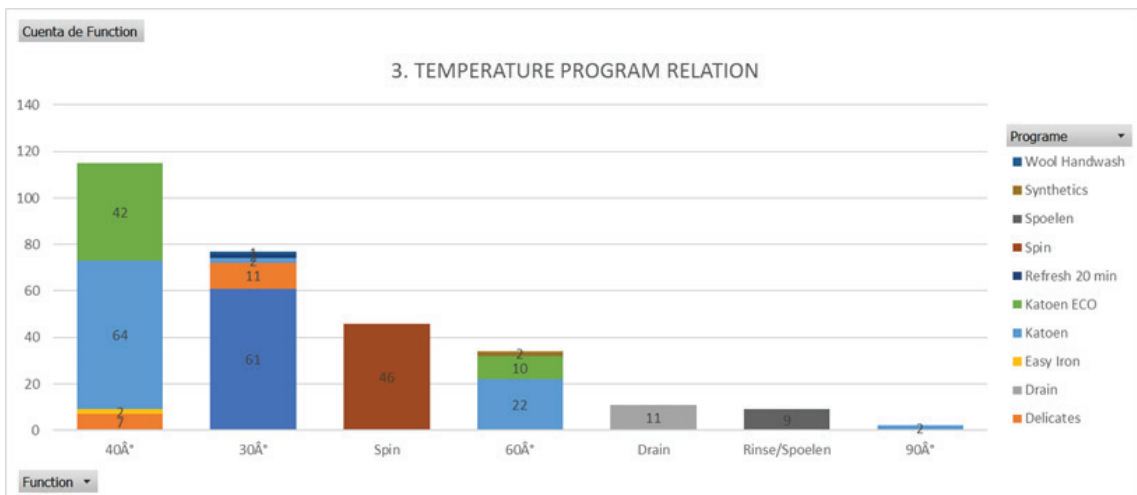
## APPENDIX 7. QUANTITATIVE ANALYSIS GRAPHS



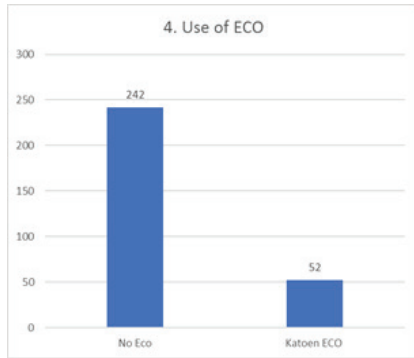
Consumption normalized per household



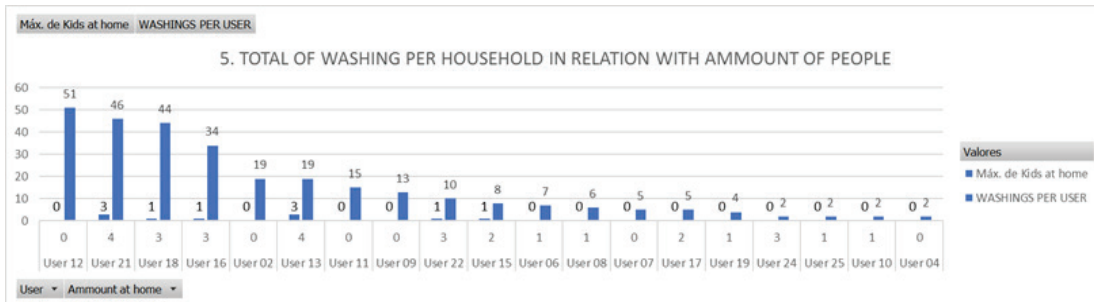
Program and temperature relation (most common programs and in which temperature are used)



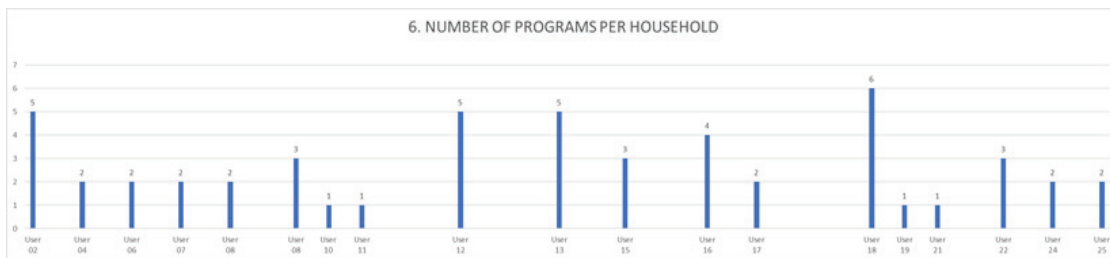
Temperature and program relation (most used temperatures and in which programs)



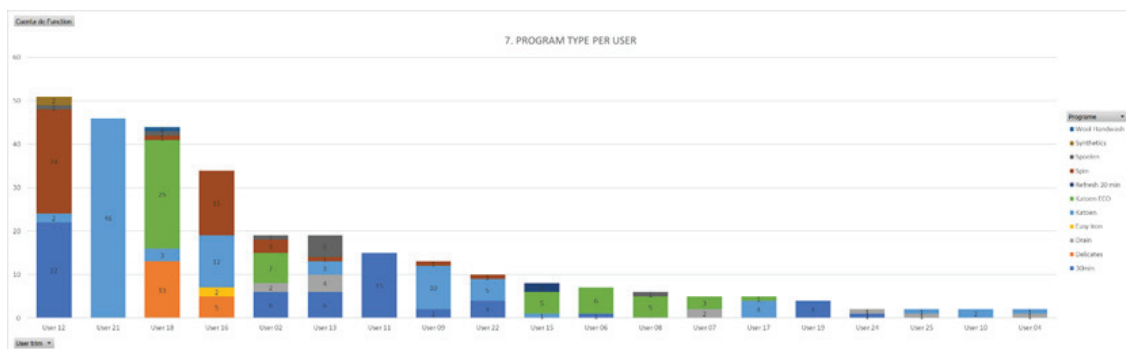
Eco vs normal functions



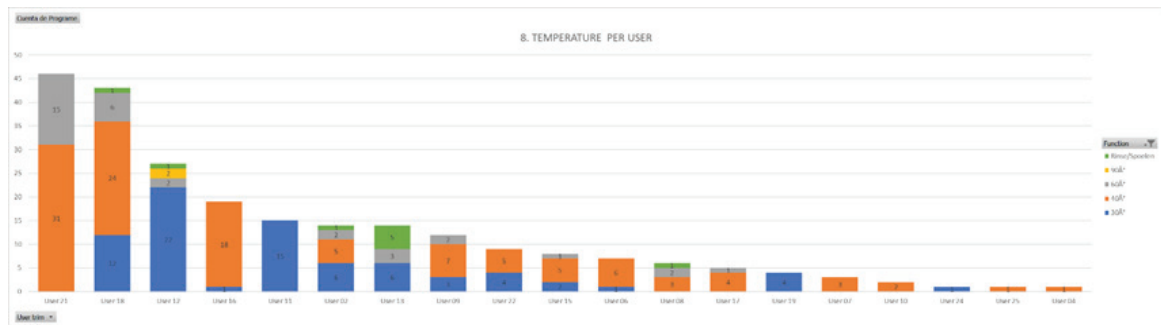
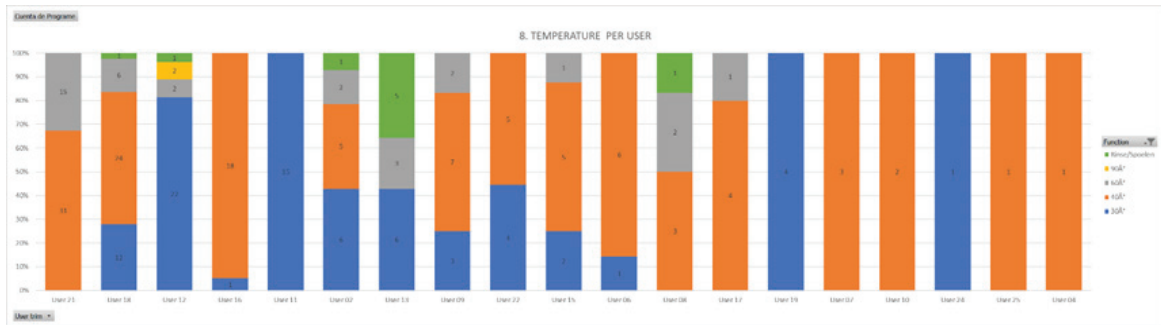
Washing per household in relation with amount of people (and children)



Number of programs used per household



Programs per user



Temperature per user

## APPENDIX 8. EXTENDED USER RESEARCH, INSIGHTS AND QUOTES

### General:

- Users are only able to wash during nights and/or weekends to be at home  
*"I wash on weekends, especially on Sunday because I am at home" User 2*
- *"I don't laundry when I know I have time to stay at home because my washing machine takes quite some time" User 2*
- Washing is triggered by 3 factors: Have available time at home, full basket, or not clean items

### **Laundry is an undesirable task, time and effort are limited to the min. possible.**

*"I don't like to do laundry, I don't want to spend more time and effort of what is required" User 6*

### Sorting:

- When sorting, users mix and match different factors, as color, temperature and material. Other less common factor is closeness to the skin (layers)  
*"I sort by color and temperature, temperature to avoid my delicate to shrink" User 5*
- The granularity of the sorting depends on certain extend on the type an amount of clothes to wash as well as users wardrobe
- More categories do not mean more cycles, multiple groups can be washed with the same program.
- Users have between 3 and 5 groups depending on their habits. It is common to see two big groups followed by 2 o 3 small groups (delicate, white, shirts, blue jeans, house stuff)
- Material is classified in hard (cotton) and soft.
- Color in white, color, dark and sometimes complemented with delicate
- Temperature is also a factor when sorting, it is usually a high temperature wash and a low one.

### Programs details:

Different categories respond to different personal concerns and are consequently washed in different programs as follows:

#### **- Delicate: "The clothes I really care about, susceptible to get damage"**

- The main concern is to ensure the condition of the clothes.
- Includes wool, blouses, dresses, skirts and expensive items.
- Washed in low temperature, usually 30.
- If specific features are used low spinning is configured, small load is preferred to avoid wrinkles.
- Program can be cotton 30, fine wash or wool hand wash
- Clothes price and personal importance is a factor when both sorting and selecting the cycle.
- In some cases, special detergent might be used
- Some extra requirements can apply when sorting this group, for example not mix it with other strong fabrics  
*"I try to not put them with socks, or towels or strong fabrics that might damage them" User 2*

#### **White: "Well if bought it white, it must remain white, right" Careful**

- The main concern is to ensure that white remains white.  
*"White goes with white that is a rule" user 6*
- *"I want them to be white, mix with colors will turn my white t-shirts pink." User 4*
- Due to the restriction to only white and light items it is not the most frequent wash.
- There is no discrimination by material
- Multiple temperatures are used from 30 to 60  
*"I use 30 because it gets me the clothes clean, I don't really need it to be higher, besides higher temperatures damage clothes" User 4*
- High spin is preferred 1400
- It can be divided in soft and hard materials, towels and bedsheets and delicate.
- It includes towels and bedsheets, t shirts, pants, underwear, bedsheets

**All the rest: “All these can go together, why not” Careless**

- Is a group of mixed colors, white and dark and multiple types of clothes, that allow users to do a full load wash.

*“If I would have to separate colors, I will have to wash way more” User 2*

- Usually is daily clothes, and might include sport as well.

- Ensuring clothes condition is not the main concern

- In this cycle “color catcher” is used by some users

- Program Cotton 30 or 40

*“I divided really simple, all together, if I have too much I would do a dark wash otherwise it goes all together” User 2*

**Color/ Dark: “All these can go together, why not” Careless**

- Might combine color and dark items

- Includes, daily clothes plus sometimes sport, bedsheets and towels d

- There is not a clear concern that defines this group

*“In this group, I wash all the things I don’t care too much about” User 6*

- Programs include: Cotton 40 or 60 if with bedsheets or synthetics 30\*40

- Not material selection

*“I want to be sure it is well cleaned” User 5*

- Towels and bedsheets: “I want to be sure all bacteria are gone” Hygienic

- It is related with heavy tough materials that can therefore handle high temperatures

- The main concern is to ensure that are clean.

