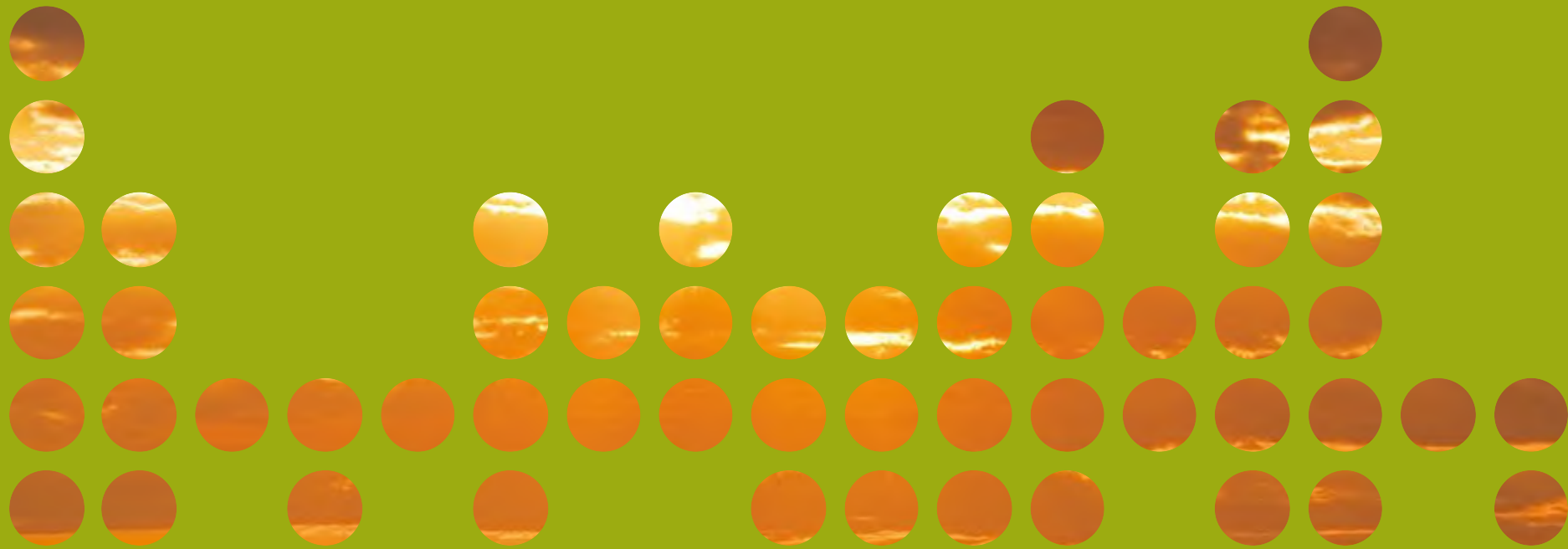


Biomassa energiecentrale Odiliapeel



Biomassa Energiecentrale Odiliapeel

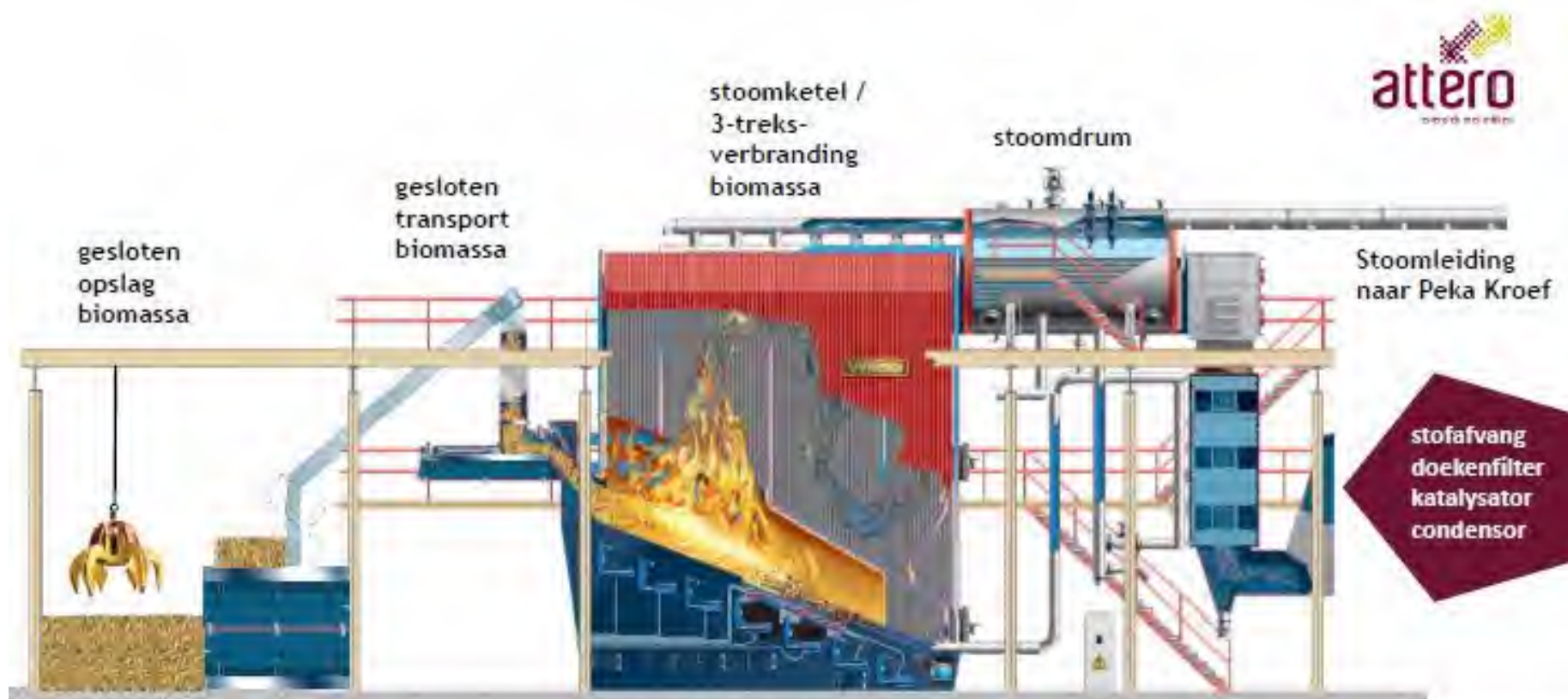


Kengetallen

- Thermisch vermogen: 8,7 MW
- Stoomproductie: 10,2 ton per uur
- Rendement: 91,2 %
- Stoomtoepassing: Stoomschillen en blancheren aardappels
- Biomassa: 27.000 ton per jaar
- Aardgasbesparing: 8,2 mln m³ per jaar
- CO₂ reductie: 14.500 ton per jaar



