



Support to Advanced Biofuel Innovation in the Horizon 2020 Work Programme “Secure Clean and Efficient Energy”

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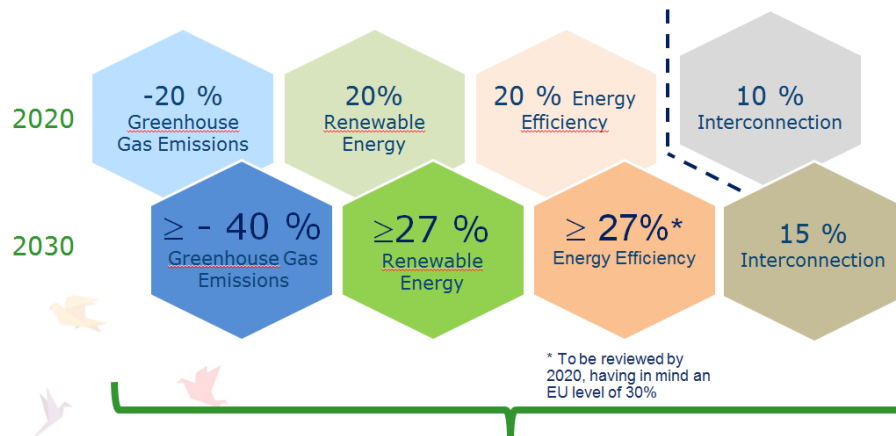
Policy Framework



"Clean Energy for all Europeans"

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

Agreed headline targets



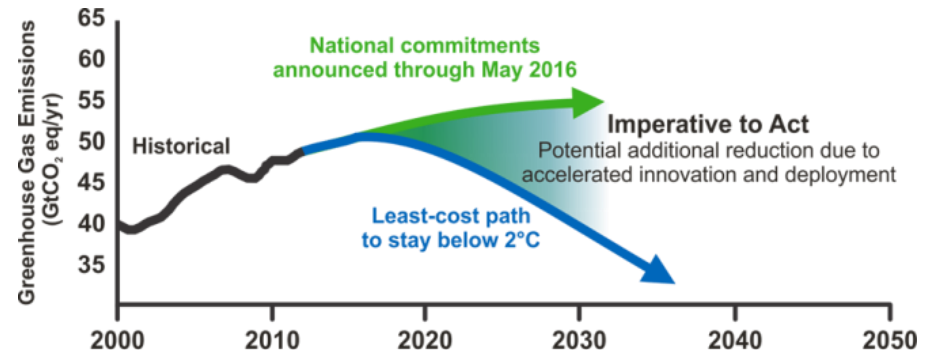
New governance system + indicators

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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
- ...

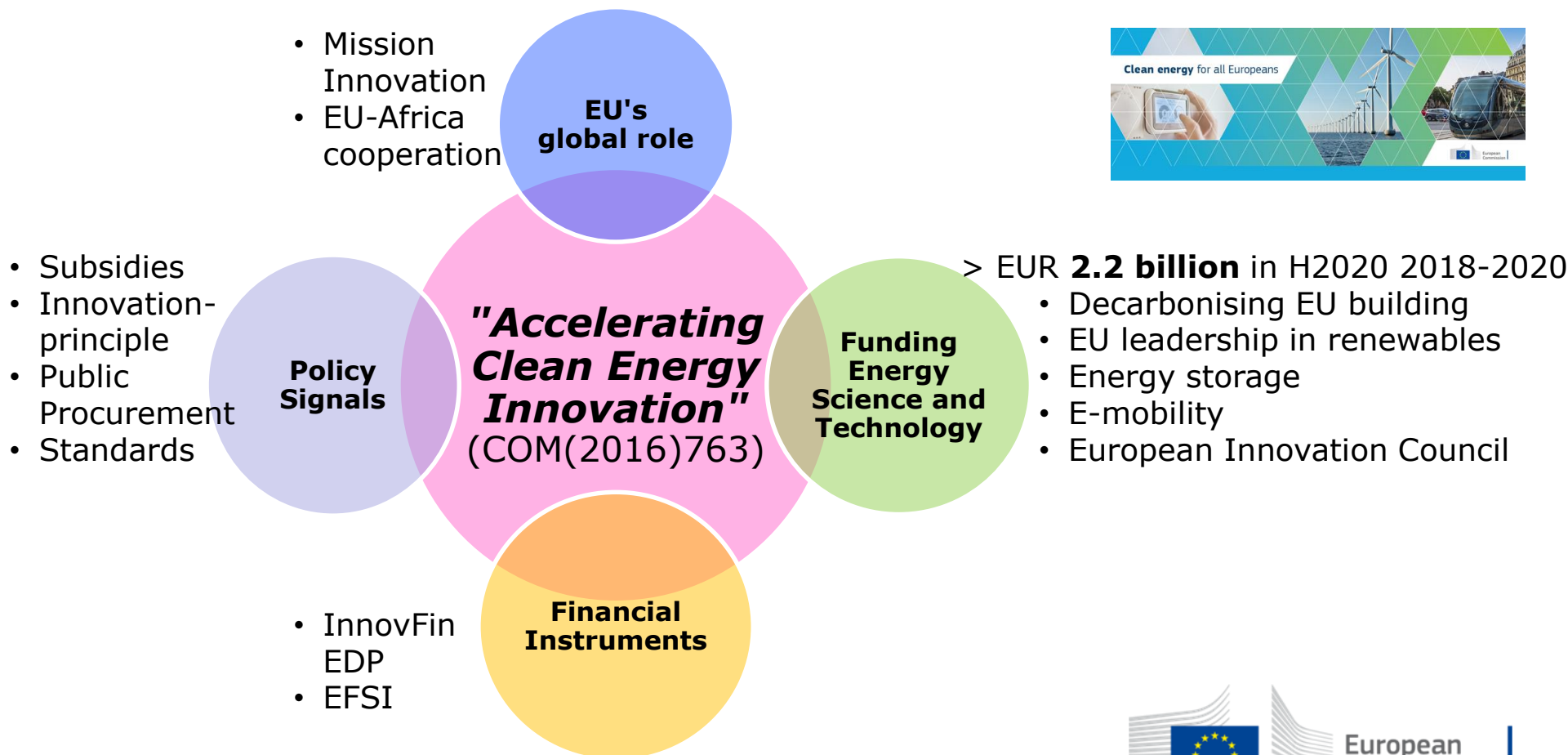
*We need to strengthen the share of renewable energies on our continent. This is not only a matter of a responsible climate change policy. It is, at the same time, an industrial policy imperative if we still want to have affordable energy at our disposal in the medium term. **I therefore want Europe's Energy Union to become the world number one in renewable energies.** COM(2016) 110 Resilient Energy Union with a forward-looking climate change policy*



