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Abstract

The GATEWAY project aims to develop a comprehensive model pilot case which, intentionally, will pave the way for carbon capture and storage (CCS) deployment in Europe. The project's chosen pilot case is the Rotterdam Nucleus, which is based on the developing nucleus of Rotterdam with storage offshore the Netherlands and with potential additional transboundary cluster connections. The CO_2 network is extended out to gas field "Fizzy" in the UK's southern north sea sector 50 to facilitate gas production with CO_2 separation and storage and could include an extension from the Port of Antwerp.

Development of the pilot case requires specific legal input, covering governance as needed at this early stage to develop the legal framework of the pilot case. This paper considers potential model contract terms and conditions for contractual issues in the CCS value chain, with a particular focus on the CO_2 transboundary transport component. Recommendations for addressing key risks and liabilities are made following a review of the literature and data collection through semi-structured interviews conducted with CCS stakeholders in the UK and Europe.

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1 INTRODUCTION

1.1 GATEWAY Pilot Case Context

The European Commission has identified carbon capture and storage (CCS) (see abbreviations in Appendix 1) as one option for achieving deep CO_2 emissions reductions in order to achieve the European Union's 2050 greenhouse gas reduction targets.[1] As explained in the TEN-E Regulation, "the Union has to prepare its infrastructure for further decarbonisation of its energy system in the longer term towards 2050. This Regulation should therefore also be able to accommodate possible future Union energy and climate policy objectives".[2]

It is within the context of decarbonising the European economy that the European Commission has identified CCS as eligible for Project of Common Interest (PCI) treatment, as set out in the list of Priority Thematic Areas: "Cross-border carbon dioxide network: development of carbon dioxide transport infrastructure between Member States and with neighbouring third countries in view of the deployment of carbon dioxide capture and storage". [3]

The GATEWAY project aims to develop a plan for a cross-border CO_2 transport project which, intentionally, will pave the way for an EU CO_2 transport network and subsequently, CCS deployment in Europe. Ideally, the GATEWAY project would qualify for PCI treatment, which would provide a number of benefits, such as streamlined permitting and access to financial support,[4] and advance wide scale deployment of CCS in Europe.

1.2 Pilot Case Description

As identified in GATEWAY deliverable 4.1,[5] the project's chosen pilot case is the Rotterdam Nucleus, which is based on the developing nucleus of Rotterdam, with the Rotterdam Climate Initiative, existing ROAD project and potential additional cluster connections. As explained in GATEWAY deliverable 4.1, the pilot case will continue to be refined over the course of the project. In this context, the main preferred addition to the pilot case (scenario) is to extend development to the CO_2 Antwerp-Rotterdam Pipeline (CAR Pipeline) scenario, as well. As such, this document includes the CAR Pipeline in the Rotterdam Nucleus case in an effort to reflect the Project's refinement efforts as is represented below in Figure 1.[6]

The Rotterdam Nucleus pilot case addresses CO_2-intense areas of the Port of Rotterdam in the Netherlands and the Port of Antwerp in Belgium, and includes a hydrocarbon development opportunity offshore UK with the production of CO_2. The pilot case envisages a four-segment CO_2 transport development scenario as follows and in Figure 1 below:

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[1] European Commission, 'Energy roadmap 2050' (COM(2011) 885 final of 15 December 2011) <https://ec.europa.eu/energy/sites/ener/files/documents/2012_energy_roadmap_2050_en_0.pdf>

[2] REGULATION (EU) No 347/2013 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 April 2013 on guidelines for trans-European energy infrastructure and repealing Decision No 1364/2006/EC and amending Regulations (EC) No 713/2009, (EC) No 714/2009 and (EC) No 715/2009, Preamble 7 ("TEN-E Regulation").

[3] TEN-E Regulation, Annex I.

[4] European Commission, 'Projects of Common Interest' (2016) <ec.europea.eu/energy/en/topics/infrastructure/pojects-common-interest>.

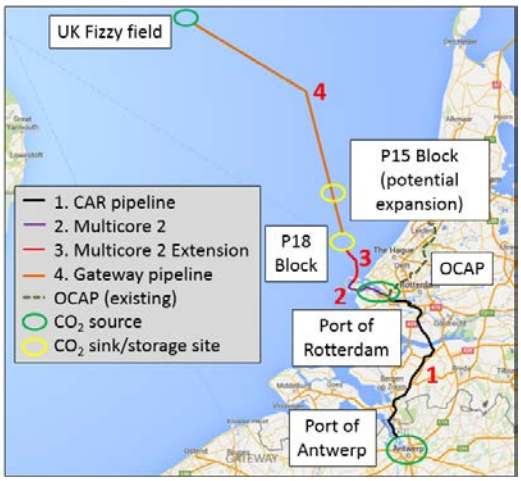
[5] GATEWAY Project, Progressive Energy Limited, 'Developing a Pilot Case aimed at establishing a European infrastructure project for CO2 transport', submitted to the European Commission 30 September 2016.

[6] This paper extends the pilot case scenario, in contrast to that of deliverable 3.1, in which the assessment reflected the scenarios of GATEWAY deliverable 4.1—'Pilot Case Definition'.

1) Transboundary transportation of CO_2 via an 80km onshore pipeline from the Port of Antwerp (Belgium) to Rotterdam, which connects to segment 2.
2) Segment 2 is a 40 km onshore pipeline between Rotterdam and Maasvlakte.
3) In segment 3, CO_2 is transported via an 18km pipeline offshore the Netherlands to P18.
4) Segment 4 is a 100km offshore pipeline from the UK's Fizzy field to the Netherlands' P18.

Possible future extensions include a shipping route connecting Germany (Ruhr Valley) to Rotterdam and a connection of Antwerp to Le Havre in France, however, the focus of this paper is the pilot case as described above.

Figure 1. Pilot Case Development Scenario



1.3 Purpose of this Paper

The individual components of the CCS value chain (i.e., CO_2 capture, transportation and geological storage) currently exist and can be found in established industries.[7] One of the challenges for widespread CCS deployment will be integration of the separate activities into a cohesive, value chain system.[8] Effective realization of this integration will necessitate appropriate risk allocation among CCS stakeholders.

Fundamentally, the GATEWAY project would be an international infrastructure project. As an infrastructure development, it would progress through the construction life cycle. While there are variations to the model, generally, the life cycle of an infrastructure project spans from concept definition to operation.[9] (See Figure 1.) Within this framework, GATEWAY is in the early concept definition phase, in which feasibility is investigated. One objective of this development phase is to understand risk allocation among stakeholders, which could influence investment

[7] Intergovernmental Panel on Climate Change (IPCC), 'Special Report on Carbon Dioxide Capture and Storage' (CUP 2005) 71 <www.ipcc.ch/pdf/special-reports/srccs/srccs_wholereport.pdf>.
[8] International Energy Agency (IEA), 'Technology Roadmap: Carbon capture and storage' (2013) 20 <www.iea.org/publications/freepublications/publication/technologyroadmapcarboncaptureandstorage.pdf>.
[9] See, e.g., Thomas E Uher and Martin Loosemoore, *Essentials of Construction Project Management* (UNSW Press 2004); Australian Government, Department of Infrastructure and Transport, *Infrastructure Planning and Delivery: Best Practice Case Studies Volume 2* (Commonwealth of Australia 2012).

outcomes and project success.[10] This risk allocation results from activities across the CCS value chain (horizontally) and within the layers of energy law and policy (vertically).

