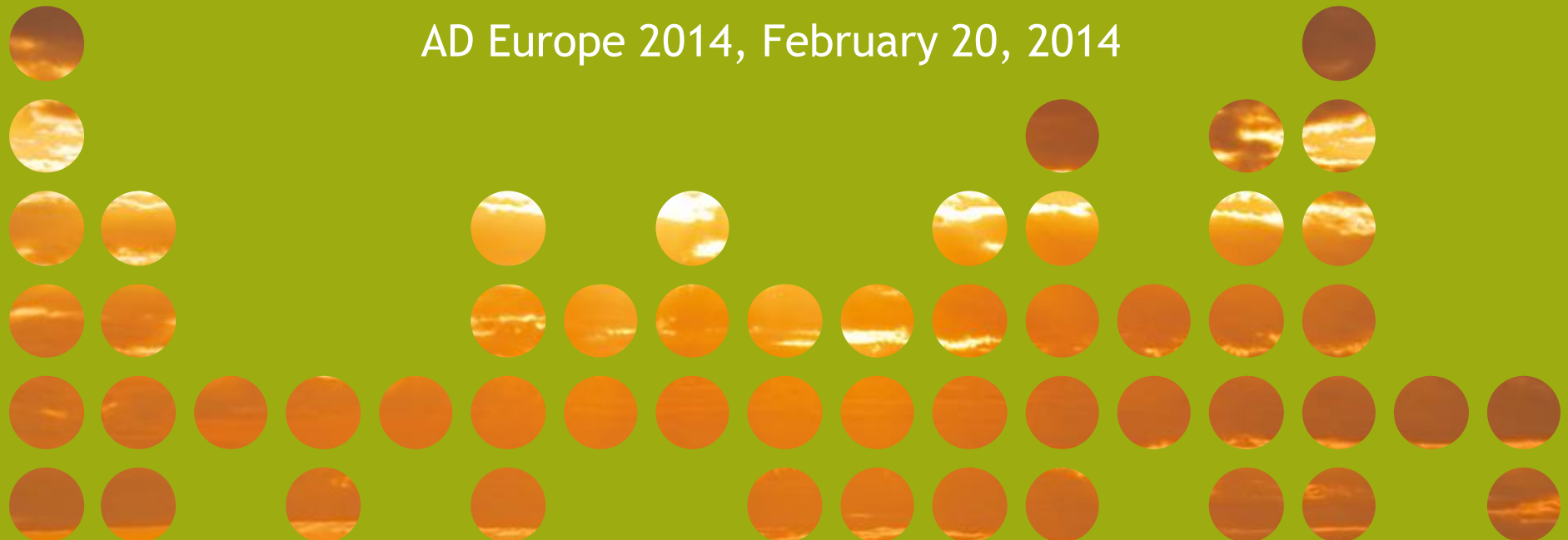


Bio-economy Opportunities for the Waste sector

Dr. Adrie Veecken, Attero

AD Europe 2014, February 20, 2014



European ambitions

European commission:

“The concept behind *Bioeconomy* itself is most compelling: moving away from a fossil fuel driven, non-renewable based economy to a bio-based, more sustainable society”

Where will this biomass come from? How can we guarantee that it is sustainable?

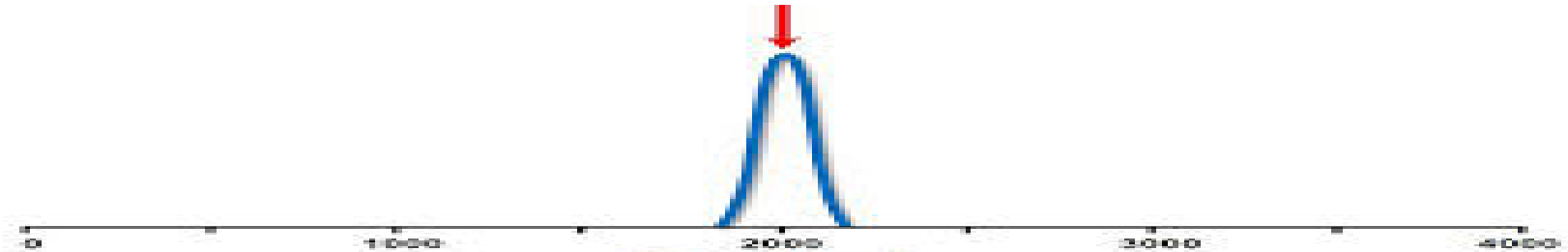
EU-27 generates 124 million tons of *bio-waste* per year. Let's use this potential as feedstock for the *Bioeconomy*.



