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ENVAC OPTIBAG

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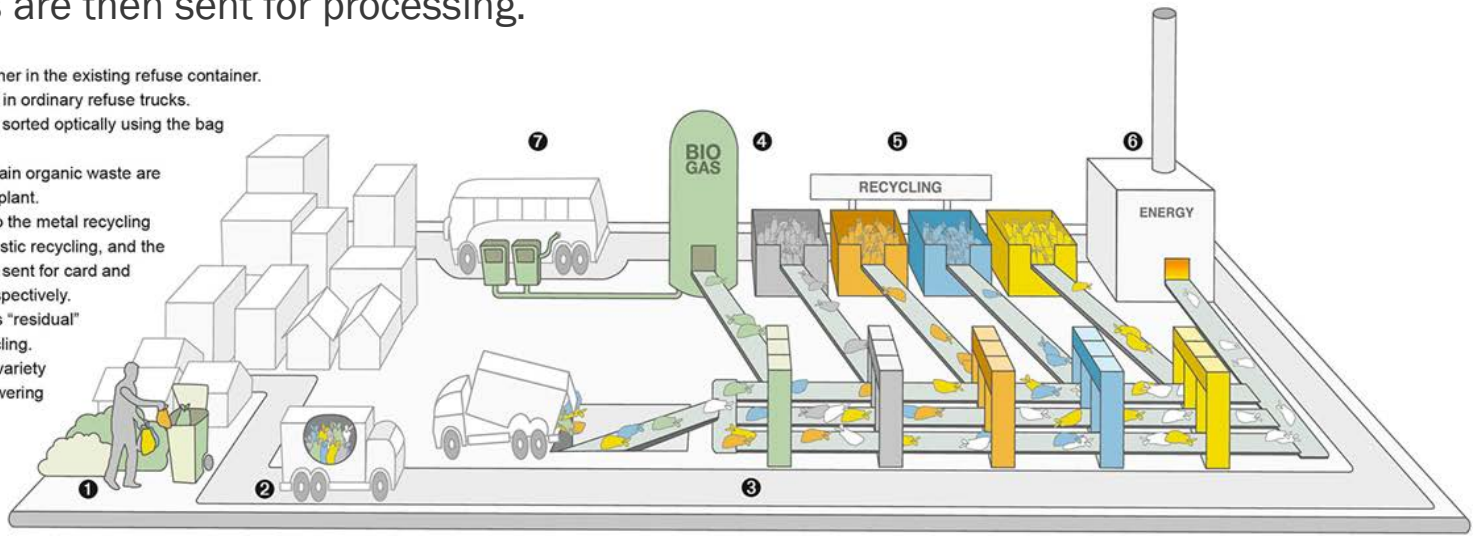
Optibag Concept

- Solid waste is source segregated into different colored bags.
- All bags are collected and transported in conventional garbage trucks or an Envac system.
- The bags are optically sorted into the relevant fractions at the Optibag plant.
- Fractions are then sent for processing.

1. All bags are placed together in the existing refuse container.
2. The refuse is transported in ordinary refuse trucks.
3. At the plant, the refuse is sorted optically using the bag colours.
4. The green bags that contain organic waste are separated for the biogas plant.
5. The grey bags are sent to the metal recycling section, the orange to plastic recycling, and the yellow and blue bags are sent for card and newspaper collection, respectively.
6. Other waste is classed as "residual" and sent for energy recycling.
7. The biogas is used for a variety of purposes including powering the local buses.



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The Optibag Approach

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Easy to understand and perform

- One colour for each fraction

- One bin for all fractions

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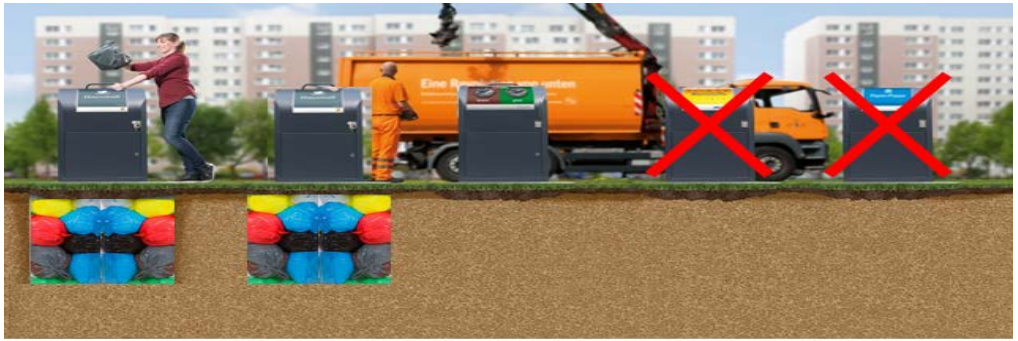
Optibag is compatible with most collection methods



