Report on the results of the Public Consultation

Vision for a long-term EU strategy for reducing greenhouse gas emissions

28 November 2018

CONTENTS

1 Approach

1.1 Target group, timing and objective

All citizens and organisations were welcome to participate. The public consultation was open for the mandatory duration of 12 weeks from July 17th 2018 to October 9th 2018. The aim of the public consultation was to gather feedback from the general public regarding the EU's long-term strategy for the reduction of greenhouse gas emissions.

1.2 Method

The public consultation consisted of a questionnaire of 74 questions uploaded on the EU Platform (https://ec.europa.eu/clima/consultations/strategy-long-term-eu-greenhouse-gas-emissions-reductions_en) and included as Annex A to this report. The analysis is presented on a question-by-question basis. The questions are coded with 'PC' ('public consultation'), to make referral across documents easier. To analyse the responses, the first step was to prepare the data. The full dataset contains the results from 2 805 responses. Additionally, the respondents were asked to add any further information they wished (PC73) and to upload relevant files or position papers (PC74). The latter are analysed in section 2.15.

References are also made to a category of respondents named 'Private enterprise, professions, trade and business associations' this represents the combined responses from three groups of respondents in the OPC survey, namely: (1) Private enterprise; (2) Professional consultancy, law firm, self-employed consultant; and, (3) Trade, business or professional association.

The dataset was also checked for coordinated groups of responses. Four such cases were detected: (1) of 4 individuals in Germany with links to the land-use sector; (2) of 4 organisations in the petroleum and fuels sector in Spain and Portugal; (3) of 9 respondents including individuals and two NGOs; and, (4) of 4 individual respondents from the same NGO. In the context of the number of total responses, these are not judged to have a significant influence on the results.

The results are quantitatively analysed in the following sections. For each question, the number of respondents (n) is indicated [n=x]. In many cases the number of respondents are also expressed as a percentage of the total, in some cases these percentages do not add up to 100%, this is due to the rounding of the numbers to the nearest whole number. Open questions were analysed using a keyword coding based approach. By determining key issues and words raised in responses, grouping these by themes and translating and searching for these in all languages, the frequency of which a particular issue was raised could be identified.

In addition, a stakeholder conference was held in June 2018, the summary of this event is included as chapter 3 of this report.

2 Results

2.1 Profile of respondents

2.1.1 *Type of stakeholder*

The first question provides an overview of the type of stakeholders answering the public consultation. Out of the respondents that answered this question, most respondents were private individuals, while the remaining were professionals responding on behalf of their organisation (see Figure 2-1).

Figure 2-1: Type of stakeholders in the public consultation

[PC1] In what capacity are you completing this questionnaire? [n=2805]
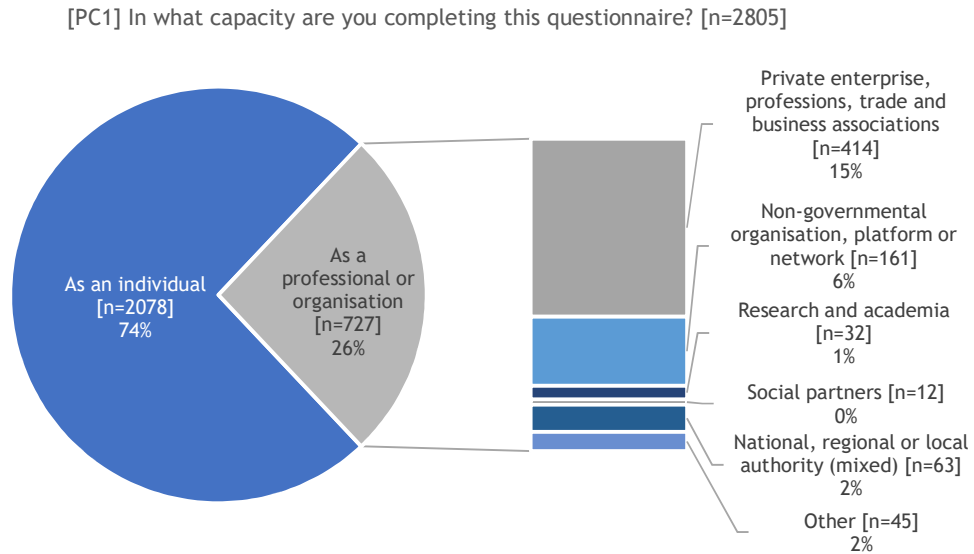
2.1.2 *Country of residence or main country of operations or headquarters*

The respondents covered 27 of the 28 EU Member States. The three largest countries represented were Germany, Belgium and Spain (see Figure 2-2). In addition to the EU respondents, there were also 82 respondents that identified themselves as non-EU.

Figure 2-2: [PC4] Country of stakeholders answering the public consultation. Map of respondents per EU Member State [n=2805]
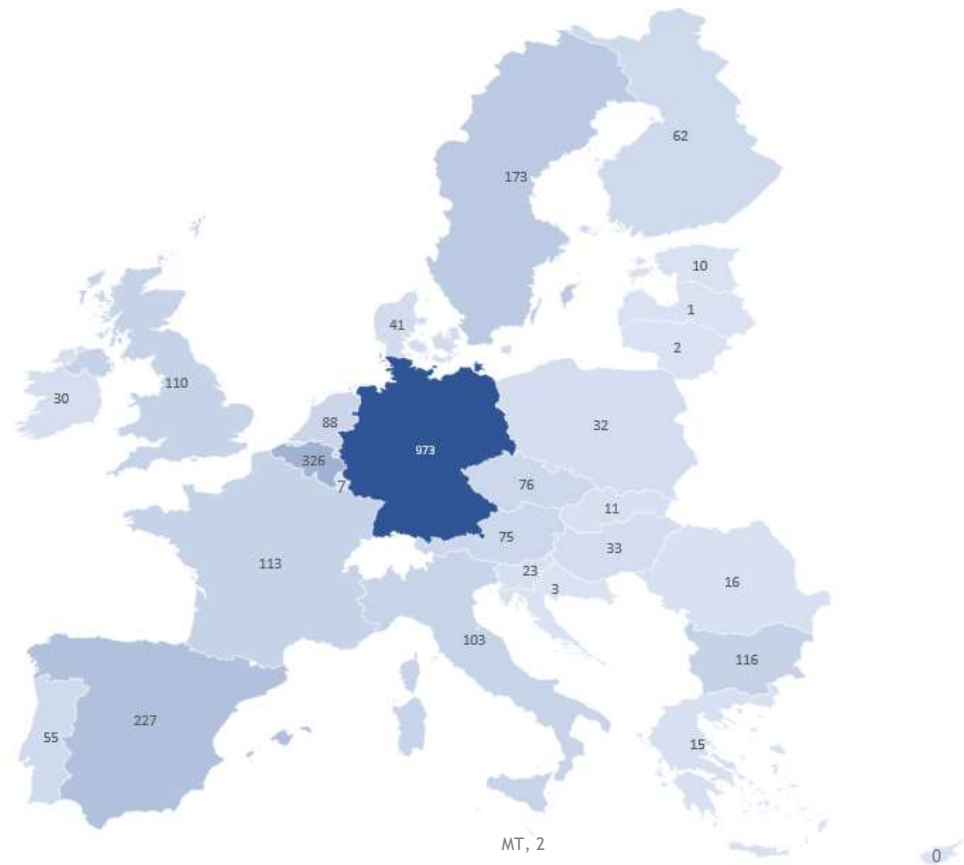
2.2 General stakeholder opinion on long-term reduction of greenhouse gases and the Paris Agreement

In this question, respondents were asked how much the EU should contribute to achieving the Paris Agreement objectives (with a view towards 2050). Many respondents believed that the EU should achieve **a balance between emissions and removals by 2050**, approximately one third believed that the EU should reduce emissions by 80-95%, while another 16% considered that the EU should reduce greenhouse gas emissions by 80% relative to 1990 levels (see Figure 2-3).

The respondents were split into 2 024 individuals and 614 organizations. In both groups, the majority of respondents believed that the EU should achieve a balance between emissions and removals by 2050 (see Table 2-1).

Figure 2-3: General stakeholder opinion on the EU's contribution to the Paris Agreement objectives

[PC11] What do you think the EU should contribute to achieve the Paris Agreement's objectives? [n=2636]

Reduce greenhouse gas emissions in the EU by 80% by 2050 compared to 1990 levels [n=413] 16%

Reduce greenhouse gas emissions in the EU more, within the range of 80 to 95% by 2050 compared to 1990 levels [n=828] 31%

Achieve already a balance between emissions and removals in the EU by 2050 [n=1395] 53%
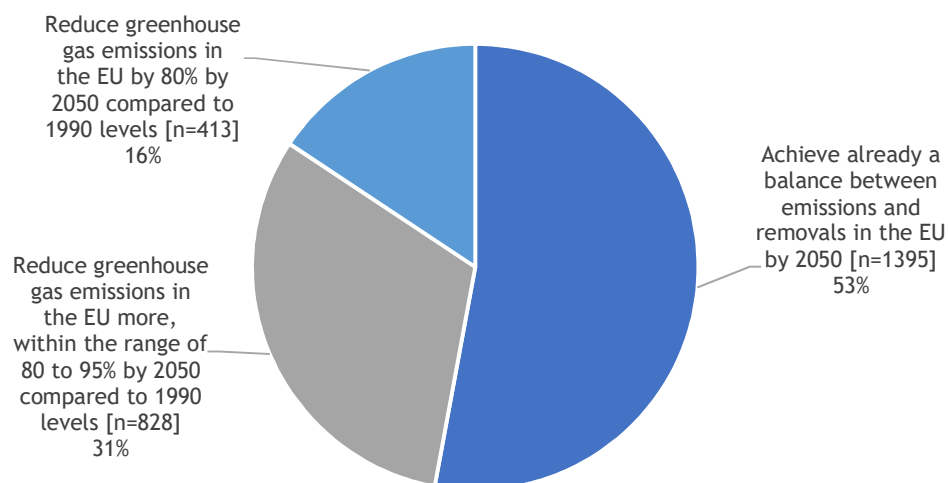
Table 2-1: General stakeholder opinion on the EU's contribution to the Paris Agreement objectives, per respondent type

Respondent type	Achieve already a balance between emissions and removals in the EU by 2050	Reduce greenhouse gas emissions in the EU more, within the range of 80 to 95% by 2050 compared to 1990 levels	Reduce greenhouse gas emissions in the EU by 80% by 2050 compared to 1990 levels
as an individual in your personal capacity [n=2024]	53%	32%	16%
in your professional capacity or on behalf of an organisation [n=612]	54%	31%	16%
Of which:			
Private enterprise, professions, trade and business associations [n=332]	43%	37%	20%
Non-governmental organisation, platform or network [n=146]	77%	18%	5%
Research and academia [n=30]	63%	20%	17%
Social partners [n=12]	42%	42%	17%
Of which: Unions [n=6]	50%	33%	17%
National, regional or local authority (mixed) [n=55]	53%	29%	18%
Other [n=37]	54%	30%	16%

Of the 13 EU Member States that responded to the consultation either through the survey or through a position paper and had a position on this subject, 2 were in favour of 80% reductions, 2 for 80-95% reductions and 6 for a balance in emissions (net zero) by 2050.

In addition to these questions, stakeholder were also asked '**[PC12] In your opinion, what are the biggest opportunities and challenges?**'

Energy was raised by 1 154 respondents, with a variety of issues, sometimes perceived as both opportunities and challenges. Among the issues raised:

- **Renewable energy** (as part of a clean or green energy system) was identified as an important issue for many (n=419), highlighting at the need to develop renewable energy source technologies and to inject more renewable energy into the grid. Some opportunities that were mentioned include the decentralisation of the energy system, more R&D to improve existing technologies and the potential to create or improve synergies between territories. Rural areas have the potential to produce renewable energy to provide for urban areas, while the South of Europe can be a hub of solar energy. Renewable energy was also seen as a challenge in terms of the need for funding and redirecting capital towards green projects, creating an over-reliance on wheather-dependent power sources and the need for energy storage (when storage costs remain high). On balance, respondents tended to perceive renewable energy as an opportunity.

- **Energy efficiency in buildings**, particularly for renovation but also new buildings was identified as an important issue for many (n=396), representing both an opportunity and a challenge. Overall, there is opportunity in inventivising new buildings to become carbon neutral and renovating the existing building stock. This requires investment in improving heating and cooling technologies; a range of different technologies is needed for a very diverse building stock. Improving the energy efficiency of homes also requires trained professionals and has the potential to create employment. Social housing and government buildings could show more leadership on this front.

- **Fossil fuels** were an important issue for many (n=362). Halting the use, import and production of fossil fuels is seen as an opportunity for the green and renewable energy market but this issue was more often viewed as a challenge. Some of the challenges that were highlighted include stopping the support of fossil fuel industries (i.e. fossil fuel subsisidies), transport infrastructure and car production being geared towards fossil fuels, delays caused by various lobby groups and fossil fuels being abundant and cheap (while alternatives may still be too expensive for poor households). Another challenge that was mentioned was the difficulty of removing the dangerous polluting substances released by fossil fuels from the atmosphere. Diminishing foreign dependency on fuel imports was deemed both an opportunity and a challenge.

- **Industry energy use and efficiency** was identified as an important issue for many (n=145). An opportunity was perceived for industries to improve their manufacturing processes to reduce energy consumption and emissions, whilst the issues was also viewed as a challenge in terms of needing significant innovations and investments to help reduce energy consumption further. On balance, respondents tended to perceive this as a challenge, given the level of uncertainty for the future and the importance of remaining competitive.

Mobility and transport emissions were raised by 866 respondents, with a variety of issues, sometimes perceived as both opportunities and challenges. Among the issues raised:

- **Cars and road transport** were identified as an important issue for many (n=256). Certain opportunities were mentioned, such as the development of biofuels and the support of cleaner modes of transport (e.g. cycling, car sharing or the use of electric vehicles). However, the

electrification of the transport sector will need to come hand-in-hand with a revamped energy system. Cars and road transport are perceived as both a challenge and opportunity, and respondents emphasised the need to discourage car-centric lifestyles and the reliance on fossil fuels for cars.

- **Public transport** was identified as an important issue for many (n=166) and closely interlinked with the issue of cars and road transport (as well as urban planning). Respondents feel that there is an opportunity in developing the network of public transport and encouraging more use of public transport as opposed to private vehicles. This may also be viewed as a challenge, since it may involve a change in lifestyle.

- **Rail transport** was identified as an important issue for many (n=104), seeing the expansion of the rail network as an opportunity. Rail transport is seen as a mode of transport that is not carbon intensive, especially when electrified. Respondents noted that more transport of people and goods should be moved from road to rail, both within cities but also for longer distances. This is sometimes seen as a challenge since it can be less expensive and faster for people to travel by air, which is a more polluting method of travel.

Public policy related issues were raised by 1 711 respondents sometimes perceived as both opportunities and challenges. Among the issues raised:

- **Public investment** – including in R&D, was identified as an important issue for many (n=366). Public investment is seen as an opportunity in supporting the clean technologies, industries and administrative solutions (examples are listed below) that are required to speed up the low carbon transition. Public transport, renewable energy sources, electric vehicles are some of the areas that require public support. However, when it comes to technologies, the lack of clear winners makes it difficult to invest in certain technologies over others.

- **Taxes and fiscal policy** was identified as an important issue for many (n=352). Taxes and fiscal measures were framed as both opportunities and challenges by respondents. Overall, taxes are expected to be more reflective of the behaviour that needs to be encouraged or discouraged. However, taxes should be redistributed back to citizens to ensure a fair transition, and the right alternatives to 'unwanted' behaviour need to be in place to avoid taxing unfairly. Having a common carbon fiscality and providing fiscal incentives for green energy were cited as opportunities. Implementing an effective system of taxing carbon and polluting behaviour or activities was mentioned several times.

- **Planning and spatial policy** was identified as an important issue for many (n=242). Some opportunities that were evoked include the creation of synergies between urban and rural areas, as well as the development of mass transportation networks within cities and solutions for transport between cities and between suburban and urban areas. The future of planning and spatial policy also faces challenges – namely the development of suburban areas and the availability of work spaces in a way that does not promote road travel. Moreover, such policy needs to account for regions and areas that will suffer from the energy transition.

- **Carbon budgets** were identified as an important issue for many (n=176), underlining the need to set ambitious targets. Decarbonisation is seen as an opportunity overall, but many uncertainties on how to achieve this make it difficult to assess the feasibility of ambitious targets. It is nonetheless considered important to set carbon budgets and regular targets, to assign responsibility to people and to orgnaisations. On balance, respondents tended to

perceive this as a challenge since the need to act fast to meet the net zero emission target (2050) is evoked numerous times, and the means to reaching this target vary. Nonetheless, there is consensus amongst respondents that all sectors need to decarbonise.

- **Regulation** was identified as an important issue for many (n=112) and perceived as both an opportunity and a challenge, in terms of the need to reduce regulatory barriers and to incentivise innovation. Respondents highlighted the necessity of a regulatory system that is not inconsistent within the EU, while at the same time ensuring flexibility. Policies should also take into account a cross-sector approach.

Specific emissions related issues were raised by 1 091 respondents, some perceived as opportunities and some as challenges. Among the issues raised:

- **Land-use change and forestry, including deforestation**, and the need for sustainable practices, was identified as an important by many (n=911). Some view the development of the carbon sequestration and carbon farming industries as an opportunity for job creation, as well as having great potential to accelerate the transition to a carbon neutral economy. Some challenges were also cited. These include the vulnerability of forests to climate change, the need for more innovation in the forestry value chain and the difficulty of integrating biodiversity and diverse landscaping into agriculture and forestry. The respondents who approached this topic agreed that there is potential to store and sequester carbon through the proper management of land and forests (as well as forest by-products and ecosystem based approaches).

- **Carbon capture, storage, use and/or removal** was identified as important by many (n=122). These solutions are perceived largely as an opportunity, presenting themselves as "new industries" from which researchers can learn about new fuels and chemical processes, while giving the EU a potential "first mover advantage". Although there are challenges to consider, such as public acceptance, engineering difficulties and the need for investing in R&D, carbon capture, storage, use (CCUS) and/or removal is viewed as having the potential to decarbonise the economy.

- **Industrial (process) emissions**, was identified as an important issue for many (n=95). Generally, industrial process emissions are themselves considered a challenge for the low carbon transition, but some see the untapped potential in improving the efficiency of industrial processes as an opportunity (e.g. through the use of alternative energy sources or through the recovery of waste heat). CCUS is sometimes cited as being part of the solution, but more R&D is still needed.

Specific economic sectors were identified by 1 176 respondents, with a variety of sectors singled out, sometimes perceived as both opportunities and challenges. Among the issues raised:

- **Agriculture** - were identified as an important issue for many (n=583). Agriculture as a whole is largely seen as an important emitter of greenhouse gases (especially industrial animal farming); the sector is therefore viewed as one with many challenges. Some opportunities are nonetheless mentioned, such as the expansion and support of local production and consumption.

- **Sustainable production** was identified as an important issue for many (n=342), underlining the need to support sustainable production systems based on green energy and to encourage the use of new technologies and circular business models. Overall, sustainable production is seen as an opportunity more than a challenge, with some people highlighting

the potential for the EU to become a frontrunner in setting sustainability standards of production.

- **Waste management, recycling, re-use and circularity in practice** - were identified as an important issue for many (n=214). Respondents mentioned the need to combine CO_2 reducing policies with policies aimed at reducing pollution (such as waste). Some respondents highlighted the opportunity to promote recycling and waste education in schools, since one important challenge to reducing waste is a change in consumer culture.

Paradigm shift was identified as a key factor by 1 104 respondents. Among the issues raised:

- **Economic models – encompassing sustainable consumption and production, circular and life cycle thinking** - were identified as an important issue for many (n=886). This entails an opportunity for more local production and consumption and for more forward looking plans, strategies and investments (sometimes meaning temporarily higher costs in the shower term, which is viewed as a challenge). Economic models need to be centered around resource efficiency, resilience and conscious consumption or production.
- **Consumer behaviour** was identified as an important issue for many (n=564). Overall, changing habits is seen primarily as a challenge since there is a need for a cultural shift towards less consumption, less waste and more conscious decisions. However, the challenge is to help consumers make the right choices and guide their decisions – for instance, by offering more signals on the carbon footprint of their decisions (e.g. through prices and labels).

Equity and fairness, were identified as important for many (n=299) and are linked to a transition that requires vast socio-economic changes and the active engagement and participation of citizens and communities. Dealing with the effects of the transition on employment is often cited as a challenge, but many changes are expected to have a positive impact on employment if the right training and education opportunities are put in place.

Co-benefits, were identified as a broad opportunity by 351 respondents, amongst the most common co-benefits identified were the possibilities for improved air quality, improved health, reduced pollution, reduced biodiversity loss, economic development around regional supply chains, new economic opportunities and job creation, energy security and other environmental benefits.

2.3 The low carbon transition from the consumer perspective

When asked about where they expected the largest changes in their daily lives to happen in order to meet the climate change challenge, the highest share of respondents mentioned **mobility** (see Figure 2-4).

Figure 2-4: Stakeholder opinion on the largest changes to happen in the daily lives of consumers [only one answer possible]

[PC13] Where do you expect the largest changes to happen in your daily life in order to meet the climate change challenge? [n=2505]

- Housing 11%
- Food 15%
- Consumer goods and services 18%
- Mobility 56%
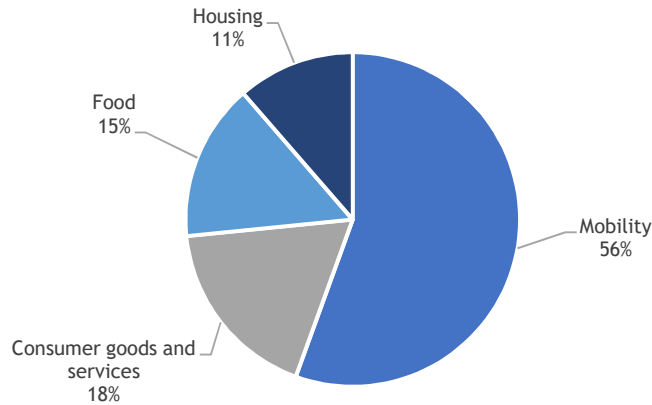
2.3.1 *Housing and offices*

Energy consumption

When asked about different ways of reducing energy consumption and related CO_2 emissions in buildings (PC14 to PC18), many respondents expected the following measures to be of **priority**: improving the energy performance of buildings through insulation, triple glazing, etc., installing heating and water boilers that run on renewables, installing heating and cooling equipment and using electrical appliances with the best energy performance label and buying carbon free electricity or generating their own renewable energy (see Figure 2-5).

Figure 2-5: Stakeholder opinion on measures to reduce energy consumption and related CO_2 emissions in buildings

To which extent would you support the following options that allow reducing the energy consumption and related CO2 emissions in buildings?

[PC14] Further improving the energy performance of your building? [n=2517] — 35% | 27% | 18% | 12% | 3% | 3%

[PC15] Installing heating and water boilers that run on renewables? [n=2498] — 38% | 17% | 16% | 14% | 7% | 6%

[PC16] Installing heating and cooling equipment and use electric appliances with the best energy performance label? [n=2495] — 36% | 29% | 14% | 13% | 3% | 3%

[PC17] Buying carbon free electricity or generating your own renewable electricity? [n=2496] — 35% | 34% | 10% | 9% | 5% | 5%

[PC18] Having a smart meter and consuming electricity mostly when prices are low?** [n=2480] — 28% | 28% | 11% | 10% | 10% | 9% | 5%

Legend:
- Yes, I already have done it
- Yes, as a priority
- Yes, but not as a priority
- No, I rent / for privacy concern**
- No, too expensive/ I do not want to change my consumption habits**
- No, other reason
- No opinion / I do not know

[PC18], in comparison to the other questions presented in Figure 2-6, displayed slightly different options to respondents; they are marked with a double asterisk (**) in the legend above.

2.3.2 *Domestic waste*

As seen in Figure 2-6, almost all respondents stated that they sort their waste. Moreover, an important share considered adapted infrastructure and financial incentives to be significant drivers for waste separation (see Figure 2-7) and many stakeholders agreed that increasing recycling and reuse is important to achieving greenhouse gas reductions (see Figure 2-8).

Figure 2-6: Stakeholder practice of separating waste

[PC19] Do you sort your waste (paper, plastics, glass, metal, glass, organic…)? [n=2496]

No
2%

I do not see the interest
1%

Yes
97%
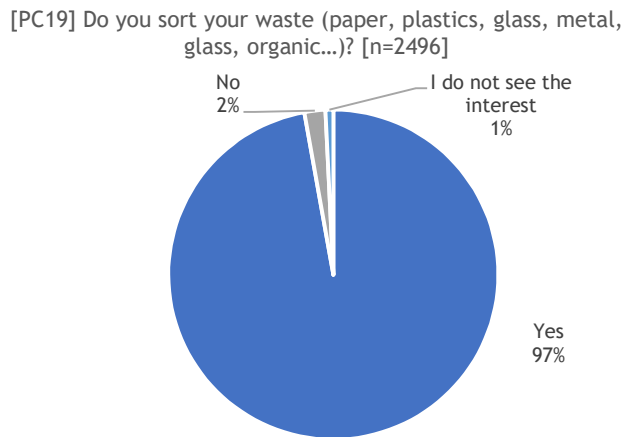
Figure 2-7: Stakeholder opinion on the drivers of waste separation [only one answer possible]

[PC20] What would make you increase the separation of waste (paper, plastics, glass, metal, glass, organic…)? [n=2391]

Awareness campaign
8%

Other
11%

Financial incentives such as deposit schemes
27%

Adapted infrastructure (containers, etc.)
54%
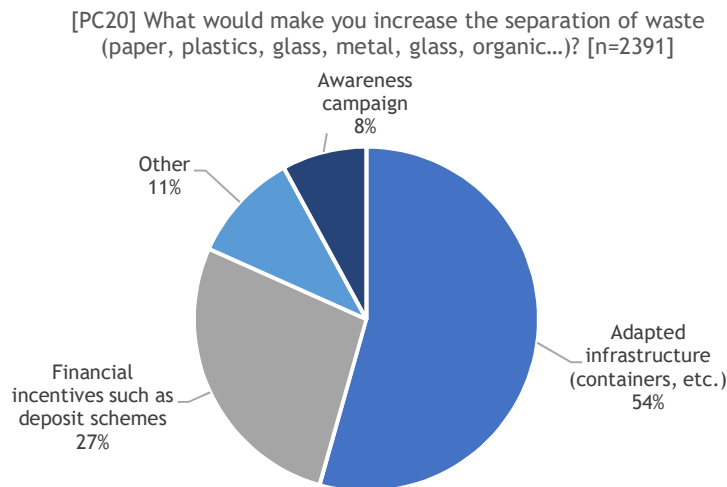
Figure 2-8: Stakeholder opinion on recycling and reuse as drivers of greenhouse gas reductions

[PC21] Do you think increased recycling and reuse are important to achieve greenhouse gas reductions? [n=2510]

I do not know
6%

No
6%

Yes
88%
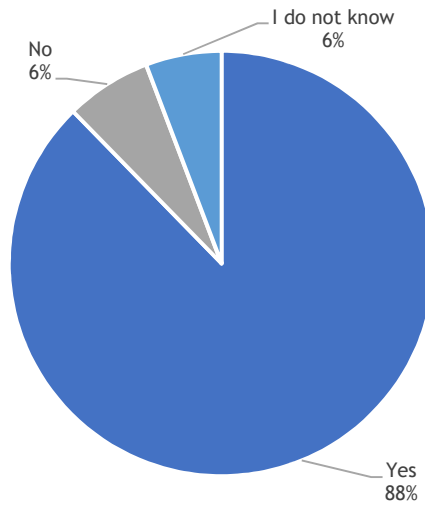
2.3.3 Mobility

When asked about buying a vehicle that does not run on petrol or diesel, **over one third of respondents supported this option**. Another third of respondents said they would buy such a vehicle if sufficient refueling infrastructure was available. Some 20% supported this option, but only if such vehicles were not more expensive than conventional vehicles (see Figure 2-9).

Figure 2-9: Stakeholder opinion on buying vehicles that do not run on petrol or diesel

[PC22] Buying a vehicle that does not run on petrol or diesel (for instance an electric car)? [n=2481]

No
10%

Yes
38%

Yes, but only if not more expensive than conventional petrol or diesel cars
20%

Yes, but only if sufficient refuelling infrastructure is available
32%
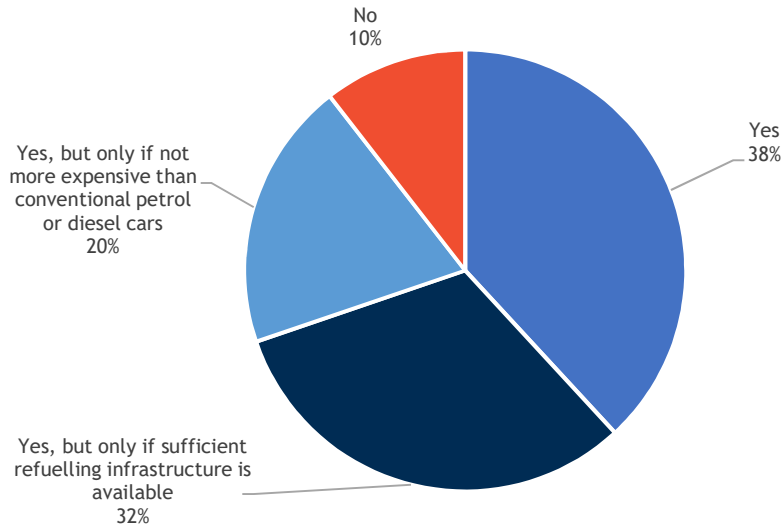
80% of respondents would consider using car-sharing services – including if an easy-to-use and affordable service was in place (see Figure 2-10).

Figure 2-10: Stakeholder opinion on using car-sharing services

[PC23] Considering using car sharing services? [n=2466]
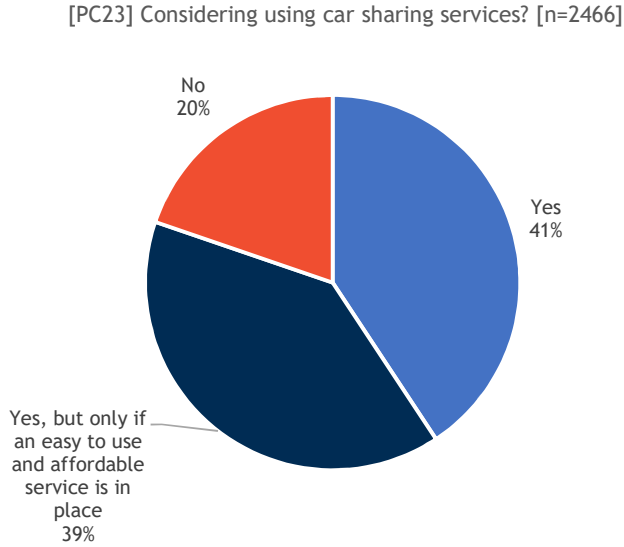
Many respondents would also consider avoiding private cars for short trips and opt for public transport, but some respondents highlight the importance of accessibility and regularity of service (see Figure 2-11).

Figure 2-11: Stakeholder opinion on using public transport for short trips

[PC24] For short trips, avoiding private car and rather using public transport? [n=2487]
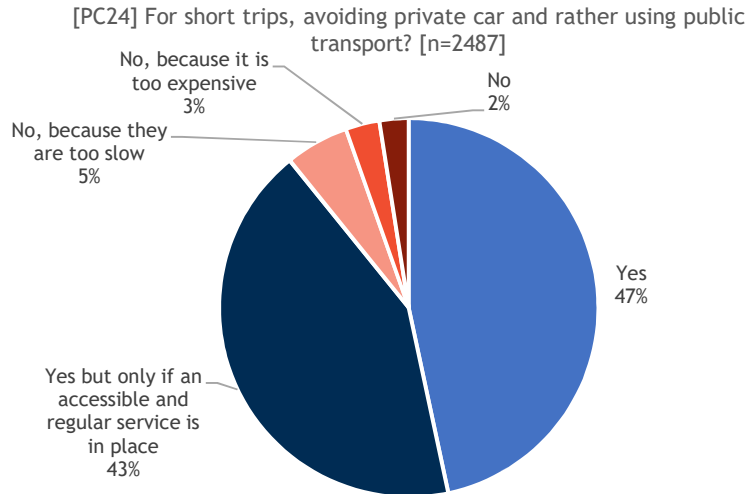
Another alternative presented to respondents for short trips were (electric) bikes and other active mobility modes. The majority considered using such alternatives and one third considered using such alternatives if proper bike lanes were in place (see Figure 2-12).

Figure 2-12: Stakeholder opinion on using bikes and other active mobility modes for short trips

[PC25] For short trips, avoiding private car and rather using (electric) bike or other active mobility modes? [n=2473]

No
8%

Yes, but only if
proper bike lanes
are in place
34%

Yes
58%
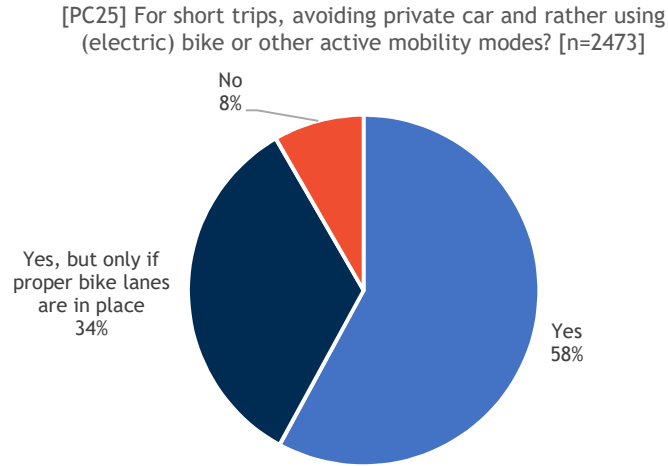
With respect to longer distances, respondents were asked whether they would consider avoiding flights or cars whenever alternatives were available. Close to 85% of respondents agreed (including if a convenient alternative was in place) (see Figure 2-13).

Figure 2-13: Stakeholder opinion on avoiding flights or cars for longer trips

[PC26] For longer distance, avoiding flights or car whenever an alternative is available? [n=2495]

No, other reason
4%

No, too expensive
5%

No, too slow
7%

Yes, provided a
convenient
alternative is in
place
55%

Yes
29%
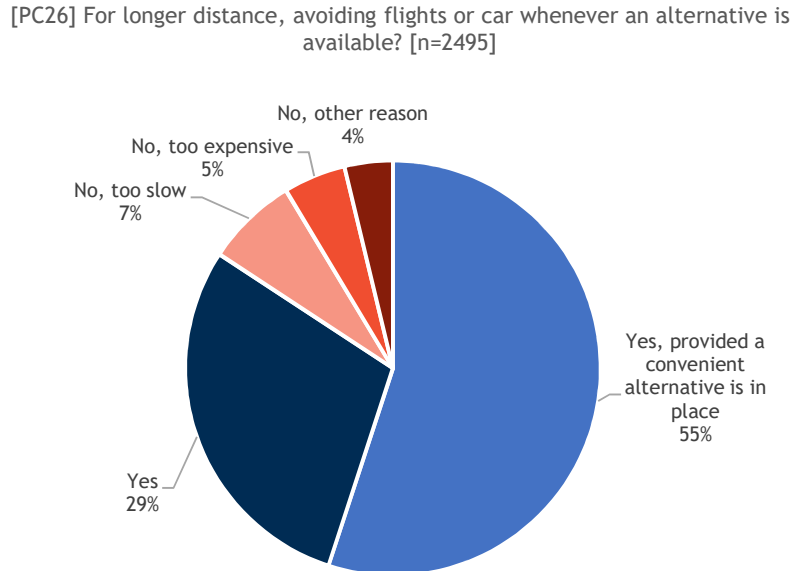
When respondents were asked whether better urban planning would reduce the use of private cars and reduce congestion in urban areas, some 60% agreed but highlighted the importance of combining urban planning with better public transport (see Figure 2-14).

Figure 2-14: Stakeholder opinion on urban planning as a means to reducing the use of private cars and congestion

[PC27] Do you think better urban planning would reduce the use of private cars and reduce congestion in the urban areas? [n=2485]

Yes, but difficult to put in place
8%

No
3%

Yes
29%

Yes, if combined with better public transport
60%
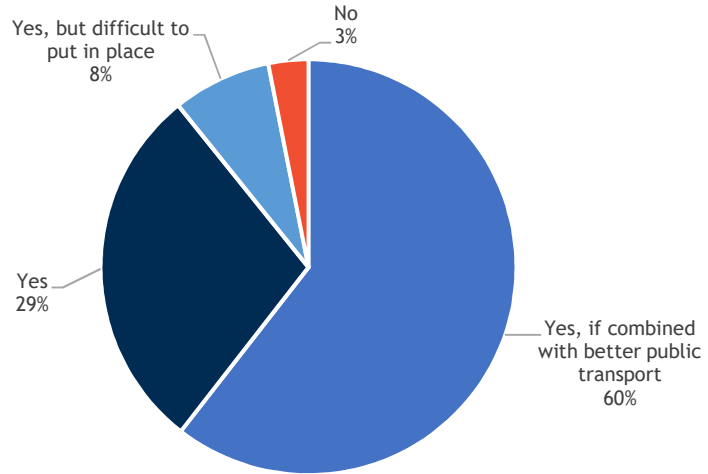
Finally, when asked about the impact of using more IT tools on mobility needs, more than half of the stakeholders expected that IT tools would reduce mobility needs to some extent (see Figure 2-15).

