A Clean Planet for all

A European strategic long term vision for a prosperous, modern, competitive and climate neutral economy

EU Refining Forum, Brussels, 7 December 2018

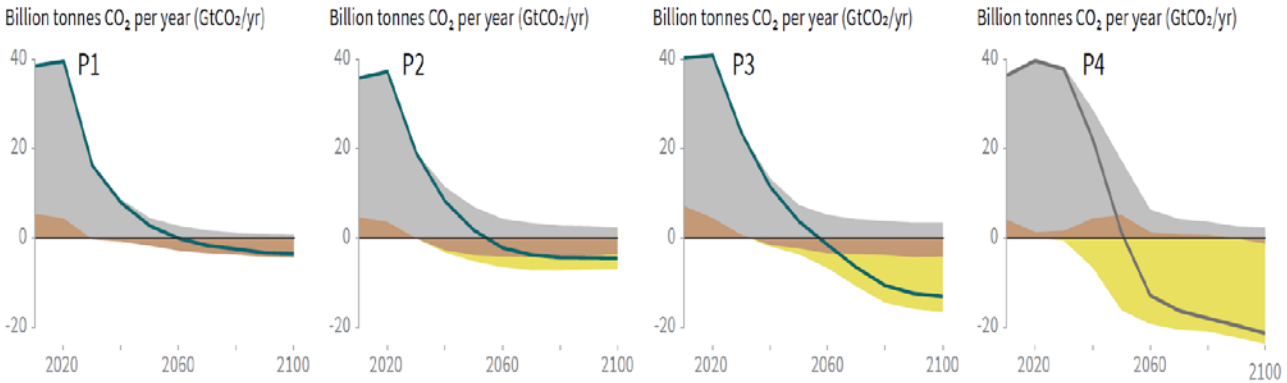
Artur Runge-Metzger

Director, European Commission

Looking to 2050: IPCC Global model pathways for CO_2 emissions

Breakdown of contributions to global net CO_2 emissions in four illustrative model pathways

Fossil fuel and industry AFOLU BECCS



P1: A scenario in which social, business, and technological innovations result in lower energy demand up to 2050 while living standards rise, especially in the global South. A down-sized energy system enables rapid decarbonisation of energy supply. Afforestation is the only CDR option considered; neither fossil fuels with CCS nor BECCS are used.

P2: A scenario with a broad focus on sustainability including energy intensity, human development, economic convergence and international cooperation, as well as shifts towards sustainable and healthy consumption patterns, low-carbon technology innovation, and well-managed land systems with limited societal acceptability for BECCS.

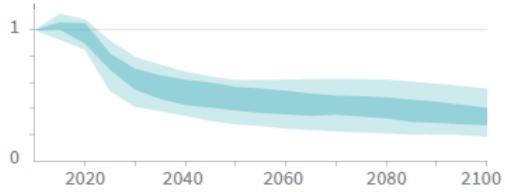
P3: A middle-of-the-road scenario in which societal as well as technological development follows historical patterns. Emissions reductions are mainly achieved by changing the way in which energy and products are produced, and to a lesser degree by reductions in demand.

P4: A resource and energy-intensive scenario in which economic growth and globalization lead to widespread adoption of greenhouse-gas intensive lifestyles, including high demand for transportation fuels and livestock products. Emissions reductions are mainly achieved through technological means, making strong use of CDR through the deployment of BECCS.

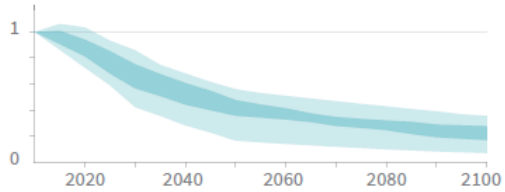
Non-CO_2 emissions relative to 2010

Emissions of non-CO_2 forcers are also reduced or limited in pathways limiting global warming to 1.5°C with **no or limited overshoot**, but they do not reach zero globally.