De installatie

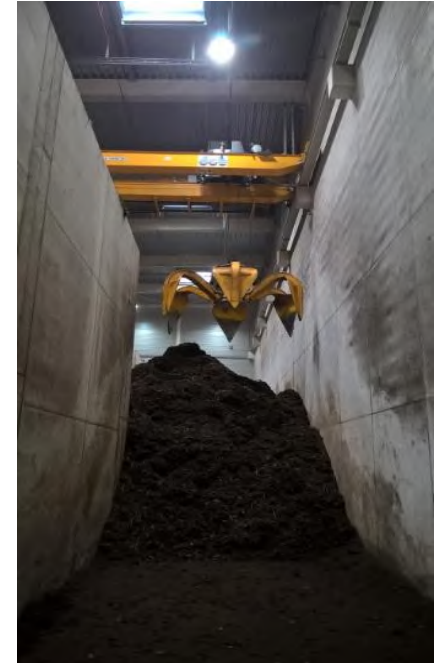


Biomassa



Input
biomassa
shreds

Volautoma-
tische
biomassa
belading



Lospunt biomassa in
stortput

Installaties

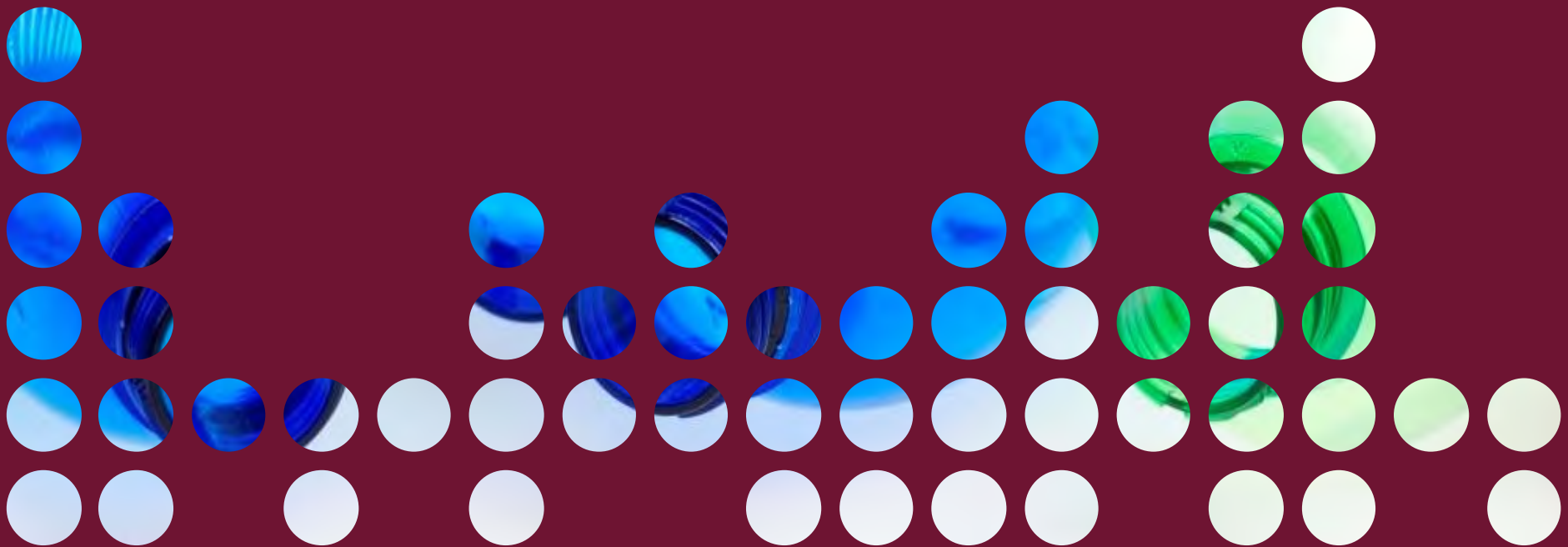


Biomassa energiecentrale Odiliapeel

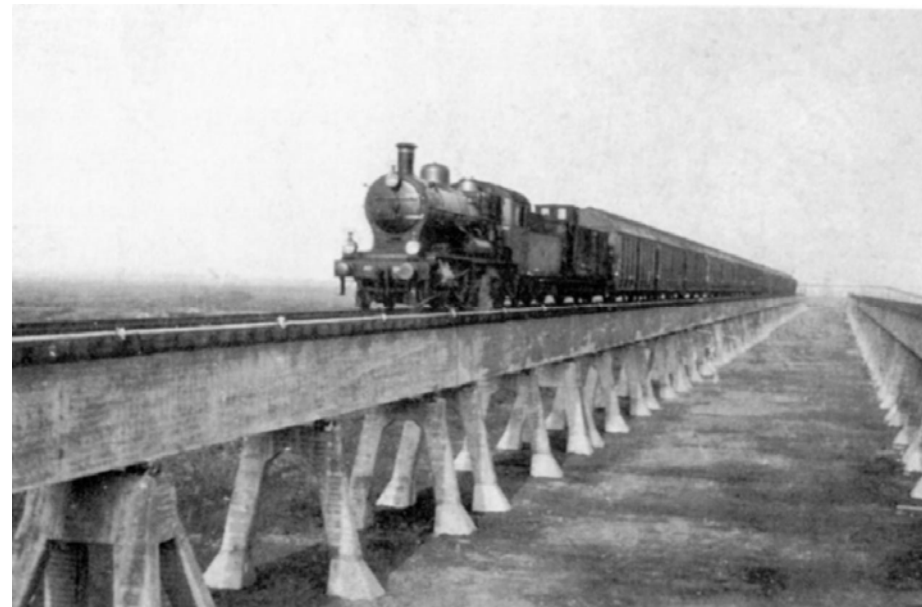




Attero's location Wijster:
Innovative in maximizing material and energy
recovery from waste since 1929

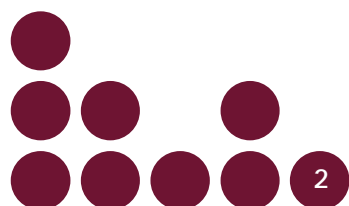


Attero Wijster 1929



Main activities:

- Railway connection with The Hague
- Composting residual waste (waste was without plastic)
- Fertilizing unfertile province of Drenthe



Attero Wijster 2011



BIOWASTE COMPOSTING

SEPARATION & WASTE-TO-ENERGY

WASTE WATER TREATMENT

TRAIN STATION

METAL RECOVERY

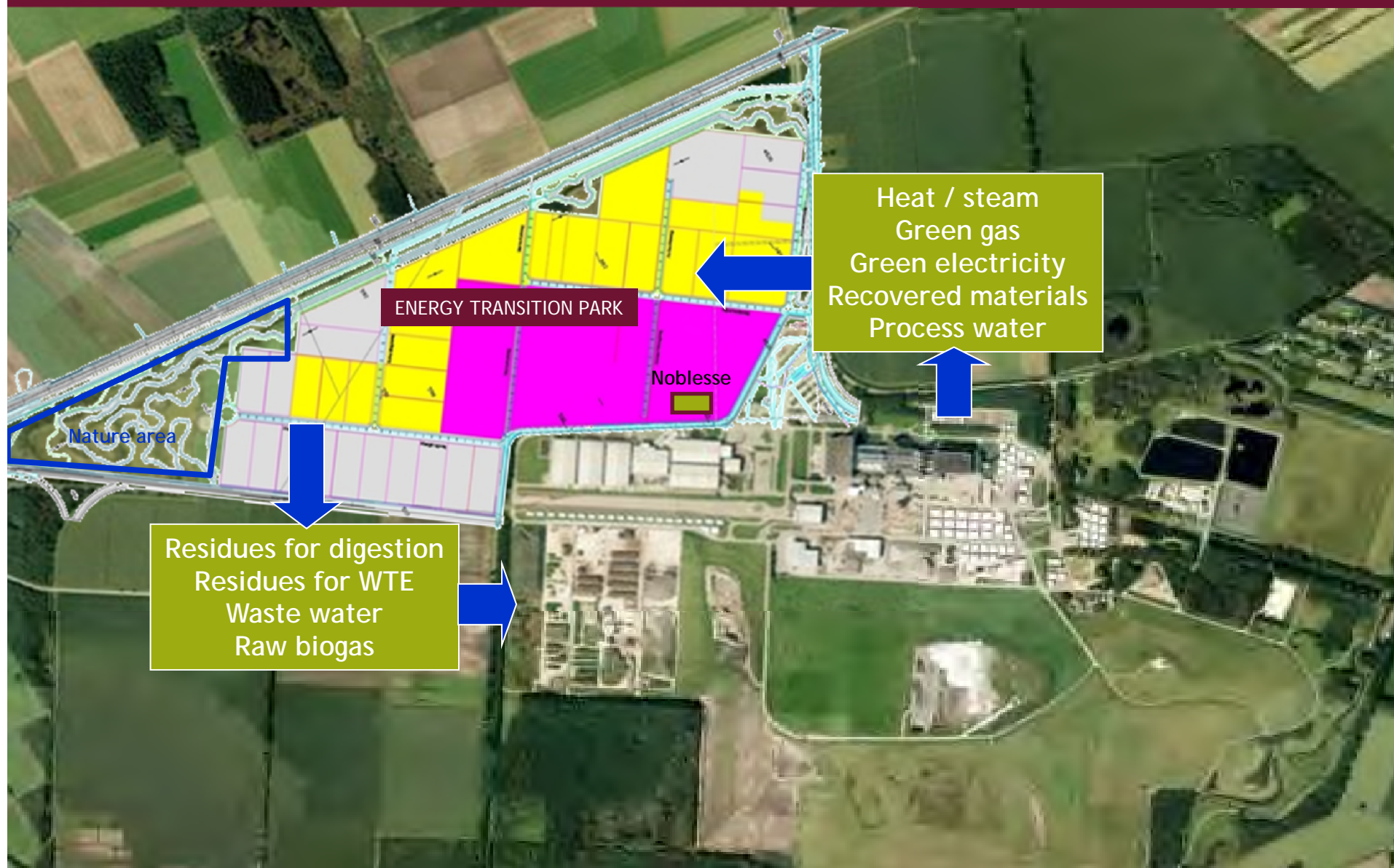
NATURAL GAS PRODUCTION

LANDFILL

Main activities:

- Production of secondary fuels from residual waste
- Waste-to-energy from residual waste
- Biowaste composting
- Landfill
- Green gas production from landfill gas

Attero Wijster 2012: Realization Energy Transition Park



ENERGY TRANSITION PARK

Noblesse

Nature area

Heat / steam
Green gas
Green electricity
Recovered materials
Process water

Residues for digestion
Residues for WTE
Waste water
Raw biogas

Attero Wijster 2012: Realization Green Gas Grid expansions



Direct green gas delivery
to Green Planet gas station



Direct green gas delivery
to gas grid for 6.000
households



Development of biogas collection network:
Connection with agricultural digesters to turn
biogas into green gas and inject in the grid



Attero Wijster 2012-2014: Realization anaerobic digestion for gas production



2013: Anaerobic digester for source-separated biowaste



2014: BioLNG production from Attero's biogas by partner Rolande

2014: CO₂ production for industrial use



2012: Anaerobic digester for post-separated biowaste



Attero Wijster 2013-2014: Realization recycling plastics, drinking cartons and metals



2013: Post separation of packaging materials from yearly 250 kton residual waste



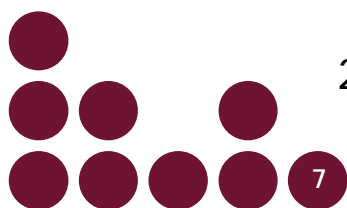
2014: Doubling of capacity for post separation of packaging materials from residual waste



