

A Clean Planet for all

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



Political context

- Parties of the Paris Agreement to present long-term low greenhouse gas emission development strategies by 2020
- In October 2017 the European Parliament also invited the Commission "*to prepare by COP24 a mid-century zero emissions strategy for the EU*"
- In March 2018, European Council invited the Commission "*to present by the first quarter of 2019 a proposal for a Strategy for long-term EU greenhouse gas emissions reduction*".
- Regulation on Governance of the Energy Union calls on the Commission to present an EU long-term strategy by April 2019, including pathways that achieve net zero GHG emissions by 2050 and negative emissions thereafter

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

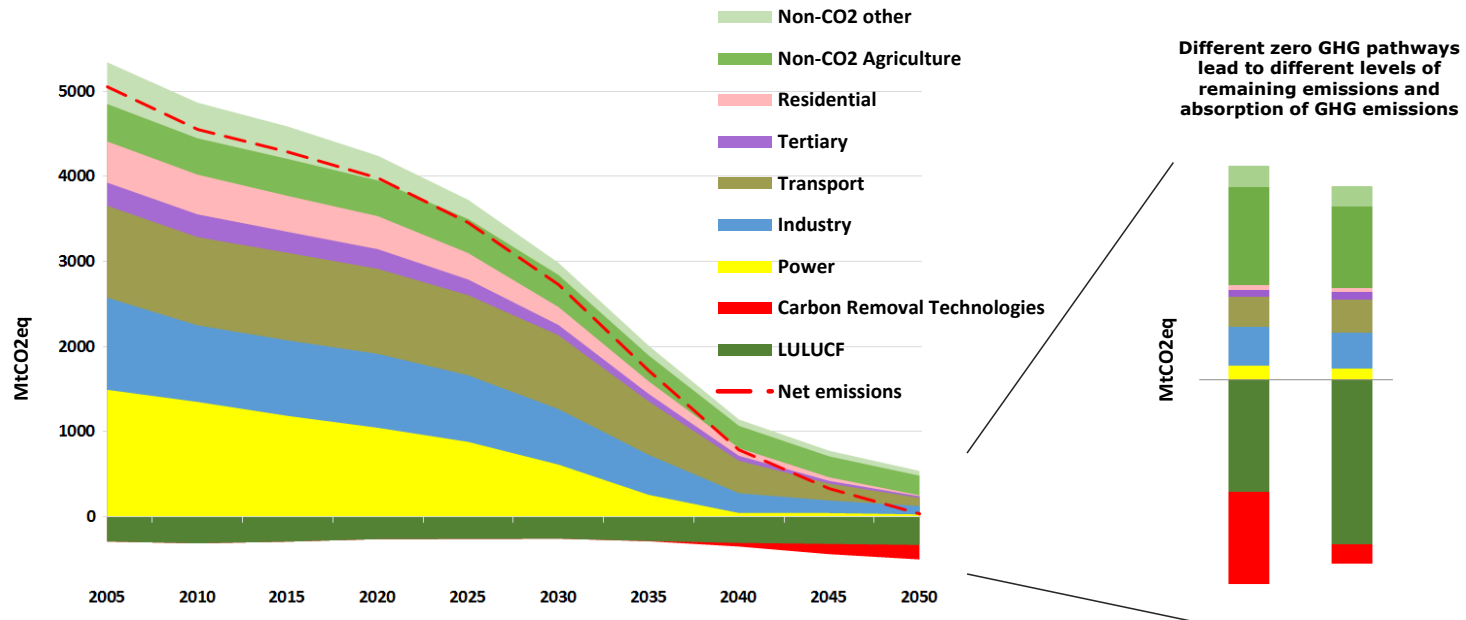


Our Vision for a Clean Planet by 2050

- The Paris Agreement objective is to keep temperature increase to well below 2°C and to pursue efforts to limit it to 1.5°C
- But the IPCC report confirms that limiting climate change to 1.5°C has to be pursued to avoid these worst impacts
- For the EU to lead the world in climate action, it means achieving net-zero greenhouse gas emissions by 2050
- The EU with this vision can inform others how we can deliver collectively a clean planet.
- The Long Term Strategy shows transforming our economy is possible and beneficial.
- It sets the direction of travel. No intention to revise the 2030 targets.

