wasteinprogress

Two districts of Schleswig-Holstein – Germany

Mixed collection system with access control for buildings and identified door to door with DIFTAR

Dennis Kissel
AWSH Abfallwirtschaft Südholstein GmbH

Something about the Referent …

Dennis Kissel

AWSH Abfallwirtschaft Südholstein GmbH
Leineweberring 13
D-21493 Elmenhorst

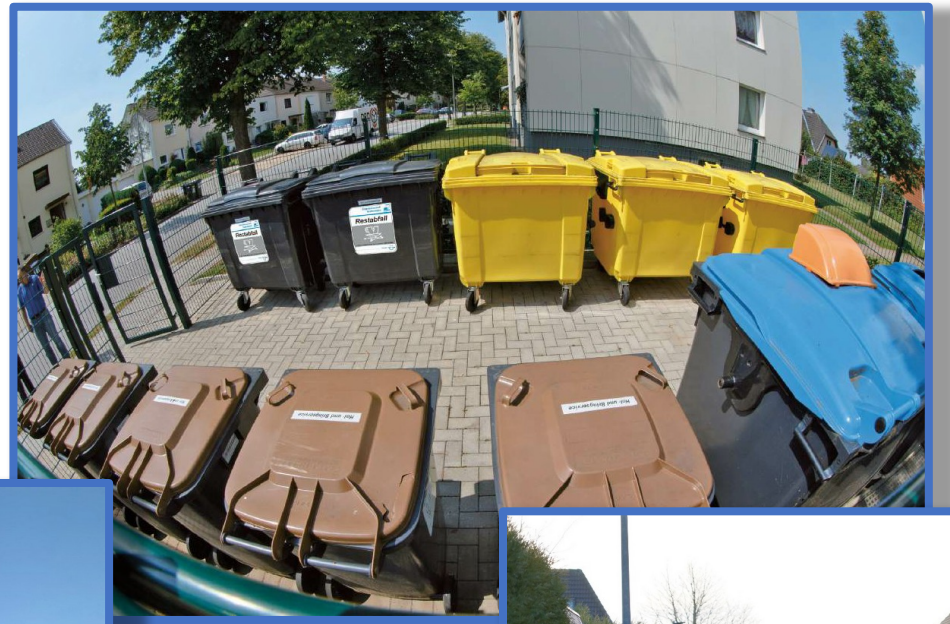
Phone +49 (4151) 87 93 296
Fax +49 (4151) 87 93 5296
E-mail d.kissel@awsh.de

1966	Born in Stade, Lower Saxony
1984	University-entrance examination in Schwarzenbek
1984 -1986	Community Service in Geesthacht (Edmundsthal Foundation)
1987 -1995	Study of Bio-Engineering and Technical Environmental Protection at Hamburg Polytechnic
1988-1994	Programmer at IPSOS, Mölln (Market Research)
1994-1995	Head of Department EDP Mail & Return, Bielefeld (Market Research)
1995-1999	Environmental Officer, Richard Buhck Verwaltungsgesellschaft, Wentorf near Hamburg (Waste Management)
1999-2001	Managing Clerk of Gesellschaft für Dienstleistungsmanagement, Hamburg (Waste Management)
2001-2008	Managing Director of Abfallwirtschaftsgesellschaft Herzogtum Lauenburg mbH, Ratzeburg (Waste Management)
2008-	Managing Director of Abfallwirtschaft Südholstein GmbH, Elmenhorst (Waste Management)
1990-2001	District Councillor (Finance and Environmental Committees, Council Party Group Chairman)

Something about the company and the region…

- is a joint local-authority enterprise, run by the two rural districts of Herzogtum Lauenburg (1,263 km²) and Stormarn (766 km²), which started operating in 1995,
- serves a population of 430,000 inhabitants (212 per km²),
- has around 160,000 private and 5,000 commercial customers,
- owns 520,000 waste containers (residual and biological waste, paper, pasteboard and cardboard, packaging waste), “producing” around 11,600,000 clearances a year,
- disposes of around 220,000 Mg of waste a year
- receives 120,000 customer phone calls and 40,000 e-mails / fax messages a year
- has 135 employees
- runs a network of 13 recycling centres

Pictures



Why do we use bins/containers and not bags?

- Reduction of pollution
  - Bags are destroyed by animals (dogs, cats, raccoons)
  - Bags break during collection
  - Bags are blown away by the wind (plastic waste)
  - …
- Occupational safety measures
  - Easy to handle (wheels!)
  - Employees do not have to lift heavy loads
  - Employees are protected from stab injuries
  - Employees are protected from hazardous substances
  - …
- Control of customers and subcontractors
  - Ident system documents emptied by subcontractors
  - Ident system only allows paid containers automatic lifter stop for unknown containers
  - ….

Our charging system

In Germany, local-authority waste management is financed by charges that every customer (household) must pay to the rural district.

Basic charge per property

Costs associated with the mere existence of a property – e.g., issuing accounts, collecting and administering charges, service centre, recycling centres, ….

Service charge per bin/container in use

Costs DIRECTLY associated with the use of the bin/container – mainly logistical and disposal costs.

The Management Board has proposed to the rural districts that charges based on container emptying should be introduced – unfortunately (so far) without result.

For reasons of waste management,

- one plastic-waste container (240l, 14-day collection)
- as many containers for paper, pasteboard and cardboard as desired (240 l, monthly collection) are free of charge per property.

Our charging system (PAYT 1.0)

Basic charge
For every household (or Building) mandatory.

My household
Charge : 4,76 €/month

Residual waste
One bin for each household (or building) is mandatory.
Minimum 5 litres of volume per capita/week

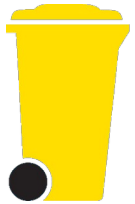
My household
3 persons => 20 litre per week
80-liter-bin, 2 weeks collection period (6,6 litres per capita/week)
Charge : 4,57 €/month

Organic waste
Optional, but in fact mandatory
(Very difficult German law)

My household
240-liter-bin, 2 weeks collection period
Charge : 3,63 €/month

Paper waste
Optional

My household
240-liter-bin, monthly collection period
Charge : -0,31 €/month



Plastic waste
Optional, but in fact mandatory
(Very difficult German law)

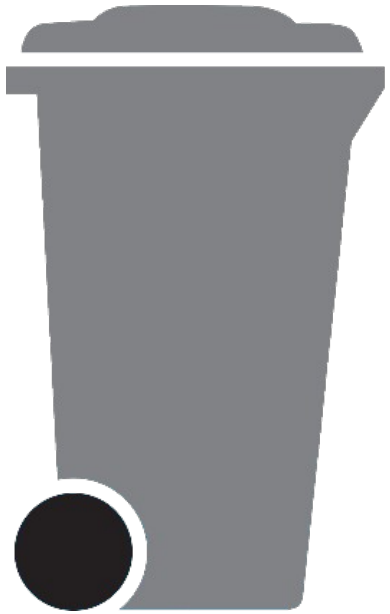
My household
240-liter-bin, 2 weeks collection period
Charge : 0,00 €/month

Total charge 12,65 € per month

The prices for organic waste and plastic waste are not calculated to cover costs

These costs are borne by the charge for residual waste

Collection system for residual waste …



Households

Typ	Volume	Number	every week	every 2 weeks	every 4 weeks	every 8 weeks
2-wheel-bin	40	11.113		6.565	3.716	832
2-wheel-bin	60	48.031		41.085	6.946	
2-wheel-bin	80	45.402		39.648	5.754	
2-wheel-bin	120	25.370		25.370		
2-wheel-bin	240	5.682		5.682		
4-wheel-bin	770	1.547	795	752		
4-wheel-bin	1.100	2.574	1.968	606		
Underground System	3.000	18		11	7	
Underground System	4.000	25	3	11	11	
Underground System	5.000	23		9	14	
Total		**139.785**	**2.766**	**119.739**	**16.448**	**832**
Percentage			**1,98%**	**85,66%**	**11,77%**	**0,60%**

