

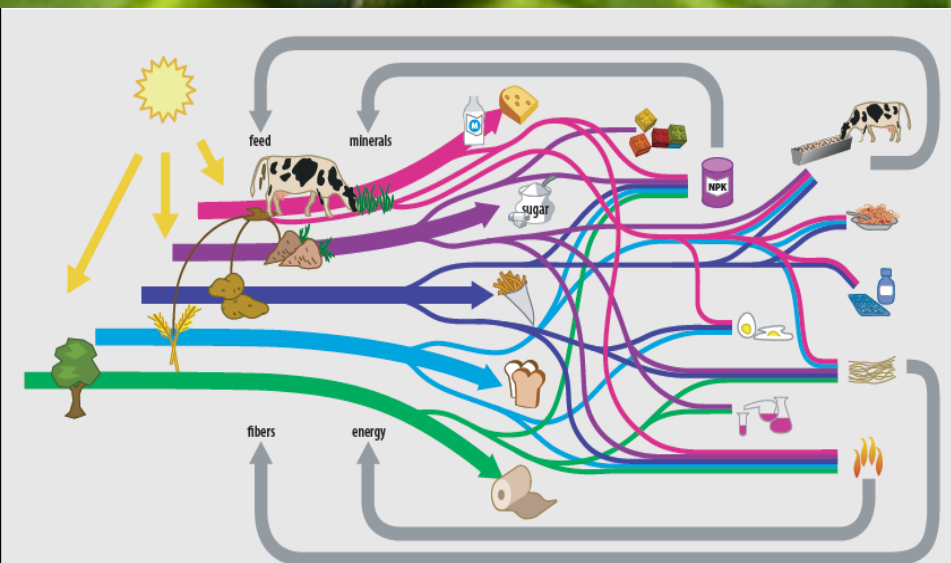


Netherlands Enterprise Agency



BioBased applications in the Netherlands

*indentification of
opportunities and
examples of biobased
applications*



Kees W. Kwant
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Diana Stamata

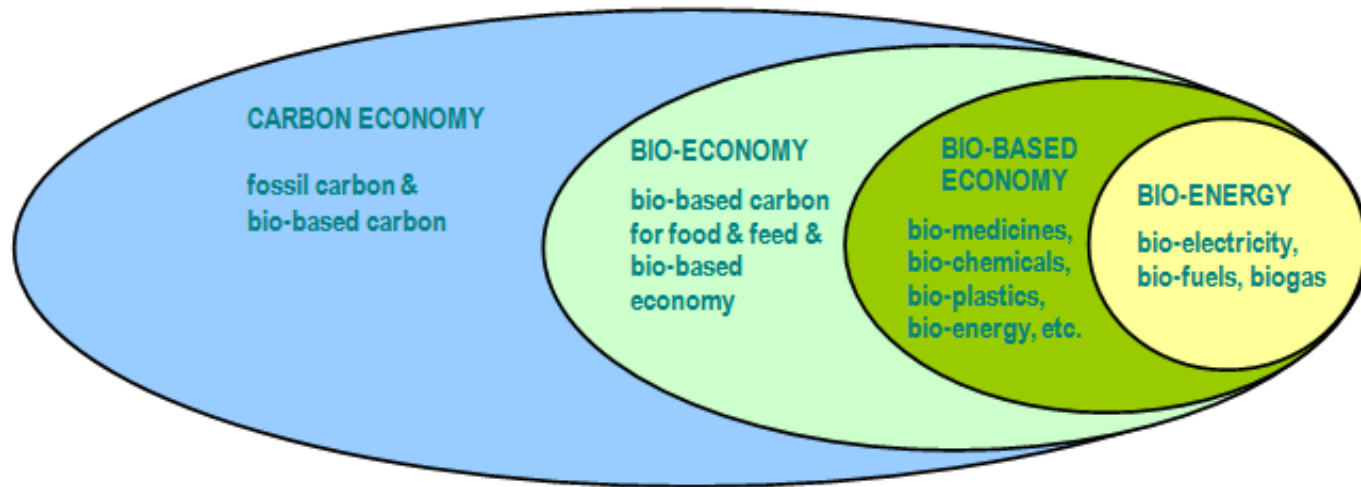


Contents

- Bioeconomy and regional development
- 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



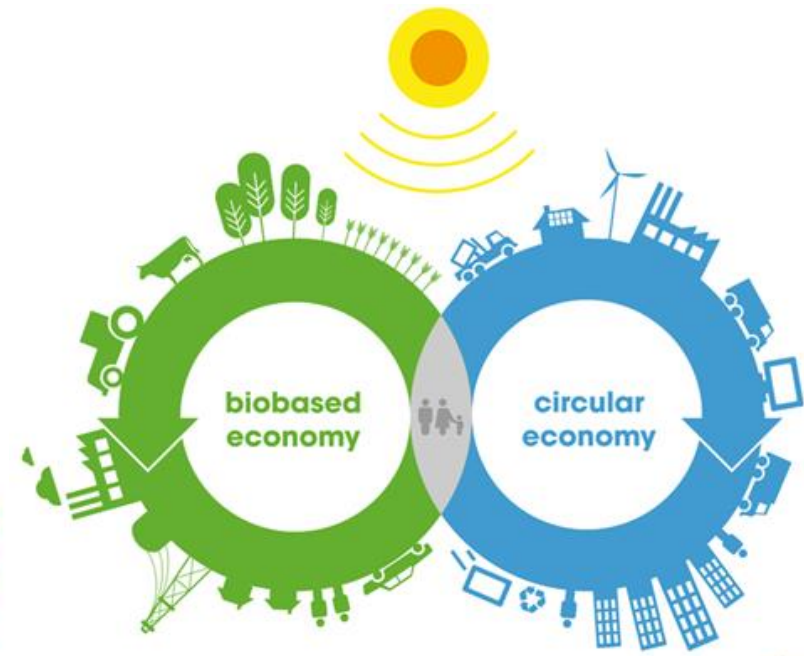
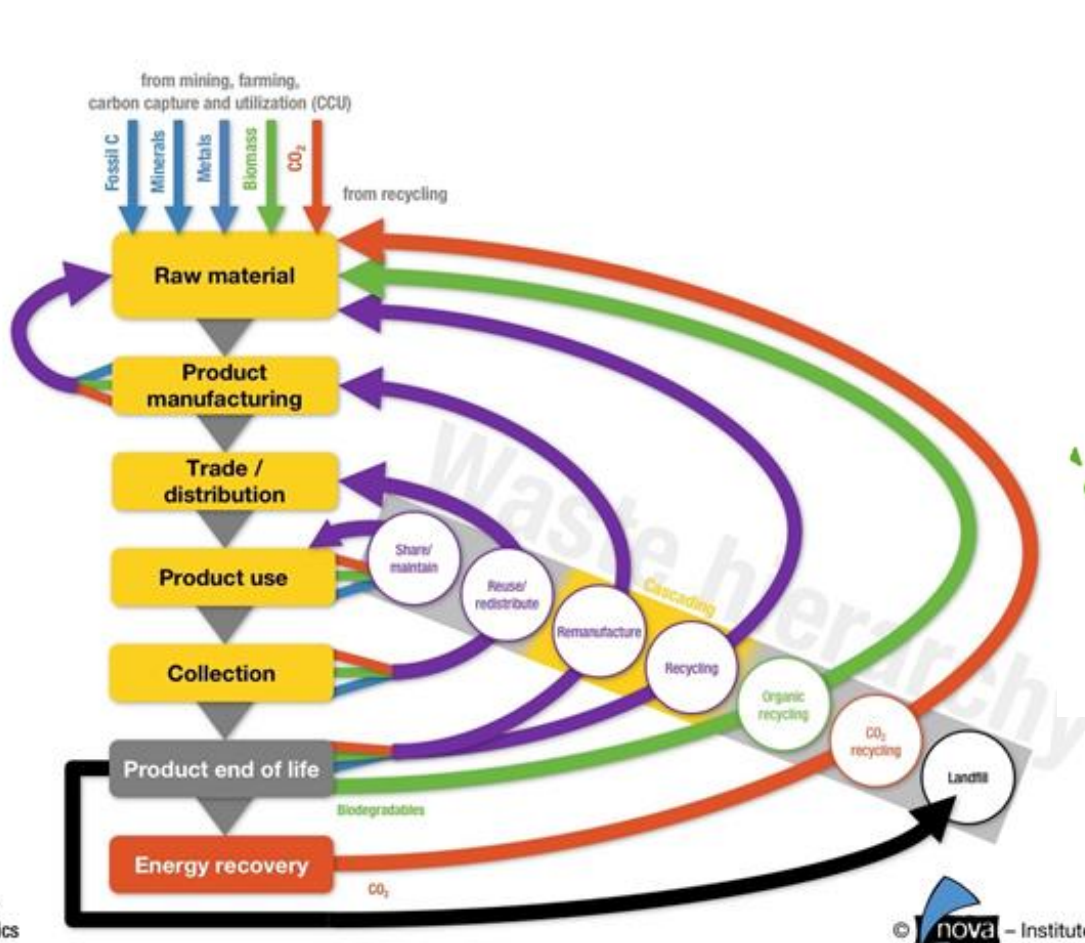
Integrated Approach for Bioenergy:– The bio-based economy in context