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, 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	<ul style="list-style-type: none"> Higher energy efficiency post 2030 Deployment of sustainable, advanced biofuels Moderate circular economy measures Digitilisation 				<ul style="list-style-type: none"> 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			<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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

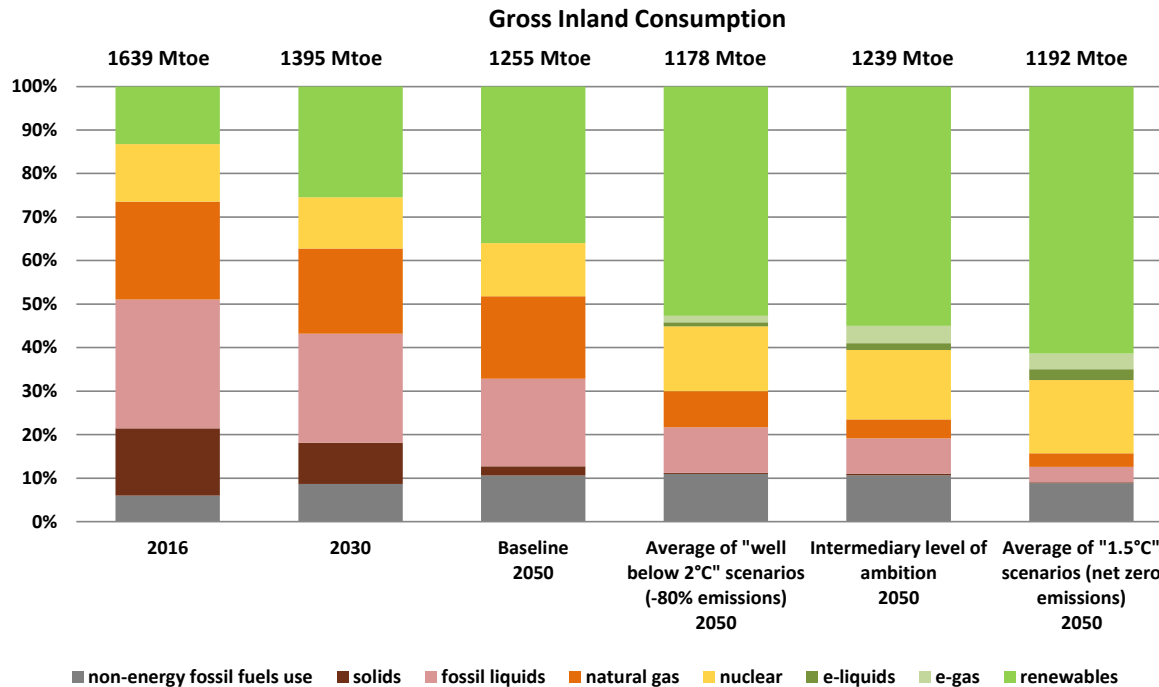
Central role, energy consumption reduced by as much as half in 2050 compared to 2005

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

Primary energy in 2050 largely coming from renewable sources



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 Block3 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

