



A Clean Planet for all

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



Beijing, 14 January 2019

*Artur Runge-Metzger, Director
DG CLIMA, European Commission*

Climate challenges

- Global warming already reached at 1°C
- 18 of the warmest years in the last 2 decades and extreme heat waves in EU for 4 of the last 5 years
- Real impact on EU economy & environment
- IPCC warns about global eco-systems in danger already at 2°C
- Climate change undermines security and prosperity in the broadest sense

Arctic region

Temperature rise much larger than global average
Decrease in Arctic sea ice coverage
Decrease in Greenland ice sheet
Decrease in permafrost areas
Increasing risk of biodiversity loss
Some new opportunities for the exploitation of natural resources and for sea transportation
Risks to the livelihoods of indigenous peoples

Atlantic region

Increase in heavy precipitation events
Increase in river flow
Increasing risk of river and coastal flooding
Increasing damage risk from winter storms
Decrease in energy demand for heating
Increase in multiple climatic hazards

Mountain regions

Temperature rise larger than European average
Decrease in glacier extent and volume
Upward shift of plant and animal species
High risk of species extinctions
Increasing risk of forest pests
Increasing risk from rock falls and landslides
Changes in hydropower potential
Decrease in ski tourism

Coastal zones and regional seas

Sea level rise
Increase in sea surface temperatures
Increase in ocean acidity
Northward migration of marine species
Risks and some opportunities for fisheries
Changes in phytoplankton communities
Increasing number of marine dead zones
Increasing risk of water-borne diseases

Boreal region

Increase in heavy precipitation events
Decrease in snow, lake and river ice cover
Increase in precipitation and river flows
Increasing potential for forest growth and increasing risk of forest pests
Increasing damage risk from winter storms
Increase in crop yields
Decrease in energy demand for heating
Increase in hydropower potential
Increase in summer tourism

Continental region

Increase in heat extremes
Decrease in summer precipitation
Increasing risk of river floods
Increasing risk of forest fires
Decrease in economic value of forests
Increase in energy demand for cooling

Mediterranean region

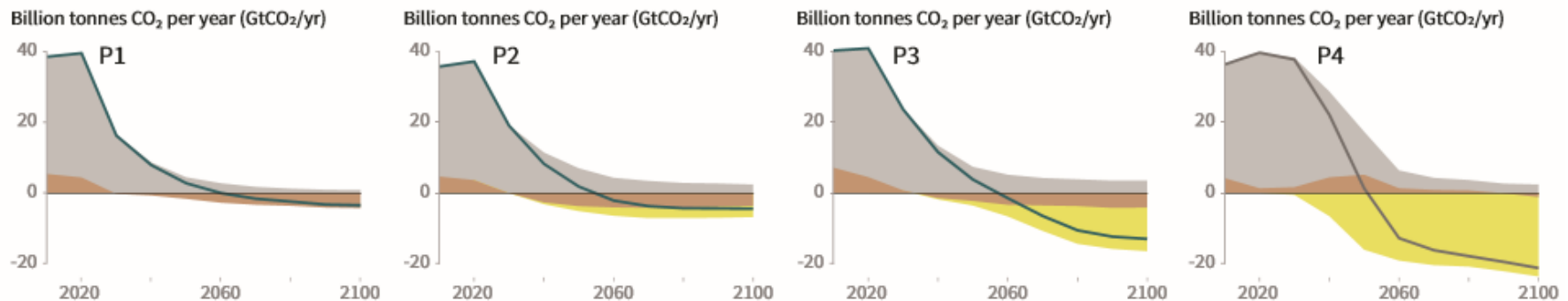
Large increase in heat extremes
Decrease in precipitation and river flow
Increasing risk of droughts
Increasing risk of biodiversity loss
Increasing risk of forest fires
Increased competition between different water users
Increasing water demand for agriculture
Decrease in crop yields
Increasing risks for livestock production
Increase in mortality from heat waves
Expansion of habitats for southern disease vectors
Decreasing potential for energy production
Increase in energy demand for cooling
Decrease in summer tourism and potential increase in other seasons
Increase in multiple climatic hazards
Most economic sectors negatively affected
High vulnerability to spillover effects of climate change from outside Europe



Vision 2050: IPCC pathways to global net zero CO₂ by 2050

Breakdown of contributions to global net CO₂ 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 downsized energy system enables rapid decarbonization of energy supply. Afforestation is the only CDR option considered; neither fossil fuels with CCS nor BECCS are used.

