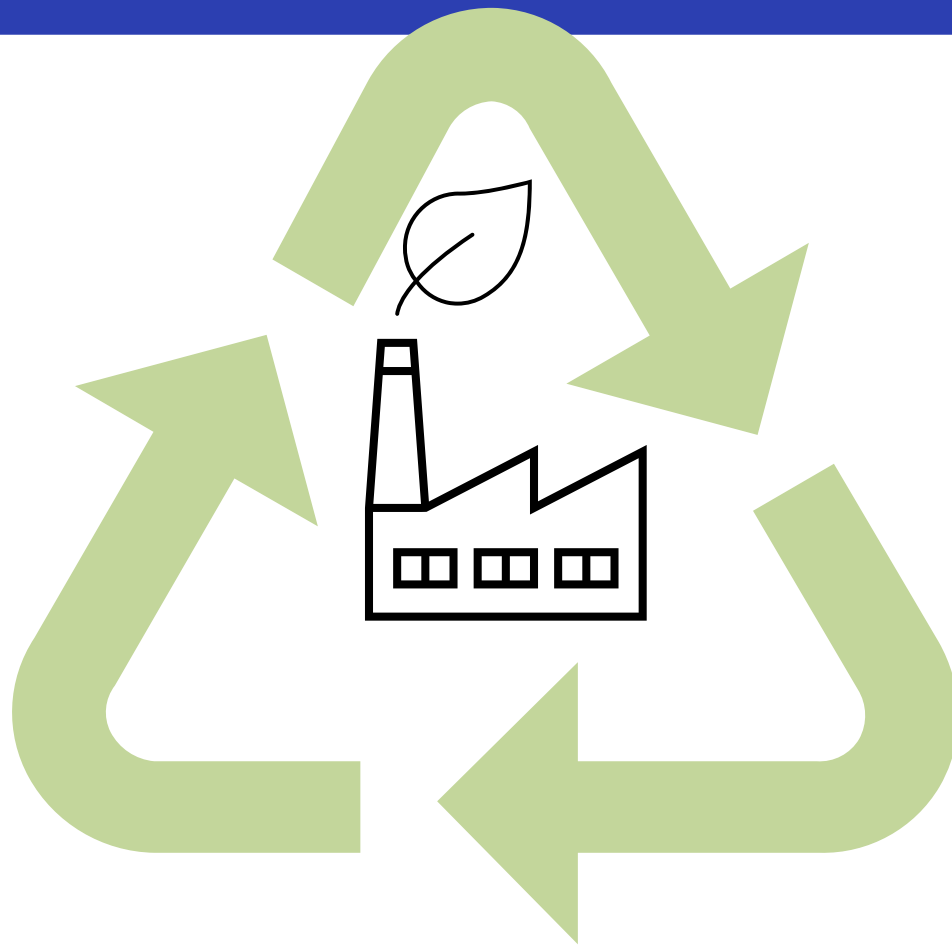


# Ciências ULisboa

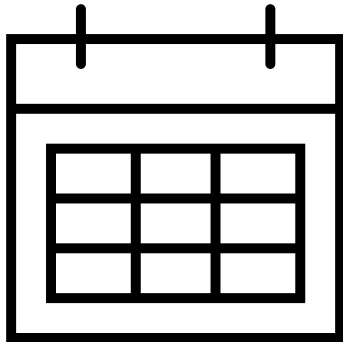
Faculdade  
de Ciências  
da Universidade  
de Lisboa

**Eng Energy & Environment**



**Biorefinery**

**Professor: Carla Silva ([camsilva@ciencias.ulisboa.pt](mailto:camsilva@ciencias.ulisboa.pt))**



**Wednesdays**

**16h-17h30**

**Room: 8.2.13**



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**Professor: Carla Silva ([camsilva@ciencias.ulisboa.pt](mailto:camsilva@ciencias.ulisboa.pt))**

5 challenges!

Oral evaluation: discussing the challenges

07-06-2022

27-06-2022

20-07-2022



## IEA Bioenergy Task 42 “Biorefineries”

**IEA Bioenergy**  
*Technology Collaboration Programme*

“Biorefining is the sustainable processing of biomass into a spectrum of marketable products and energy”.

2007



**The biorefinery concept:** Using biomass instead of oil for producing energy and chemicals, *Energy Conversion and Management*, Volume 51, Issue 7, 2010, Pages 1412-1421, ISSN 0196-8904, <https://doi.org/10.1016/j.enconman.2010.01.015>



Francesco Cherubini

Professor, Director of the Industrial Ecology Programme

Department of Energy and Process Engineering

✉ francesco.cherubini@ntnu.no

☎ +47 73598942

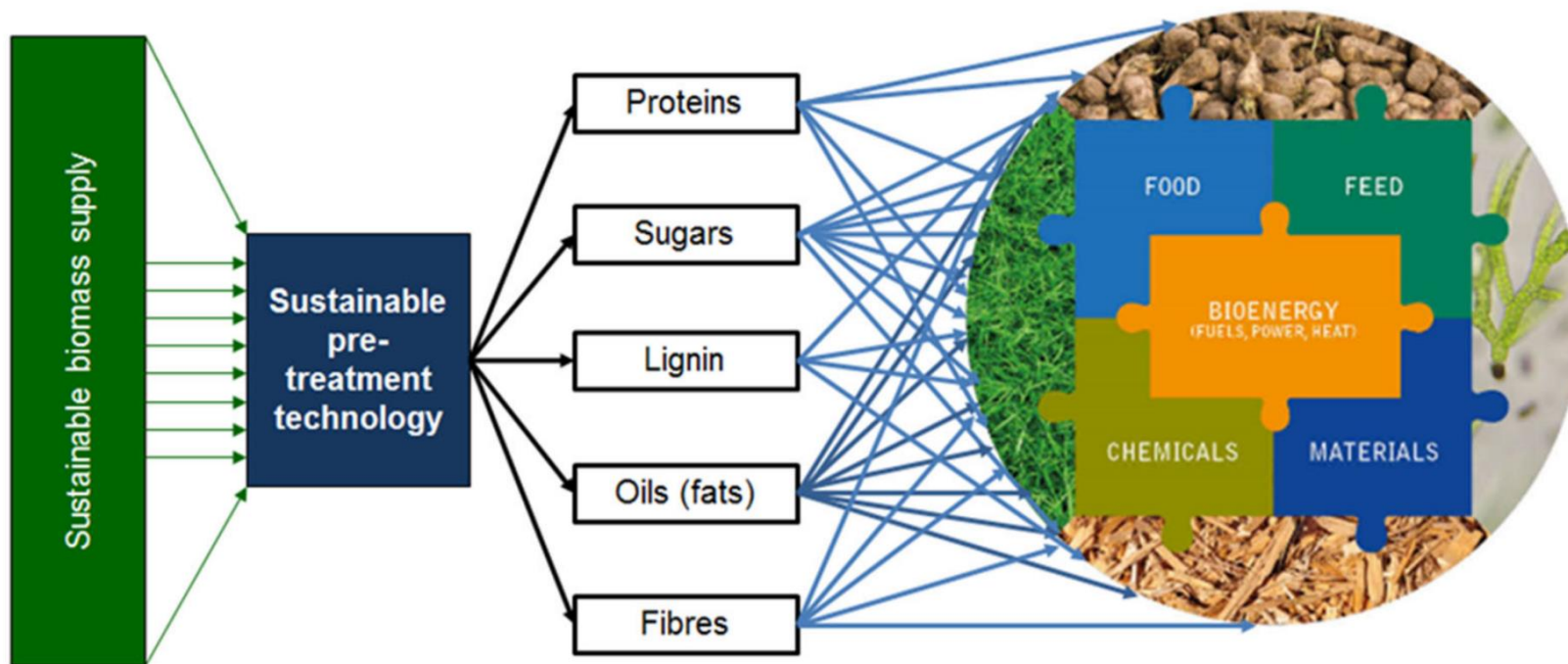
Realfagbygget, E4-142, Gløshaugen, Høskoleringen 5