- The need for cleanness might be related with the direct use on the skin

*“I have the feeling that I use them so much close to my skin” User 3*

- Programs: Cotton 40, 60 or 90. It is common to do some washes in 40 or 60 and then occasionally higher.

*“I want to achieve the feeling of soft cotton” user 1*

- High spin is preferred to get dry result

**Sports:**

- Short program in synthetic 30, Cotton 40 or 60

- It might be mixed with underwear

- Due to its use it is usually dirty.

*“I want to clean the stuff that I really want to get clean” User 2*

**House stuff:**

Some users accept to mix these items with others while others not because of hygiene concerns

*“I don’t wash the kitchen towels with my other clothes because they are greasy and dirty” User 5*

**Program General:**

- There is a general lack of knowledge about the difference between different programs, how is water, energy, time and temperature regulated, and how that impacts clothes

*“I know the cycles do something different but I don’t think it actually affects the results of washing” User 4*

*“Nobody knows the difference between different programs, is like a black box you select the preset and that is it” User 4*

*“Most of the settings I have no idea what they are, is it something extra? Should I now about it” User 4*

*“I don’t see the point of too many cycles, because after all it is just mixing water with soap and detergent (He always use cotton modified cycle)” User 5*

- Some users rely completely on the pre-set functions while other start with cotton and modify both temperature and spin according to their knowledge

*“The settings are already done, I don’t do anything else, I trust the default” User 6*

*“Usually I start from cotton eco because is kind of the generic one” user 2*

- Cotton is seen as the generic, average cycle

*“I don’t know it just seem the most suitable one, somehow” user 2*

**- Lack of knowledge about the most suitable (efficient) program settings in relation with the type of clothes lead to doubts when selecting the cycle.**



- Some users have a dilemma when choosing the temperature, is higher temp actually cleaner is it worth it?  
*"I am always doubting, should I do it 40 or 60? 60 because I want I cleaner, then I think, bullshit is not cleaner, then I do 40"* User 5
- Users do not relate the name of the program with the type of cloth  
*"For jeans, I wouldn't go for jeans I would use cotton"* User 1
- There might be resistant to try new cycles  
*"I won't use fine wash because I don't know it yet. I don't trust the washing machine"* User 1
- Some users handwash delicate items, underwear and swimming suits

### Temperature:

The perception of low or high temperature vary from user to user.

High temperature is related with better cleanness, and it is used mostly in hard materials that can resist the temperature without getting damaged, it provides a feel of safety.

*"I choose 60 because it makes me feel safer, for towels and underwear specially"* User 6

Low temperature is related with ensuring clothes condition, usually used in delicate and especial items (expensive or with personal value). In this items cleanness is moved to a second level of importance.

*"I use 30 because is the recommended temperature in most clothes label, I would use 40 though if it is very dirty"*

*"High temperatures can damage the clothes, so to keep it in good condition I try to use low temperatures"* User 4

Cleanness required and therefore temperature can be defined or affected by social factors

*"My flatmates are always complaining that 30 is not enough for bedsheets, it does not make any sense because the sheets are mine"* User 2

### Concerns:

Clothes condition and cleanness are the main users concern, this means maintain quality and ensure cleanness. These needs completely overrule any other factor, including consumption.

*"I won't wash my clothes less well for saving energy or water"* User 4

*"I concern more about my clothes, even if I feel guilty for doing a wash for only 3 items"* User 5

Energy and water consumption are seen as one group of factors, which received either medium or low level of attention.

### Time:

Some users are not concerned about length of the cycle if

they are at home to wash

Quick was is seen as an efficient way to clean occasionally  
*"If I am in a hurry I would use super quick option"* *"We use the 15-min washing sometimes"*

### Clean:

Concerns regarding the result (clean, white, dry) of laundry varies from user to user.

*"I don't care too much if it finishes not that clean or not that soft"* User 1

Leaving laundry into the machine for long time is undesirable for some users

*"I hate that my clothes stay in the washing machine for long time"* User 2

There are two positions regarding the cleanness requirement on one hand users prefer to thoroughly clean items that get in direct contact with the skin, while others remark that those items are not that important because are personal.

*"I fell my towels are not that dirty because I am usually clean"* User 6

### Material:

There is a concern about the potential damage that temperature can do to delicate items, on the other hand cotton is perceived to resist high temperatures

*I am afraid that the machine is going to damage the clothes, I would hate if the delicate clothes lose the color"* User 1

Users rarely check the clothes washing recommendation labels, only in case of expensive items or that they care about. Some users never do it

*"I only check the labels when I am not at sure"* User 2

*"I only check the labels for things I care about or are expensive"* User 6

### Eco:

It is not clear what eco function does

*"I don't actually know what exactly is eco, does it use less water and energy?"* User 4

*"I don't know what it does, I would use it but it depends in what will change"* User 5

There is however, an assumption that eco uses/ regulate less energy and water

*"I assume that eco consumes less water"* User 2

This assumption leads in some extend to skepticism about the eco-function. The purpose of saving resources lead to the idea of a softer, less hard cycle. Users describe eco as too standard and not reaching its potential of cleaning

*"I think that it is a bit bullshit or it does not wash with all the potential."* User 5

*“I feel that eco is not going to wash it in a hard way (but they always have eco turn on)” User 6*

Even if there is interest in energy and water consumption, that interest cannot be translated into actions due to the lack of information for a conscious decision making.

*“I don’t know how to regulate water and energy” User 5*

*“I am interested in energy and water consumption, but I am not sure how to deal with it” User 3*

Users are open to suggestions in more sustainable programs.

*“I want to know what is the best for the environment and what for my clothes so I can take a decision” User 5*

*“I would like this IoT thing to tell me what is the best program in terms of energy*

Using eco as default works for steering users towards eco program use.

*“We always have the ECO turn on, because we assume it save us a bit of energy” User 6*

Users ideas to wash more sustainable are, reduce temperature, use shorter programs and do full load. This washing machine does not have a load indicator though.

*“I have two freakiness when washing, the shortest cycle possible to be more sustainable, and wash with low temperature to ensure clothes last longer” User 2*

Complete load is seen as an efficient way to do the laundry, it saves time, energy and water.

*“I have a rule. If there is hand from the top of the clothes to the top of the washing machine, it can be washed” User 6*

*“I would put load here (high level of concerns) because I care about consumption, it is relevant to me” User 3*

### Detergent:

Users have no idea on how much detergent to pour, Intuition is the most common method

*“I have absolutely no idea on how much detergent to pour, I usually use one cup” User 2*

*“I just pour, if it is a big load I pour a bit more” User 1*

*“I really don’t know how much should I pour to get it clean” User 5*

The amount varies from user to user, some decide to use the less possible while others the maximum.

Even though bottles do indicate the recommended amount, the instructions are not clear, kg is hard to measure and level of dirtiness is a subjective measure.

*“The package says for this amount of kg, how do I know is a kilo, how can I measure it” User 5*

Detergent is selected based on different needs: cheap, antiallergic, tradition, smell, quality, time of color or type of wash.

*“I was allergic to certain things, so my mom always took cautions, I know the brand that doesn’t affect me” User 5*

*“I usually go for the cheap one that is liquid and concentrated, the one I use smells good, I am not sure if it washes good though” User 6*

Detergent is related with the local water hardness, that is a factor that can be used to steer users towards a certain amount of detergent.

*“If I would know the water hardness, I would consider changing the amount but I don’t know it. User 4*

The perceived quality can influence the amount of detergent used.

Some users try to experiment to figure out the right amount.

### Feedback:

There is no clear relation between the used program and its energy and water consumption. This way is hard to identify which is better in terms of sustainability.

*“I don’t know yet what I am supposed to do with this data, what is the purpose” User 5*

*“It doesn’t say anything to me, I don’t find it useful, I used eco but what does it mean?” User 6*

*“There is no relation between the variables, did I do eco in 40 or 60” User 2*

*“It is not easy to say which month was better in sustainability” User 3*

Similarly, to the results in the user research, there is not a clear understanding of how eco function affect the consumption.

*“Know that I used eco doesn’t tell me anything, I want to know what was the result” User 5*

Users would like to see a progression in time to evaluate how has their consumption changed

*“I would like to see a clearer comparison, to check how my performance changed” User 6*

*“It might be interesting to have a progression per month, not only two months, so I can notice that I use more” User 1*

The goal of the feedback is not clear. The information is clear but how can that be translated in user’s actions is not.

*“It is clear but I don’t know how to link it with my own behavior” User 5*

*“I don’t understand how is temperature and programs related with consumption” user 2*

The current hierarchy give more importance to the details of consumption than energy and water. Users point out that they are more interested in water and energy (locate on top) than in the details of consumption.

*“You have to analyze all these details that are not that important, those should be in a lower hierarchy” User 6*

*“The most important information is the water and energy, because that is the info I don’t know”*

The units of water and energy are not understandable on practical terms, it is too abstract

*"This does not say anything to me, 164 energy doesn't say anything to me, I would rather to compare it with my daily activities, how many times could I have charged my laptop"* User 1

*"Ok you tell me how many liters, is that high or low?"* User 2

As information is presented users are required to calculate, consequently consumption is not easy to read. It would be nice to have already the results.

*"It is hard to compare months, I have to think and do math"* User 2

*"The amount of washes is not easily perceived in the pie chart, it makes hard to follow the comparison."* User 5

Pie chart are not visually comparable

*"Pie charts are difficult to understand"* User 5

Use always the same color for the same program or temperature

**Provide feedback in terms of good and bad actions, what exactly was done wrong and how to improve it. Include personalized suggestions.**

*"I would like to know first if I did something good or wrong in terms of consumption"* User 6

*"I would like to know what can I do better"* User 2

Time is not relevant for most of the users, there is no clear relation with sustainability, how time of the day impact the consumption.

*"Why does the time I washed matter"* User 4

*"How is time related with sustainability"* User 3

Provide an average or normalized washing temperature to facilitate comparison

*"If I washed 30 or 40 might depends in other factors than temperature. I would be more interested in an average at the end of the month, also to see how it changed in relation with the month before"* User 4

*"Take it back to 1, because I washed more some moths for external reasons so I would like to see an average of the consumption"* User 3

*"I would like to know what can I do better"* User 2

Provide the feedback when selecting the cycle not after.

*"if it is about sustainability, I would like to have the feedback before"* User 5

**Social comparison:**

No clear information arrangement. Two columns expected. No clear difference between social comparison and personal information

*"With the two headers, I would expect information to be arranged accordingly"* User 4

Size and location of icons can be misleading

Compare with similar households, using easier to

compare graphs and clear units (maybe normalized)

*"Why compare with a family and not with a user similar to me"* User 6

*"I would like to relate comparison with other person and their info, how clean is their clothes"* User 5

**Interaction channels**

There is no common agreement on the best interaction channel, the most suitable depends on the user routine, behavior and concerns.

The use of an app can create a closer relationship with user and add value with extra functions as remote control, reminders and notification, however it can disturb and annoy users in the daily life with a topic that is not of their main interest, laundry. There is also unwillingness to download an app if it is not strictly necessary.

*"I don't want it on my phone because I carry it all the time and I don't want it to bother me"* User 4

*"I wouldn't download an app"* User 2

Mails are nice as an occasional feedback; however, users report that is easy to overlook them.

*"Nice to have an email, it creates a relation with the company"* User 6

*"Cute to receive an email that congratulates me once in a while"* User 5

*"I would use remote control to start the laundry when I am away, such I can arrive home and it's ready"* User 4

Washing machine as a direct interaction channel has the advantage of providing relevant information during the decision-making process

*"I would rather the feedback directly in the machine so I can take it into account when taking a decision"* User 3

## APPENDIX 9. SEMI-STRUCTURED INTERVIEW, EXTENDED USER RESEARCH

1. Introduction
  - a. Introduce myself, HOMIE
  - b. Explain general idea and purpose of the interview. There are no wrong answers all responses are good.
  - c. Would you mind if I record the interview? and take some pictures? Ensure confidentiality
  - d. Explain the steps of laundry
2. General information
  - a. Age
  - b. Household people. How many people live with you? Who?
  - c. Occupation
  - d. Nationality
  - e. Who does the laundry
  - f. Do you have a preference on days or time of the days for doing laundry?
3. Sorting the cloth
  - a. We are interested in understanding how do you usually sort the cloth? So, we have these small pieces of clothes and I would like you to sort it as you would do it at home, and to explain me what do you think during the process.