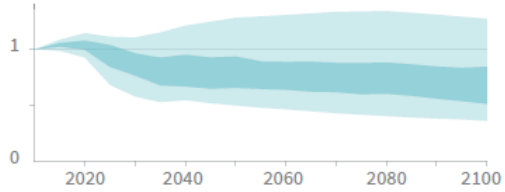
Methane emissions



Black carbon emissions



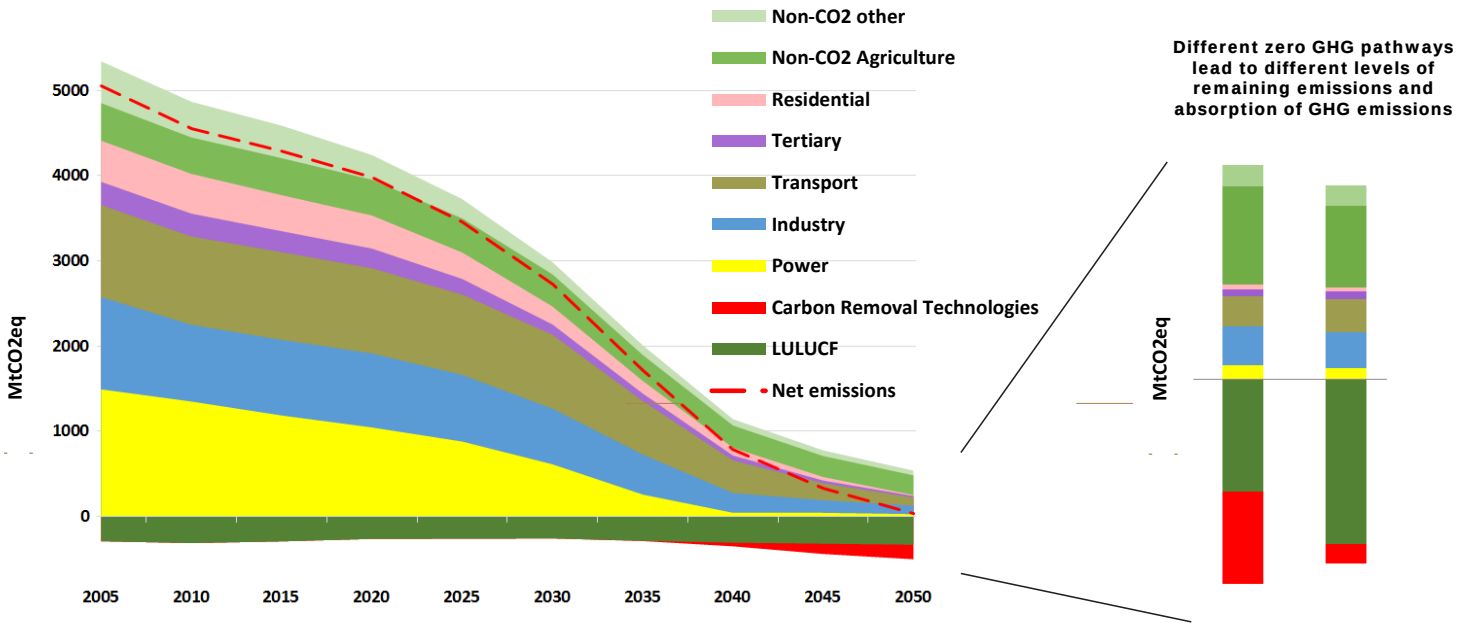
Nitrous oxide emissions



Source: IPCC Special Report on 1.5 degrees, 2018

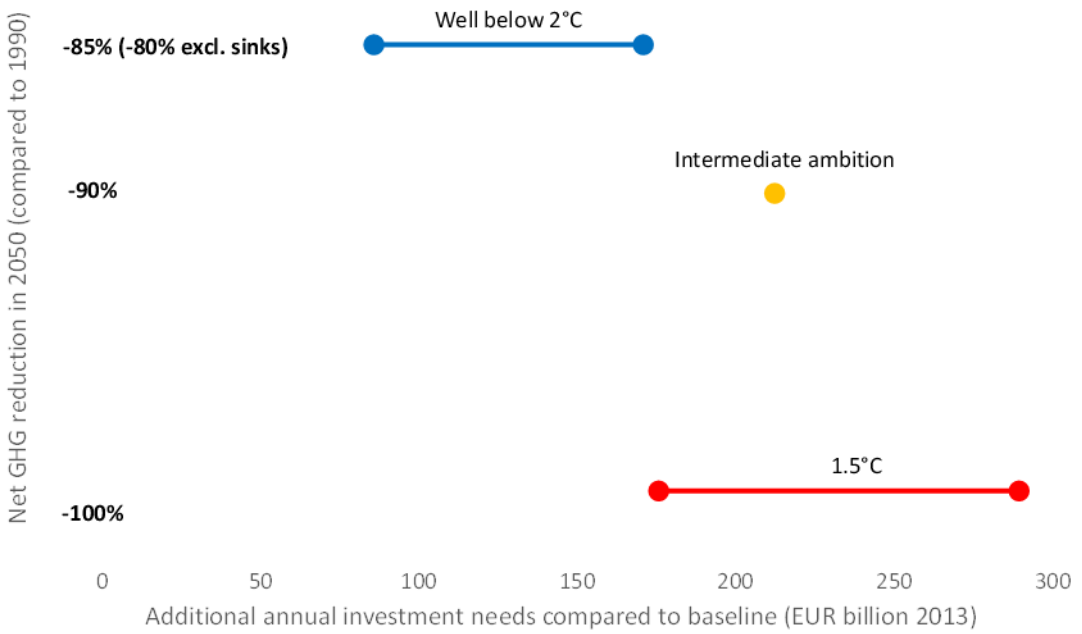
Vision for a Clean Planet by 2050

There are a number of pathways for achieving a climate neutral EU, challenging but feasible from a technological, economic, environmental and social perspectives.