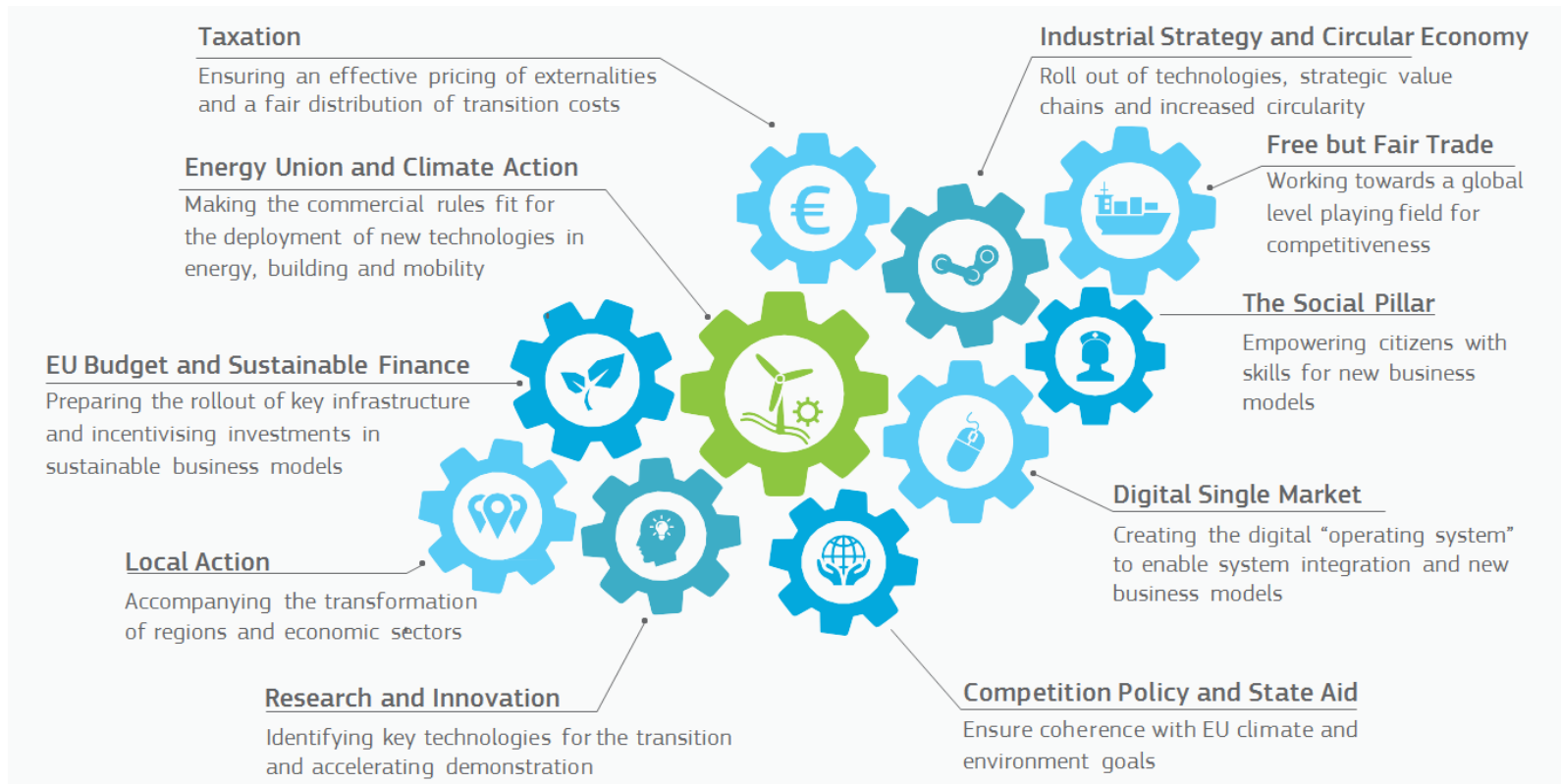
Rapid deployment of renewable energy and new options to decarbonize industry reduced the need for CCS.

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.

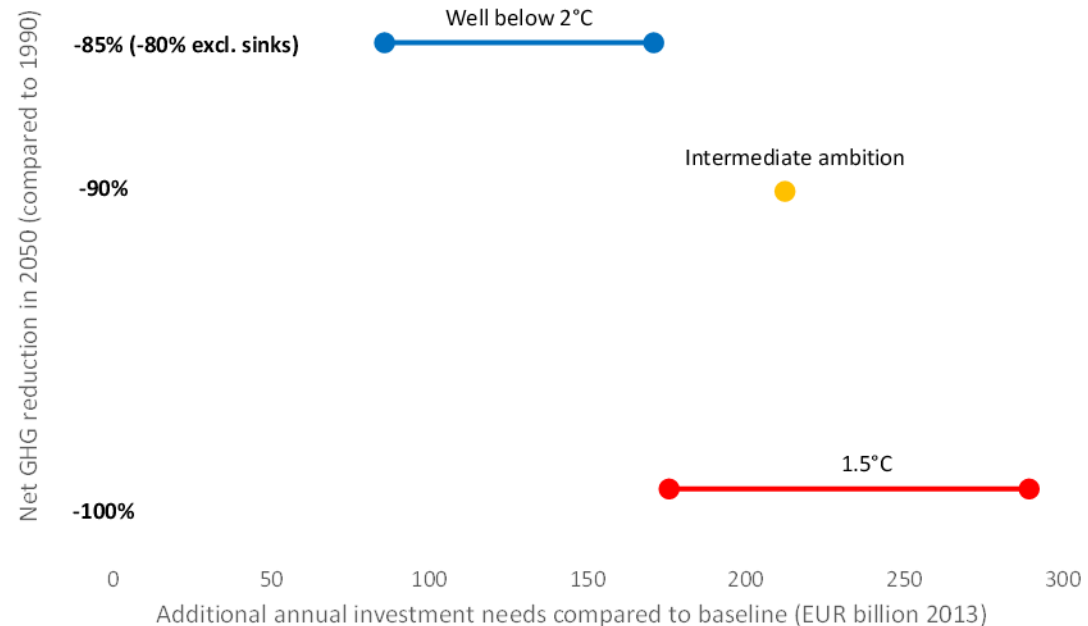
Coordinated action needed on demonstration and commercial facilities to overcome the obstacles