Commercial

Typ	Volume	Number	every week	every 2 weeks	every 4 weeks	every 8 weeks
2-wheel-bin	40					
2-wheel-bin	60	731		723	8	
2-wheel-bin	80	547		542	5	
2-wheel-bin	120	1.075		1.075		
2-wheel-bin	240	1.759		1.759		
4-wheel-bin	770	1.590	621	934	35	
4-wheel-bin	1.100	2.469	1.761	658	50	
4-wheel-bin	2.500	82	53	27	2	
4-wheel-bin	4.500					
4-wheel-bin	5.000	39	25	9	5	
Total		**8.292**	**2.460**	**5.727**	**105**	
Percentage			**1,76%**	**4,10%**	**0,08%**	

Overall

Total		**148.077**	**5.226**	**125.466**	**16.553**	**832**
Percentage			**3,74%**	**89,76%**	**11,84%**	**0,60%**

Collection system for organic waste

Households

Typ	Volume	Number	every week	every 2 weeks	every 4 weeks
2-wheel-bin	40	51		51	
2-wheel-bin	60	21.631		21.631	
2-wheel-bin	80	38.292		38.292	
2-wheel-bin	120	38.089		38.089	
2-wheel-bin	240	27.861		27.861	
Underground System	2.000	55	2	23	30
Underground System	3.000	3		1	2
Total		**125.982**	**2**	**125.948**	**32**
Percentage			**0,00%**	**99,97%**	**0,03%**

Commercial

Typ	Volume	Number	every week	every 2 weeks	every 4 weeks
2-wheel-bin	40				
2-wheel-bin	60	306		306	
2-wheel-bin	80	212		212	
2-wheel-bin	120	528		528	
2-wheel-bin	240	562		562	
Underground System	2.000				
Underground System	3.000				
Total		**1.608**		**1.608**	
Percentage				**100,00%**	

Overall

Total		**127.590**	**2**	**127.556**	**32**
Percentage			**0,00%**	**99,97%**	**0,03%**

Collection system for paper & cards

Households

Typ	Volumen	Number	every week	every 2 weeks	monthly
2-wheel-bin	120	16.397			16.397
2-wheel-bin	240	93.475			93.475
4-wheel-bin	1.100	2.652	884	907	861
Underground system	3.000	9		9	
Underground system	4.000	4	2	2	
Underground system	5.000	3		3	
Total		**112.540**	**886**	**921**	**110.733**
Percentage			**0,79%**	**0,82%**	**98,39%**

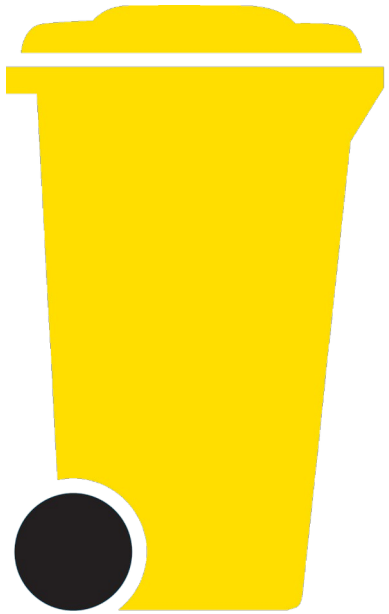
Commercial

Typ	Volumen	Number	every week	every 2 weeks	monthly
2-wheel-bin	240	2.630	15	40	2.575
4-wheel-bin	1.100	1.739	601	727	411
4-wheel-bin	3.000				
4-wheel-bin	5.000	53	19	34	
Total		**4.422**	**635**	**801**	**2.986**
Percentage			**14,36%**	**18,11%**	**67,53%**

Overall

Total		**116.962**	**1.521**	**1.722**	**113.719**
Percentage			**1,30%**	**1,47%**	**97,23%**

Collection system for plastic waste



Households

Typ	Volumen	Number	every 2 weeks
2-wheel-bin	120		
2-wheel-bin	240	126.506	126.506
4-wheel-bin	1.100	3.880	3.880
Underground system	2.000		
Underground system	3.000	5	5
Underground system	4.000	13	13
Underground system	5.000	15	15
Total		**130.419**	**130.419**
Percentage			**100,00%**

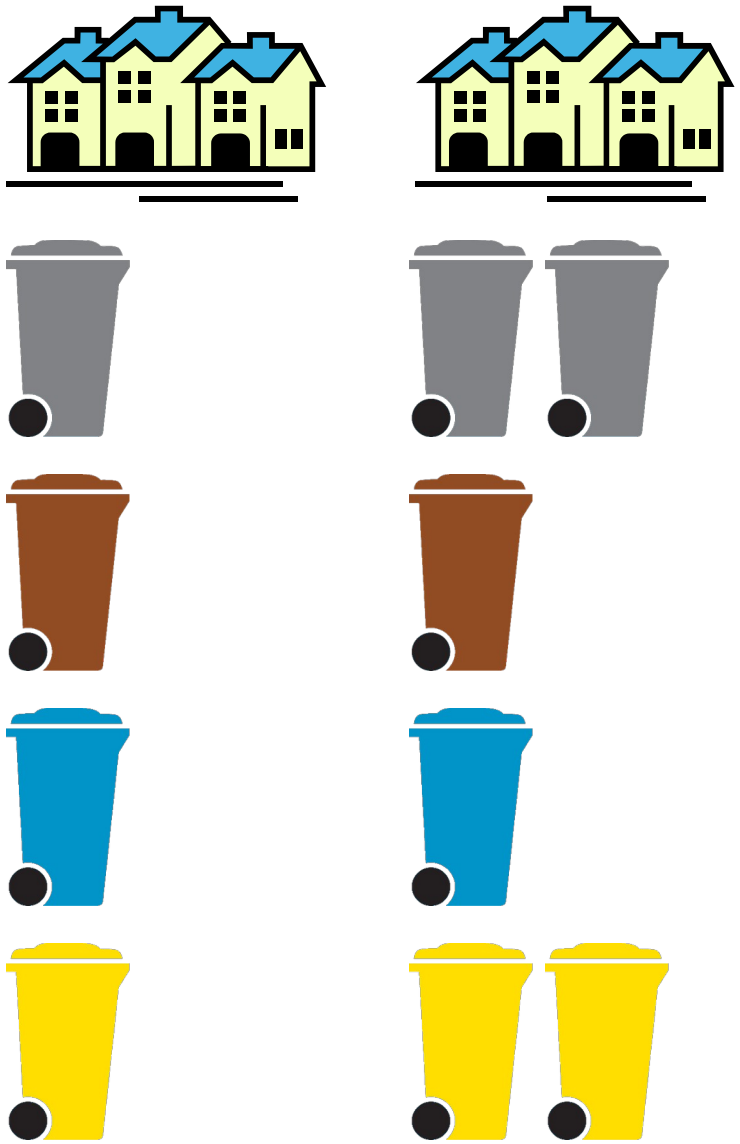
Commercial

Typ	Volumen	Number	every 2 weeks
2-wheel-bin	240	4.677	4.677
4-wheel-bin	1.100	1.654	1.654
Total		**6.331**	**6.331**
Percentage			**100,00%**