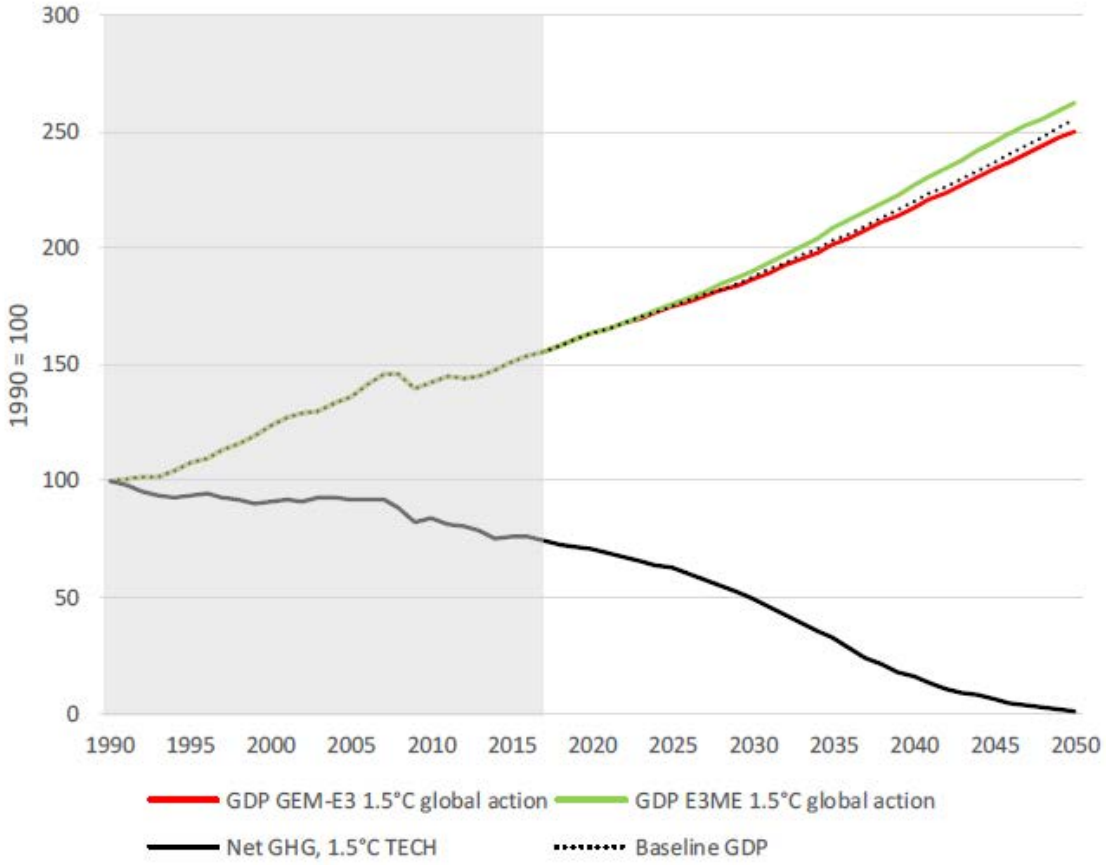


Increased Investment in the EU economy

- Modernising and decarbonising the EU's economy will stimulate significant additional investment
- From 2% of EU GDP invested in the energy system today to 2.8% to achieve a net-zero greenhouse gas emissions economy
- Positive for growth and jobs, with GDP impact up to 2%
- Co-benefits: energy imports down, public health, etc.



Full decoupling of EU GDP growth and emissions by 2050



Sources: PRIMES, ESTAT, JRC-GEM-E3 and E3ME.

Caveat:
This does not take into account differences in climate change damages, nor adaptation costs between baseline and 1.5° C.