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Accelerating Clean Energy Innovation

- ✓ R&I 5th pillar of the Energy Union
- ✓ New EU R&I strategy for the coming years
- ✓ Energy Union Winter Package/Clean Energy for all European 30.11.2016



Mission Innovation



Overall objective:

To reinvigorate global efforts in clean energy innovation, Mission Innovation members share a common goal to **develop and scale** breakthrough technologies and substantial **cost reductions**. MI members aim to seek to **double public clean energy research & development investment** over 5 yrs

EC is proactively engaged :

- 150 Million € on MI-relevant calls by 2020 in Horizon 2020
- Engaged in all the 7 Innovation Challenge (IC)
 - ✓ smart grids, off-grid access to electricity, CCS, biofuels, solar fuels, clean energy materials, H&C buildings
- Co-leading IC5 and IC7
- Chair of MI Steering Committee
- Co-host ministerial meeting in Malmo, Sweden 23-24 May 2018

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The Strategic Energy Technology Plan (SET Plan) - *coordinating research and innovation across Europe*



Overall objective: Accelerating the development and deployment of low-carbon technologies through cooperation among EU countries, companies, research institutions, and the EU itself, based on **common priorities, targets and actions**.

Priority Actions:

- 1&2. Improving performance and reducing cost of renewable energy
3. Smart solutions for consumers
4. Smart Resilience and Secure Energy System
5. Energy Efficiency in Buildings
6. Energy Efficiency in Industry
7. Batteries and e-Mobility
8. **Renewable Fuels and Bioenergy**
9. Carbon Capture Utilisation and Storage
10. Nuclear Safety

Defining priorities

- SET-Plan Communication 2015

Setting targets

- Declaration of Intent

Implementation Plans (IP)

- Temporary Working Groups

Execution of IPs

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Action 8 - Renewable Fuels and Bioenergy

- ✓ Targets in Declaration of Intent – November 2016
- ✓ Implementation Plan will be endorsed in June 2018
- ✓ R&I activities:
 1. Advanced liquid and gaseous biofuels
 2. Other renewable liquid and gaseous fuels
 3. Renewable hydrogen
 4. High efficiency large scale biomass CHP
 5. Solid, liquid and gaseous intermediate bioenergy carriers

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>



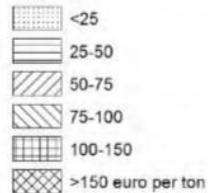
European
Commission



Supply from Agriculture

final_feedstocks_costs

straw



base_pot

straw_pot1_yr12

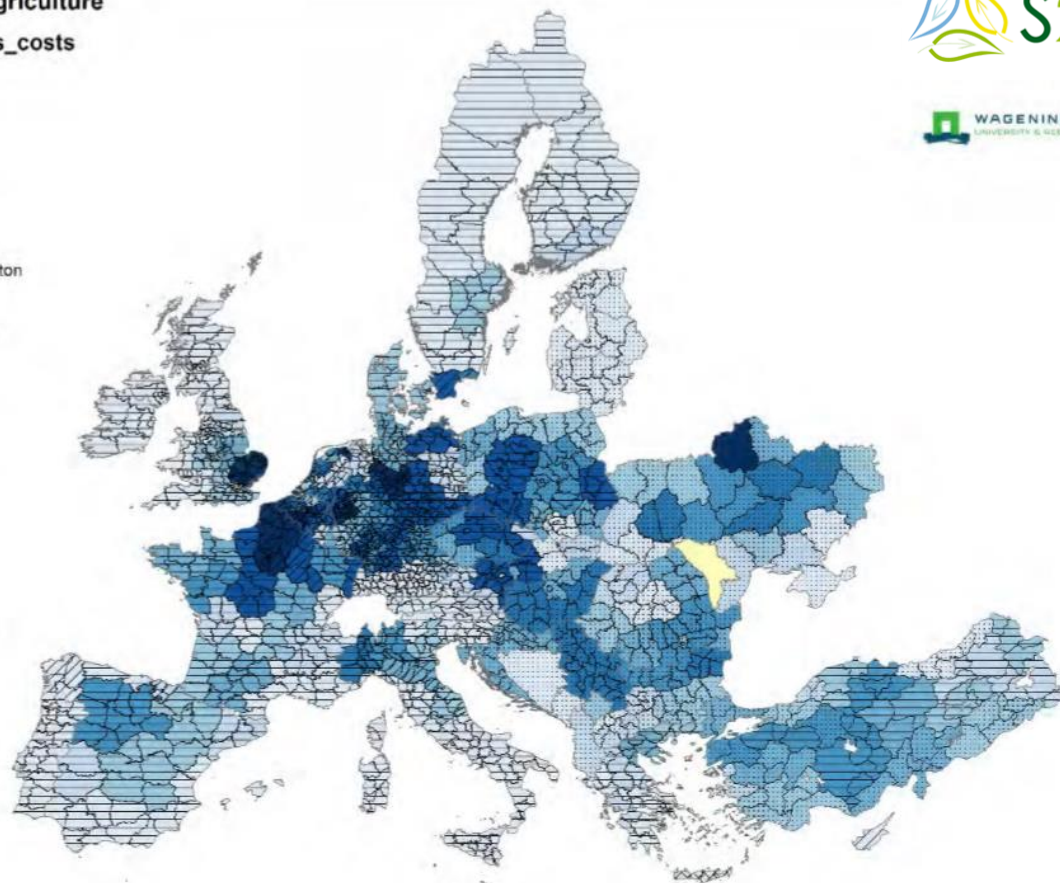
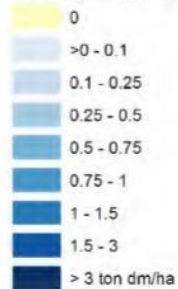