As a transboundary, full-scale CCS project, the GATEWAY project would be a seminal project for the EU. Delivery of an international CCS project, such as that contemplated by the pilot case, requires the involvement of multiple stakeholders acting across the CCS value chain. Such a project would require numerous contracts (e.g., treaties, construction/EPC, finance, permits, tolling agreements), the content and format of which would depend upon the stakeholders who choose to participate (e.g., whether the entire value chain will be operated by one operator or several), as well as economic and financial decisions that drive contract design. However, there are significant issues that concern stakeholders of international CCS projects, including in the pilot case, which not only need to be identified but also the contractual means of addressing these matters must be understood.

This paper explores key liability risks that concern stakeholders in the delivery of the Rotterdam Nucleus pilot case, and which have relevance for other transboundary CCS projects, and identifies potential model contract terms and conditions to allocate these risks among project parties. As the project is in the early stages, this is not a comprehensive, life cycle analysis of legal risks. The model contract terms and conditions for international CCS identified in this paper have been informed by the literature review and qualitative research of the views/concerns of CCS stakeholders, regarding CCS liability exposures. Given the international transboundary aspects of the pilot case, a particular focus will be placed on the CO_2 transport component.

This paper is structured as follows. First, a review of the literature is presented, which focuses on key liability exposures faced by project participants across the value chain in international CCS projects. Second, the methodology for the study is presented, including the hypotheses. Third, study results are presented. This is followed by an exploration of information collected in participant interviews, as well as recommendations for addressing liability contractually in international CCS projects (with specific considerations for the pilot case). Finally, conclusions and areas for further investigation are presented.

1.4 Context

As the pilot case entails the international (transboundary) transportation of CO_2 for offshore storage, it is necessary for legal analysis to include the three levels of energy law (international, national and local),[11] and also issues across the CCS value chain (capture, transport and storage). The European Commission has sought to provide a foundation for CCS deployment, such as promulgation of the CCS Directive,[12] which establishes a framework for CO_2 storage in the EU.

While the CCS Directive requires Member States to coordinate in transboundary CCS projects,[13] issues remain in the integration of the CCS value chain. Despite Member States' transposition of

[10] Thomas E Uher and Martin Loosemoore, *Essentials of Construction Project Management* (UNSW Press 2004).
[11] Raphael J Heffron and Kim Talus, 'The development of energy law in the 21st century: a paradigm shift?' (2016) 9(3) Journal of World Energy Law and Business 189.
[12] IEA, '20 years of Carbon Capture and Storage' (2016) <www.iea.org/publications/freepublications/publication/20YearsofCarbonCaptureandStorage_WEB.pdf> accessed 15 November 2016.
[13] Directive 2009/31/EC.

the CCS Directive[14] into national law, a lack of consistency remains in the policies and support for CO_2 transportation infrastructure projects across EU Member States. As explored in GATEWAY deliverable 3.1., this inconsistency could hinder CCS transboundary network development, impacting the realization of cross-border projects.[15] Thus, for the GATEWAY project, unlocking CCS in the EU by harnessing momentum in countries in which CCS is viewed favourably and seeking to maximise transboundary linkage of sources and sinks will be important factors for project success.

Currently, no CCS projects operate at a commercial scale within the EU.[16]- However, two commercial projects—Sleipner and Snohvit are operated in Norway (by Statoil), [17] which are domestic Norway projects. Thus, as a proposed international CCS project, the pilot case presents risks as a result of the unknowns of a nascent, international industry.

While some of the literature highlights certain risks as unique to CCS, in many cases, analogies can be made to other industries, which can inform how risks and liabilities in the CCS value chain.[18] And as explained by one author:

> "To some extent, the arguments [about CCS liability] are simply a surrogate for more fundamental disagreements about the merits of CCS as a climate change measure, merits that really concern, not liability, but judgements about the risks involved compared with other benefits that could be achieved. CCS is a contentious option, so everything about it, including liability, is subject to dispute.
>
> There is also something familiar about the liability arguments themselves. For all the similarities with existing technologies, a decision to adopt CCS worldwide as part of a strategy to decarbonize the economy, is clearly a new departure and on a grand scale".[19]

While CCS is novel in some ways, its similarities to other industries can inform the risks to be addressed contractually in which analogies from similar industries can be drawn[20] (e.g., CO_2

[14] Directive 2009/31/EC of the European Parliament and of the Council of 23 April 2009 on the geological storage of carbon dioxide and amending Council Directive 85/337/EEC, European Parliament and Council Directives 2000/60/EC, 2001/80/EC, 2004/35/EC, 2006/12/EC, 2008/1/EC and Regulation (EC) No 1013/2006 (CCS Directive).
[15] Milieu, 'Identification of future CO2 infrastructure networks' (November 2015, Report for the European Commission ENER/B1/FV2014-731/SI2.639451).
[16] IEA, '20 years of Carbon Capture and Storage' (2016) <www.iea.org/publications/freepublications/publication/20YearsofCarbonCaptureandStorage_WEB.pdf> accessed 15 November 2016.
[17] Element Energy, 'One North Sea' (2010, Report for The Norwegian Ministry of Petroleum and Energy and The UK Foreign and Commonwealth Office) <www.npd.no/Global/Engelsk/3%20%20Publications/Reports/OneNorthSea/OneNortSea_Final.pdf>; Statoil, 'Carbon capture and storage' (2014) www.statoil.com/en/TechnologyInnovation/NewEnergy/Co2CaptureStorage/Pages/default.aspx>.
[18] Chris Clarke, 'Long-term Liability for CCS: Some Thoughts about Specific Risks, Multiple Regimes and the EU Directive', in Ian Havercroft, Richard Macrory and Richard B Stewart, *Carbon Capture and Storage: Emerging Legal and Regulatory Issues* (Hart Publishing 2011) 180.
[19] Chris Clarke, 'Long-term Liability for CCS: Some Thoughts about Specific Risks, Multiple Regimes and the EU Directive', Ian Havercroft, Richard Macrory and Richard B Stewart, *Carbon Capture and Storage: Emerging Legal and Regulatory Issues* (Hart Publishing 2011) 180.
[20] Behdeen Oraee-Mirzamani, Tim Cockerill and Zen Makuch, 'Risk Assessment and Management Associated with CCS' (2013) 37 Energy Procedia 4757.

transportation as similar to natural gas pipelines; long term storage of CO_2 and the long term storage of nuclear waste).
The three layers of energy law—international, national and local[21]—provide a framework for considering the liability issues that could the Gateway project's pilot case could face. As described in GATEWAY deliverable 3.1, at the international level, energy law is informed by treaties and international organisations.[22] The national level includes the aims of government (energy law and policy) and finance availability (law and economics). Finally, the local level considers local perspectives of individuals and communities, including impacts of infrastructure development.[23] Change at one level, for example, at the international law stage, will generally affect national and local legal issues and vice-versa.[24]

Table 1 below details the legal issues for CO2 transport in the EU on each level, based on the research analysis completed for this project, which were explored in GATEWAY deliverable 3.1. This framework provides a structure for identifying the key liability concerns of project stakeholders to enable recommendations for addressing these risks contractually (as opposed to legislatively or adjudicatively).

