

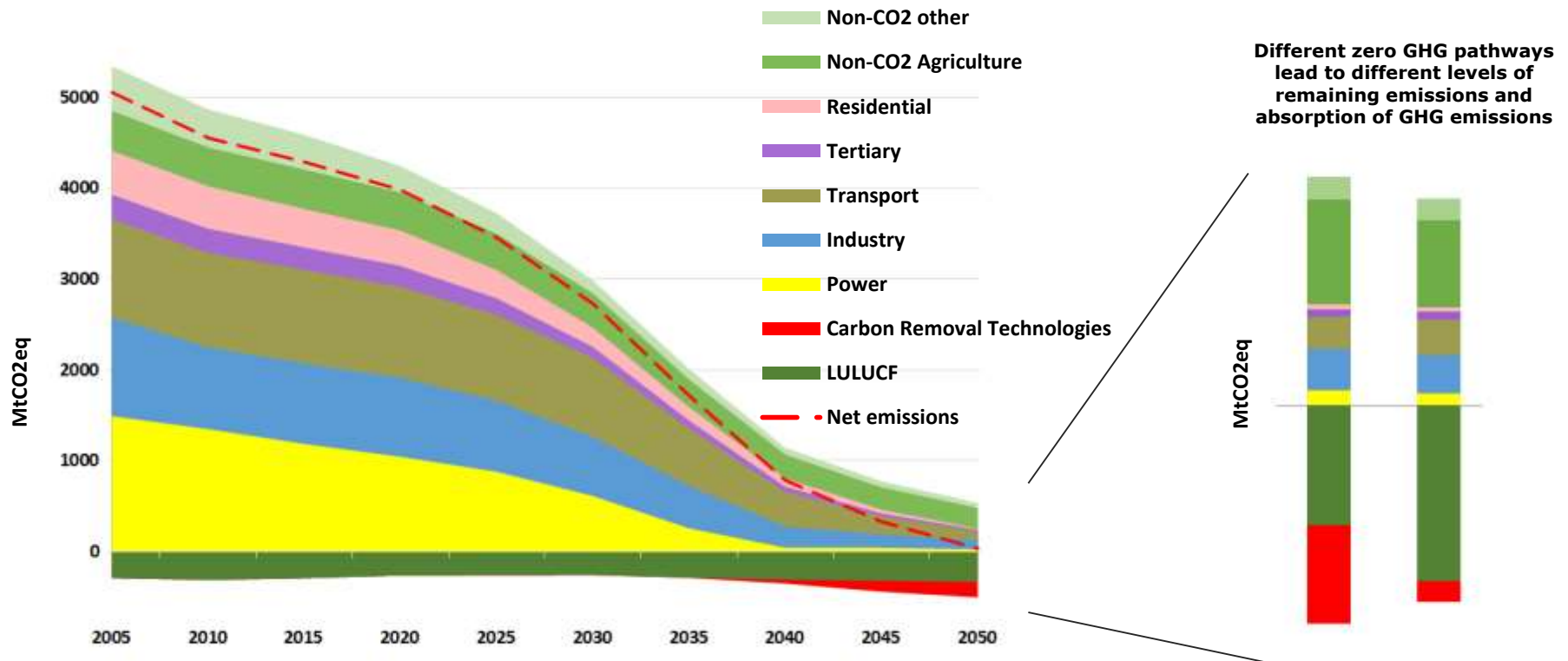
A Clean Planet for all

**A European strategic
long term vision for a
prosperous, modern,
competitive and
climate neutral
economy
by 2050**



Vision for a Clean Planet by 2050

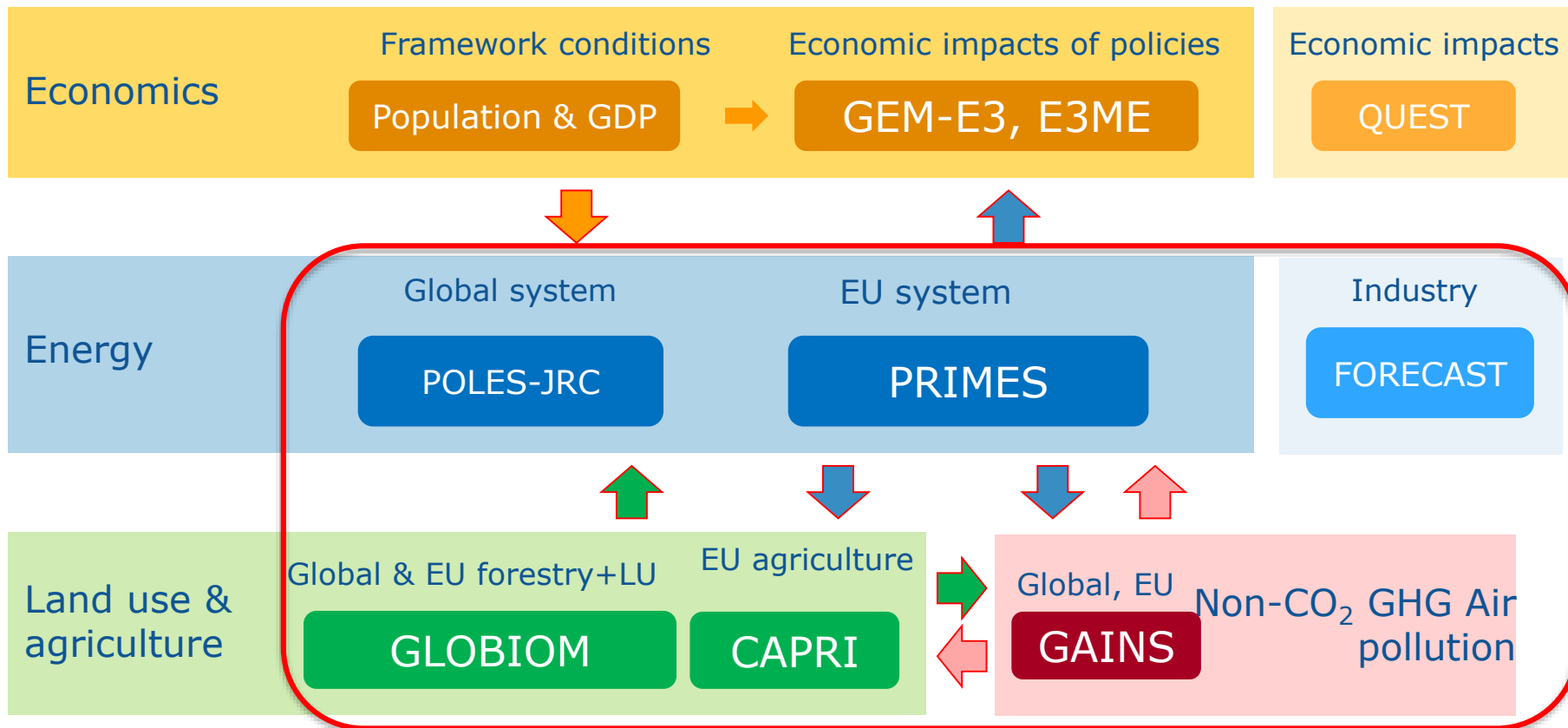
There are a number of pathways for achieving a climate neutral EU, challenging but feasible from a technological, economic, environmental and social perspectives.





European Commission

