



# **Prospects on R&I potential for advanced biofuels and bioenergy based on DG RTD study "Research and Innovation perspective of the mid- and long-term Potential for Advanced Biofuels in Europe."**

**Thomas SCHLEKER, PhD**  
Renewable Energy Sources  
DG Research & Innovation  
EUROPEAN COMMISSION

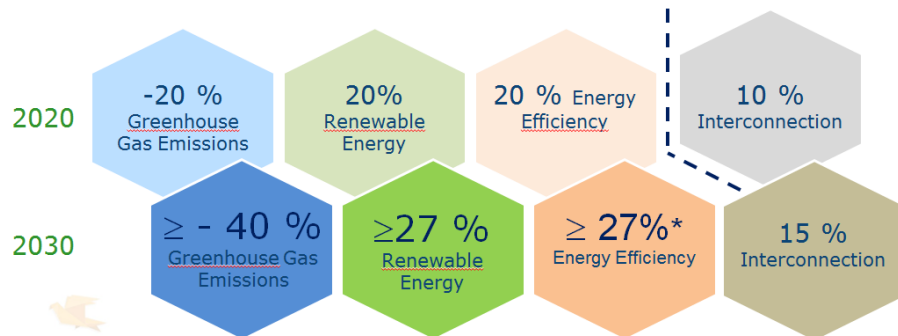
# Policy Framework



## "Clean Energy for all Europeans"

- Putting energy efficiency first
- Demonstrating global leadership in renewables
- Delivering a fair deal for consumers

Agreed headline targets



\* To be reviewed by 2020, having in mind an EU level of 30%

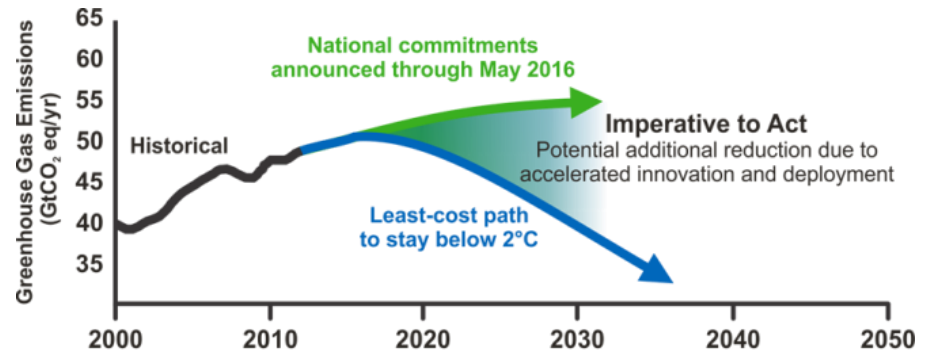
New governance system + indicators

NOT LEGALLY BINDING

## Paris Agreement

Holding the increase in the global average temperature to **well below 2°C** above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels

Accelerating, encouraging and enabling **innovation** is crucial...



Adapted from UNFCCC, Synthesis report of INDCs, May 2016

## Other EU policy priorities

- Digital Single Market
- Jobs, Growth and Investments
- EU as a strong global actor
- ...



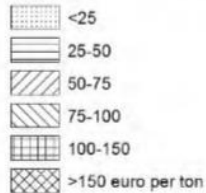
European  
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### Supply from Agriculture