Figure 2-15: Stakeholder opinion on using IT tools to decrease mobility needs

[PC28] Do you think using more IT tools such as tele-working or video-conferencing could reduce mobility needs? [n=2486]

No, as difficult to put in place
3%

No
6%

Yes
36%

Yes, to some extent
55%
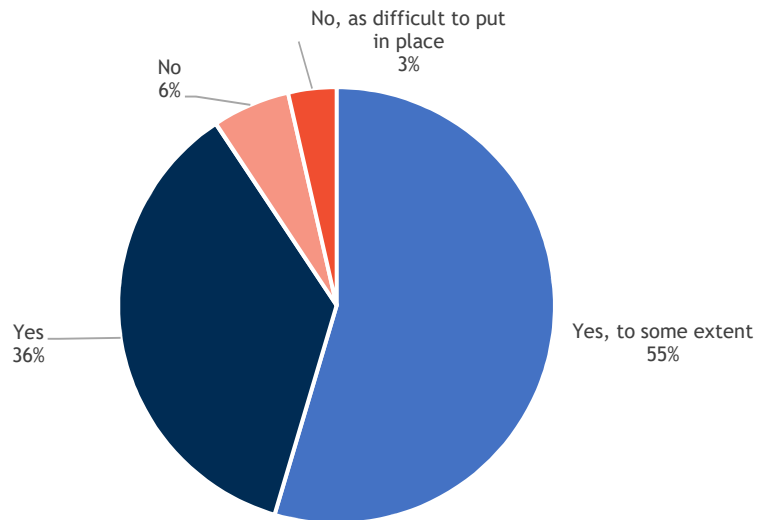
2.3.4 *Food*

When questioned about the importance of raising awareness about the impact of various types of food consumption on the climate, almost all respondents agreed that this was important (see Figure 2-16).

Figure 2-16: Stakeholder opinion on raising awareness about the impact of food consumption on climate change

[PC29] Would you consider it important to further raise awareness about the impact of various types of food consumption on climate? [n=2443]

No
8%

Yes
92%
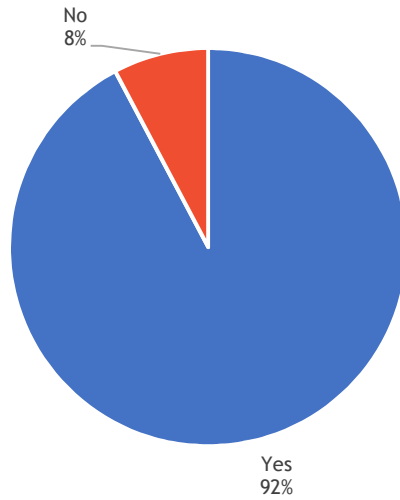
A large majority of respondents (over 80%) stated that they consider the impact of their food purchases on greenhouse gas emissions (with an important part of this share of respondents considering their impact when information is available on the carbon intensity of food products) (see Figure 2-17). In addition, many respondents would consider changing their food diets (Figure 2-18).

Figure 2-17: Stakeholder opinion on consumer choices of food and the consequent impact on greenhouse gas emissions

[PC30] Would you consider the impact of food on greenhouse gas emissions when buying it? [n=2431]

Not if more
expensive
6%

No
10%

Yes, if information is
available about the
carbon intensity of
food
44%

Yes
40%
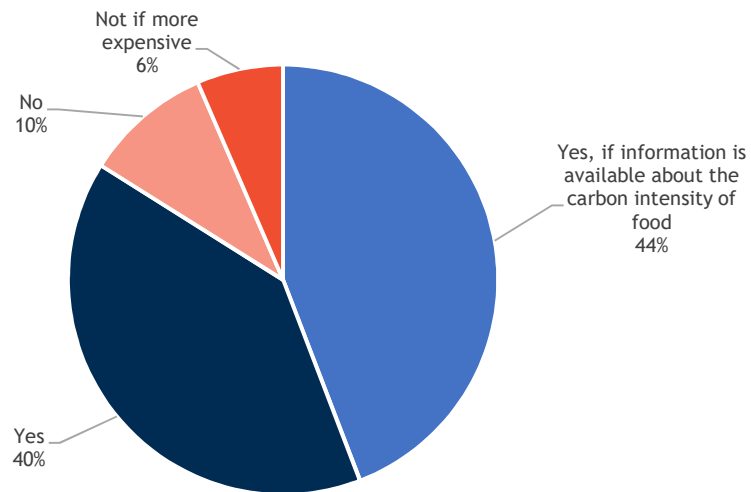
Figure 2-18: Stakeholder opinion on switching to a less carbon intensive food diet

[PC31] Also taking into account the importance to have a balanced diet for health purposes, would you consider changing to a less carbon intensive food diet? [n=2422]

No
9%

I would require more
information before
changing my diet
17%

Yes
74%
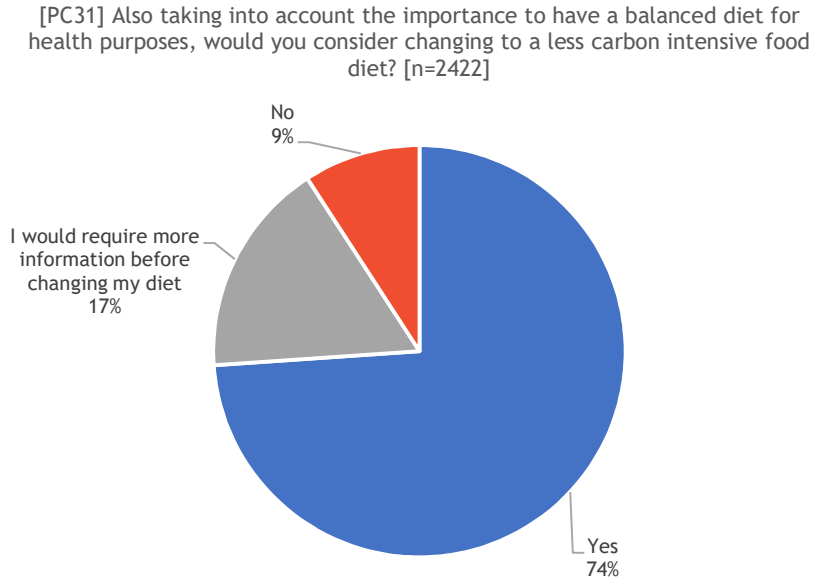
2.3.5 *Consumer goods and services*

Many respondents also stated that they consider the impact of their purchasing decisions (of products or services) on greenhouse gas emissions but that they often lack the necessary information to make such an assessment (see Figure 2-19).

Figure 2-19: Stakeholder opinion on the impact of consumer choices of products and services and the consequent impact on greenhouse gas emissions

[PC32] Do you ever consider the impact on greenhouse gas emissions when buying and consuming a product or services? [n=2449]

No, I don't consider
this
12%

Yes I do so regularly
33%

Yes but I often lack
the information to do
so
55%
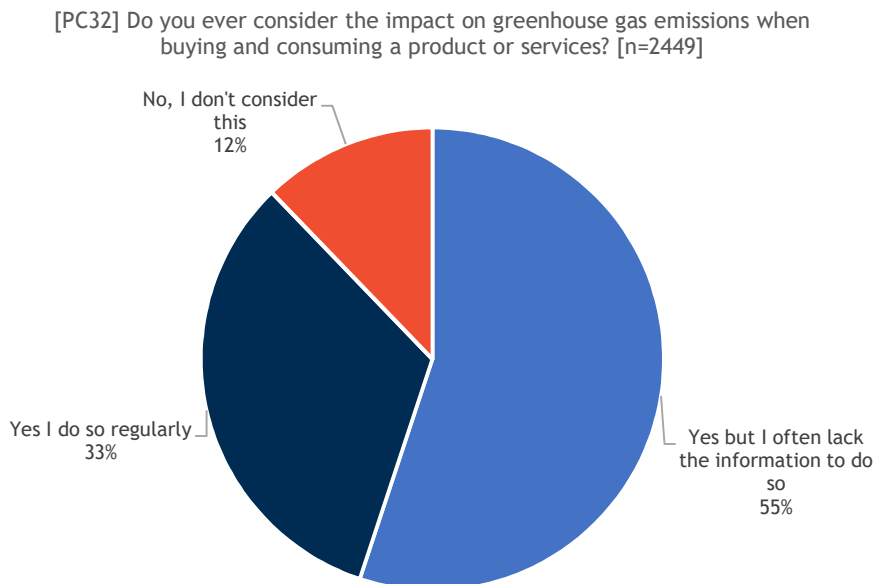
In addition, many stakeholders considered it important to buy products and services from companies that produce goods and services in a greenhouse gas neutral manner, but a fifth would not choose this option if it would be more expensive (see Figure 2-20).

Figure 2-20: Stakeholder opinion on purchasing products and services from companies that produce in a greenhouse gas neutral manner

[PC33] Would you consider buying products and services from companies that produce their goods and services in a greenhouse gas neutral manner? [n=2453]

No, other
3%

No opinion / I do
not know
3%

No, if more
expensive
15%

Yes
79%
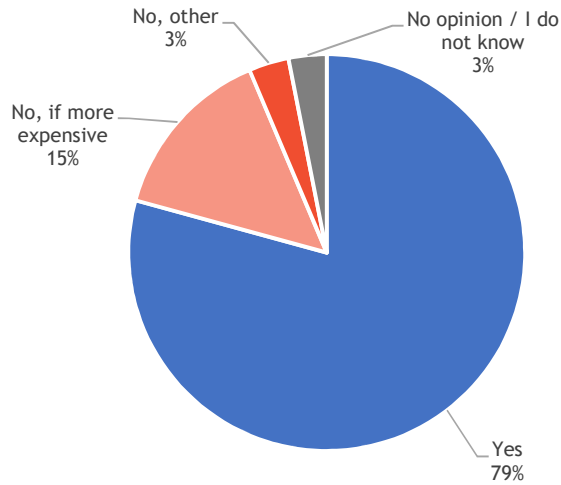
2.4 Expectations and opinions on changes in work and the economy

2.4.1 *Employment and a socially fair transition*

Stakeholders were asked about the effect of the low carbon transition on employment. There was an almost equal split between respondents that expected the transition would create jobs and respondents that either had no opinion or did not know what the effect of the transition would be (see Figure 2-21 and Table 2-2).

Figure 2-21: Stakeholder opinion on the impact of the low-carbon transition on the creation of jobs

[PC34] Do you expect your company to create or reduce jobs due to the low-carbon transition? [n=2529]

Reduce
9%

Create
46%

No opinion / I do
not know
45%
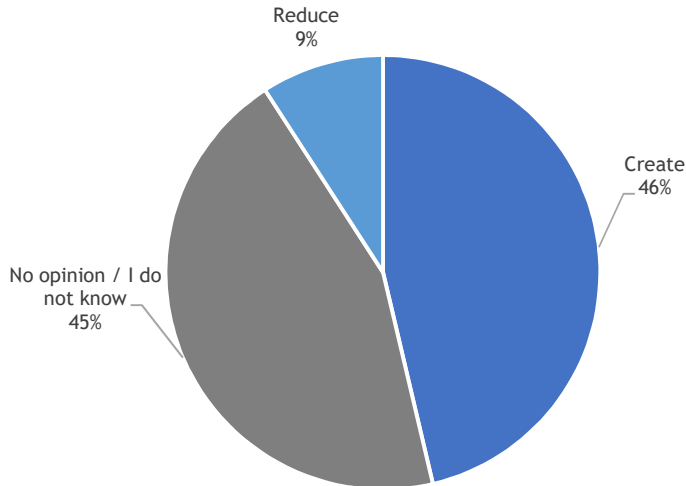
Table 2-2: Distribution of answers according to respondent type (PC34)

[PC34] Do you expect your company to create or reduce jobs due to the low-carbon transition? [n=2529] - Per respondent type			
Respondent type	Create	No opinion / I do not know	Reduce
as an individual in your personal capacity [n=1955]	40%	50%	10%
in your professional capacity or on behalf of an organisation [n=574]	67%	27%	6%
Of which:			
Private enterprise, professions, trade and business associations [n=341]	67%	26%	6%
Non-governmental organisation, platform or network [n=120]	79%	18%	3%
Research and academia [n=27]	48%	52%	0%
Social partners [n=8]	38%	50%	13%
Of which: Unions [n=3]	0%	67%	33%
National, regional or local authority (mixed) [n=46]	65%	33%	2%
Other [n=32]	50%	34%	16%

When asked about the factors or trends that could affect jobs most in the future, the highest ranked factor was 'digitalisation' followed by 'socio-economic policies' and 'the low-carbon transition' (see Figure 2-22).

Figure 2-22: Stakeholder opinion on the factors and/or trends that will affect jobs in the future [only one answer possible]

[PC35] What could affect your job most in the future? [n=2497]

- Other 9%
- Digitalisation 31%
- Impact of globalisation 10%
- The low carbon transition 24%
- Socio-economic policies (for instance fiscal policy) 26%
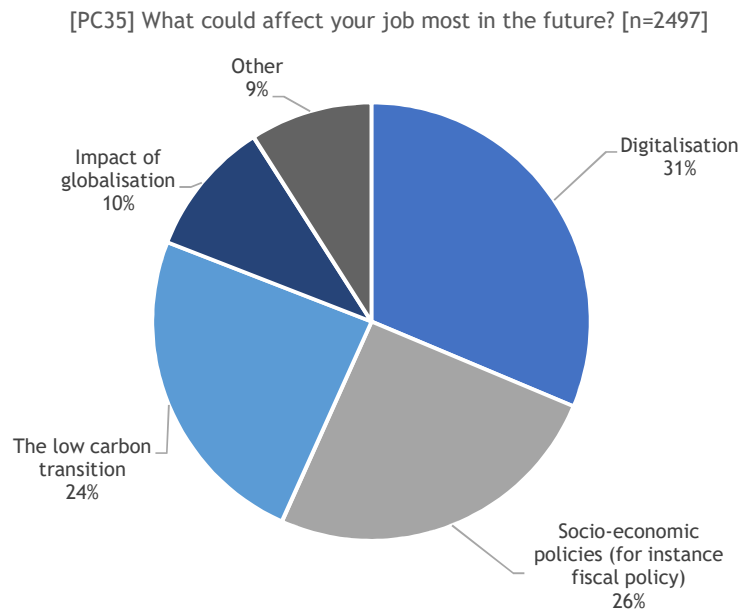
Table 2-3: Distribution of answers according to respondent type (PC35)

[PC35] What could affect your job most in the future? [n=2497] - Per respondent type					
Respondent type	Digitalisation	Socio-economic policies (for instance fiscal policy)	The low carbon transition	Impact of globalisation	Other
as an individual in your personal capacity [n=1934]	35%	28%	18%	11%	7%
in your professional capacity or on behalf of an organisation [n=563]	18%	16%	45%	6%	15%
Of which:					
Private enterprise, professions, trade and business associations [n=337]	17%	12%	48%	5%	18%
Non-governmental organisation, platform or network [n=115]	9%	18%	53%	10%	10%
Research and academia [n=26]	27%	27%	23%	8%	15%
Social partners [n=9]	33%	22%	11%	0%	33%
Of which: Unions [n=4]	50%	0%	0%	0%	50%
National, regional or local authority (mixed) [n=46]	37%	28%	22%	4%	9%
Other [n=30]	13%	17%	57%	10%	3%

When asked whether they or their sectors would benefit from training in the context of the energy and low-carbon transformation, close to 40% of respondents expected that training would be beneficial to some extent and the same share of respondents fully agreed with the benefits of training (see Figure 2-23 and Table 2-4).

Figure 2-23: Stakeholder opinion on the benefits of staff training in the context of the energy and low-carbon transition

[PC36] Do you think you or the sector you are active in would benefit from training of staff in the context of the energy and low carbon economy transformation? [n=2540]

No opinion / I do not know
8%

No
14%

Yes
39%

Yes, to some extent
39%
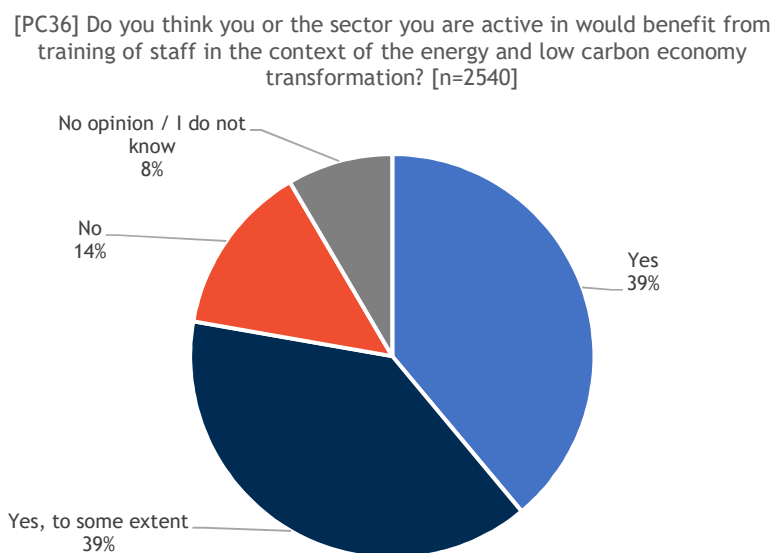
Table 2-4: Distribution of answers according to respondent type (PC36)

[PC36] Do you think you or the sector you are active in would benefit from training of staff in the context of the energy and low carbon economy transformation? [n=2540] - Per respondent type				
Respondent type	Yes	Yes, to some extent	No	No opinion / I do not know
as an individual in your personal capacity [n=1960]	33%	41%	17%	10%
in your professional capacity or on behalf of an organisation [n=580]	59%	32%	3%	5%
Of which:				
Private enterprise, professions, trade and business associations [n=345]	56%	35%	4%	5%
Non-governmental organisation, platform or network [n=118]	75%	19%	3%	3%
Research and academia [n=25]	48%	48%	0%	4%
Social partners [n=11]	55%	36%	0%	9%
Of which: Unions [n=5]	60%	40%	0%	0%
National, regional or local authority (mixed) [n=49]	59%	39%	0%	2%
Other [n=32]	53%	31%	6%	9%

2.4.2 *The impact of the low carbon transition on certain sectors*

Around 45% of respondents expect that the low-carbon transition represents an opportunity for their sector and some 10% considered the transition to be a challenge (see Figure 2-24 and Table 2-5). Non-governmental organisations and research and academia considered the transition solely as an opportunity to a larger extent than private enterprises, professions, trade and business associations who also tended towards perceiving it as an opportunity but where a majority perceived it as both an opportunity or a challenge.

Figure 2-24: Stakeholder opinion on whether the low-carbon transition represents an opportunity or a challenge

[PC37] Do you consider the low carbon transition as an opportunity or as a challenge for your sector? [n=2582]

- No opinion / I do not know 4%
- None 9%
- A challenge 10%
- Both 32%
- An opportunity 45%
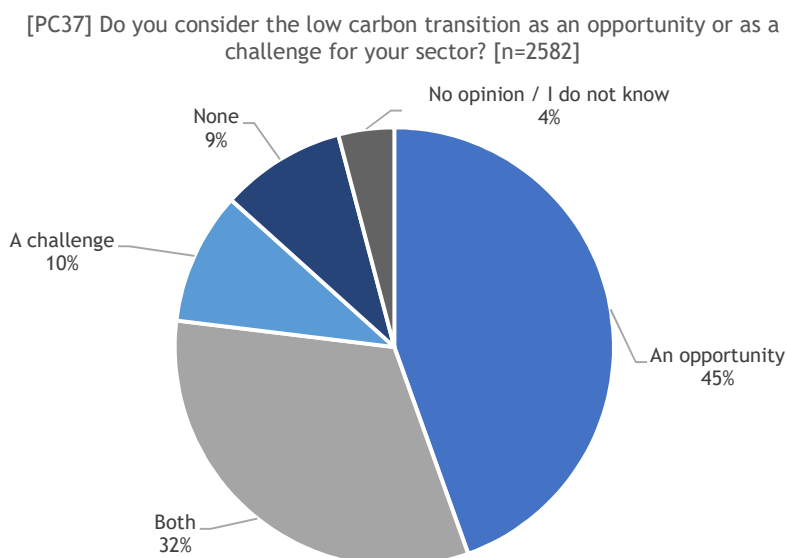
Table 2-5: Distribution of answers according to respondent type (PC37)

[PC37] Do you consider the low carbon transition as an opportunity or as a challenge for your sector? [n=2582] - Per respondent type					
Respondent type	An opportu-nity	Both	A challen-ge	None	No opinion / I do not know
as an individual in your personal capacity [n=1949]	42%	29%	12%	12%	5%
in your professional capacity or on behalf of an organisation [n=633]	51%	44%	4%	0%	0%
Of which:					
Private enterprise, professions, trade and business associations [n=380]	41%	54%	5%	0%	0%
Non-governmental organisation, platform or network [n=127]	76%	20%	2%	0%	2%
Research and academia [n=27]	78%	22%	0%	0%	0%
Social partners [n=11]	18%	82%	0%	0%	0%
Of which: Unions [n=5]	0%	100%	0%	0%	0%
National, regional or local authority (mixed) [n=52]	46%	46%	6%	2%	0%
Other [n=36]	64%	31%	6%	0%	0%

When asked about the potential of their sector to reduce greenhouse gas emissions, close to half of respondents said that their sector could reduce emissions by more than half or entirely (see Figure 2-25 and Table 2-6).

Figure 2-25: Stakeholder opinion on sectoral potential to reduce greenhouse gas emissions
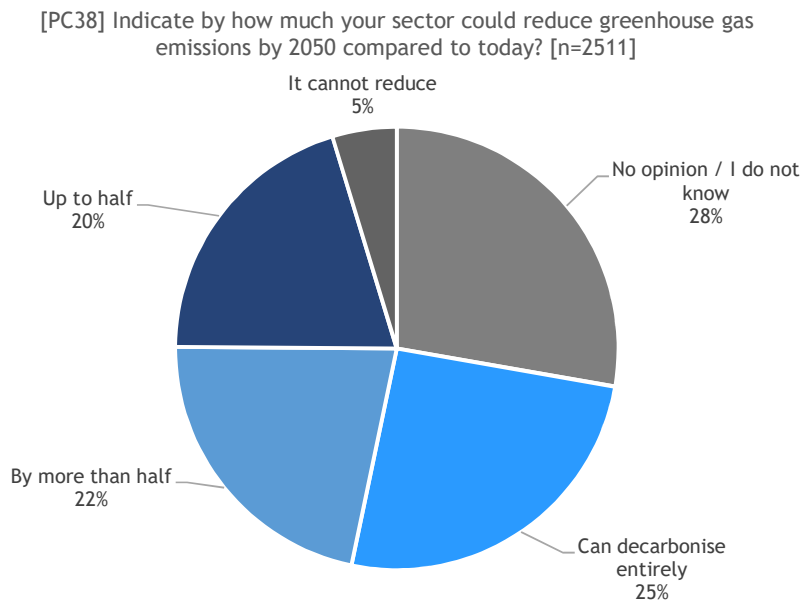
[PC38] Indicate by how much your sector could reduce greenhouse gas emissions by 2050 compared to today? [n=2511]

It cannot reduce 5%
No opinion / I do not know 28%
Up to half 20%
By more than half 22%
Can decarbonise entirely 25%

Table 2-6: Distribution of answers according to respondent type (PC38)

[PC38] Indicate by how much your sector could reduce greenhouse gas emissions by 2050 compared to today? [n=2511] - Per respondent type					
Respondent type	No opinion / I do not know	Can decarbonise entirely	By more than half	Up to half	It cannot reduce
as an individual in your personal capacity [n=1929]	32%	22%	20%	21%	6%
in your professional capacity or on behalf of an organisation [n=582]	13%	38%	29%	18%	1%
Of which:					
Private enterprise, professions, trade and business associations [n=345]	14%	31%	32%	23%	1%
Non-governmental organisation, platform or network [n=121]	11%	63%	16%	9%	2%
Research and academia [n=25]	20%	24%	20%	36%	0%
Social partners [n=10]	30%	20%	20%	30%	0%
Of which: Unions [n=4]	50%	25%	25%	0%	0%
National, regional or local authority (mixed) [n=49]	14%	37%	45%	4%	0%
Other [n=32]	6%	44%	28%	13%	9%

When asked how their sector could potentially reduce greenhouse gas emissions, over 20% of respondents expected that this could be achieved through improved **energy efficiency**. Others expected that the circular economy, further electrification, low carbon fuels (like hydrogen), and new products and business concepts could help (see Figure 2-26 and Table 2-7).

Figure 2-26: Stakeholder opinion on the means to achieving greenhouse gas emission reduction

[PC39] What would be the preferred route to reduce these emissions in your sector? [n=2545]

- No opinion / I do not know 10%
- Development of new products and business concepts 10%
- Use other low carbon fuels, like hydrogen 10%
- Further electrify 13%
- Circular economy, including recycling and re-use 16%
- Other 18%
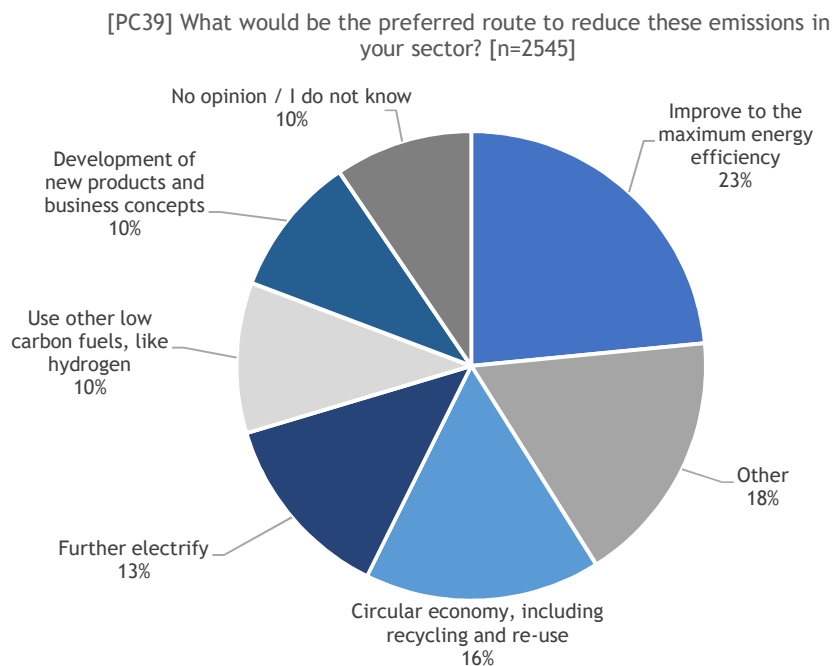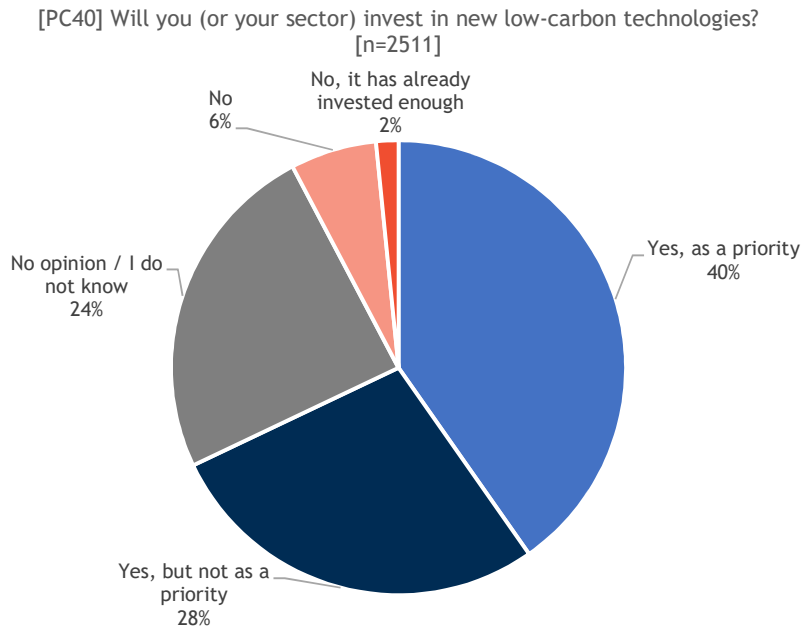- Improve to the maximum energy efficiency 23%

Table 2-7: Distribution of answers to question [PC39] according to respodent type

[PC39] What would be the preferred route to reduce these emissions in your sector? [n=2545] - Per respondent type							
Respondent type	Improve to the maximum energy efficiency	Other	Circular economy, including recycling and re-use	Further electrify	Use other low carbon fuels, like hydrogen	Development of new products and business concepts	No opinion / I do not know
as an individual in your personal capacity [n=1930]	26%	11%	18%	13%	10%	10%	12%
in your professional capacity or on behalf of an organisation [n=615]	15%	38%	11%	12%	12%	8%	3%
Of which:							
Private enterprise, professions, trade and business associations [n=370]	13%	42%	9%	13%	12%	9%	1%
Non-governmental organisation, platform or network [n=125]	12%	31%	10%	14%	13%	10%	9%
Research and academia [n=25]	28%	28%	20%	8%	4%	12%	0%
Social partners [n=9]	33%	56%	0%	0%	11%	0%	0%
Of which: Unions [n=3]	67%	0%	0%	0%	33%	0%	0%
National, regional or local authority (mixed) [n=52]	29%	23%	19%	12%	15%	0%	2%
Other [n=34]	15%	35%	21%	9%	12%	6%	3%

In addition, many respondents (40%) expected that they (or their sector) will invest in low-carbon technologies as a priority (see Figure 2-27 and Table 2-8).

Figure 2-27: Stakeholder opinion on sector-wide investment in new low-carbon technologies

[PC40] Will you (or your sector) invest in new low-carbon technologies? [n=2511]

No 6%
No, it has already invested enough 2%
No opinion / I do not know 24%
Yes, as a priority 40%
Yes, but not as a priority 28%

Table 2-8: Distribution of answers according to respondent type (PC40)

[PC40] Will you (or your sector) invest in new low-carbon technologies? [n=2511] - Per respondent type					
Respondent type	Yes, as a priority	Yes, but not as a priority	No opinion / I do not know	No	No, it has already invested enough
as an individual in your personal capacity [n=1916]	31%	30%	30%	7%	2%
in your professional capacity or on behalf of an organisation [n=595]	70%	21%	6%	2%	1%
Of which:					
Private enterprise, professions, trade and business associations [n=363]	72%	22%	3%	2%	0%
Non-governmental organisation, platform or network [n=116]	66%	22%	9%	3%	1%
Research and academia [n=24]	46%	21%	21%	13%	0%
Social partners [n=8]	50%	38%	13%	0%	0%
Of which: Unions [n=2]	50%	50%	0%	0%	0%
National, regional or local authority (mixed) [n=50]	70%	16%	12%	0%	2%
Other [n=34]	79%	15%	3%	0%	3%

On further integrating their sectors with other sectors in order to decrease emissions and increase efficiency, around 40% expected this was possible and a similar proportion had no opinion or did not know (see Figure 2-28 and Table 2-9). The respondent group with the highest proportion (75%) expecting that further integration would help was in the private enterprises, professions, trade and business organisations group.

Figure 2-28: Stakeholder opinion on the potential for improved sector integration

[PC41] Do you think your sector could be further integrated with others so as to decrease emissions while increasing overall efficiency? [n=2495]

No opinion / I do not know 43%

No 16%

Yes 41%
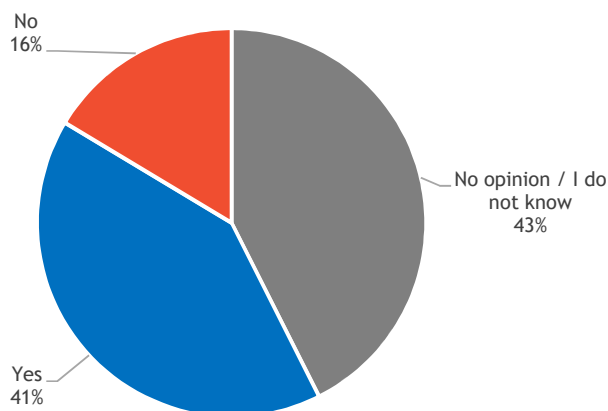
Table 2-9: Distribution of answers according to respondent type (PC41)

| [PC41] Do you think your sector could be further integrated with others so as to decrease emissions while increasing overall efficiency? [n=2495] - Per respondent type			
Respondent type	No opinion / I do not know	Yes	No
as an individual in your personal capacity [n=1899]	48%	32%	19%
in your professional capacity or on behalf of an organisation [n=596]	24%	69%	7%
Of which:			
Private enterprise, professions, trade and business associations [n=365]	19%	75%	6%
Non-governmental organisation, platform or network [n=118]	35%	56%	9%
Research and academia [n=24]	42%	46%	13%
Social partners [n=8]	13%	63%	25%
Of which: Unions [n=2]	0%	0%	100%
National, regional or local authority (mixed) [n=48]	40%	60%	0%
Other [n=33]	21%	73%	6%

Many respondents (60%) expected the low-carbon transition to modernise and reinforce the competitiveness of the EU, while close to a third of stakeholders expected this to happen only if non-EU countries and regions also engage in the low-carbon transition (see Figure 2-29 and

Table 2-10).

Figure 2-29: Stakeholder opinion on the impact of the low-carbon transition on EU competitiveness

[PC43] Do you think the low carbon transition will lead the EU economy to: [n=2561]

- Lose competitiveness 6%
- No opinion / I do not know 4%
- Modernise, and reinforce its competitiveness, but only if non-EU countries and regions also engage in the transition towards a low carbon economy 30%
- Modernise and reinforce its competitiveness 60%
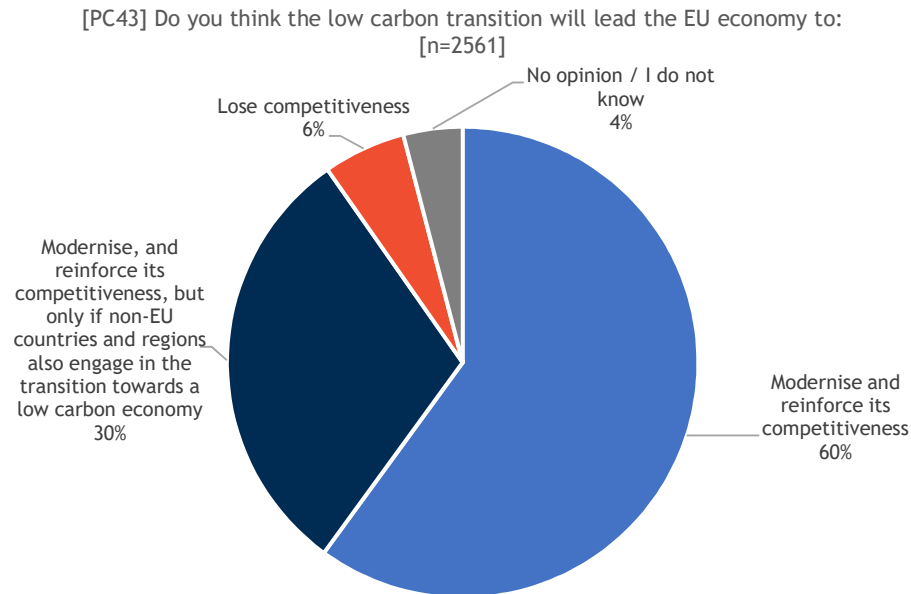
Table 2-10: Distribution of answers according to respondent type (PC43)

[PC43] Do you think the low carbon transition will lead the EU economy to: [n=2561] - Per respondent type				
Respondent type	Modernise and reinforce its competitiveness	Modernise, and reinforce its competitiveness, but only if non-EU countries and regions also engage in the transition towards a low carbon economy	Lose competitiveness	No opinion / I do not know
as an individual in your personal capacity [n=1938]	60%	28%	7%	5%
in your professional capacity or on behalf of an organisation [n=623]	59%	37%	2%	2%
Of which:				
Private enterprise, professions, trade and business associations [n=372]	48%	48%	3%	1%
Non-governmental organisation, platform or network [n=128]	82%	13%	1%	4%
Research and academia [n=26]	65%	27%	0%	8%
Social partners [n=10]	50%	50%	0%	0%
Of which: Unions [n=4]	50%	50%	0%	0%
National, regional or local authority (mixed) [n=52]	75%	23%	0%	2%
Other [n=35]	60%	31%	3%	6%

Regarding the impact of the low-carbon transition on EU modernisation and growth, more than half of the respondents expected the transition to help the EU modernise and grow (see Figure 2-30 and Table 2-11). An additional 21% of respondents expect this to happen in case of public support and 19% in case of non-EU countries and regions engagement in the transition.

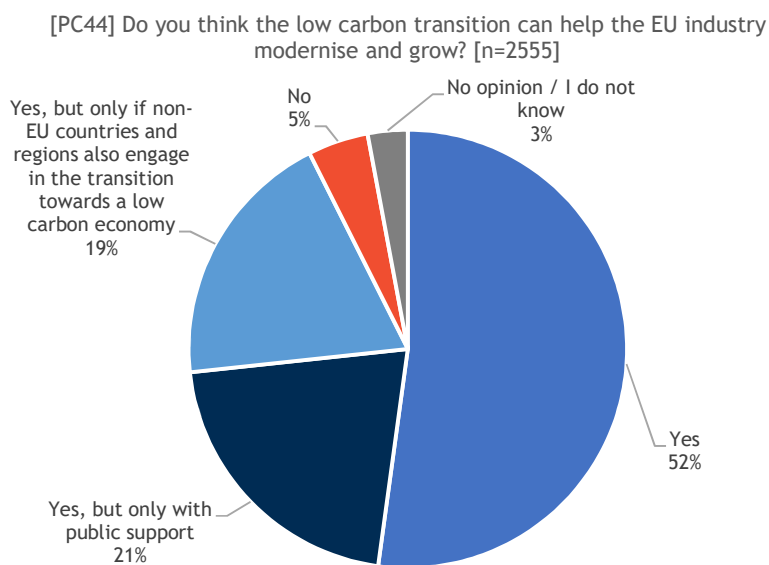**Figure 2-30: Stakeholder opinion on the impact of the low-carbon transition on EU modernisation and growth**

[PC44] Do you think the low carbon transition can help the EU industry modernise and grow? [n=2555]

- No opinion / I do not know 3%
- No 5%
- Yes, but only if non-EU countries and regions also engage in the transition towards a low carbon economy 19%
- Yes, but only with public support 21%
- Yes 52%

Table 2-11: Distribution of answers according to respondent type (PC44)

[PC44] Do you think the low carbon transition can help the EU industry modernise and grow? [n=2555] - Per respondent type					
Respondent type	Yes	Yes, but only with public support	Yes, but only if non-EU countries and regions also engage in the transition towards a low carbon economy	No	No opinion / I do not know
as an individual in your personal capacity [n=1934]	53%	22%	17%	5%	3%
in your professional capacity or on behalf of an organisation [n=621]	50%	19%	28%	1%	2%
Of which:					
Private enterprise, professions, trade and business associations [n=372]	40%	20%	37%	2%	1%
Non-governmental organisation, platform or network [n=125]	76%	10%	9%	1%	5%
Research and academia [n=26]	54%	23%	12%	8%	4%
Social partners [n=11]	36%	36%	27%	0%	0%
Of which: Unions [n=5]	40%	40%	20%	0%	0%
National, regional or local authority (mixed) [n=52]	56%	29%	13%	0%	2%
Other [n=35]	49%	20%	23%	0%	9%

Stakeholders were also asked '**[PC45]: How can opportunities and challenges (in particular related to carbon intensive sectors or regions) be addressed? What key economic transformations should the EU pursue to achieve a low carbon and resilient economy?'**

In total there were n=1 523 responses to this question.