Macro-economics and employment in the EU LTS



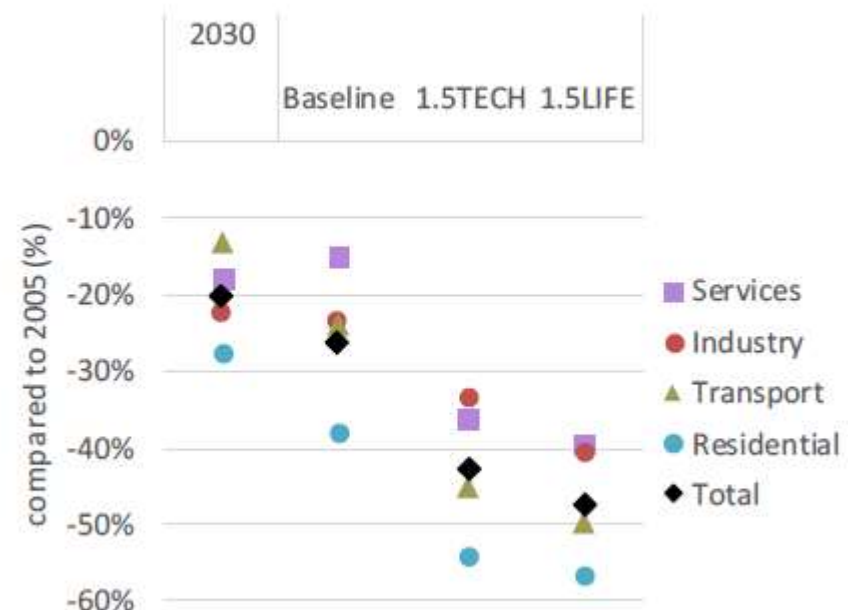
7 Building Blocks

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 1 - Energy efficiency

- Will play a central role
- Energy consumption to be reduced by as much as half in 2050 compared to 2005
- Buildings key, most of the housing stock of 2050 exists already today
- Requires adequate financial instruments and skilled workforce to sustain significantly higher renovation rates