#### final\_feedstocks\_costs

##### straw



##### base\_pot

##### straw\_pot1\_yr12

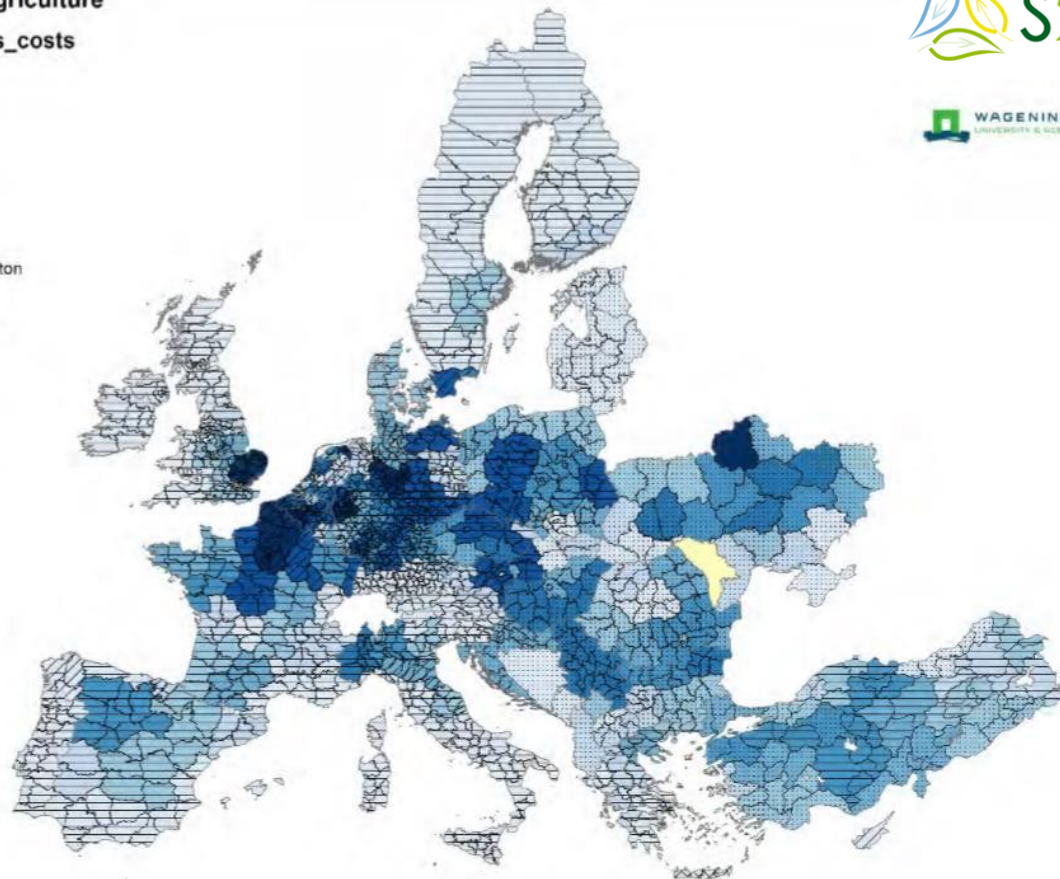
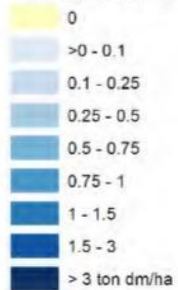


Figure 12 Cost and supply levels- for straw & stubbles

Drees et al. (2017):  
[http://www.s2biom.eu/images/Publications/D1.8\\_S2Biom\\_Atlas\\_of\\_regional\\_cost\\_supply\\_biomass\\_potential\\_Final.pdf](http://www.s2biom.eu/images/Publications/D1.8_S2Biom_Atlas_of_regional_cost_supply_biomass_potential_Final.pdf)

NOT LEGALLY BINDING  
Research and  
Innovation



S2Biom has received funding from the European Union's 7<sup>th</sup> Framework Programme for research, technological development and demonstration under grant agreement No FP7-608622

# MANDATE ON THE PROVISION OF DATA AND ANALYSIS ON BIOMASS SUPPLY AND DEMAND BY THE JRC ON A LONG-TERM BASIS

JRC is requested by Commission services to periodically provide data, processed information, models and analysis on EU and global biomass supply and demand and its sustainability

More information:

- <https://biobs.jrc.ec.europa.eu/analysis/jrc-biomass-mandate>

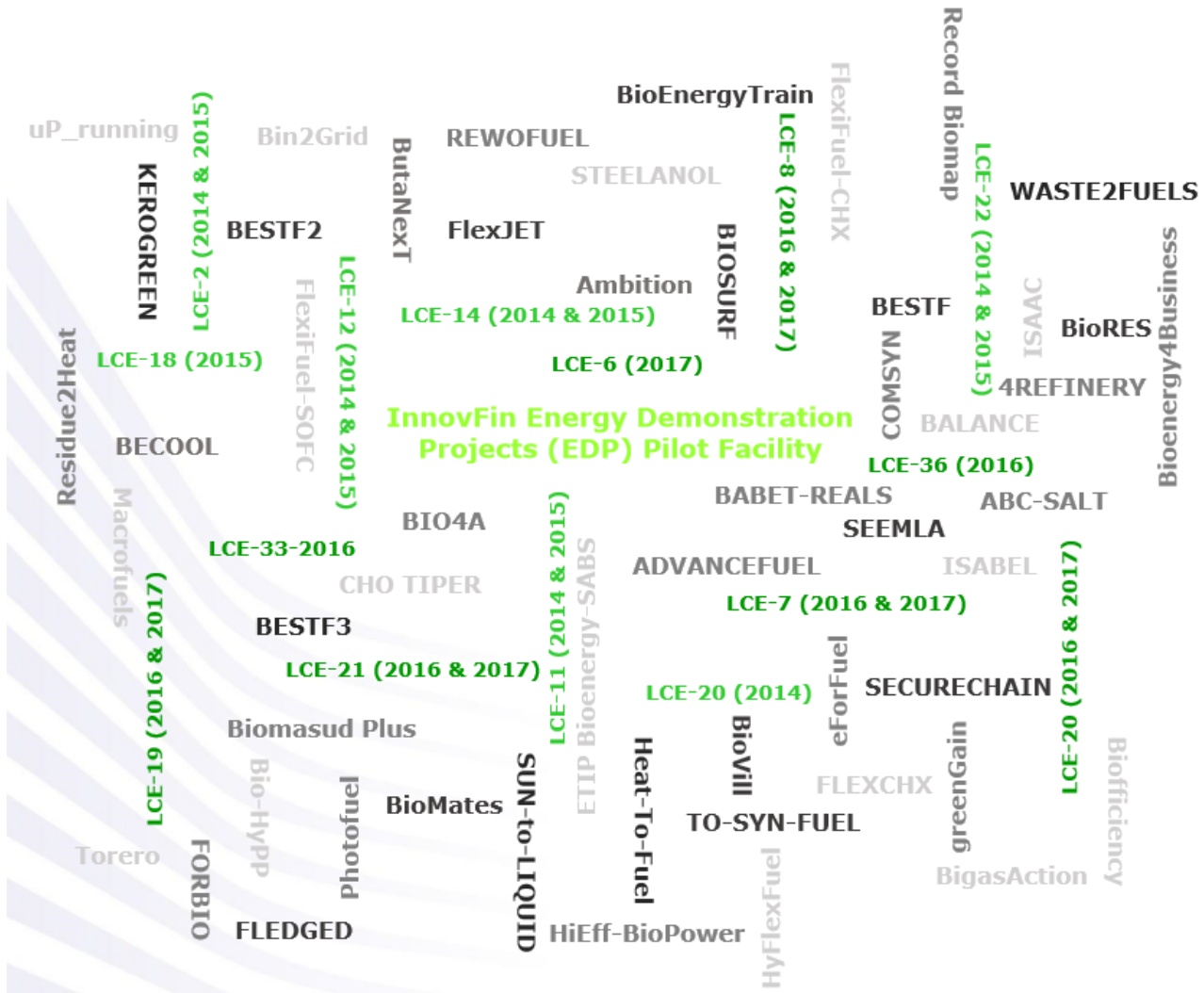
# Advanced Biofuels/Renewable Fuels Bioenergy – Strategy in Horizon 2020