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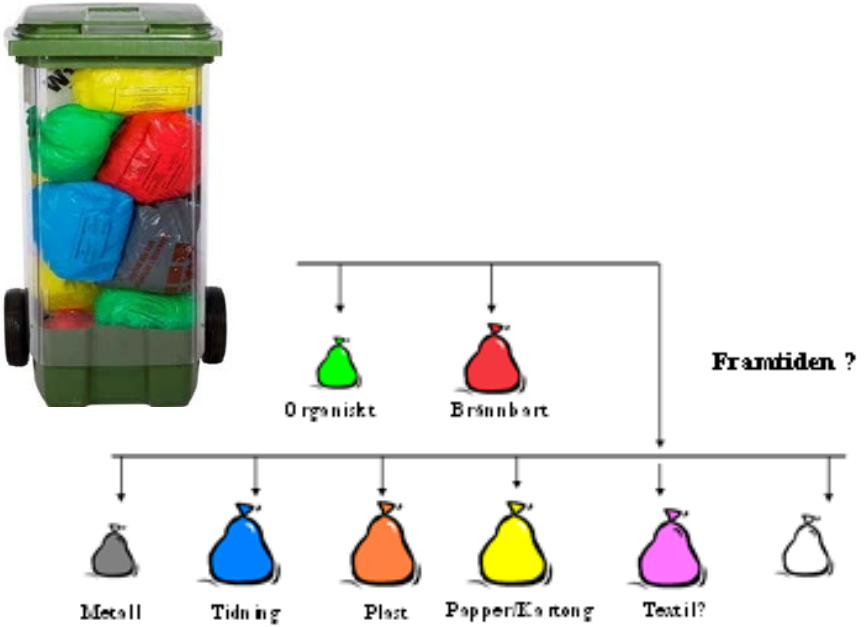
A flexibel System

- Easy to add future fractions.
  - (Textile in the near future?)
- Optimum utilization of bin volume.
- Rational logistics / minimized by transport.
- Waste generation/fractions change with time.



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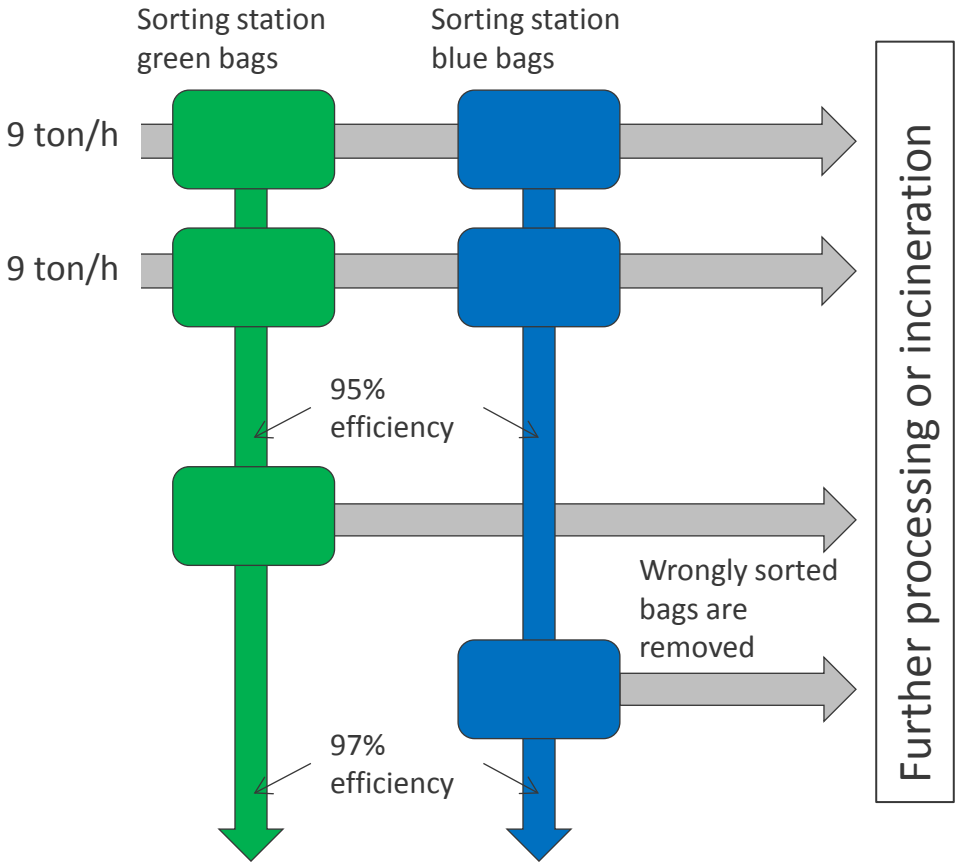
Key figures

