

Biofuels for the transportation sector in Europe:
analysis of the potential
development of advanced biofuels through a modeling
approach

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Agenda

- 1. Introduction : Energy demand of the transportation sector and European targets for 2030
- 2. Methodology : a general modeling framework combining biomass supply, oil refining and biofuel production to reach the liquid fuel demand
- 3. Empirical results : spatial distribution of the biofuel supply in the European Union, interaction with the biomass supply and the crude oil supply
- 4. Conclusion

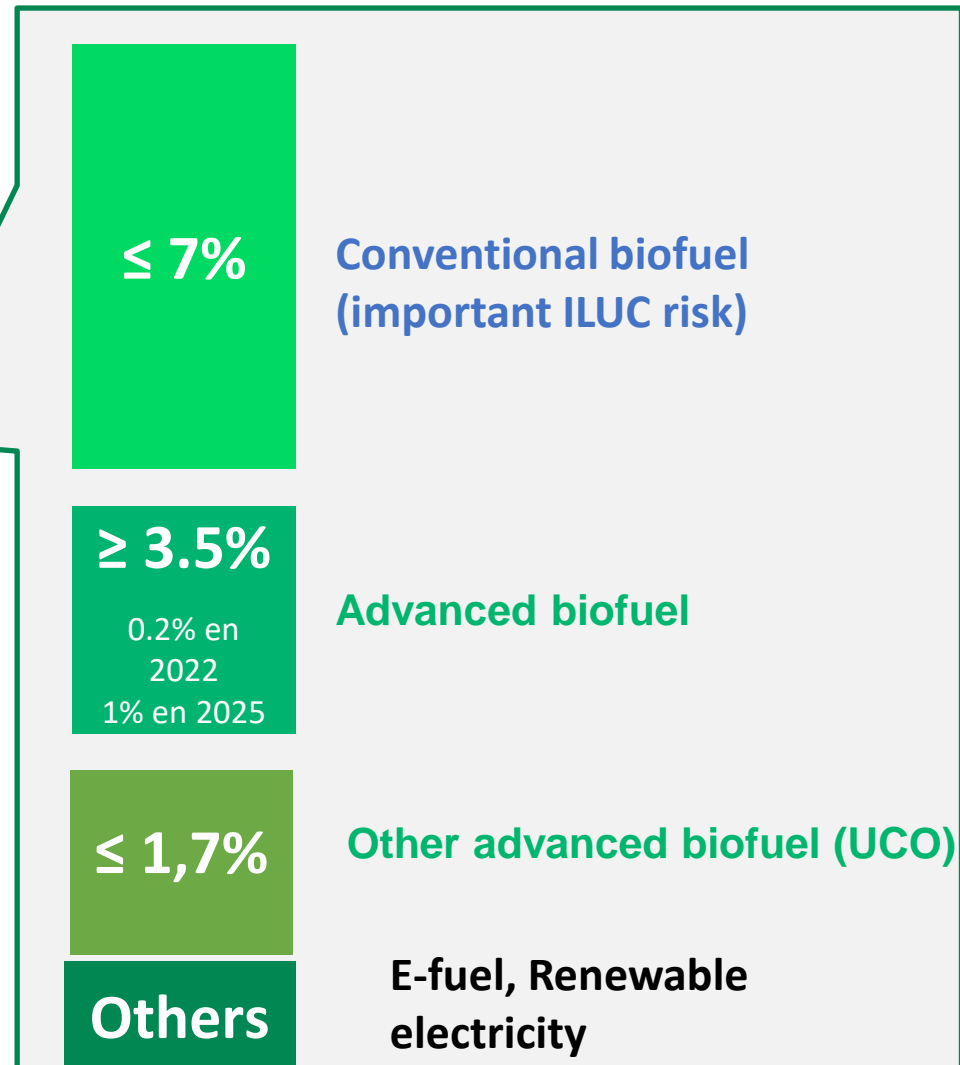
Renewable Energy targets in the European Union for 2030

- The Member States give an objective for the energy suppliers to increase the uses of renewable energy
- Target for 2030 :