Figure 12 Cost and supply levels- for straw & stubbles

Drees et al. (2017):
http://www.s2biom.eu/images/Publications/D1.8_S2Biom_Atlas_of_regional_cost_supply_biomass_potential_Final.pdf

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 Research and
 Innovation



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



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)



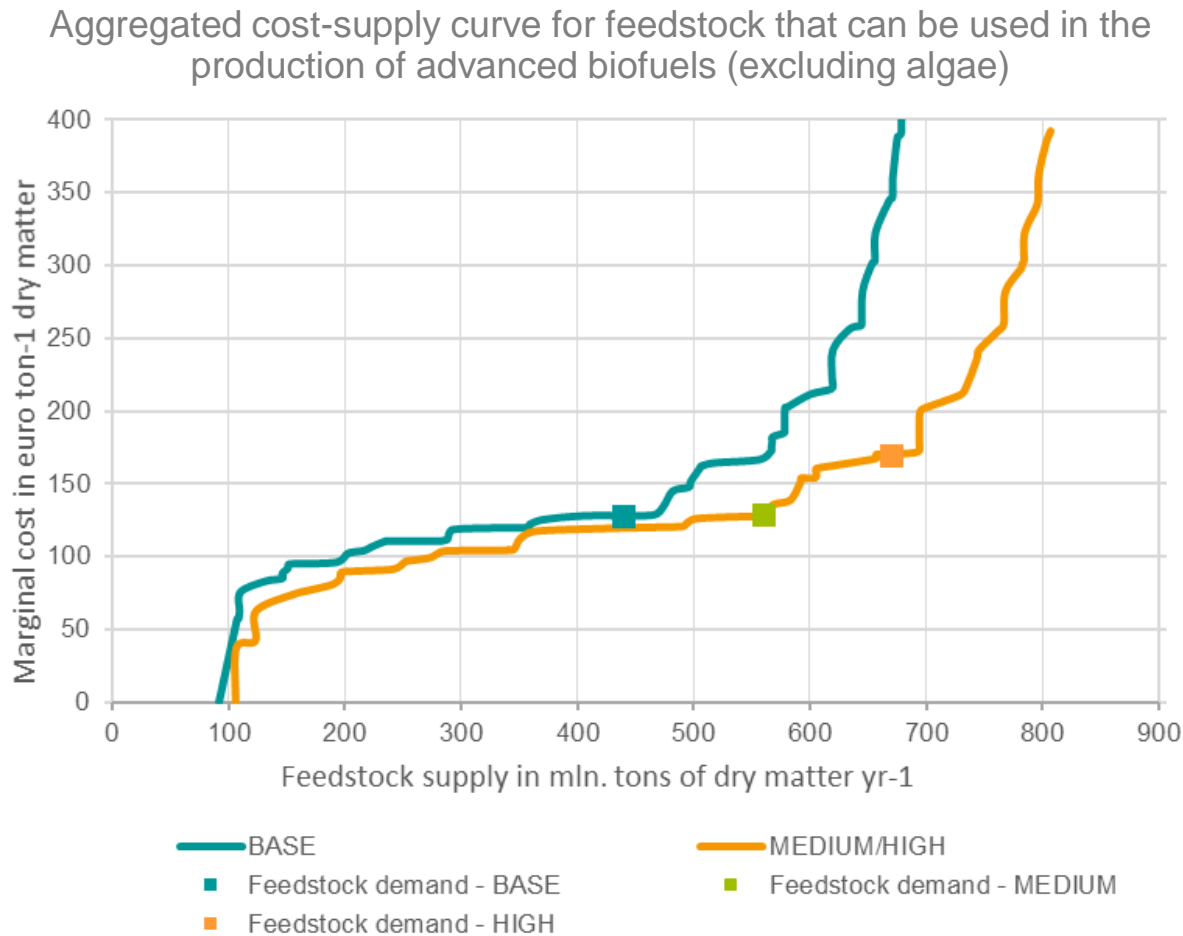
November 2017

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

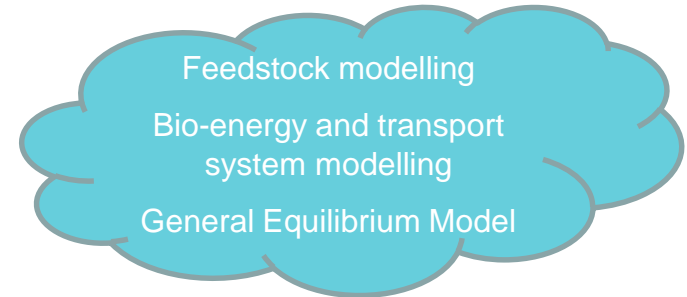
Task 3: Compares advanced biofuels with alternative fuel options for the road, maritime, and aviation transport sectors










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



Approach:

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

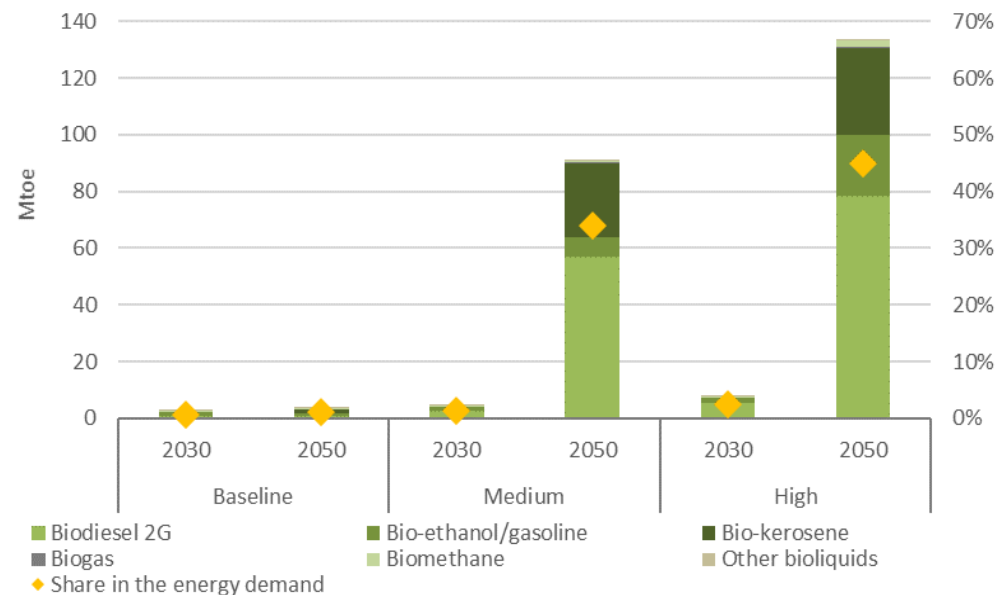


Scenario	Biomass feedstock	Conversion technologies	Demand for biofuels
BASE scenario	Option A0 – Baseline case 	Option B0 – Low learning rates for conversion technologies at low TRL 	Option C0 – Baseline: Low demand for biofuels 
MEDIUM scenario	Option A2 – High R&I case 	Option B1 – High learning learnings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

Advanced biofuels can help achieve the EU climate and energy goals

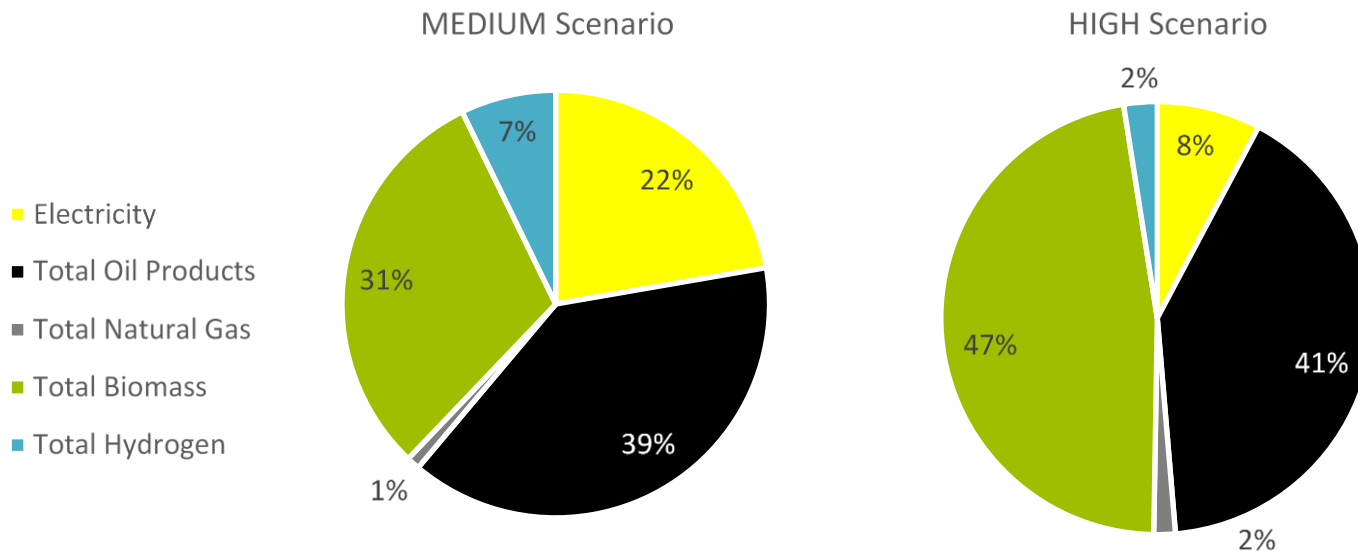
- Advanced biofuels have much lower Well-To-Wheel emissions than conventional fuels.
- Under targeted R&I policies for feedstock utilization and conversion technologies, advanced biofuels will be able to meet around **50% of the EU transport sector's energy demand**.
- Wide penetration of advanced biofuels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

Bioenergy demand for EU-28 in the main Bioenergy scenarios



Competition between advanced biofuels and electrification in passenger transport

Fuel mix passenger cars in 2050

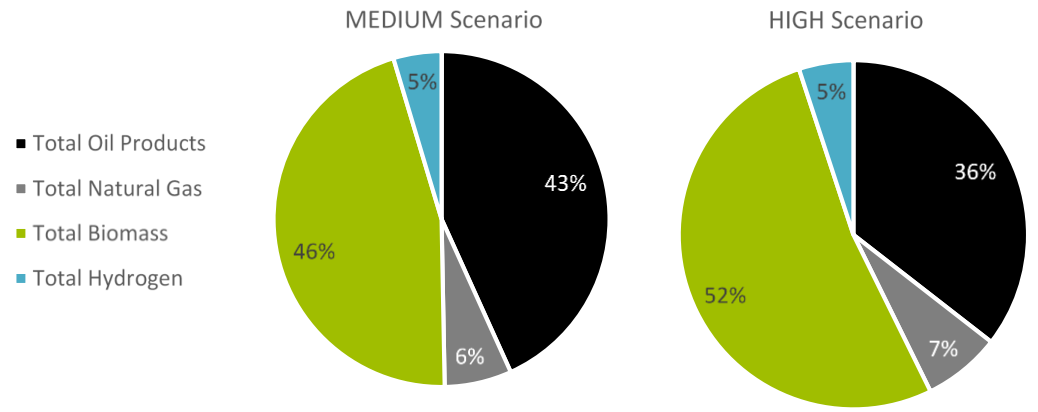


- Passenger cars are front-runners in the adoption of electric powered motors.
- Both advanced biofuels and electrification are necessary to cover overall demand.