\*\*\*\* Exercise with the mock up

  - b. Why those?
  - c. How would you name the categories?
  - d. Do you have in mind other categories that you might use at home?
4. Program selection
  - a. Now with this groups I would like to know which program would you choose per each group and why. This is a mockup of the washing machine interface, you can select here the program, temperature and features you would use.

\*\*\*\* Interface mock up

  - b. Why those? Which factors do you consider when selecting the most appropriate program for each category?
  - c. Do you use any other cycle occasionally?
5. Factors when selecting the program
  - a. These are some factors that we have identified are important when selecting the cycle. Can you arrange them from the most important to the less important? Feel free to create new ones

\*\*\*\*\* Card sorting

  - b. Do you have or can think about strategies to wash more sustainable?
  - c. What do you think about the eco-function?
6. Detergent
  - a. What type of detergent do you use? Why that one?
  - b. Does it change according to any of the categories?

c. How much do you use? How much do you know that is the right quantity?

7. Current feedback

a. This is an example of the feedback that HOMIE you are receiving about it we wonder:

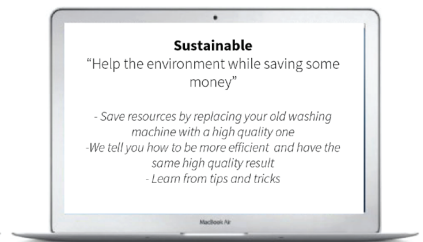
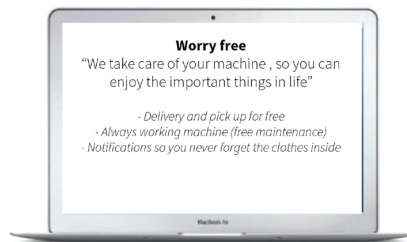
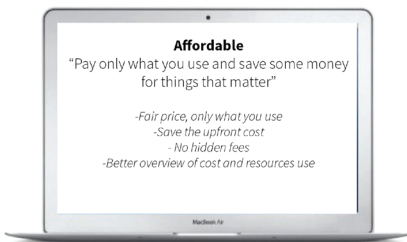
\*\*\*\* hand in feedback + likert scales

- i. What do you think about receiving this type of feedback a month?
- ii. What do you like and dislike?
- iii. What would you improve it?
- iv. Which additional information would you like to see in the feedback?
- v. What information do you feel is vague, not clear or not useful?
- vi. If you could choose, where would you like to receive the feedback (app, webpage, email, text message)

## APPENDIX 10. WEB PAGE FEATURES IDEAS

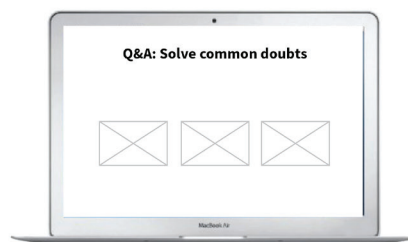
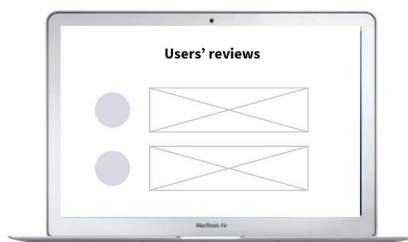
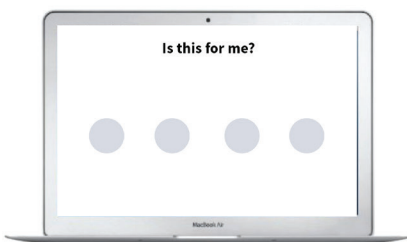
### MOTIVATING ADOPTION

#### An affordable, worry free and sustainable washing machine at your home



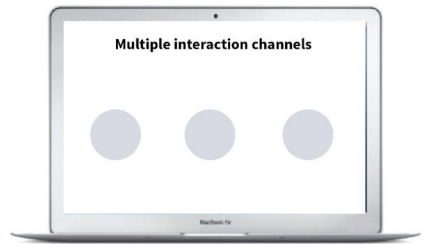
### MOTIVATING ADOPTION

#### Overcome doubts



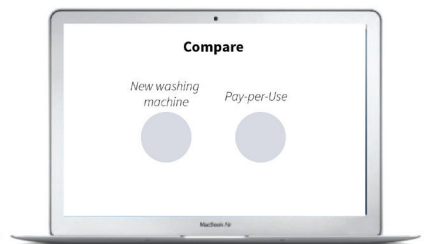
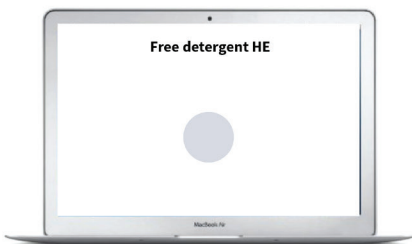
## MOTIVATING ADOPTION

### Ease the process



## MOTIVATING ADOPTION

### Motivate





## APPENDIX 11. EXPERT CONCEPT EVALUATION

A evaluation session was carried out with HOMIE CEO to evaluate the business aspects and relevance of each concept in HOMIE future vision.

### *Concept 1, “Bring smartness to your house”*

Positive

Notifications

Smart grid, easy to check the energy (potential partner with Easy Energy)

Negative

It is weird that cycle programing is done in the app, high dependency can be annoying

Doubts

Auto dispenser is nice but can be expensive.

Design evaluation:

It includes all the levels of sustainable behavior strategies, especially at the area of technology control, however eco-feedback is weak. Partnership creation is interesting in the future. It is important to consider the cost associated with high technology.

### *Concept 2, “Save money while saving the planet”*

Positive

Social comparison is important

The focus on feedback (not sure about personalization), make it funny and personal

Tailored suggestions, short tips linked to media content

Negative

Showing price is not the strongest point of CBM, it is better to focus on high quality and longevity.

Doubts

Not sure if inspirational words would be something people will use

Gamification would only work for certain users, it might work when combined with social comparison, also consider involvement in long term.

Not sure about the use of remote control, if it is actually useful.

Design evaluation:

Design sustainable interventions only focuses in eco-feedback, which won't ensure a long-term behavior change.

### *Concept, “your laundry assistant”*

Positive

Notifications, include how long is left in notifications

Nice detergent measure, it would be helpful along with bundles

Negative

The calendar feature is not clear, it seems to only tackle shared households. It can be misleading

Doubts

Smart programming seems nice, it seems to be a helpful function, but not sure if users will feel to lose control, add a layer of final control. Cleanliness should not be a factor. Use dirty instead of soil. Provide explanations about cycle suggestion features.

Design evaluation: The design is not very clear to Colin, what indicates some weakness in UX, especially in calendar feature. Feasibility is medium because it is possible to use a commercial washing machine. It achieves all sustainable behavior strategies.

### *Other comments:*

Consider holiday inactivation

Simplify the use of delay option, and provide control before coming home. This would make sense with calendar HOMIE is interested in implementing feedback improvements as soon as possible, as well as webpage. Improvements in the washing machine are seen in long term when it is possible to make partnerships with manufacturers.

## APPENDIX 12. CONCEPT EVALUATION MATRIX

### BRING SMARTNESS TO YOUR HOUSE

#### User Experience

		Low considered	High considered	Concerns
Control	Remote control and monitoring. Users don't select directly the program features.	○ ○ ○ ● ○		This alternative rely mostly in machine decision-making, therefore the value of certainty can vary according to user's expectation and previous experience.
Certainty (guidance)	If users trust the machine decisions, certainty can be provided. Flexible cycles	○ ○ ● ○ ○		
Time management	The calendar allow users to remotely control and adapt the laundry to their schedule. Also, with smart grid	○ ○ ○ ● ○		
Sustainable concerns	Since most decisions are taken by the machine, low room is given for user actions	● ○ ○ ○ ○		

3

#### HOMIE

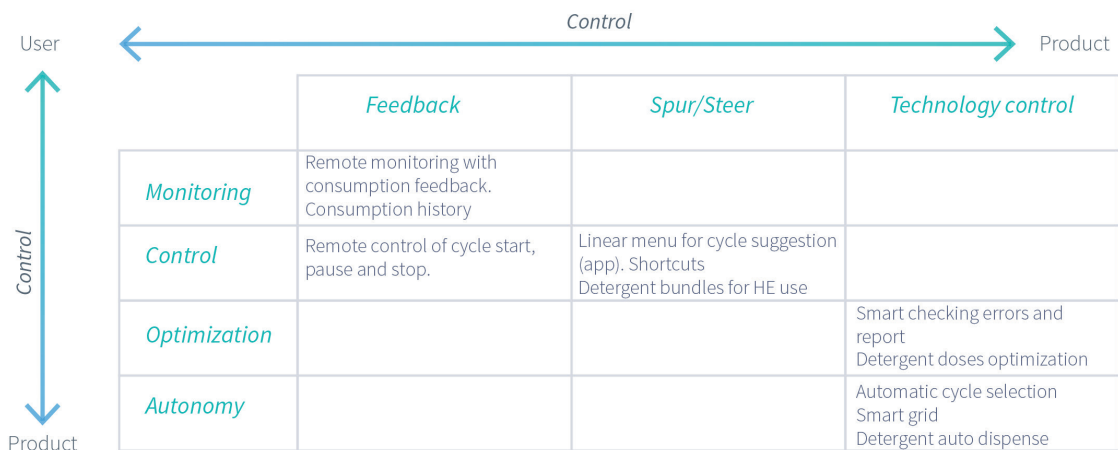
Worry-free	Remote monitoring, bundles, preventive maintenance, automatic cycle selection. Notifications	○ ○ ○ ● ○	
Affordable	Due to the high tech required this alternative will not be as affordable as the other concepts.	● ○ ○ ○ ○	
Feasibility	High tech required, as well as algorithms	○ ○ ● ○ ○	

2.6

#### Sustainable behavior and IoT

All the spectrum of sustainable behaviour strategies is covered, special focus is put on technology control	○ ○ ○ ● ○	Automatic cycle selection without user's input is risky. It also limits env. awareness
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4



**Total: 9.6 points**

## YOUR LAUNDRY ASSISTANT

### User Experience

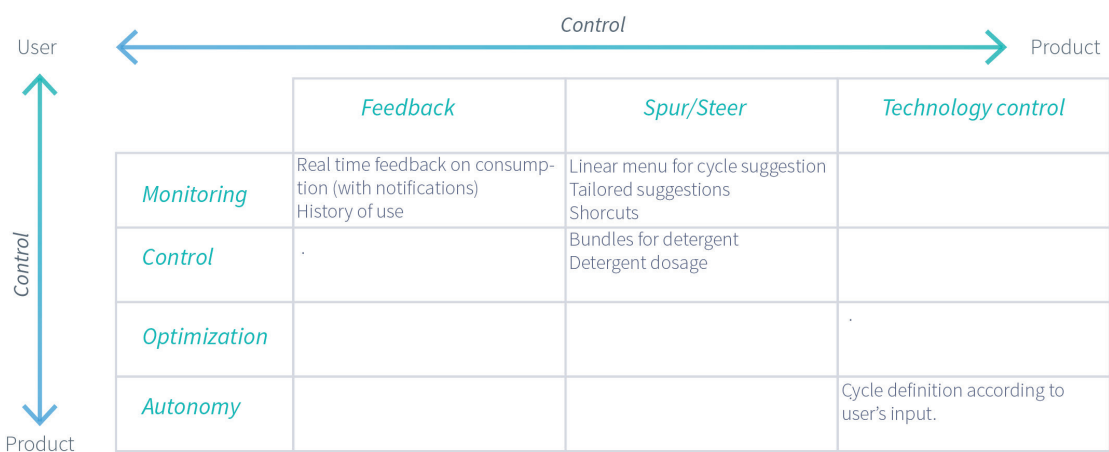
		Low considered	High considered	Concerns	
Control	No control on usual features, only on things user know (soil availability). remote monitoring	○ ○ ● ○ ○		Hiding the temperature and other common features can impact users sense of control. Calendar feature is not clear	2.75
Certainty (guidance)	The system suggest the most suitable and eco program	○ ○ ● ○ ○			
Time management	Calendar with multiple options, booking, and shared spaces	○ ● ○ ○ ○ ○			
Sustainable concerns	Feedback (Eco-index) is provided along with recommended programs	○ ○ ● ○ ○			

### HOMIE

Worry-free	Remote monitoring	○ ○ ● ○ ○		3
Affordable	It can be related with the increasing efficiency triggered by the feedback	○ ○ ● ○ ○		
Feasibility	Medium due to the washing machine interface intervention	○ ○ ● ○ ○		