- The bio-energy arena is a subset of the bio-based arena (non-food use of biological resources), itself a subset of the bio economy, and ultimately of the 'carbon economy'.
- Our society is to a significant extent based on the 'carbon economy', fed both by fossil and renewable (or biological) carbon.



Circular & Biobased Economy





NL Governmental plan Circular Economy

September 2016

- efficient use of resources
- optimal reuse of resources
- sustainable mining of resources
- less resources used, circular design
- efficient products and services
- intermediate ambition in 2030: realize 50% less consumption of primary resources (mineral, fossil and metal)



Development of Biobased Economy In the REGIONS

Flevoland

WUR/Accres, Prov. Flevoland en Eneco,
HarvestaGG, CAH Viltum, Ringg, OMFL

Focus:

- * Bio-energie
- * Cascadering
- * BBE experimenteren/testen/
demonstraties

Biobased Connections

ICL, Cargill, Greenmills, AEB, Haven Amsterdam, Orgaworld, AIM, Schiphol, HvA, UvA, Amsterdam Economic Board Waterjet, Aalsmeer, Haarlemmermeer, Amstelveen, NPSP, Photonol, SADC, Ursapaint, Pharmafilter, Jagran, Hempflax etc.

Focus:

- * Inzet organische reststromen voor bio-energie, biofuels en biomaterialen

Biobased Delta

Green Chemistry Campus, DOW, Cosun, Purac, Sabic, Bio Base Europe, Avans Hogeschool, Prov. Zeeland, Brabant en Zuid-Holland, Haven Rotterdam (BioPort), TUD, Leiden Univ., Plant One, RCI, BE-BASIC, DSM, Pilotplant, Biotechpark Delft Kenniscentrum Plantenstoffen, Growport, Greenport, BOM, REWIN, Impuls, InnovationQuarter etc.

Focus:

- * biobuilding blocks
- * biobased aromatics
- * Performance materials & chemicals
- * Agro functionals/hoogwaardige plantinhoudsstoffen
- * Aquatische biomassa
- * Coatings
- * Witte bio-technologie voor fuels en chemicaliën
- * Bioport

Biobased Business Brainport

Focus:

- * Verwaarden van mineralen uit dierlijke en plantaardige nevenstromen richting food, feed en pharma

Biobased Economy Noord Nederland

Avebe, FrieslandCampina, Cosun, Agrifirm, BioMCN, Grassa, DOC, PKI, API, Cumapol, Eemshaven, Stenden PRE, Wetsus, biobRUG, Biocab, Hanze Hogeschool, CCC, HANNN, Prov. Groningen, Drenthe en Friesland, NOM etc.

Focus:

- * Verwaarding organische reststromen
- * Eiwitten & koolhydraten (food/feed/industrie)
- * Fybes en biopolymeren
- * Chemical buildingblocks
- * Biofuels

Biobased Economy Oost Nederland

Bio-energie Cluster Oost Nederland, BTG, Byosis, Ten Cate, AkzoNobel, Van Wijhe, Rolsma, ROVA, GTC, Utwente, WUR, BIC Oost-Nederland, Prov. Gelderland en Overijssel, OostNV etc.

Focus:

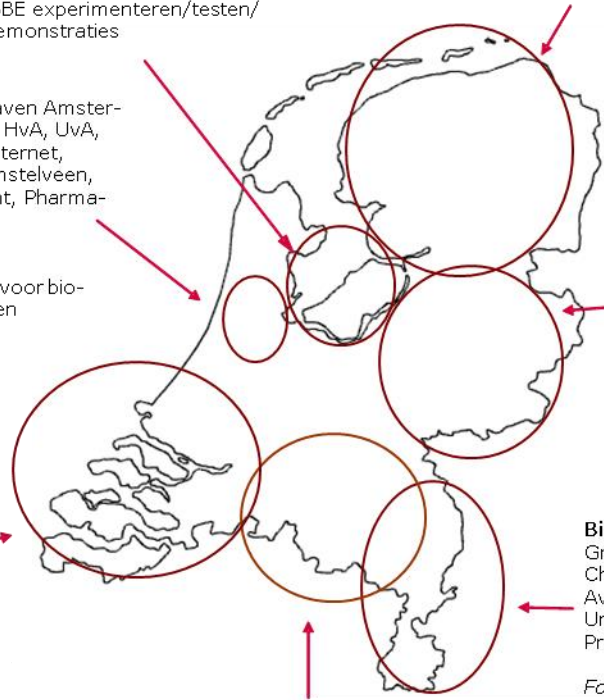
- * Bio energie (pyrolyse/fermentatie)
- * biobased coatings
- * Biobased garens, textiel en biopolymeren
- * Verwaarden van cellulose houdende materialen, gebruik van mest en slib als biomassagrondstoffen toepassing van nieuwe biomassaströmen algen en kroos

Biobased Economy Limburg

Greenport & biotransitiehuis Venlo, Chemelot, DSM, Sabic, Lanxess, Avantium, Papier & Kartonindustrie, Univ. Maastricht, Zuyd Hogeschool, Prov. Limburg, Liof etc.

