WIRE

Waste biorefinery technologies for accelerating sustainable energy processes

Biorefineries of complex wastes: from polymers to food wastes

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EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

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Contents

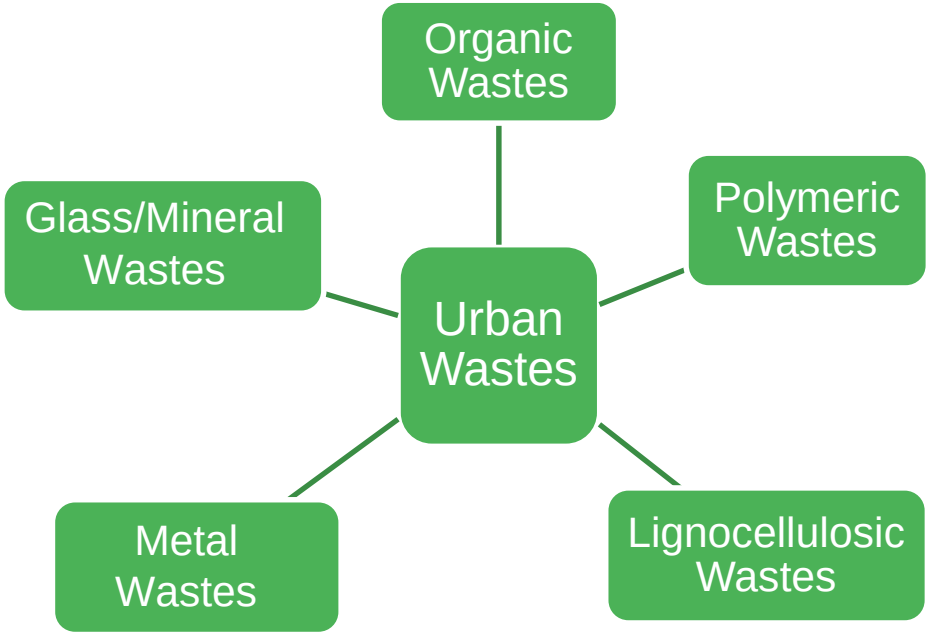
Polymers & Biomass

Key challenges:

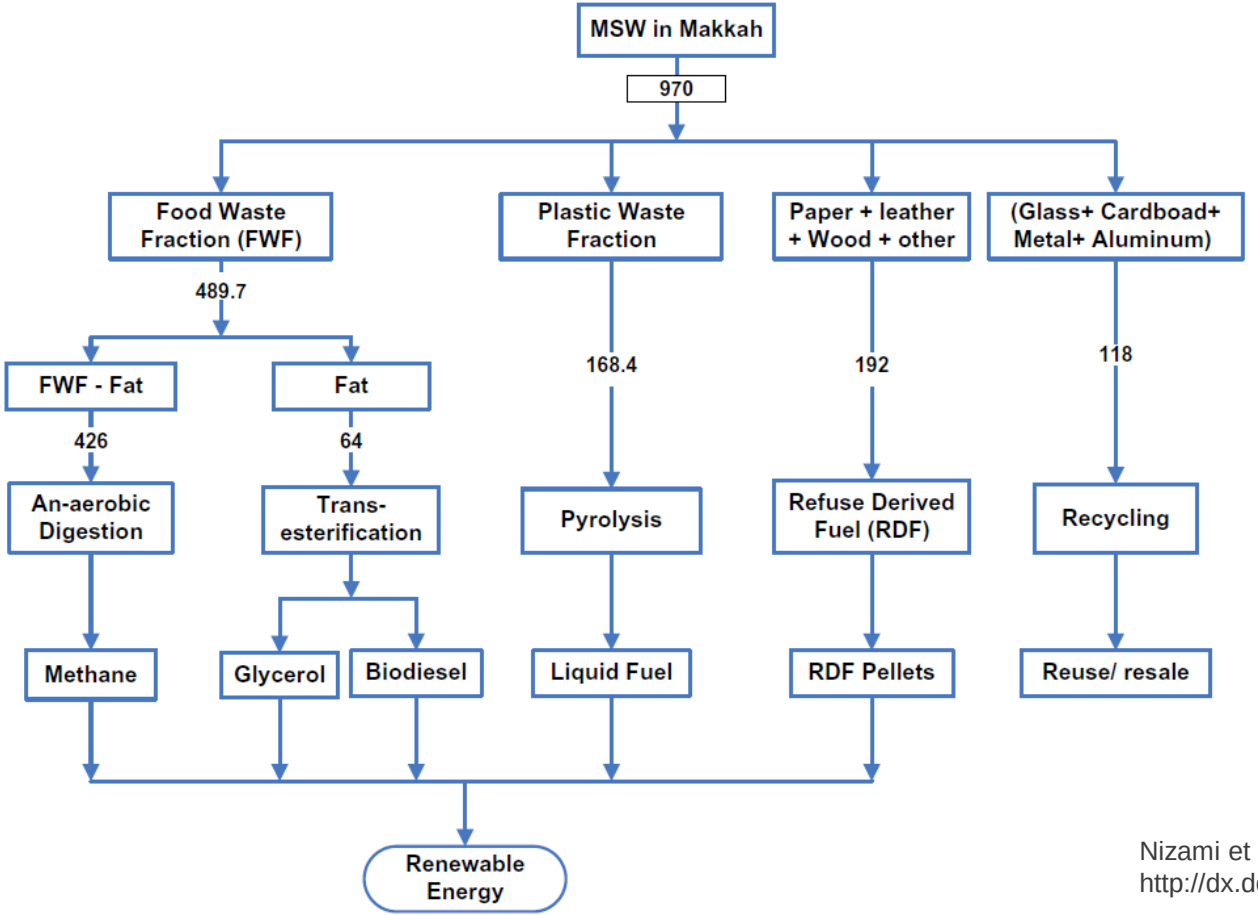
- Composition
- Heating value
- Thermochemical behaviour
- Chlorine, nitrogen and sulphur
- Antimicrobial activity