Overall

Total		**136.750**	**136.750**
Percentage			**100,00%**

Very user-friendly collecting System



Customers have the opportunity to find individual solutions:

- 20 combinations of volume/collection period for residual waste
- 10 combinations of volume/collection period for organic waste
- 9 combinations of volume/collection period for paper waste
- 5 combinations of volume/collection period for plastic waste

They can choose from 9000 different combinations

Customers actually ordered around 5.000 different combinations

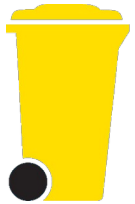
Some data about emptied containers/bins

Objects (plots, estates, …) that must be approached **120.000**

Residual waste **3.500.000 emptied containers per year**

Organic waste **3.300.000 emptied containers per year**

Paper waste **1.400.000 emptied containers per year**



Plastic waste **3.400.000 emptied containers per year**

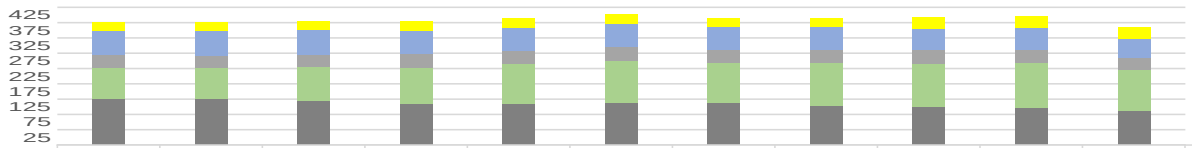
11.600.000 emptied containers per year

45.000 emptied containers per day

5.600 emptied containers per hour

94 emptied containers per minute

Results of selective waste collection – historical and actual data

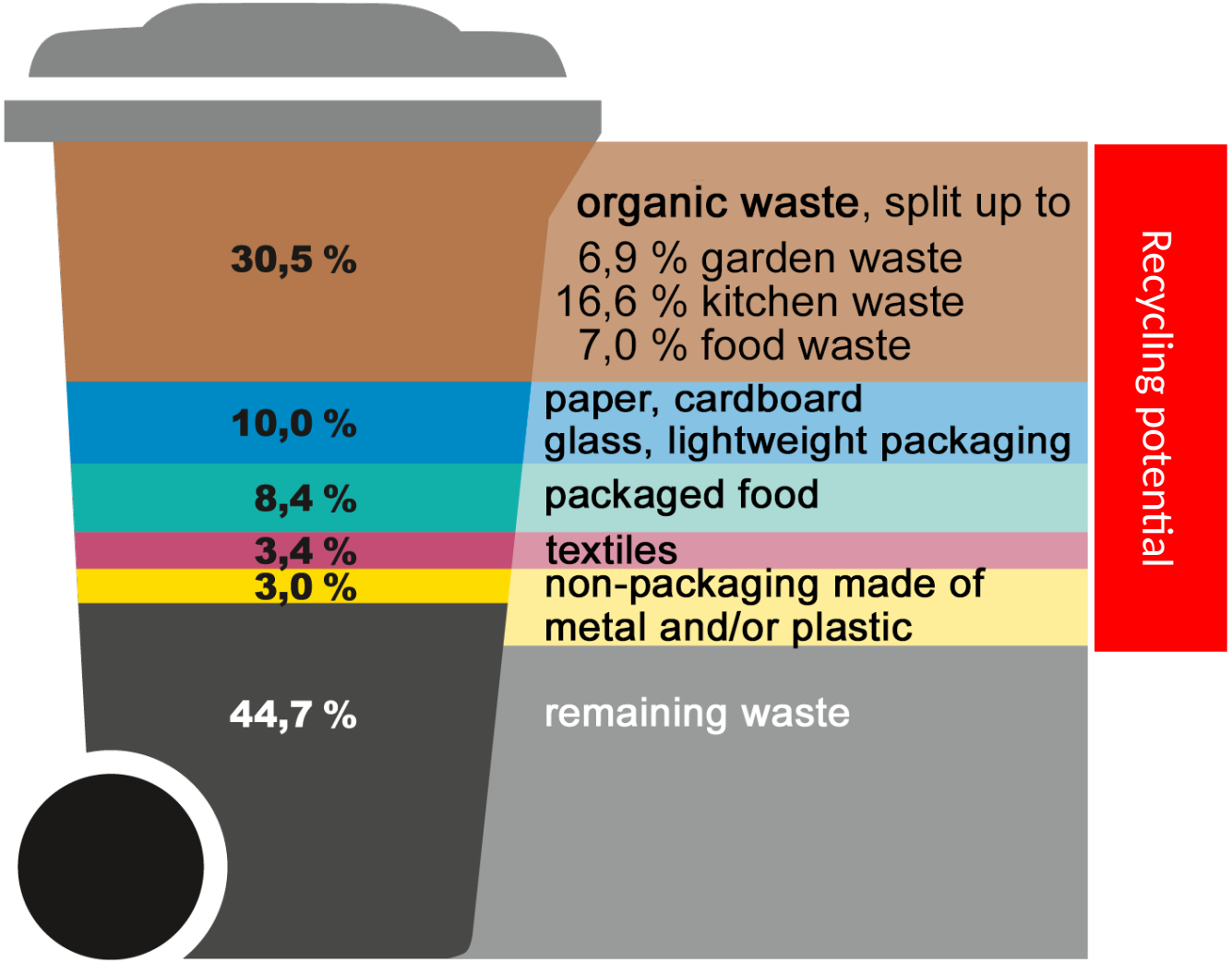


[kg per inhabitant]

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
residual waste	151.1	149.22	144.02	135.57	135.54	136.71	136.67	129.66	126.16	121.63	113.11
organic waste	102.23	103.98	111.42	119.13	130.35	140.37	133.59	138.49	139.29	147.16	132.97
bulky waste	39.54	39.98	40.45	42.71	43.18	43.19	42.67	45.49	44.83	43.34	38.47
paper & cards	81.61	80.17	79.09	75.52	74.88	75.23	73.73	72.27	70.7	70.65	63.63
plastic waste	28.29	28.53	28.84	29.58	29.92	30.15	28.83	28.69	37.05	39.17	37.53
total	402.78	401.87	403.82	402.51	413.86	425.65	415.48	414.6	418.03	421.95	385.7