*Overall strategy is to target and support the following sector challenges:*

- Technology and cost competitiveness
  - Technology improvement, resource efficiency and diversification
- Feedstock availability
  - Feedstock diversification, energy intermediates
- Commercialization
  - Focus on particular transport sectorial needs
  - Aligned market up-take measures



European Commission



# Advanced Biofuels

What is the mid- and long-term outlook from a research and innovation perspective?



## Research and Innovation perspective of the mid - and long-term Potential for Advanced Biofuels in Europe

Authors: Paul Baker, Olivier Chartier, Robert Haffner, Laura Heidecke, Karel van Hussen, Lars Meindert, Barbara Pia Oberč, Karolina Ryszka (Ecorys), Pantelis Capros, Alessia De Vita, Kostas Fragkiadakis, Panagiotis Fragkos, Leonidas Paroussos, Apostolis Petropoulos, Georgios Zazias, (E3MLab), Ingo Ball, Ilze Dzene, Rainer Janssen, Johannes Michel, Dominik Rutz, (WIP Renewable Energies), Marcus Lindner, Alexander Moiseyev, Hans Verkerk (EFI), Peter Witzke (Eurocare), Magda Walker (IUNG)



November 2017

**Task 1: Assesses the potential for R&I to enable secure, low-cost, and low ILUC biomass feedstock for energy for the 2030 and 2050 time horizons**

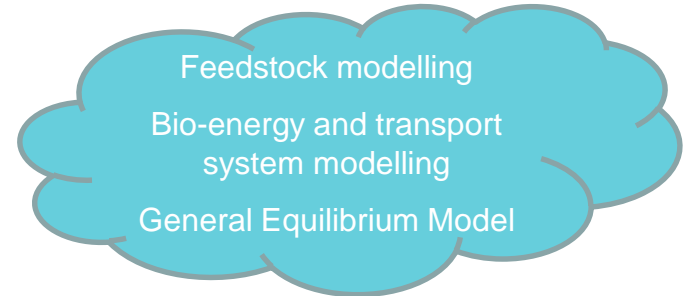
**Task 2: Assesses the potential contribution of advanced biofuels to achieving the EU's ambitious climate change objectives**










**Task 3: Compares advanced biofuels with alternative fuel options for the road, maritime, and aviation transport sectors**



**Approach:**

- 1) Extensive qualitative research on R&I potential and competitiveness
- 2) Quantitative modelling with three scenarios



Scenario	Biomass feedstock	Conversion technologies	Demand for biofuels
<b>BASE scenario</b>	Option A0 – Baseline case 	Option B0 – Low learning rates for conversion technologies at low TRL 	Option C0 – Baseline: Low demand for biofuels 
<b>MEDIUM scenario</b>	Option A2 – High R&I case 	Option B1 – High learning learnings for all technologies 	Options C1 – Moderate biofuels demand 
<b>HIGH scenario</b>	Option A2 – High R&I case 	Option B1 – High learning learnings for all technologies 	Option C2 – High biofuels demand 

