Nordbro

Master Thesis
Industrial Design
Product report
Group 8
Aalborg University
June 2020

TITLE PAGE

Title	Nordbro
Theme	Master Thesis in Industrial Design
Project period	February 1st to 22nd of June 2020
Project team	Msc04- Group 8
Main supervisor	Linda Nhu Laursen
Technical supervisor	Jørgen Asbøll Kepler
Pages	25

INDEX

MEET THE TEAM

JESPER S. SØRENSEN

JULIE E. MUNK

ANDERS D. HOLM

IN COLLABORATION WITH

Thermex®

ABSTRACT

This master thesis is developed by three graduate student from Industrial design, Aalborg university. The project describes the design process of creating a portable cooker hood for younger people in the age of 20-30 years old living in small apartments with either bad or no cooker hoods.

The end result is Nordbro a battery driven portable cooker hood made in collaboration with Thermex. With Nordbro the younger people can have a cooker hood with better performance than a conventional cooker hood without making any larger installments or commitments as it is easily brought with them, when they move to a new household, this fits perfectly in with the trend and lifestyle of young peoples relocation patterns.

PREPHASE

This master thesis is made by group 8 on MSc04 Industrial Design, Aalborg university The project has been developed from 1st of February 2020 to 22th of June 2020 with a submission date on 3rd of June. This project was made in collaboration with Thermex. The project consists of a process report, a product report, technical drawings and appendix.

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Furthermore a thanks to Morten Bach Sørensen from Thermex, Frank P. Kristensen from Thermex, Henrik Dahl Thomsen from ebmpapst. Lastly a thank you to all the users who have provided photos and insights to help shape the project.

PROBLEM STATEMENT

How can a Cooker Hood be re-designed to be a compact and portable unit, that fits in with the target group's re-location patterns, and consumption patterns?

INTRODUCTION

Nordbro is a minimalistic scandinavian cooker hood aimed at small apartments. Its name is inspired by Nørrebro a district in Copenhagen, which is the place in Denmark with the most citizens in the age between 20-30 per square kilometers.
Nordbro is developed in collaboration with Thermex and is meant to be a sub-brand to their product portfolio with a new product category targeted at a new segment.
Nordbro is portable and designed for a lifestyle of relocation, which makes it perfect for people who does not want to make big installments in their current household.

UNIQUE SELLING POINTS

PORTABLE

Nordbro runs on rechargable batteries and is portable, which makes it a versatile product that can be placed where ever it is needed. This also enables it to be put away when the cooking session is over.

COMPACT

Nordbro is very compact, light weight and can easily be stored away in a kitchen cupboard or be placed next to the stove without taking up too much space.

DESIGN

Nordbro has a minimalistic design and fits into your scandinavian home. The materials and details makes it a design object worth displaying in your kitchen and is a sure conversation-starter.

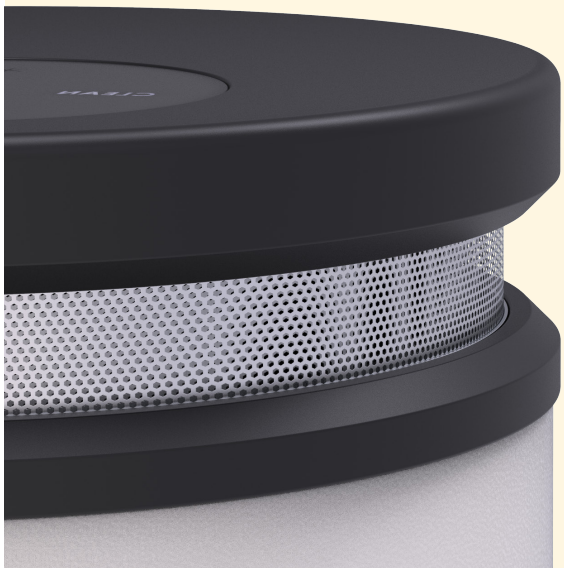
EASY TO CLEAN

Nordbro has a lacquered metal surface that makes it very easy to wipe off after a cooking session. In addition the entire top part consists of a metal grease filter and two polypropylene parts, which can easily be taken apart and go into the dishwasher.

EASY CLEAN

SIMPLE

ROBUST YET ELEGANT



POWERFUL SUCTION

CHARGABLE

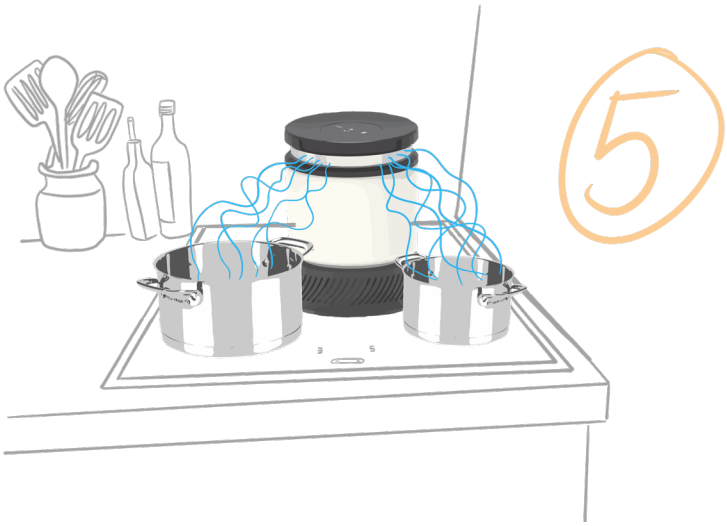
USER SCENARIO

Nordbro is small enough to be stored in the kitchen cabinets.

When you are ready to start cooking, take out Nordbro and place it at the table or on the stove.

Nordbro will show you how much power is left on the battery. If there is power left it is ready to be used, and if not, it can also be used with the cable.

Turn on the suction and choose between level 1, 2 or 3 by pressing the fan button on top.



Nordbro will absorb the steam from your pots and pans. The product is made of heat resistant materials which allow you to move Nordbro close to your pots and pans while cooking.

When you are done cooking, and while you clean, leave Nordbro on suction level 1 for fifteen minutes to absorb remaining smells.

Clean the surface of Nordbro with a wet cloth and it is ready to go back into the cabinet.

DIMENSIONS

Nordbro only measures 225x166mm which means it takes up significantly less space than your regular cooker hood. It can be stored in the cabinet, on a shelf, or stand on your table depending on the layout of your kitchen. Nordbro's diametre allow it to be placed on the the stove without being in the way of the other pots and pans while cooking.

PORTABLE

Nordbro runs on batteries which means the product is highly mobile and this makes it a great companion during cooking sessions in small apartments. The portable feature also means the product can be used in multiple scenarios, e.g. if using a portable hub or if using a raclette in the living room with your friends.

PERFORMANCE

Nordbro has one single button: the fan button. This is the one you press to turn on the product, and for each press the suction increases. Apart from the tactile feedback of the button, small LED's will turn on to provide a visual feedback of which level the suction is currently at. The suctions can therefore be adapted to different cooking scenarios or needs. The 1st level can e.g. be useful during boiling or simmer dishes. Furthermore it can also be used after cooking, to clean the air from remaining steam and smells.

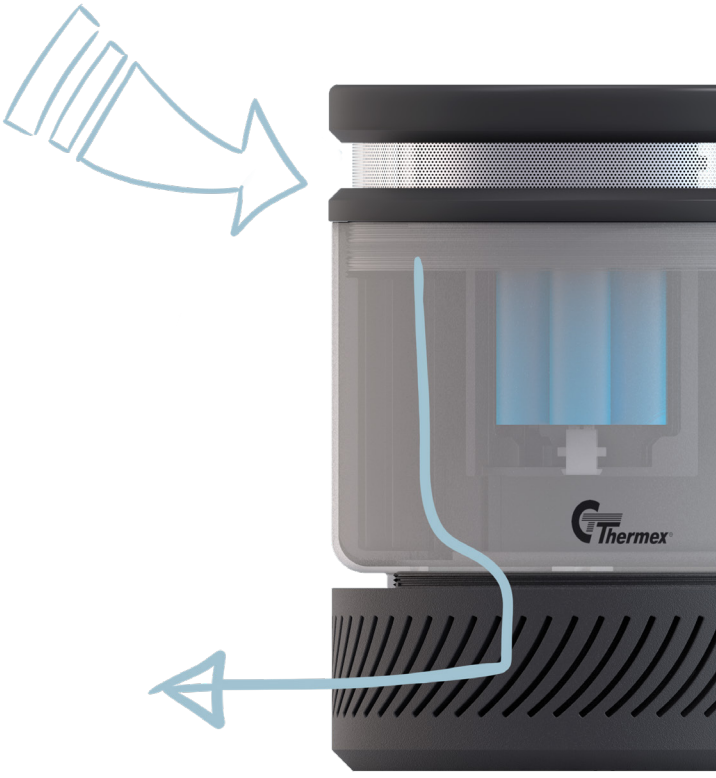
Level 1

Level 2

Level 3

FLOW

Nordbro works with a recirculation system. It sucks the air from the top where the largest particles are sorted when flowing through the metal filter. The air is led further down through the product where a narrowing hole will make sure there is less air turbulence. The air then goes through the motor, out through a carbon filter which removes smell and toxic particles and finally through the perforations in the bottom.




Thermex

PLACEMENT

Nordbro is designed to be able to stand both next to the stove, but also on one of the four stove hobs not being used. Nordbro has a strong and long lasting battery that makes it able to run for 2,5 hours on the highest suction level.

EASY CLEANING

Nordbro has black material on all the parts the user has to interact with. When the grease filter needs cleaning, it lights up to indicate a warning for the user. To clean the grease filter the top is easily clicked off to seperate it from the rest of Nordbro. The Carbon filter can also be changed and this is done by twisting the bottom part off and the filter can simple be removed from the inside.

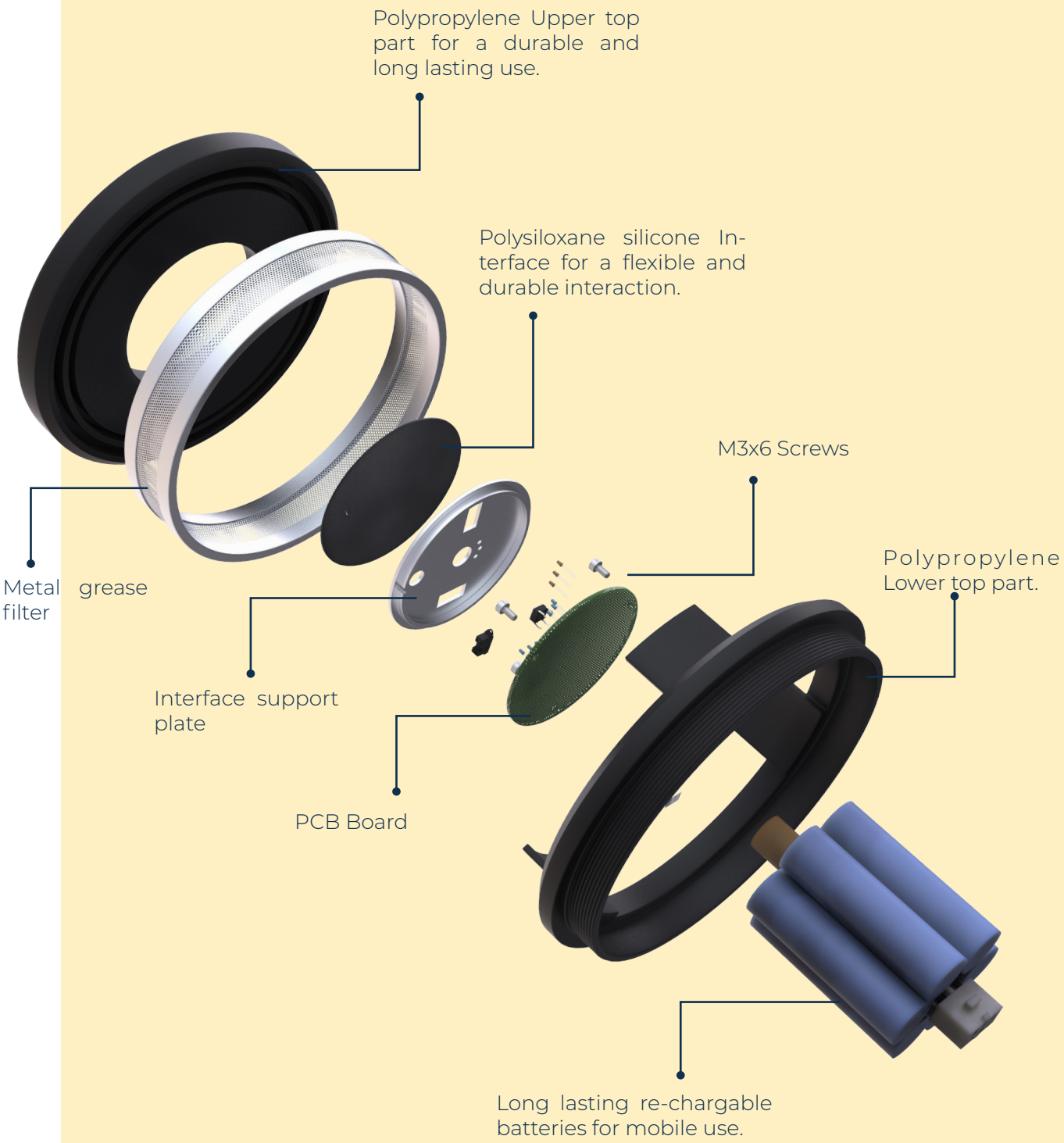
The interface is made as one homogenous surface to make it easier to wipe off with a piece of cloth. The fan has a tactile button to make it more comfortable to interact with Nordbro even with greasy fingers!

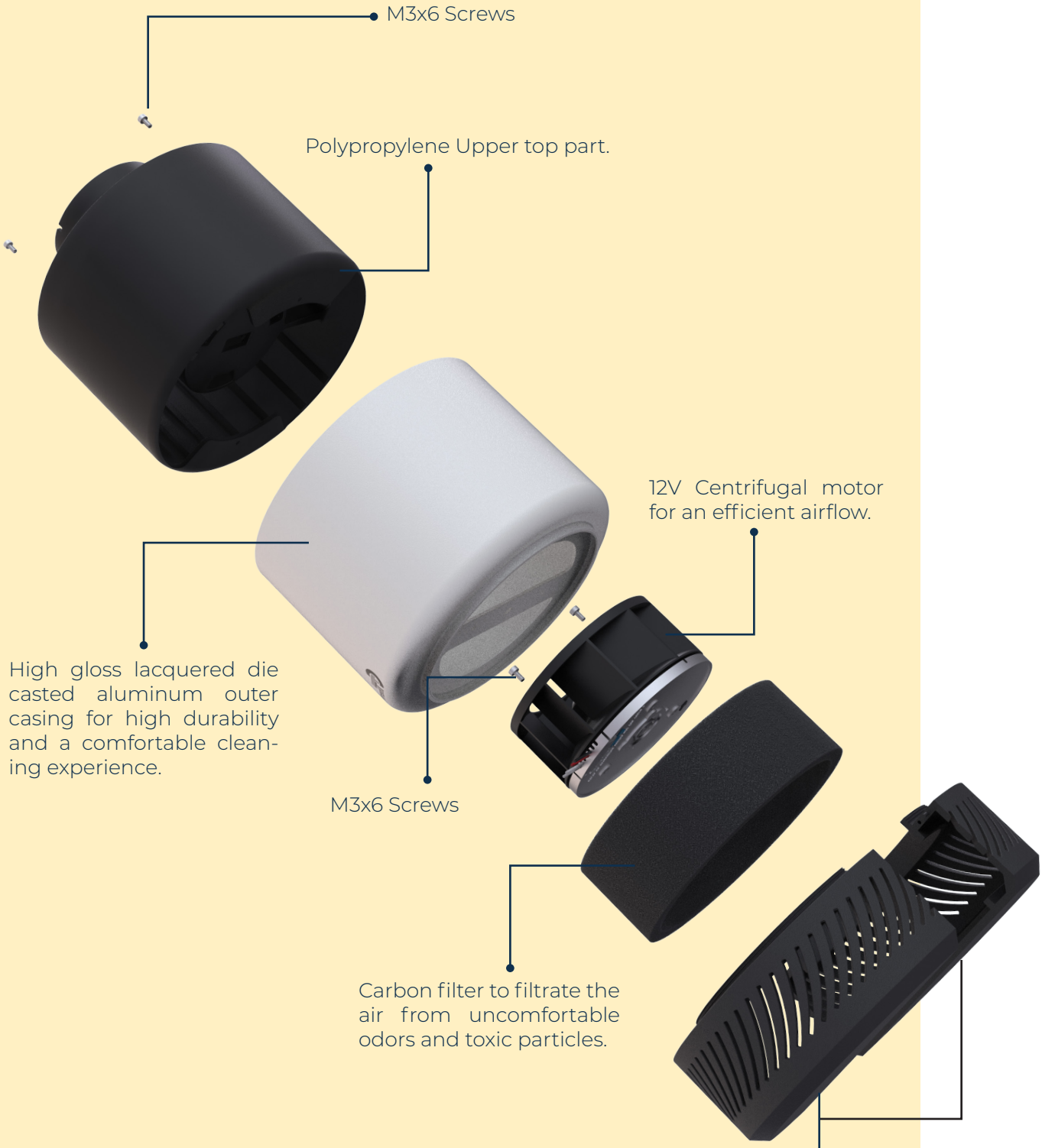
The surface on Nordbro is lacquered, which makes it easy to clean with a piece of cloth if it has gotten dirty during the cooking session.

SCANDINAVIAN DESIGN

Fitting in is an art form, Nordbro stays in touch with the minimalistic scandinavian colour palets and stays true to Thermexs efficiency.

CONSTRUCTION




M3x6 Screws
Polypropylene Upper top part.
12V Centrifugal motor for an efficient airflow.
High gloss lacquered die casted aluminum outer casing for high durability and a comfortable cleaning experience.
M3x6 Screws
Carbon filter to filtrate the air from uncomfortable odors and toxic particles.
High gloss lacquered die casted aluminum suction outlet created in two parts from the same mould, glued together.

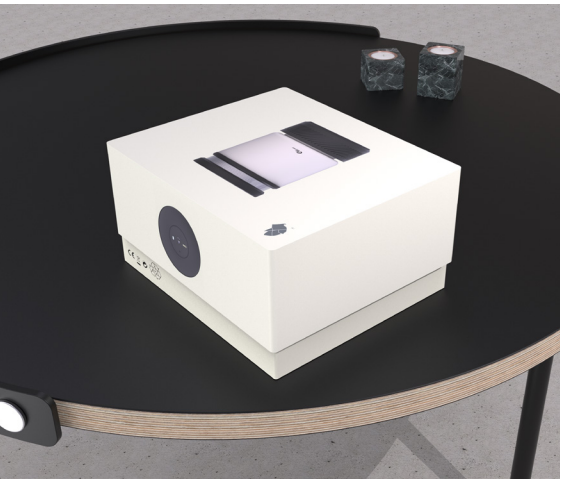
ECONOMY

This budget show how Nordbro is a profitable investment and will breakeven in the third year of business. The budget is based on targeting 0,2% of the Danish market the first year and with a calculated increase of 1% each year. The first year 1.330 units will be sold, and the first profitable year ends in 333.785 DKK after 4.029 units has sold.

BUDGET	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL
Parts sold	1.330	1.343	1.356	1.369	1.382	6.780,00
Sales price (factory)	1.005,94	1.005,94	1.005,94	1.005,94	1.005,94	
Product cost	718,53	718,53	718,53	718,53	718,53	
Turnover	1.337.906,77	1.350.984,05	1.364.061,34	1.377.138,62	1.390.215,91	6.820.306,69
Variable costs	955.647,69	964.988,61	974.329,53	983.670,44	993.011,36	4.871.647,64
Contribution margin	382.259,08	385.995,44	389.731,81	393.468,18	397.204,54	1.948.659,06
Return / Breakeven analysis						
Investment	-824.201,29	-441.942,21	-55.946,77	333.785,04	727.253,22	
Contribution	382.259,08	385.995,44	389.731,81	393.468,18	397.204,54	
Remaining	-441.942,21	-55.946,77	333.785,04	727.253,22	1.124.457,76	

KEY NUMBERS

PRODUCT COST	INVESTMENT	BREAKEVEN
718 DKK	824.201 DKK	333.785



UN-BOXING

The Nordbro packaging fits perfectly on the shelves in any hardware store. Nordbro is a great experience even from the first encounter with it. Through it's exclusive snug fit the user is ensured a satisfying experience.

EXPANSION

Nordbro is a very agile and portable product, this would also fit in with other lifestyles, such as the camping industry. This context is essentially also a small kitchen and would require some refreshened air. Nordbro could also expand into the air purifier market as a new line of products for Thermex.

COLOR VARIATIONS

Nordbro comes in a modern color palette, which enables you to get the one that fits perfectly into your own personal style.

AALBORG UNIVERSITY

STUDENT REPORT

Nordbro

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TABLE OF CONTENT

ABSTRACT

This master thesis is developed by three graduate student from Industrial design, Aalborg university. The project describes the design process of creating a portable cooker hood for younger people in the age of 20-30 years old living in small apartments with either bad or no cooker hoods. This process report takes one through the findings and challenges of creating a consumer product and navigating the fuzzt front end.

The process is structured with a few design parameters that also serves as the topic in which the report will describe. This is done to split the immensive amount of testing and research into digestible bits, so that it becomes easier to understand the choices made throughout the process.

The end result is Nordbro a battery driven portable cooker hood made in collaboration with Thermex. With Nordbro the younger people can have a cooker hood with better performance than a conventional cooker hood without making any larger installments or commitments as it is easily brought with them, when they move to a new household, this fits perfectly in with the trend and lifestyle of young peoples relocation patterns.

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COLLABORATION AND KNOWLEDGE PARTNERS

Throughout the project different companies and people were contacted to obtain knowledge. The main partners are highlighted below.

Through this project Thermex has been a partnering company, for whom the concept is developed.
Thermex has provided key insight and expert knowledge regarding cooker hoods, prices, business aspects and cooker hood spare parts.
The communication has been conducted through phone, mail, Skype-meetings and a physical meeting.

Product development

Morten Bach Sørensen
Production manager

Quality

Frank P. Kristensen
Quality, lab, product service

Ebmpapst have provided expert knowledge regarding motor selection and counter-pressure within the construction.
The contact was established after the second interview with Thermex. The communication was established through phone and continued over mail.

OEM

Henrik Dahl Thomsen
Product manager ventilators.
OEM & projects

NORDJYLLANDS BEREDSKAB

For the initial project framing of how to reduce fires in private homes, Nordjyllands Beredskab was contacted. Their Fire station and training facilities were visited multiple times, to test fire extinguisher and obtain expert knowledge.
Knowledge regarding safety, fire handling and fire problematics was gained.

Jesper Steen Rasmussen
Team leader.
Firefighter.

Tommy
Educator.
Firefighter.

READING GUIDE

This project consists of four parts; Product report, process report, technical drawings and appendix.
The process report showcases the process which the team has been through from the start until the final product proposal. The final product will be presented in the product report.
It is recommended to read the product report before reading the process report to achieve the best understanding of the project and product. Afterwards the technical drawings can be seen to get a better understanding of the product.

The process report is divided in chapters of each design parameter, which means the process report isn't structured chronological, this is done to ease the understanding for the readers by deviding the research into different focus areas.
Each topic ends with a sum up consisting of key insights, requirements and a conclusion.

If nothing is stated the pictures and illustrations are of own production.
Worksheets are referred to as (Appendix #) throughout the report.
The Harvard format is used as references method throughout the reports.

Along the report the following icons and boxes will occur:

The investigation gave important insights that will need further investigation.

The investigation confirmed or validated a previous insight or hypothesis.

The investigation has dismissed or invalidated a previous insight or hypothesis.

The investigation has lead to a conclusion that will affect the final solution.

PROCESS TIME LINE

1. Meeting w. Beredskabet	7/2-20
Fire extinguisher types	13/2-20
Kitchen mapping	13/2-20
Mapping of fire cycle	18/2-20
Mapping of Bo's fire cycle	24/2-20
First sketching round	25/2-20
Purchaase barrier - fire alarms	3/3-20
1. User tests of prototypes	11/3-20
COVID-19	11/3-20
Photo ethnographic	26/3-20
Fire problematics - cooker hoods	30/3-20
Preventing grease	1/4-20
1. Meeting w. Thermex	3/4-20
Sketching round 1 & 2	13/4-20
Qualitative interview	20/4-20
1. Prototyping	20/4-20
UVC Light	26/4-20
Ideation - Handles & plug/wiring	6/5-20
Bauhaus - Prototyping	12/5-20
Ideation - Interface	14/5-20
User scenario test	16/5-20

11/2-20	Fire statistics
24/2-20	Fire extinguisher survey
19/2-20	2. Meeting w. Beredskabet
20/2-20	Interview w. Bo
10/2-20	Existing products
27/2-20	Product tests w. Beredskabet
11/3-20	1. Mock-ups and user tests
12/3-20	Field study - decorative items
18/3-20	1. Digital product catalogue test
26/3-20	What is a cooker hood?
27/3-20	Who are Thermex?
8/4-20	Cooker hood timeline & competitors
14/4-20	Quality criteria
14/4-20	2. Digital product catalogue test
15/2-20	Taking cooker hood apart
24/4-20	2. Prototyping
4/5-20	Ideation - top, grip & bottom
8/5-20	3. Digital Product catalogue test
13/5-20	Prototype test (height)
14/5-20	Meeting with Thermex

DETAILING

ill. 1. Process time line

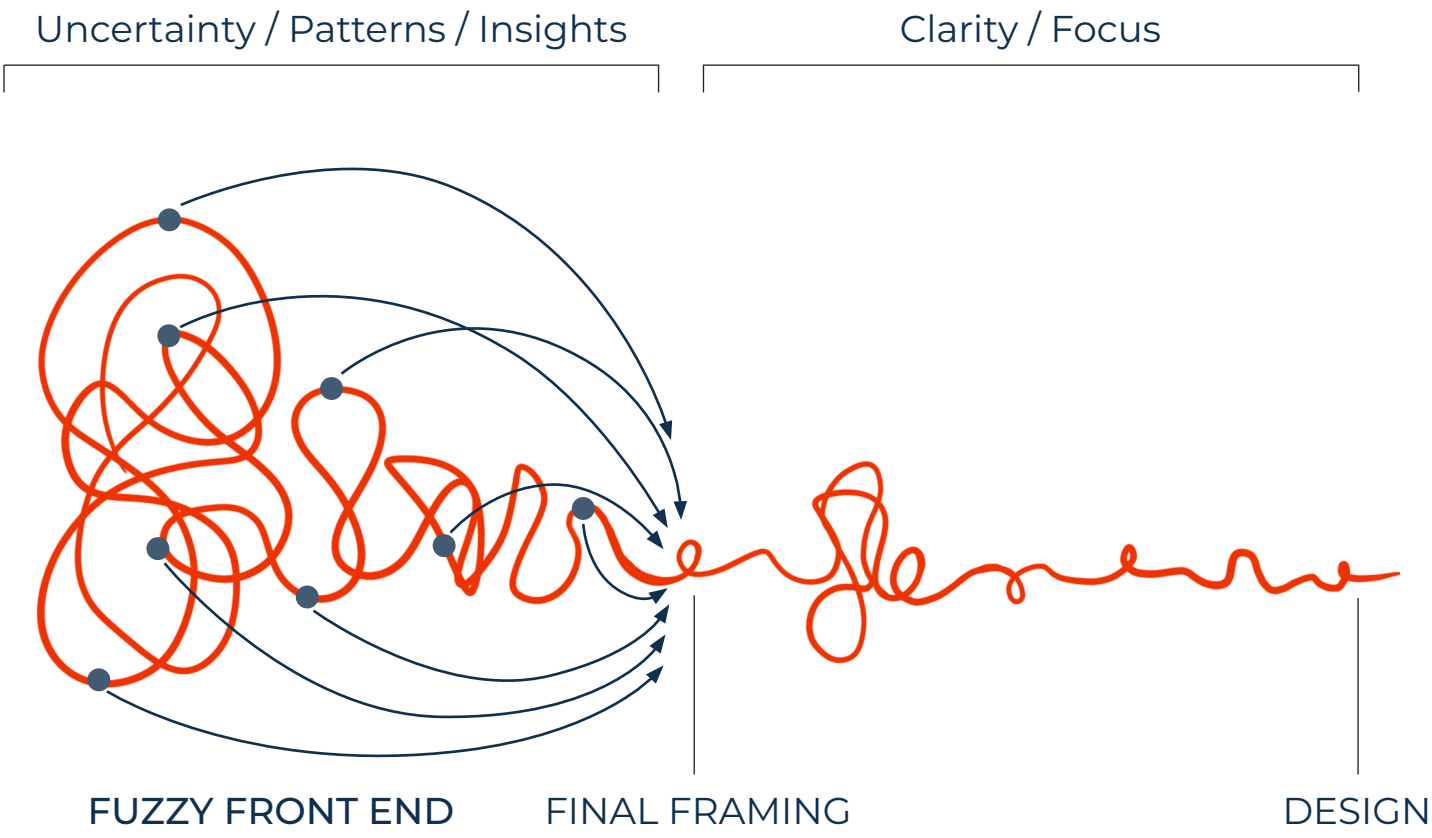
REPORT STRUCTURE

During this project a big focus was the framing and how to strategically position the product. As the goal was to create a new product category and target the consumer market, the project needed to be constantly iterated as new insights were gained. This meant working on both the problem space and solution space simultaneously.
During the research and concept development the project has been re-framed several times. The data gathered in this part of the process has added to the knowledge which eventually led to the final framing and gave key insights into the user group, the market and the design parameters for the final concept.

This report will start with the framing to show the final focus of the project, but throughout the project, data has been collected from earlier framings as well. The chronological order of the project can be seen on illustration 1, but to better explain the final framing and the rationale behind, the report has been divided according to the design parameters:

- What is a cooker hood?
- Portable
- Scandinavian Design
- Clear use
- Easy Cleaning
- Performance

Afterwards the detailing of the product will be explained. In each subject research and insight will be used to explain the arguments behind the framing.
The illustration 2 show how the process has been, and how knowledge obtain earlier in the project has been used later to specify the final framing and as key insights.



ill. 2. Actual overview of the process.

INTRODUCTION

The trend within consumer products is moving from being stationary installments to being smaller portable units. This new trend follows the behavioral patterns of younger people in the age of 20-30 years. Successful brands like Sonos and B&O already create loud speakers for this segment and it is more popular than ever to own these portable products. These products are in the high end price range, however the target group prioritize to spend their money on these conversation starter and identity creating objects.

The users relocate very often and while still being in this temporary mindset, they often skip simple things such as hanging up a picture on the wall, because they are just going to take it down again when they have to move. If they wont put up a frame on the wall, how can we expect them to install a big space consuming cooker hood?

Right now the current cooker hoods suction ability is so low that the users avoid cooking things with curry as it sticks to their apartment and clothes for days. The target group live in small apartments, which often means not being able to avoid the smells by closing doors and opening windows.

By designing a portable cooker hood, Thermex can move into a new market segment and push the conventional cooker hood industry with a new product category. The solution provides the target group with a desirable product that can be brought with them to their next home, which fits in with the users relocation patterns.

FRAMING

In the following section, the project scope is specified and the goal is to create an understanding of the problem framing, target group, market positioning, and finally the design parameters. This will serve as the ground of the further concept development and design decisions.

ill. 3. Picture from Photo ethnographic research

PROBLEM FRAMING

Many young people live in apartments with small kitchens, either including an old cooker hood with poor performance or no cooker hood at all. This result in a bad indoor climate and/or smell from cooking. As they move often they see their apartment as temporary and therefore don't spent money on bigger kitchen appliances, but interior and portable products instead.

WHO ARE THEY?

The target group are young people between 20-30 years old, who live in 1-2 rooms apartments. They move every second year, due to study, job or other life changeing events.

TARGET GROUP

USER CHARACTERISTICS	RESULT OF CHARACTERISTICS
Move often	Mobile interior
Students/new on job market	Tight economy/limited resources
Small apartments and small kitchens	Limited table and storage space -Priority in kitchen tools
Building identity	Interior reflects social markers

ill. 4. Kitchen

COOKER HOOD CATEGORIES

Generally cooker hoods are divided into six categories on the market.

1. Cabinet Integrated

LAGAN data:
- Price: **299 DKK.**
- Dimensions:
  - Length: 600 mm.
  - Width: 510 mm.
  - Hight: 130 mm.

[IKEA, 2020a].

2. Wall Mounted

PRESTON data:
- Price: **10.299 DKK.**
- Dimensions:
  - Length: 900 mm.
  - Width: 485 mm.
  - Hight: 1430 mm.

[Thermex, no date d].

3. Ceiling Integrated

Metz Maxi Sky data:
- Price: **12.995 DKK.**
- Dimensions:
  - Length: 1200 mm.
  - Width: 600 mm.
  - Hight: 70 mm.

[Thermex, no date b].

4. Central ventilation

AIRSLIM data:
- Price: **7.299 DKK**
- Dimensions:
  - Length: 598 mm.
  - Width: 446 mm.
  - Hight: 245 mm.

[Thermex, 2020b].