+34 623 448 579

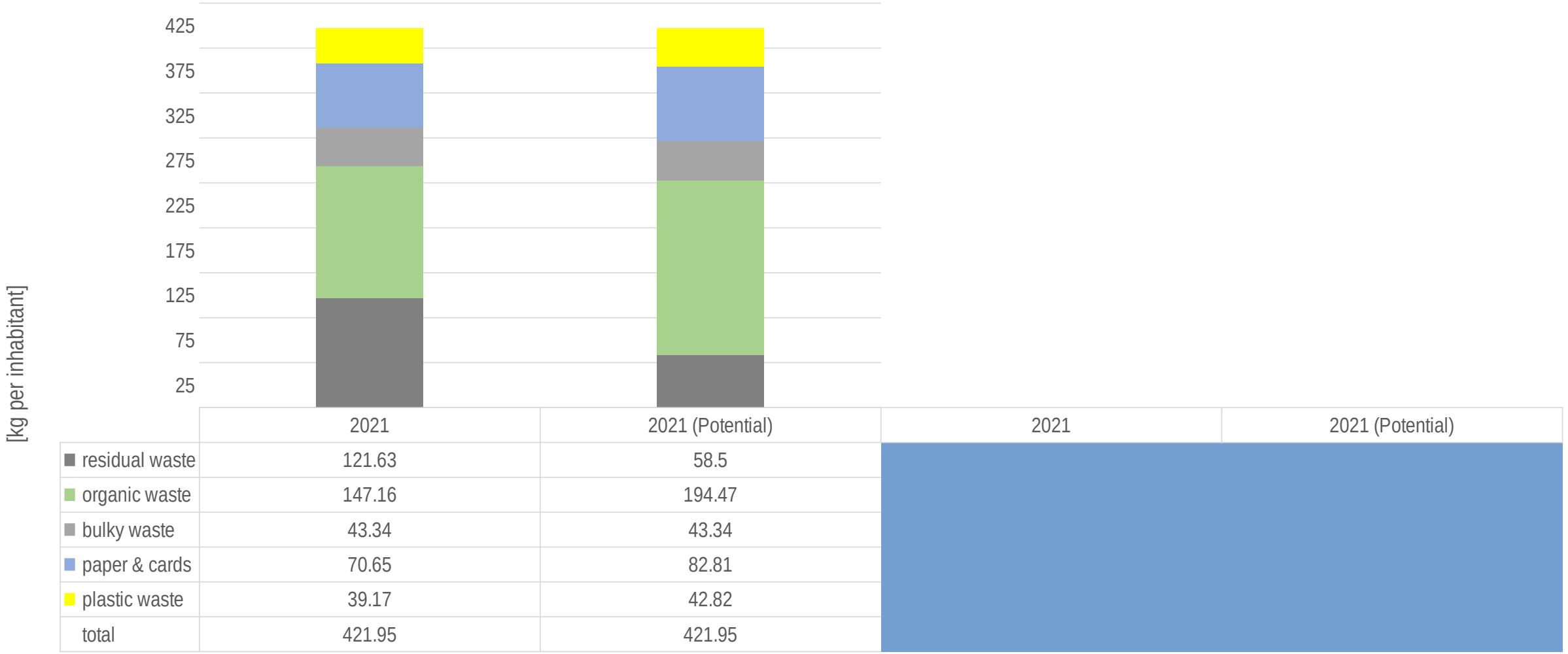
Contents of residual waste bins – actual data



We analysed the content of the bins/containers for residual waste in 2022.

The results are similar throughout Germany

Results of selective waste collection – how it may be in future



	2021	2021 (Potential)
residual waste	121.63	58.5
organic waste	147.16	194.47
bulky waste	43.34	43.34
paper & cards	70.65	82.81
plastic waste	39.17	42.82
total	421.95	421.95

2021	2021 (Potential)

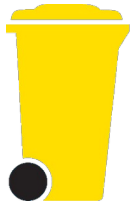
Our target charging system (PAYT 2.0)

Basic charge
No changes

Residual waste
One bin for each household (or Building) is mandatory.

Organic waste
Free of charge

Paper waste
Free of charge



Plastic waste
Free of charge

Residual waste (NEW)

- Minimum 240 litres of volume per capita/year
- Minimum 6 services per household/year
- Basic charge for 6 services
- Additional charge for every additional service

Idea behind

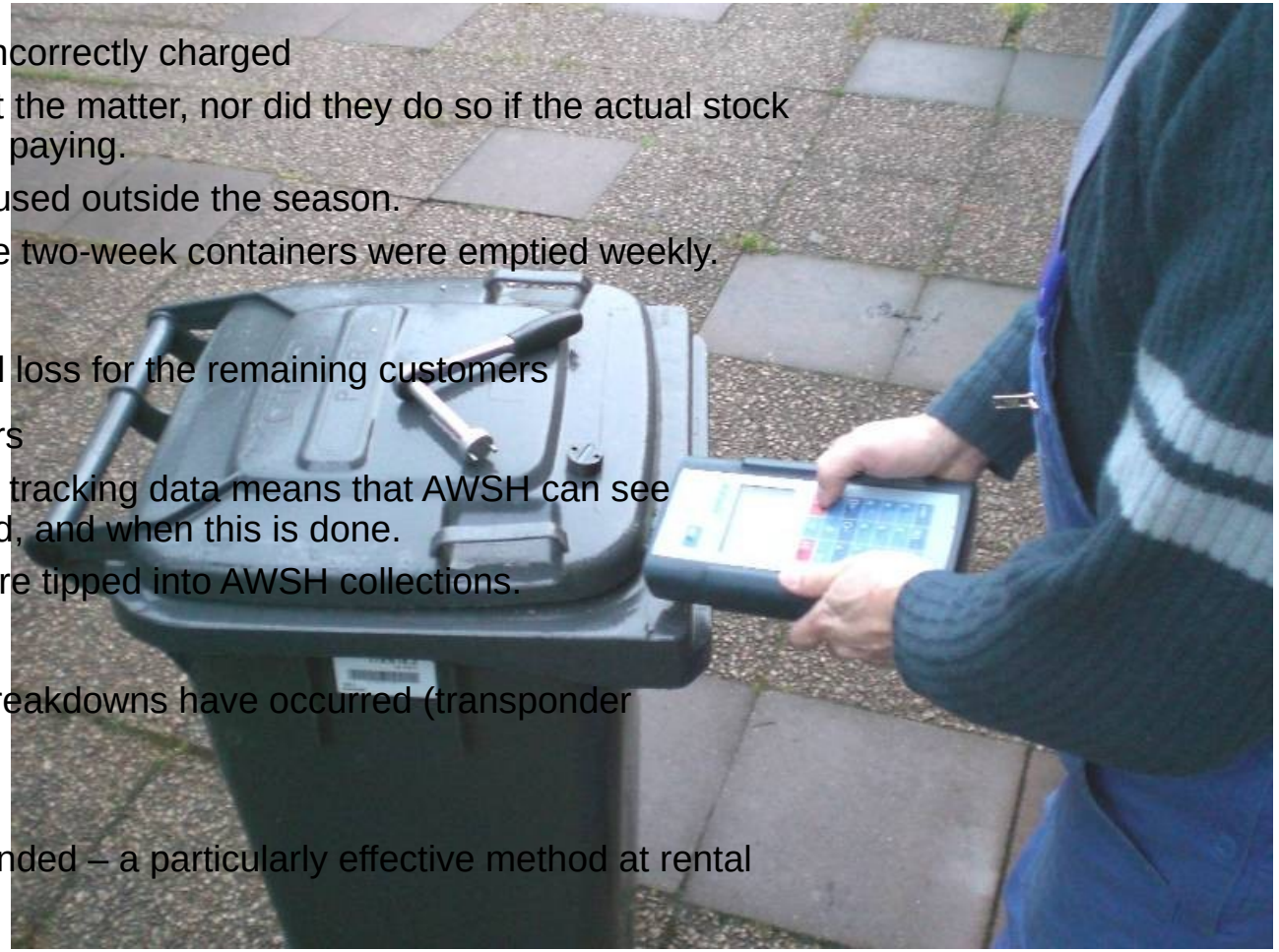
Inhabitants will reduce their residual waste to save money. For that, they have to improve waste separation in the household.

We have to check the content of the “free-of-charge-bins“ in the future.

PAYT 2.0 will not work without ID-System!

Aims for container-identification system?