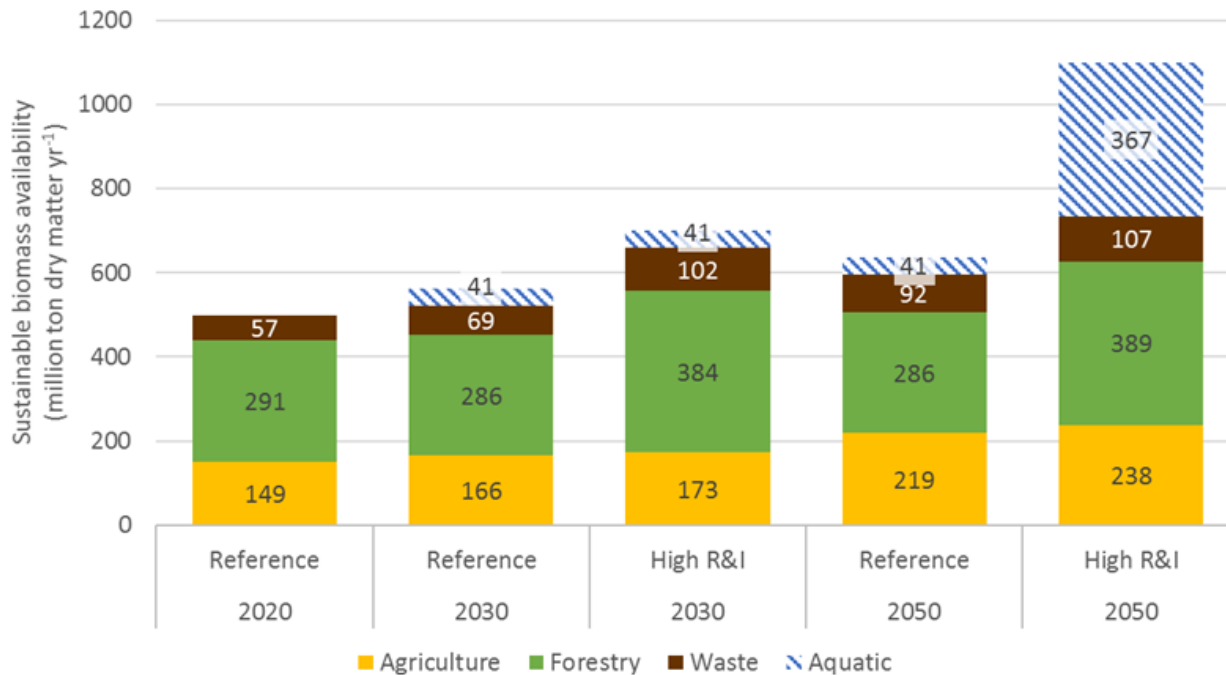
# Task 1:

# R&I Potential for Biomass Feedstock



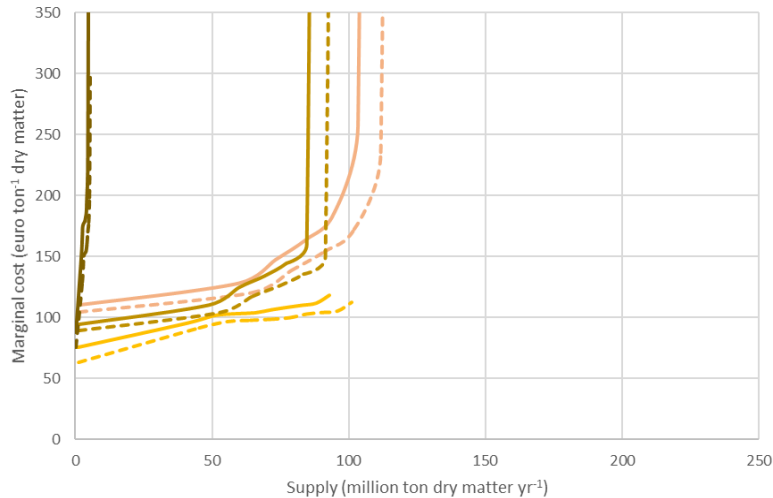
**R&I measures can significantly increase the availability of biomass by 2050 – by up to 120% as compared to the reference scenario in 2020**

Maximum estimated potential availability of biomass for energy use in the EU

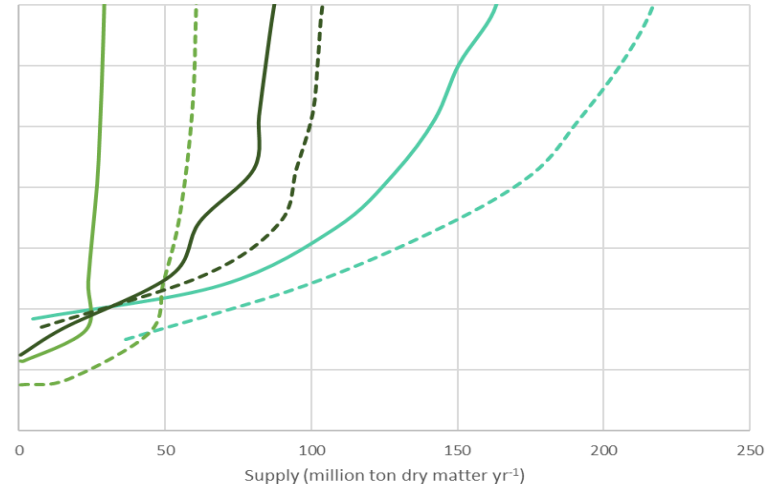


# R&I measures are estimated to lead to more biomass being available from agricultural and forestry sectors at lower costs