14 %

of Renewable Energy in the
Transportation Sector

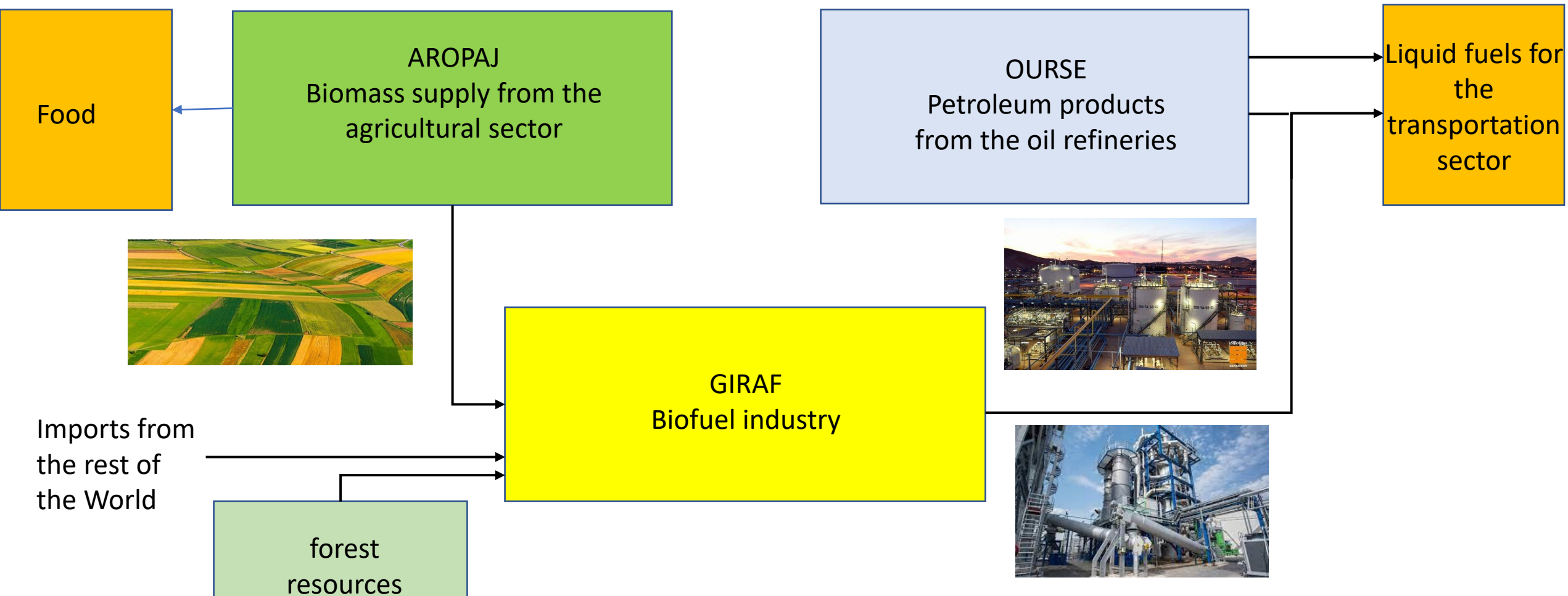
This target should be recasted in 2023



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Modeling framework based on large scale optimization models taking into account the spatial location of the production units and of the demand