Changes in sectoral final energy consumption
(% change vs 2005)

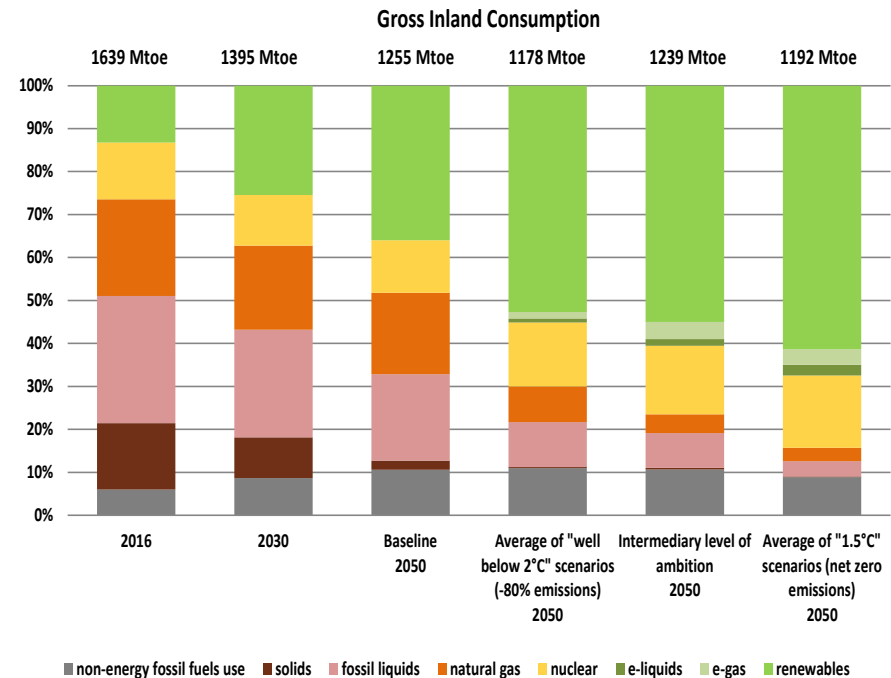


Note: "Services" includes here the agriculture sector.

Source: Eurostat (2005), PRIMES.

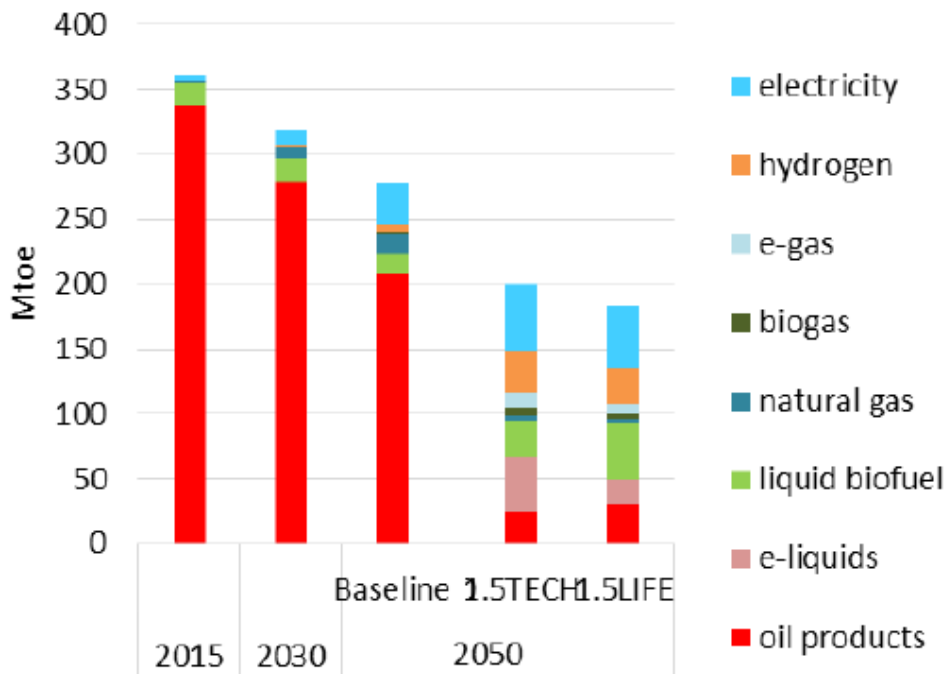
Building Block 2 - Deployment of renewables

