



ACCSEPT Survey on CO₂ Capture and Storage: Resume of Key Findings and Implications

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Respondents



- 512 respondents from June-December 2006
- 40% response rate (excluding parliamentarians)
- Most commonly represented are academics / researchers (34%) and energy sector (28%)
- Government respondents a further 13%, NGOs 5% and parliamentarians 4%



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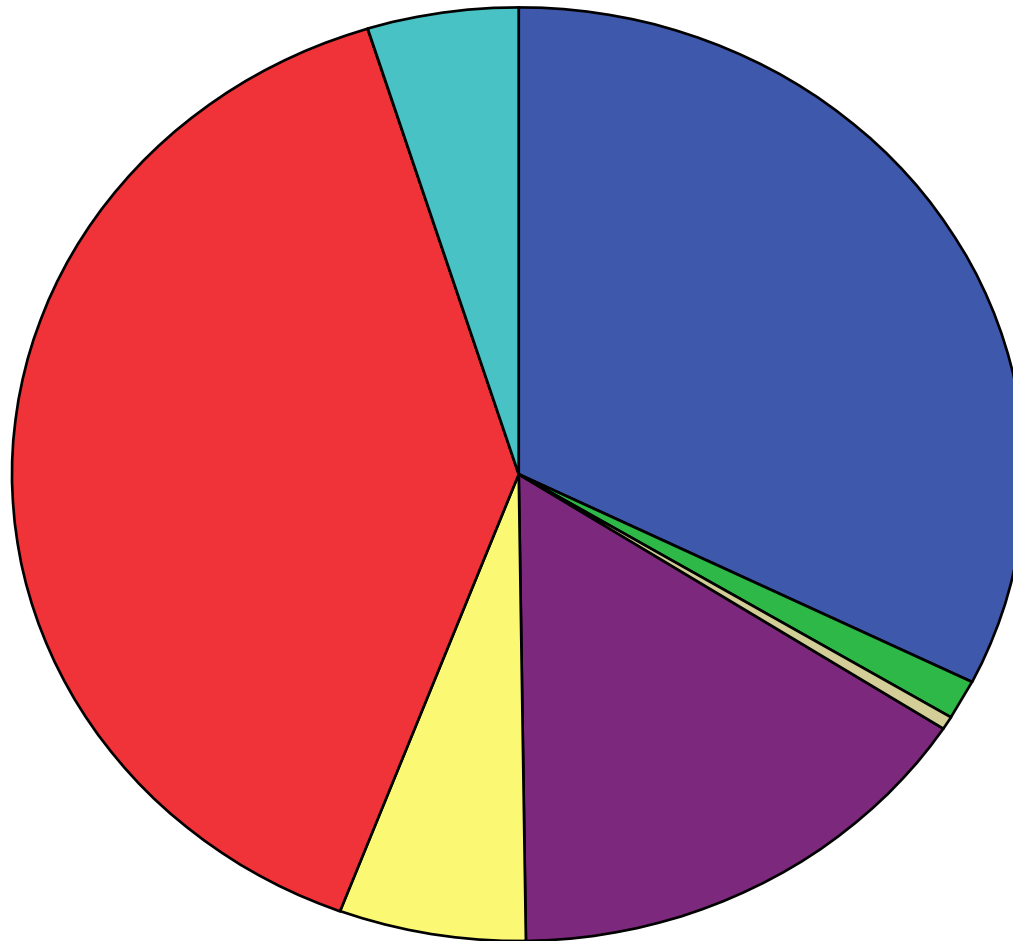
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Breakdown of respondents by stakeholder type



- Energy
- Chemicals/other industry
- Transport
- Government
- NGOs
- Academic/research
- Parliamentarians



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Respondents by Country



- 20% from the UK
- 11% from Germany
- 9% from Netherlands
- 6% from France and Italy
- 5% from Denmark, Spain and Norway
- 4% from Belgium
- 3% from Finland and Sweden
- Statistical analysis restricted to UK, Germany, Denmark, Netherlands, Norway, Belgium, Sweden and Finland (based upon number of respondents per capita)



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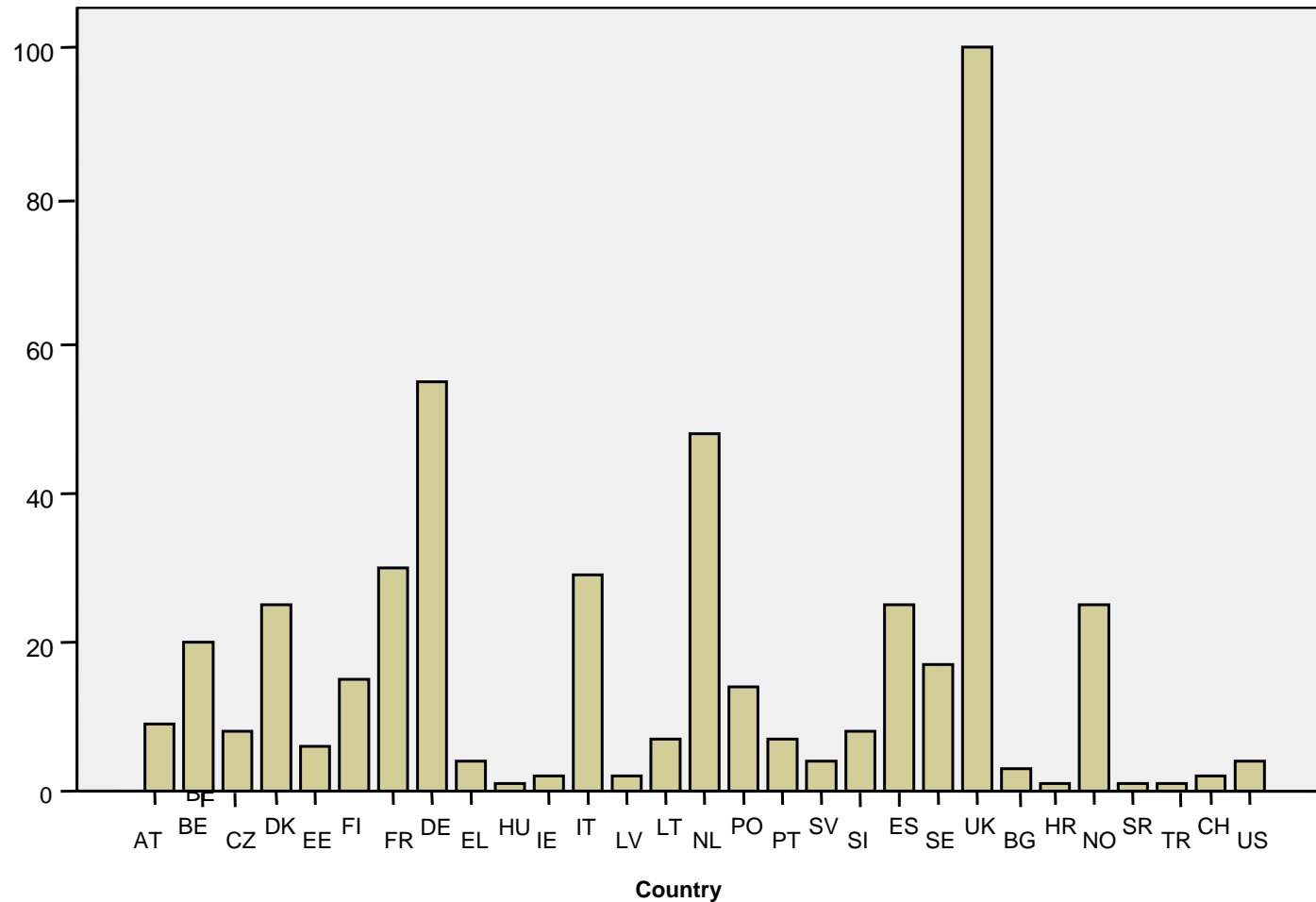
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Breakdown of respondents by country



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Statistical analysis: Organisational positions on CCS and underlying reasons



- Comparison of means for countries, stakeholder groups, regional groupings, fossil fuel status, etc., to test for significance using independent t-test (p value of 0.05)
- Comparison of correlation between variables using Pearson's coefficient (p value of 0.01 or 0.05)
- Nearly half of respondents reported that their organisation was 'very positive' towards CCS and a further quarter were 'slightly positive'.
- Most frequent reasons given: potential to continue use of fossil fuels, potential magnitude of CO₂ emission reductions and potential for rapid cuts, and business opportunities



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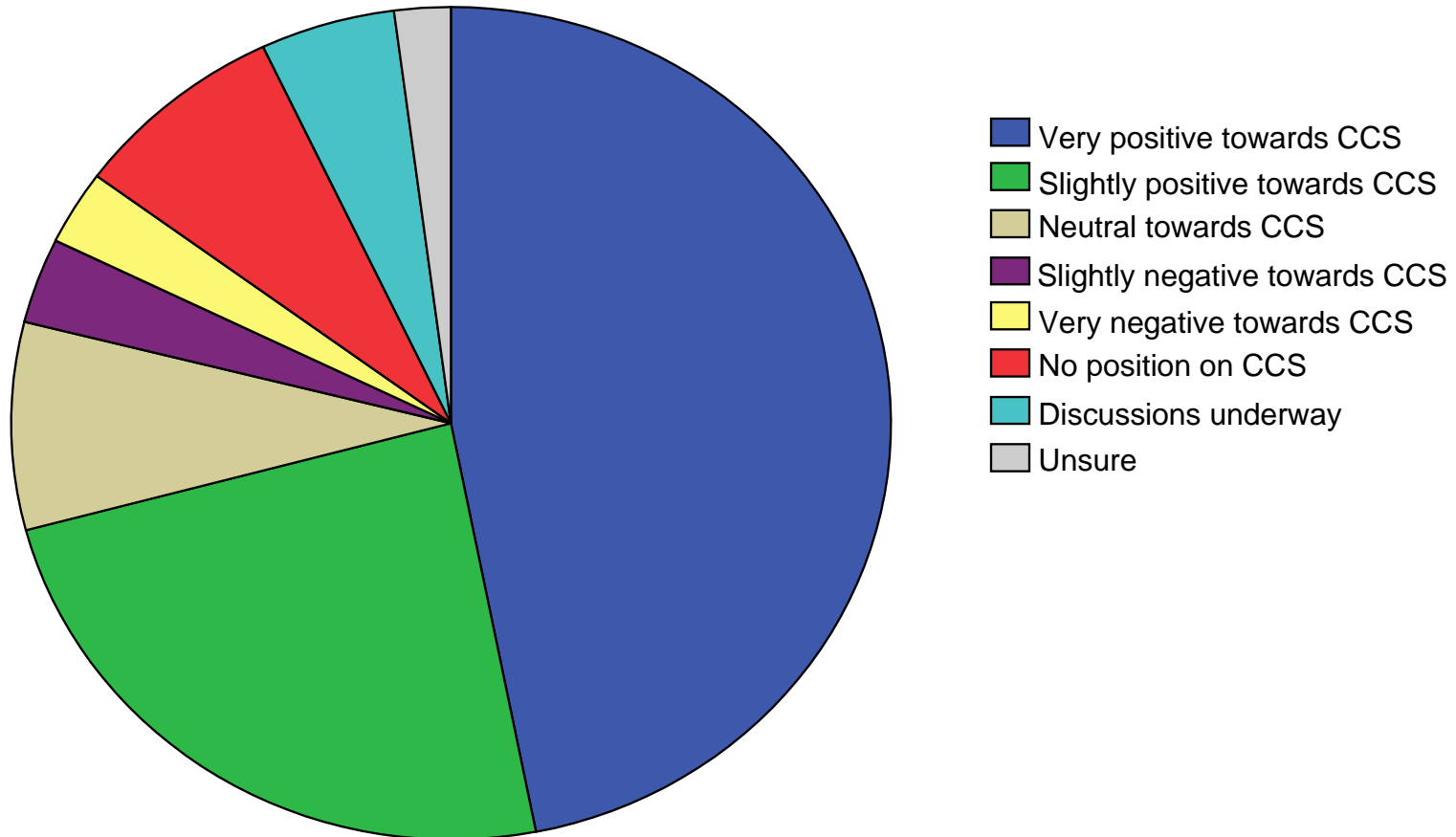
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Organisational positions on CCS