5. Free hanging

CAEN data:
- Price: **32.499 DKK.**
- Dimensions:
  - Diameter: 570 mm.
  - Hight: 450 mm.

[Thermex, 2020a].

6. Stove Integrated

Elica NikolaTesla data:
- Price: **25.995 DKK.**
- Dimensions:
  - Length: 830 mm.
  - Width: 515 mm.
  - Hight: 210 mm.

[Eico, no date a].

Interior cooker hood

The first cooker hood with references to an interior product was designed to look like a lamp and launched in 2005. Cooker hood which has interior references are placed on the high end market, for people willing to spent a large amount of money on a cooker hood which do not look as the “classic” ones. Though this change in the category was made fifteen years ago, there has not been any further development, and the price and design remain the same in the newest models.

Requires installment

All of these cooker hoods has to be mounted which will require some sort of change in the apartment (drilling into wall/ceiling, new stove, or cut-out in the ceiling).
Also none of these solutions are easy to implement after the kitchen is designed, as they all require quite the amount of space. This means whenever the cooker hoods are installed they become a part of the kitchen and are not likely to be moved/brought with you when you move.

No alternative

There is no alternative for young people who do not have a lot of money to spent and who do not want to make any invading changes to their apartment when installing a cooker hood.

HOW DO YOUNG PEOPLE SPEND THEIR MONEY?

In 2016 young people spend more than a third of their money on clothing and personal care. This indicates that they are very focused on how they look, and what people think about them. They use around 10% of their money on their homes and the kitchen appliances.

ill. 5. How young people spent their money [Willemoes, no date].

- 0,6% Auto-, ship- and bike equipment.
- 2% Other.
- 2,5% Hobby and office supplies.
- 4,2% Electronics and kitchen appliances.
- 4,6% Cultural experiences.
- 4,6% Sport- and leisure equipment.
- 5,4% Groceries, food and drinks.
- 5,8% Travel.
- 6% House and garden.
- 7,2% Care, cosmetics, medicine and dietary supplements.
- 11% IT, Phone and photo.
- 21% Movies, music, books, games and toys.
- 25,1% Clothing, shoes and jewelry.

MARKET POTENTIAL

With around 650.000 young Danish people in the age 20-30 a rough estimate would land on a market potential of reaching 6500 (1%) the first year. Thermex expects an increase of at least 1% per year and after the first year they would look into expanding to Sweden and Norway.

When Thermex introduce a new product on the market they would often produce a few fully functional cooker hoods and probe them on people through their sales channels, being kitchen retailers, such as HTH and Invita. Morten from Thermex says that a portable cooker hood would probably be sold at different retailer, such as builder merchants.

The loud speaker industry have within the last few year moved from being bigger installments in peoples homes into a piece of portable furniture. This fits in with the same target group as this project focus on.
This makes it interesting to see whether this could happen to the cooker hood industry as well. Ultimately this would mean moving into a new segment for Thermex. Younger people seem displeased with their current cooker hoods in general, It has a bad performance, it is ugly and it takes up a lot of space. This is a perfect opportunity for Thermex to conquer a new marked.

EASY LIVING - PLUG'N'PLAY

A home is a very personal space, and when you invite someone in, it is like inviting someone to see part of who you are. When you are young, it is very important to have a nice represented home when your friends come over. It should show your personality, your style and be clean and tidy. This is e.g. why you don't want your home or your clothes to smell like the food you made the day before. However when you are young and living in a small, temporary apartment and with limited resources, you rarely make any large changes such as a new kitchen with new appliances.
When you live somewhere you know is only for a limited time period, your relation to it is not the same as a place where you "settle down". So the question is:

How do you live somewhere "temporary" for 5 years but still make it feel like a home?

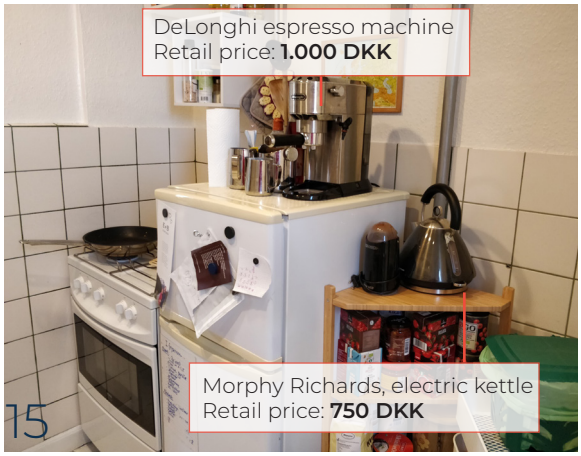
"I think we always considered the apartment to be temporary while we save to move to something more permanent which is why we haven't made any major changes to it." *-Marie S. 28 y/o*

INTERIOR PRODUCTS SHOW YOUR IDENTITY AND IS SMALL STATEMENTS

One way to decorate your home without committing to "bigger" installments is to use portable interior products. These reflect your personality and can be brought with you when you move to new homes. This means young people often prioritize their money and spend them on these types of products instead of bigger kitchen appliances or more permanent interior.

This apartment is a condominium and has no cooker hood and old kitchen appliances. A typical reason to why apartments don't already has the cooker hood, is because the apartment is old and it was not a priority once they were build. Furthermore the young people living there now, see the apartment as temporary and therefore don't make any bigger changes to it.

"I guess we never bought a cooker hood becasuse the apartment is old and I thought it would be too much work"
-Marie S. 28 y/o



15

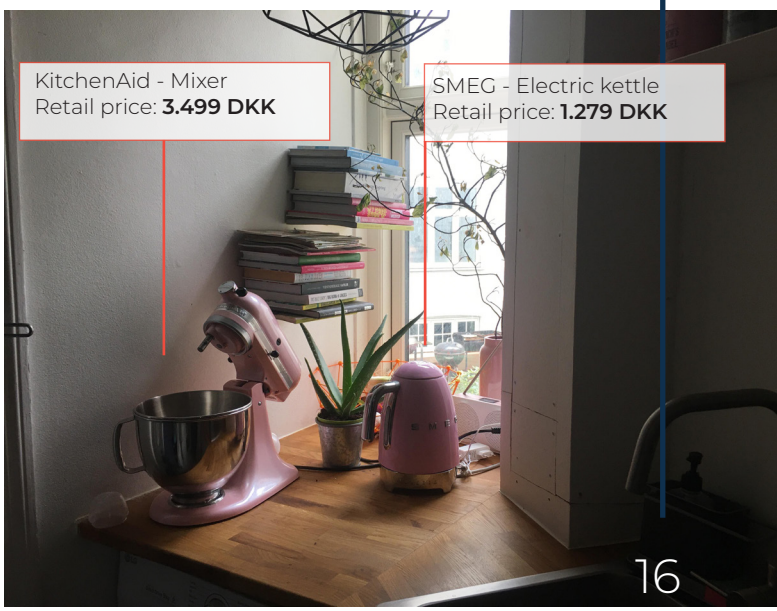
SMALL SPACES AND BAD INDOOR CLIMATE

Kitchen tools such as coffee machines, electric kettles, chopping boards and knives if often prioritized to have a spot in the otherwise limited table space. These are also products which can be brought with you when you move, but also products which reflect personal style and interests. They contribute to the image you want to show other people, and the design is important. These are therefore products the young people are more willing to spent money on.

"I almost never cook anything with curry because the apartment smells of it for days afterwards"
-Rasmus E. 26 y/o

This apartment is a rental and also has no cooker hood. The conditions of the kitchen appliances in a rental apartments can vary a lot, and the residents do not want to enhance them (e.g. by renovating the kitchen or buying bigger appliances), because it isn't their apartment and they plan to move again within a few years.

"I love my new Mixer, it makes my life so much easier, and it's very beautiful in pink"
-Mathilde F. 27 y/o



DESIGN PARAMETERS

Through field studies and testing the different design parameters of the project became more clear. The parameters has been organized according to their priority to best aim the concept for the target group.

1. PORTABLE
2. SCANDINAVIAN DESIGN
3. CLEAR USE
4. EASY CLEANING
5. PERFORMANCE

PROBLEM STATEMENT

How can a Cooker Hood be re-designed to be a compact and portable unit, that fits in with target groups re-location patterns, and consumption patterns?

ill. 6. Kitchen context

WHAT IS A COOKER HOOD?

The purpose of this chapter is to provide the reader with the necessary and basic knowledge of cooker hoods discovered through research, interviews and taking existing products apart. This knowledge is used through the following phases every time a new design parameter is investigated.

ill. 7. Thermex's showroom in Hjørring.

TYPES OF COOKER HOODS

Cooker hoods structure is investigated to get an understanding of how they work and what types of cooker hoods exists (Appendix 1).

There are seven different categories of cooker hoods and they all use one of the two systems, either conventional- or recirculation systems (explanation of technologies on next page).
When choosing a cooker hood many reasons to which cooker hood to choose play a part. One of the reasons is according to the layout of your kitchen and how it is constructed. Under each of the categories it is described which type of kitchen it fits into. Another reason is the type of aesthetic "expression" wanted in your kitchen.

These categories of cooker hoods can be divided into two - the ones which is trying to "hide" what they are through different features, and the ones which "embrace" being a cooker hood.
Generally the ones "hiding" are in the high end price range, because people are more willing to pay a higher amount if it means the cooker hood is more hidden. The ones which "embrace" what they are, are generally more cheap, as the people buying them is buying the function and does not worry that much about them being visible.

ill. 8. Lamp inspired cooker. [Thermex, no date].

This cooker hood is "hiding" by having the appearance of a lamp providing the light while you cook. This type appeal to people who want the suction while cooking, but do not want to look at a cooker hood when the kitchen is not in use. It can be used when you have a cooking island or if you have a stove against a wall with no cabinets above.

ill. 9. Stove integrated cooker. *[Thermex, no date].*

This cooker hood is "hiding" by being integrated into the stove, it is only visible when cooking. This type appeal to people who do not like the looks of a cooker hood or do not want something hanging above the stove. It can be used in any layout of the kitchen as it does not take up any space above, however it takes up space underneath the stove.

ill. 10. Ceiling mounted cooker. *[Thermex, no date].*

This cooker hood is "hiding" by being integrated into the ceiling. This is less space consuming, than a traditional cooker hood but still has the "conventional" suction and appeal to people willing to spent money on a more "invading" installation if it means the cooker hood is hidden. it can however only be used in kitchen with free passageway from the stove to the ceiling.

ill. 11. Free hanging cooker hood [Thermex, no date].

This is a typical example on a traditional cooker hood which is not trying to hide what it is. This appeal to people who want an effective suction and use the cooker hood as a visible and central part of the kitchen when designing it. Furthermore this is solely designed to be used when you have a cooking island.

ill. 12. Wall mounted cooker hood. [Thermex, no date].

This cooker hood is less space consuming than the free hanging, but still with a high suction quality. This appeal to people who find it important to have a good suction but do not want something hanging over the stove.
It is solely designed to be used when a stove is placed against a wall and with no cabinets above.

ill. 13. Cabinet integrated cooker hood. *[Thermex, no date].*

This cooker hood is the one which is used the most by bigger housing companies who rent out apartments (with small size kitchens). It can be bought cheap and is bought only based on function. It is solely designed to be used in kitchens with cabinets hanging above. It takes up almost all the space in the cabinet.

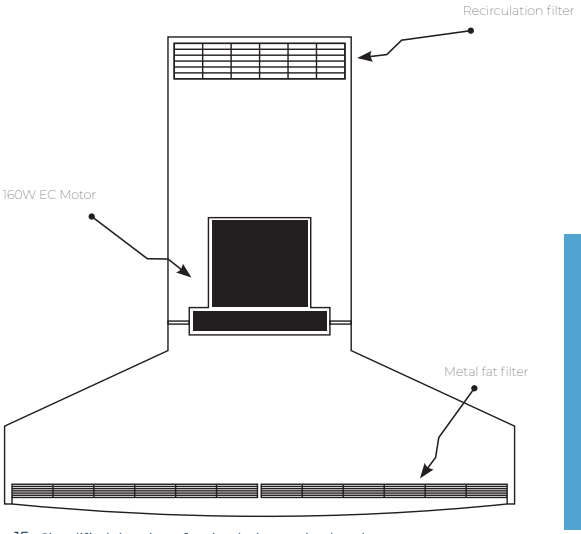
ill. 14. Central ventilation cooker hood. *[Thermex, no date].*

This cooker hood is designed specifically to housings with a central ventilation implemented. The same kitchen layout as the cabinet integrated cooker hood applies and it takes up the same amount of space, but require more installation as it needs to be connected to the integrated ventilation. It is therefore often bought by the housing when designing/constructing the entire building.

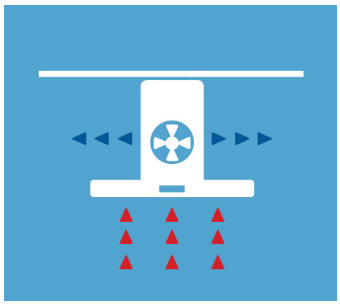
CONSTRUCTION

As earlier mentioned, cooker hoods use either a conventional cooker hood system or a recirculation system. To get an understanding of how each of these technologies work, a further investigation was done (Appendix 1).

RECIRCULATION FILTRATIONS SYSTEM



ill. 15. Simplified drawing of recirculation cooker hood system.



ill. 16. Showcasing airflow in recirculating cooker hood. [Thermex, 2017b]

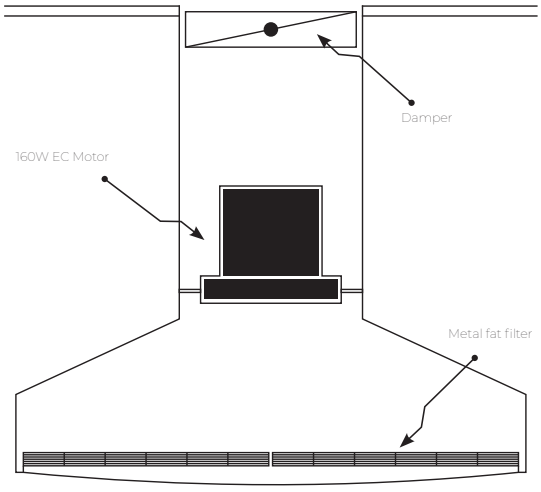
Overall the cooker hood consists of a casing around a motor with a fan connected, which allows the suction of air through a set of filters. Either by shoving the air out of the building (see illustration 17 & 18) or recirculating clean air into the room (see illustration 15 & 16).
The cooker hood also has a user interface where it is possible to control fan speed and brightness of the light.

Cooker hoods filtrate the air with a metal grease filter, which collects the fat from the cooking.

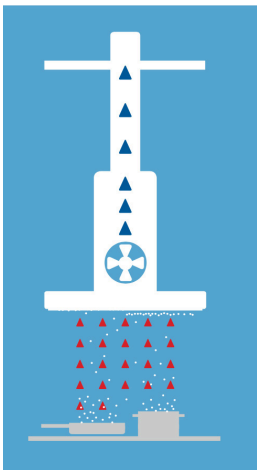
Is it a recirculating cooker hood, is the air also filtrates through a carbon filter, which neutralizes the smell and smaller particles.

Dampers makes sure the wind can't come through into the cooker hood and into the kitchen, but the motor in the cooker hood can still open the dampers and get rid of the steam.
[Thermex, no date e].

CONVENTIONAL COOKER HOOD SYSTEM



ill. 17. Simplified drawing of conventional cooker hood system.



ill. 18. Showcasing airflow in conventional cooker hood. [Thermex, 2017a].

Basic knowledge regarding the cooker hoods construction was gained, but further investigation has to be made regarding the specific components, what technology to use, and how much power and quality needed to have a good ventilation and get rid of all the steam.

In order to obtain further knowledge is it wanted to get in contact with Thermex, a large cooker hood manufacturer in Denmark. It is also the goal to get a cooker hood to take apart and get a closer look at each component used.

- Recirculating system vs. Conventional system.
- Which type of kitchen layout should we design to?

WHAT DO YOU NEED TO BUILD A COOKER HOOD?

To get the hands-on knowledge of the construction and subparts, LAGAN cabinet integrated cooker hood was bought and taken apart. The reason why it is exactly this one which is chosen, is because it was the cheapest found (299 DKK), and the goal is to figure out what the minimal viable components are, to construct a cheap but still well functioning cooker hood.

COOKER HOOD COMPONENTS

ill. 19. Subparts of LAGAN cooker hood.

*Only a half grease filter, the other half was used to prototype.

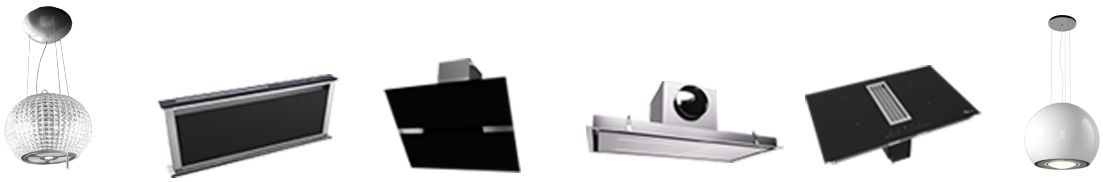
The task provided knowledge on the most viable components to construct a cooker hood. This knowledge will be used later in the process when prototyping.

COOKER HOODS EVOLUTION

After gaining knowledge of the inside of a cooker hood, the next step is to gain knowledge of the "outside" and therefore the development and market of the cooker hood (Appendix 2).

The cooker hood hasn't evolved much since it was invented back in the 1920's *[Oldworldstoneworks, 2020].*
It is a stationary product, requiring installment either in the wall, ceiling, cabinets, kitchen counter or build in the stove.
When looking at a different product, such as the speaker, the market has evolved significantly through the years (see illustration 20). The products start out as stationary and large, and through the years they become more and more compact and mobile. This change has enabled the speaker industry to reach a broader spectrum of users, as the price ranges then can start at a significantly lower level. Furthermore it fits in with the lifestyle of young people who are always on the move and spent their money on these designer/identity products which are easy to bring with them when they move around.
This is directly equivalent with the target group this project is aiming at. For cooker hoods to appeal to the younger segment they must follow the trend of the young people and their lifestyle.

1965 1972 1976 1985 1994 2002



2005
Elica - "STAR"
Size: D: 47 cm, H: 34.4 cm
Retail price: **29.995 DKK**

2007
Thermex - "NIMES LUX"
Size: W: 11.5 cm, L: 88 cm H: 105 cm
Retail price: **17.499 DKK**

2009
Thermex - "PRESTON"
Size: W: 48.5 cm, L: 90 cm H: 143 cm
Retail price: **8.699 DKK**

2016
Thermex - "METZ MAXI"
Size: W: 60 cm, L: 120 cm H: 36 cm
Retail price: **17.199 DKK**

2017
Thermex - "LE MANS"
Size: W: 52 cm, L: 80 cm H: 63 cm
Retail price: **12.999 DKK**

2018
Thermex - "CAEN"
Size: D: 57 cm, H: 45 cm
Retail price: **32.495 DKK**

ill. 20. Cooker hood time line. [Thermex, 2020a] [Thermex, 2020b] [Elica, no date]

ill. 21. Beosound 3000, Beolab 4000, Beo4 & Light control.[Lauritz, no date].

ill. 22. Beoplay P2 (14cm x 8 cm x 2cm, 275 g. [Bang&Olufsen, no date a].

The cooker hood hasn't evolved with how young people live. They don't have much space in their kitchen, they live in rental apartments where the conditions of the resident and the fixed products varies a lot. Furthermore, they do not get any earnings from upgrades or renovations in rental apartments.
Meaning the possibility for them to invest in a expensive cooker hood that is fixed in a kitchen which they move from in few years is rather small. Based on the trend of the loud speaker industry it would be interesting to investigate the market potential for cooker hoods being more mobile and compact and follow the lifestyle trend of the young segment of users.

- Making a cooker hood more compact and mobile might appeal to young users

HIGH-END VS. LOW-END

In order to understand the price range of cooker hoods better, two very different cooker hoods in very different price ranges were investigated and compared: Faber Belle and IKEA's LAGAN. This was done firstly to get an overview of what the features and technologies are within the high end segment and get inspiration for the development of the concept. Secondly it is done to get a deeper insight of what makes Faber Belle way more expensive than LAGAN. The goal with comparing these two products is to find aspects from both products that can be combined to better appeal to the target group (Appendix 2).

FABER

Faber has created cooker hood's for over 60 years. Faber has a large variation of cooker hood's for different applications and kitchen types. They have stove-/ table integrated hoods, ceiling- and wall mounted hoods, cabinet integrated hoods, external hoods and islands hoods. They both have cooker hoods which recirculates the air and uses duct out *[Faber, no date].*

Illustration 23 shows Faber Belle one of Fabers newest additions to their collection of products. This cooker hood is recirculating the air.
The interaction surface of Faber belle is placed in the middle of the bottom of the product and is a touch surface.

ill. 23. Faber belle [Faber, no date a]

Faber Belle Specifications

Maximum intensity:
Air capacity(m^3h): 600
Pressure (PA): 540
Power (Watt): 230
Noise level (db): 68

Price: 20.760 DKK
Energy class: A
Dimensions: W: 695 mm.
H: 481 mm + 35 mm.

ill. 24. Faber belle interface

INTENSIVE SPEED
A function that activates maximum extraction power for 6 minutes to meet special cooking needs.

DELAY 30
The Delay-switch-off function allows automatic delayed switching off of the motor to complete the elimination of the residual odors.

FILTER ALARM
The filter alarm warns you when it is time to clean the anti grease filter or substitute the odor filter.

HOUR 24
Key 24 function allows the hood to be switched on for 24 hour a day for continuous air renewal with a level of noise that is imperceptible.

UP & DOWN
Up & down technology is designed to increase the hoods efficiency by gently lowering it towards the hob and raising it back up toward the ceiling when not in use.
By a remote control.

COMFORT LIGHT
The Courtesy Light permits reduced hood light intensity with the simple press of a button. Thanks to its low level of energy consumption, the courtesy light can be left on for long periods of time.

LIGHT DIMMER
The Light Dimmer adjusts the hood's courtesy light with the simple press of a button to meet all your kitchen needs.

PERIMETER EXTRACTION
Technology reduces the perceived sound by 25%. This extraction equipment guarantees optimized effectiveness exploiting the principles of the Venturi effect.

ill. 25. Faber technologies [Faber, no date b]

IKEA - LAGAN

IKEA also produce cooker hoods, mainly free hanging, cupboard and wall mounted solutions. They also provide both cooker hoods with duct out and recirculation. It was chosen to look at their cheapest version to gain insight of how to create a product with very simple features and interactions and then compare these to the high-end cooker hood.

The interaction surface is placed on the front of the product and uses simple sliders as potentiometers to control 3 suction levels and switching the light on and off *[IKEA, 2020a].*

IKEA LAGAN Specifications

Maximum intensity:
Air capacity(m^3h): 75
Pressure (PA): N/A
Power (Watt): 115
Noise level (db): 71
Price: 299 DKK
Energy class: D
Dimensions: W: 600 mm. H: 130 mm L: 510 mm.

ill. 26. LAGAN interface [IKEA, no date]

ill. 27. LAGAN [IKEA, no date]

COMPARISON

Price and features:
The Faber Belle is almost 70 times more expensive than the IKEA LAGAN. IKEA use cheaper and simpler production methods and materials as it is made of lacquered bend sheet metal and Faber is using shapes that is more expensive to produce. LAGAN has only the most important features: suction level and light, while the Faber Belle has high-tech features such as filter cleaning indicator, light dimmer function, delay switch -off function and so on.

Interface:
The placement of the interface on LAGAN is much more intuitive than the placement on Belle. It is placed in eye-height and gives the user a tactile feedback when adjusting the fan speed. With a minimum height of 650mm above the stove it would be difficult to see the buttons on Belle without bending underneath to see it. This might however be avoided if Belle is placed higher.

Take-aways:
The Faber Belle has a lot of extra features which add to the complexity of the product, and might not be appealing to the project´s target group. However it has some features which add significantly to the user experience, such as the cleaning indicator and the touch interface. These combined with the simplicity and low price level from the LAGAN could be interesting to test in prototyping. Both products offer multiple suction levels.

- Multiple suction levels.
- Cleaning alarm
- Touch interface
- Visible interface

WHO IS THERMEX?

After establishing contact with Thermex, a Skype meeting was arranged. As preparation some research were done to get a better understanding of what the company consist of. The goal is to get knowledge regarding their story and an overall idea of their design language and technology. The desired result is to gain some knowledge that would help shape some design parameters that fit into Thermex product portfolio and be used in the further concept development (Appendix 3).

Thermex have designed and developed cooker hoods for over sixty years both for private people and businesses. They have the biggest assortment of cooker hoods in Denmark. Their products are exhibited in over 900 kitchen distribution stores across the entire nation *[Thermex, no date f]*.

Aesthetics

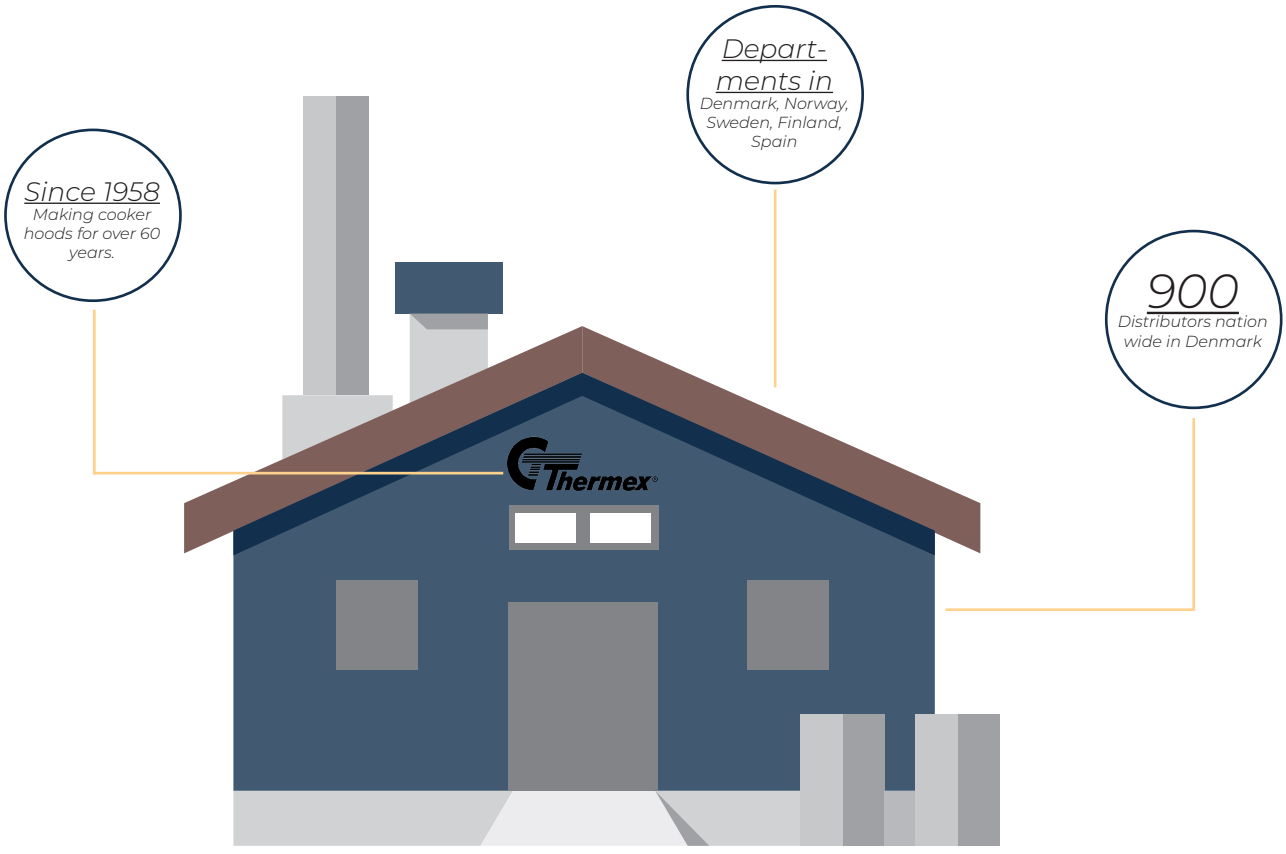
Thermex's products have a simplistic expression with a high sense of quality. All of their cooker hoods have an expression that strives to blend in with the kitchen. This is done through simple shapes and neutral colors with a hint of exclusiveness from the materials. Thermex often use materials like: Stainless steel, glass, black or white lacquered steel. The price range of their products vary depending on the type of cooker hood.

Sale

Their products are divided into two lines: Yellow line and Blue line. The Yellow line is sold at retailers and on the Internet while Blue line is sold solely at kitchen retailers such as Svanekøkken and HTH køkkener.
This is also in line with the fact that a cooker hood is a big investment to the home and not something which is change every year, but more like every 15th year.
Thermex tried to renew themselves by launching lamp model cooker hoods (Worksheet 30).

Technologies

Thermex have developed their own carbon filter (Plasmex) for their cooker hoods. It charges the air particles, which is twice as effective as a conventional carbon filter. It filtrates up to 96.5% of the cooking fumes.
Thermex's ceiling mounted cooker hoods come with a remote control to control fan strength and light brightness *[Thermex, no date c]*.



ill. 28. Thermex story illustration.

INTERVIEW - THERMEX

ill. 29. Thermex - Mini bordeaux. Price: 12.399 DKK. [Thermex, 2020a].

ill. 30. Thermex - Metz mini. Price: 9.499 DKK. [Thermex, 2020a].

ill. 31. Thermex - York III. Price: 1.149 DKK. [Thermex, 2020b].

ill. 32. Thermex - Gemini. 3.999 DKK. [WhiteAway, no date].

The intention with this interview is to get a cooperation with Thermex. The goal is to figure out if Thermex has a product platform which can be used as base for the product development and therefore use them as stakeholders for the project.
Furthermore it is wished to get an understanding of the company (what production methods do they use, what are their specialties, which technologies do they use, and where is the next trend in cooker hoods?) and use their knowledge to choose the direction with the most potential for at new product (Appendix 4).

Morten Bach Sørensen - Product manager.

Morten reviled that the products Metz, Mini Bordeaux, York and Gemini were Thermex's top sellers at the moment. York and Gemini are the cheap and basic versions mainly sold to the housing associations, where the Metz series and Mini Bordeaux are the top sellers for the private market.
Thermex do not produce any of their products themselves - they use sub suppliers to get the best tech for their money. This also opens up for a lot of possibilities according to production methods and materials.
They sell their products in Denmark, Norway, Sweden, Finland and Spain. This indicates that they mainly target the Scandinavian market. Energy consumption is an important aspect of a cooker hood. Recirculation eliminates the ventilation shaft resulting in no direct opening to the outside. This reduce the energy wasted when cooking.
Morten said that the trend moves towards hiding the cooker hood away and /or making it blend more and more into the kitchen.

"Recirculation is energy saving, and might be the new direction for all cooker hoods"
- Morten Bach Sørensen

- Recirculation system ✓

- Scandinavian design.
- Self-cleaning/ low maintenance.
- Smart home compatible (Wifi and Bluetooth).
- Recirculation filters

KEY INSIGHTS

Cooker hoods
Basic knowledge regarding cooker hoods, Thermex and the market has been gained, and led to a series of insights which should later be confirmed or lead to requirements.

One insight was confirmed and turned into a requirement for the end product. Thermex implied that recirculation is the future within cooker hoods, and more and more products is using this technology. As another insight claims making the product more portable and mobile, a technology like this would be ideal. The next step is to figure out how to implement this technology and its necessary components into a compact product.

Within the cooker hood industry there is essentially seven different types. The construction of a cooker hood is very simple and consists of a casing, a motor, filters and an interface. They consist of two different systems, either recirculation or duct out. Thermex sees the future of cooker hoods moving in the direction of recirculation. The industry of other product categories have moved from being stationary solutions to mobile units to target the younger segment of users. This indicates a market potential for the future of cooker hoods.

	Findings	Requirements	Source
✓	Recirculating system.	-	Thermex interview.
⚡	Recirculating system vs. Conventional system.	-	Construction.
	Making a cooker hood more compact and mobile might appeal to young users	-	Cooker hood evolution.
	Which type of kitchen layout should we design to?	-	Construction.
	Multiple suction levels.	-	High-end vs. low-end.
	Cleaning alarm.	-	High-end vs. low-end.
	Touch interface.	-	High-end vs. low-end.
	Visible interface.	-	High-end vs. low-end.
	Scandinavian design.	-	Thermex interview.
	Self-cleaning/ low maintenance.	-	Thermex interview.
	Smart home compatible (Wifi and Bluetooth).	-	Thermex interview.
	Recirculation filters.	-	Thermex interview.

PORTABLE

This chapter will concentrate on essential research leading to the design parameter: Portable. In order to get insight in the lifestyle of young people research was made, along with qualitative user interview and a photo ethnographic research of young people's homes. Finally this chapter will end with a sum up including insights and an overall conclusion.

ill. 33. Model test, scenario.

THE DANISH PEOPLE ARE NOMADS

"Young people moves every second year the first years after they move from their childhood home". *- Hans Skifter Andersen.*

In 2019 around 900.000 Danish people moved, equally to around 15% of the Danish population. The Danish people are the population who move **second most in Europe**, only beaten by Sweden.