Energy was raised by n=1 018 (67%) respondents, with a variety of issues, sometimes perceived as both opportunities and challenges. Among the issues raised:

- **Renewable energy** (as part of a clean or green energy system) was identified as an important issue for many (n=378 respondents); scaling up the use of renewable electricity was seen as a necessity by almost all across many technologies, but particularly solar and wind energy. In addition, on one hand many view it as an opportunity for EU industry, leadership and to reduce trade imbalances, on the other hand many recognise the challenge in scaling up renewable energy so rapidly and converting to 100% renewables.
- **Fossil fuels** were an important issue for many (n=322 respondents) with almost all respondents being clear on the necessity to reduce their use. This was viewed as both and opportunity and a challenge, with issues like stopping the mining and use of coal seen as an opportunity to reduce emissions but also an important social challenge to manage the change for affected workers and communities. Removing subsidies for fossil fuels was identified as a significant opportunity to both 'level the playing field' and to potentially save money to spend on energy efficiency or renewable energy.
- **Energy efficiency in buildings,** particularly for renovation but also new buildings was identified as an important issue for many (n=316 respondents); for new buildings this was primarily seen as an opportunity, with a focus on moving to zero-emission buildings; but for the renovation of old buildings the opinions perceived this as crucial but also challenging, with an important role for policy either to invest, incentivise or compel energy efficient renovation of existing buildings.
- **Industry energy use and efficiency** was identified as an important issue for many (n=182 respondents). Energy intensive industry was highlighted as a key sector, with challenges in terms of competitiveness and technical limitations to increase efficiency. Some respondents highlighted the risk that strict measures in Europe could lead to an 'export' of emissions as industry relocated outside Europe; whilst a similar proportion of people felt that greater efficiency in industry was an important opportunity for European industry for both cost reduction and image.
- **Other issues** identified as important, but at lower frequency, included citizen involvement in energy generation (prosumers), the potential opportunity for other energy sources, especially power-to-fuel, fusion, nuclear and ocean; and the important potential opportunities from decentralisation, smart grids and energy storage.

Mobility and transport emissions were raised by n=759 (50%) respondents, with a variety of issues, sometimes perceived as both opportunities and challenges. Among the issues raised:

- **Cars and road transport** were identified as an important issue for many (n=285 respondents). This was a critical issue for many perceived almost equally as an opportunity and challenge, with a need to reduce the use of individual vehicles identified as challenging, many suggesting the use of taxes and removal of subsidies to influence consumers.
- **Public transport** was identified as an important issue for many (n=210 respondents). Clearly linked to those advocating a reduction in car use was also the need to expand

public transport to provide an alternative, with a particular focus on urban areas. Many noted the need for further subsidies.

- **Electrification of transport** was identified as an important issue for some (n=96 respondents). This was perceived as an opportunity by most respondents, for reduced emissions and clean air.
- **Other issues** identified as important, but at lower frequency, included **air and maritime transport**, primarily noted in the context of the technical challenge to reduce emissions, and many suggested for air travel that short-haul flights should be more highly taxed. Improved **cycling i**nfrastructure was also mentioned by many.

Public policy related issues were raised by n=1 448 (95%) respondents, therefore almost every respondent saw some role for government action, with a variety of issues, sometimes perceived as both opportunities and challenges. Among the issues raised:

- **Taxes (carbon), pricing (ETS) and fiscal policy, including subsidies,** was identified as an important issue for many (n=567 respondents). This category received some of the strongest opinions, with respondents almost universally clear that policy should create market frameworks which result in prices and fiscal incentives at appropriate levels to encourage more sustainable choices, that polluters pay, and that climate-friendly choices should be the 'cheap option'. Within this there were a few important sub-strands, with some favouring a switch in taxation away from labour and towards consumption; many identified carbon taxes as a measure; whilst some focused specifically on the EU ETS calling for policymakers to ensure higher prices, potentially through the use of a price floor; Many respondents reconised the challenge of adjusting taxes and incentives in the context of global industrial competitiveness, and found it important that the impact on EU industry was considered. Among these one sub-group was keen that trade policy be used by the EU to encourage global sustainable choices, e.g. through tariffs on imports of goods produced in nations with no, or weak, climate mitigation policy, the United States (and its withdrawal from the Paris Agreement) was among those identified in this context. In the context of sectors that must be decarbonised there was support for managing the transition for those that would lose out, through subsidies and public investment.
- **Public investment** – was identified as an important issue for many (n=498 respondents), The key opportunities were seen for public funding of research and development, and pioneering innovative technologies and approaches. Among the challenges identified was the risk of corruption and the danger of 'picking winners'.
- **Planning and spatial policy** was identified as an important issue for some (n=144 respondents). It was seen as particularly important to achieve the right balance between national, regional and local action, with an emphasis on the opportunity for more action at local level. Opportunities were identified to improve urban development, to make this more sustainable, and particularly to improve cycling infrastructure through planning.
- **Regulation** was identified as an important issue for some (n=133 respondents). Some identified this as a powerful tool to compel climate action, among the specific issues related to this was the need to regulate for energy efficient renovation of existing buildings and the need to ban single use plastic bags and packaging. A small minority favoured de-regulation, seeing it as a way to 'free' the private sector to innovate solutions.

- **Other issues** identified as important, but at lower frequency, included education with the desire to introduce sustainability concepts into school curriculums among the key themes.

Specific emissions related issues were raised by n=404 (27%) respondents, with **Carbon capture, storage, use and/or removal** identified as the most important issue among this group (n=135 respondents). A specific opportunty was perceived by some for the development of Carbon Capture and Use (CCU) in sectors such as chemicals. Whilst the main focus of opinion on carbon storage was on the opportunity and potential for reforestation.

Specific economic sectors were identified by n=913 (60%) respondents with a variety of sectors singled out, sometimes perceived as both opportunities and challenges. Among the issues raised:

- **Waste management, recycling, re-use and circularity in practice** - were identified as an important issue for many (n=274 respondents). Respondents saw an opportunity (and need) to move to a more circular economy and improve recycling rates.
- **Sustainable production** was identified as an important issue for many (n=196 respondents). This was seen as an essential need for industry, with many identifying here that sustainability should be introduced at the product design stage and include aspects such as durability.
- **Agriculture** - were identified as an important issue for many (n=183 respondents). An opportunity was noted by many to reduce or adapt subsidies to make agriculture more sustainable. A strong link was made to the carbon footprint of food production and diet, with the opportunity (and challenge) to reduce meat and dairy production noted as specifically important.
- **Other sectors** referred to directly, but less frequently, included ICT (digital communications), chemicals (opportunities for reducing plastic and energy use), cement (challenge to actually reduce emissions) and textiles.

Paradigm shift was identified as a key factor by n=997 (65%) respondents, with a variety of issues, sometimes perceived as both opportunities and challenges. Among the issues raised:

- **Economic models – encompassing sustainable consumption and production, circular and life cycle thinking** - were identified as an important issue for many (n=843 respondents)**.** Whilst many found the need for a change in the current economic model and incentives it provides to producers and consumers there was a mix of opinion on what this should entail. Respondents were split relatively evenly between those that advocated a more radical rethink of economic growth and a transition to an alternative, such as a steady state economy – on the basis of the impossibility of infinite growth on a finite world; and those that saw more incremental changes to curb the worst excesses of the current system and achieve the necessary emissions reductions. Amongst the specific opportunities and measures were the need for increased circularity in economic thinking, an overhaul of neo-liberal economics and policy and to raise awareness amongst industry and others on what was actually possible.
- **Consumer behaviour** was identified as an important issue for many (358 respondents). The main focus of opinion here focused on improving consumer awareness and understanding of climate impacts – so that they could modify their behaviour accordingly, this was perceived as both an opportunity and a challenge.

- **Changing diet – eating less meat and dairy,** was identified as an important theme for many with this seen as providing a significant opportunity to reduce emissions.
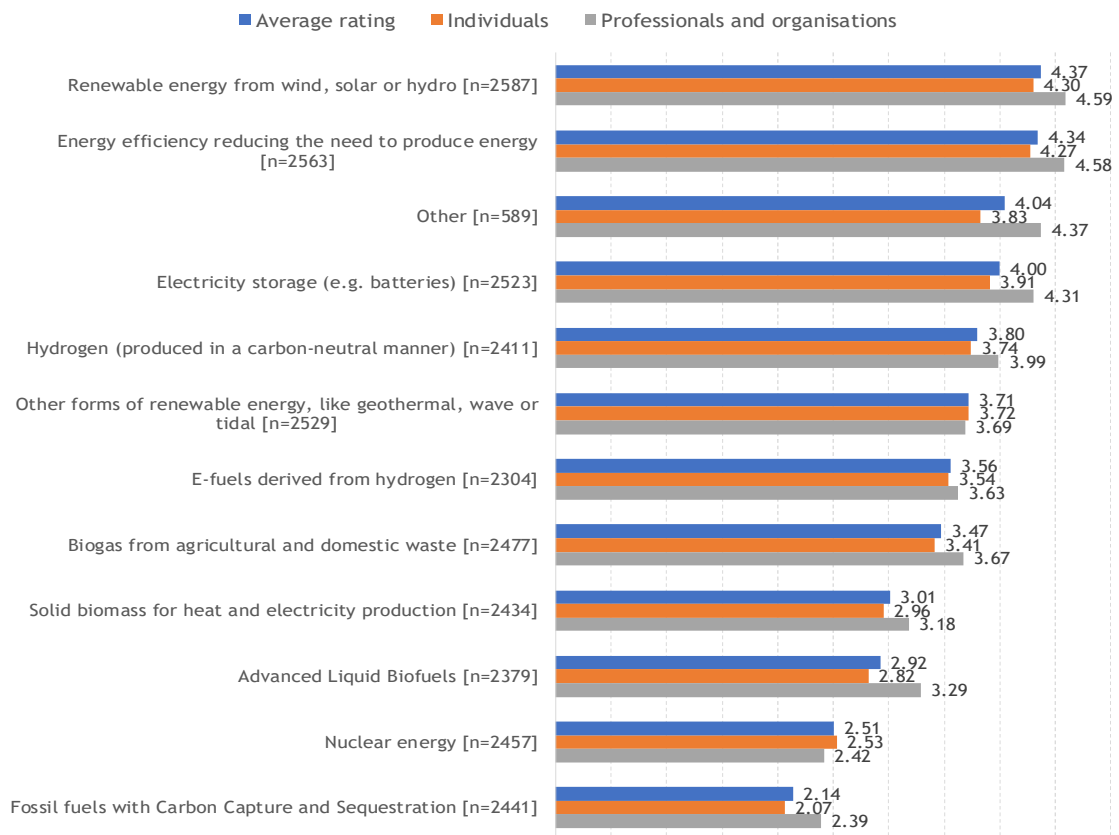
2.5 Expectations and opinions on the future of the energy system

When asked to rank the importance of energy technologies in the clean energy transition, respondents indicated that **renewable energy** was the most preferred technology. The least important role was envisaged for **fossil fuels with carbon capture and sequestration** with the lowest average rating of 2.14 (see the average rating per person, including the ranking of technologies in Figure 2-31).

Since respondents were asked to rate each technology on a scale of 1 to 5, the technology with the most importance was given the highest weight (5)[1]. Thus, the **average ratings** (or scores) represent a weighted average of the ratings that were assigned to each technology by the respondents. This method of calculating scores is valid for similar questions below.

Figure 2-31: Stakeholder ranking of energy technologies (from 1 (not important) to 5 (important))

[PC46] In the following table listing different energy technologies, please rank each option in the table below on what role you think they will play in the clean energy transition?

■ Average rating   ■ Individuals   ■ Professionals and organisations

Technology	Average rating	Individuals	Professionals and organisations
Renewable energy from wind, solar or hydro [n=2587]	4.37	4.30	4.59
Energy efficiency reducing the need to produce energy [n=2563]	4.34	4.27	4.58
Other [n=589]	4.04	3.83	4.37
Electricity storage (e.g. batteries) [n=2523]	4.00	3.91	4.31
Hydrogen (produced in a carbon-neutral manner) [n=2411]	3.80	3.74	3.99
Other forms of renewable energy, like geothermal, wave or tidal [n=2529]	3.71	3.72	3.69
E-fuels derived from hydrogen [n=2304]	3.56	3.54	3.63
Biogas from agricultural and domestic waste [n=2477]	3.47	3.41	3.67
Solid biomass for heat and electricity production [n=2434]	3.01	2.96	3.18
Advanced Liquid Biofuels [n=2379]	2.92	2.82	3.29
Nuclear energy [n=2457]	2.51	2.53	2.42
Fossil fuels with Carbon Capture and Sequestration [n=2441]	2.14	2.07	2.39

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[1] In the survey, respondents were asked to rank each technology on a scale of 1 (important) to 5 (not important). For the scope of this analysis, the ranking system was inversed for ease of readability. The technologies with the highest average rating (or score) are therefore the most important technologies and the ones with the lowest average rating (or score) are the least important.

Other technologies proposed by the respondents included: heat pumps, membrane technology, sorption dryers, CIP (cleaning in place), biofuels and biogas, fossil fuels, cold fusion, nuclear fusion, hydrogen (made using electrolysis of water), smart grids and solar technology.

Finally, respondents were requested to answer, in an open question format, the following questions: [PC47] **'What are the biggest opportunities, including for the wider economy? What are the biggest challenges, including as regards public acceptance or the availability of land and natural resources, related to these future developments?'**

Energy was raised by n=1031 (76%) respondents, with a variety of issues, sometimes perceived as both opportunities and challenges. Among the issues raised:

- **Renewable energy** (as part of a clean or green energy system) was identified as an important issue for many (n=455 respondents), an opportunity was perceived for this to creating new jobs and technologies whilst it was also viewed as a challenge in terms of its intermittency, availability and storage. Some elements were perceived as both challenges and opportunities, such as energy security (security of supply).
- **Energy efficiency** was identified as an important issue for n=376 respondents. A majority of respondents perceive this as an opportunity, such as to balance increases in energy demand, improve well-being and public health and reduce energy costs costs for the industry.
- **Energy storage, smart grids, digitalisation and other transformations of the energy system** was identified as an important issue for many (n=261 respondents), an opportunity was perceived for this to, for example, decentralize energy generation and promote local production, whilst it was also viewed as a challenge in terms of energy storage. On balance respondents tended to perceive this as carrying both challenges and opportunities.
- **Energy costs and affordability** was identified as an important issue for n=205 respondents, an opportunity was perceived for this to reduce energy costs for consumers, whilst it was also viewed as a challenge in terms of the overall cost of the energy transition and new technologies.
- **Nuclear** was mentioned by n=183 respondents, with some repodents seeing its opportunity in terms of balancing intermittent renewable energy sources, but also challenges in terms of public acceptance.
- **Hydrogen** was brought up by n=123 respondents, as was perceived as an opportunity in terms of energy storage, but also a challenge with regards to its future development and deployment and cost.
- **Fossil fuels** was identified as an important issue for n=118 respondents, an opportunity was perceived in the sense that currently low prices might facilitate a remove away from fossil fuels, whilst it was also viewed as a challenge in terms of phasing it out given many countries and/or industries dependence on fossil fuels. On balance respondents tended to perceive this as a challenge.

Mobility and transport were raised by n=470 (35%) respondents, with a variety of issues, sometimes perceived as both opportunities and challenges. Among the issues raised, electric vehicles were seen as an opportunity to reduce noise and air pollution, but also a challenge in ensuring the sustainability of

the source of the electricity. Many respondens also saw the mobility sector a challenging sector to decarbonise, especially with regards to aviation and shipping.

Education and research related issues were raised by n=575 (43%) respondents, with a variety of issues, sometimes perceived as both opportunities and challenges. Among issues raised:

- **Innovation and research** was identified as an important issue for n=359 respondents, an opportunity was perceived for this in terms of creating new jobs and growth in Europe, whilst it was also viewed as a challenge in terms of international competition and investment needs. On balance, innovation and research were identified as both key enablers and challenges to the energy transition.
- **Funding and investment** was identified as an important issue for n=221 respondents, an opportunity was perceived for this to use the European Investment Bank and the European Investment and Structural Funds to invest in for example infrastructure and research project, whilst it was also viewed as a challenge in terms of mobilizing sufficient funding from both public and private sources. On balance respondents tended to perceive this as an important challenge to overcome.
- **Acceptance and human adaptability** was identified as an important issue for n=180 respondents, an opportunity was perceived for this to to spur action at the local and individual level, whilst it was also viewed as a challenge in terms of public acceptance of certain technologies (such as nuclear and CCS) or land use for the production of biofuels or wind farms. On balance respondents tended to perceive this as a challenge.
- **Education and public awareness** was identified as an important issue for n=68 respondents, an opportunity was perceived for this to reindusturalise Europe, whilst it was also viewed as a challenge in terms of changing individual lifestyles and re-educating parts of the workforce. On balance respondents tended to perceive this as a challenge.

Public policy related issues were raised by 93% (n=1253) respondents, with a variety of issues, sometimes perceived as both opportunities and challenges. Among the issues raised:

- **Taxes and fiscal policy, including subsidies,** was identified as an important issue for n=314 respondents, and was perceived as an opportunity to shift production and consumption patterns (tax reform), whilst it was also viewed as a challenge in terms of subsidies of fossil fuels distorting competition.
- **Public investment** – including in R&D, was identified as an important issue for n=278 respondents, with an opportunity was perceived for this to leverage private investments and support invesments in key infrastructure, whilst it was also viewed as a challenge in terms of the overall cost of the investments needed to decarbonise the European economy (public investment alone is not sufficient).
- **Planning and spatial policy** was raised by n=228 respondents, with an opportunity was perceived for this to adapt to climate change and building codes to improve energy performance in buildings, whilst it was also viewed as a challenge in terms of planning of energy systems and location of energy production, such as wind parks.

Issues relating to the wider economy were identified by 54% of respondents (n=731), with a variety of sectors singled out, sometimes perceived as both opportunities and challenges. Among the issues raised:

- **Sustainable production** was identified as an important issue for many (n=503 respondents), an opportunity was perceived for this to stimulate a circular economy and sustainable food production, whilst it was also viewed as a challenge in terms of incentivising companies and industries to change production patters.
- **Trade and economic growth** was identified as an important issue for n=402 respondents. Opportunities were perceived for strengthening European competitiveness globally by being an early mover (developing technologies etc) and to integrate environmental and social concerns in international trade agreements. Perceived challenges also related to international competition, especially for the industrial sector.

Sustainability concerns were raised by 66% (n=892) respondents. Among the issues raised:

- **Destruction of natural spaces (including deforestation, land artificialisation)** was mentioned by n=794 respondents. Challenges in this conext as highlighted by respondents included the conversion of prime forests into forest plantations (for bioenergy or carbon offsetting) and soil degradation. Preserving natural spaces (such as ecosystems) was identified as an opportunity for adaptation.
- **Biomass sourcing** was mentioned by n=237 respondents, and was identified both as an opportunity in terms of creating jobs in rural areas and providing material for the bioeconomy, while it was also considered a challenge relating to land availability and biodiversity concerns, as alluded to above.
- **Land availability** was mentioned by n=231 respondents, mainly in relation to the effects of climate change on agricultural land but also competition between crops and their end use (such as food crops and energy crops), which also related to challengs related to food security.
- **Biodiversity** was raised by n=195 respondents, both as benfiting from climate mitigation (preserving healthy ecosystems) but also as a challenge in adverse effects both in Europe and abroad stemming from monoculture and land use change to produce biofuels.

Paradigm shift was identified as a key factor by 66% (n=883) respondents, with a variety of issues, sometimes perceived as both opportunities and challenges. Among the issues raised:

- **Economic models – encompassing sustainable consumption and production, circular economy and degrowth** - were identified as an important issue for n=624 respondents, and was perceived as an opportunity to shift to more sustainable consumption patterns and means of production, whilst it was also viewed as a challenge in terms of replacing current consumption patterns and lifestyles.
- **Lifestyles and work, including "fair transition", local economies and inequalities,** were identified as an important issue by n=434 respondents, an opportunity perceived was several of the benefits of the energy transition (such as green jobs and cleaner air) whilst it was also viewed as a challenge in terms of public acceptance and economic consequences for specific regions and industries.
- **Consumer behaviour** was in this context identified as an important issue by n=311 respondents

2.6   Stakeholder opinion on the role of forests and land use

Respondents were asked to rank activities in the land use sector and their importance in terms of reducing greenhouse gas emissions. Using a similar scoring method as mentioned in subsection 2.5, a ranking of all activities was calculated (see Figure 2-32). Stakeholder ranked the role of **forests as carbon sinks** as the most acceptable and important land-use activity to increase CO_2 absorption; while the least acceptable activity was **agriculture as a source for bio-energy (based on food crops)**.

Figure 2-32: Stakeholder ranking of land-use activities (from 1 (not important) to 5 (important))

[PC48] In the context of a long term strategy please rank each land-use activities in the table below to indicate which are acceptable and can be important to reduce greenhouse gas emissions and increase CO_2 absorptions (not all options need to be ranked)
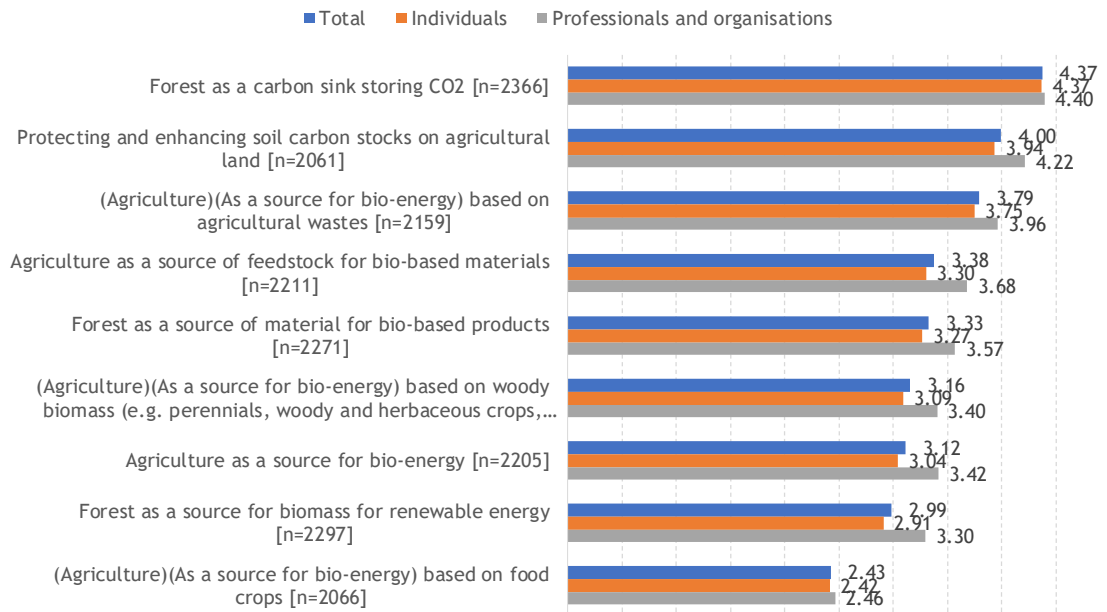
Respondents were also asked to comment, in an open question format, on the role, possibilities and challenges related to the land-use sector: **[PC49] 'What should be the role of the land-use sector in reducing emissions and increasing absorptions emissions? For what purposes should biomass be used most to reduce greenhouse gas emissions? How and which sustainability concerns should be addressed?'** several issues were raised:

This question received n=1042 responses.

On the question of **the role of the land-use sector in emissions reduction** a handful of key themes emerged in responses:

- **Increasing forest areas and improving forest management** were among the main focuses of respondents, with almost all respondents recognising the key role that forests play as carbon sinks, and also that reforestation and improved management would be important to achieve emissions reductions. Some respondents identified co-benefits to biodiversity and mental health from increased forest cover.

- **Reduced livestock production** was identified as an important way in which emissions could be reduced, as both a large emitting activity and as part of a needed shift in diet.
- **Soils and peatlands,** particularly soils, were identified as important carbon sinks that could play an important role in emissions reduction and absorption. Respondents identified a variety of ways in which agricultural techniques such as low or zero tillage, and crop rotation, could play a role in achieving this.
- **Other issues** also mentioned, although less frequently, included the potential for **urban farming** and the need for Bio-Energy Carbon Capture and Storage (**BECCS**).

On the question of **for which purposes biomass should be used for emissions reduction** the following key themes emerged from responses.

- **Bad idea to use biomass for power,** this was amongst the most commonly expressed views with respondents clearly sceptical of the emissions reduction/neutrality and finding food production the key purpose of cropland. Respondents were also concerned about low energy content compared to other fuels, the particulate and other pollution and also on the scale (and type) of biomass needed and the land this would require.
- **Local production and consumption** was preferred by respondents, particularly in context of using forest residues or industrial wastes as fuels for heating. Additionally the use of anaerobic digestors for biogas production for local use was also noted as having potential.
- **Construction and furniture materials,** were amongst the preferred uses for biomass, as in this way emissions were 'locked in' and if they displaced more carbon intensive materials such as cement or steel then this would be of benefit.
- **Other issues raised,** but less frequently, included the possibility for biomass to be used to **improve soil carbon retention**, the use of biomass to produce **bioplastics**, and the use of **biomass in transport fuels**.

**Sustainability concerns** were common to many responses, with the following key themes emerging:

- **Biodiversity concerns,** from continued expansion of agricultural land, or increased production of energy crops. The emergence of monocultures was flagged as a particular concern.
- **Tropical deforestation,** was raised as a key issue, with fears that EU demands for biofuels for transport was causing indirect land-use change, particularly in countries such as Indonesia and Malaysia and therefore that the net emissions balance was actually negative.
- **Not to convert land from food to energy production,** was noted as an important social sustainability concern, with reduced food production seen as potentially tipping poorer people into hunger.

2.7 Facilitating the low carbon transition through education, research and innovation

This section addressed the central role of accelerating research and innovation to facilitate the transition to a low-carbon economy. Respondents indicated that awareness raising to change attitudes, values and mind-sets could best be done **at school through education** (see Figure 2-33 and Table 2-12**),** alongside local and regional and national and EU wide campaigning. Moreover, the **energy, industry** and **transport sectors** were considered those on which R&D efforts should focus on primarily in the coming decade to best support the low carbon transition (see Figure 2-34 and Table 2-13).

Figure 2-33: Stakeholder opinion on raising awareness to change attitudes and values or mind-sets [At most 3 choices]

[PC50] How best could awareness be raised to create the right attitude and values/ mind-sets? [n=2515]
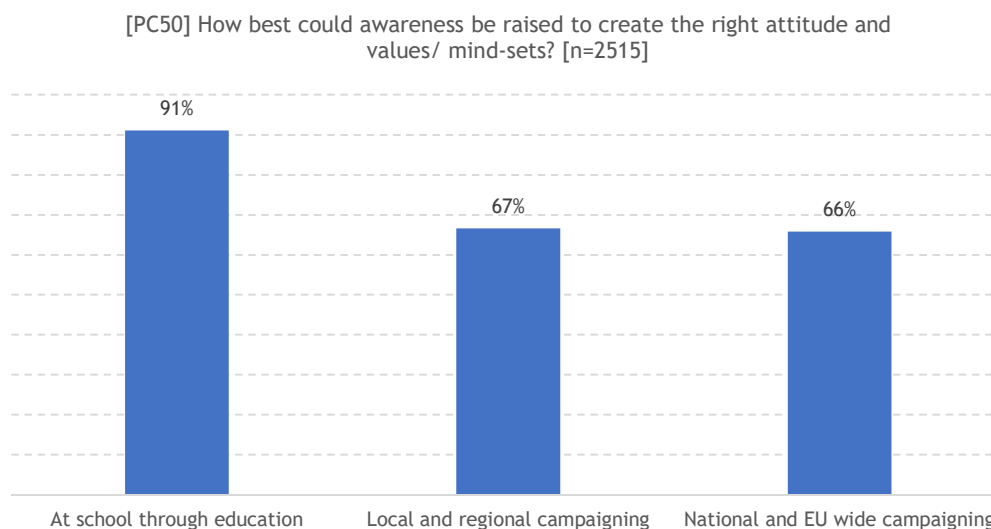
Table 2-12: Frequency of answers according to respondent type (PC50)

[PC50] How best could awareness be raised to create the right attitude and values/ mind-sets? [n=2515] - Per respondent type			
Respondent type	At school through education	Local and regional campaigning	National and EU wide campaigning
as an individual in your personal capacity [n=1934]	91%	64%	63%
in your professional capacity or on behalf of an organisation [n=581]	91%	75%	76%
Of which:			
Private enterprise, professions, trade and business associations [n=325]	89%	73%	78%
Non-governmental organisation, platform or network [n=128]	92%	84%	80%
Research and academia [n=28]	89%	54%	68%
Social partners [n=11]	82%	91%	73%
Of which: Unions [n=5]	80%	100%	80%
National, regional or local authority (mixed) [n=54]	93%	83%	61%
Other [n=35]	97%	66%	60%

Figure 2-34: Stakeholder opinion on focus sectors for R&D efforts [At most 6 choices]

[PC51] On which sectors should R&D efforts focus primarily in the coming decade to best support the low carbon transition? [n=2575]
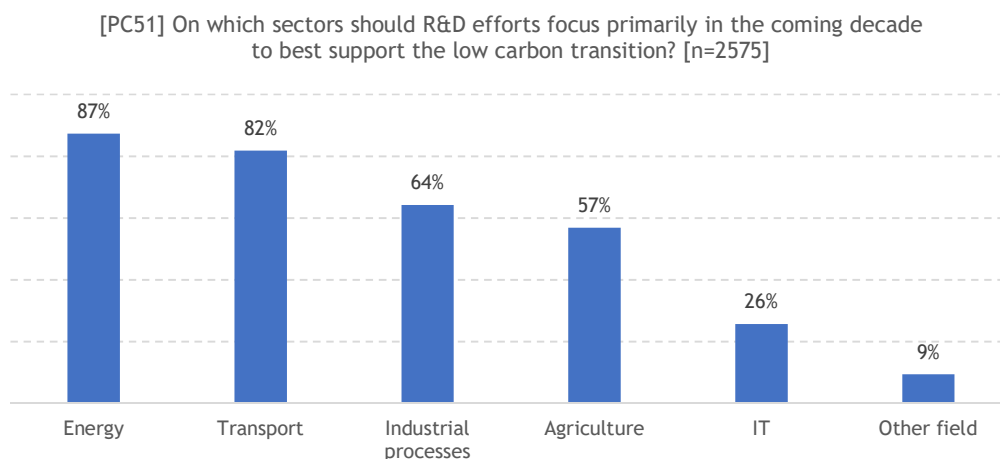

Table 2-13: Frequency of answers according to respondent type (PC51)

[PC51] On which sectors should R&D efforts focus primarily in the coming decade to best support the low carbon transition? [n=2575] - Per respondent type						
Respondent type	Energy	Transport	Industrial processes	Agriculture	IT	Other field
as an individual in your personal capacity [n=1959]	86%	82%	62%	58%	23%	7%
in your professional capacity or on behalf of an organisation [n=613]	90%	81%	73%	53%	36%	16%
Of which:						
Private enterprise, professions, trade and business associations [n=361]	91%	77%	70%	45%	29%	17%
Non-governmental organisation, platform or network [n=127]	90%	88%	81%	73%	59%	11%
Research and academia [n=29]	76%	69%	62%	48%	21%	17%
Social partners [n=10]	90%	80%	100%	40%	40%	20%
Of which: Unions [n=4]	100%	100%	100%	25%	50%	0%
National, regional or local authority (mixed) [n=52]	88%	96%	71%	63%	37%	12%
Other [n=34]	100%	88%	76%	53%	35%	24%

Finally, respondents answered the following questions in an open question format: **[P52] 'On which cross-sectoral domains should R&D efforts focus in the coming decades? Is there a particular need for large scale deployment of certain innovative technologies? Is there a different role for authorities and private sector in support R&D and innovation'**. Respondents focused mainly on:

- **Renewable energy** was mentioned by 59% (n=611) of respondents. R&D focus should focus on new and promising technologies such as tidal energy, but efforts should also be directed towards reducing the deployment cost of currently available technologies. Many respondents further emphasised the need to decarbonise the power sector, which will in turn facilitate the reduction of emissions in the mobility sector through the electrification of the vehicle fleet. In
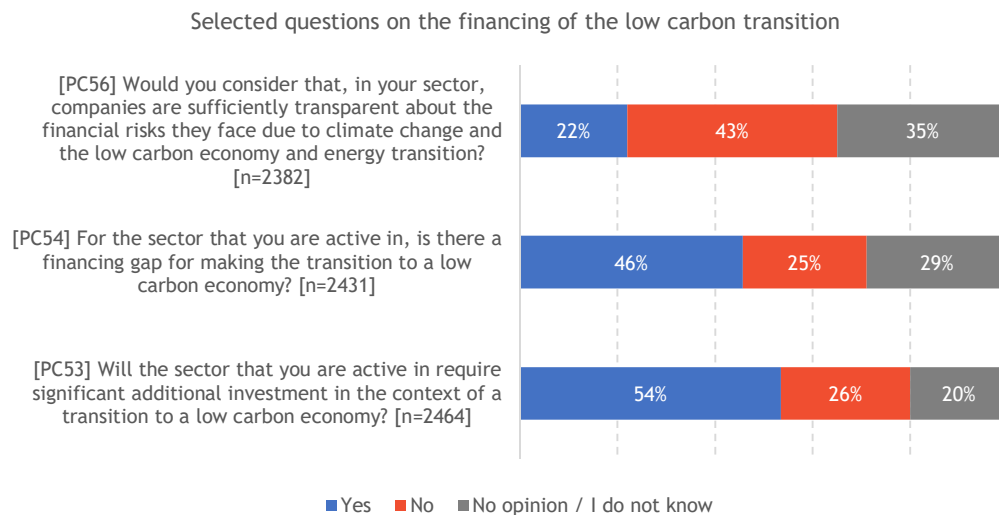
addition to the power sector, the deployment of renewables in the heating and cooling sector was also emphasised.

- **Energy efficiency,** included in n=506 responses, should be targeted and improved both for industry and regular consumers (such as efficiency in buildings).
- **Industrial processes,** covered by n=333 respondents, should receive further attention, especially to target sectors and industries with process emissions. In this context, several respondents mentioned the importance of CCUS technologies.
- **Mobility and transport - electrification, charging stations, hydrogen, public transport –** was deemed important by n=325 respondents. Electrification was the most common theme in this category, while some respondents also saw a role for CCS technology for heavy transport. Batteries and battery technology was also prominent in comments regarding transport.
- **Energy storage - batteries, decentralized storage and supply,** was highlighted by n=199 respondents. Described as one respondent as "the holy grail" of the energy transition, energy storage technologies will be key to deploy in several sectors, especially the power sector. Improved storage technologies would improve the stability in the energy system.
- **Hydrogen,** mentioned by n=188 respondents, should be further improved to develop technologies such as hydrogen fuel-cells and power-to hydrogen for energy storage, but also to decarbonise the transport sector.

2.8 Financing the low carbon transition

More than half of the respondents indicated that the sector in which they are active requires **significant additional investments** to undertake the transition to a low carbon economy, with almost half of respondents acknowledging that there is a **financing gap** in their sector. In addition, over 40% of stakeholders highlighted that companies are **not transparent** enough about climate change and the low carbon transition and the financial risks that they face due these changes (see Figure 2-35, Table 2-14, Table 2-15 and Table 2-16). With regards to financial risks there was a significant difference between respondent groups: only 17% of the individual respondents believed companies were sufficiently transparent, compared to 52% of those responding on behalf of a private enterprise, profession, trade of business organisation.

Figure 2-35: Stakeholder opinion on the financing of the low carbon transition

Selected questions on the financing of the low carbon transition

[PC56] Would you consider that, in your sector, companies are sufficiently transparent about the financial risks they face due to climate change and the low carbon economy and energy transition? [n=2382] — 22% / 43% / 35%

[PC54] For the sector that you are active in, is there a financing gap for making the transition to a low carbon economy? [n=2431] — 46% / 25% / 29%

[PC53] Will the sector that you are active in require significant additional investment in the context of a transition to a low carbon economy? [n=2464] — 54% / 26% / 20%

■Yes ■No ■No opinion / I do not know

Table 2-14: Distribution of answers according to respondent type (PC53)

[PC53] Will the sector that you are active in require significant additional investment in the context of a transition to a low carbon economy? [n=2464] – Per respondent type			
Respondent type	Yes	No	No opinion / I do not know
as an individual in your personal capacity [n=1860]	44%	32%	25%
in your professional capacity or on behalf of an organisation [n=604]	84%	11%	5%
Of which:			
Private enterprise, professions, trade and business associations [n=363]	88%	8%	4%
Non-governmental organisation, platform or network [n=118]	74%	17%	9%
Research and academia [n=25]	68%	12%	20%
Social partners [n=11]	91%	9%	0%
Of which: Unions [n=5]	80%	20%	0%
National, regional or local authority (mixed) [n=50]	86%	10%	4%
Other [n=37]	81%	19%	0%

Table 2-15: Distribution of answers according to respondent type (PC54)

| [PC54] For the sector that you are active in, is there a financing gap for making the transition to a low carbon economy? [n=2431] – Per respondent type			
Respondent type	Yes	No	No opinion / I do not know
as an individual in your personal capacity [n=1847]	36%	29%	35%
in your professional capacity or on behalf of an organisation [n=584]	76%	13%	11%
Of which:			
Private enterprise, professions, trade and business associations [n=350]	81%	11%	9%
Non-governmental organisation, platform or network [n=114]	71%	17%	12%
Research and academia [n=25]	40%	24%	36%
Social partners [n=11]	91%	9%	0%
Of which: Unions [n=5]	80%	20%	0%
National, regional or local authority (mixed) [n=48]	71%	17%	13%
Other [n=36]	75%	17%	8%

Table 2-16: Distribution of answers according to respondent type (PC56)

[PC56] Would you consider that, in your sector, companies are sufficiently transparent about the financial risks they face due to climate change and the low carbon economy and energy transition? [n=2382] – Per respondent type			
Respondent type	Yes	No	No opinion / I do not know
as an individual in your personal capacity [n=1824]	17%	45%	38%
in your professional capacity or on behalf of an organisation [n=558]	40%	36%	24%
Of which:			
Private enterprise, professions, trade and business associations [n=332]	52%	23%	26%

[PC56] Would you consider that, in your sector, companies are sufficiently transparent about the financial risks they face due to climate change and the low carbon economy and energy transition? [n=2382] - Per respondent type			
Respondent type	Yes	No	No opinion / I do not know
Non-governmental organisation, platform or network [n=113]	19%	65%	16%
Research and academia [n=24]	25%	50%	25%
Social partners [n=10]	50%	20%	30%
Of which: Unions [n=4]	50%	25%	25%
National, regional or local authority (mixed) [n=46]	22%	43%	35%
Other [n=33]	24%	52%	24%

Respondents were asked about their opinion on the public sector's involvement in ensuring adequate financing for the low carbon transition. A large share agreed that the **public sector should be more involved in ensuring adequate financing**, either through **direct investments** or by **ensuring more low cost finance for sustainable investments** (see Figure 2-36 and Table 2-17).