- The share of electricity in final energy demand will at least double, more than 80% of it will be renewable.
- Renewable electricity allows production and deployment of carbon-free energy carriers such as hydrogen and e-fuels to decarbonize heating, transport and industry.
- Decentralized, smart and flexible power system.
- Reduction of energy import dependence, cumulative savings from reduced import bill of € 2-3 trillion over the period 2031-2050.



Building Block 3 - Clean, safe & connected mobility

Fuels consumed in the transport sector in 2050

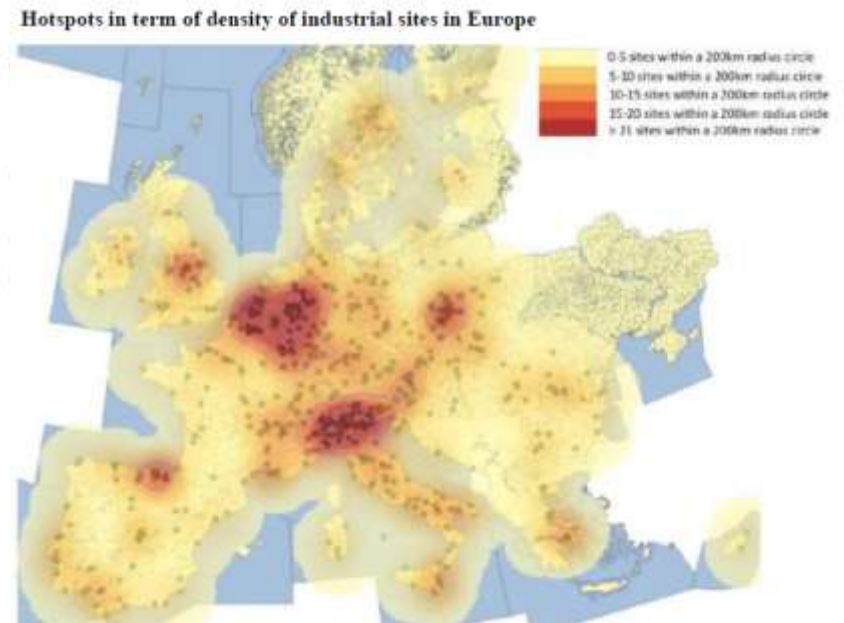


Source: PRIMES.

- Cheaper, efficient and sustainable batteries, highly efficient electric powertrains, connectivity and autonomous driving offers prospects to decarbonise road transport.
- No single silver bullet for all transport modes with alternative fuels having a role in heavy duty or long distance transport modes (advanced biofuels, carbon-free e-fuels, hydrogen).
- Digitalisation, data sharing and interoperable standards leading to a more efficient mobility system.
- Innovative mobility for urban areas and smart cities, underpinned by changing behaviour, leading to improvement of quality of life.