34%

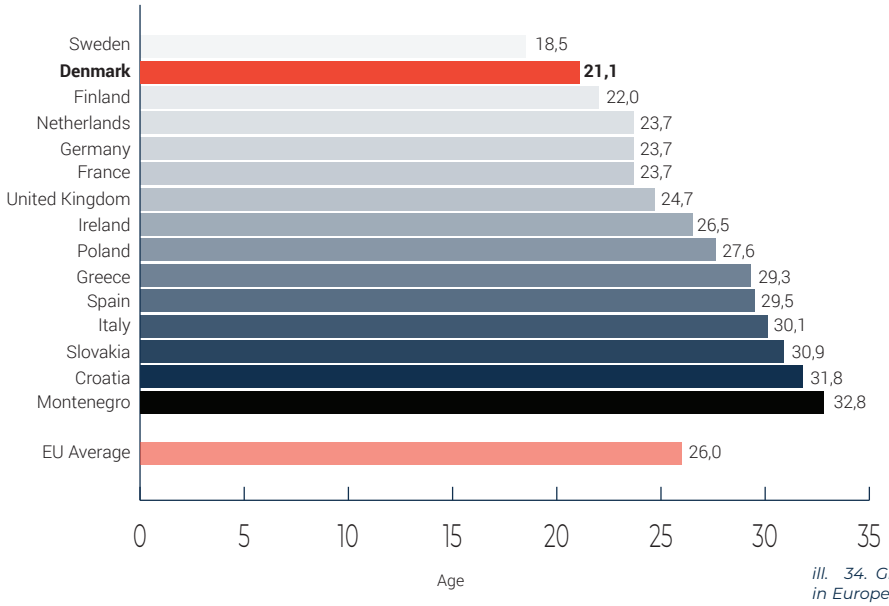
of all Danish people
change residence location within a five year period.

The typical Dane moves six times in their life. When a person reaches the age 18, they are likely to move around 9 times in average the rest of their life.

Hans Skifter Andersen says:" There is high frequency of moving for the young segment, people in their twenties. But it settles down through the years. People older than 50 years rarely moves".
People are relocating when an essential change happens in their lives. This applies especially to young people.
There are many circumstances which has an influence the young peoples desire to move: **Job or study location,** need for more **space** (e.g. because of **family expansion),** getting in a **relationship/ married** and so on.
They can also be forced to move, due to lost job, divorce, limited renting period etc.
[Tilitz, no date].
(Appendix 5).

WHEN DO WE MOVE?

Average age at which young people leave the parental household (2018)



ill. 34. Graph showing when young people in Europe leaves their parental house hold. [Armstrong, no date].

Danes are the second youngest when they move

Danes are typically around 21 years old when they move from their parents the first time, which is the second youngest in Europe. 51% of the young Danes moves because they want more freedom. 41% moved to get closer to their studies.

According to Hans Skifter Andersen, professor at Statens Byggeforskningsinstitut: "Within the first years after young people have moved from their parents, they move around every second year. Mainly due to studies and moving in with a roommate or girl-/boyfriend.
[Dieckmann, no date].

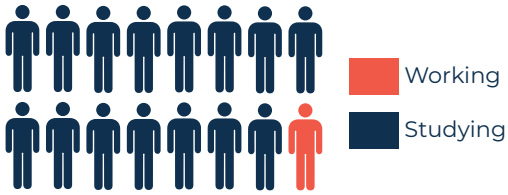
Conclusion

Learning that the young Danish people moves many times through their study time (and generally when they are young) it is interesting to see how they live, under which conditions their residential are and which products they have in their homes.

- Young people moves frequently.

QUALITATIVE USER INTERVIEW

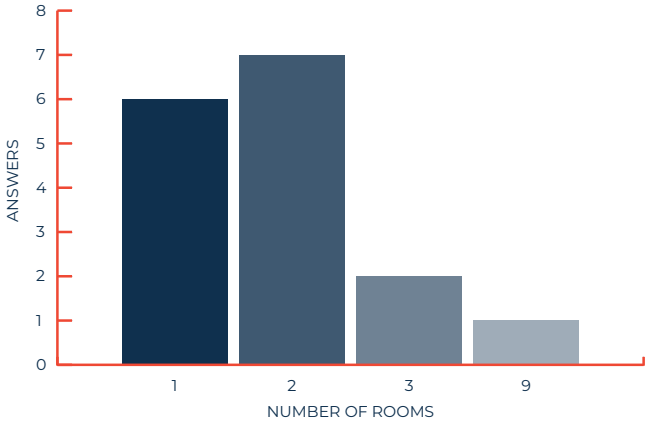
In order to confirm or invalidate the young people moving patterns from the desktop research, a group of people within the target group was asked to answer a survey, about how long they have lived in their current apartment, are planing to move but also if they have spend money on kitchen appliances. Some of them were further interviewed through the phone (Appendix 6) .



ill. 37. Distribution of employment based on the 16 users questioned.

Students live in small apartments

15 out of 16 of the questioned users were currently studying and only one was employed (see illustration 37)
The majority(81%) of the people asked had an apartment with only one or two rooms (see illustration 38) the average apartment size was 70 m^3.

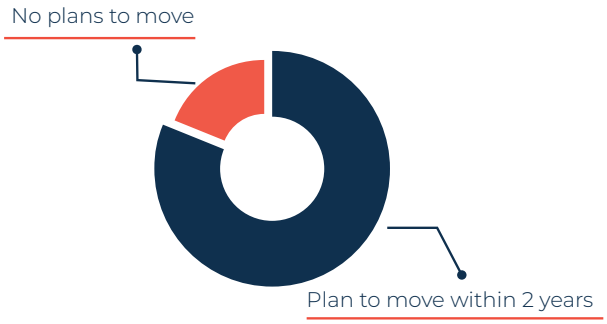


ill. 38. Distribution of the number of rooms in the users apartments.

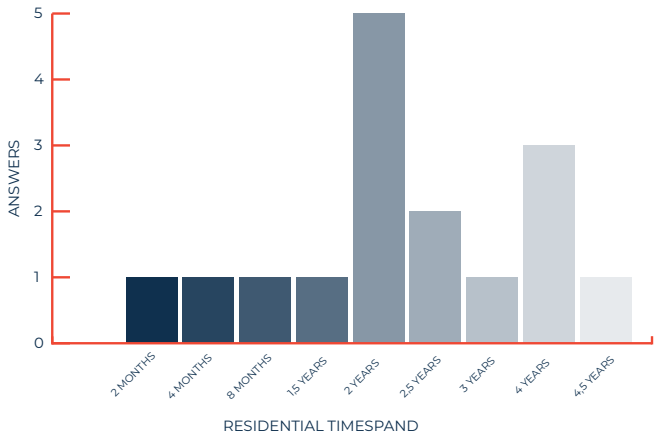
...And they move often

The users have lived in their apartments between 2 months and 4,5 years (see illustration 39). When the users were asked if they had any plans to move out 13 out of 16 were planning to move within the next two years (see illustration 35)

"I moved 3 times through my study time"
- Jeppe 28 y/o



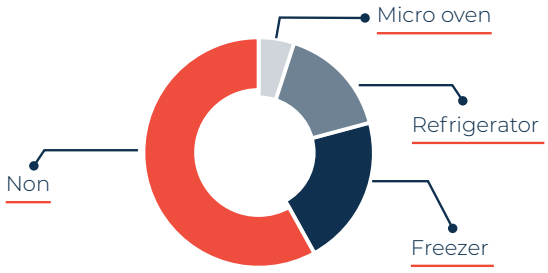
ill. 35. Overview of when the target group is planning on moving.



ill. 39. Overview of how long the users have lived in their current apartment.

"Refrigerator! Bought it used for 600 DKK!" *- Anonymous*

11 out of the 16 people hasn't purchased any additional kitchen appliances to their kitchen (see illustration 36). They settle with the appliances which already are installed instead. Some are more than 10 years old.



ill. 36. Kitchen appliances people has bought.

Conclusion

This qualitative interview confirmed that people in their twenties moves within a few years. A large part of the target group are students and their residents are rather small and compact, with only 1-2 rooms. Young people settles with the pre-installed appliances, even though they might be old and in variating condition. Some purchases kitchen appliances, mainly to store or prepare food.

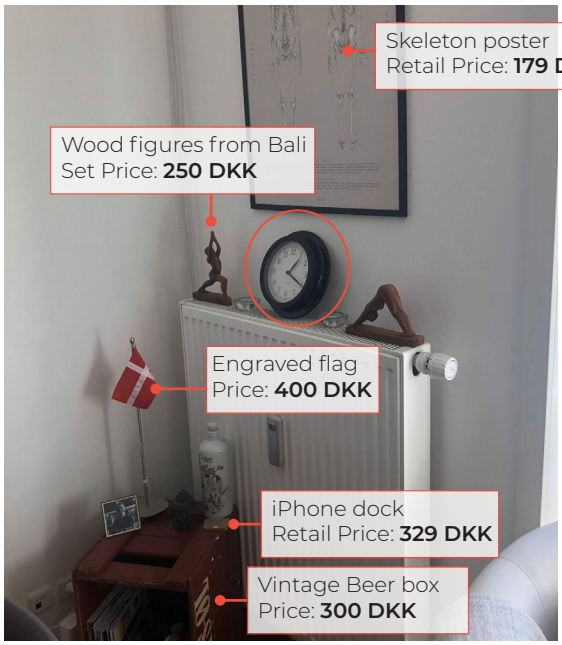
- Young people settles with quality, to safe money.
- Young people moves frequently.

PHOTO ETHNOGRAPHIC RESEARCH

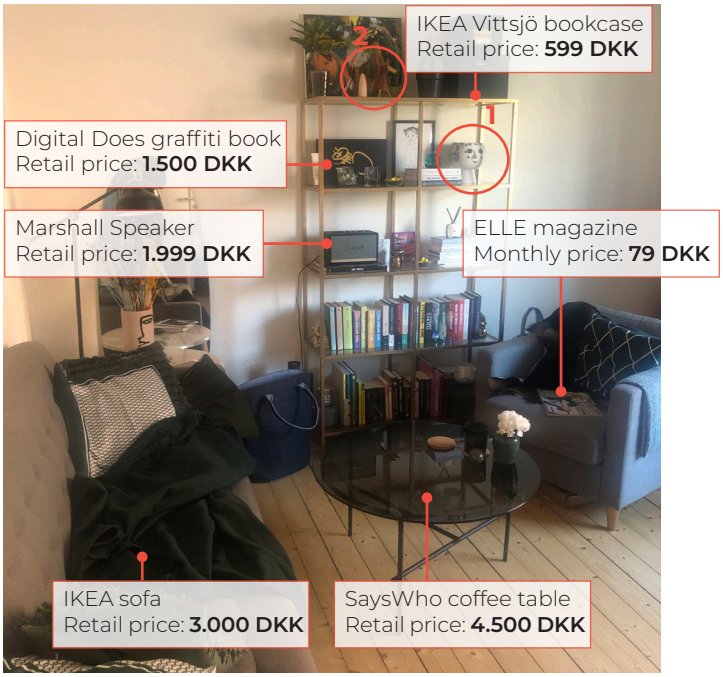
To get an understanding of how young people live, a photo ethnographic research was conducted where young people were asked to take pictures of their living room, kitchen and products they hide. The revived pictures were analyzed to get an understanding of what they spend money on (Appendix 6 & 7).

LIVING ROOM

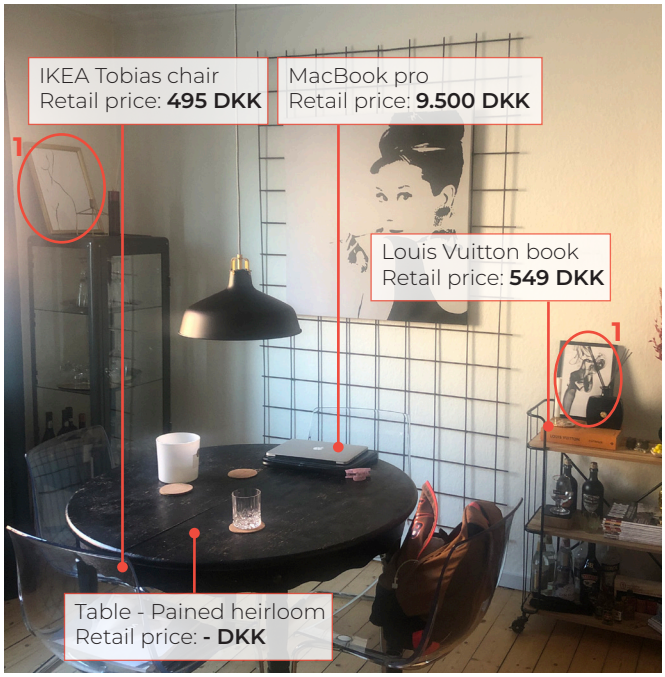
This was Mie's first apartment. Many of the furnitures were either bought used or brought from her childhood home.
The lamp (marked with a circle) had a free hanging cord.



Wall clock was standing and not hanged. She had displayed many products bought on a travel to Bali. Furthermore, she had bought a vintage beer box for a third of the price she gave for her sofa.



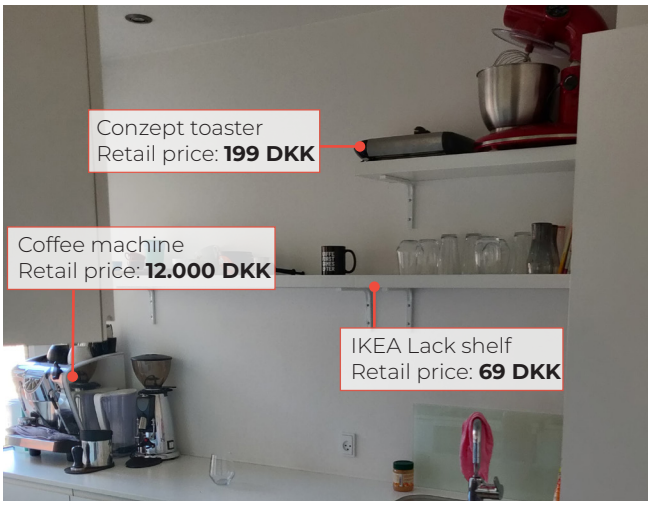
There are classic Danish designs: Bjørn Wiinblad vase (1) and Spring Copenhagen figures (2): PeberFuglen (699 DKK) and SaltPingvinen (699 DKK). The functional furnitures is almost same cost as the decoration/ identity products.



There has been spent more money on a Louis Vuitton catwalk book compared to the chairs.
Furthermore, multiple pictures are standing and not hanged on the wall (1).

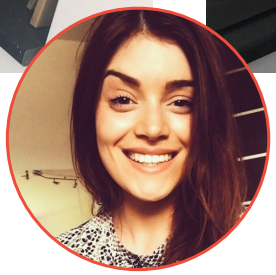
KITCHENS

The kitchen is very neat. There isn’t any superfluous items. Only a whitewashed electric kettle.



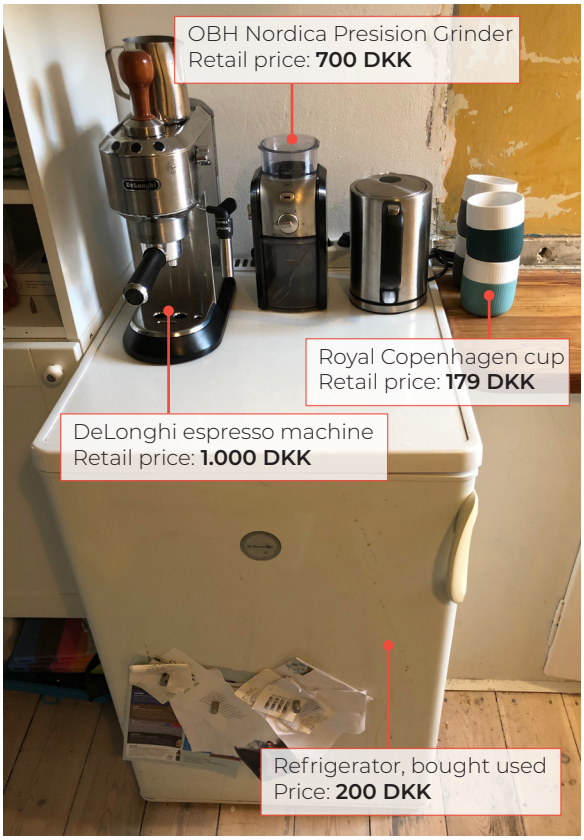
Coffee equipments seems important for the user, it takes up a large amount of space in the kitchen, and are the most expensive elements in the kitchen.
Mixer and toaster has a more discreet place in the kitchen, on the top shelf.

When the refrigerator and washing machine was bought, the low price was an important aspect, but the quality should still be efficient, according to Mie. Products used every day had a place in the kitchen where they were easily accessible (1).



“The kitchen scale is a heirloom from my grandparents. It doesn’t work, but I didn’t have the heart to put it in my storage because it is so beautiful”

-Mie 23 y/o

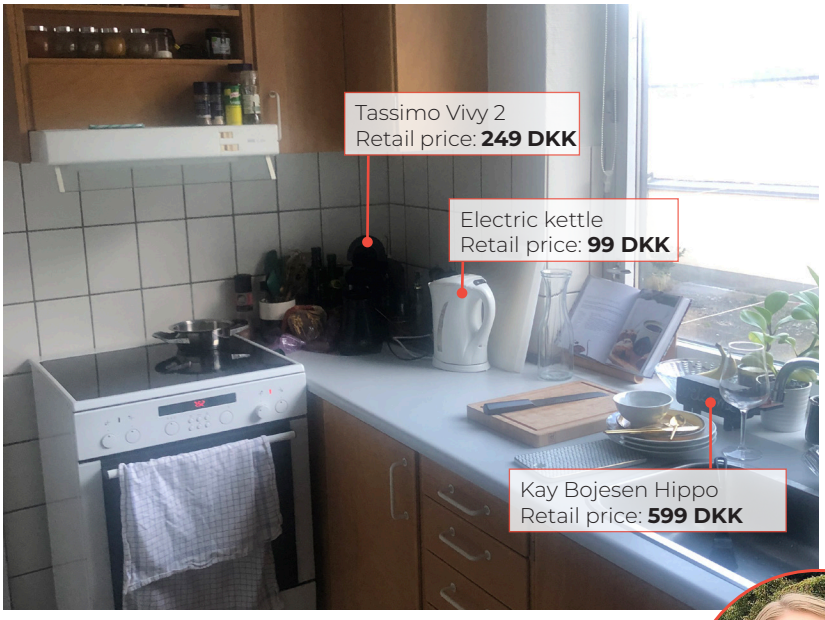


The picture indicates that more time and effort has been used on selecting the right coffee equipment than on the refrigerator, where they are placed.
The refrigerator top is used as table extension.

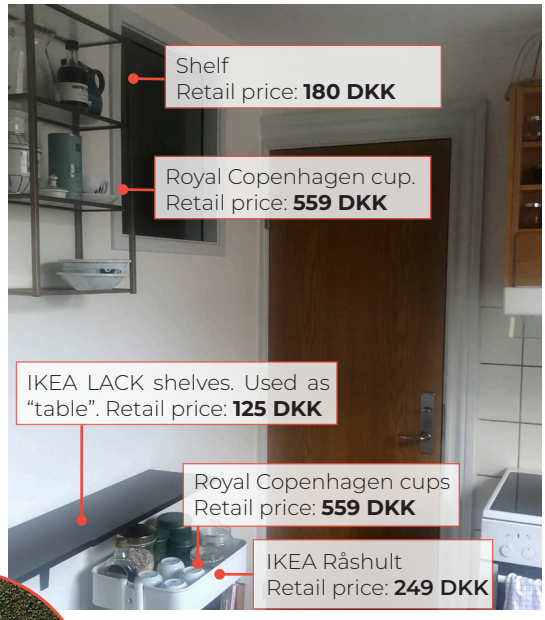
The kitchen appliances are old, and there isn't installed a cooker hood. The (back) door's hinge was used to store aprons.

"I almost never cook anything with curry because the apartment smells of it for days afterwards"

-Rasmus E. 26 y/o



The kitchen is old looking with old kitchen appliances. There is a Kay Bojesen Hippo wood figure, which is the most expensive (loose) object in the kitchen. Royal Copenhagen cutlery is displayed in a open shelf and in a trolley.



"I have used shelves as a temporary 'kitchen table', due to the size of the kitchen.

-Emma 23 y/o

"I guess we never bought a cooker hood because the apartment is old and I thought it would be too much work"

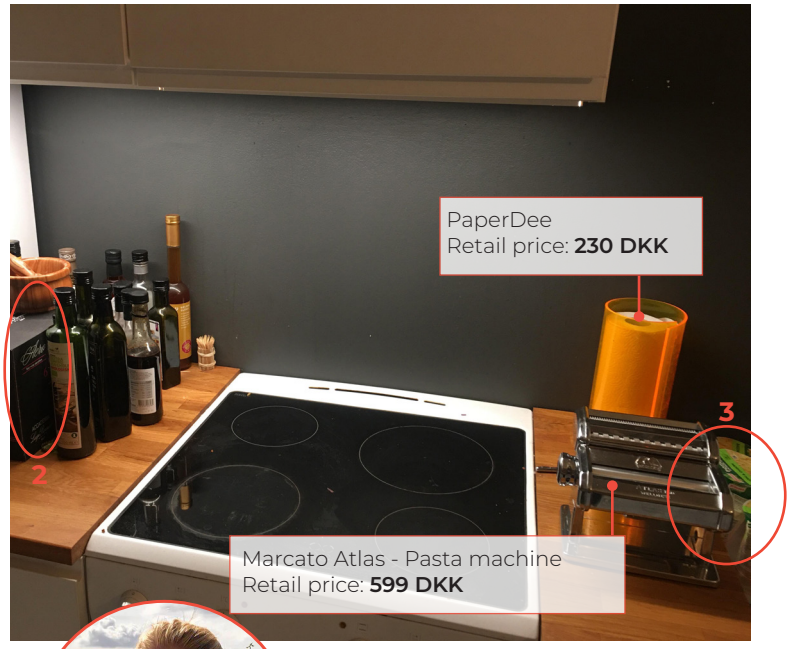
-Marie S. 28 y/o

"I think we always considered the apartment to be temporary while we save to move to something more permanent which is why we haven't made any major changes to it." *-Marie S. 28 y/o*

The pictures show there isn't much space in the kitchen. They used the refrigerator top as coffee area and had two different storage racks, a wood rack and a trolley. There isn't any cooker hood installed in this kitchen.

They had installed shelves to gain more storage, for dry foods and small kitchen appliances.
In the corner of the picture is an old and small washing machine with a top lit, which is also used as table extension.

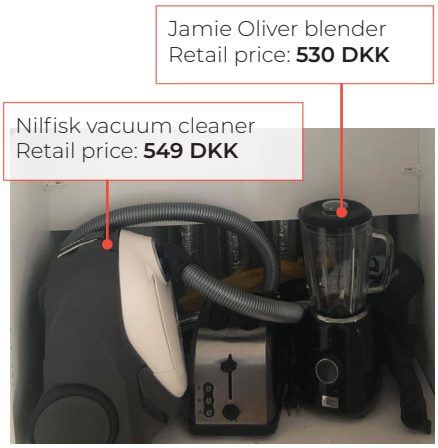
The space is tight around the stove, but spices and cooking equipment is prioritized. Additional shelves has been installed both close to the stove(1) and the sink(2) to expand storage possibilities. Extra shelves and other larger products are stored on top of the refrigerator. (3) The (back) door was used to hang equipments that is required around the stove and sink.
(4) Even though multiple shelves had been installed two pictures are still free standing and not hanged.
There is no cooker hood in this kitchen.



The mixer and kettle is taking up much of the space on the table. There is a contrast in having a designer kitchenware next to a wall with visible screws and cuts(1). Even though the space is tight on the kitchen counter, it is prioritized to have a box (for wineglasses) standing(2). There is also a fun paradox in having a pasta machine standing next to cup noodles(3).
There is no cooker hood in this kitchen.

"I love my new Mixer, it makes my life so much easier, and it's very beautiful in pink"
-Mathilde F. 27 y/o

PRODUCTS THEY HIDE



The products which the people hide are products they don't use every day, or products they use because of their function but don't like aesthetically.
Looking at the Kenwood Chef mixer on the picture above and comparing it to the KitchenAid mixer, the aesthetic differences is rather large. The old Kenwood mixer is more plain. It doesn't stand out and the plastic materials makes it look cheap. Most of the products which was analyzed to be identity creators was small, mobile products.
Even though the space is tight it is prioritized to display products like a KitchenAid mixer, because it tells a story about itself and the owner, such as quality, interests etc.
Trolleys are used as storage both in kitchens and living rooms, which allows the user to move it around. A repeating thing, was that people displayed inherited products from their family and stuff which they have brought from their teenage room. But also to buy many of the larger elements used; Sofas and refrigerators.

Instead of drilling holes in the wall, the surrounding are used creative, people are using door hinges and handles as hangers, and pictures is standing.

Conclusion

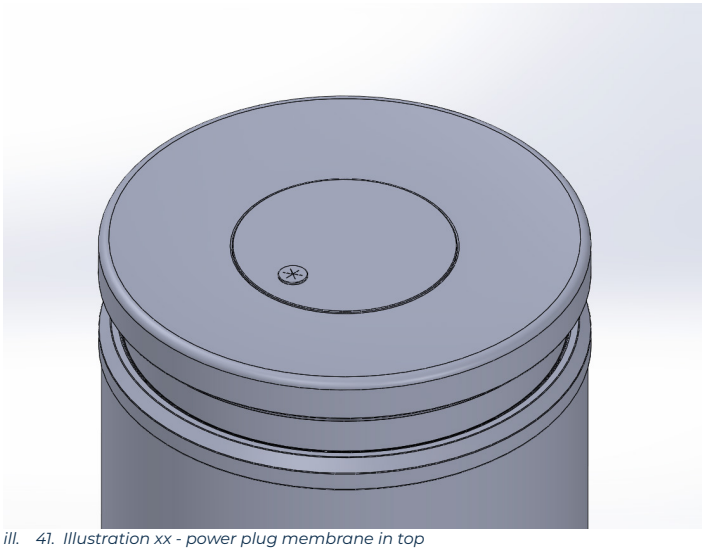
The pictures indicate young people are willing to spend more money on products which are identity creating and they can relate to, than products which are just functional and necessary to get through the everyday tasks. For example 12.000 DKK was spend on a coffee machine and the shelves above only costs around 69 DKK. The refrigerator is purchased cheap from the former owner and an expensive coffee machine is placed on top of it. This confirms that they are settling with the quality of some products to save money, but they do not settle with the quality of the identity creating products.

- Young people settles on bad quality, to save money, unless it is identity creating products ✓
- There is a market potential in identity creating products. ⚡
- Price range: <2.000 DKK. ⚡

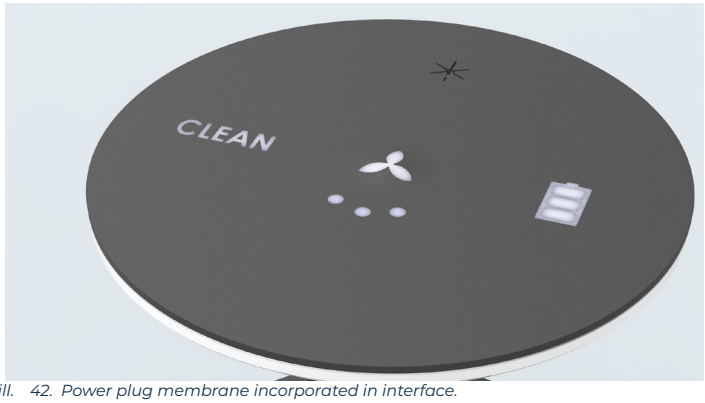
PORTABLE IMPLEMENTATION

By accumulating all the research and investigations of peoples homes, it was decided to make a portable cooker hood.
When creating a portable cooker hood it is important to consider the target groups minimal space and what limitations it sets for the concept development.
Specifically it means being able to move it around and put it away when it is not in use.
To be able to fulfill these demands it was chosen to make the product battery driven. With a big motor running on big batteries it would be preferable to have the possibility to recharge the batteries. Illustration 40 shows an iteration of the concept with the power cord in the side of the product. This position was chosen based solely on connecting the power to the PCB board, however this way the power cord would be able to collide with fire hazardous stoves. Furthermore the internal wiring would interfere with the cleaning of the filter.
Therefore it was chosen to place the power plug in the top of the product (see illustration 41) to get it as far away from the stove as possible.
To further increase the safety of the product it was chosen to create a rubber membrane surrounding the power plug to make it splash proof from grease and water. Lastly it was chosen to further incorporate the rubber membrane idea into the entire concepts interface(see illustration 42).

ill. 40. - Power plug in side.



ill. 41. Illustration xx - power plug membrane in top



ill. 42. Power plug membrane incorporated in interface.

- Battery driven.
- Rechargeable
- Splashproof inlet

KEY INSIGHTS

Young people moves every second year
From the conducted research and interview, it was made clear that young people moves frequently - around every second year.

Connects to identity creating products
Young people connects more to products than to the physical surroundings of their apartment, because the location and building is only temporary.
They purchase smaller products which they can bring along when they move, and these products are prioritized over larger functional products, which they are willing to buy used or use products they have inherited.

Aesthetics are important
The aesthetics and materials of at products is very important for young people, and not only the function. - Especially in order to earn a place in the kitchen instead of being hidden in a drawer or cabinet.

Avoid to damage the physical surroundings
Young people avoid making any damages or changes to the apartment, if they can. Pictures isn't mounted on the wall, but standing on shelves, tables and cabinets. To avoid drilling holes for hooks a door handle and hinges was used as storage instead.

	Findings	Requirements	Source
✓	Young people moves frequently.	-	Qualitative user interview.
	Young people settles on bad quality, to save money, unless it is identity creating products	-	Photo ethnographic research.
⚡	There is a market potential in identity creating products.	-	Photo ethnographic research.
	Price range < 2.000 DKK.	< 2.000 DKK.	Photo ethnographic research.
⚙	Battery driven.	-	Portable implementation.

SIZE MATTERS

In order for a product to become portable the size and weight are very important factors. The following chapter will showcase research on how other product categories has become smaller over time to follow the evolution of young people's lifestyle and trends. Furthermore tests are conducted to gain knowledge and hands-on-experience with cooker hoods and their subparts. The chapter will end in a sum up of insights and a conclusion of the topic.

ill. 43. Getting feedback, visit at Thermex.

KITCHEN APPLIANCE TO INTERIOR TOOL

An investigation of brands and products located in kitchens was conducted through desktop research. The goal was to gain knowledge on how the products are designed to the young segments lifestyle and small apartments. These elements can then be implemented into a cooker hood (Appendix 8).

Downsizing

IKEA Tillreda - Portable stove

ill. 44. Ikea portable stove - Tillreda. Price: 369 DKK. [IKEA, 2020].

"Tillreda is a portable induction stove, ***usable wherever it is needed****. Plug it in a power outlet and start cooking".* - Klara Petersén.

"Tillreda is suited to fit people with ***limited space*** and those who need an extra stove". - Klara Petersén.
[IKEA, 2020b]

Logik - Table dishwasher

ill. 45. Logik table dishwasher. Price: 1.799 DKK. [Elgiganten, 2020]

ill. 46. Jeppe's Kitchen. - From Photo ethnographic research.

Logik table dishwasher gives the same effect as the regular sized dishwasher, just with lower capacity. The product requires the same installment; Power supply and water in- and outlet, but the size allows it to be placed multiple places, inside a drawer (or instead of a drawer) on the kitchen counter. One of the kitchens obtained from Photo ethnographic research had a table dishwasher installed instead of a drawer (see illustration 46) *[Elgiganten, 2020].*

Caso - Combi oven

ill. 47. Caso Micro-/Combi oven. Price: 2.199,95 DKK. [Imerco, 2018a].

Caso's size, and its multifunctionality makes it ideal for small kitchens or apartments where there is not installed an oven. The product doesn't requires any installments, it's plug-and-play, which is an advantage in rental apartments where the rentals aren't allowed to make any installments (Or they don't want to because of the deposit)*[Imerco, 2018a].*

Customization and brand

KitchenAid - Mixer

ill. 48. Kitchen Aid - Customized mixer. Price: 2.590 DKK. [KitchenAid, 2020]

"MORE THAN A MIXER.
Boldly designed to unlock possibilities – in a range of colors as ***unique as you.****"* - Kitchen Aid.

"SHOW YOUR TRUE COLORS
Your kitchen, and everything in it is a ***reflection of who you are****. Select elements to customize your stand mixer and allow it to inspire endless creativity."* - Kitchen Aid.
[KitchenAid, 2020b][KitchenAid, 2020a].

SMEG - Toaster

ill. 49. SMEG toaster, price: 1.299 DKK. ill. 50. SMEG product range [Smeg, 2020], [Imerco, 2018b].

"Attention to detail and design solutions bring homes that reflect the image of their occupants to life. With Smeg, appliances ***take centre stage in the heart of the home****, a place where people can congregate. The kitchen integrates all of their functions and becomes a perfect, fully-equipped backdrop for those precious and enjoyable moments".* - SMEG.
[Imerco, 2018b][Smeg, 2020].