### Sustainable behavior and IoT

Implement all the levels, however technology control is limited	○ ○ ● ○ ○	All levels are achieved but technology control is limited	3
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Total: 8.75 points

## SAVE MONEY WHILE SAVING THE PLANET

### User Experience

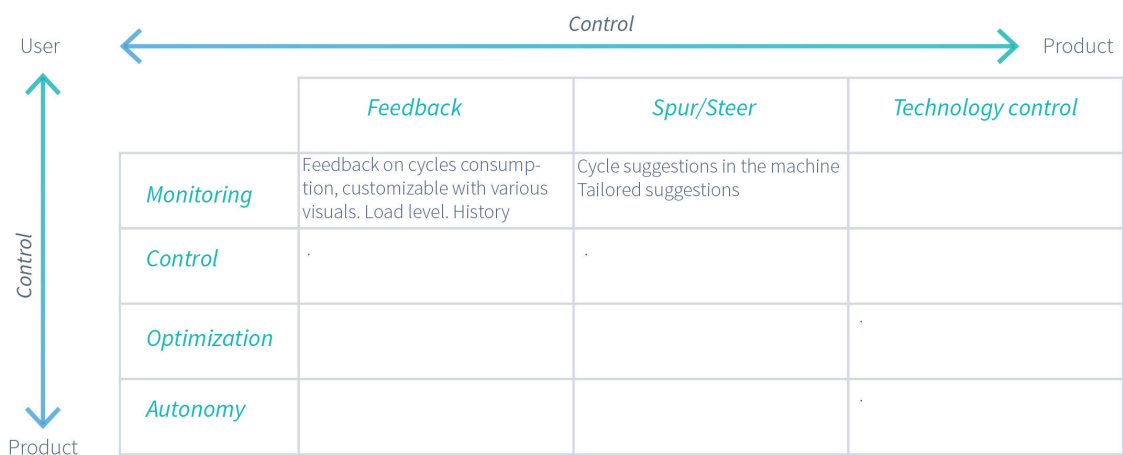
		Low considered	High considered	Concerns	
Control	Users have control over program features. These are accompanied by feedback. No remote control	○ ○ ● ○ ○		Gamification can be annoying for a task in which users don't want to think too much about.	2.75
Certainty (guidance)	Feedback is provided on resources consumption and recommendations are done for pre-set functions	○ ○ ● ○ ○			
Time management	No specific feature for this is provided	● ○ ○ ○ ○ ○			
Sustainable concerns	Feedback (Eco-index) is provided along with recommended programs	○ ○ ○ ● ○			

### HOMIE

Worry-free	No specific feature for this is provided	● ○ ○ ○ ○ ○	3
Affordable	It can be related with the increasing efficiency triggered by the feedback	○ ○ ● ○ ○ ○	
Feasibility	Due to the use of pre-set functions a high intervention of the product is not required.	○ ○ ○ ○ ○ ●	

### Sustainable behavior and IoT

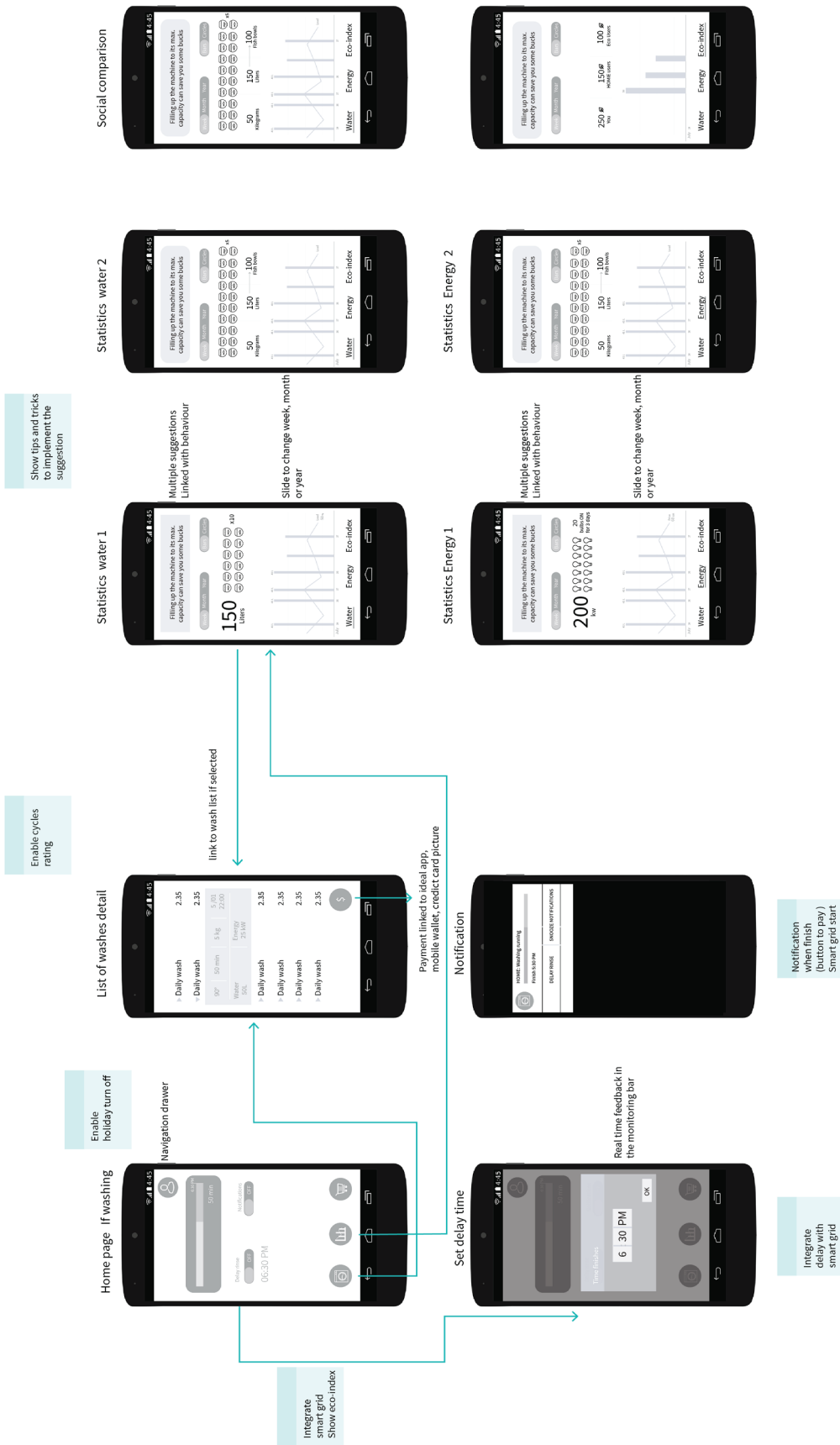
There is limited implementation of strategies, most focus in feedback leaving aside technology control	● ○ ○ ○ ○ ○	Using only feedback has a high consumer acceptance but behaviour change is not guarantee	1
--	-------------	--	---



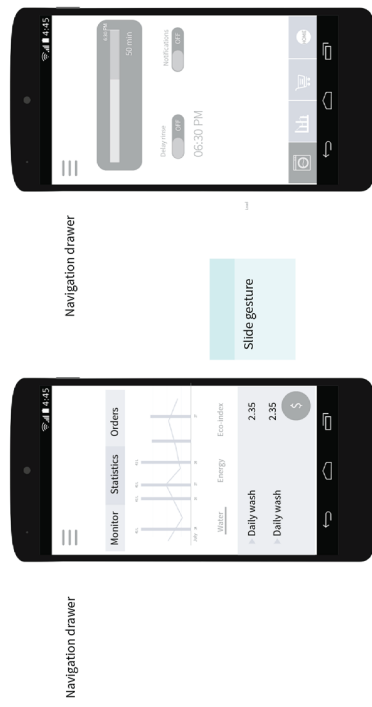
Total: 6.75 points

## APPENDIX 13. WIREFRAMES

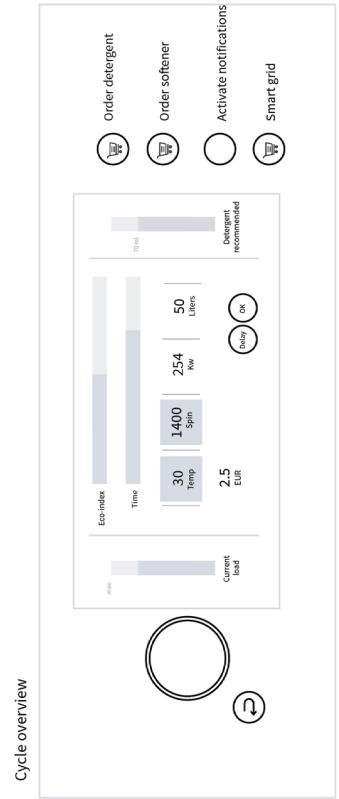
### App, bottom navigation circular menu and independent screens



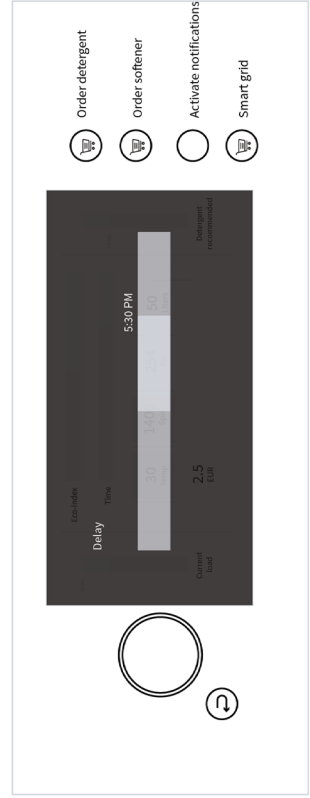
## App, tabs navigation with permanent access



