IDENTIFICATION OF EVERYDAY FOOD-RELATED BEHAVIOUR PATTERNS WITH HIGH POTENTIAL FOR DIRECT AND INDIRECT ENERGY SAVINGS

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BEHAVE CONFERENCE
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Nowadays, electricity consumption associated with food-related everyday behaviours is significantly increasing due to the situation of covid-19, which continuously forces people to cook mostly at home.

If the estimate of energy usage associated with cooking was previously determined by 2-7% of the total electricity consumption from the household’s total energy demand, then today this figure has grown up to 15-20%.
STUDY SCOPE

The experimental study was designed to examine in detail the behaviours of tenants at KTH Live-in-Lab to identify individual food-related behaviour patterns with the low, medium, and high level of energy saving potential.

Despite the small study group, we tried to focus specifically on identifying behavioural patterns that are associated with individual choices of a particular persona profile and its impact on energy consumption. Such patterns can be identified and tracked at the individual level, and only then proceed to a larger-scale experiment.
KTH Live-in-Lab testbed

*KTH Live-in Lab is a platform of multiple testbeds for accelerating innovation rates in the construction and real-estate sectors.*

4 apartments are living laboratory, 300 apartments are passive laboratory for the scale up
DESIGN RESEARCH METHODOLOGY

1. Exploration
   - Ethical approval
   - Data strategy
   - Persona making

2. Direct energy usage
   - Data collection
   - Feedback loop
   - Personalised prescriptions

3. Indirect energy usage
   - Data collection
   - Feedback loop
   - Personalised prescriptions

Policy prescription
   - Behavioural insights for policy making

Policy evaluation

300 students persona making survey
4 experimental apartments for active R&D
300 students feedback loop & scale up … or continue to iterate
KTH Live-in-Lab: Personas

Based on the survey (125 / 300)

5 personas were created, 4 were represented at living laboratory

- **Busy**: 35%
  - ‘I want to be more environmentally friendly, but I have no time’

- **Doesn’t matter**: 25%
  - ‘I just don’t care’

- **Gourmet**: 17%
  - ‘I LOVE food and it is a huge source of pleasure for me’

- **Veggie**: 14%
  - ‘I do care about planet and ethics of food’

- **Athlet**: 9%
  - ‘Food is a fuel for my body’
RESEARCH BOUNDARIES

S1: Individual

Activities, preferences, physiological and emotional signals

S2: Kitchen

Home appliances (electricity)

S3: Apartment

Building systems (lightning, water, electricity)

S4: City (shops, markets, cafes)

Logistic (distance, type of delivery)

Food related information
FOOD SUPPLY CHAIN: INDIVIDUAL LEVEL OF INTERACTION

Production → Processing → Packaging → Trade → Household → Waste

Transport

Accessing
Acquisition
Delivery

Cooking
Eating
Storing

Disposal

Direct energy use

Indirect energy use
DATA COLLECTION

Food supply chain data

- Trade
- Household
- Waste

Food bills
Data:
- Product name
- Product code
- Price

Meta data:
- Store location
- Item country of origin
- Item type of package
- Item temperature of storing
- Timestamp

Electricity meters
Data:
- Electricity usage: oven, microwave, stove, plugs over the kitchen

Meta data:
- Type of home appliance
- Preparation type
- Timestamp

Food pictures
Data:
- Image of each meal

Meta data:
- Size of the portion
- Preparation type
- Timestamp

Bin sensors
Data:
- Weight of: Mixed waste, plastic, carton / paper, glass, metal

Meta data:
- Timestamp

Personal data

Daily survey
Data:
- Meal content description
- Preparation type
- Eating alone / Together
- Quantity of leftovers

Meta data:
- Timestamp

Wearable device
Data:
- Activity rate
- Sleeping rate

Meta data:
- Timestamp
### FOOD RELATED ACTIVITIES ENERGY ANALYSIS: 1 MONTH PERIOD