- Capacity of up to 9 ton/hour per sorting line, which corresponds to about 8,000-9,000 bags/hour.
- Real power consumption at 3-5 kWh/ton sorted waste.
- Purity of sorted bags 95%.
- An optional after-sorting station increases the efficiency to 97% as wrongly sorted bags can either be returned to receiving bunker or are transported further treatment.
- Guideline for maintenance & repair costs 0.5-1% of capex per year for one-shift operation



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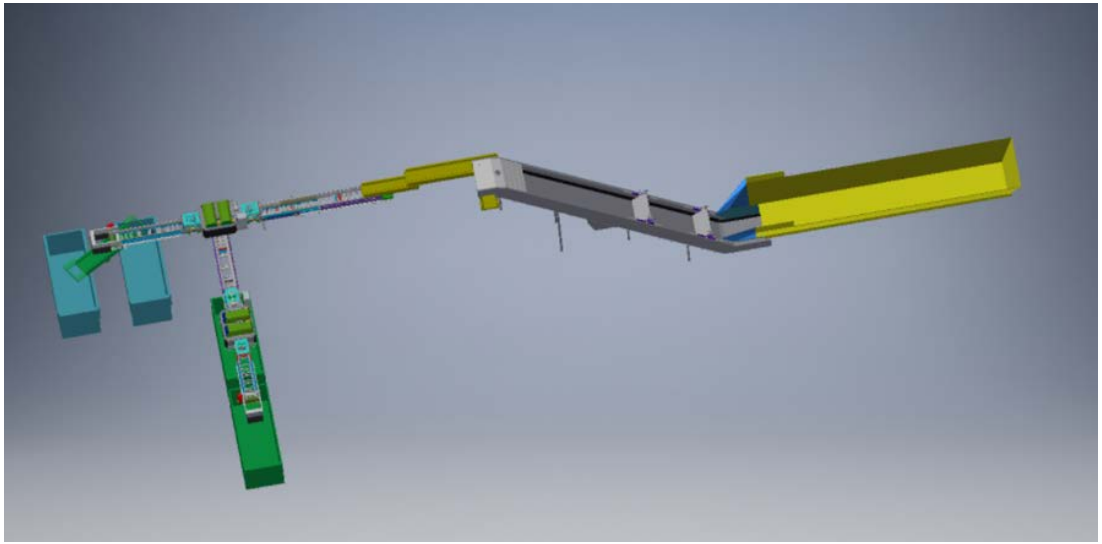
1 LINE / 2 FRACTIONS / 9 TONS



- Lines: 1
- Fractions: 2
- Capacity: 9 ton/hour
- TPY: 18,000-36,000
- Building area: 1,000m^2

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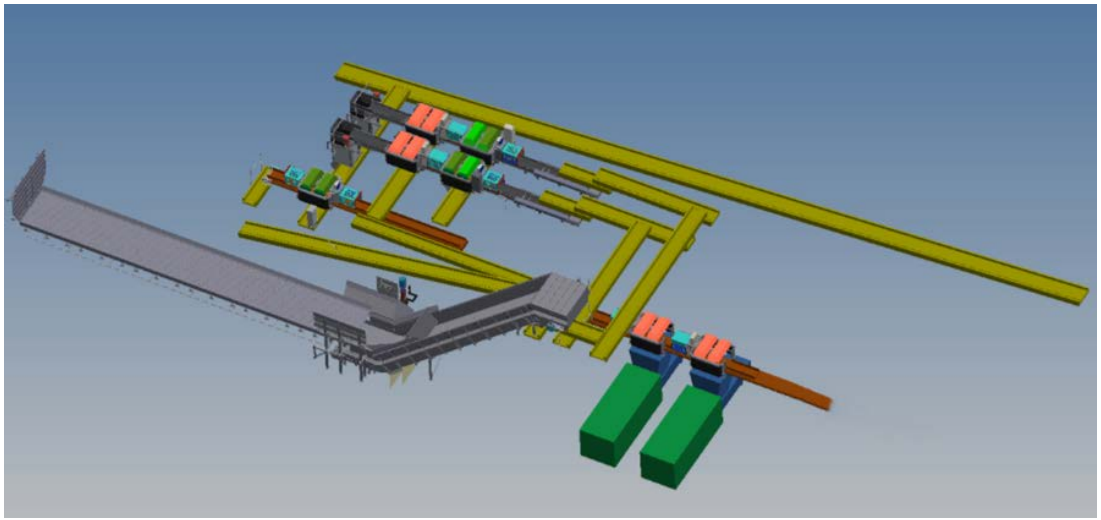
2 LINES – 4 FRACTIONS – 18 TONS