Collect and pre-treat:

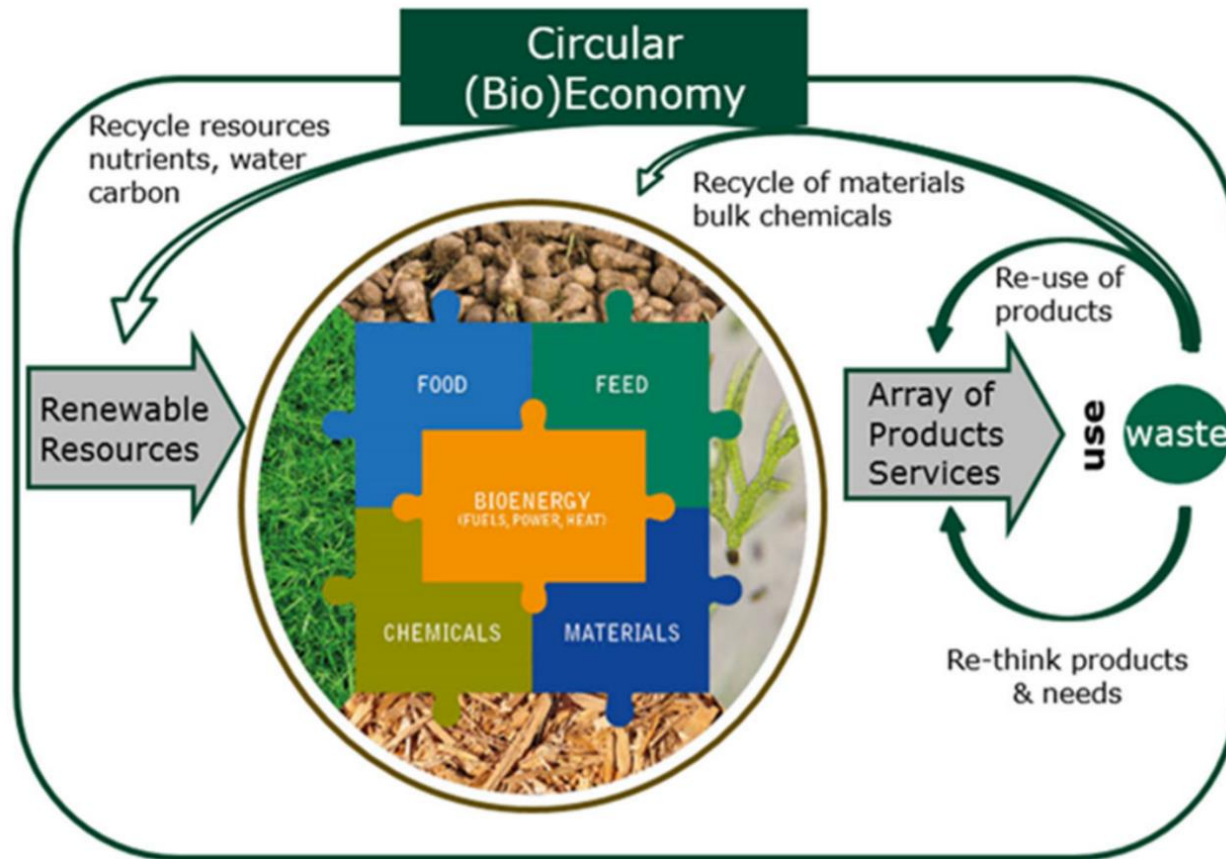
Decompose biomass in:

Build products:

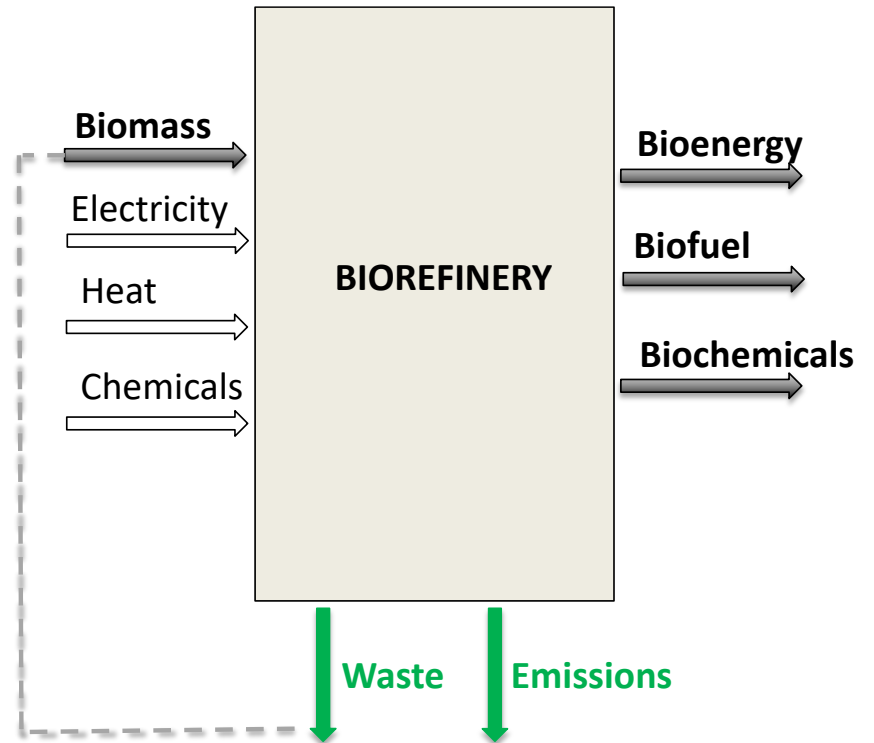
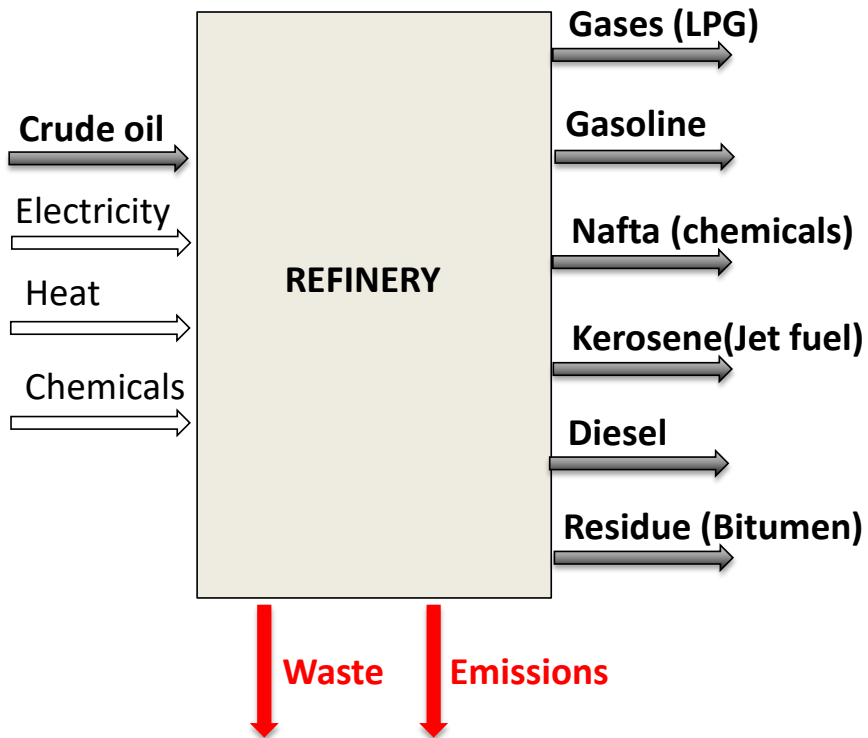




