

# Bioeconomy and its trade-offs towards meeting the SDGs and the Paris Agreement

INSA Toulouse November 19, 2019

## Welcome

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Lorie Hamelin, Ph.D  
Senior Researcher, PI and laureate of  
the Make Our Planet Great Again call



@hamelinlab



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Toulouse Biotechnology Institute  
Bio & Chemical Engineering

Financial support from:

Metaprogramme GloFoods of



[www.toulouse-biotechnology-institute.fr](http://www.toulouse-biotechnology-institute.fr)

- **Welcome and context for this event**
- **Audience: students, I want to hear your voice!**
- **Dialogue: don't be shy & make my convenor job easier**
- **Programme**
- **Recording – All slides and videos will be uploaded on the event website**
- **Wifi: Behind your badge**



# Programme (1/2)

- 9.00 – 9.30 Welcome word & The Cambioscop project – Carbon Management and bioresources strategies for scoping the transition towards low fossil carbon, [Lorie Hamelin](#), INSA-Toulouse
- 9.30 - 10.30 Sustainably feeding 10B people in a warming World, [Paul West](#), University of Minnesota
- **10.30 – 11.00 Coffee break in the Amphitheater**
- 11.00 – 12.00 Bioeconomy: insights from GBEP, IEA Bioenergy and how the Sustainable Development Goals can guide the development of bioeconomy, [Uwe Fritsche](#), IINAS
- 12.00 – 12.30 The 4 per mille initiative – status of the study, [Eric Ceschia](#), CESBIO
- 12.30 – 13.00 Inter-linkages between the Bioeconomy concept and the SDGs: Insights from the European Union and French cases, [Tevecia Ronzon](#), JRC
- **13.00 – 14.00 Lunch at library hall**

# Programme (2/2)

- 14.00 – 15.00 Bioeconomy and the role of hydrogen, [Brian Vad Mathiesen](#) (remote presentation), Aalborg University
- 15.00 – 16.00 Key messages and recommendations of the IPCC SRCCL report and of the French High Climate Council (HCC), [Jean-François Soussana](#), IPCC author, INRA vice-president and member of the French High Council for Climate (remote presentation)
- 16.00 – 16.30 The current bioeconomy status in France, [Yvon Le Hénaff](#), President, IAR, the French Bioeconomy Cluster
- **16.30 – 17.00 Coffee Break**
- 17.00 – 17.30 Bioeconomy is also about fertilizers, insights from new research, [Davide Tonini](#), JRC
- 17.30 – 18.00 Bio-based materials and their environmental trade-offs: summarizing 10 years of research, [Li Shen](#), Utrecht University
- 18.00 – 18.20 Green biorefinery as the tool for disruption of Northwestern European agriculture, [Uffe Jorgensen](#), Aarhus University
- 18.20 – 18.30 Take home messages, [Lorie Hamelin](#) and audience

# Cambioscop

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Toulouse, Nov.19<sup>th</sup>, 2019



Toulouse Biotechnology Institute  
Bio & Chemical Engineering



Université  
Fédérale  
Toulouse  
Midi-Pyrénées

# How it started?



Science Magazine. Dec 2017.



- 42 French laureates (18 + 14 + 12; 2 declined)
- France: Many spin-offs
- 13 German laureates

**Carbon management & Bioresources strategies for scoping the transition towards low fossil carbon**



2018 - 2023



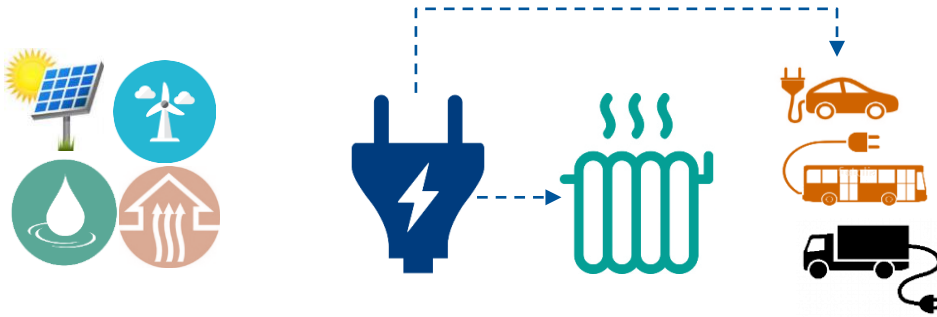
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Why ?