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

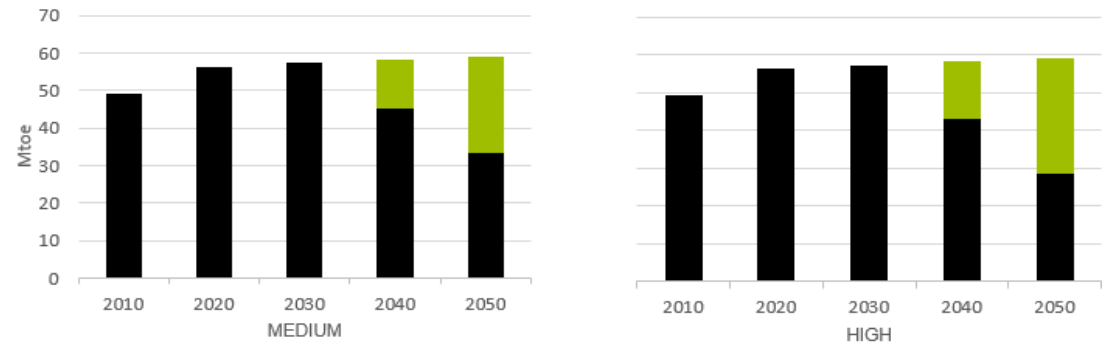
Fuel mix heavy duty road transport in 2050

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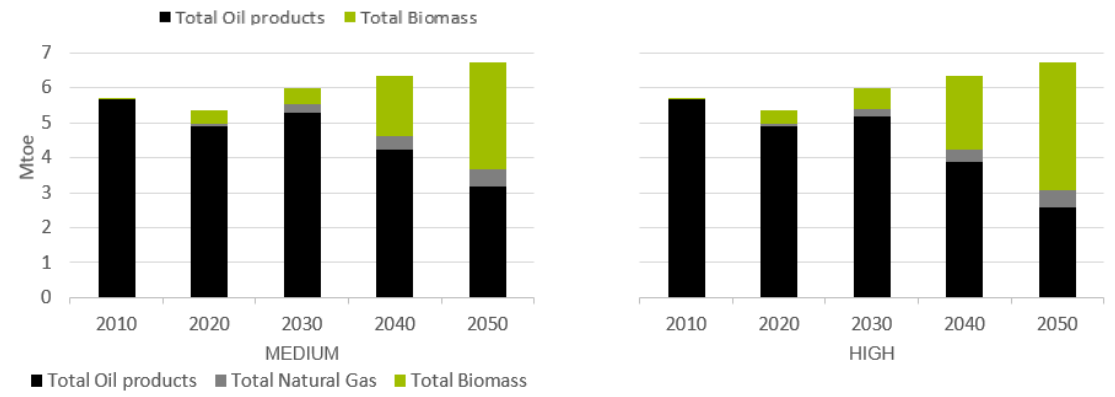
Fuel mix aviation transport in 2050

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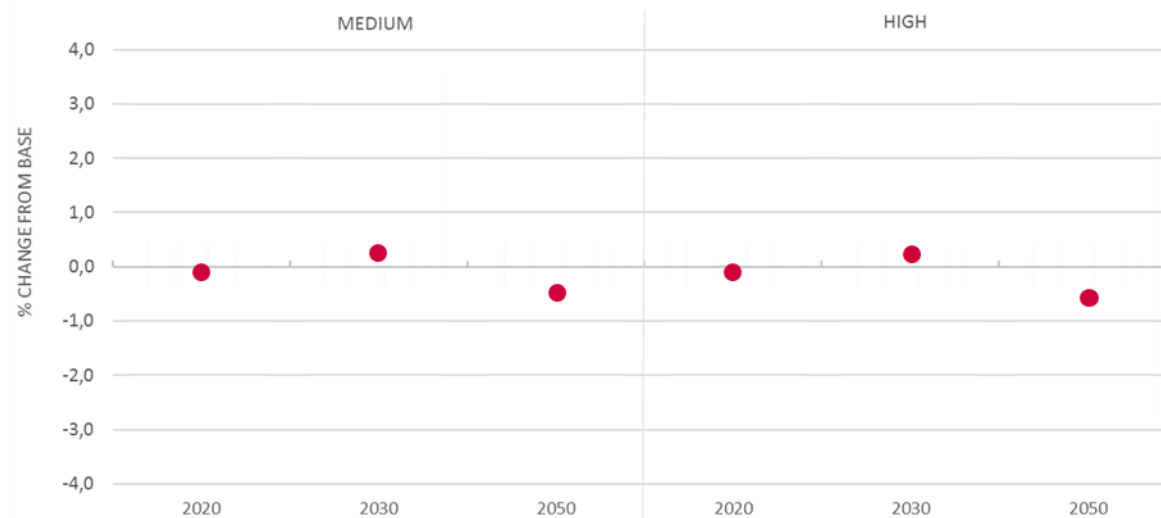
Fuel mix maritime transport in 2050

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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