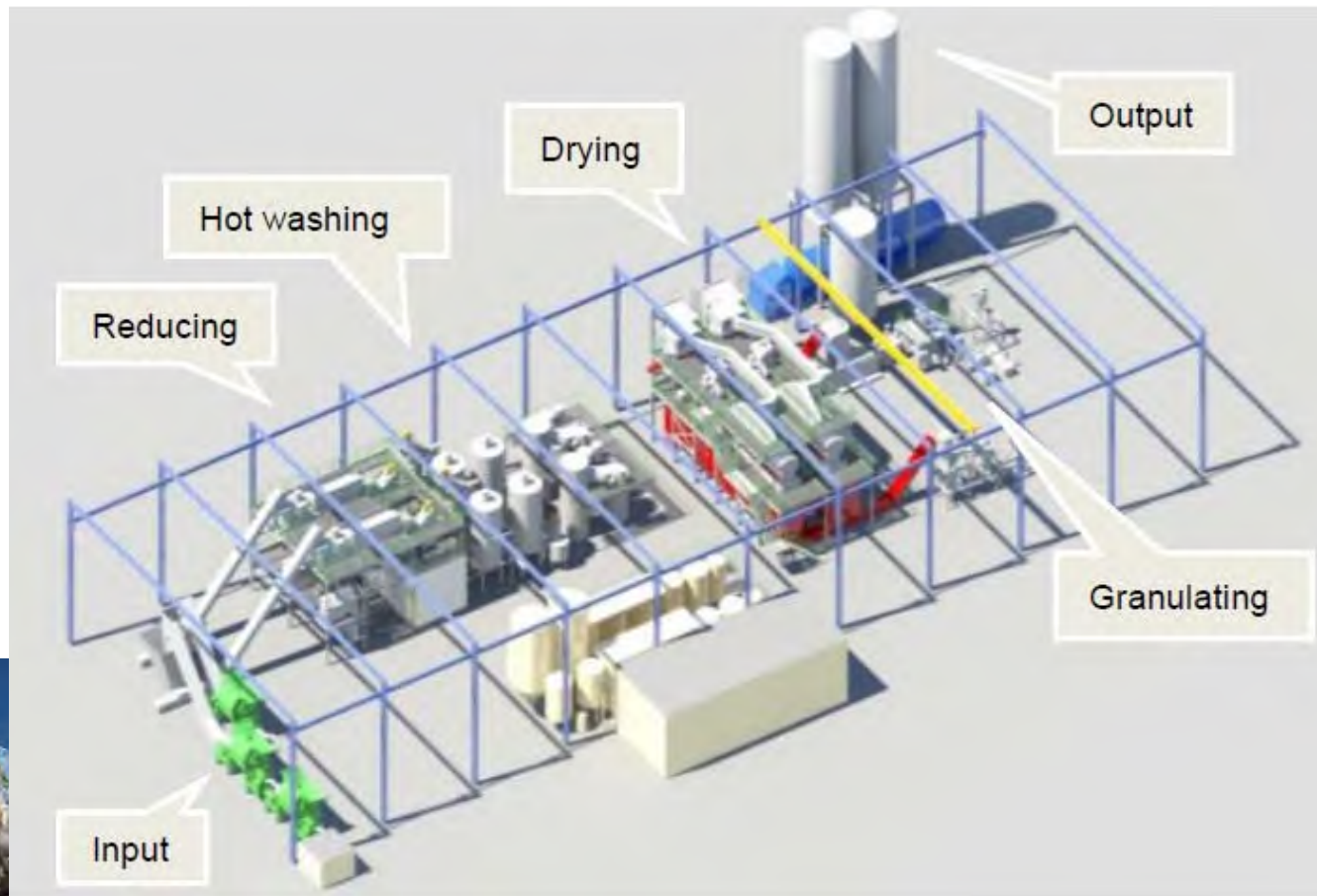
2014: Sorting plant for 80 kton post-separated and source-separated packaging waste



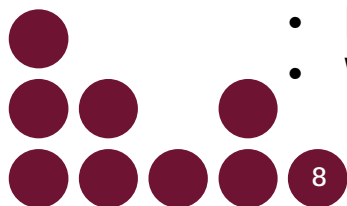
2013: Inashco ADR non-ferro metal recovery plant installed (non-ferros from bottom ashes)



Attero Wijster 2017: Realization flaking, hot-washing and granulating plastics



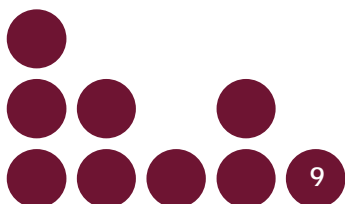
- Heat for hot washing and power from own waste-to-energy plants
- Water treatment in own water treatment plant

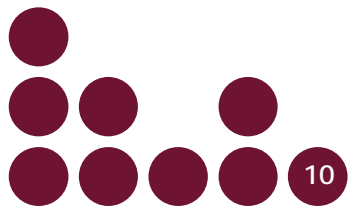


Attero Wijster near future: Realization Green Gas Booster



- Attero at times produces too much green gas for the local gas grid
- At times of over-production the green gas is automatically changed to higher pressure and injected into the national gas grid





Questions? Contact Attero:
Robert Corijn, Marketing Manager
E-mail: robert.corijn@attero.nl, Mobile: +31 6 15 85 70 95



[Energy for Change]

Euro day
2016

Innovations



AVR.



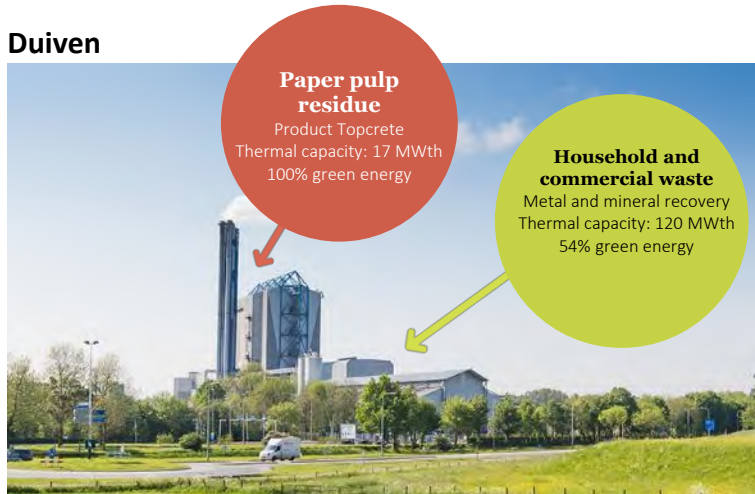
AVR treats different types of residual waste streams

- AVR is the largest Energy-from-Waste (EfW) company in the Netherlands.
- EfW permitted capacity of over 1,700 kt/annum and 699 MWth of total installed thermal capacity (steam and heat) of which 60% is classified as renewable energy.
- AVR has a 22% EfW market share in total Dutch permit capacity

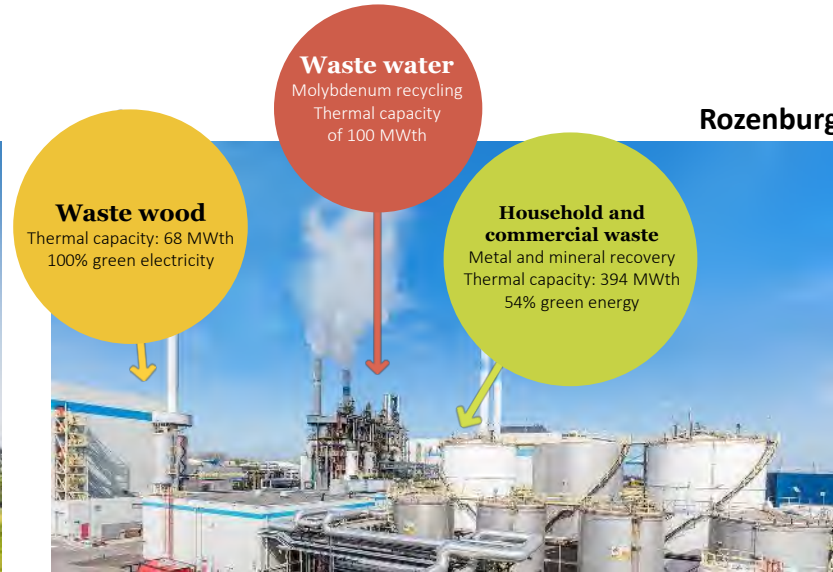


AVR. 

Duiven



Rozenburg



AVR the central heating source of Rotterdam

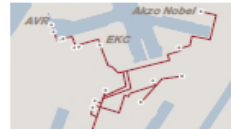
AVR.



