

10. December 2018

Fact Sheet: EU 2050 strategic vision “A Clean Planet for All”

Brief Summary of the European Commission proposal

On 28 November, 2018, the European Commission (EC) published a set of documents presenting its analysis of options for long-term climate policy in the European Union (EU).¹ These provide the basis for discussion among the EU institutions to deliver Europe’s formal long-term climate strategy to the United Nations by 2020, as per the Paris Agreement. The 2050 vision is also intended to become a topic at the “Future of Europe” summit in May 2019. In the documents, the EC lays out a vision for a transition to a climate neutral economy by 2050 - meaning Europe’s net greenhouse gas emissions (GHGs) will be zero in that year. The vision states that this is technologically possible, and that it can be done in a socially fair and cost-efficient manner. While the EC points out the challenges involved, it also highlights opportunities this transformation offers to Europe’s citizens and economy, including increased overall economic growth due to higher investments.

Table 1: Essential elements and messages of the EC’s EU2050 strategy proposal

Topic area	Description
Long-term goal (ambition)	Net-zero GHG emissions by 2050 (climate neutrality) as an EU contribution to limiting global temperature increase to 1.5 C over pre-industrial levels, citing recent science and the Paris Agreement.
Scenarios	Eight different scenarios, five of which achieve 80% reduction (85% with sinks included), each with a different technology focus. Scenario 6 is a combination of the first four scenarios and reaches 90% reduction (incl. sinks). Building on this hybrid, two additional scenarios (7 and 8) use different options to reach net zero (7: natural carbon sinks and bio-energy carbon capture and storage (BECCS), 8: circular economy, lifestyle changes and more natural carbon sinks).
Joint action areas	Strategic priorities: 1. Energy efficiency (incl. net zero buildings), 2. Renewable energy, 3. Mobility, 4. Industry and circular economy, 5. Network infrastructure and inter-connections, 6. Bioeconomy and carbon sinks, 7. Carbon capture and storage technology
Investments	An extra 0.8% of the EU’s GDP (2.8% instead of 2%) would need to be invested into the energy system and infrastructure annually (= around € 175 to 290 billion a year) - this would lead to 2% additional GDP in 2050.
Just Transition	A socially fair transition is a recurring theme in the EU vision. It anticipates growth of high quality green jobs locally, but also sees challenges for regions with jobs dependent on fossil fuel exploration or energy-intensive industries. Challenges should be addressed through proactive employment and social policies (including EU cohesion policy).
Milestones 2030, 2040	For 2030, the analysis acknowledges overachievement of current target of -40% (reference scenario shows -45%), but does not propose changes or the launch of new policies. No 2040 milestone.
Process & next steps	EC received >2800 responses and >100 position papers in a public consultation. The Commission invites Member States and the European Parliament as well as all stakeholders to provide feedback and will tour national capitals.

The new EU climate strategy will replace the 2011 “Roadmap to a low-carbon economy by 2050”². A revision of the underlying analysis had become necessary following the adoption of the Paris Agreement and further reductions in the cost of renewable energy and storage technologies, as well as the Special Report “Global Warming of 1.5C” by the Intergovernmental Panel on Climate Change (IPCC). The March 2018 European Council had requested that the EC deliver a proposal by the first quarter of 2019. The requirement to produce long-term strategies (for Member States and the Union) has since been enshrined in EU law in the “Regulation for the Governance of the Energy Union”, asking for a draft strategy by the EC by April 1, 2019. For the EC, the November 2018 documents comply with that requirement.

1 Essential elements of the 2050 vision

1.1 The Commission’s net-zero 2050 vision – cross-cutting issues

The EC’s vision document sets a clear long-term goal of transitioning to an economy with net-zero GHG emissions by 2050. This transition should be socially fair and cost-effective. Citing the IPCC’s most recent Special Report, the vision document points out the magnitude of likely climate change impacts and the urgency to reduce GHG emissions. It does not reference carbon budgets in the main document. Using a series of different scenarios to analyse possible pathways for emissions reductions in Europe, the analysis leads to proposed joint action in seven strategic priority areas. The communication document lays out insights on several cross-cutting themes - including the need for additional innovation, the role of citizens and local communities, and the EU’s role in global climate change diplomacy. It puts an emphasis on how to mobilize the necessary investments and on the economic aspects of the transformation.