Models

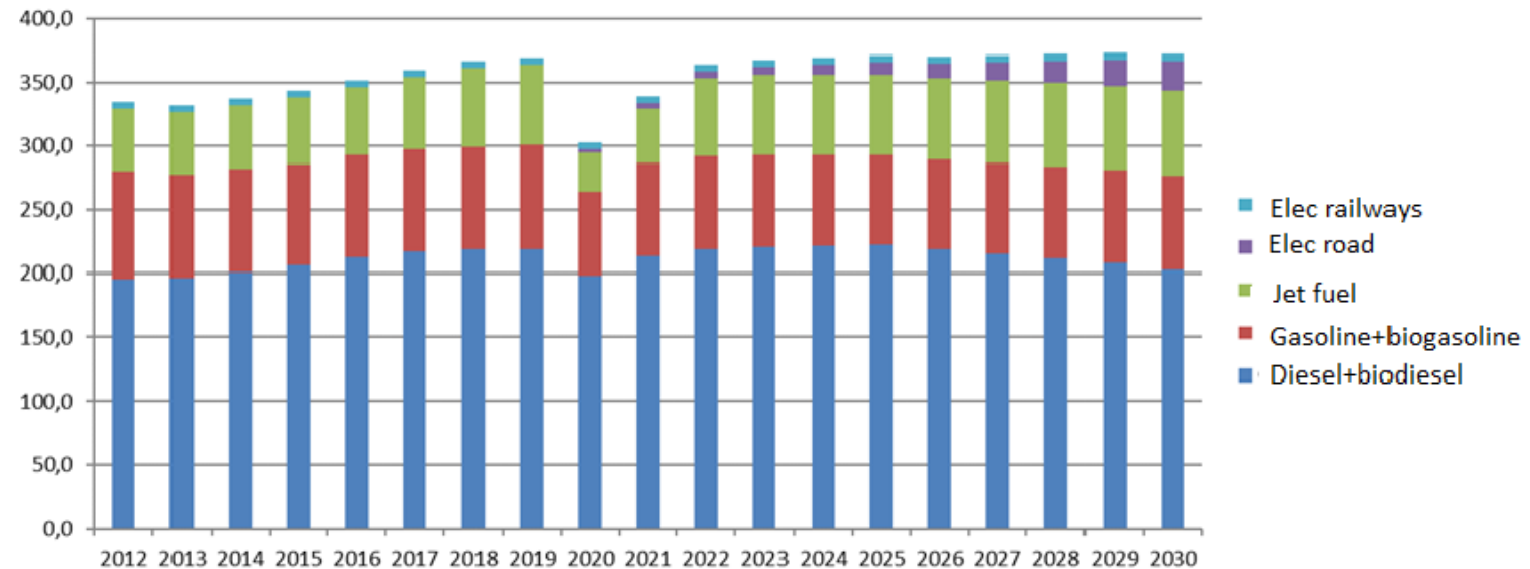
- Aropaj : The EU Agri-Biomass supply Side model representing 1980 typical farms spazialized in Europe (Optimization problem, 400 000 equations, 64 million variables)
- Ourse : Oil refining and liquid fuel deliveries (blending petroleum products and biofuels) in Europe , representing 81 refineries (Optimization problem, 20 000 equations 100 000 variables)
- Giraf : The European biofuel supply in Europe, Spatializing of the plants and determination of the transportation costs of raw materials and biofuel deliveries, representing 600 existing units (Optimization problem, 154 000 equations, 2 000 000 variables)