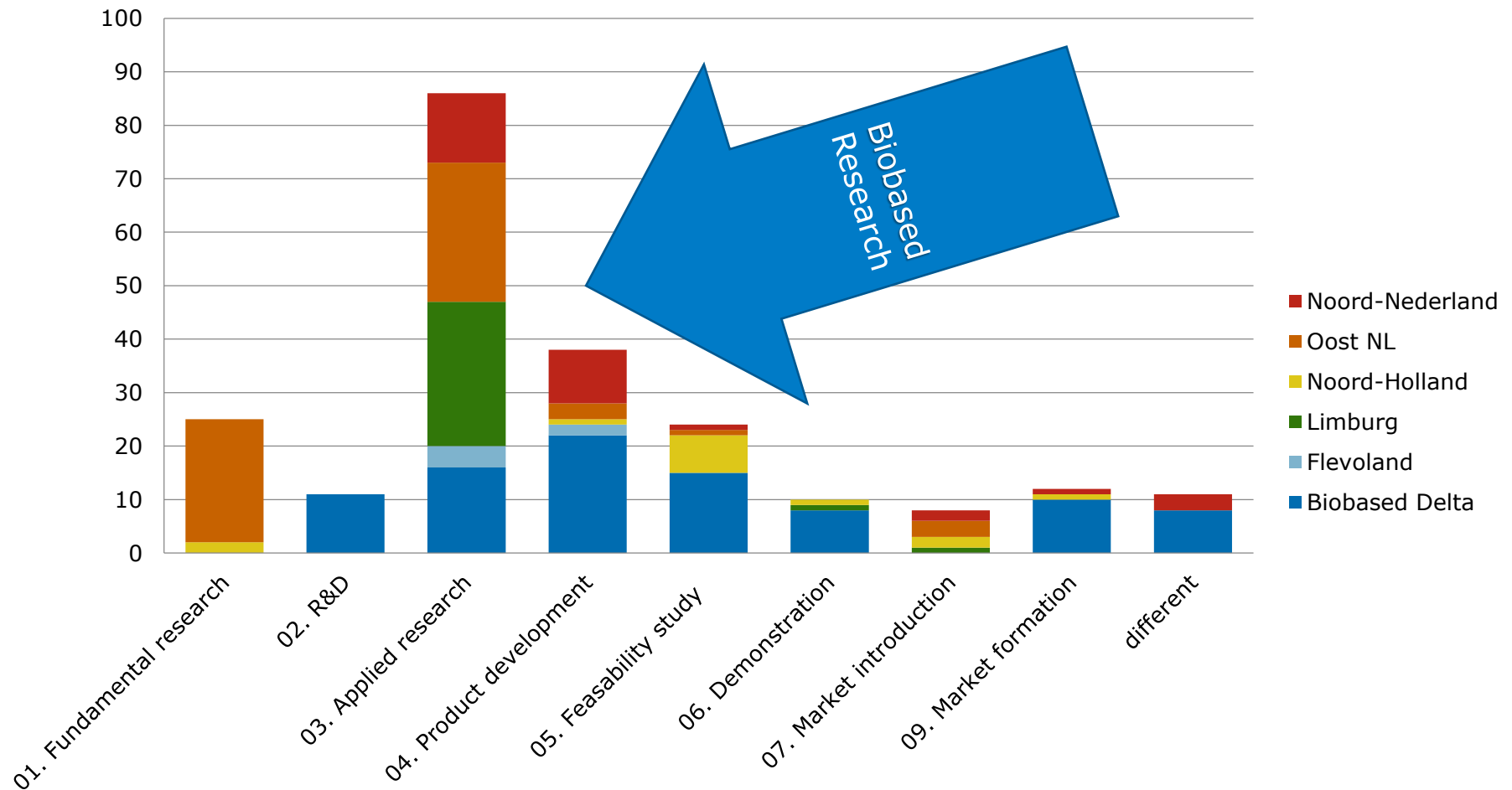
Focus:

- * Biobased performance materials & chemicals
- * Biomedical materials
- * Processtechnolgy & biobased buildingblocks
- * biobased tuinbouw toepassingen & Agrorafinage
- * Nutraceuticals en cosmetica





Projects from regions on the S-curve





Markets Slow: Biobased Procurement

- **Sustainable Procurement**
- Biobased <-> Biodegradable
- Biobased <-> Sustainable
- Complete Chain Evaluation