Biorefinery Potential?

Urban Wastes



Urban Waste



Nizami et al, 2017
http://dx.doi.org/10.1016/j.apenergy.2016.04.116

Lipid Wastes

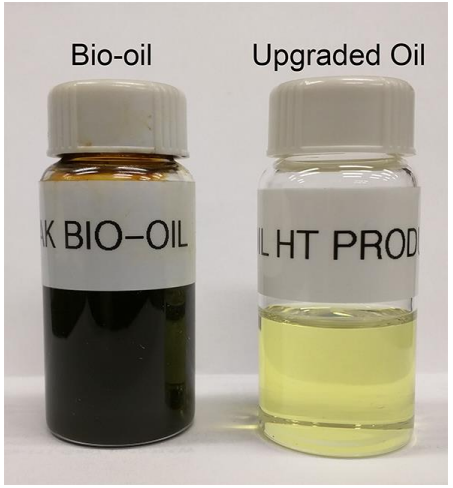
Challenges:

- Unfit for food or feed applications
- Unfit for biodiesel production
- Contaminated with non-lipid materials

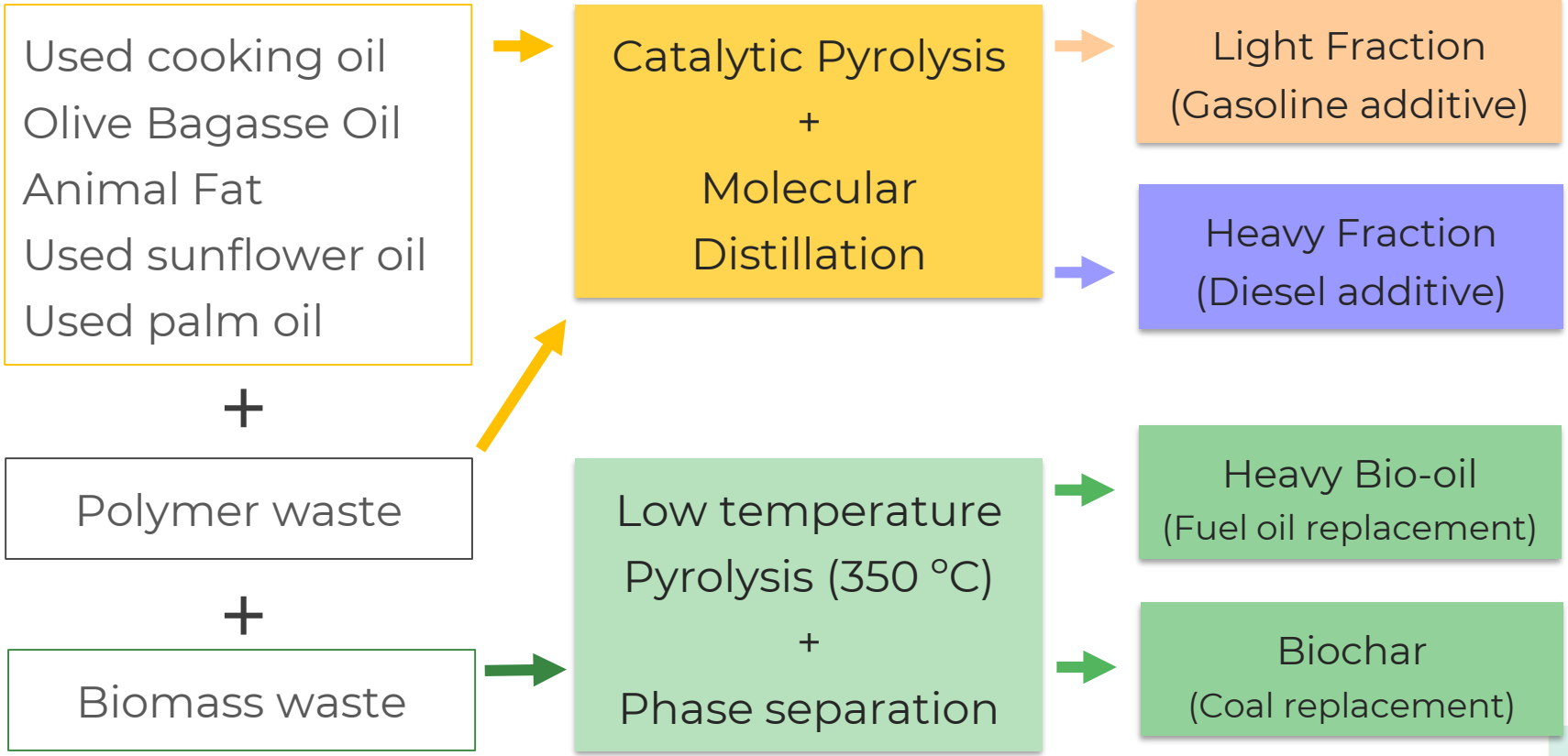
Pyrolysis

+

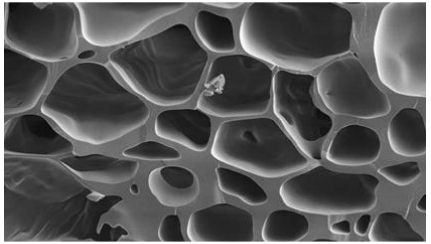
Upgrading

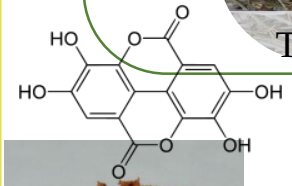


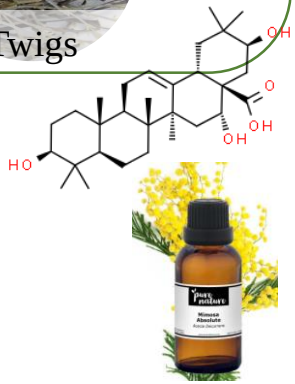
Lipid Wastes



Lignocellulosic Wastes



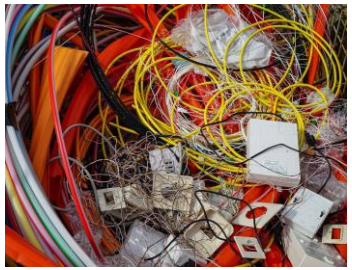




Polymeric Wastes

Challenges:

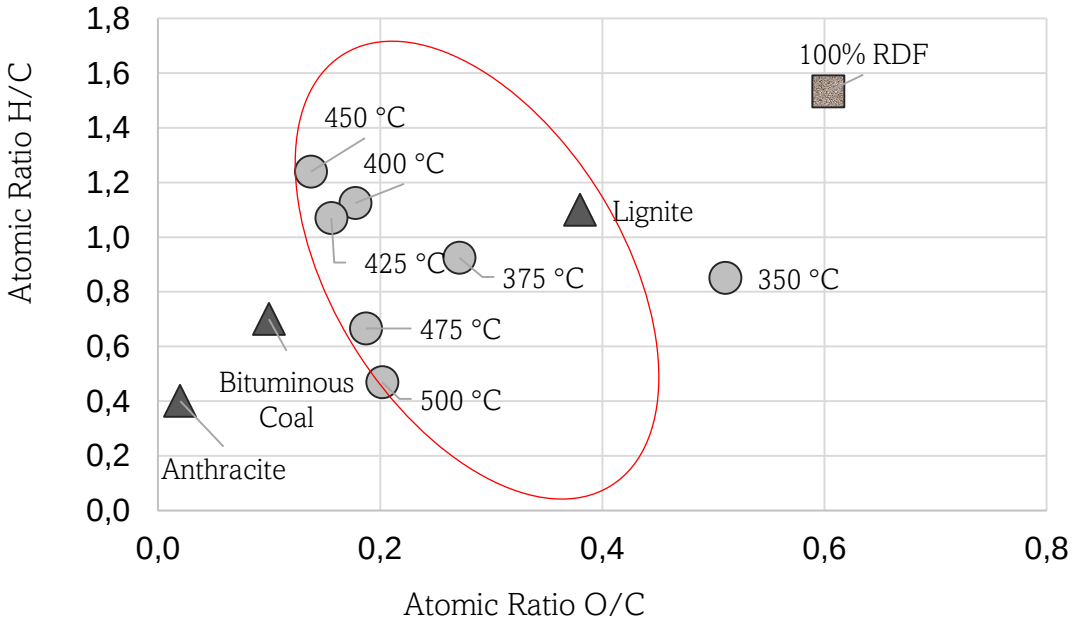
- Low density
- High moisture and ash content
- Chlorine content
- Contamination with organic wastes