Key metrics

Steam

District heating



Tronox

EKC

WBR

Eneco

- CO₂ reduction (Kton)
- Thermal energy (PJ)
- # household equivalents

50

80

70

95

0,75

0,75

>1.5

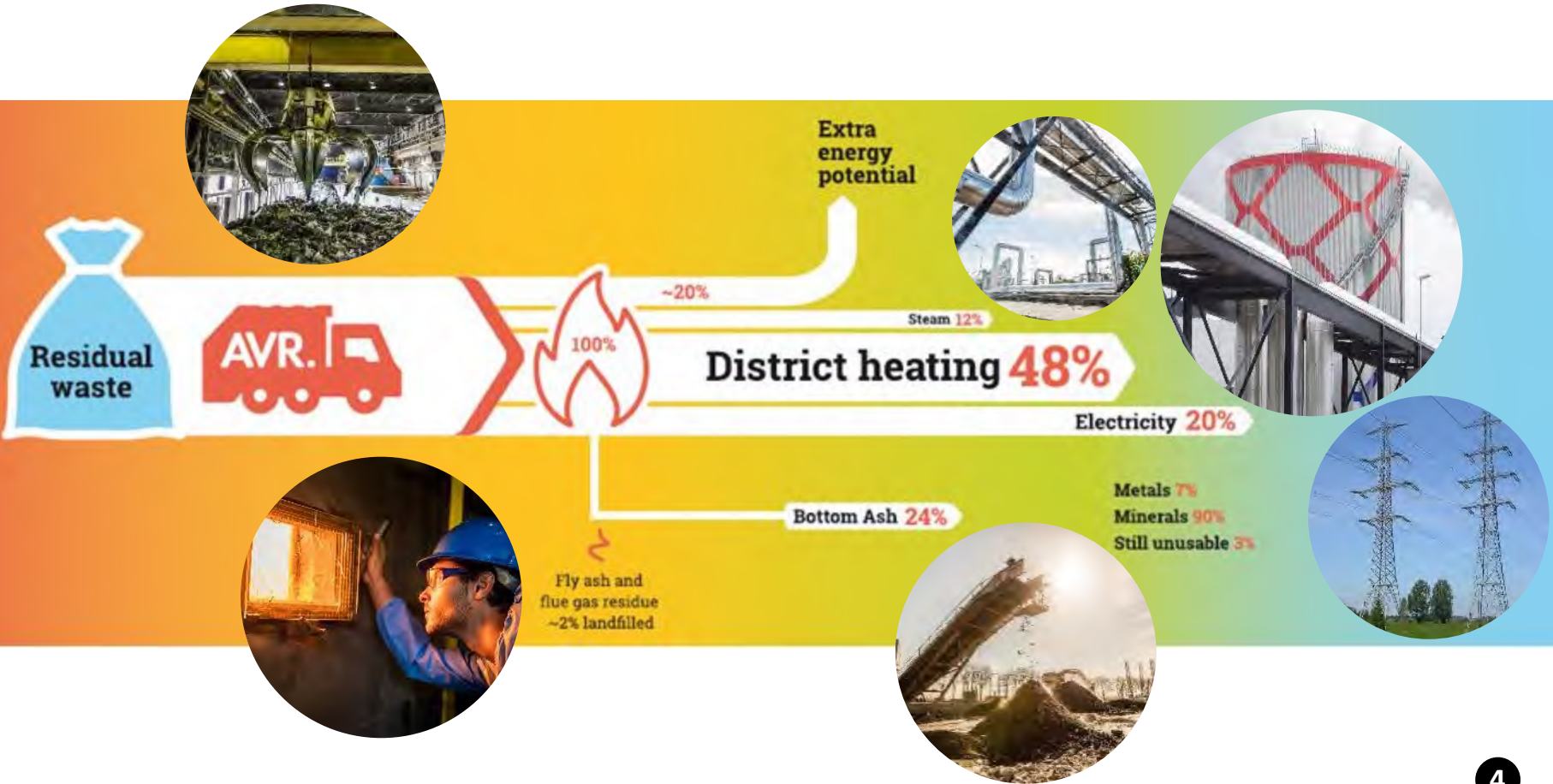
>3.5

50,000

100,000


Realised steam and heat projects avoiding ~300 kton CO₂ emissions

Energy and resource recovery






Our motivation:
A clean world in which nothing is wasted.



Made from waste: Heat for 160.000 households



Made from waste: Electricity for 200.000 households



Made from waste: Metals and minerals



Innovation: CO₂ as a raw material

Case study:

Co₂ as a product

Regulatory landscape

POLITICAL AMBITIONS

GLOBAL

- COP 21
- EMISSIONS CAP & TRADING SCHEMES
- EU 20-20-20 TARGETS
- DUTCH ENERGY AGREEMENT 2023
- DUTCH ENERGY AMBITIONS 2050
- RECYCLING TARGETS

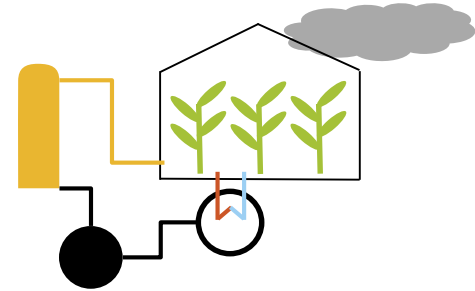
LOCAL

- LANDFILL BANS



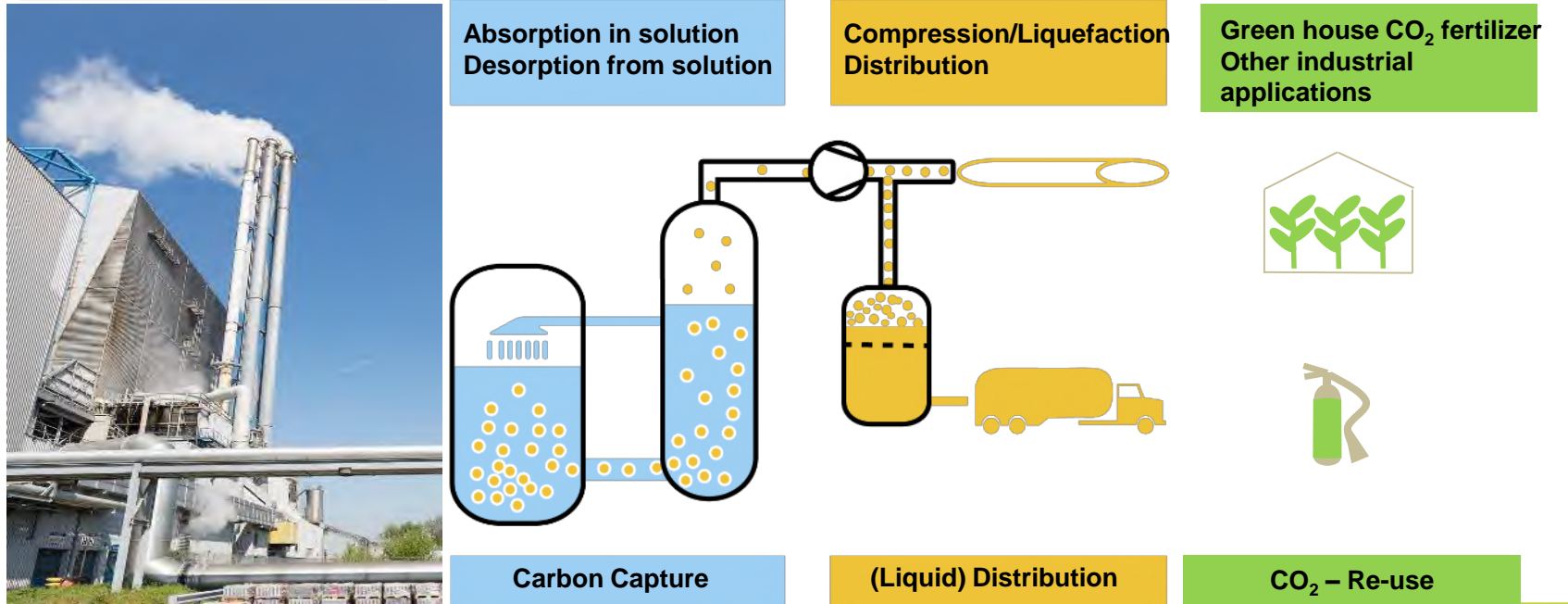
CO₂ as a crop fertilizer

Greenhouses in the Netherlands use CO₂ gas as a fertilizer to stimulate crop growth. Like for cucumbers, paprika's



Current practice:
Exhaust gases from natural gas fuelled CHP-engines are used as a CO₂ source

CO₂ as a raw material



Combination of CO₂ supply and heat enables Greenhouses to reduce natural gas consumption significantly.

Carbon capture and utilization

Utilization a valuable alternative to storage

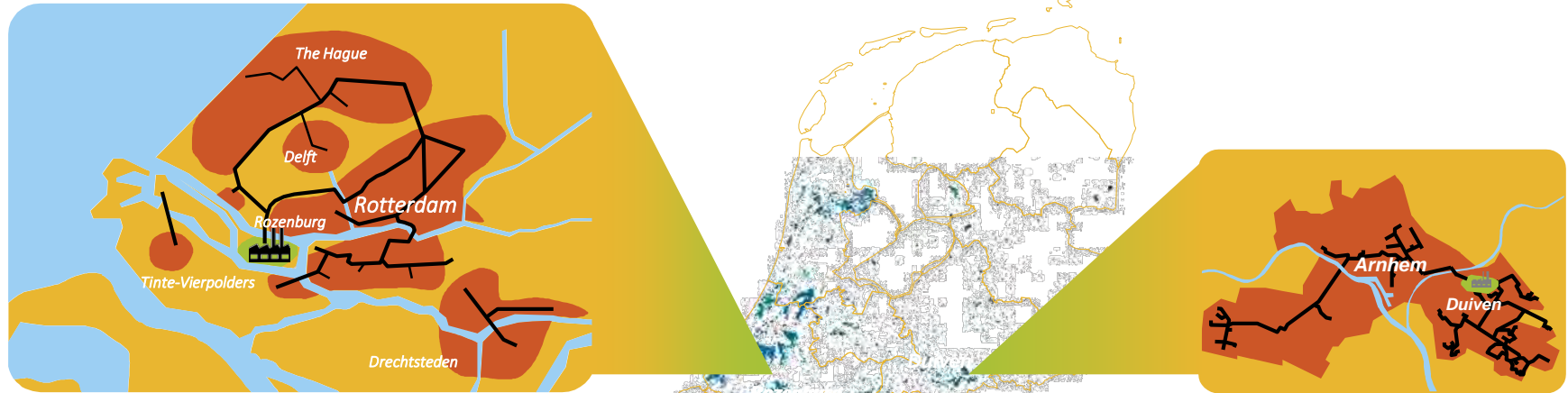
Once connected to renewable heat sources, demand for CO₂ increases significantly.

The locally captured CO₂ from EfW plants (and other industries) can meet this demand.



Market potential CO₂

AVR. 



Rozenburg

Enormous advanced greenhouse area

Existing gas CO₂ network *under supplied*

Several liquid CO₂-suppliers to industries

Network for CO₂ and heat available and extensions are under development

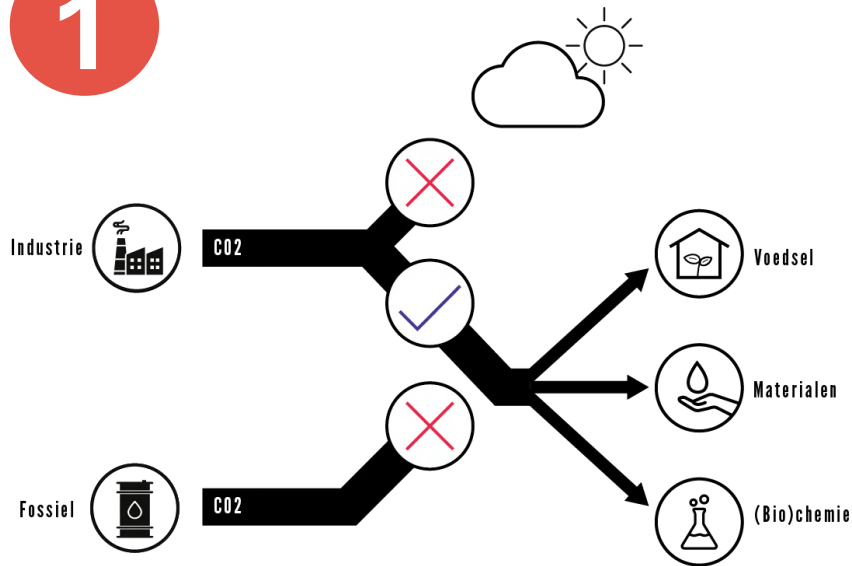
Duiven

Existing nearby greenhouse areas supplied by liquid CO₂ and exhaust gas CHP.