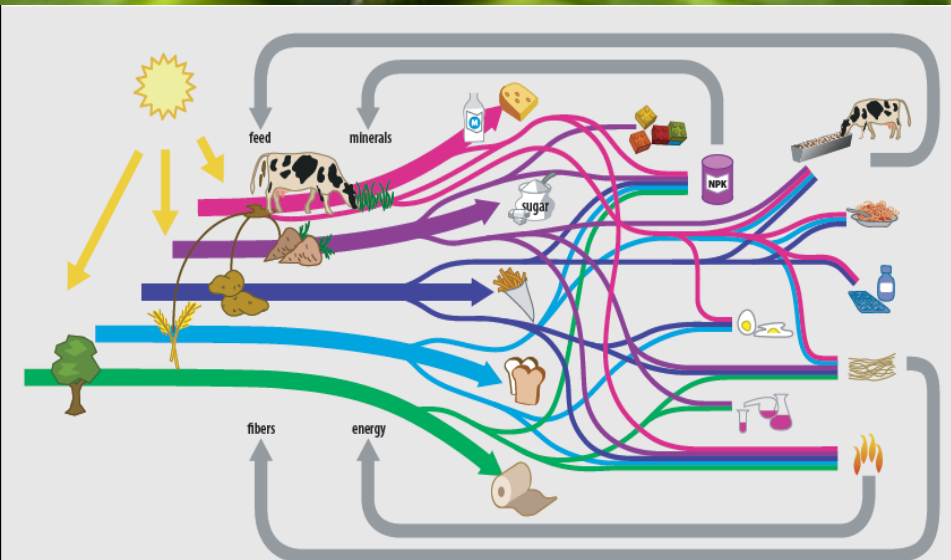




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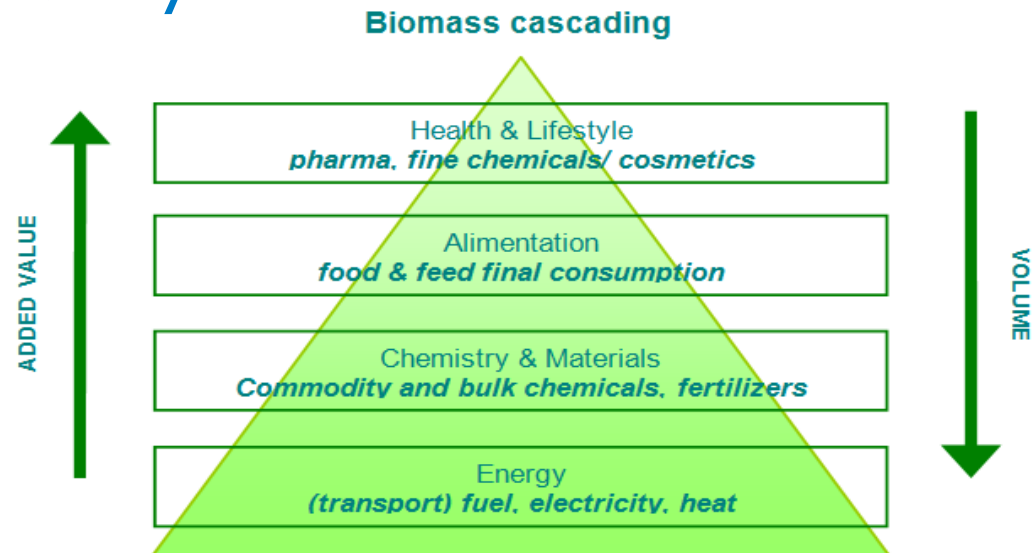


Value Add





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



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

Residues

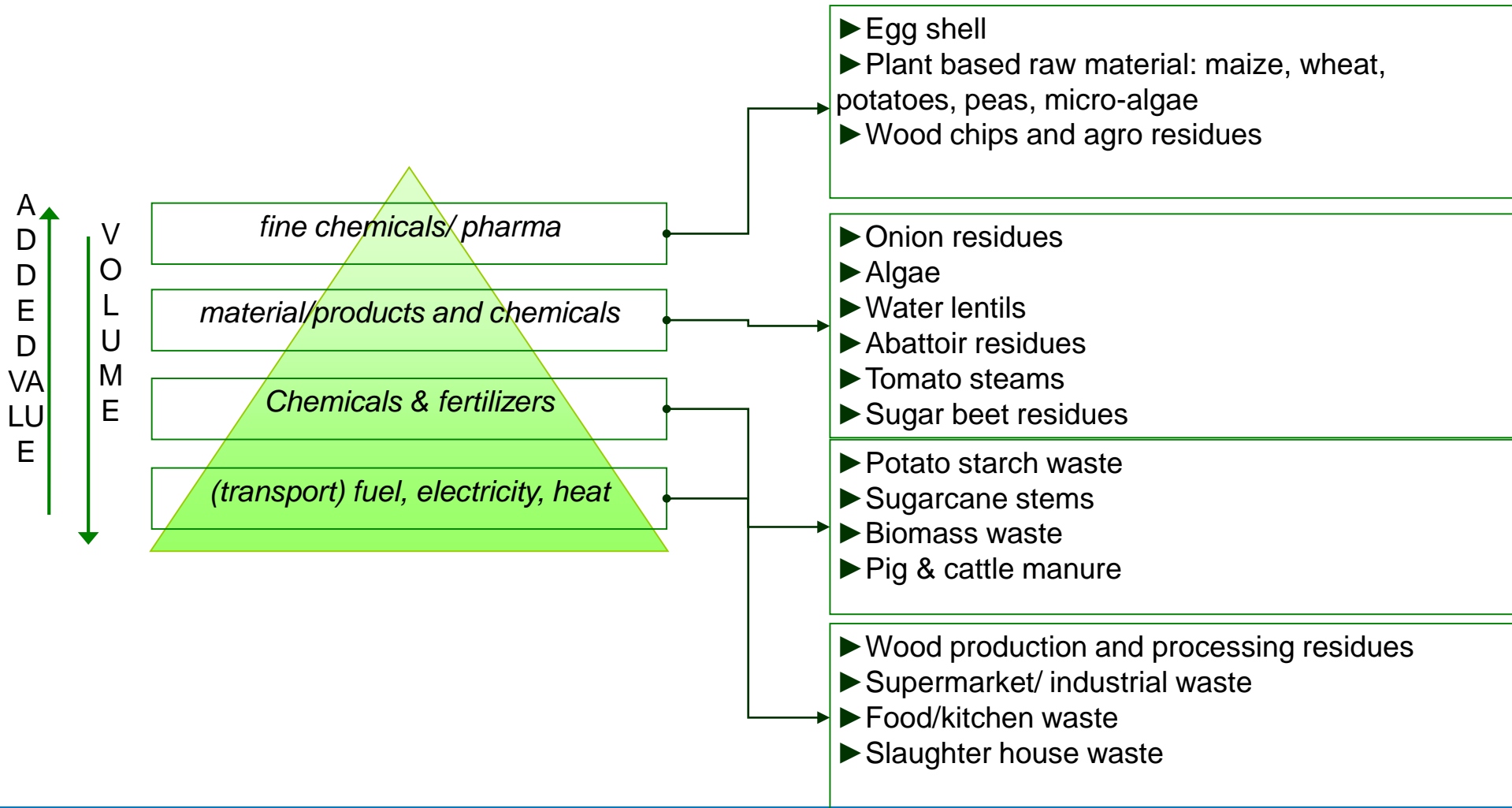
Level 1:
Agricultural

Level 2:
Industrial
Residues from
processes

Level 3:
Wastes after
Use



BioBased value-add hierarchy

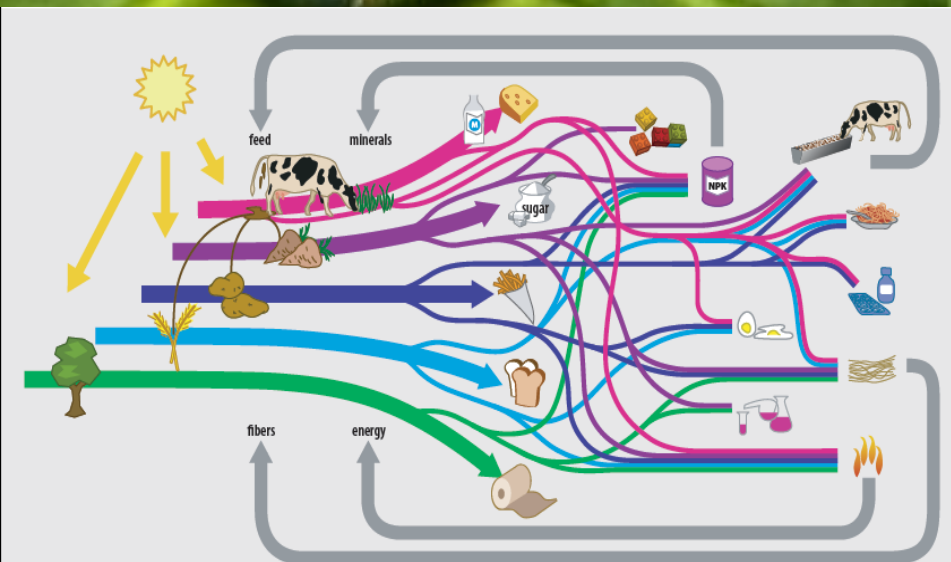




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A: Livestock Residues





Heat & Power

Host

<http://www.host.nl/en/biogas-plants/>



- **Green waste, sludge from house waste, water treatment plants** are processed into **electricity, phosphatefertilisers** and **feedstock powerplant**.
- Production
- **Option for many WWTP in South Africa that have to be renovated and renewed.**