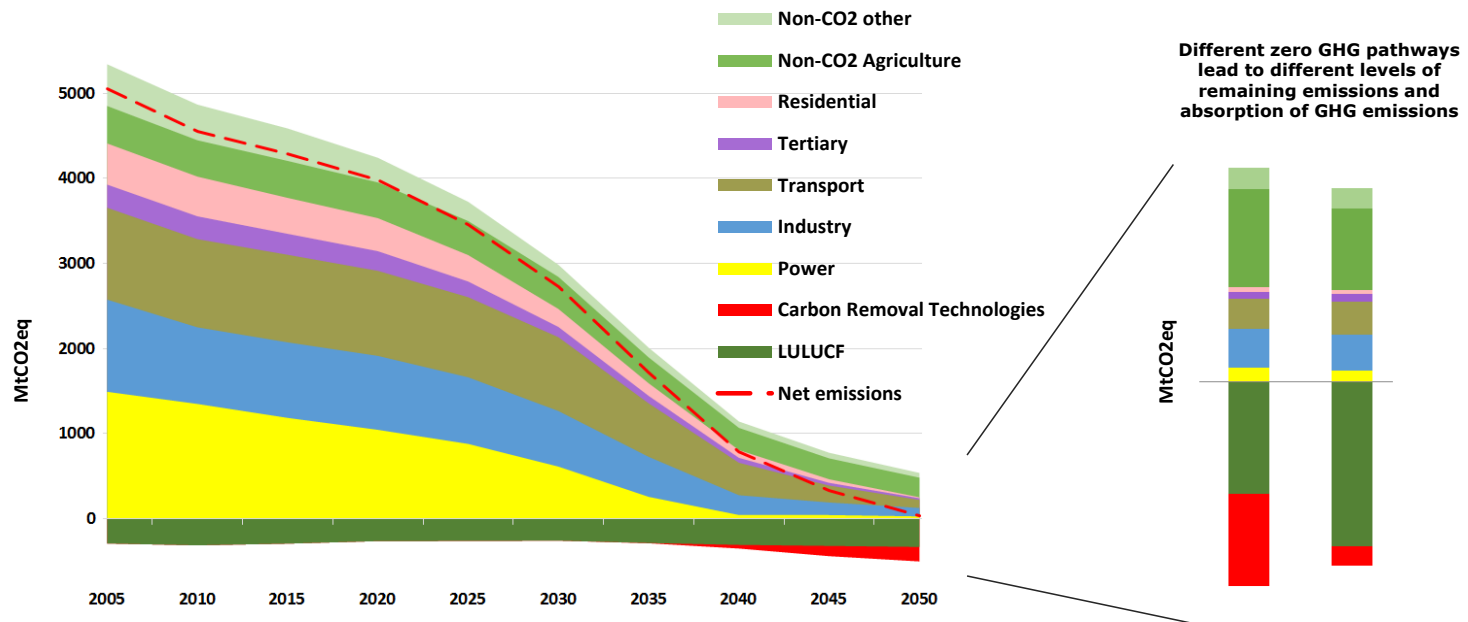
P2: A scenario with a broad focus on sustainability including energy intensity, human development, economic convergence and international cooperation, as well as shifts towards sustainable and healthy consumption patterns, low-carbon technology innovation, and well-managed land systems with limited societal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

Our Vision for a Clean Planet by 2050

- EU leads in clean energy transition and GHG emissions reduction. Ambitious 2030 targets. 60% reductions in 2050 with current policies – not in line with the Paris Agreement.
- Radical transformations necessary: central role of energy system, buildings, transport, industry, agriculture.
- There are a number of pathways for achieving a climate neutral EU (net zero GHG emissions) challenging but feasible from a technological, economic, environmental and social perspective.



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 1 Energy efficiency

Central role, energy consumption reduced by as much as half in 2050 compared to 2005

Buildings key, most of the housing stock of 2050 existing already today, higher renovation rates, fuel switching

Requires adequate financial instruments and skilled workforce, integrated policy approach and consumer engagement to sustain higher renovation rates

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**.