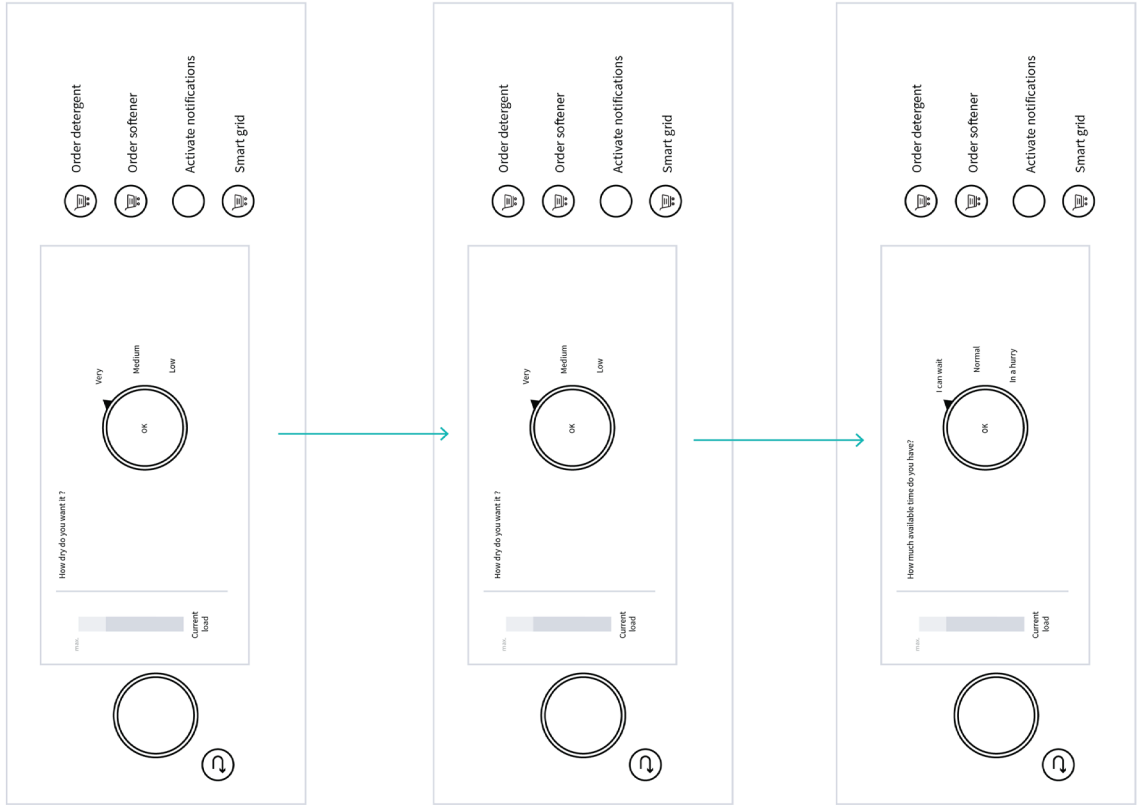
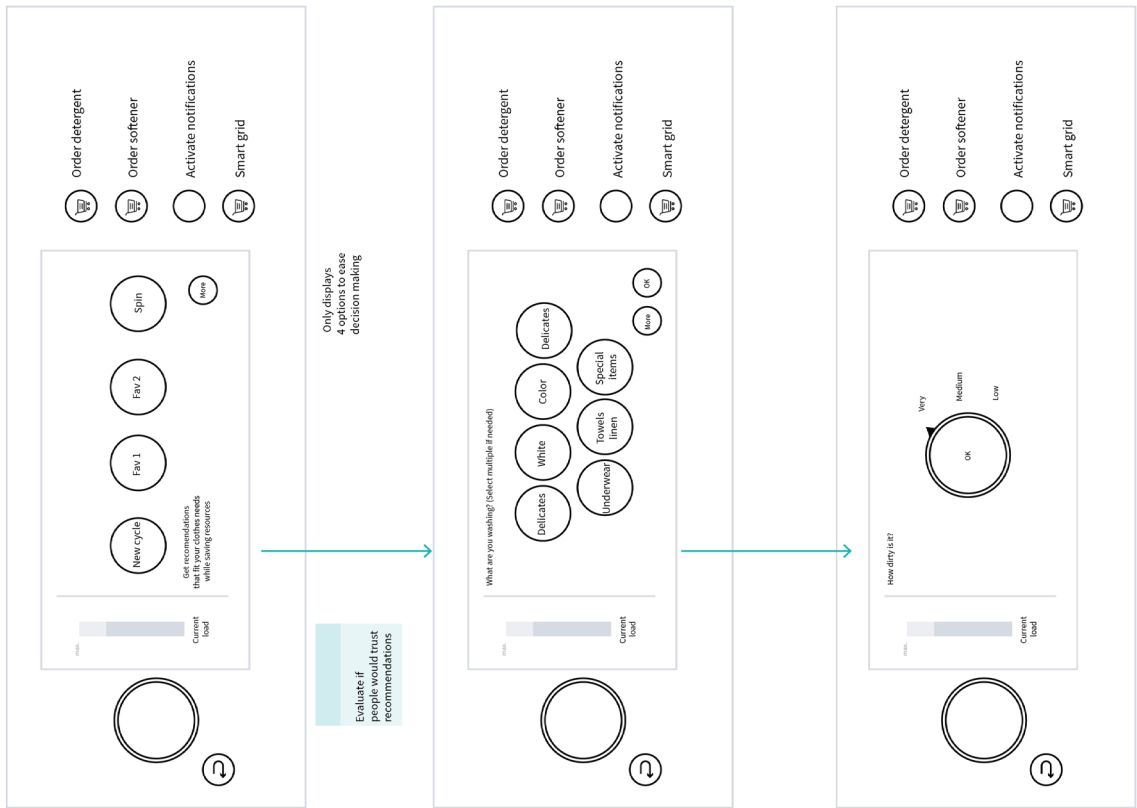
## Washing machine, linear menu with knob



Delay, with smart grid delay rinse

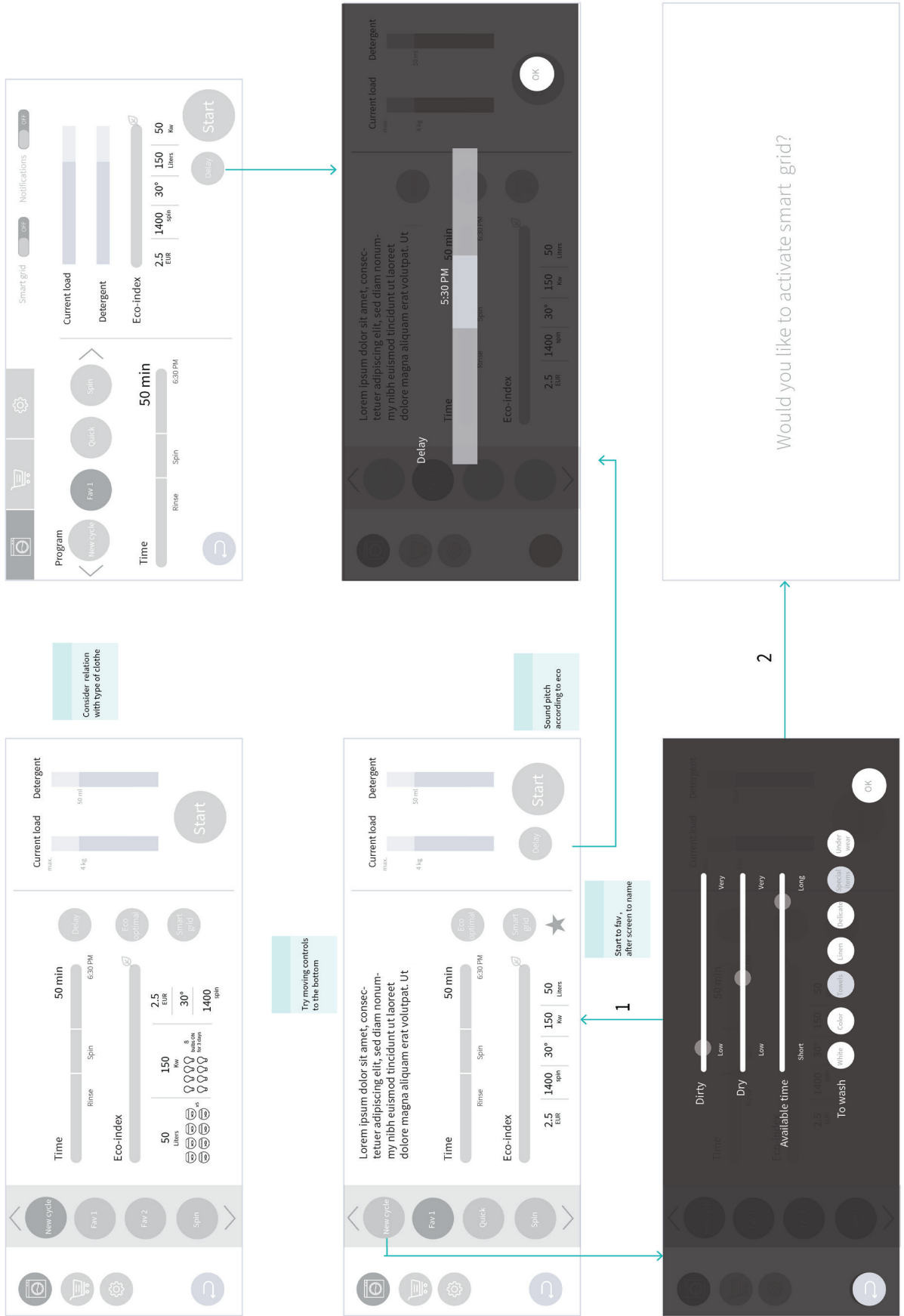


# Washing machine, linear menu with knob





# Washing machine, Touch screen



Responsive webpage, clear and persuasive message  
General home appliances approach

HOMIE Service Price Support About us [Log in](#)

## PAY PER USE HOME APPLIANCES

Worry free, affordable and sustainable

### How it works

- Book online delivery of your appliance
- Receive your appliance at home for free
- Pay only when you use it
- If something goes wrong we fix it for free

### Our products

- [Price](#)
- Coming soon
- Coming soon

### Our promise

- Worry free**  
Always have a full functioning appliance
- Affordable**  
Save money for more important things
- Sustainable**  
Energy efficient appliances plus data drive suggestions

[Sign up](#)

### Price

Washing machine description [Get it](#)

- A cold wash costs €1,13 (incl. VAT)
- A 30° C wash costs €1,18 (incl. VAT)
- A 40° C wash costs €1,31 (incl. VAT)
- A 60° C wash costs €1,47 (incl. VAT)
- A 90° C wash costs €1,69 (incl. VAT)

### The story behind

Video circular economy [Learn more](#)

### What people is saying

◀ [Learn more](#) ▶

◉ ◉ ◉

**Support**  
Contact us  
Our team  
Download the app  
Privacy  
Frequently asked questions

**Company**  
About us  
Press kit

**Sustainability letter**

[f](#) [t](#) [in](#)

Responsive webpage, clear and persuasive message  
Washing machine focus

[Log in](#)

## HOMIE

Pay only when you wash we take care of the rest

Video service

### Our service

- Get your washing machine at home for free
- Pay only when you use it, no hidden fees
- Receive data-driven suggestions to optimize your consumption
- Maintenance for free
- Reduce your foot print with a high efficient machine

[Learn more](#)

### Worry free service in 4 steps

- Book online delivery of your washing machine
- Receive your appliance at home for free
- Pay only when you use it. Enjoy clean clothes
- If something goes wrong we fix it for free

[Sign up](#)

### Our promise

#### Affordable

>Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed diam nonummy nibh euismod tincidunt ut laoreet dolore magna aliquam erat volutpat. Ut wisi enim ad minim

#### Worry free

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#### Sustainable

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### Price

[Learn more](#)

\$2.5 EUR

30° 40° 30° 30° Spin Rinse


[Learn more](#)

sponsive webpage, clear and persuasive message  
 washing machine focus


HOMIE
Log in

We take care of your washing machine  
so you can save money and enjoy life


### What you get?




High quality washing machine for free



Delivery to your house and pick-up for free



Maintenance included



Recommendations for reducing your consumption and taking care of your clothes

### Pay per use

The story behind

Video  
HOMIE- circular economy

**Reduce environmental impact by circulating products**

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed diam nonummy nibh euismod tincidunt ut laoreet dolore magna aliquam erat volutpat. Ut wisi enim ad minim

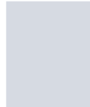
**No ownership means worry free**

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**No upfront cost**


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### Our offer




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\$2.5 EUR




[Sign up](#)

### What people is saying



Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed diam nonummy nibh euismod tincidunt ut laoreet dolore magna aliquam erat volutpat. Ut wisi enim ad minim veniam, quis nostrud exerci tation ullamcorper suscipit lobortis nisl ut aliquip ex ea






**Support**

- Contact us
- Our team
- Download the app
- Privacy
- Frequently asked questions

**Company**

- About us
- Press kit

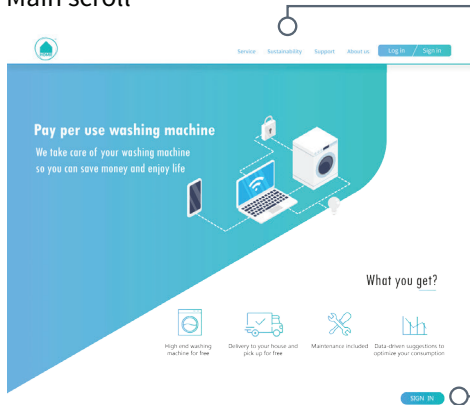
**Sustainability letter**



# APPENDIX 14. DESIGN RATIONALE CONCEPT DEVELOPMENT

## Main scroll



Value proposition in the landing page

Clear description of the service advantages with icons.

## Sustainability



Video to explain service circularity and Pay-per-Use

Washing machine description with focus in sustainability

Practical steps for getting the service. Making it look easy

Worry free laundry in 3 steps

- 1 Book delivery**  
Easily book online or date and time that best fits your schedule.
- 2 Hassle free installation**  
We will bring the washing machine to your house for free and be sure everything is working.
- 3 Pay per use**  
Through a built-in tracker the machine sends to our database up-to-date information about the use, so you only pay what you use.

BOOK HERE



### Rates

Since temperature is the most energy demanding part of the washing cycle, we charge different price according to the temperature used. The machine's time, drum and spin-programmes are offered for free.



VIEW MORE

### Footprint reduction

Sustainability is at the heart of what we do. By using a high efficient washing machine you already reduce your water and energy consumption. Additionally, you can optimize your washing behavior through tips and tricks to extra save energy and use water more efficiently. Finally, it is in your best interest to preserve the machines in its best state the longest possible so if you don't use it anymore, don't worry you don't have to deal with the hassle of selling it! We will pick it up and someone else will use it long life for the machine.