- Lines: 2
- Fractions: 4
- Capacity: 18 ton/hour
- TPY: 36,000 - 72,000
- Building area: 1,000 - 1,500m^2

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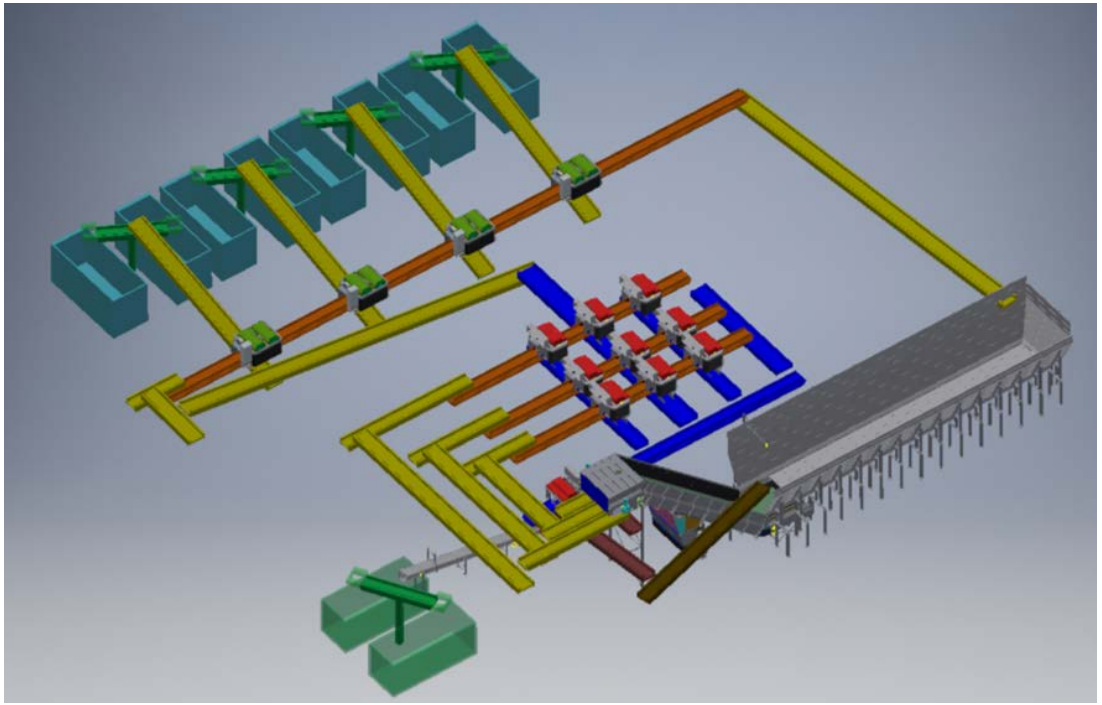
3 LINES – 6 FRACTIONS – 27 TONS



- Lines: 3
- Fractions: 6
- Capacity: 27 ton/hour
- Tonnage/year: 54,000 – 108,000
- Buildng area: 1,500 – 3,000m^2

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Optibag Service

- Support
  - On phone or on location.
- Service agreement
  - Service inspections
  - Technical support
  - System security package
- Spareparts
  - Fast delivery of critical parts for customers with service agreement. order@optibag.se
- Feedback
  - Exchange of experience in our closed Facebook group and at our popular usergroup meetings.