Moving from a fossil-based to a bio-based economy

Consumption of fossil resources:

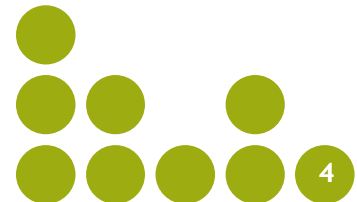
Peak extraction in
fossil feed stocks



- Develop a sustainable and circular economy; extracting less fossil resources and producing less waste
- Fossil resources will (soon) reach peak production, oil, gas, phosphorus, peat
- Climate change/global warming: need to reduce greenhouse gas emissions
- Need to be less dependent on fossil imports

Attero vision on Bio-based Economy

- Energy from biomass is temporary. Biomass potential is too small
Renewable energy from sun, wind, etc.
Biomass for replacement of materials and chemicals
- A sustainable Bioeconomy demands closing of cycles at regional level (NW Europe)
Nutrients and organic matter to be returned to agriculture
- Avoid competition between food, fuel and materials
Use organic waste as feedstock



Presenting Attero

power generation

2 waste to power plants



composting

6 plants



digestion

5 plants
2 underconstruction
1 planned

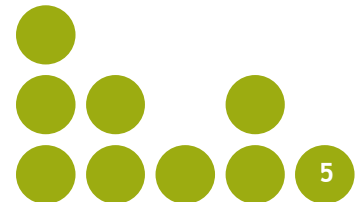


separation

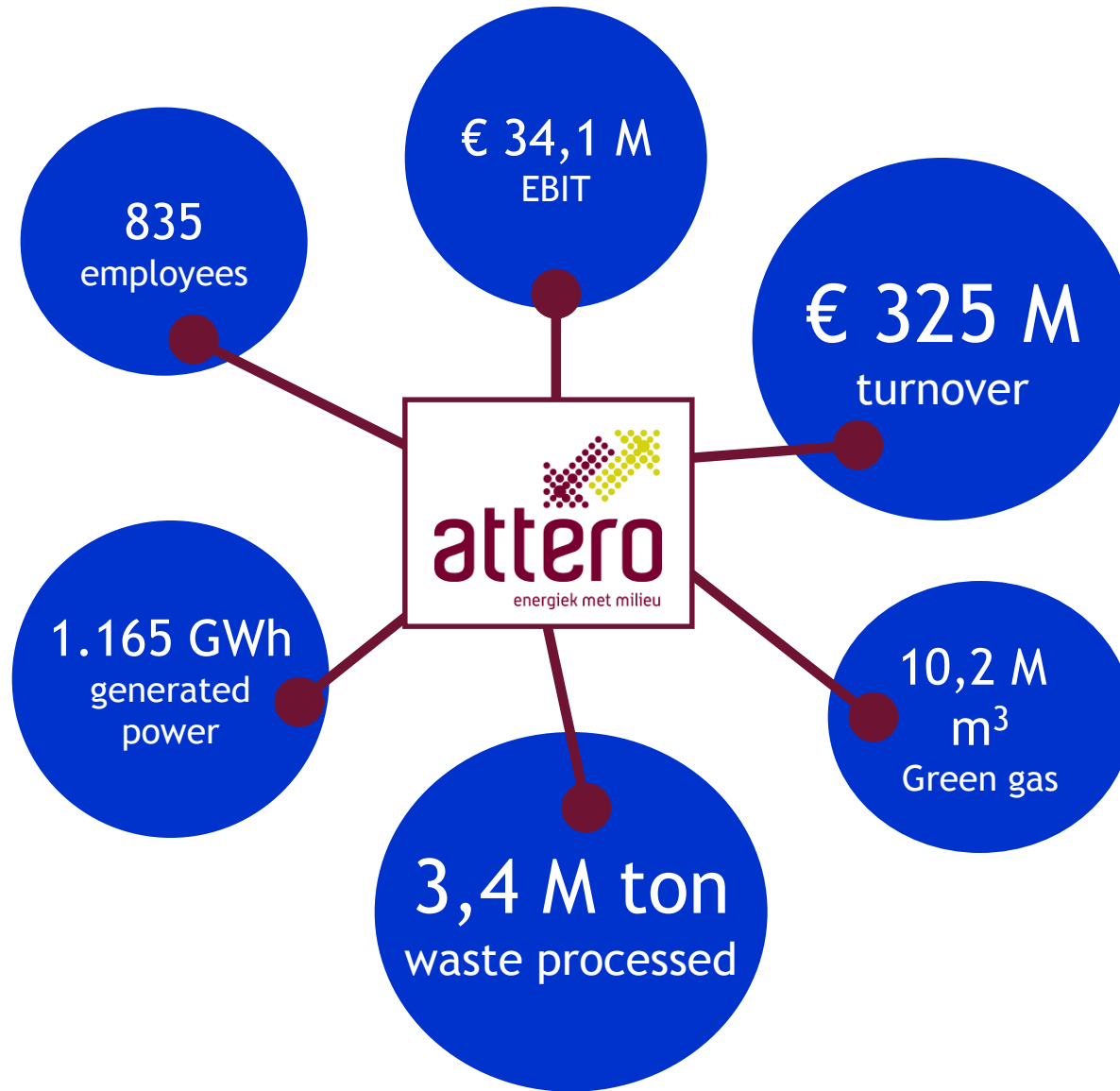
4 plants



Attero processes municipal solid waste of 6 million people in the Netherlands



Key figures Attero 2012

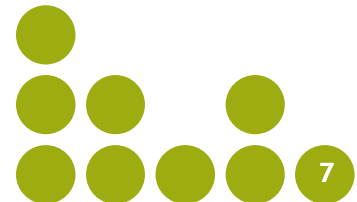


Assessment of current practices

Typical for Dutch situation



- Compost is a valuable product but no economic value
- Biogas is low-value product: only competitive through subsidy programs
- Can we do more with biomass? From a sustainable and economic perspective



Value of organic waste

Organic matter:

- Energy carrier: biogas, electricity, heat
- Feedstock for production of chemicals, feed, pharmacy (physical, thermo-chemical, biochemical technologies)
- Fibers for building and construction
- Carrier of CO₂: application in greenhouses

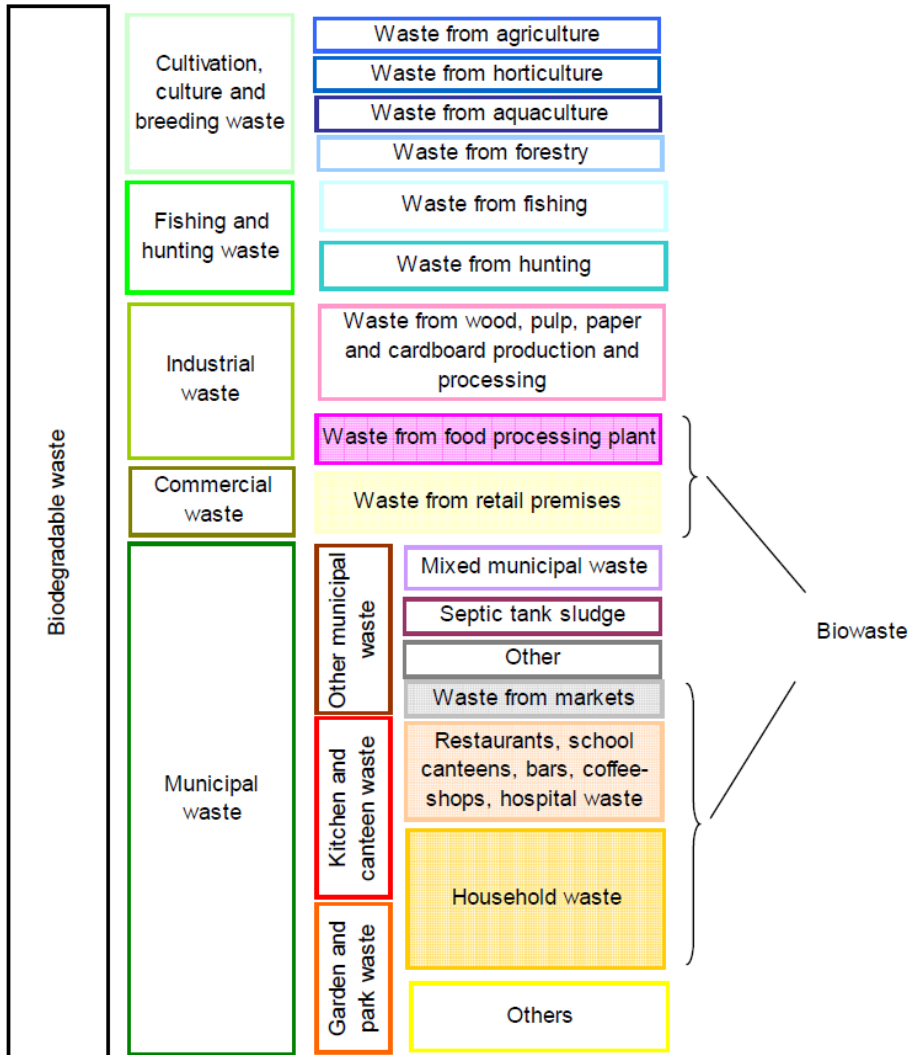
Nutrients:

- N, P, K to replace artificial fertilisers (can have economic value)

Residues as stabilised organic matter (=compost, humus) for agriculture and horticulture



What is Bio-waste?



