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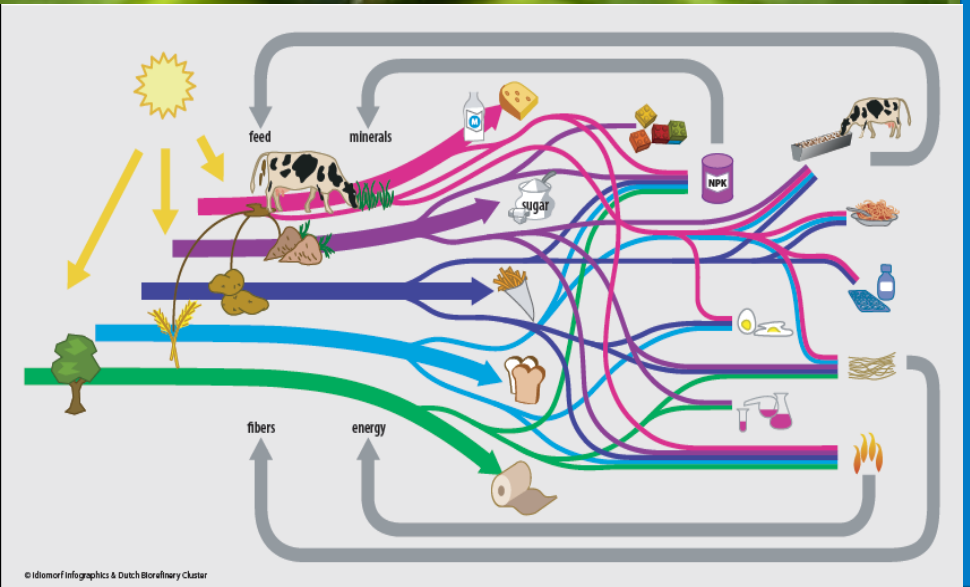
BioBased applications in the Netherlands

indentification of opportunities and examples of biobased applications



Kees W. Kwant

Anne de Boer

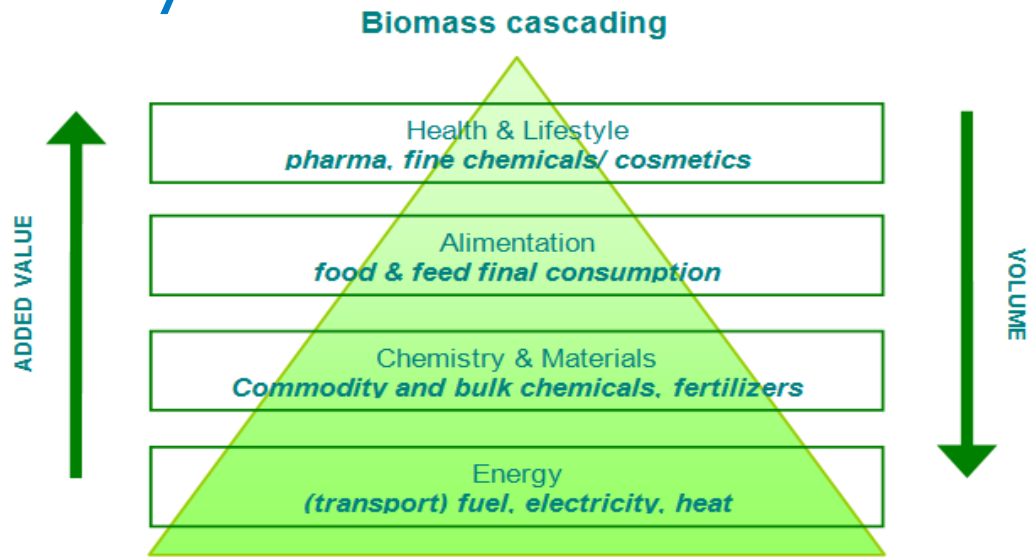
Astrid Hamer

Diana Stamata

Contents

- BioBased value-add hierarchy
- Opportunities identification that add value to organic waste streams in Western Cape
- Existing biobased partnerships in Western Cape
- List of companies
- References

Strategy: Maximize Value; Resource Efficiency



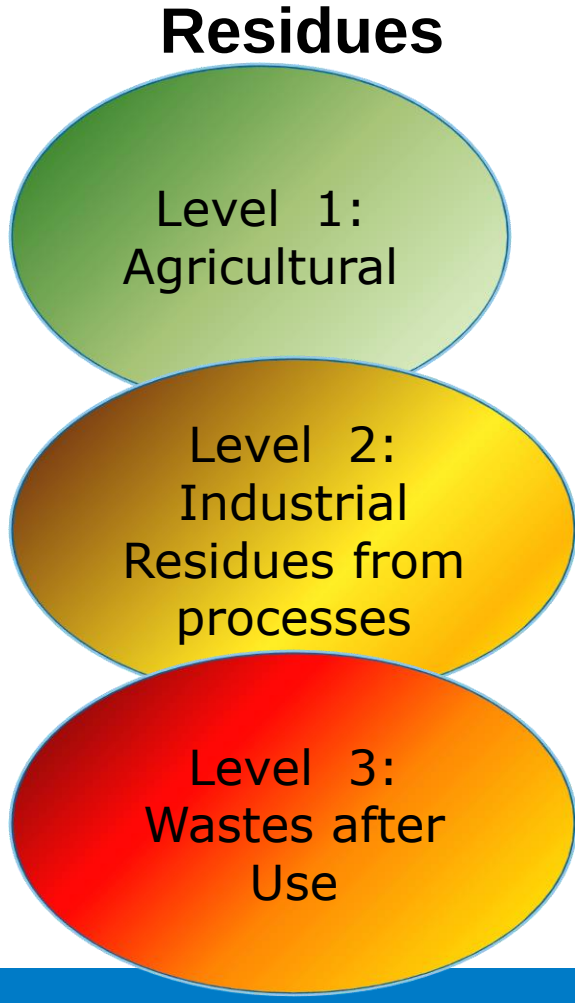
Optimum use of bio-resources implies 'cascading'

- Cascading in time: expanding the utilization of harvested biomass by re-using (or even upgrading) waste streams
- Cascading in value: maximizing and optimizing the economic benefit of the bio resource life cycle.
- Cascading in function: benefiting from all potential functions, e.g. through bio-refinery