Investment: The strategic vision suggests increasing investment in Europe’s energy system and infrastructure from the current 2% of GDP per annum to 2.8% of GDP to reach net zero, which is an additional € 175 to 290 billion a year (for the 80% reduction scenarios only around half of that amount is needed; circular economy and lifestyle changes reduce cost). To achieve this, private sector financial flows must be directed towards low carbon investments. Credible, long-term political signals can support this, including specific instruments like taxation as well as involvement of stakeholders in transparent planning processes and targeted public spending (including EU funds).

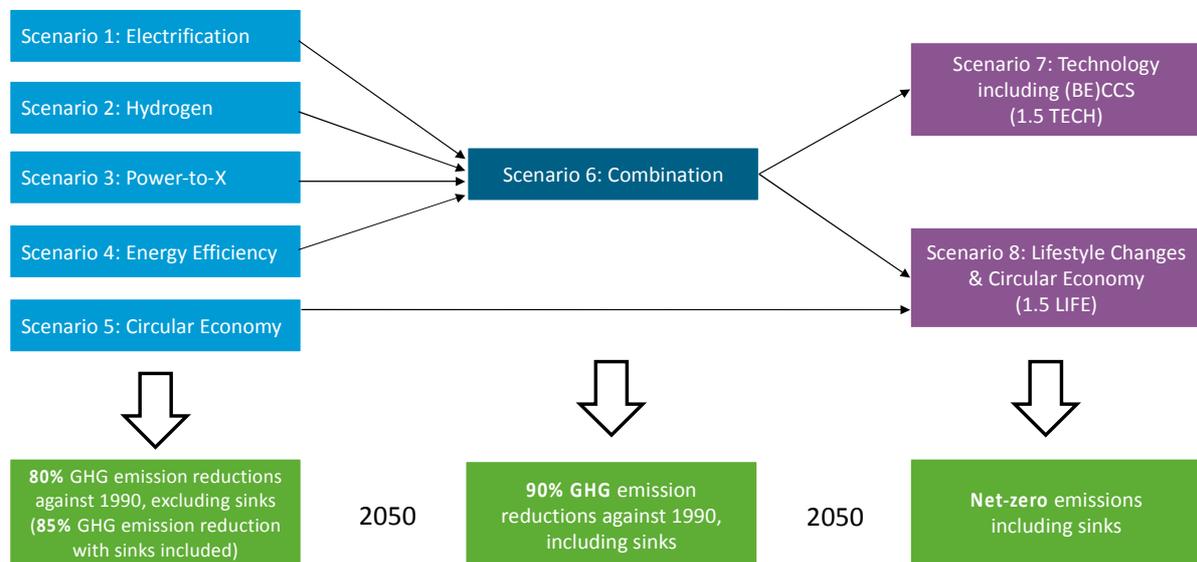
Economic and social aspects: The EC’s analysis reveals that transformation to a net-zero GHG emissions economy will have a positive impact on the EU’s GDP, even without taking into account avoided costs of climate change related damages resulting from inaction, which are not quantified. The reduction in energy imports also has a significant positive economic effect. While the modernisation will create jobs in many places, it requires changes in skills for some sectors and regions - this could present a challenge, especially for lower income Member States. Therefore, proactive social and economic policies – in coordination between the EU and national policies - must ensure that the transformation takes place in a socially fair manner.

A.1.1 Main scenarios used in the Commission analysis

The analysis of 2050 pathways presented in the EC documents is based on a reference scenario that includes only existing policies and targets for 2030 (including the EU ETS). It results in 45% emission reductions by 2030 and 60% by 2050. Several ways of going beyond this reference scenario were formulated and modelled, each involving a different set of technology options. The analysis finds that only a combination of these different *pathways* can achieve net-zero

emissions. Figure 1 below shows the main technology focus in the connections between the scenarios (see also Figure 3 in the Annex).