Enabling framework crucial to deliver transformation



Increased Investment in the EU economy

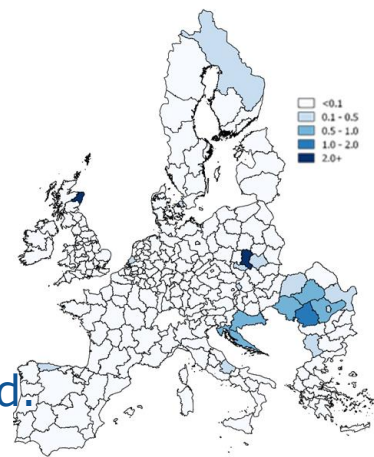
- Modernising and decarbonising the EU's economy will stimulate significant additional investment
- From 2% of EU GDP invested in the energy system today to 2.8% (up to € 575 bn per annum) to achieve a net-zero greenhouse gas emissions economy
- Positive for growth and jobs, with GDP higher by up to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



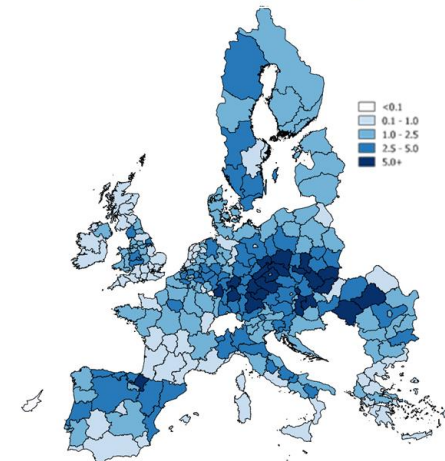
Just transition

- 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 dimension

- Open markets, a globalised world and multilateralism are a precondition to benefit from this transition domestically and globally.
- The EU's long-term strategy cannot be pursued in isolation. Role of energy and climate diplomacy but also other political dialogues, security and development cooperation.
- EU's position will change, prepare for geopolitical and geo-economic shifts with new and changed dependencies.
- Trade policy to promote uptake new technologies while defending our right to fair access to markets and critical raw materials.
- EU must take all necessary measures to safeguard and boost its own prospects for economic and social development.
- As the world's largest single market, EU's standards on products affect global markets, putting European companies at the forefront.

Role of citizens and local authorities

- Moving towards a net-zero greenhouse gas economy can only be successful with citizens that embrace change, get engaged and experience it as beneficial for their lives and that of their children.
 - Increasing willingness of consumers to engage in sustainable activities. Personal lifestyle choices can make a real difference, while improving quality of life.
 - Cities are already the laboratories for transformative and sustainable solutions with 75% of our population living in urban areas. City refurbishment and better spatial planning are drivers to renovate houses, improving living conditions, reducing travel time.
 - Improved planning and public infrastructure to withstand more extreme weather events will be imperative.
 - The EU should capitalise on and expand the role of regions, cities and towns.
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Overriding priorities for action

- Accelerate the clean energy transition
- Strengthen the central role of citizens and consumers
- Roll out carbon-free, connected and automated mobility
- Boost industrial competitiveness, ensure competitive markets
- Promote a sustainable bio-economy, safeguard our natural resources
- Strengthen infrastructure and make it climate proof
- Accelerate R&I and entrepreneurship on zero-carbon solutions
- Promote sustainable finance and investment
- Invest in human capital, education and training skills
- Align growth-enhancing policies (competition, labour, skills, cohesion, taxation, etc.) with energy and climate policies
- Fair transition, coordinate with Member States and regions
- Continue international collaboration, bring all on board, share knowledge



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.
- EU leaders to reflect on this in Sibiu summit, 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.