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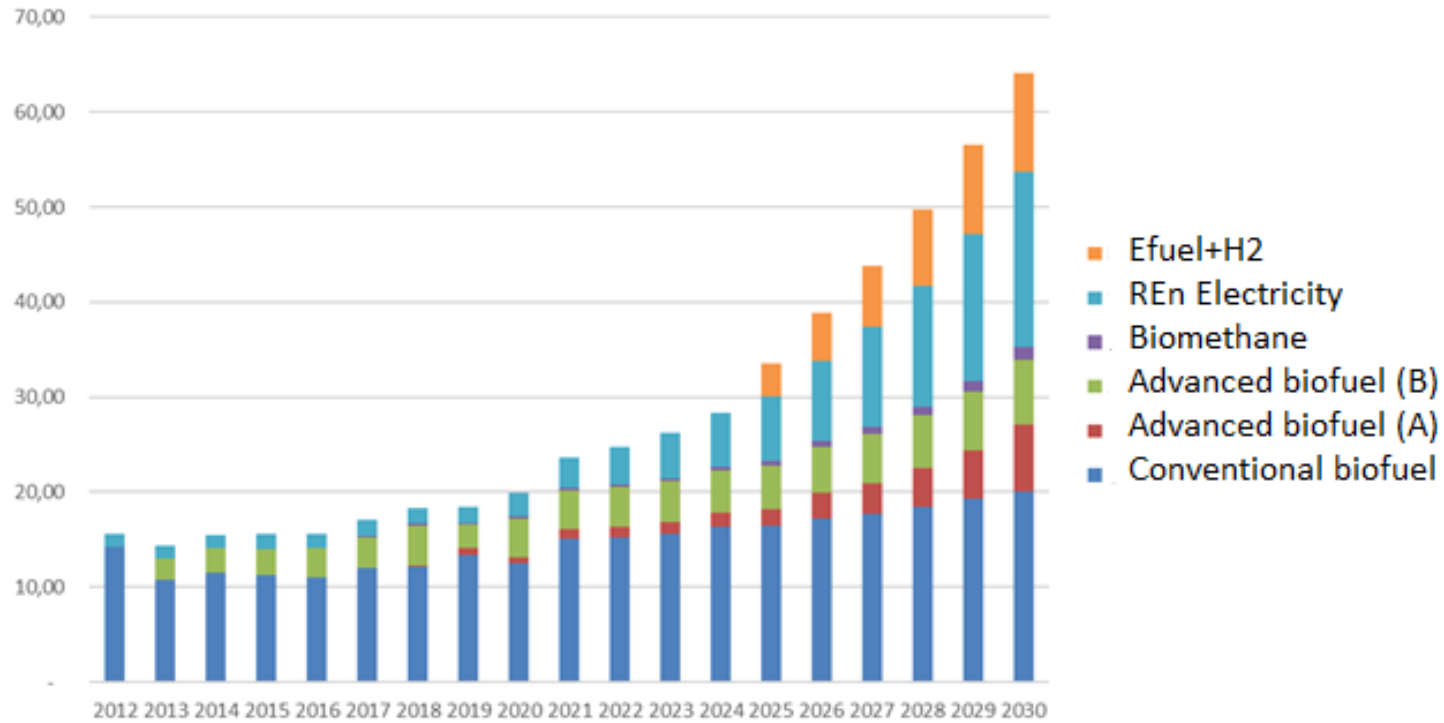
Demand scenario for the transportation sector 2030 in Europe

- Bottom-up approach taking into account the stock of vehicles per vintage and the level of activity (passengers*km, Mt*km)
- Development of Electric Vehicles following the recent trends