Figure 1 Overview over the scenarios in the EC 's 2050 vision



Source: visualization by Ecologic Institute, drawing on the EC In-Depth Analysis document

The main pathways are as follows:

The **first five main scenarios** each follow a specific technological focus in the industry, buildings and transport sectors - all are based on total decarbonisation of the power sector. **Scenario 1:** Electrification; **Scenario 2:** Hydrogen; **Scenario 3:** Power-to-X (electric fuels); **Scenario 4:** Energy Efficiency; **Scenario 5:** Circular Economy. Each of scenarios 1-5 only achieve around 80% emission reductions compared to 1990 levels (85% with sinks included).

Scenario 6 combines the main technology options of the first four scenarios - not to their maximum capacity, but on the basis of cost-efficiency. This combination would lead to about 90% GHG reductions (incl. sinks).

For **Scenario 7**, CCS technologies (partially combined with bioenergy) are applied on top of the developments in Scenario 6, paired with an expansion of natural carbon sinks. **Scenario 8** is based on a version of Scenario 6, but with a stronger circular economy element (Scenario 5) across all sectors. Furthermore, this scenario adds the impacts of lifestyle changes to the emission reductions and an even more substantial enhancement of natural carbon sinks. These two scenarios (7+8) reach net-zero emissions by 2050.

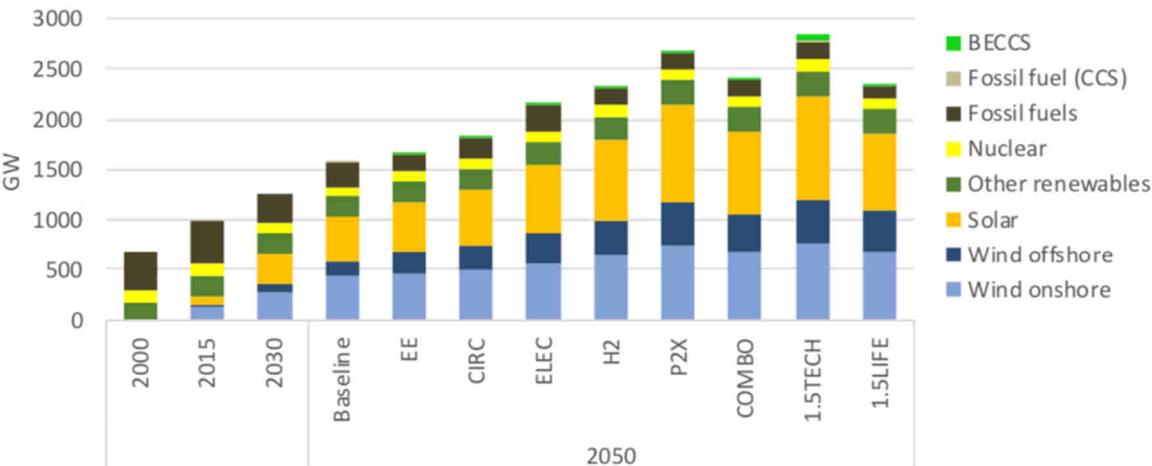
The scenario results share a set of common developments:

Power sector: In all scenarios, Europe's power sector is decarbonised by 2050 with a high share of renewables (81-85%) complemented by 12-15% from nuclear energy. Around 20GW of coal capacity remains in all scenarios (current capacity is ca. 160 GW³) except for Scenario 7, which has close to twice that amount. See also Figure 2 below.

Other energy system results: After 2030, energy efficiency must increase significantly, especially in the transport system. All scenarios involve biofuel use. Import dependency for energy would decrease to 20% in 2050 leading to €2-3 trillion cumulated cost savings.

Digitalisation: The deployment of smart technological solutions, of networks and an increase in inter-connections are important across all scenarios and all sectors.

Figure 2 EC visual on power generation capacity in the 8 scenarios (Figure 24 IDA)



Source: Eurostat (2000, 2015), PRIMES.