# Let's not get confuse in the terms

- Where can we get the C from?
- Decarbonization?: Carbon is not daemon and we need it
- Not about C, but about fossil C





# Postponing C-releases in the atmosphere

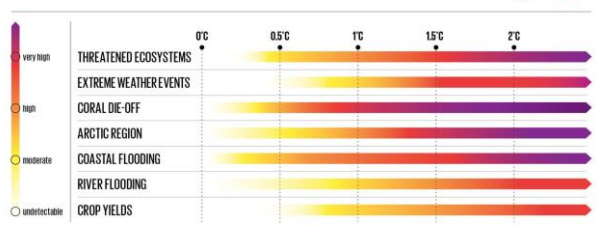
-Emergency to stabilize global mean annual surface temperature



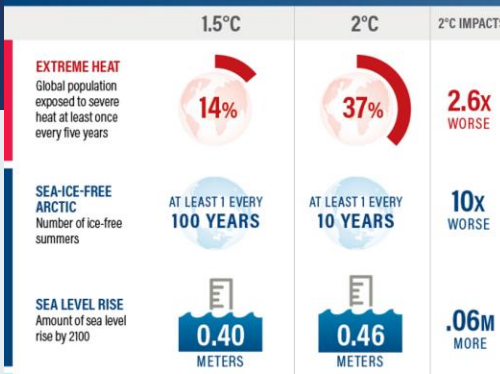
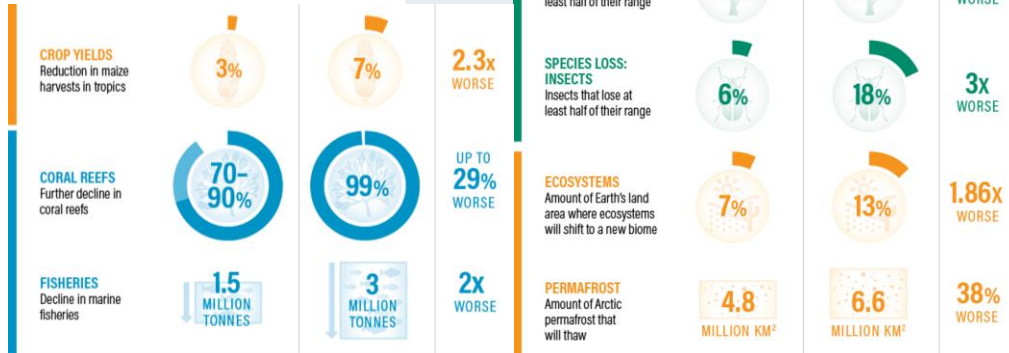
## HALF A DEGREE OF WARMING MAKES A BIG DIFFERENCE: EXPLAINING IPCC'S 1.5°C SPECIAL REPORT

- Limiting warming to 1.5°C requires:
  - Reducing GHGs by 45% (40-60%) by ~2030 (vs 2010 levels) ... and to ZERO by ~2050 (2045-2055)
  
- Limiting warming to below 2°C requires:
  - Reducing GHGs 20% (10-30%) by ~2030 (vs. 2010 level) ... and to ZERO by ~2075 (2065-2080)

### RIISING TEMPERATURES, RISING RISKS



Source: IPCC Special Report on Global Warming of 1.5°C



2

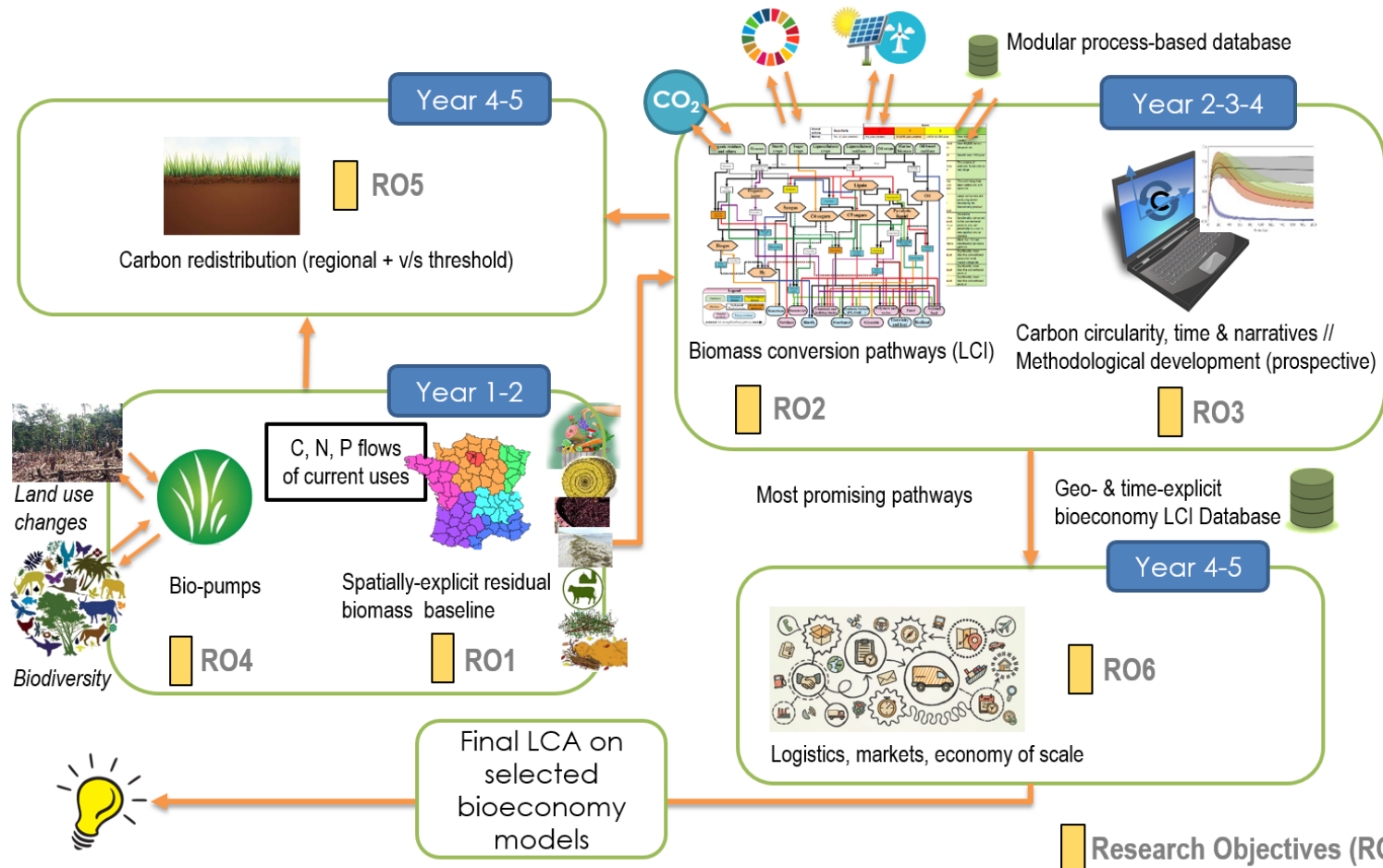
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# Cambioscop in a nutshell