Conclusion

To fit young people's lifestyle the products are available in smaller and less space consuming versions, where the function or efficiency is reduced. Storage, placement and handling are re-thought compared to the original product, they fit into drawers or on the kitchen counter and handles are added to ease handling of the product.
They are personalizing the products, the products are appealing to peoples interests and values.

- Weight < 3 kg.
- There is a market potential for identity creating products.
- Is it possible to construct a compact cooker hood?

COOKER HOODS ARE NOT TARGETING THE YOUNG SEGMENT

The size of cooker hoods has not changed much through the years, even though the cooker hoods has evolved to be implemented into the kitchen counter, ceiling and so on. They do not seem to take up much space externally but internally they are still very space consuming. Furthermore the cooker hoods have not followed the same tendency as the kitchen appliances according to the earlier analysis.

Don't choose their cooker hood

In the photo ethnographic research it was shown that almost all young people, who have a cooker hood, has a cabinet integrated version. Which has been preinstalled before they moved in, which mean they haven't chosen their cooker hood themselves, but has to settle with the one installed.

Cheap, stripped and anonymous versions

This was also confirmed when speaking with Morten from Thermex (Appendix 4), where he could inform that the products they sell to housing associations are the cheap and stripped versions. York (see illustration 52) and Gemini (see illustration 51) are their two top sellers to housing associations. Thermex are mainly selling cabinet integrated cooker hoods to the young segment and they do not differ much aesthetically and are rather anonymous.
The problem regarding the cooker hoods which are "sold" to the young segment, is that they aren't bought or selected by the young people themselves, but are designed to the housing associations. Generally Thermex's products for the young segment are all competing on the same parameters; efficiency and price.

Conclusion

The only element which has changed in order of space and damage reduction is that the cooker hoods has the ability to recirculate, which doesn't require installment to air duct.
But they aren't using any of the aspects the kitchen tools in the previous analysis did, like fitting into the young segments lifestyle, moving patterns, demanding value creating products, customization and something they can relate to. The only one of the four cooker hoods on this page which is available in another color than white is York stainless steel version.

ill. 51. Thermex - Gemini. 3.999 DKK. [WhiteAway, no date].

ill. 52. Thermex - York III. Price: 1.149 DKK. [Thermex, 2020b].

ill. 53. Thermex - Turbo K702 II. Price: 2.499 DKK. [Thermex, 2020b]

ill. 54. Thermex - Manchester. Price: 1.349 DKK. [Thermex, 2020b]

COOKER HOOD DISASSEMBLY

Through the previous topic it was learned that kitchen appliances is available in compact versions as a result of aiming at small apartments. But this hasn't been done to cooker hoods.
Testing the possibility of a downsizing a cooker hood, required further knowledge of cooker hoods structure and their components. Therefore two cooker hoods were disassembled and compared (Appendix 9).

IKEA

ill. 55. LAGAN cooker hood. [IKEA, no date]

LAGAN:
- Price: 299 DKK.
- Size:
  - Length: 600 mm.
  - Width: 510 mm.
  - Hight: 130 mm.
- Air flow: 273 m³/h.
- Recirculation air flow: 75 m³/h.
- Sound level (max level): 71 dB (A).
- Motor effect: 115 W.
- Voltage: 220-240 V.
- 3 suction levels.

[IKEA, 2020a]

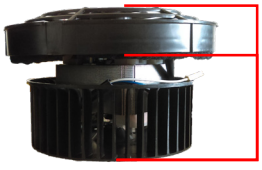
ELICA

ill. 58. Nikola Tesla cooker hood. [Hvidevaregrossisten, 2017]

Nikola Tesla One BL/F MIX:
- Price: 29.995 DKK.
- Size:
  - Length: 830 mm.
  - Width: 515 mm.
  - Hight: 210 mm.
- Air flow: 536 m³/h.
- Sound level (max level): 65 dB (A).
- Motor effect: 160 W.
- Voltage: 220-240 V.
- 9 suction levels.

[Eico, no date b]

MOTOR DIMENSIONS

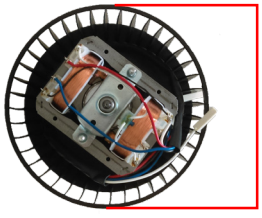


ill. 56. LAGAN motor - Side view.

Height without filter: 90 mm.
Height with filter: 115 mm.
Weight: 1.550 g.

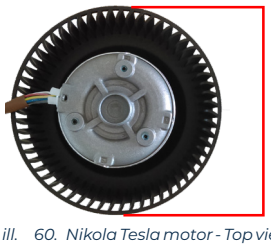
ill. 59. Nikola Tesla motor - Side view.

Height without filter: 120 mm.
Height with filter: 150 mm.
Weight: 2.172 g.



ill. 57. LAGAN motor - Top view.

Diameter without filter: 140 mm.
Diameter with filter: 180 mm.



ill. 60. Nikola Tesla motor - Top view.

Diameter: 180 mm.

The motor size influences its efficiency. Nikola Tesla's motor is larger (30 mm higher and 40 mm wider) and heavier (622 g) than LAGAN's and can almost move twice the amount of air.

- Suction efficiency > 75 m³/h.

DISASSEMBLY OF NIKOLA TESLA

ill. 61. Nikola Tesla cooker hood box.

Combination of stove and cooker hood

The disassembled Nikola Tesla cooker hood were damaged, the glass ceramic plate (stove) were broken and the filter were missing.
Nikola Tesla One BL/F MIX is a combination between a stove and a cooker hood. The cooker hood is implemented in the middle of the stove, where it is hidden. This corresponds with Morten's (From Thermex) statement; People want to hide the cooker hood.
There are bigger requirements to the suction, because it has to redirect the steam downwards, whereas the steam is naturally raising towards the traditional cooker hoods suction inlet.

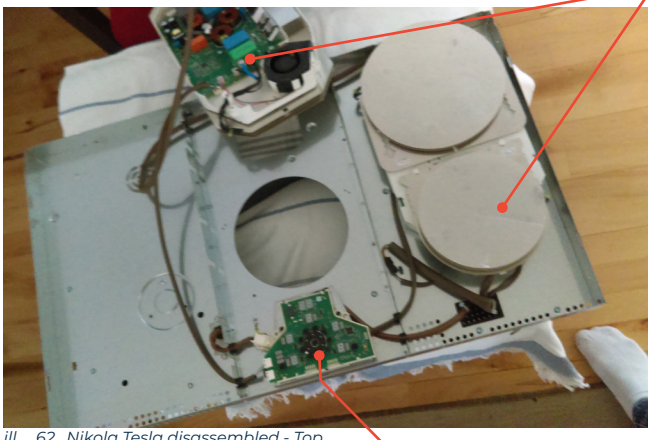
Stove function takes up much space

Removing the ceramic plate reviled, electronics and the heating plates which were all connected and fitted by a bended sheet metal case (see illustration 62). The stove's functions takes up a large area in the product. The electronics was the only elements on the top part which was related to the cooker hood's function.

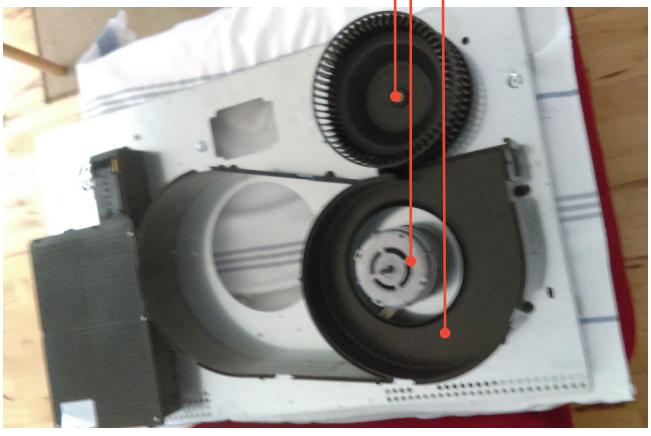
ill. 63. Nikola Tesla cooker hood in box.

... Unused space

On the other side of the metal case, was the motor, fan and air duct (see illustration 64). The fan was placed around the motor (not on its original place (see illustration 63) . There was lots of unused space around the air duct. Which could be used more efficiently.



ill. 62. Nikola Tesla disassembled - Top.



ill. 64. Nikola Tesla disassembled - Bottom.

DISASSEMBLY OF LAGAN

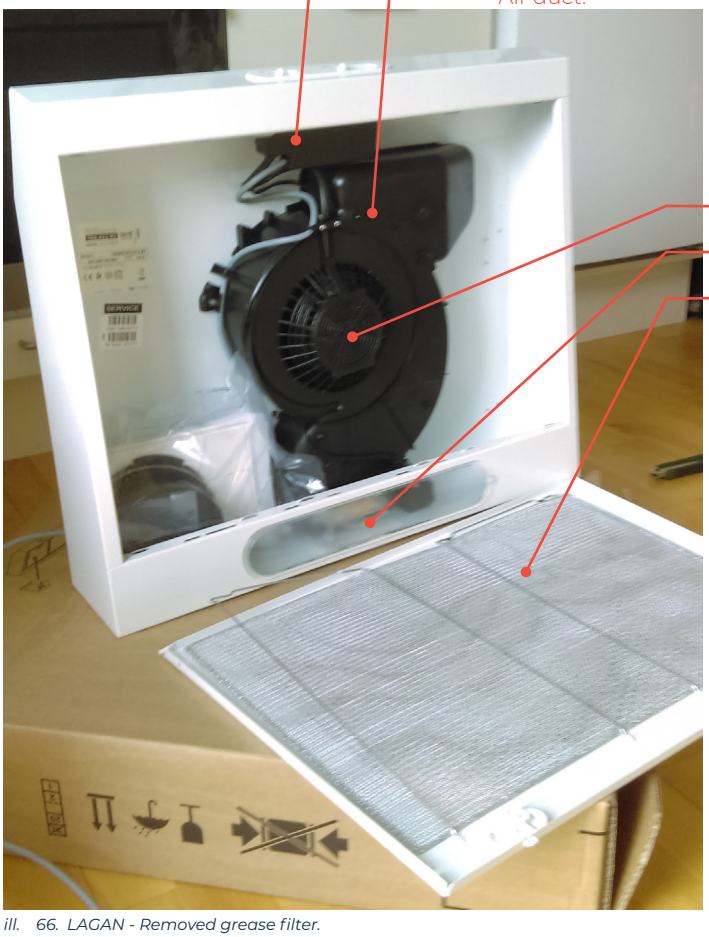
ill. 65. - IKEA LAGAN cooker hood box.

Fit kitchen cabinets standard measurements

Opening up the cooker hood reveiled lots of wasted space inside. The parts which was necessary for the cooker hood to function was inside the black plastic parts (see illustration 66). The size of LAGAN was determined by kitchen cabinets standard sizes.
This indicated a possibility for improvement when thinking of utilizing the space and downsizing cooker hoods.

Central ventilation & recirculating

LAGAN can be connected to central ventilation through the damper or recirculate the air. In order for LAGAN to recirculate the air, it was required to plug the damper with a plastic lit and add a carbon filter (Carbon filter has to be bought separately).

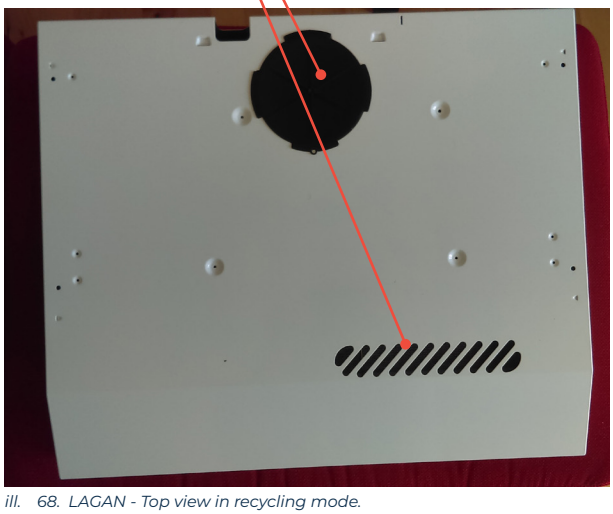


ill. 66. LAGAN - Removed grease filter.

ill. 67. LAGAN - Wall mounting.

Mounting

Recirculating cooker hoods require less space and installment than the central ventilating cooker hoods.
For LAGAN to be central ventilating it required a connection between the damper and ventilation shaft leading the air out of the building, and it still needs to be mounted on the wall or to a top cabinet with screws.
Whereas recirculating only required LAGAN to be mounted with screws. For wall mounting was three screws required (see illustration 67). Mounting at the bottom of the top cabinets requires four screws.



ill. 68. LAGAN - Top view in recycling mode.

Conclusion

Waste space
It was discovered that both cooker hoods had a lot of wasted space inside. Mainly because they had to fit standard measurements of other elements in the kitchen and additional functionalities.

Recirculating requires less space
Recirculating cooker hoods are less comprehensive to install then central ventilating cooker hood, which requires air shaft through the wall/ ceiling to the outside.

Motors variates according to performance
Comparing the LAGAN motor to the Elica Nikola Tesla motor, showed a substantial difference both in size, weight and performance.
It might be problematic to compare the two motors, since they are in widely different price ranges. However this showed that the cheaper version can be smaller and more compact products than the more expensive ones.
Due to LAGAN's motor size it was shown to be possible to create a down sized cooker hood. The main part (motor) required an area of 140 x 140 x 90 mm. It was decided to use LAGAN's motor as minimum requirements according to efficiency.

Next step
Create prototypes using parts from the two disassembled cooker hoods, and experiment with creating a more compact solution.

PROTOTYPING 1

Parts from the disassembled cooker hoods was implemented in mock-ups, with the intention of investigating the potential of a compact cooker hood. The motor from LAGAN was used in the mock-ups.

Match the motor shape

To utilize the space most sufficiently and reduce wasted space, the casing was made round to fit the motor shape, which also minimized edges inside the product that could potentially interfere with the airflow.
It was assumed both grease filter and carbon filter can be sized and shaped to fit the products, due to the materials.

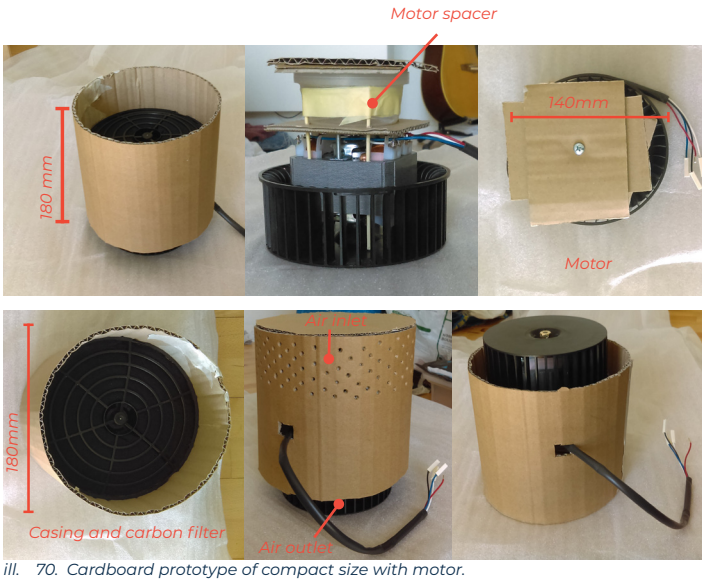
Separation

The motor had to have some kind of support structure to fixate it and create distance between the carbon filter and the electronic components. Placing the motor inside the cardboard casing showed problematics regarding the power cord. This was managed with a hole in the side of the product.

The compact size seemed feasible, component wise. But the effect had to be tested.

ill. 69. Cardboard model size test on the kitchen counter.

- Recirculation cooker hood.
- A lot of waste space in cooker hoods. ✓



ill. 70. Cardboard prototype of compact size with motor.

Conclusion

Compact size was feasible
The prototype test gave some valuable insights of how compact the end product might become.
The motor is the largest component in a cooker hood, and is the component which require the most space. Therefore, it was evaluated to be feasible to create a compact cooker hood.
The test was done with an actual motor and recirculation filter from a cooker hood, which made it easier to know what sizes to compel to for the casing. However the amount of space needed for the support structure and construction is unknown, this might very well result in a larger product to make the construction more stable.

Discovered problematics
The efficiency had to be tested, because of the new suction direction and because the inside airflow was unknown. Other problematics were also discovered; space for electrical components, wire handling, power supply.

Next step
With the size and the basic components roughly settled the next step would be to incorporate and detail more on the specific aspects of the product, including: Interface, suction ability, placements and the interaction surfaces.

- It is possible to construct a compact cooker hood. ✓
- Round shape to fit motor shape
- Power supply.
- Electrical components.

KEY INSIGHTS

Fit the user and create identity
Many interior products are appealing to different values in the customers. Some by adapting the products to specific scenarios and users. For example many product are made in smaller and portable versions to fit apartments and small rooms.
Other brands are trying to create value by creating a bond between the product and owner. This is done through customization, quality and so on.

Wasted space
Disassembling two different cooker hoods showed, there are a lot of unused space inside of them, because they have to fit the top cabinets standard measurements or is a combination of a cooker hood and a stove.

Recirculating technology
Recirculating cooker hoods require no installments, in contrary to conventional cooker hoods. Recirculating is suitable for the young segment, who moves frequently and don't want to make any damage or installments in their residents. This will also make it a more "plug 'n' play"-solution.

External matches the internal components
Through mock-ups it was learned that a round shape fit with the internal components and minimize corners and edges which could potentially affect the airflow.

	Findings	Requirements	Source
✓	It is possible to construct a compact cooker hood.	Hight: 200 mm. Diameter: 200 mm.	Prototyping 1
	There is a market potential for identity crating product.	-	Kitchen appliance to interior tool.
	A lot of waste space in cooker hoods.	-	Cooker hood disassembly
⚙	Recirculating cooker hood.	Carbon filter.	Cooker hood disassembly
	Round shape to fit motor	-	Prototyping 1.
	Weight	<3 kg.	Kitchen appliance to interior tool.
⚡	Suction efficiency.	75 m^3/h	Cooker hood disassembly
	Power supply	-	Prototyping 1.
	Electrical components.	-	Prototyping 1.

SCANDINAVIAN DESIGN

This chapter will focus on how to create a desirable expression that will appeal to the target group. This is done through mock-up tests, digital product catalogues and ethnographic field research. The chapter ends with an overall sum up and conclusion.

ill. 71. Vipp department in Magasin Friis, Aalborg.

MOCK-UPS & USER TEST

Purchase barrier

Through the process a purchase barrier was discovered. In order to overcome this purchase barrier, it was the goal to test what appeals to the target group, which qualities they valued, and what would make them “Buzz”. At this point in the project the focus were on creating a fire extinguisher.
The mock-ups tested different aspects of value creation. The models was created from cardboard and old plastic bottles which made it hard for the test person to look past the aesthetics and only focus on the concept. However a couple of the mock-ups made the test people “buzz”, meaning that they could see some potential in having a product that would have either an iconic Scandinavian design or being caricatured and would invite to be a conversation starter in ones home. The full test can be found in Appendix 10.

ill. 72. Mock-up test.

Feedback on concepts

Two of the mock-ups made for the testing session are highlighted, because they got particularly good feedback compared to the rest of the mock-ups, and created a “buzz” in the test persons.

Transparent fire extinguisher

One of the mock-up’s which created a buzz was a transparent concept, it showcased the internal elements and was a bit gimmicky. Furthermore, the minimalism and simplicity was perceived very well. In addition the symbol indicated what it was (Flame icon).

“Ohh if you could make a transparent fire extinguisher! Damn that would be nice, then I would have it visually displayed 100 percent, then it would be a design thing”

-Quang 24 y/o

ill. 73. Transparent fire extinguisher mock-up.

Colors and customization

At the second mock-up (see illustration 74) it was positively perceived that it was minimalistic and all the unnecessary elements was removed. The single color with eye catching icons was found interesting. People would like it to be customizable, enabling the user to select the color which would fit the users taste best.

“It looks like a Kitchen Aid product. It would be nice with other Pantone color variations”

-Anton 27 y/o

ill. 74. Minimalistic, single color fire extinguisher mock-up.

Conclusion

The two fire extinguishers showed that by creating a unique expression it might be possible to make a sellable consumer product even though the product might be considered to be in a different context and not something you would like to display originally.
After elaborating on the feedback given by the users it was realized that it was necessary to create concepts with a higher desirability and a higher degree of detail in the design.
The users had a hard time looking past the quick and crude models and their feedback had focus on the functionality. This was especially complicated since it was sought to get feedback on the desirability and aesthetics

- Desirability is found in the finish and in products that are gimmicky.
- Minimalistic design.
- Customization.

MARKET RESEARCH

To get an indication of what young people spend their money on different interior stores were visited. This is done to get an insight in which qualities and features young people value, but also to understand how other brands have handled similar problems.
The two stores visited: Imerco Friis and Magasin are typical stores where young people come to get inspiration and buy products for their homes Appendix 11.

ill. 75. Margasin, Friis Aalborg, interior department.

From everyday to icon

A few brands were selected to investigate further, including Vipp, B&O and SMEG, all three brands have interesting elements and are targeting young people (in different ways).

ill. 76. Margasin, Friis Aalborg, Vipp products.

Vipp

Vipp has taken everyday objects which people often would hide away, and turned them into icons and a design statements.
Their design language is minimalistic and geometrical (cylinder). The different parts is often made in blank, painted or coated metal. Their products are long lasting, which is supported by having changeable elements/ parts. The products signal quality. They are working with neutral colors, which fits into every home; black, white and gray. They are using known interacting methods to for example opening the garbage can and turning the light on.

B&O

B&O is a brand who mainly creates speakers. But they have reframed the concept, to speakers that functions as furnitures and sculptures in the room, and still remain good quality and function. B&O's design language is soft, they are often working with the round shape. Many of their product consists of combined materials, like metal and fabric, metal and wood or metal and leather. Some of B&O's products uses gesturing to interact with them and hides the interfaces in the shape/ surface.
A few years ago, the launched B&O Play, which are targeting the younger segment. B&O Play speakers are smaller and portable, they are designed to be brought around with the user. The price range is also more affordable for young people.

ill. 77. Margasin, Friis Aalborg, B&O Play.

SMEG

SMEG (see illustration 78) is making 50's inspirated kitchenware. Their products are both signaling retro and quality. SMEG has turned normal, functionally product into products that has their own area in the kitchen, where they are "displayed".
They are using metal, pastel colors, their logo (name) is visual on all their products. Mix between metal and colored metal. Soft shapes, rounded corners, large buttons/ interfaces.

ill. 78. Imerco, Friis Aalborg, SMEG products.

Conclusion

Many brands are rethinking the product categories where their products belong or their approach to target a new segment.

Turned everyday product into statements
Both Vipp and SMEG has turned everyday products into products which the owners proudly display. They are not just functional products they are also indicating a value which the user want to show.

Reframing to target a new segment
B&O has reframed the B&O Play products to aim at a younger segment and their life style. The products are less space consuming, doesn't require installment and are portable.

There are many decorative objects, interiors brands, which all have different selling points and design language. There are two poles - the once which are gimmicky and the more classic once.

It can be assumed that stores like Imerco and Magasin sells products which are popular and well liked by the customers.

- Minimalistic Scandinavian design. ✓
- Everyday product are turned into "design" products. ⚡

CATALOGUE 1

To present the user with a mock-up with a higher degree of detail it was chosen to do some rapid 3D modeling with the inspiration from other designer brands, such as Bang and Olufsen, SMEG, Alessi and Elica (Appendix 19).
To give the user a sense of how the product would look like, it was chosen to create a product catalogue that would show the concepts in a context. Furthermore, the concepts were trying to test different ways to create value for the users.

The first concept (see illustration 79) was inspired by SMEG. The intention was to see how the target group would react on the 50's style and color, but also that the concepts show what it is visually on the product design.

"It looks a bit like a small trash can, but it is really nice if i visited someone who had it, then I would ask what it was, it is a eye catcher".

-Alisa 26 y/o

The second concept (see illustration 80) gets its inspiration from Alessi and seeks to be a more caricatured product which was playing on humorist aspects and become a centerpiece in the kitchen.

"Pretty cool design and it adds something original to the room. It does not hurt with the colors, that's just nice".

-Christian 35 y/o

The third concept (see illustration 81) was inspired by Elica's Nikola Tesla stove integrated cooker hood. This concepts was testing how the user would react to added functionally values. - Multifunction.

"Very beautiful design. I think it would fit great into many Copenhagen apartments with a gas stove and without cooker hoods".

-Marie 28 y/o

ill. 79. SMEG fire extinguisher concept.

Concept 1 - SMEG

ill. 80. Alessi fire extinguisher concept.

Concept 2 - Alessi

ill. 81. Elica fire extinguisher concept.

Concept 3 - Elica

Conclusion

The earlier mock-up tests had the hypothesis that if the product had a high finish and was gimmicky it would appeal to the target group this was confirmed through this product catalogue.
The people who gave feedback on the product catalogue seemed to "buzz" at the items that had a Scandinavian minimalistic design and had something unique that would invite them to ask the owner of the product what it was. They seemed to want it if it becomes a centerpiece for conversations in peoples kitchens.

- Desirability is found in the finish and in products that are gimmicky. ✓

PRE-SKETCHING

The aesthetic research made up untill now through this section, have settled the appearance of an interior product that would appeal to the target group.
The last part of this section will focus on creating the cooker hood concept and the implementation of how a cooker hoods can become a portable interior product.
Different key insights was found through the process and was used as foundation to create concepts on sketching format.
The sketches was subsequently taking into 3D, because the goal was to get feedback on desirability (Appendix 12 & 20).

Key insights

1 Wall mounted

2 Light source (work light)

3 Compatible with Thermex's electrical platform

4 Indicate when filters need to be changed/ cleaned

5 Fit(blend) into kitchen context

6 Easily cleaned (outside and inside)

7 Monitoring

8 Recirculation of air

"Indicate what it is but is still subtle".
- Jeppe 28 y/o (catalogue 1).

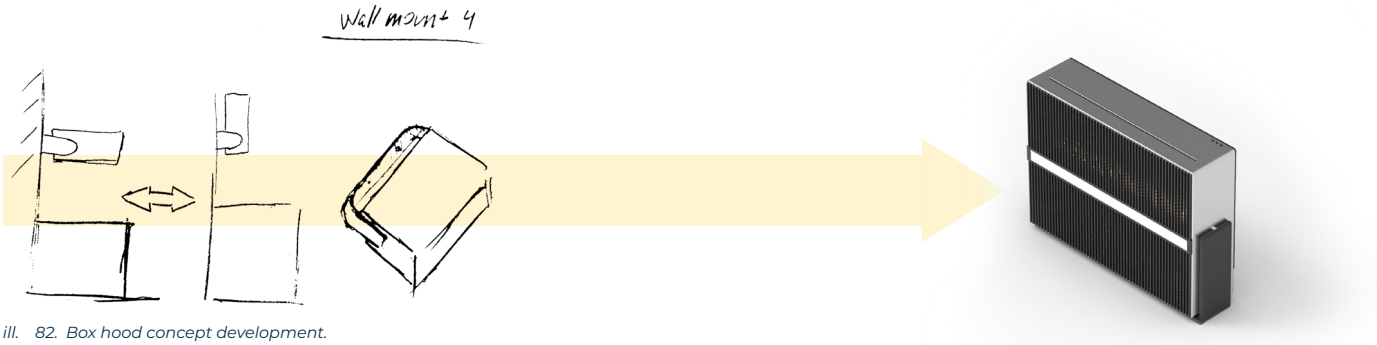
"The ongoing trend is hiding the cooker hood and make it blend into the kitchen".
- Morten Bach Sørensen (Thermex interview).

"People prefer a good light above the food on the stove, rather than a good suction".
- Morten Bach Sørensen (Thermex interview).

CONCEPT DEVELOPMENT

In the following section, the development of different concepts will be illustrated, from the first sketch to the final render (Appendix 12 & 13).
The final renders of the concepts was tested through a digital catalogue (See page 54).

Box hood concept



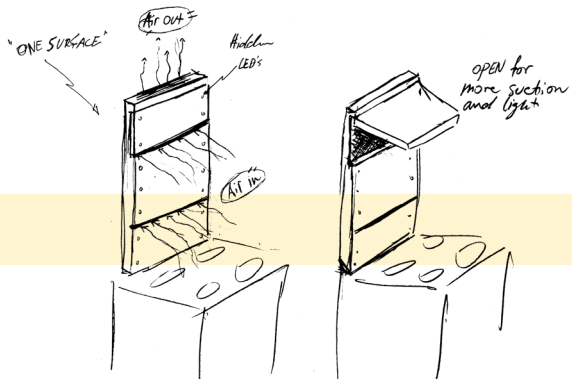
ill. 82. Box hood concept development.

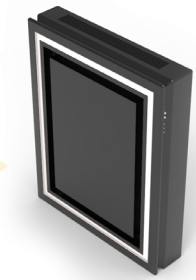
The initial idea was to create a wall mounted cooker hood, which was easy to mount.

When the concept was 3D modeled, additional focus on key insight nr. 2, 4, 5 and 6 was incorporated.

The final concept was testing to add value by providing easy mounting and have a shelf-top.

Backplate hood concept





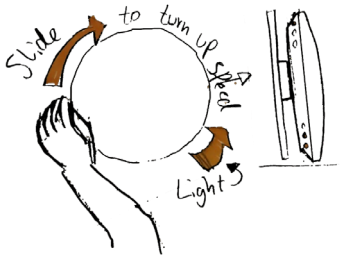
ill. 83. Backplate hood concept development.

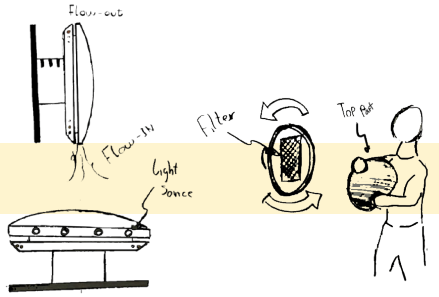
The backplate concept was inspired by the grease plates which often are placed on the wall at the stove area.

The concept was meant to blend into the kitchen and function both as grease splatter plate and cooker hood.

When modeled in 3D the concept was downsized, to reduce the complexity, make it possible to install under top cabinets, the goal was to make it as slim as possible.

Round hood concept





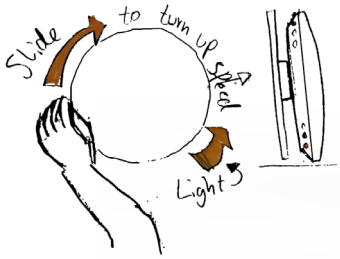
ill. 84. Round hood concept development.

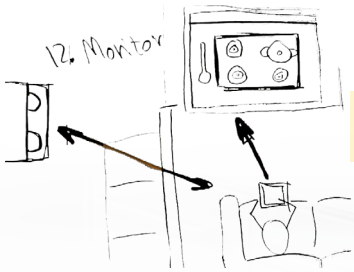
The concept was focusing on wall mounting and easy cleaning. The interactions was hidden on the back, inspired by B&O A9.

The concept was further developed through sketching. The concept was detailed further according to air in- and outlet and filter cleaning.

The concept changed through 3D modeling, and the final aesthetic found inspiration in speaker. This was used to test, if a known look would appeal to the users.

Eliptical hood concept





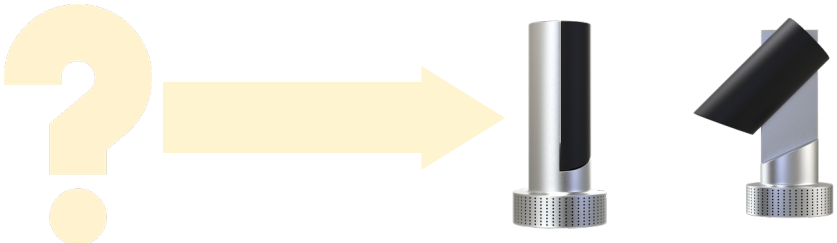
ill. 85. Eliptical hood concept development.

This concept was based on the same sketch as the Round hood concept.

It was combined with the key insight Monitoring. The idea was, that the concept only was controlled by an APP.

The final concept was intended to test how the target group would react on a smart-product cooker hood.

Vertical hood concept



ill. 86. Vertical hood concept development.

This concept was developed directly in 3D. It came to be, as a result of trying to provoke the common understanding of a cooker hood even more.

This concept only had one suction level and a direct light. This was made in order to see how the users would react. Furthermore, couldn't this concept be wall mounted.