1. Taking an inventory of containers
   - In 2006, AWSH had no idea where containers ACTUALLY were or in what sizes.
2. Identifying containers that have previously been uncharged or incorrectly charged
   - If customers were not/incorrect charged, they did not report the matter, nor did they do so if the actual stock of containers was larger than the stock for which they were paying.
   - Seasonal containers (holiday homes, camping sites) were used outside the season.
   - Four-week containers were emptied every two weeks, while two-week containers were emptied weekly.
3. Increase in income
   - Through the failure of not/incorrect charging => commercial loss for the remaining customers
4. Transparency of collection services, monitoring of subcontractors
   - The Transfer of tipping information in conjunction with GPS tracking data means that AWSH can see transparently which container is being approached or tipped, and when this is done.
   - In some cases, customers/containers of subcontractors were tipped into AWSH collections.
5. Better complaint management
   - The AWSH service centre has an opportunity to see why breakdowns have occurred (transponder defective, container not paid for)
6. Debt collection
   - If debt collection is necessary, container emptying is suspended – a particularly effective method at rental properties



Choosing the technology

RFID-based system

- Pro
  - Relatively often used in Germany
  - Certified by the German government (“BSI Bundesamt für Sicherheit in der Informationstechnik“)
  - Data accepted by German courts
  - …
- Cons
  - Higher costs for transponders
  - More difficult to install, especially on bins „in the field“
  - (Barcode) labels are needed for the installation of bins and to show the user “their” individual container number (displayed on their bill)

Barcode-based system

- Pro
  - Lower costs (no transponders, even some barcode labels)
- Cons
  - Not certified by the Government
  - Not accepted by German courts
  - Only a few installations in Germany

We decided to introduce an RFID-based identification system

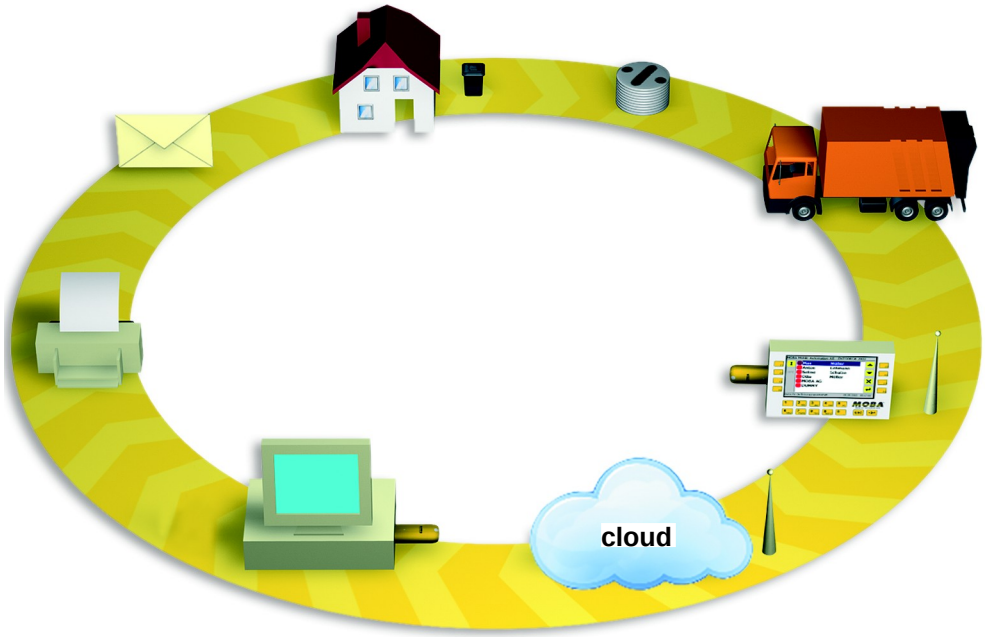
Identification system - diagram

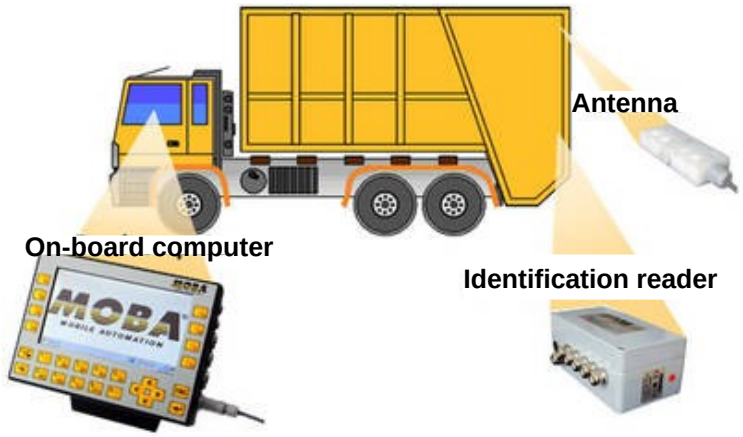
- Transponder in waste bins/container
  - RFID
  - Contains no data; only a number

- Collection vehicle with identification system
  - Note: The discharge system and installation point of transponders must be coordinated for 4-wheel containers (>770l)

- Data transfer to rural districts
  - Currently, data is transferred by cellular directly from the collection round every 15 minutes to AWSH.

- Container management, rural district's billing software
  - The interface between the rural district's own billing software and the identification system must be clearly defined.





Course of project

2005
Design stage
Resolutions by governing bodies

2006
System acquisition (tender process)

2007
System launch
Trial run

2008
System goes live

2009-10
System optimisation

2010-23
System is running

CHARGING MODEL
The charging model contains no basic charges. Conversion to a **real** PAYT system will therefore be extremely problematic.

From 2005 to 2015
Charging model without basic charges

2016
A new charging model and basic charges are introduced to the charging system.

BUT : PAYT 2.0 was rejected by the local parliament
**Next try in 2 years **

SUBCONTRACTORS PAYMENT
When awarding the tender for waste-collection services, it was forgotten to make the number of emptied containers the basis of the subcontractor‘s payment .

2007 - 2014
The number of emptied containers is NOT the basis of the subcontractor‘s payment

2015- 2020
New subcontractor.
The number of emptied containers IS the basis of the subcontractor‘s payment

2021- 20XX
New subcontractor.
Subcontractor uses the IT-System of AWSH !

Data flow

AWSH

CRM private households

Complete data

MOBA-System

CRM commercial customers

Complete data

Only information REALLY required by the contractor, such as address (without names), RFID-bin number