## Large-scale sustainable use of biomass

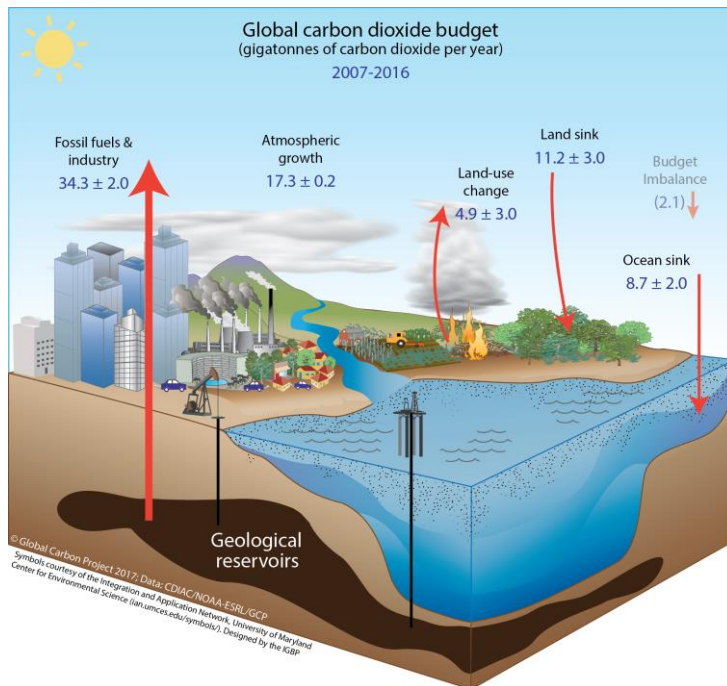


## Circular economy



## Fossil fuel

Took million years to form and another million years to be replaced



## Biomass

Took hours, days, month to form and can be replaced in a short term



garbage

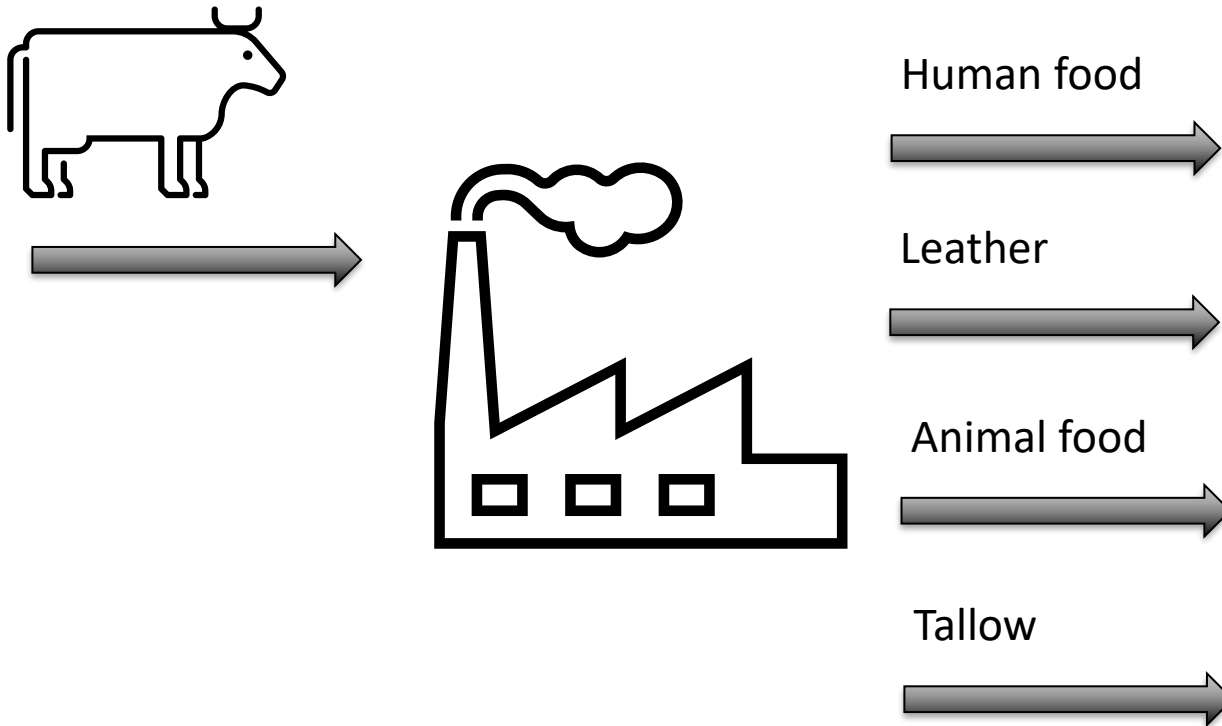


sewage

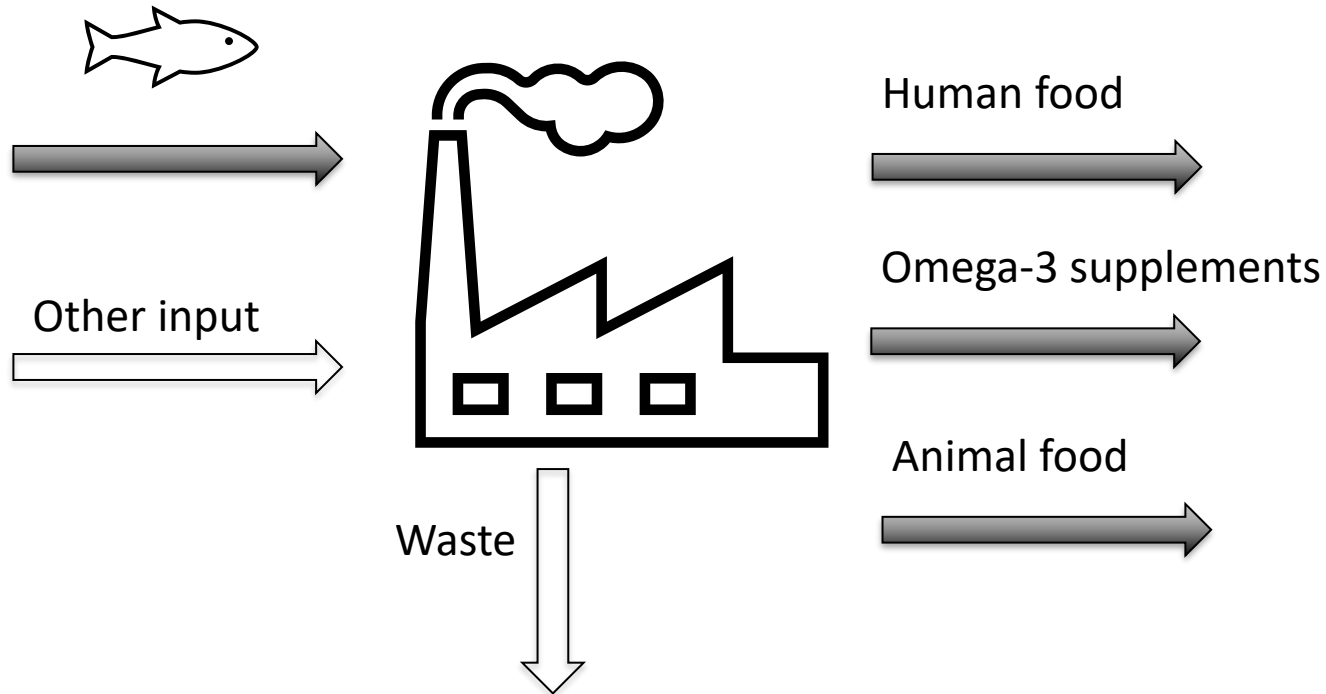


Forestry/  
Agriculture/  
industrial waste

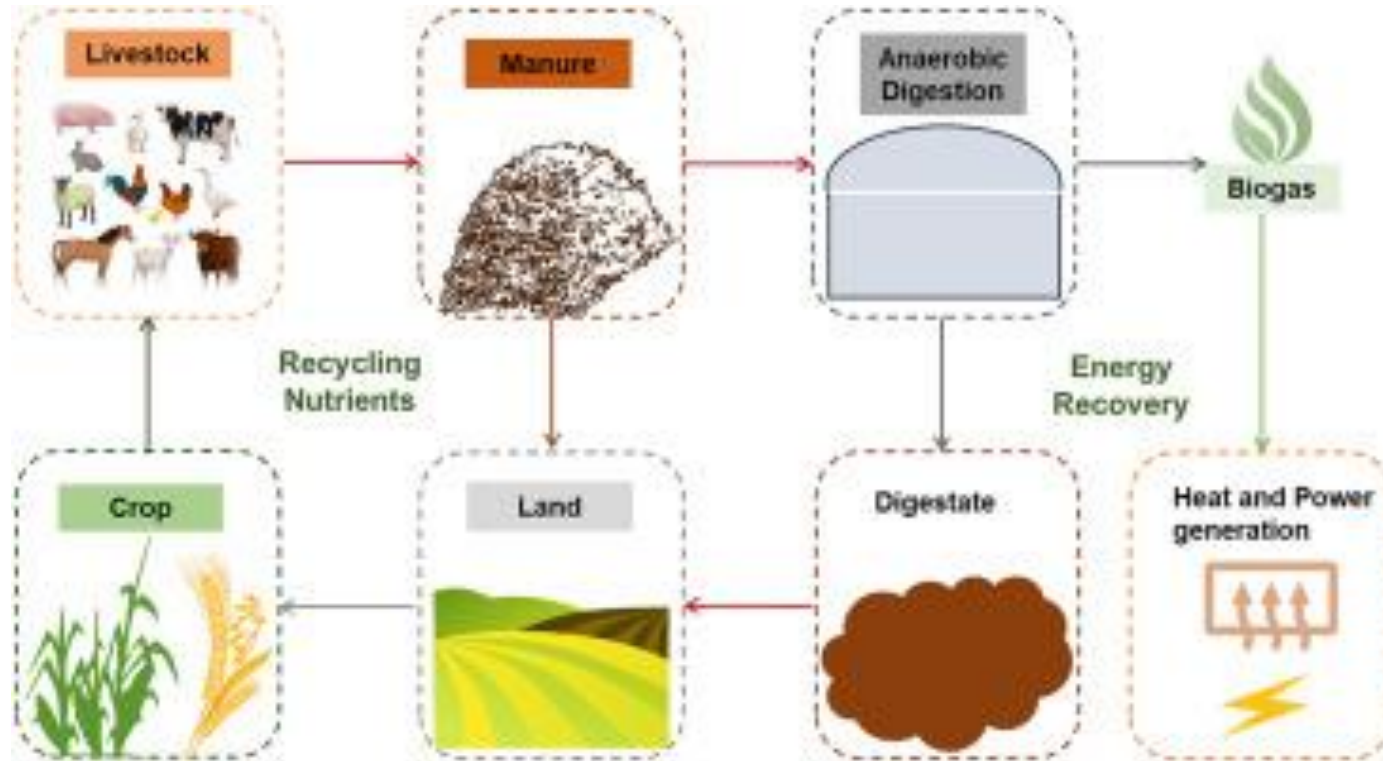
## livestock biorefinery



## livestock biorefinery



## livestock manure biorefinery



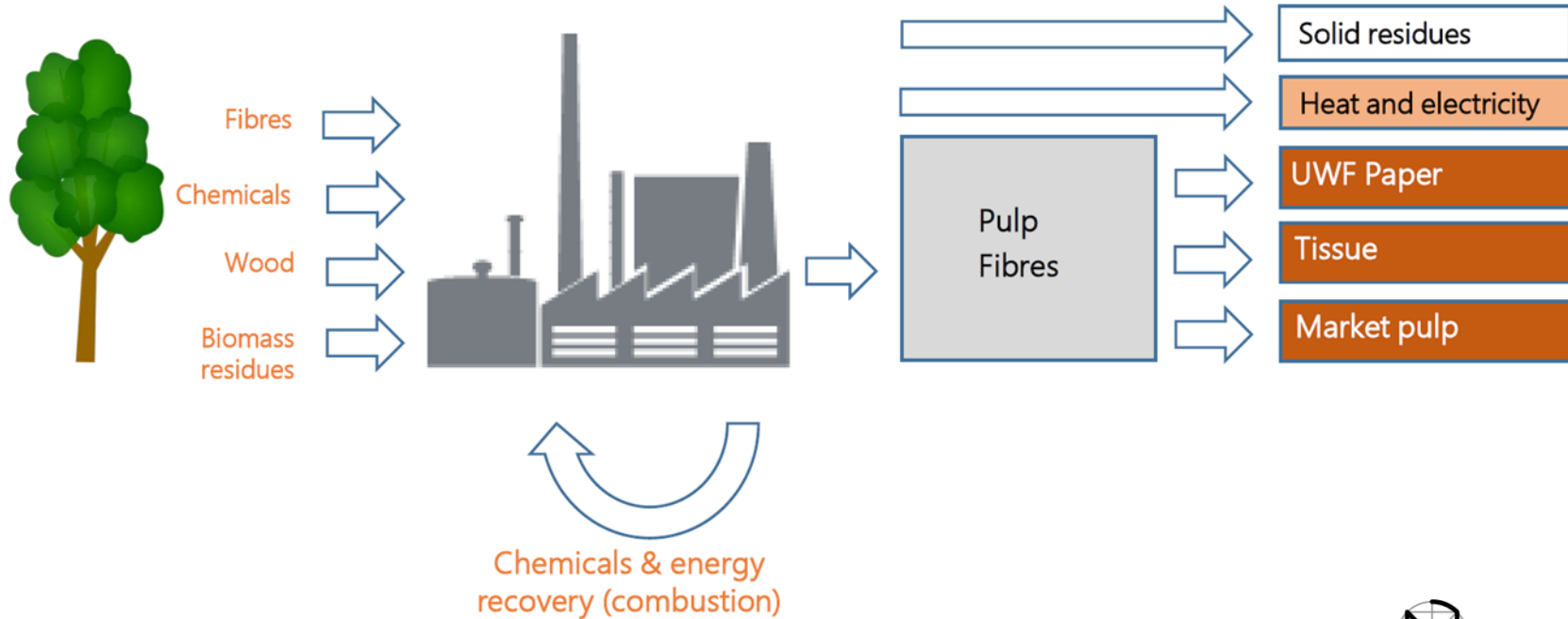
Sanjeev Kumar Awasthi, Manish Kumar, Surendra Sarsaiya, Vivek Ahluwalia, Hongyu Chen, Guneet Kaur, Ranjna Sirohi, Raveendran Sindhu, Parameswaran Binod, Ashok Pandey, Rashmi Rathour, Sunil Kumar, Lal Singh, Zengqiang Zhang, Mohammad J. Taherzadeh, Mukesh Kumar Awasthi, Multi-criteria research lines on livestock manure biorefinery development towards a circular economy: From the perspective of a life cycle assessment and business models strategies, *Journal of Cleaner Production*, 2022, 130862, ISSN 0959-6526, <https://doi.org/10.1016/j.jclepro.2022.130862>