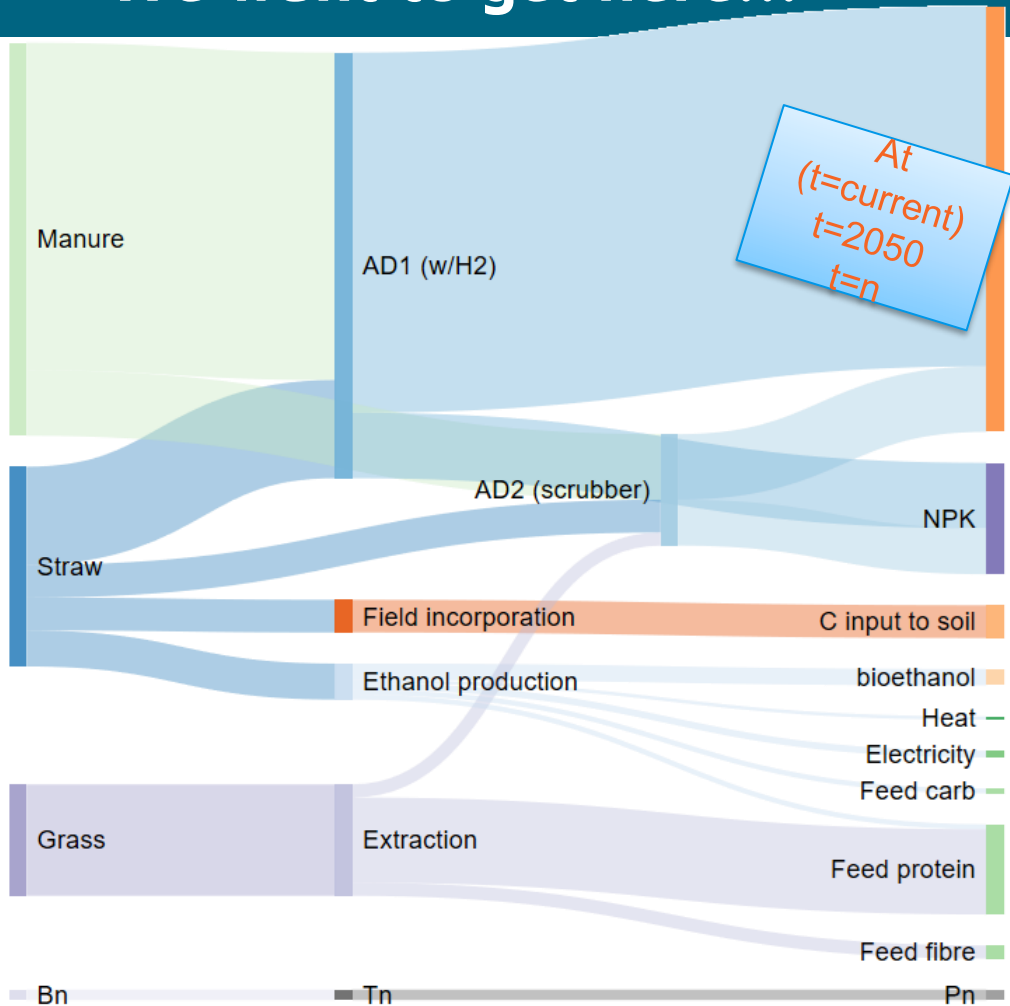


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# Six Research objectives

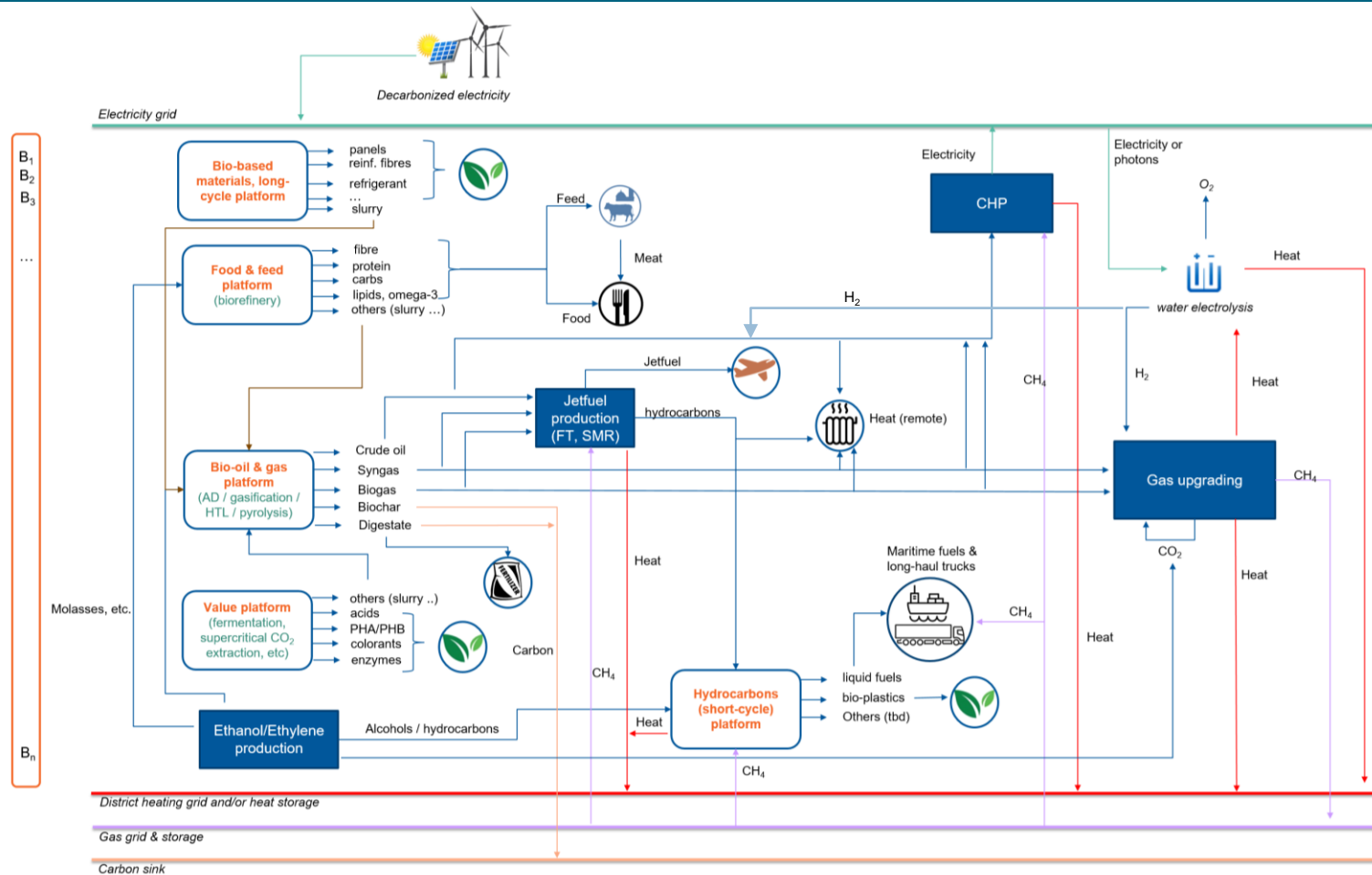


# We want to get here...



Note: (1) fluxes (f values) presented herein are fictive; (2) Avoided products not represented for simplicity

# Without considering biomass in isolation



Of course, not only about C (nor CO<sub>2</sub>)