Building Block 4 - Competitive industry

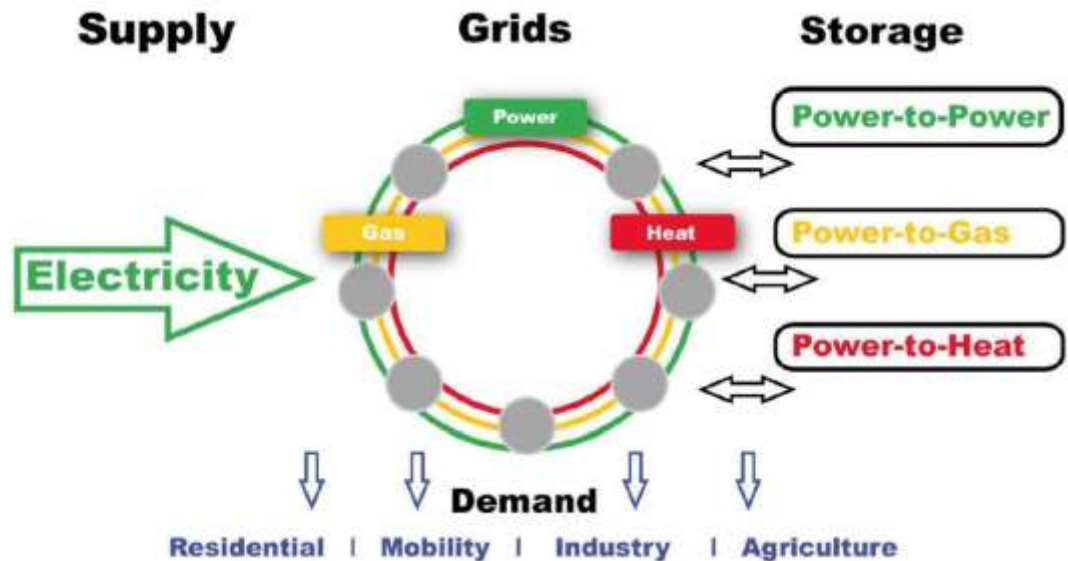
- Competitive resource-efficient industry and circular economy, increased recovery and recycling of raw materials (including critical materials), new materials and business concepts.
- Electrification, energy efficiency, hydrogen, biomass and renewable synthetic gas to reduce energy emissions in the production of industrial goods.
- Process-related reductions more difficult. Biomass and hydrogen can reduce certain emissions (steel production, some chemicals), others will require CO₂ 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.



Source: EPOS SPIRE Project.

Building Block 5 - Network infrastructure

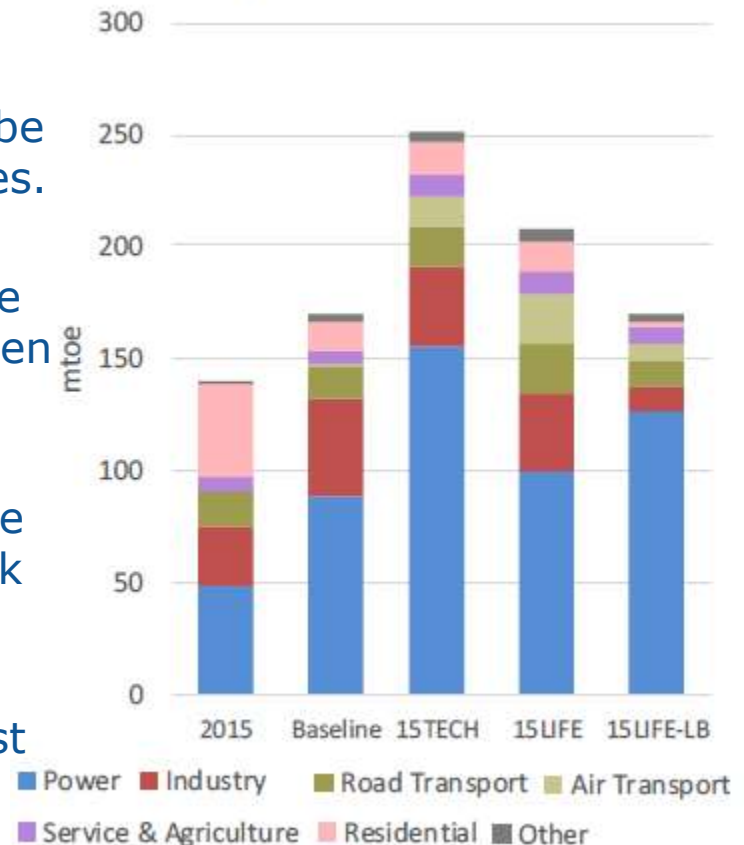
- Integrated and interconnected smart infrastructure.
- Completion of the Trans-European Transport and Energy Networks.
- Smart electricity and data/information grids, hydrogen pipelines, further sector integration.
- Smart charging or refuelling stations for transport. Increased synergy between transport and energy systems.
- Retrofitting existing infrastructure and assets and timely replacement of ageing infrastructure compatible with the deep decarbonisation objective.



Building Block 6 - 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).