Table 1. Issues within Legal Layers for CO_2 transport in the EU

Level	Issues
International	• The countries involved having a positive international outlook and/or involvement in CCS and/or CO_2 transport activity. • Ratification of the London Protocol – in particular, agreement with the amended Article 6.
National	• Law and policy – existence of and favourable national policy and legislation • Law and economics – financial commitments, subsidies on offer and research activities • Liability issues – liability regime present
Local	• Planning law and permitting issues – stable application procedures, demonstration projects, past experience • Other issues (e.g., local economy, social issues)

1.5 International Level

For CCS, the international level of energy law concerns transboundary matters between states, with implications for project parties. Here, one significant risk—the London Protocol—could restrict CO_2 transportation, with implications for the GATEWAY project.

1.5.1 Transport - London Protocol

One significant risk found at the international level with applicability to the CCS transport stage is the London Protocol's prohibition on the transboundary export of waste for disposal at sea. As described in GATEWAY deliverable 3.1, the London Protocol, which was adopted on 7

[21] Raphael J Heffron and Kim Talus, 'The development of energy law in the 21st century: a paradigm shift?' (2016) 9(3) Journal of World Energy Law and Business 189.
[22] Raphael J Heffron & Kim Talus The development of energy law in the 21st century: a paradigm shift? (2016) Journal of World Energy Law and Business, 9(3), 189.
[23] Raphael J Heffron & Kim Talus The development of energy law in the 21st century: a paradigm shift? (2016) Journal of World Energy Law and Business, 9(3), 189.
[24] Raphael J Heffron & Kim Talus The development of energy law in the 21st century: a paradigm shift? (2016) Journal of World Energy Law and Business, 9(3), 189.

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November 1996, is an international agreement that prohibits the dumping of wastes at sea, including the export of waste for such disposal.[25] This prohibition applies only to the London Protocol's contracting parties. A map identifying these parties can be found on the website of the International Maritime Organisation.[26] The Protocol's terms have a number of implications for transboundary CCS projects.

First, for context, Annex I of the London Protocol sets out exceptions for the prohibition on dumping of wastes at sea. In 2006, an amendment to Annex I was enacted to allow offshore storage of CO_2 for the purpose of CCS.[27] This amendment entered into force on 10 February 2007.[28] As this change was to an *annex* of the London Protocol, rather than to an *article*, the amendment approval process was passive. That is, the Annex I amendment automatically entered into force for any contracting party that did not lodge an objection to the amendment within the prescribed timeframe in accordance with Article 22 (entitled 'Amendment to the Annexes').[29]

Second, Article 6 of the London Protocol currently forbids the Protocol's contracting parties to engage in international transboundary transportation of CO_2 for offshore storage. Specifically, Article 6 states, "Contracting Parties shall not allow the export of wastes or other matter to other countries for dumping or incineration at sea".[30] An amendment to Article 6 was proposed by Norway in 2009 and adopted by the Protocol's parties in accordance with Article 21 (entitled 'Amendment of the Protocol'), however, the amendment comes into force only after ratification by two-thirds of the Protocol's 48 (current) Parties.[31] That is, unlike an amendment to an Annex, the amendment to an Article is an active process, requiring affirmative action by the parties, rather than a deemed approval.

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[25] International Maritime Organisation (IMO), 'Carbon Capture and Sequestration' (2016), <www.imo.org/en/OurWork/Environment/LCLP/EmergingIssues/CCS/Pages/default.aspx>.

[26] IMO, 'Parties to the London Convention and Protocol' (9 December 2016) <www.imo.org/en/OurWork/Environment/LCLP/Documents/Parties%20to%20the%20London%20Convention%20and%20Protocol%20Dec%202016.pdf>.

[27] International Maritime Organisation (IMO), 'Carbon Capture and Sequestration' (2016), <www.imo.org/en/OurWork/Environment/LCLP/EmergingIssues/CCS/Pages/default.aspx>.

[28] International Energy Agency (IEA), 'Carbon Capture and Storage and the London Protocol: Options for Enabling Transboundary CO2 Transfer' (Working Paper) (Paris: OECD/ IEA 2011) <www.iea.org/publications/freepublications/publication/CCS_London_Protocol.pdf>.

[29] International Energy Agency (IEA), 'Carbon Capture and Storage and the London Protocol: Options for Enabling Transboundary CO2 Transfer' (Working Paper) (Paris: OECD/ IEA 2011) <www.iea.org/publications/freepublications/publication/CCS_London_Protocol.pdf>.

[30] 1996 PROTOCOL TO THE CONVENTION ON THE PREVENTION OF MARINE POLLUTION BY DUMPING OF WASTES AND OTHER MATTER 1972 (London Protocol) Article 6.

[31] IMO, 'Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter' <www.imo.org/en/OurWork/Environment/LCLP/Pages/default.aspx>; International Maritime Organisation (IMO), 'Carbon Capture and Sequestration' (2016), <www.imo.org/en/OurWork/Environment/LCLP/EmergingIssues/CCS/Pages/default.aspx>; Justine Garrett and John McCoy, 'Carbon capture and storage and the London Protocol: Recent Efforts to Enable Transboundary CO2 Transfer' (2013) 37 Energy Procedia 7747; Chiara Armeni, 'Legal Developments for Carbon Capture and Storage under International and Regional Marine Legislation' in Ian Havercroft, Richard Macrory and Richard B Stewart (eds), *Carbon Capture and Storage: Emerging Legal and Regulatory Issues* (Hart Publishing 2011) 145.

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As explained by the IEA, ratification of the amendment is not necessarily a priority for all the Protocol's contracting parties, given not all London Protocol signatories are involved in CCS.[32] This makes ratification a challenge for those parties seeking to deploy transboundary CCS projects. China was the only contracting party to vote against the amendment, raising a concern that it could weaken the Protocol by opening the door for other wastes to be exported, and commenting that the technical and legal issues of CO_2 export remained unclear.[33]

Under the pilot case, CO_2 is transported internationally for offshore storage at two points: 1) from the Port of Antwerp (Belgium) through the Rotterdam area and onward to P18 (the Netherlands' continental shelf); and 2) from the UK's Fizzy field to the Netherlands (at the P18 storage site).

Belgium, the UK and the Netherlands have signed up to the London Convention and Protocol, and are bound by its terms accordingly. However, while the UK and the Netherlands have ratified the amended Article 6 of the London Protocol, the amendment is not yet effective. In addition, it is noted and significant that, to date, Belgium has not ratified the Article 6 amendment.

Options to overcome the London Protocol's transboundary CO_2 transport restriction have been explored in the literature. For example, the IEA has suggested several possible approaches that contracting parties could take in an effort to address the London Protocol Article 6 issue. These include:

> "1. an interpretative resolution based on the general rule of interpretation;
> 2. resolving to provisionally apply the 2009 amendment;
> 3. subsequent agreement between contracting parties (bilateral or multilateral);
> 4. modification of the operation of relevant aspects of the London Protocol as between two or more contracting parties; and
> 5. suspension of the operation of relevant aspects of the London Protocol as between two or more contracting parties".[34]

However, there is a lack of consensus as to how the London Protocol problem can be effectively addressed in absence of an operative amendment to Article 6. As opined by Richard Macrory et al., any attempted alternative remedies would remain 'suspect' under international law.[35]

However, if the Rotterdam Nucleus case is to proceed, then project parties (governments, operators, investors) would need comfort in the least, and certainty at the most, that the transboundary transport of CO_2 would not be in contravention to international law, particularly as the three countries contemplated by the Pilot Case are London Protocol signatories.

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[32] International Energy Agency (IEA), 'Carbon Capture and Storage and the London Protocol: Options for Enabling Transboundary CO2 Transfer' (Working Paper) (Paris: OECD/ IEA 2011) <www.iea.org/publications/freepublications/publication/CCS_London_Protocol.pdf>.