Biomass cost-supply curves in the Reference and the Combined R&I scenarios in 2050 – for agriculture (left) and forestry (right)



- Reference - Straw
- Reference - Herbaceous energy crops
- Reference - Woody energy crops
- Reference - Prunings
- - - Combined R&I - Straw
- - - Combined R&I - Herbaceous energy crops
- - - Combined R&I - Woody energy crops
- - - Combined R&I - Prunings



- Reference - Stemwood
- Reference - Forest Residues
- Reference - Wood Residues
- - - Combined R&I - Stemwood
- - - Combined R&I - Forest Residues
- - - Combined R&I - Wood Residues

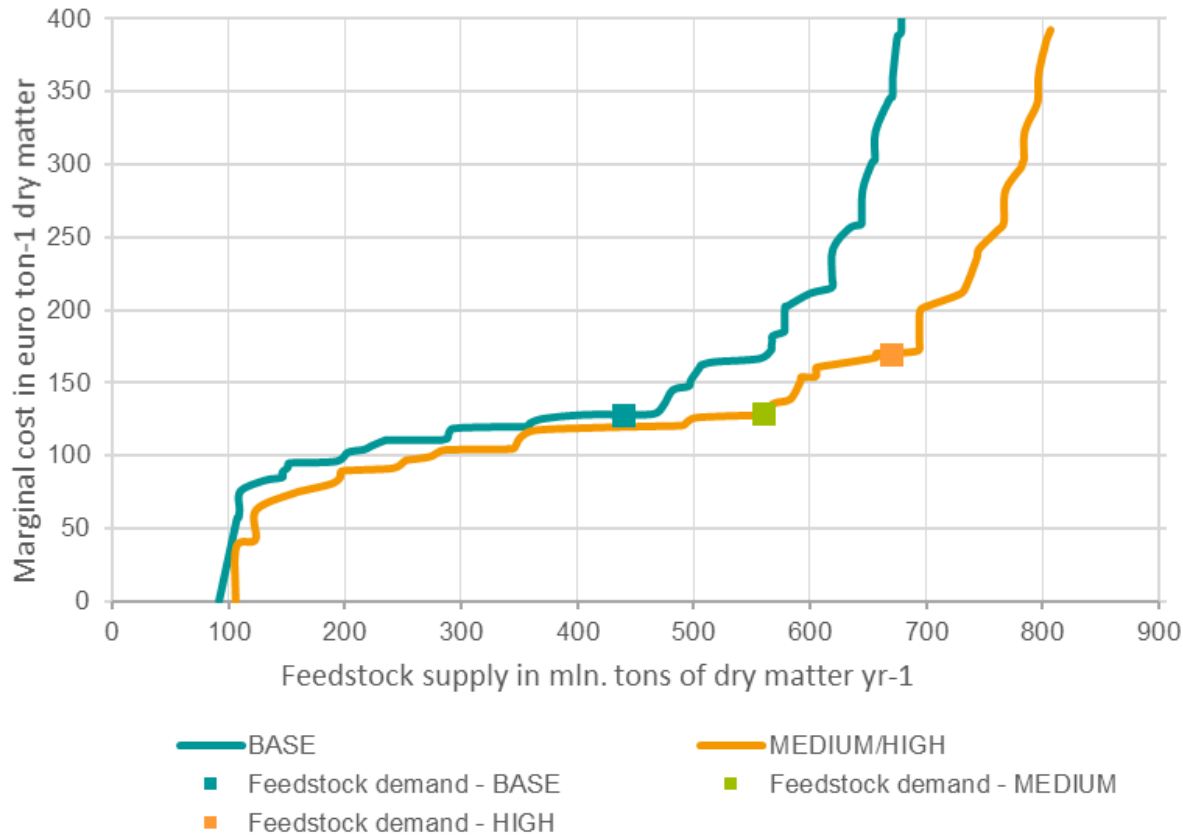
↓  
= cost reduction

→  
= volume increase

**Aggregated:  
+ 100 – 120 Mt  
dry matter / year**

# For every level of feedstock demand, R&I significantly decreases the cost of biomass

Aggregated cost-supply curve for feedstock that can be used in the production of advanced biofuels (excluding algae)



# Task 2:

## Potential Contribution of Advanced Biofuels to the EU Climate and Energy Targets



## To achieve the climate goals, significant investments in advanced biofuels' capacity are needed

### 2020 targets:

- Current installed capacity must increase from 0.2 GW to 1.1 GW
- Estimated cost of 4.5-5 billion euros