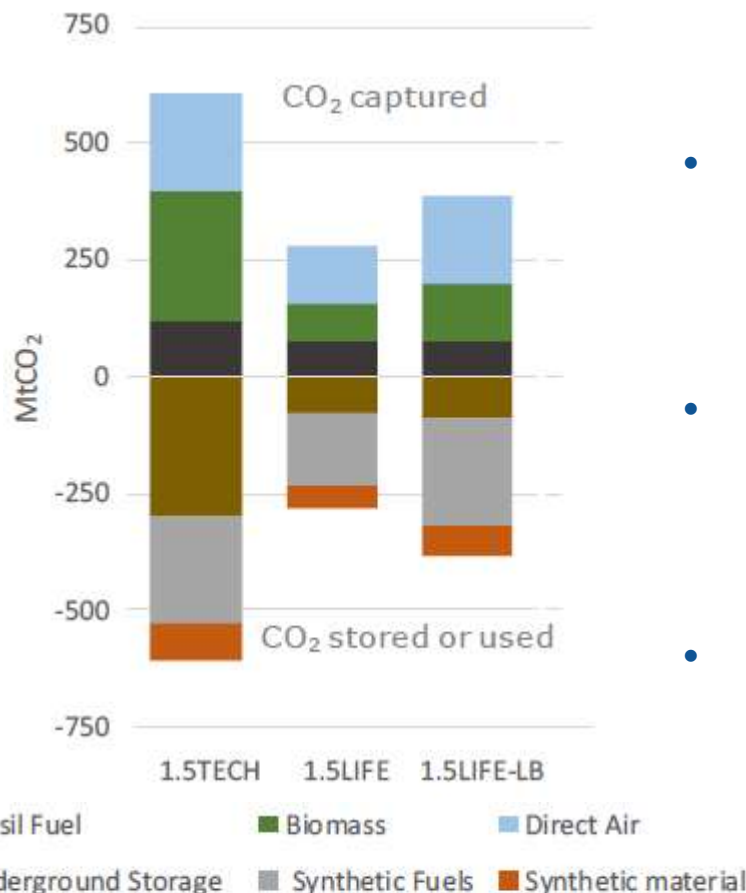
Use of bioenergy by sectors and by scenario in 2050



Source: PRIMES.

Building Block 7 - Carbon Capture and Storage

CO₂ capture and storage or reuse (2050)

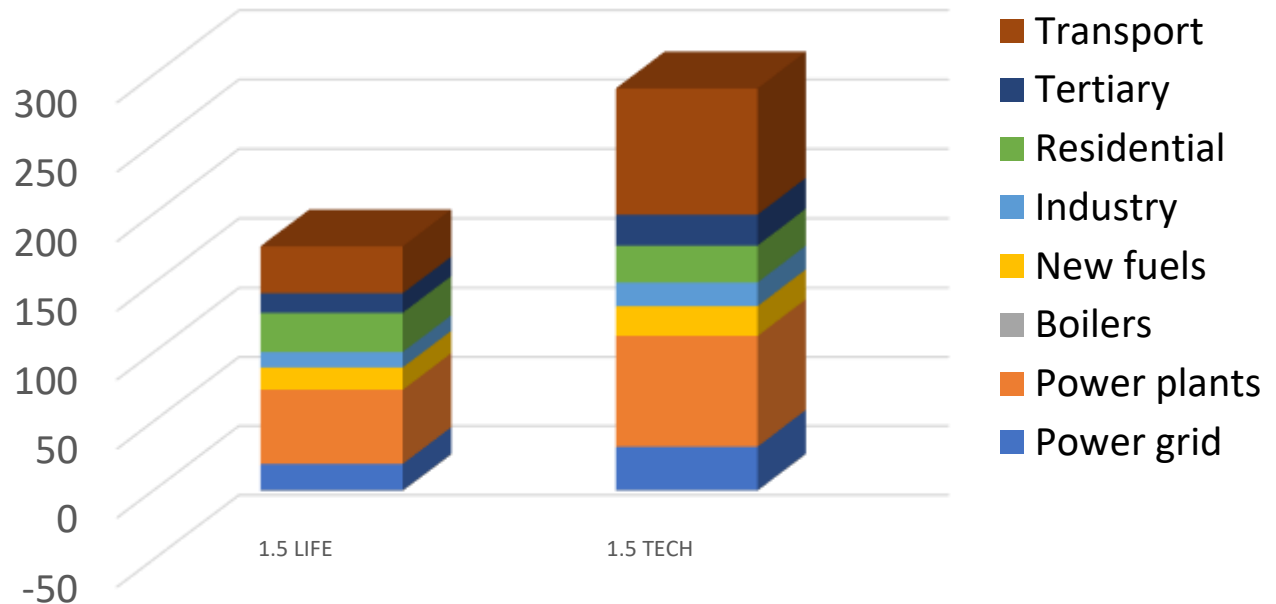


- Rapid deployment of renewable energy and new options to decarbonize industry reduced the need for CCS.
- But to achieve net-zero greenhouse gas emissions, CCS still required for certain energy-intensive industries and eventually to generate negative emissions.
- CCS today is facing barriers: lack of demonstration plant and proof of economic viability, regulatory barriers in some MS, public acceptance.
- An enabling framework is needed to spur research and innovation, scale up private investments, provide the right signals to the markets and reassure public opinion.