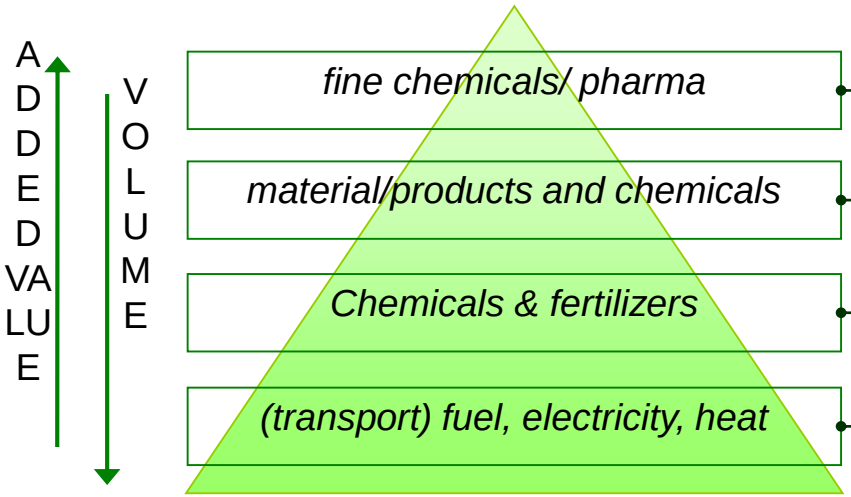
Source: van Beeck, Kwant, Moerkerken & Stuij – An Innovative Perspective, Transition towards a bio-based economy - see reference last page

Add Value to Organic Wastes

- Organic Wastes:
  - A: Livestock residues
    - > Manure
    - > Slaughterhouse waste
  - B: Industrial wastes
    - > Packaging, fibres
    - > Food industry
  - C: Municipal Waste
    - > Waste water treatment plants
    - > Green Garden wastes, Food wastes
    - > Mixed Solid wastes
  - D: Agricultural residues



BioBased value-add hierarchy



- ▶Egg shell
- ▶Plant based raw material: maize, wheat, potatoes, peas, micro-algae
- ▶Wood chips and agro residues

- ▶Onion residues
- ▶Algae
- ▶Water lentils
- ▶Abattoir residues
- ▶Tomato steams
- ▶Sugar beet residues

- ▶Potato starch waste
- ▶Sugarcane stems
- ▶Biomass waste
- ▶Pig & cattle manure

- ▶Wood production and processing residues
- ▶Supermarket/ industrial waste
- ▶Food/kitchen waste
- ▶Slaughter house waste

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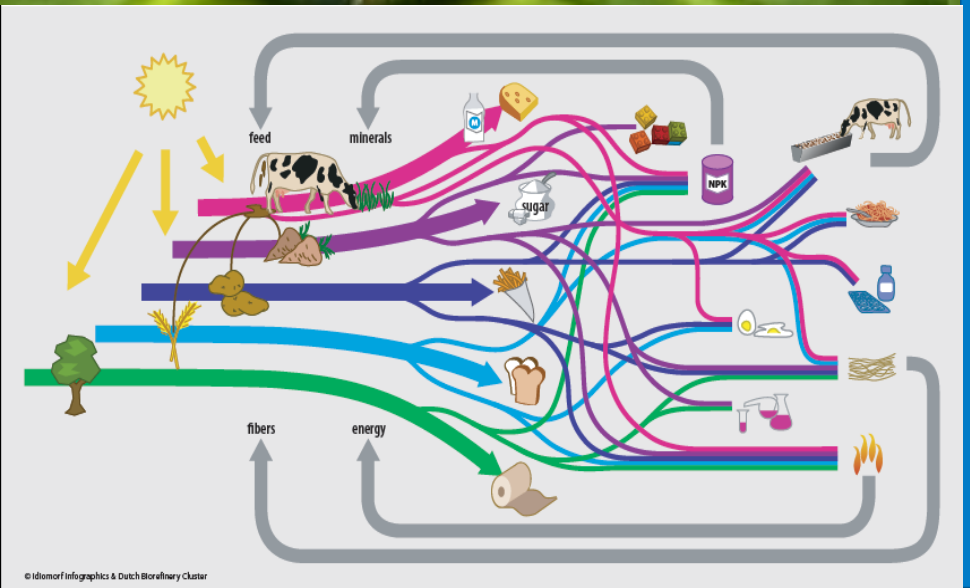
A: Livestock Residues



Host
http://www.host.nl/en/biogas-plants/

- **Green waste**, **sludge from house waste**, **wate treatment plants** are processed into to **electricity**, **phosphatefertilisers** and **feedstock powerplant.**
- Production

➢ **Option for many WWTP in South Africa that have to be renovated and renewed.**

Groot-Zevert
http://www.groot-zevert.nl/vergisters

- **Pig and cattle manure** transformed in **biogas**, **P+N fertilisers**, **organic matter**.
- R&D pilot phase.

➢ **Supplier:**
➢ **Nijhuis** http://www.nijhuisindustries.com/about/nijhuis-water-technology/

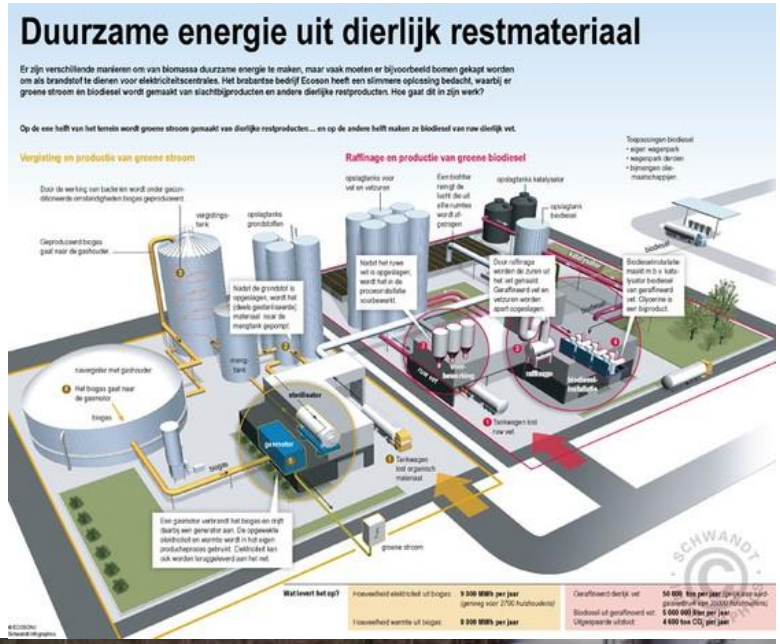
➢ **Add value to pig and cattle manure.**

Material/products – Food & Feed

/ **Sonac Ecoson**
https://www.sonac.biz/

- Raw material of animal origin transformed in animal fats and proteins to produce: **Incredients for food, animal and aqua feed**. Also **incredients for fertilisers**, **oleochemicals** and **pharmaceuticals**.
- Production phase.