Material/products – Chemicals/fertilisers

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:** <http://www.nijhuisindustries.com/about/>
- **Nijhuis** 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.**

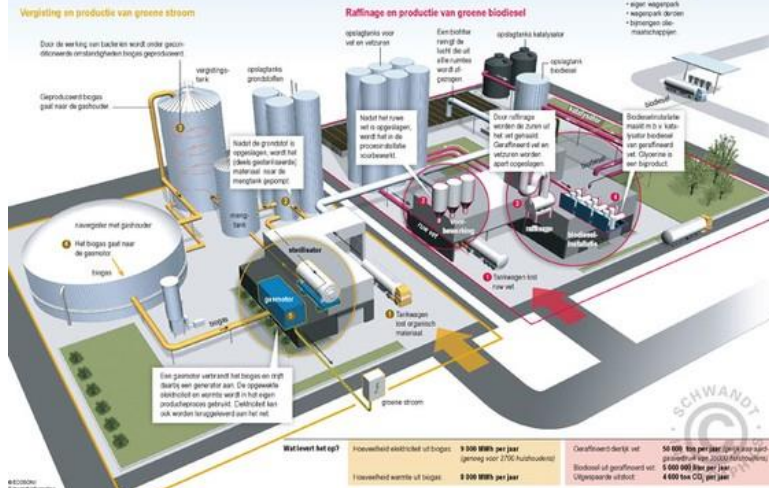
sonac

DARLING
INGREDIENTS

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 slimme oplossing bedacht, waarbij er groene stroom en biogas wordt gemaakt van slachtblijproducten 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 biogas van raw dierlijk vet.



Er zijn verschillende manieren om een 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 slimme oplossing bedacht, waarbij er groene stroom en biodiesel wordt gemaakt van slachtofferproducten en andere dierlijke restproducten. Hoe gaat dit in zijn werk?

Vergisting en productie van groene stroom

400 g CO₂ per

Biodiesel bestaat uit een mengsel van plantaardige oliën en vetten met glycerine. Het is een milieuvriendelijke alternatieve brandstof voor diesel.

ver. 1.0	50
ver. 2.0	50
ver. 3.0	50

Abstract: 400

Special
for
Open
in
the



2009: 1 ton per jaar (op
werkdagen vóór 2000)
20 000 liter per jaar

00 Soc CD, per year



1

100%

100%

50 000 tpa per year (2014-2020)

© 2000 Blackwell Science Ltd *Journal of Internal Medicine* 247: 391–397

Biologisch afgevoerd uit:	5 000 000 liter per jaar
Uitgevoerd naar:	4 000 000 liter per jaar

4 600 t/a CO₂ per jaar

- 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

ecoson

Op deze locatie worden slachtbijproducten en reststromen van dierlijke oorsprong verwerkt tot duurzame energie en biobrandstoffen. De grondstoffen zijn reststromen uit de vleesverwerkende industrie. Ze zijn dus niet geproduceerd voor dit doel, waardoor ze geen extra belasting vormen voor het milieu.





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.**

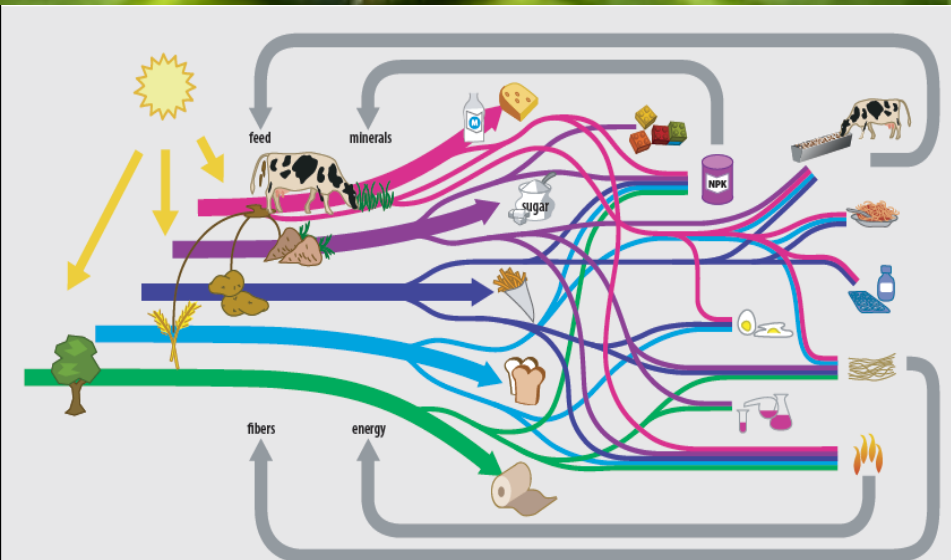




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B: Industrial Residues/ Wastes