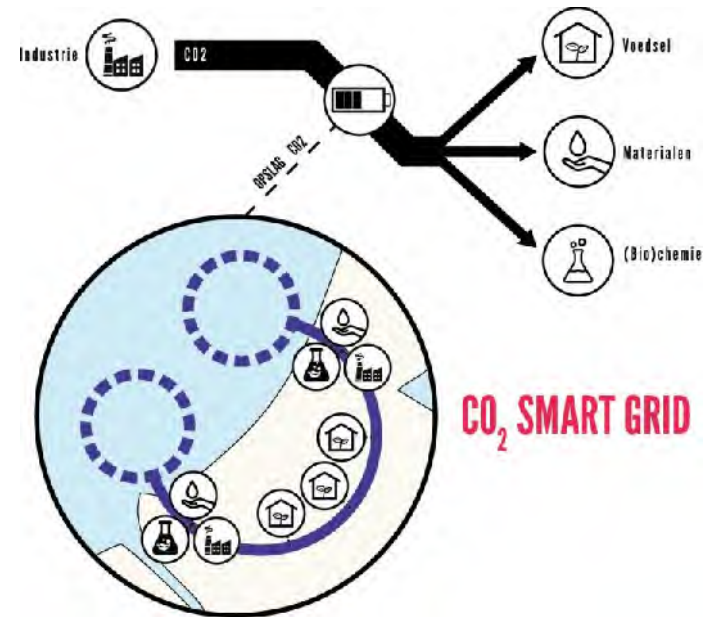
*Pending liquid CO₂ demand
Regional heat network under construction*

Concept – CO2 smart grid

1



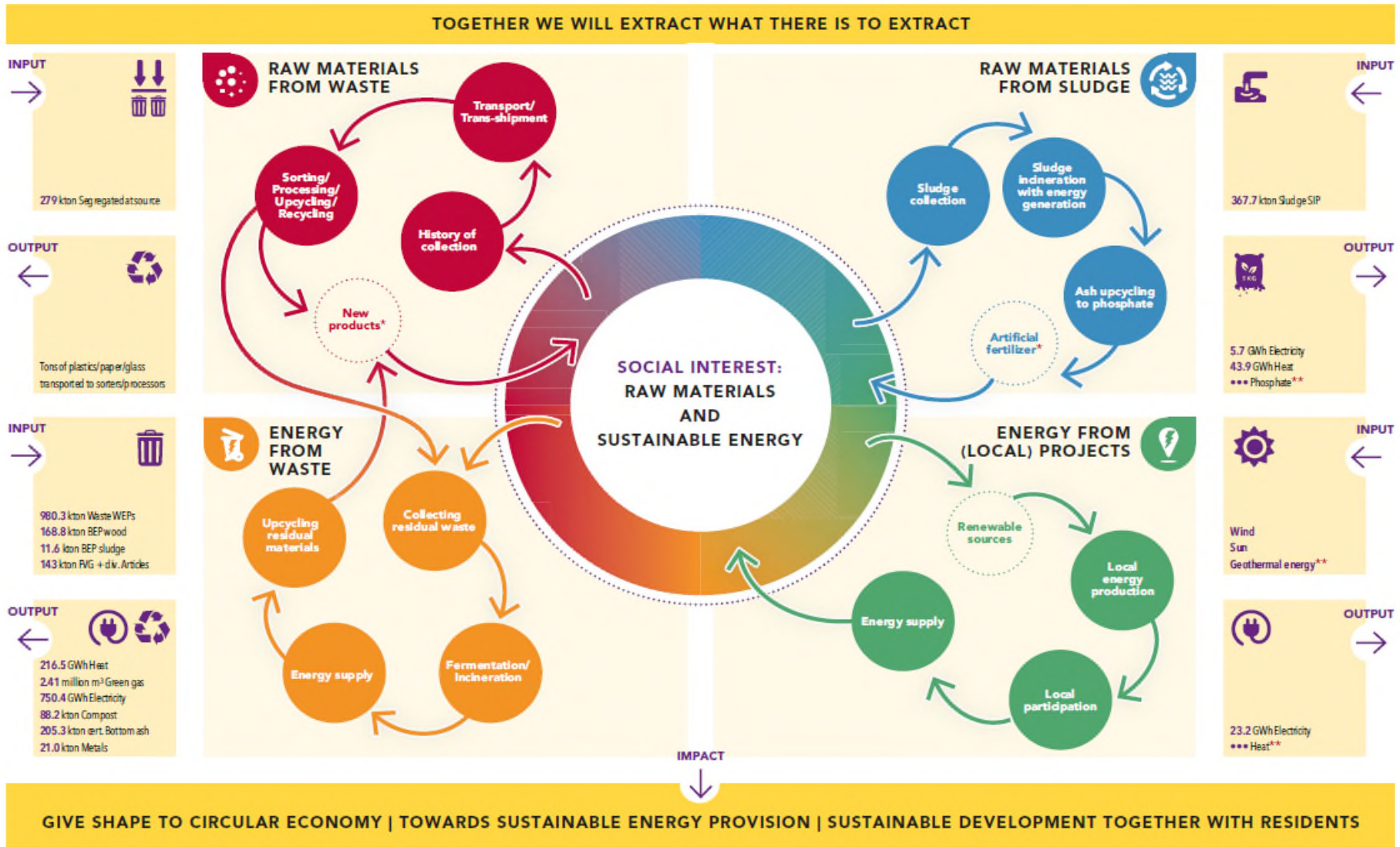
2





Questions? Jasper.de.Jong@avr.nl

HVC: active in Resource Recovery and Renewable Energy



* No HVC activity.
** Innovations in preparation.

HVC: together we will extract what there is to extract

CONNECTION WITH
SHAREHOLDERS/RESIDENTS

OPERATING RESPONSIBLY

FINANCIAL ROBUSTNESS

Corporate
themes

RAW MATERIALS

ENERGY
FROM WASTE

ENERGY
LOCAL SUSTAINABILITY

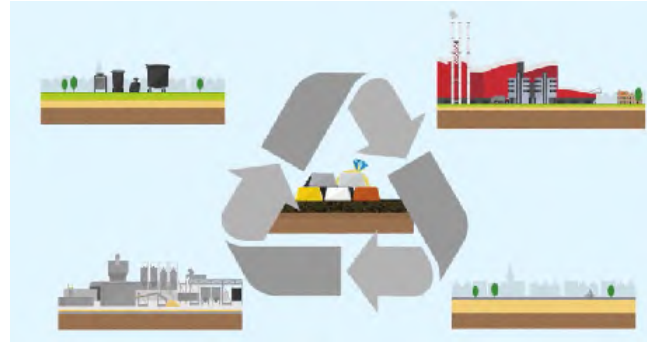
SLUDGE WATER CHAIN

Strategic
pillars

- 52 shareholders: municipalities, water companies and district water control boards
- Empowering citizens: waste prevention, separate collection, energy saving, renewable energy
- The waste-to-energy plants process 980 kton of waste annually and are both classified R1 plants.



1. Recycling: washing and fractionating of bottom ash



This unique plant can upcycle the incinerator bottom ash left after the incineration of residual waste so that it can be used as a substitute for sand and gravel on the market for infrastructure and building materials. The plant will contribute to the circular economy and implement the green deal for incinerator bottom ash.

Main products from bottom ash washing:



[Link video-item: https://vimeo.com/186380409](https://vimeo.com/186380409)

2. Renewable energy: district heating

- Waste-to-Energy plants in Alkmaar and Dordrecht
- Clients: Households and companies in the direct vicinity of Alkmaar and Dordrecht (20.000 household equivalents)
- Energy savings mount up to 75% CO₂-emission per household (compared to ordinary natural gas heating)
- Connection to the CHP gas-fired district heating grid of Langedijk and Heerhugowaard. Investment of € 17 mln.

Other heat initiatives:

- 30 kton/yr cow's manure drying
- 100 kton/yr CO₂ capture





www.hvcgroep.nl

N.V. HVC, Jan-Peter Born
strategy & business development

mobile: +31 622463367
E-Mail: j.born@hvcgroep.nl



Meerlanden

Samen sneller circulair!