# RO1 – Spatial inventory & baseline LCA



**Shivesh Karan,**  
Postdoc



Manure



Straw & crop  
residues



Garden & park  
waste



household



Unused  
meadows



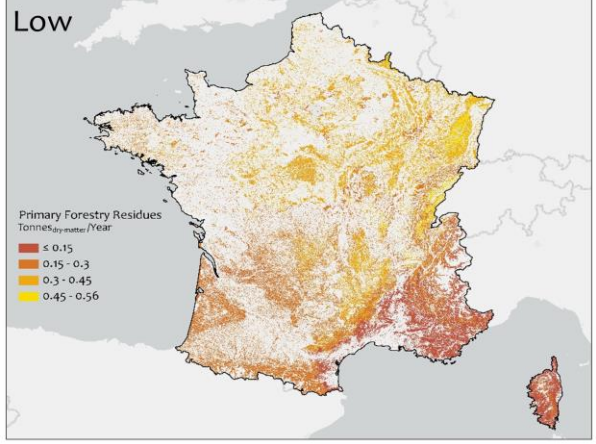
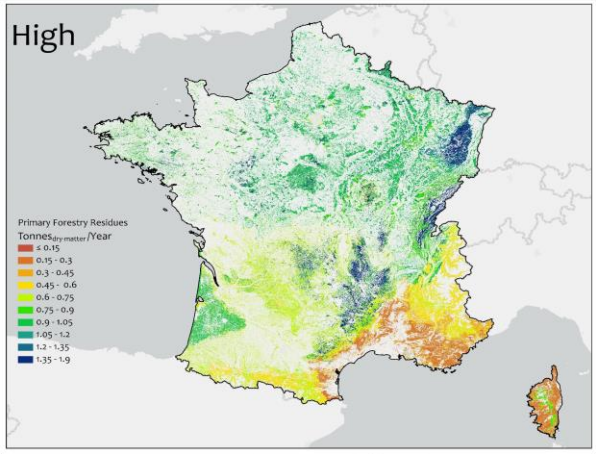
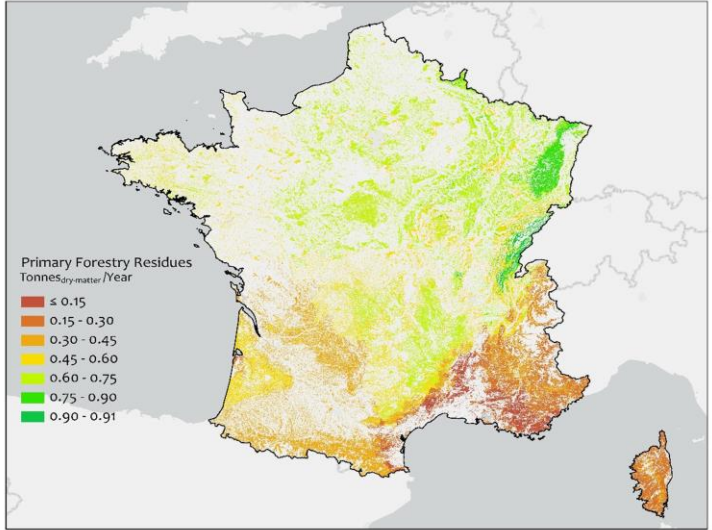
Industrial  
(selected  
streams)



Sewage sludge



Logging residues

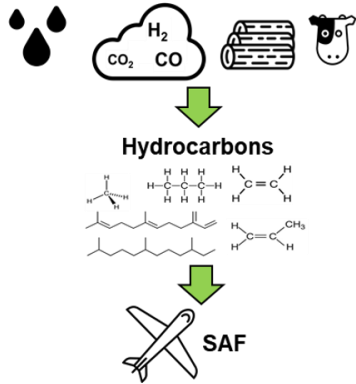


# RO2/bio - oil & gas module



**Pimchanok Su-Ungkavatin,**  
PhD Student

C, H, O, N, P material compositions



## STAGE 1

- Review the renewable aviation fuels (RAF) production conversion technologies
- Screening the involving technologies with the input/output products also the co-products generation

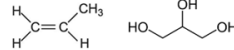
**PAPER 1**

## STAGE 2

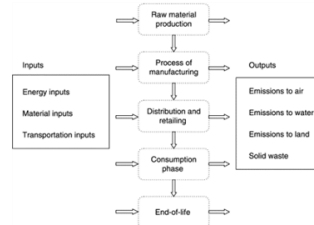
- Building the life cycle inventory (LCI) of RAF technologies and upscaling (if needed)
- Establishing the input-output algorithms for selected technologies based on the input feedstock