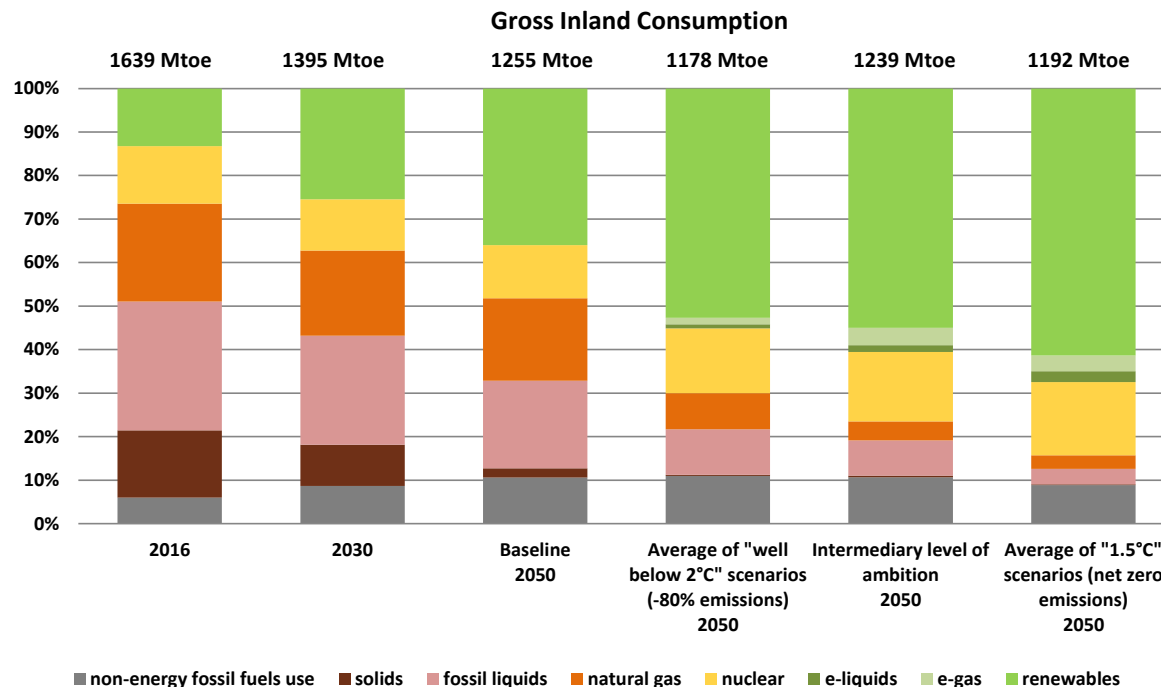
Renewable electricity allows production and deployment of **carbon-free energy carriers** such as hydrogen and e-fuels to decarbonize heating, transport and industry.

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 2 Deployment of renewables

Primary energy in 2050 largely coming from renewable sources



Building Block 3 Clean, safe & connected mobility

Carbon-free power, cheaper and efficient 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.

Building Block 5 Network infrastructure

Integrated and interconnected smart infrastructure, spurring **sectoral integration**.

Completion of the Trans-European Energy and Transport Networks.

Smart electricity and data/information grids, hydrogen pipelines.