R&I outlook from the study results

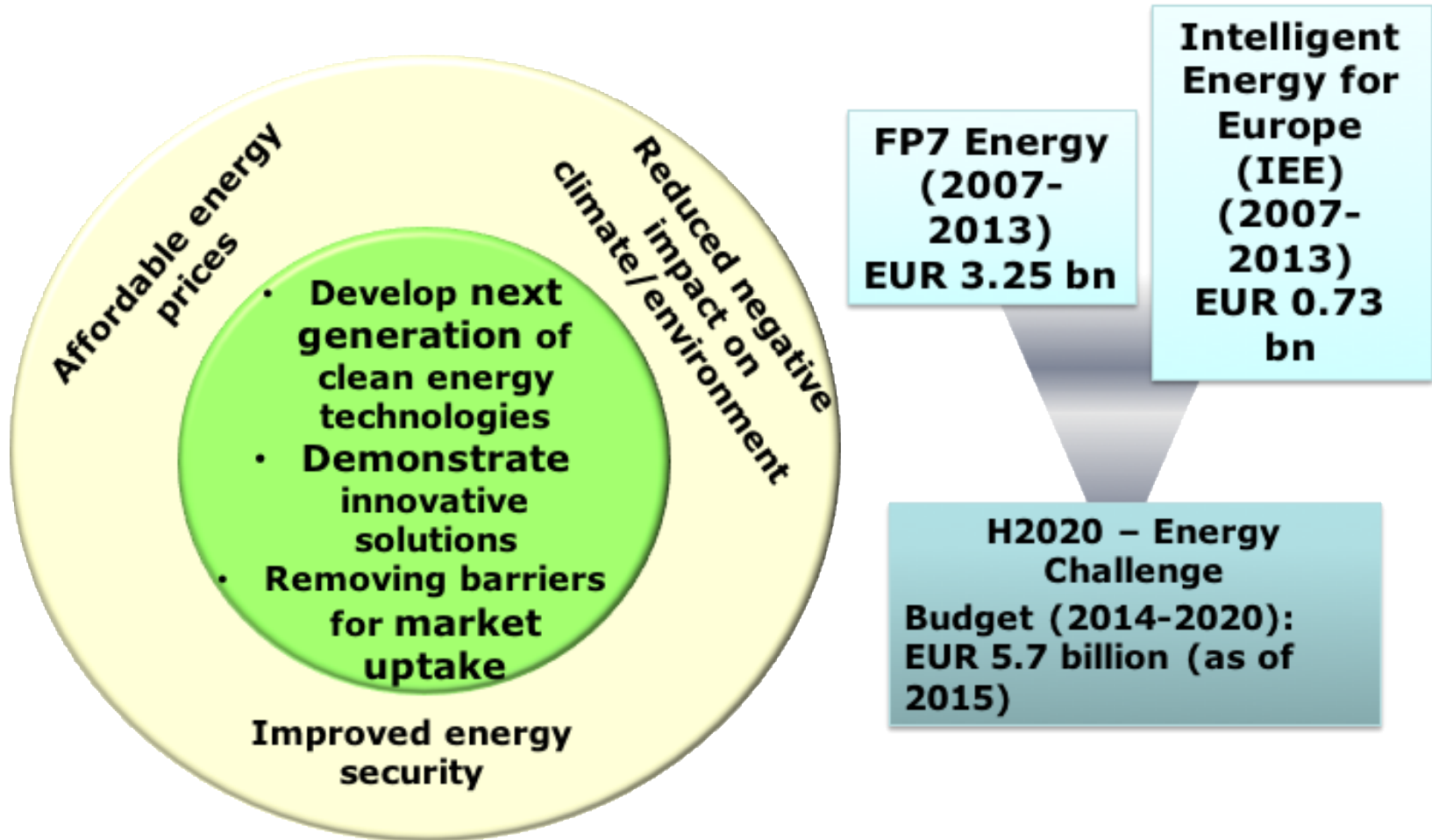
- **R&I on several fronts can lead to successful development of advanced biofuels**
Improved biomass feedstock supply, reduced conversion costs
- **Successful Advanced Biofuel value chains need to be created**
Biomass logistics, flagships
- ***Substantial share of advanced biofuels in overall transport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

Opportunities and Challenges for Bioenergy, Advanced Biofuels Renewable Fuels

- Advanced biofuels and bioenergy intermediates essential for both **energy storage and use** (grid balancing, use in electricity, heat and transport)
- Growing market for advanced biofuels
- Biofuels are the medium term solution for road & maritime and the **long-term** solution for air transport
- Reaching **competitiveness** by lowering production costs of advanced biofuels and addressing feedstock constraints
- European leadership in advanced biofuels technologies but little deployment in Europe
- **R&I** needed to improve cost, performance and sustainability
- Coordinated R&I funding and risk-funding availability needed for **market-uptake**
- R&I needed for **renewable fuels** that **outperform** fossil fuels

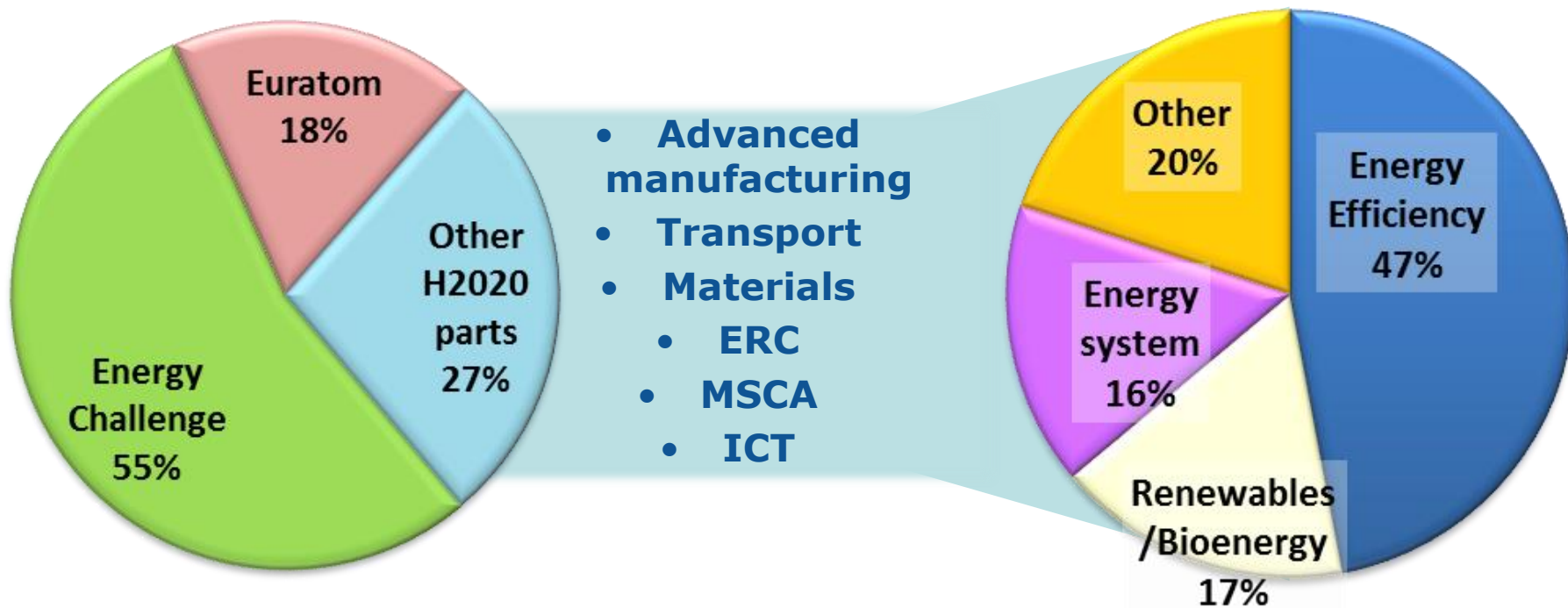
Research Policy Framework (1)