[33] Chiara Armeni, 'Legal Developments for Carbon Capture and Storage under International and Regional Marine Legislation' in Ian Havercroft, Richard Macrory and Richard B Stewart (eds), *Carbon Capture and Storage: Emerging Legal and Regulatory Issues* (Hart Publishing 2011) 145, 152 (footnote citation omitted).

[34] International Energy Agency (IEA), 'Carbon Capture and Storage and the London Protocol: Options for Enabling Transboundary CO2 Transfer' (Working Paper) (Paris: OECD/ IEA 2011) 14 <www.iea.org/publications/freepublications/publication/CCS_London_Protocol.pdf>. The IEA is due to release an update on options for overcoming the London Protocol restriction in 2017.

[35] Richard Macrory and others, UCL Carbon Capture Legal Programme, 'SCCS CO2-EOR JIP Legal Status of CO2 – Enhanced Oil Recovery' (2013) <www.sccs.org.uk/images/expertise/reports/co2-eor-jip/SCCS-CO2-EOR-JIP-WP6-Legal.pdf>.

1.6 National Level

At the national level of energy law and policy, risks can be found at the capture, transport and storage phases of the CCS value chain.

1.6.1 Transport and Storage - CO_2 Leakage

CO_2 leakage at any part of the CCS value chain could give rise to several liabilities. These include civil liabilities (e.g., litigation by third parties against the pipeline operator and/or CO_2 suppliers), administrative liabilities arising from breach of environmental laws and emissions trading (EU-ETS) liability.[36]

In the literature, much of the focus on risks associated with CO_2 leakage is concentrated on the storage phase, as the potential magnitude of liability exposure from storage (civil, administrative and EU-ETS) is considered the key risk of CCS.[37] This is a long-term liability risk that would need to be agreed between industry and government, with the liability exposure being allocated accordingly among stakeholders.

The EU-ETS liability has been highlighted as a particular long-term concern for storage operators.[38] Where CO_2 leakage occurs, operators would be required to relinquish allowances. As the carbon price is not set, where it increases over time, the operator's quantum of liability exposure would increase accordingly.[39] Moreover, as the risk of CO_2 loss of containment could be comprehensive, *in theory*, the magnitude of the liability could be unlimited. (Research suggests the *reality* is amount of leakage from storage is likely to be small.)[40]

How these risks exposures would be allocated among the stakeholders would need to be determined in contract, through mechanisms such as indemnification. Who has the risk and with whom it would be shared would depend on where risk is transferred along the CCS value chain, which is currently an unknown for the pilot case.

1.6.2 Capture, Transport and Storage – Financial Incentives and Legal Certainty

The need for governments to incentivize investment in the CCS industry through financial mechanisms and by establishing certainty of CCS policies and fiscal regimes has been explored

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[36] Ian Havercroft and Richard Macrory, *Legal Liability and Carbon Capture and Storage: A Comparative Perspective* (Global CCS Institute Ltd 2014); Chris Clarke, 'Long-term Liability for CCS: Some Thoughts about Specific Risks, Multiple Regimes and the EU Directive', Ian Havercroft, Richard Macrory and Richard B Stewart, *Carbon Capture and Storage: Emerging Legal and Regulatory Issues* (Hart Publishing 2011) 179.

[37] *See, e.g.,* IEA, '20 years of Carbon Capture and Storage' (2016) 43 www.iea.org/publications/freepublications/publication/20YearsofCarbonCaptureandStorage_WEB.pdf; Parliament of Australia, House of Representatives Committee, Standing Committee on Science and Innovation, *Between a rock and hard place: The science of geosequestration* (Commonwealth of Australia August 2007) chapter 5.

[38] See, e.g., ROAD CCS, 'Permitting Process: Special report on getting a CCS project permitted' (January 2013) <http://hub.globalccsinstitute.com/sites/default/files/publications/94946/permitting-process-special-report-getting-ccs-project-permitted.pdf>.

[39] Ian Havercroft and Richard Macrory, *Legal Liability and Carbon Capture and Storage: A Comparative Perspective* (Global CCS Institute Ltd 2014).

[40] *See, e.g.,* IEA, '20 years of Carbon Capture and Storage' (2016) 43 www.iea.org/publications/freepublications/publication/20YearsofCarbonCaptureandStorage_WEB.pdf.

widely in the literature.[41] Policy certainty is required for long-term project financing, and investment.[42] As explained by Allan Baker, Global Head of Power at Societe Generale, in the IEA's *20 Years of Carbon Capture and Storage*:[43]

> "While there has been some evident financial support for CCS, this has been sporadic and subject to changing economic or political priorities. This was starkly illustrated by the UK Government termination of the CCS Commercialisation Competition immediately prior to final bids from the shortlisted projects. The apparent failure of CCS to make it into the core energy policy in any meaningful way is more damaging to the prospects of financing large-scale projects. This, combined with the cost and complexity of the larger projects, leaves the finance community questioning whether the sector will develop in a financeable form – from a policy perspective the impression is that CCS is in the 'too difficult' box".

Fiscal incentives, such as grants and tax breaks may be required to encourage investment both for construction and operations.[44]

1.6.3 Transport– Risks of CO_2 Pipelines

Although commercial scale CCS has not yet been realized in the EU, the risks from CO_2 transport, as observed by the European Commission, are not considered to be an unknown: "The risks entailed in transport of CO_2 are no higher than those of the transport of natural gas or oil and there have been no events or suggestions to warrant any change in current regulations".[45] This suggests,

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[41] *See, e.g.,* IEA, '20 years of Carbon Capture and Storage' (2016) <www.iea.org/publications/freepublications/publication/20YearsofCarbonCaptureandStorage_WEB.pdf>; Poyry Management Consulting (UK) Ltd, 'Options to Incentivise UK CO2 Transport and Storage' (May 2013) <www.thecrownestate.co.uk/media/389727/ei-options-to-incentivise-uk-co2-transport-and-storage.pdf>; Heleen de Coninck and Sally M Benson, 'Carbon Dioxide Capture and Storage: Issues and Prospects' (2014) 39 The Annual Review of Environment and Resources 243.

[42] IEA, '20 years of Carbon Capture and Storage' (2016) <www.iea.org/publications/freepublications/publication/20YearsofCarbonCaptureandStorage_WEB.pdf> accessed 15 November 2016.

[43] IEA, '20 years of Carbon Capture and Storage' (2016) 94 <www.iea.org/publications/freepublications/publication/20YearsofCarbonCaptureandStorage_WEB.pdf> accessed 15 November 2016.

[44] IEA, '20 years of Carbon Capture and Storage' (2016) <www.iea.org/publications/freepublications/publication/20YearsofCarbonCaptureandStorage_WEB.pdf> accessed 15 November 2016; Poyry Management Consulting (UK) Ltd, 'Options to Incentivise UK CO2 Transport and Storage' (May 2013) <www.thecrownestate.co.uk/media/389727/ei-options-to-incentivise-uk-co2-transport-and-storage.pdf>.