Communicate service sustainability from an user perspective

### What people are saying

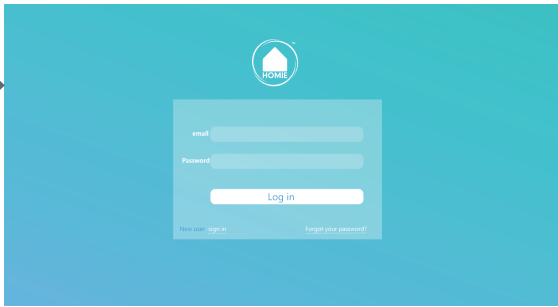


"The service is pretty good, completely worry free and cheap. I like that I could book online as the process was very interesting, we had recently moved and we got the machine very fast."

BOOK HERE

User reviews to promote trust

### Log in



### Sign in



### Booking

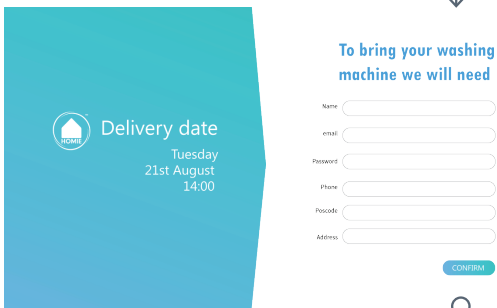
When do you want your washing machine at your house?



NEXT

Online order easy and fast

### Booking 2

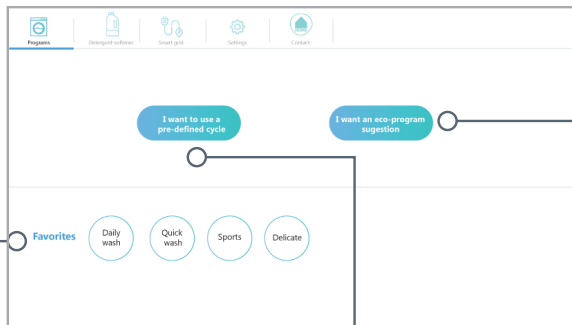


Friendly language and clear feedback

### Confirmation

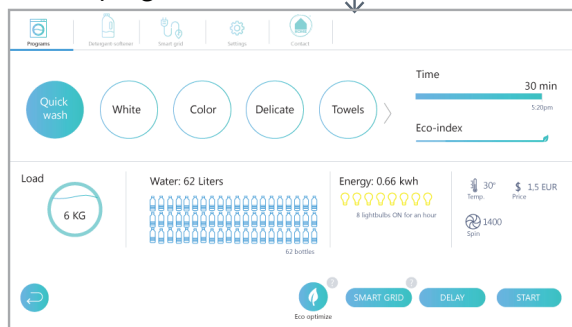


### Programs home screen



Steering  
Shortcuts for favorite programs

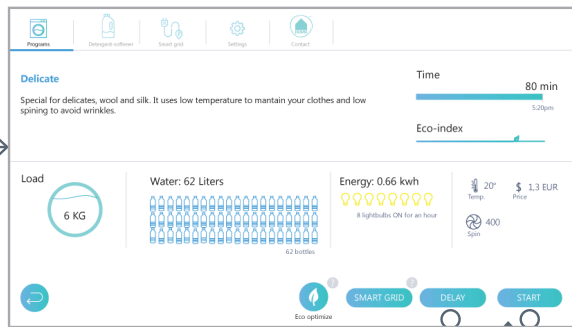
### Pre-set program selection



Eco-feedback  
Energy and water consumption translated in bottles and lightbulbs

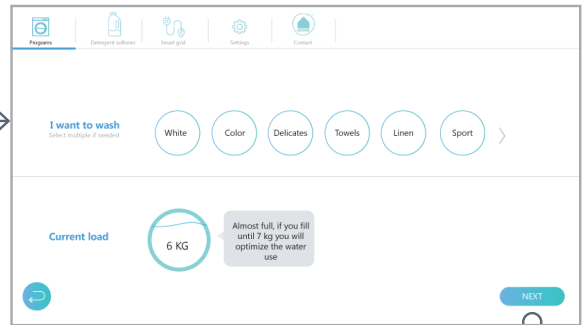
Eco-feedback  
Eco-index for fast and easy evaluation of cycle sustainability

### Favorite overview



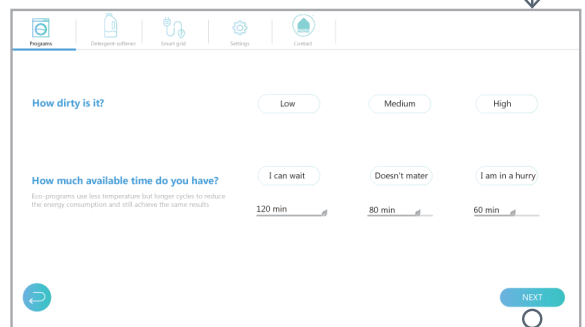
Technology control  
Eco-optimize automatically update settings to sustainable optimal

### Eco-program linear menu



Steering  
Linear menu  
cycle suggestion

Eco-feedback / Steering  
Current load with suggestions for optimization

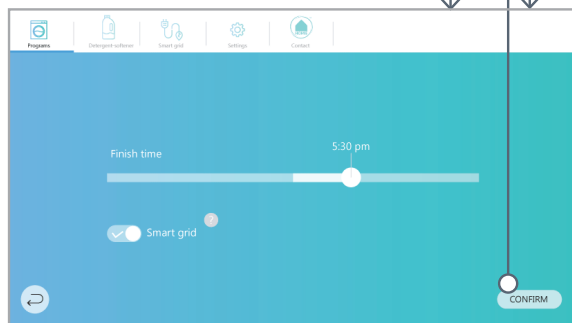


Steering  
Encourage dirty level reflection



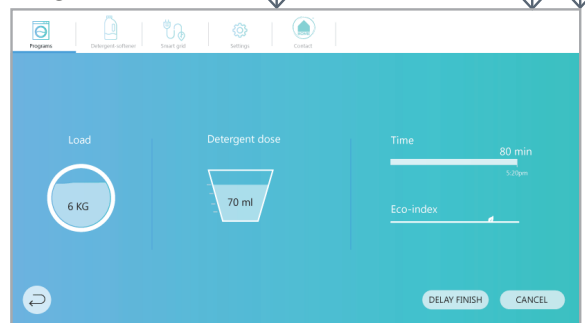
Steering  
Limited access and low hierarchy to temperature setting

### Delay



Steering  
Delay with smart grid as default

### Program overview



Steering  
Detergent amount suggestion

for  
ion

### Smart grid



Eco-feedback  
Energy cost savings feedback

### Detergent order

HE Detergent 12 EUR  
Softener 12 EUR  
Color catcher 12 EUR  
Whitening 12 EUR

TOTAL 36

Steering  
Facilitate the use of High  
Efficient detergents

### Smart grid options

Set finish time  
 Automatic schedule

### Contact

Whatsapp  
Facebook messenger  
Call  
Email

### Automatic schedule

Automatic schedule

CONFIRM

Technology control  
Smart grid automatic schedule  
when energy is cheap

### Set finish time

Set finish time  
 Automatic schedule

5:30 pm

CONFIRM

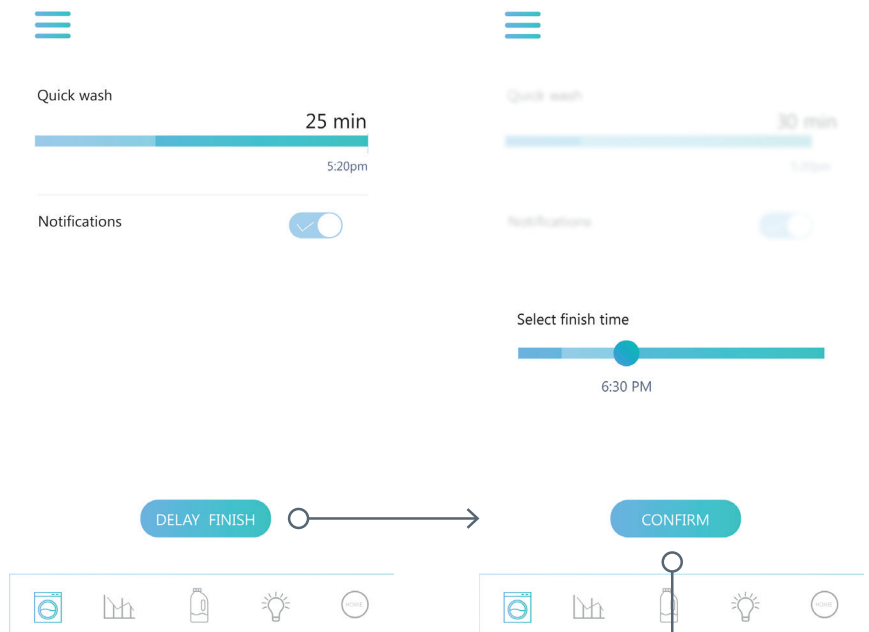
Steering  
Facilitate the use of smart grid  
with finishing time feature



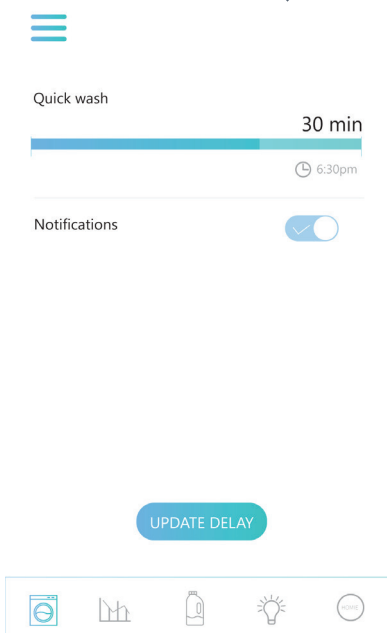
### Launch



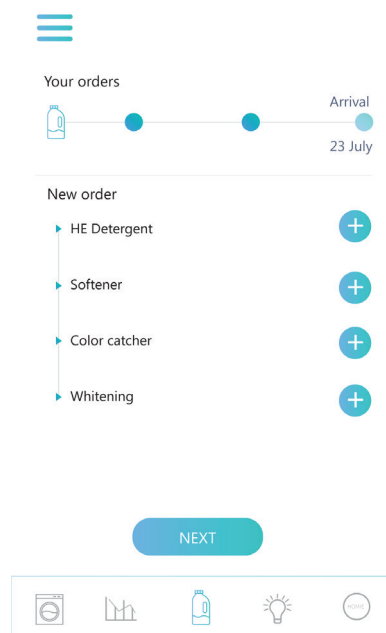
### Monitoring



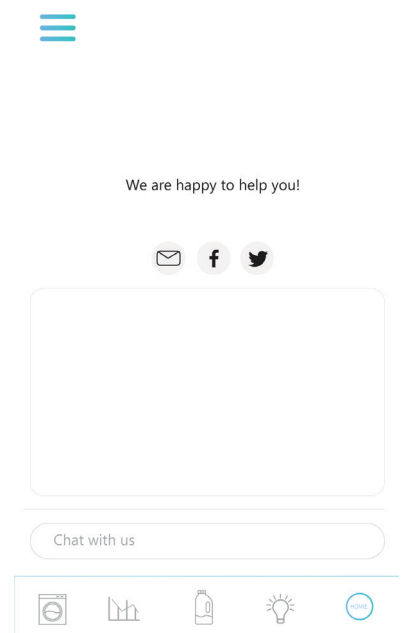
### Monitoring with update delay



### Detergent order



### Contact us with chat



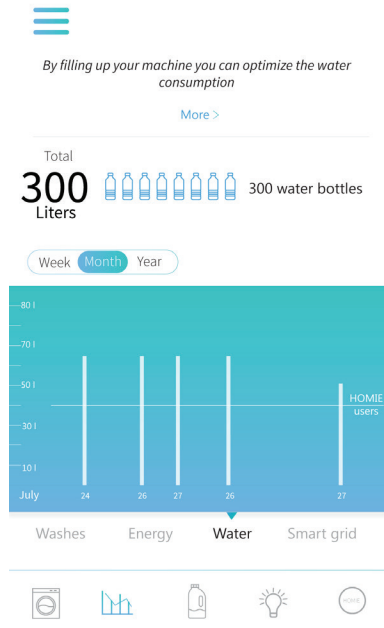
Steering  
Facilitate the use of High  
Efficient detergents