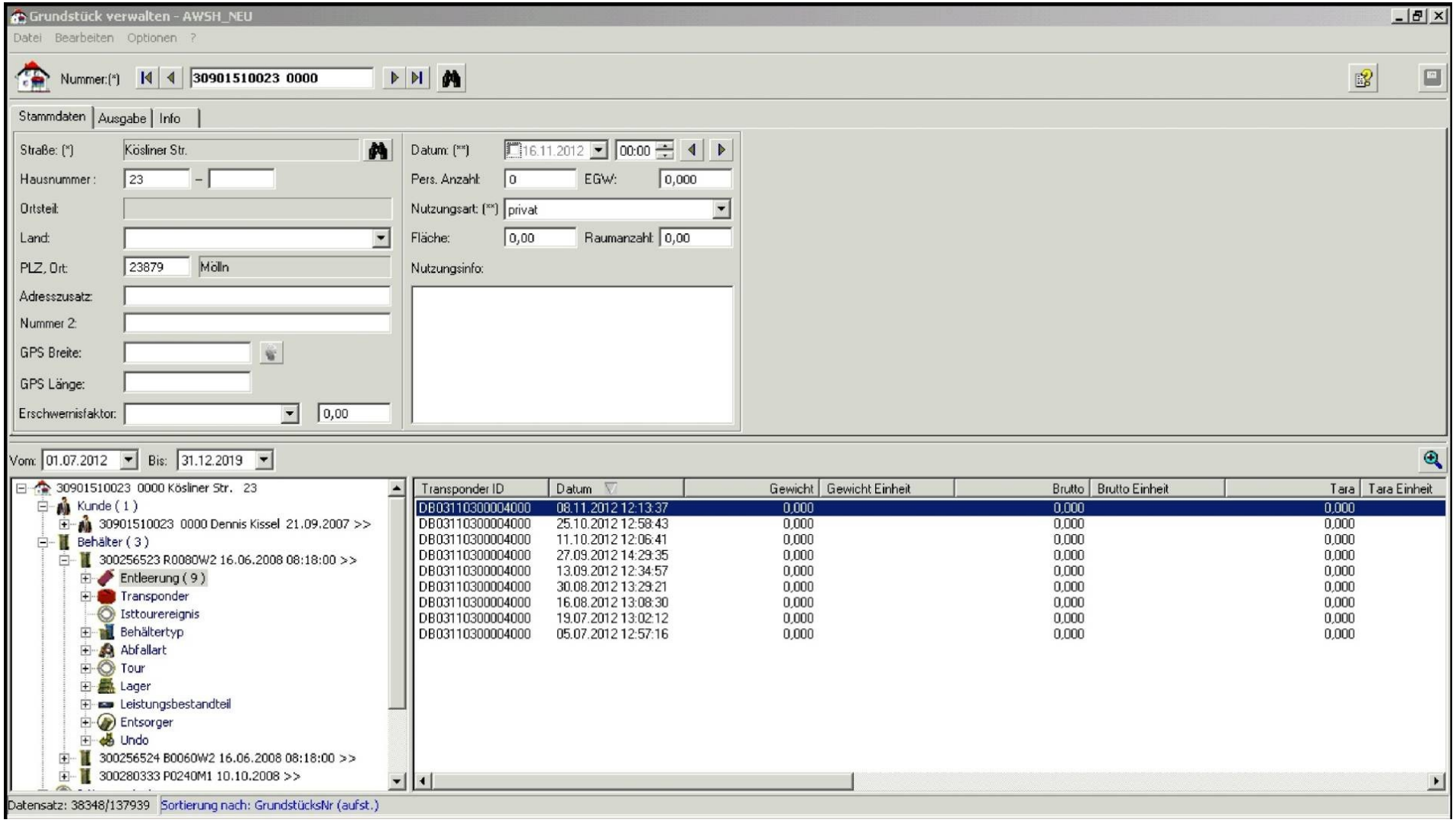
Contractor

MOBA-System

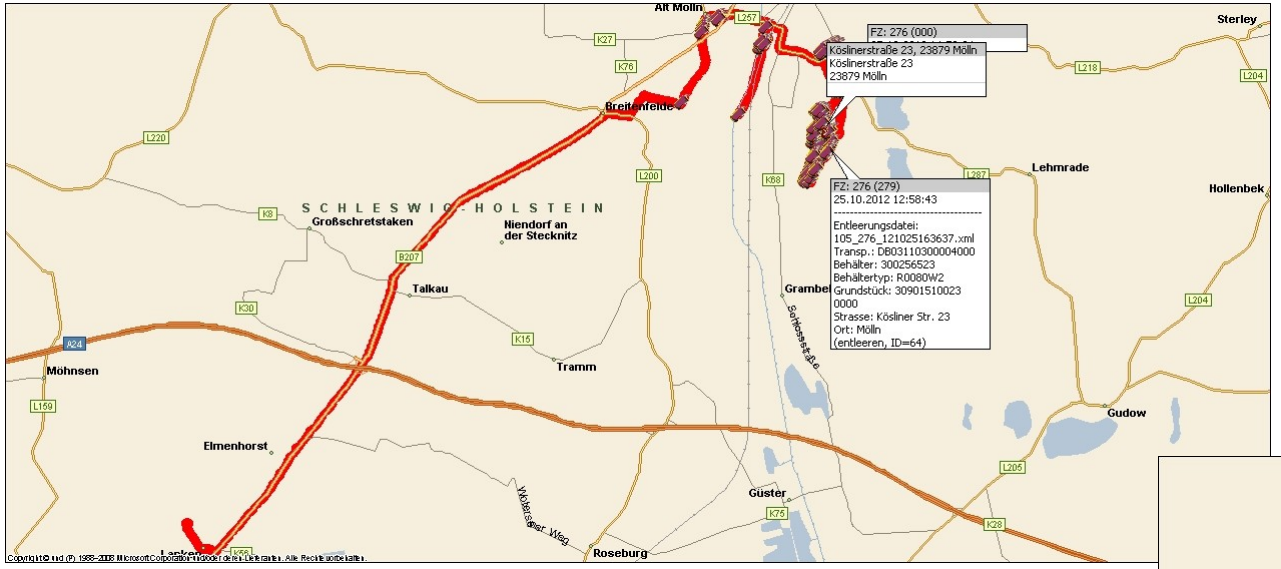
Contractor‘s IT-System

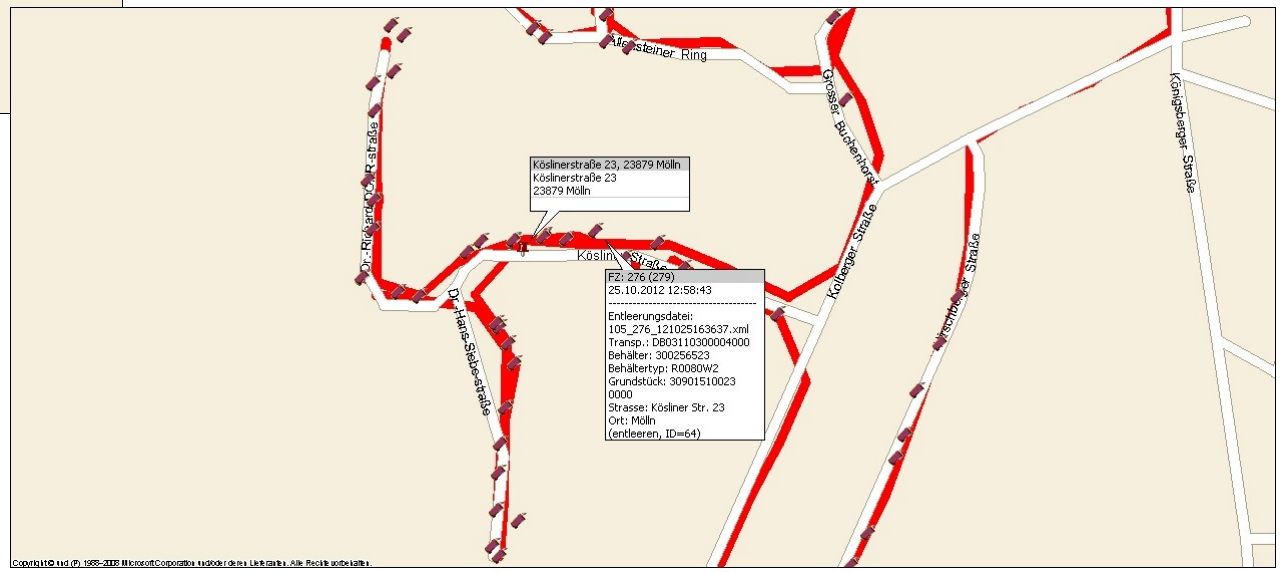
All the data WE need, e.g., GPS-data, date and time of emptying, RFID-number of bin, etc.