Figure 2-36: Stakeholder opinion on the public sector's involvement in ensuring adequate financing for the low-carbon transition

[PC55] Should public sector be more involved in ensuring adequate financing for the low carbon transition? [n=2473]
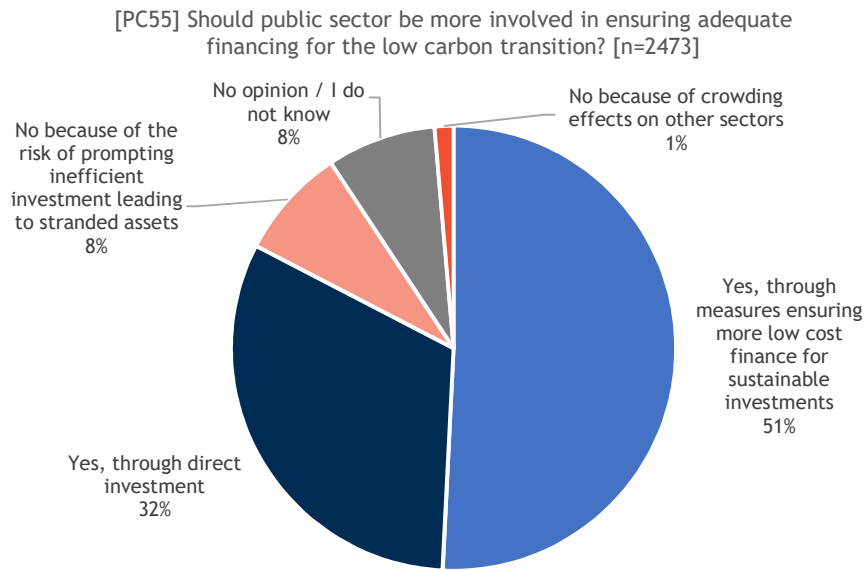
Table 2-17: Distribution of answers according to respondent type (PC55)

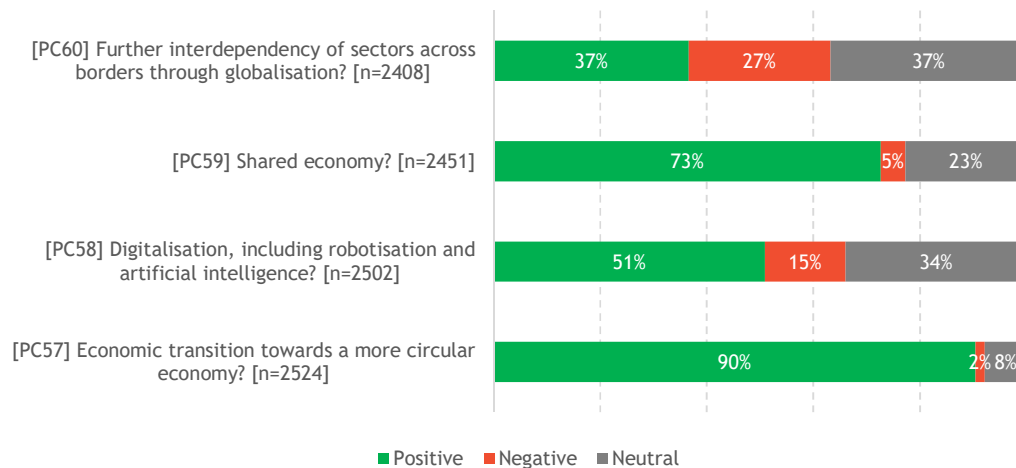| [PC55] Should public sector be more involved in ensuring adequate financing for the low carbon transition? [n=2473] - Per respondent type					
Respondent type	Yes, through measures ensuring more low cost finance for sustainable investments	Yes, through direct investment	No because of the risk of prompting inefficient investment leading to stranded assets	No opinion / I do not know	No because of crowding effects on other sectors
as an individual in your personal capacity [n=1876]	49%	32%	9%	8%	1%

45

in your professional capacity or on behalf of an organisation [n=597]	58%	30%	4%	6%	1%
Of which:					
Private enterprise, professions, trade and business associations [n=355]	57%	29%	6%	7%	1%
Non-governmental organisation, platform or network [n=123]	58%	33%	4%	4%	2%
Research and academia [n=26]	54%	38%	0%	8%	0%
Social partners [n=10]	70%	30%	0%	0%	0%
Of which: Unions [n=5]	60%	40%	0%	0%	0%
National, regional or local authority (mixed) [n=49]	57%	39%	0%	2%	2%
Other [n=34]	74%	15%	0%	12%	0%

2.9 Meta trends

In this section, respondents were asked which trends currently shaping our societies are important to reducing greenhouse gas emissions. A vast majority of stakeholders considered the **economic transition towards a more circular economy, digitalisation and the shared economy** positive trends enabling the reduction of greenhouse gas emissions. The views were relatively more dispersed when talking about the benefits of sector interdepency in the context of globalisation (see Figure 2-37, Table 2-18, Table 2-19, Table 2-20 and Table 2-21).

Figure 2-37: Stakeholder opinion on the trends that are important to reducing greenhouse gas emissions

Do you think the following trends are important to reduce greenhouse gas emissions?

	Positive	Negative	Neutral
[PC60] Further interdependency of sectors across borders through globalisation? [n=2408]	37%	27%	37%
[PC59] Shared economy? [n=2451]	73%	5%	23%
[PC58] Digitalisation, including robotisation and artificial intelligence? [n=2502]	51%	15%	34%
[PC57] Economic transition towards a more circular economy? [n=2524]	90%	2%	8%

■ Positive ■ Negative ■ Neutral

Table 2-18: Distribution of answers according to respondent type (PC57)

[PC57] Economic transition towards a more circular economy? [n=2524] - Per respondent type			
Respondent type	Positive	Negative	Neutral
as an individual in your personal capacity [n=1923]	89%	2%	9%
in your professional capacity or on behalf of an organisation [n=601]	95%	1%	4%
Of which:			
Private enterprise, professions, trade and business associations [n=347]	95%	1%	5%
Non-governmental organisation, platform or network [n=127]	94%	2%	5%
Research and academia [n=26]	96%	4%	0%
Social partners [n=11]	100%	0%	0%
Of which: Unions [n=5]	100%	0%	0%
National, regional or local authority (mixed) [n=55]	98%	0%	2%
Other [n=35]	97%	0%	3%

Table 2-19: Distribution of answers according to respondent type (PC58)

[PC58] Digitalisation, including robotisation and artificial intelligence? [n=2502] - Per respondent type			
Respondent type	Positive	Negative	Neutral
as an individual in your personal capacity [n=1919]	46%	18%	36%
in your professional capacity or on behalf of an organisation [n=583]	67%	7%	27%
Of which:			
Private enterprise, professions, trade and business associations [n=345]	74%	3%	23%
Non-governmental organisation, platform or network [n=113]	40%	19%	42%
Research and academia [n=25]	40%	16%	44%
Social partners [n=11]	82%	0%	18%
Of which: Unions [n=5]	60%	0%	40%
National, regional or local authority (mixed) [n=53]	74%	6%	21%
Other [n=36]	78%	0%	22%

Table 2-20: Distribution of answers according to respondent type (PC59)

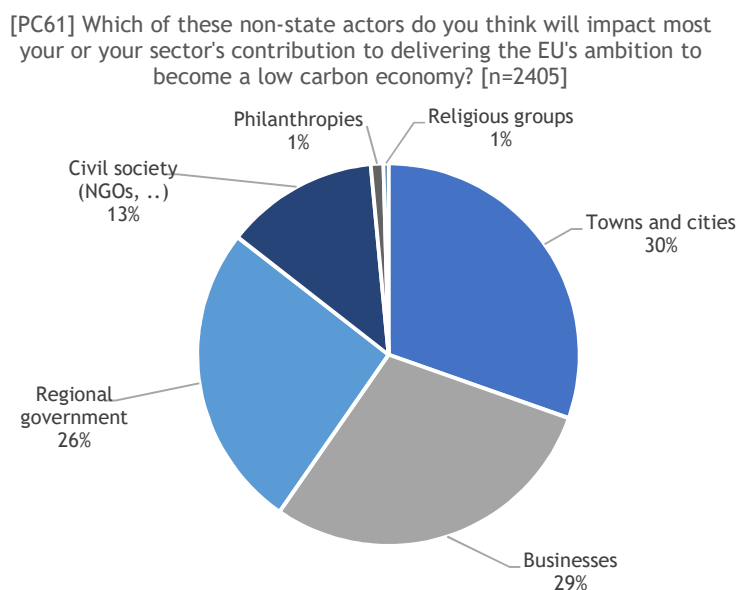| [PC59] Shared economy? [n=2451] - Per respondent type			
Respondent type	Positive	Negative	Neutral
as an individual in your personal capacity [n=1890]	71%	6%	23%
in your professional capacity or on behalf of an organisation [n=561]	77%	1%	22%
Of which:			
Private enterprise, professions, trade and business associations [n=321]	71%	1%	28%
Non-governmental organisation, platform or network [n=123]	88%	1%	11%
Research and academia [n=26]	85%	0%	15%
Social partners [n=10]	70%	10%	20%
Of which: Unions [n=3]	25%	25%	50%
National, regional or local authority (mixed) [n=46]	82%	2%	16%
Other [n=30]	81%	0%	19%

Table 2-21: Distribution of answers according to respondent type (PC60)

[PC60] Further interdependency of sectors across borders through globalisation? [n=2408] - Per respondent type			
Respondent type	Positive	Negative	Neutral
as an individual in your personal capacity [n=1878]	35%	29%	35%
in your professional capacity or on behalf of an organisation [n=530]	41%	17%	42%
Of which:			
Private enterprise, professions, trade and business associations [n=314]	44%	13%	43%
Non-governmental organisation, platform or network [n=106]	25%	20%	55%
Research and academia [n=25]	32%	36%	32%
Social partners [n=9]	44%	22%	33%
Of which: Unions [n=3]	33%	33%	33%
National, regional or local authority (mixed) [n=46]	52%	20%	28%
Other [n=30]	50%	30%	20%

2.10 Actors of the low carbon transition

In this section, respondents were asked which non-state actors would have the biggest impact on their sector's contribution to deliver on the EU's ambition (n=2405). About a third of the respondents expected **towns and cities** would have the most impact and some comparable shares indicated **regional governments** and **businesses** (see Figure 2-38). However, when looking at the responses of private organisations and businesses[2], close to half of respondents (45%) expected **businesses** to have the most impact (see Table 2-22).

Figure 2-38: Stakeholder opinion on the non-state actors that have an important role in the transition to a low-carbon economy

[PC61] Which of these non-state actors do you think will impact most your or your sector's contribution to delivering the EU's ambition to become a low carbon economy? [n=2405]

Philanthropies 1%
Religious groups 1%
Civil society (NGOs, ..) 13%
Towns and cities 30%
Regional government 26%
Businesses 29%

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[2] Sub-category 'Private enterprise, professions, trade and business associations' (n=322).

Table 2-22: Distribution of answers according to respondent type (PC61)

[PC61] Which of these non-state actors do you think will impact most your or your sector's contribution to delivering the EU's ambition to become a low carbon economy? [n=2405] - Per respondent type						
Respondent type	Towns and cities	Business-es	Regional govern-ment	Civil society (NGOs, ..)	Philan-thropies	Religious groups
total [n=2405]	30%	29%	26%	13%	1%	0%
as an individual in your personal capacity [n=1855]	29%	28%	28%	13%	1%	1%
in your professional capacity or on behalf of an organisation [n=550]	34%	35%	19%	11%	1%	0%
Of which:						
Private enterprise, professions, trade and business associations [n=322]	28%	45%	23%	3%	0%	0%
Non-governmental organisation, platform or network [n=117]	44%	12%	9%	35%	1%	0%
Research and academia [n=21]	62%	14%	14%	10%	0%	0%
Social partners [n=7]	14%	43%	14%	29%	0%	0%
Of which: Unions [n=3]	0%	33%	33%	33%	0%	0%
National, regional or local authority (mixed) [n=49]	47%	29%	16%	8%	0%	0%
Other [n=34]	26%	38%	26%	6%	3%	0%

Respondents were further asked, in an open question format, to provide examples of types of initiatives of particular importance to underline the role of such actors in the low carbon economy and energy transition, [PC62] related to:
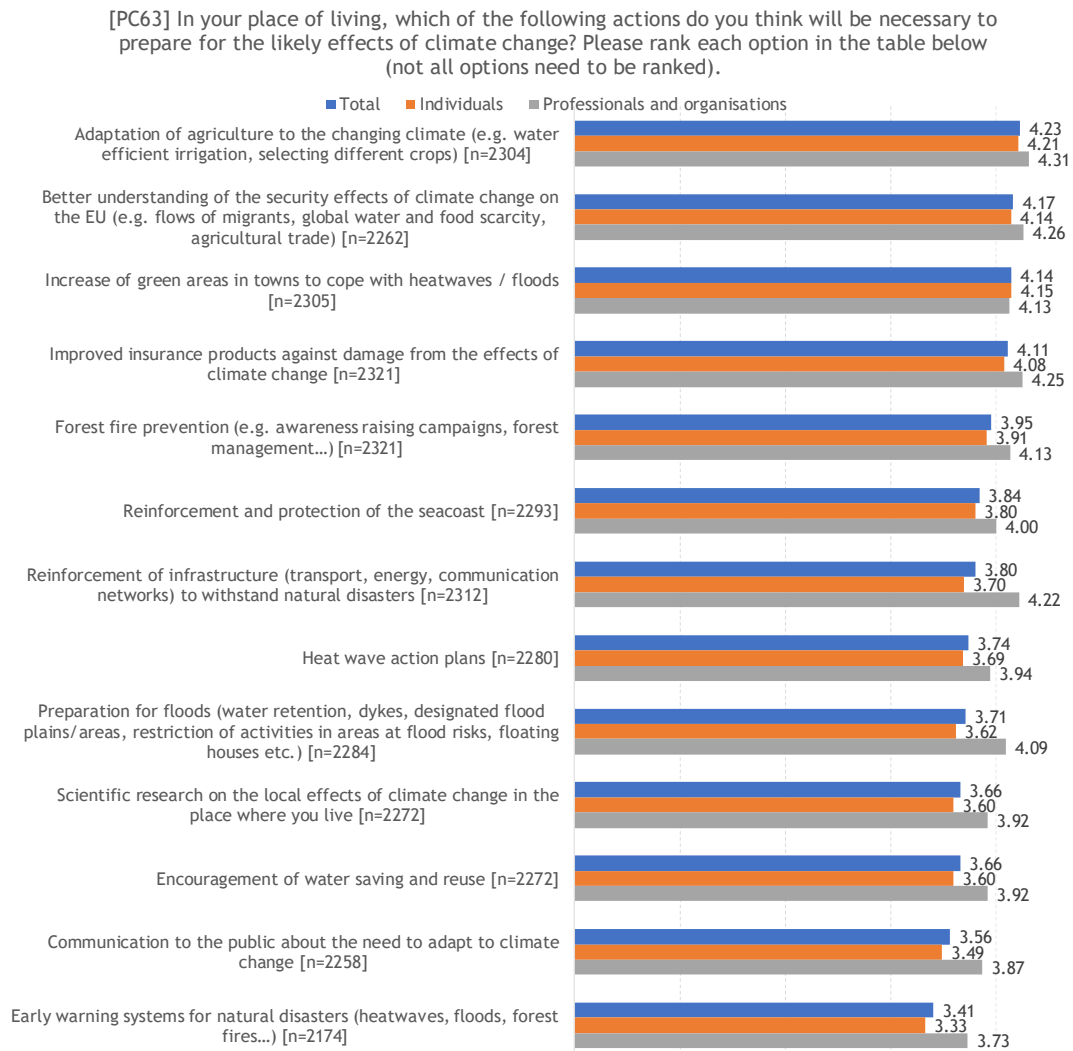
- **Infrastructure and spatial planning** was identified as one of the crucial areas for action by regional government, towns and cities. The majority of respondents focused on **transport and mobility** issues, highlighting the need for improved cycling and pedestrian infrastructure, the need to encourage cleaner vehicles and/or deter more polluting vehicles, the need for better public transport and overall a better conception of urban planning and integrated transport planning. To a lesser extent respondents also noted the potential to do more to address **heating** related issues through the expansion of district heating networks or better insulation of buildings. Finally, there were a handful of references to examples such as urban farming.

- **Action at different levels of governance,** was noted as important, whilst EU and national level seen as playing an important role in rule setting and major decisions an important role was foreseen for other actors in spatial planning (regional government) and in more practical day-to-day issues (local/city government).. Whilst regional level was seen as particularly relevant and powerful in the area of spatial planning. Local government (cities and towns) were seen as important actors due to being the closest governance level to citizens and with powers to affect some of the most practical issues in peoples lives.

- **Energy generation** was identified by around 1/3 of respondents as an important area for action and initiative. Many of the examples focused on local, decentralised renewable energy generation (primarily solar PV), either by individual citizens or through cooperatives or associations. Some noted the potential for municipal involvement in these projects, with a sharing of profits. A minority of respondents focused on a perceived aversion to nuclear power by the public and decision makers as hindering the low carbon and energy transition.

- **Private sector action** was not a major focus of respondents, but those who did highlight it felt that it would play a major role, but only if the market and policy framework provided the right incentives (through prices and taxes) for action.

2.11 Adaptation

Respondents were asked to rank which actions they thought would be necessary to to prepare for and adapt to the likely effects of climate change in their place of living. All proposed measures received average ratings ranging from 3.41 to 4.23 (see subsection 2.5 for an explanation of the method of calculating average ratings), thus indicating an overall high level of importance given to all adaptation measures. **Adapting agriculture to the changing climate, better understanding of the security effects of climate change on the EU and increasing the amount of green areas in cities to cope with heatwaves and floods** were ranked as the top three measures (see Figure 2-39).

Figure 2-39: Stakeholder ranking of actions to prepare for the likely effects of climate change (from 1 (not important) to 5 (important))

[PC63] In your place of living, which of the following actions do you think will be necessary to prepare for the likely effects of climate change? Please rank each option in the table below (not all options need to be ranked).

Legend: ■ Total ■ Individuals ■ Professionals and organisations

Action	Total	Individuals	Professionals and organisations
Adaptation of agriculture to the changing climate (e.g. water efficient irrigation, selecting different crops) [n=2304]	4.23	4.21	4.31
Better understanding of the security effects of climate change on the EU (e.g. flows of migrants, global water and food scarcity, agricultural trade) [n=2262]	4.17	4.14	4.26
Increase of green areas in towns to cope with heatwaves / floods [n=2305]	4.14	4.15	4.13
Improved insurance products against damage from the effects of climate change [n=2321]	4.11	4.08	4.25
Forest fire prevention (e.g. awareness raising campaigns, forest management…) [n=2321]	3.95	3.91	4.13
Reinforcement and protection of the seacoast [n=2293]	3.84	3.80	4.00
Reinforcement of infrastructure (transport, energy, communication networks) to withstand natural disasters [n=2312]	3.80	3.70	4.22
Heat wave action plans [n=2280]	3.74	3.69	3.94
Preparation for floods (water retention, dykes, designated flood plains/areas, restriction of activities in areas at flood risks, floating houses etc.) [n=2284]	3.71	3.62	4.09
Scientific research on the local effects of climate change in the place where you live [n=2272]	3.66	3.60	3.92
Encouragement of water saving and reuse [n=2272]	3.66	3.60	3.92
Communication to the public about the need to adapt to climate change [n=2258]	3.56	3.49	3.87
Early warning systems for natural disasters (heatwaves, floods, forest fires…) [n=2174]	3.41	3.33	3.73

Finally, respondents were asked, in an open question format, which adaptation measures were of particular importance for their sector, and why [PC64] and answered.

This question received n=704 open responses. Many respondents continued to focus on emissions mitigation issues rather than actual adaptation issues and measures. Amongst the key themes for adaptation that were mentioned:

- **Greater preparation is needed,** was a common theme across every sector, with few if any respondents believing they were already well prepared. The types of preparation included better design of infrastructure, improved coastal infrastructure (against sea-level rise and storms), better water management (floods and droughts) and improved planning for extreme events. Agriculture and Energy were among the key sectors specifically at risk.
- **Awareness raising** was noted by many as an important step, with a strong perception that few (including politicy makers) really understood the impacts of climate change, the risks and vulnerabilities it would bring and the types of actions that would be needed. Migration from affected non-EU countries into the EU was highlighted by many as an issue, with some linking this to security concerns.
- **Adaptation measures** were highlighted for a handful of specific cases, including an increase in number of green areas and trees in cities, improved insultation and cooling of buildings, and improved insurance.
- **Mitigation as adaptation** was highlighted by some respondents, with one of the key adaptation measures being to mitigate emissions sufficiently that less adaptation would be needed.

2.12 Sector specific greenhouse gas reduction options

2.12.1 *Industry*

Stakeholders were asked to list up to ten industrial sectors and associated mitigation options, and to indicate the mitigation potential, economic viability, technological readiness and year of large-scale deployment for each option. 482 respondents provided an answer to this question, filling in 1 598 rows in total.

The following table (Table 2-23) lists the subsectors that were referred to in the sector question on transport, with a list of the most commonly cited technology options and average perception of mitigation potential, economic viability, technological readiness and expected year of large scale deployment. Each option could be rated as high (+++), medium (++) or low (+), in each column. When respondents presented a wide variety of ratings, the average rating is considered as 'varied' (~).

Please note that some responses (n=119) did not fit into the theme of this question or could not be clearly identified.

Table 2-23: Industry table (PC65)

Subsector	Technology option	Mitigation potential	Economic viability	Technology readiness	Expected year of large scale deployment
Manufacturing as a whole [n=314]	Use of renewable energy in the production process	+++	+/++	++	Unknown

Subsector	Technology option	Mitigation potential	Economic viability	Technology readiness	Expected year of large scale deployment
	Recycling and re-use of material in the production process (e.g. glass, plastic, paper, metals, cement)	~	++/+++	+++	After 2019
	For the ceramics sector, new kiln design (ecodesign) and heat recovery in the production process	+++	++	++	Unknown
	In the automotive manufacturing sector, electrification of the automotive fleet and more use of renewable energy and hydrogen were both generally seen as important measures	+++	+++	++/+++	Up to 2025
Energy [n=256]	Renewable energy	+++	+++	++/+++	Now
	Nuclear energy	+++	++/+++	++/+++	Up to 2070
	Heat pump technology	+++	+++	++/+++	Now
Chemicals manufacture and refining [n=233]	CCS and CCU	++/+++	+/++	~	After 2020
	Hydrogen production	++/+++	+/++	++	After 2020
	Biorefinery, biomass as feedstock and other biofuels/gas	++/+++	~	~	Up to 2030
Iron and Steel and other metals manufacture [n=179]	Use of bio-based fuels (coke, gas, coal and biochar)	+++	~	++	After 2025
	Use of hydrogen	+++	~	~	After 2025
	CCS and CCU	++/+++	~	~	After 2020
Cement manufacture (including lime and concrete) [n=170]	Substitution of clinker	+++	+++	++	Now
	Employing CCS/CCU	+++	+/++	+/++	After 2025
	Substitution of cement with other material, as well as recycling of cement/concrete	++/+++	++/+++	+++	Now
Transportation and logistics [n=87]	Electrification of transport (including electrification of shore-side activity in ports)	+++	~	~	Up to 2035
	Hydrogen	+++	~	~	Up to 2060
	Biofuels	++	~	+++	After 2020
Whole economy [n=84]	Reduce consumption	~	~	~	Now
	Increase recycling	+++	+++	+++	Now
	Energy efficiency, industrial symbiosis and use of waste heat	~	~	+++	Now

Subsector	Technology option	Mitigation potential	Economic viability	Technology readiness	Expected year of large scale deployment
	Telecommunications and ICT were picked out by a handful of respondents - these identified the potential for more carbon neutral datacenters and low-energy cooling	~	~	~	Now
	More distance/remote working	+++	+++	+++	2020
	Other specific measures raised by a handful of respondents included a ban on cryptocurrency in the financial sector, the need for greater integration of renewables and energy efficiency into architecture	+++	++/+++	~	Up to 2035
Construction [n=54]	Renovation and insulation	+++	+++	+++	Now
	Use of wood	++/+++	~	~	After 2020
	Heat pump technology in buildings/homes	~	~	+++	Now
Agriculture, forestry and fishing [n=48]	Use of bio-based material for packaging, construction, textiles and other goods	++/+++	~	~	Now
	Additionally, a handful of respondents noted the reduction of meat production, resource efficiency in agriculture, and recyling and resuse of waste as potential measures	++/+++	~	~	After 2020
Water and waste [n=20]	Heat recovery and industrial recycling	++/+++	++/+++	++/+++	After 2020
	Waste-to-energy	++/+++	+/++	++/+++	Up to 2035
	Composting of organic waste and landfill diversion	+++	+++	+++	Now

2.12.2 Transport

Similarly, stakeholders were asked to list up to ten parts of the transport sector and associated mitigation options. 549 respondents provided an answer to this question, filling in 1 977 rows in total.

The following table (Table 2-24) lists the subsectors that were referred to in the sector question on transport, with a list of the most commonly cited technology options and average perception of mitigation potential, economic viability, technological readiness and expected year of large scale deployment. Each option could be rated as high (+++), medium (++) or low (+), in each column. When respondents presented a wide variety of ratings, the average rating is considered as 'varied' (~).

Please note that some responses (n=101) did not fit into the theme of this question or could not be clearly identified.

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Table 2-24: Transport sector table (PC66)

Subsector	Technology option	Mitigation potential	Economic viability	Technology readiness	Expected year of large scale deployment
Shipping, maritime travel or similar [n=330]	Fuel switch to hydrogen (including green hydrogen)	+++	+/++	++	Unknown
	Fuel switch to Liquified Natural Gas (LNG) (including bio-LNG)	++	++/+++	+++	Up to 2030
	Solar and/or wind power	~	+++	+++	After 2025
Commercial vehicles [n=283]	Electric heavy-duty vehicles	+++	~	+++	After 2020
	Improved logistical efficiency (including smarter infrastructure)	+++	++/+++	+++	Up to 2030
	Use of rail for freight/merchandise transport	+++	+++	~	Unknown
Road transport [n=275]	Electrification and use of batteries (especially for cars and light-duty vehicles)	+++	++/+++	+++	Up to 2030
	Fuel switch to synthetic fuels, biofuels, LNG and biogas	~	++	++/+++	Up to 2040
	Modal shift (away from road travel)	+++	+++	+++	Now
Aviation [n=270]	Electrification and use of biofuels (including electrification of airport equipment)	++/+++	~	~	Up to 2050
	Improvements in fuel efficiency (i.e. through aircraft design improvements)	++	~	~	After 2030
	Modal shift towards land and sea (especially for short-distance flights)	+++	+++	+++	Now
Private cars [n=198]	Car sharing	+++	+++	+++	Now
	Electrification of cars (fuel cells and batteries)	+++	~	~	After 2020
	Switch to biofuels	+++	++	++/+++	Unknown
The transport sector as a whole [n=194]	Low carbon energy sources (bio- and low carbon fuels, electrification, use of hydrogen and CNG/LNG)	++/+++	~	++/+++	Up to 2040
	Improved urban planning (e.g. shortened travel distances, promotion of electric vehicles, parking spaces close to public transport)	+++	++/+++	+++	Up to 2030
	Development of multimodal (or intermodal) transport solutions and modal shift towards more low carbon methods of transportation (e.g. from road to rail)	++/+++	++/+++	+++	Up to 2030
Rail [n=144]	Electrification of rail networks	+++	+++	+++	Up to 2040
	Expansion and integration of the European rail network	++/+++	++/+++	++/+++	Up to 2040
	Higher speed trains, as an alternative to short-distance flights	~	~	~	After 2020

Subsector	Technology option	Mitigation potential	Economic viability	Technology readiness	Expected year of large scale deployment
Public transport [n=129]	Expansion of the public transportation system (e.g. extension of metro lines), as well as improving the accessibility and affordability of the system	+++	+++	+++	Up to 2030
	Fuel switch to electricity, hydrogen or biofuels	+++	++	~	Up to 2030
Other [n=63]	Cycling promotion and cycling infrastructure	+++	+++	+++	Now
	Fuel switching for powered two-wheeler vehicles (e.g. electric scooters)	+++	~	~	Up to 2030
	Encouraging walking (in cities)	++/+++	+++	+++	Now

In addition, respondents were asked to provide their opinion on whether they would consider switching from road to alternative modes of transport for freight transport. The large majority of respondents said they would make the switch (see Figure 2-40 and Table 2-25).

Figure 2-40: Stakeholder opinion on switching from road to alternative modes of transport for freight transport

[PC67] For freight transport, would you consider switching from road to alternative modes like rail, waterways or coastal shipping? [n=1858]

No, too slow or complicated
10%

No, too expensive
2%

No opinion / I do not know
12%

Yes
76%
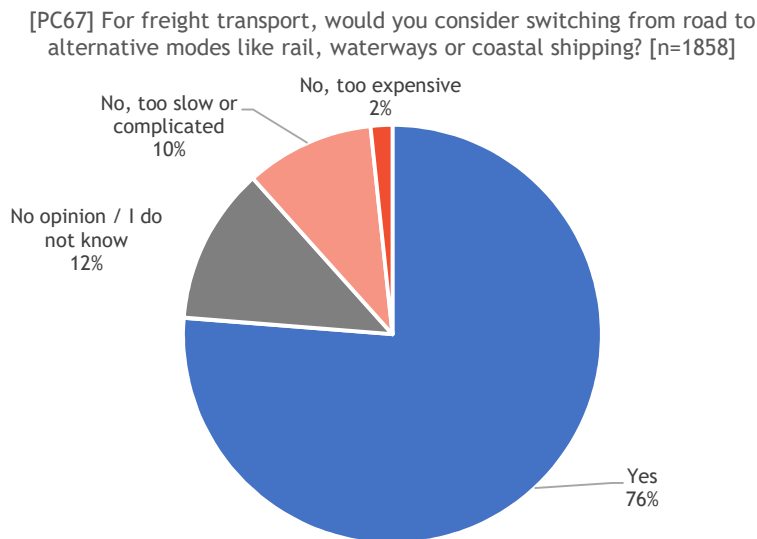
Table 2-25: Distribution of answers per respondent type (PC67)

[PC67] For freight transport, would you consider switching from road to alternative modes like rail, waterways or coastal shipping? [n=1858] - Per respondent type				
Respondent type	Yes	No opinion / I do not know	No, too slow or complicated	No, too expensive
as an individual in your personal capacity [n=1448]	77%	11%	9%	2%
in your professional capacity or on behalf of an organisation [n=410]	72%	15%	12%	1%
Of which:				

Private enterprise, professions, trade and business associations [n=224]	61%	21%	17%	2%
Non-governmental organisation, platform or network [n=91]	92%	5%	2%	0%
Research and academia [n=19]	79%	11%	11%	0%
Social partners [n=6]	100%	0%	0%	0%
Of which: Unions [n=3]	100%	0%	0%	0%
National, regional or local authority (mixed) [n=42]	79%	14%	7%	0%
Other [n=28]	75%	11%	14%	0%

Respondents were also asked about making a switch from road to alternative modes of transport for first/last mile logistics. More than half of respondents stated that they would consider such a switch in the future (see Figure 2-41 and Table 2-26).

Figure 2-41: Stakeholder opinion switching from road to alternative modes of transport for first/last mile logistics

[PC68] For first/last mile logistics in urban areas, would you consider switching from road to alternative modes like (electric) cargo bike or similar zero-emission vehicle? [n=1834]

- No, too slow 3%
- No 3%
- No opinion / I don't know 12%
- Yes, in the future 52%
- Yes, I am already doing it 30%
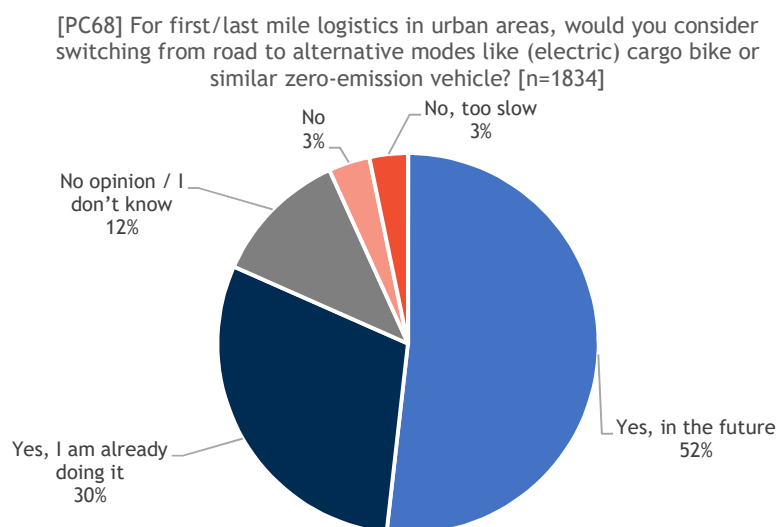
Table 2-26: Distribution of answers per respondent type (PC68)

[PC68] For first/last mile logistics in urban areas, would you consider switching from road to alternative modes like (electric) cargo bike or similar zero-emission vehicle? [n=1834] - Per respondent type					
Respondent type	Yes, in the future	Yes, I am already doing it	No opinion / I don't know	No	No, too slow
as an individual in your personal capacity [n=1437]	55%	28%	11%	3%	3%
in your professional capacity or on behalf of an organisation [n=397]	41%	36%	15%	5%	4%
Of which:					
Private enterprise, professions, trade and business associations [n=213]	42%	23%	23%	8%	4%
Non-governmental organisation, platform or network [n=93]	24%	71%	3%	1%	1%
Research and academia [n=19]	58%	37%	5%	0%	0%
Social partners [n=5]	100%	0%	0%	0%	0%
Of which: Unions [n=2]	100%	0%	0%	0%	0%
National, regional or local authority (mixed) [n=41]	49%	39%	10%	0%	2%

Other [n=26]	58%	23%	4%	0%	15%

2.12.3 *Agriculture*

Stakeholders were asked to list up to ten parts of the agricultural sector and associated mitigation options. 303 respondents provided an answer to this question, filling in 903 rows in total.

The following table (Table 2-27) lists the subsectors that were referred to in the sector question on agriculture, with a list of the most commonly cited technology options and average perception of mitigation potential, economic viability, technological readiness and expected year of large scale deployment. Each option could be rated as high (+++), medium (++) or low (+), in each column. When respondents presented a wide variety of ratings, the average rating is considered as 'varied' (~).

Please note that some responses (n=74) did not fit into the theme of this question or could not be clearly identified.

Table 2-27: Agricultural sector table (PC69)

Subsector	Technology option	Mitigation potential	Economic viability	Technology readiness	Expected year of large scale deployment
The agricultural sector as a whole [n=352]	Organic (bio) farming and the use of organic soils	+++	~	~	Now
	Biofuels, biomethane, biogas and biomass (including the use of agricultural waste for the production of bioenergy and the use of biofuels for agricultural machineries)	+++	~	+++	Up to 2030
	Carbon sinks (soil, including soil cover crops), CCS and CCU	+++	~	+++	Up to 2030
Livestock [n=241]	More spacious farms (i.e. shift away from industrial livestock farming)	+++	++	+++	Up to 2020
	Encourage behavioural change to more plant-based diets (i.e. reduce meat production)	+++	++	+++	Now
	Improved manure management, use of manure for biogas production and change of animal diets to reduce emissions from manure	+++	++	+++	Up to 2030
Agriculture (crops) [n=201]	Better management of fertilisers and pesticides (e.g. more natural products, low ammonia-emitting fertilisers, controlled release fertilisers, digestate), including less use of fertilisers and pesticides	+++	++	+++	Up to 2030
	Vertical or indoor farming (including greenhouses heated using alternative fuels, renewable energy or hybrid systems)	++ / +++	~	~	After 2020

Subsector	Technology option	Mitigation potential	Economic viability	Technology readiness	Expected year of large scale deployment
Other [n=31]	Forestry was named as one issue, with measures including reforestation, afforestation and improved forest management; use of bio-based products and wood (e.g. in construction); and, planting of fire resistant trees (e.g. oak)	++/+++	++/+++	~	Up to 2050
	Fisheries were mentioned by a handful of respondents, with measures including: micro algae production; digitalisation and robotisation; and, reduction of fish consumption and regeneration of fish populations	+++	+++	~	After 2020
	Energy generation from agricultural waste (local networks, power and heat generation from pyrolysis and methane production)	~	+++	+++	Now
	Insect farming	+++	+++	+++	2030

2.13 Stakeholder opinion on the role of CO$_2$ removal

Furthermore, respondents were asked to estimate and rate the role of various CO$_2$ removal and storage methods and technologies in the EU in delivering negative emissions, taking into account issues such as economic and technical feasibility, storage potential, environmental integrity and social acceptance.

Amongst the five proposed measures, **direct air capture** received the lowest average rating (see method of calculation in subsection 2.5), while **other measures**, **intensive afforestation** and **woody perennial plantations** were in the top three (see Figure 2-42). It is interesting to note that the most important method of capture for individuals is **intensive afforestation**, while for professionals it is **other options**. Options mentioned by professionals include: improved land and forest management, the protection and restoration of forests and natural ecosystems (including reforestation), BECCS, biochar, CCU, pre-combustion capture, the sea as a carbon sink and oceanic algal blooms.