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 Carbon Capture and Storage

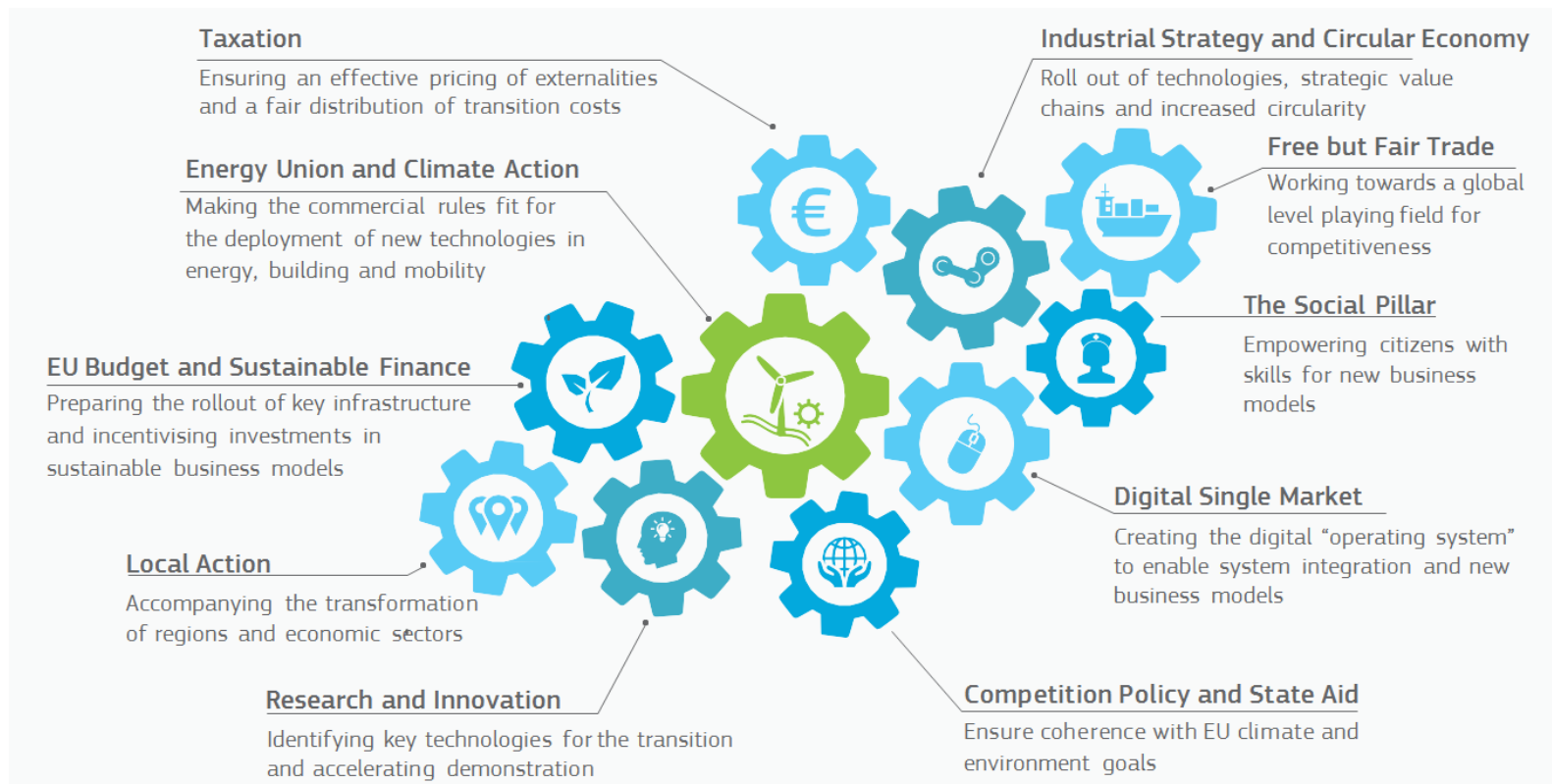
Rapid deployment of renewable energy and new options to decarbonize industry reduced the need for CCS.

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.