Detailed assessment supported by scenario analysis

Long Term Strategy Options

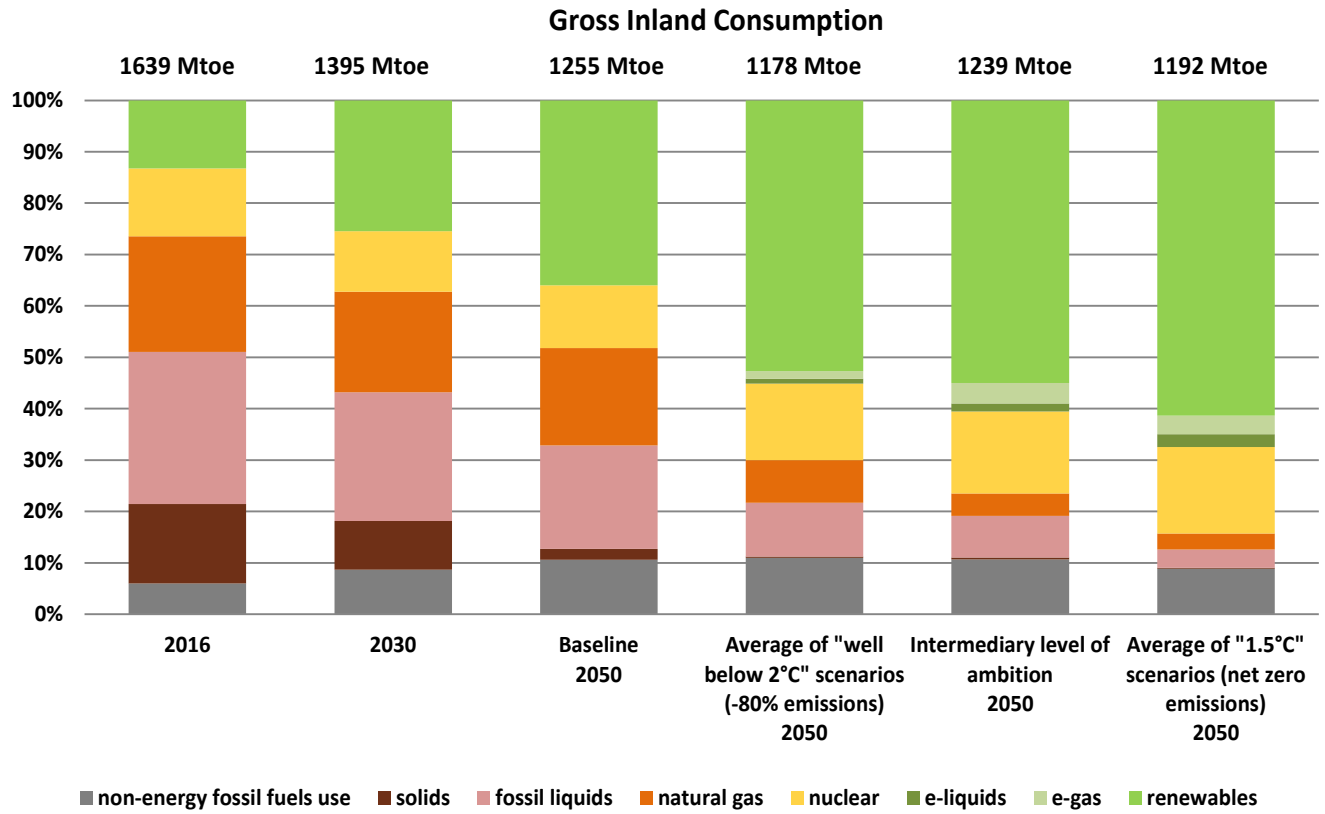
	Electrification (ELEC)	Hydrogen (H2)	Power-to-X (P2X)	Energy Efficiency (EE)	Circular Economy (CIRC)	Combination (COMBO)	1.5°C Technical (1.5TECH)	1.5°C Sustainable Lifestyles (1.5LIFE)
Main Drivers	Electrification in all sectors	Hydrogen in industry, transport and buildings	E-fuels in industry, transport and buildings	Pursuing deep energy efficiency in all sectors	Increased resource and material efficiency	Cost-efficient combination of options from 2°C scenarios	Based on COMBO with more BECCS, CCS	Based on COMBO and CIRC with lifestyle changes
GHG target in 2050	-80% GHG (excluding sinks) ["well below 2°C" ambition]					-90% GHG (incl. sinks)	-100% GHG (incl. sinks) ["1.5°C" ambition]	
Major Common Assumptions	• Higher energy efficiency post 2030 • Deployment of sustainable, advanced biofuels • Moderate circular economy measures • Digitilisation					• Market coordination for infrastructure deployment • BECCS present only post-2050 in 2°C scenarios • Significant learning by doing for low carbon technologies • Significant improvements in the efficiency of the transport system.		
Power sector	Power is nearly decarbonised by 2050. Strong penetration of RES facilitated by system optimization (demand-side response, storage, interconnections, role of prosumers). Nuclear still plays a role in the power sector and CCS deployment faces limitations.							
Industry	Electrification of processes	Use of H2 in targeted applications	Use of e-gas in targeted applications	Reducing energy demand via Energy Efficiency	Higher recycling rates, material substitution, circular measures	Combination of most Cost-efficient options from "well below 2°C" scenarios with targeted application (excluding CIRC)	COMBO but stronger	CIRC+COMBO but stronger
Buildings	Increased deployment of heat pumps	Deployment of H2 for heating	Deployment of e-gas for heating	Increased renovation rates and depth	Sustainable buildings			CIRC+COMBO but stronger
Transport sector	Faster electrification for all transport modes	H2 deployment for HDVs and some for LDVs	E-fuels deployment for all modes	Increased modal shift	Mobility as a service			• CIRC+COMBO but stronger • Alternatives to air travel
Other Drivers		H2 in gas distribution grid	E-gas in gas distribution grid				Limited enhancement natural sink	• Dietary changes • Enhancement natural sink