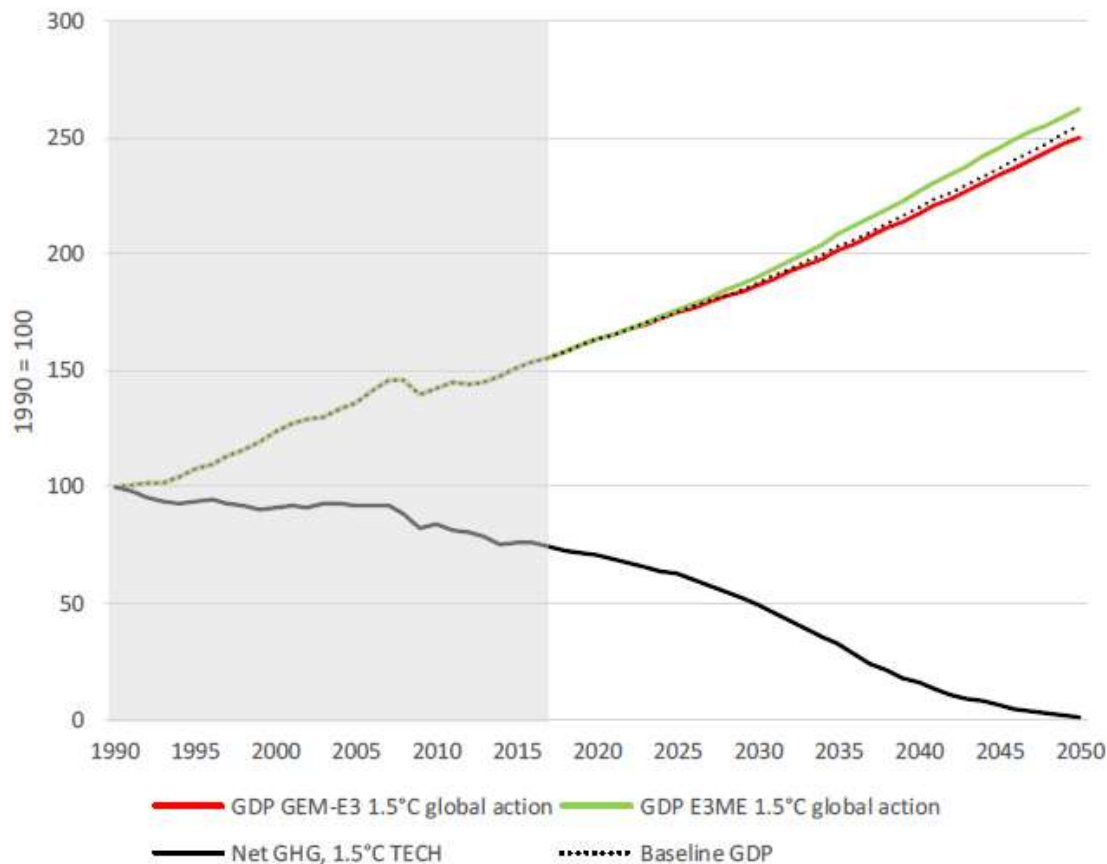
Stimulating clean investment into the EU economy

- Modernising 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

Incremental annual sectoral investment to reach a climate neutral Europe by 2050, [in bn €, average 2031-2050]