Unit: Million of Ton of Oil Equivalent, Mtoe

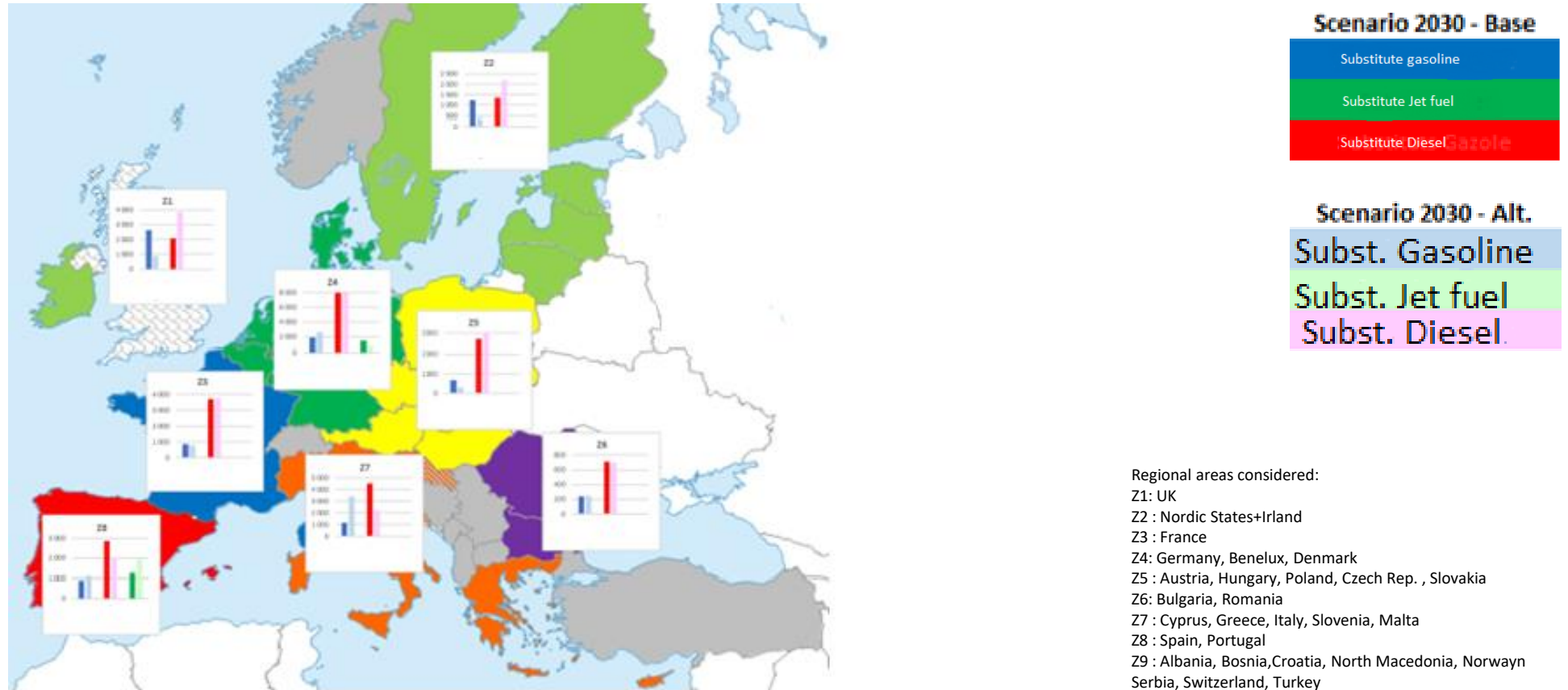
Simulation of the biofuel demand(2030)



Unit: Mtoe

Results of the simulation 2030 : biofuel blending in the liquid fuel demand

Two crude oil supply scenario are considered : Base case with Ural crude oil supply and Alternative case without Ural crude oil supply