Polymeric Waste

High temperature carbonization



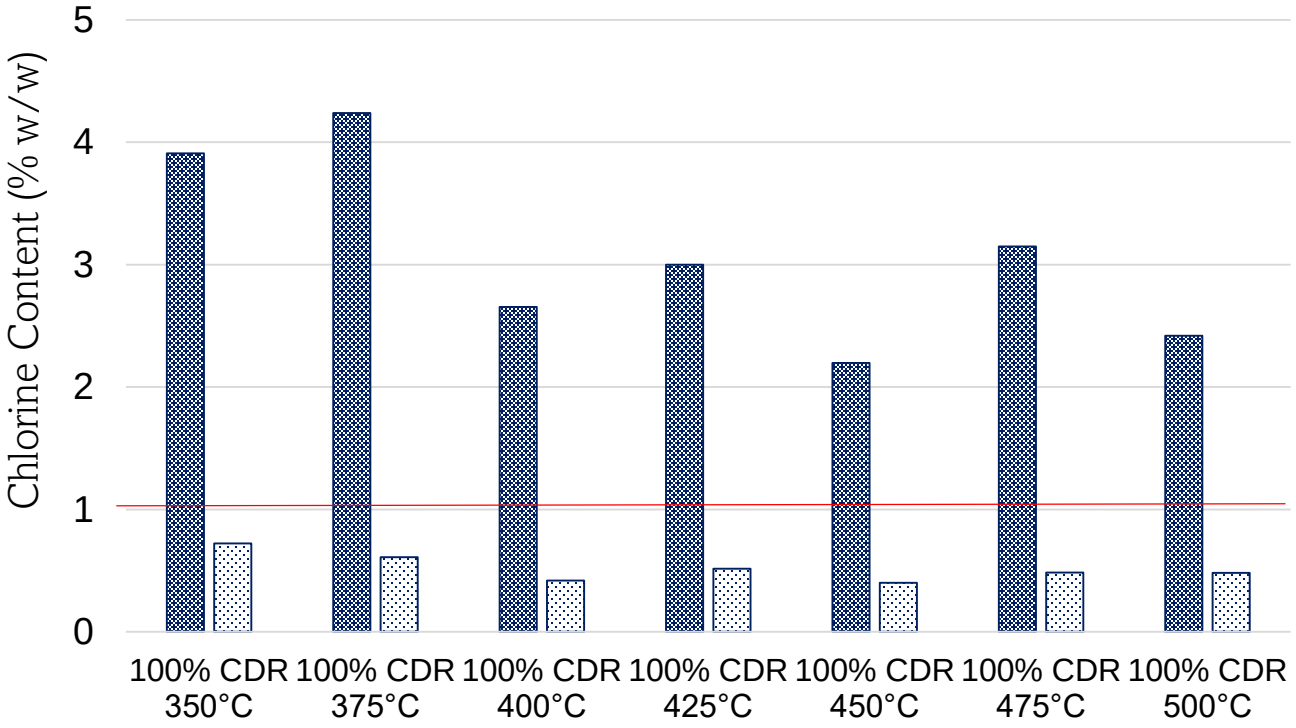
Apparent Density

0.091 g/dm^3

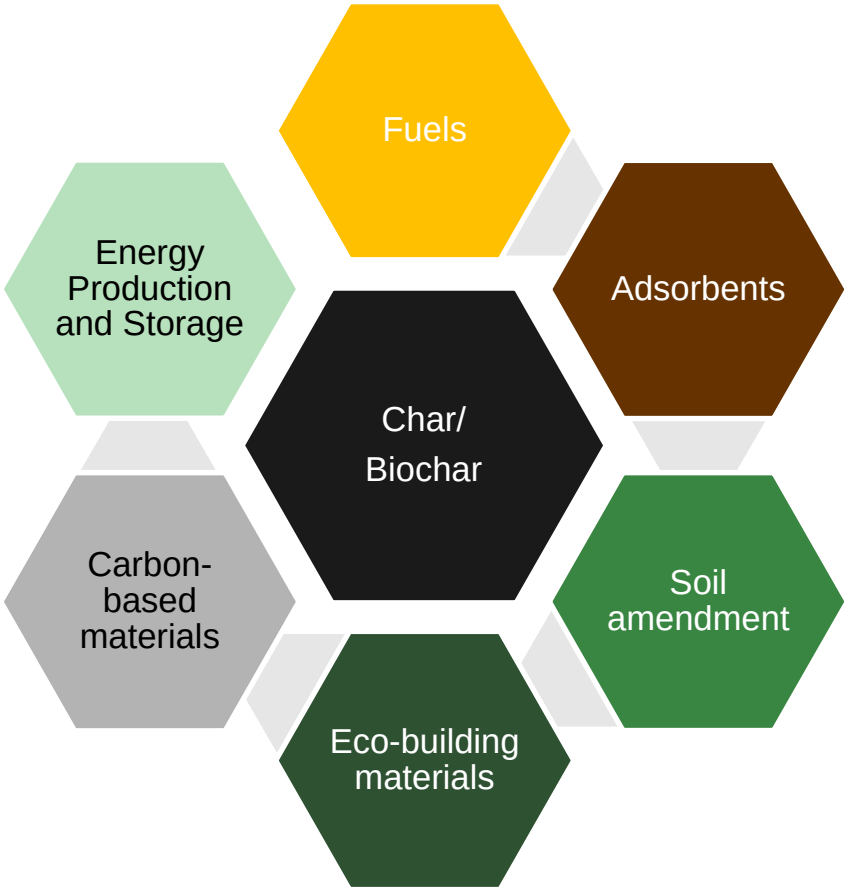
0.2 – 0.4 g/dm^3

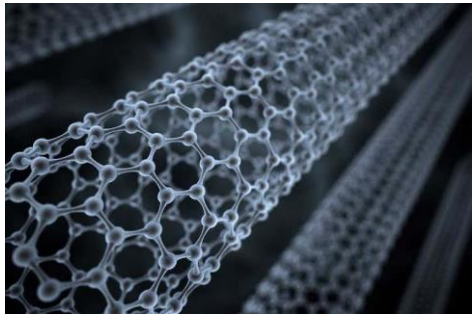
Polymeric Wastes

Steam treatment for chlorine removal from RDF char



Carbonization-based biorefineries



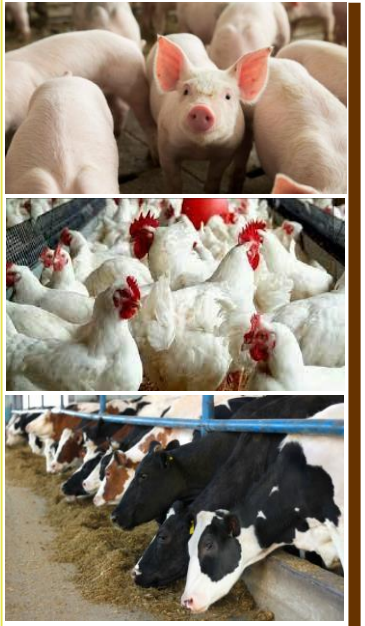


Organic Wastes

Challenges:

- Avoid waste decomposition and contamination
- Efficient separation between proteins, lipids and carbohydrates
- Valorization of effluents

Animal production effluents



Biomass Ash Treatment

Animal Production Effluent

Pre-treated effluent pH= 12

Atmospheric Carbonation

Ash + Coagulated organics

Soil Amendment

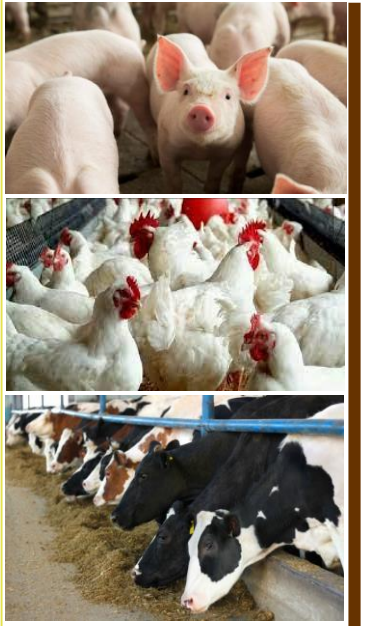
Neutralized Effluent pH= 7

Microalgae

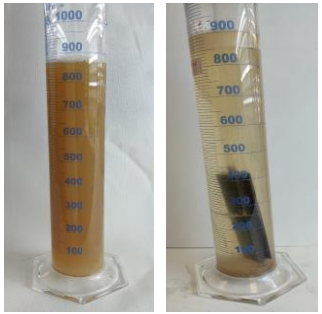
CO_2, digestate