7 Building Blocks

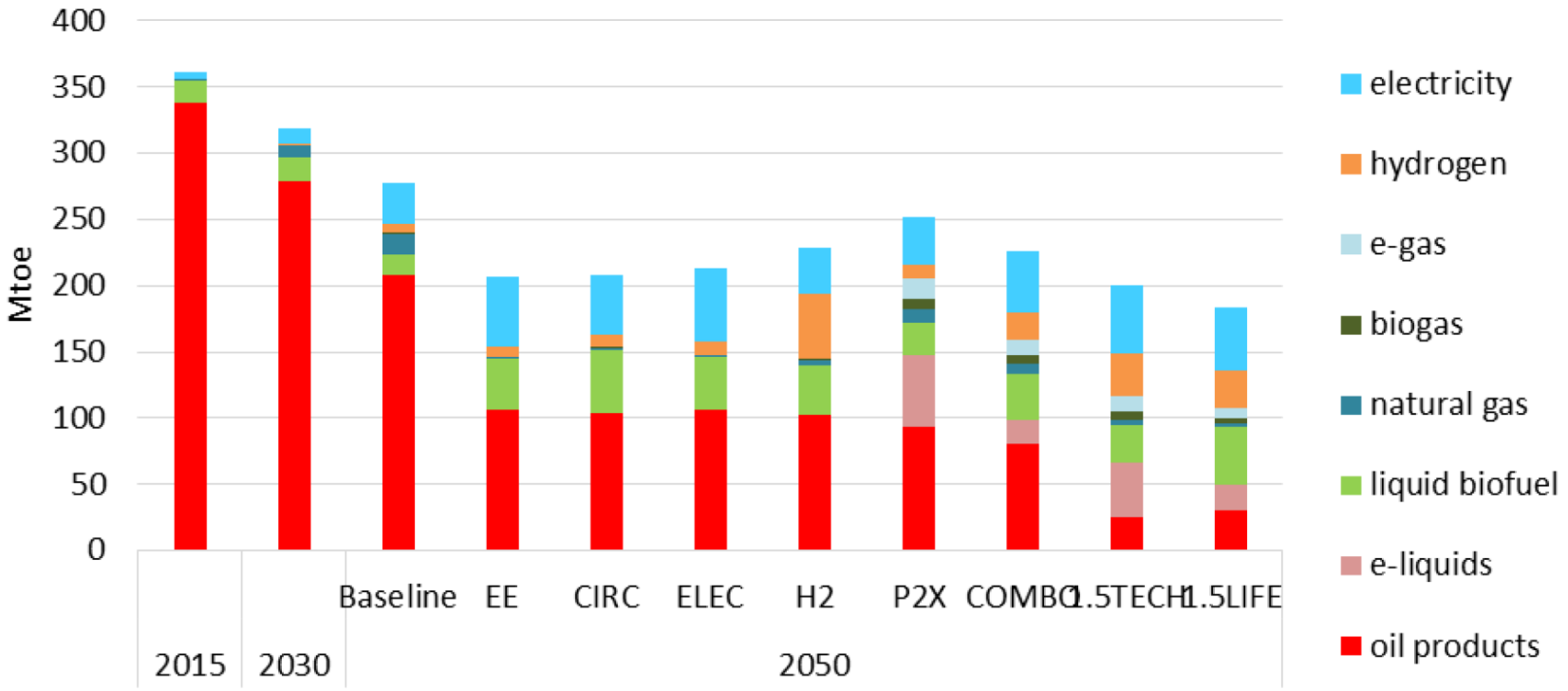
1. Energy efficiency
2. Deployments of renewables
3. Clean, safe & connected mobility
4. Competitive industry and circular economy
5. Infrastructure and inter-connections
6. Bio-economy and natural carbon sinks
7. Tackle remaining emissions with carbon capture and storage