**PAPER 2**

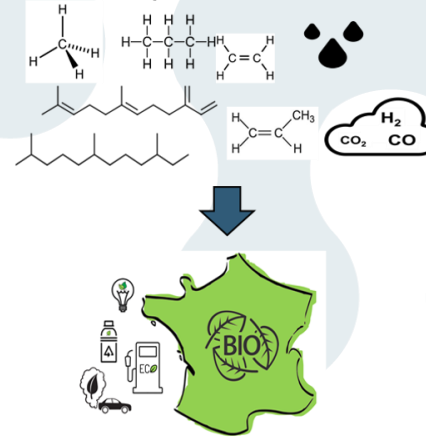
**C and H compounds**  
(Hydrocarbons)  
Bio-based aviation fuels



**Life cycle inventory analysis**



**Co-products**



## STAGE 3

- The optimal use of co-products generated in the first stage (strategic LCAs for RAF) (**PAPER 3**)
- Studying the other uses of bio-crude oil and bio-based gas (**PAPER 4**)

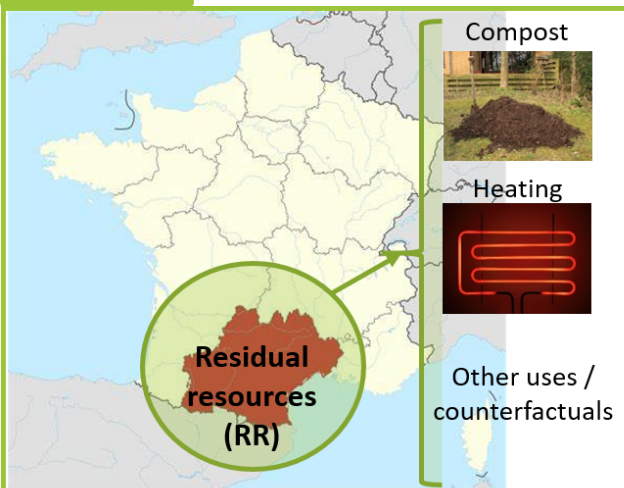


# RO2 / Bio - oil & gas module



Concetta  
Lodato

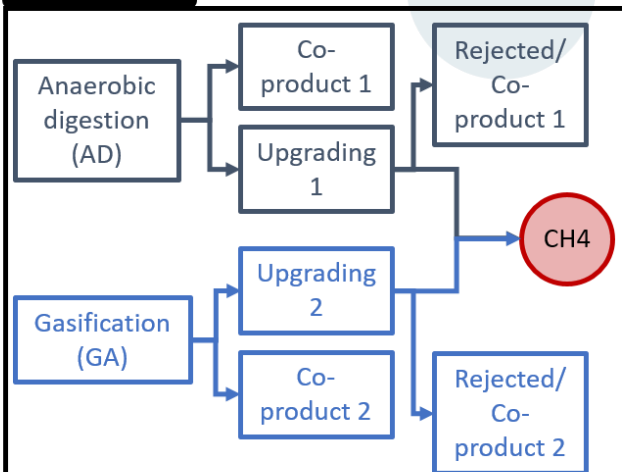
## STAGE 1



Identification of:

- **Residual resources (RR) available** in Occitanie region based on technical reports
- **Current uses** of RR
- Effects of diverting the RR from their current use/function to bio-based gas production (**counterfactual**)

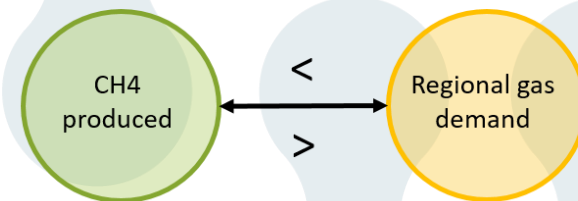
## STAGE 2



Analysis of the bio-based gas production (focus on CH<sub>4</sub>):

- **Technology pathway** (anaerobic digestion, AD, and/or gasification, GA)
- **Technology upgrading** for CH<sub>4</sub> maximization
- **Management of co-products and rejected**

## STAGE 3

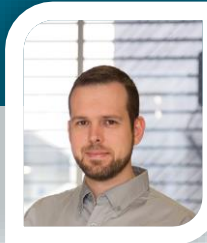


Determination of the **two hypotheses based on the regional gas demand** (current and future):