<table>
<thead>
<tr>
<th>Food related activity</th>
<th>‘GOURMET’</th>
<th>‘BUSY’</th>
<th>‘ATHLET’</th>
<th>‘VEGGIE’</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Energy use (direct)</td>
<td>Energy use (indirect)</td>
<td>Potential for energy saving</td>
<td>Energy use (direct)</td>
</tr>
<tr>
<td>Acquisition</td>
<td>-</td>
<td>28 kWh</td>
<td>High</td>
<td>-</td>
</tr>
<tr>
<td>Delivery</td>
<td>-</td>
<td>1.2 kWh</td>
<td>Low</td>
<td>-</td>
</tr>
<tr>
<td>Cooking</td>
<td>30 kWh</td>
<td>-</td>
<td>High</td>
<td>15 kWh</td>
</tr>
<tr>
<td>Eating</td>
<td>2.4 kWh</td>
<td>-</td>
<td>Low</td>
<td>2.4 kWh</td>
</tr>
<tr>
<td>Storing</td>
<td>6.4 kWh</td>
<td>-</td>
<td>-</td>
<td>6.4 kWh</td>
</tr>
<tr>
<td>Cleaning</td>
<td>1.8 kWh</td>
<td>-</td>
<td>Low</td>
<td>1.8 kWh</td>
</tr>
<tr>
<td>Packaging</td>
<td>10 kg</td>
<td>High</td>
<td>7 kg</td>
<td>High</td>
</tr>
</tbody>
</table>

### Energy use (direct): kWh
- **Acquisition:** 28 kWh
- **Delivery:** 1.2 kWh
- **Cooking:** 30 kWh
- **Eating:** 2.4 kWh
- **Storing:** 6.4 kWh
- **Cleaning:** 1.8 kWh
- **Packaging:** 10 kg

### Potential for energy saving:
- **High**
- **Low**
## Behavioural Strategies for Each Persona

<table>
<thead>
<tr>
<th></th>
<th>Gourmet</th>
<th>Busy</th>
<th>Veggie</th>
<th>Athlet</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Acquisition</strong></td>
<td>Buy less processed food</td>
<td>Buy less processed food</td>
<td>-</td>
<td>Buy less processed food</td>
</tr>
<tr>
<td><strong>Cooking</strong></td>
<td>Low energy cooking recipes</td>
<td>Preparing more leftovers</td>
<td>Preparing more leftovers</td>
<td>Preparing more leftovers</td>
</tr>
<tr>
<td><strong>Packaging</strong></td>
<td>Buy less packaged food</td>
<td>Buy less packaged food</td>
<td>-</td>
<td>Prepare own snacks</td>
</tr>
</tbody>
</table>

*Taste is important* | *Time is important* | *Ethics is important* | *Sport diet is important*
POTENTIAL FOR ENERGY SAVING: DIRECT & INDIRECT

4 Living laboratory apartments

- Direct: 18-20% per month
- Indirect: 7-12% per month

300 students' apartments

- Direct: 10-15% per month
- Indirect: 5-10% per month
1. **Trade**: most of the decisions about food related behaviours are happening in the grocery store and we need to rethink the acquisition process (zoning, labelling, etc)

2. **Household**: motivate kitchen appliances producers design not only default ‘ECO’ functions, but build upon the products assistive services to interact with the end-users
“We must design for the way people behave, not for how we would wish them to behave.”

— Donald A. Norman | Living With Complexity
KTH LIL CHEFS

The Barista
Jamie Oliver Daughter
Leak Tart Expert
Pizza Builder

THANK YOU +
## APPENDIX

<table>
<thead>
<tr>
<th>1. Baked meal</th>
<th>Wh</th>
<th>2. Long cooking recipes</th>
<th>Wh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homemade pizza</td>
<td>1284</td>
<td>White bean dish (tomato, bacon)</td>
<td>881</td>
</tr>
<tr>
<td>Leak pie</td>
<td>1080</td>
<td>Vegan tikka massala</td>
<td>846</td>
</tr>
<tr>
<td>Baked chicken with veggies</td>
<td>1262</td>
<td>Stew chicken</td>
<td>822</td>
</tr>
<tr>
<td>Self made bagels</td>
<td>1155</td>
<td>Soup (kale, onion, carrot, leak, potatoes)</td>
<td>681</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cooked veggies and rösti</td>
<td>691</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Pasta with homemade sauce</td>
<td>561</td>
<td>Boiled potato or mashed potato</td>
<td>177</td>
</tr>
<tr>
<td>Rice with chicken in sauce</td>
<td>405</td>
<td>Scrambled eggs (+bacon)</td>
<td>187</td>
</tr>
<tr>
<td>Curry with vegetables</td>
<td>457</td>
<td>Boiled eggs</td>
<td>132</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Instant noodle</td>
<td>114</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>246</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>105</td>
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</tbody>
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