Building Block 2 Deployment of renewables

Primary energy in 2050 largely coming from renewable sources

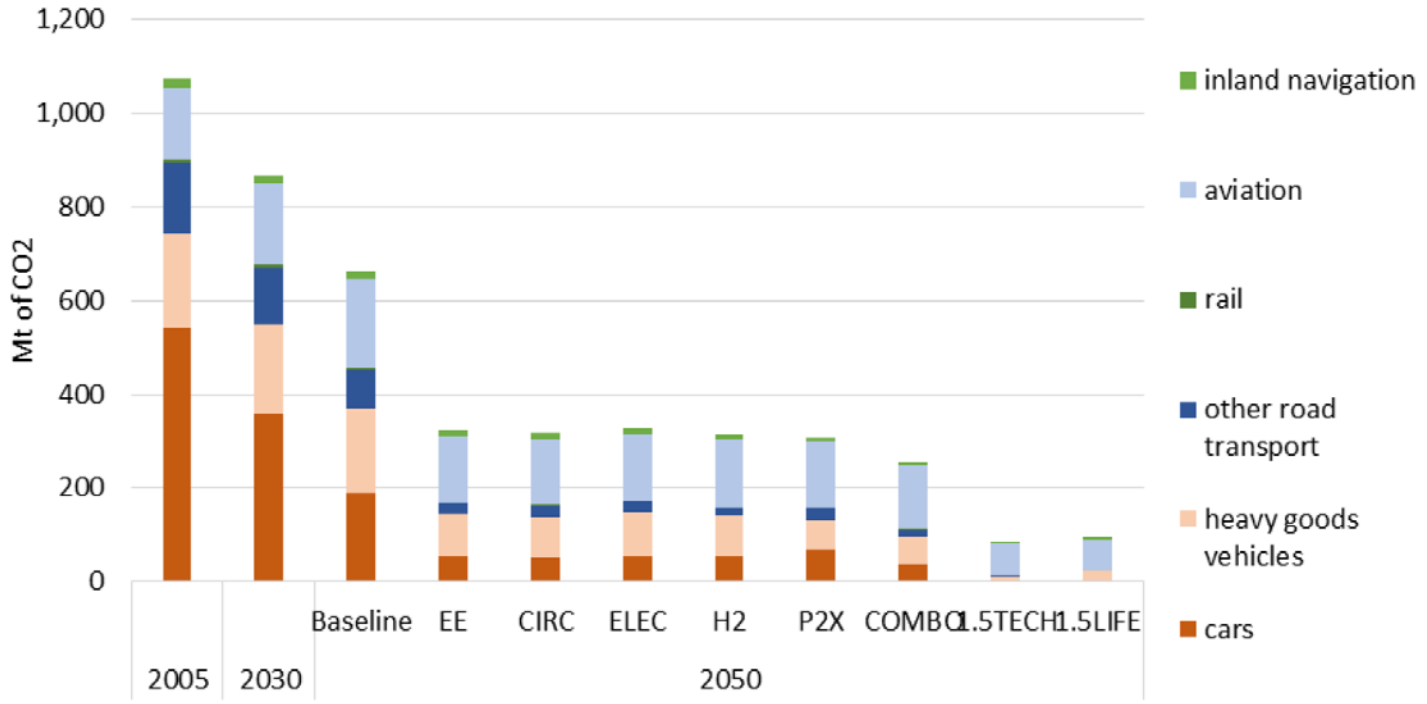


Building block 3: Mobility - Mix of transport fuels



Source: PRIMES.

Building block 3: Mobility - CO_2 emissions



Source: PRIMES.

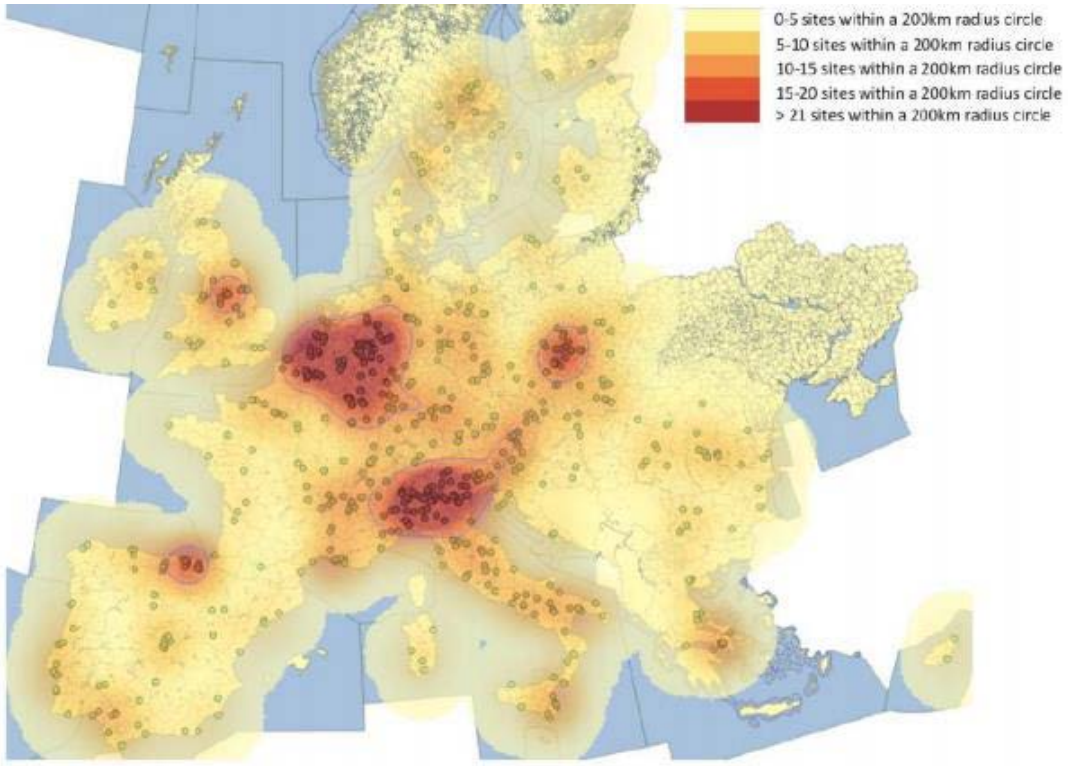
Building block 4: Competitive industry

Competitive resource-efficient industry and circular economy, increased recovery and recycling of raw materials (including critical materials), new materials and business concepts.

Electrification, energy efficiency, hydrogen, biomass and renewable synthetic gas to reduce energy emissions in the production of industrial goods.