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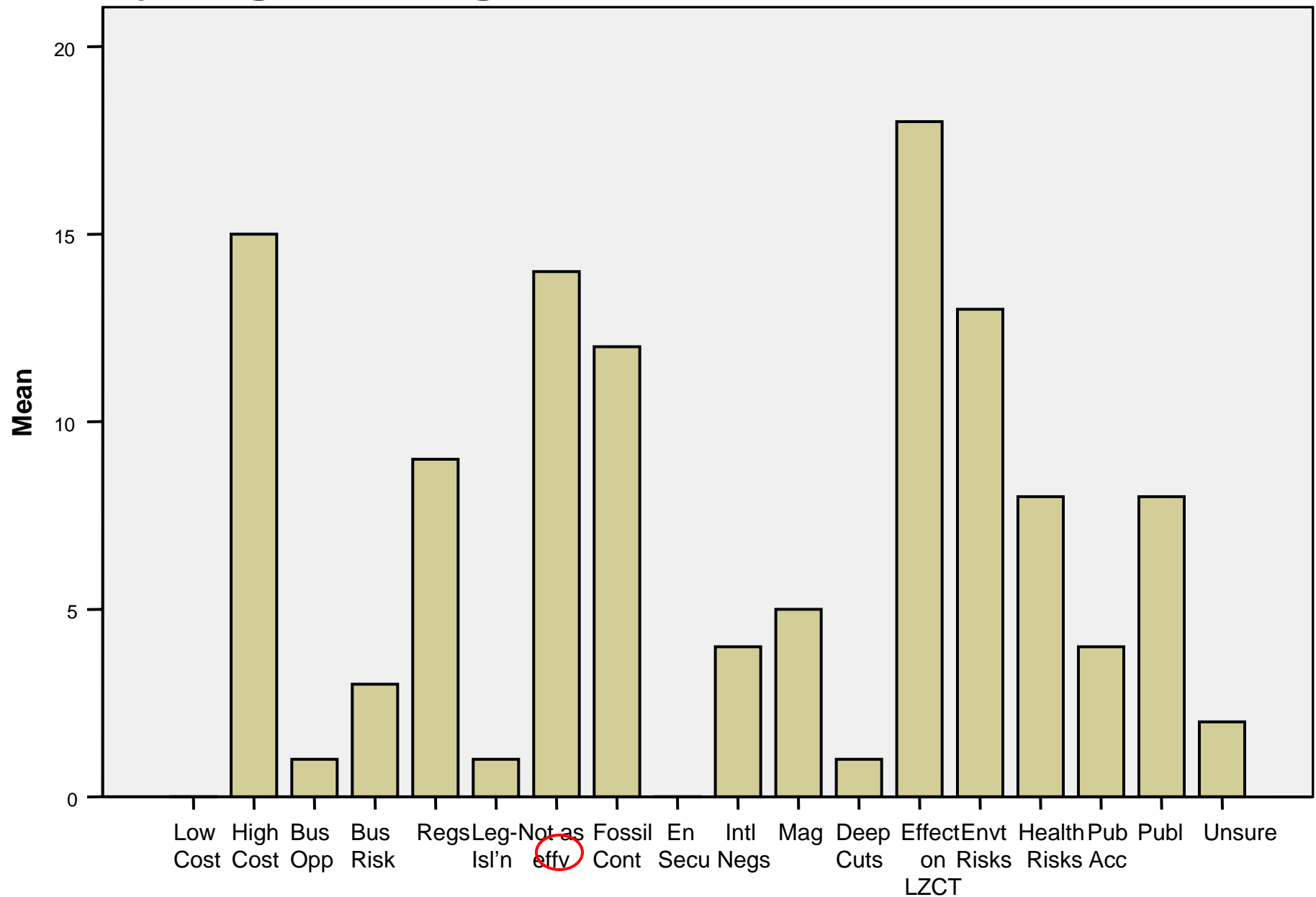
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Reasons for position by slightly or very negative organisations



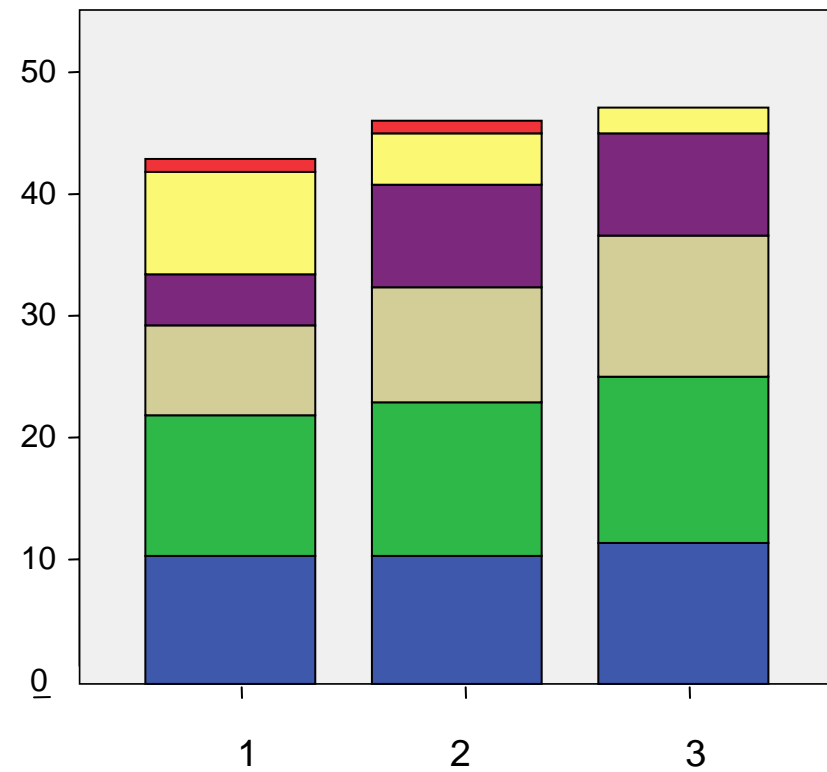
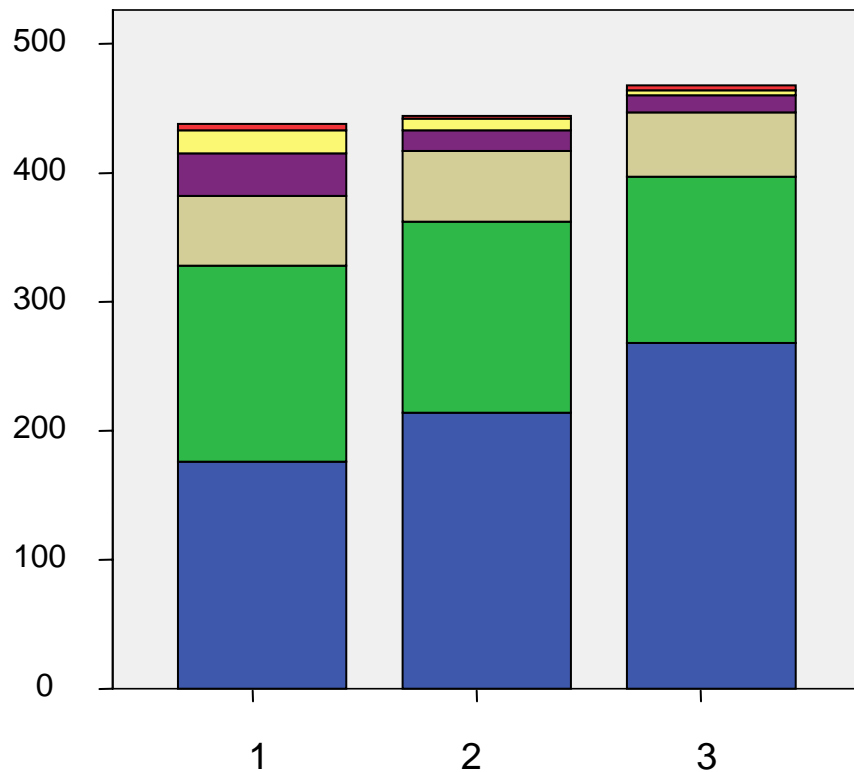
Perceived need for CCS in own country, EU and globally



- A large percentage of respondents believe that CCS is definitely or probably necessary, increasing from own country, to EU to global scale
- Respondents from Norway, UK and Netherlands stand out as most enthusiastic about role of CCS
- Finland, Sweden and respondents from Central and Eastern European countries are the least supportive of CCS, but are still on balance in favour of a role for CCS
- Energy, government and research stakeholders strongly supportive of CCS
- NGOs are more ambivalent regarding CCS, with parliamentarians largely supportive but with some scepticism



Perceived need for CCS in own country (1), EU (2) and globally (3) (left) and for NGO & parliamentary respondents only (right)



- Definitely necessary
- Probably necessary
- Only necessary if
- Probably not necessary
- Definitely not necessary
- Unsure



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(Changing) Role of CCS in the National Debate



- CCS is perceived to play a large or moderate role in the current national debate (57%)
- Significantly larger role of CCS in debate in Norway, followed by Netherlands, UK, Germany.
- Smaller role in debates in Denmark, Finland, Sweden
- Role of CCS is generally increasing
- The role of CCS is increasing most in Norway, Germany, Netherlands and UK (i.e. in those countries in which it is already important)