Figure 2-42: Stakeholder ranking of CO2 capture options (from 1 (not important) to 5 (important))

[PC70] Capture of CO2 from the atmosphere

■Total　■Individuals　■Professionals and organisations

Other [n=253]
- 4.25
- 3.92
- 4.59

Intensive afforestation [n=1963]
- 4.21
- 4.27
- 4.00

Woody perennial plantations [n=1816]
- 3.76
- 3.83
- 3.49

Forest and cropland residues [n=1786]
- 3.75
- 3.79
- 3.61

Direct Air Capture [n=1797]
- 2.94
- 2.97
- 2.84
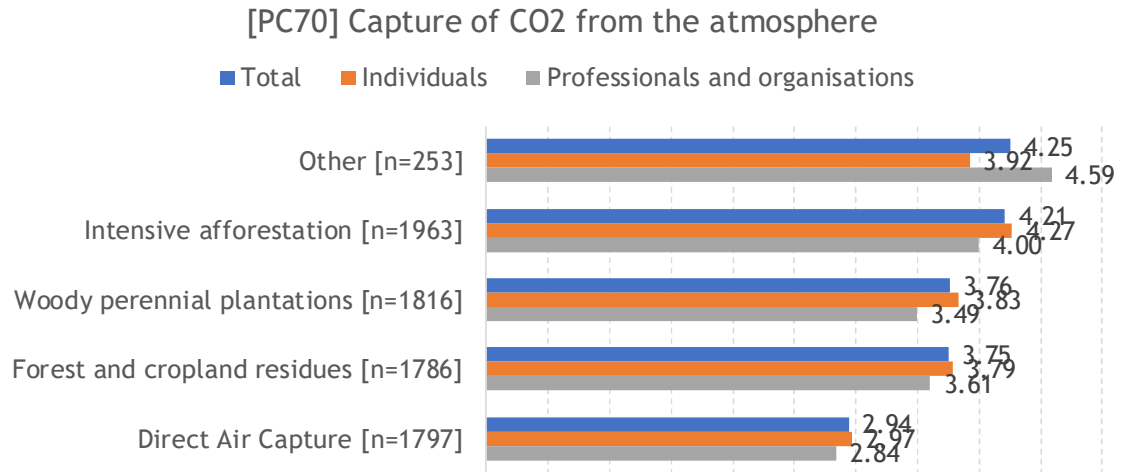
Carbon Capture and Storage (CCS) in onshore or offshore geological sites were ranked as the least important carbon storage technologies, while respondents estimated **increased permanent stock in plants and soils** and **other methods** to be the most important (see Figure 2-43). Once again, professionals opted for **other options** over the methods presented in the table, while individuals rated **increased permanent carbon stock in plants** as the most important method. The other methods highlighted by professionals include: restoration of forests and natural ecosystems, CCU, BECCS, carbon stocks in the sea, biochar and wood products.

Figure 2-43: Stakeholder ranking of CO2 storage options (from 1 (not important) to 5 (important))

[PC71] Storage of CO2

■Total　■Individuals　■Professionals and organisations

Increased permanent carbon stock in plants [n=1677]
- 3.84
- 3.83
- 3.87

Other [n=137]
- 3.81
- 3.44
- 4.21

Increased permanent carbon stock in soils [n=1631]
- 3.60
- 3.50
- 3.90

Carbon Capture and Utilisation (CCU) (long lived products) [n=1654]
- 3.39
- 3.33
- 3.55

Carbon capture and storage (CCS) with enhanced oil or gas recovery [n=1645]
- 2.66
- 2.66
- 2.65

CCS in offshore geological sites [n=1604]
- 2.62
- 2.55
- 2.83

CCS in onshore geological sites [n=1622]
- 2.60
- 2.60
- 2.59

Finally, respondents were asked to comment on, in an open question format: **[PC72] 'What main barriers do you see currently preventing the large scale deployment of CCS, including on how to use it to generate negative emissions? What are the particular challenges related to biomass CCS? What type of CCU (Carbon Capture and Utilization) would lend itself to create long term storage? Are there other technologies that should also be considered? What policies do you think the EU should pursue to better help development and deployment?'**

Respondents (n=705) highlighted the following aspects as being important:

Barriers to large scale CCS that were identified include
- **Efficiency and scalability** (n=163), with concerns expressed over both the energy required to implement CCS, and the availability of sufficient geological storage facilities. Alongside this some respondents doubted whether there was sufficient time to scale up CCS by 2040 or 2050.
- **Public support and acceptability** (n=62), was noted as an important issue by many, with doubts over the safety and permanence of CCS storage being particularly prominent.
- **Economic viability** (n=49), was highlighted as an important issue by many respondents, with significant doubts over the business model for CCS, particularly whether the savings (income) could actually outweigh the costs. A related concern was over who would pay for the costs.

Challenges to BECCS (Bio-energy carbon capture and storage) (n=165). BECCS was an important point of discussion among the responses, with major concerns expressed over the actual emissions savings achievable with this technology, many doubted that negative emissions could be achieved and that it may in fact be counterproductive given the energy inputs needed (in its value chain) and diversion of resources from other technologies. Additionally, whether it could be scaled up sufficiently given competing land-uses was a concern.

Carbon Capture and Use (CCU) (n=212) was identified as a potential opportunity, particularly in the area of building and construction materials, fuels and for specific industrial sectors such as steel, cement and chemicals, and would be preferred by some if the business case could be established. There were considerably more doubts over the efficiency, cost and feasibility of applying CCU in the power generation sector. There was also some opposition to further CCU in the oil and gas sector (for enhanced recovery) as this was thought to sustain these industries longer than necessary.

Other technologies that could be considered were:
- **Renewable energy** (n=284) and the potential for CCS to compete with it was among the foremost concerns of respondents, who saw that CCS would divert attention from renewable energy and unnecessarily prolong the use of fossil fuels.
- **Ecosystem-based carbon capture**, e.g. re- or afforestation, or other natural systems, was a preferred option expressed by many respondents.
- There was also a significant minority arguing that **CCS was no solution** and a more fundamental paradigm shift was needed to avoid emissions in the first place.

Policies
- The need for more **pilot projects and further research** (n=190) was highlighted by some as an important priority, to achieve the cost reductions necessary. But there were also many

respondents concerned about the research funding already spent for little apparent progress. Others found that spending on further research could better look at alternative technologies such as synthetic foods or next generation (III and IV) nuclear power.

- Further policy discussion saw a handful of respondents noting the necessity of setting the right incentive frameworks, looking at the EU-ETS function and pricing and in public funding of elements of the CCS value chain (e.g. transport and storage infrastructure).

2.14 Other comments

Respondents were also asked for any other comments, n=684 respondents gave a final answer. Most respondents returned to previous themes to re-emphasise particular issues. Amongst the key themes referred to were:

- **Public policy** – was addressed by almost all respondents in one way or another, with particular attention drawn to taxes and fiscal policy, carbon budgets, planning and spatial policy and public investments.
- **Energy** – with more than half of the respondents returning to this issue in one form or another. Common themese in this category were on the need to reduce fossil fuels and to increase renewable energy and energy efficiency.
- **Land use change and deforestation** was also an important issue that was noted by respondents (n=371) and closely linked to this were those that drew attention to sustainability concerns and biodiversity loss (n=354), and the role of agriculture (n=251).
- **The need for a paradigm shift and different economic models** was returned to by many respondents (n=396) with many (re-)noting the need to reduce consumption.
- **Other issues** returned to included Mobility and transport (n=247) and public support and awareness (n=133).

Feedback on the survey itself was also received from some respondents. Amongst these there was a lack of understanding of the sector table questions (analysed in section 2.12), some concerns about the length and nature (leading) of the questions, and also the ability of people to actually answer them.

2.15 Submitted position papers

In addition to the OPC questionnaire, stakeholders could also submit position papers. In total, 175[3] papers were submitted by the end of the the OPC, of which 39[4] already did in reaction to the roadmap consultation (https://ec.europa.eu/info/law/better-regulation/initiatives/ares-2018-3742094_en).

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[3] This Chapter does not include summaries of submissions that were not given consent to be be published
[4] In total, 39 papers were submitted but one submission was removed as it did not comply with the European Commission's rules for publishing feedback

2.15.1 *Papers submitted as part of the Roadmap consultation*

Summary: Submissions under the roadmap consultation covered a broad range of topics. Some stakeholders outlined their support for an EU strategy that is in line with the 1.5gC goal of the Paris Agreement, with the long-term goal of Europe attaining net-zero emissions by 2050. The majority of respondents did however rather emphasise considerations and elements to be included in the strategy. Common views were the need to ensure a global rule-based order (level playing field) for climate action, the need to invest in further innovation, ensuring a just transition, continue to put energy efficiency first, the cost-effectiveness of continued use of the existing gas-infrastructure and the prominent role of the EU ETS. Moreover, several stakeholders underlined the importance of ensuring transparency in the drafting process of the Strategy, both with regards to modelling, methodologies and assumptions.

Aedes (Dutch association for housing corporations). Refurbishing the building stock can be an important contribution to the long-term strategy, but large investments will be needed. It is therefore important to facilitate bottom-up initiatives and sectorial agreements as well as fit-for-purpose financial instruments suitable for smaller local projects, and stimulate innovation for affordable renovations.

BASF (chemical company). Reindustrializing Europe needs to be a key aim of the strategy, and economic and social aspects needs to be taken into account. Carbon is an important component (substance) in the chemical industry and will so remain – "decarbonizing European industry" is therefore an inappropriate expression. A stable and innovation friendly policy framework is needed not to undermine trust for investments in Europe.

Belgian Federation for Chemistry and Life Science (ESSENSCIA). ESSENCIA welcomes the new strategy for long-term greenhouse gas emissions, but underlined that such a strategy can only be developed in a correct way it includes a deep and calculated impact assessment of EU policies vis-à-vis possible policy scenarios in other regions. Furthermore, investments in innovation to develop cost-competitive technologies will be key.

Central Europe Energy Partners (CEEP). Designing long-term climate strategy is a highly complicated and complex task, as it encompass many sectors and social and economic policies. The Strategy should therefore be accompanied by proper quantitative and qualitative analysis and must include a deep and detailed impact assessment on the functioning of the EU's industry, transport and power sectors. It should also acknowledge the differing preconditions and starting points of Member States. CEEP also stresses the technology neutrality principle, as only a combination of technologies will allow fulfilling the objectives of the Paris Agreement. Moreover, given the significant investment needed to undertake the low-carbon transition, the Multi-Annual Financial Framework for years 2021-27, and every subsequent EU budget thereafter, should increase spending on energy and climate.

The Confederation of European Forest Owners (CEPF). The Confederation of European Forest Owners underlines the role of forests in sequestering carbon and the move to a low-carbon bio-economy. The Strategy should analyze scenarios taking into account the core link between sustainable management and long-term climate goals to be achieved via increased carbon sequestration, carbon storage and substitution of fossil-based materials. Maintaining the forest carbon stock is crucial, thus requiring a

separate target for the LULUCF sector and the sector remaining a separate pillar also in the post-20320 period. Reducing emissions from energy intensive sectors such as transport by switching to renewable materials should be given priority over "compensating" these emissions by increased carbon uptake in the LULUCF sector. Given the increasing risks of for example forest fires, sustainable sourcing of woody biomass to substitute fossil fuel based material must be promoted and incentivized, in line with the concept of sustainable forest management.

European Chemical Industry Council (**CEFIC).** The European Chemical Industry Council also does not promote the term "decarbonizing EU industrial production" but rather "low-carbon EU industrial production", as carbon continue to constitute an essential component of the chemical industry. Reindustrializing Europe should be key objective of the Strategy, and climate ambition should go hand in hand with competitiveness. Moreover, the Strategy must be based on solid and transparent assumptions. Investors need a stable and innovative-friendly framework and stable policy objectives. Finally, industrial emissions must be tackles globally, not only in the EU.

European Centre of Employers and Enterprises providing Public Services and Services of General Interest (CEEP). As a cross-industry social partner, CEEP underlines that digitalization and the energy transition is a revolution for companies and enterprises. Measures need to be undertaken to enable a 'just transition' of the workforce. The Strategy should enable a level playing field for all decarbonization technologies, ensure a better alignment of EU energy- and climate policies and emphasize the role of local actors. Finally, decarbonization of the power sector and electrification should be actively pursued.

The European Association for the Promotion of Cogeneration (COGEN Europe). Cogeneration will be key in delivering Europe's long-term decarbonisation objectives, as it constitutes an efficient, consumer-led, fuel-flexible systems integrating solution. The EU long-term strategy should continue to put efficiency first, take an integrated approach to energy systems and promote a mix of decarbonisation solutions across key energy infrastructures (electricity, heating&cooling and gas). Moreover, the Strategy should account for the role and contribution of different energy consumers, pay special attention to the cost-effective decarbonisation of heat and developed a framework that foster investment security for both solution providers and energy consumers. Beyond 2030, cogeneration should be prioritised for all thermal generation of heat and electricity, thus avoiding waste of valuable resources. A doubling of cogeneration capacity in Europe by 2050 will complement the increasing share of intermittent renewable energy sources, thus ensuring system efficiency and reliability, as well as consumer empowerment. The burden of decarbonisation should not be put on one sector alone but will require and integrated approach to energy planning and system operation, thus also unlocking synergies between different energy infrastructures and levels.

ECOFYS – Gas for Climate. Meeting the goals of the Paris Agreement will require a major redesign of our energy systems. Accordingly to this study - which baseline assumption is for all gas consumption in Europe to be carbon neutral by 2050 - ECOFYS estimates that renewable gas production (biomethane and renewable hydrogen) can be scaled up to a capacity of 122 billion cubic meter by 2050. Moreover, using existing infrastructure will save up to EUR 138 billion compared to decarbonisation scenarios excluding natural gas. The majority of the gas consumption would be allocated to the buildings and power generation sectors, followed by the industry sector. Moreover, gas offers flexibility and baseload power to a gird dominated by intermittent renewable energy sources.

EDF (utility company). The guiding objective for the Strategy must be a cost-effective decarbonisation of the European economy, which is easiest done by decarbonising electricity and electrify the economy. Policy and investments decisions must be based on a strong carbon price signal. Ambitious milestone targets are essential, and the EDF Group supports an increased EU target for 2030, translated into higher ambition in the power sector. To this end, electricity will have to be fully decarbonised by 2050. Since the share of electricity should be around 50% the future mix will combine different energy carriers. EDF submitted a document with complementary comments regarding the consultation on the EU Strategy for long-term Emission Reduction. In this document it highlights the need for more public spending on R&D of non-emitting generation (RE, nuclear) and energy uses (industrial processes, heat pumps, electrolysers). It also underlines the need for improved market based ETS mechanisms. EDF also writes that energy efficient measures that increase GHG emissions should not be promoted ant that the description of standards to differentiate products based on their GHG impact will be important. These measures should be promoted also internationally.

EmpowerSource. As an organisation for the advancement of decentralised energy production and self-consumption on the smallest level, advocated for a further promotion of policies strengthening decentralized production and consumption of renewable energy.

The European Shipowners Association (ESCA). The European Ship Owners Association is committed to adopting by 2030 the IMO Strategy on reducing emissions from international shipping. To enable an efficient and effective implementation while reducing the risk of carbon leakage and modal shifts, the European Commission should play a strong and supportive role to help the European shipping industry to stay competitive. The EU should also strive to promote a coordinated and effective implementation also at the international level.

Eustream a.s & SPP-Distribúcia a.s. The companies stress the different starting points and energy mixes of Member States. Full and effective utilization of existing transmission and distribution gas networks including interaction between transmission and distribution gas networks should be supported with targets to avoid stranded assets with a negative impact on EU citizens, such as energy poverty. The Strategy should also focus on "positive nudging" of the public to achieve desired behavioural changes. Finally, the Strategy should be supported by clear and precise economic assessments and risks identifies connected with the failure of reaching the defined goals.

European Vegetarian Union. Meat, dairy and egg production are among the leading causes of climate change – in total the global system accounts for nearly 30% of all anthropogenic emissions. If the consumption of animalistic products continue to increase at current rates, global emissions from animal agriculture will rise by nearly 80% by 2050. Reducing the production and consumption on animalistic products is therefore an essential step towards achieving the temperature goals of the Paris Agreement. Aiming for a gradual shift in diets at both the European and international level is therefore crucial and should therefore be part of the EU's long-term strategy.

The European State Forest Association (EUSTAFOR). Forests cover over 40% of the EU's land areal, and in addition to sequestering carbon they also provide the bioeconomy with renewable materials and other ecosystem services. As such, forests are crucial to achieve a balance between greenhouse gas emissions and removals and achieve a wide range of EU policy objectives. The sector therefore deserves

a better consideration in the Strategy than it was granted at the high level stakeholder conference organised by the Commission in on 10-11 July.

The trade association for the European nuclear energy industry (FORATOM). The trade association for the European nuclear energy industry emphasises the important role of nuclear energy in the clean energy transition and that this should be further highlighted by the Strategy. Cutting CO2 emissions while maintaining an economically sustainable system should be recognised as the ultimate goal of the Strategy, which will require nuclear energy. The EU ETS should be the main policy instrument to drive decarbonisations, and actions on market design are needed to restore confidence among potential investors, especially for large scale capital intensive low-carbon generation projects. In the framework on the current debate on sustainable finance, a clearly and specifically defined Level 1 regulation for sustainable investments has to focus on the climate impact and provide technologically neutral criteria.

French Authorities. The strategy put forward by the Commission must be in conformity with the Governance Regulation of the Energy Union and thus have as its long-term objective to attain net-zero emissions as soon as possible. The French government supports a goal of attaining net-zero emissions by 2050. If several scenarios are presented, France along with the other members of the Green Growth Group requires that they are in line with the Paris Agreement, that at least one scenario is in line with the 1.5 degree C target and at least one scenario targets net-zero emissions by 2050 followed by negative emissions. In addition, the consistency of the current target of at least 40% reduction compared to 1990 levels needs to be considered for each scenario. Scenarios only considering the post-2030 period will not be acceptable. The French government stresses the importance of building the strategy on the IPCCs forthcoming Special Report on the 1.5 C target. The assessments should allow for a comparison of impacts across sectors and between the EU ETS and ESR sectors. All methodologies and assumptions underpinning the scenarios need to be made available to the member states.

Finnish Energy. The EU should adopt a target for 2050 that is in line with the 1.5gC target of the Paris Agreement and define an intermediate target for 2040. The EU ETS should be the main tool to speed up the decarbonisation process, which would imply a strong Market Stability Reserve and an enhanced scope. Other key recommendations include to decarbonise the heating and transportation sector and using markets to promote renewables and energy efficiency. With regards to digitalisation and smart grids, a level playing field and data regulations to foster new services will be key.

GasNaturally[5] (association representing the European gas wholesale, retail and distribution sectors). Affordability and technology leadership need to be at the heart of the 2050 Strategy. The gas sector's potential to offer affordable and reliable low-carbon solutions in both the short and long term should also be reflected in the preparation of the Strategy. Natural gas can complement electrification, and could lower the cost of transitioning to a low-carbon economy as current gas infrastructure can be used. A credible long-term strategy needs to include solutions for difficult sectors, such as heating, industrial processes, heavy-duty transport, seasonal storage and system balancing – all areas in which natural gas can play an important enabling role. By 2050, road transport will no longer use fossil fuels.

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[5] Three submissions were made under the GasNaturally partnership, whereby they are presented together

Gasunie (energy infrastructure company). A completely CO2-neutral, reliable energy supply by 2050 is technically and economically feasible. Different energy sources, energy carriers and energy technologies can back each other up in an integrated energy system, and balancing the grid will be essential. By 2050, the energy demand in the built environment will have fallen by more than 40% compared to today. Industry will focus on energy efficiency, hydrogen and CCS. Insofar as natural gas is still being used in industry after 2030, that will be in combination with CCS as much as possible; natural gas as a primary energy source will have largely disappeared by 2050. The use of CCS is unavoidable if targets of 100% CO2 reduction in the energy supply by 2050 and 54% CO2 reduction by 2030 are to be met in an affordable and reliable manner. Finally, the report concludes that the total annual costs for the energy supply will rise from the current amount of EUR 25 billion to more than EUR 60 billion in 2050.

Gas Transmission Operator GAZ-System. The Strategy should duly recognise pathways that make full use of natural gas and its infrastructure, and adopt a holistic approach that created a regulatory framework that keeps pace with market conditions and takes into consideration market needs and challenges relating to the energy transition. Although the transition to a low-carbon economy if a common goal, Member States have different starting points. In Central and Eastern Europe, high-emission fossil fuels can make up as much as 50% of the energy mix, and in these contexts gas can play a key enabling role for the energy transition while also generating positive impacts on air quality and fuel poverty while also enhancing energy security.

Gas infrastructure Europe (GIE). The GIE requests that the Commission fully considers the financial, environmental and social benefits provided by gases. A technology-neutral approach much therefore be embraced. Moreover, the EU should continue working towards achieving a well-connected, diversified and well-functioning internal gas market, for which coordinated national and regional approaches will be essential. Gases and gas-energy are cost efficient components of the energy transition as it uses current infrastructure to deliver a low-carbon fuel for the power, heating and transportation sectors while targeting energy poverty. Developing the EU gas and electricity infrastructure should be planned in an interlinked approach.

Gazprom. The development of the EU long-term strategy should take duly account of the potential of natural gas in the energy transition. Not only does natural gas allow for the continued use of existing infrastructure but also enables fuel-switching in sectors such as transport and mitigates energy poverty. Therefore, the technology neutrality principle should be recognized and a full life-cycle of all energy sources should be taken into account (such as transportation emissions from solar panels imported from China). The company also provided a discussion paper proposing a three-stage decarbonisation plan for the EU economy. At the first stage natural gas could effectively replace coal in power generation and other more polluting fuels in various sectors (which could have been done earlier at an even greater pace). At the second stage more significant rates of reducing CO2 emissions could be reached through the wider use of methane-hydrogen energy carriers. Finally, nearly complete reduction of CO2 emissions could be achieved by 2050 and beyond due to innovative technologies of hydrogen production from methane which allow sequestrating solid carbon for further use in economy sectors.

GdW. Housing companies are facing the challenge of ensuring energy supplies for their buildings with significantly lower greenhouse gas emissions while not significantly increasing housing costs. The strategy also should drastically simplify the local use of electricity from renewable energies for flats,

heat and electromobility. . So far the liberalization of the energy market has taken into account only that electricity is generated locally and then fed into the grid, but not that locally generated solar power is also used locally.

Holding Slovenske Elektrarne (HSE) Group. The HSE Group is the biggest Slovenian organisation in the field of electro energetics and the biggest manufacturer and trader in electric energy in the wholesale market of Slovenia. Achieving the necessary emissions reductions to meet the objectives of the Paris Agreement will not be possible without synchronized climate and energy policies at both the EU and national levels. Key elements to achieving a balanced approach includes: electrification is crucial, the EU ETS must remain a key driver to reduce emissions, a just-transition must be safeguarded, investment stability to attract the necessary investments is key and Member States must take lead in shaping their national energy- and climate policies.

International Association of Oil and Gas Producers (IOGP). Delivering on the Paris Agreement relies on supporting transitions to a low-emission or net-zero emission future while ensuring enough energy to meet the needs of the world's growing population. Affordability and efficiency need to be a central part of the 2050 Strategy if the EU is to retain the support of its citizens for significant emission cuts and incentivize, rather than discourage, other countries from following its lead. The Strategy should also seek to take into account the impacts of different ambition levels between regions and countries in the world on competitiveness of the EU industry sectors exposed to carbon leakage. Natural gas can provide a cleaner and more efficient energy system, more secure energy supply, and a more innovative Europe.

Orgalime. Orgalime is the European federation representing the interests at the level of the EU institutions of the European mechanical, electrical, electronic and metal articles industries as a whole. The Strategy should include a scenario aimed at achieving net zero greenhouse gas emissions within the Union by 2050 and negative emissions thereafter, including the implications on the global and Eu carbon budgets to identify appropriate and cost-efficient EU implementation measures. A horizontal approach is needed, tackling emissions from all sectors and parts of the economy while building on technology neutrality, increased speed of implementation and stakeholder engagement, while also being mindful of the socio-economic aspects of the energy transition. Steady, long-term price signals are key to allow timely adoption of enabling technologies, especially seeing that the next decade is critical for the EU to ensure that the proper infrastructure underpinning the energy transition is put in place. Finally, the European industry needs a global playing field, including for trade and carbon dumping.

Polish Oil and Gas Company (PGNiG). Natural gas plays an important role in ensuring the EU's energy security, and can be used to produce both electricity, heat and as a low-emission fuel for vehicles. Gas power generation can ensure stability in the electricity grid as a complement to renewable energy. Considering the importance of energy security, there is a need for diversification of supply sources in the EU. Natural gas should therefore be included as a vital component of the EU's long-term strategy.

ProVeg International. ProVeg is a leading international food awareness organisation working across four continents, with ongoing plans for future expansion. The European agriculture sector contributes significantly to global warming, especially with regards to the productions on animal products. In addition to the direct emissions from animals, land use changes also contributes to increased emissions.

Producing plant-based sources of protein is both less energy and emissions intense. The EU should therefore considering promoting a change in diet towards a more plant-based one.

Technology Industries Finland. Climate change is a global problem that requires global solutions. A rule-based global order is needed to guarantee a level playing field and not distort global trade. Currently, European heavy industry is losing global market share due to the EU unilateral carbon price – a global price on carbon is needed, as well as the introduction of sanctions against carbon dumping under the WTO. Ambitious climate action by all G20 members is a pre-requisite for the "re-industrialisation" or Europe, and the EU should only revise its 2030 targets in 2023.

Vereinigung der Fernleitungsnetzbetreiber Gas e.V.[6] (FNB GAS). FNB Gas requests EC to take a holistic and macroeconomic approach towards means to reduce GHG emissions. Continued use of the existing gas infrastructure can carry several financial, environmental and societal benefits and is a valuable long-living asset. The strategy should promote sector integration and cross sector solutions and services. Decisions aiming at long-term targets need to be taken very shortly. The energy transition will create new products, services and jobs, but will hardly work without sector coupling and digitalization.

Individual citizens/Others

Anonymous (Belgium). National implementation of the Energy Performance of Buildings Directive rules should not impede higher scale optimum solutions (in terms of energy use, GHG emissions and/or life cycle cost. The optimum sustainable energy solution at district or city level may be different from the optimum at building level. All barriers to peer-to-peer markets should be removed and investments in energy efficiency measures maximized.

Anonymous (Germany). This respondent emphasises the environmentally negative impacts of an elevated consumption of animalistic products, and advocated for a plant-based diet.

Chris Davies, former member of the European Parliament and rapporteur for the 2011 Roadmap and the 2009 Directive on the Geological Storage of CO_2. The EUs actions to reduce emissions so far have been inadequate and insufficient. Emission reductions to date are mainly the result of the reduction in coal use, the transfer of industrial production to third countries and limited economic growth. Moreover, the Commission has put too much emphasis on renewable energy, whereas CCS technology has been neglected and side-lined although the EU has preconditions for successful deployment of the technology.

Fatima Azevedo (Portugal). Foresight tools will be critical to a reasonable back-casting in order to integrate all differences (some, huge) among Member States across main issues, sectors and public choices. To do so, it will be important do an effective "iceberg analysis" in order to identify the drivers and, above all, the enablers of synergies across policies, but it will be also important to work - having in mind a long view - some wild cards and weak signs that could become barriers or facilitators/accelerators of the desired mission. Circular economy will also be an important and necessary paradigm shift.

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[6] From DE: Association of Transmission System Operators Gas e.V

Michael Brody (Unites States). Recalling the heatwaves across the globe the previous summer, there is an increasing urgency to reduce global emissions. One of the easier changes for Europe would be to phase out the use of coal at a faster paste.

Riccardo Parra (Italy). The respondent highlights the benefit of utilizing natural processes to mitigate climate change, with a particular emphasis on sea algeas.

2.15.2 *Position papers submitted under the OPC*

In total 136 different submissions were received and evaluated.

National, regional or local authority (19 papers)

Summary: Of the 13 EU Member States that responded to the consultation, six Member State governments (DK, FR, NL, PT, SE, UK) and NO submitted individual position paper attachments to the consultation. In addition, the 17 Members of the Green Growth Group submitted a joint statement. A number or local and regional authorities also took the opportunity to express more detailed opinions under the consultation. Within this stakeholder group there is a seemingly **strong support for the EU long-term strategy to adopt a net-zero target by 2050** in order for the Strategy to be **compatible with the 1.5°C target of the Paris Agreement**, or for the Strategy to explore at least one pathway compatible with such a target. The need to build on and take into account the conclusions of the **IPCCs Special Report** on the 1.5°C target was further emphasised. Moreover, several MS further advocated for a revision of the 2030 target in light of the Paris Agreement and the EU's revised long-term target.

Chairs Conclusions from the High-Level meeting on 13 April between the Nordic Ministers for the environment and climate and business leaders. This roundtable took place in Stockholm and included Nordic Ministers as well as 9 business leaders. The Chairs Conclusion noted inter alia that Nordic businesses are already started the journey towards a low-carbon economy and considers this a good business opportunity. It was further noted that ambitious national and EU targets are important enablers to promote companies to take on far-reaching targets and actions. All parties emphasised the importance of concluding the Paris Agreement Work Programme at COP 24 in December 2018.

Convention of Scottish Local Authorities (COSLA). Local authorities are key in delivering the implementation of national climate mitigation and adaptation ambitions. COSLA supports to increase the GHG emission reduction ambition for 2050 from 80% to at least 90%, and to net-zero as soon as practicable. For the decarbonization of the transport sector within Scotland, COSLA has called for even more ambitious emission reduction targets. The covenant of Mayors has been effective in translating local urban climate ambitions into concrete action plans, but more funding is needed to execute these action plans. Therefore, sustained support from national and EU in the form of regulatory frameworks and budget commitments is needed.

Council of Municipal and Regional authorities (CEMR). An important first step for the long-term strategy would be to acknowledge the important role that local and regional authorities have in the implementation of actions needed to achieve the objectives of the Paris Agreement. The legal framework should allow for flexibility in how local and regional governments would like to address the common climate objectives. Furthermore, the achievement of climate goals should be further mainstreamed into sectoral policies such as CAP, industrial policy, etc. Another issue is that there is currently a large deficit in the funding that is available to implement climate adaptation strategies.

The next MFF should therefore reserve a substantial share of the budget for supporting local and regional climate adaptation activities. There is a need for more technical support for local and regional authorities for the implementation of climate mitigation and adaptation projects. Networks for the exchange of good practices should be expanded and mechanisms for data collection and sharing need to be set up. Lastly, engagement of citizens in climate actions should be promoted more strongly.

Danish Ministry of Energy, Utilities and Climate. Denmark calls for setting a long-term direction towards net zero emissions by 2050 at the latest. In addition, Denmark identifies other key priorities for the EU long-term low emissions strategy. Denmark insists on driving down the costs of climate action by exploring different EU policies that can promote R&I and help shift financial flows towards low and zero emission technologies. Denmark notes that the policy framework must be adaptive to rapid change and disruptive innovation. It sustains that a transition towards a fully renewable-based energy system must be based on a cost-effective market-driven transition. In addition, it remarks that the use of renewable energy will be more efficient by coupling sectors into smarter and more integrated systems. Moreover emphasis should be placed on a targeted effort to reduce industrial emissions and the decarbonization of the transport sector. Denmark supports a common European framework and measures for emissions in agriculture. Lastly, it also prioritizes putting in place a policy framework for increasing removal and storage of CO2.

EnergyCities. The attached report "Local Energy and Climate Roadmaps" outlines the 2050 Strategy and visions of 5 European cities: Grenoble (France), Manchester (UK), Münster (Germany), Salzburg (Austria) and San Sebastián (Spain). Common features include various measures to decarbonise the transport sector and reduce waster generation.

French Authorities. This note further elaborates the position of the French government under the themes present in the questionnaire. With regards to *long term greenhouse gas reductions* the French government supports an EU long term goal of achieving net-zero emissions by 2050. On *consumer choices*, France underlines that the green transition will require changes to modes of production and consumption across the entire supply chain, with improved information to consumers (such as labels on the carbon intensity of products) helps consumers make more sustainable choices. On *impacts on employment and the economy,* measures should be taken to ensure a just transition and an EU-level CO2 border adjustment tax for imported goods should be introduced. On *different technologies in the energy sector,* a technology neutral approach is favoured and the key role of electrification and the need to further investigate potential risks and side effects of CCS technology are underlined. On *the role of the land-use sector*, the preservation and enhancement of forests will be important, and the use of biomass for products should be prioritised based on the duration of the end-product. *On agriculture*, food production should be prioritised on arable land and sustainable agriculture promoted. On *education, research and innovation*, further R&D will be needed for all major sectors to improve efficiency and develop new technologies. On *financing the transition*, both public and private investments will be necessary and disclosure of climate related risks should be enhanced. *Adaptation* and resilience should be streamlines across all policy areas. On *negative emissions technologies*, natural sinks and technologies should be prioritised, and by no means should negative emissions technologies enable a prolonged utilisation of fossil fuels.

Government of the autonomous region of the Açores. The government of the autonomous region of the Açores identified climate change as one of the main challenges to its development and has

accordingly approved in 2011 a Regional Strategy on Climate Change (ERAC) and in 2018 finalized a Regional Program on Climate Change (PRAC). Following 7 strategic objectives, the PRAC contains 12 measures on climate change mitigation organized in 7 areas, and 64 measures related to climate change adaptation organized in 9 areas. The mitigation measures aim towards a reduction of emissions between 19% and 40% by 2030, for example through the expansion of renewable electricity sources, the mass introduction of electrifying vehicles and the increase of forested areas. Highlighted adaptation measures include expanding the automated monitoring of water volumes in the lakes of Açores, the creation of water reservoirs, and the mapping of natural risks and its integration in territorial planning by government authorities.

Green Growth Group (GGG) (16 EU MS + Norway). GGG welcomes a discussion on a new strategy that should be based on the latest available science and especially the special IPCC report on 1.5 °C. The discussion should take into account proposals that consider several pathways for reducing GHG emissions towards carbon neutrality in compliance with the long-term objectives of the Paris Agreement, including a 1.5°C scenario and at least one pathway towards net zero GHG emissions in the EU by 2050 followed by negative emissions thereafter. Moreover, the GGG considers that the current GHG emission reduction targets of at least 40% in 2030 compared to 1990 must be reexamined in order to be consistent with the long-term strategy. The group believes that the European sector-specific policies might enable the EU to achieve higher emission reductions by 2030 than the ones expected based on the current EU Climate and Energy Framework.

ICLEI *"Making Europe future-proof: an inclusive pathway to implement a low-carbon and resilient future for the EU"*. 1,019 local and regional governments under ICLEI have collectively committed to reduce their emissions by 26.8 gigatons by 2050. They note that carbon neutrality is possible for all European cities given they prepare long-term policies that engage their communities, particularly in the 100% generation of energy from renewable sources. A further focus for cities and regions, as identified by ICLEI, is improving heating and cooling, which currently represents 50% of Europe's' primary energy demand. A means to achieve all of these challenges is via territorial cohesion and regional cooperation, with legislative, financial support/funding programmes – all of which to foster awareness, build capacity and promote normative change.

Mission of the Government of Norway to the European Union. Norway appreciates the close collaboration with the EU to address climate change. Norway is planning to submit its own national long-term strategy by 2020, based on the 2050 target set out in the 2017 Norwegian Climate Act [Norway to be carbon neutral by 2050, reviewers remark]. The submission highlights the following key messages: A well-functioning EU ETS and efficient energy markets area precondition of energy security and affordable and available energy in Europe; renewables and energy efficiency are central reduce greenhouse gas emissions, with natural gas providing a stable source of baseload power to intermittent renewable energies. Beyond 2050, European gas infrastructure can be used for both biogas and hydrogen made by natural gas reforming. In addition, CCS technology are crucial to meet the targets of the Paris Agreement, which was recently confirmed by the IPCC's special report on the 1.5g target. Moreover, technology development and dissemination of new technologies is vital to support GHG reductions in all sectors.

National government of the Netherlands. The long-term climate strategy should be based on the latest scientific evidence from the IPCC and should contain at least one pathway towards zero emissions

in 2050. In such a pathway, the sustainable development goals need to be taken into account as well. The Dutch government also supports a thorough analysis on the cost effectiveness of the 40% GHG emission reduction target for 2030 in the context of the transition to zero emissions in 2050. The scenarios should pay sufficient attention to the way in which emissions can be reduced in specific sectors. Also, the costs as well as the benefits of the transition to a zero emission economy should be clarified. For the modelling of the scenarios, it is important that there is full transparency on the assumptions, e.g. technology costs and the underlying data.

Open letter to Vice-President Maroš Šefčovič & Commissioner Miguel Arias Cañete from 10[7] European Mayors. The signatories urge the European Commission to set the 1.5g and net-zero goals of the Paris Agreement as objectives of the long-term Strategy to be achieved by 2050. Prompted by the worrying increase in EU emissions in 2017 the signatory cities enhanced their ambition by pledging to become emission neutral by 2050. The signatories further emphasis the importance of this year and the next to keep global temperature rise below 1.5gC. With its decision to develop a long-term strategy, the EU is sending the right political message, but it needs to adopt the above stated targets and couple the strategy with consistent and Paris-compatible economic and energy policies, a coherent post-2020 EU budget for climate action (including measures to phase out fossil fuel) as well as an enhanced 2030 emissions reduction target.

Portuguese Republic. Portugal is committed to carbon neutrality by 2050. Portugal highlights the importance of taking into account the latest scientific findings, including the IPCC Special report on the impact of global warming of 1.5 ˚C above pre-industrial levels. Portugal agrees that the energy future should be founded in endogenous, renewable energy sources. It points to the need for electrification and investment in public clean transportation. In addition, Portugal mentions the importance of energy efficiency, energy transformation of the industrial sectors and need to build smart cities. Moreover, the importance of promoting sustainable and resilient forests as carbon sinks is highlighted. An additional point made regards the marker and regulatory instruments and the relevance of carbon pricing policies.