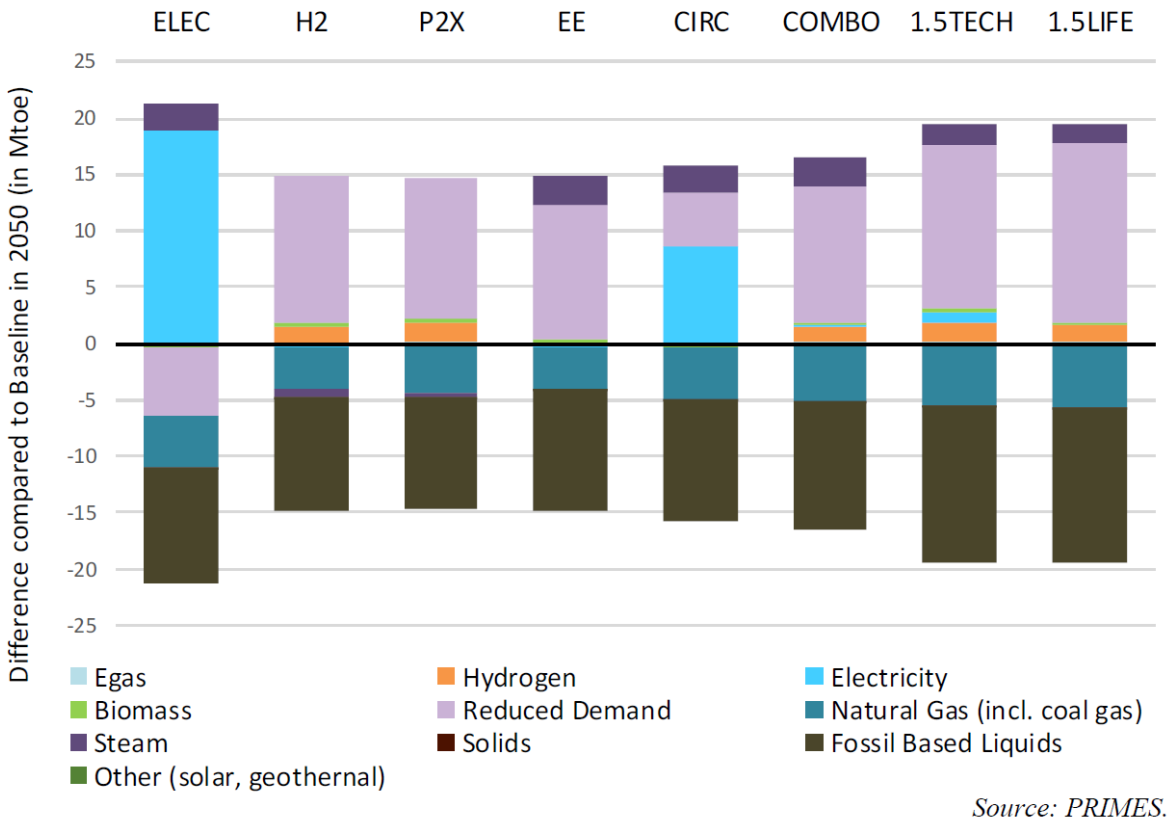
Process-related reductions more difficult. Biomass and hydrogen can reduce certain emissions (steel production, some chemicals), others will require CO_2 to be captured and stored or used.

In the next 10 to 15 years, technologies that are already known will need to demonstrate that they can work at scale.



Building block 4: Refining industry in 2050

Difference in final energy consumption compared with baseline



Source: PRIMES.

Integration into new value chains producing clean molecules, heat, H_2, synthetic fuels, biofuels, CO_2

Building Block 5 Network infrastructure

Integrated and interconnected smart infrastructure.

Completion of the Trans-European Transport and Energy Networks.

Smart electricity and data/information grids, hydrogen pipelines, further sector integration.

Smart charging or refuelling stations for transport. Increased synergy between transport and energy systems.

Retrofitting existing infrastructure and assets and timely replacement of ageing infrastructure compatible with the deep decarbonisation objective.