Companies in fine chemicals/pharmaceutical level

Frisian Egg <http://frisianegg.com/>

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



SHELLBRANE



Egg
Powder

Fluid
egg-products



Shall Brane <http://shellbrane.eu/>

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

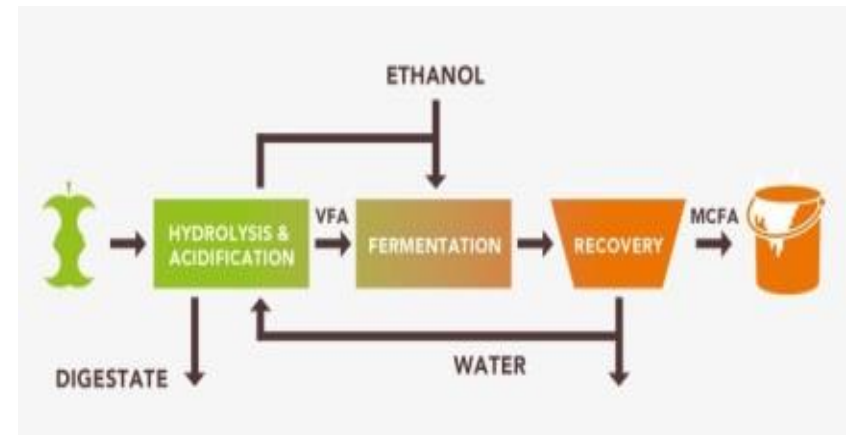
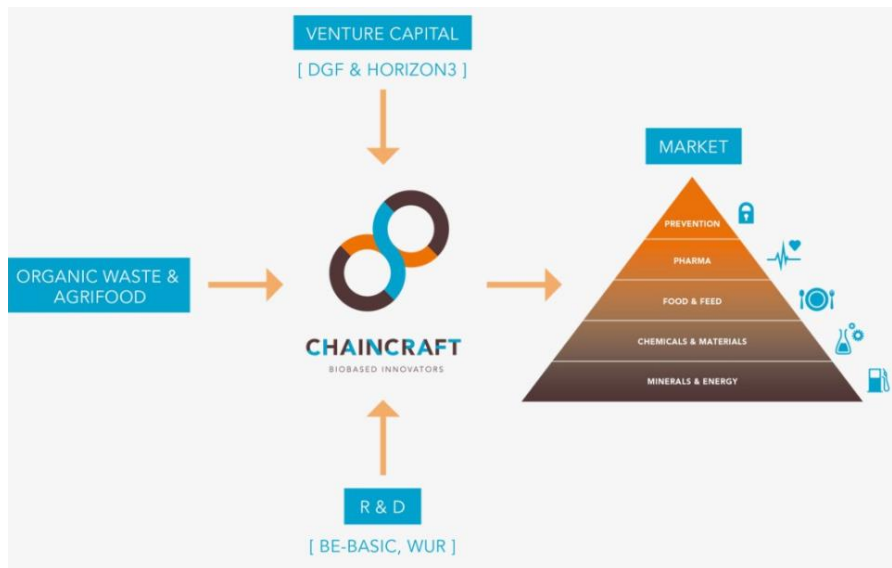
This applications can reduce cost and reduce cost by adding value to the side products.



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.**



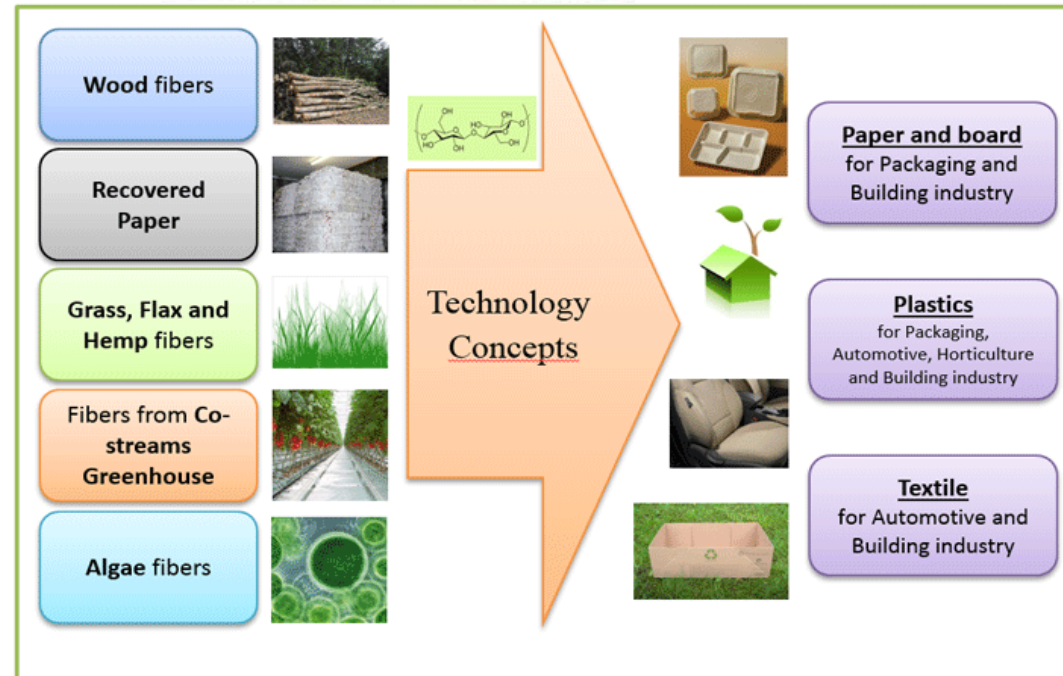


Material/products and chemicals

Milvision

<http://www.milvision.eu/>

- **Grass, tomato stems, sugar beets pulps** 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 coffee **packaging**.
 - In production phase.
- **This application might also be possible with biomass available in South Africa.**

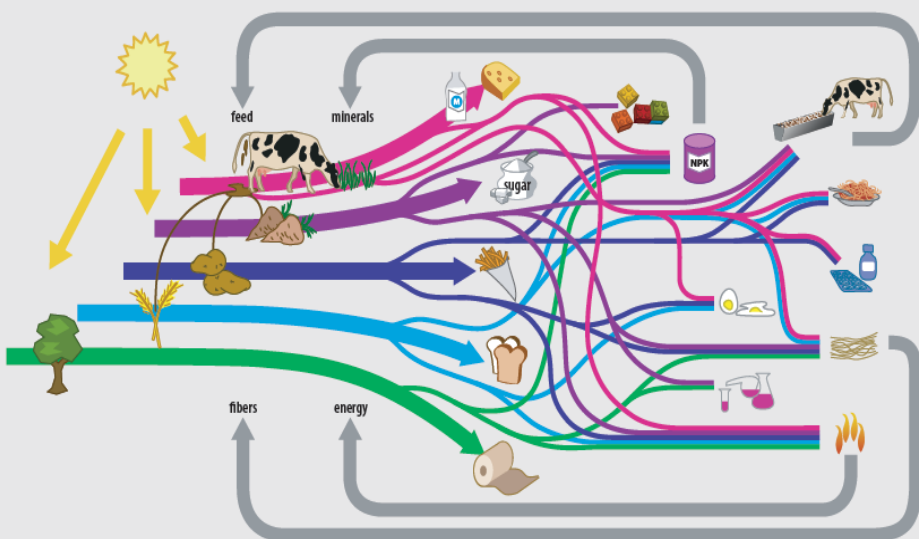




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C: Municipal Wastes





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.**

Furfuryl Alcohol &
PolyFA resins from sugarcane



Furfuryl Alcohol & PolyFA for wood modification



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?**





Heath & Power.