Source: EC IDA, page 77

A.1.2 Strategic priority areas for joint action

Building the analysis of pathways and incorporating the main challenges, the EC puts forward seven strategic priority areas for joint action to accomplish decarbonisation.

1. Maximise the benefits of energy efficiency, including zero emission buildings: The EU should aim to reach the full potential of energy efficiency - especially in the buildings sector, which currently accounts for 40% of energy demand. Digital smart solutions, labels, and standards can help achieve this goal, which also requires more frequent modernisation, more efficient appliances, sustainable renewable heating, and consumer engagement.

2. Maximise deployment of renewables and use of electricity to fully decarbonise Europe’s energy supply: A significant increase in renewable energy is necessary in all scenarios calculated by the European Commission. An electricity supply that is fully decarbonised by 2050 must come to approximately 80% from renewable generation (as per the EC’s calculations). Electrification is an important decarbonisation vector for key economic sectors in all scenarios. An increasing share of the EU’s additional renewable energy should come from offshore wind.

3. Clean, safe and connected mobility. The EU’s transport sector must transition to cleaner, safer and more connected technologies and systems. Higher electrification rates are needed to decarbonise road transport, but other technology options are also needed. Specifically, smart system technologies (incl. automation) could reduce traffic and induce behavioural change. Rail transport and aviation must shift to low-emission fuels like hydrogen and biofuels. Cities and regional infrastructure developments are key to the transition, which holds many ancillary benefits (reduced pollution and noise).

4. A competitive EU industry and the circular economy: The EU’s industries should increase their resource efficiency and recycling, becoming part of a circular economy. Key subsectors like steel and cement could adopt new technologies, such as biomass- or hydrogen-based production, to lower net emissions. New materials and traditional ones (wood) may also play a

role – as well as consumer choices. Carbon capture technologies could be applied for using captured CO₂ used as feedstock or for storing it underground.

5. Develop an adequate smart network infrastructure and inter-connections: Digitalisation is a key aspect across sectors in the transition towards a decarbonised economy. Smart solutions for the use of energy and electricity as well as for transportation and industrial operations are necessary to achieve efficiency and connectivity in the system. The necessary infrastructure must be built up quickly, as it can define the path of the transition.

6. Reap the full benefits of bio-economy and create essential carbon sinks: Agriculture and forests play important roles in a net zero transition. A sustainable supply of biomass can open up new business opportunities, but growing demand for biomass can lead to conflicts over land use and imports come with additional economic and biodiversity concerns. The agriculture sector is a source of non-CO₂ GHG emissions, which it must reduce through sustainable practices and smart technologies. Aquatic and marine resources, such as algae, could play a role in the production of protein without use of land. Carbon sinks are an important negative emission option must be increased, while benefitting biodiversity and soils.

7. Tackle remaining CO₂ emissions with carbon capture and storage: The role of CCS in net emission reduction is less prominent in the pathways considered than previously anticipated, due to advances in renewable energy– but the technology is still seen as necessary for carbon reduction in energy intensive industries. CCS is not yet commercially viable and would require a significant push in term of research and innovation as well as deployment.

2 Main conclusions

The European Commission's **new long-term objective of achieving a climate neutral economy** is one in which greenhouse gas emissions reach “net zero” meaning that remaining emissions are compensated by carbon sinks or storage.

Key messages are that “net zero” is **necessary** (in the context of the global fight against climate change), that it is **possible** (existing technology options can get us there), and that undergoing this transition is **beneficial** for Europe – in fact it could be the platform for a stronger, modernised economy.

The EC is fully aware of the magnitude of the challenge and states that “reaching this objective requires deep societal and economic transformations within a generation, touching every sector of the economy.” The communication stresses the potential benefits and outlines in which areas action is required. It assesses the extent to which current EU activities are already working in support of such benefits.

However, the documents do not lay out a detailed technical strategy - they present a strategic vision for a climate neutral EU. Moreover, the EC steers clear of mentioning concrete policies or sectoral objectives and does not address interim targets towards the 2050 goal.

3 Questions for further enquiry

A detailed analysis of all the underlying material is yet to be carried out. However, the following points merit more detailed enquiry.