➢ **Availability for abattoir residues.**



ECO SON

Duurzame energie uit dierlijk restmateriaal
Er zijn verschillende manieren om van biomassa duurzame energie te maken, maar vaak moeten er bijvoorbeeld bomen gekapt worden om als brandstof te dienen voor elektriciteitscentrales. Het brabantse bedrijf Ecoson heeft een slimmere oplossing bedacht, waarbij er groene stroom en biodiesel wordt gemaakt van slachtbijproducten en andere dierlijke restproducten. Hoe gaat dit in zijn werk?
Op de ene helft van het terrein wordt groene stroom gemaakt van dierlijke restproducten... en op de andere helft maken ze biodiesel van ruw dierlijk vet.
Vergisting en productie van groene stroom
Raffinage en productie van groene biodiesel
Toepassingen biodiesel
• eigen wagenpark
• wagenpark derden
• bijmengen olie-maatschappijen
Door de werking van bacteriën wordt onder geconditioneerde omstandigheden biogas geproduceerd
vergistingstank
opslagtanks grondstoffen
Geproduceerd biogas gaat naar de gashouder
Nadat de grondstof is opgeslagen, wordt het (deels gestabiliseerde) materiaal naar de mengtank gepompt
opslagtanks voor vet en vetzuren
Een biofilter reinigt de lucht die uit alle ruimtes wordt afgezogen
opslagtanks katalysator
opslagtank biodiesel
Nadat het ruwe vet is opgeslagen, wordt het in de procesinstallatie voorbewerkt.
Door raffinage worden de zuren uit het vet gehaald. Geraffineerd vet en vetzuren worden apart opgeslagen.
Biodieselinstallatie maakt m.b.v. katalysator biodiesel van geraffineerd vet. Glycerine is een bijproduct.
biodiesel
mengtank
navergister met gashouder
Het biogas gaat naar de gasmotor
biogas
sterilisator
gasmotor
ruw vet
voorbewerking
raffinage
biodieselinstallatie
Tankwagen lost ruw vet
Tankwagen lost organisch materiaal
Een gasmotor verbrandt het biogas en drijft daarbij een generator aan. De opgewekte elektriciteit en warmte wordt in het eigen produkteproces gebruikt. Elektriciteit kan ook worden teruggeleverd aan het net.
groene stroom
Wat levert het op?
Hoeveelheid elektriciteit uit biogas: 9 000 MWh per jaar (genoeg voor 2700 huishoudens)
Hoeveelheid warmte uit biogas: 8 000 MWh per jaar
Geraffineerd dierlijk vet: 50 000 ton per jaar
Biodiesel uit geraffineerd vet: 5 000 000 liter per jaar
Uitgespaarde uitstoot: 4 600 ton CO2 per jaar
SCHWANDT

VION Ecoson (2013)

- Integrated production of biogas, CHP and biodiesel from animal waste
- Production capacity per year:
  - 9,000 MWh from biogas
  - 50,000 ton refined fat
  - 5,000 ton biodiesel
- Biophosphate plant opened officially on 6th October 2014

http://www.ecoson.nl

Material/products - Food & Feed

Ten Kate
http://www.tenkate.nl/en/

- **Animal by-products** processed to ingredients for **foodstuffs**, **animal feed** and technical products, such as **soap** and **detergents**, **lubricants**, **leather**, **biofuel**.
- Production phase.

➢ **Availability for abattoir residues.**

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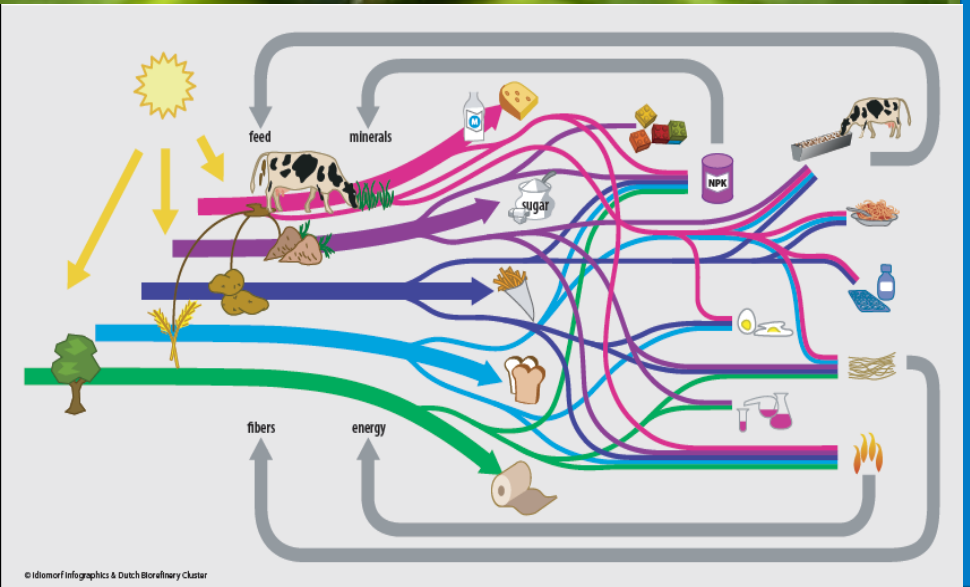
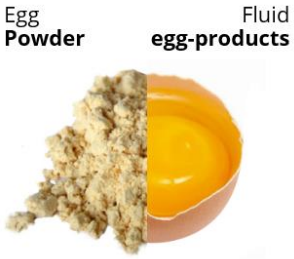
B: Industrial Residues/ Wastes



Companies in fine chemicals/pharmaceutical level

Frisian Egg http://frisianegg.com/

- Processing **egg shell** into **additives** for **fodder/fertilisers**.
- Production phase.