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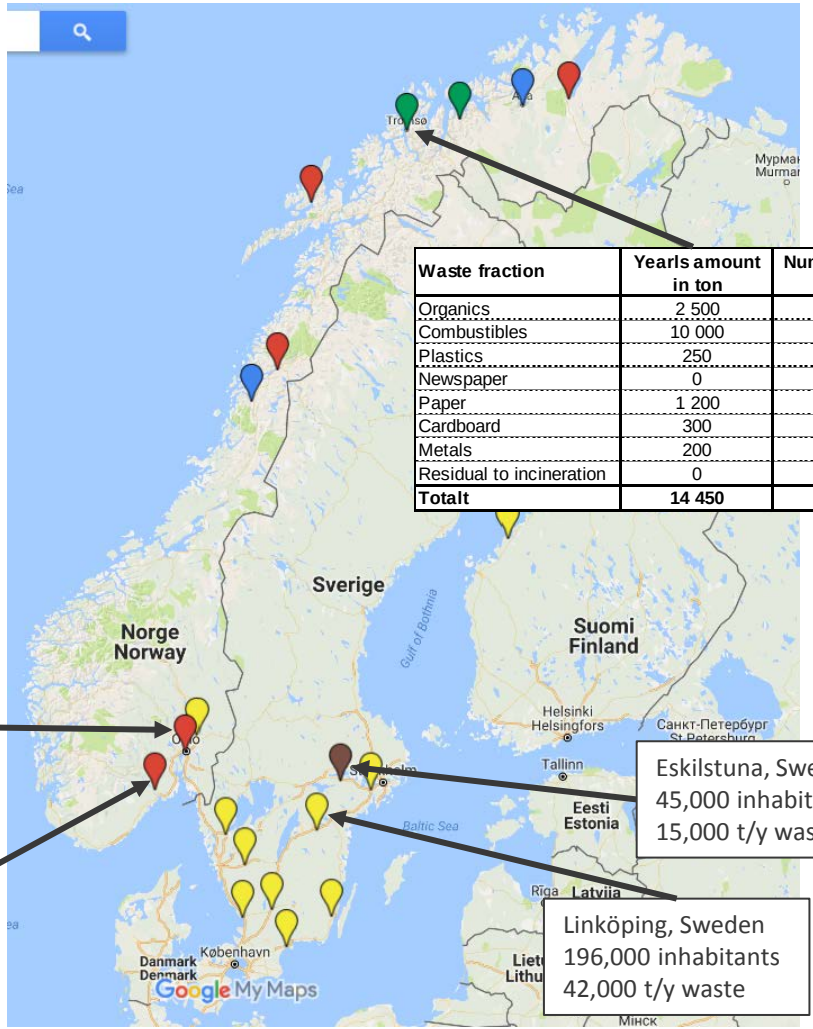
Reference installations

Number of sorted fractions

- 2 fractions
- 3 fractions
- 4 fractions
- 5 fractions
- 6 fractions

First installed plant is still in operation since 1994.

In total, more than 2 million users are connected to an Optibag plant



Waste fraction	Yearls amount in ton	Number of bags per year
Organics	2 500	5 000 000
Combustibles	10 000	7 500 000
Plastics	250	2 300 000
Newspaper	0	0
Paper	1 200	2 300 000
Cardboard	300	2 000 000
Metals	200	N/A
Residual to incineration	0	0
Totalt	**14 450**	**19 100 000**

Oslo, Norway
580,000 inhabitants
150,000 t/y waste

Skien, Norway
112,000 inhabitants
25,000 t/y waste

Eskilstuna, Sweden
45,000 inhabitants
15,000 t/y waste

Linköping, Sweden
196,000 inhabitants
42,000 t/y waste

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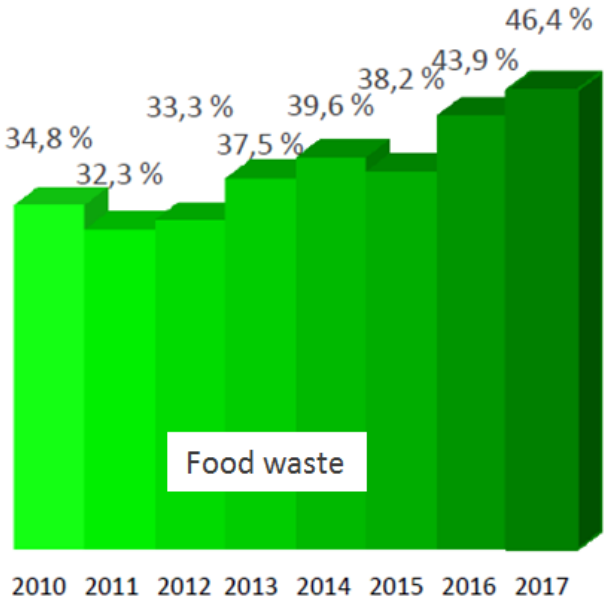
Food waste collection in Oslo, Norway - 2017