H2020 ENERGY Challenge



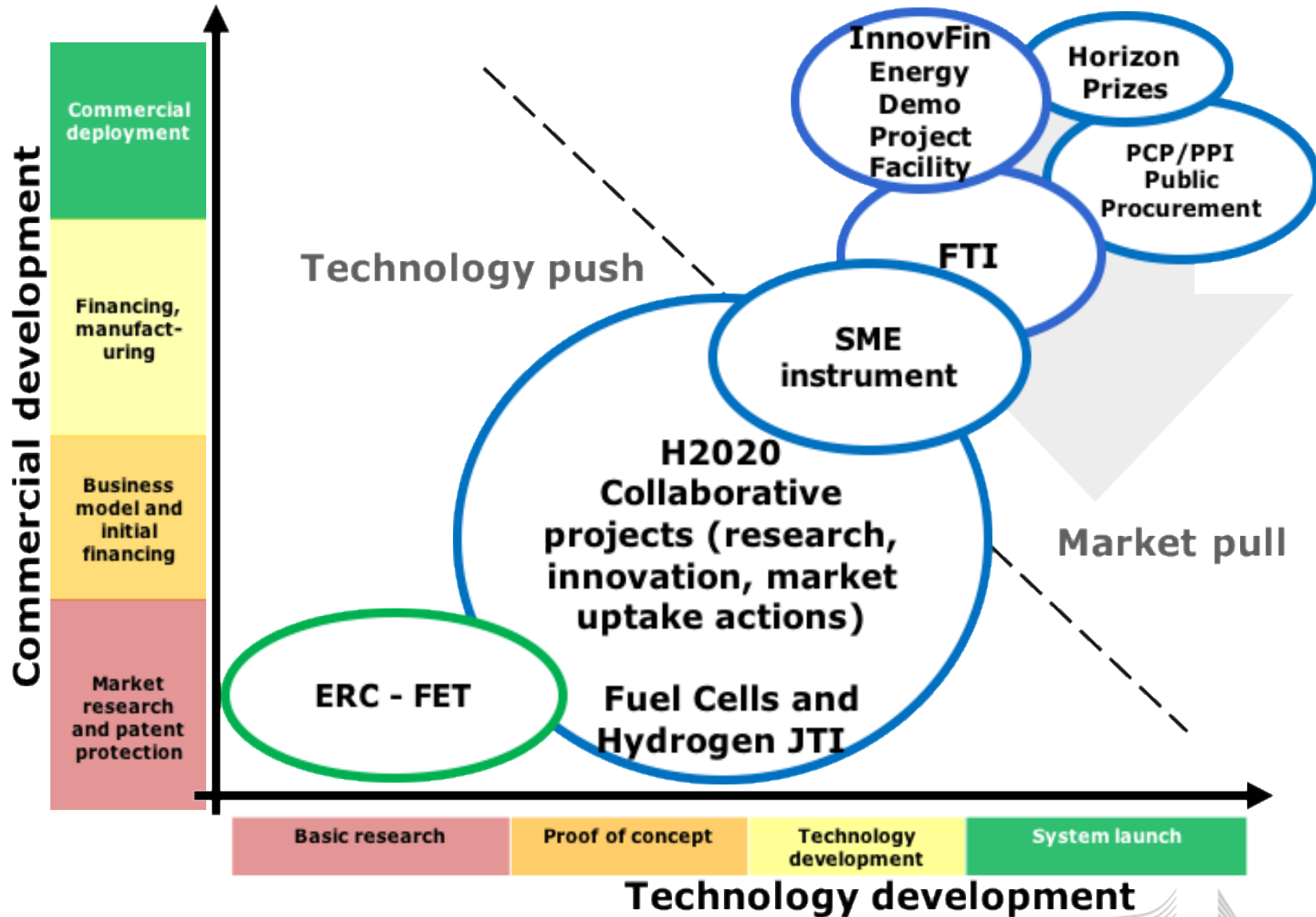
Research Policy Framework (2)

Energy in other parts of H2020



- ✓ Additional energy-related spending in H2020 outside Energy Challenge: ~ **50% of the Energy Challenge budget**
- ✓ Total budget for energy in H2020: ~ **EUR 8.5 billion** (11.4% of the total H2020 budget)

Research Financing Instruments



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Technology Readiness Levels (TRLs)

- TRL 1 – basic principles observed
- ☐ TRL 2 – technology concept formulated
- ☐ TRL 3 – experimental proof of concept
- ☐ TRL 4 – technology validated in lab
- ☐ TRL 5 – technology validated in relevant environment (industrially relevant environment in the case of key enabling technologies)
- ☐ TRL 6 – technology demonstrated in relevant environment (industrially relevant environment in the case of key enabling technologies)
- ☐ TRL 7 – system prototype demonstration in operational environment
- ☐ TRL 8 – system complete and qualified
- ☐ TRL 9 – actual system proven in operational environment