## Anaerobic digester biorefinery



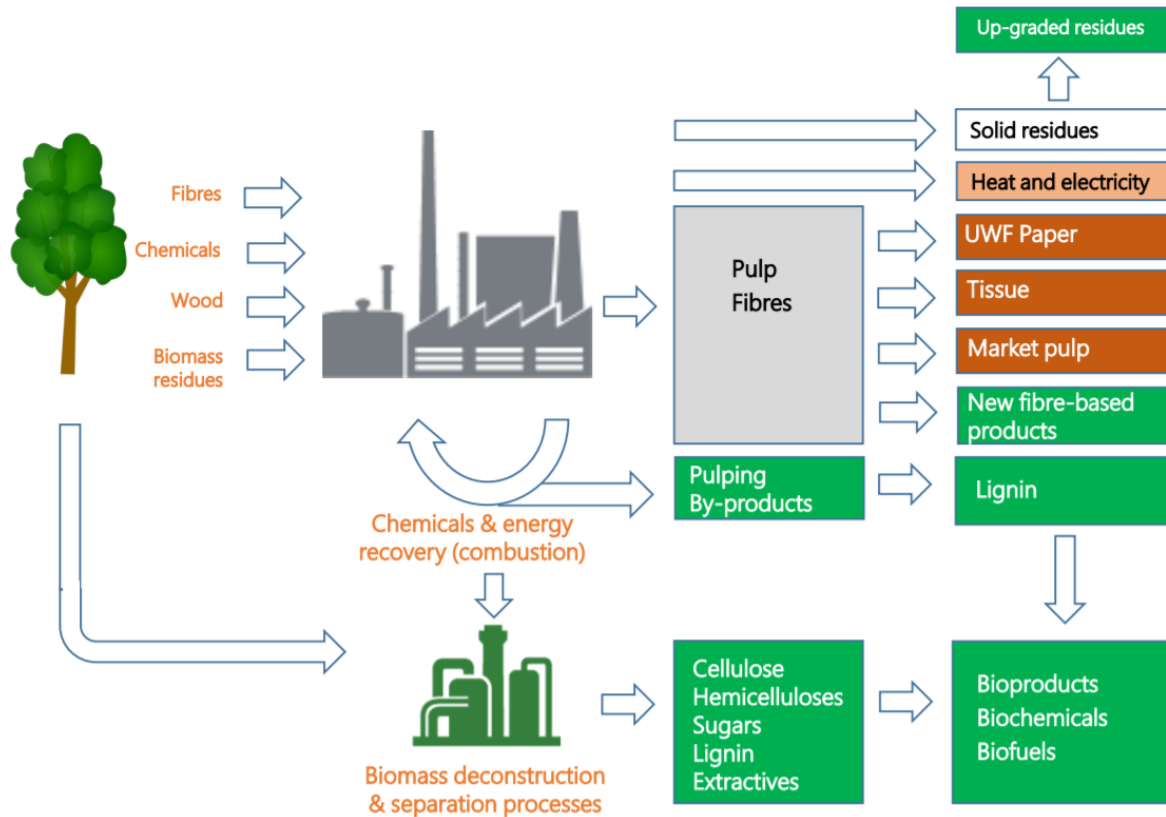
[Video 1](#)

[Video 2](#)