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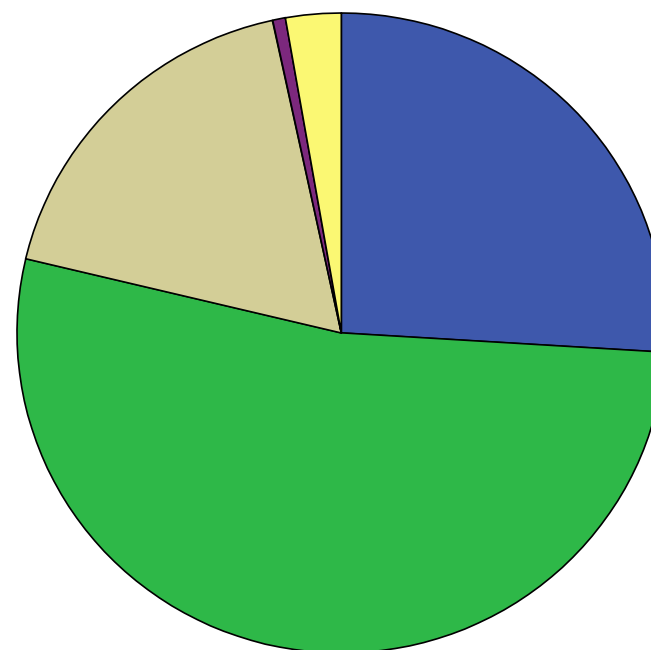
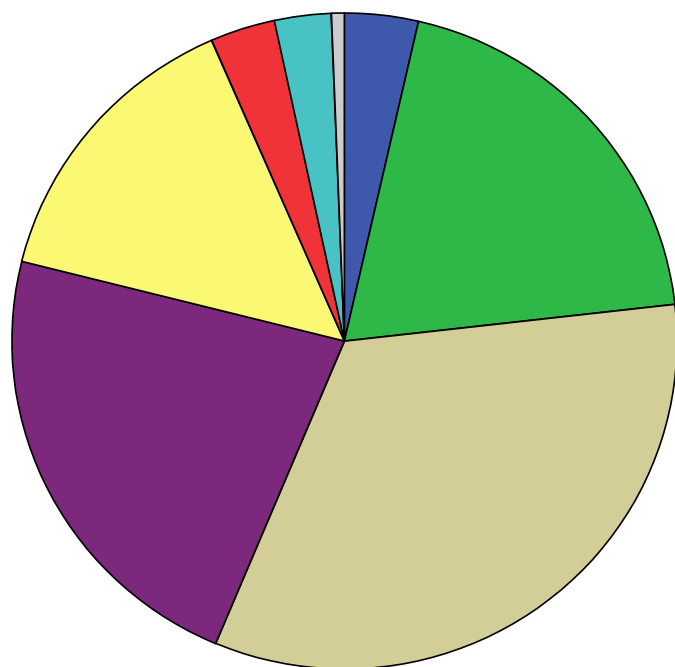
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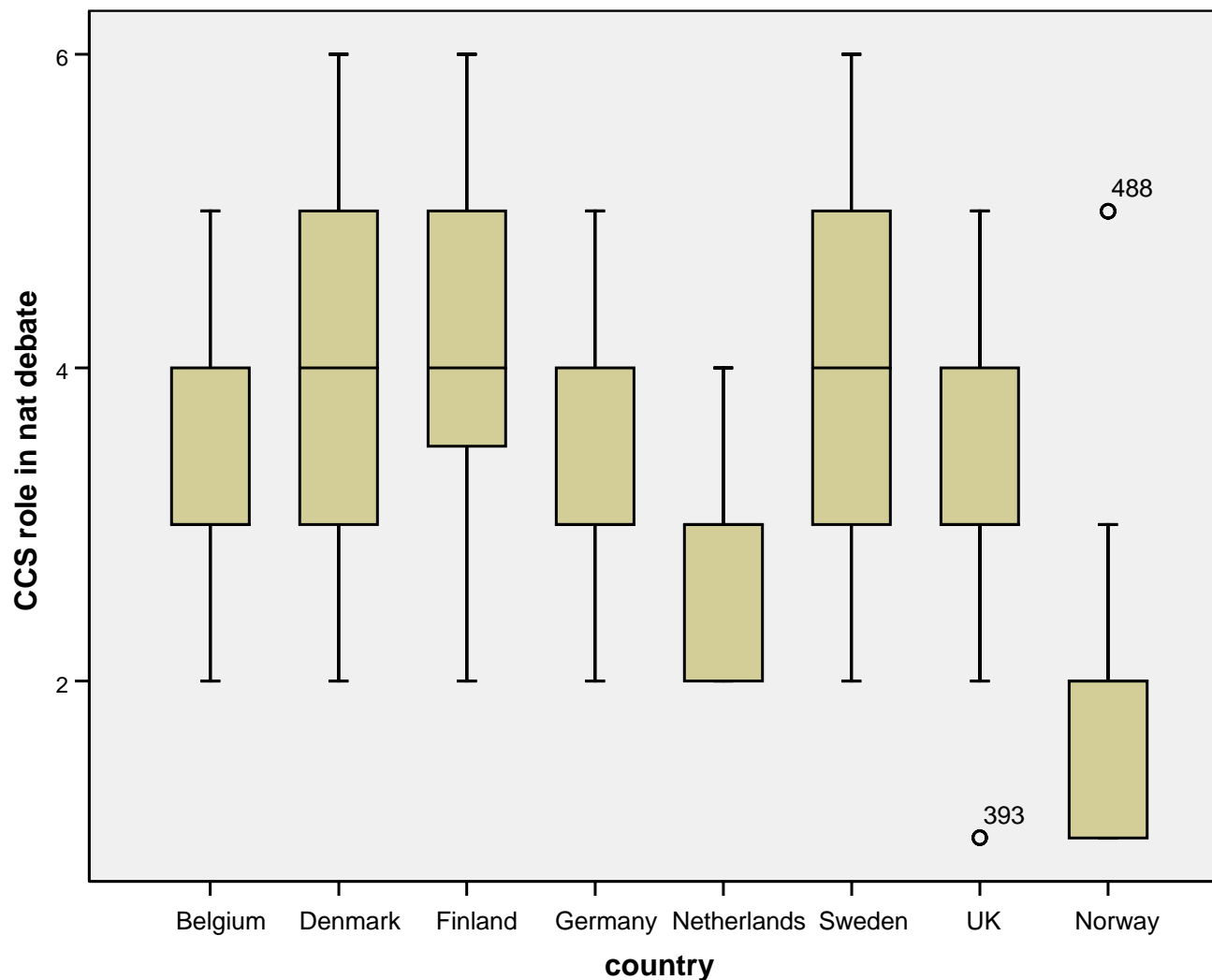
Role of CCS in national debate (left) and how it is changing (right)



- Very Large
- Very small
- Large
- None
- Moderate
- No debate in country
- Small
- Unsure

- Increasing substantially
- Increasing slightly
- Staying the same
- Decreasing slightly
- Unsure

The changing role of CCS in the national debate in the eight selected countries



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The Enabling Context for CCS in Home Country

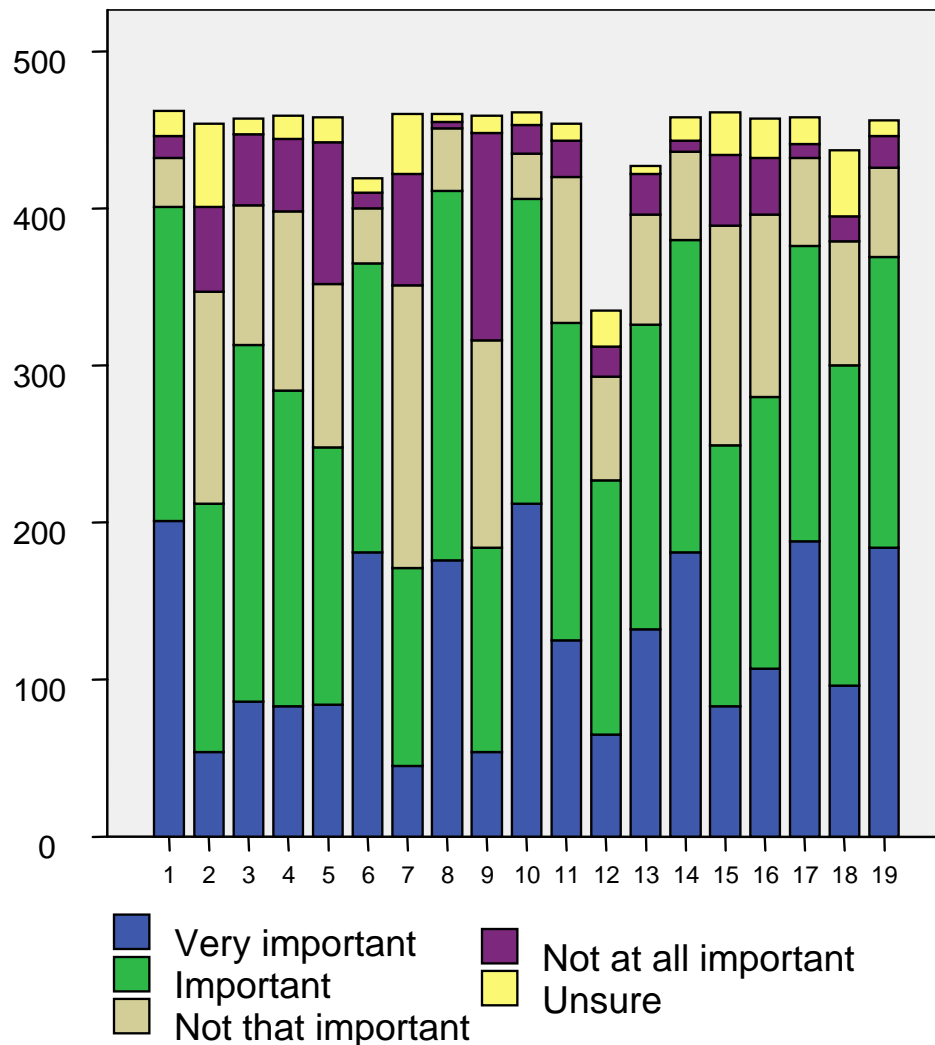


The most important factors influencing the development of CCS are (in descending order):

- availability of suitable geological storage sites,
 - price of carbon under the EU ETS
 - reduction in costs of CO₂ capture
 - development of R&D base
 - a post-Kyoto phase with tighter national emission reduction requirements
 - development of legal & regulatory basis for CCS and
 - public perceptions of CCS
- Least important: availability of venture capital, development of H₂ economy, availability of domestic supplies of coal.
 - Countries with own coal (e.g. Poland, Germany, UK) tend to regard this as more important factor, whilst those with oil and/or gas (Norway, UK, Netherlands, Denmark) tend to regard enhanced hydrocarbon recovery as more important.
 - NGOs and parliamentarians regarded public perceptions as less important enabling factor



Importance of factors in the development of CCS in own country



- 1: price of carbon under the EU ETS
- 2: availability of venture capital
- 3: concerns about energy security
- 4: need to replace aging power plant
- 5: opportunities for EOR/EGR with CO₂
- 6: reduction in costs of CO₂ capture
- 7: development of the H₂ economy
- 8: development of the research and technological base for CCS
- 9: availability of domestic supplies of coal
- 10: availability of suitable geologic storage sites
- 11: development of other zero- or low-carbon energy generation technologies
- 12: existence of relevant skills base
- 13: Kyoto Protocol commitments
- 14: a post-Kyoto phase with tighter national emission reduction requirements
- 15: negotiating stance & policy of the USA
- 16: negotiating stance & policy of China & India
- 17: development of legal and regulatory basis for CCS (e.g. accounting, monitoring, liability)
- 18: eligibility of CCS for CDM and/or JI
- 19: public perceptions of CCS

Provision of financial incentives for CCS



- 39% think CCS should be given similar incentives as renewables, 33% think lower than renewables, 11% think higher than renewables. 12% think incentives for CCS are not needed.
- NGOs and parliamentarians least enthusiastic about generous incentives for CCS. 52% and 38% of respondents respectively doubtful that incentives are needed at all
- Danish, British and Dutch respondents most in favour of more generous incentives.