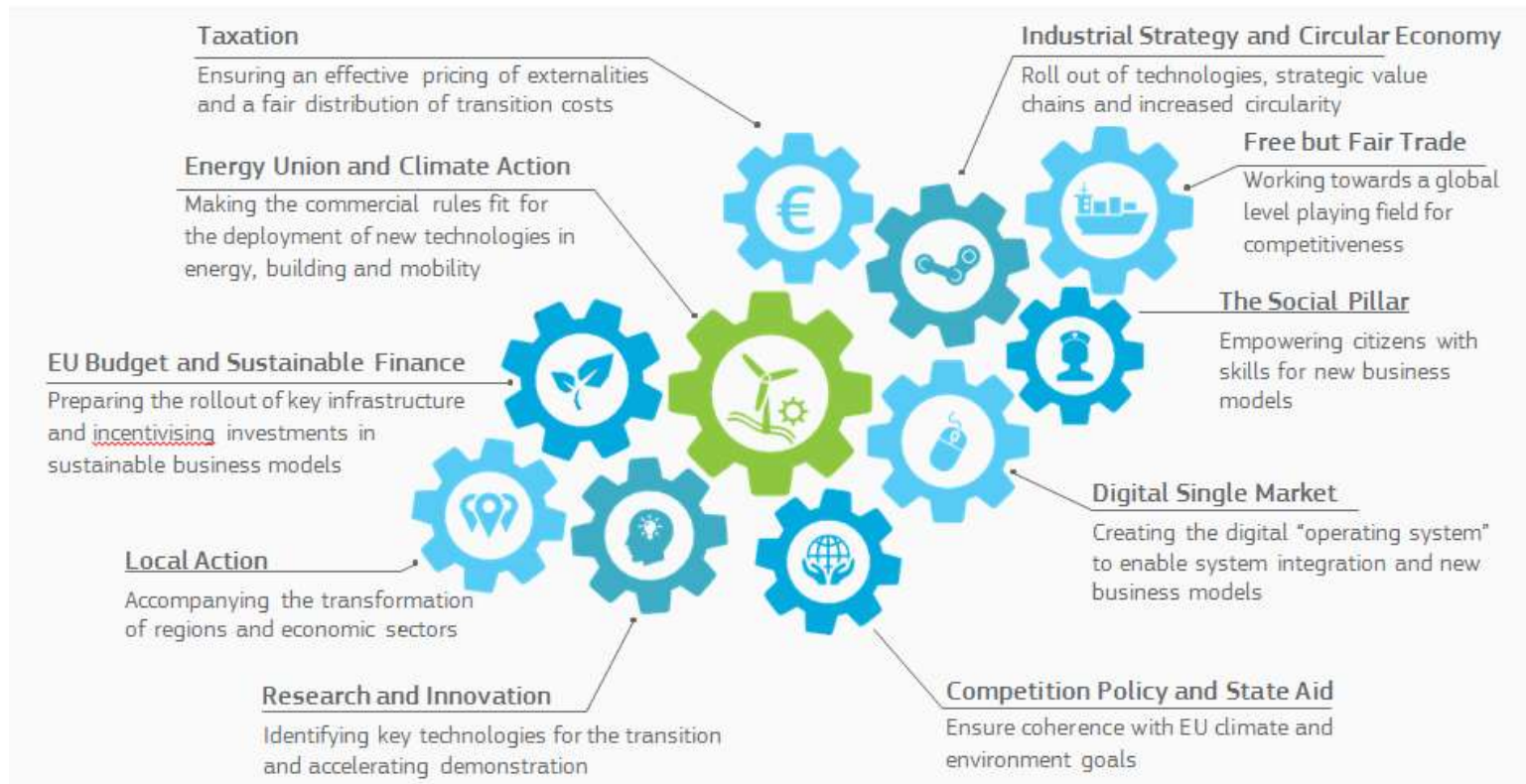


Modernisation with full decoupling of EU GDP growth and emissions by 2050



- Positive for growth and jobs, with GDP impact up to +2%
- Co-benefits: energy imports down, public health, etc.
- Caveat: This calculation does not take the damages caused by the adverse effects of climate change into account, nor the adaptation costs between baseline and 1.5° C as well as co-benefits of climate action.

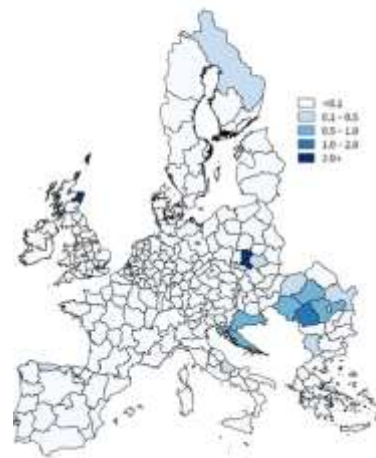
Enabling framework crucial to deliver transformation



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

Share of employment
fossil fuel extraction and mining



Share of employment
Energy Intensive Industries &
Automotive Manufacturing