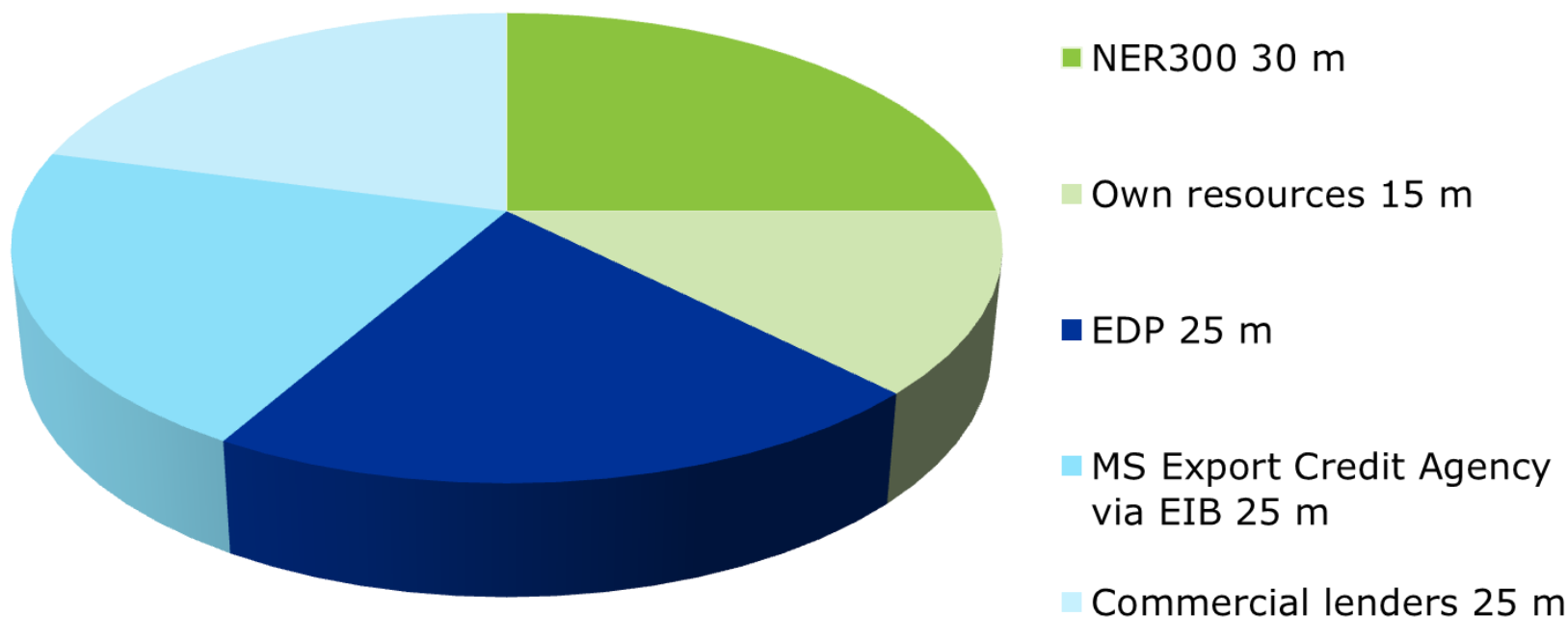
Basic features

- Risk-finance instrument (loans/loan guarantees) - Pilot launched in June 2015 focused on renewable energy but scope is now enlarged
- Implemented by the EIB
- Budget up to € 800 million
- Single proponents are the norm
- Criteria are Innovativeness, Replicability, Bankability during operations (revenue stream), Commitment by promoters

How it works

- Projects apply to the EIB
<http://www.eib.org/products/blending/innovfin/products/energy-demo-projects.htm>
- EIB process: Eligibility (EC confirmation) → due diligence → approval
- EIB provides loans with max 15 years & covering up to 50% of project costs
- EC (via Horizon 2020) provides guarantee on loan covering riskiest phase of the project

Example of financial engineering of First of a Kind Plant



Financial needs = EUR 120 million

Advanced Bioenergy, Biofuels and Renewable Fuels in Horizon 2020 ⁽¹⁾

- Bottom-up approach to long-term research and technology development
- Advance and demonstrate the technology, reduce its costs, improve its performance and prove its reliability
- Technology-specific demonstration activities
- Support mechanisms for first-of-a-kind plants with a higher leverage than 'standard grants' (e.g. through the Innovfin EDP facility)
- Market up-take measures
- Breakthrough market-creating innovation
- EU contribution under ENERGY calls ~ **€350** Mio

Advanced Bioenergy, Biofuels and Renewable Fuels in Horizon 2020 ⁽²⁾

Overall strategy is to target the following sector challenges

- Technology and cost competitiveness through technology improvement and diversification
- Feedstock availability through feedstock diversification
- Market up-take by focusing on particular transport sectorial needs and aligning market up-take measures
- Breakthrough research and market-creating innovation for completely replacing fossil fuels
- International cooperation to reinforce knowledge and innovation link and tackle global societal challenges

in order to create

- Positive social and economic impact by targeting Europe's competitiveness, environmental benefits and energy security

LCE-08-2016: Development of next generation biofuel technologies RIA TRL from 3-4 to 4-5

Specific Challenge:

- Improving the technology competitiveness by upgrading the conversion efficiency and possibly diversifying the technology
- Improving the feedstock supply by reducing the supply cost and possibly diversifying the biomass feedstock

Scope:

- Paraffinic biofuels (e.g. diesel and jet fuel) from sugars through chemical and biochemical pathways or through a combination of these pathways;
- Biofuels from pyrolysis or hydrothermal liquefaction and process integration with existing biodiesel or oil refineries;
- Synthetic biofuels/hydrocarbons through biomass gasification

Expected Impact:

- The new developed technology pathways should improve the economic, environmental and social benefits of biofuels (cost reduction, GHG, energy balance, enlarged feedstock basis, energy security, EU competitiveness)

[illegible]

Forthcoming: Topics of WP2020 under preparation

LC-SC3-RES-1-2020: Developing the next generation of renewable energy technologies

LC-SC3-RES-3-2020: International Cooperation with USA on alternative renewable fuels for energy and transport

LC-SC3-RES-18-2020: Demonstration of the solutions based on renewable sources that provide flexibility to the energy system

LC-SC3-RES-25-2020: International cooperation for Research and innovation on advanced biofuels and alternative renewable fuels

LC-SC3-RES-26-2020: Development of next generation biofuel and alternative renewable fuel technologies from CO₂ and renewable energy (Power and Energy to Fuels)

LC-SC3-RES-27-2020: Demonstration of advanced biofuels production from aquatic biomass

LC-SC3-RES-28-2020: Market Uptake Support

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



HORIZON 2020

Thank you for your attention!

Find out more:

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