Anaerobic Digestion

Pig farming effluents



Operation	COD (mg O_2/L)	Removal efficiency (%)
-	37000	-
Pre-treatment with fly ash	4810	87
Atmospheric carbonation	1731	8.3



C. vulgaris
18.1 mg/L.dia

T. obliquus
30.5 mg/L.dia

Fish wastes

Alkaline/Acid Treatment

Lipid Fraction

- Triglycerides
- Phospholipids

Mineral Fraction

- Chitin → Chitosan
- Acid Solution

Protein solution pH= 12

Atmospheric Carbonation

Nutrient solution pH= 7

- Microalgae
- Anaerobic Digestion

Recovered Protein

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Thank you for your attention

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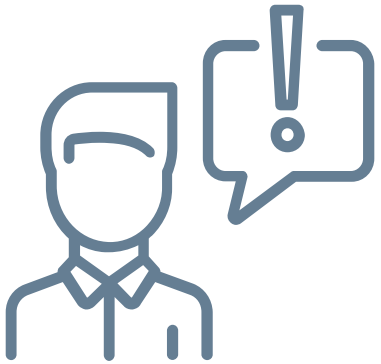

Questions or comments?

NOVA SCHOOL OF SCIENCE & TECHNOLOGY

MEtRICs
Mechanical Engineering and Resource Sustainability Center

VALORIZA
Centro de Investigação para a Valorização de Recursos Endógenos