[45] European Commission, 'Report on review of Directive 2009/31/EC on the geological storage of carbon dioxide Accompanying the document Report from the Commission to the European Parliament and the Council, Climate action progress report, including the report on the functioning of the European carbon market and the report on the review of Directive 2009/31/EC on the geological storage of carbon dioxide (required under Article 21 of Regulation (EU) No 525/2013 of the European Parliament and of the Council of 21 May 2013 on a mechanism for monitoring and reporting greenhouse gas emissions and for reporting other information at national and Union level relevant to climate change and repealing Decision No 280/2004/EC, under Article 10(5) and Article 21(2) of the Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emissions allowance trading within the Community and amending Council Directive 96/61/EC and under Article 38 of Directive 2009/31/EC of the European Parliament and of the Council on the geological storage of carbon dioxide)' (Brussels, 18.11.2015) (COM(2015) 576 final) 7.

as has been noted elsewhere,[46] that the regulation and risk allocation of CO_2 pipelines should be analogous to upstream gas pipelines.

The CCS Directive, which largely concerns CO_2 storage, includes provisions that address CO_2 transport, such as access of third parties to transport infrastructure (Article 21), and transboundary cooperation for CCS infrastructure by Member States (Article 24). The analogy of CCS to natural gas pipelines can also be found here, with these concepts reflecting those of the Third Energy Package's common rules for the internal market of a natural gas network.[47]

However, the CCS Directive does not comprehensively address CO_2 transport.[48] To the extent the pipeline traverses international boundaries, as contemplated in the pilot case, then agreements would need to be arranged between nations to address infrastructure installation, establish pipeline standards, et cetera.

1.7 Local Level

At the local level, public objections to CCS have been identified as a key risk for realization of CCS projects.

1.7.1 Public Opinion as a Risk to CCS Development[49]

The primary risk at the local level is failure to obtain support for CCS activities of the local community. Research suggests that populace objections to CCS in Europe have concerned CO_2 storage, particularly onshore storage. [50] For example, community objections have been cited as the influencing factor for the cancellation of the Barendrecht project in the Netherlands, [51] and the Janschwalde project in Germany,[52] both of which entailed onshore storage of CO_2.

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[46] Martha M Roggenkamp and Avelien Haan-Kamminga, 'CO2 Transportation in the European Union: Can the Regulation of CO2 Pipelines Benefit from the Experiences of the Energy Sector?' in Ian Havercroft, Richard Macrory and Richard B Stewart, *Carbon Capture and Storage: Emerging Legal and Regulatory Issues* (Hart Publishing 2011) 107.

[47] UCL Carbon Capture Program, 'CO2 transportation for storage: Regulatory regimes—European and Regional—The CCS Directive' < www.edwardianconsultants.co.uk/UCLNEW2/ccstransport-europe-CCS.php>.

[48] UCL Carbon Capture Program, 'CO2 transportation for storage: Regulatory regimes—European and Regional—The CCS Directive' < www.edwardianconsultants.co.uk/UCLNEW2/ccstransport-europe-CCS.php>.

[49] In the context of the GATEWAY project, information on public opinion can be found in GATEWAY Deliverable 2.1 ('Review of European public perception studies pertaining to CO2 transport') and Deliverable 2.4 ('Design for assessing public perception of the Pilot Case') both led by Forschungszentrum Juelich GmbH.

[50] Max Prangnell, '*Communications for Carbon Capture and Storage: Identifying the benefits, managing risk and maintaining the trusts of stakeholders'* (Global CCS Institute February 2013) <http://hub.globalccsinstitute.com/sites/default/files/publications/92266/communications-carbon-capture-storage.pdf>; Ragnar Lofstedt, Effective risk communication and CCS: the road to success in Europe' (2015) 18(6) Journal of Risk Research 675.

[51] Milieu, 'Identification of future CO2 infrastructure networks' (November 2015, Report for the European Commission ENER/B1/FV2014-731/SI2.639451).

[52] Max Prangnell, '*Communications for Carbon Capture and Storage: Identifying the benefits, managing risk and maintaining the trusts of stakeholders'* (Global CCS Institute February 2013) <http://hub.globalccsinstitute.com/sites/default/files/publications/92266/communications-carbon-capture-storage.pdf>.

Research of public perceptions of the transport phase of CCS is limited.[53] Findings of one study showed greater public concern about storage transport of CCS (in populated areas).[54] However, a 'not in my backyard' (NIMBY) effect was observed when the scenario of living near CO_2 pipelines was posed (but findings showed respondents were more accepting of living near CO_2 pipelines than natural gas pipelines).[55]

The Rotterdam Nucleus pilot case contemplates CO_2 transport from industrial areas and in regimes where petroleum transportation (e.g., UK North Sea) is well established for offshore storage. Thus, it is reasonable to assume public concern as to the CO_2 transportation component would be reduced, with minimal impact on residential areas (and hence a reduced risk of the NIMBY effect). Yet, given the stigma that CCS has experienced in some parts of Europe, stakeholders may wish to minimize public concerns by educating the public about CCS and its activities. (It is noted that environmental impact assessment (EIA) can be required (either automatically or by imposition) for certain CCS activities, including CO_2 pipelines, which would include public engagement.)[56]

1.8 Value Chain Integration

Research suggests that the integration of the CCS value chain also presents risks, in particular with management of value chain interfaces, dependencies and the transfer of liabilities across multiple value chain operators.[57] Integration management includes issues such as determining CO_2 specifications (e.g., purity) and flow rates and allocation of financial and contractual risks.[58]

1.9 Risk Allocation

As explored above, an international CCS project of the scale of the Rotterdam Nucleus would require that several types of risks are addressed at different stages in the project's development. These risks include:

- Legal uncertainty at the international level of law (i.e., London Protocol Article 6 restriction)
- CO_2 leakage liability
- Fiscal and policy uncertainty at the national level
- Public objection to project development
- Allocation of risks across the CCS value chain

[53] Elisabeth Dutschke, 'Differences in the public perception of CCS in Germany depending on CO2 source, transport option and storage location' (2016) 53 International Journal of Greenhouse Gas Control 149.
[54] Lasse Wallquist and others, 'Public acceptance of CCS system elements: A conjoint measurement' (2012) 6 International Journal of Greenhouse Gas Control 77.
[55] Lasse Wallquist and others, 'Public acceptance of CCS system elements: A conjoint measurement' (2012) 6 International Journal of Greenhouse Gas Control 77.
[56] Meyric Lewis and Ned Westaway, 'Public Participation in UK CCS Planning and Consent Procedures' in Ian Havercroft, Richard Macrory and Richard B Stewart, *Carbon Capture and Storage: Emerging Legal and Regulatory Issues* (Hart Publishing 2011) 277; Directive 85/337/EC; Directive 2009/31/EC.
[57] Olafr Rosnes and others, 'A methodology for value chain assessment of CCS projects' (2011) 4 Energy Procedia 2478.
[58] Martin Oettinger, 'CCS Project Integration: IEAGHG Summer School – Panel Discussion' (2012) <www.ieaghg.org/docs/General_Docs/Summer_School/2012/6IntroPanel_Discussion_Project_Integration_MOSEC.pdf>.

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These issues were explored in the stakeholder interviews, which are presented in the following sections of this paper.

2 METHODOLOGY

Following the literature review, six hypotheses were developed to assess perspectives on risk allocation at each layer of law in the Rotterdam Nucleus case. The hypotheses, including a description/rationale for the hypothesis, questions posed to each participant and expected outcome of hypothesis testing are presented in Table 2.

The hypotheses were tested through semi-structured interviews, which were conducted with representatives from government, industry and academia. A list of organisations who participated is presented in Appendix 2.

Potential research participants were identified following engagements with stakeholders at two GATEWAY stakeholder meetings held in November 2015 and September 2016,[59] interactions with stakeholders at CCS events in the UK and Europe and informed by the literature review conducted for this work and for GATEWAY deliverable 3.1.[60] Seventeen participants were invited to interview.[61] Participants were informed their responses would be reported anonymously. The research interviews were approved by QMUL's ethics committee.