- Optical sorting was made a compulsory system for the entire city area
- Target: 50% food waste recovery by 2018.
- Optical sorting was built 2009/2010 at two sites
  Klemetsrud: 50,000 ton/year
  Haraldrud: 100,000 ton/year
- 3 fractions: food waste in green bags
  plastic packaging in blue bags
  residual waste in any other coloured bag
- Both sorting plants are linked to waste incinerators with a district heating network as well as power generation
- **Target of 50 wt% food waste collection by the year 2018**
  In 2017: 46.4% was collected



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NOW 7 FRACTIONS IN ESKILSTUNA

Food waste	Green bag
Metal packaging	Grey bag
Plastic packaging	Orange bag
Paper packaging	Yellow bag
Newspaper	Blue bag
Other household waste	Any other
Texiles	Purple bags

No investment cost at plant for extra fraction!

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Some impressions from delivered plants

Sorting paddle ”hitting” a green bag

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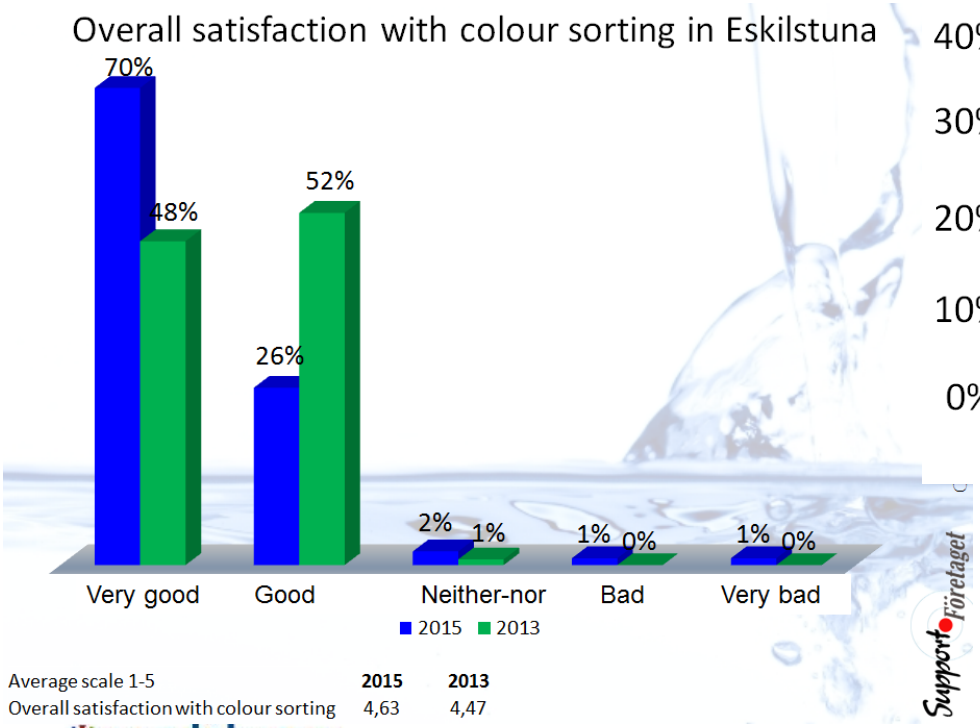
Customer satisfaction with optical sorting in Sweden



