

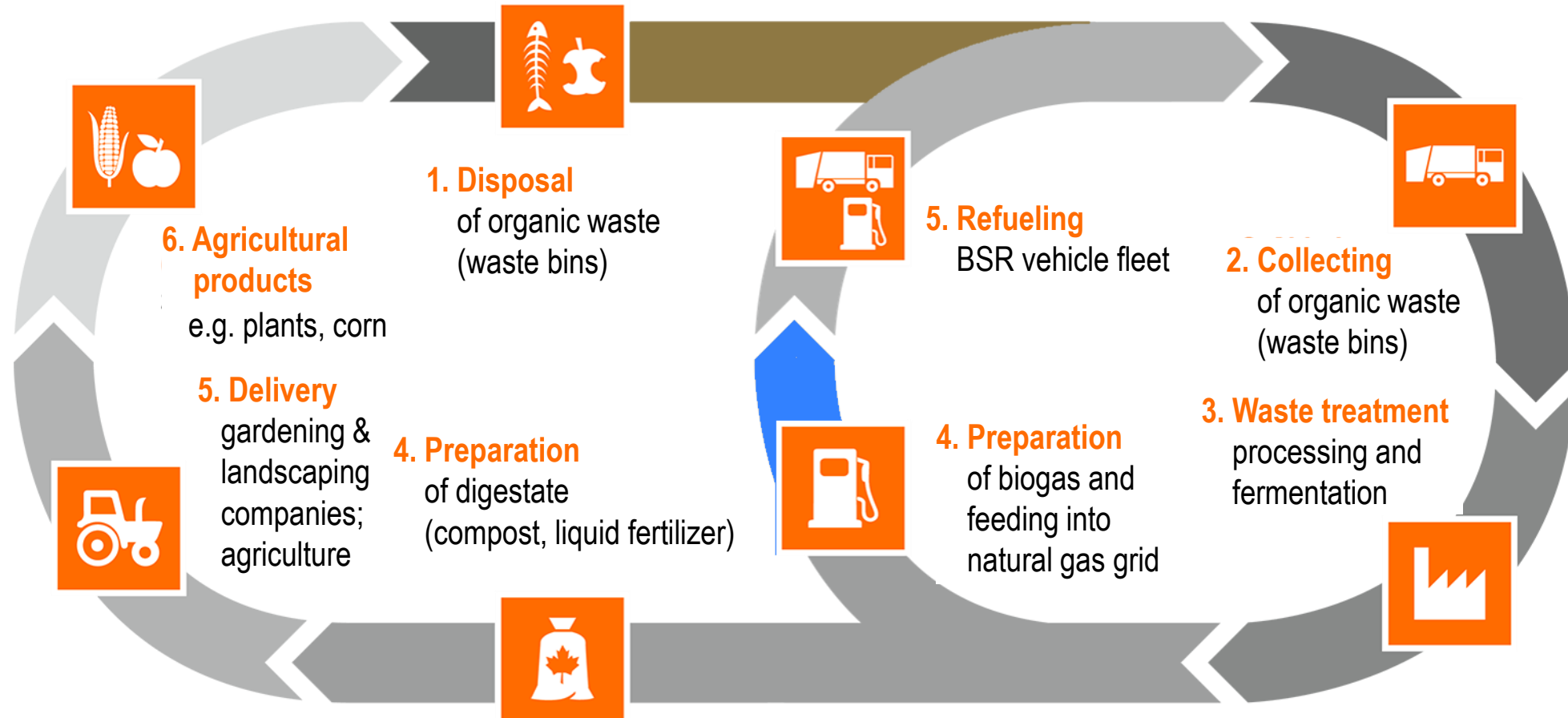


# From Organic Waste to Fuel

The Biogasplant in Berlin  
November, 5th 2021



# Closed cycles through organic waste fermentation



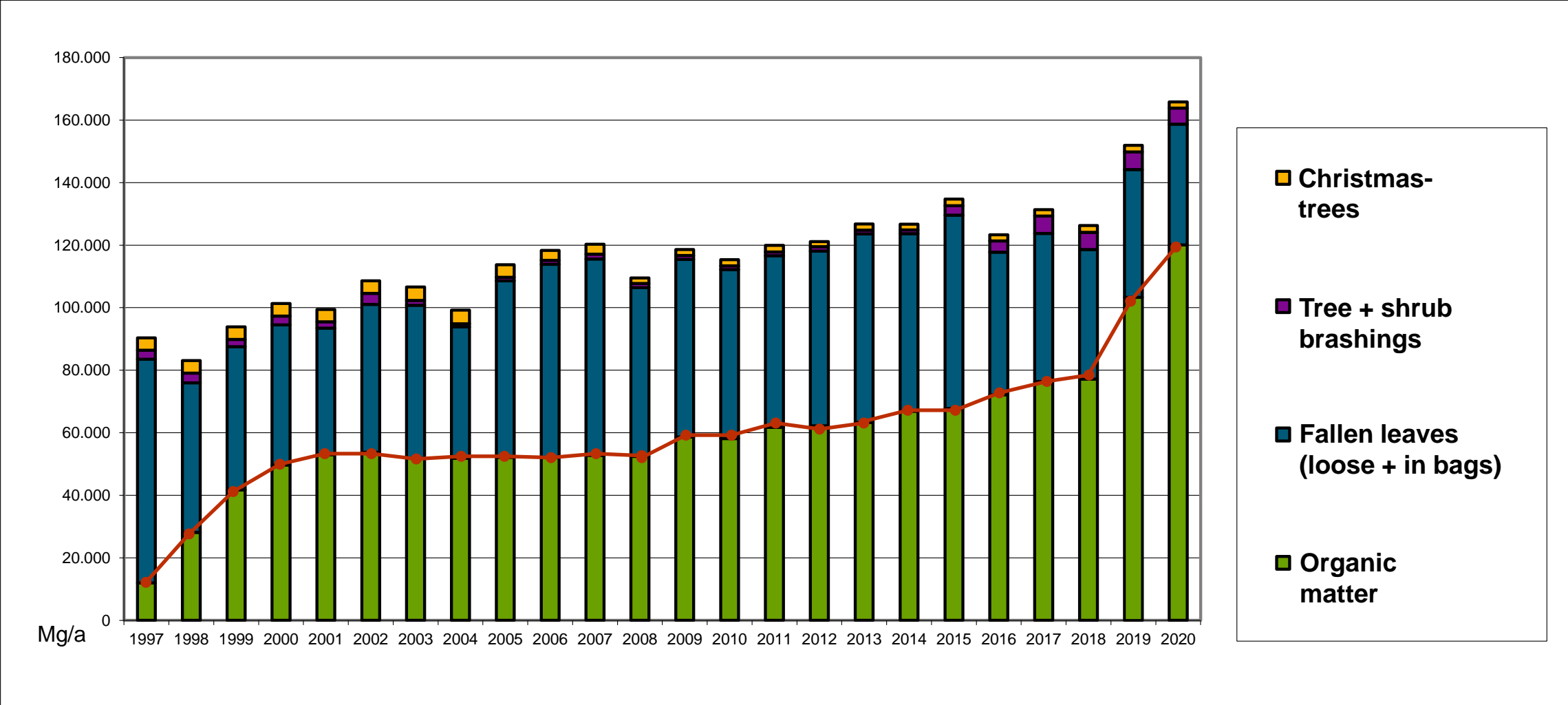
# History of organic waste recycling in Berlin

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<b>1990/91:</b>	Trial of organic waste collection with scientific monitoring
<b>1996:</b>	Begin of initial introduction in inner city area
<b>2000:</b>	Begin of collection in the “suburbs” within Berlin
<b>from 2004:</b>	Optimization process of organic waste collection
<b>2007:</b>	BSR decision to build biogas plant in Berlin
<b>2008:</b>	Planning and EU tender for construction of biogas plant Ruhleben
<b>2009:</b>	Allocation to EPC-contractor
<b>2010:</b>	Procedure of permission with the authorities and the public
<b>2011:</b>	Official permit to build the plant
<b>2013:</b>	Start of operation in March; Taking over the plant from EPC contractor (STRABAG) in October
<b>2018:</b>	Decision of Berlin government: Expansion of the collection system (obligation for all private households to use a garbage container for organic waste)
<b>2018/8:</b>	take-over of biogas & composting plant Hennickendorf

# Development of organic waste in Berlin

## Berlin without Brandenburg



# Utilisation of biogenous waste

Organic Waste			
	- hardly fermentable -		- fermentable -
	non-compostable	compostable	
	<ul style="list-style-type: none"> <li>wood</li> <li>fallen leaves</li> </ul>	<ul style="list-style-type: none"> <li>organic waste</li> <li>tree- and shrub brashings</li> <li>fallen leaves</li> </ul>	<ul style="list-style-type: none"> <li>organic waste</li> <li>leftovers e.g. canteen)</li> </ul>
recycling	incineration	composting	fermentation