 **Meerlanden**
afval | openbare ruimte | bio-energie

Meerlanden

Zes strategische doelstellingen



Meer winnen
uit afval



Meer
betrokkenheid
bij de buurt



Meer groene energie
en warmte



Meer mogelijkheden
voor mensen



Meer biobased
producten & biodiversiteit

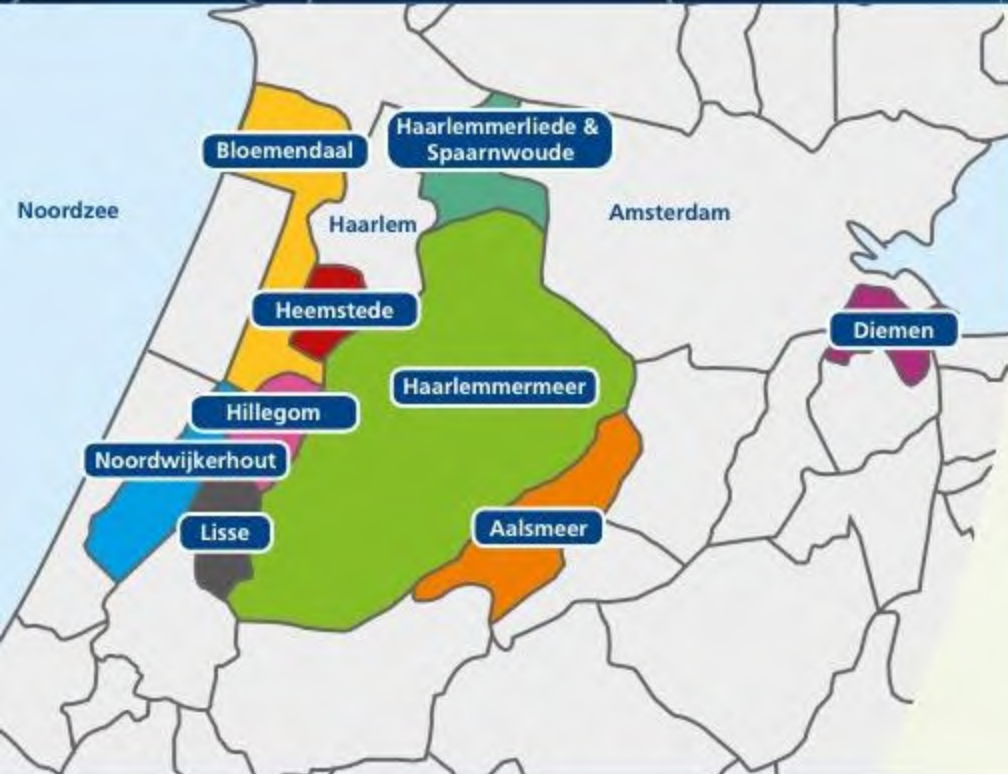


Meer financiële
waarde



Meerlanden

In cijfers



- 30 gemeenten, 9 aandeelhoudende
- 314.000 inwoners, 3.500 bedrijven
- 62.000 ton organische stromen:
 - afval (o.a. GFT, swill, oud brood)
 - beheer openbare ruimte:
 - sloot- & bermmaaisel
 - takken- & snoeiafval
- 180.000 ton anorganische reststromen, o.a.:
 - plastic
 - papier
 - glas
 - hout



Project: Groene Energiefabriek van Meerlanden



55.000 TON

GFT ingezameld in 2015

1,6

miljoen m³
CO₂

2,5

miljoen
ZAKKEN
MEERCOMPOST



2,4

mln m³ groengas

900 x



10.000.000

kWh warmte



4.380.000

liter



Ontwikkeling 6e product
uit GFT voor productie verf

Project: Levering CO2 uit vergisting aan OCAP



Doel

Het leveren van CO2 uit vergisting van organische afvalstromen aan bestaande OCAP-leiding en daarmee afzet aan glastuinbouwgebieden tussen Amsterdam en Rotterdam. De CO2 wordt onttrokken uit biogas in onze Cirmac-installatie.

Status

Momenteel doen we onderzoek naar de kwaliteit van de te leveren CO2 en de manier van leveren aan OCAP.

Resultaat

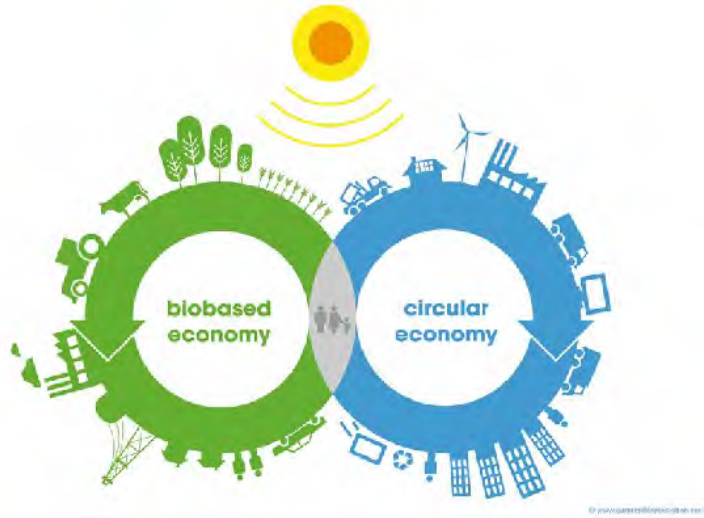
Eind 2016 levering aan OCAP.

Subsidie

TKI Groengas



Project: Roadmap naar een Biobased economie



De Biobased economie

richt zich op verlagen van afhankelijkheid van fossiele brandstoffen en het daarvoor ontwikkelen en produceren van biogene alternatieven.

Doel

Onderzoek naar de haalbaarheid voor Meerlanden als Biobased grondstoffenproducent en de mogelijkheden om tot een hogere verwaarding van biologische rest- en afvalstromen te komen.

Status

Momenteel is volumepotentie in verzorgingsgebied van Meerlanden en een straal daaromheen in kaart gebracht. Daarnaast beoordeling van bestaande verwerkingstechnieken en potentiële afzetmarkten en hun specifieke vereisten.

Resultaat

Businessplan voor een nieuw te bouwen installatie in 2017.



Project: Papier van Haarlemmermeers gras



Doel

Haalbaarheid toetsen om met verschillende partijen uit Haarlemmermeer lokaal papier en karton te produceren uit organische reststromen uit de openbare ruimte, te weten olifantsgras en bermmaaisel.

Status

Onderzoeksfase

Resultaat

Installatie om bermgras en olifantsgras te drogen als onderdeel van onze Groene Energiefabriek.



Orgaworld & Circular Economy

Orgaworld
Part of Shanks Group

Shanks
Making more from waste



Innovation agenda 2016 - 2021

“To be the most respected waste-to-product company

- Shanks Group is a leading international sustainable waste management business
- Founded in 1880 in Scotland we now operate in three divisions: Hazardous, Commercial Waste and Municipal
- Operations in the Netherlands, Belgium, United Kingdom and Canada
- Shanks employs around 3,500 people.

Sustainability is at the heart of Shanks' business. Our strategy is to create value by making products from material which is otherwise thrown away.



Peter Dilnot
Peter Dilnot
Group Chief Executive

- Founded in 2001, part of Shanks group since 2007
- Focus: valorization of organic waste into fuels and raw materials
- Design built own operate & innovation (process, product)
- Sites in The Netherlands and Canada
- Specialisation
 - composting and biologic drying
 - anaerobic digestion
 - waste water treatment
 - bio based raw materials





Composting

SSO
Food scrap
L&Y Waste
Digestate
biosolids

Tunnel/in-vessel
composting

Compost
Bio stimulants



Anaerobic digestion

SSO
Food scraps
Supermarket waste
Fatty byproducts

Wet and dry AD

Sustainable electricity
Residual heat (industry,
residential)
Bio transport fuels



Waste water treatment

Industrial waste water
non-toxic

MBR,
aerobic treatment

Clean water

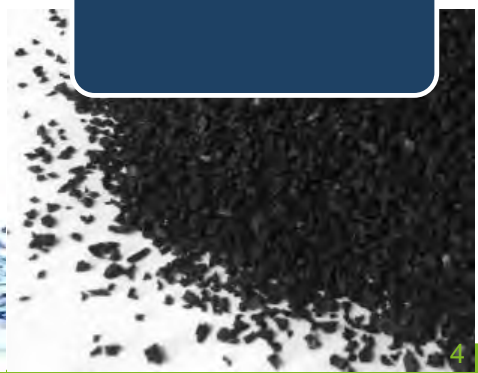


Sludge drying

Digestate, biosolids

Steam dryer (residual
heat)

P-rich dry fertilizer



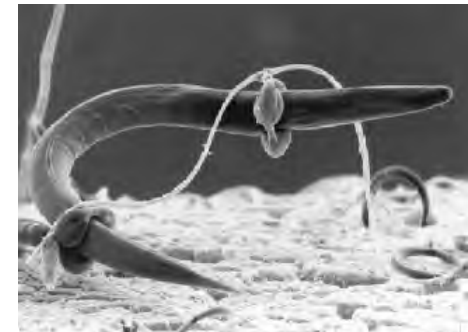
Innovation: bio stimulants



- Add specific bacteria and fungi to compost
- Symbiosis between fungi and root system
- Disease barrier
- Enzymes dissolve cells from pathogens

Effects

- Better developed root system
- Better intake of nutrients
- Higher crop yields
- Less chemicals needed



Illustrative example

Innovation: cardboard from organic waste



- Valorisation of organic residues into cardboard
- Cluster project of Shanks Van Vliet, several knowledge institutes and end users