Average scale 1-5	2015	2013
Overall satisfaction with colour sorting	4,63	4,47

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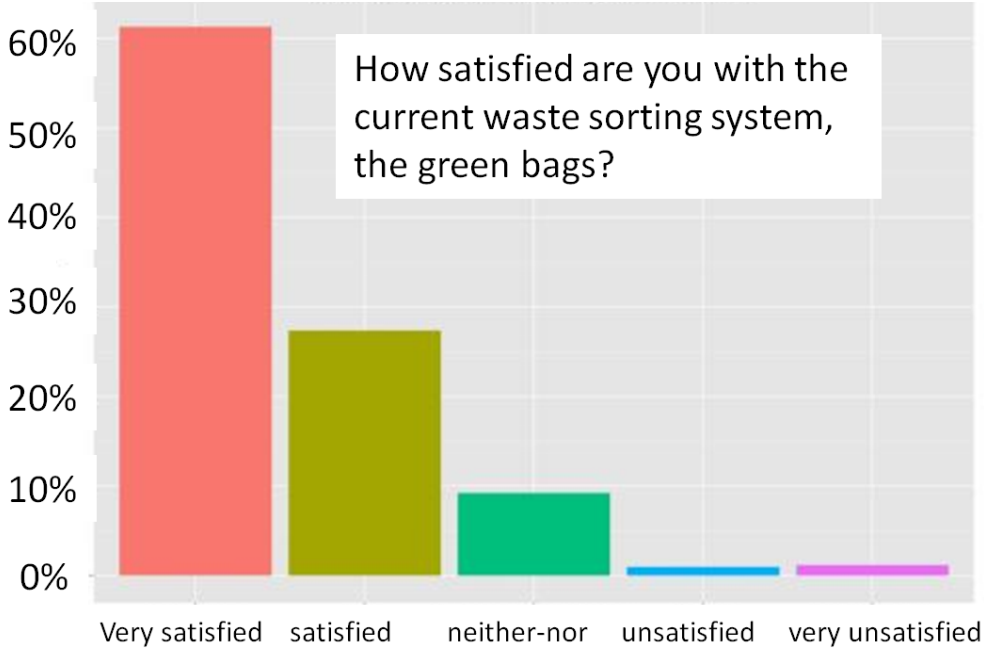

Trucks

- No special Optibag trucks
- Most client use 2- or three 3-axis trucks.
- Back-loaders or side-loaders mostly used. Side-loaders gain more attractiveness due to reduced staff need.
- In some areas in the country-side, only side-loaders may be used as no personnel is allowed to leave the truck without safety car behind them. Risk of being hit by another car on roads with 70 or 90 km/h speed limit.
- Load level between 5 and 12 tons on average

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Bags

- The bags are included in a closed system and must be recycled!
- Recycled plastic bags are used in Linkoping.
- On the market there are also degradable plastic bags and paper bags that work for optical sorting.
- This is circular economy in practice.
- Bags also designed for collection via Envac system.

Bags for waste collecting - plastic vs. non-plastics

- Different materials have been tested successfully
  - Bio-plastics from either ethanol or forest residues
  - Plastics bags from recycled material
  - Conventional plastic bags

- We believe bags from recycled plastics give the best environmental performance at best cost-benefit ratio.
- Bio-plastics which are compostable are a preferred option but further development and/or cost reduction is required in terms of consumer adaption.
- Paper bags are not yet strong enough for very wet wastes like yoghurt etc.
- Some paper bag are being trialed for collecting dry waste.

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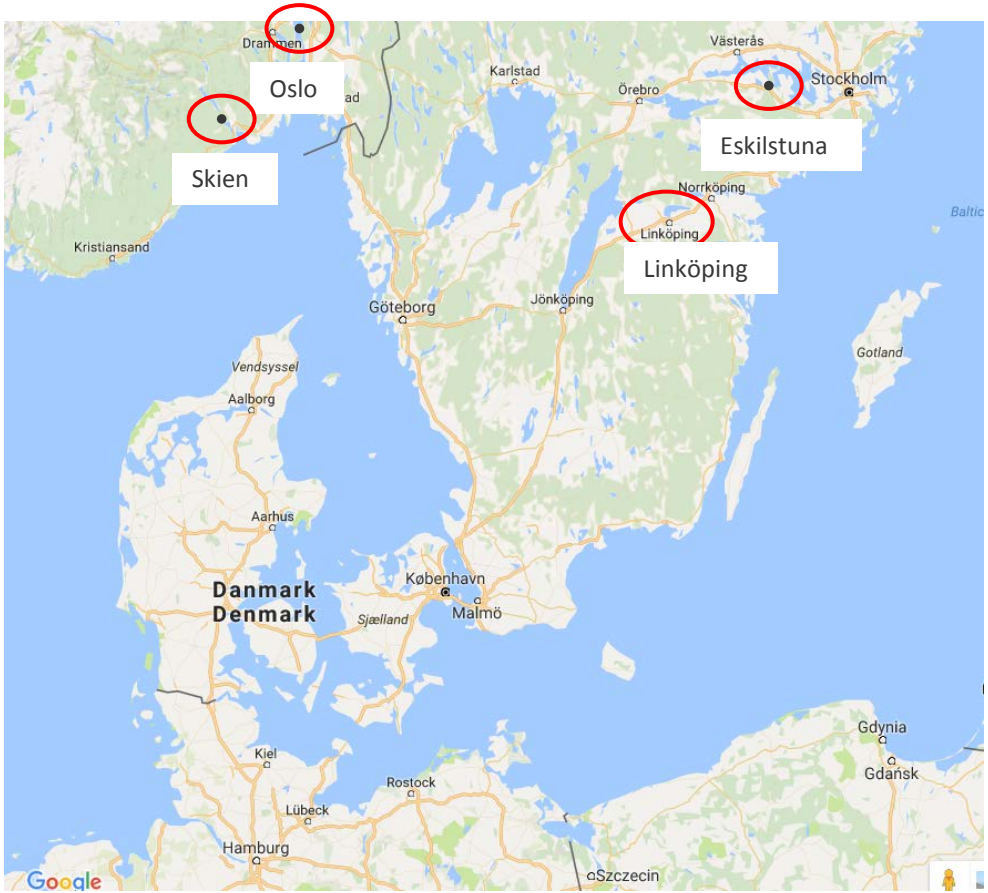
Possibility for study visits