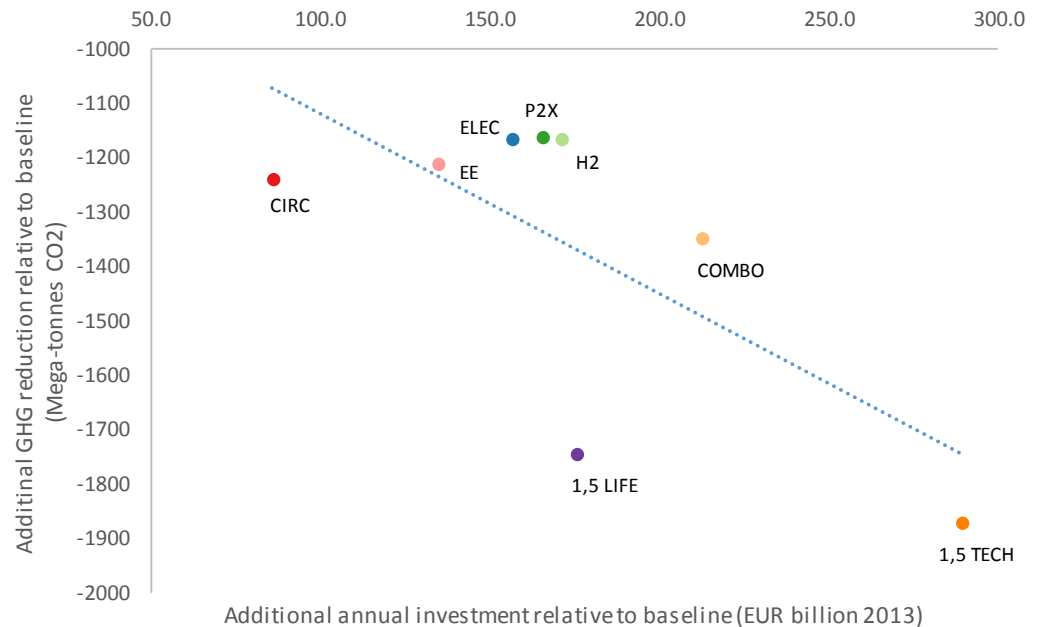
Coordinated action needed on demonstration and commercial facilities to overcome the obstacles

Enabling framework crucial to deliver transformation



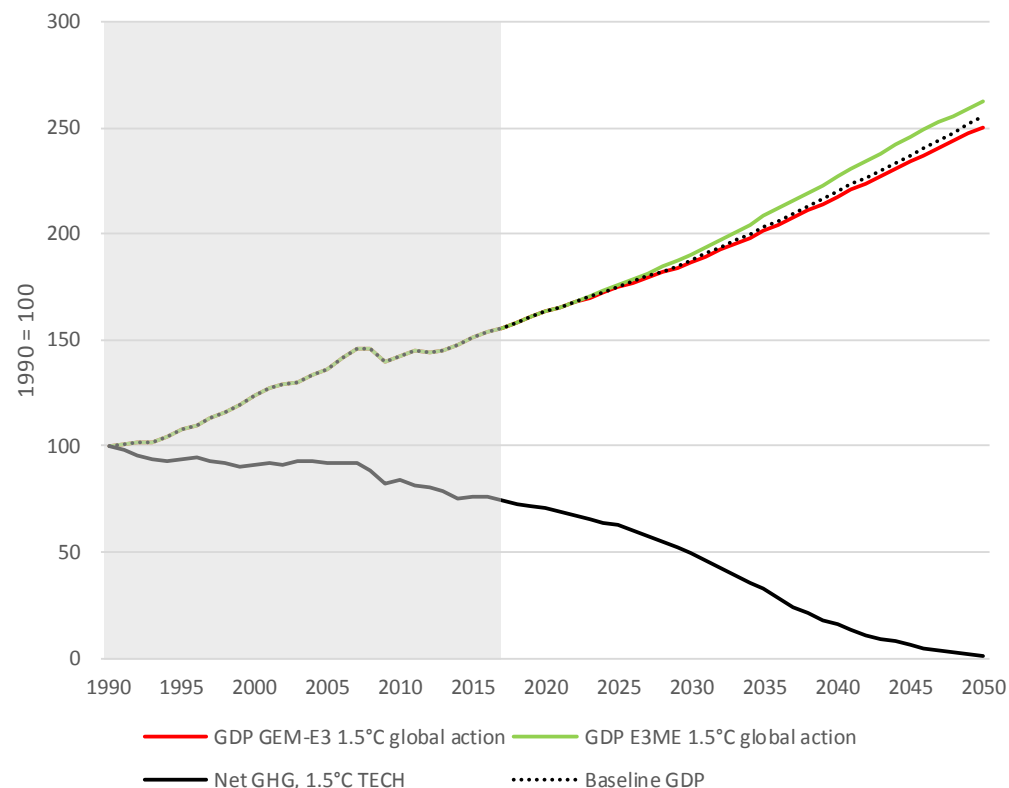
Increased Investment in the EU economy

- 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% (up to € 575 bn per annum) to achieve a net-zero greenhouse gas emissions economy
- Positive for growth and jobs, with GDP impacts moderate and some projections showing growth up to 2% in 2050
- Co-benefits: energy imports down, public health, etc.