Bio-waste (WF Directive 2008/98):

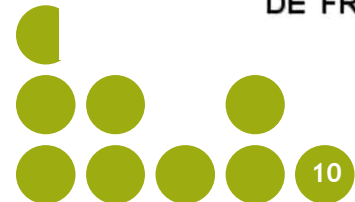
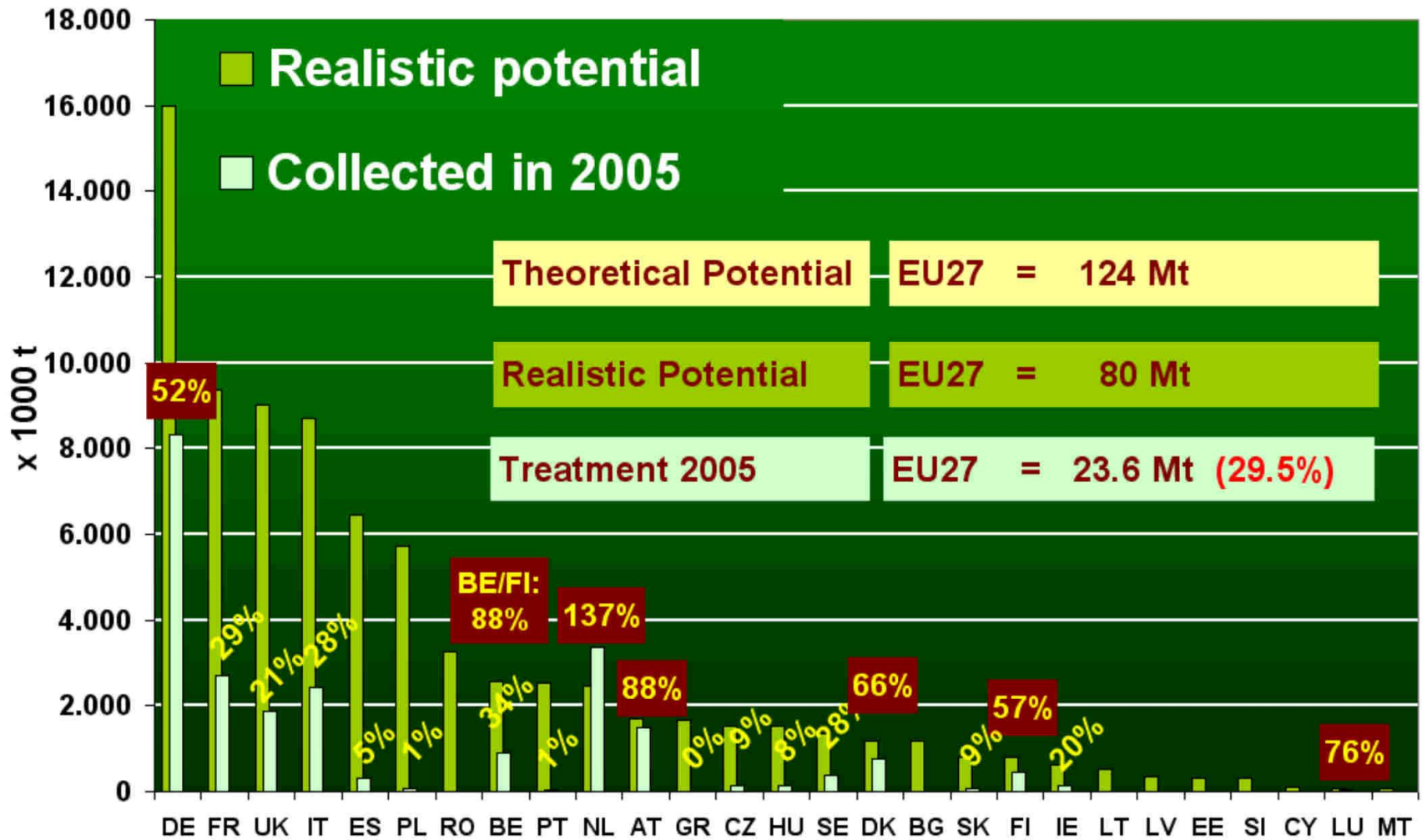
Garden and park waste

Food and kitchen waste from households, restaurants, caterers, retail premises and comparable waste from food processing plants