### Statistics, washes



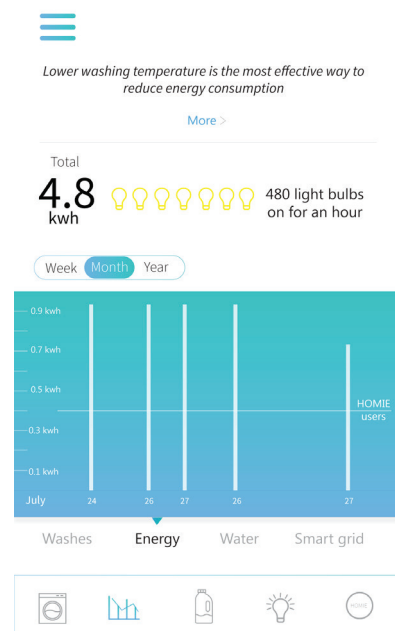
Eco-Feedback  
Cycle eco-index and price relation

### Statistics, water



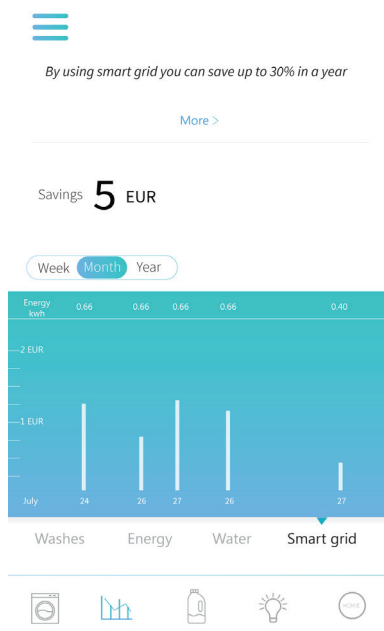
Steering  
Suggestions for consumption optimization

### Statistics, energy



Eco-Feedback  
Energy consumption through time with social comparison

### Statistics, smart grid



### Tips and tricks

Tips and tricks  
How to make the most of your resources?

- Energy**
  - 4.8 is the consumption of a family house per day kWh
  - Washing with 30° can save you up to 30% in energy consumption
  - Soil is satisfactory removed at 30° instead of 40° when washing
  - Cold washes can also extend your clothes life
- Water**
  - 300 are absorbed by a large tree per day, which can provide a day's supply of oxygen for up to four people
  - Shorter cycles have less rinses, if your clothes is not that dirty consider to use shorter cycles
  - Large loads can improve water use. Try color catcher so you can mix colors and have good results
- Smart grid**
- Detergent**

Buy here >

Steering  
Tailored suggestions for consumption optimization

## APPENDIX 15. USER TEST SEMI-STRUCTURED INTERVIEW

### *Contextual interview and test general users*

1. Introduction
  - a. Introduce myself
  - b. Explain general idea and purpose of the interview. There are no wrong answers all responses are good.
    - i. Design goal: Increase acceptance, improve the UX and promote sustainable behavior
    - ii. Present the design: 3 interfaces
    - iii. Test goal: I will ask you some general questions and to perform some small tasks to evaluate the interfaces content and usability.
  - c. Would you mind if I record the interview? and take some pictures? Ensure confidentiality
2. General information
  - a. Household people. How many people live with you? Who?
  - b. Fill form general information
  - c. Who does the laundry?
3. Web page interface:
  - a. We are interested in evaluating the new service interface, features and content so I invite you to explore this mock up during 2 min and if you can think out loud during the process would be nice, you can mention what is clear or unclear, what do you like and dislike or if there is missing information. There are some limitations in the functionalities since it is a mock up, so I will inform you if you are trying to do something that is not possible due to these limitations  
 \*\*\*\*\* Web prototype laptop 3 min
  - b. What do you understand as the service offer? What of those aspects are relevant important for you? What are not?
  - c. How clear is the service offer for you?  
 \*\*\*\*\* Task
  - d. Now, I would like you to sign in and ask the service for a time that match your agenda
  - e. How easy was the process?
4. Sorting and selecting the cycle
  - a. The next step of the service would be installation and use phase. So, I would like you to sort out these pieces of clothes as you would do it at home.
  - b. With this groups in mind, can we go to your washing machine?
  - c. I will quickly introduce you to the washing machine interface and app  
 \*\*\*\*\* Task
  - d. And select the cycle you would use group and why in the washing machine mockup. If you can mention what is clear or unclear, what do you like and dislike or what is missing would very helpful.  
 \*\*\*\*\* Washing machine mock up
  - e. What do you think about the detergent doses recommendation?
  - f. How sure are you about the performance of the program in relation with your clothes?
  - g. How in control did you feel when selecting the cycle?
  - h. How guided by the interface did you feel?
  - i. How likely would you be to use the detergent delivery service?
  - j. How likely would you be to use smart grid?
  - k. Is there any feedback you are missing during the process?
  - l. If new cycle was not used---- then ask why and to use the menu
5. App
  - a. First, if you were offered to receive feedback and notifications of your consumption by email, app or sms what would you choose  
 \*\*\*\*\* app mockup
  - b. I would like you to explore it for 2 min
  - c. Which features you find interesting?

- d. Which features would you use? And which won't
- e. What do you think about the resources statistics?
- f. How clear is your consumption of water and energy?
- g. How clear is the comparison with other users?
- h. What do you think about the tips and tricks?
- i. How meaningful is information presented for you?
- 6. Wrap up
  - a. How would you improve the service and/or interfaces?
  - b. System Usability Scale

### *Remote testing, HOMIE users*

1. Introduction
  - a. Introduce myself
  - b. Explain general idea and purpose of the interview. There are no wrong answers all responses are good.
  - i. Design goal: Increase acceptance, improve the UX and promote sustainable behavior
  - ii. Present the design: 3 interfaces
  - iii. Test goal: to evaluate the interfaces content and usability. I will ask you some general questions and to perform some small tasks so we can together find weaknesses and
    - c. Would you mind if I record the interview? and take some pictures? Ensure confidentiality
2. General information
  - a. Household people. How many people live with you? Who?
  - b. Fill form general information
  - c. What do you like about HOMIE service?
  - d. What would you improve?
  - e. How do you like the current monthly feedback? Do you use it?
  - f. How have HOMIE service influenced your washing behavior?
3. Introduce the design, service steps
4. Web page interface:
  - a.
  - b. We are interested in evaluating the new interface, features and content so I invite you to explore this mock up during 3 min and if you can think out loud during the process would be nice, you can mention what is clear or unclear, what do you like and dislike or if there is missing information.
  - c. There are some limitations in the functionalities since it is a mock up, so I let me know if you have any problems

\*\*\*\*\* Web prototype laptop 3 min

  - a. What do you think about the webpage? What do you like? How would you improve it?
  - b. How much does the new webpage with HOMIE the values you experience?
  - c. Which information and or functionalities do you miss?
5. App
  - a. As part of the service improvements we have designed an app to create a stronger relationship with users and provide fast help and access to the consumption information
  - b. First, I would like to know if you were offered to receive feedback and notifications of your consumption by email, app or sms what would you choose

\*\*\*\*\* app mockup

  - c. Send link
  - d. I would like you to explore it for 2 min
  - e. Which features you find interesting?
  - f. Which features would you use? Which won't?

## APPENDIX 16. USER TEST SCALES

### USER TEST SCALES

USER

1. How clear is the service offer for you?	<input type="range"/>	Very unclear	Very clear
2. How sure are you about the performance of the program in relation with your clothes?	<input type="range"/>	Very unsure	Very sure
3. How in control did you feel when selecting the cycle?	<input type="range"/>	Not in control at all	Completely in control
4. How guided by the interface did you feel?	<input type="range"/>	Very unguided	Very guided
5. How likely would you be to use the detergent delivery service?	<input type="range"/>	Very unlikely	Very likely
6. How likely would you be to use smart grid?	<input type="range"/>	Very unlikely	Very likely
7. How clear is your consumption of water and energy?	<input type="range"/>	Very unclear	Very clear
8. How clear is the comparison with other users?	<input type="range"/>	Very unclear	Very clear

	Strongly disagree	1	2	3	4	5	Strongly agree
I think that I would like to use this system frequently.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I found the system unnecessarily complex.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I thought the system was easy to use.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I think that I would need the support of a technical person to be able to use this system.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I found the various functions in this system were well integrated.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I thought there was too much inconsistency in this system.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would imagine that most people would learn to use this system very quickly.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I found the system very complicated to use.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt very confident using the system.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I needed to learn a lot of things before I could get going with this system.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



## APPENDIX 17. QUALITATIVE ANALYSIS USER TEST RESULT

**Main scroll**

- No info. about the app
- Weird lightbulb
- Not clear difference between log in and sign in.
- No clear booking easy access button.
- Visual design influence trustworthiness
- What to get gave a "humanish" question, empathy
- Nice visual design, blue is like water and washing
- Use bread-crumbs to clarify navigation
- Sustainability tab not clear
- Consider view more tabs for detailed information

**Sustainability**

- Is nice that there is a video that explains easier what is this about
- Explain the video how the service works
- Help users to feel certainty about the tech of the washing machine
- Some users ask more flexibility and extra info of the machine.
- Too long text simplify the message. Bigger titles
- Start with no upfront cost left to right
- Include "order here" with the machine description
- Include coming soon dryers here
- Not sure what is e-waste
- 3 steps clear and practical that make it look easy
- Fun facts are catching and interesting
- Not sure if I will change my behavior Because of this
- Worry free laundry in 3 steps
- Rates vs price
- 3 steps clear and practical that make it look easy
- Fun facts are catching and interesting
- Not sure if I will change my behavior Because of this

**The washing machine**

- Reduce environmental impact by choosing products
- No ownership means worry free
- No upfront cost
- Too long text simplify the message. Bigger titles
- Start with no upfront cost left to right
- Include "order here" with the machine description
- Include coming soon dryers here
- Not sure what is e-waste
- 3 steps clear and practical that make it look easy
- Fun facts are catching and interesting
- Not sure if I will change my behavior Because of this

**Data driven suggestions**

- Clarify that is personal data, and how long it takes to do it
- Fun facts are catching and interesting
- Not sure if I will change my behavior Because of this

**Footprint reduction**

- Update format. Short text with visual info.
- Infographic normal vs HOMIE machine impact
- Too cliché content, long text, send a more visual message

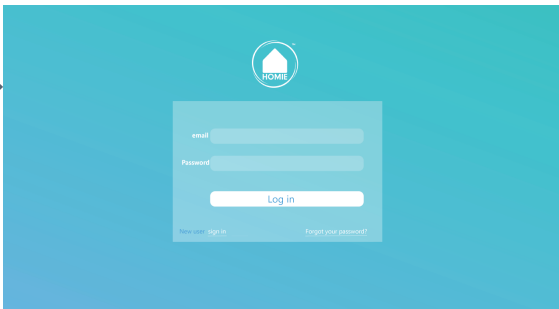
**What people are saying**

- Reviews are not always considered trustful.
- But for some users inspire more trust
- Users were not very interested in the letter
- Consider to include chat for service questions

**Support**

- Slider is clear variable cost is also clear
- View more should related with price information
- Include a calculator to facilitate decision making

### Log in



“Stylish and neat, what make it looks trustworthy”

“I like to think that the brand cares about how I feel when I see it”

“Clear landing page icons”

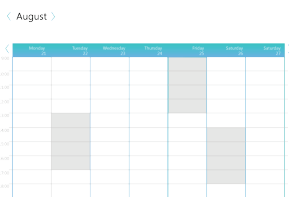
### Sign in



ore than receiving a monthly report”

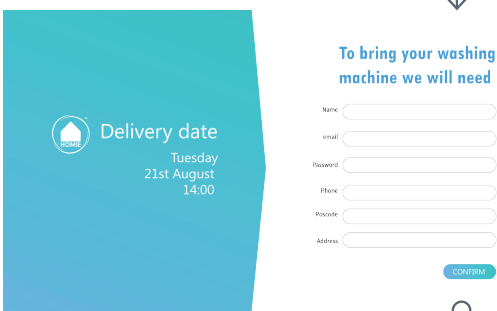
### Booking

When do you want your washing machine at your house?