- **Science and ambition, budgets and fairness:** The EC documents focus on net 2050 emission levels but do not address the underlying *cumulative* emissions, which ultimately determine the impact on atmospheric GHG concentration. The EC considers all the modelled scenarios compatible with the Paris Agreement, but that is a questionable interpretation⁴

given that the Paris Agreement’s goal is to keep global temperature increases “well below 2°C” - an 80% emission reduction by 2050 is likely not in line with that goal. The Commission also assumes that net-zero by 2050 is a sufficient contribution by the EU to the global climate change mitigation effort, but other stakeholders have argued that achieving net-zero earlier (e.g. WWF: net zero by 2040)⁵ constitutes a contribution more in line with Europe’s responsibility for climate change. In this context, it can be argued that the EC has stretched the requirements under Article 15 of the Governance Regulation, which demand that the analysis cover “the implications of the scenarios (...) on the remaining global and Union carbon budget in order to inform a discussion about cost efficiency, effectiveness and fairness of greenhouse gas emission reduction.” While these issues are addressed in the In-Depth-Analysis (IDA) – though only briefly and in isolation – they are not a topic of the “vision” communication. Cumulative emissions differ widely among the scenarios (they range from 23 to 57 GtCO₂ by 2100, see Table 9, p. 198 IDA). All scenarios also assume negative emissions in the second half of the century, another issue not addressed in the Communication because of the focus on 2050.

- **Milestones:** The documents avoid a focus on 2030 and the topic of a potential review of Europe’s current emission reduction target - but they do include analysis that shows that target will be overachieved. The EU is obligated under the Paris Agreement to address this issue for the NDC update in 2020.
- **Energy sector and other technologies:** In the public consultation, several stakeholders have demanded 100% renewable electricity by 2050 – the EC scenarios only see a share of 80%. A related issue is the role of nuclear energy in the 2050 electricity mix and the remaining coal-fired generation capacity that the EC scenarios assume. Moreover, the risks associated with CCS technologies need to be carefully considered.
- **Circular economy vs negative emissions:** The EC’s scenarios spell out a potential trade-off between the implementation of a circular economy (and changes in lifestyle) as a means of getting closer to net zero emissions and the extensive use of negative emissions options like LULUCF and BECCS. This trade-off is not addressed explicitly, but could be a central issue for future consideration.
- **From vision to strategy:** It is unclear how the vision should be turned into a strategy document to be submitted to the UN under the Paris Agreement by early 2020 (see also section 4. Next steps). A strategy document might need to contain additional specifics, such as more concrete policies and measures – which are not addressed in the EC documents.
- **National plans:** Article 15 of the EU Governance Regulation requires that the Commission proposal for a strategy take into account the draft national energy and climate plans that Member States will submit by the end of 2018. The vision documents can, by definition, not have complied with this requirement, as the plans are not yet available.
- **National strategies:** What implications, if any, do the EU 2050 vision and a future strategy have for national long-term strategies that Member States have to prepare by 1 January 2020? What is the relationship between the national and the EU strategies - do they need to match up, and will there be a process for alignment or coordination?

4 Next steps

The EC documents do not spell out a specific path towards adoption of an EU strategy to be submitted to the United Nations under Article 4 para. 19 of the Paris Agreement – individual Member States have already submitted these (e.g. CZ, DE). The documents do, however, state that submission of a strategy should be the objective, and provide the timing indication “by early

2020.” They do not specify what form such a strategy document will take and how it will differ from the “strategic vision” presented on 28 November.