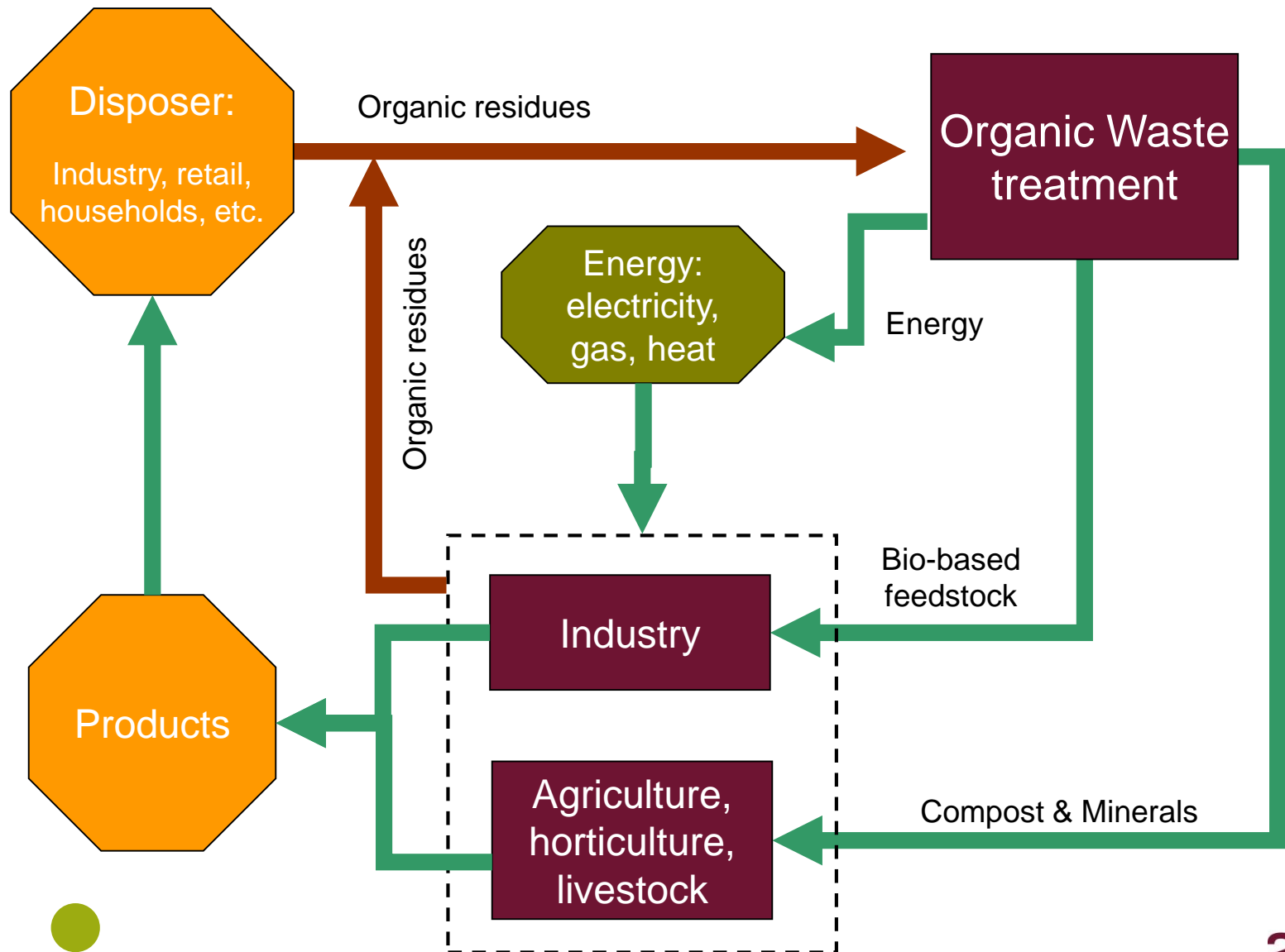
Bio-waste does not include:

forestry/agricultural residue and other biodegradable materials such as wood, paper, cardboard, sewage sludge, natural textiles, etc.