Shall Brane http://shellbrane.eu/

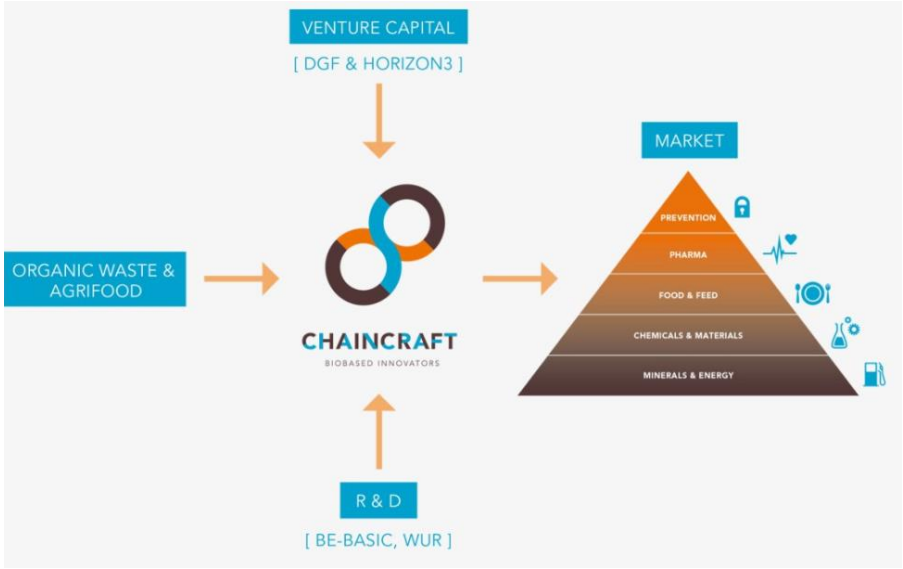
- From **egg shell membranes** they producce more types of **collagenis, hyaluronic acid or amino acids**.
- The acids are used in **dietary supplements** and **cosmetics**.
- R&D phase.

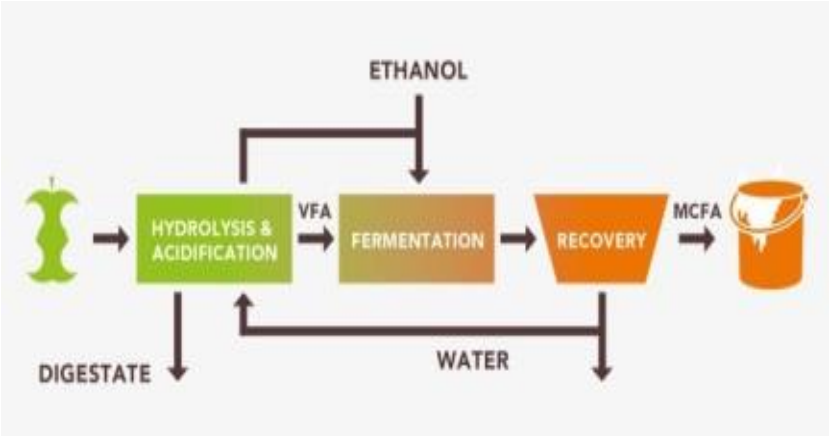
This applications can reduce cost and reduce cost by adding value to the side products.

Companies in fine chemicals/pharmaceutical level

ChainCraft http://www.chaincraft.nl/home-en/

- Organic waste and agro-food residues are transformed in **medium chain fatty acids** ,which are the base for food/feed applications, flavors, polymers, paint, coating.
- **Commercialization** of a profitable **technology** for processing organic waste and agro-food residues to valuable chemicals.





Material/products and chemicals

Solidus-solutions
http://solidussolutions.com/home/

- Produce packaging from **tomato stems fibers**.
- Limited production.

Landstomaten
http://www.lanstomaten.nl/home.html

- Tomato plant grower delivering the stems.

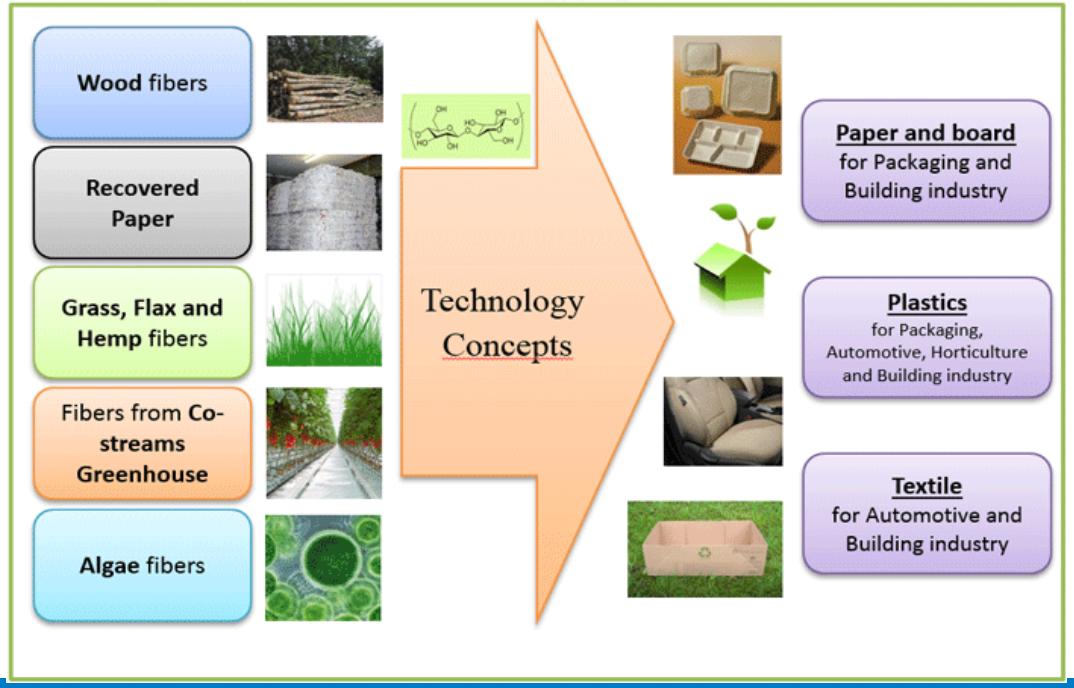
➢ **Both companies make good use of residues from horticulture.**

Material/products and chemicals

Milvision
http://www.millvision.eu/

Millvision
Partners in Strategy and Business Innovations

- **Grass,tomato stems, sugar beets puls** are processed in fibers from which **paper, carton boxes, guide rails** along roads are made.
- Testing guide rails.