Regional Government of Thuringia, Germany. The government shares its draft of a regional climate law. First, the document covers mitigation aspects such as concrete emissions reduction targets (60-70% compared to 1990 levels by 2030, 70-80% by 2040 and 80-95% by 2050), a climate-friendly energy system, sustainable mobility and a climate-neutral built environment. In the next section, it discusses the implementation of regional and local adaptation action. Ultimately, monitoring and governance mechanisms of the climate law are presented.

Scottish Government. The Scottish Government is committed to the targets of the Paris Agreement and current EU efforts to mitigate climate change. They see several factors as instrumental to achieve these goals. These include long-term (and interim) targets; pan-sectoral action, which can be influenced by government; a serious focus on energy, driving transition, energy efficiency, innovation, and a focus on hydrogen; making sustainable changes for infrastructure, transport, agriculture, land

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[7] Anne Hidalgo, Mayor of Paris; Karin Wanngård, Mayor of Stockholm; Giuseppe Sala, Mayor of Milan; Ada Colau, Mayor of Barcelona; Eckart Würzner, Lord Mayor of Heidelberg; Frank Jensen, Lord Mayor of Copenhagen; Sadiq Khan, Mayor of London; Ashok Sridharan, Mayor of Bonn; Minna Arve, Mayor of Turku; Robert Cornells Nordi, Mayor of Arendal

use/forestry, and waste systems/design. To achieve this they note consumers are pivotal for invoking change. They lastly highlight how it is crucial to focus on a just transition to ensure a more equal society. For all the above, the paper provides examples where the Scottish government can provide best practices with the rest of Europe.

Stockholm County Council, Growth and Regional Planning. The County Council considers it important that the EU maintains the goal of restricting global warming to 1.5 ˚C and well below 2 ˚C by 2100 and zero GHG emissions by 2050. However the Country Council argues that the zero GHG emissions target will be impossible to achieve without mobilising local and regional levels. The Council outlines for targets for the Stockholm region by 2030: less than 1.5 tonnes of direct GHG emission per resident and halving the emissions from consumption, no more than 16 MW/yr. of energy consumption per person and making regional energy production 100 % renewable, making journeys by foot, bicycle or public transport constitute at least 70% all journeys within the region, capping household waste to 360 kg/person/yr and making at least 70% of this waste recyclable. The Council highlights the importance of nature and ecosystem services and of developing green infrastructure.

Swedish Government. Provided one formal position paper and two information notes on the Swedish Climate Policy Framework and Climate Act. Sweden, along with 13 other member states of the Green Growth Group, has emphasized that the proposal for a long-term climate strategy should contain several pathways for reducing greenhouse gas emissions. This would include a 1.5 ˚ C scenario and at least one pathway towards net zero GHG emissions in the EU by 2050 followed by negative emissions thereafter. The Swedish Parliament has called for the EU to set itself a goal of net-zero emissions by 2050 at the latest. Sweden has, with broad parliamentary support, adopted a national target of net-zero emissions by 2045 accompanied with a climate law, mandating the current and future Swedish governments to design policies to reach this target. The EU long-term climate strategy should include in its narrative the opportunities of the transformation as well as take into account the costs of inaction. Sweden also underlines the importance of full transparency regarding the modelling and assumptions used in the strategy.

UK National government. Long-term GHG emission targets set by the EU should be aligned with emission trajectories that are compatible with the 1.5ºC global warming target set under the Paris Agreement. Therefore, it is pivotal that the latest scientific evidence including the IPCC special report are taken into account when formulating long-term targets and making scenarios. At least one of the scenarios should show a pathway to carbon neutrality by 2050. Apart from the costs associated with decarbonisation it is important that the benefits of climate action, e.g. health benefits, are also quantified. Ideally, scenarios should also look at emissions after 2050 and more attention should be paid to sectors that are hard to decarbonise, although specific sectoral emission reduction targets are not desired. The Strategy should also set out how any target would be met (technologies and sectors targeted) and to focus on the role of significant EU policies after 2030, without proposing targets for individual Member States The UK supports the inclusion of LULUCF in the EU's long-term climate strategy and proposes to consider at least two LULUCF oriented scenarios, one with a strong contribution of bioenergy with CCS (BECCS) and one where priority is put on stocking carbon in ecosystems or wood products. In addition, the Strategy should also include and review the potential role of CCUS to decarbonise certain sectors and enable negative emissions. Furthermore, further reforms of the ETS are supported, in order to achieve a carbon price level that promotes a robust price signal and stimulates innovation. Ambitious carbon emission performance standards for cars are

supported as well, where the focus of the long-term strategy and scenario should be on the shift to zero-emission vehicles. Regardless of the result of the Brexit negotiations, the UK is committed to continue its cooperation with the EU in the area of climate action.

Trade, business or professional association (53 papers)

Summary: Attachments from this stakeholder category covered a broad range of topics, reflecting the variation of sectors covered. Approximately 20 stakeholders expressed **support for an EU long-term target of net-zero emissions/carbon neutrality by 2050**. Several stakeholders also pointed to the need for the EU to revise its 2030 target. However, representatives from in particular the industrial, energy and employment sectors also emphasised the need of aiming for realistic targets in relation to **cost-efficiency, competitiveness** and **employment security (**in the context of a **"just transition")**. These are not necessarily incompatible with an ambitious 2050 goals, but needs to be taken into consideration. Several submissions highlighted the role of the **EU ETS** in driving the energy transition, some providing estimates of an ideal carbon price (for instance between EUR45-55/tonne CO2). Another aspect brought up by many stakeholders was the need for the Strategy to promote and ensure **long-term stability and predictability** for actors and investors on the market. With regards to specific technologies, the need to put **efficiency first** was raised together with its cost-effective advantages, as well as the need to **promote the further development of CCUS technology**, including further research on the potential and limits of sustainably sourced bioenergy combined with CCS technology (BECCS). Furthermore, achieving a full **decarbonisation of the power sector** in combination with further **electrification** was also promoted as crucial measures to reduce emissions. The gas-sector further emphasised both the medium-and long-term benefits of **fuel switching from coal to natural gas** – not only could gas provide stability in the grid to complement intermittent renewable energy sources, but the possibility of using already existing infrastructure would promote the cost-efficiency of the energy transition. Moreover, some stakeholders also expressed the view that the Strategy should adopt a **technology neutral approach**, or at least to the extent possible avoid to pre-empt future technological advances.

Aldersgate Group, Leaders for a Sustainable Economy. The internal coherence of the EU energy and climate targets should be improved and the EU should aim for net-zero emissions by 2050. The ETS needs to be strengthened to arrive at a carbon price of at least €45-55 per tonne CO_2 and revenues should be used for providing energy-intensive industries with access to cheap renewable energy and for the promotion of circular business models. Leaving global temperature rise unaddressed will, apart from all the physical and social impacts, lead to vast economic losses. An average temperature increase of 2°C can result in an economic loss in Europe of €120 bn. The first clear impacts of climate change are already becoming visible, so the EU needs to move away more quickly from business-as-usual to green growth. The 2030 Climate and Energy package can strengthen the EU's international leadership role in climate action and bring benefits to EU citizens, but is still not ambitious enough to keep global temperature rise below 2°C. Therefore, more policy action is needed, including an additional €178 bn in annual investments as well as a much more granular policy strategy. Policymakers should realise that ambitious, well-designed and well-enforced environmental legislation can deliver substantial economic and competitiveness benefits, apart from meeting long-term environmental and climate targets. Also, investments done by public financial institutions like the EIB should all be in line with the Paris Agreement.

American Chamber of Commerce. Developing the 2050 strategy is a challenging task which should start by ensuring that fundamental principles like technology-neutrality, predictability, transparency are encompassed in the existing and future regulatory framework, clarifying the objectives to achieve while identifying the key levers and barriers to remove. It is essential to translate ambition into a stable regulatory framework which drives progress in the years to come, while integrating measures to ensure that European industry is not put at a cost disadvantage to other global regions that would encourage carbon leakage (the displacement of businesses overseas). Moreover, implementing price signals and other regulatory tools will only be successful if investment in technologies is able to flow effectively. This requires targeted policies to remove barriers to potential solutions. A critical assessment of the remaining administrative and regulatory barriers to the extension of innovative technologies, both at EU and national levels, should be part of the 2050 Strategy.

Asociacion Española de Fabricantes de Magnesia (MAGES)[8]. MAGES emphasizes the importance of the EU-ETS in making industrial low CO2 technologies increasingly competitive in the market. However, supporting such technologies needs to be accompanied by policies that offset the costs of these technologies for industries exposed to global competition. It is important that CCUS technologies become affordable and accessible to the largest possible number of industries. The Association also recognizes the need for the strategic mapping of infrastructure needs requires for industry to transition to a low-carbon economy. In addition, framework conditions for the next investment cycle must be addressed within the next 10 years in order to promote the decarbonization of energy intensive companies by 2050.

Association for European Energy Exchanges (Europex). The development of an EU long-term strategy should provide guidance for short- and mid-term action. In this context, Europex underlines the importance of stable and predictable energy and climate policies in the mid-century perspective, while keeping costs low and maintaining a high level of security of supply. Fostering the development of efficient, liquid and transparent energy markets will be vital in order to meet these objectives and drive the energy transition. The EU ETS should continue to remain the EU's primary policy instrument in the fight against climate change, and climate and energy policies should be coherent and mutually reinforcing. Auctioning should remain the default method of allocation for participants. Moreover, efficient energy and emissions markets are a vital enabler for cost- and resource-efficient decarbonisation. In addition to this, a cross-sectoral and entire energy system wide approach (including electricity and gas both conventional and renewable) is necessary to achieve the goal of cost-efficient decarbonisation.

Asturias Foundation of Energy (FAEN)[9]. FAEN points out that the Asturias Region is heavily dependent on coal. FAENs positions with regards to the Energy Transition is that energy independence is an important aspect to considered to mitigate the potential for future internal or external economic crises. It is also important to consider the impact that high electricity prices will have on the economic activities of different sectors. The Foundation considers it import ant to find a way to guarantee an energy mix that is stable in the medium and long term and favors productive inversion in industry. Technologies that will allow for electricity from carbon-sources with CCU will play an important role nonetheless this technologies are not sufficiently developed at the moment.

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[8] From Spanish: Spanish Association of Magnesite Manufacturers
[9] From Spanish: Fundacion Asturiana de la Energia

Austrian Trade Union Federation. The organization emphasizes the importance of a healthy environment for the population. It also highlights the unfair distribution of adverse climate effects on the economically weaker part of the population. For governments and policymakers, it is therefore paramount to adhere to the 'Just Transition' process when designing the structural changes needed for a climate-friendly economy in the future. The organization delivers a comprehensive list of actions that should be considered in this endeavor among which: full funding of retraining schemes, a comprehensive assessment of social- and employment effects, enhanced technology transfer to developing countries, improve energy efficiency, international sanctions in case of non-compliance, sustainable investment in growth and employment and application of 'true-cost' in the transport sector.

Austrian Wind Energy Association (IG Windkraft). Europe should adopt a Strategy consistent with the aims of the Paris Agreement, aiming to reaching net-zero emissions by 2050, and raise its emissions reductions targets for 2030 to 65%. Electrification of various sectors in combination with an increase of renewables in the power sector will be key (at least 78% by 2050). Moreover, the transformation of renewable electricity to other energy carriers (such as synthetic gas or hydrogen) will be necessary. To this end, policy recommendations include that the EU's Connecting Europe Facility prioritizes electricity projects and the development of charging infrastructure and that Member States should spell our electrification measures as part of their National Energy and Climate Plans to 2030.

Bioenergy Europe. By 2050, sustainably sourced bioenergy could cover nearly half of the energydemand in Europe if increased power demand is balanced by energy efficiency measures. For instance, bioenergy in combination with CCS technology (BECCS) will be an "almost inevitable" solution to attain the ambitious 1.5°C target of the Paris Agreement, while also contributing to energy security. This technology is already available, but an unfavourable political framework (such as the absence of an EU-level mechanism that credits negative emissions) has hindered its deployment. Moreover, the bioenergy sector could account for 1.5-2 million jobs in 2050. There is already sufficient biomass potential available and commercially available technology solutions, but several key political decisions are needed to fully untap the potential for the use of bioenergy in a 2050 net-zero carbon economy. These include inter alia creating incentives to decarbonise the heating and transport sector by for instance a carbon tax and replacing fossil fuels by bioenergy in the power sector

CER (interest group, European Railway). The group highlights the importance of modal shift targets to reach emissions reduction goals in the transport sector. They make aware of the fact that the share of electricity from renewables supplied to the railway sector were already 20% in 2015 and that this is already meeting the 2030 target set out for the transport sector. They recommend to (i) legally confirm the 2011 White paper target for the transport sector; (ii) support further electrification of rail; (iii) facilitate R&D investments targeting multimodal solutions and clean tech; (iv) make best use of inter-modality; (v) internalize all external costs fairly (polluter-pays principle) for all modes of transport (also via a more balanced carbon price in the transport sector).

Český plynárenský svaz[10]**.** The Czech Gas Association believe that gas and gas infrastructure can contribute to achievement of climate and energy targets, energy efficiency targets and increasing the RES share in the energy mix, and with a cost-effective means. There exist technologies which allow for decarbonization of gas (CCU and CCS, hydrogen, synthetic methane and biogas). There is a need for

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[10] From CZ: Czech Gas Association

incentives to support market entrance of these technologies. According to them, climate and energy policy should be set such that the market can decide by itself which technology mix is the most optimal to have. Local conditions in MS should be taken into account, and they advocate for a gradual change towards decarbonization. As such they promote are for a dual system – electricity and gas infrastructure rather than full electrification, as it is perceived more efficient and safer.

The Coalition for Energy Savings. The group highlights the importance of energy efficiency for the long-term GHG emissions reduction strategy. They mention that the 2030 and 2050 targets (for energy efficiency and annual energy savings respectively) currently still fall short of tapping the cost-effective potential of energy efficiency but that full enforcement of them must remain paramount. Furthermore, the 'energy efficiency first' should be applied at all times when planning the transition. The group calls for a revisions of the PRIMES model, as it is currently not able to properly address energy efficiency and demand-side policies. Hereby, use of the right baseline and fair representation of costs and benefits will also be crucial.

Commission Centrale Pour La Navigation Du Rhin (CCNR): CCNR recognizes that greening of the inland navigation fleet is a key challenge that must be addressed urgently. The organization envisions a number of mechanisms which can support the IWT fleet in becoming greener. These include but are not limited to: subsidies at EU and national level, EIB financing, state guarantees, reverse funds and other funding and financing solutions. The CCNR has adopted a resolution on the development and preservation of berths for inland navigation in order to reduce noise and air pollutants in urban areas.

Confederación Española de Organizaciones Empresariales[11]. The confederation points out that the long-term GHG emissions reduction strategy must have as its objective the implementation of a stable, coherent and harmonized regulatory framework. They emphasize that the environmental objectives should, at all times, exhibit synergies with competitivity, economic growth, and employment – both in the Spanish and the EU market. Special focus should also be on identifying the most (economically) viable technologies and steer R&D investments into their direction via smart policy action. Cost-benefit, technical, technological and economical assessments should be regularly carried out for technology options and M&E mechanisms should be in place to monitor progress. Consumer demand should furthermore be pushed towards the purchase of the most energy efficient products.

Confederation of European Paper Industries (CEPI). The European pulp and paper industry is committed to reducing its emissions, while continuing to contribute to the growing bioeconomy. Achieving a successful EU long-term strategy will require a reduction of emissions in all sections of society. A circular bioeconomy should be at the core of the low-carbon economy, which also entails maintaining enabling conditions to prevent investment leakage in related European industries to ensure international competitiveness. Moreover, acknowledging the role of sustainable forest management as an enabler for the bioeconomy and enhancing Europe's natural carbon sinks while helping them adapt to the effects of climate change. Although biomass is a renewable feedstock, end-use should focus on higher added-value products with carbon-storage potential. The deployment and promotion of BECCS should therefore be limited.

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[11] From Spanish: Spanish Confederation of Employing Organizations

Deutscher Gewerkschaftsbund[12]. The union underlines importance for the organisation that workers are offered a long-term perspective in the structural changes that are required with the energy transition. They state that a 'just transition' hence must be a guiding principle of the long-term strategy. Furthermore, the union advises to tie the long-term strategy together with the financial framework of the Union to guarantee strategic focus on relevant structural challenges of the future. They highlight the importance of the ETS and the necessity to push for a common CO2 price among the G20 states in the long-term strategy. Concerning transport, the DGB calls for increased inter-modal connection, electrification of railways, energy storage infrastructure and research into batteries. Hereby, they envision an industry-political concept for the European transport industry that safeguards the industrial value chains, potential for innovation and jobs at production plants across Germany in the long-term.

Energy UK. Energy UK is the trade association for the GB energy industry with a membership of over 100 suppliers, generators, and stakeholders with a business interest in the production and supply of electricity and gas in the UK. The EU should define ambitious milestones leading up to 2050, and the 2030 target must be in line with the 2050 target. Energy UK supports a more ambitious 2030 target that is in line with the Paris Agreement. Cost-effective decarbonisation is crucial fo Europe to remain competitive globally, and the power sector is committed to leading this transition. The Commission 2050 Strategy must therefore give guidance on long-term pathways for economy-wide decarbonisation, considering environmental but also social sustainability. Carbon neutral electricity will be key to help decarbonise also other sectors than the power sector, which will require a 60% electrification of the EU economy by 2050. Finally, the Strategy must unlock the benefits of digitalisation, enruse a fully integrated power market, develop a CCUS industry and enable a fair transition.

Entreprises pour l'énvironnement.[13] The French Association of Enterprises for the Environment are currently preparing a study on a scenario for a carbon neutral France by 2050. Some initial findings from the study concludes that, inter alia, such a transition would deliver several social co-benefits for the population, as well as having a positive impact on the national GDP. However, the pace of the transition depends on international cooperation and engagement as well as investments.

Eurelectric. The European power sector fully subscribes to the Paris Agreement and accelerates its efforts to be carbon neutral well before 2050. Electrification is a critical enabler to decarbonise energy-intensive sectors like heating and cooling, transport and industry. Decarbonisation must be achieved in a cost-effective way. With regards to the stakeholder consultation on the technology cost modelling assumptions, Euroelectric calls on the Commission to consider taking into account a proper regional differentiation for investment costs, domestic energy sources potential, technology learning curves, lifetime calculations or estimated capacity factors. It also calls on the Commission to recognise that regulatory frameworks, political decisions and societal benefits will also play a prominent role in the development and adoption of some technologies. In addition, the EU must recognise that Member States with low GDP/capita levels and all EU coal and carbon-intensive regions necessitate comprehensive EU financial support to ensure a just energy transition.

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[12] From German: German Trade Union Confederation
[13] From FR: Entreprises for the Environment

European Automobile Manufacturer's Association (ACEA). The group mentions that cost-effectiveness, rather than absolute CO2 emissions, should be the deciding factor behind choosing the right abatement measures in the economy. They point out that, due to its importance to the European economy, focus of GHG reduction measures in the transport sector will need to be put on improving efficiency rather than restrictions and taxes. Furthermore, they highlight that 'modal shifts' will not have the expected emission reduction effects. Rather, they call for an integrated approach to CO2 emissions reduction taking into account consumer behavior, alternative fuels, vehicle technology, infrastructure, vehicle taxation and urban policies altogether.

The European Alliance of Companies for Energy Efficiency in Buildings (EuroACE). EuroACE supports the 'net zero GHG emissions by 2050' as the feasible and right ambition for the EU Long-term Strategy. EuroACE supports using the Energy Efficiency First principle when designing the pathways to achieve the EU's 2050 strategy. Moreover, EuroACE is convinced that the energy efficient building renovation will have a crucial role in the decarbonization process up to 2050 and that this role should be reflected in the EU's Long-Term Strategy.

European Confederation of Woodworking Industries. Achieving the objectives of the Paris Agreement can only be reached through a transition to a low-carbon and circular bio-economy, in which the wood industry can play an enabling role in fueling green growth and providing employment in rural communities. The carbon storage capacities of wood should be taken into account, for instance by promoting the use of timber as a construction material. Supporting and enabling this transition will require a continued mobilization of wood from sustainably managed forests. EU funding should support further innovation in biobased materials.

European Federation of Public Service Unions. EPSU argues for the inclusion of a legally binding deadline by 2050 latest for the EU and member states to become net-zero emitters. The organisation emphasizes the need for a just transition, where governments commit to contribute to economic growth and the creation of sustainable high-quality employment. The long-term strategy should hence put special attention to the workers in carbon-intensive industries and Europeans affected by energy poverty. This has to be guaranteed by solid public investment (mainstreaming the 'just transition' in the MFF) and strong public policies (sectorial roadmaps). Focus should lie on making the long-term strategy future proof by calibrating it towards investment needs, technological developments and skills development policies. Public ownership must be central in the long-term strategy, guaranteed by an important role delegated to the public services and local communities.

European Geothermal Energy Council (EGEC). Renewable heating and cooling is key to decarbonisation and should therefore be further promoted and supported at the EU level. It is the only dispatchable source of renewable energy capable of driving a consistent and reliable (24h per day, 365 days per year) electricity production. A continuation of the three-targets approach, including binding targets for renewable energy covering all sectors (electricity, heating and cooling and transport), will be needed to achieve the 2050 targets in the most cost-efficient way. Furthermore, the EU ETS needs to be strengthened as it is currently not sufficiently promoting innovation, nor competitiveness and job creation. Renewables for heating and cooling and flexible renewable electricity generation, such as geothermal, must be a pillar of the EU's strategy for long-term greenhouse gas emissions reductions. In 2050, the economic potential of geothermal power in the EU could amounts to 2570 TWh (potentially covering as much as 50% of the projected electricity produced in the EU). Moreover, EGEC are critical

of the PRIMES modelling used for the recast of the Renewable Energy Directive, e.g. the absence of transparency regarding its parameters and algorithms.

European Insulation Manufactures Association (Eurima). Paris-compatible targets require that Europe reaches net-zero by 2050 at the latest. This will require action across all sectors, wherein energy efficiency can play a key role. The contribution of buildings is a cornerstone of any scenario: reaching zero-carbon buildings requires putting energy efficiency first with rapid improvements of the depth and the quality of renovation in more and more buildings. A minimum of a 3% renovatation rate per year, combined with an average energy efficiency improvement by 75%, need to be rached by 2030. Moreover, saving energy in buildings reduces power demand while bringing flexibility to the power sector. Co-benefits of energy efficiency in buildings amount to two to three times the required investments, and this is without taking into account avoided climate damages.

The European Oleochemicals & Allied products Group (APAG). APAG recommends the Commission to take into full account the role of bio-based materials (such as rendered animal fats) and circular economy production models in achieving GHG emissions reductions and to ensure that promotion of bioenergy does not artificially divert raw materials from existing higher level uses to energy. As such, distortions of raw material markets should be avoided and the waste hierarchy and circular economy principles should be respected.

European Organization of the Sawmill Industry (EOS). The paper provides recommendations in relation to the ongoing revision of the EU Forest Strategy to provide coherent actions to boost the competitiveness of the sawmill industries and to promote the contribution of the forest sector to a sustainable green economy. EOS believes that the active sustainable management of forests can contribute to enhancing the competitiveness of forest-based industries, climate change mitigation, rural development, biodiversity conservation, and forest protection. For example, wood can replace fossil based materials while it also constitutes a low-carbon construction material. Both the EU and Member States should therefore promote the role of wood-based products in the bioeconomy and thus adapt/implement relevant legislation (such as the LULUCF regulation) accordingly.

European Solar Thermal Electricity Association (ESTELA). The submitted document summarizes the benefits of solar thermal electricity for Europe. In particular it emphasizes the benefits associated with job creation, dispatchability of CO2-free electricity which in turn can contribute to energy security in Europe and the EU's Southern Neighborhood and competitiveness of this source of electricity in parts of the world with good Direct Natural Irradiation. In addition, ESTELA submitted a paper prepared in collaboration with Greenpeace International and Solar PACES on the 2016 global outlook for solar thermal electricity.

Finnish Forest Industries Federation. The forest-based industry can play an important role to tackle climate change, promote sustainable economic growth and improve energy security. To achieve this, the paper outline three issues: the EU needs to look after its industrial competitiveness by promote the bioeconomy and related products, such as fiberbased packaging and wood for construction. Second, promoting sustainable forest management helps provide sustainably sourced raw material for the bioeconomy while enhancing the carbon sink potential of forest. Finally, CO2 emissions from the European industry can be further decreased by for example promoting fossil fuel electricity and increasing investments in research and development.

Finnish Industrial Union. Environmentally-friendly energy that is affordable is rare in Europe. Therefore some form of nuclear power is required as an intermediate energy production form. The outsourcing of EU manufacturing and consequentially emissions is therefore viewed as illogical to achieve the global challenge posed under the UNFCCC. A sufficiently long transition period is therefore required to develop the necessary new energy production technologies

FuelsEurope. The paper highlights the increased importance on mitigating the carbon emissions of liquid hydrocarbons progressively, as global trends show their demand will increase until 2040. A potential low-carbon roadmap (developed by Concawe) could reduce GHG emissions from refining by 80% by 2050, compared to 1990 levels. It concludes that by 2050, GHG life-cycle emissions could potentially be reduced to less than 13% of their 2015 values. In Tank-to-Wheel terms, life-cycle emissions could be 90% lower than in 1990. This would utilise efficient GHG emission technologies in refineries and cost a minimum of €50,000 million. To achieve such targets FuelsEurope suggest three steps the policy-framework should take: firstly, adjustments to current regulatory frameworks (RED II and TTW vehicle emissions standards) are required to stimulate the development of low-carbon fuels and efficient vehicles; in the mid-term, a common CO_2 market at first for road transport; and in the long-term, a cross-sectoral common CO_2 market with a single carbon price.

GasNaturally. Wherever possible, gas should be used to replace coal in power generation, which will reduce emissions and improve air quality. In parallel, as the share of biomethane and hydrogen from different sources in the gas mix increases, flexible gas-fired power generation that supports the integration of variable renewables could become increasingly lowcarbon. Moreover, continued exploration and use of European gas and gas infrastructure will further safeguard and produce jobs in Europe, provide for a cost effective enery transition and promote energy security and affordability. Finally, gas can pay an important role in devarbonising other sectors than power, such as heating and cooling and transport. In order to support the increasing role and applicability of gas in the European energy mix, the EU should, inter alia, Support market-based policies, such as carbon pricing, to incentivise the most cost-efficient solutions to reduce GHG emissions and achieve a well-functioning energy market in which mature technologies are subject to the same conditions and introduce a policy framework that facilitates the growing use of decarbonised gas and renewable gases, allowing sufficient flexibility in regulation to give space for market participants to introduce innovative business concepts.

German Mechanical Engineering Association (VDMA). VDMA believes that the transition into a low carbon economy can be a chance for a comprehensive modernization of all parts of the economy and that Europe can become world leader for low carbon technologies, which can also contribute to make a change outside the EU on a global basis. In conjunction with the Paris Agreement the EU should indicate different scenarios and climate pathways in its EU long-term strategy on GHG emissions, which outline appropriate and cost-efficient implementation measures in order to reach the climate targets. A technology-neutral approach and the cross-sectorial approach, together with digital networking and resource and energy efficiency are key components for a successful Strategy.

Hydrogen Europe. The sectorial industry association highlights the many ways in which hydrogen can play a role in the energy transition. It can be used to store renewable energy (power-to-hydrogen),

facilitate sectorial integration between the power and transport sector, decarbonise the transport and heating sectors and enable a larger share of renewables in the industrial sector.

Hydrocarbon Resins, Rosin Reisns and Pince Chemicals Producers Association (HARRPA). HARRPA calls on the Commission to recognise the role of bio-based materials in achieving GHG emissions reductions, while ensuring that promotion of bioenergy does not displace existing high value uses of renewable raw materials. For example, the displacement of tall oil from existing high value uses can be counterproductive to the objective of decarbonising the transport sector, as utilising tall oil for biofuel production emits 25% more CO2 than when used for bio-based products.

Institutional Investors Group on Climate Change (IIGCC). The long-term objective should be to achieve net zero emissions by 2050 at the latest and the 2030 target should be strengthened to bring them in line with the 2050 goal and the Paris Agreement. The Strategy represents a timely opportunity for the EU to align all relevant policy frameworks with the goals of the Paris Agreement, thereby sending a clear and strong long-term investment signal. As such, the Strategy should outline how new EU policies and investment decisions will be assessed to ensure their full alignment with the 2050 goal. Finally, the modelling underpinning the Strategy must factor in climate damage estimates, given that the current baseline scenario assumes no cost associated with business as usual scenarios.

Oficemen (Cement Manufacturers Association of Spain). The cement industry as well as other energy-intensive industries will be essential actors in the energy transition. However, supportive and stable framework conditions will be necessary for the cement industry to successfully transition to a low-carbon, circular economy while maintaining production in Europe. This includes, inter alia, a decarbonised energy sector that can meet increased electricity demand (including efforts to lower regulatory costs related to electricity consumption by energy intensive industries), continued protection for energy intensive industries (preventing carbon leakage) and an ambitious research, development and innovation support. Moreover, as the gestation time of breakthrough technologies is long it is important that all the technology pathways get their "fair chance" in the context of policy choices and financing strategies. Under the right conditions, these transformations can enable new business models and structures to further strengthen existing value chains.

Orgalime (European Technology Industries). The EU's long-term GHG reduction strategy should set the right level of ambition to reach the Paris climate targets. Implementing the Paris Agreement requires a global effort of net-zero GHG emissions by 2050 and the EU should take every effort to drive the global community to this ambition. Key measures will entail inter alia boosting efficiency, electrification, alternative fuels in the transport sector, digitalisation, a financial market framework that rewards clean energy technology development.

PACE (Pathway to a Competitive European Fuel Cell micro-CHP Market). The PACE project is supported by H2020, Hydrogen Europe, and Hydrogen Research co-funding. They are motivated to install more than 2,800 units of fuel cell micro-Cogeneration in Europe. Europe has approximately 80 million inefficient heating appliances, and merely replacing one third of these with fuel cell micro-CHP by 2030 would deliver more than 32 million tons of CO_2 emissions. Furthermore with the progressive use of the technology by 2050 would reduce infrastructural and operation costs for electrical distribution. They present policy recommendations to facilitate this, such as accounting for the right boundary conditions of the actual electricity displaced by micro-CHP, creating a level playing field for

decarbonisation at the lowest cost, and more simplified administration procedures to access grid or support schemes for micro-CHP users.

Skogsindustrierna – Swedish Forest Industries Federation. The group emphasizes that the Swedish pulp, paper and saw milling industry which it represents has decoupled its production from emissions almost completely and has made internal processes approximately 96 percent fossil free. They state that becoming carbon neutral by 2050 should be the central goal for the EU (preferably on an MS-level). Additionally, the long-term strategy should (i) acknowledge the importance of active and sustainable forest management, (ii) define substitution as a core concept, (iii) integrate LULUCF in a way that incentivizes MS to support the bio-economy, (iv) focus on maximizing value creation from biomass, (v) secure that impacts are fairly assessed in EIAs, (vi) facilitate more efficient and low-carbon transportation, (vii) create viable conditions for further R&I in bio-based products, and (viii) connect to global development.

The Spanish CO2 Technology Platform (PTECO2). The Platform makes reference to the goal of cutting 80% below 1990 levels by 2050. PTECO2 believes that it is possible to archive this goal with an effective energy mix in which Energy Efficiency, RE and the deployment of CCUS work together. Industry will require substantial EU support in order to contribute to the solution. An important effort must be made to lower regulatory costs related to electricity consumption on a level playing field basis across the EU and vis-à-vis international competition. The gap between R&D and low CO2 technologies commercialization must be addressed.

Anonymous. It believes that R&D measures and the development of the European energy framework should be focused on further enabling energy storage as new, low-cost storage systems are needed. It is convinced that hr e development of efficient, integrated energy storage systems will be a game changer in the energy transition.

Swedenergy, Energiforetagen Sverige. Swedenergy calls upon the EC to propose a sharpening of the 2030 target and propose new target levels in line with the Paris Agreement for 2040 and 2050. Swedenergy also proposes a tightening of the linear reduction factor in EU ETS by at least 2,6% per year for the whole period between 2020-2050. In order to make sure that the ETS has the intended guiding effect market stability reserves and overlapping policy measures should regularly be analyzed and if necessary amended. There is a need for developing a European strategy for electrification. In addition, Swedenergy would like to see the creation of conditions to expand fossil-free district heating and combined heat and power. This must be coupled with increased investment in R&D and demonstration projects within the energy field, both for technologies such as CCS and BECCS, energy storage and alternative fuels in the transport sector.

Swedish Wind Energy Association. Electrification is important to reduce greenhouse gas emissions, but the lack of skilled staff in electro engineering may be a barrier. The EU should undertake measures to promote education in this field, as well ensuring that gender considerations and equal representation in the transition to a log greenhouse gas future. The next decade will be

Union Français de l'Eléctricité[14] (UFE). The European sector as a whole is committed to be carbon neutral well before 2050. The Strategy should ensure consistency between the policies and tools implemented and rely on a strong carbon price signal for the short and long term. A stable, long term framework is necessary to allow for the necessary investments. Moreover the importance of investing in research, development and innovation should be stressed. Political acceptance by citizens of the energy transition will also be important, indicating the need to allow for a just transition.

Union zur Förderung von Oel- und Proteinpflanzen e.V.[15]. The group highlights the importance of biofuels and bioenergy in general for successful decarbonization pathways. Biofuels should be seen as a naturally sustainable way of bridging the gap to full electrification of our transport system. Only 4 percent of the world's agricultural land is currently used for biofuel production. Institutions should craft policies that counteract unsustainable production and consumption patterns of soy or palm oil, which drive deforestation of the tropical rainforest much more than, e.g., rape or canola. If the EU were to stop allowing biofuels to be mixed into conventional fuels for transport, the supply for rape and canola as protein sources would falter, too. Unmet demand would then i.e. be satisfied by soy products, which would put more pressure on forests and lead to a decrease in worldwide carbon sinks.

Verband der Chemischen Industrie[16]. The group mentions that the low-carbon transition and large-scale GHG reductions in the chemical industry cannot happen at zero cost – carbon leakage protection compatible with free trade rules will thus remain essential. The price of renewable energy and feedstock should also be radically lowered. Furthermore, they state that regulation must facilitate a more adequate understanding of the future demand of energy and that substituting fossil carbon resources is in very few cases economically viable at the moment. The group makes aware of the need to provide promising technologies with the right R&D funding options and that the long-term strategy should aim at providing the necessary visibility and certainty for the market. The group states that a 59% reduction of emissions in the European chemical industry is possible by 2050. Achieving this will, however, not only depend on technological feasibility but also on the long-term strategy filling economic gaps, enabling efficient pricing and availability of renewable energy, enabling the reduction of process emissions and taking into account investment and retrofitting costs for the chemical industry.

WindEurope. Taking into account the Paris Agreement and the IPCCs Special Report on the 1.5gC target, the EU should adopt a consistent strategy aiming at reaching net-zero emission by 2050. The EU should also ramp up its ambition for 2030 to 45% and use the 2030 ratchet-up mechanism to adjust its emission reduction trajectory to its long-term decarbonisation objective. Decarbonising electricity will be crucial to meet the net-zero objective – but we need to move beyond the power sector, targeting also industrial processes, transport and buildings. WindEurope in cooperation with DNV GL has assessed that, with the right policies, it is technically and economically possible to increase the share of electricity in the European energy use from 24% today to 62% in 2050, 78% of which would be coming from renewables. This wider use of renewables-based electricity beyond the power sector would reduce related emissions by 90% by 2050, helping to keep Europe on course to the achievement of net-zero emissions.

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[14] From FR: Trade association for the French electricity sector
[15] From German: Union for the promotion of oil- and protein plants
[16] From German: Chemical Industry Union

Wirtschaftskammer Österreich[17]. The group emphasizes the importance of Europe as a global leader in climate- and energy strategy, catalyzing innovation and investments into clean technologies and advertising a sustainable economic model. Hereby, challenges are to be tackled holistically and systematically – the competitiveness of Europe needs to be the centerpiece of the long-term strategy. The group advocates for a 40% emission target and discourages continuous upward adjustments that confuse players in the economy. At no point should an exit from fossil fuels be rushed without the proper (renewable) back-up energy sources being in place for businesses to rely on. The group further calls for an extension of the carbon leakage instrument, a global price for CO_2 and increased focus on carbon sinks (forests and oceans).

Zero Emissions Platform (ZEP. ZEP emphasises the crucial role of carbon capture and storage (CCS) for the decarbonisation of the EU. CCS can play a vital enabling role, most notably in the power (choice and flexibility in meeting increased electricity demand) and industry (abating process emissions) sectors. CCS will also be vital to decarbonise the EU economy in a cost-effective and socially inclusive manner given the potential social implications of the energy transition in certain parts of the EU. One of the main barriers to the implementation of CCS is the absence of a clear business model which is why an EU strategy for the development for CCS with a designated "market maker entity" is required, also with regards to cross-border transport of CO2. Funding for CCS and carbon capture and usage (CCU) can be provide under current EU funds, provided that industry access to funding for CCS is improved (e.g including CCS in the "digital and industry cluster" of Horizon 2020) and granting access to funding from the EU Structural Funds. CCU could be developed alongside CCS but not be seen as a replacement for CCS.

Non-governmental organisation, platform or network (23 papers)

Summary: Several stakeholders in this category argued for the EU to set as its long-term target to **attain net-zero emissions by 2050 (or earlier**), in light of the 1.5gC target of the Paris Agreement. In this context many attachments alluded to the (then forthcoming) IPCC Special Report on the 1.5gC. Additionally, some stakeholders also advocated for a revision of the 2030 target. From the environmentalist groups, a strong emphasis was given to the **land use sector** and the role or restoring, protecting and preserving forests and other ecosystems. In this context, two stakeholders emphasised the share of global emissions attributed to livestock farming and consumption of related products and promoted a **transition towards a plant-based diet**. The importance of further promoting and strengthening **investments for research and development** of clean technologies was also highlighted across the stakeholder group. Not only will such investments be necessary to achieve the necessary emission reductions, but also for the EU to retain its competitiveness and leadership role internationally.

Collectif 'Europe' de l'Isère (civil society). *Citizen initiative for a rapid energy transition in Europe (TERE initiative).* The collective shortly presents its 'TERE initiative' in the document. The initiative has as its goal to push Europe to achieve, unilaterally and respecting relevant climate constraints, the energy transition in 30 years.