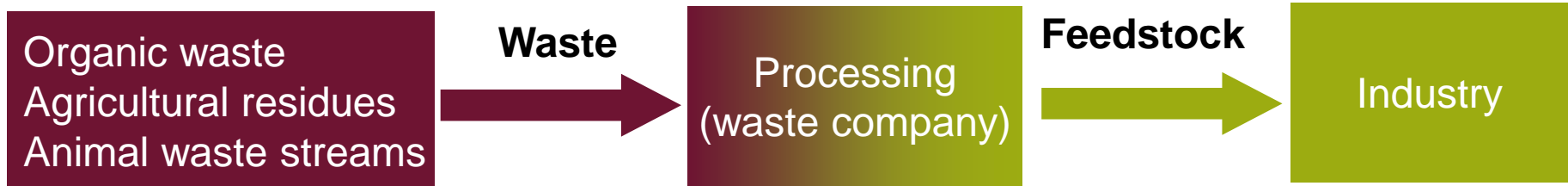
Potential of Bio-waste in EU-27



Sustainable Bioeconomy: closing the biological cycle



Bio-waste treatment sector: link in the Bio-based chain



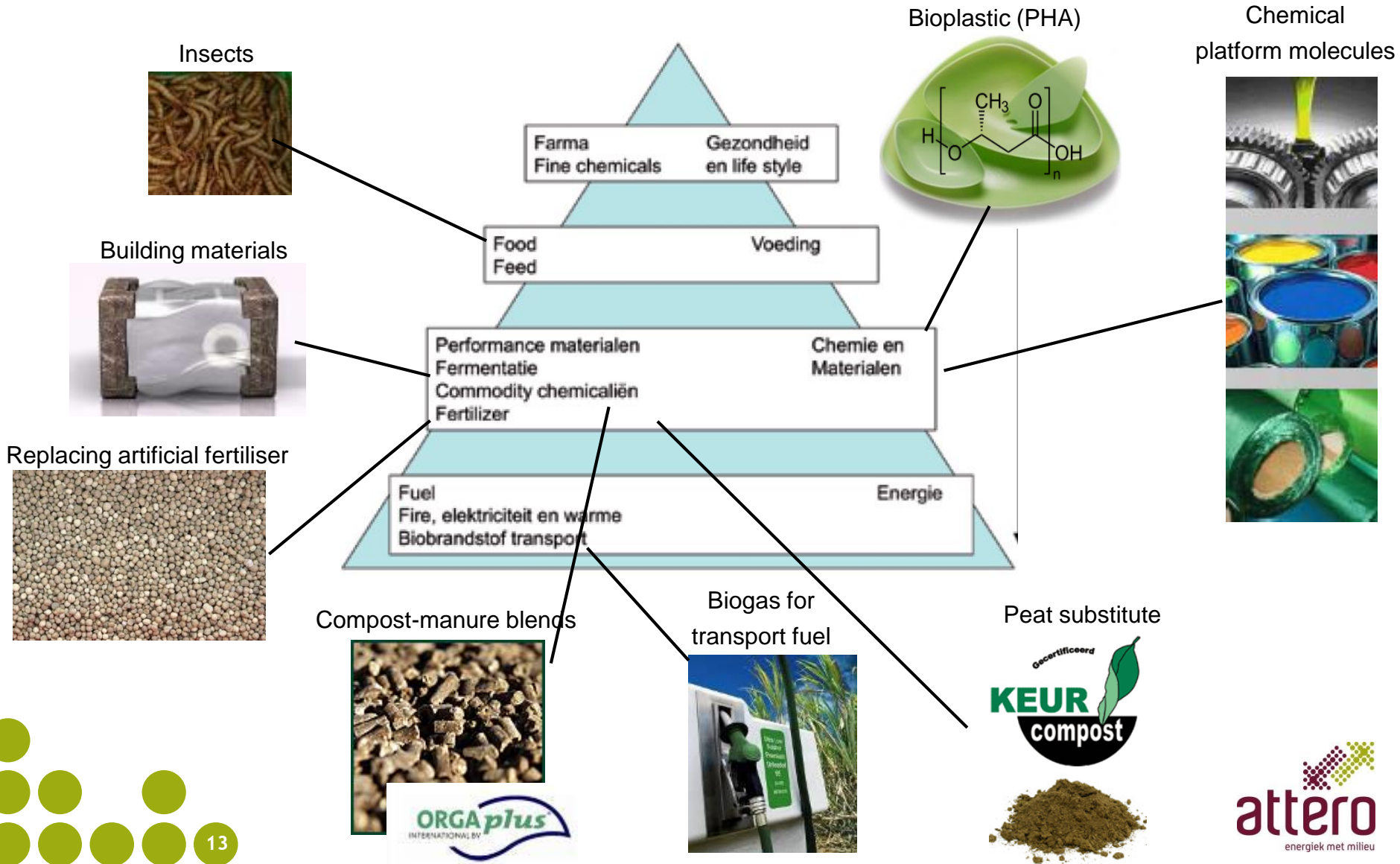
Developments fits well with current activities:

- Processing of organic waste is core business
- Economies of scale
- Producer of green power and green gas
- Closing cycles of nutrients and carbon
- Availability of locations, infrastructure, permits