Unit: kt

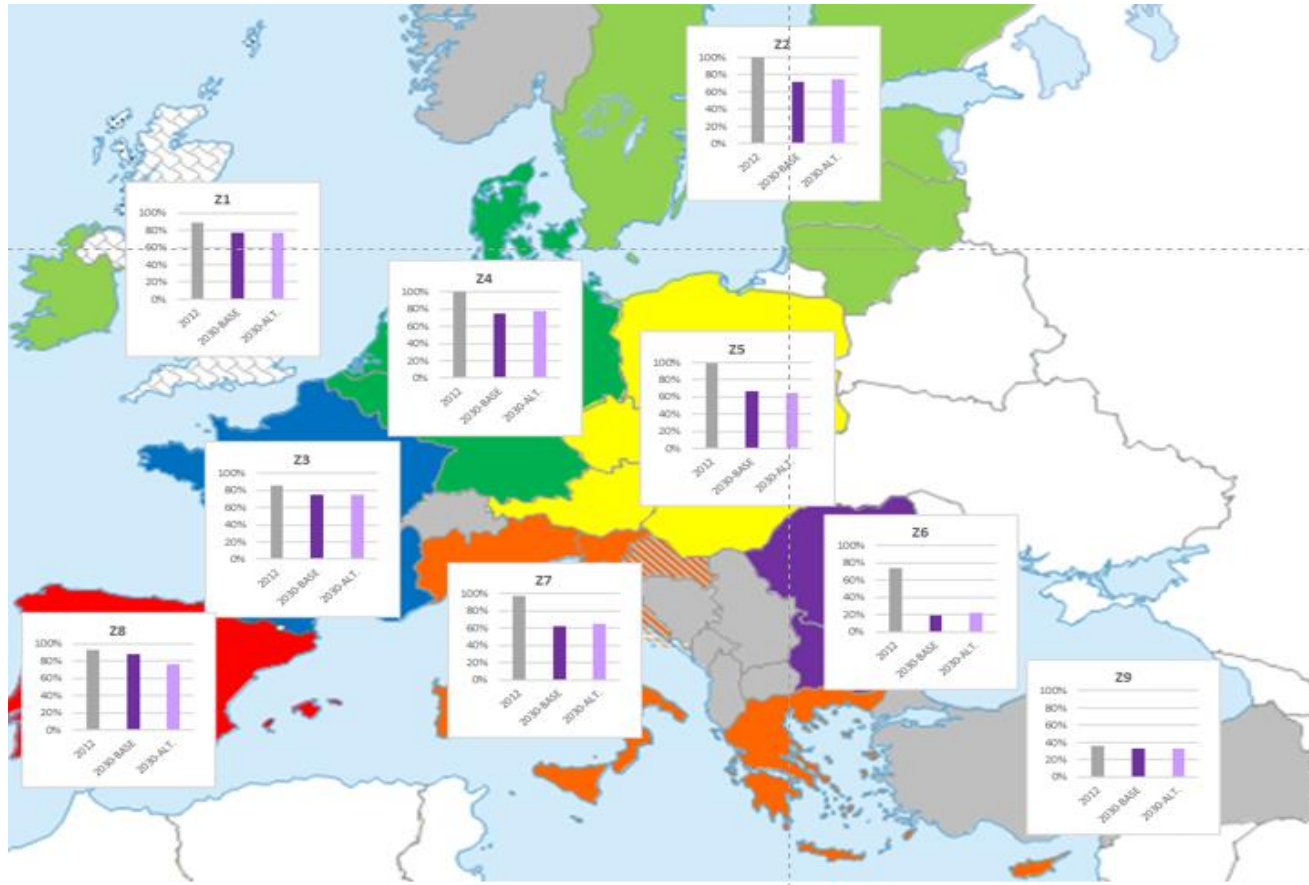
Results of the simulations : Biofuel supply for 2030

	Biofuel production in EU-27 blended in the EU-27 refineries	Biofuel Imports in EU-27	Total quantity of biofuel blended in the European refineries
Diesel Substitutes	22.15	3.62	25.77
Gasoline Substitutes	7.26	2.37	9.64
Jet fuel substitutes	1.03	1.68	2.72
Total	30,45	7.68	38.13

Conventional and advanced biofuels

	Conventional biofuels	Advanced biofuels	Other advanced biofuels	Total biofuels	Total demand	Blending rate (in mass term)
Gasoline Pool	4.66	4.75	0.22	9.6	71.16	13.5%
Diesel Pool	18.20	1.12	6.45	25.8	197.17	13.1%
Jet fuel Pool	0	2.25	0.47	2.7	64.42	4.2%
Total	22.86	8.1	7.1	38.1	333.34	11.4%
Blending rate (in mass term)	Max 6.86%	Min 2.44%	Max 2.15%			

Rate of use of the European Oil refineries



Regional areas considered:

Z1: UK

Z2 : Nordic States+Ireland

Z3 : France

Z4: Germany, Benelux, Denmark

Z5 : Austria, Hungary, Poland, Czech Rep. , Slovakia

Z6: Bulgaria, Romania

Z7 : Cyprus, Greece, Italy, Slovenia, Malta

Z8 : Spain, Portugal

Z9 : Albania, Bosnia, Croatia, North Macedonia, Norway

Serbia, Switzerland, Turkey

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Conclusion

- We have simulated the contribution of advanced biofuels for the transportation sector in Europe
- The RED II target can be reached with some raw material imports and changes in the crude oil supply will have some consequences on the production
- Decrease of agricultural crops and increase of lignocellulosic crops
- The advanced generation of biofuel is needed to reach the RED II target
- Main producers : France, Germany
- However, we could have a strong competition for the uses of the resources (cereal, biomass and lands) and imports of raw material remain necessary