Bruinsenkwest

<http://www.bruinsenkwest.nl/>

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

➤ **Biomass from alien Species**



bruins & kwast
biomass management





Heat & Power

Orgaworld

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

- **Food & kitchen waste, supermarket waste and polluted 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>

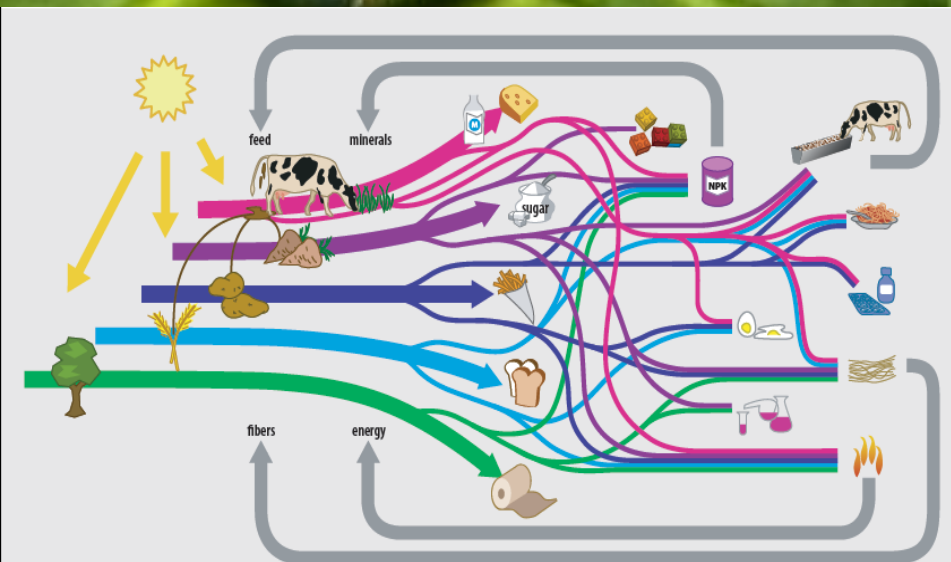




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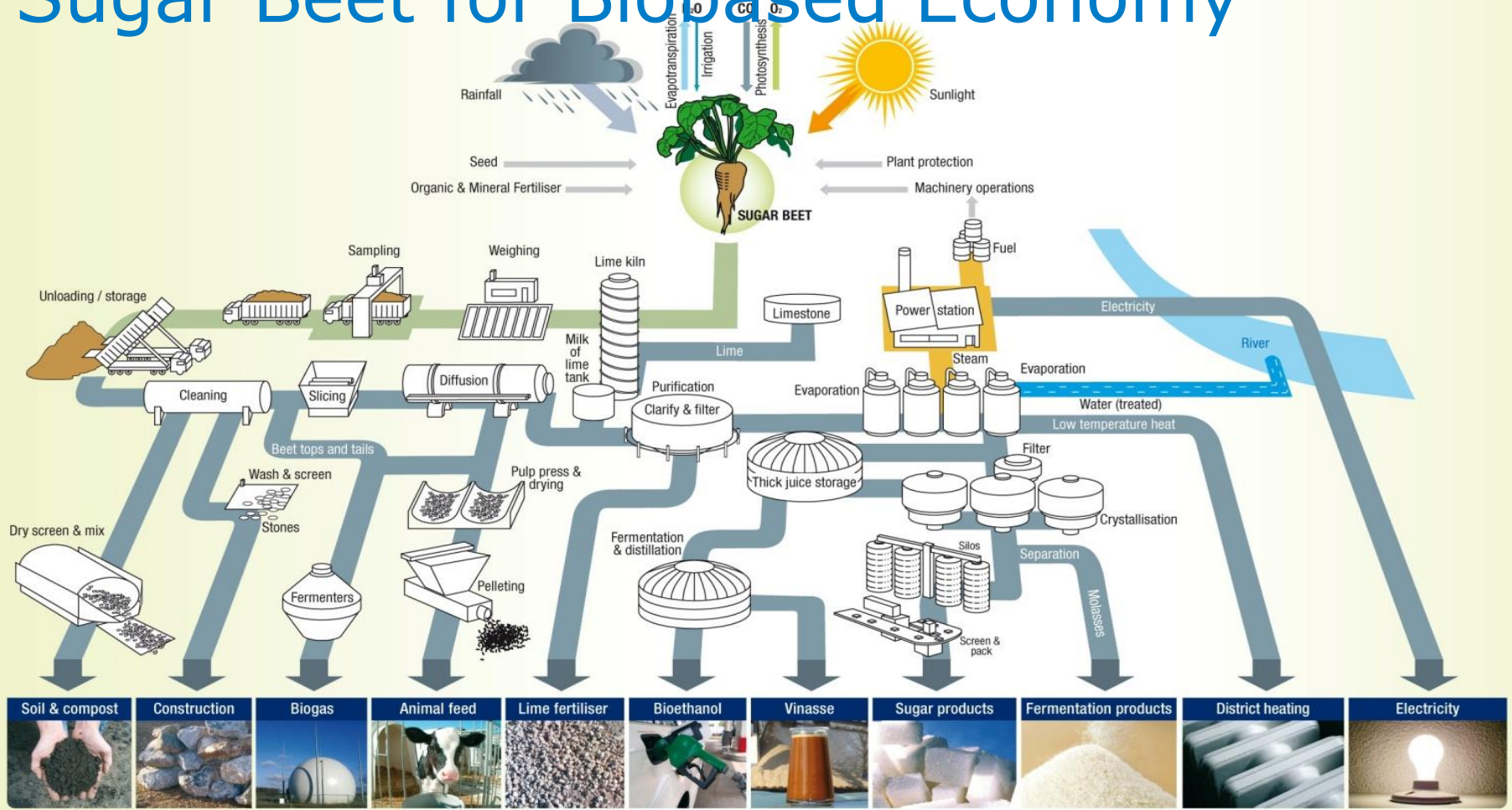