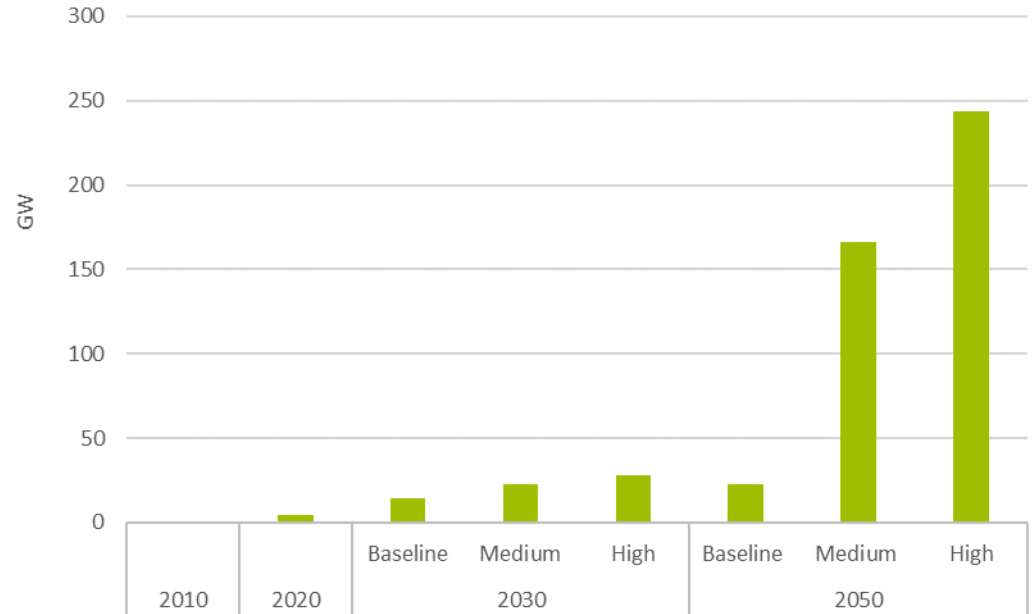
### 2030 targets:

- Capacity must increase to 30 GW

### 2050 targets:

- Capacity must increase to 250 GW

Production capacity needed to cover domestic production needs for advanced biofuels

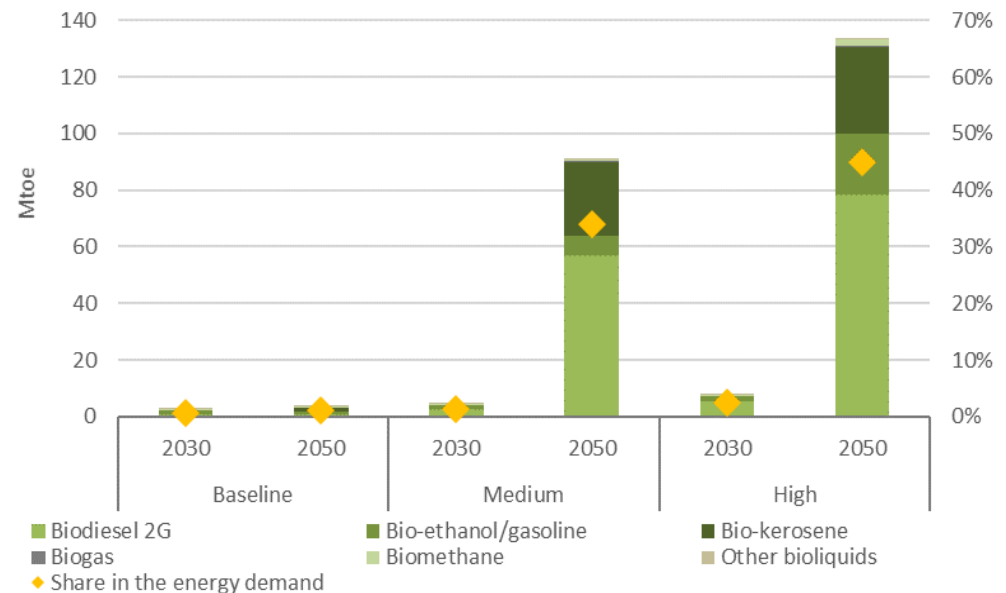


→ Fuel and Feedstock Flexibility are key

## Advanced biofuels can help achieve the EU climate and energy goals

- Advanced biofuels have much lower Well-To-Wheel emissions than conventional fuels.
- Under targeted R&I policies for feedstock utilization and conversion technologies, advanced biofuels will be able to meet around **50% of the EU transport sector's energy demand**.
- Wide penetration of advanced biofuels in energy mix will enhance energy security.