Building Block 6
Agriculture, forest and bio-economy

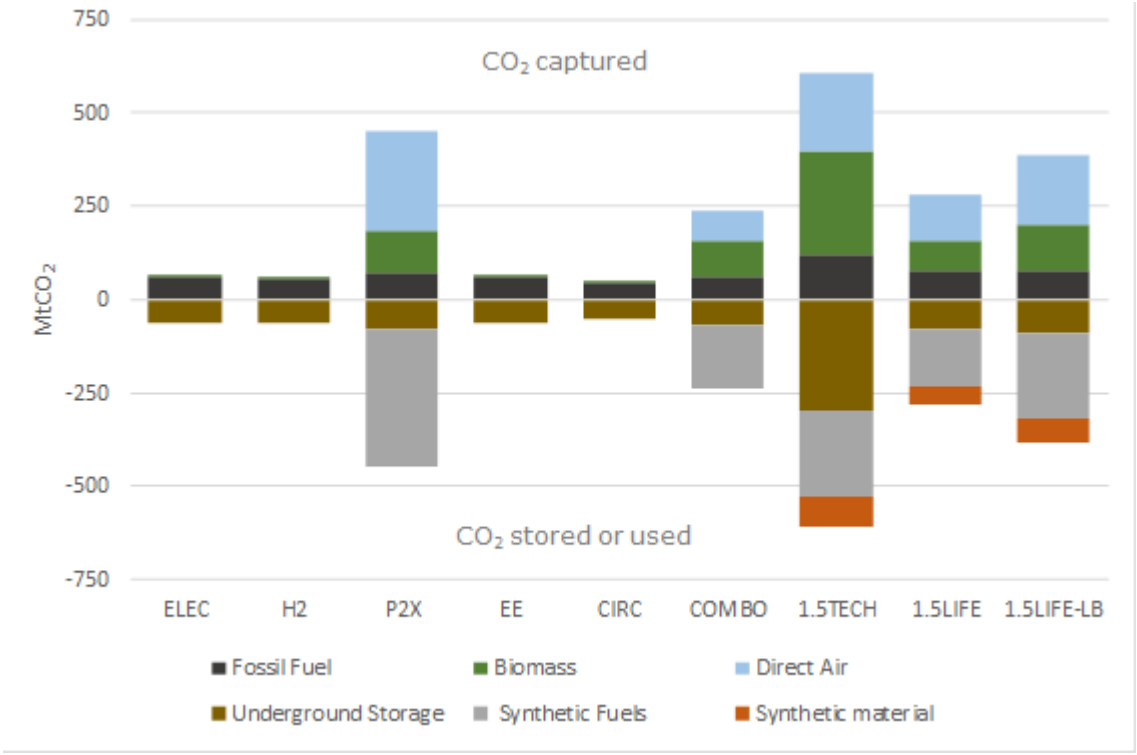
Agriculture to provide sufficient food, feed and fibre. Agricultural non-CO2 emissions can be reduced (but not to zero) and soil carbon can be increased through improved farming techniques.

Biomass is multipurpose: supply direct heat, biogas, biofuels, alternative to carbon intensive materials and generate negative emissions when coupled with carbon capture and storage; therefore increased demand (up to 80%).

Key role of energy crops to avoid unsustainable use of forests, maintain the natural carbon sink while preserving ecosystems.

Natural carbon sink can be enhanced through afforestation and restoration of degraded forest lands and other ecosystems (benefiting biodiversity, soils and water resources and increase biomass availability over time).

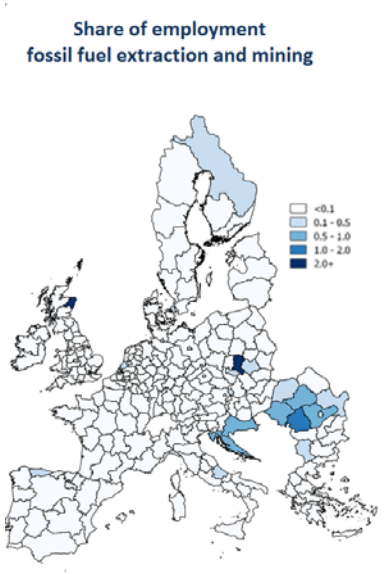
Building block 7: The role of CCS

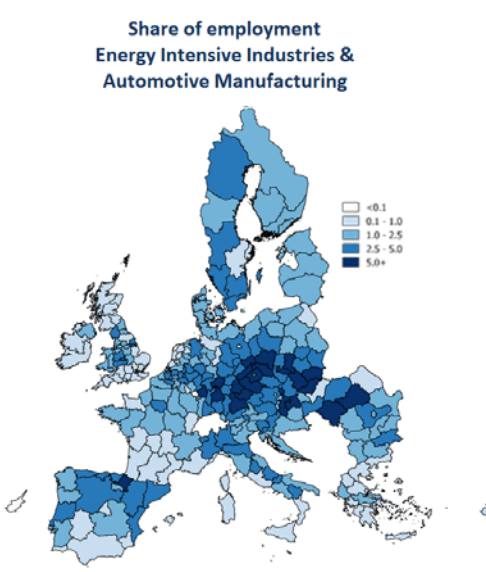


- CCS reduces emissions of any residual fossil fuels use or process emissions (power sector, industry)
- CCS combined with biomass generates negative emissions
- Storage in synthetic materials (e.g. in plastics)
- Use in synthetic fuels (e.g. HDV, shipping, aviation)

Just transition

- Overall economic impacts of the deep transformation are positive.
- The transition will spur growth in new sectors. 'Green jobs' already represent 4 million jobs in the EU.
- But some sectors will face challenges (e.g. coal mining and fuel extraction) and others will transform (e.g. energy-intensive industries and automotive sector).
- This will affect some regions more than others.
- Modernisation process has to be managed, no-one left behind, EU budget, employment and cohesion policies have a role
- Skill training is key





Next steps

- National Climate and Energy Plans under development. Together with stakeholders vision on 2050 will enrich the debate.
- Invitation to all the EU institutions to consider the EU vision.
- Sibiu summit should reflect on this, all relevant Council formations should hold policy debates in preparation.
- Societal debate in 2019 is key! In an open and inclusive manner with National Parliaments, business, non-governmental organisations, trade unions, cities and communities, as well as citizens and the youth.
- EU to adopt and submit an ambitious strategy by early 2020 to the UNFCCC as requested under the Paris Agreement.
- Show leadership and work with other parties to do the same.

#EU2050

https://ec.europa.eu/clima/news/commission-calls-climate-neutral-Europe-2050.en