Increased Investment in the EU economy

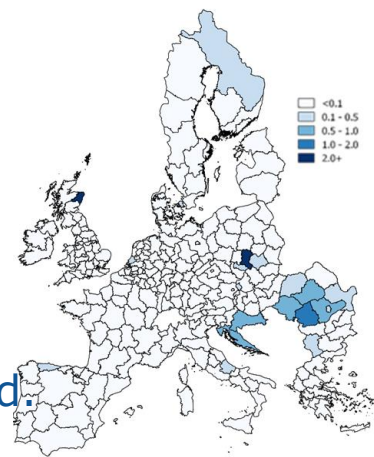
- Modernising and decarbonising the EU's economy will stimulate significant additional investment
- From 2% of EU GDP invested in the energy system today to 2.8% (up to € 575 bn per annum) to achieve a net-zero greenhouse gas emissions economy
- Positive for growth and jobs, with GDP impacts moderate and some projections showing growth up to 2% in 2050
- Co-benefits: energy imports down, public health, etc.



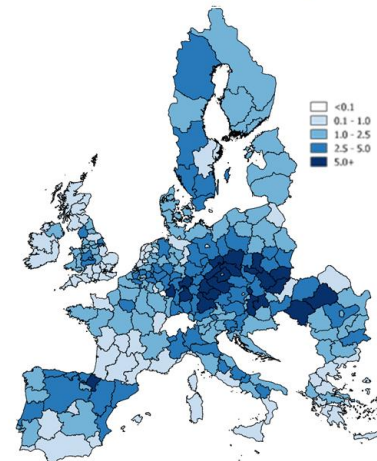
Just transition

- 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 often in lower income MS, more than others.
- Modernisation process has to be managed, no-one left behind, relevant policies must be deployed to the fullest. EU budget, employment and cohesion policies have a role.
- E.g. Platform and pilots for coal and carbon-intensive regions to be reinforced
- Skill training is key

Share of employment
fossil fuel extraction and mining



Share of employment
Energy Intensive Industries &
Automotive Manufacturing



Global and local dimensions

- **Role for energy and climate diplomacy** but also other political dialogues, security and development cooperation to prepare for geopolitical and geo-economic shifts.
- **Trade policy to promote uptake new technologies**, ensure right to fair access to all markets and critical raw materials. Role of EU's standards on products improving product efficiency on global markets.
- **Citizens and consumers** to embrace change and get engaged. Personal lifestyle choices can make a real difference, while improving quality of life.
- **Cities** are already the laboratories for transformative and sustainable solutions. Better spatial planning are drivers to improving living conditions and increasing energy and CO2 efficiency.
- Improved **planning and public infrastructure** to withstand more extreme weather events will be imperative.

Public Consultation to prepare Commission proposal

- More than 2800 responses received, individuals around 75% of contributions, more than 150 position papers received.
- Organised stakeholders:
 - >50% come from business and sector associations
 - >20% from NGOs
 - 13 Member States
- Key Messages:
 - Just over half respondents considered that the EU should achieve a balance between emissions and removals in the EU by 2050.
 - Majority (60%) expects low-carbon transition to modernise and reinforce the EU's competitiveness. Another third expects the same in case also non-EU countries engage in the transition.
 - Overall, the low carbon transition is considered more of an opportunity than a challenge with many considering it to be both, especially for what concerns energy and mobility.

Public Consultation to prepare Commission proposal

- Key Messages:
 - In the transition to clean energy, **renewables** and **energy efficiency** are judged to play the most important role
 - A majority of respondents expresses a desire to receive more information on the **impact of the consumer choices**.
 - Almost half of the respondents are **confident** that their sector could significantly or entirely reduce emissions by 2050.
 - A vast majority of stakeholders consider **circular economy**, **digitalisation** and **shared economy** to be the main enablers of emission reductions.
 - While most individuals prefer intensive **afforestation** to best capture and store carbon, specific sector organisations look at **CCS** as well.



Next steps

- National Energy and Climate Plans under development for 2030. Together with stakeholders vision on 2050 will enrich the debate.
- Invitation to all the EU institutions to consider the EU vision.
- Societal debate in 2019 will be key, with national parliaments, business, non-governmental organisations, trade unions, cities and communities, as well as citizens and the youth.
- Ambition is for the 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.