Emptying-data for one property (my personal household)



Visualising a collecting tour



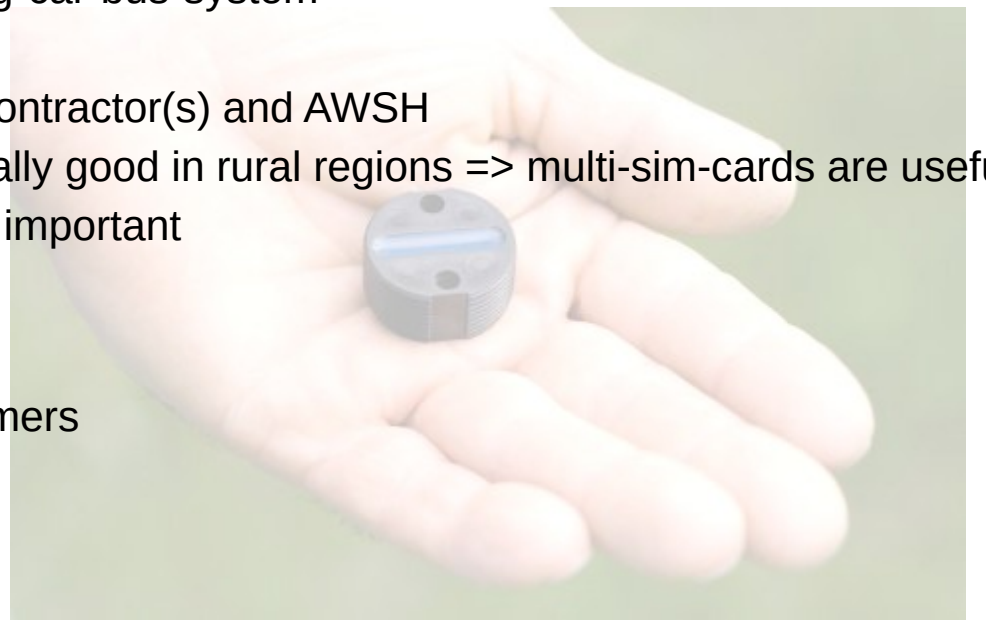


Has it worked?

Technology & Handling

Following launch, the identification system has operated largely problem-free

- A few technical defects are occurring on vehicles
  - Sometimes onboard detecting units will not identify bin
  - Antennas being destroyed
  - Electrical problems with the collecting-car-bus-system



- Transmission problems between the subcontractor(s) and AWSH
  - The German cellular network isn't really good in rural regions => multi-sim-cards are useful!
  - WiFi-backup-system in depot yard is important

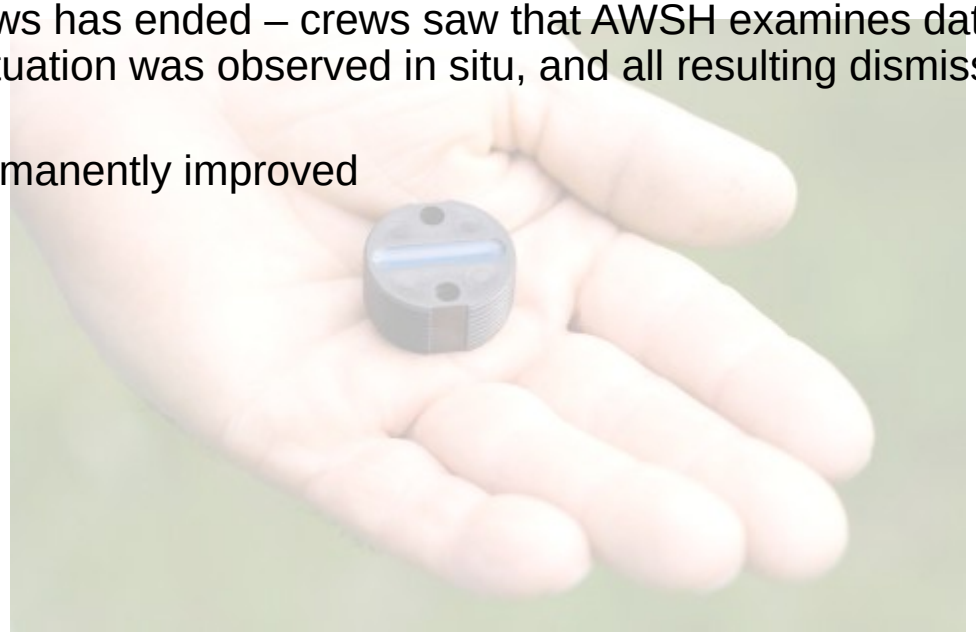
- Defective transponders
  - Destroyed and dismounted by customers
  - Destroyed by collecting cars

- Software
  - AWSH is using a separate CRM-System – it is very important to define exactly the process of data transfer
  - Check data transfer more than once a day
  - Update your software !

Has it worked?

- System accepted by customers
  - Combating illegal waste-disposal was stated aggressively as a goal; this goal was very well understood (but of course not by the illegal waste disposers)

- Internal objectives were largely achieved
  - Container stocks are largely transparent
  - “Secondary business” by vehicle crews has ended – crews saw that AWSH examines data to identify anything unusual. If anything unusual transpired, the situation was observed in situ, and all resulting dismissals were confirmed by the employment tribunal.
  - Customers‘ readiness to pay has permanently improved



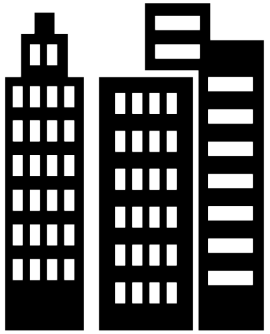
Two different types of households for PAYT

private houses

both charged per emptying of the container

€

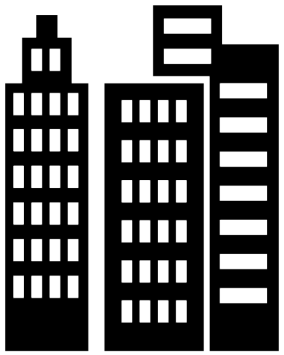
Tower blocks



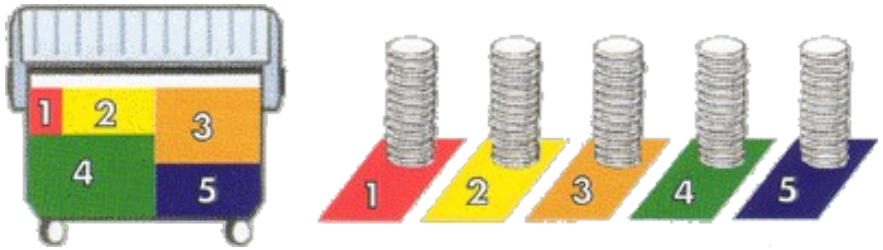
but: how is the usage of the tenants?

+34 623 448 579

Idea : RFID waste lock system

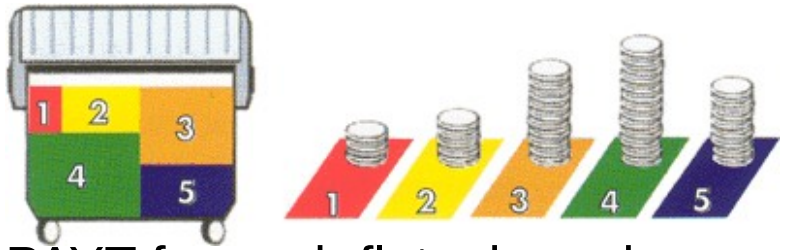


NOW



Each flat pays the same amount for waste per square metre of apartment size !

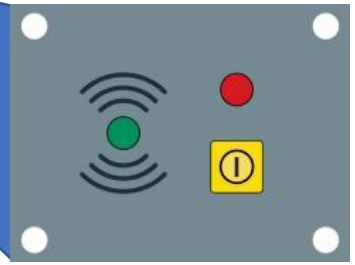
Future ?