The EC invites all EU institutions to “consider” the vision. It specifically requests all Council formations to “hold extensive policy debates” on the EC’s documents in the run-up to and as preparation for the May 2019 informal European Council on the “Future of Europe.” In addition, the EC has announced that it will take the debate to the national level. Commissioner Šefčovič may travel to Member State capitals. He has previously undertaken similar “Energy Union tours” to engage directly with Member State representatives. The EC also suggests it will organise “Citizens’ Dialogues” on the topic, a format it has been using to create opportunities for discussion with individuals in the form of “town hall debates.”⁶

Possible next steps include:

- Political debate, following (partial) formal endorsement of the vision by EU Heads of State and Government and the European Parliament, possibly including through a mention in the “Future of Europe” process
- A mandate to the European Commission to draft a formal strategy document

Disclaimer:

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¹ The 25-page communication (“Clean Planet for all. A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy” COM(2018) 773) is supported by an in depth analysis of close to 400 pages. Further publications on the long term climate vision include a Questions & Answers document, a press release, and four fact sheets – these are all available online at https://ec.europa.eu/clima/policies/strategies/2050_en

² European Commission (2011) A Roadmap for moving to a competitive low carbon economy in 2050 (COM(2011)112)

³ Current coal power capacity in the EU 28 as of 2017 is specified as 153MW existing capacity, plus 6 MW under construction (Europe Beyond Coal Database; status: 16 Nov 2018)

⁴ See e.g. Jakob Wachsmuth, Michiel Schaeffer, Bill Hare (2018) The EU long-term strategy to reduce GHG emissions in light of the Paris Agreement and the IPCC Special Report on 1.5°C. Working Paper Sustainability and Innovation No. S 22/2018. Available at https://www.isi.fraunhofer.de/content/dam/isi/dokumente/sustainability-innovation/2018/WP22-2018_The_EU_long-term_strategy_to_reduce_GHG_emissions_WAI.pdf

⁵ WWF position paper (2018) The EU’s long-term climate strategy.

⁶ Overview of EC Citizens’ Dialogues online at https://ec.europa.eu/info/events/citizens-dialogues_en

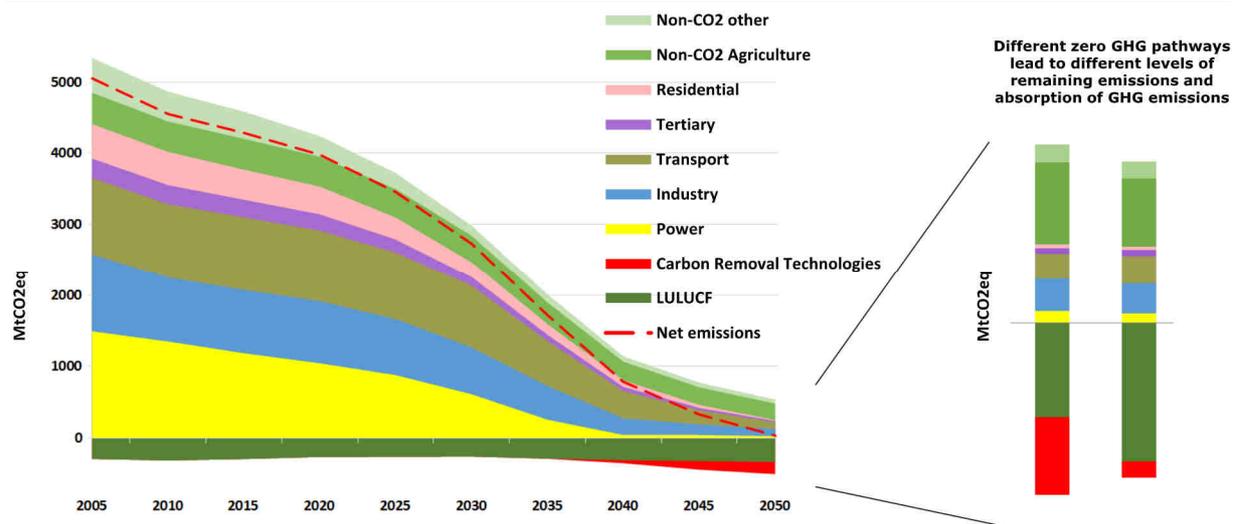
Annex

Figure 3: Overview of the main building blocks of the 8 EC scenarios (Table 1 IDA)

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

Source: EC IDA, page 56

Figure 4: GHG trajectory to net zero in 2050 (scenarios 7 & 8) (Figure 6, EU2050 communication)



Source: EC communication COM(2018)773, page 23