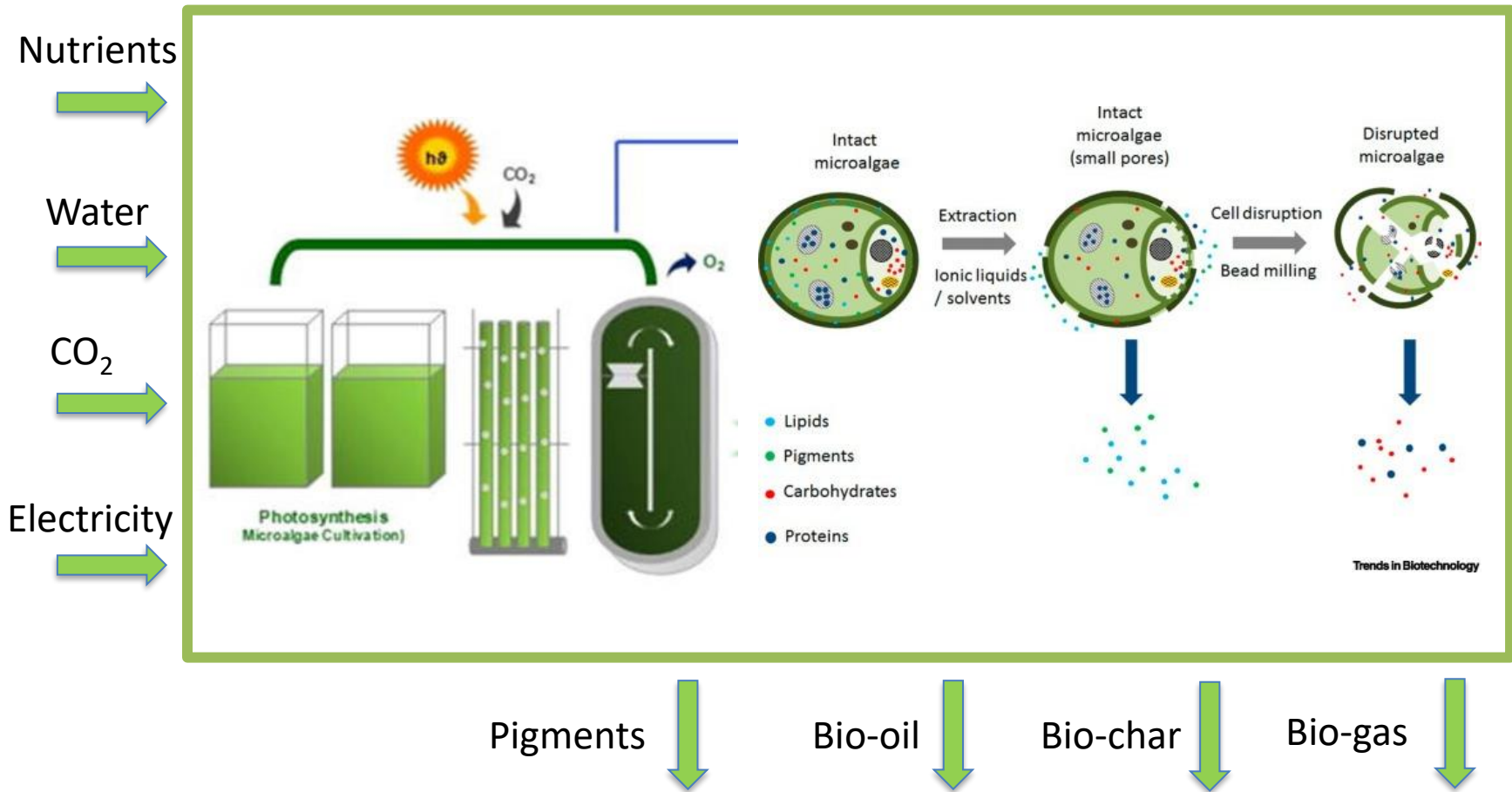


## Tomorrow pulp & paper biorefineries

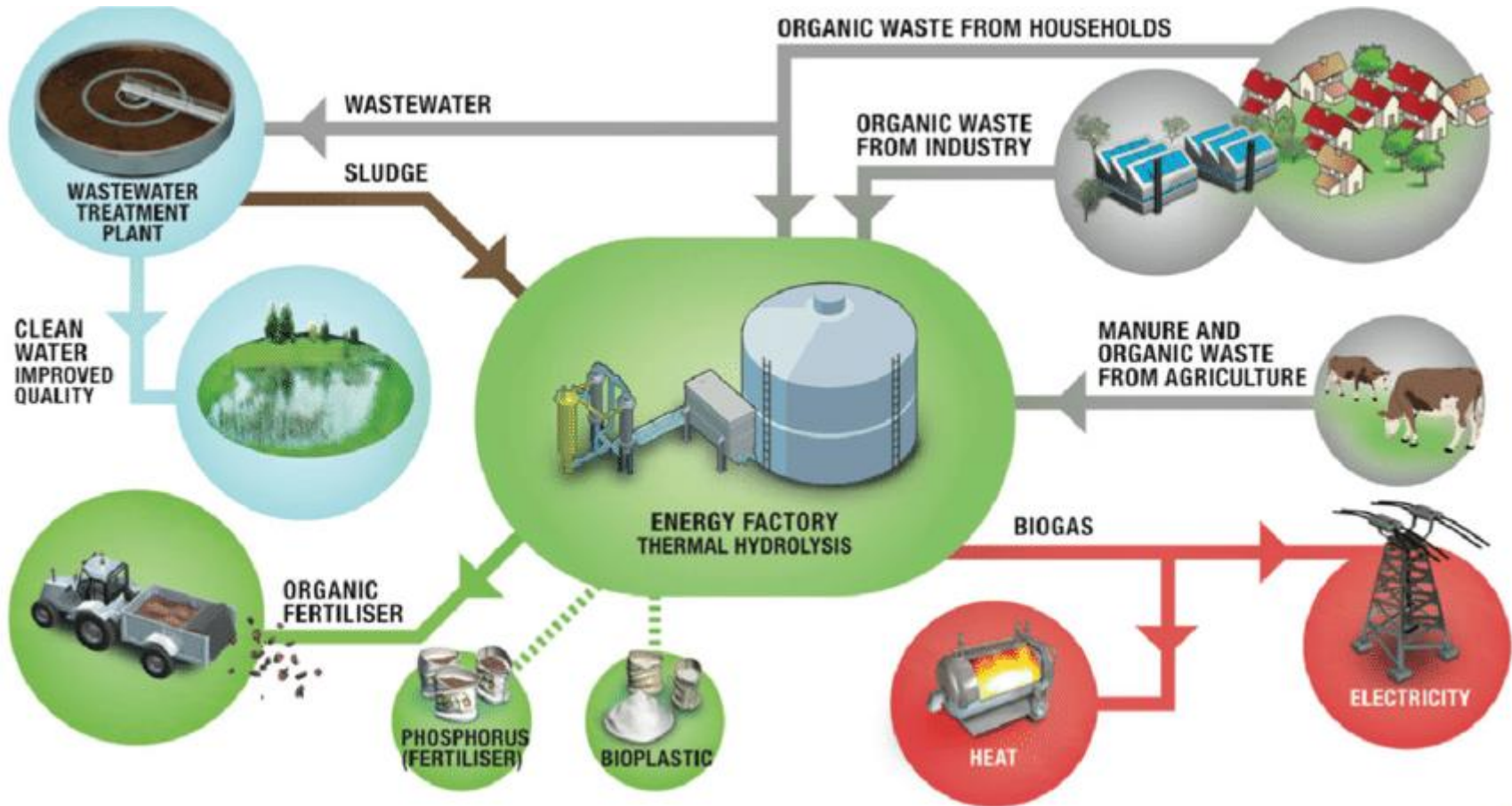


*science boosting a cutting-edge forest bioeconomy* **RAIZ**  
Instituto de Investigação da Floresta e Papel