➢ **This application might also be possible with biomass available in South Africa.**

Material/products and chemicals

Peeze
https://peeze.nl/en/

- From **sugar beets residues** are making bio-based cofee **packaging**.
- In production phase.

➢ **This application might also be possible with biomass available in South Africa.**

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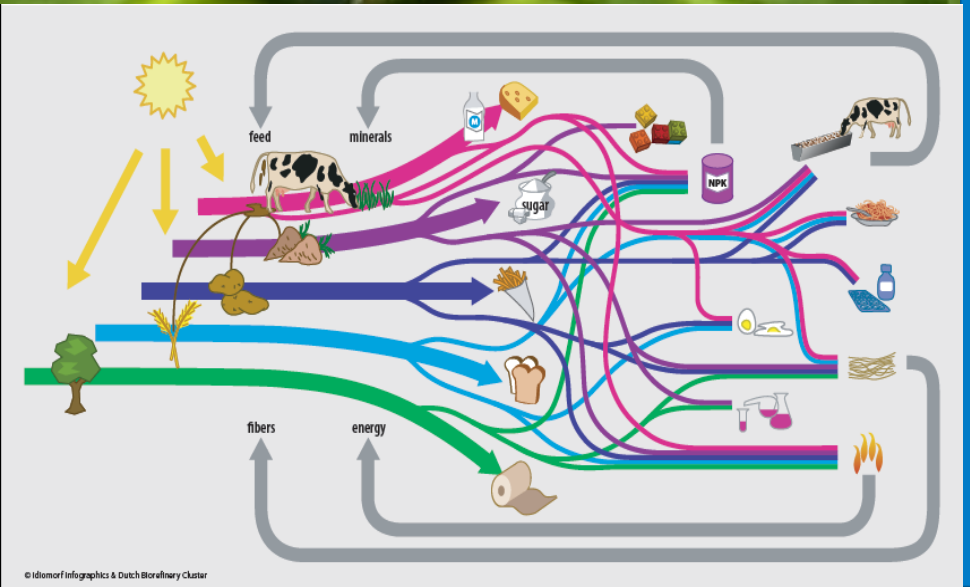
C: Municipal Wastes



Material/products- Food & Feed

Ruitenberg
http://ruitenberg.com/en/

- **Vegetable proteins** are developed and processed in **ingredients** for food producers.
- R&D and production phase.

➢ **Would Water Hyacinth be a potential protein resource?**

Material/products – Chemicals/fertilisers

Transfurans
http://www.transfurans.be/

- **Biomass waste** and **sugar cane** stems processed into **biobased chemicals**.
- Production of resin.

➢ **Could use the biomass waste and sugarcane stems available in South Africa.**

TFC
BIOMASS BASED CHEMICALS

Material/products – Chemicals/fertilisers

Foreco
http://www.foreco.nl/en/index.html

- From **biomass waste** and **sugarcane stems** use **innovative timber treatment technologies** to produce **impregnated pine wood**.
- Full scale production unit.
- Imports Eucalyptus Cloeziana from South Africa.

➢ **Does South Africa also use this timber treatment to get a higher durability?**

Bruinsenkwast
http://www.bruinsenkwast.nl/

bruins & kwast
biomass management

- **Wood production** and **processing residues** into **hight quality pellets** and **compost for horticulture**.
- Production phase.

➢ **Biomass from alien Species**

Orgaworld

http://www.orgaworld.com/more-about-our-business/our-locations/amsterdam-greenmills

- **Food & kitchen waste, supermarket waste** and **polutted industrial waste water** processed into **heat and power**, **fertilisers** and **purified water**.
- Production.

➢ **The food/kichen, supermarket, polutted industrial waste are used to add value.**

23 Dutch water authorities put wastewater to good use :

- **Increased Output:**
  - energy, biogas to power cars or electricity
  - raw materials ; phosphate, which is used to produce fertilizers.
- **Collaboration**
  - the water boards have set up a collaborative network organization called Energy & Raw Materials Factory (EFGF). http://www.efgf.nl/english
  - Joint Research programme with Universities