Ten semi-structured interviews were conducted via telephone and lasted between 23 and 60 minutes, with the average time being 43 minutes. The participants were asked to identify whether they agreed or disagreed with the hypothesis statement presented in hypotheses 1 to 5 and to explain their responses. Additional questions were asked as needed to clarify or further explore points. Hypothesis 6 was investigated through more open ended questions designed to elicit key stakeholder concerns.

Interviews followed usual qualitative data collection techniques. The questions asked of each participant (exclusive of follow up/clarification questions) are presented in Table 3.

Transcripts were typed during each interview. The transcripts were reviewed and data was entered into an Excel spreadsheet and coded as follows:

- Yes (agreed with hypothesis)
- No (disagreed with hypothesis)
- Yes(Q) (conditionally agreed with hypothesis)
- No(Q) (conditionally disagreed with hypothesis)

Data was then reviewed to identify themes against each hypothesis and to identify where key concerns lie which could be, or should be, addressed through contractual mechanisms.

[59] See Appendix 3.

[60] GATEWAY Deliverable 3.1 presents a legal analysis concerning four alternative scenarios for the Pilot Case. The legal analysis categorises the law into three levels – international, national and local – and considers the four scenarios in light of these three levels of law.

[61] One declined, citing intellectual property concerns (i.e., not wishing to disclose views that the participant could use for business purposes), one had to postpone the interview due to a scheduling conflict and one referred us to a colleague who participated instead.

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Table 2. List and categorization of hypotheses.

No.	Hypothesis	Risk Category	Description	Prediction
1.	**The London Protocol article 6 amendment is a barrier to investment in, and development of, the Rotterdam Nucleus expansion scenarios.**	International	Under Article 6 of the London Protocol, signatories are prohibited from the transboundary export of waste for disposal at sea, which includes CO_2. The countries contemplated in the GATEWAY pilot case (UK, the Netherlands and Belgium) are London Protocol parties. An amendment to Article 6 has been proposed and ratified by some parties, however, the amendment is not yet effective, as it still requires the necessary number of signatures from London Protocol parties. While the UK and the Netherlands have ratified the amended Article 6 of the London Protocol, it is noted that, to date, Belgium has not ratified the Article 6 amendment.	It is expected Hypothesis 1 will be supported by all stakeholder categories.
2.	**The magnitude of risk exposure of CO_2 leakage from geological storage is an unacceptable risk for Industry stakeholders, which government needs to address.**	National	Where a leakage occurs from storage, project parties could have liability exposures from third parties and government (including EU-ETS exposures). These liability exposures could be unrestricted or unlimited, unless governments cap liability. Certainty of these risk exposures will be required in order for government to attract investment.	It is expected Hypothesis 2 will be supported by all stakeholder categories.
3.	**The risks associated with transportation of CO_2 via pipeline in the Rotterdam Nucleus base case and expansion are analogous to those posed by natural gas pipelines, and as such, the risks of CO_2 transport can be treated in a similar manner contractually.**	National	Although commercial scale CCS is a relative novelty, the risks from CO_2 transport are not greater than those of natural gas or oil transportation, which are established EU industries. Thus, the regulation and risk allocation of CO_2 pipelines should be analogous to upstream gas pipelines, with natural gas pipeline contracts and their risk allocations serving as the basis for CO_2 transport contracts.	It is expected Hypothesis 3 will be supported by all stakeholder categories.
4.	**The lack of certainty in government policies and fiscal incentives to CCS investment, including clarity in the points of risk transfer across the CCS value chain, are a deterrent to investment in CCS infrastructure.**	National	Governments need to incentivize investment in the CCS industry (through mechanisms such as subsidies) and provide certainty of CCS policies in order to encourage investment.	It is expected Hypothesis 4 will be supported by all stakeholder categories.
5.	**For the Rotterdam Nucleus case, the risk of public objections to the project are expected to be minimal, however, clarity of how public support will be achieved is important for investment certainty.**	Local	CCS projects in some areas have been rejected by local communities, particularly where CO_2 would be stored onshore. As the Rotterdam Nucleus is an offshore storage model and transportation is through currently existing industrial areas, the risk of public objection is expected to be low. Yet, project stakeholders will want to ensure minimal public objections occur to enable project success. This assurance could be obtained through contractual/MOU terms that set out the actions stakeholders will undertake to engage and educate communities.	It is expected Hypothesis 5 will be supported by all stakeholder categories.
6.	**Integration of the CCS value chain will present liability concerns that the stakeholders will view differently.**	Value Chain Integration	The integration of the CCS value chain for the GATEWAY Project could present issues of concern for project stakeholders. Understanding these value chain concerns are important for developing contract terms and conditions.	It is expected Hypothesis 6 will be supported by all stakeholder categories.

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Table 3. List of standard interview questions.

No.	Hypothesis	Questions
1.	**The London Protocol article 6 amendment is a barrier to investment in, and development of, the Rotterdam Nucleus expansion scenarios.**	• Do you agree or disagree with this hypothesis? Please explain why.
		• If the article 6 amendment is not enacted, what action would you like to see governments take to address this issue?
2.	**The magnitude of risk exposure of CO_2 leakage from geological storage is an unacceptable risk for Industry stakeholders, which government needs to address.**	Do you agree or disagree with this hypothesis? Please explain why.
3.	**The risks associated with transportation of CO_2 via pipeline in the Rotterdam Nucleus base case and expansion are analogous to those posed by natural gas pipelines, and as such, the risks of CO_2 transport can be treated in a similar manner contractually.**	Do you agree or disagree with this hypothesis? Please explain why.
4.	**The lack of certainty in government policies and fiscal incentives to CCS investment, including clarity in the points of risk transfer across the CCS value chain, are a deterrent to investment in CCS infrastructure.**	• Do you agree or disagree with this hypothesis? Please explain why.
		• With regard to the Rotterdam Nucleus, do you have any specific concerns?
5.	**For the Rotterdam Nucleus case, the risk of public objections to the project are expected to be minimal, however, clarity of how public support will be achieved is important for investment certainty.**	Do you agree or disagree with this hypothesis? Please explain why.
6.	**Integration of the CCS value chain will present liability concerns that the stakeholders will view differently.**	• Where do you see the legal issues for CCS across the value chain?
		• Which do you see as being the problem/troublemaker?
		• Are there any other legal hurdles to CCS that you think we have not covered?

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3 RESULTS, ANALYSIS AND RECOMMENDATIONS

3.1 Results

The results of stakeholders' agreement or disagreement with Hypotheses 1 – 5, are presented in Table 4. As can be seen in the table, stakeholders' viewpoints were largely aligned across most hypotheses. The greatest differences in opinion were observed in the resolution of the London Protocol hypothesis. Overall, and as can be observed in the analysis to follow, the results suggest a willingness of the CCS sector to engage and collectively find a solution to these challenges.

Table 4. Stakeholders' agreement/disagreement with hypotheses.