Different installations can easily be visited

- Eskilstuna, 6 fractions (food waste, plastics, newspaper, paper, metal and residual)
  ca. 15,000 t/y
- Linköping, 2 fractions (food waste and residual)
  ca. 42,000 t/y
- Oslo, 3 fractions (food waste, plastics and residual)
  ca. 100,000 t/y
- Skien, 3 fractions (food waste, plastics and residual)
  ca. 25,000 t/y



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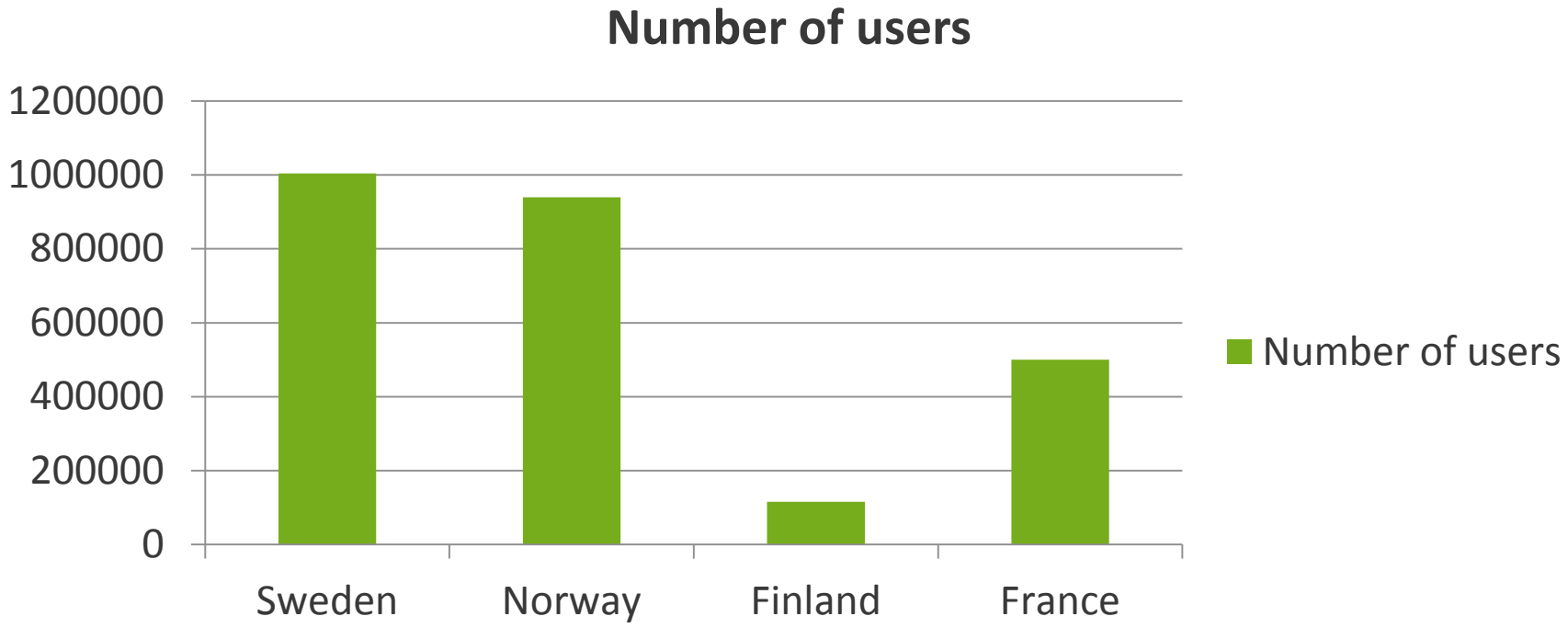
TOTAL NUMBER OF USERS



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SMART CITIES
A NEW DEPTH