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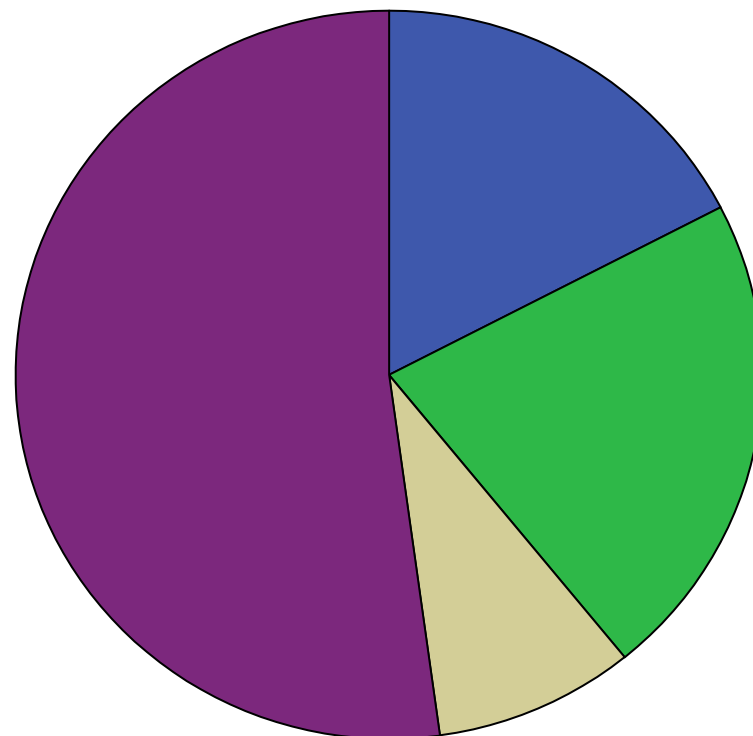
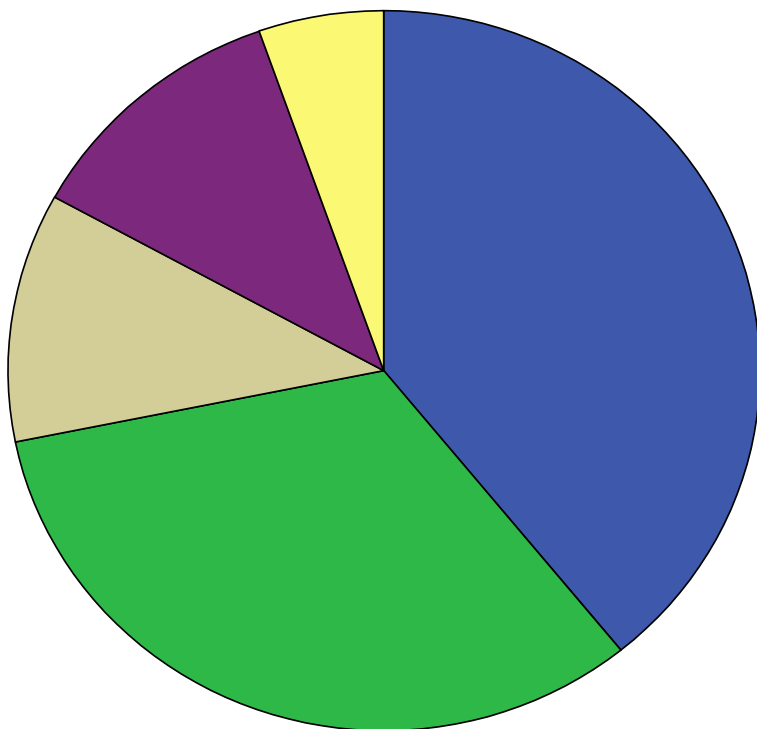
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Provision of financial incentives for CCS (left) and NGO views on incentives (right)



- Are needed comparable level to renewables
- Are needed, lower level than renewables
- Are needed, at higher level than renewables
- Are not needed
- Unsure

Opinion on type of financial incentives for CCS



- Most popular is RD&D (over 90% in favour)
- Followed by early commitment to extend the EU ETS with tighter emission caps (77% in favour, 8% against)
- Third most popular is requirement for electricity generators to supply a given % of zero- or low-carbon electricity
- Least popular is guaranteed feed-in tariff for CCS electricity (though still more in favour than against)
- Substantial minorities of all stakeholder groups opposed to CCS electricity requirement or feed-in tariffs
- All stakeholders appear to support an early commitment to extension of the EU ETS with tighter national emission caps.



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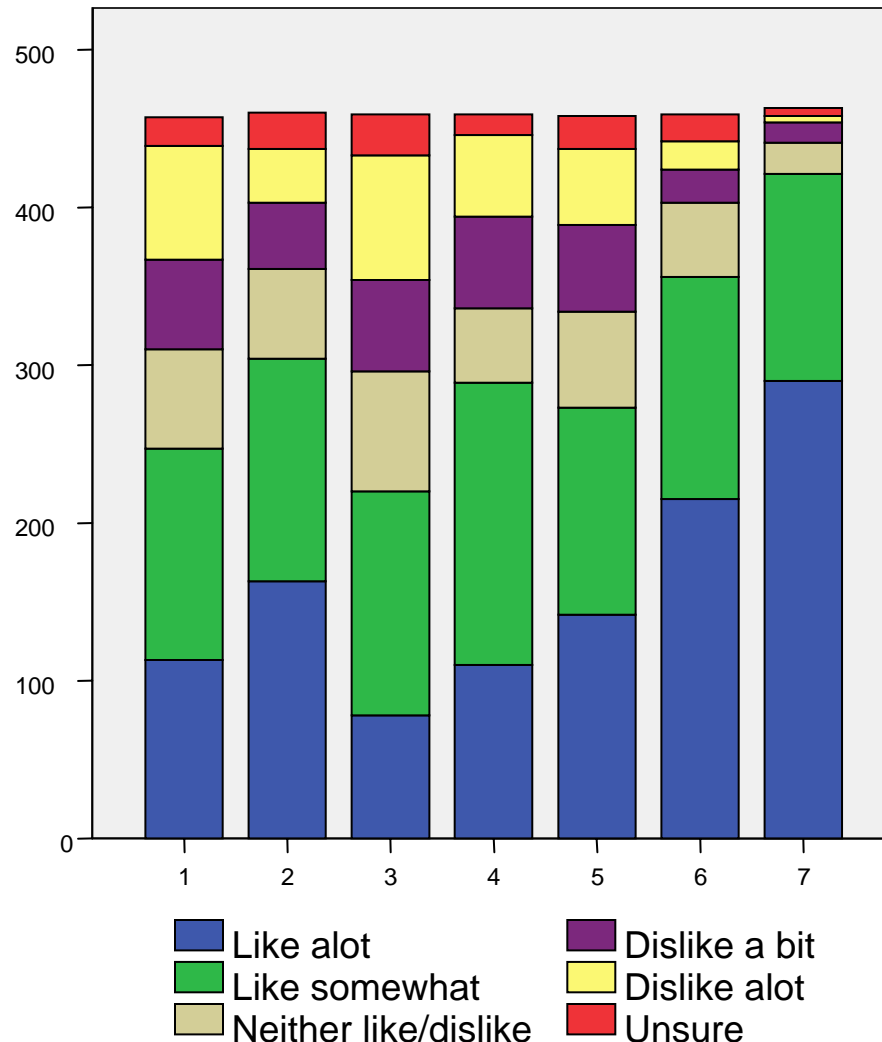
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Opinion on financial incentives



- 1: a requirement for electricity generators to supply a given % of zero- or low-carbon electricity through CCS
- 2: a requirement for electricity generators to supply a given % of zero- or low-carbon electricity (all sources)
- 3: a guaranteed feed-in price for electricity produced by CCS
- 4: a capital subsidy scheme to support construction of CCS plant
- 5: an economy-wide carbon tax
- 6: an early commitment to extend the EU ETS beyond 2012 with tighter emission caps
- 7: support for research, development and demonstration projects

Implementation of incentives & how CCS should be regulated



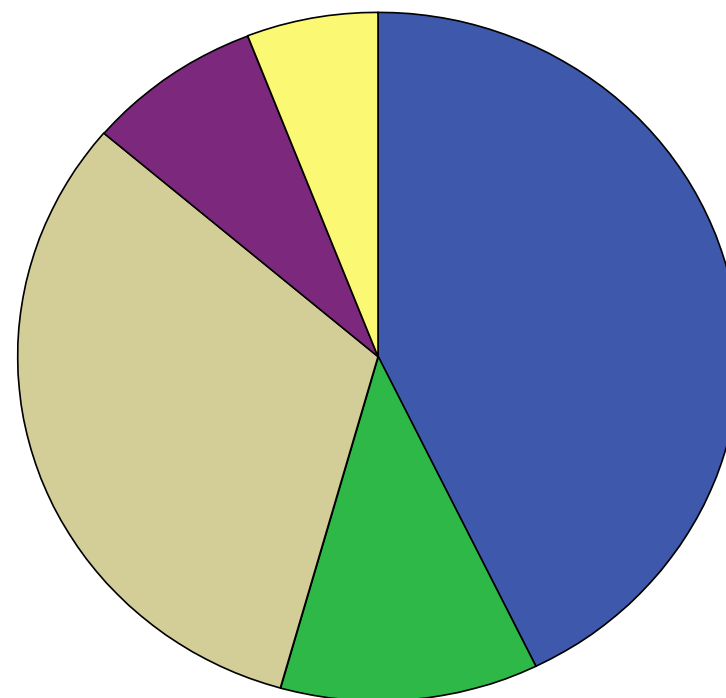
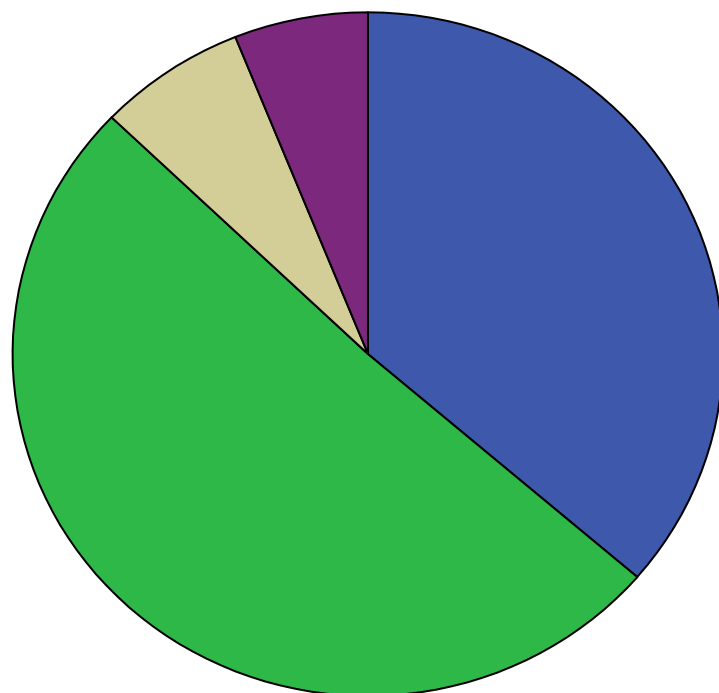
- Respondents somewhat favoured a common price for CO₂ through EU ETS plus additional national incentives (50%)
- A common incentives structure across EU without any additional national incentives was also supported (36%)
- All stakeholder groups except for NGOs favoured EU ETS plus additional national incentives
- Very few supported phasing out of the EU ETS and passing over responsibility to member states.
- The most popular option for regulating CCS was an internationally agreed set of standards (43%) followed by EU wide standardisation with national implementation (32%).
- Least popular is a system of information sharing (8%) and regulation through an agency of the EU Commission (2%)
- NGO respondents are most sceptical about EU wide harmonisation, and are more in favour of an international set of standards (57%)