# Concept of organic waste fermentation

hydrolysis



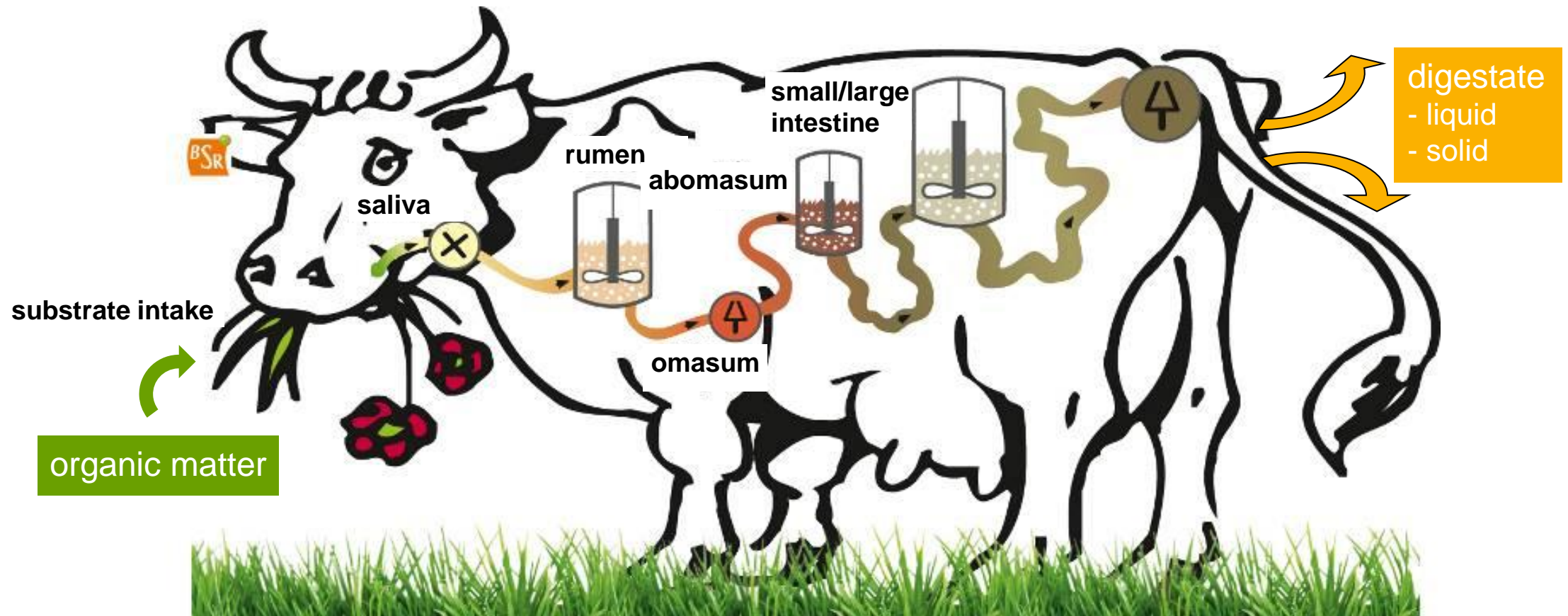
propionic acid



acetic acid



methane+CO<sub>2</sub>



# Possibilities to use biogas

standard	filling into public – natural gas grid		biofuel	biogas pipeline (micro gas grid)
	biogenous fermentable waste			
	production of biogas			
	biogas-processing			biogas pipeline
	biomethane into grid		biomethane fillingstation	
combined heat and power (CHP) <ul style="list-style-type: none"> <li>electricity</li> <li>heat</li> </ul>	withdrawl from grid		natural gas vehicle fleet	
	other consumers	BSR methane filling stations		
		BSR vehicle fleet		
				combined heat and power (CHP) <ul style="list-style-type: none"> <li>electricity</li> <li>heat</li> </ul>