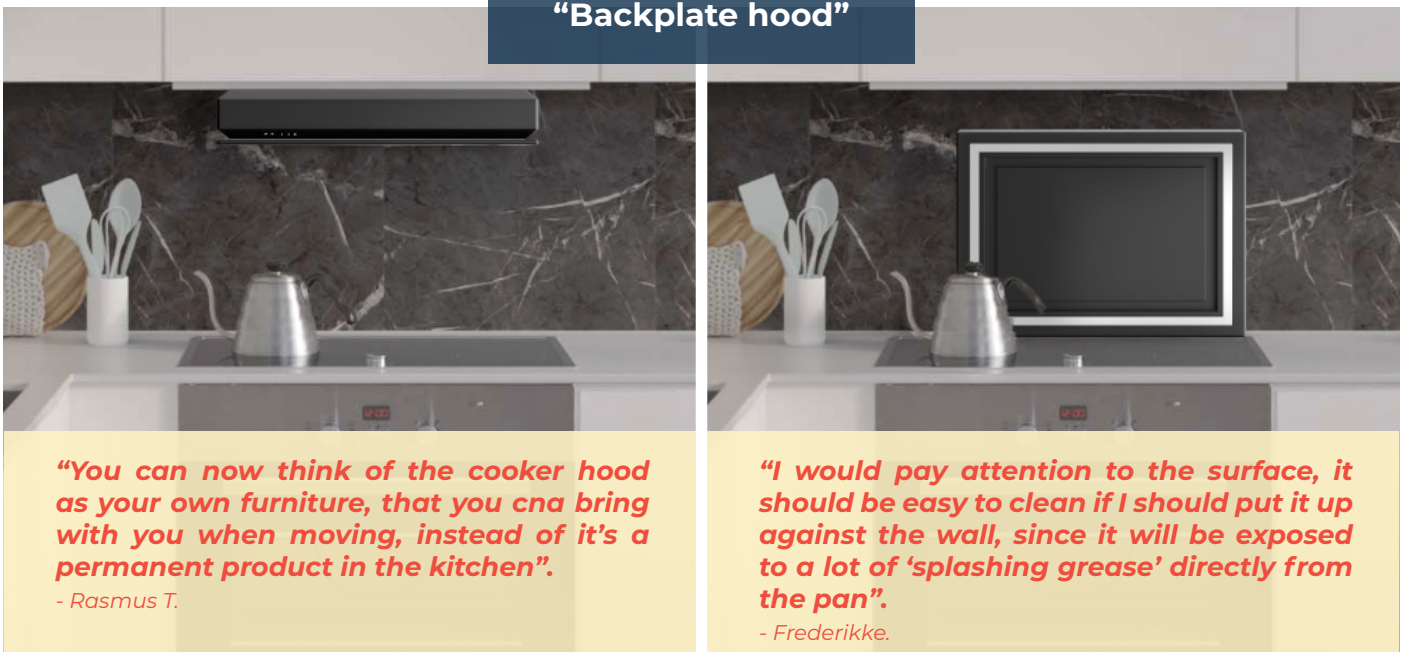
Conclusion

The five concepts will be presented to the user group through a digital catalogue.
In order to uprise the quality on the feedback, was the concepts placed in contexts, to visualizes the size and use of the product.

CATALOGUE 2

In order to get feedback on the five concepts a catalogue including context renders and feature explanations was made and send to the target group. The goal was to get feedback on the individual unique features of the five different concepts (Appendix 13).

“Backplate hood”
The cooker hood can either be mounted in top cabinets or stand behind the stove and **function as a backplate that will cover the wall from fat stains.** The suction level and light is adjusted with buttons located on the side of the product. The air is sucked in through the front (with the light) and circulated out of the top. The filter is taken out, by pushing the filter edge, on the side of the product, it appears and can be removed from the product.



ill. 87. Concept 1 in the catalogue - Cabinet mounted & Standing.

“Box hood”
The concept can either stand or be wall mounted. It comes with an easy mounting solution, where the base is first mounted on the wall whereas the cooker hood can be slided into the base afterwards (see illustration 89). The cooker hood sucks in air through the grills and releases it in the back part of the top. The top of the cooker hood is submerged a bit, so it functions as a shelf.

“Nice that you can store your spices on it”.
- Sebastian.

ill. 88. Concept 2 storage with salt and pepper.

ill. 89. Concept 2 mounting plate.

ill. 90. Concept 2 in the catalogue - Wall mounted & Standing.

Eliptical hood:
This concept is **controlled only by APP**. It can either be wall mounted or stand. I The air is sucked into the product in the grove and released in the bottom. The top is taken off, whereas the grease filter can be removed afterwards and washed in the dishwasher.

ill. 91. Concept 3 in the catalogue - Wall mounted & Standing.

"Eliptical hood"

"I think this one is pretty nice. It is a big plus that it cna be put in the dishwasher. Fine idea with the APP, but can it also be controlled manually? If my parents borrow my apartment it would be nice they could use it without installing anything".
- Marie.

"Round hood"
This concept is a recirculating cooker hood that can be placed where it is needed or wall mounted. To reduce the grease a catalyst is incorporated. The air comes in from the front and released at the side (when hanging). It has LED lights along the side and functions as working light. The light brightness and color can be adjusted either manual on the side or with an APP. In order to reach the filter, the top part has to be taken off. **This concept sought to be more like a loud speaker in its design.**

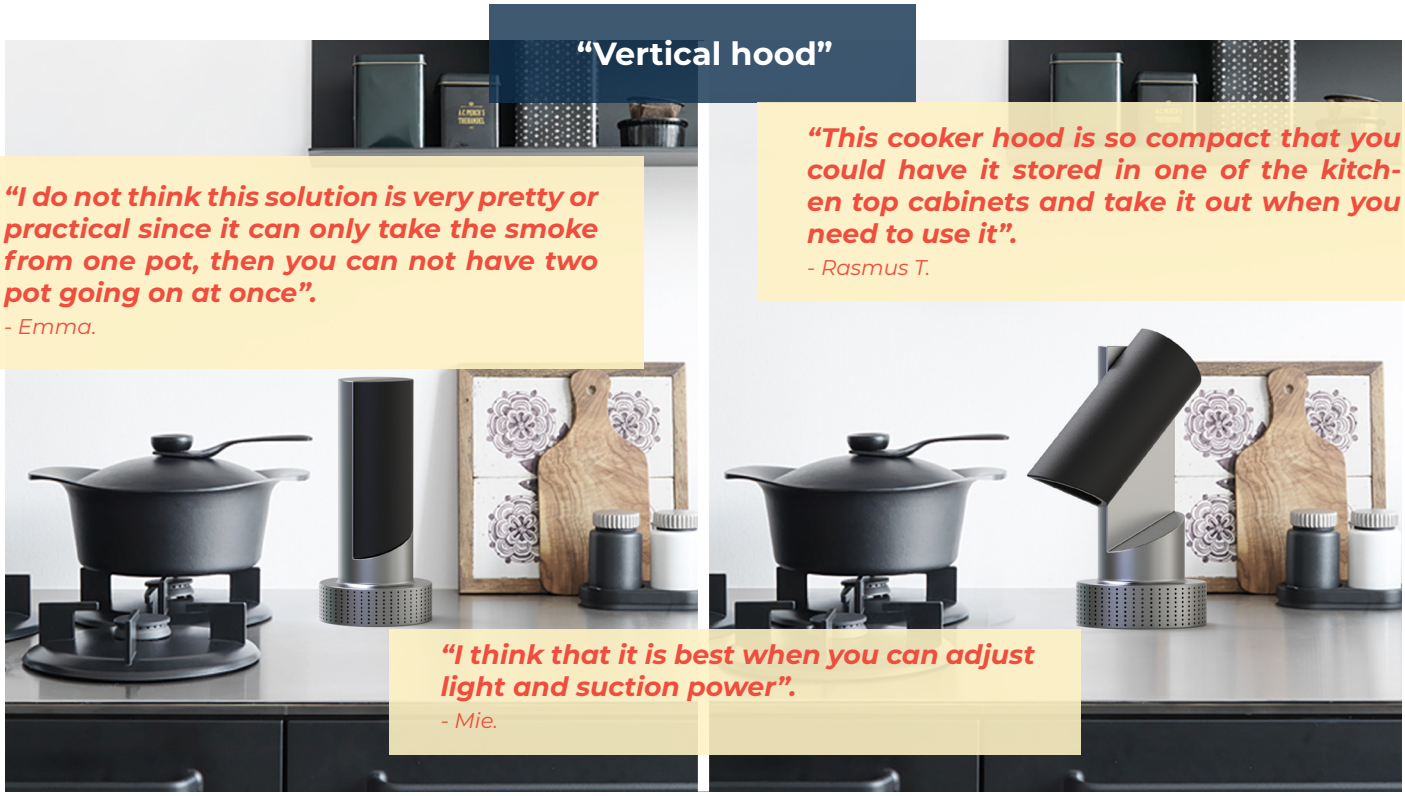
"Round hood"

"I really like this one design wise, although I might be nervous that it is not as effective as the Backplate and Box concept".
- Jeppe & Cecilie.

"It is attractive this it can be put into the dishwasher and be cleaned external with a wet cloth and it's a kick ass design".
- Frederikke.

ill. 92. Concept 4 in the catalogue - Wall mounted & Standing.

“Vertical hood”
This concept is a recirculating, mobile cooker hood. The concept **only has one suction function** and light brightness, which activates by turning the “head”. The air is sucked from the head and released in the bottom of the product. The suction is only **directed at one pot or pan at a time.**



ill. 93. Concept 5 in the catalogue - Passive & Active.

Conclusion

Mounting
People found value in a cooker hood which could be placed/ mounted multiple places. But also that the mounting wouldn’t require large damages to the walls, cabinets or other elements in their apartment.
Having a base unit which was mounted first, and then the cooker hood placed in it, was a value many could see if they had to mount it.

Performance
The size and weight of the product is also important, if it should be relocated or provide the possibility to hide it when it isn’t used.
People had doubts regarding the suction effect with some of the concept - based on the concepts design.
The product should have manual control. - APP control can be an extra feature/ add on.

Cleaning
It should be easy to take out the filters, when it needs to be cleaned or changed. The product should also indicate when the filter needs cleaning.

Aesthetics
The concepts had similar design language, minimalistic and same materials/ colors.
Aesthetics are very individual from person to person. Some like that the concept looks like a speaker others doesn’t.

- Recirculation.
- Mobile cooker hood.
- Cooker hood as interior product.

- Smart product.

- Multiple suction levels
- Cleaning indicator.

- Does it need a work light for cooking?
- Mounting vs. no mounting.
- Furniture-like cooker hood.
- Easy cleaning in dishwasher.

THERMEX INTERVIEW 2

After receiving feedback on the product catalogue 2, it was presented to Morten, from Thermex, over Skype to get his feedback but also insight regarding the further development.

Morten was very intrigued by the project direction and could see a large potential in creating a portable cooker hood, also for Thermex as a company, because it differs from all their other products. It would also be a way for Thermex to differ from competing cooker hood manufactures and a way to enter a new market segment.

Overall Morten liked the aesthetics of the product and thought they would fit well into Thermex's existing portfolio. He liked the simplicity.

Compliment internal components

Mortens favorite concept was the Round Hood concept, because it spoke to his engineer background. The shape compliments the internal components, like the motor and a round shape will minimize corners which could affect the airflow.

Edge suction

Furthermore, he could easily see how edge suction could be implemented around the edge. - Edge suction is more efficient than suction from a large area (see illustration 94).
According to Morten the edge suction increases the airflow from a small crack all along the edge of the product, this increases the suction power, but will also affect the noise level.

More than one suction level

As many of the people who gave feedback on the catalogue Morten also question the concept with only one suction level. From Morten's experience it is preferable with three different suction levels. 1 with a low noise level. 2 Where the motor perform optimal. 3 FULL POWER.

Performance

It should be able to run for at least 1 hour on full power as a typical cooking session last for 1 hour.
According to Morten cooling of the motor and removal of steam and moist is covered by the airflow of the cooker hood.

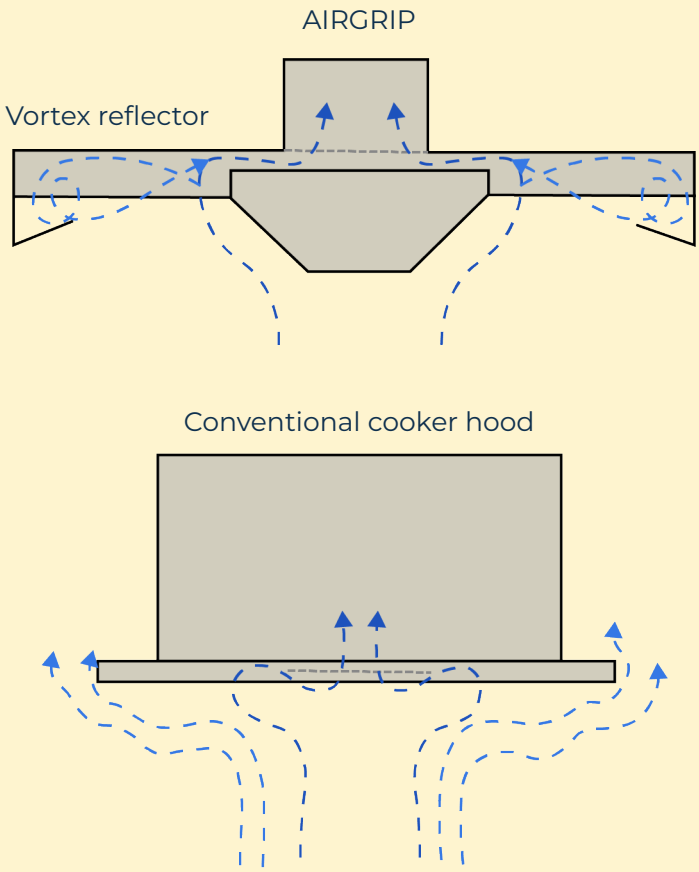
Thermex are using motors from ebmpapst, and Morten recommended to contact them in order to get knowledge and ideas regarding motor selection and how to obtain a sufficient suction effect.

Morten implied that it would not be necessary to implement light in a product that is a mobile unit such as the concepts from catalogue 2.

Conclusion

Morten and Thermex found the product direction interesting. Having a round form, will both embrace the internal components and minimize edges and corners which can have an impact on the airflow through the concept.
Implementing edge suction will be preferable when creating a small product, because the suction is more efficient than having suction over a large surface, which will make it easier to gain a sufficient suction from a small motor.

Next step was to contact ebmpapst, in order to gain knowledge regarding motor selection and efficiency.



ill. 94. Based on illustration in Thermex Yellow line catalogue page 76. [Thermex, 2020b]

- Use motors from ebmpapst.
- Go with the "round hood".

- Remove light source

- 1 hour use on max.
- Use 3 suction levels.
- Use edge suction.

KEY INSIGHTS

Minimalistic design and add value
Companies like SMEG and Vipp has turned everyday products into products that people gladly display in their homes. This highlighted how important the aesthetics is, but also that the product has to provide some sort of value to the owner. Both SMEG and Vipp has a minimalistic design, which fit well into many homes.

Testing
Through testing it was discovered that people found it hard to abstract from the visuals of the mock-ups. In order to get feedback on the desirability was it necessary to mimic a finish product.
Through the different test was it shown, that people found either product which was minimalistic or gimmicky interesting. They buzzed at the product swhich could function as a conversation starter.

Morten (Thermex) like the minimalistic design of the products in catalogue 2. And could easily see them in their existing product portfolio.

Functions
Edge suction is more effective than a suction of a large surface, which can potentially lower the requirement of the motor. When creating a small product, it would be preferable to use as small components as possible, but still gain sufficient performance.
The target group didn't like cooker hoods which only had smart control (APP).

	Findings	Requirements	Source
✓	Minimalistic Scandinavian design.	-	Market research.
	Desirability is found in the finish and in products that are gimmicky.	-	Catalogue 1.
	Cooker hood as interior product.	-	Catalogue 2.
	Recirculation.	-	Catalogue 2.
	Mobile cooker hood.	-	Catalogue 2.
⚙	Use edge suction.	-	Thermex interview 2.
	1 hour use on max.	1 hour use on max.	Thermex interview 2.
	Cleaning indicator.	-	Catalogue 2.
	Multiple suction modes.	Low, medium and high level	Catalogue 2 & Thermex interview 2.
⚡	Go with the "round hood".	-	Thermex interview 2.
	Use motors from ebmpapst.	-	Thermex interview 2.
	Everyday product are turned into "design" products.	-	Market research.
	Customization.	Color variations	Mock-up test.
✕	Smart product.	-	Catalogue 2.
	Remove light source	-	Thermex interview 2.

CLEAR USE

It is important that the user can see what the product is, and that it is intuitive to use and handle, therefore this chapter will enlighten the overall interactions with the concept, and the reasoning behind, be explained. It includes interface placement, interface interaction research and a user scenario. The chapter will end with a sum up of the found insights and a conclusion of the topic.

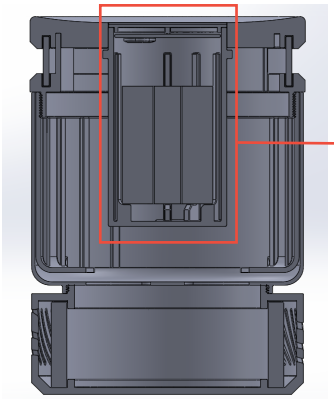
ill. 95. Disassembly at Thermex visit

INTERFACE

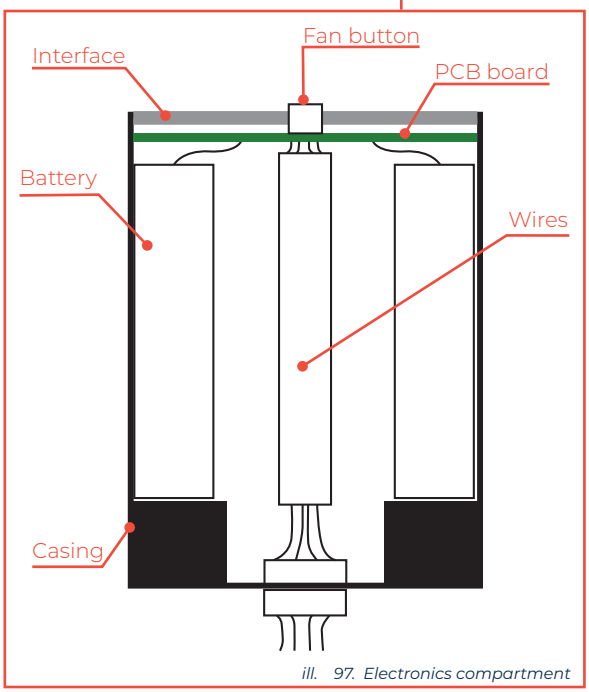
This section will focus on what kind of interactions and features should be included to create the best user experience.

Interface placement

From the earlier tests it was found that the best and most intuitive placement of the interface was on the top of the concept (Appendix 14).
The products inn parts and electronics, had a huge impact on the interfaces placement on the product.
The concept has both a motor and electronic components that all require power to function. To gather all the electronic components, and protect them when you open the product to clean the filter, it was decided to gather it all in a cylinder compartment in the middle (see illustration 96).



ill. 96. Section view of the final concept.



ill. 97. Electronics compartment

LAGAN cooker hoods interface

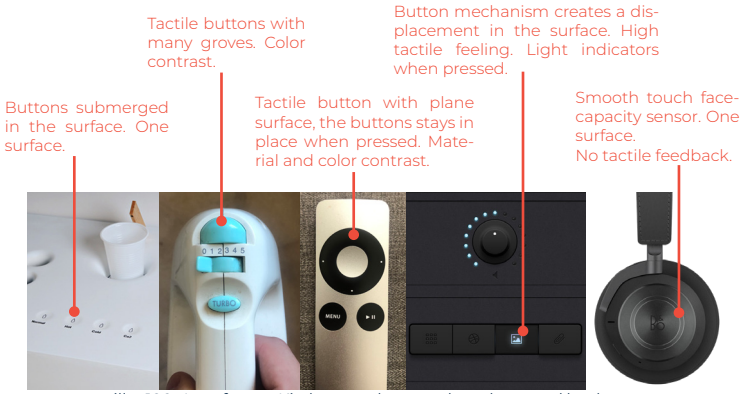
The LAGAN cooker hood from IKEA which were taken apart, was used earlier as reference, and its functions were described as minimum requirement for the developed product.
The LAGAN cooker hood had a very simple interface only consisting of the essential functions; an on/off switch for the light source and a four step slider for controlling the fan (see illustration 98) The slider begins at 0 (for turning it off) and has 3 different suction intensity levels. However this type of interface is not easy to clean (later described in chapter 5. Easy cleaning). The interface should be easier to clean than the LAGAN cooker hood's interface, both from grease residues and dirt. Illustration 99 show an example of a cooker hood with a used slider interface. As the illustration shows, are the small edges and groves making removal and cleaning of accumulating grease and dirt.

ill. 98. LAGAN cooker hood - Control panel.

ill. 99. Cooker hoods dirty control panel.

The interface

The interface was inspired by B&O H9's touch interface, with one smooth surface and a capacity sensor, to ease cleaning (see illustration 100). The interface functions by sliding clock-wise to increase suction and counter clock-wise to decrease the suction. Through the project a cleaning indicator was found useful in order to ease the cleaning aspect, and the requirements of three different suction levels. This elements were implemented in the interface as well.



ill. 100. Interfaces - Kitchen products and product used by the target group.

Interface test

The interface was testing on the target group, in order to see if they found it intuitive. Most of the people asked thought the suction was turned up by pressing "+" or down by pressing "-", and not by sliding. Furthermore the cleaning icon was tested. The users were confused of its meaning, no one understood that it meant the filter should be cleaned the icon was meant to illustrate a dishwasher, as the product can be washed in one). One person suggested it had something to do with the stove, but not cleaning. This indicated changes should be made, to make it more intuitive.

- Three suction levels
- Easy clean interface
- Filter cleaning indicator

ill. 101. Interface test - Catalogue 3.

PHYSICAL MEETING WITH THERMEX

The group got the chance to visit Thermex in Hjørring to see their showroom and workshop. The latest concepts was shown and discussed with Morten and Frank. The visit validated the selected features, and gave inspiration regarding additional features and interface solutions.

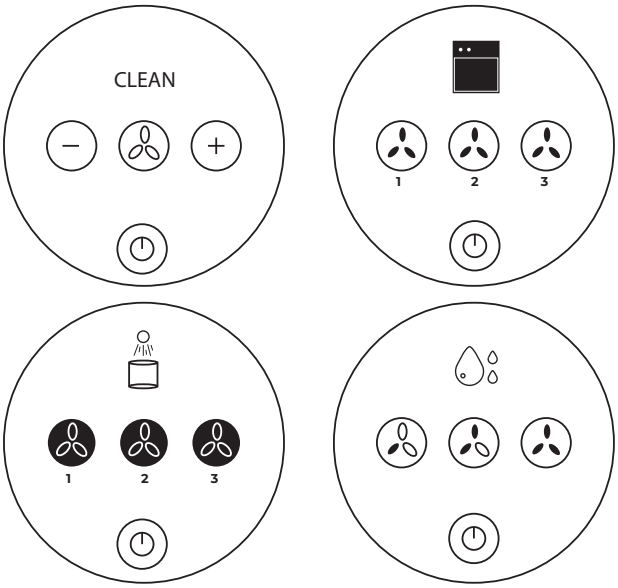
At the visit it was possible to interact with their cooker hoods and try out the different interfaces. This gave an idea of how to display the basic features of the cooker hood. Many of their interactions was touch surfaces which makes it easier to clean. All their cooker hoods had three suction levels and some sort of light switch.
The next step is to test out a touch interface with inspiration from Thermex. Instead of a light switch it should contain some sort of indicator of when the filters need to be cleaned (as seen on the analysis of Faber Belle).

ill. 102. Visiting Thermex in Hjørring

INTERFACE AFTER THERMEX VISIT

Between 3. catalogue and Thermex visit

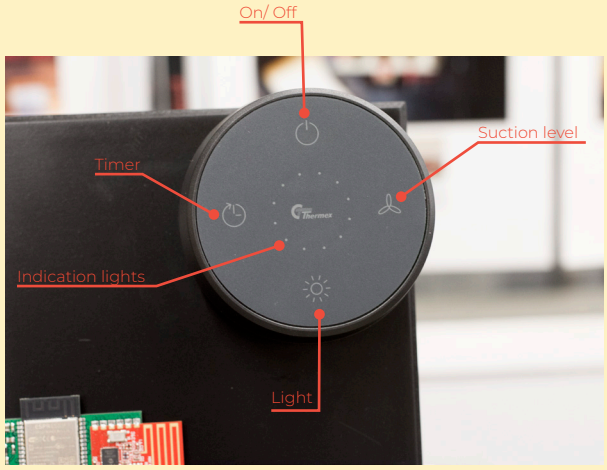
After the 3. catalogue test, there were created iterated on the interface, in order to make it intuitive and simple to use (see illustration 103).



ill. 103. Interface layout test.

Thermex's new remote control interface

Illustration 105 shows Thermex newest not yet released remote control for a cooker hood they are developing. In order to match Thermex's newest addition and design.
The remote controls interface gave tactile feedback when pressing the buttons. The remote could control four interactions; fan speed, light, timer and on/off. To change the different functions intensity level was the buttons pressed multiple time for example to reach suction level 2, should the fan button be pressed twice.
The remote had a circle of light to indicate the different selections .



ill. 105. Thermex remote control.

Interface after Thermex visit

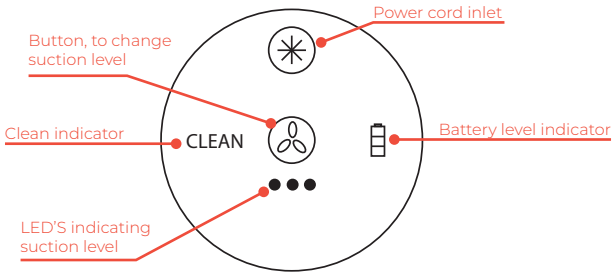
After looking at the existing solution made by Thermex some inspiration was drawn and together with the earlier iterations of the interface, it was decided to implement some aesthetics reference and functions from the remote to the interface.
Furthermore, it was chosen to use an interface with tactile buttons instead of touch, because of the feedback and concerns regarding the functionality, when combining capacity sensor and greasy fingers. The surface will still be kept "unbroken" as a touch surface and is therefore still easy to clean, an example of an interface using this can be seen on illustration 104. Furthermore, was the translucent feature also wished to implement in the final interface.

ill. 104. Reference interface Harman/ Kardon speaker

- Touch interface. ✗

Final interface

After investigating existing interfaces the final interface made. It consists of one button, to shift between the suction levels, a cleaning indicator, made as the text "CLEAN" which will illuminate which cleaning is required, a battery indicator and a charger inlet.
Furthermore, a battery indicator implemented to provide the user with visual feedback, and the placement of the charger inlet was changed to the top. The final interface layout can be see on illustration 106 and a render on illustration 107.



ill. 106. Final interface layout.

ill. 107. Final interface render.

TEST OF USER SCENARIO

In order to know where and how to interact with the product, a user scenario was set up and tested with a mock-up with the right size and weight. The goal was to map out the most intuitive ways to handle the product to afterwards design the grip surfaces. This test was solely to test interactions and not the suction performance of the mock-up.

The context where the product was tested in is a studio apartment with a small kitchen, which was close to both bed and clothes (a scenario where smells isn't preferable because the owner sleep in the same room). This was done to get as close to the user scenario as possible.

1

Firstly, the mock-up was placed in the cabinet closest to the stove (there is no room over the stove).

The product should be able to fit into a standard height IKEA cabinet.

2

The food was prepped, and the pots and pans placed on the stove. The "cooker hood" was grabbed from the cabinet - the interaction was in the bottom part of the mock-up and with both hands.

It has to be possible to get a firm grip in the bottom part of the product.

3

The cooker hood was placed on the remaining hob to be as close to the pots as possible to save table space.

The products diameter must not exceed the diameter of the largest hob (21 cm).

4

The stove was turned on and so was the existing cooker hood, the speed was set to on suction level 1.

The product should be able to withstand the heat that the pots and pans emits while cooking.

5

The boiling pots are placed close to the mock-up to afterwards see how much grease has plashed onto it. As the bacon gets more cooked it start to smoke more and the fat starts to splash more, the fan speed on the existing cooker hood is then turned up to full speed.

The product should have a material/coating that is easy to clean after cooking.

6

As the kitchen space was limited, the kitchen counter was cleaned several times during cooking. As the mock-up was placed on the stove it made it easier to clean the counter.

7

As the bacon was done and removed from the stove, the mock-up was moved closer to the two remaining pots, to reduce the distance, this was done by sliding the product.

The product should not damage the stove.

8

When the rest of the food was done, the stove was turned off and cleaned. The mock-up was moved from the stove. Once again it was lifted with two hands in the bottom/middle part for a firm grip.

9

10

After wiping the kitchen clean, the mock-up was wiped as well. The top was used to get a firm grip while the mock-up was wiped clean.

11

Afterwards the top of the mock-up is wiped clean (the interface).

The product should have an easy cleaned interface

12

The mock-up was finally placed back in the cabinet, with a two hands around the middle part.

Conclusion

This task gave indications of where it was most intuitive to lift and interact with the product. As things are going quite fast during cooking, there is no need for a handle or something similar for grabbing, as the fastest way is to just grab around the body of the product. Therefore it should be investigated how these surfaces could be made to enhance a firm grip. Furthermore some dimensions for the final product has been decided based on dimensions in the kitchen such as cabinet and hob.

- Fit inside cabinets.
- Fit on the stove with three pots.

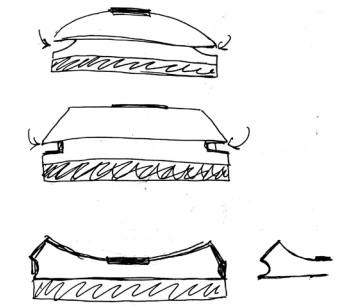
- Easy-clean surfaces/ materials.
- Grip surface.
- Heat resistant materials.

GRIP SURFACES

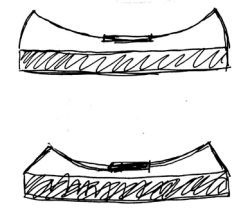
As the product should be easy to disassemble for cleaning, different top parts are explored to see how this can be incorporated into the aesthetics. The product is designed to be moved around, so it is also interesting to look at how this can be made easier. This section will explore different shapes and features to make the grip surfaces of the product.

Top part

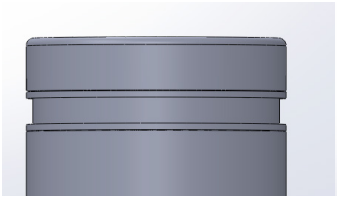
The user has to get the top part off to put this into the dishwasher and to get to the metal filter. The sketches show the exploration of integrating a shape into the top which makes is easier to have a firm grip both to move the product and to "twist" it off. Illustrations 108 and 109 show the initial sketches for the shape of the top part. These all had focus on finding a balance between a good grip surface and a desirable aesthetic. Afterwards some of these were explored in 3D modeling to get a 3 dimensional view to better determine the aesthetics. Finally it was chosen to go further with the shape shown on illustration 113 and lastly it was decided to make the top part a tight fit solution where it is torn off instead of twisted. This decision was made due to the diameter of the product being too wide for one hand to twist.



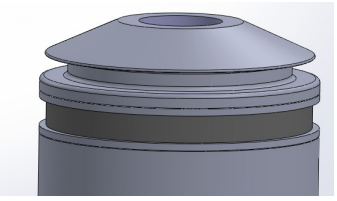
ill. 108. Top part sketches 1.



ill. 109. Top part sketches 2.

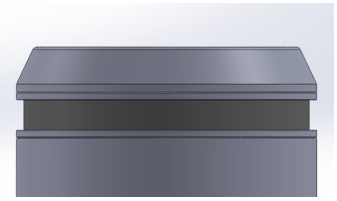


ill. 110. Top part 3D 1.

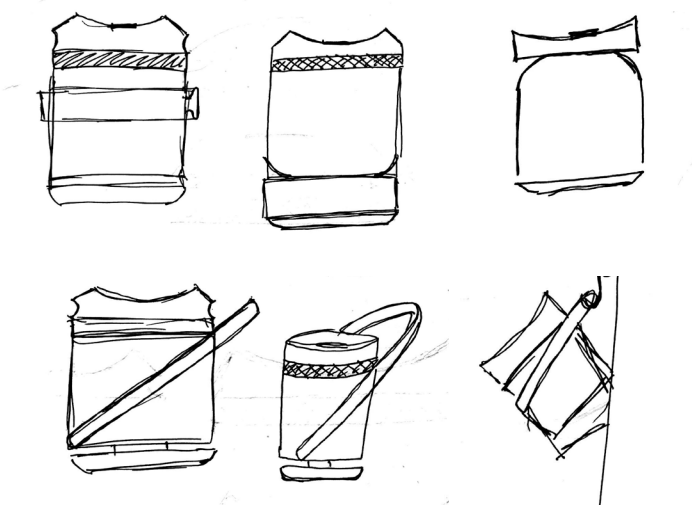


ill. 111. Top part 3D 2.

ill. 112. Top part 3D 3.



ill. 113. Top part 3D 3.



ill. 114. Sketches of handles.