Products from waste water sludge

- Energy
- Fosphate
- Cellulose
- Bioplastics & Acids
- Alginate
- CO2

- Movie:
- https://www.youtube.com/watch?v=CT9lVE6wfIc

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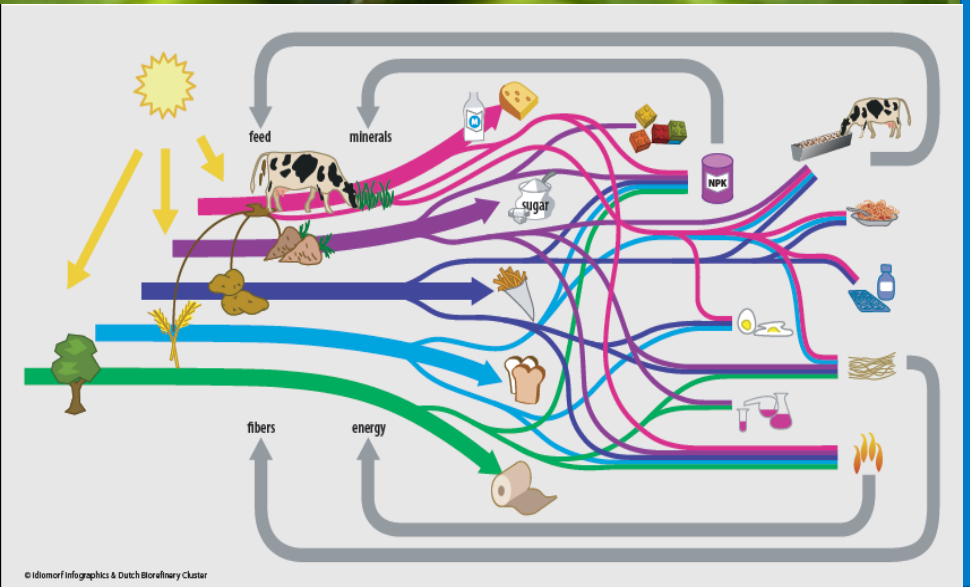
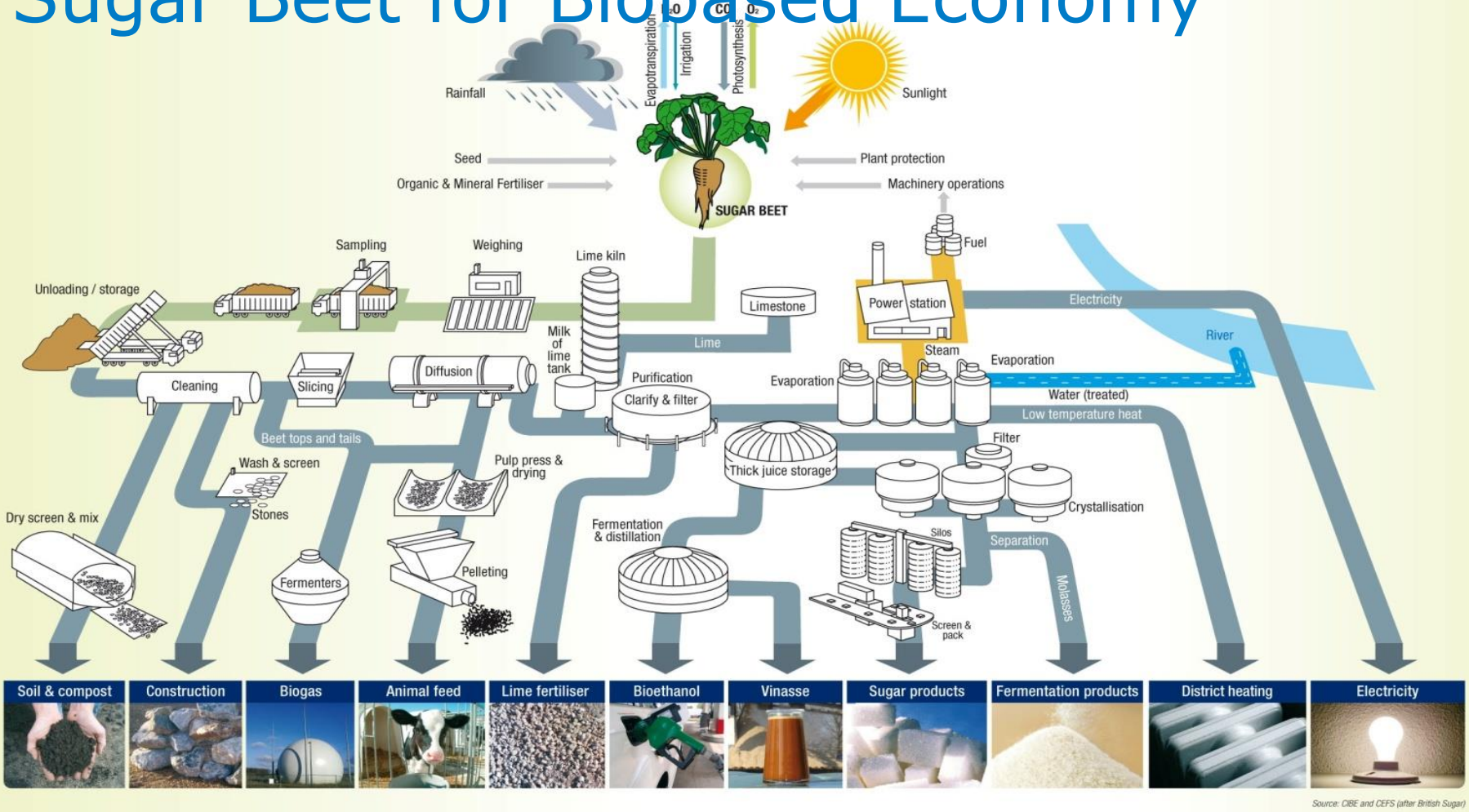
D: Agricultural Residues

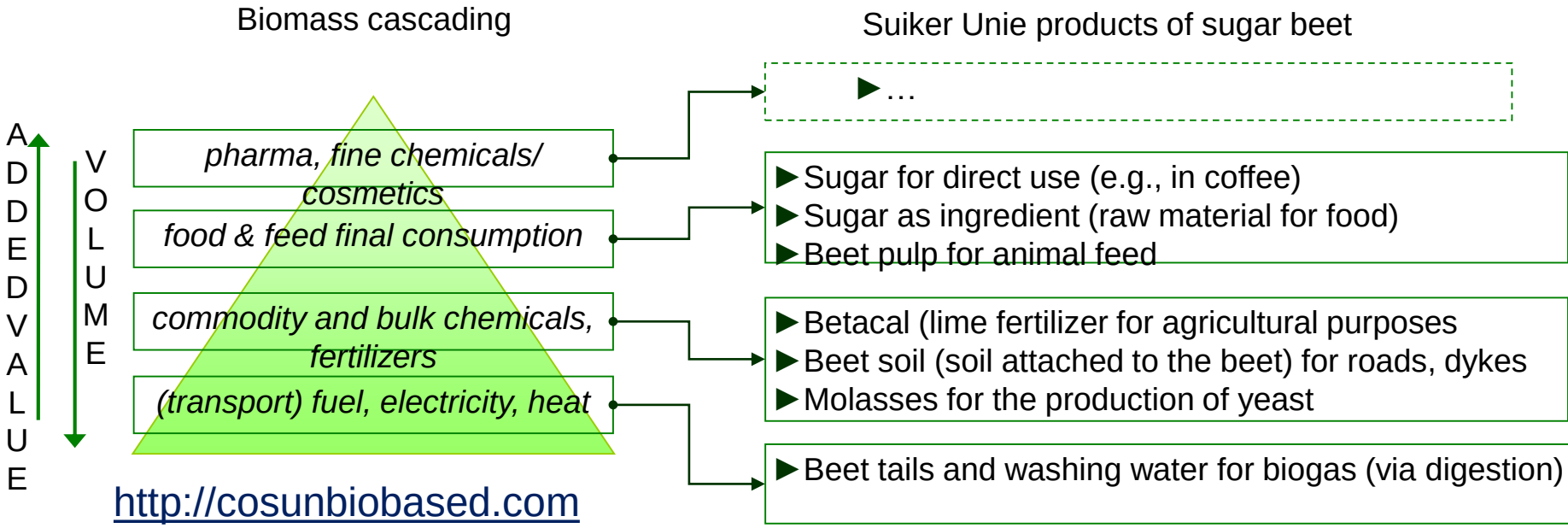


Sugar Beet for Biobased Economy



Source: CIBE and CEFS (after British Sugar)