Bioenergy demand for EU-28 in the main Bioenergy scenarios





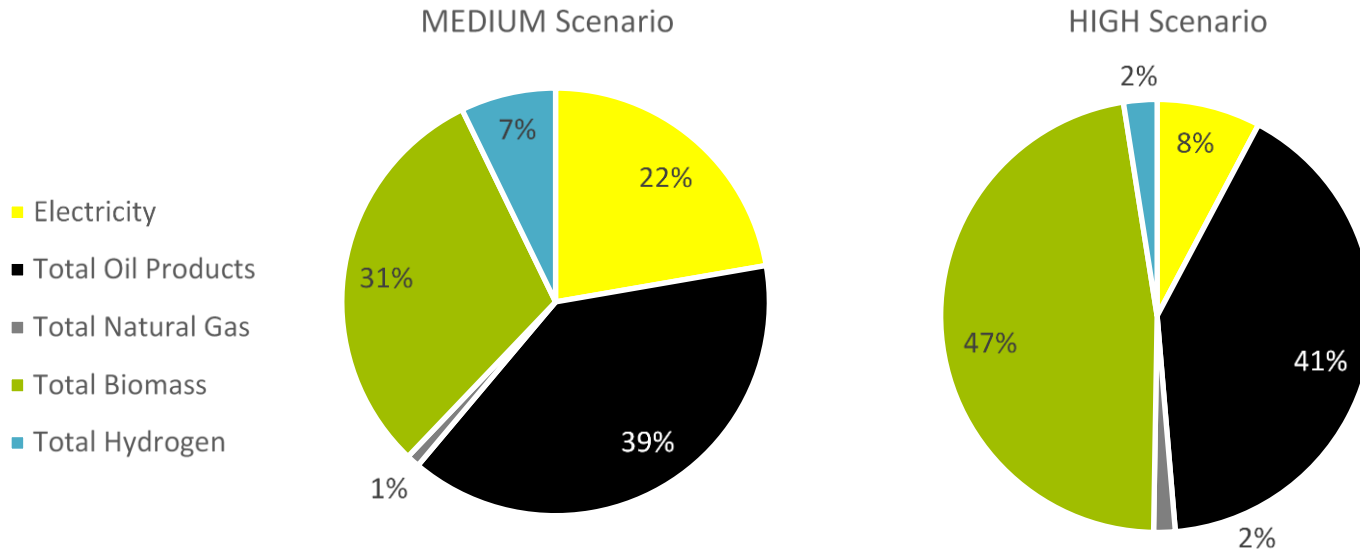
# Task 3:

## Comparison of Fuel Options for Transport up to 2030 and 2050



## Competition between advanced biofuels and electrification in passenger transport

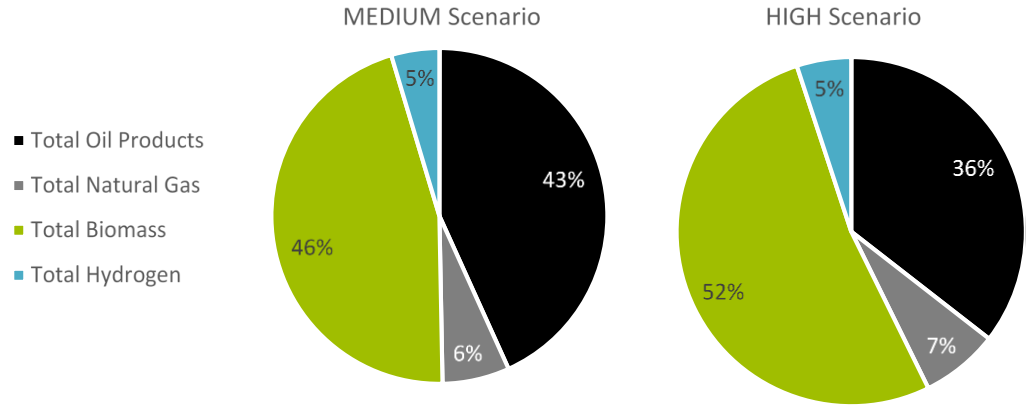
Fuel mix passenger cars in 2050



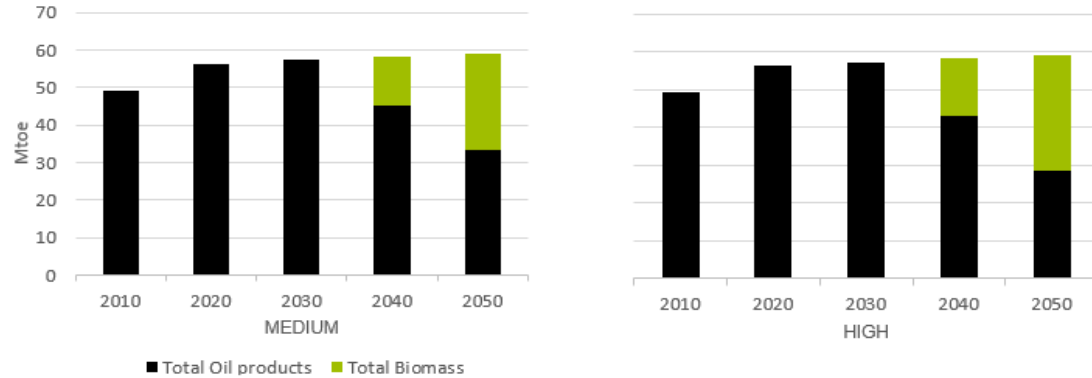
- Passenger cars are front-runners in the adoption of electric powered motors.
- Both advanced biofuels and electrification are necessary to cover overall demand.