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Implementation of incentives for CCS (left) and on how CCS should be regulated (right)



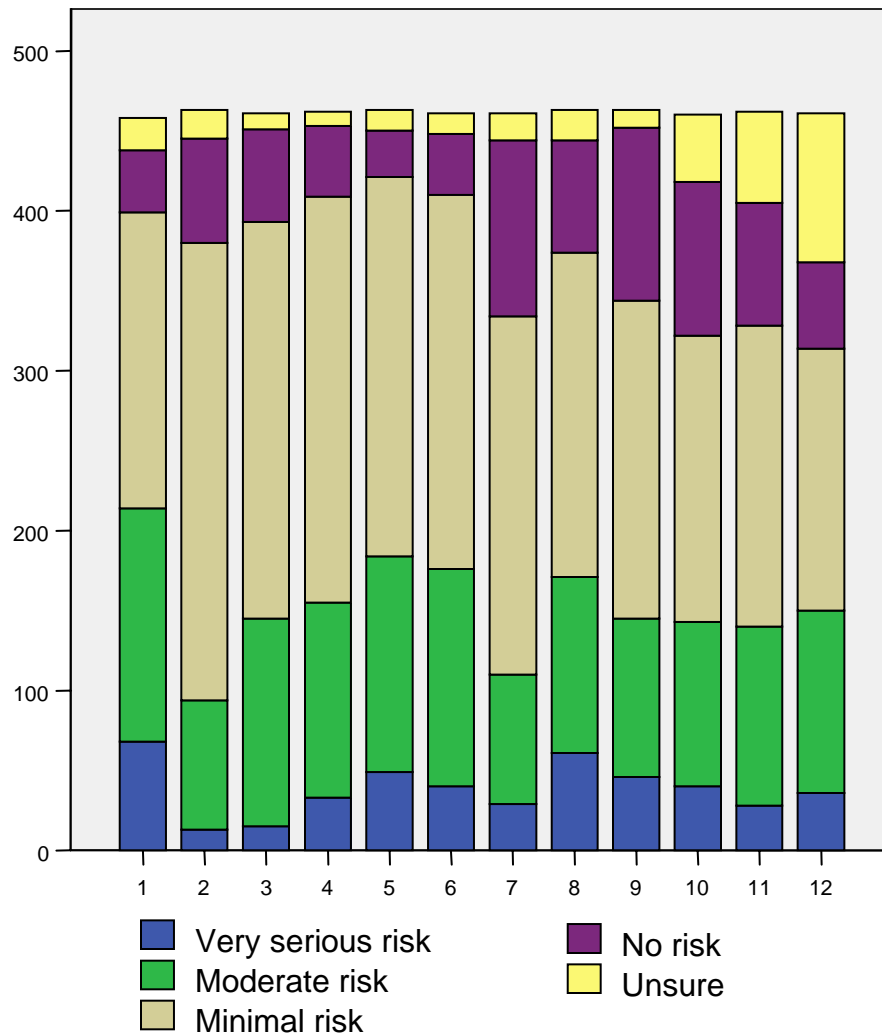
- Same incentives across EU
- Common price for C but additional left to member states
- Left to national government, phase out EU ETS
- Unsure

- International set of standards
- Agency of EU Commission
- EU wide standardisation but implement nationally
- Information sharing between states
- Unsure

Potential risks of CCS

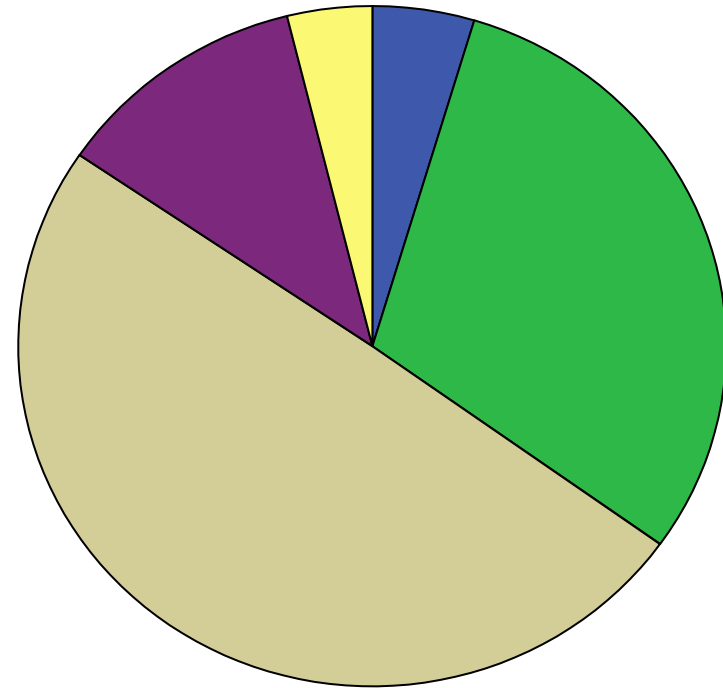
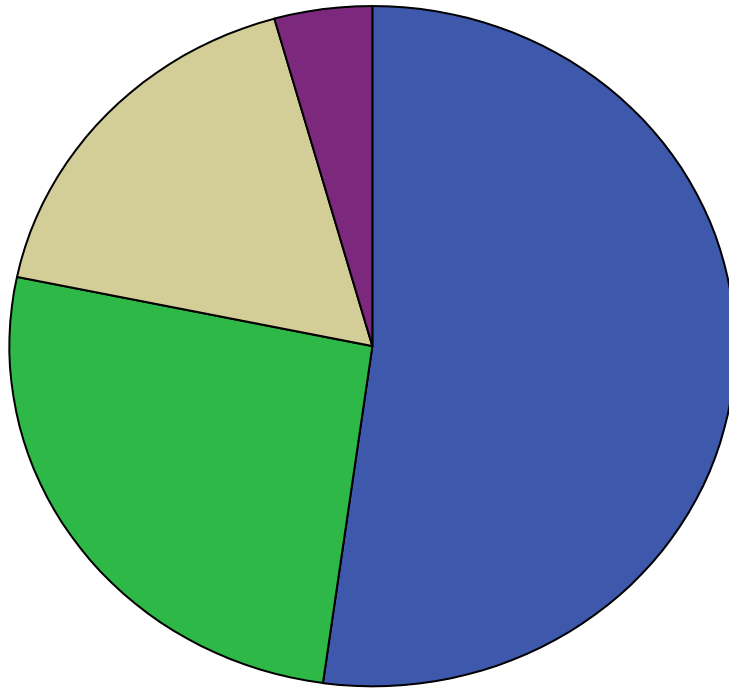
- Risk perceptions are not large – the most common response is ‘minimal risk’
- Highest risks identified: additional fossil fuel use from energy penalty, human health & safety and environmental damage from onshore CO₂ storage and environmental damage from offshore CO₂ storage
- Lowest levels of perceived risk associated with accidents arising from inclusion of CO₂ capture at power stations and human health & safety risks from offshore CO₂ storage site leakage
- NGO respondents – and to a lesser extent parliamentarians - far more concerned about potential risks than other respondents (e.g. 52% identifying energy penalty as ‘very serious risk’, cf. parliamentarians at 30%, energy sector 5%, 10% researchers, 16% government)



Potential risks of CCS



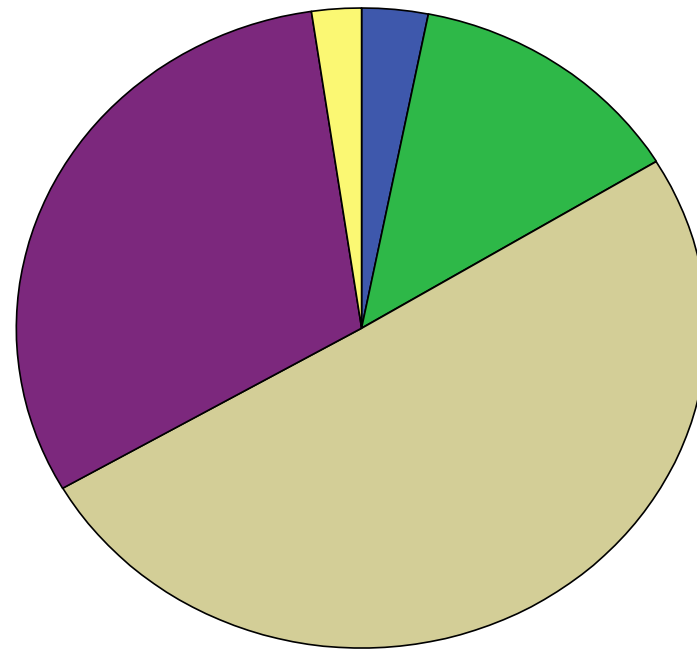
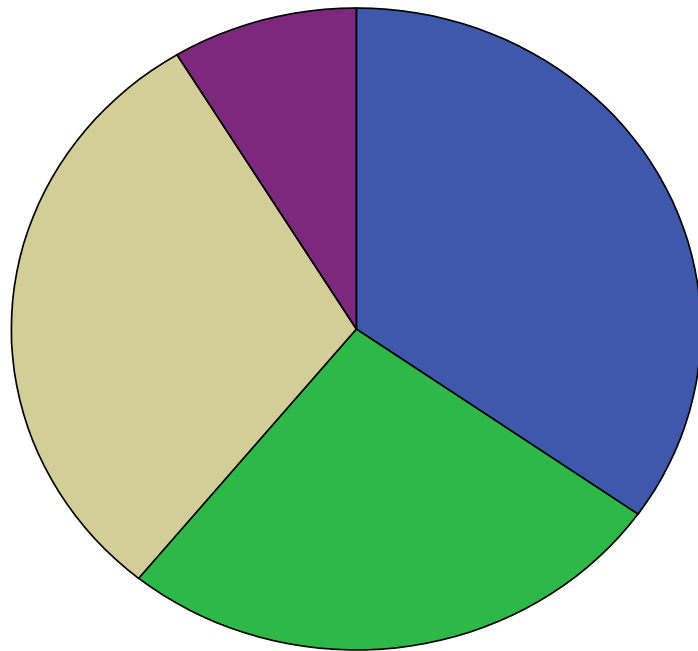
- 1: impacts arising from additional extraction of fossil fuels to compensate for the energy penalty associated with CO₂ capture
- 2: accidents arising from inclusion of CO₂ capture at power stations
- 3: impacts of new CO₂ pipeline network on landscape and environment
- 4: human health and safety risks from leakage from CO₂ pipelines
- 5: human health and safety risks from **onshore** CO₂ storage site leakage
- 6: local environmental damage from **onshore** CO₂ storage site leakage
- 7: human health and safety risks from **offshore** CO₂ storage site leakage
- 8: local environmental damage from **offshore** CO₂ storage site leakage
- 9: global climate impacts from CO₂ storage site leakage
- 10: global climate impacts due to additional greenhouse gas emissions resulting from enhanced hydrocarbon recovery
- 11: impacts of CO₂ storage upon drinking water reservoirs
- 12: impacts of CO₂ storage upon micro-organisms within the storage site