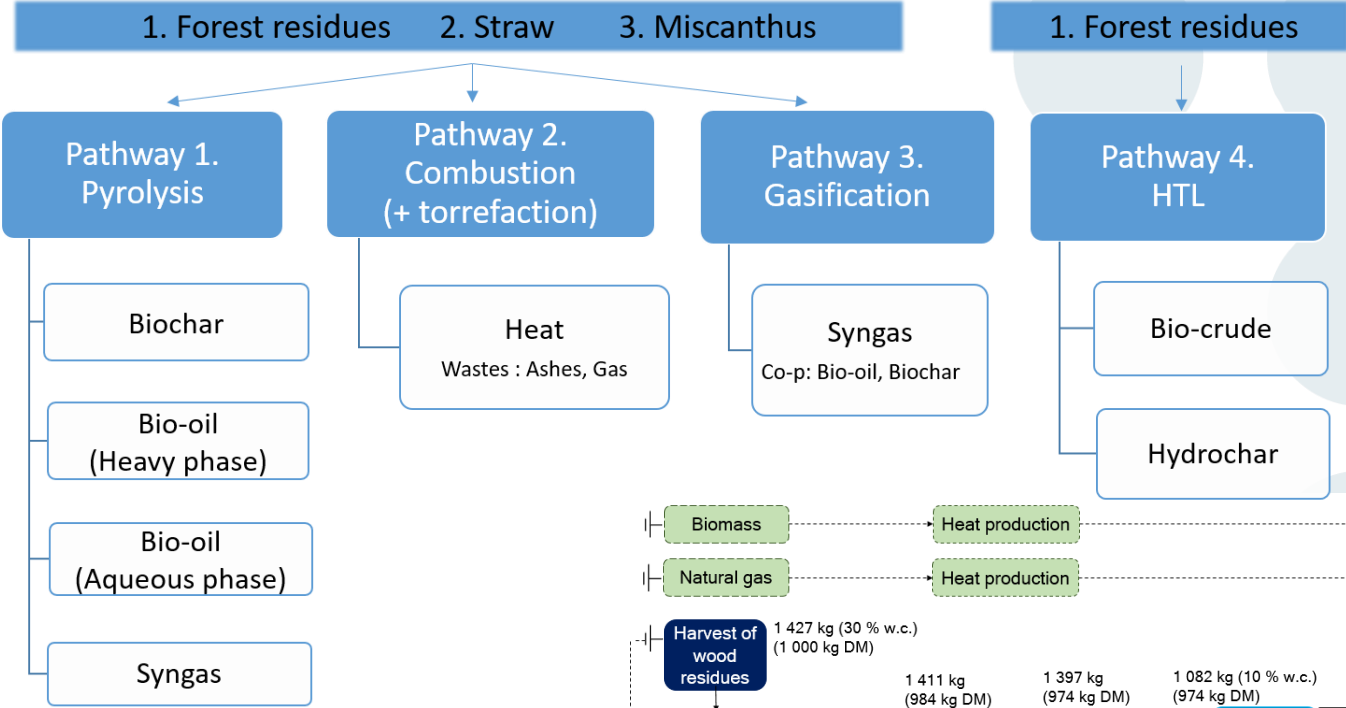
- The supply of bio-based gas > regional gas demand
- The supply of bio-based gas < regional gas demand