Carrying

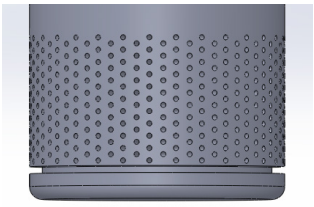
As the product is meant to be portable and mobile it was interesting to explore whether the concept should have a handle for carrying it around. Illustration 114 shows different initial sketches of handles / carrying spots on the product. Some of the sketches were chosen to be modeled in 3D to get a better understanding of the aesthetics (see illustration 115). However the cooking session test showed that when the product needs to be used, it was quickly picked out of the cabinet and gripped firmly around the bottom/ middle part. The space above the cooker hood was very tight, therefore it would not be preferable to have a handle that would consume even more space. The test showed that it was convenient to grasp around the middle of the product and that a handle was not necessary. Therefore it was decided to delimit the product from having a handle.

ill. 115. Renders of different handles.

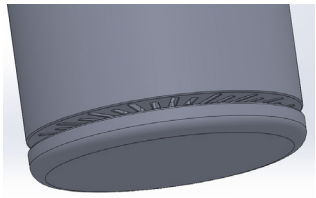
CLEAR AIRFLOW

When creating a product that should be a battery driven portable unit it is important to make the user feel that it still has the same power as a conventional cooker hood. Therefore different shapes and grooves are created to find a way to make the product seem more trustworthy.

The bottom part of the product is where the airflow outlet is placed. For this it was decided to find ways to improve the airflow experience for the user.
The initial iterations of the airflow outlet had their focus on trying to make the entire product look like a speaker to try and appeal to the target group. This however made it more and more difficult to determine the actual use of the product. Illustration 117 tries to hide away the outlet to make the airflow diffused, this was discarded as it did not make it obvious enough where the airflow was.
The further development (see illustration 116) had holes covering the majority of the product, this had too much of a reference to air purifiers and the association to something with a slow and quiet airflow, this would not be preferable and was discarded. Illustrations 118, 119 and 120 show the next iterations of separating the airflow outlet from the main body, this gave a clearer indication of the airflow, however the shape of the grooves were still too weak.



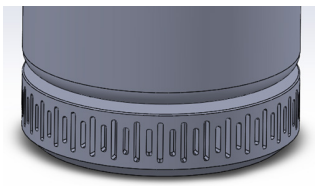
ill. 116. Suction outlet 1.



ill. 117. Suction outlet 2.

ill. 118. Suction outlet 3.

ill. 119. Suction outlet 4.



ill. 120. Suction outlet 5.

ill. 121. Plane turbine. [ScienceFocus, no date]

Turbine reference

To make the aesthetics express a better suction, inspiration was drawn from an airplane turbine (see illustration 121), which is a product that gives people a clear reference to something that creates a large airflow with a great force.

ill. 122. Suction outlet 6.

Implementing in the bottom part

Airflow outlet occur in the bottom part of the concept, therefore was it essential to make it express its function. Illustration 122 shows the chosen bottom part.
The slightly tilted and curved grooves gets inspiration from the fans on the turbine which emphasizes a strong and effective airflow.

KEY INSIGHTS

Construction and cleaning aspect
The interface placement was controlled by the choice of not having any electronics in the top part to ease the cleaning. Originally the interface was meant to be touch, with a homogeneous surface. But after a cooking session (User scenario) the stove touch surface didn't respond on dirt fingers and there weren't ant feedback, was it chosen to use a tactile button with a rubber cover. Thermex approved the choice and found it better.

Interface
After visiting Thermex and trying their products interfaces the complexity of the interface layout was reduced. Instead of 4 buttons it was chosen to use one button to handle all the functions.

Appearance
In order to bring references to suction and airflow, different elements from fans and turbines were tried to be implemented in the design. This is reflected in the bottom part. Furthermore, different ways to handle the product was tested. Through the scenario test, it was evaluated that the overall shape and round edge in the bottom was efficient to move the product around on the kitchen counter as well as in and out of cabinets.

	Findings	Requirements	Source
⚙	Fit inside cabinets.	Max height: 240 mm.	Test of user scenario.
	Fit on the stove with three pots.	Max diameter: 210 mm.	Test of user scenario.
⚡	Easy-clean surfaces materials.	-	Test of user scenario.
	Grip surfaces.	-	Test of user scenario.
	Heat resistant materials.	Stand on hob.	Test of user scenario.
	Three suction levels.	-	Interface.
	Easy clean interface.	-	Interface.
	Filter cleaning indicator.	-	Interface.
✕	Touch interface.	-	Interface after Thermex meeting.

EASY CLEANING

Cleaning is a very important aspect of cooker hoods in order to maintain performance and keep a healthy in door climate.
Through this chapter different cleaning elements will be presented. Investigations regarding problematics with cooker hoods and the cleaning aspect. Furthermore, grease reduction technologies and surface treatments will be investigated. Finally the overall cleaning principle of the concept will be showcased as well as a insight sum up and chapter conclusion.

ill. 123. Removing grease filter at Thermex visit

COOKER HOODS PROBLEMATICS

By investigating cooker hoods different problematics was discovered. According to reduced performance, fire risks and damaged indoor climate (Appendix 15).

Decreased function

A cooker hoods main function is to remove frying odors, grease, smoke and steam when cooking. If the cooker hood doesn't get cleaned frequently the suction will decrease over time resulting in grease, odor and smoke spreading in the house and aggravate the indoor climate.

Fire risk

Decreased suction results in grease, odors and smoke to accumulate in and on the cooker hood as well as in the ventilation shaft.
Heat and fire (intended; flambéing and unintended; stove fires) can ignite accumulating grease both internal and external of the cooker hood.
The fire will spread along the ventilation shaft, causing huge fire damages both inside the kitchen but also in exterior walls.
To prevent the fire from spreading, it is important to turn off the cooker hood.
Cooker hood's often has build in working light for the stove. The electrical installations can also be a hazard, if caught on fire.
[Elgiganten, no date] [Boding and Blomsterberg, no date].

"Never flambé under a cooker hood and clean the filters on time." - Gorenje.

"The cooker hood should be cleaned regularly both external and internal (at least 1 x per month). Insufficient cleaning or damaged filters can cause fire hazard". - Gorenje.

[Gorenje, no date]

Conclusion

It is important to ensure that the users clean their cooker hood frequently, once a month, in order to keep a healthy indoor climate and to minimize the fire risk.
The manufactures are aware of the fire risk, but are not trying to solve it.

How it is overcome
A standing, portable cooker hood makes it easier to handle a potential fire. It is easier to cover with a fire blanket furthermore is the risk of fire spreading through the ventilations shaft eliminated by creating a recirculating cooker hood.

ill. 124. Cooker hood fire problematics

QUALITATIVE USER INTERVIEW

A survey was conducted to obtain knowledge regarding the target groups use of cooker hoods. The survey was aiming on the use of the cooker hood along with when and how they clean it. Furthermore, they were asked to send pictures of their cooker hood and stove area, which can be found in (Appendix 6)

"No it would smell in my entire apartment"
- Anonymous.

"Yes, but only when i boil things"
- Anonymous.

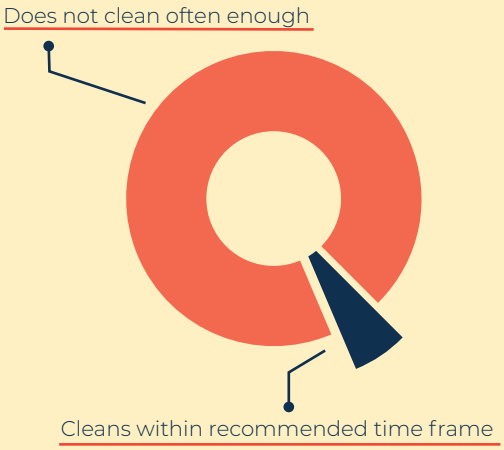
DO YOU EVER COOK WITHOUT USING THE COOKER HOOD?

"Only if i forget it by accident"
- Anonymous.

The users were asked to answer if they ever cooked food without using their cooker hood.
Nine people never (rarely) cook without using the cooker hood. Three people do not use the cooker hood when boiling food on the stove and one user rarely use the cooker hood when cooking.

Do they clean it often enough?

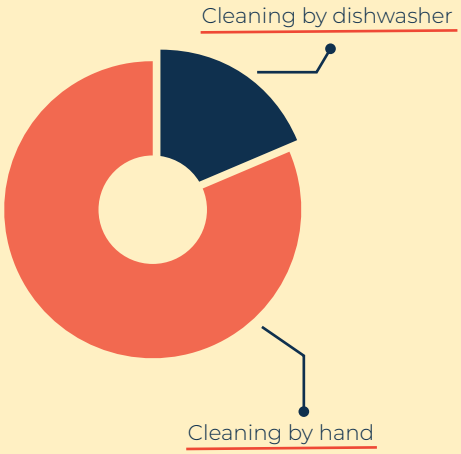
The cooker hood companies recommend that the fat filters are cleaned once a month, however this survey showed that only 1 out of 16 actually cleaned their filters once a month. The 15 remaining cleans theirs between once every third month up to once every second year (see illustration 125)



ill. 125. Pie chart showing cooker hood cleaning patterns.

How do they clean the filters?

The users were asked to answer how they cleaned the grease filters of their existing cooker hoods and the majority (13 out of 16) did it by hand, the rest would put it into their dishwashers (see illustration 126)



ill. 126. Overview of how the users clean their grease filters.

Conclusion

The survey indicated that people do not clean their cooker hood according to the recommended instructions.
The majority cleaned the grease filter by hand, but from earlier research (Photo ethnographic research) it was learned that few people in the target group owned a dishwasher. They would properly clean the filers in a dishwasher if they had one.

- Grease filter cleanable in dishwasher and by hand.
- Clean indicator.

CLEANING GREASE FILTER

Cleaning the grease filter is an important aspect in order to maintain a good performance and suction. Therefore this action was investigated further.

Cleaning LAGAN cooker hood filter

The cleaning of the grease filter was acted out, to investigate the necessary steps and actions.
After six actions it was possible to clean the grease filter. The filter was washable in a dishwasher but it wasn't possible to soak the filter in the sink because the filter was to big. The many required steps make cleaning a comprehensive task (Appendix 9).

STEP 1

Press down the two sliders, to disconnect the outer "filter".

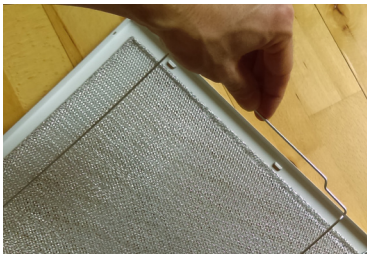
STEP 2

The grease filter is attached to the bottom part.

STEP 3

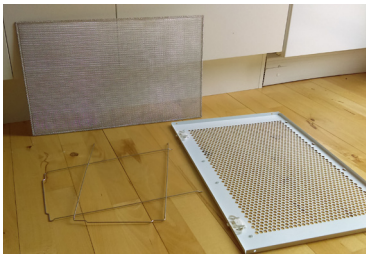
Disconnect the metal wires holding grease filter in place on the bottom part.

STEP 4



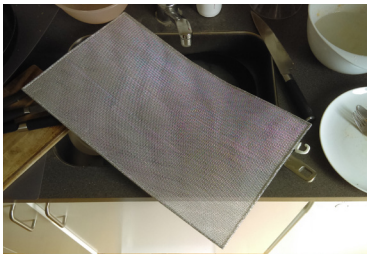
Remove metal wires.

STEP 5



Remove grease filter.

STEP 6



The filter can be washed in dishwasher. It is too big to fit in the sink.

ill. 127. LAGAN grease filter process.

Nikola Tesla cooker hood filter cleaning

Compared to the LAGAN it is only required to go through two steps to clean the grease filter at Nikola Tesla cooker hood. First the grill is removed and then it is possible to remove the grease filter (see illustration 127)

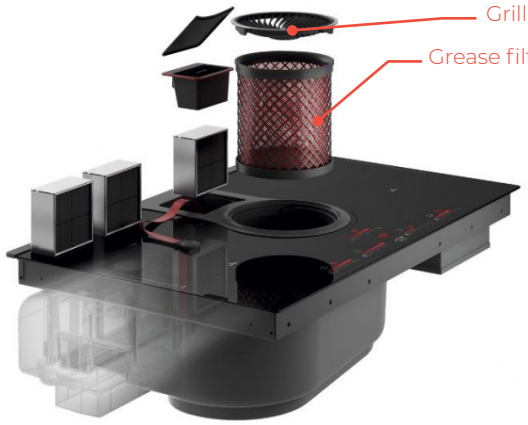
Two step removal

At the visit at Thermex, was it tried to change/ remove grease filter in multiple cooker hoods. Their expensive models only required 2-3 action in order for the filter to be removed, whereas it were more comprehensive on their cheaper models.

Conclusion

Cleaning the grease filter on cheap cooker hoods requires many actions and can be a comprehensive task. Whereas on the high-end models the filter is removed within 2-3 actions.
In order to overcome the problematic of people not cleaning the grease filter frequently the solution can be to ease and minimize the required actions before it is possible to clean the filter.

- Two step grease filter removal.
- Filter fit into dishwasher and sink.



ill. 128. Nikola Tesla - Cleaning filter. [Hvidevaregrossisten, 2017]

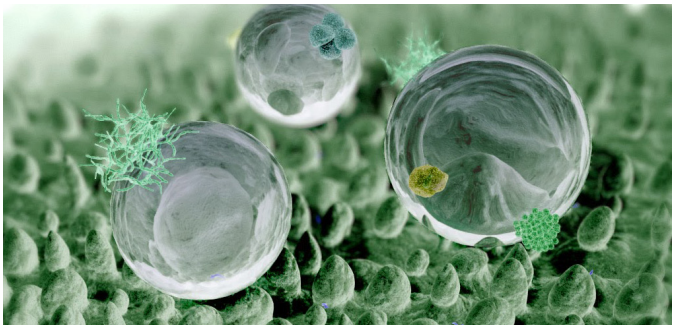
PREVENTING GREASE

With a wish of reducing the cleaning requirements for cooker hoods cleaning and grease reductions technologies was researched (Appendix 16 and 17). In the following topic, both surface treatment and grease removal technologies will be investigated. The research was done through desktop, and contact with multiple experts and companies through phone calls and mail correspondences.

Surface treatment

One way to overcome the problematics regarding reduced functionality and grease accumulation in the cooker hoods is to ease the cleaning. This can potential be done with surface treatments.

ill. 129. GJ metal coating. [Gj Coating, no date]



ill. 130. Lotus leaf micro structure close up. [Thielicke, no date]

Lacquering/ coating

GJ Coating is mainly creating different types of lacquer, useful in different contexts and environments. In order to surface treat a cooker hood either to be more repellent against grease or to ease cleaning of the elements, they could provide a lacquer, that would create a smooth surface, and remove/ minimize impurities in the surface and thereby make it easier to clean. It would be possible to get this lacquer in a variation of colors.

Nano treatment

To get a better understanding of Nanotechnology Danish Technological Institute was contacted. Kenneth Brian Haugshøj was skeptic regarding nano-treatment on a product like a cooker hood, he didn't think it would be possible to make it grease degrading but it could be possible to make it easier to clean, but it would require frequently care.

Preventing grease conclusion

Nano treatment
Nano treatment is often done through reapplying new layers of coating once in a while, this would not be preferable to expect from the users. Especially not inside the product. It could be a possibility on the outside of the product.

Lacquering
GJ coating is a company specialized in lacquering products. Lacquering metals is also a commonly used process for cooker hoods in Thermex's collection.

Considering that the product should be easy to clean and also require minimum maintenance, Nano-treatment was deselected and lacquering was chosen as a process to treat the casing of the cooker hood, this also fit to Thermex's product portfolio and aesthetics.

· Lacquering exterior of the product.

GREASE REMOVAL

Another way to deal with the accumulating grease is to automatically remove the grease inside the cooker hood. Different technologies with this quality was researched (Appendix 16 & 17).

ill. 131. JIMCO UV-C commercial kitchen. [Jimco, no date]

UV-C light

UV-C is commonly used in germicidal applications and often used to sterilizations of water and air.
There exist two types of UV-C lamps; ozone producing and non-ozone producing. In order to break down grease particles the ozone production has shown to be beneficial.
The UV-C lamps are placed behind the grease filter. The UV-C light destroy contaminants in the air, which reduce odor and grease emission. This results in a cleaner cooker hood as well as ventilation shaft *[UVO3, 2020].*

How UV-C light works on grease

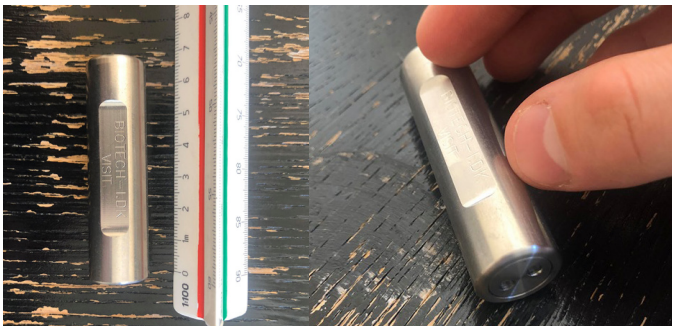
The process which are used is called Photolytic oxidation. The UV-C light splits the fat particles into smaller particles, making them more acceptable to ozone. The fragmented fat and grease particles will oxide and create water (H_2O), oxygen (O_2) and carbon-dioxide (CO_2) *[Jimco, no date][Halton, 2017].*

Disadvantages with UV-C

UV-C light is harmful in direct contact, to the skin and can cause skin cancer after long term exposer.
UV-C light bulbs has to be changed over time, which would be added to the required actions the user should take care of. Furthermore they will require much space inside the product.
If the skin gets in contact with the UV-C light, can it cause burnings and in worst case cancer. This means the user has to be protected from the light, when cooking and handling the product *[Kahn, 2020].*

UV-C conclusion

Due to troubles finding prices on UV-C LED's and the burning hazard which it could add, when handling the product (cleaning) was UV-C technology dismissed. It wasn't wanted to incorporated bulb UV-C due the size and their short lift time. In stead of degrading grease will the focus be on easy cleaning.
The cheapest UVC LED with a wave length between 260 and 280 nm cost 135 DKK for one.
It was unclear how many LED's which was necessary to gain the wished result and effect.



ill. 132. Power Pack - Biotech Innovations.

Power Pack

The Power Pack (PP) is a catalyst that makes a cold combustion, meaning it removes the static charge in the air (Similar to when leaves decompose in nature). Placing the PP inside a cooker hood, will result in a reduction of grease particles. This was tested in Tivoli's (Copenhagen) commercial kitchens, with a huge reduction of accumulating grease.
In order to get a better understanding of how the product actually work the creator, Lars Leth Pedersen, of the PP was contacted.

How does Power Pack work

Either Lars or DTU chemical engineering researcher Nikolaj Blom, who have research the PP in many years, knows exactly how the PP works, just that it has an effect on many different elements and can be used many scenarios.

"You would be the first in the world, if you knew how it functions" *- Lars Leth Pedersen.*

Vores PP-Visit er den mindste PP vi har, der passer til en privat emhætte, men den er uden aflader, det vil sige at den skal monteres på så den har kontakt til selve emhætten, så er det personen der tænder og slukker den, der så aflader den.

Pris pr. stk.	729,- + moms
Pris pr. stk. ved 50 stk.	656,- + moms
Pris pr. stk. ved 100 stk.	583,- + moms
Pris pr. stk. ved 250 stk.	510,- + moms

Der gives ikke større rabatter

Med venlig hilsen

Lars Leth Pedersen
Adm. direktør

Power Pack conclusion

Based on research, mail correspondence and phone calls with both Lars Leth Pedersen and Nikolaj Blom (DTU researcher) it was chosen to dismiss the Power Pack technology, due to lacking knowledge regarding the technology, which no one could explain. The exact function of the chemical reaction could not be specified.

Grease removal conclusion

It was chosen not to implement any grease removal technology, due to lack of knowledge regarding the technology (PP), but also to minimize the complexity and cost of the product.
Instead of focusing on grease removal, the goal is to ease the cleaning aspect of the product.

- Self-cleaning. ✗

CLEANING PRINCIPLE

From research and test, it was indicated that something had to be done, to ease the whole cleaning aspect of a cooker hood. Both due to safety and convenience.

In order to improve and ease the cleaning, compared to existing cooker hoods, the focus was on getting the filters out easy and quick with few steps. But also that the parts could go into the dishwasher and sink.

Since the product is recirculating the air a carbon filter is required. In order for the carbon filter to collect odors and particles from air and generated in the motor, it is required to be placed after the motor, just before the air outlet. Whereas the grease filter has to be at the inlet of the air. Both filters requires frequently cleaning. To ease the process further, ii is preferable not to have any electronic components in the parts which would require they highest amount of cleaning (Grease filter and carbon filter).

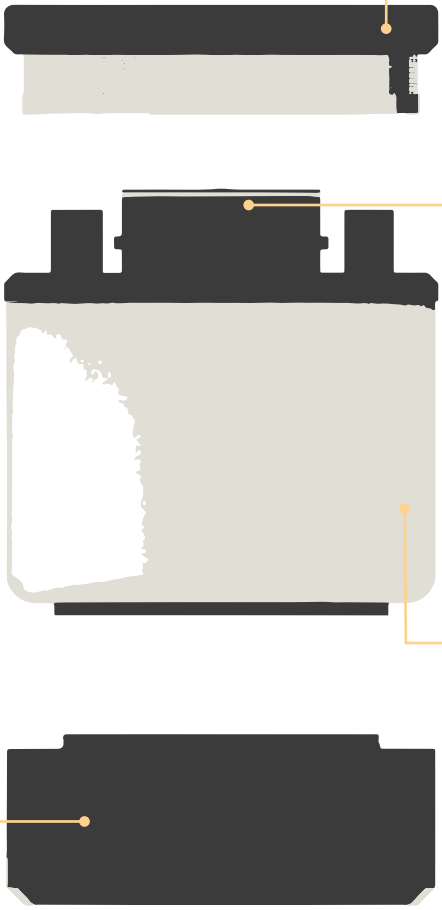
"It is attractive that it can be put into the dishwasher and be cleaned otherwise with a wet cloth!"
- Frederikke (Catalogue 2).

"Nice, that it can be cleaned in the dishwasher"
- Marie (Catalogue 2).

"Cool, that the filters can be washed in the dishwasher"
- Sebastian (Catalogue 2).

Top and grease filter in one

To ease the cleaning aspect, it is possible to removed the whole top part and wash it in the dishwasher (Top part and grease filter).
Or the top can be removed, and then the grease filter can be disconnected from the top part and cleaned.



Easy access to carbon filter

Recirculating cooker hoods require carbon filters to sort odor and small particles from the air.
To support easy access and fast cleaning, the bottom part are removable, and can be washed in a dishwasher, with and without the carbon filter inside.

Carbon filter selection

There are different types of solutions:

Classic carbon filter
Require less space and is cheap. But has to be cleaned and/ or changed over time (every 2-3 month).
Thermex have made Plasmex filter, which uses ionization to clean the air, this filter has a long life time, but is rather expensive, large and require electricity.

Based on the knowledge obtained through the project, it was chosen to go with the classic carbon filter, in order to lower the price and weight of the product.

Separated electronics

All electronic components and wires has to be gathered in non-cleaning-critical parts and covered from grease and steam.

Exterior cleaning

To ease exterior cleaning the focus has been on reducing groves, gaps and so on. Create a smooth surface.

ill. 133. Conceptprinciple.

KEY INSIGHTS

Conclusion

Have to clean more frequently
The target group do not clean their cooker hood according to the recommended guideline from the manufacturers. Instead of cleaning the filter once a month, are they more likely to clean it once every second year. Which can influence the indoor climate and create a potential fire risk. The majority of the asked people cleaned the grease filter by hand, but it was also learned that very few people in the target group own a dishwasher.
Through the project it was concluded a cleaning indicator would make the users more aware of then to clean the product - and thereby get the most out of their product and a better indoor climate.

Easy cleaning
By minimizing the steps/ actions required to remove the grease filter could make it less comprehensive to clean the product. More expensive hood cooks only require 2-3 actions before the grease filter can be moved, whereas the cheap LAGAN required 6 actions.
The product external are lacquered to remove impurities and create a smooth surface.

No grease removal
Different technologies and methods has been investigated.
Through discussions and research was grease removal technologies deselected due to price and uncertainties regarding the technology (PP).

	Findings	Requirements		Source
⚙	Grease filter cleanable in dishwasher and by hand.	Hight:	430 mm.	*[Electrolux, no date]*
		Width:	550 mm.	
	Filter fit into dishwasher and sink.	Depth:	500 mm.	Qualitative user interview.
	Clean indicator	Runtime before cleaning	30 h*	Thermex meeting 3.
	Two step grease filter removal.	-		Cleaning grease filter.
	Lacquering exterior of the product.	-		Preventing grease.
✕	Self-cleaning.	-		Grease removal.

* Thermex said a typical cooking session lasts 1 h. Monthly cleaning is then 1h * 30 day = 30.

PERFORMANCE

To be able to compete with other cooker hoods on the market it is important to have a good suction level. This section will go into detail with the concepts suction performance, mock-up tests and expert interviews will lay ground for the suction design and the motor specifications.
The chapter will end with an overall conclusion and showcase found insights.

ill. 134. Building mock-up.

SUCTION MOCK-UPS

In order to get a understanding of the suction a mock-up test was conducted with a vacuum cleaner, which simulated the motor and airflow in the mock-ups (Appendix 14). Two different suction designs was made to test how the air inlet placement affects the suction.

Vacuum cleaner suction test

In order to fully understand the airflow capacity of the vacuum a suction test was performed with a 100 liter plastic bag. The plastic bag was filled with air, and then it was time how long it took the vacuum cleaner to deflate the bag. This gave a rough estimate of how many cubic meters of air was traveling through the vacuum cleaner per hour. With the lowest suction of the vacuum cleaner an airflow of around 24,6 m^3/h was reached, which is around a third of the suction performance by IKEA LAGAN cooker hood in recirculating mode.
The average deflation time was: 14,62 seconds.

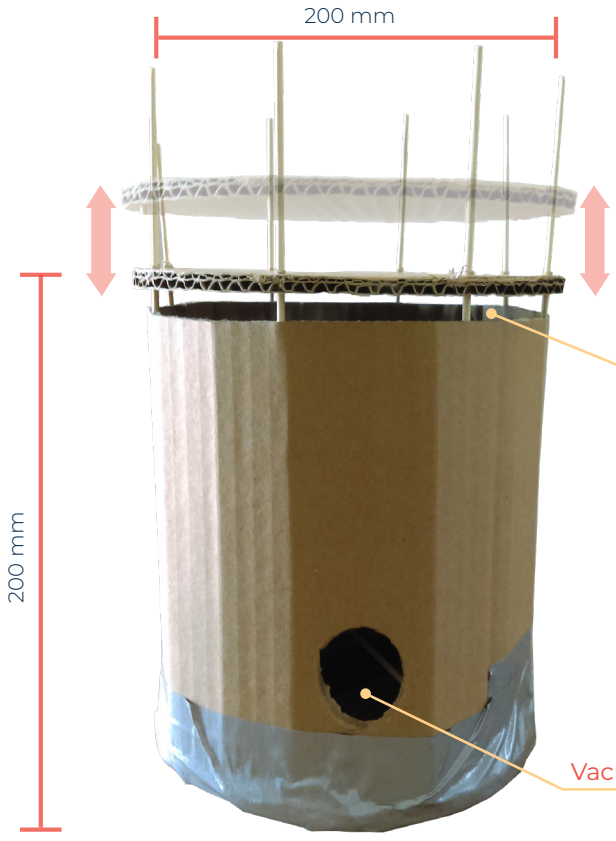
(100 L/ 14,62 S) * 3600 S = 24623 L/h = 24,6 m^3/h

ill. 135. Inflating 100 L plastic bag.

ill. 136. Deflated 100 L plastic bag.

Mock-up 1

This mock-up was based on knowledge from Thermex, where it was recommended to use edge suction. In order to test how the air inlet size would affect the efficiency, an adjustable top was made. The suction inlet was 360°.



ill. 137. Mock up 1 - Adjustable top.

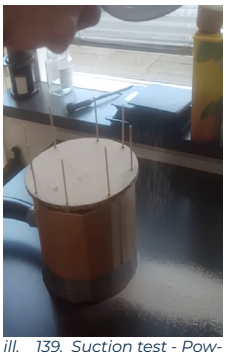
Mock-up 2

It was wanted to test how a top inlet would affect the airflow compared to side suction (see illustration 137 and 138). This mock-up was also using the edge suction principle, with a narrow air inlet distance, and 360° inlet.

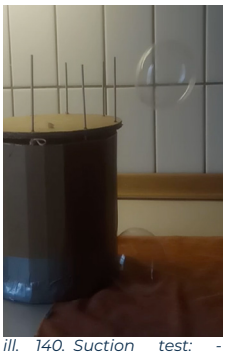
ill. 138. Mock up 2 - Top, center suction.

SUCTION TEST

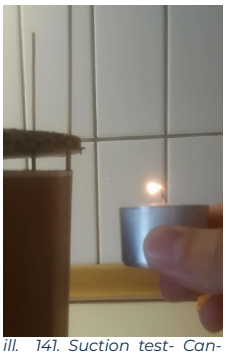
After having determined the suction effect and the edge suction, with a tight distance, was most efficient, it was wanted to get an indication of the air flow. Different materials and methods was tried in order to display the air flow.



ill. 139. Suction test - Powdered sugar.



ill. 140. Suction test: - Soap bubbles .



ill. 141. Suction test- Candle light.

Airflow indication

Either of the materials used at illustration 139, 140 & 141 showed the airflow. But it gave an indication of how powerful the suction was, with 25 m^3/h.

Later it was decided to make a test made with cigarette smoke, which gave an indication of the inlet airflow. However it didn't showcase the internal airflow, or how the exhausted air acts, due to the test setup.

Smoke test

Mock-up 1

Holding the cigarette around to the air inlet at mock-up 1, showed the smoke being drawn into the mock-up. Furthermore, did the test indicate the suction was more intensive with a narrow air inlet (10-15 mm) compared to a larger inlet area (<100 mm).

Mock-up 2

Suction in the middle of the top seemed to create a quite intense suction, but the smoke had to get a bit closer than when testing Mock-up 1. Furthermore, the suction was more efficient on smoke above the mock-up.

ill. 142. Mock up 1 - Suction test with smoke.

ill. 143. Mock-up 2 - Suction test with smoke.

Conclusion

Side suction

Through the tests it was showed that a side suction was more effective, it could reach the smoke from a further distance and suck in smoke earlier when rising from below.

Handling the smoke from below was preferable as pots and pans will be lower than the concept and the steam will flow upwards.

The efficiency was based on touch feeling and would need to be further tested in a lab for the final product, however this gave a good indication of which direction to bring the concept.

The test didn't give any indications regarding the airflow inside the mock-up or how the exhausted air react.

- Side suction.
- 10-15mm edge suction.
- Higher than large pot.

HENRIK - EBMPAPST

To get a better understanding and expert knowledge regarding choosing the right motor to obtain the wanted performance and suction ebmpapst was contacted. They are delivering motors for some of Thermex's cooker hood and has a lot of experience with motor and fan selection for cooker hoods.

Established contact to ebmpapst.

Contact with Henrik Dahl Thomsen, Chief of Products OEM and projects was established through phone calls and an ongoing mail correspondence was made through the project.
By showing the concept to Henrik, different problematics was pointed out.

Construction changes

The concepts was made with the intention of using an axial fan, and lead the airflow direct through the product (see illustration 144). But Henrik, emphasize the problematic of counter-pressure which axial motor/ fan doesn't withstand well, instead he recommending using a centrifugal motor/ fan. Henrik would estimate 70-100 pascal counter-pressure would occur in the product. Henrik recommended a RER101-36/12N as motor in the concept.
The new knowledge meant some changes had to be made on the concept. Mainly the air outlet and placement of motor and carbon filter (see illustration 145)
The motor required an inlet ring, which will reduce airflow disturbances before the air is sucked through the fan, reduce noises and make the motor function most functional at the given power consumption. This is complimented in the products shape, with the dent between the casing and bottom part.

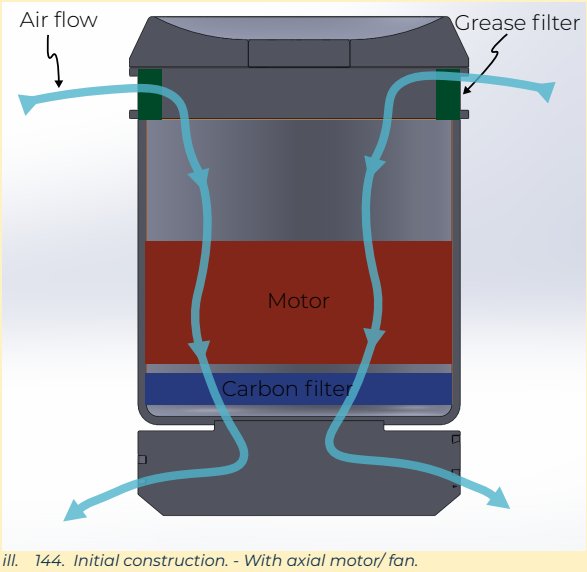
Key points from mails with Henrik

1: vores erfaring med emhætter/Emfang:

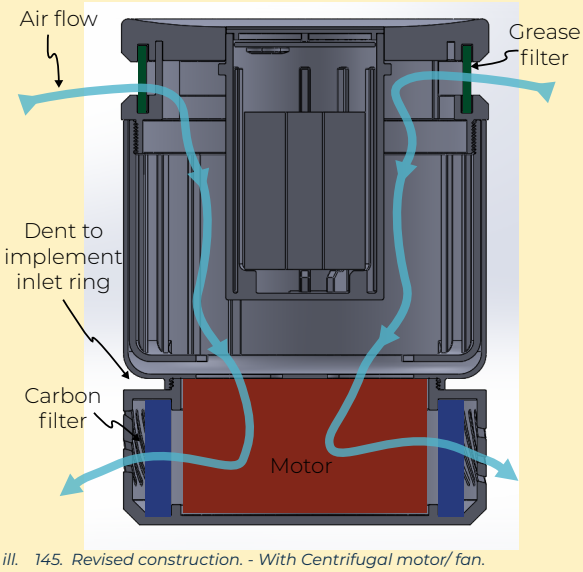
1: Lufthastigheden kan blive for stor (suget for kraftigt): Det vil medføre at fedtet ikke opfanges af fedtfilteret. Det vil i stedet sætte sig på ventilatorer m.m.
2: Kulfiltre yder en rimelig modstand = Modtryk. Så vidt det er muligt, bør man kende trykstigningen over filteret (den er typisk udtrykt ved pr. m/sek.)