Biomass Cascading and Valorisation



- Total concept, including a 50% increase in sugar beet yield per hectare, a 50% reduction in fertilizer use, and a 50% efficiency improvement in the sugar plant (all in about 20 years).
- Further optimization includes export of waste heat, and site utilization for renewable energy production (solar and wind).

Material/products and chemicals

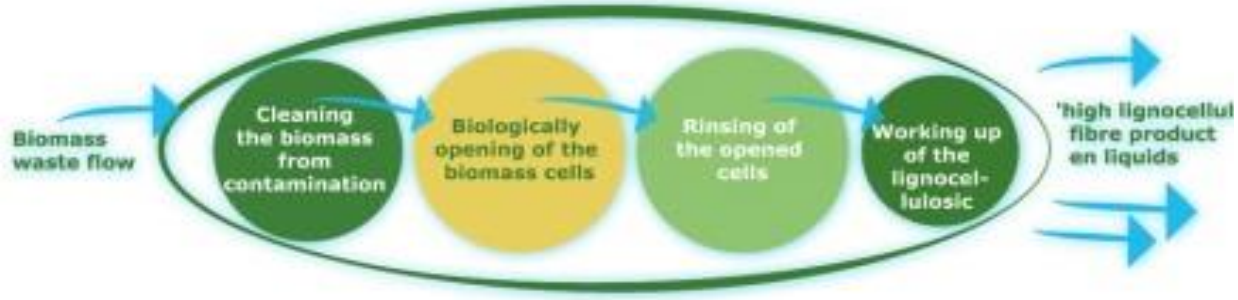
NewFoss /Huhtamaki

https://newfoss.com/en/

- Non- woody biomass: **natural grass, roadside grass** and **horticulture foliage** produce **paper, cardboard** and **isolation material.**
- Developing and producing raw materials phase.
- http://www.huhtamaki.com/
- Using grass biobased fibres to produce green egg boxes (50% grass fibre, 50% recycled carton)

NewFoss
Biobased products and techniques

➢ **NewFoss is searching for alternative grass feedstock e.g. elephant grass.**



Material/products – Food & Feed

Bodeldijk
http://www.bobeldijk.nl/

- From **onions residue**, **algae**, **water lentils** to **vegetarian proteins**.
- Produce **veretarian food products-** meat/ sauces.
- R&D and production phase.

BOBELDIJK
FOOD GROUP

➢ **This application might also be possible with vegetable residues in South Africa.**

Material/products – Chemicals/fertilisers

Wijzonol
http://www.wijzonol.nl

- From **potato starch, biobased waste** making of **binding agents** to produce **paint** and pack it in a recycled plastic buckets.
- Production

➢ **Added value to potato waste/starch, food/feed or compost.**

Material/products and chemicals

Rodenburg Biopolymers

http://biopolymers.nl/

- Potato starch from process water making compounds to produce **bio-plastic** used in **chocolate bars wrappers**.
- R&D phase.

Mars International

http://international.mars.com/netherlands/en/about-mars/contact-us.aspx

- Producer of chocolate bars and testing biobased wrapper.
- Pilot and market introduction phase.

➢ **In South Africa this companies could add- value to potato waste/starch.**

Reverdia http://www.reverdia.com/

- Bio-based **succinic acid** from plant-based raw material such as: ***maize, wheat, patatoes, peas and micro-algae.***

- Used in packaging, textiles, pharmaceuticals, foodflavour etc.

- Production phase**.** Reverdia is a leading company in the bio-based economy.

➢ **Opportunity to substitute oil-based chemicals with plant-based chemicals**

Companies in fine chemicals/pharmaceutical level

Avantium https://www.avantium.com/renewable-chemistries/zam tobezi/

- Wood chips, pulp and agro residues to **glucose** and **lignine** to produce woody biomass for bioenergy.
- They are in the R&D phase and **looking for partnerships**.

➢ **South Africa could use their technology to add value to the biomass from alien species.**

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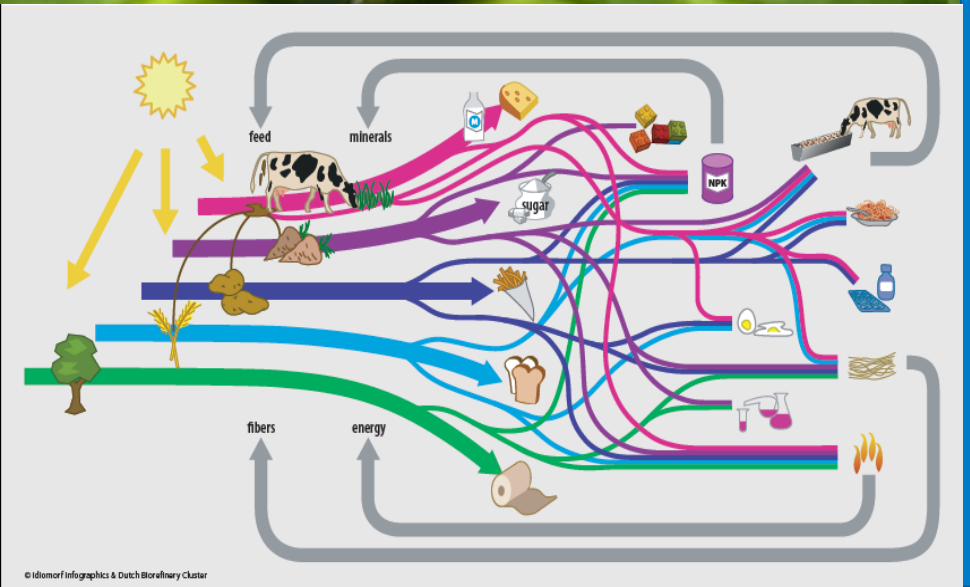
Existing bio based initiatives NL-SA in Western Cape