→ A small step towards production of bio-based feedstocks



Inspiration: the Bio-based value pyramid



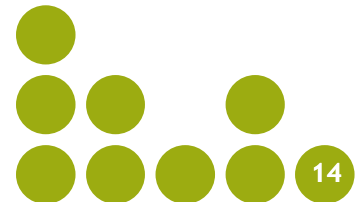
Example: bio-waste treatment facility Venlo

Transition from composting → AD → bioplastics production

1992: tunnel composting facility
 product: compost

2010: two-stage digestion + post-composting
 product: biogas + compost

2017 (?): PHA (bioplastic) production + post composting
 product: bioplastics + compost



What we did in the past: composting

Processing of 90.000 ton/year bio-waste

Pre-composting in 10 tunnels for 2 weeks

Post-composting in 8 tunnels for 2 weeks



What we do now: 2-stage AD of bio-waste



Processing of 90.000 ton/year bio-waste

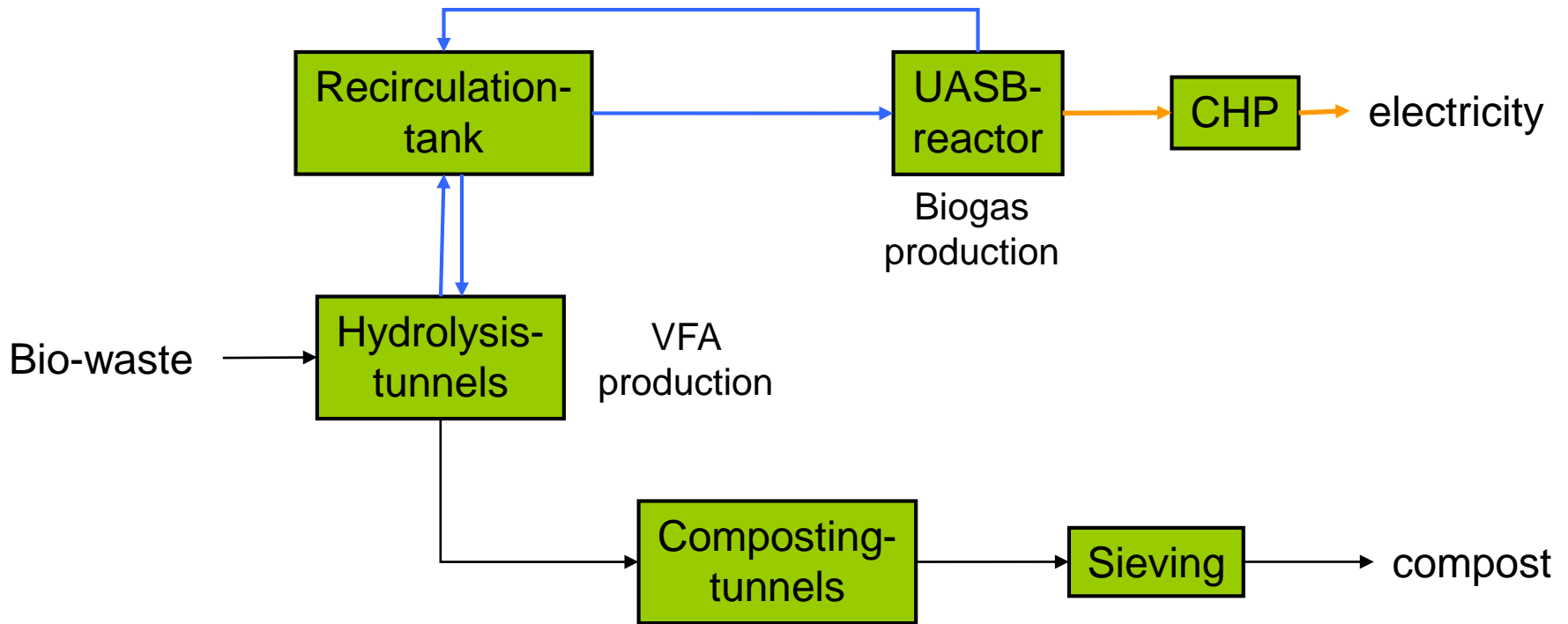


Hydrolysis in 9 tunnels for 7 days: production of volatile fatty acids

Post-composting of hydrolysed bio-waste in 8 tunnels for 2 weeks

Production of biogas from VFA in UASB

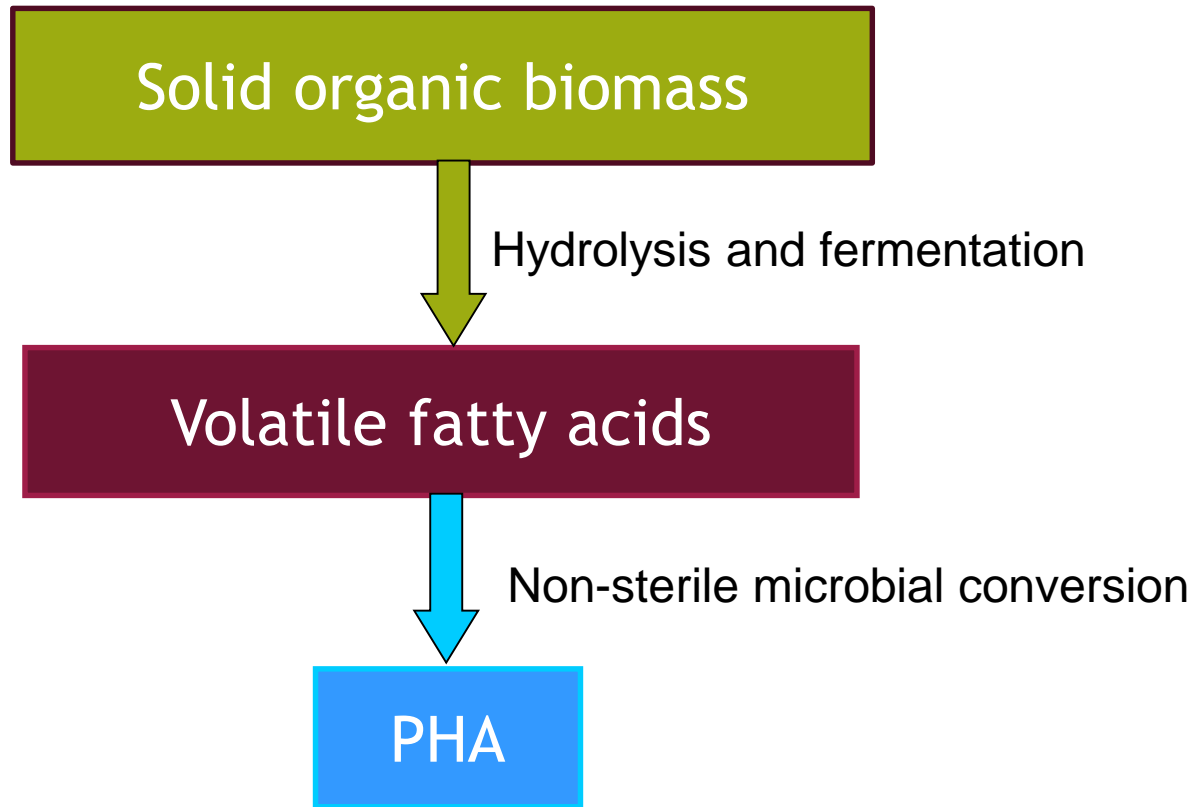
Flow-scheme of 2 stage digestion