## microalgae biorefinery



## wastewater biorefinery

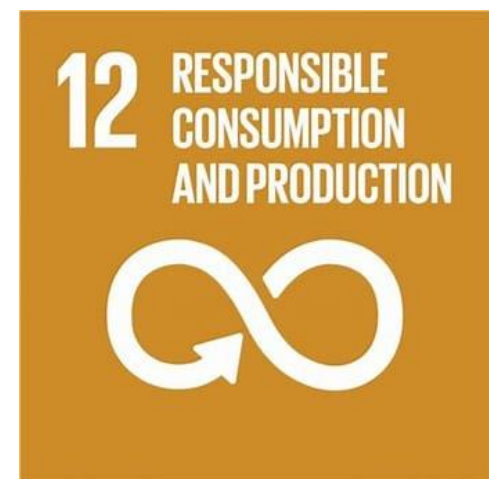


<http://www.billundbiorefinery.dk/en/>

## organic waste biorefinery

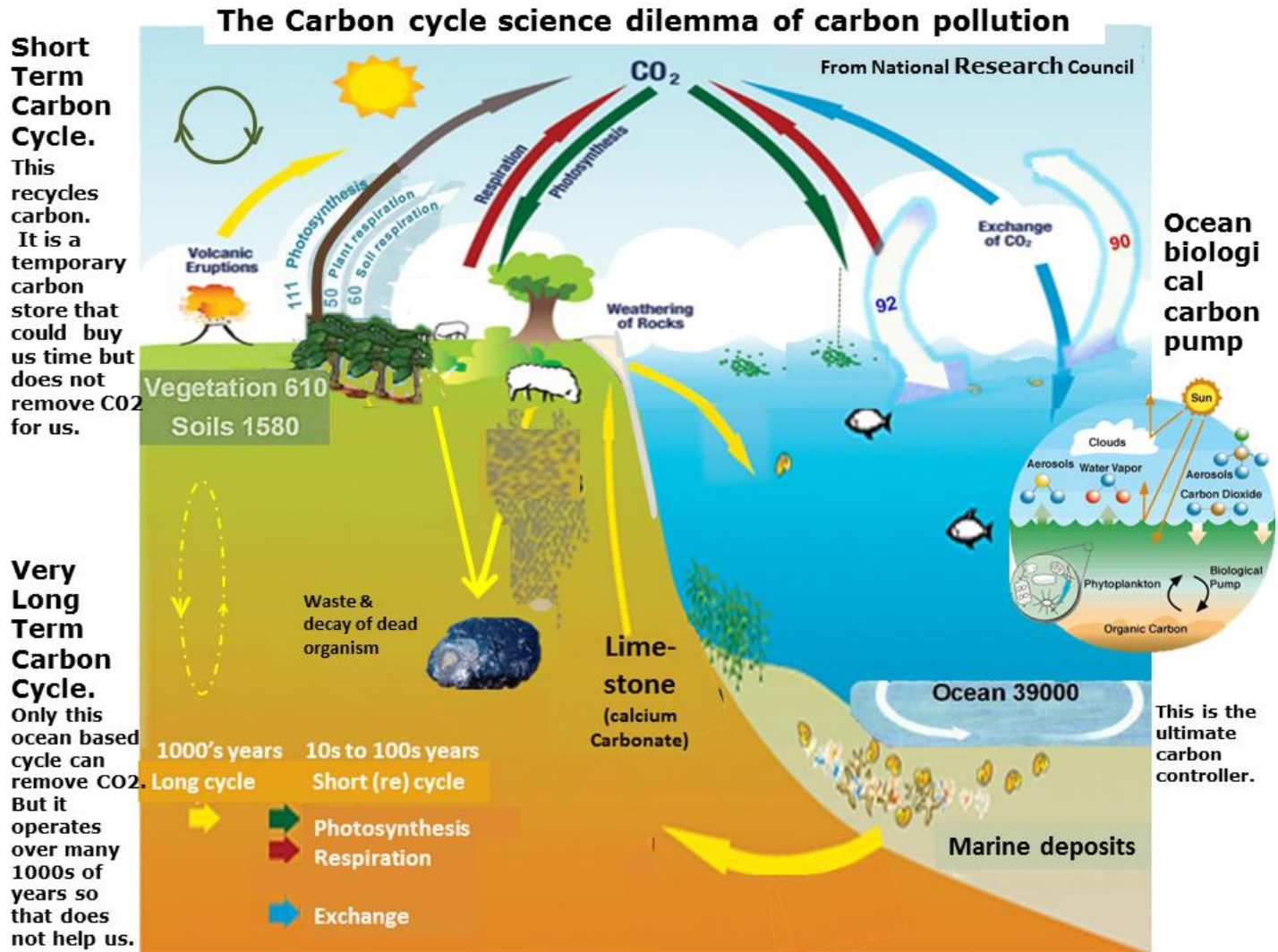


## SUSTAINABLE DEVELOPMENT GOALS





# Framework

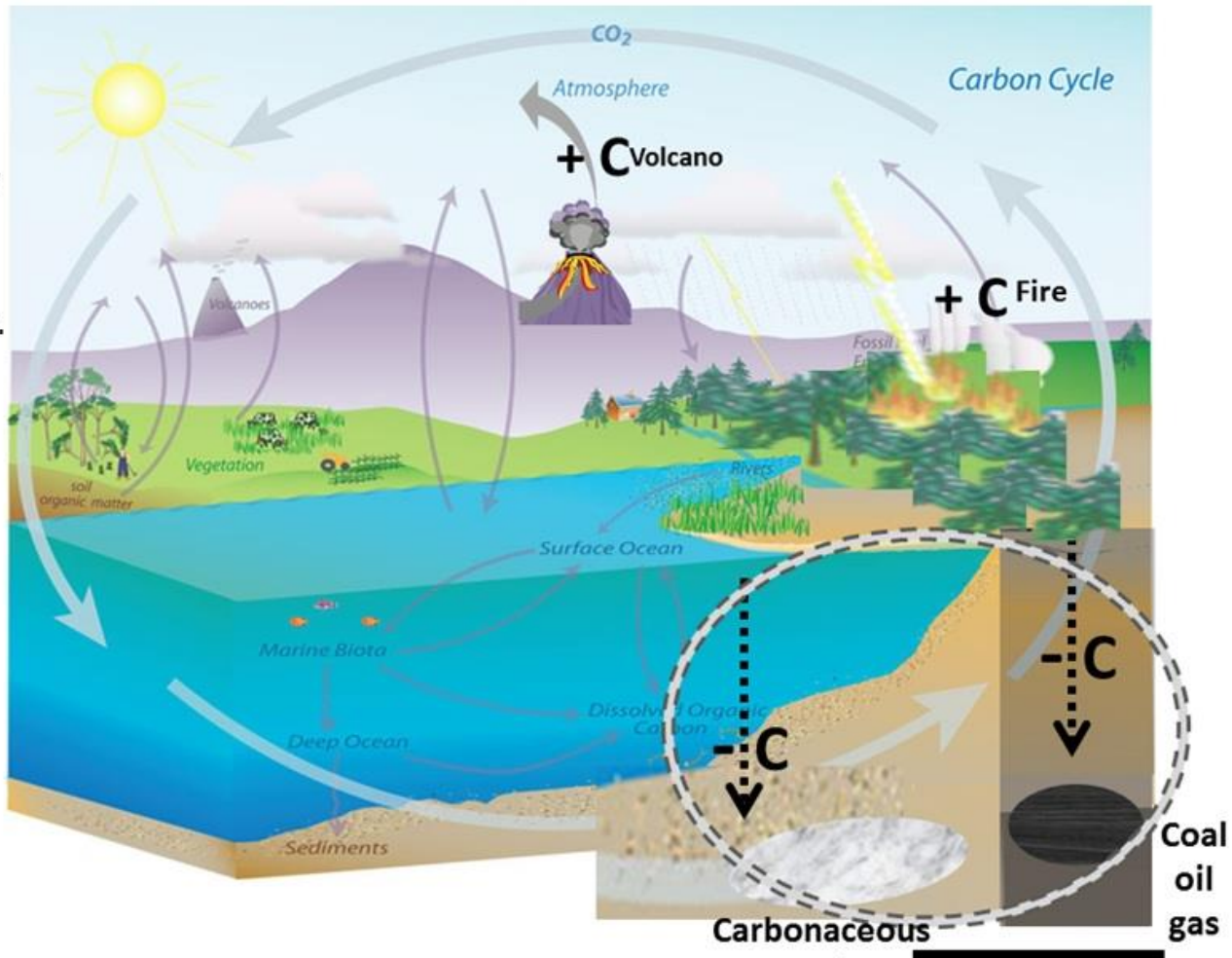


Carbon Neutral Commons by Ted Redelmeier is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License.

# Framework

## Ultra long term carbon cycle

The short term land and ocean cycle is shown by the thin lines inside the thick lines of the long term ocean cycle.





## IEA Bioenergy Conference 2021

[Overview](#)[Agenda](#)[Speakers](#)

# The role of biomass in the transition towards a carbon neutral society

The IEA Roadmap 'Net Zero Emissions by 2050' recognizes bioenergy as an important option, representing 18% of total energy supply in 2050, and playing a major role to reach carbon neutrality of the global energy system, either through the direct replacement of fossil fuels, or to offset emissions indirectly through the combined use of bioenergy with carbon capture and storage/utilisation.

**An increasing role of biomass/biofuels will be needed in industry, transport as well as heat and power production.** The conference sessions considered latest **developments and prospects of biomass/bioenergy in different sectors**, as well as sustainable feedstock mobilisation and the role of biomass in a circular bio-economy.