PAYT for each flat – based on an RFID card or keyfob

RFID waste lock system (“Müllschleuse”)

An underground container is equipped with an RFID unit. The built-in electronics first check whether the transponder is "permitted", if it is released, the lid can be opened, the waste falls into the underground container and the usage is stored with an RFID number, date, and time.



RFID waste lock system (“Müllschleuse”)

[redacted]

Abrechnungsblatt Müllkosten

19.04.2005

(Abrechnungsperiode: 01.11.2004 - 31.12.2004)

Wohneinheit: [redacted]
Mieter:
Stellplatz:

Chip: 000027970, von 01.11.2004 bis 31.12.2004

Berechnung

Gesamtkosten der Wohnanlage / des Stellplatzes

Zeitraum	Kostenart	Kosten	Bemessungsgrundlage	Kostenaufteilung
01.11.-31.12.04	Abfallgrundgebühr		Fixkosten	4,40 € je Person
01.11.-31.12.04	Entleerungskosten	63,40 €	2.730,00 Liter	0,02322 € je Liter
01.11.-31.12.04	Systemkosten		Fixkosten	3,07 € je Chip und Monat
01.11.-31.12.04	Hausmeistereinwürfe	2,55420 €	110,00 Liter	0,02322 € je Liter
01.11.-31.12.04	Hausmeistereinwürfe	2,55420 €	1.586 Einheit-Tage	0,00161 € je Einheit und Tag

Kosten Ihrer Wohneinheit

Zeitraum	Tage	Kostenart	Kostenaufteilung	Ihr Anteil	Betrag
01.11.-31.12.04		Abfallgrundgebühr	2,20000 € je Person und Monat	2 Personen	8,80 €
01.11.-31.12.04	61	Entleerungskosten	0,02322 € je Liter	90,00 Liter	2,09 €
01.11.-31.12.04		Systemkosten	3,07 € je Chip und Monat	1 Chip	6,14 €
01.11.-31.12.04	61	Hausmeistereinwürfe	0,00161 € je Einheit und Tag	1 Einheit	0,10 €

Summe: 17,13 €

Software manages the transponder for the tenants, the permission lists, the data transfer over the cloud, and the individual invoice for all tenants.

Einzelleerungsübersicht für Mieter (Nr.: 001.1.01)

Entleerungen

Chipnummer	Datum	Uhrzeit	Volumen
000027970	05.11.2004	12:01:12	10,0 Liter
000027970	10.11.2004	12:26:04	10,0 Liter
000027970	18.11.2004	17:36:43	10,0 Liter
000027970	22.11.2004	16:52:38	10,0 Liter
000027970	29.11.2004	19:17:31	10,0 Liter
000027970	09.12.2004	18:32:21	10,0 Liter
000027970	13.12.2004	18:01:32	10,0 Liter
000027970	20.12.2004	12:45:03	10,0 Liter
000027970	25.12.2004	18:43:56	10,0 Liter

Gesamtvolumen: 90,0 Liter
Anzahl Entleerungen: 9

Idea vs. reality

!!! KEYLOCKS !!!

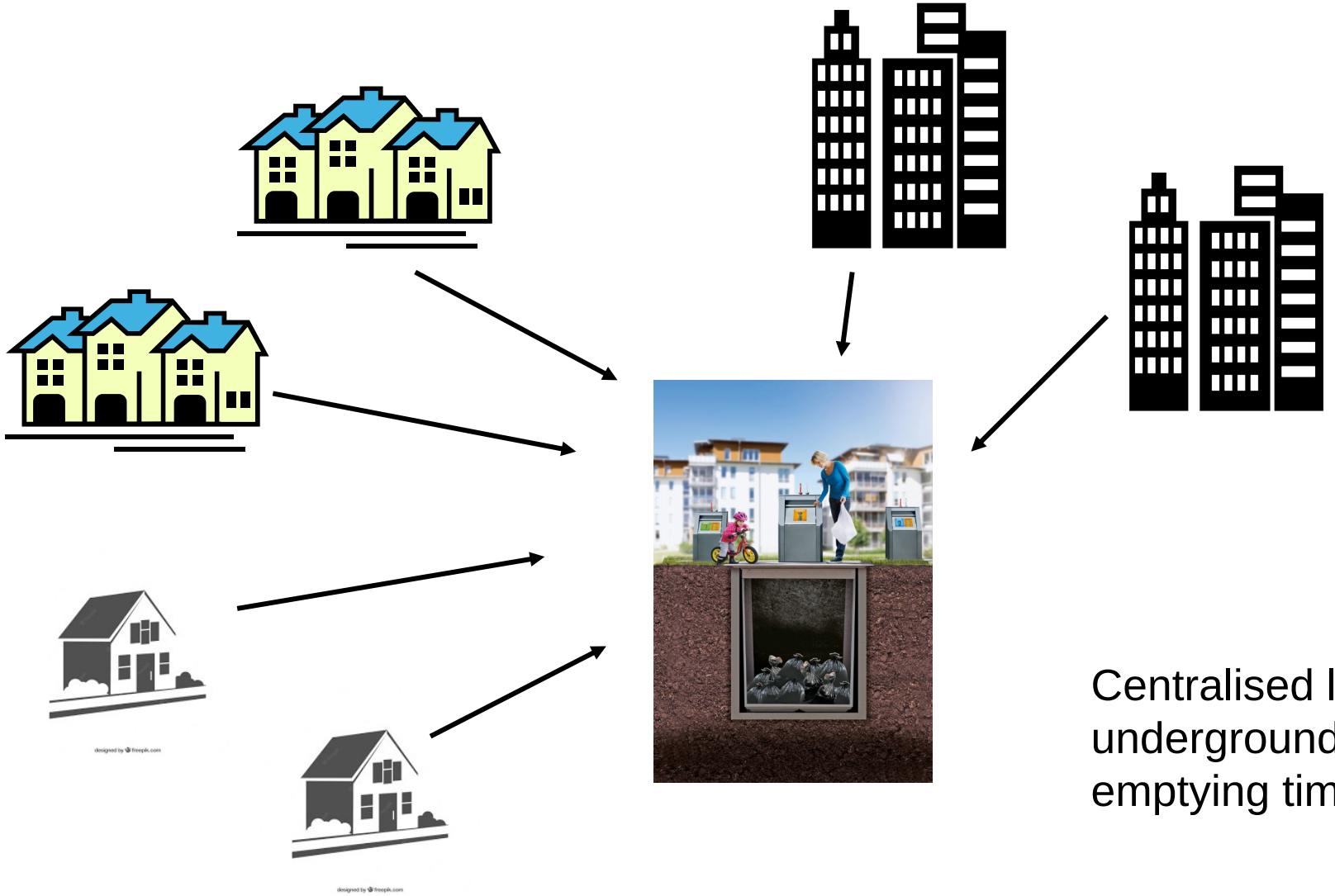
„Reasons“ for Keylocks

- Cheaper than RFID-Systems
- Easy to handle (central locking system for the whole building)
- No „deep state“ inside
- „We never used RFID-chips before ”
- ….
- Easy charging process for the housing company!

**Unfortunately - there is an acceptance problem in Germany **

**BUT WE DON’T GIVE UP **

New: underground container with PAYT for mixed properties



Our new Project - in cooperation with (a part) of the housing industry.

Centralised location with different PAYT underground containers – for saving emptying time, costs, and CO2 emission

Thank you for your attention

If you enjoyed the presentation, please tell others.

If you did NOT like the presentation, please do not tell anyone - including me.