NEXT

### Booking 2



It is nice to see the overview in the screen

### Confirmation



Booking flow is intuitive and clear. Confirmation works

You will receive a confirmation by email  
If something come up you can update the delivery information directly in your account

HOME PAGE



### Programs home screen

**Eco is associated with environmental friendly and cheap**

**Clarify difference between pre-defined and eco-programs**

**More hierarchy to eco-program move to left**

**Users tend to use the directly available options. Short cuts**

**Consider the use of the machine by multiple users**

### Eco-program linear menu

**No clear order detergent icon**

**No multiple selection was done.**

**Provide suggestions in terms of actions no descriptions "Put smt else"**

**Users missed the next because usually machines are one screen nav.**

### Pre-set program selection

**Clarify max and min in eco-index. More prominent**

**Missed current load. Not clear that is the current one**

**Consider to include footprint**

**Time vs eco relation is not clear. Text is not read**

**Doesn't matter was the preferred option**

### Favorite overview

**Simplify use with autostart option for favorites**

**Connect energy and water feedback with water**

**Lack of feedback in overview screen when cycle is delayed**

**Too many options without a clear distinction**

**Provide explanation about automatic defined settings**

**Smart grid question mark navigation to a new screen confuses users**

**Questions marks work for clarification.**

**Ensure that eco-optimize provide the same cleanliness**

**Relate temp change with consumption**

**Give more importance to price. Consider to detail price per resource**

**Temperature does not seem updatable.**

### Delay

**When do you need it done? instead of finish time**

**Clarify delay feature**

### Program overview

**Detergent suggestion should be done before the start**

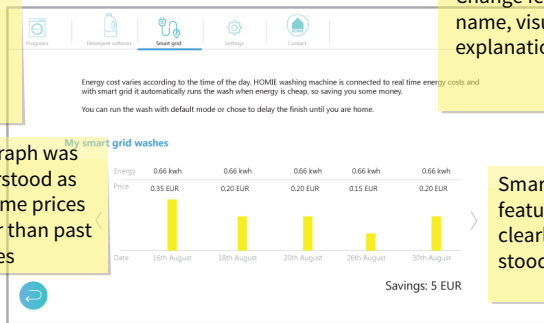
**It is nice to have an overview but load does not seem relevant in this step**

**Clarify how eco-index is calculated**

**Eco-index works to provide a fast evaluation of impact**

### Smart grid

Users are interested in feedback about energy price variation



The graph was understood as real time prices rather than past washes

Change feature name, visual explanation

Smart grid feature was not clearly understood

### Detergent order

No clear plus and minus, include counter

### Smart grid options

Clarify the difference between both options

### Contact

Whatsapp contact was appreciated

### Automatic schedule

Consider to join smart grid and delay function

Clarify what it means cheap energy, is it a range?

*"oh shit that is a lot of water, I am sensitive to water consumption"*

*"I will choose eco because I guess is cheaper"*

*"If the eco-index is low I would feel guilty and I will change the cycle next time"*

*"I like environmentally friendly companies they have my sympathy"*

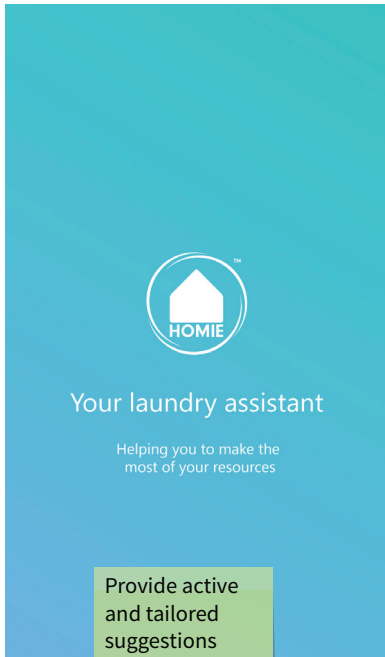
*"I would use the detergent suggestion because I never know how much to pour"*

*"The eco-program suggestion is nice because it can teach me to wash better, I learn from my mom how to wash but I guess that is already outdated"*

*"Smart grid should be a grid literally"*

### Set finish time

### Launch



Provide active and tailored suggestions when opening the app

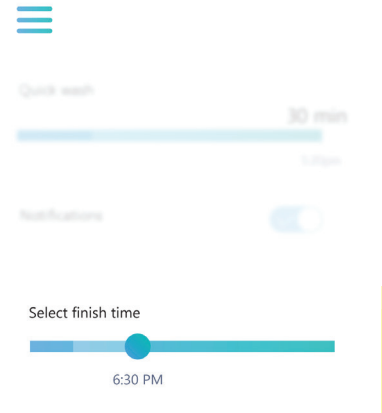
### Monitoring



Clarify time meaning, consistency with machine interface

Clarify types of notifications

Finish time is more important than left time



No clear up list.

Intuitive

DELAY FINISH

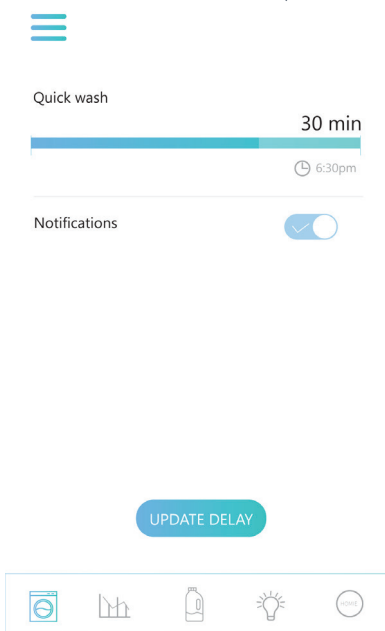
CONFIRM



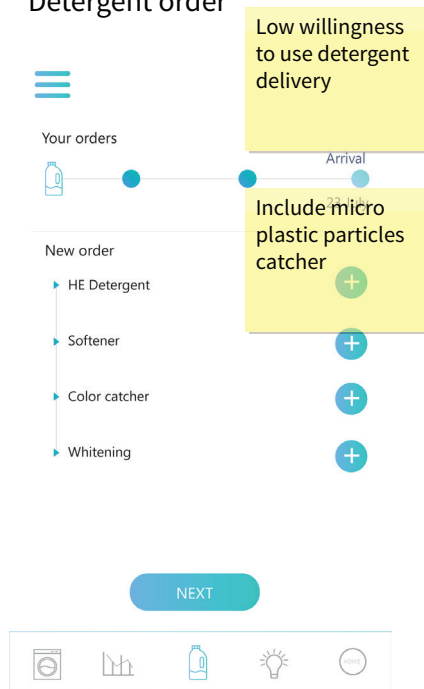
Delay finish feature is not clear. Support explanation

Clear menu icons and tab navigation

### Monitoring with update delay



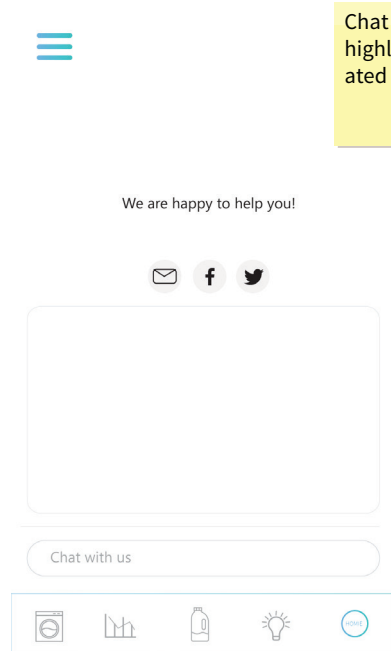
### Detergent order



Low willingness to use detergent delivery

Include micro plastic particles catcher

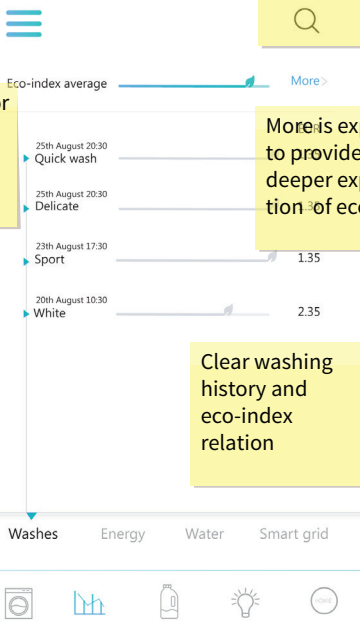
### Contact us with chat



Chat feature is highly appreciated

### Statistics, washes

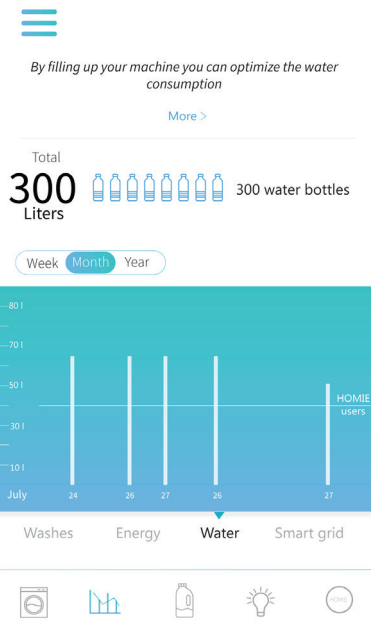
Overlay for explanation



More is expected to provide a deeper explanation of eco.

Clear washing history and eco-index relation

### Statistics, water



Some users missed the suggestions

Graph not easy to understand, units in small font

Use gamification as motivator, rewards, acknowledgments

No clear social comparison

Be positive with analytics "30% better than last month". Make it funny

"Nice translation! I have now a reason to care about consumption"

"I like delay so if I have to go in a hurry or I have to be out longer I can still have fresh clothes"

"I would like to see stars and stickers to make my life worthwhile or at least keep it funny"

No clear what time is showed (month, week)

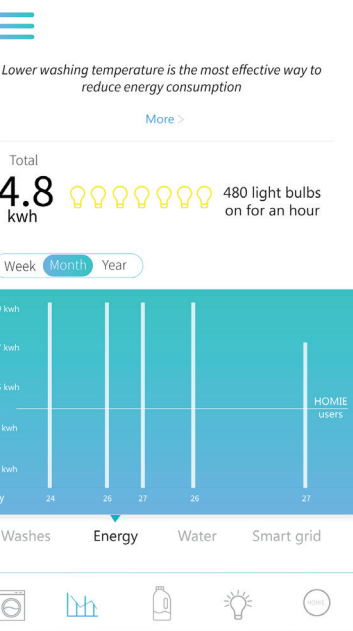
Users interested in comparatives to track changes

To translate consumption in price can be more impactful

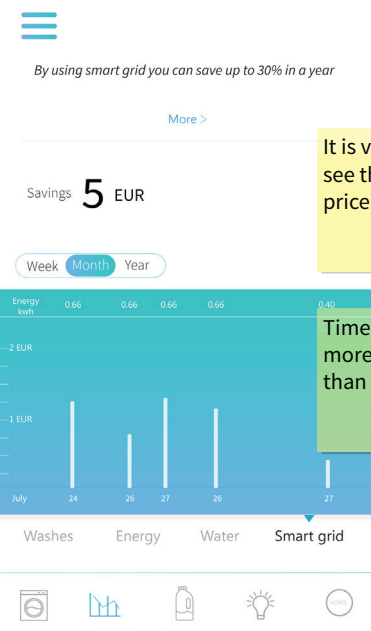
Translate consumption in daily activities

Energy and smart grid are seen as close and overlapped

### Statistics, energy



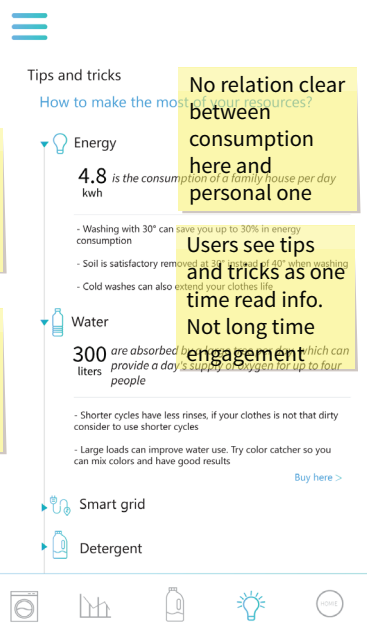
### Statistics, smart grid



It is valuable to see the savings in price

Time of the day is more relevant than date

### Tips and tricks



No relation clear between consumption here and personal one

Users see tips and tricks as one time read info. Not long time engagement