Da Jeres applikation formentlig har et modtryk på mere end 70-100 Pascal. Er I nok nødsaget til at bruge en Radial ventilator. De flyttet mindre luft, men er til gengæld trykstærke.

En RER101-36/12N .. bør kunne klare opgaven og fås til 12 VOLT



ill. 144. Initial construction. - With axial motor/ fan.



ill. 145. Revised construction. - With Centrifugal motor/ fan.

· Centrifugal motor

ill. 146. Frank from Thermex, investigating the concept.

FRANK - THERMEX

At the visit at Thermex Morten showed all the facilities and their test shop. Frank P. Kristensen was the one care taking of the shop and was performing quality tests as well as product services. Here Frank had his office and test equipment. Frank had worked with ventilation in many years, both as installer/ maintenance worker of house ventilation systems and as tester/ developer at Thermex.
The concept was shown to Frank, in order to gain his feedback regarding the construction and the requirements of the different components.
According to Frank would a motor delivering around 200 m^3/h be more than sufficient in this case.

The airflow visualization problematics were presented to them, with the intension to hear how they perform tests. The final test are done external at specialized testing facilities. But they used a "mist maker", mainly for their stove integrated cooker hoods, to gain an indication of how the products airflow is. The "mist maker" is a machine that turn water into cold steam. A new fan, that had more power, was given by Thermex, so it would be more visible to see the airflow.

MIST MAKER TEST

A new mock-up was created, with the fan received from Thermex and a 9V battery, to perform the airflow test with the “mist maker”. The vision was to get a visualization of the entire airflow through the mock-up.

ill. 147. Mist maker at Thermex

Unclear internal airflow

Even though the “mist maker” created a thick mist, it wasn’t possible to see how the air react inside and around the product. From the test there wasn’t any indications of problems with air circulation, between the air inlet and air outlet.

Suction indication

The “mist maker” creates cold mist, meaning it falls down, when it gets out of the pot, which isn’t reflecting the exact use scenario, but it gave an indication of how the product would handle mist/ steam, which was rather positive according to the intension.

The effect will be increased with the motor recommended by Henrik, because it can move more air, and withstand counter-pressure better than the axial motor used in this test.

ill. 148. Model suction test w. mist maker.

ill. 149. Model suction test 2 w. mist maker.

KEY INSIGHTS

Suction
Through testing and by Thermex's recommendation it was selected to use edge suction. Edge suction creates an intensive airflow around the narrow inlet.
The "mist maker" test indicated a sufficient suction function, and furthermore there wasn't any signs on air circulation between the air inlet and outlet.

Construction
After establishing contact with ebmpapst new knowledge was gained, and a new type of motor was necessary in order to withstand the counter-pressure. Instead of using an axial motor a centrifugal motor was selected (Motor data sheet can be found in Appendix 26).

Motor specifications:
Type: RER101-36/12N
Size:
Diameter 101 mm
Hight: 53 mm
Weight: 305 g
Airflow: 190 m^3/h

	Findings	Requirements	Source
⚙	Edge suction.	10-15 mm inlet.	Suction test.
	Side suction.	-	
	Centrifugal motor; RER 100-36/12N	Diameter: 101 mm. Hight: 53 mm. Power 12 V.	Henrik - ebmpapst.
	Higher than a large pot.	Hight: min. 175 mm	Suction test.

PRODUCT DEVELOPMENT TIME LINE

The following pages will function as a summary of the concepts to show the development which eventually led to the final product.

Nikola Tesla inspired concept

This was the first concept that explored the opportunity of an alternative/new type of cooker hood. The concept test showed potential.

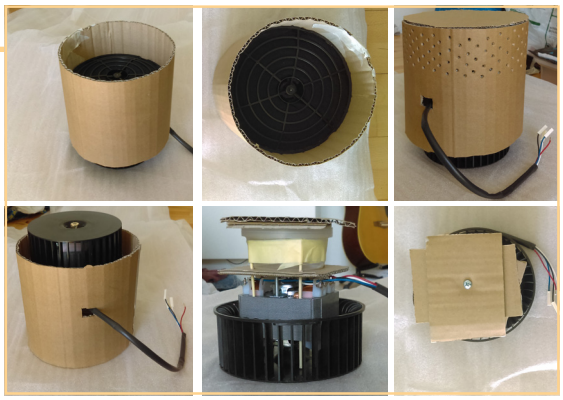
“Round Hood” concept

This concept focused on functions, where mounting, cleaning and interactions were described for the target group. The result showed potential for edge suction, but also the importance of easy cleaning and aesthetics.

Mounted concept

This concept explored mounting on the wall, shape and placement of interactions. This test resulted in discarding mounting, and that the placement of the interface should be at the top of the concept.

Cylinder concept - Compact

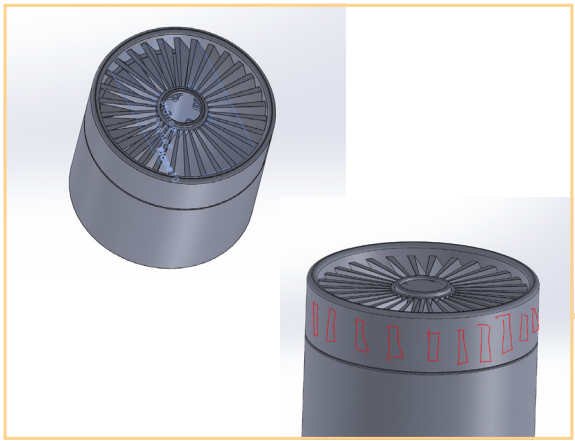


This prototype explored a compact design and airflow. The result was the potential for a compact cylindrical product with no waste space.

Angled interface concept

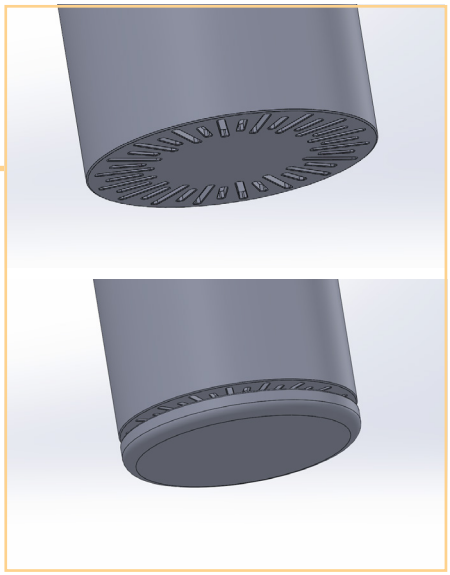
This concept had incorporated edge suction, materials Thermex use, and touch interaction at the top. The design was questioned, and this resulted in a new direction aesthetically.

Cylinder concept



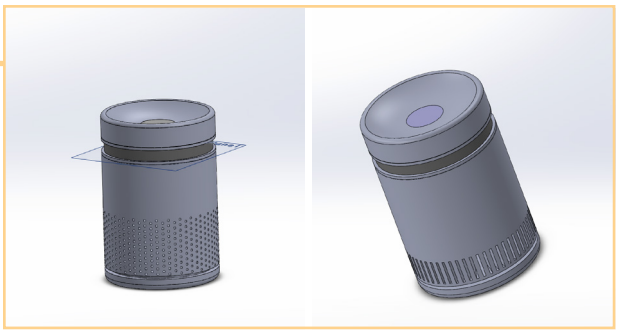
The new direction focused on making the compact look affective and trustworthy. A more clear communication of its functions. The top was however discarded again due to the difficulty of cleaning.

Invisible outlet concept



Here the outlet was “hidden” in the shadow groove to prevent grease from getting stuck. This was kept for the further iterations.

B&O inspired concept



This concept took inspiration from the shapes of a B&O speaker, with a shadow groove in the bottom and perforations as outlet. The interface was now one smooth surface. The result of this iteration was that the perforations was discarded (due to poor cleaning possibilities), the shadow groove and interface was kept for further iterations.

Incorporated grip concepts

To incorporate a better grip when taking the top part off or moving the product, a concave shape was added to this part. This did however not work as the top part was too small and the corners would result in more dirt and difficulty in cleaning.

Outlet in sides

The bottom part was enlarged to fit the motor which has outlet around the sides. The perforation was added again but with new aesthetics. This iteration was kept.

Concepts with handles

Materials was added to get a sense of aesthetics and texture in the parts meant for interaction. Handles was tried out, but soon discarded due to extra cost and extra cleaning. The parts of which the user interact was made black.

Final concept

PRODUCT PRINCIPLE

The final concept is a result of the key insights gained from the target group, prototyping, expert knowledge, and testing.

INTERFACE

The interface is inspired by Thermex and has only one button in the middle which provide a tactile feedback when pushed. The battery indicator will show when it is time to charge the product and the “CLEAN” indicator will turn on whenever its time to clean the filters.

CABLE

The cable inlet is placed at the top to keep it in a distance from the stove, and the interface is made in a soft plastic material to ensure a water mist resistant inlet to the cable.

TOP

The top part can be removed and the grease filter is connected to the top and go directly into the dishwasher. It is also possible to disconnect the grease filter from the top and the two parts can be cleaned separately.

BOTTOM

The bottom part can be removed with a simple twist, the carbon filter is removed and the bottom can go straight into the dishwasher. This is the same way you would change the carbon filter whenever its needed.

ill. 150. Product principle.

FINAL SPECIFICATION

The table shows measurable elements of the final product. An overview of the findings and insights has been confirmed or discarded and translated to requirements which can be found in Appendix 25.

Metric	Requirements		Source
Product dimensions	Hight: Diameter:	225 mm 166 mm	Test of user scenario, Suction test, Qualitative user interview and *.
Weight		2,4 kg	Kitchen appliance to interior tool & Catalogue 2.
Runtime before cleaning		60 h**	Thermex meeting 3.
Power		12 V	Henrik - ebmpapst.
Run time (on max)		2,35 hour	Battery calculation (Worksheet xx), Thermex interview 2.
Suction mode 1		6V	Performance
Suction mode 2		9V	Performance
Suction mode 3		12V	Performance
Sales price		<2.000 DKK	Photo ethnographic research
Airflow		>75m^3/h	Cooker hood disassembly

* *[Electrolux, no date].*

**Thermex said a typical cooking session lasts 1 h. Monthly cleaning is then 1 h * 30 days = 30 h. If the cooker hood is uses twice a day 1 h * 2 * 30 days = 60 h.

DETAILING

In the following section the final product will be presented. How the aesthetics came to be will be shown as well as the different components and their manufacturing methods.
A business plan is develop to provide an estimate of the product price and break even analysis.

ill. 151. Thermex visit, airflow pipe.

AESTHETICS AND FORM

Through the process and earlier research on styling and consumer products it was found that minimalistic Scandinavian design was very desirable to the target group.
The final concept gets a lot of it's inspiration from B&O and Vipp, who is known for their minimalistic design.

ill. 152. Vipp trashcan. [RetroToGo, no date]

The Vipp trashcan has curved surfaces with soft transitions, and the interactions areas has another material and color than the rest of the product. This was implemented in the overall shape and the parts which the user should interact with are divergent in color, compared to the rest of surfaces.

ill. 154. Final concept side view.

ill. 153. Beosound Balance [Bang&Olufsen, no date b]

The Beosound Balance has served as inspiration for the characteristic shadow groove between the main body casing and the bottom part. The shadow groove creates a structural lightness in the otherwise massive constriction, but also functions as inlet ring for the motor.

ill. 155. Airplane turbine [PixaBay, no date]

References from airplane turbines was used to emphasize the product function of moving air. The propeller pattern was used as air outlet in the bottom part.

ill. 156. Final concept in perspective.

CONSTRUCTION, PRODUCTION AND MATERIALS

This section will focus on the construction, production and materials of the final solution. This section was created with the help of Thermex to find manufacturers and by using their strategic approach for creating the first product iterations.

1

If the sales of the product is successful the type of plastic will be Polypropylene (PP) and these would be injection molded *[Thompson, 2017c].*
However Thermex told that the start up process of the product would be very different and they would start out by only producing small number of pieces for a test period to probe the product in their exhibition stands and at the kitchen retailer shops. For this they would use rapid tooling.

2

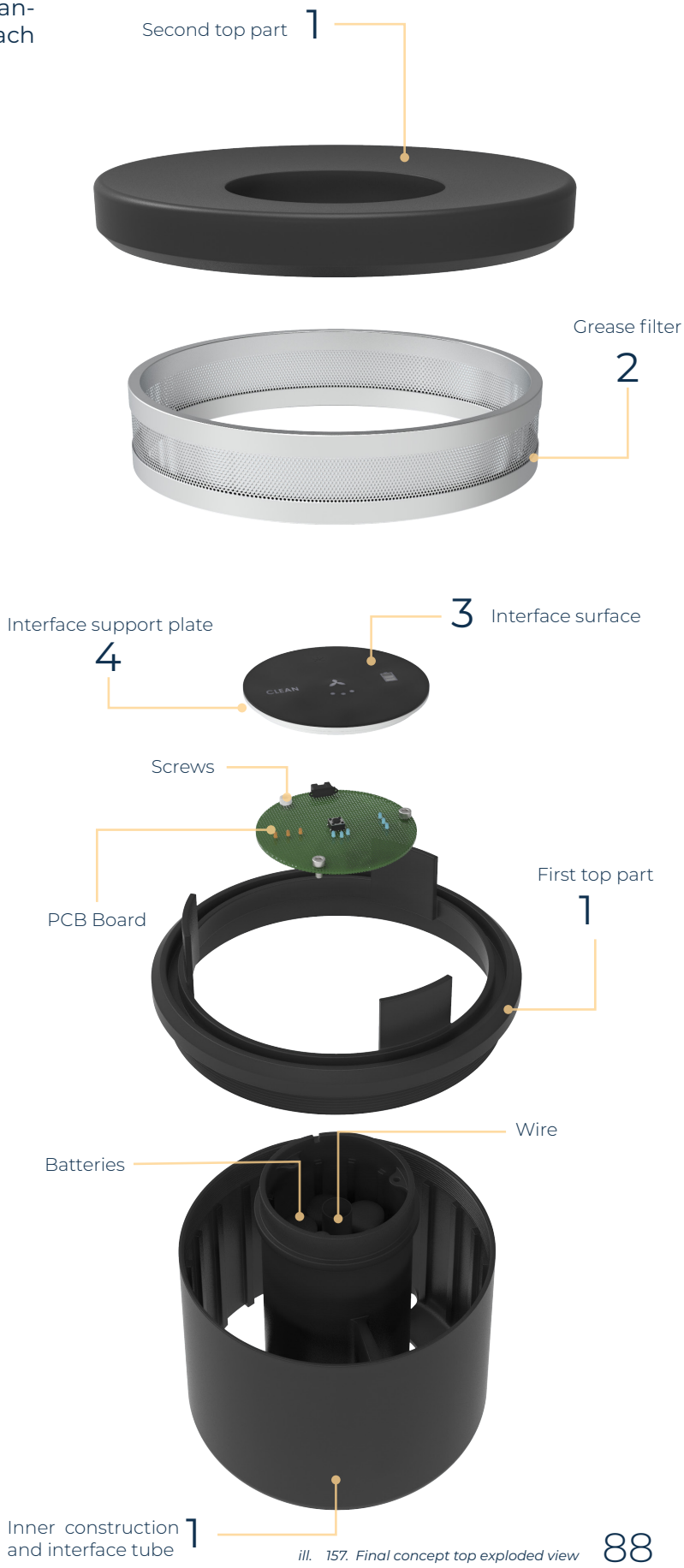
Thermex told that the grease filters can be produced to fit any shape. The filter is a bend sheet metal clamped together with two metal rings, also made from bend sheet metal. The holes in the filter is created with laser cutting.
[Reservedele, no date]

3

For the rubbery interface material it is chosen to use Polysiloxane, silicone. This material is frequently used in house holding for items such as flexible ice trays *[Thompson, 2017d].*

4

This part is a 4000 series aluminum sheet metal. It is produced with water jet cutting to reduce tooling costs and due to the anticipated low number of pieces. Thermex have no internal production, which means that if the number of pieces sold increases the production method for this part can be shifted to turret punching *[Thompson, 2017a].*



ill. 157. Final concept top exploded view

5

The outer casing is made of aluminum alloy 4000 series as it contains silicon, which makes it good for casting.
For this part it is chosen to produce it with low pressure die casting, This is chosen to minimize tooling costs *[Thompson, 2017b].*
However the product gets a highglans coating *[Gj Coating, no date].*

6

Carbon filters are created from granulated active carbon charcoal. Thermex told that the filters can be tailored to fit any shape *[Cocarb Solution, 2019].*

7

Aluminum alloy 4000 series is also chosen for this part *[Metalsuppliers, 2020]*. It is low pressure die casted in two halfs and is welded together afterwards *[Thompson, 2017b].*

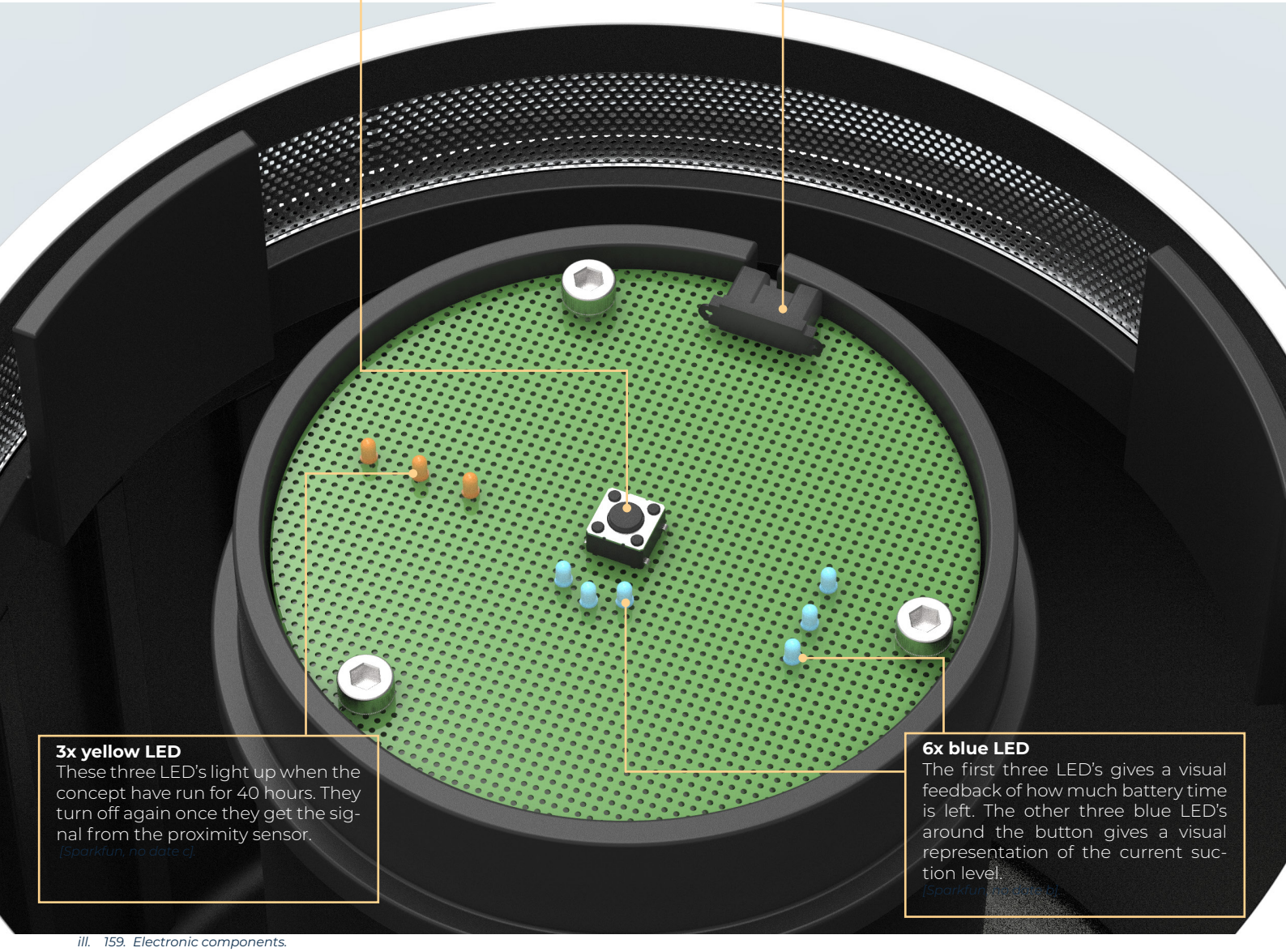
ill. 158. Final concept bottom exploded view

ELECTRONICS

To get an overview of the electronic components illustration 156 have been made to get a visual representation of the components placement and together with the flowchart, this will show how the interface should function when the user interacts with the concept.

Proximity sensor
The concept has a proximity sensor with the purpose of measuring the distance to the top cover. This is done to know when to reset the CLEAN function described in the flowchart.
[Sparkfun, no date a].

Pressure button
This button controls the fan speed on the motor. By pressing it from 1-4 times, switching between: off and level 1, 2 and 3.
[Sparkfun, no date d].

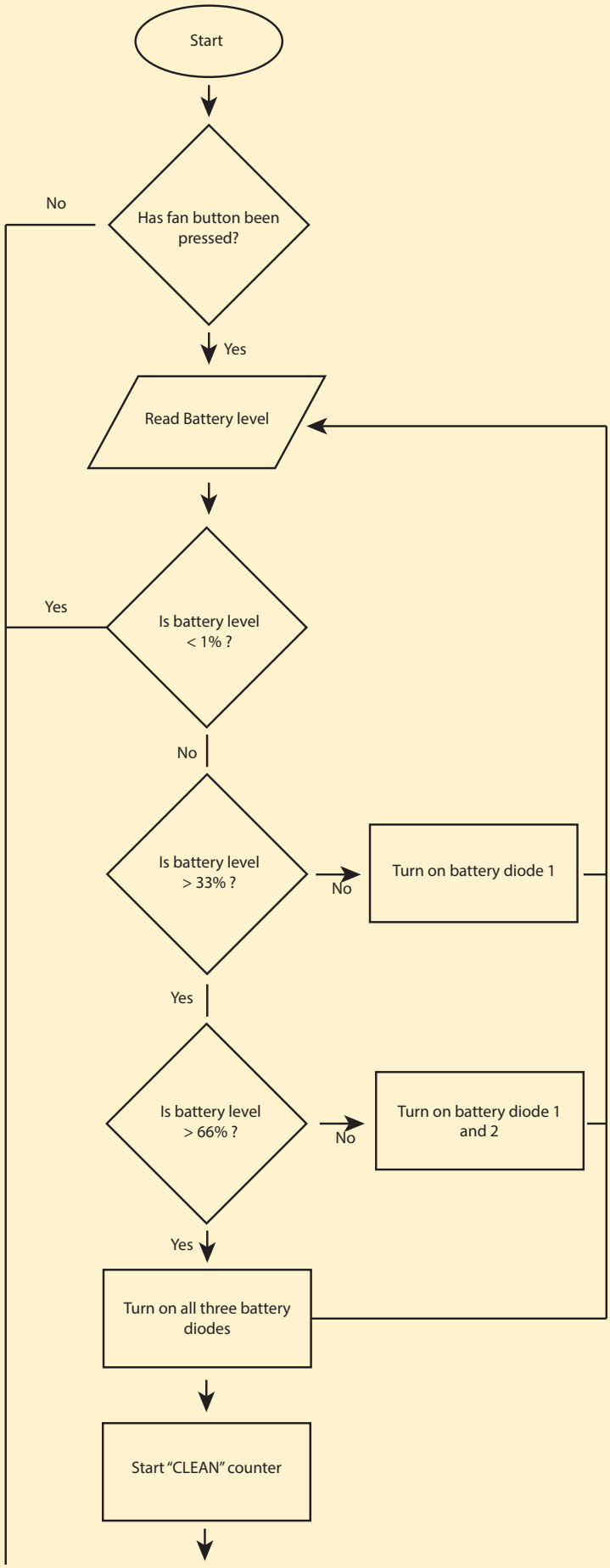


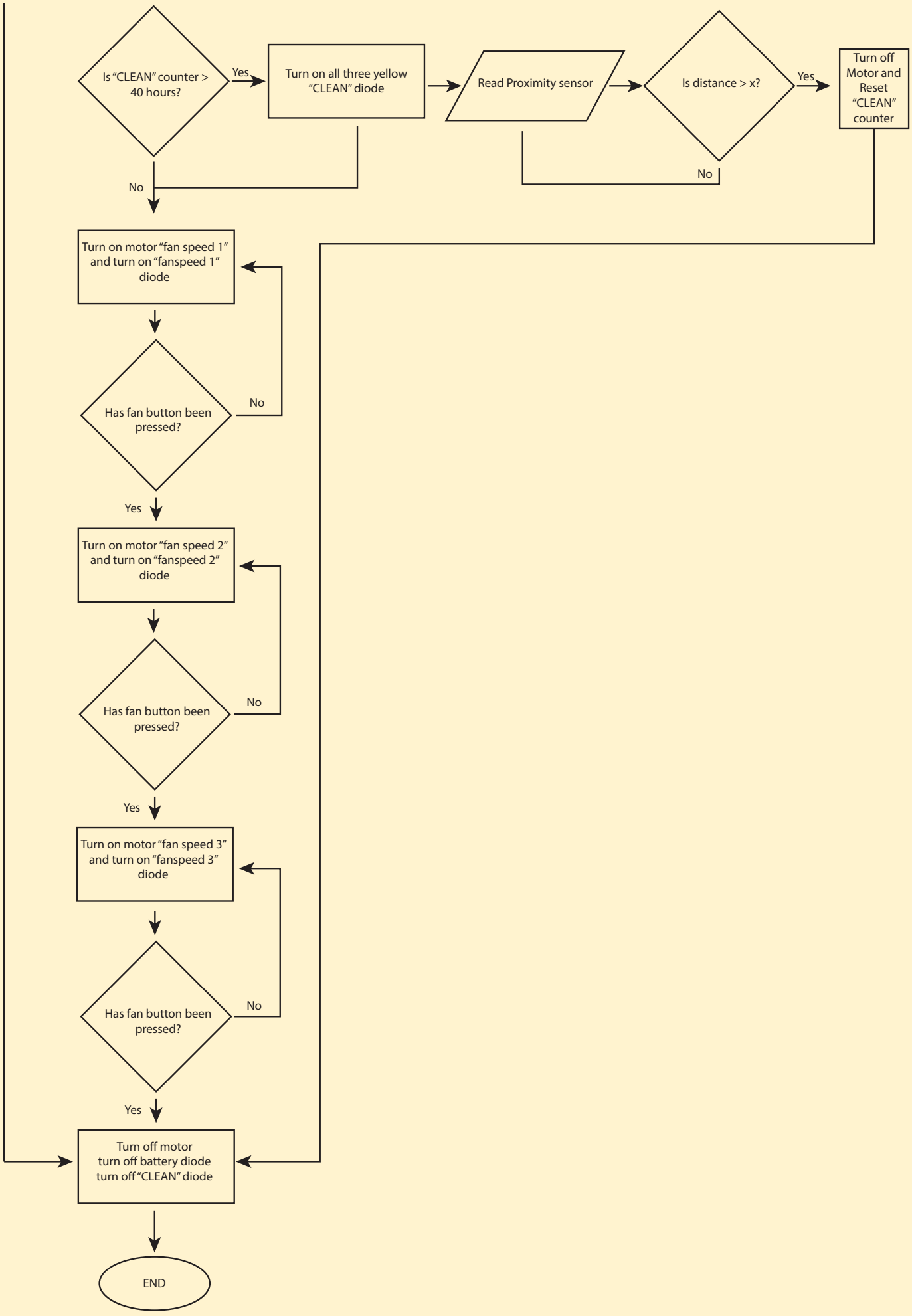
3x yellow LED
These three LED's light up when the concept have run for 40 hours. They turn off again once they get the signal from the proximity sensor.
[Sparkfun, no date c].

6x blue LED
The first three LED's gives a visual feedback of how much battery time is left. The other three blue LED's around the button gives a visual representation of the current suction level.
[Sparkfun, no date b].

ill. 159. Electronic components.

FLOWCHART


Start
Has fan button been pressed?
No
Yes
Read Battery level
Is battery level < 1% ?
Yes
No
Is battery level > 33% ?
No
Turn on battery diode 1
Yes
Is battery level > 66% ?
No
Turn on battery diode 1 and 2
Yes
Turn on all three battery diodes
Start "CLEAN" counter


Is "CLEAN" counter > 40 hours?
Yes
Turn on all three yellow "CLEAN" diode
Read Proximity sensor
Is distance > x?
Yes
Turn off Motor and Reset "CLEAN" counter
No
No
Turn on motor "fan speed 1" and turn on "fanspeed 1" diode
Has fan button been pressed?
No
Yes
Turn on motor "fan speed 2" and turn on "fanspeed 2" diode
Has fan button been pressed?
No
Yes
Turn on motor "fan speed 3" and turn on "fanspeed 3" diode
Has fan button been pressed?
No
Yes
Turn off motor
turn off battery diode
turn off "CLEAN" diode
END

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BUSINESS PLAN

This topic will give an overview of the essential consideration regarding launching a new product. The intention was to utilize Thermex value chain and company structure and test the market for a new and unique cooker hood category but also keep the risk low as well as the start investments (Appendix 18).

Thermex is a well established brand within the cooker hood category, especially in Scandinavia. At the moment Thermex's products is mainly targeting the middle to high end market, but they do also have cheaper product sold to renovations and constructions of residential complexes.

Two product lines

BLUE LINE

Sold as Business to business product to kitchen dealers, like HTH køkken.
Blue line products are forbidden to sell online.

YELLOW LINE

Sold as Business to business product, but as online sale, like Skousen.dk and WhiteAway.dk

Company structure

Thermex get their products produced aboard, and the majority is directly shipped to the retailers resulting in a very low in house storage.
They have an online store, where they sell spare parts and the Plasmex filter, but no cooker hoods. This is done to minimize the requirement of storage.
This company structure makes it easy to implement new product and production methods. Because they aren't limited by in house production methods or technologies.

Business to Business

Thermex's company structure is adapted to Business to Business sale, meaning it would be easier for them to facilitate the sale of a new product this way, even though it is for a new segment.
Sales through Business to Business allows the product to be manufactured in a higher amount, as the companies to whom the products are sold, buys it in bulks. This also reduces the required storage, as the products can be send directly to the customers (Retailers).
This sales method will also lower the manufacturing price, because materials and parts can be ordered in larger bulks, based on the orders from the retailers.
Selling a product as Business to Business delegates many costs and activities to the retail companies. Like marketing, sales and storage aspects. Which saves Thermex costs and time, but it also results in losing a part of the products profit, because the retailers price is 40-50% higher due to contributions.
Branching out and selling through other companies and stores, is also a great way to reach a broader market.

How would Thermex do?

Thermex was asked about how they typically implement a new product on the market.

Low risk
In order to test the waters with a low risk, Thermex would start by investing in cheap tooling to manufacture a rather low quantity of units.
If the product is received well on the market, they would invest in better mass production tooling, to lower the unit price.

Retail
When Thermex is releasing a new product they are indirect ly dialogue with their dealers in order to see who could sell the product in their store.
In some cases Thermex offer a free stand, which Thermex set-up themselves at the dealers store to display the product. This means the store hasn't bought the product yet, so Thermex will first get earnings when the products are sold to customers.

Morten could imagine to use this method as gateway into the new segment and create relations to new retail stores (who sells products to the same target segment), it could be stores like Imerco.
Furthermore, they are using fairs to showcase new products, and make people aware of them as a brand.

Morten would start with implementing the product onto the Danish marked before expanding to the rest of Scandinavia due to the warranty rules in the different counties. In Denmark the warranty is 2 years, whereas it is 3 years in Sweden and 5 years in Norway.

Sub-brand: Thermex Portable

Introducing their brand to the young segment, through a sub-brand would create awareness of their main brand and products to the new segment. The awareness from a younger segment could potentially generate new customers to the main brand, because the young segment are the future house owners, who's gonna need a stationary cooker hood, for their kitchens. (The same business strategy B&O uses with their sub-brand B&O Play).
Furthermore, it can be a gateway to expand their product portfolio and market.