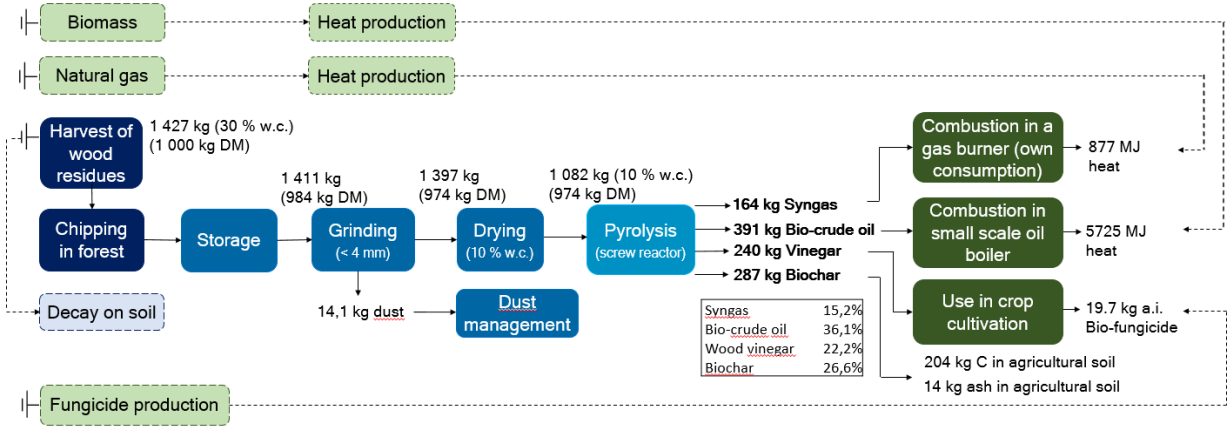
# RO2 / Bio- oil & gas module



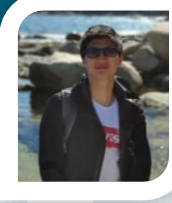
**Patrick Brassard,**  
Postdoc



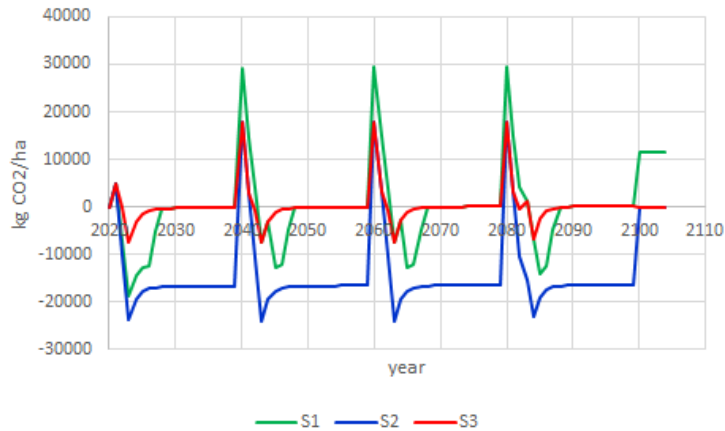
**Consequential LCA platform for thermochemical conversion**



# RO4 - Biopumps



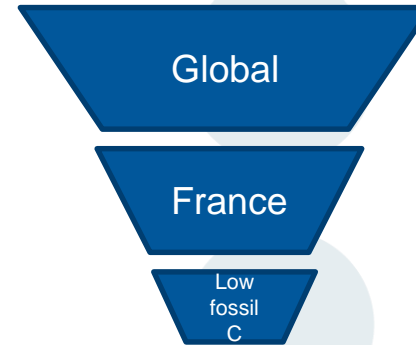
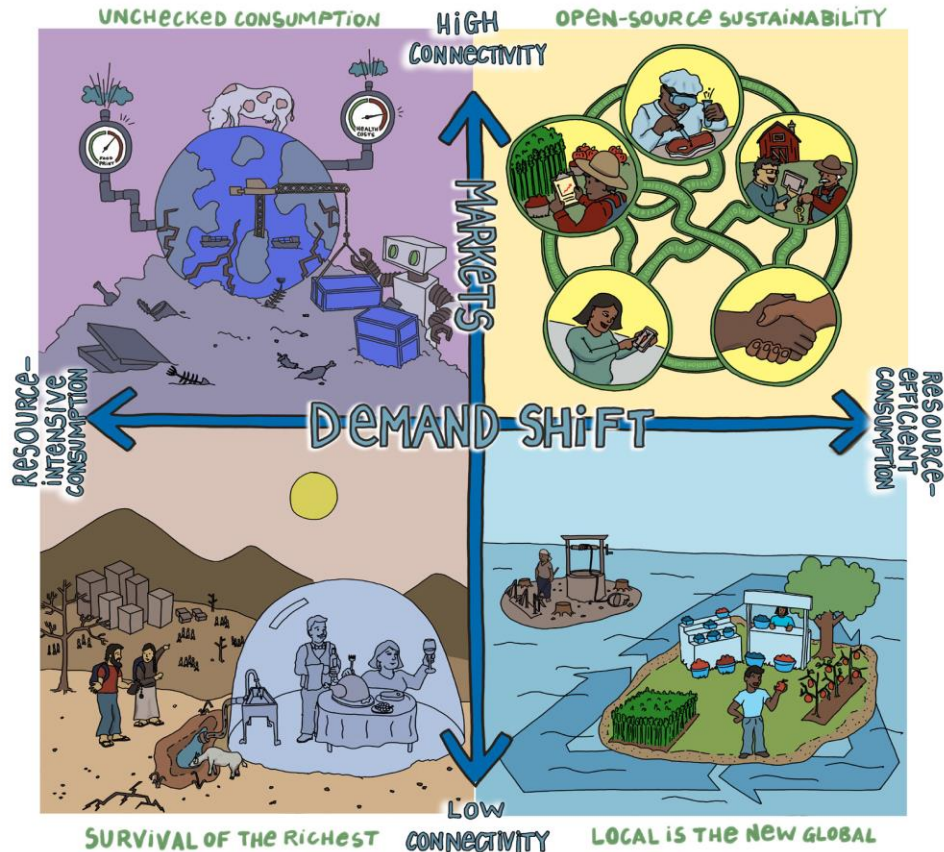
Zhou Shen



# RO3 – Prospective assessments



Seung-Hye Lee



Source: World Economic Forum, 2017

# Thanks for your attention



<https://cambioscop.cnrs.fr/>



Lorie Hamelin,  
PI



Shivesh Karan,  
Postdoc



Seung-Hye Lee,  
PhD Student



PhD Student



Pimchanok Su-  
Ungkavartin,  
PhD Student



Patrick Brassard,  
Postdoc, FRQNT  
fellow



Zhou Shen,  
PhD student

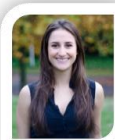
PhD students associated  
to Cambioscop



Concetta  
Lodato, DTU



Dominika  
Teigiserova, AU



Alejandra Gomez  
Campos, INP



Ligia Barna,  
Professor



Aras Ahmadi,  
Associate  
Professor

Interface system assessment  
/ Process engineering



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