Impacts arising from energy penalty: NGOs (left), energy sector (right)



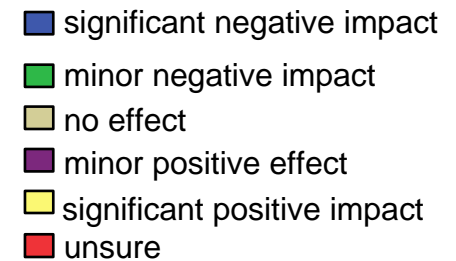
-  Very serious risk
-  Moderate risk
-  Minimal risk
-  No risk
-  Unsure

Impacts arising from global impacts of leakage: NGOs (left), energy sector (right)

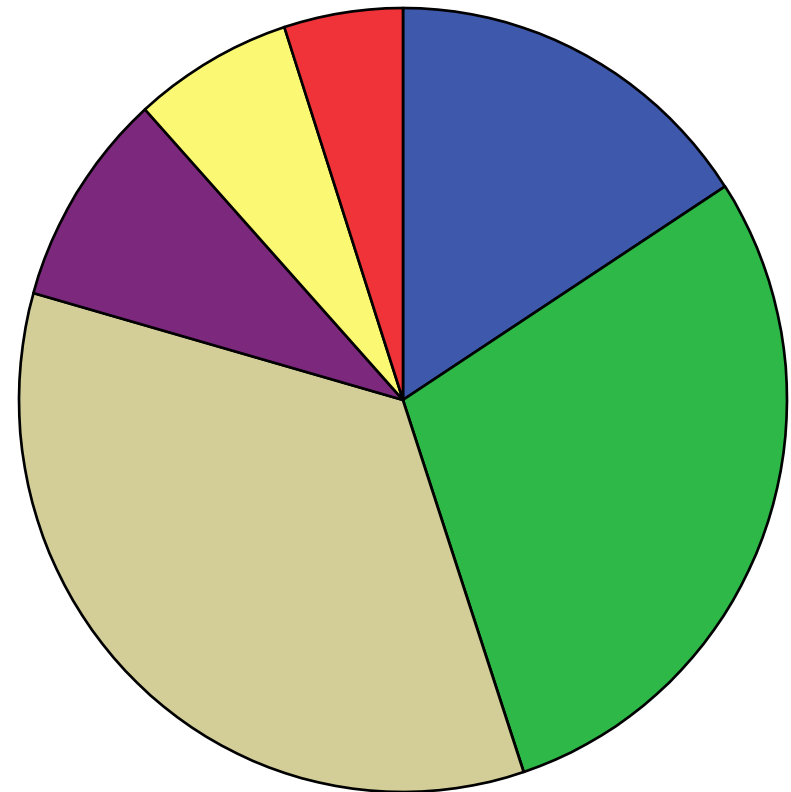


-  Very serious risk
-  Moderate risk
-  Minimal risk
-  No risk
-  Unsure

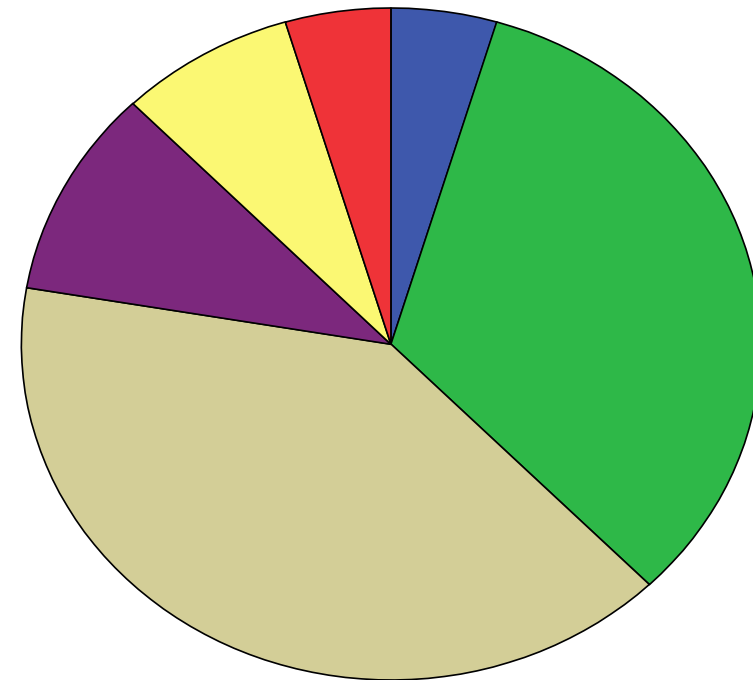
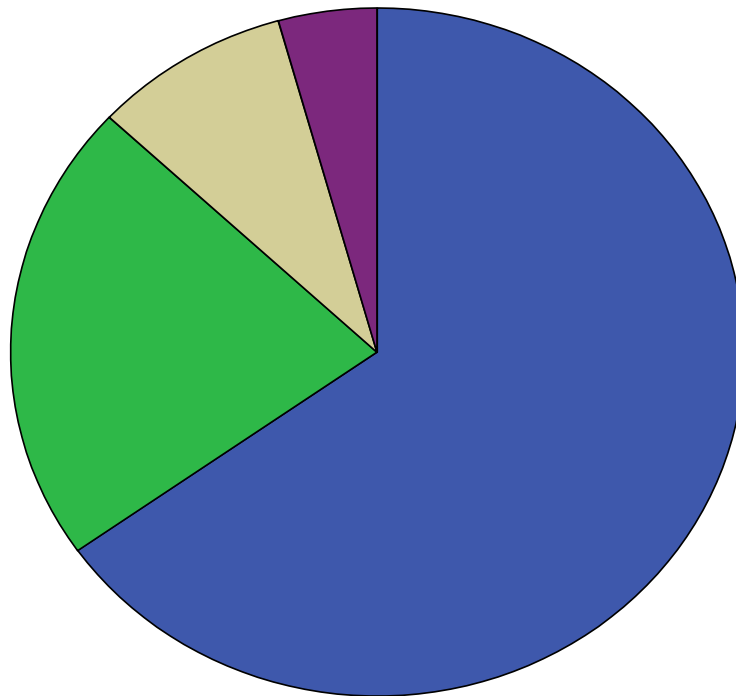
Impacts of CCS investment upon investment in other LZCTs in own country



- Sample is split between those who believe that CCS has a negative impact upon other LZCTs (44%) and those who do not or see it as potentially positive (51%)
- NGOs are most concerned about impact of CCS upon other LZCTs (65% significant negative impact) and Energy stakeholders least concerned (40% no impact, 18% positive impact)

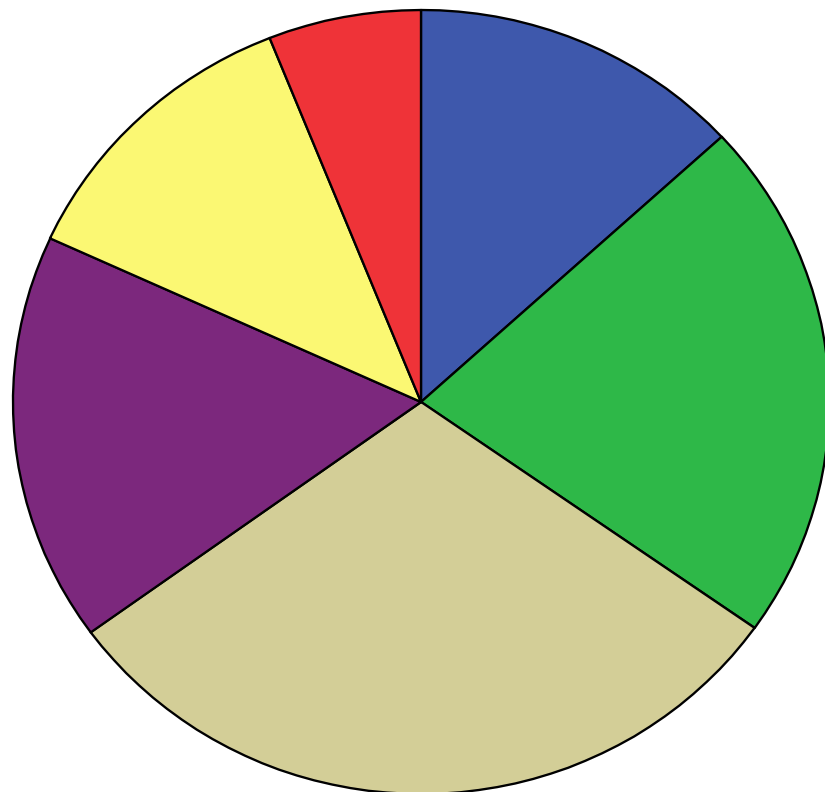


Impacts of CCS investment upon investment in other LZCTs in own country: NGOs (left), energy sector (right)



- significant negative impact
- minor negative impact
- no effect
- minor positive impact
- significant positive impact
- unsure

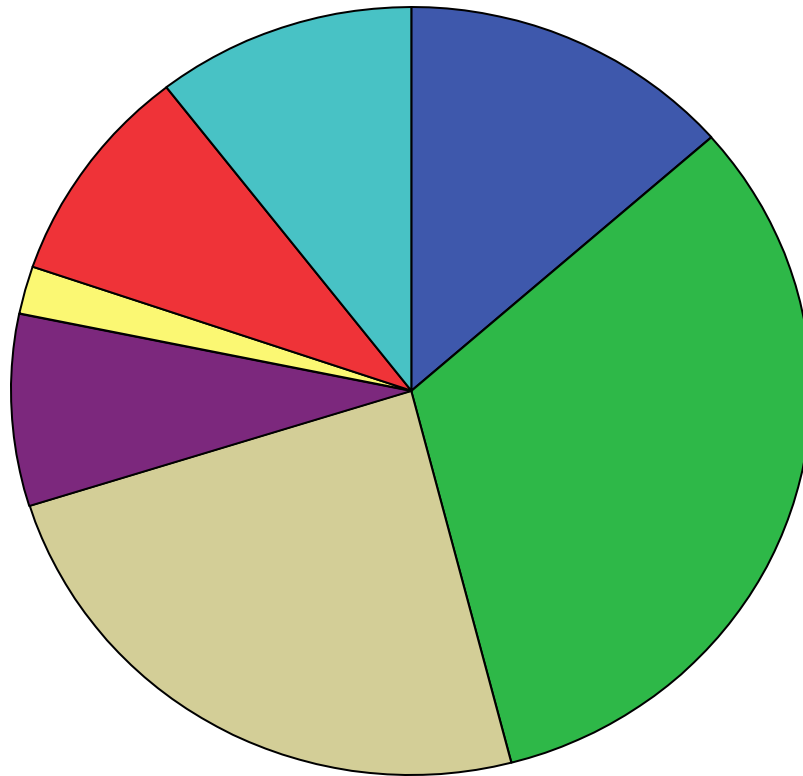
Impacts of CCS investment upon investment in energy efficiency and energy demand reduction in own country



- Overall response similar to other LZCTs, but with slightly fewer negative impacts anticipated. Positive impacts also anticipated more frequently.
- NGOs are much more concerned about the impacts upon energy efficiency / demand reduction than other stakeholders. Energy and government stakeholders saw more positive impacts



Extent to which CCS might increase dependency upon centralised power system



- Very negative impact on DG
- Slightly negative impact on DG
- No impact on DG
- Slightly positive impact on DG
- Very positive impact on DG
- Unsure
- Other

- Energy, government and academic stakeholders do not perceive a very negative impact of CCS upon distributed generation
- NGOs and parliamentarians regard the risk as much greater.
- Nearly half of stakeholder groups do acknowledge a slightly negative impact of CCS upon distributed generation

Impacts of CCS upon energy security in the EU



- Most frequent response is that coal with CCS will improve energy security in the EU (44%), whilst 28% think that there will be no impact.
- Sample more concerned about risks to energy security from gas with CCS. 37% think that there would be a reduction in energy security, whilst 27% think there will be no impact, and 18% think energy security will be enhanced.
- NGOs and parliamentarians are most concerned about impact upon energy security from gas with CCS, but the differences with other stakeholder groups are not large.