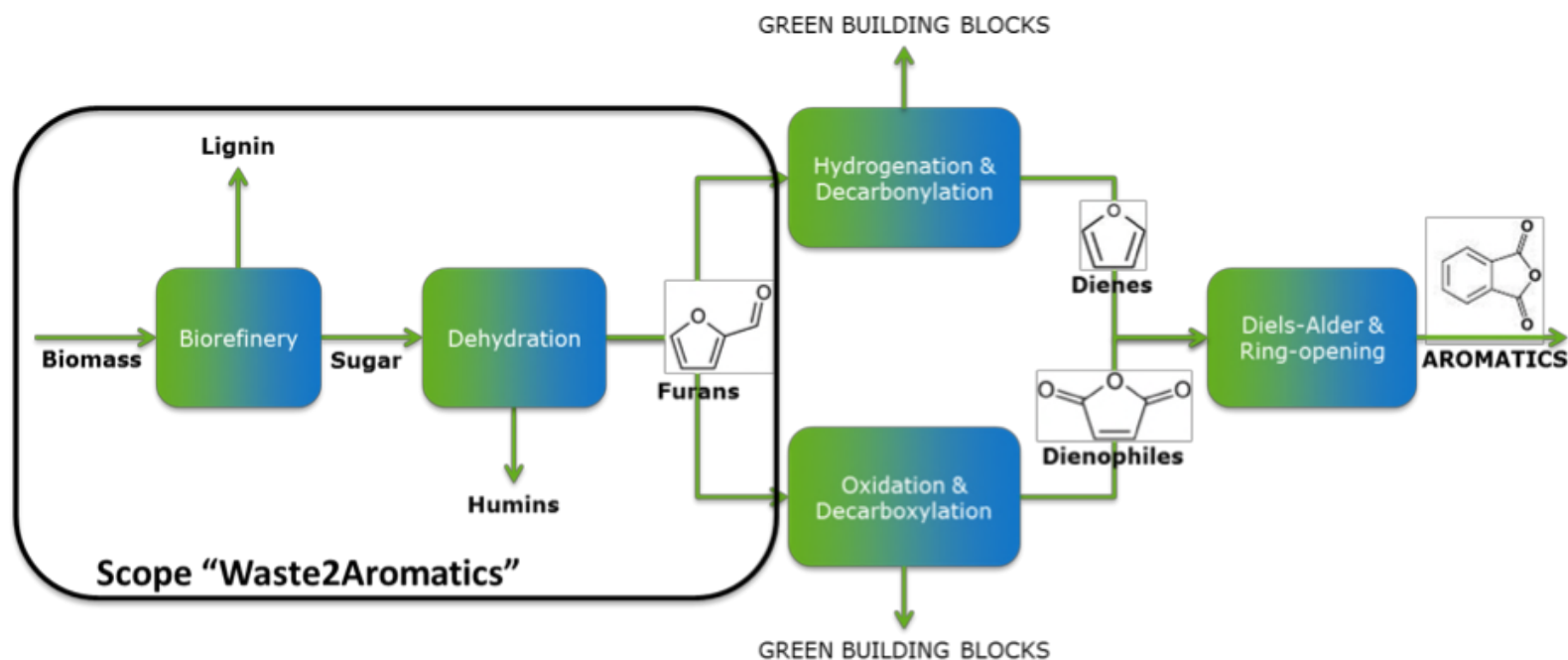
Effects

- Bio-based cardboard from tertiary fibers instead of primary/secondary fibers

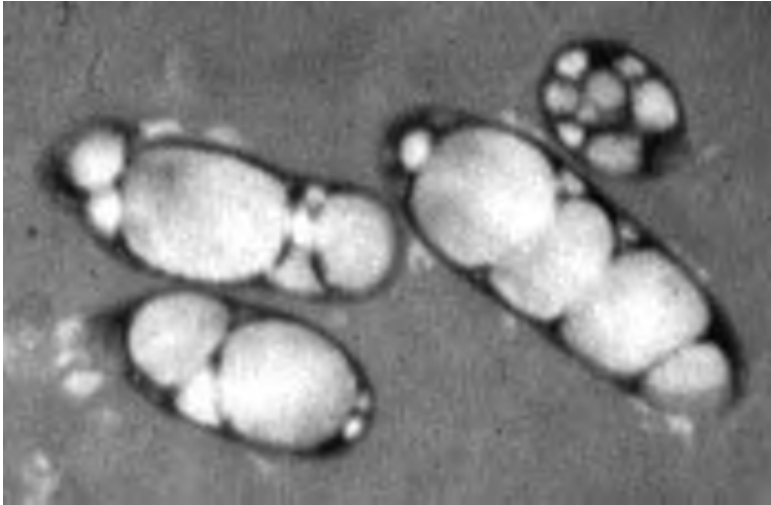


Innovation bio-aromatics

- Recover bio-aromatics from organic waste
- Replace fossil aromatics by bio based (benzene, toluene etc.)
- Partnership within waste sector (TNO lead party)
- R&D, market introduction 5-10 year



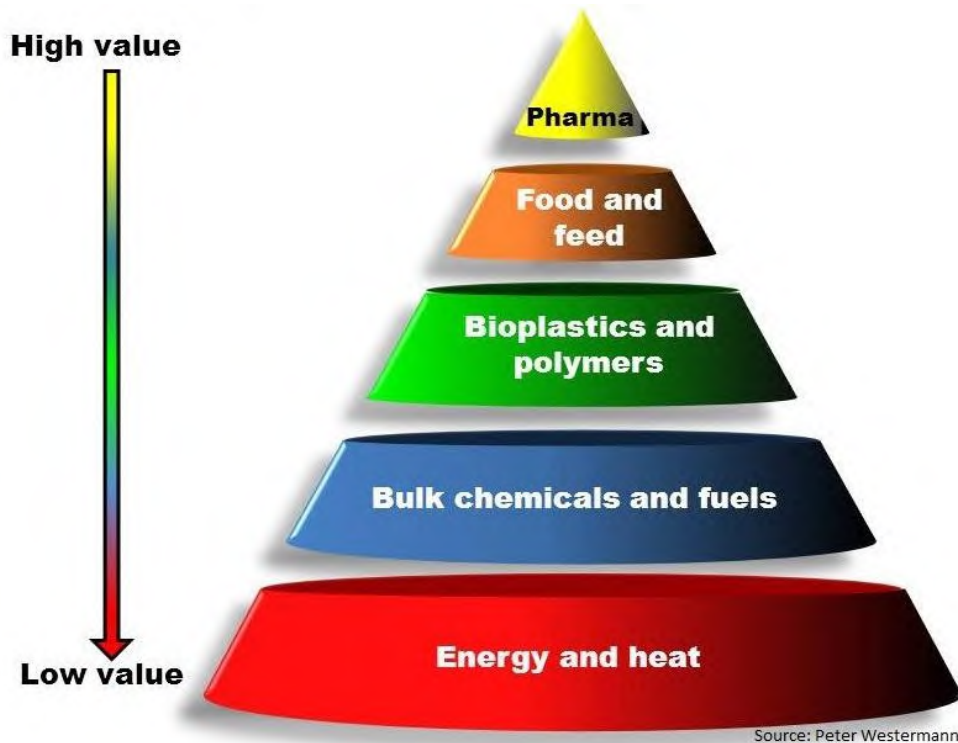
Innovation: PHA



- Polyhydroxyalkanoates (PHA) are linear polyesters from sugars and fats
- Bio based & biodegradable
- Pilot in Lelystad
- SSO and similar waste streams
- Market introduction 5-10 years



Position in circular economy



Orgaworld PHA
Orgaworld bio-aromatics
Cardboard from biomass

Orgaworld Powermix © fertiliser
Granulate high in P2O5

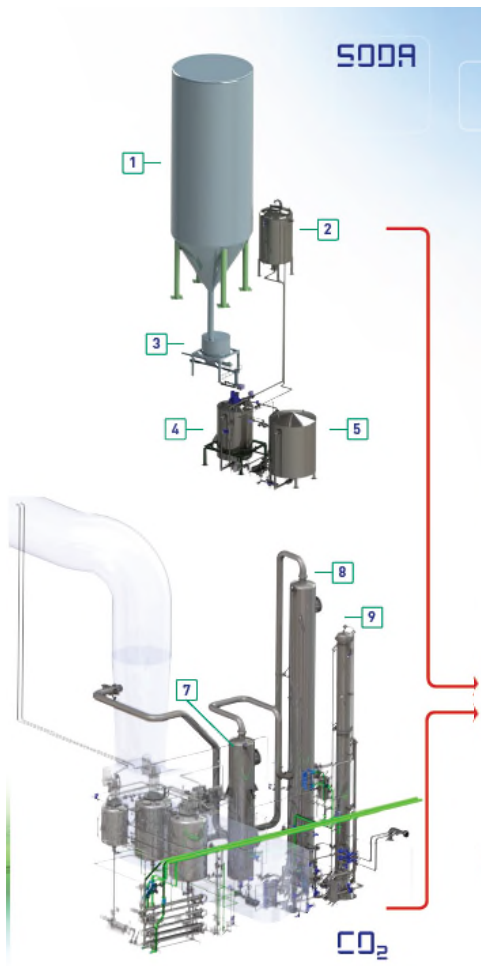
Orgaworld composts (specials)
Composts, bio-stimulants

Orgaworld Biomethane
Biomethane for city vehicles (Surrey-Canada)

Orgaworld Sustainable heat
2.000 households in Amsterdam heated with
Orgaworld residual heat from CHP's (via WPW)

Orgaworld Sustainable electricity
20.000 households can buy from us directly Orgaworld
Green Electricity

CO₂ capture & sodium bicarbonate production

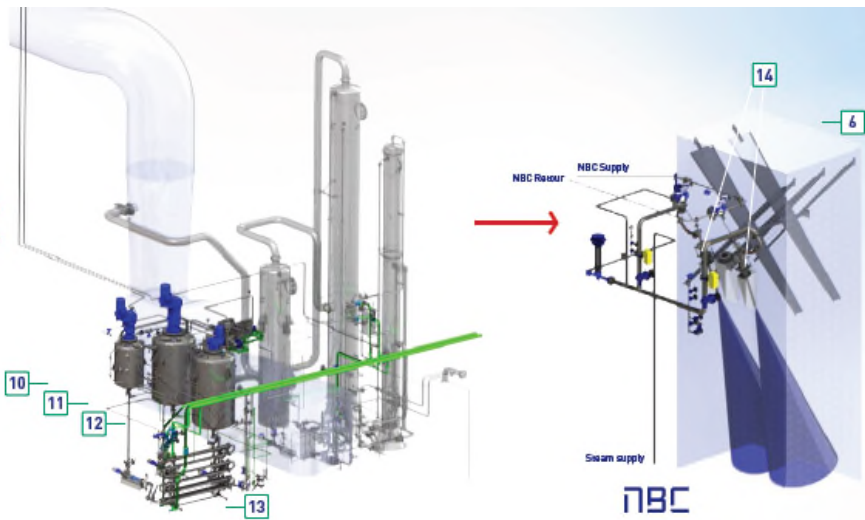


Together with other parties, Twence has developed equipment to capture CO₂ in the flue gas scrubbing system of the Energy from Waste plant. We use this for the production of sodium bicarbonate, which is used as a cleaning agent for the cleaning of flue gases. A small cycle, which provides us with knowledge about a very topical issue: the capture of CO₂. We are examining the options of expanding this to a larger scale.