# Advanced biofuels are the main alternative for aviation, maritime, and heavy-duty road transport

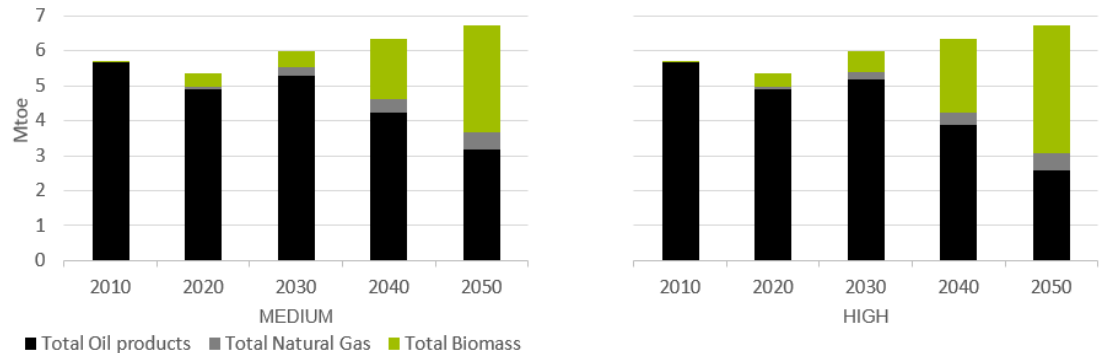
Fuel mix heavy duty road transport in 2050



Fuel mix aviation transport in 2050

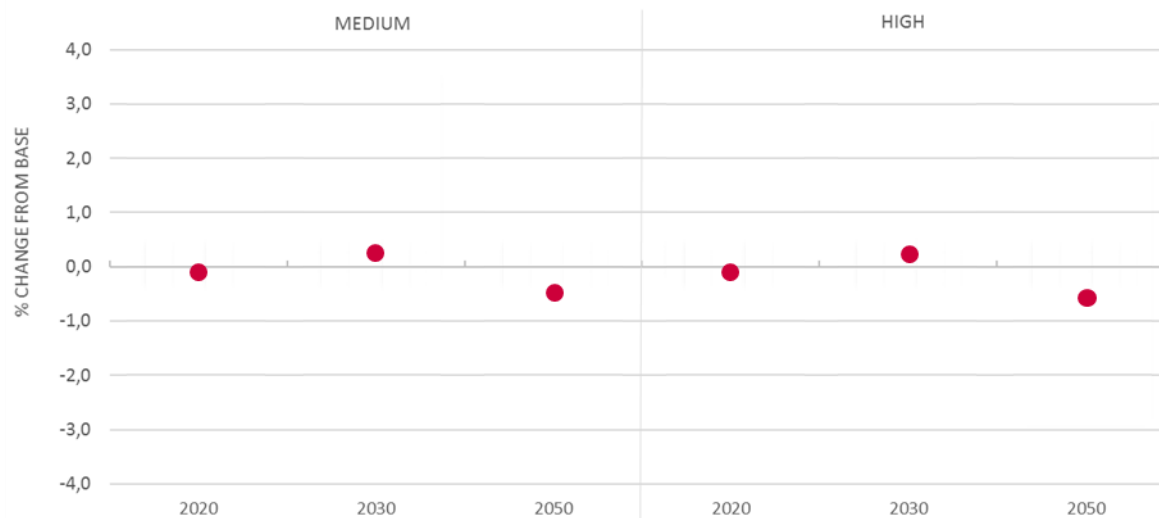


Fuel mix maritime transport in 2050



## Decarbonizing the energy system using advanced biofuels is achievable without a negative impact on GDP

Decomposition of GDP impact- EU28



**108,000** new jobs are created up to 2050 in the HIGH scenario

# Conclusions



## Highlight of conclusions:

→ Impact R&I measures:

*Up to +120% available feedstock – at lower prices  
Up to -40 to -60% capex for conversion*

→ Role of Adv. Biofuel:

*Up to 50% share of transport energy demand  
Only **limited competition** with other green fuels  
Reaching fossil fuel price levels in 2050*

→ Macro-economic impact

*€365 billion market (1.6% of EU's GDP)  
**No negative GDP impact and +108k jobs**  
Net increase energy security*

→ Feedstock limitations



*Scale drives cost reduction*

- improve feedstock mobilisation*
- focus on fuel and feedstock flexibility*
- EV and FCV: competitors or complementary?*
- synergies with fossil and 1<sup>st</sup> gen. feedstock*

# R&I outlook from the study results

- **R&I on several fronts can lead to successful development of advanced biofuels**  
*Improved biomass feedstock supply, reduced conversion costs*
- **Successful Advanced Biofuel value chains need to be created**  
*Biomass logistics, flagships*
- **Substantial share of advanced biofuels in overall transport is possible by 2050**  
*Substantial market volume, GDP-neutral decarbonisation, energy security, jobs*



# HORIZON 2020

**Thank you for your attention!**

Find out more:

**<http://ec.europa.eu/programmes/horizon2020>**