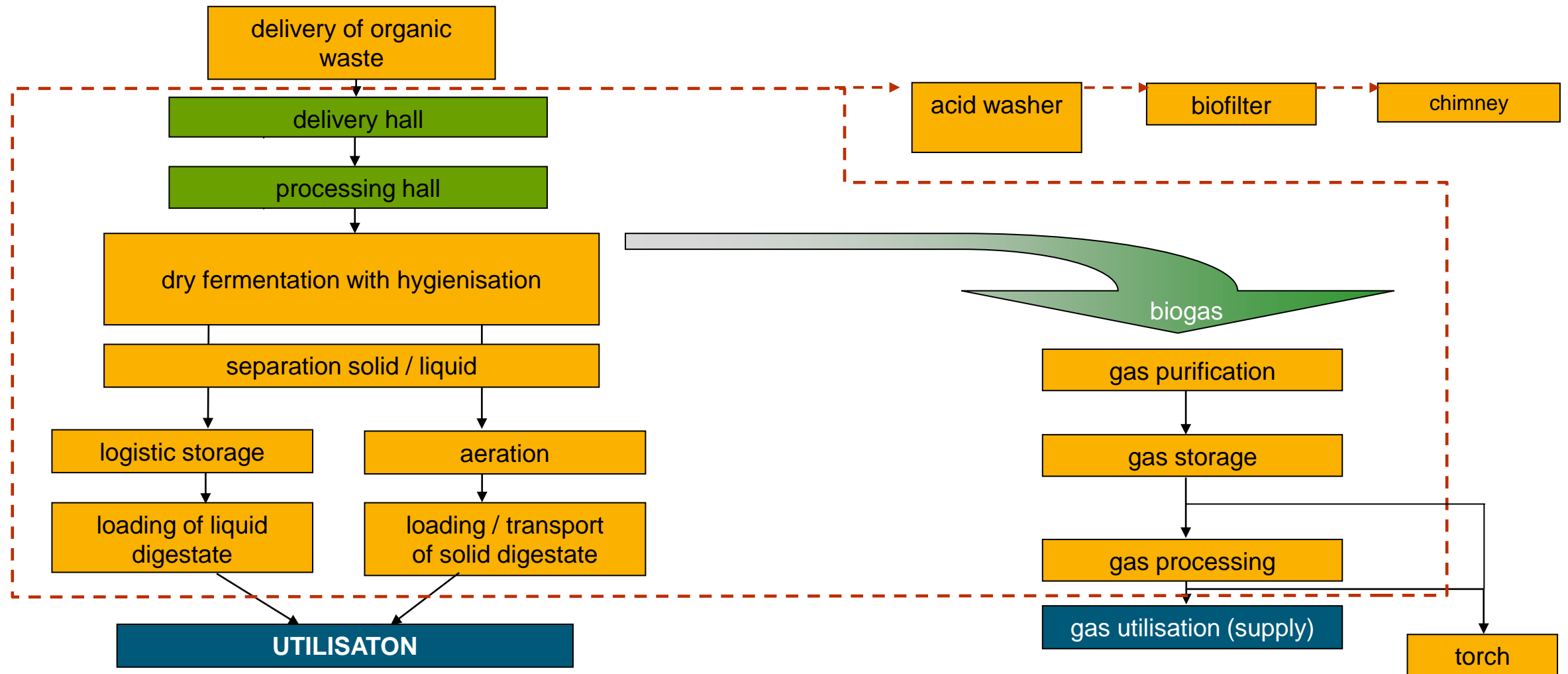


# BSR biogas plant Ruhleben





# Process flow of biogas plant



# Key figures 2020

- Input: 75,000 Mg/a organic waste from households
- Area: 2.7 ha
- Employees: 16
- Exhaust air for odorization : 40,000 m<sup>3</sup>/h
- Production of raw biogas: 104 m<sup>3</sup>/Mg Input with Ø 56% CH<sub>4</sub>
- Annual production of raw biogas: ~ 6 Mio. m<sup>3</sup> /a
- Production of biomethan: ~ 3 Mio. m<sup>3</sup>/a
- Net production of energy: ~ 33 Mio. kWh
- Substitution of diesel fuel: ~ 2,5 Mio. litres
- CO<sub>2</sub>-reduction potential: ~ 13.800 Mg CO<sub>2</sub> from substitution of fuel and c-sequestration  
or 185 kg CO<sub>2</sub>/Mg Input
- Output solid aerated fermentation residue: 22,300 Mg/a
- Output liquid digestate : 41,000 Mg/a



# Filling stations for biogas

## Compressor

- number: 3
- inlet pressure: 4 - 10 bar
- outlet pressure: 250 bar
- quantity: 100 – 190 Nm<sup>3</sup>/h each compressor

## Storage

108 x 80 l – 8,64 m<sup>3</sup>

## Further modules

- 2 gas-drying units
- steering unit
- 4 gas pumps
- building (noise insulated)



# Half of BSR vehicle fleet runs with biogas

**160** of these trucks are using energy from organic waste



- this is 63 % of the entire waste-collecting vehicle fleet of BSR
- covers a distance of approx. 2,533,000 km
- which is 52 % of the entire covered distance, collecting waste from households
- vehicles transport approx. 586,000 Mg garbage from households (incl. organic waste)  
= 63 % of the entire garbage of private households of Berlin

**Approx. 60 % of the whole garbage of Berlin is collected and transported with no effect on our climate**



# Conclusion and prospects

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- The high level of contributing households to the organic waste collection reduces costs for the collection system
- High ecological standards are achieved for logistics due to the chosen concept (CO<sub>2</sub>, noise, PM 10 particles)
- The recycling of digestate improves the humus balance and reduces the need for artificial fertilisers
- Prices for utilization of compost and fluid fertilizer increase because of different legal developments
- Secured access to the public natural gas network by law is essential (storage function of grid)
- Political strategies for the transport sector are changing; Daimler stops production of CNG-trucks for waste collection
- Small extra money selling a quota for renewable fuels (BioKraftQG)



Together — for Berlin