	Hypotheses				
	International	National			Local
Category	1	2	3	4	5
Government	No(Q)	Yes	Yes	No(Q)	Yes
Industry	Yes	Yes	No	Yes	Yes
Industry	No(Q)	Yes	Yes	Yes	Yes
Industry	No	Yes	Yes	Yes	Yes(Q)
Industry	Yes(Q)	Yes	Yes	Yes	Yes
Industry	Yes(Q)	Yes	Yes	Yes	-
Industry	Yes	Yes	Yes	Yes	Yes(Q)
Industry	Yes	Yes(Q)	Yes(Q)	Yes	Yes(Q)
Research	Yes	Yes	Yes	Yes	Yes
Research	Yes	Yes	Yes	Yes	Yes

3.2 Analysis and Recommendations

In this section, information recorded and insights gained from participant interviews regarding risks and risk allocation for international CCS projects and views of the GATEWAY pilot case are presented. As the purpose of this deliverable is to identify potential standard terms and conditions for international CCS contracts, recommendations are made for addressing identified risks contractually, which address concerns raised by interviewees. These standard contract terms are presented in the context of memoranda of understanding and contracts.

It is reasonable to expect stakeholders would seek certainty on how these risks could and would be addressed before investment was undertaken. Thus, where clarity is required to guide subsequent contract negotiations, parties may wish to enter into memoranda of understanding, the outcomes and risk allocation of which would be memorialized in a subsequent contract.

A memorandum of understanding (also known as a letter of intent) is:

> "A document that sets out the main terms of an agreement between two or more parties and their intention to enter into a binding contract once certain details have been finalized. A letter of intent

> is not itself a formal contract but certain of its provisions (e.g. concerning payment for any work completed) may nevertheless be enforceable…."[62]

Addressing these items may be done in parallel or consecutively. For example, governments could seek to rectify the London Protocol matter in parallel to operators negotiating pipeline and CO_2 supply contracts, with the resolution of the treaty level matter being a condition precedent for effectiveness of the project contract.

The structuring and timing of the contracts would be a commercial decision that would ultimately be influenced by the project's participants. However, the present research explores anticipated concerns and identify contractual means to address these issues, with standard terms and conditions that may be relevant for non-binding MOUs and/or binding contracts. The overall result of the data analysis and recommendations are presented in Table 5.

3.3 Issues at the International Layer of Energy Law and Policy

3.3.1 Hypothesis 1 – London Protocol

Hypothesis 1, which explored a legal risk at the international level of law, stated that the London Protocol Article 6 amendment is a barrier to investment in, and development of, the Rotterdam Nucleus expansion scenarios. Interviewees' support for hypothesis 1 was split. These views could be categorized in two ways: 1) vocalizing that yes, the London Protocol prohibition is a serious issue that must be addressed as the legal uncertainty creates investment uncertainty (i.e. it is a potential 'showstopper'); or 2) it is merely one of many issues in a CCS project, which could be overcome.

The opinion of all was that ratification of the London Protocol Article 6 amendment was the best course of action, which would provide absolute legal certainty. However, many of interviewees (being those who expressed no, qualified no and qualified yes) opined that the hurdle could be overcome by means outside the London Protocol itself (e.g., through a bilateral or multilateral agreement among countries participating in the Rotterdam Nucleus case). This view is one of 'where there is a will there is a way', and governments could find solutions to deliver CCS if it is made a priority. One interviewee (Category Industry) explained that absolute legal certainty was not always a guarantee for any project (as there are often shades of grey), and final investment decisions would depend on the facts and commercial issues of a specific project. Another interviewee (Category Industry) explained:

> Is it a barrier today? It's not a reason people are not going through with projects, but there are many other barriers to be addressed. There are many issues for projects… I would say [to government] 'please sort it out', whether it's the [European] Commission or whoever. But otherwise we can get around it. When we have a project, we'll go to government and seek approval to take the CO_2 cross boundary.

The contrary view of other interviewees coincided with that of Richard Macrory et al. (2013), [63] which is that any attempted resolution short of ratification of the Article 6 amendment by the

[62] Jonathan Law (ed), *Oxford A Dictionary of Law (8th ed.)* (OUP 2015).

[63] Richard Macrory and others, UCL Carbon Capture Legal Programme, 'SCCS CO2-EOR JIP Legal Status of CO2 – Enhanced Oil Recovery' (2013) <www.sccs.org.uk/images/expertise/reports/co2-eor-jip/SCCS-CO2-EOR-JIP-WP6-Legal.pdf>.

necessary number of London Protocol parties would leave uncertainty that would prohibit transboundary CCS projects.

For example, one interviewee (Category Research) commented that resolution of the London Protocol restriction may not happen in time for the Rotterdam Nucleus case to proceed (assuming development was imminent), particularly as the interviewee's opinion was that ratification of the Article 6 amendment was necessary for transboundary CCS, which would take time and was not a certainty.

Another stakeholder (Category Industry) voiced that the London Protocol's transboundary CO_2 transport restriction could in fact be a showstopper for transboundary projects (such as the Rotterdam Nucleus case), particularly where private financing would be required. This was due to banks being hesitant to provide money where a legal obstacle that could stop a project is present. Finally, one interviewee (Category Research) commented that the London Protocol issue needs to be resolved as it creates uncertainty and CCS faces enough uncertainty already.

Resolution of the London Protocol restriction was clearly viewed by interviewees as being the responsibility of governments. When asked how governments should resolve the issue, opinions were mixed, but the common theme was that governments must take action if transboundary CCS projects are to proceed in Europe. In the Rotterdam Nucleus case, this action would need to be taken by the UK, the Netherlands and Belgium.

Some interviewees suggested specific solutions such as:

- Governments setting a target date (2022) at which the amendment should be enacted, with CCS governments pushing others to agree.
- The European Commission taking a lead to encourage countries to enact the Article 6 amendment on the basis that if CCS is to be unlocked in Europe with transboundary transport, then resolution of the London Protocol issue is essential. The discussion included the possibility of the PCI scheme as being a catalyst for the European Commission to engage and encourage countries to act.

One interviewee (Category Industry) commented that Belgium had not signed the Article 6 amendment (unlike Norway, the UK and the Netherlands), which could be a further hurdle to be overcome to enable exportation of CO_2 from Belgium (which it is noted is contemplated in the expansion of the Rotterdam Nucleus pilot case).

3.3.1.1 Recommendations

Generally, it was acknowledged that the London Protocol restriction is a project risk which could be resolved by governments. But, it is a risk that may take time to resolve. Thus, work could proceed on a project in parallel to the London Protocol matter being concluded, with a final investment decision for the CCS project depending on resolution of this legal matter.

From a contractual perspective, it is recommended that the Rotterdam Nucleus countries agree a way forward to resolve this matter through an MOU. Project parties may wish to include a similar obligation/condition precedent upon government to encourage government to act. It would be reasonable to include resolution of the London Protocol issue as a condition precedent in contracts

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to enable a contract exit in the event legal certainty is not achieved to the standard required by project participants.

Government action could be delivered in accordance with the timeframe suggested by one interviewee (2022 deadline). In addition, as suggested by another interviewee (Category Industry), the European Commission could take a lead in encouraging Member States (who are parties to the London Protocol) to ratify the Article 6 amendment. Moreover, European Commission involvement could be driven by PCI funding, as success of transboundary CCS projects will require a resolution of the London Protocol obstacle.

3.4 Issues at the National Level of Energy Law and Policy

At the national level of energy law, several issues were explored in the investigations of Hypothesis 2, Hypothesis 3 and Hypothesis 4:

1) magnitude of risk exposure from geological storage;

2) identification of a suitable regime for regulation of CO_2 transport; and

3) value chain integration and certainty of government fiscal incentives to encourage investment.

In this section, the comments of interviewees with regard to Hypothesis 2, Hypothesis 3 and Hypothesis 4 are explored. As these hypotheses present overlapping issues, the recommendations for these issues at the national level of energy law are presented collectively in section 3.4.4.

