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- Food waste monitoring and energy
- Results
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- Summary
Food waste
Aspects of food wastage

• social
• ethical
• ecological
• economical
Value chain

Agriculture

Industry and crafts

Trade

Consumption

Value chain

Agriculture

Food processing

Trade

Consumption
Losses vs. wastes

- Agriculture
- Food processing
- Trade
- Consumption
  - Out-of-home
  - Households

FOOD LOSSES
- Optimization potential
  - Waste
  - Donation

FOOD WASTE
- Avoidable
- Partially avoidable
- Unavoidable

Quelle: (Hafner, 2014)

Food waste

- Unavoidable
  - Preparation residues
    - (e.g. bones, peeling residues)

- Partially avoidable
  - Food leftovers
    - (e.g. cooked noodles, rice, bread crust, etc.)

- Avoidable
  - Food
    - (not eaten, not marketable, etc.)
**Food waste in Germany**

- **households**
- **6.68 Mio. t**

  - **avoidable**: 3.14 Mio. t
  - **partially avoidable**: 1.2 Mio. t
  - **unavoidable**: 2.34 Mio. t

  Total: 53 kg/(cap*a)

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**Food losses worldwide**

- **FAO study (2011)**
  - 1.3 billion tons of food waste worldwide every year.
  - 1/3 of all food produced worldwide is thrown away.

- **EU-study FUSIONS (2016)**
  - 88 million tons of food waste in Europe per year.
  - 20% of all EU-wide produced food is thrown away.
United Nations prevention target

-50 %
Food losses until 2030

research projects
related to monitoring + energy
Energy savings through waste avoidance

Potential for energy saving by avoiding food waste in Bavaria
(2014 - 2015)

Results (excerpt)

Energy savings through waste avoidance

Primärenergetisches Einsparpotenzial durch Vermiedene Lebensmittelverluste 2011 [TJ/a]
EnKü – Energy efficient kitchen

1. Determining the actual situation

2. Identification of energy-intensive areas
EnKü – Energy efficient kitchen

3. Power consumption measurements
4. Calculation of CO₂-emissions

Local vs. food from abroad // fresh vs. convenience

**Energetischer Rucksack (ausgewählte Beispiele)**

<table>
<thead>
<tr>
<th>Item</th>
<th>Local CO₂-eq (kg)</th>
<th>Foreign CO₂-eq (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obst</td>
<td>0.16 (Inland)</td>
<td>3.89 (Inland)</td>
</tr>
<tr>
<td>1.8 (Ship transport)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Obst</td>
<td>0.17 (Inland)</td>
<td>1.8 (Ship transport)</td>
</tr>
<tr>
<td>0.3 (Foreign)</td>
<td></td>
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</tr>
<tr>
<td>Frisch</td>
<td>0.16 (Inland)</td>
<td>3.89 (Inland)</td>
</tr>
<tr>
<td>4.3 (Foreign)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Angaben in kg CO₂-eq pro kg Lebensmittel
- Angaben beziehen sich auf konv. Anbau

Gerold Hafner
Naxos/ 13 June 2018
**EnKü – Energy efficient kitchen**

Animal-based food vs. plant based food

**ENKÜ – Energetischer Fußabdruck**

**CO₂-Emissionen von Lebensmittel**

<table>
<thead>
<tr>
<th>Tierische Lebensmittel</th>
<th>Pflanzliche Lebensmittel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rindfleisch</td>
<td>Biatsalat</td>
</tr>
<tr>
<td>Schweinefleisch</td>
<td>Kartoffel</td>
</tr>
<tr>
<td>Geflügel</td>
<td>Apfel</td>
</tr>
<tr>
<td>Vollmilch</td>
<td>Karotte</td>
</tr>
<tr>
<td>Joghurt</td>
<td>Gurke</td>
</tr>
</tbody>
</table>

14,00 kg CO₂/kg LM

0,08 kg CO₂/kg LM

Food waste in project kitchens

- Fachbereich Lebensmittelwesen und Tourismus
- Fachbereich Wirtschafts- und Sozialwissenschaften
- Maßnahmen: 13 Juni 2018

Food waste per meal [g/Portion]

- Winter
- Summer
- Christmas
- Pentecost

- Food waste per week
- Wochenmittel an LMA pro verkaufter Hauptseise
- Anzahl verkaufter Hauptspeisen pro Woche
Origin of food waste

Avoidable food waste

Schulrückläufe
Teilerreste
Überproduktion
Produktionsverluste

46%
74%
40%
90%
Food waste related to food input

<table>
<thead>
<tr>
<th>Institution</th>
<th>Quantity per year [kg/year]</th>
</tr>
</thead>
<tbody>
<tr>
<td>BSH Navitas</td>
<td>8%</td>
</tr>
<tr>
<td>WWK</td>
<td>13%</td>
</tr>
<tr>
<td>InfraServ</td>
<td>6%</td>
</tr>
<tr>
<td>Campus</td>
<td>33%</td>
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</tbody>
</table>