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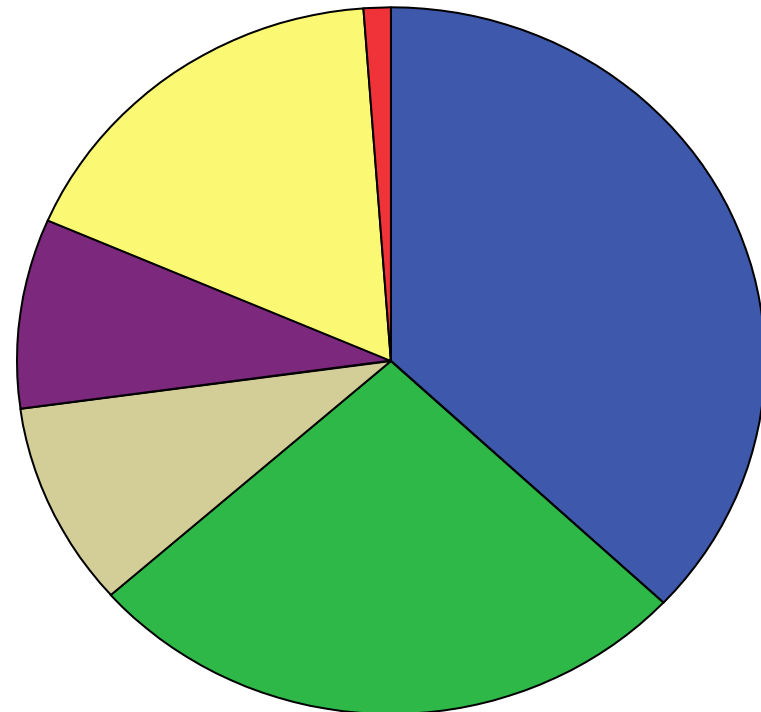
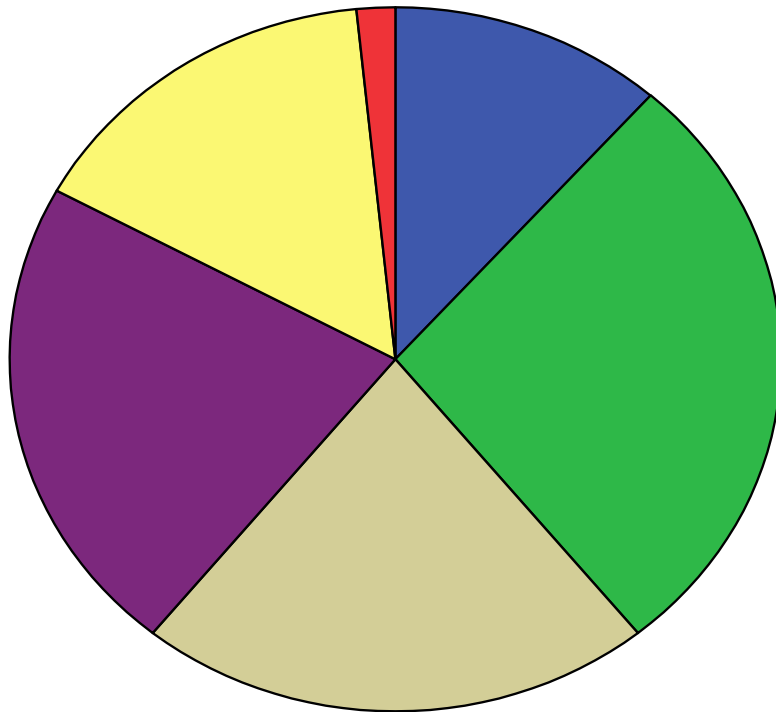
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Impact upon energy security in EU of CCS with coal (left) and gas (right)



- Increase reliance from unstable countries
- Reduce reliance from unstable countries
- No impact on energy security
- Unsure
- Increase reliance from stable countries
- Other



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Public perceptions of CCS in own country and in EU



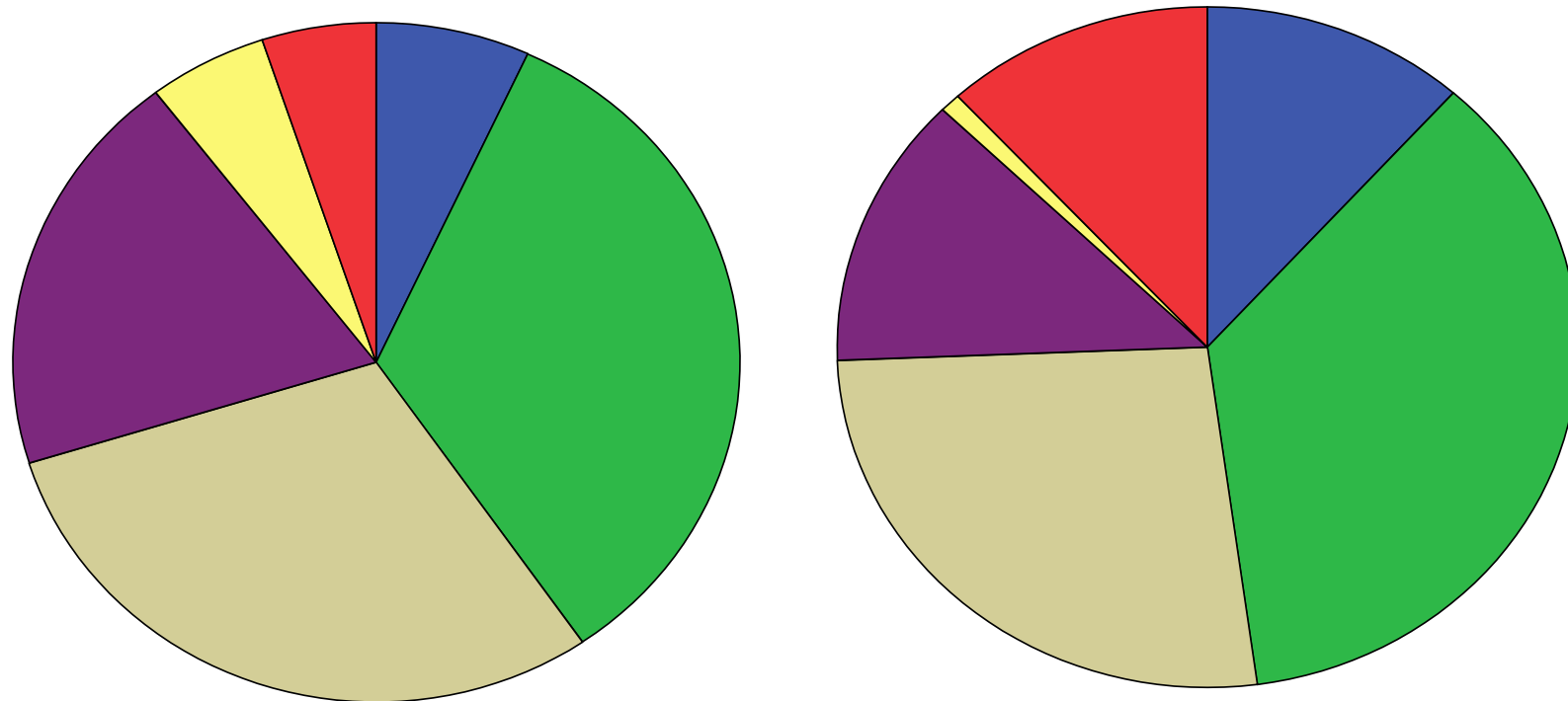
- Most frequent response is that the public will 'moderately support' CCS (34%) in own country, followed by 'neutral' (30%). Only 4% think the public would be 'strongly opposed', and a further 19% think the public will be 'moderately opposed'. Only 5% think public will be 'strongly supportive'
- On balance, public support for CCS greater than opposition (40% vs. 25%).
- Norwegian respondents perceive strongest support for CCS (45% 'strongly supportive') and further 39% 'moderately supportive'.
- UK and Netherlands also see public as more positive than sample average, whilst Germany and Denmark see public as less positive than average.
- NGOs and parliamentarians least convinced that the public will be supportive, none selecting the 'strongly supportive' option. They see public as 'neither positive nor negative' most frequently.
- Respondents think that the public will be more supportive of CCS at the EU scale than in their own countries.



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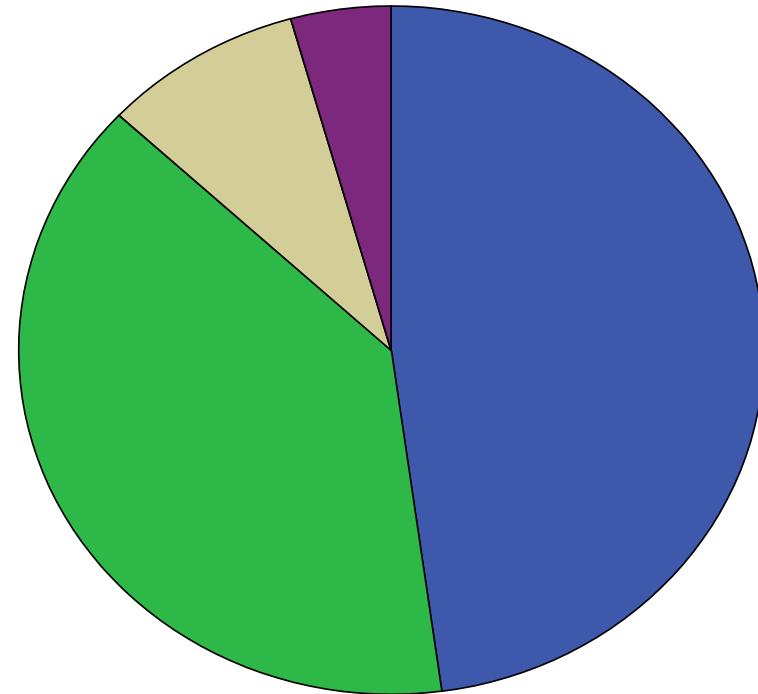
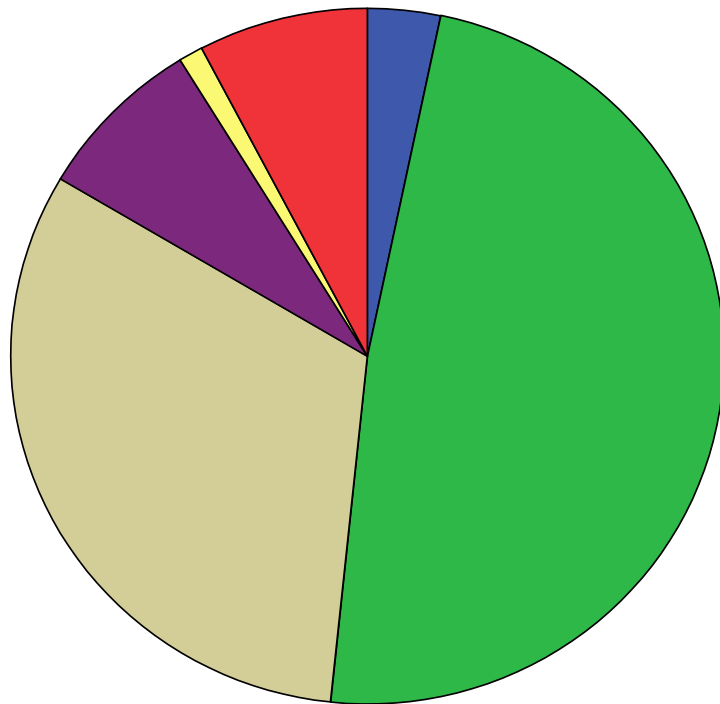