D: Agricultural Residues





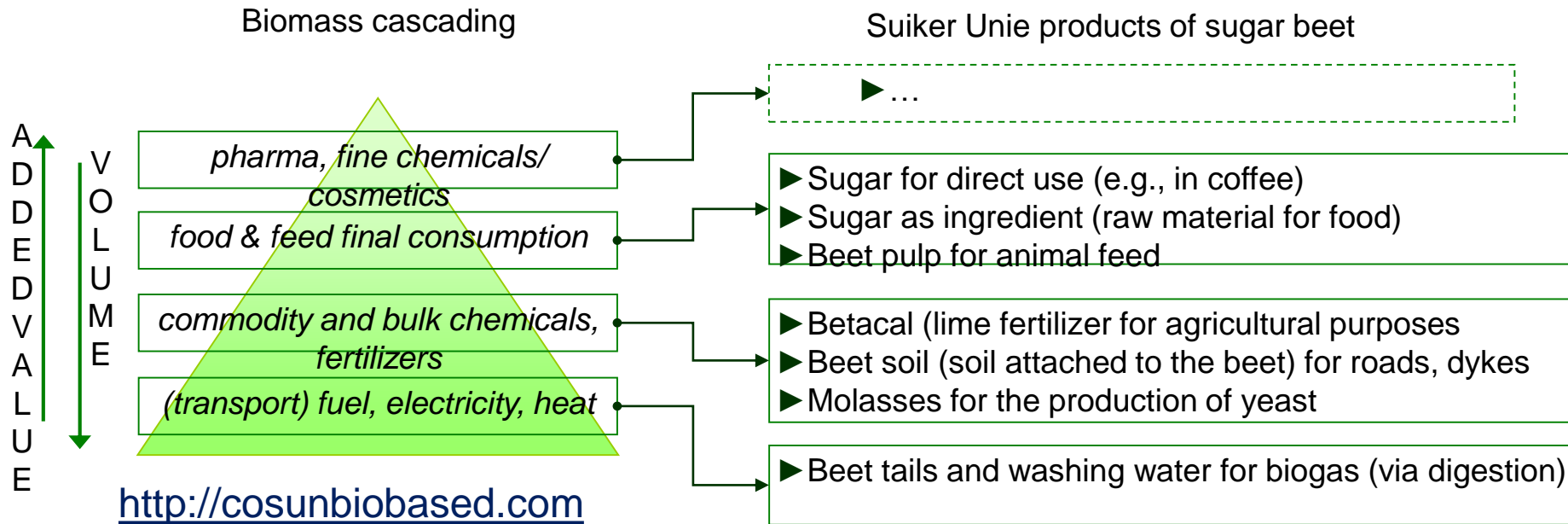
Sugar Beet for Biobased Economy



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

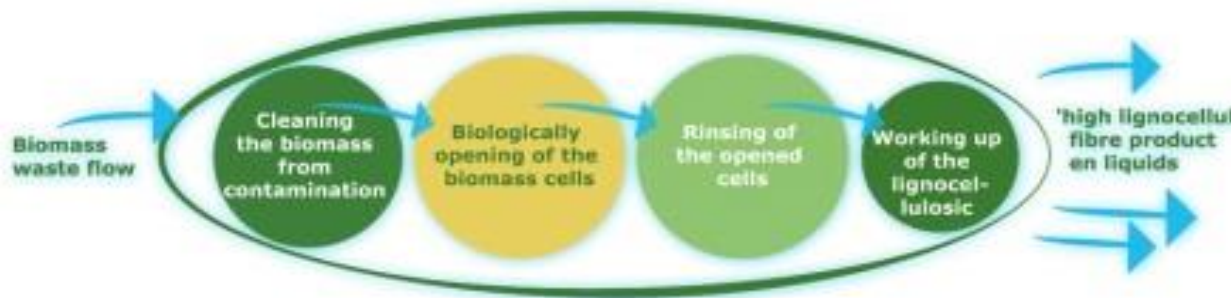
NewFoss / Huhtamaki

<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 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 **vegetarian food products**- meat/ sauces.
 - R&D and production phase.
- **This application might also be possible with vegetable residues in South Africa.**



BOBELDIJK
FOOD GROUP





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.**



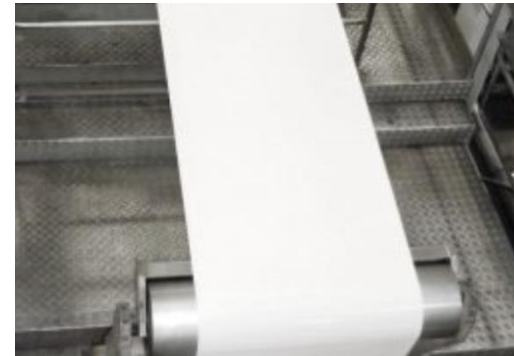


Material/products and chemicals

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.**



Companies in fine chemicals/pharmaceutical level

Reverdia <http://www.reverdia.com/>

- Bio-based **succinic acid** from plant-based raw material such as: **maize, wheat, potatoes, 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/](https://www.avantium.com/renewable-chemistries/zam%20to%20bezi/)

- 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.**

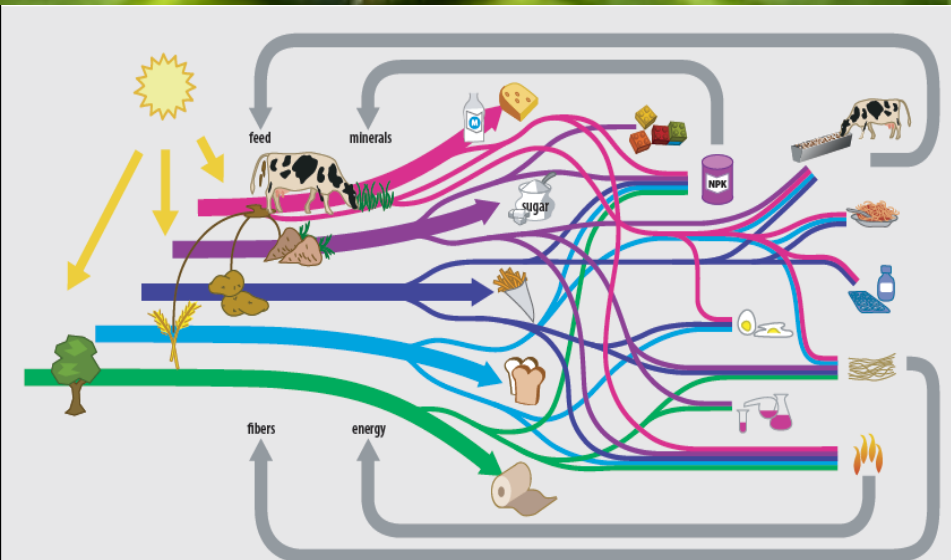




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Existing bio based initiatives NL-SA in Western Cape





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 feasibility for exportation of Charcoal to EU
- A large quantity 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

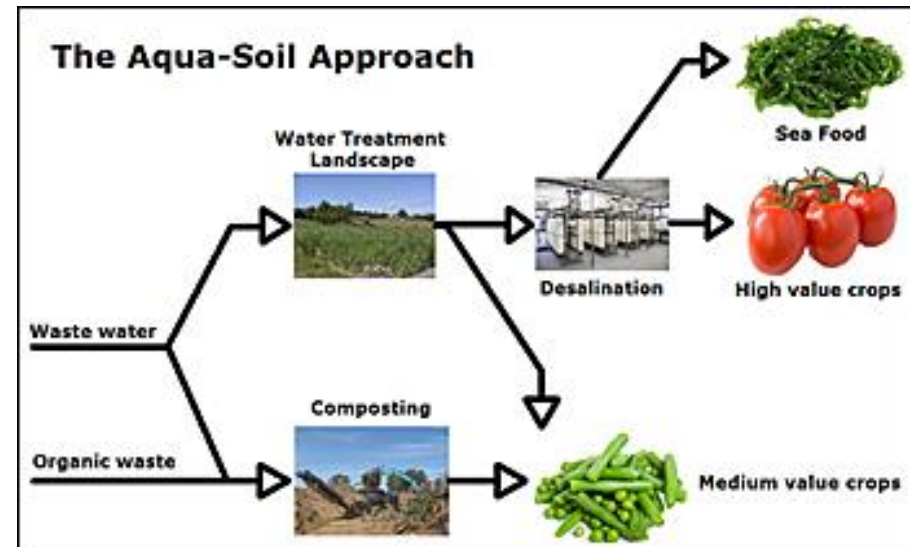
What is needed:

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



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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