<https://www.ieabioenergyconference2021.org/>



**EU-INDIA-BCE  
CONFERENCE**

**PROGRESS IN  
ADVANCED  
BIOFUELS**

**2 - 4 MARCH 2022  
ONLINE**

## Next steps for Zero Emission Vehicles in the UK

*Morning, Friday, 11<sup>th</sup> March 2022*

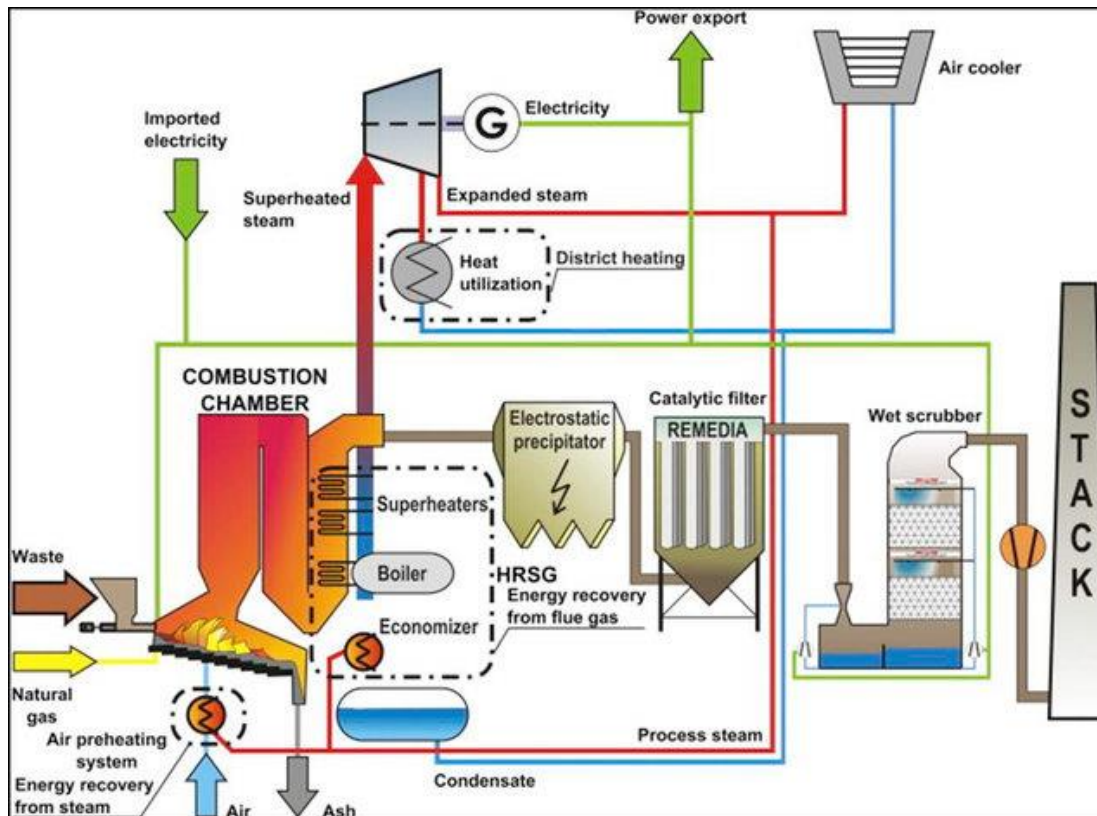
This conference will examine the future for Zero Emission Vehicles (ZEVs) in the UK, with discussion on:

- progress toward the Government's targets of ending the sale of new petrol and diesel cars by 2030 and ensuring all new cars and vans are zero emissions at the tailpipe by 2035
- priorities for reforming the regulatory framework
- how supply chain issues around materials and computer chips can be addressed
- next steps for scaling up electric vehicle and charge point rollout

Discussion will also look at how to support the UK automotive industry in the transition to ZEVs, what opportunities there are for commercialisation, and how to scale up and tackle commercial barriers in the context of the Government's policy ambitions for transport and its net-zero targets.

i) An incineration unit with energy valorization of heat and electricity can be considered a biorefinery? Justify by pinpointing your arguments.

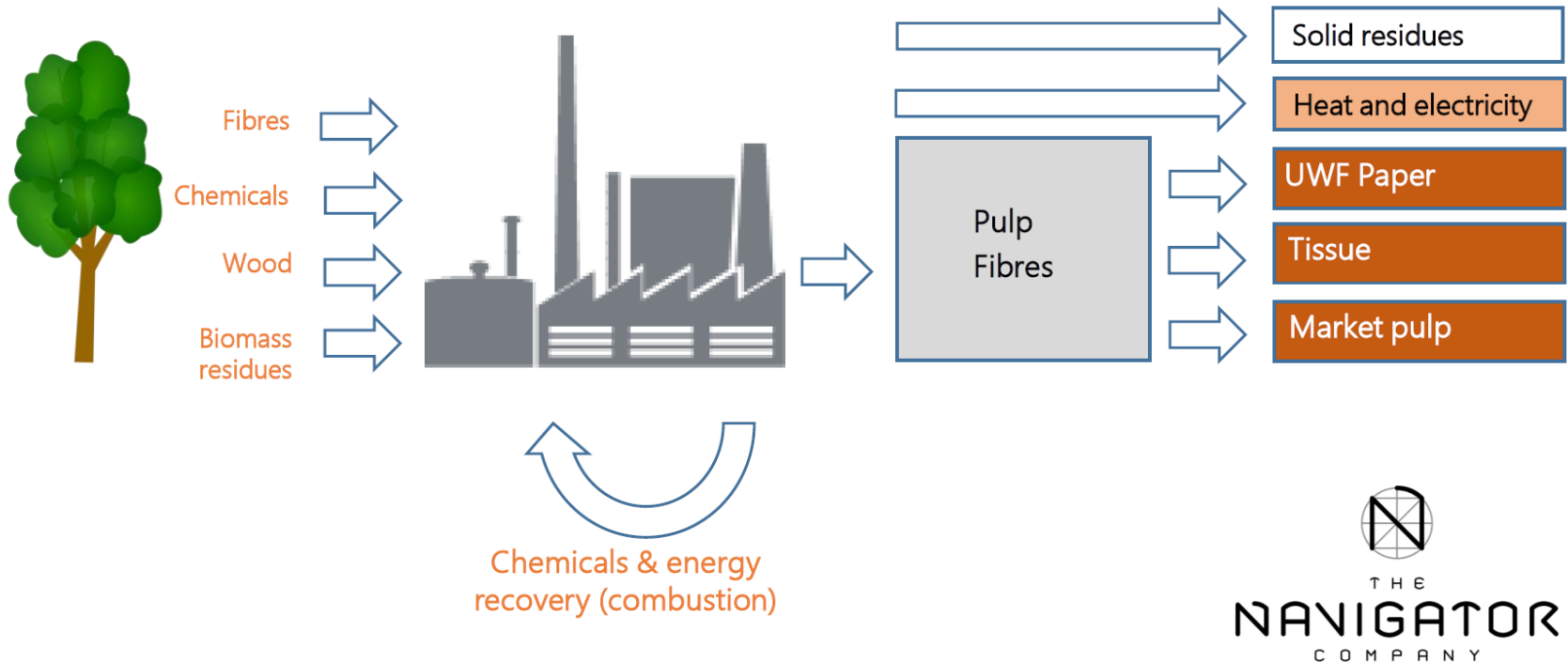
<https://youtu.be/1DpneIFBbsI>



ii) Go to

[https://datam.jrc.ec.europa.eu/datam/mashup/BIOBASED\\_INDUSTRY/index.html](https://datam.jrc.ec.europa.eu/datam/mashup/BIOBASED_INDUSTRY/index.html)

And identify how many pulp and paper biorefinery there are in Portugal and in Europe.

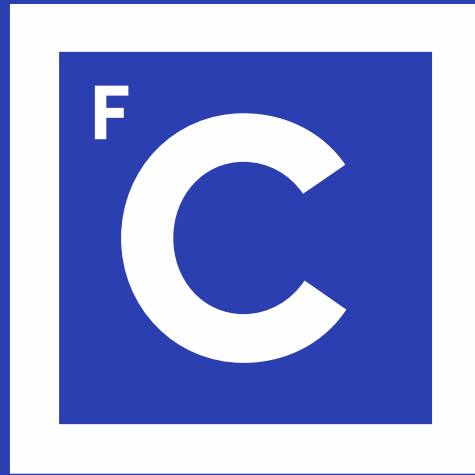


iii) If a system converts biomass to biofuel and bioproducts but displaces more fossil fuels than the fossil-based comparators can be considered a biorefinery?

Deadline: 8 March

Delivery: pdf by e-mail [camsilva@fc.ul.pt](mailto:camsilva@fc.ul.pt)

**Thanks**



# Ciências ULisboa

Faculdade  
de Ciências  
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