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[17] From German: Austrian Chamber of Commerce

Conservation International Europe, Nature Conservancy Europe. "Unlocking the potential of Natural Climate Solutions: Why addressing imported deforestation and ecosystem degradation should be part of EU climate action". In their common submission, the two NGOs outline the need for the EU's long-term GHG emissions reduction strategy to ambitiously address imported deforestation, and the conservation of natural ecosystems. The recommend that the next MFF aligns to the Paris Agreement to include 50% targets for environment and climate spending. The EU should continue data sharing with free and open source satellite data. Lastly the potential and integration of preserved forests should be included in NDCs and the Paris Agreement rulebook. They further promote natural climate solutions such as reforestation, afforestation, and restoration, including zero-deforestation supply chains; "blue carbon" storage, via restoring coastal wetlands; enriching soil health. These can be delivered via avoiding habitat conversion and promoting indigenous leadership.

Climate Action Network Europe (CANEurope). In order to meet the 1.5°C target, CAN stresses the importance of adopting a target to achieve net-zero GHG emissions by 2040, which will require steep emission reductions in all sectors. In addition, the organization advocates for the immediate revision of the 2030 targets to at least 40% in GHG reductions. Therefore, the EU needs to enable a drastic shift in financial flows away from fossil fuels to invest in renewable energies and energy efficiency technologies. Moreover, the EU also needs to invest in protecting biodiversity to reduce emissions from the LULUCF sector and enhance the carbon removal capacity of natural ecosystems. Moreover, while the energy transition represents a possibility of creating new green jobs various regions will be affected differently, thereby requiring maximum support to be provided to workers and vulnerable communities to enable a just transition.

European Climate Foundation – NetZero 2050 report series. "Funding Innovation to Deliver EU Competitive Climate Leadership" (author: Climate Strategy & Partners). To meet the objectives of the Paris Agreement Europe will need to transition to a net-zero emissions economy by or before 2050. Europe will therefore need to continue to attract and train world-class scientists and entrepreneurs, to develop the products and solutions that can decarbonize Europe's energy, industrial and agricultural systems. Increased levels of targeted research and innovation ("R&I") funding from public and private sources are required along with more risk-tolerant and patient capital as well as supportive public policies so that successful projects can be deployed much faster. The report concludes the Europe needs to increase its climate-related R&I in the 2021-27 period by a third to reach the Paris Agreement goals. As an example, Horizon Europe should require nearly half (47%, up a third from 35%) of its funding to be relevant to climate action, and the climate and impacts of R&I investment be more transparent, tracked and disclosed by the private sector. **Net Zero 2050 "Net Zero by 2050: From Whether to How"**(author: CLIMACT). Reaching net-zero emissions in 2050 is feasible and can cost less than the business-as-usual scenario, but this will require raising the 2030 amibiton level (55-65% reduction comparted to 1990).This paper modelled over 10 scenarios in which explore reaching net-zero emissions by 2050. Out of these three were illustrated as good means to achieve the objective of being emission neutral by the mid-century. These three scenarios were: the "shared effort" scenario, reductions are shared equally across all sectors and levels; the "technology" scenario, emphasising efficiency and innovation with electrification, hydrogen-use, and CCUS and BECCS from sustainably sourced biomass (assuming CCS technology is available at large scale by mid-century) leading to 41% lower energy demand by 2050; and the "demand-focus" scenario, where demand-side levers for example with energy (-64% by 2050), product, and meat consumption.**European Environmental Citizens Organisation for Standardisation (ECOS).** ECOS calls on the EC to maintain the ambition to

reduce emissions by 95% by 2050 compared to 1990 levels. The organization also calls to support zero global warming potential solutions by making them accessible in the European and global markets. It highlights the important role of standards in the reindustrialization of Europe through digital, circular and low carbon innovation and clean mobility. It proposes to strongly disincentivize or ban any activities, products and sources of energy that go against the Paris Agreement Objectives.

European Energy Research Alliance (EERA). The EU's current 2030 commitments are insufficient to attain the 2gC target. Disruptive changes are urgently needed in the energy-intensive sectors is needed to meet the current 2050 target of an 80-95% reduction in emissions. Also the transport sector must reduce its emissions rapidly (road, air and sea transport). The urgent need for disruptive innovations requires more ambitious investment programmes in R&D.. The Mission Innovation Challenges are essential to deepen collaboration and encourage increasing efforts amongst its members. Given its prominent role as a carbon sink, the LULUCF sector should covered by the strategy. Finally, the strategy should take into account national and regional specificities across the EU.

FERN. By 2021 the world will have most likely missed the opportunity to achieve the 1.5 degree goal through emissions cuts only. The EU long-term strategy should therefore focus on protecting and restoring the EU's natural carbon sinks (mainly forests) and reduce reliance on carbon removal technologies. Improving the health of forests will also benefit biodiversity, soil- and water quality and improves the resilience of ecosystems to the impacts of climate change. Current legislation (e.g. the revised Renewable Energy Directive and the LULUCF regulation) runs counter to these objectives. The EU should: be careful about promoting the growing bioeconomy (due to potentially negative climate- and environmental trade-offs) prohibit the use of forests as offsets and restrict bioenergy use (e.g. restrict public subsidies) and reliance on large scale bioenergy carbon capture and storage (BECCS).

The Foundation for the Economics of Sustainability (Feasta). Feasta argues that one of the serious challenges to achieving the long term GHG reductions is the pervasive assumption that economic growth is crucial to human wellbeing. Feasta proposes some key economic transformations that the EU should pursue to achieve a low carbon and resilient economy. Firstly, money should be issued on a debt-free basis by an accountable institution so as to decouple the payments system from GDP growth. Next, a binding cap should be placed on fossil fuel production and imports, with producers being charged for production permits and with the permitted production shrinking over time to zero. Revenue from the auctioned permits should be distributed on a per-capita basis ('Cap and Share'). Moreover, food security and carbon sink protection should be prioritized. A Universal basic income, land value tax and other resource-based taxes should be introduced. In relation to energy, an economy powered by largely locally-produce renewables will enhance energy security of the EU and would be an opportunity to significantly democratise the energy sector. Feasta believes that given the shortage of time available to achieve decarbonisation, the degree of investment required to develop and scale up CCS and the disappointing results thus far of CCS research, greater emphasis should be placed on land-use techniques for CO_2 removal.

Greenpeace. The EU must commit to fully decarbonising by 2040 and revise its 2030 climate and energy targets upwards to be in line with the 1.5 °C goal. All public spending needs to be "climate-proofed" to redirect investments in support of the energy transition. Action will be needed across all sectors, including the greening of the financial system. Although natural climate solutions such as sequestration from forests can play an important role, they cannot justify weaker efforts to reduce emissions at

source. CCUS/BECCS technologies should not be promoted or taken into considerations as they are unproven and risk creating severe unintended impacts. The EU should further take on a leading role, both regionally and internationally, to stop deforestation. Efficiency first should be an underpinning principle of the Strategy, and the EU should be fully powered by renewable energy by 2040, with coal phased out by 2030. Bioenergy can only play a limited role in a future energy system, given its many negative externalities. The EU should have an active climate diplomacy, and promote climate action in all its diplomatic relations.

Heinrich Böll Stiftung. The authors criticize the lack of representation of no-growth or negative growth scenarios in contemporary climate change scenario modelling. They call for the promotion of research projects investigating development paths that go beyond growth and that incorporate voices outside of the economic mainstream. They furthermore call for an extension of models and their underlying theories, so that they incorporate growth-constraining measures and a welfare qualification of those measures that takes into account the manifold necessities of humankind. As long as this is not granted, they call for a more careful interpretation of results stemming from contemporary climate change modelling. The foundation calls on politics and civil society to enforce these changes by means of promotional programs, measures and communication.

Institute for European Environmental Policy (IEEP). IEEP concludes that the EU's current 2030 targets are not sufficiently ambitious to be on track for the 1.5˚C maximum warming target. An effective strategy must consider the economy as a whole. In addition IEEP considers that there is a need to move away from excessive reliance on incremental price signals. Progress on new low and zero- and carbon negative technologies is required. In addition, the institute emphasized the need to address issues of consumption and to think through the governance of the EU's decarbonization policies. With regards to emission reduction the Institute focuses on the following areas: Agriculture, Forestry and Other Land Use (AFOLU), Transport, Buildings and the Emissions Trading System. IEEP thinks that the Sustainable Development Goals and Agenda 2030 must be respected and any efforts must be aligned with these. It mentions that the EU must seek to minimize GHG emission leakage and that it should recognize the impact that development cooperation and trade agreements will have on the overall long term strategy.

International Energy Agency Greenhouse Gas R&D project (IEAGHG). Energy efficiency, renewables, fuel-switching and CCUS (including biomass-CCUS) must all be taken into account to achieve the targets of the Paris Agreement, which has been the conclusion of several "below 2 degrees" scenarios published recently. Currently, the main challenges for implementing CCUS are the availability of storage infrastructure and the current cost-commpetitiveness of deploying such technologies. In the case of biomass-CCS there is a need to clarify it status with regards to negative emissions and discuss and review options for incentivising negative emissions. CCUS will be a key technology, and it is currently the only available technology to abate process emissions from the industrial sector. There are already two full scale power plants that operate successfully with CCS technologies, and several research initiatives across the globe aim to reduce the cost of these technologies.

Movimento per la Decrescita Felice[18] (MDF). The organisation points out three key areas for action: put energy efficiency first in the upcoming strategy, phase out climate-harming fossil fuel subsidies and

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[18] From IT: The Movement for Happy Degrowth

end investments in new fossil fuel related activities. Moreover, one of the primary instruments for achieving European decarbonisation is a greening and climate proofing of fiscal policy.

Platform for ElectroMobility. The decarbonisation of the transport sector should be the subject of a detailed assessment in the European Commission's 2050 strategy. The transport sector should be comprehensively examined, including its non-greenhouse gases pollutants emissions, as well as land use impacts and both final and primary energy consumption of different pathways. The scenarios should also consider the rapidly evolving costs of different technologies, as EV battery costs are falling continuously and expected to reach $100 per kWh on a pack level in the near future. The Commission should withdraw from the technology neutrality principle when maturity and energy efficiency of a technology are demonstrated by the market (not just based on scenarios) and put forward a "zero emission mobility package" that conforms to the Paris Agreement. The next Multiannual Financial Framework should and related investment programmes must also be adapted to this end.

Shift Project. The shift project is an independent think tank that has developed a manifest with 9 key strategies for climate mitigation in Europe. These include a rapid replacement of coal-fired power plants by renewable energy sources, aggressive decarbonisation of the transport sector by setting fuel standards of 2L/100km or less, promoting a modal shift from cars to public transport and bicycles in urban areas and investments in high-speed rail infrastructure to decarbonise long-distance travelling. Furthermore, better insulation and the deployment of heat pumps should contribute to the decarbonisation of heat demand in the built environment. Increased focus on afforestation and dynamic forest management in combination with increased use of wood is seen as an attractive carbon capture and storage strategy. Lastly, the food sector has a large potential to contribute to emission reductions by reducing food waste, e.g. through awareness campaigns and by restructuring agricultural policy so that emission reductions in the livestock sector are promoted.

Swedish Climate Parliament 2018. The 2018 Swedish Climate Parliament gathered 700 climate activist citizen in Stockholm. 12 proposals were put forward to the Swedish government which included amongst others that Sweden should advocate for the creation of a EU Rail Agency to coordinate and improve the interconnectedness between the European rail networks and set a "deadline" for phasing out fossil fuels.

Transport & Environment. The paper focuses on technological solutions from a powertrain/fuels perspective, as those can especially be driven by EU policy. It provides an overview of GHG emissions per transport mode, describes strategies for decarbonization for each of the modes (including bunkers – i.e. aviation and shipping), and discusses energy requirements of these transformations. They highlight that action to decarbonize the transport sector needs to be immediate and point to the importance of concurrent decarbonization in the power sector. Lastly, the NGO states that they will provide further, more detailed, research and implementation recommendations for each transport mode in the coming months.

World Green Infrastructure Network. "Urban Green Infrastructure: a solution to reduce EU greenhouse gas emissions". Cities are at the centre of the clean energy transition: they are major producers of greenhouse gas emissions and the global urban population is estimated to reach over six billion by 2045. The introduction of more green spaces and green infrastructure (such as green roofs) in cities can help reduce the urban heat island effects in cities, raising temperatures in cities to 5-7Gc higher than in

rural areas while simultaneously improve the air quality. Therefore, the EU should support green urban infrastructure developments within the next Multiannual Financial Framework and link the EU budget financial programming with the development of national climate change adaptation plans and strategies. Recommendations for the Member State level include, inter alia, to ensure action to facilitate the implementation of Green Infrastructure within the national climate change adaptation plans and strategies.

World Wide Found (WWF). The window for meeting the 1.5gC target is closing rapidly and the long-term aim of the EU should therefore be to attain zero-net emissions by 2040. This requires reducing emissions from all sectors by (nearly) 100% by 2040 in parallel with enhancing carbon sinks (which includes phasing out of bioenergy policies with adverse effects). The EU should revise its 2030 climate and energy targets, identify where additional research and innovation funding is needed to make EU a leader in breakthrough technologies, provide support to enable a just transition for the workforce and regions, outline a mechanism for assessing the consistency of new EU policies or infrastructure investment in line with the new 2040 goal, assess how the EU can contribute to reducing emissions in third countries. It should set out how EU public and private financial flows -especially the EU budget – should be reoriented towards these objectives.

Private enterprise (14 papers)

Summary: All stakeholders but two in this category which submitted additional attachments operate in the energy sector. Only one enterprise expressed a firm view on the long term target, advocating to aim for carbon neutrality by 2050 and also called for a strengthening of the 2030 target to 45%. Several companies commented on the prominent role of the EU ETS as the main tool to steer European and sectorial decarbonisation., with some companies advocating an increase in its scope and strengthening of the trading scheme. Moreover, there was also a strong emphasis on the importance of decarbonising the power sector and to aim for further electrification. CCUS technology was also frequently mentioned as an enabling tool to further reduce emissions, requiring more investment in research and development and an enabling policy framework.

CEZ Group (utility company). CEZ estimates that increasingly ambitious renewable energy and energy efficiency measures will likely result in a "less manageable surplus" of allowances in the EU ETS /It welcomes the Commission's envisaged biennial assessment (as of 2021) of the overall impact of Member States integrated national plans on the EU ETS. However, only active and coherent energy and climate policies will result in a robust price signal. CEZ believes a carbon price that covers all emissions will be essential for a successful long-term strategy, thus advocating for the introduction of a carbon price also for the non-trading sector.

Equinor (energy company). The company considers that increased gas consumption at the expense of higher carbon content fuels will fast track carbon reduction. From 2030 onwards, natural gas can be combined with renewables in hybrid solutions (mixing with hydrogen, biogas or combined electric/gas appliances) and towards 2050 natural gas could be fully decarbonised by reforming it to hydrogen and carbon dioxide. Meaningful strategic actions should include immediate policy actions for future hydrogen and CCS networks by modernizing the Fuel Cell and Hydrogen Joint Undertaking, fast-tracking CCS research and cost reductions by making it a research priority under Horizon Europe, modernising the Connecting Europe Facility and the guidelines for trans-European energy infrastructure and by designing an EU Innovation Fund to support the deployment of large-scale CCUS and hydrogen

technologies. Moreover, Equinor calls for a new focus on carbon management and industrial climate action in the timeframe of 2019-2024. Suggested actions include ideas on future proofing EU hydrogen legislation, establishing an alliance for industrial scale sustainable hydrogen pilot schemes, establishing a high-level group on Carbon Dioxide Removal action, building further market demand for clean products, strengthening the EU Maritime Transport Strategy and the role of the European sustainable Shipping Forum, strengthen the EU's offshore wind capacity and potential and use the review mechanisms foreseen under the EU ETS to their fullest extent. The has company also set out three energy market scenarios (Reform/Renewal/Rivalry), of which the Renewal scenario sets out a 2 degrees consistent pathway, expecting strong policy intervention and operates with a global carbon budget.

Fortum (energy company). The EU should align its long term climate ambition with the Paris Agreement with the view of being carbon neutral by 2050. In addition, the EU should establish an emission trajectory towards 2050 with an ambitious intermediary target for 2040 and enhance its 2030 target to at least 45%. The EU ETS needs to be further strengthened and to cover new sectors, mainly heating and cooling and the linear reduction factor be set to at least 2.6% in the 2024 review. Both direct and indirect electrification is needed to decarbonise heating and cooling. Electrification, hydrogen and sustainable biofuels will also enable the low-carbon transition in transport. In order to make CCS technologies commercially viable, the EU should develop a market mechanism to reward the removal of CO_2 and dedicate an integrated part of its research and innovation programme to these technologies. Cascading use of biomass could enable enhanced resource efficiency, while the combination of bioenergy and CCS (BECCS) is an interesting option to achieve negative emissions.The EU research and development programme (Horizon 2020) should focus on finding new solutions for this wide range of low-emission technologies, while public investments will be needed to help mobilize and secure private funding and financing.

GRTgaz (TSO). The organization highlights that full electrification of the energy system is not the main solution to decarbonizing the EU. Rather, multiple pathways taking into account renewable and low-carbon gases should be explored. Policies should be technology-neutral and sectoral integration should be promoted. Furthermore, the organization calls for policymakers to give more responsibility to gas infrastructure operators to facilitate the industrial deployment of new, sustainable gas technologies. R&D efforts should be channeled towards green gas production and gas end-user technologies to levy renewable gas potential through energy efficiency. Lastly, they state that the market rules will have to evolve to better integrate renewable gases and ensure their development (e.g. via harmonization of the connection regime and a renewable gas certification system).

Iberdrola (international power utility). The company has publicly committed to reducing the intensity of its CO2 emissions to 150 grams per kWh in 2030. This corresponds to a level 50% less than its emissions in 2007. The company also committed to becoming carbon-neutral by the year 2050. Iberdrola considers that the current commitments and actions under the Nationally Determined Contributions are not enough to meet the Well below 2˚C Scenario. The company calls for legally binding targets to be reached by 2030 and 2050 and regular assessments with upwards revisions. The company also calls for approving stringent implementation guidelines for the Paris Agreement at COP24. Iberdrola favours a robust climate policy framework that recognizes fossil fuel combustion as the main cause of climate change and acknowledges the key role of electrification based on RE. It also supports taxation policies based on the "polluter pays principle".

Naturgy (energy company). In its long-term climate strategy the EU should utilize all the levers available, including energy efficiency, renewables, fuel switching and CCS, to curb greenhouse gas emissions. The use of energy distribution and transportation networks needs to be increased, and in new developments distribution networks should be prioritised, including their digitalisation and automation. Decarbonisation of the electricity sector is key to achieve the 2050 targets, so sustained efforts are needed to support this development. At the same time, there should be separate targets for renewable gases in addition to the overall renewable energy target. The decarbonisation of the transport sector requires a specific strategy and action plan. In addition to policies aiming at the decarbonisation of energy supply, policy measures are needed to reduce demand for energy and products and the shift to a circular economy should be promoted. Moreover, price signals provided by capacity markets or market-based instruments for the development of RES will be indispensable to guarantee the necessary investments in the energy sector. The introduction of competitive mechanisms and regulatory monitoring will ensure that such instruments are effective as well as efficient. International diplomacy should be used to ensure that international multilateral organisation also contribute to climate change abatement. Within Europe, the interactions between member states and neighbouring countries should be aligned with the objectives of European energy and climate policy.

OMV Aktiengesellschaft (energy company). OMV is fully committed to the implementation of the Paris Agreement in its global context, and looks forward to contributions also from other signatories than the EU. In order to work out robust pathways to achieve the Paris targets, a full transparency of the underlying assumptions, approaches, and exercises done by the EU Commission must be guaranteed. All models, e.g. PRIMES, used and referred to should be publicly available in order to improve the scientific dispute in finding the most suited approach to achieve the targets. Implementation of legislation supporting the Paris target occurs in different speeds at global scale and must not lead to a competitive disadvantage of the European economy. Current measures to protect the energy intensive European industries from carbon leakage, but covers only a part of the European economy experiencing global competition. Burden and risk shall not be carried by single groups but by all market participants in a fair and balanced manner. This is also true when it comes to security of energy supply: a well-functioning and connected gas market is essential for security of supply for industries and households.

Orano (utility company). Orano supports a strengthened EU 2030 emissions reduction target (at least -45% compared to 1990). The overarching objective of the long-term EU strategy should be the full decarbonisation of the EU economy (net zero emissions, carbon neutrality). Decarbonising the European power sector is a no-regret option that will be one of the main enablers to decarbonising the European economy. This will however require major investments in low-carbon generation, and it is unlikely that the reformed power market design for the 2020-2030 period will offer appropriate solutions. The Commission should therefore put forward concrete proposals on how to facilitate investments in all typses of low-carbon generation, including nuclear energy.

Public Power Corporation S.A. (utility company). The Strategy should adopt an ambitious approach as regards the fulfilment of EU's obligations under the Paris Agreement, achieving a balance between emissions and removals of GHG as early as possible in the second half of this century and, in certain Member States (MS), potentially by 2050. It is also vital that the Strategy materializes in a stable, transparent (but sufficiently flexible)regulatory framework. Moreover, it should also take into account the crucial and decisive role of national specificities and different starting points of Member States,

while recognising the potential social consequences. Electrification in combination with the promotion of renewable energy generation are key pillars in allowing for a cost efficient energy transition.

REPSOL (energy company). The mitigation potential of the oil and gas sector depends greatly on the various framework conditions. Increased technological developments that can provide a reliable and sustainable energy supply in the long-term is crucial. This requires significant investments, which should be possible in an investment-friendly environment. They view a global carbon pricing as a good policy framework to create a level playing field for all businesses.

Saint-Gobain (construction and building material). The window of action allowing the world to pursue the 1.5° path is rapidly closing, and the EU must continue showing its leadership as a driving force to curb emissions by adopting a target of achieving net-zero emissions by 2050. The building sector should be a starting point for this transformation for three main reasons. First, the sector contains vast untapped and effective potential to reduce emissions, equating to nearly 50% of the emissions reductions needed to meet the goals of the Paris Agreement. Moreover, renovations in the building sector will help balance increasing energy demand – requiring the current renovation pace to be speed up. Finally, actions in the building sector will also carry several co-benefits for European citizens.

Shell (energy company). The company welcomes the recent reform of the EU ETS and encourages further reforms of the System in order to help deliver on the goals set out in the Paris Agreement. However, Shell notes that the electricity market regulations should be aligned with the EU's climate objectives. This can be achieved through the introduction of emission performance standards that determine eligibility to public subsidies. Shell is convinced that Article 6 of the Paris Agreement is key to help deliver Net Zero Emissions. Article 6 established the ability to transfer verified emissions from one country/region to another. In addition, Article 6.4 should establish a mechanism to facilitate the process of quantifying a broad range of mitigation activities, including those from natural and geological sinks. Support to new low CO_2 technologies during their early stages is vital to mitigate high technology risks and associated capital costs. These technologies include CCUS and low-carbon transport technologies such as electric vehicles, LNG, advanced biofuels, and low carbon liquid fuels and modern ICE vehicles.

Vattenfall (utility company). The high ambitions of the Paris Agreement and the new scientific evidence from the IPCC will require the EU to increase the ambition levels of its current 2030 target, and set a target to achieve net-zero emissions by 2050, while also formulating a 2040 target. Vattenfall believes that the EU ETS should be the principal instrument to achieve the EU's climate targets. The decision to increase the 2030targets for energy efficiency and renewable energy should be met with a stronger EU ETS. The company is broadly supportive of its 2017 reform, but believed the linear reduction factor should be further strengthened (over 2.6%). The review of the Market Stability Reserve should lead to a continuation of the 24% annual intake. Moreover, a corresponding carbon price should be introduced for the non-trading sector. Vattenfall has the ambition to become fossil-free within one generation, which has already led to significant changes in the company's portfolio.

Veolia (transport).The European Commission should adopt a long-term goals of achieving net-zero emissions by 2050. Energy efficiency first should be the backbone principle of the decarbonisation transformation, which should also be led by a territorial and district-based approach (such as supporting community-led energy infrastructure projects like district heating systems). Achieving a circular

economy will also enable decarbonisation, with should encompass action on plastic consumption and waste-to-energy techniques. In conjunction to this, digitalisation is another meta-trend that offers possibilities for the decarbonisation project. To achieve this, an ambitious earmark of EU funds to climate action will be a first crucial step in providing the necessary investments, while European climate action would also benefit from a reinforced carbon-price signal and public-private partnerships.

Research and academia (3 papers)

European Academies Science Advisory Council (EA SAC). The paper from EA SAC focuses on the opportunities and challenges associated with research on food and nutrition security and agriculture in Europe. The report emphasizes local–global interconnections. It notes that overconsumption in Europe has implications for the rest of the world but it is also the case that European R&I can contribute significantly to addressing global issues.

FVV (research association). The association highlights that road transport must become predominantly climate-neutral by 2050. They assess three different '100% scenarios' for this (full electric, hydrogen, or e-fuels). Albeit coming to the conclusion that all three scenarios would enable climate-neutral mobility by 2050 from a technical standpoint, they state that application of these scenarios is neither desirable nor sensible (due to a wide range of economic and market-related issues).

Professional consultancy, law firm and self-employed consultant (2 papers)

Antoaneta Yotoya (freelance expert in environmental policies)**. Building on a review of international, European and international climate policies, the paper argues for a synergy between top-down (legislation) and bottom-up (local and voluntary initiatives) actions. Legislative top-down action often takes a long time to be agreed upon while bottom-up actions can respond faster to local and regional contexts.

Mario Valentino Romeri (consultant. Mr.Romeri submitted a paper titles "Considering Hydrogen Fuel Cells Powertrain as Power Generation Plant – 2017 review" in the paper he outlines the future of the Hudrogen Fuel Cell Powertrain for the propulsion system of Fuell Cell Vehicles which could be considered as a small power generation plant.

Other (24 papers)

Summary: Several individuals and groups of concerned citizens provided additional input to the OPC. Topics covered includes, inter alia, the presentation of alternative or, according to the authors, disregarded technologies and innovations, the need to reduce meat consumption and the moral imperative to reduce our overall ecological footprints.

A. Duncanson. *"More growth or a healthy, sustainable future?"*. The author advocates a shift towards de-growth in favour of the wellbeing of humans and the environment. By focusing on healthy people and ecosystems rather than GDP growth can give us the basis for a lasting, secure future.

American Enterprise Institute. Attachment of a graph demonstrating that the EU is among the ten countries with the largest increase in CO2 emissions (in millions of tons) in 2017, whereas the US is among the then countries with the largest reduction.

Dipl.-Ing. Andreas Plihal. "*Contributions to world restoration"***.** The author admits that he does not, in any way, possess expert knowledge in any of the relevant fields to combat climate change. However, he would like to make his ideas heard to solve some of the pressing issues that endanger the planet. These ideas include harnessing volcanic energy and forestation of the Sahara.

Andreas Wolfsteiner. "*Paris was a success – let us act now"*. The author calls for two distinct action points for the EU to achieve the goals of the Paris agreement: First, the emissions reduction targets should be adjusted with the remaining global CO2 budget. For 2030, this means increasing the target to 50% reductions compared to 1990 levels. Second, the EU should expand the ETS to all CO2 emissions. This would allow for an effective CO2 price enabling a cross-sectoral decarbonization in the electricity, mobility, heat and industrial sectors.

Dr. Carlos Pinilla Ruiz, Professor at the University of Jaén. "*Photo-bioreduction of CO2 via the forced cultivation of microalgae"***.** The project brought forth by Dr. Pinilla presents the application of photo-bioreactors at a Spanish cement plant in order to cut CO2 emissions and use the final product as fuel (in the same plant), animal food, organic fertilizer or for human consumption. The final product is produced by first injecting CO2-enriched air into controlled algae cultivation cylinders that are then heated collaterally to the plant's primary production processes.

Collectif d'Ingénieurs bien informés. "*L'énergie nucléaire et la verité"***[19]** The authors argue that the risks often associated with nuclear energy have been grossly exaggerated, especially by the environmental movement but also certain European politicians. However, those countries that currently include nuclear energy in their energy mix are those with the lowest overall greenhouse gas emissions.

Erik Ooms. "*Transform the objective of sustainable mobility into sustainable accessibility to create long-term spatial instead of short-term sector-based solutions"***.** The author makes a case to connect both the demand and supply side of mobility, taking on a spatial perspective. Without this 'sustainable accessibility' approach, EU policy will continue to have a negative impact on sustainable development.

Anonymous. "*Relationship between climate change mitigation, development aid and use of direct current"***.** They present a modular energy- and food supply concept for individual, not yet industrialized settlements in developing countries. They propose to build up electricity supply in those settlements on a hazard-free 48V direct current basis. Furthermore they draw up solutions such as solar PV installations, biogas reactors and small-scale hydropower installations.

Grainis Ldt. "*Water-Electrolysis Production of Hydrogen, Oxygen, SOH and MOH gases***."** Accounts for three different energy technologies.

Jan Juffermans. "*Towards Footprint Justice"***.** Given the inequalities between countries with regards to the ecological footprint per capita, this group argues for the launch of a movement for "footprint justice" to ensure each human is granted the right to an equal ecological footprint size.

Jose Juan Zubiria. Mr.Zubiria emphasizes the importance of wind energy and mentions the progress made in this sector since the first windmills were installed in Europe. In addition, he has submitted a

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[19] From FR: Group of well-informed engineers – Nuclear energy and the truth

document outlining the mechanisms behind certain technologies and the new technology of Undigenerador.

Leandro Roberto Ferreyra, European Director of Carbón Industrializado Sostenible, S.L.
"Sustainable production of charcoal." The company developed a new generation of ovens that can cut and control CO_2 emissions from its production processes. It can also use non-traditional inputs such as pine and wood from other trees (e.g. citrus fruit or olives) for the production of charcoal.This use of alternative wood types can decrease e.g. deforestation.

Manuel Garcia. *"Turbomotor 2000 by Manuel García – A way to generate clean, free and unlimited energy"*. The picture shows the blueprint of a machine that uses the force of earth's gravity on fluids of different densities to produce energy.

Matevž Jeran and Jure Vrhovnik. *"Čas je za novo - trajnostno - prehransko politiko"*[20]. This submission focuses on the negative effects of animalistic products and food production, making the argument that current global consumption and production of animalistic products is too elevated. At present, global livestock production accounts for 14.5% of all global anthropogenic emissions of greenhouse gases, which is comparable to emissions from the global transportation sector. Reducing especially meat consumption has several health benefits in addition to environmental benefits. Efforts should be made to raise awareness of the various benefits of a vegan diet, both for people and the planet.

[Submitter unknown] The author expresses some doubts as to whether climate change is actually happening or if it is man-made. Before endeavouring on the challenging we need sound and robust scientific evidence to proof the existence of man-made climate change.

[Submitter unknown] The clean energy transition requires a change in modes of production that duly takes into account negative externalities. The required technological solutions are already available to enable a large progress, but future developments of these technologies will not be useful unless there is a market for them. The three main obstacles to this are i) the number of sectors deeply dependent on fossil fuels; ii) the scale of investments needed and; iii) the competitive disadvantages of alternative technologies to cheap fossil fuels. Therefore, steps need to be undertaken to decarbonise key sectors (such as transportation) and facilitate a "just transition", develop new financial tools to mobilize the necessary investment and introduce an ambitious, green fiscal system to leverage competition between clean technologies and fossil fuels, while also helping to promote a circular economy.

[Submitter unknown] *"Accoppiamento energetico e chimica verde BEI non finanzia e ritardo italiano"*[21]. A 398 pages document containing various extracts of texts, graphs and images with information on various energy and green chemical technologies which the author finds has not received sufficient funding to further develop.

[Submitter unknown] *"Regulating Aviation – Let Europe be the first to create an effective climate policy for aviation"*. The CORSIA agreement struck in the International Commercial Aviation

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[20] From SO: It is time for a new -sustainable – nutrition policy
[21] From IT: Energy coupling and green chemical technology the EIB does not finance and Italian delay

Organisation is not sufficient to tackle the negative impacts of aviation on the climate. Neither alternative fuels nor technical solutions offer a solution due to limited feedstock and financial cost. The only viable solution is to drastically limit the number of flights. This could be by: amending current legislations such as the European Slot Regulation or the European Guideline Airport Charges or introducing additional EU wide taxes on aviation to finance high-speed trains.

[Submitter unknown] *"Methodological Luddism: A concept for tying degrowth to the assessment and regulation of technologies; Agriculture and degrowth: state of the art and assessment of organic and biotech-based agriculture from a degrowth perspective"*. These papers argue for the reassessment and regulation of technologies to decide how they should be designed and developed to attain certain social and/or ecological needs and how to incorporate the concept of degrowth in the agriculture sector.

[Submitter unknown] *"Public consultation on the strategy for long-term EU greenhouse gas emissions reduction."* Mentions various options to reduce emissions with an emphasis on the role of hydrogen and biogas in five sectors: transport, industry, heating, electricity and agriculture.

[Submitter unknown] *"State of emergency: is a sustainable and honest society a thing of the past?"* Calls for the declaration of a state of emergency to facilitate the implementation of measures to halt the currently unsustainable way of life of our population. The author sees this as a 'thought experiment' and delivers a compilation of measures to be considered.

[Submitter unknown] *"Energy usage in kWh per 100km (tank to wheel)"*. Comparison between various car models.

[Submitter unknown] « *Environnement et santé*[22] » Promote public transport and other means of transportation other than private cars. Phase out of diesel cars by 2025-2030, adopt strategy to improve energy efficiency in buildings.

[Submitter unknown] *"CO2 abatement costs"* Graph demonstrating the effective costs of different climate mitigation measures per ton of avoided CO2 emissions.

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[22] From FR: Environment and health

3 Results of stakeholder meeting

3.1 Stakeholder conference: introduction

A stakeholder conference was held on **10th and 11Th July, at the Université libre de Bruxelles.** More than 1000 people attended. The discussion on the EU's vision for a modern, clean and competitive economy was welcomed by all speakers and panellists. It highlighted the need to have a unified European vision ahead of COP24**. Europe's Long Term Strategy for Greenhouse Gas (GHG) emission reduction** will not only guide European efforts in the coming decades and serve as an example for other nations and important stakeholders.

A number of themes were addressed. Some of the most important themes regard the trends of the energy sector, the regulatory environment in the EU, as well as the social dimension of the low-carbon transition. Overall**, there is consensus on the need for an ambitious long-term strategy**, with many participants acknowledging that in practice this means **net zero emissions at some point**, perhaps as early as 2040, but according to most around 2050. It was recognised that this strategy should focus mainly on the long-term in order to urge decision-makers to maintain a forward-looking vision, despite their shorter-term priorities. As a result, the strategy should specifically include attention for measures creating negative emissions. It should help set milestones for the short- and medium-term also in order to stimulate timely action. Most panellists emphasised the need to view the transition ahead as an opportunity, rather than a cost or a threat. In order to demonstrate that, the cost of inaction should be communicated more clearly.

More specifically, many panellists agreed that the key to realising the transition lies in e**nergy efficiency and renewable energy**, these being able to deliver 80-95% of the total change required. **Electrification of heating and transport, digitisation and the further growth of solar and wind energy** were seen among the major developments needed. Other technologies such as nuclear fission and fusion, hydrogen, CCS and natural gas were all also discussed, as potential bridges or future hopes for a low or zero carbon future. Yet traditional sources of energy still account for a large share of the energy mix, so the focus should not only be on electrification, but also making all energy cleaner. It was noted that despite progress on EU policy there remain **important steps still to be taken in many sectors.** . In addition, discussions on **the role and use of natural resources** noted that **agriculture and forestry have a crucial role to play** in meeting food and resource needs, whilst contributing to decarbonisation and potentially acting as carbon-sinks.

Since climate change is not only a European problem, but a global concern, panellists agree that Europe must collaborate with its partners and show leadership. The EU also faces a lot of competition, though, notably from China. This means that **while transitioning towards a low-carbon economy, Europe needs to stay competitive**. To achieve this, **there must be investment in infrastructure, research and the labour force**. Moreover, we need to ensure that supply and value chains and innovators stay in Europe. Now is the time to build a comparative advantage in areas that will be of value in the future (e.g. digitalisation, battery production). Furthermore, when thinking about the future, we have to account for a mix of solutions (there is no 'one' solution). This is why it is important to keep the conversation open and to consider diverse viewpoints. **Engaging citizens** and gaining their support for

the developments that are taking place was highlighted by a number of panellists. **Communication and regulation were cited as significant drivers** of citizen engagement. Beyond that, panellists called for a cohesive regulatory framework that cuts across all sectors and that reduces regulatory redundancy between Member States. Regulation should encourage private investment and business opportunities, while discouraging detrimental business (and consumer) behaviour. Although some panellists called for a stronger price signal on carbon, the oil & gas industry believes that it is already heavily taxed and is not in favour of an increase in carbon pricing.

Affordability was also an important angle to the discussion. Whilst some renewable energy and energy efficiency solutions have a low or negative cost, it is clear that not all low carbon options are of this nature and there are significant implications for existing industries and households. This issue should not be neglected, as millions of Europeans today have difficulty accessing affordable energy services. In general, **it is important to keep in mind all the possible disruptions that a transition can cause and how to address them in a fair, just and responsible way**.

3.2 Stakeholder conference: Day 1

3.2.1 *Opening addresses*

In the opening addresses, speakers Cañete (Commissioner for Climate Action and Energy), Kelly (Member of European Parliament), Hudák (Vice-President of the EIB) and Plank (General Secretary at Federal Ministry for Sustainability and Tourism Austria) stressed the importance of developing a long term strategy for reducing Greenhouse Gas (GHG) emissions in the EU:
The strategy for long-term emissions reduction will not have a legal standing, but it will form a vision. To hit the 1.5 degree mark, we need to reduce emissions by more than 80%. This includes looking into net zero emissions pathways.

The challenge of reducing emissions should be viewed as an opportunity, not as a burden. There is a large funding gap for emission reduction measures (~€200 bn/year), but there are large opportunities for successful business models, particularly in areas like digitalisation, electrification, transport and energy efficiency.

The strategy should reflect that the transition needs to be inclusive. It is also important to communicate more with citizens and involve them actively, especially those from regions or sectors that might lose out most.