Summe der eingekauften Lebensmittel
Summe vermeidbarer Lebensmittelabfall

Surplus production

<table>
<thead>
<tr>
<th>Institution</th>
<th>Hauptkomponente</th>
<th>Beilagen</th>
<th>Vorspeise</th>
<th>Dessert</th>
<th>Gemüsebeilagen</th>
<th>Salatbuffet</th>
<th>Suppe</th>
<th>Saucen</th>
</tr>
</thead>
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<td>BSH</td>
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</table>
Composition of energy consumption

- Ventilation: 35%
- Heating: 9%
- Hot water preparation: 6%
- Kitchen processes: 25%
- Lighting: 6%

Energy consumers

**Infraserv**
- 3 Kombidämpfer: 25 kWh/day
- Topfspülmaschine: 20 kWh/day
- 2 Wärmebecken: 15 kWh/day
- 2 Kippbratpfannen: 10 kWh/day
- 1 Wärmebecken: 5 kWh/day
- 2 Vario Cooking Center: 10 kWh/day
- Kipper links: 5 kWh/day
- Gläserspülmaschine: 5 kWh/day

**Campus**
- Doppelkammerspülm...: 50 kWh/day
- Kombidämpfer 1: 20 kWh/day
- Kombidämpfer 2: 15 kWh/day
- Freezer: 10 kWh/day
- Chiller: 10 kWh/day
- Großkochfeld: 5 kWh/day
- 2 Tiefkühlschränke: 5 kWh/day
- 3 Kühlzellen: 5 kWh/day

Legend:
- red: Lüftung
- blue: Kühlung
- orange: Spülen
- green: Andere
Recommendations (excerpt)

Operation
- Switching the equipment on and off according to necessity.
- Filling heating basins with warm instead of cold water,
- better utilization of dishwashers and refrigerators.

Selection of food
- Reduction of food with high energy demand.

Equipment
- Replacement of old and inefficient devices.

example

Heating basins – status quo ante
example

Heating basins – after optimization

Covering of basin

Energy saving: 10%

Filling with warm water

Energy saving: 29%

example

Heating basins – switch on when needed

Adapted switch on management

Energy saving: 14%

Stepwise switch off

Energy saving: 32%
ENERGY CONSUMPTION PER PORTION

<table>
<thead>
<tr>
<th></th>
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<th>InfraServ</th>
<th>Campus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main courses [portions/year]</td>
<td>160,447</td>
<td>126,578</td>
<td>215,481</td>
<td>38,725</td>
</tr>
</tbody>
</table>

GHG EMISSIONS FROM ENERGY CONSUMPTION

emission factors:
- Electricity ~ 0.61 – 0.65 [kg CO₂e per kWh]
- Heat ~ 0.20 – 0.27 [kg CO₂e per kWh]

The majority of GHG emissions are due to electricity consumption and thus above all to kitchen processes.

source: GEMIS
A2UFood - Avoidable and Unavoidable Food Wastes
A Holistic Managing Approach for Urban Environments, 2018 - 2021
http://www.uia-initiative.eu

- Heraklion, Crete (GR)
- monitoring + system optimisation in hotels
- restaurant for surplus food
- Production of plastics from food waste

Tools for industry, households and small restaurants, 2018 - 2020

- industry partner: Bizerba
- Zollernalbkreis, (district in Baden-Württemberg)
- Ministry of the Environment Stuttgart
- Canteens, restaurants, households in the district
Monitoring Tools

If you can't measure it, you can't manage it.

(Was man nicht messen kann, kann man nicht kontrollieren.)

Alliance against food losses of Bavaria
„We save food!“

Bündnis
Wir retten Lebensmittel!

Eine Initiative von
Bayerisches Staatsministerium für
Ernährung, Landwirtschaft und Forsten

RESOUCEREMANAGER FOOD

RESOUCEREMANAGER-FOOD

Wegung  »  Erfassung  »  Echtzeit Visualisierung  »  Einsparung

In cooperation with
RESOURCENAGER FOOD

composition

The measuring system consists of:

- All-in-One-PC or Tablet
- electronic scale (USB)
- Software and user interface: RESOURCEMANAGER-FOOD

RESOURCENAGER FOOD

User interface
measured facilities:
• hotels,
• company canteens,
• care,
• university canteens
• school cantines
• food vending machines
• catering events
• system gastronomy

measurement results (example)
Food waste at the breakfast buffet
Food waste "food vending machine" measurement results (example)

food vending machine (KW 17 - KW 24, 2017)

Produktion (Stück)  Verwurf (Stück)  Verlustquote (%)

Quelle: http://www.crane-gmbh.de (2017)
RMFOOD Mobile
RMFOOD.DE

Local system: Hardware + Software

Online-System

RMFOOD.DE

Mobile Website Features:

• Enter measurement data online
• Weighing or quantity recording
• Online data processing
• Visualization and Benchmarks
• Free use

www.rmfood.de
Titel der Präsentation

RESOURCENAMEanager FOOD - ONLINE
www.rmfood.de

RESOURCENAMEanager FOOD - ONLINE
www.rmfood.de
Conclusions (excerpt)

• 15% reduction of energy consumption (average)

• Most of the measures can be implemented quickly and easily, usually with economic advantages

• External incentive necessary, e.g. awareness raising (measuring / monitoring), consulting, training and support during implementation phases.

• Significant reduction of GHG
Thank you very much!

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