Closed water circuit: no production of wastewater



What are our plans: bioplastics (PHA) production

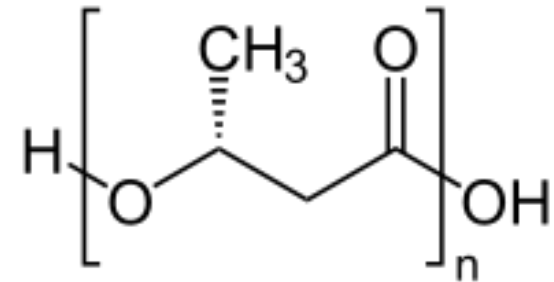


- First step of the process is the same as anaerobic digestion
- Polyhydroxyalkanoates (PHA) are biodegradable (bio)polymers that certain bacteria use as an intermediate storage compound.

PHA production from bio-waste

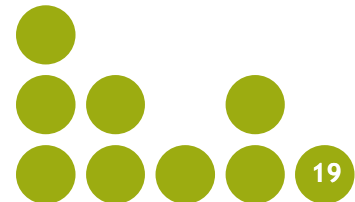
PHA = Polyhydroxyalkanoate

- A bio-based, biodegradable plastic
- Properties comparable to polypropylene
- 100% biodegradable
- Market price: 2-5 €/kg



Advantages compared to current PHA production

- Feedstock is bio-waste (sugars)
 - A non-sterile process (sterile)
 - Natural selection of bacteria (genetically modified bacteria)
- Production process is much cheaper



The future of the organic waste sector:

Transition from a waste processing company
towards a bio-based feedstock supplier

Adrie Veeken

Business developer Bio-based products

E adrie.veeken@attero.nl

M +31 6 11394268