3.2.2 *Session I: Cost-efficient ways for achieving a post-carbon European economy*

Chairman Ristori (Director-General DG Energy) and speakers Katainen (Vice- President for Jobs, Investment and Competitiveness European Commission), Galán (chairman and CEO Iberdrola), Dr. Teyssen (CEO E.ON), Dickson (CEO WindEurope), Turk (Acting Director at IEA), Frassoni (President at European Alliance to save Energy) and Trio (Director CAN Europe) discussed the cost implications of Europe's path to decarbonisation:

1. The circular economy, energy efficiency and renewable energy are key towards decreasing emissions. The EU's long-term vision needs to include a growth strategy, climate action is an opportunity rather than a threat.
2. In the energy sector, the challenges include the fact that more power is needed (due to electrification), it needs to be green, it requires more local solutions (with regional

interconnections) and supply needs to be smarter. Especially in the latter area, the EU can be a front-runner but the access to lots of (privacy secured) data is needed. Some consider a price signal on carbon as necessary, but revenues from these policies should be recycled back to consumers (e.g. subsidising own green energy). Wind and solar are the cheapest forms of power generation and significant potential still remains. The speakers agreed that the largest part of the challenge can be met by energy efficiency and renewables. The synergy between both needs to be exploited more though.

3. The challenge ahead is still large as the difference between business-as-usual and what is needed by 2040/2050 is large, even if 2030 targets are kept. The IEA rates only 4 out of 38 sectors to be on track for 2 degrees. Some speakers point to the importance of showing the cost of inaction in order to spur action.

4. The strategy should focus on the long term and prepare for creating net negative emissions before 2050 by focusing amongst others on land use. A too strong focus on cost-efficiency would ignore the potential for future cost reductions as well as the large co-benefits from most of the measures.

3.2.3 *Session II: The long-term strategy in an international context*

Chairman Petriccione (Director-General at DG CLIMA) and speakers Skea (Chair of Working Group III at IPCC), Tubiana (CEO European Climate Foundation), Giacomini (Deputy Managing Director, EEAS), Young (Director at World Energy Council), Gielen (Director at IEA), Rising (Director-General at World Nuclear Association) and Watson (CEO at SolarPower Europe) discussed the strategy from an international perspective, where the EU faces the trade-off from the opportunities of collaboration as well as the threat of carbon leakage:

1. The EU only accounts for less than 9% of global emissions so needs to proceed multilaterally by supporting its partners. The strategy should take into account the economic and political risks incurred by partner countries, especially from an energy supply perspective. Each country has to follow a tailor-made path to a low-carbon future, based on culture, context and capabilities.

2. The transition to decarbonisation does not come in isolation. A transition to decentralisation and digitalisation also needs to be managed (differently) by countries. The 'top-down' approach no longer works and the transition needs to take into account the societal complexity and regional diversity of energy systems. The approach needs to be interactive, innovative and collaborative.

3. Nuclear could play a significant role in the transition as clean energy both in terms of the environment and the climate. It is also complementary to renewables. There are globally speaking many countries with successful nuclear programmes that lead the way. Solar energy was another specific technology discussed as having a large potential in the transition, experiencing strong (if not the strongest) growth rates in the renewable energy sector.

3.2.4 *Session III: Benefits of a low-carbon world for all Europeans – a citizen's perspective*

The chair Wörsdörfer (Director, DG Energy) and speakers Goyens (Director-General, BEUC), Wates (Secretary-General, EEB), Alverà (GasNaturally), Boni (Secretary General, Eurocities), Liebhaberg (Director-General, CERRE), Todts (Executive Director, Transport & Environment) and Denis (Advisor, ETUC) discussed the social dimension of the transition and the need for the involvement of citizens in the transition:

1. It is important for policy makers to be ambitious and send clear signals that the transition towards a low carbon economy is supported. This needs to be visible and clear for consumers when making choices: e.g. electric cars should be easier to buy for consumers. Energy efficiency is a no-brainer for consumers as not consuming energy is a clear driver for them.

2. To engage citizens more in the transition an important role could be played by city authorities, sometimes more ambitious than national government.

3. Regulation should encourage low-carbon choices for consumers by offering better information (labelling), incentives (price signals) and supporting specific individuals engaged in the changes.

4. Transport is a big challenge and close to consumers. Citizens want electric vehicles that are quiet and cause less pollution, in line with the decarbonisation strategy.

5. For consumers to be engaged, the transition should be 'just', and we need to assess the impact of the transition on employment and devising plans for mitigation measures.

3.2.5 *Session 4 Keynote address*

Maroš Šefčovič, European Commission Vice-President for the Energy Union

Developing the long term strategy is important not to be overtaken by every-day tasks, by low-hanging fruit and quick-wins and think of the next generation and not pass on our problems to them.
Good steps have already been taken by the EU, such as through the Energy Union, the Effort Sharing Regulation, the revised ETS and the higher renewable energy and energy efficiency targets. There is also a new governance system to track progress at both an EU and national level. Europe has the opportunity to be the forerunner of the 4th Industrial Revolution. This is why industrial and innovation policies are key (e.g. private-public partnerships), as well as the facilitation of the clean energy transition in poorer regions. Climate action not only needs to be sustainable, but 'fair', ensuring that people are provided with the necessary skills for the future (e.g. European Youth for Climate Action programme equips young people with digital skills).

3.3 Stakeholder conference: Day 2

3.3.1 *Session I: Experience with long-term strategies in Europe*

This session highlighted the important targets and plans that their countries have incorporated into their own long-term strategies. Portugal committed to becoming a carbon-neutral economy by 2050. It's path to carbon neutrality (Carbon Neutrality Roadmap, ready in 2019) includes phasing out coal, preparing mitigation strategies for the transport sector, improving energy efficiency and promoting carbon sequestration. Other actions include phasing out fossil fuel subsidies.Norway plans to decrease GHG emissions by 80-95% (2050 target). Its carbon tax is the corner stone of climate policy, covering a large share of emissions. It is also planning some ambitious policies, notably with regards to its fleet of electric vehicles and CCS developments. Its largest challenges lie in the field of cement production and waste-to-energy technology.Germany has already submitted a long term strategy to the IPCC at the end of 2016 (Klimaschutzplan 2050), including how carbon neutrality by 2050 can be achieved translating into targets for 95% emission reduction by 2050. The country's national reduction objective is broken down into sectoral objectives to ensure that responsibility is not passed around from sector to sector and that all ministerial resorts in Germany are accountable. A clear plan for stakeholder engagement is also a unique element of the strategy.

The Czech Republic wishes to decrease emissions by 80% (2050 target) and tested three pathways to reach the goal: (i) importing electricity and biomass, (ii) the development of CCS and (iii) renewable and nuclear energy and energy efficiency. As hydropower seems largely exploited and wind power potential limited, most of the potential stems from biomass and PV development as well as nuclear power.

France aims to eliminate the use of coal by 2022 and to stop funding fossil fuel research by 2040. Its strategy also supports the roll-out of electric vehicles. France plans to further investigate options for the agriculture and food industries, and attention will be given to the circular economy and renewable energy.

3.3.2 *Session II: Economy, finance, investment*

This session discussed how investments and finance will be mobilised to implement the necessary measures:The energy revolution can be compared to the telecom revolution.The transition will be driven by digitalisation and new business models and will be as disruptive. The challenge therefore consists of finding sources of sustainable growth.The economy will increasingly rely on direct electrification for its production processes. To meet an 80%/90%/95% emission reduction, some 38%/48%/60% of final energy consumption respectively will, next to increased energy efficiency, have to be met by electrification according to EURELECTRIC. In the construction sector, renovation constitutes the key part of the transition challenge: some 75% of the buildings are energy inefficient. 6% of emissions stem from buildings. The cost of addressing the problem add up to €100bn: 15% of the construction sector's turnover. Finding capital is not an issue but the role of policy is vital as it can improve the risk-return profile of the necessary 'green' investments, which are currently unpopular and constitute merely 1% of the total finance available. Regulatory stability and packaging loans are ways to reduce risks, as well as greater transparency about the risk-return profile of green investments.

3.3.3 *Session III: Innovation and technology*

This session his third session addressed the potential of businesses and technology to transform the economy and to integrate innovations into the wider economic system. Many solutions in 2050 will be based on chemistry, and we need to make sure that chemicals are still produced in Europe. Investment in R&D and infrastructure is vital (we need some large-scale innovation projects across Europe).One area of focus for the next period is cooling and heating. The technology is ready for 2050, the replacement rate of inefficient installations needs to increase in order to realise the potential of the technology.Aso hydrogen has a lot of potential as it can store energy and can be distributed at low cost. The challenge is to decarbonise the production of hydrogen and there are innovative ways of doing so.Fusion is another energy source with potential for the future, but it is at an experimental stage. Lastly, in combination with CCS, innovations can also make fossil fuels cleaner, such as using oil as non-burnable feedstock, LNG in shipping and hydrogen transport and natural-gas-to-hydrogen with CCS. The expertise from the sector in working with natural resources could prove a valuable asset.

3.3.4 *Session IV: Role and use of natural resources*

The session focused on long-term emissions reduction pfrom the perspective of the agricultural and forestry sectors. These sectorsemittGHG emissions but also are a carbon sinkT. They will face difficult challenge in the transition facing increased demand for agricultural products for food consumption, products, energy generation as well as the potential to create negative emissions. Economics will guide the farmers during this trade-off and therefore the economic framework needs to be right. Farmers

may require a strengthened insurance system in order to strengthen their adaptation measures. The CAP will continue to play an important role in either supporting or hindering the progress of the sector towards climate targets. Despite recent advances in this area more needs to be done to improve the environmental performance of the sector. Research should look at ways to reduce emissions from fertiliser/nitrogen use, the sustainable production (and consumption) of meat, as well as plant-based substitutes for wood. Focusing on the production side is not enough and the entire food system needs to be considered. Forests (including wood products if recycled) and soil have the potential to store carbon, but forests need to be given the time to grow. The benefits of soil as a carbon sink have been underestimated and more research is needed.

3.3.5 Keynote address: Industry and long-term emissions reduction

Elżbieta Bieńkowska, *European Commissioner for Internal Market, Industry, Entrepreneurship, & SMEs*

This keynote addressed stated that the low-carbon transition is one of the many transitions the EU economy needs to undergo, together with the digital, clean and circular transition towards a new economy. There are first-mover advantages awaiting those that act fast. Europe is in the position to reap those benefits.

The EU industry is pivotal in this transition. For example, in transport, the move to zero emission cars is crucial for emission reduction and for industry competitiveness, but there is no mass production of large battery cells in Europe. The EC is therefore working with the Battery Alliance to create a solid battery value and supply chain in Europe.Industry needs a stable and predictable framework, especially so that long-term investment cycles can be planned. ACompleting the Energy Union is key for the delivery of reliable, clean and affordable energy for the industry in the long run. InvestEU and HorizonEurope are important new financing instruments that will be part of the solution.

3.3.6 Closing session: From Paris to Katowice

In this closing session, the chairsRistori (Director-General at DG ENER) and Petriccione (Director-General at DG CLIMA) and speakers Fabius (President COP21), Barkowski (Deputy Permanent Representative of Poland to the EU), Kurtyka (President COP24) and Cañete (European Commissioner for Climate Action and Energy) compared the context of COP21 and that of COP24. They highlighted the important topics to be addressed at COP24: A long-term vision is important because: (i) we need to face the social consequences of the transition, (ii) long-term movements are happening (e.g. the new business motto is 'green is gold') and (iii) we need to be even more ambitious because the numbers are not good enough. We need to show people that this phenomenon has an impact on their everyday lives and that it is not an impossible mission.We need to remove ambiguities from the long term strategy. The Paris Agreement includes ambiguities (e.g. Art. 4, Par.1) that could not be avoided in Paris, but these need to be clarified in Katowice.Europe is an important stakeholder - we need to show leadership and keep other major stakeholders engaged and involved.

The clean energy transition is a reality and major European companies have shown a strong commitment in terms of investments and concrete actions. We need to include all sectors and actors in this transition. Moreover, the demand side has real economic potential and the more consumers are informed about the impact of their choices, the greater the transformation.

Annex A: Open Public Consultation - Questionnaire

The public consultation consisted of a questionnaire containing four sections, uploaded to the EU online platform (https://ec.europa.eu/clima/consultations/strategy-long-term-eu-greenhouse-gas-emissions-reductions_en). In total, respondents were presented with up to 74 questions. The questionnaire was as follows:

Part 1: Introduction

Climate change is happening and without further global action to mitigate it, temperatures will rise within this century well beyond a 2°Celsius compared to pre-industrial times. This will have major impacts on our economies and societies. In order to prevent this, 178 global partners cooperating under the United Nations Framework Convention on Climate Change (UNFCCC) have ratified the Paris Agreement that calls upon all countries to keep global temperature increase to well below 2°C, and to pursue efforts to limit the increase to 1.5°C above pre-industrial levels. Parties to the Paris Agreement are to communicate by 2020 their long-term low greenhouse gas emission development strategies.

In March, the European Council invited the Commission to present a proposal for a strategy for long-term EU greenhouse gas emissions reductions in accordance with the Paris Agreement, taking into account the national plans. The European Parliament made a similar request.

The EU is on track to achieve its 2020 targets and is currently putting in place policies to reduce greenhouse gas emissions by at least 40% in 2030 and achieve high level of ambition in energy efficiency and renewable energy (the so called energy and climate framework for 2030). The policies, legislative instruments and support programmes from the European budget will put the EU on a trajectory compatible with the Paris Agreement, but further measures are needed for the time after 2030.

The EU has currently an objective in the context of necessary reductions by developed countries as a group, to reduce emissions by 80-95% by 2050 compared to 1990 levels.

Delivering the Paris Agreement will require a worldwide transition towards a global economy that will not further affect the climate in the second half of the century.

To pursue these latter objectives, the EU's long term strategy should put forward a vision for the mid-century and how the European Union can help protect the planet, defend its people and empower its economy. The EU's new long term strategy should describe economy-wide pathways with various options for decarbonisation and their implications on technology choices and socioeconomic factors.

The strategy will reflect on a long-term vision of a modern European economy working for all Europeans. Studies and stakeholder input will contribute to the formulation of this vision and help explain the choices to be made. The strategy should reflect on the essential opportunities and challenges stemming from the long-term decarbonisation and clean energy transition of the EU:
- modernising the economy;
- improving citizens' quality of life;
- ensuring fair transition and tackling social challenges;
- reindustrialising Europe through digital, circular and low carbon innovation and clean mobility;
- promoting free, fair and sustainable global competition for markets, trade and investments; and
- maintaining the EU's global leadership position on key geostrategic and security issues.

The strategy will analyse cost-efficient scenarios towards decarbonisation in line with the Paris Agreement underpinned by holistic analysis of transition options across all key sectors of the economy. This includes a wide variety of sectors, starting with the central role of energy, buildings, transport and mobility, industrial production and the provision of services, waste, agriculture and land-use, as well as the use of natural resources. It will examine the potential and implications of the deployment of innovative technologies, sectoral integration, and of facilitating alternative choices for consumers. It will examine implications for security of supply, investments, competitiveness and socio-economic factors, such as economic growth and job creation, also considering the impacts on citizens, businesses. Regions that stand to be negatively affected by decarbonisation should be supported making this transition just

and socially fair.

The visions and reflections of stakeholders involved from all sectors of the economy and society on how to reach the EU's ambition will be an important input into this process. Therefore, the European Commission is very much interested in your views on a strategy for long-term greenhouse gas emissions reductions for the European Union. Please take a moment to fill in our questionnaire. We welcome contributions from the general public, stakeholders and authorities alike. Your views will help to enrich our assessment of what the EU should do in order to meet its commitment under the Paris Agreement.

Part 2: Guidance on the questionnaire

After a few introductory questions related to your general profile in section 1, the questionnaire has a number of questions in section 2.

To participate in the public consultation you are not obliged to fill in all questions. The different sections include questions on greenhouse gas reductions, the impact of consumers, the economic activity, energy, forests and land use, education and research, financing, meta trends, actors and adaptation to climate change. The final section is technical and more focussed on sectoral stakeholders (industry, transport, agriculture, land use).

Some questions are multiple choice questions. Other questions are open to which you can add if you want your comments. Please keep comments clear and concise because there is a limit on the number of characters you can enter.

If you want to express your views in more detail you can also upload a document with your views and insights.

As the results will be published on the Internet, please read the specific privacy statement attached to this consultation. It informs you about how your personal data and contribution will be dealt with. In the interest of transparency, if you are replying on behalf of an organisation, please register with the register of interest representatives if you have not already done so. Registering commits you to complying with a Code of Conduct. If you do not wish to register, your contribution will be treated and published together with those received from individuals.

Part 3: General information about respondents[23]

[PC1] In what capacity are you completing this questionnaire?
- as an individual in your personal capacity
- in your professional capacity or on behalf of an organisation

[PC2] Please give your name if replying as an individual/private person, otherwise give the name of your organisation: *[Open question]*

[PC3] Email address: *[Open question]*

[PC4] For individuals, country of residence; for professionals, headquarters and main country of operations: *[List of MSs or Other]*

If other, please specify. *[Open question]*

[PC5] Type of organisation (please select the answer option that fits best):*
- Private enterprise
- Professional consultancy, law firm, self-employed consultant
- Trade, business or professional association
- Non-governmental organisation, platform or network
- Research and academia

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[23] Respondents answering in their professional capacity or on behalf of an organisation were presented with some additional identification questions. They are marked with an asterisk (*).

- Social partners
- National, regional or local authority (mixed)
- Other

[PC6] Please indicate the economic sector you are active in (as an individual or as an organisation)
- Agriculture, Hunting and Forestry
- Financial Intermediation
- Fishing
- Real Estate, Renting and Business Activities
- Mining and Quarrying
- Public Administration and Defence
- Manufacturing
- Education
- Electricity, Gas and Water Supply
- Health and Social Work
- Construction
- Other Community, Social and Personal Services
- Wholesale and Retail Trade
- Activities of Private Households as Employers
- Hotels and Restaurants
- Extraterritorial Organisations and Bodies
- Transport, Storage and Communications
- Other

[PC7] If you are a civil society organisation or a public administration, please indicate your main area of focus or your area of competence:* *[Open question]*

[PC8] What size does you organisation have?*
- Micro or small enterprise (10-49 persons employed)
- Medium-sized enterprise (50-249 persons employed)
- Large enterprise (250 or more persons employed)

[PC9] If your organisation is registered in the Transparency Register, please give your Register ID number:* *[Open question]*[24]

[PC10] Please indicate your preference for the publication of your response on the Commission's website:
- Under the name given: I consent to publication of all information in my contribution and I declare that none of it is subject to copyright restrictions that prevent publication.
- Anonymously: I consent to publication of all information in my contribution and I declare that none of it is subject to copyright restrictions that prevent publication.
- Not at all – please keep my contribution confidential (it will not be published, but will be used internally within the Commission)

(Please note that regardless of the option chosen, your contribution may be subject to a request for access to documents under Regulation 1049/2001 on public access to European Parliament, Council and Commission documents. In this case the request will be assessed against the conditions set out in the Regulation and in accordance with applicable data protection rules.)

Part 4: Questions

4.1 Long term greenhouse gas emissions reductions

[PC11] To achieve its temperature objectives, the Paris Agreement also includes a long term ambition to achieve a balance between emissions and removals of greenhouse gases by human activities in the second half of this century. Given that addressing climate change is a global challenge requiring all parties of the Paris Agreement to act, what do you think the EU should contribute to achieve the Paris Agreement's

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[24] Respondents were presented with the option to register their organisation if not yet registered.

objectives:
- Reduce greenhouse gas emissions in the EU by 80% by 2050 compared to 1990 levels
- Reduce greenhouse gas emissions in the EU more, within the range of 80 to 95% by 2050 compared to 1990 levels
- Achieve already a balance between emissions and removals in the EU by 2050

[PC12] In your opinion, what are the biggest opportunities and challenges? *[Open question]*

4.2 Consumers

Next to the deployment of available and forthcoming technologies, when looking at the long term, consumer choices also have a key role in achieving the decarbonisation of our economy. Please fill in this section based on your habits if you are an individual or, if you are from an organisation, considering the organisation practice.

[PC13] In your opinion, where do you expect the largest changes to happen in your daily life in order to meet the climate change challenge?
- Housing
- Mobility
- Food
- Consumer goods and services

4.2.1 Housing and offices

Energy consumption

To which extent would you support the following options that allow reducing the energy consumption and related CO2 emissions in buildings?

[PC14] Improving further the energy performance (insulation, triple glazing, etc.) of your building?
- Yes, I have already done it
- Yes, as a priority
- Yes, but not as a priority
- No, I rent
- No, too expensive
- No, other reason
- No opinion / I do not know

If other, please specify. *[Open question]*

[PC15] Installing heating and water boilers that run on renewable? *[Same answers as above]*

If other, please specify. *[Open question]*

[PC16] Installing heating and cooling equipment and use electric appliances with the best energy performance label? *[Same answers as above]*

If other, please specify. *[Open question]*

[PC17] Buying carbon free electricity or generating your own renewable electricity? *[Same answers as above]*

If other, please specify. *[Open question]*

[PC18] Having a smart meter and consuming electricity mostly when prices are low? *[Same answers as above]*

If other, please specify. *[Open question]*

Domestic waste

[PC19] Do you sort your waste (paper, plastics, glass, metal, organic…)?

- Yes
- No
- I do not see the interest

[PC20] What would make you increase the separation of waste (paper, plastics, glass, metal, organic…)?
- Adapted infrastructure (containers, etc.)
- Awareness campaign
- Financial incentives such as deposit schemes
- Other

If other, please specify. *[Open question]*

[PC21] Do you think increased recycling and reuse are important to achieve greenhouse gas reductions?
- Yes
- No
- I do not know

4.2.2 Mobility

To which extent would you support the following options that allow reducing the energy consumption and related CO_2 emissions?

[PC22] Buying a vehicle that does not run on petrol or diesel (for instance an electric car)?
- Yes
- Yes, but only if not more expensive than conventional petrol or diesel cars
- Yes, but only if sufficient refuelling infrastructure is available
- No

[PC23] Consider using car sharing services?
- Yes
- Yes, but only if an easy to use and affordable service is in place
- No

[PC24] For short trips, avoiding private car and rather using public transport?
- Yes
- Yes, but only if an accessible and regular service is in place
- No, because they are too slow
- No, because it is too expensive
- No

[PC25] For short trips, avoiding private car and rather using (electric) bike or other active mobility mode?
- Yes
- Yes, but only if proper bike lanes are in place
- No

[PC26] For longer distance, avoiding flights or car whenever an alternative is available?
- Yes
- Yes, provided a convenient alternative is in place
- No, too slow
- No, too expensive
- No, other reason

If other, please specify. *[Open question]*

[PC27] Do you think better urban planning would reduce the use of private cars and reduce congestion in the urban areas?
- Yes
- Yes, if combined with better public transport
- Yes, but difficult to put in place
- No

[PC28] Do you think using more IT tools such as tele-working or video-conferencing could reduce mobility needs?

- Yes
- Yes, to some extent
- No, as difficult to put in place
- No

4.2.3 Food

Food production, processing and delivery have an impact on greenhouse gas emissions and natural resources consumption.

[PC29] Would you consider it important that further awareness raising is undertaken about the impact of various types of food consumption on climate?
- Yes
- No

[PC30] Would you consider the impact of food on greenhouse gas emissions when buying it?
- Yes
- Yes, if information is available about the carbon intensity of food
- Not if more expensive
- No

[PC31] Also taking into account the importance to have a balanced diet for health purposes, would you consider changing to a less carbon intensive food diet (e.g. reduce red meat consumption)?
- Yes
- No
- I would require more information before changing my diet

4.2.4 Consumer goods and services

The products/services you consume and the way they are produced also impact energy consumption and related greenhouse gas emissions.

[PC32] Do you ever consider the impact of greenhouse gas emissions when buying and consuming a product or services?
- Yes I do so regularly
- Yes but I often lack the information to do so
- No I don't consider this

[PC33] Would you consider buying products and services from companies that produce their goods and services in a greenhouse gas neutral manner?
- Yes
- No, if more expensive
- No, other
- No opinion / I do not know

If other, please specify. *[Open question]*

4.3 Your work and your economic sector

For both individuals and organisations, details on the economic sector should be provided in Section 1.

4.3.1 Employment and a socially fair transition

In the coming decades, the transition to a low carbon economy will impact even more how we work and how we produce goods and services. Which statements below correspond in your opinion to the impact of climate change and the low carbon transition in your working environment?

[PC34] Do you expect your company to create or reduce jobs due to the low-carbon transition?
- Create
- Reduce
- No opinion / I do not know

[PC35] What could affect your job most in the future?
- The low carbon transition

- Digitalisation
- Impact of globalization
- Socio-economic policies (for instance fiscal policy)
- Other

If other, please specify. *[Open question]*

[PC36] Do you think you or the sector you are active in would benefit from training of staff in the context of the energy and low carbon economy transformation?
- Yes
- Yes, to some extent
- No
- No opinion / I do not know

4.3.2 The impact of the low carbon transition on your sector

[PC37] Do you consider the low carbon transition as an opportunity or as a challenge for your sector?
- An opportunity
- A challenge
- Both
- None
- No opinion / I do not know

[PC38] Indicate by how much your sector could reduce greenhouse gas emissions by 2050 compared to today?
- It cannot reduce
- Up to half
- By more than half
- Can decarbonise entirely
- No opinion / I do not know

[PC39] What would be the preferred route to reduce these emissions in your sector?
- Further electrify
- Use other low carbon fuels, like hydrogen
- Improve to the maximum energy efficiency
- Circular economy, including recycling and re-use
- Development of new products and business concepts
- Other
- No opinion / I do not know

If other, please specify. *[Open question]*

[PC40] Will you (or your sector) invest in new low carbon technologies?
- Yes, as a priority
- Yes, but not as a priority
- No, it has already invested enough
- No
- No opinion / I do not know

[PC41] Do you think your sector could be further integrated with others so as to decrease emissions while increasing overall efficiency?
- Yes
- No
- No opinion / I do not know

[PC42] If your sector can be further integrated to others, please mention how and to which sector(s): *[Open question]*

[PC43] Do you think the low carbon transition will lead the EU economy to:
- Modernise and reinforce its competitiveness
- Modernise, and reinforce its competitiveness, but only if non-EU countries and regions also engage in the transition towards a low carbon economy
- Lose competitiveness

- No opinion / I do not know

[PC44] Do you think the low carbon transition can help the EU industry modernise and grow?
- Yes
- Yes, but only with public support
- Yes, but only if non-EU countries and regions also engage in the transition towards a low carbon economy
- No
- No opinion / I do not know

[PC45] How can opportunities and challenges (in particular related to carbon intensive sectors or regions) be addressed? What key economic transformations should the EU pursue to achieve a low carbon and resilient economy? *[Open question]*

4.4 Energy

The energy system today is responsible for ca. 75% of the EU's greenhouse gases emissions and undergoes a rapid transition due to e.g. cost reduction of renewables, improvements of energy-efficiency and rapid development of new technologies (e.g. batteries) driven i.a. by policies put forward by the EU and its Member States. Accelerating this change will play a central role in the transition of our economy towards a carbon-neutral economy.

[PC46] In the following table listing different energy technologies, please rank each option in the table below from 1 (important) to 5 (not important) on what role you think they will play in the clean energy transition (not all options need to be ranked)?
- Energy efficiency reducing the need to produce energy
- Renewable energy from wind, solar or hydro
- Other forms of renewable energy, like geothermal, wave or tidal
- Nuclear energy
- Fossil fuels with Carbon Capture and Sequestration
- Solid biomass for heat and electricity production
- Advanced Liquid Biofuels
- Biogas from agricultural and domestic waste
- Electricity storage (e.g. batteries)
- Hydrogen (produced in a carbon-neutral manner)
- E-fuels derived from hydrogen
- Other

If other, please specify. *[Open question]*

[PC47] What are the biggest opportunities, including the wider economy? What are the biggest challenges, including as regards public acceptance or the availability of land and natural resources, related to these future developments? *[Open question]*

4.5 The role of forests and land use

Today, EU's forests, agriculture and land absorb more CO2 than they emit, which is referred to as the EU's sink. Forests and agriculture land produce renewable biomass that can be used to substitute other carbon intensive products or to produce bioenergy, which in turn reduce greenhouse gas emissions from fossil fuels and industrial processes. Depending on how this biomass is produced, this can impact the size of the EU's sink, as well impact other services delivered by agriculture and forest land including biodiversity and ecosystem services.

[PC48] In the context of a long term strategy please rank each land-use activities in the table below from 1 (important) to 5 (not important) to indicate which are acceptable and can be important to reduce greenhouse gas emissions and increase CO2 absorptions (not all options need to be ranked):
- Forest as a source for biomass for renewable energy
- Forest as a source of material for bio-based products
- Forest as a carbon sink storing CO_2
- Agriculture as a source of feedstock for bio-based materials
- Agriculture as a source for bio-energy
    - Based on food crops
    - Based on agricultural wastes
    - Based on woody biomass (e.g. perennials, woody and herbaceous crops, short rotation

>   coppice)
> • Protecting and enhancing soil carbon stocks on agricultural land

[PC49] What should be the role of the land-use sector in reducing emissions and increasing absorptions emissions? For what purposes should biomass be used most to reduce greenhouse gas emissions? How and which sustainability concerns should be addressed? *[Open question]*

4.6 Education, research and innovation

Considering the long time frame of the strategy, and the inherent magnitude of the decarbonisation transition, the central role of accelerating research and innovation for facilitating this transition will be crucial.

[PC50] How best could awareness be raised to create the right attitude and values / mind-sets? [At most 3 choice(s)]
• At school through education
• Local and regional campaigning
• National and EU wide campaigning

[PC51] On which sectors should R&D efforts focus primarily in the coming decade to best support the low carbon transition? [At most 6 choice(s)]
• Energy
• Industrial processes
• Transport
• IT
• Agriculture
• Other field

If other, please specify. *[Open question]*

[PC52] On which cross-sectoral domains should R&D efforts focus in the coming decades? Is there a particular need for large scale deployment of certain innovative technologies? Is there a different role for authorities and private sector in support R&D and Innovation? *[Open question]*

4.7 Financing

In many cases, the low carbon economy and energy transition needs high upfront investments with subsequent reductions in operating and fuel costs. In addition, this transition as well as climate change itself will most likely affect the value of existing investments and assets of companies. Finally, to achieve the transition efficiently, the viability and profitability of investments need to be ensured on the long-term. Most of these investments will have to be funded via private finance.

[PC53] Will the sector that you are active in require significant additional investment in the context of a transition to a low carbon economy?
• Yes
• No
• No opinion / I do not know

[PC54] For the sectors that you are active in, is there a financing gap for making the transition to a low carbon economy?
• Yes
• No
• No opinion / I do not know

[PC55] Should public sector be more involved in ensuring adequate financing for the low carbon transition?
• Yes, through direct investment
• Yes, through measures ensuring more low cost finance for sustainable investments
• No because of the risk of prompting inefficient investment leading to stranded assets
• No because of crowding effects on other sectors
• No opinion / I do not know

[PC56] Would you consider that, in your sector, companies are sufficiently transparent about the financial risks they face due to climate change and the low carbon economy and energy transition?

- Yes
- No
- No opinion / I do not know

4.8 Meta trends

Do you think the following trends are important to reduce greenhouse gas emissions.

[PC57] Economic transitions towards a more circular economy?
- Positive
- Negative
- Neutral

[PC58] Digitalisation, including robotization and artificial intelligence?
- Positive
- Negative
- Neutral

[PC59] Shared economy?
- Positive
- Negative
- Neutral

[PC60] Further interdependency of sectors across borders through globalisation?
- Positive
- Negative
- Neutral

4.9 Actors

Local authorities such as cities and local communities, as well as other actors such as civil society and the private sector, can play an important role in achieving the energy transformation, reducing greenhouse gas emissions and adapting to climate change. Indeed thousands of cities, companies and citizens' organisations are implementing the low carbon economy and energy transition through projects covering energy, transport, food and waste management, often achieving important local co-benefits related to economic development, health and wellbeing.

[PC61] Which of these non-state actors do you think will impact most your or your sector's contribution to delivering the EU's ambition to become a low carbon economy?
- Regional government
- Towns and cities
- Businesses
- Philanthropies
- Civil society (NGOs, ..)
- Religious groups

[PC62] Do you have an example that you think is of particular importance to underline the role of such local and private sector actors in supporting the low carbon economy and energy transition? *[Open question]*

4.10 Adaptation

[PC63] The adverse effects of climate change will increase in the coming decades unless strong mitigation policies are implemented globally. In your place of living, which of the following actions do you think will be necessary to prepare for the likely effects of climate change? Please rank each option in the table below from 1 (important) to 5 (not important) to indicate which, in your place of living, you think will be necessary to prepare for the likely effects of climate change (not all options need to be ranked).
- Scientific research on the local effects of climate change in the place you live
- Reinforcement of infrastructure (transport, energy, communication networks) to withstand natural disasters
- Preparation for floods (water retention, dykes, designated flood plains/areas, restriction of activities in areas at flood risks, floating houses, etc.)
- Adaptation of agriculture to the changing climate (e.g. water efficient irrigation, selecting different crops)

- Heat wave action plans
- Increase of green areas in towns to cope with heatwaves / floods
- Encouragement of water saving and reuse
- Forest fire prevention (e.g. awareness campaigns, forest management…)
- Reinforcement and protection of the seacoast
- Early warning systems for natural disasters (heatwaves, floods, forest fires…)
- Communication to the public about the need to adapt to climate change
- Improved insurance products against damage from the effects of climate change
- Better understanding of the security effects of climate change on the EU (e.g. flows of migrants, global water and food scarcity, agricultural trade)

[PC64] Which adaptation measures are of particular importance for your sector and why? *[Open question]*

4.11 Specific sectoral questions

These questions are focused on sector specific greenhouse gas reduction options, and as such are primarily directed to sectoral stakeholders.

4.11.1 Reducing industrial greenhouse emissions

[PC65] Industry has a diverse set of greenhouse gas emissions sources, the majority are linked to energy consumption but also a significant amount of emissions comes from chemical processes, for instance in the steel, cement and chemical sectors.

Industry has a number of mitigation options to reduce its greenhouse gas emissions. These typically involve improved efficiency (e.g. using more efficient products and technologies, reusing waste heat, etc.) and fuel substitution (e.g. electrification of its processes). But it also includes feedstock substitution, be it with bio-material or by employing Carbon Capture and Utilisation (CCU) technologies that see CO_2 emissions being re-used in other production processes. These technologies also often benefit from further integration of energy and industrial sectors.

Please indicate for which sector you see any of the above or other mitigation options of particular importance. Please indicate what your view is in terms of mitigation potential, economic potential and technology readiness. Assess each option as High, Medium, Low or Zero for each criterion and indicate in which year you think the technology would be ready for large scale deployment.

	Industrial Sector	Technology option	Mitigation potential	Economic viability	Technology readiness	Year of large scale deployment
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

4.11.2 Reducing greenhouse gas emissions from transport

[PC66] Transport has a number of options to reduce its greenhouse gas emissions. While low- or zero-emission technologies are already successfully deployed for parts of the transport sector (e.g. cars and vans), the technological development is in earlier stages of development or deployment for other parts of the transport sector (e.g. long-haul trucks, aviation or maritime).

Please indicate for which part of the transport sector you see particular mitigation options and their importance. Please indicate what your view is in terms of mitigation potential, economic potential and technology readiness. Assess each option as High, Medium, Low or Zero for each criterion and indicate in which year you think the technology would be ready for large scale deployment.

	Transport Sector	Technology option	Mitigation potential	Economic viability	Technology readiness	Year of large scale deployment
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

In addition, would you please indicate your choice for the following options that allow reducing the energy consumption and related CO_2 emissions?

[PC67] For freight transport, would you consider switching from road to alternative modes like rail, waterways or coastal shipping?
- Yes
- No, too slow or complicated
- No, too expensive
- No opinion / I do not know

[PC68] For first/last mile logistics in urban areas, would you consider switching from road to alternative modes like (electric) cargo bike or similar zero-emission vehicle?
- Yes, I am already doing it
- Yes, in the future
- No, too slow
- No
- No opinion / I do not know

4.11.3 Reducing greenhouse gas emissions from agriculture

[PC69] Several options exist to reduce greenhouse gas emissions in agriculture even though the mitigation potential of the agricultural sector, notably related to the sector's non-CO2 emissions, is seen as more limited than for other sectors. Furthermore, agriculture is a sector that through its impact on land use also will affect how our natural sink, and thus the related CO2 absorptions, will evolve.

Please indicate which mitigation options are of particular importance. Assess each option as High, Medium, Low or Zero for each criterion and indicate in which year you think the technology would be ready for large scale deployment.

	Agricultural Sector	Technology option	Mitigation potential	Economic viability	Technology readiness	Year of large scale deployment
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

4.12 Role of CO2 removal

The objectives of the Paris Agreement are challenging and many scientists consider that it will be necessary at a certain point to remove a significant amount of CO2 from the atmosphere in order to stay

below 2°C and certainly in case the temperature increase should be limited to 1.5°C. There are a limited number of options to remove CO2 from the atmosphere.

The removal of CO2 can be accomplished by 1) capturing CO2 via natural photosynthesis or artificial chemical processes, and then 2) storing CO2 in long term geological sites or within biomass and (bio)materials.

Rank from 1 (important) to 5 (not important) on what role you think this removal and storage options can have in the EU to deliver negative emissions taking into account issues such as economic and technical feasibility, storage potential, environmental integrity and social acceptance.

[PC70] Capture of CO_2 from the atmosphere
- Intensive afforestation
- Forest and cropland residues
- Woody perennial plantations
- Direct Air Capture
- Other

If other, please specify. *[Open question]*

[PC71] Storage of CO_2
- Carbon capture and storage (CCS) with enhanced oil or gas recovery
- CCS in onshore geological sites
- CCS in offshore geological sites
- Carbon Capture and Utilisation (CCU) (long lived products)
- Increased permanent carbon stock in soils
- Increased permanent carbon stock in plants
- Other

If other, please specify. *[Open question]*

[PC72] What main barriers do you see currently preventing the large scale deployment of CCS, including on how to use it to generate negative emissions? What are the particular challenges related to biomass CCS? What type of CCU (Carbon Capture and Utilization) would lend itself to create long term storage? Are there other technologies that should also be considered? What policies do you think the EU should pursue to better help development and deployment? *[Open question]*

4.13 Additional comments

[PC73] If you wish to add further information, comments or suggestions - within the scope of this questionnaire - please feel free to do so here: *[Open question]*

[PC74] In addition, you could also upload a document proving further information, comments or suggestions: *[Option to upload document]*

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