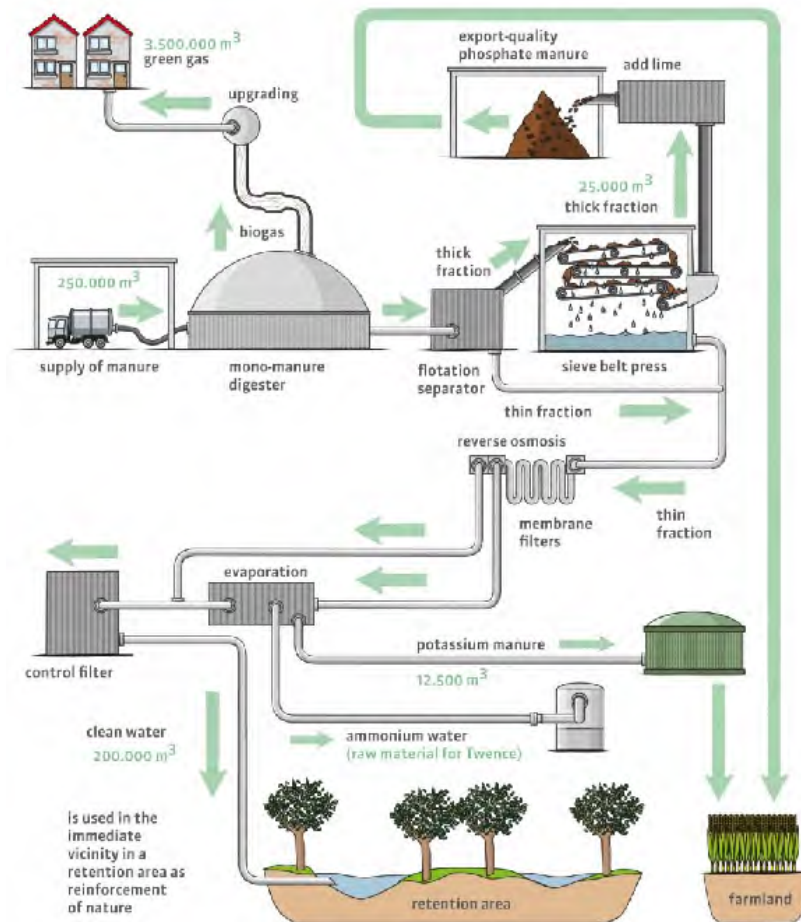
Twence innovative projects

CO₂SBC

Sustainability report 2015



Manure treatment project



Twence intends to build a large-scale manure treatment facility for the processing of 250,000 tonnes of manure/year. Manure contains valuable nutrients such as phosphate, nitrogen and potassium; raw materials that form the basis of everything that grows and flourishes. We want to recover these nutrients. The facility that has been designed can convert the manure to 100% re-usable materials.

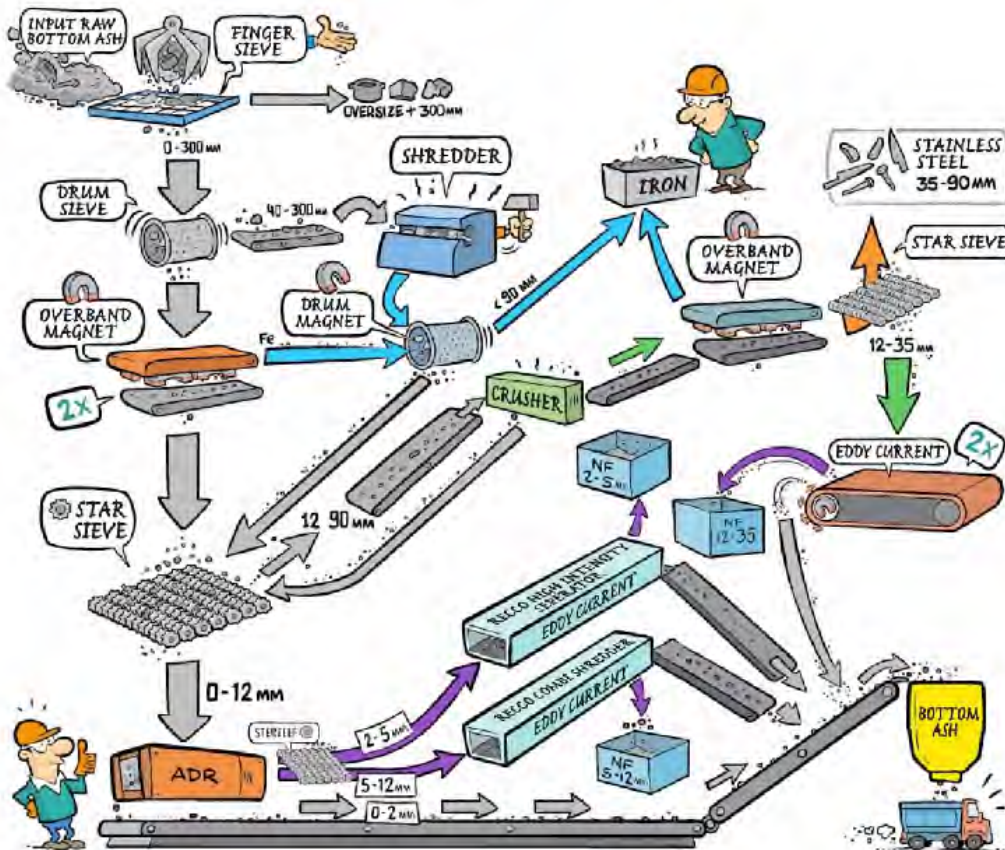
Twence manure treatment

Twence recycled nutrients

Biorizon

Sustainability report 2015

Advanced recovery of metals from bottom ash



Using highly advanced new separation techniques, Twence is able to recover very high concentrations of ferrous (>90%) and non-ferrous metals (>80%) such as aluminium, copper and zinc from the ash that remains after creating Energy from Waste. The recovery percentages are increasing every year thanks to increasingly detailed research.

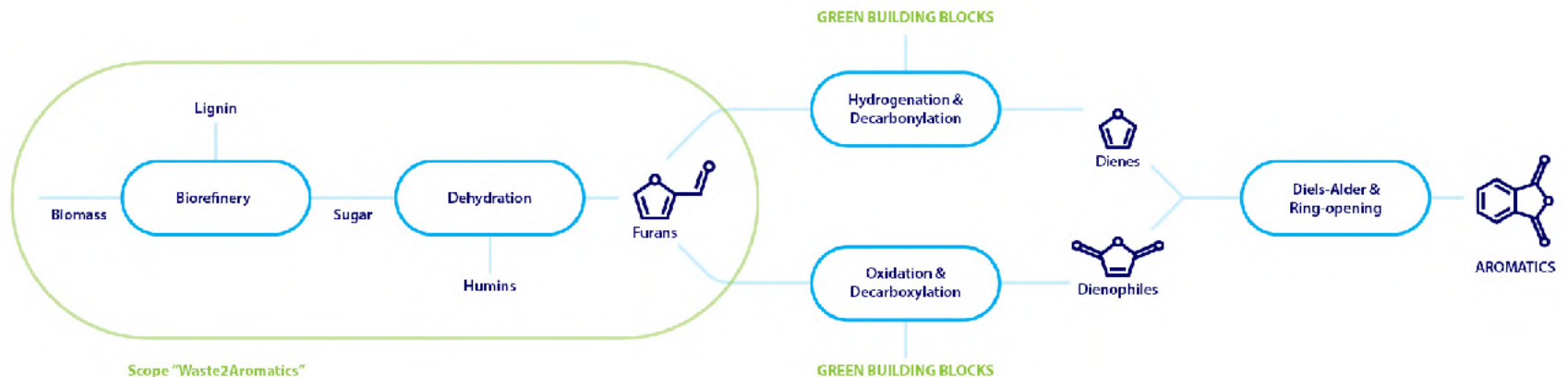
Twence innovative projects

Sustainability report 2015

Waste2Aromatics research project

A broad consortium, which includes Twence, has been formed with TNO. This consortium is studying the recovery of aromatics from organic kitchen and garden waste, soiled nappies, sieved material and manure. Aromatics are basic raw materials in chemistry. The ultimate goal is to deliver a design for a pilot factory. The production of furans could be operational in 2019.

**TNO – Bio aromatics
from waste**





Structure of Vlakglas Recycling Nederland (VRN)

2002: Funding of Vlakglas Recycling Nederland, voluntary initiative of the Dutch Glass Industry. Reason to meet producer responsibility (EPR)

- Financing
- Recycling levy is € 0,40 for every m² of insulated glass
- Produced in or imported into the Netherlands
- Around 277 participants

Collection structure in 2015:

- Network of 403 collection points. Rental locations at/near +/- 326 companies.
- 531 temporary locations per year (at demolition and renovation sites).
- 192 collection points at waste park.

Recycling and re-use of sheet glass waste

Results

2014: 69,415 ton sheet glass cullet collected

2015: 69.998 ton sheet glass cullet collected

*Destination of the waste sheet glass
Average result 2013-2015, re-used in:*

- Sheet glass industry 11%
- Insulation products 19%
- Packaging industry 69%
- Others 1%





Innovation- Project Life Flat to Flat

- VRN participates together with Maltha Glasrecycling as a partner in “Life Flat to Flat” a project of AGC. This project has received a Life+ subsidy from the European Union.
- This project aims to develop and validate an innovative method for re-cycling and up-cycling of flat glass.

Expected results:

- 12% CO2 reduction
- 5% energy saving
- 25% less use of raw materials
- LIFE12 ENV/BE/000214

Contact at VRN : Louise Soares

- **More info: www.agc-flattoflat.eu**