The sub-brand is launched as an extension to the Yellow line. Which both allow online and physical retail sale. Furthermore, it is sold from Thermex's online shop. The small size of the product doesn't require much storage and by storing a low quantity of units in house, it would enable them to get a larger profit (online retail price).

ill. 160. Thermex products Blue line. [Thermex, 2020a].

ill. 161. Thermex products Yellow line + Nordbro. [Thermex, 2020b]

Sales

The final price for the consumers in retail stores is estimated to be 1.886,15 DKK.

It is expected to sell around 1.300 units per year, with an expected increase of 1% each year. 1.300 units is equal to 0,2% of all Danish people between 20-29 years. After five years is the total unit sale estimated to be 6.780.
Similar sales could be achieved in Sweden and Norway, where Thermex already is a well established brand as well (See the full spreadsheet in worksheet xx).

Expenses

The estimated manufacturing price per unit is 718,53 DKK. These estimations was calculated base on worse case scenario, since the benefits of mass production are hard to estimate. The product cost will decrease when more units are produced, some of the parts will increase in price when bought in bulks.

Thermex will have to make some initial investments in form of tooling. Where the injection molds are the most expensive investments. Whereas all the electrical components are standard components.
All parts will be shipped to Thermex's current facilities off shore and be assembled before being shipped directly to the retailers.

Denmark	Sales to 0,2 %	Increase 1 %	Increase 1 %	Increase 1 %	Increase 1 %	
Budget	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Total**
Parts sold	1.330	1.343	1.356	1.369	1.382	6.780,00
Sales price (Factory)	1.005,94	1.005,94	1.005,94	1.005,94	1.005,94	
Product cost	718,53	718,53	718,53	718,53	718,53	
Turnover	1.337.906,77	1.350.984,05	1.364.061,34	1.377.138,62	1.390.215,91	6.820.306,69
Variable costs	955.647,69	964.988,61	974.329,53	983.670,44	993.011,36	4.871.647,64
Contribution margin	382.259,08	385.995,44	389.731,81	393.468,18	397.204,54	1.948.659,06
Investment	-824.201,29	-441.942,21	-55.946,77	333.785,04	727.253,22	
Contribution	382.259,08	385.995,44	389.731,81	393.468,18	397.204,54	
Remaining	-441.942,21	-55.946,77	333.785,04	727.253,22	1.124.457,76	

ill. 162. Nordbro break even analysis.

CLOSURE

This last section will close off the project by firstly conclude on the problem statement and the final product proposal. Secondly by taking a reflective look upon the process, the choices made during it, and the results achieved.

CONCLUSION

The project started with a different focus than cooker hoods and the project framing have changed throughout the project period in general. This have meant prioritizing time exploring the different possibilities with a lean start-up approach. From the day of the final framing the cooker hood company Thermex have served as partners for developing the project. They are a company with 60 years of experience within the cooker hood industry. They currently have 7 different cooker hood categories that all require some degree of installment within the home.
By combining the knowledge from Thermex and the knowledge gathered from the users a new product category emerged and the portable/mobile cooker hood direction came to be.
The research showed a tendency within the target group of not staying in the same home for longer than an average of 5 years and so this relocation pattern together with the consumption patterns lead to the project framing and the problem statement:

"How can a Cooker Hood be re-designed to be a compact and portable unit, that fits in with target groups re-location patterns, and consumption patterns?"

Through the process of creating a portable cooker hood the target groups consumer habits were investigated. Overall this gave an indication of the importance of the products desirability. This lead to an understanding of what products the users prioritize to use their money on and how other brands have adapted to these patterns. The design parameters emerged from this research:

- Portable
- Scandinavian design
- Clear use
- Easy cleaning
- Performance

The solution
Nordbro is a mobile and portable cooker hood designed for younger people in the age of 20-30 living in small apartments with no or bad cooker hoods.

Nordbro has no waste space, and is compact enough to be placed on a shelf or in a cabinet to optimize space in the kitchen. It runs on rechargeable batteries, which enable the user to move the product around while cooking and adapt to multiple cooking scenarios. The aesthetics of the final solution reflects a minimalistic Scandinavian design and draws inspiration from Vipp and B&O products to appeal to the target group. The interface of the product is simple and contain only a single button, which provide both a tactile and visual feedback. Information of when to clean Nordbro is achieved through a visual feedback. Cleaning is made easy by simply taking off the top and bottom part and placing it in the dishwasher.
After close cooperation with motor experts and Thermex, the product is presumed to perform just as good as the IKEA LAGAN cabinet integrated cooker hood. The portable feature can be used to enhance the suction as it can be moved significantly closer to the steam. This will of course need further testing in a professional test lab.

Nordbro is designed to be a sub-brand to Thermex and aim for the younger segment of the market. The investment of Nordbro is 824.201 DKK, the production cost is 718 DKK pr. unit and it has a retail price of 1.886 DKK. Break even will happen in the third year, and will result in a revenue of 333.785 DKK.

REFLECTION

Overall this project have worked with the principle of getting out of the building and getting things tested. Usually a lot of thorough investigations lead to reasonable conclusions, but this project have been all about how the users feel and behave and what they find interesting.
This have been tackled with a lean start-up and agile development approach of failing fast, learning from it and moving on, in order to find the right approach and framing of the project. This have been extremely effective and have moved the project to lengths it otherwise would not have reached. For this the product catalogues sent to the users were a particularly good way of gathering the desired information.

Challenges
The entire project has its focus on creating a consumer product, this have created a lot of challenges and meant spending a lot of time in the fuzzy front end of the process which has sometimes lead to frustrations. This process however showed a lot of consumer patterns that have pushed the cooker hood into a new product category. This testifies that using a lot of time trying to understand the users needs can lead to an innovative end result.
The project started with a focus on creating a new small fire extinguisher for kitchens. This was an interesting topic, but after a while it was realized that the target group and users found the topic interesting but couldn't see themselves buying the product. This is where the purchase barrier became clear and resulted in the first switch in project direction. The focus was getting to know what would make them want to buy a fire extinguisher and these investigations still provided the project with valuable insights. This goes to show that you almost never end up making what you initially thought you would when dealing with a design process.

Covid-19
This project was created during the Covid-19 crysis, which have also made an impact on how some of the aspects of the project was handled. Daily skype meetings insured a connection between the group members and it has overall resulted in switching many of the otherwise physical tests into digital tests. This have in many ways been an advantage as it ensured a focus on the aesthetics, as the project was quickly moved into 3D. However it has also been a great challenge as there have been no direct connection to the test people, which have made it complicated to explain features and functions.
As there were no opportunity for shadowing/observing the patterns of the users ourselves and by doing it digitally, the result may have been affected. When asking the users to explain certain behaviors, interests, or answering questions, all the answers were from their perspective and certain patterns we might have observed was lost. Because the university closed down very early in the process, there has been no access to the workshop (schools facilities), tools and knowledge from the workshop workers.
Therefore other ways to seek clarity have been made, for this Thermex have been a great help. They provided the project with test material and expert knowledge.

Opportunities
Thermex has shown a lot of interest in both the project and in the product and so has the target group. The base factor for going further with the project is if Thermex thinks that this product is feasible. They do however they find the new product categori very interesting. Lastly it is needed to construct a final prototype with the chosen motor and bring it to a professional testing lap to test the airflow and performance properly.

Even though there has been some struggles, it has been a great learning experience working with a consumer product and strategic positioning, as this is new for all of the group members. It has also been very giving and interesting working close with such a professional and established company as Thermex. The Covid-19 circumstances pushes us all into a brand new way of co-working which required all of the tools gathered through this education, so it is safe to say that this project has been out of everyones comfort zone and in the end turned out very rewarding.

REFERENCE LIST

Boding, J. T. and Blomsterberg, I. (no date) ***Her er boligens 10 største brandfælder, 4/6-2017***. Available at: https://www.bolius.dk/her-er-husets-10-stoerste-brandfaelder-15428 (Accessed: 1 June 2020).
Cocarb Solution (2019) ***ACTIVATED CARBON FILTERS***. Available at: https://www.cocarb.com/activated-carbon-filters/ (Accessed: 1 June 2020).
Dieckmann, M. (no date) ***Danskernes flyttevaner, 2/3-2020***. Available at: https://www.bolius.dk/danskernes-flyttevaner-89770 (Accessed: 1 June 2020).
Eico (no date a) ***NIKOLATESLA ONE BL/A/MIX***. Available at: https://www.eico.dk/katalog/elica-spa/nikolatesla-one-blamix/c-24/c-279/p-1801 (Accessed: 1 June 2020).
Eico (no date b) ***NIKOLATESLA ONE BL/F/MIX***. Available at: https://www.eico.dk/katalog/emfang/integreretloftbord-kombination/nikolatesla-one-blf-mix/c-24/c-171/p-1802 (Accessed: 1 June 2020).
Electrolux (no date) ***ESF2400OW***. Available at: https://www.electrolux.dk/kitchen/dishwashing/dishwashers/free-standing-compact-dishwasher/esf2400ow/ (Accessed: 1 June 2020).
Elgiganten (2020) ***Logik opvaskemaskine LDWTT17E***. Available at: https://www.elgiganten.dk/product/hvidevarer/bordopvaskemaskiner/LDWTT17E/logik-opvaskemaskine-ldwtt17e?gclid=CjwKCAjw4871BRAjEiwAbxXi2-QapM5B14F_Bab8mNalRPJrtG3XHmYyH3jTZ7qA-IRW9Axr-ZtbIxoCWCgQAvD_BwE&gclsrc=aw.ds (Accessed: 1 June 2020).
Elgiganten (no date) ***Ser din emhætte sådan du?, 23/2-2016***. Available at: http://www.mynewsdesk.com/dk/elgiganten/pressreleases/ser-din-emhaette-saadan-du-1323178 (Accessed: 1 June 2020).
Faber (no date) ***INVENTORS OF THE COOKER HOOD***. Available at: https://www.faberhoods.co.uk/the-inventors-of-the-cooker-hood/ (Accessed: 1 June 2020).
Gj Coating (no date) ***Højglanslakering af plastemner for virksomheder***. Available at: https://gjcoating.dk/vi-tilbyder/lak/hoejglanslakering (Accessed: 1 June 2020).
Gorenje (no date) ***ES1274M***. Available at: http://partners.gorenje.com/captest/staging/htmlmanuals/manuals/ES1274M/EN/index.html#ES1274M_overview.html (Accessed: 1 June 2020).
Halton (2017) ***UV-light technology - the most efficient grease filtration technology in the market***. Available at: https://www.halton.com/nl_NL/marine/science-innovations/galley-ventilation/galley-ventilation/uv-light-technology (Accessed: 1 June 2020).
IKEA (2020a) ***LAGAN***. Available at: https://www.ikea.com/dk/da/p/lagan-vaegmonteret-emhaette-hvid-50401383/ (Accessed: 1 June 2020).
IKEA (2020b) ***TILLREDA***. Available at: https://www.ikea.com/dk/da/p/tillreda-transportabel-induktionskogeplade-hvid-00331627/?gclid=CjwKCAjw4871BRAjEiwAbxXi2wBbbbL3cr93ZIXaZBgr3LdpXjPd2Tjhr2QFtXjILAhpuVj7GQ76kBoCYCQQAvD_BwE&gclsrc=aw.ds (Accessed: 1 June 2020).
Imerco (2018a) ***Caso Mikro-/kombiovn CS3354***. Available at: https://www.imerco.dk/caso-mikrokombiovn-cs3354?id=100386047&dfw_tracker=61960-100386047&utm_medium=cpc&utm_source=google&utm_campaign=6536174591&gclid=CjwKCAjwztL2BRATEiwAvnALcnjIaRPLq9axNWwMrKyHk_Myg0R1Uww5_70NxtgFAZi93HOP8ZhOzBoCfrkQAvD_BwE (Accessed: 1 June 2020).
Imerco (2018b) ***SMEG Brødrister***. Available at: https://www.imerco.dk/smeg-broedrister?id=100360177 (Accessed: 1 June 2020).
Jimco (no date) ***JIMCO - Kitchen Pollution Control, 10/5-2016***. Available at: https://www.youtube.com/watch?v=LsatQ0BL_eI&feature=emb_logo (Accessed: 1 June 2020).
Kahn, K. (2020) ***Is UVC Safe?*** Available at: https://www.klaran.com/is-uvc-safe (Accessed: 1 June 2020).
KitchenAid (2020a) ***KitchenAid***. Available at: https://www.kitchenaid.com (Accessed: 1 June 2020).
KitchenAid (2020b) ***SHOW YOUR TRUE COLORS***. Available at: https://www.kitchenaid.com/custom.html (Accessed: 1 June 2020).
Metalsuppliers (2020) ***Aluminum 4032***. Available at: https://www.metalsuppliersonline.com/research/Property/metals/444.asp (Accessed: 1 June 2020).
Oldworldstoneworks (2020) ***History of range hoods***. Available at: https://oldworldstoneworks.com/history-range-hoods/ (Accessed: 1 June 2020).
Reservedele (no date) ***Fedtfilter, Thermex emhætte***. Available at: https://reservedele.nu/da/product/fedtfiltre/fedtfilter-thermex-emhaette-34089?gclid=EAIaIQobChMI_9e5mtDT6QIVSagYCh1lYgxCEAQYBCABEgLcHvD_BwE (Accessed: 1 June 2020).
Smeg (2020) ***About us***. Available at: https://www.smeg.com/company/about-us (Accessed: 1 June 2020).
Sparkfun (no date a) ***Infrared Proximity Sensor - Sharp GP2Y0A21YK***. Available at: https://www.sparkfun.com/products/242 (Accessed: 1 June 2020).
Sparkfun (no date b) ***LED - Super Bright Blue***. Available at: https://www.sparkfun.com/products/529 (Accessed: 1 June 2020).
Sparkfun (no date c) ***LED - Super Bright Yellow***. Available at: https://www.sparkfun.com/products/530 (Accessed: 1 June 2020).
Sparkfun (no date d) ***Mini Pushbutton Switch***. Available at: https://www.sparkfun.com/products/97 (Accessed: 1 June 2020).
Thermex (2020a) ***Blue line - Catalogue***. Available at: https://issuu.com/thermex/docs/dk_thermex_blueline_2020?fr=sNDRhNjExMDA3OTk (Accessed: 1 June 2020).
Thermex (2020b) ***Yellow line - Catalogue***. Available at: https://issuu.com/thermex/docs/dk_thermex_yellowline_2020?fr=sNTEwMTEzMTgyMDY (Accessed: 1 June 2020).
Thermex (no date a) ***AIRSLIM***. Available at: https://www.thermex.dk/produkt/1033/airslim (Accessed: 1 June 2020).
Thermex (no date b) ***Metz Maxi Sky***. Available at: https://www.thermex.dk/produkt/86/metz-maxi-sky (Accessed: 1 June 2020).
Thermex (no date c) ***Motorer & tilbehør***. Available at: https://www.thermex.dk/emhaetter/emfang/motorer (Accessed: 1 June 2020).
Thermex (no date d) ***Preston II***. Available at: https://www.thermex.dk/produkt/40/preston-ii (Accessed: 1 June 2020).
Thermex (no date e) ***Thermex***. Available at: https://www.thermex.dk (Accessed: 1 June 2020).
Thermex (no date f) ***Thermex — siden 1958***. Available at: https://www.thermex.dk/om-thermex (Accessed: 1 June 2020).
Thompson, R. (2017a) ***Manufacturing processes for design professionals***. Thames & Hudson.
Thompson, R. (2017b) ***Manufacturing processes for design professionals***. Thames & Hudson.
Thompson, R. (2017c) ***The materials sourcebook for design professionals***. Thames & Hudson.
Thompson, R. (2017d) ***The materials sourcebook for design professionals***. Thames & Hudson.
Tilitz, F. (no date) ***Mere plads og en større have: Derfor flytter danskerne, 22/9-2019***. Available at: https://santanderconsumer.dk/magasinet/bolig/mere-plads-og-en-stoerre-have-derfor-flytter-danskerne/ (Accessed: 1 June 2020).
UVO3 (2020) ***4 Benefits Of Using A UV Lamp In The Kitchen***. Available at: https://www.uvo3.co.uk/4-benefits-of-using-a-uv-lamp-in-the-kitchen/ (Accessed: 1 June 2020).

ILLUSTRATION LIST

Armstrong, M. (no date) *When Europeans fly the nest*, *14/5-2019*. Available at: https://www.statista.com/chart/13885/when-europeans-fly-the-nest/ (Accessed: 1 June 2020).

Bang&Olufsen (no date a) *BeoPlay P2*. Available at: https://multiroom.dk/shop/bangogolufsen/hoejtaler/portable/beoplay-p2/ (Accessed: 1 June 2020).

Bang&Olufsen (no date b) *Beosound Balance*. Available at: https://www.bang-olufsen.com/da/hoejttalere/beosound-balance-google-assistant (Accessed: 1 June 2020).

Elgiganten (2020) *Logik opvaskemaskine LDWTT17E*. Available at: https://www.elgiganten.dk/product/hvidevarer/bordopvaskemaskiner/LDWTT17E/logik-opvaskemaskine-ldwtt17e?gclid=CjwKCAjw4871BRAjEiwAbxXi2-QapM5B14F_Bab8mNaIRPJrtG3XHmYyH3jTZ7qA-IRW9Axr-ZtbIxoCWCgQAvD_BwE&gclsrc=aw.ds (Accessed: 1 June 2020).

Elica (no date) *FUTURE IS IN THE AIR*. Available at: https://elica.com/IT-en/discover-elica (Accessed: 1 June 2020).

Faber (no date a) *Belle Plus*. Available at: https://www.faberhoods.co.uk/hoods/belle/ (Accessed: 1 June 2020).

Faber (no date b) *Faber Pioneers New Frontiers in Technology*. Available at: https://www.faberhoods.co.uk/technology/ (Accessed: 1 June 2020).

Gj Coating (no date) *Metal - Overfladebehandling af metaller*. Available at: https://gjcoating.dk/overfladebehandling/metal-overfladebehandling (Accessed: 1 June 2020).

Hvidevaregrossisten (2017) *Eico NikolaTesla BL/F/Mix*. Available at: https://www.hvidevaregrossisten.dk/hvidevarer/madlavning/kogeplade-m-indbygget-emfang/eico-4706-bordintegreret-emfang.html (Accessed: 1 June 2020).

IKEA (2020) *TILLREDA*. Available at: https://www.ikea.com/dk/da/p/tillreda-transportabel-induktionskogeplade-hvid-00331627/?gclid=CjwKCAjw4871BRAjEiwAbxXi2wBbbbL3cr93ZIXaZBgr3LdpXjPd2Tjhr2QFtXjILAhpuVj7GQ76kBoCYCQQAvD_BwE&gclsrc=aw.ds (Accessed: 1 June 2020).

IKEA (no date) *LAGAN*. Available at: https://www.ikea.com/dk/da/p/lagan-vaegmonteret-emhaette-hvid-50401383/ (Accessed: 1 June 2020).

Imerco (2018a) *Caso Mikro-/kombiovn CS3354*. Available at: https://www.imerco.dk/caso-mikrokombiovn-cs3354?id=100386047&dfw_tracker=61960-100386047&utm_medium=cpc&utm_source=google&utm_campaign=6536174591&gclid=CjwKCAjwztL2BRATEiwAvnALcnjlaRPLq9axNWwMrKyHk_Myg0R1Uww5_70NxtgFAZi93HOP8ZhOzBoCfrkQAvD_BwE (Accessed: 1 June 2020).

Imerco (2018b) *SMEG Brødrister*. Available at: https://www.imerco.dk/smeg-broedrister?id=100360177 (Accessed: 1 June 2020).

Jimco (no date) *Commercial kitchen*. Available at: https://jimco.dk/products/commercial-kitchen.aspx (Accessed: 1 June 2020).

KitchenAid (2020) *SHOW YOUR TRUE COLORS*. Available at: https://www.kitchenaid.com/custom.html (Accessed: 1 June 2020).

Lauritz (no date) *Bang & Olufsen. Beosound 3000, Beolab 4000, Beo4 samt Lightcontrol LC2*. Available at: https://www.lauritz.com/da/auktion/bang-olufsen-beosound-3000-beolab-4000-beo4-samt-lightc/i1264115/ (Accessed: 1 June 2020).

PixaBay (no date) *Airplane Engine*, *5/7-2017*. Available at: https://www.pexels.com/photo/airplane-engine-459402/ (Accessed: 1 June 2020).

RetroToGo (no date) *The timeless Vipp Bin range*, *20/11-2007*. Available at: http://www.retrotogo.com/2007/11/the-timeless-vi.html (Accessed: 1 June 2020).

ScienceFocus (no date) *Who really invented the jet engine?* Available at: https://www.sciencefocus.com/science/who-really-invented-the-jet-engine/ (Accessed: 1 June 2020).

Smeg (2020) *Smeg product serie*. Available at: https://www.smeg.dk/product/ecf01creu/ (Accessed: 1 June 2020).

Thermex (2017a) *SÅDAN FUNGERER ET EMFANG*. Available at: https://www.thermex.dk/upload/Raad_Vejledning/01_Thermex_Collection2017_Sådan fungerer.pdf (Accessed: 1 June 2020).

Thermex (2017b) *VENTILATION & MOTOR*. Available at: https://www.thermex.dk/upload/Raad_Vejledning/01_Thermex_Collection2017_VentilationMotor.pdf (Accessed: 1 June 2020).

Thermex (2020a) *Blue line - Catalogue*. Available at: https://issuu.com/thermex/docs/dk_thermex_blueline_2020?fr=sNDRhNjExMDA3OTk (Accessed: 1 June 2020).

Thermex (2020b) *Yellow line - Catalogue*. Available at: https://issuu.com/thermex/docs/dk_thermex_yellowline_2020?fr=sNTEwMTEzMTgyMDY (Accessed: 1 June 2020).

Thermex (no date) *Hvilken emhætte passer bedst til dit køkken?* Available at: https://www.thermex.dk/emhaetter/emfang (Accessed: 1 June 2020).

Thielicke, W. (no date) *Computer graphic of a lotus leaf surface*, *6/12-2007*. Available at: https://en.wikipedia.org/wiki/Lotus_effect#/media/File:Lotus3.jpg (Accessed: 1 June 2020).

WhiteAway (no date) *Central Gemini III*. Available at: https://www.whiteaway.com/hvidevarer/emhaette/indsats-emhaette/product/thermex-central-gemini-iii/?gclid=CjwKCAjwqpP2BRBTEiwAfpiD-_DIEbUfx61f4c51-xoYf9ZqP9YmOcm616-rll13ju-tjetZoK4SCRoCTCAQAvD_BwE (Accessed: 1 June 2020).

Willemoes, S. (no date) *HVEM KØBER HVAD PÅ NETTET?*, *28/2-2017*. Available at: https://www.fdih.dk/nyheder/2017/februar/hvem-kober-hvad-pa-nettet (Accessed: 1 June 2020).

Illustration references

Armstrong, M. (no date) When Europeans fly the nest, 14/5-2019. Available at: https://www.statista.com/chart/13885/when-europeans-fly-the-nest/ (Accessed: 1 June 2020).

Bang&Olufsen (no date a) BeoPlay P2. Available at: https://multiroom.dk/shop/bangogolufsen/hoejtaler/portable/beoplay-p2/ (Accessed: 1 June 2020).

Bang&Olufsen (no date b) Beosound Balance. Available at: https://www.bang-olufsen.com/da/hoejttalere/beosound-balance-google-assistant (Accessed: 1 June 2020).

Elgiganten (2020) Logik opvaskemaskine LDWTT17E. Available at: https://www.elgiganten.dk/product/hvidevarer/bordopvaskemaskiner/LDWTT17E/logik-opvaskemaskine-ldwtt17e?gclid=CjwKCAjw4871BRAjEiwAbxXi2-QapM5B14F_Bab8mNaIRPJrtG3XHmYyH3jTZ7qA-IRW9Axr-ZtbIxoCWCgQAvD_BwE&gclsrc=aw.ds (Accessed: 1 June 2020).

Elica (no date) FUTURE IS IN THE AIR. Available at: https://elica.com/IT-en/discover-elica (Accessed: 1 June 2020).

Faber (no date a) Belle Plus. Available at: https://www.faberhoods.co.uk/hoods/belle/ (Accessed: 1 June 2020).

Faber (no date b) Faber Pioneers New Frontiers in Technology. Available at: https://www.faberhoods.co.uk/technology/ (Accessed: 1 June 2020).

Gj Coating (no date) Metal - Overfladebehandling af metaller. Available at: https://gjcoating.dk/overfladebehandling/metal-overfladebehandling (Accessed: 1 June 2020).

Hvidevaregrossisten (2017) Eico NikolaTesla BL/F/Mix. Available at: https://www.hvidevaregrossisten.dk/hvidevarer/madlavning/kogeplade-m-indbygget-emfang/eico-4706-bordintegreret-emfang.html (Accessed: 1 June 2020).

IKEA (2020) TILLREDA. Available at: https://www.ikea.com/dk/da/p/tillreda-transportabel-induktionskogeplade-hvid-00331627/?gclid=CjwKCAjw4871BRAjEiwAbxXi2wBbbbL3cr93ZIXaZBgr3LdpXjPd2Tjhr2QFtXjILAhpuVj7GQ76kBoCYCQQAvD_BwE&gclsrc=aw.ds (Accessed: 1 June 2020).

IKEA (no date) LAGAN. Available at: https://www.ikea.com/dk/da/p/lagan-vaegmonteret-emhaette-hvid-50401383/ (Accessed: 1 June 2020).

Imerco (2018a) Caso Mikro-/kombiovn CS3354. Available at: https://www.imerco.dk/caso-mikrokombiovn-cs3354?id=100386047&dfw_tracker=61960-100386047&utm_medium=cpc&utm_source=google&utm_campaign=6536174591&gclid=CjwKCAjwztL2BRATEiwAvnALcnjlaRPLq9axNWwMrKyHk_Myg0R1Uww5_70NxtgFAZi93HOP8ZhOzBoCfrkQAvD_BwE (Accessed: 1 June 2020).

Imerco (2018b) SMEG Brødrister. Available at: https://www.imerco.dk/smeg-broedrister?id=100360177 (Accessed: 1 June 2020).

Jimco (no date) Commercial kitchen. Available at: https://jimco.dk/products/commercial-kitchen.aspx (Accessed: 1 June 2020).

KitchenAid (2020) SHOW YOUR TRUE COLORS. Available at: https://www.kitchenaid.com/custom.html (Accessed: 1 June 2020).

Lauritz (no date) Bang & Olufsen. Beosound 3000, Beolab 4000, Beo4 samt Lightcontrol LC2. Available at: https://www.lauritz.com/da/auktion/bang-olufsen-beosound-3000-beolab-4000-beo4-samt-lightc/i1264115/ (Accessed: 1 June 2020).

PixaBay (no date) Airplane Engine, 5/7-2017. Available at: https://www.pexels.com/photo/airplane-engine-459402/ (Accessed: 1 June 2020).

RetroToGo (no date) The timeless Vipp Bin range, 20/11-2007. Available at: http://www.retrotogo.com/2007/11/the-timeless-vi.html (Accessed: 1 June 2020).

ScienceFocus (no date) Who really invented the jet engine? Available at: https://www.sciencefocus.com/science/who-really-invented-the-jet-engine/ (Accessed: 1 June 2020).

Smeg (2020) Smeg product serie. Available at: https://www.smeg.dk/product/ecf01creu/ (Accessed: 1 June 2020).

Thermex (2017a) SÅDAN FUNGERER ET EMFANG. Available at: https://www.thermex.dk/upload/Raad_Vejledning/01_Thermex_Collection2017_Sådan fungerer.pdf (Accessed: 1 June 2020).

Thermex (2017b) VENTILATION & MOTOR. Available at: https://www.thermex.dk/upload/Raad_Vejledning/01_Thermex_Collection2017_VentilationMotor.pdf (Accessed: 1 June 2020).

Thermex (2020a) Blue line - Catalogue. Available at: https://issuu.com/thermex/docs/dk_thermex_blueline_2020?fr=sNDRhNjExMDA3OTk (Accessed: 1 June 2020).

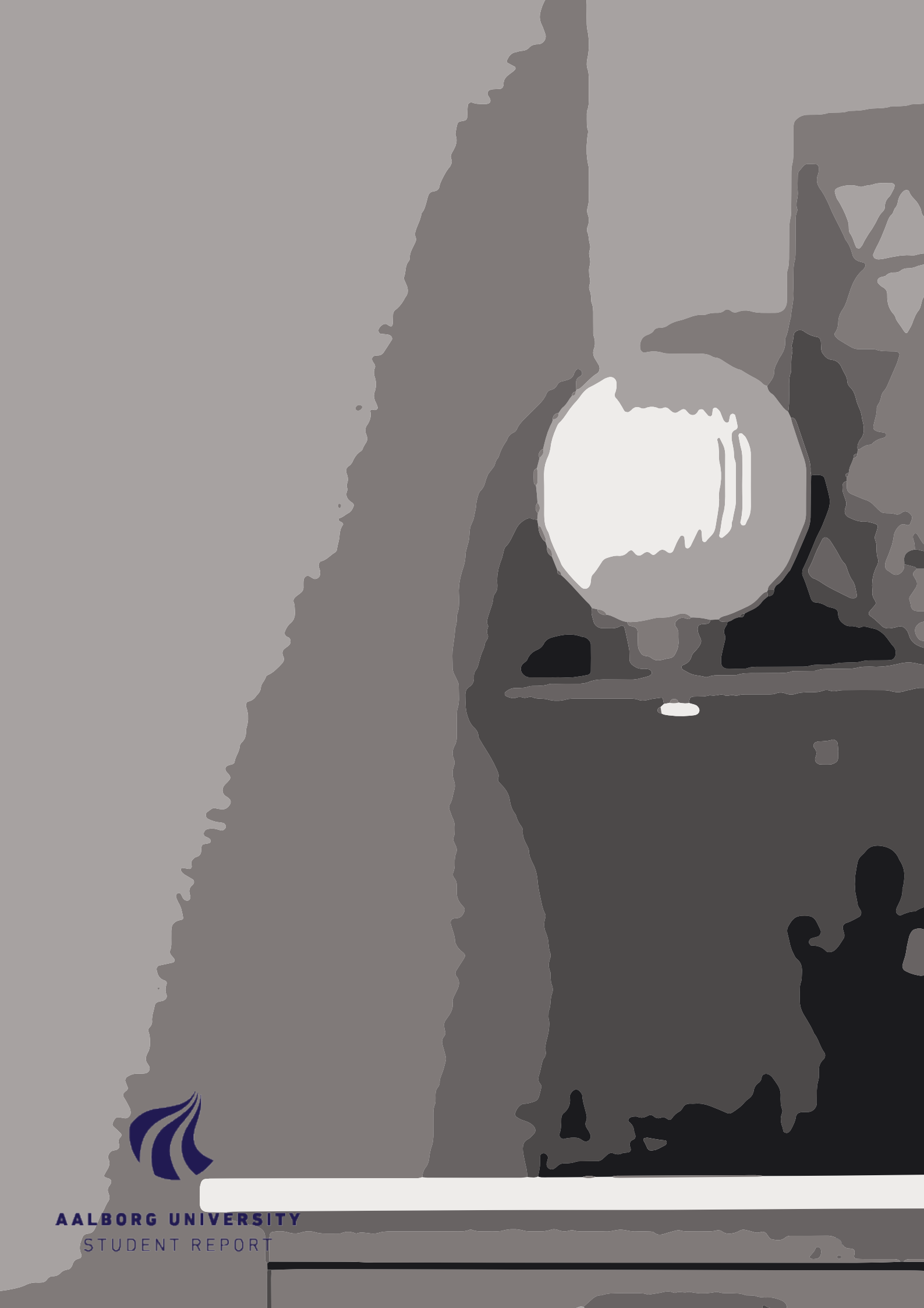
Thermex (2020b) Yellow line - Catalogue. Available at: https://issuu.com/thermex/docs/dk_thermex_yellowline_2020?fr=sNTEwMTEzMTgyMDY (Accessed: 1 June 2020).

Thermex (no date) Hvilken emhætte passer bedst til dit køkken? Available at: https://www.thermex.dk/emhaetter/emfang (Accessed: 1 June 2020).

Thielicke, W. (no date) Computer graphic of a lotus leaf surface, 6/12-2007. Available at: https://en.wikipedia.org/wiki/Lotus_effect#/media/File:Lotus3.jpg (Accessed: 1 June 2020).

WhiteAway (no date) Central Gemini III. Available at: https://www.whiteaway.com/hvidevarer/emhaette/indsats-emhaette/product/thermex-central-gemini-iii/?gclid=CjwKCAjwqpP2BRBTEiwAfpiD-_DIEbUfx61f4c51-xoYf9ZqP9YmOcm616-rll13ju-tjetZoK4SCRoCTCAQAvD_BwE (Accessed: 1 June 2020).

Willemoes, S. (no date) HVEM KØBER HVAD PÅ NETTET?, 28/2-2017. Available at: https://www.fdih.dk/nyheder/2017/februar/hvem-kober-hvad-pa-nettet (Accessed: 1 June 2020).



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