Public perceptions of CCS in own country (left) and in EU (right)



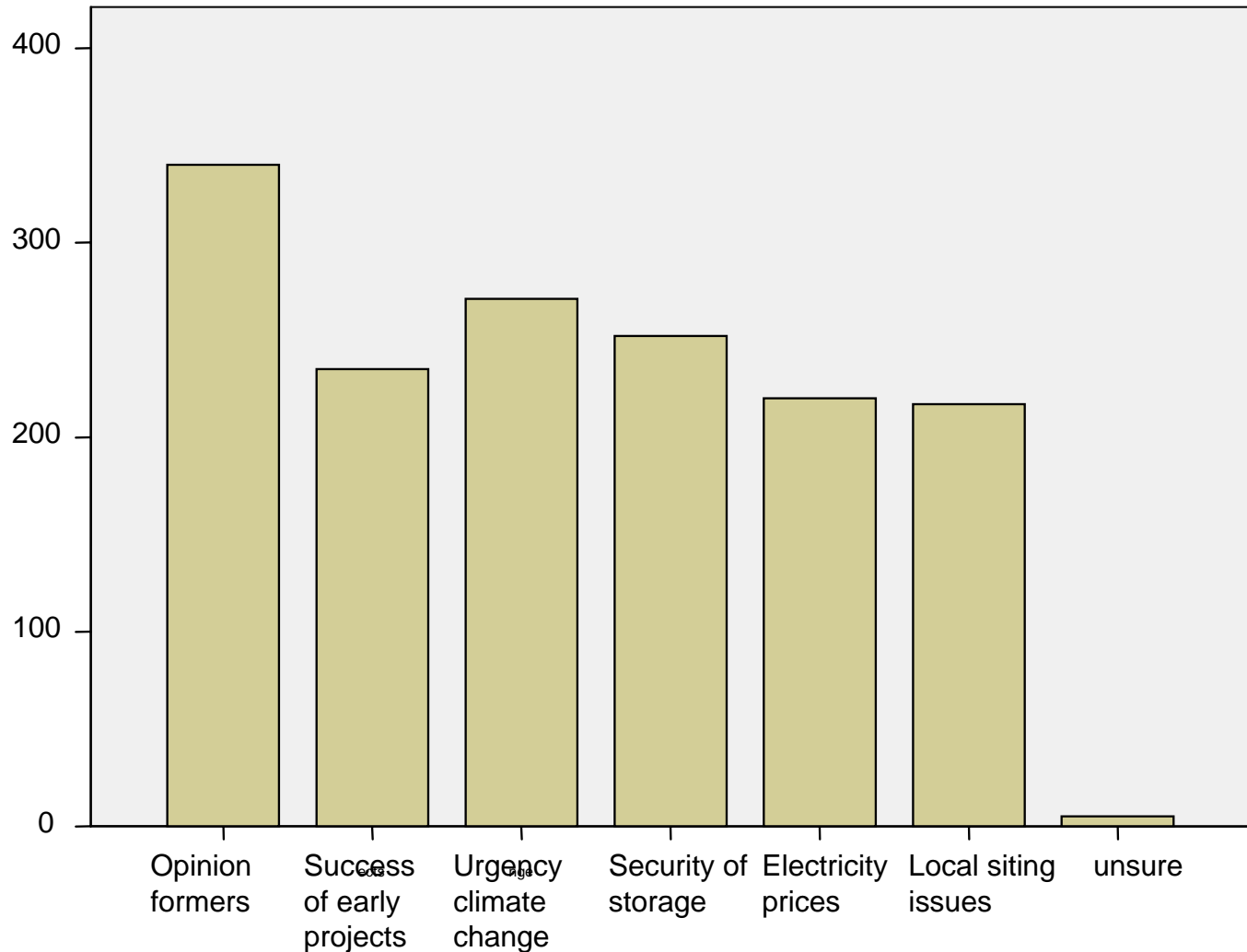
- Strongly supportive
- Moderately supportive
- Neither positive or negative
- Moderately opposed
- Strongly opposed
- Unsure

Public perceptions of CCS in own country: UK (left), Norway (right)



- | | |
|--|--|
|  Strongly supportive |  Moderately opposed |
|  Moderately supportive |  Strongly opposed |
|  Neither positive or negative |  Unsure |

What factors are most likely to influence public perceptions of CCS?



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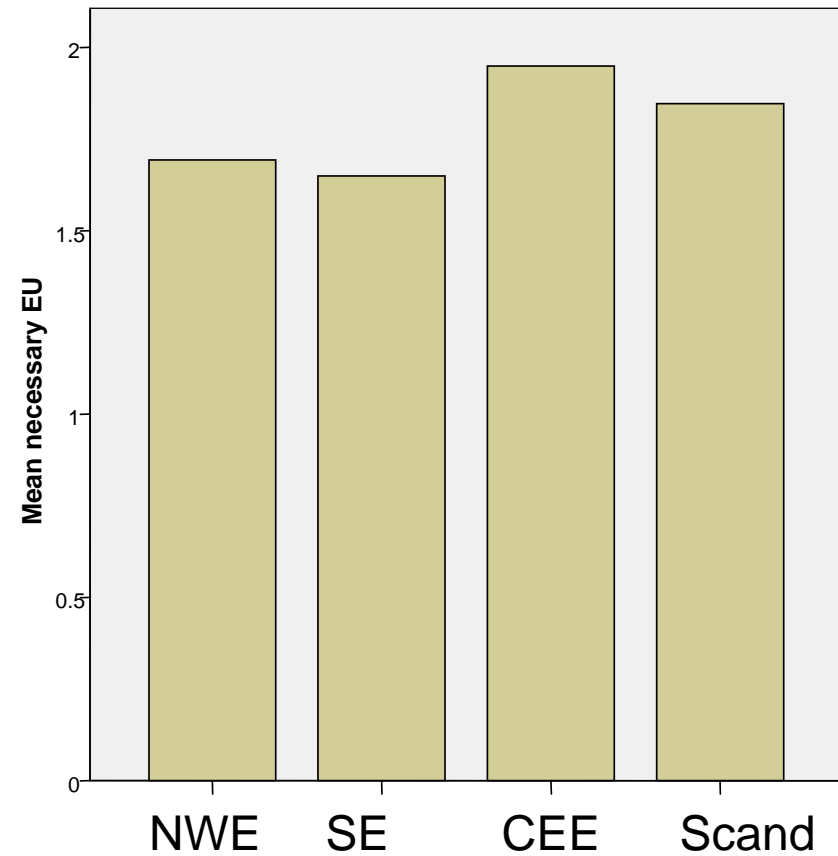
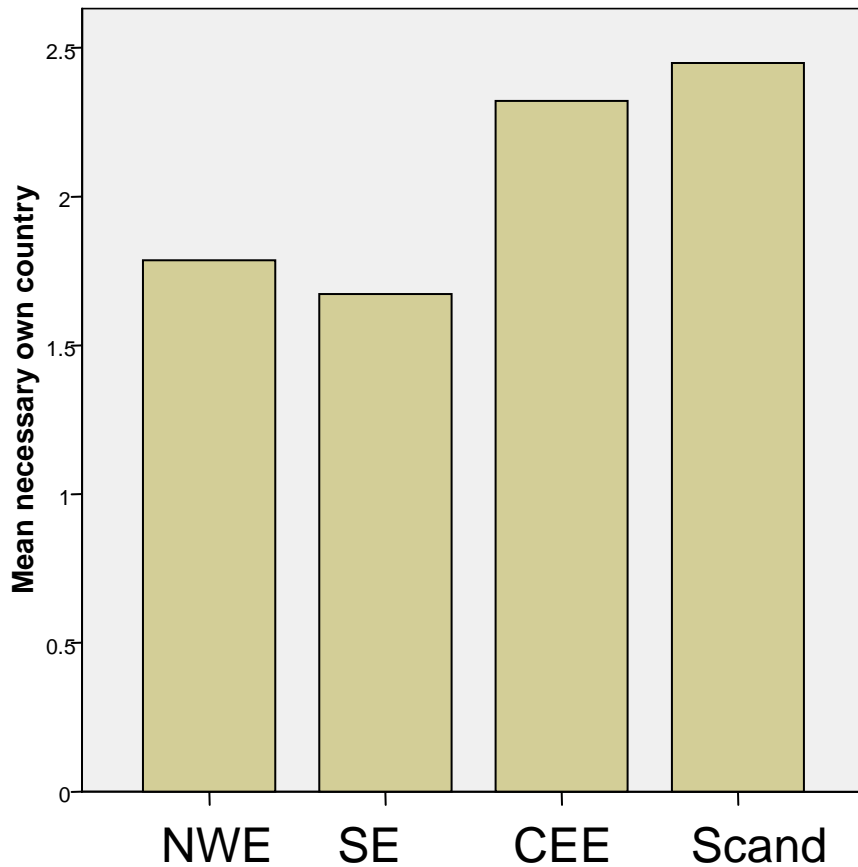


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Analysis by Regions

- North West Europe (NWE) and Southern Europe (SE) keener on CCS in own country than Central & Eastern Europe (CEE) and Scandinavia (Scand)
- Response of Scand conceals a bipolar response between Norway and Finland / Sweden & Denmark
- Role of CCS in national climate change debate in CEE is much less than for other countries
- Support mechanisms: CCS requirement and guaranteed-feed in tariff least liked in Scand, followed by NWE, CEE and SE
- Extension of EU ETS with tighter caps most popular in NWE
- Respondents in Scand and CEE tend to prefer common incentives across EU, whilst NWE and SE tend to prefer EU ETS plus additional national incentives
- Regulation through international standards was most popular in Scand, whilst EU standardisation most popular in NWE and SE

Perceived need for CCS in own country (left) and EU (right) (lower value indicates greater perceived need)



Country groups

Country groups



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Analysis by Regions

- Risk perceptions of CCS are greatest for respondents from CEE for each of the twelve factors they rated the risks as higher than other regions
- For a few of the risks, e.g. risks of CO₂ leakage for global climate, Scand respondents regarded as higher than NWE and SE
- CEE and Scand respondents more likely to regard CCS as having negative impact on decentralisation
- Scand regarded CCS with coal as improving energy security in EU more than other groups
- SE respondents thought public perceptions of CCS in own country would be more negative than other groups