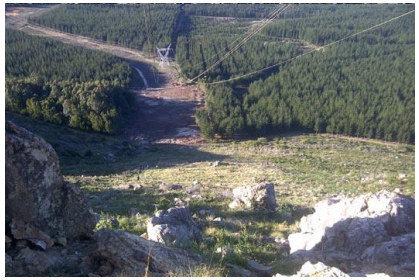


Wood alien species

BBQ charcoal for export in Europe

Clean Fuels
http://www.cleanfuels.nl/
Developing technology & producing units

Electricity



TorontoGroup
http://www.torontogroup.co.za/
Contractor harvesting biomass, producer of charcoal

TorontoGroup is going to make an operational production site in Wellington along the Berg river.

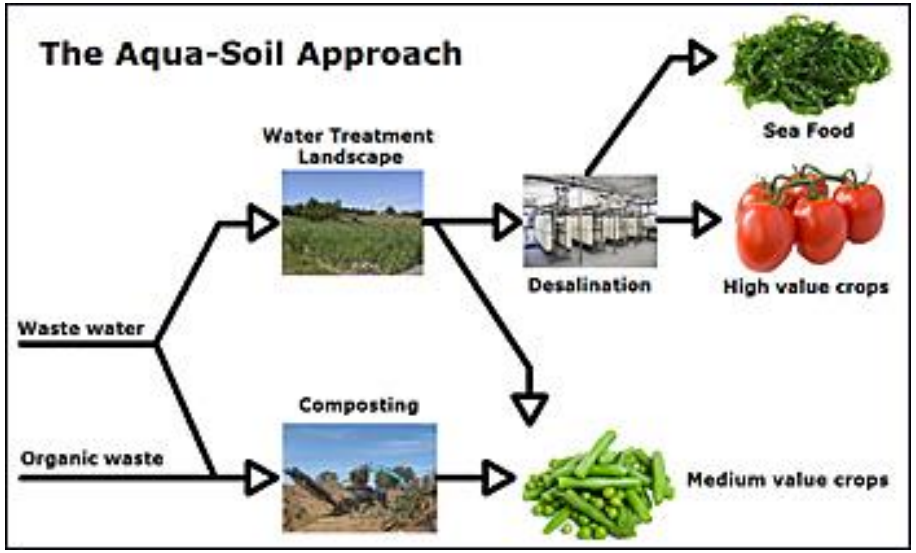
- **There are existing partnerships**
- **Positive fesability for exportation of Charcoal to EU**
- **A large qunatity of biomass from alien species is valorised.**

Fluid and solid fractions of waste water treatment works

Aqua Soil Approach (ASA)

Aqasolutions Group
http://www.aquasoilgroup.com/
Developing & delivering technology and installations

Bioaresources
http://bioresources.co.za/
Interested in Aqua Soil Approach



What is needed:
- **To find a good location**
- **South African investors to start-up a production site**

Bebeffits for South Africa
- **Local food production**
- **Job creation**

Video: https://youtu.be/UyEyycSltR8

List of companies

1. Frisian Egg
2. Shell Brane
3. Reverdia
4. Avantium
5. ChainCraft
6. Solidus Solutions
7. Lans tomaten
8. Rodenburg biopolymers
9. Mars International
10. Peeze
11. New Foss
12. Huhmaki
13. Badeldijk
14. Ruitenberg
15. Ten Kate
16. Sonac
17. Wijzonol
18. Transfurans
19. Fereco
20. Groot-Zevert
21. Bio-Oil
22. Bruinsenkwast
23. Orgaworld
24. Host
25. Clean Fuels
26. Toronto Group
27. Aqua Soil Group
28. Bioresources

References

The applications from the Netherlands were selected from the following resources:

1. Report "Monitoring Biobased Economy in Nederland 2016" compiled by the Netherlands Enterprise Agency

2. BioBased database of the Netherlands Enterprise Agency.

3. The website: http://www.biobasedeconomy.nl/english/

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Thank you for your attention

Questions?

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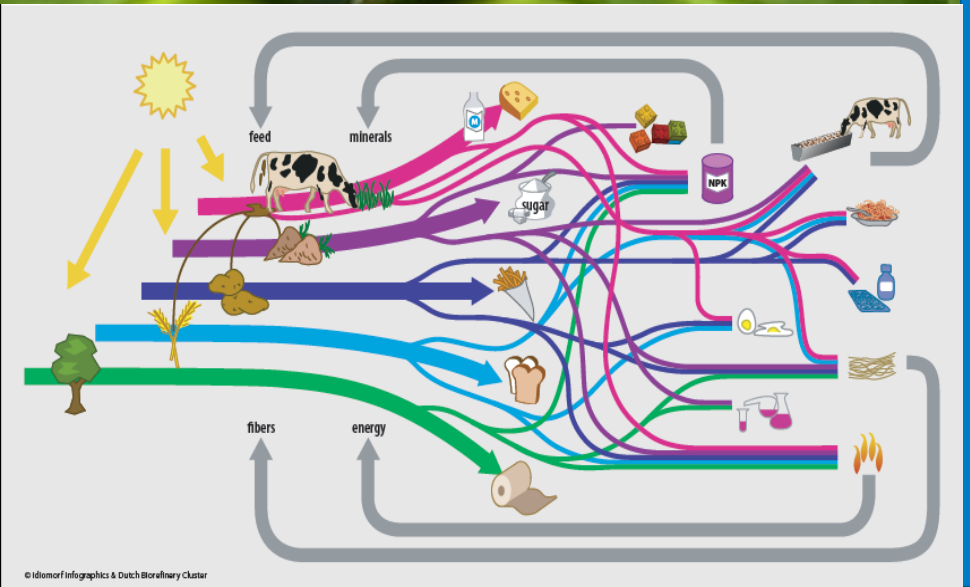
Anne.deBoer@rvo.nl