3.4.1 Hypothesis 2 – Magnitude of Risk Exposure from Geological Storage

Hypothesis 2 stated that the magnitude of risk exposure of CO_2 leakage from geological storage is an unacceptable risk for Industry stakeholders, which government needs to address. Hypothesis 2 was supported by all interviewees. Notably, many interviewees made a distinction between actual risk (of leakage from geological storage) and regulatory risk, with the latter being unreasonable given the former. Some comments from interviewees included:

- The CCS Directive creates tremendous risk exposure that industry cannot accept.
- The definition of leakage is a concern.
- We need a storage liability we can quantify.
- The probability of leakage outside the storage site and harm to environment is just about zero. But the penalty of leakage is unquantifiable but potentially huge…For Operator, if [you] put methane in[to the] ground for storage, or with nuclear with water, [then you are] not penalized. But inject CO_2 and you get killed for it from a liability perspective. The reality is as operator, you would never choose a reservoir that would leak.
- In the first stages of the development of storage, this is a particular issue. Governments want to see CCS develop in countries and should share the risk…Everyone says storage is safe, so why focus on the worst case? Even if leakage occurs, it can be mitigated and stopped…So, governments should be proactive and share the risk. Then later, when a few projects have been delivered and there is evidence storage is safe, insurance companies will be willing to underwrite the risk.
- Risk exposure should be separated into real – risk to people and property – and invented – risk from EU-ETS and other commercial mechanisms. The real risks are minimal and

> should be addressed via business as usual best practice engineering and management. Invented risks should be removed to incentivized CO_2 storage without punitive penalty which acts as an artificial barrier to CCS and perversely means that an emitter who pays a fine to pollute carries less risk. Parties who emit significant CO_2 amounts through negligence should be dealt with as a different case…An analogy should be made with methane leakage from UK natural gas systems and how parties are treated, where a certain amount of leakage is accepted and parties are incentiv[ised] to reduce leakage, rather than give a 100% target and be disproportionately punished for small leaks.

One interviewee (Category Industry) questioned the idea that liability could be unlimited under the CCS Directive, noting that UK law prohibited listed companies from having unlimited liability exposures. However, this would only be where one assumes that the company operating the CCS infrastructure would be a listed company. In many ways this debate over liability draws resonance with the nuclear liability debates in the nuclear energy sector.[64]

It is important to note here that while the liability associated with storage was identified as an unacceptable risk, not all interviewees considered it to be the greatest risk or even an insurmountable risk. One interviewee (Category Industry) stated the greatest risk was across the value chain and ensuring the business case is robust.

Another interviewee (Category Government) opined that the liability risk of storage was not the main deterrent to CCS development and that it was an exaggerated concern. Further, the latter interviewee explained that as everyone says storage is safe, it was not clear why there was a focus on the worst case, and even if leakage occurred it could be stopped or mitigated (and therefore the worst case scenario would not be realized).

3.4.2 Hypothesis 3 – Transport of CO_2 via Pipelines as Analogous to Natural Gas Pipelines

Hypothesis 3 stated that the risks associated with transportation of CO_2 via pipeline in the Rotterdam Nucleus base case and expansion are analogous to those posed by natural gas pipelines, and as such, the risks of CO_2 transport can be treated in a similar manner contractually. Stakeholders largely agreed with the hypothesis, with most commenting that natural gas pipeline regulation is a good reference point.

Comments of those who agreed included:

- Absolutely agree. It's another gas. You have so many moving gas pipelines around the Rotterdam Area that CO_2 is just another gas…But the problem with CO_2 is that there is not a norm for it [as opposed to natural gas]. There is not calculable risk. So it is difficult to get CO_2 transportation permitted…Permitting will be an issue where transporting CO_2 when there is existing infrastructure…Risk calculations for CO_2 pipelines don't exist, so can't assess, so can't permit…If build from Antwerp on virgin land, then okay. But, if lay against other existing infrastructure, how you do leakage calculations and how you import will be an issue.

[64] For a recent analysis on nuclear liability and its relationship to non-nuclear sectors see: Raphael Heffron and others, The Global Nuclear Liability Regime Post Fukushima Daiichi. *Progress in Nuclear Energy* 90 (July 2016), 1.

- We have standards—oil and gas industry has established standards—but trouble with CO_2 is it is not an energy containing gas. It's a waste product or byproduct. The closest we have is OCAP which is not high pressure transport. There's no legislation for laying CO_2 pipes. It's a chicken and egg thing. You need to have an industry before you can regulate it, but you're trying to regulate an industry that does not exist. So, we're making sure nothing happens.
- Yes, it is a logical place to start. But clearly when you get to the technical details there will be differences as it is not methane.
- In general, that's right. Risk and risk allocation would work in same way. But CO_2 does have different physical properties [which requires different flow]…The operation may be different because of the different properties.
- There are other technical things…[such as] storage operators like steady flow whereas plant operators [emitters] merrily turn supply on and off so you would need something in the middle to work like a buffer…It is a very strange thing to be penalized because of lost value for lack of a product. But here, you do not want to be penalized. Supply must be encouraged. So expect we will end up with different partnerships rather than service agreements between players…Transporter has to overbuild capacity then people can take away whenever they want. If you cut back, say, 20%--plant owner says 'no, I have an on/off button, not a 20% or 40% button. If you constrain me, then it's turned off. So approach to this is different than to gas transportation.

Thus, while natural gas frameworks could be a logical reference point for CO_2 transport contracts and regulations, the design of contracts and commercial structures would need to account for the technical differences between CO_2 and natural gas.

The views of the industry interviewee (Category Industry) who disagreed with the idea that natural gas pipelines were an appropriate reference point for CO_2 transportation, concerned the liability, safety and environmental regime of natural gas. That is, CO_2 does not present the explosive risk as that of methane and therefore the natural gas regime would be too stringent for CO_2 transport networks. The interviewee's view was that, instead, CO_2 transport should be analogized to transport of water via pipeline (which is also pressurized but does not have an explosive risk), perhaps more so than natural gas. Moreover, natural gas has an explosive risk and yet it is connected to people's homes (contrary to CO_2).

The suggestion that water transport would be a more appropriate reference point than natural gas for a CO_2 regulatory and legal framework was explored with other participants. The logic was acknowledged by the majority of interviewees across the three stakeholder categories who could see its relevance and, in some cases, its potential.

3.4.3 Hypothesis 4 – Lack of certainty in government positions, including interconnectivity of CCS value chain

Hypothesis 4 states that the lack of certainty in government policies and fiscal incentives to CCS investment, including clarity in the points of risk transfer across the CCS value chain, are a deterrent to investment in CCS infrastructure.

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The majority of stakeholders across the three stakeholder categories agreed with this hypothesis. Largely, their comments centred on the need to understand the government business case for the value chain and recognition that CO_2 is a waste product that does not have value. Understanding of business case also includes how project rates of return are structured along with whether or not there are multiple operators across the value chain or one operator. These influence the cross value chain risk, that is, if a project is funded through capital expenditure with, for example, a 15 year rate of return, then there is a cross default risk across the value chain for that duration.

The one stakeholder who disagreed with the hypothesis did so with a qualification—that it is a lack of a business case that is the primary deterrent to CCS. Arguably, that is what the lack of certainty in government policies and fiscal incentives to CCS investment is—a lack of a business case. And so, this respondent's data was recorded as a qualified no.

Another interviewee commented that government incentives do not have to be fiscal only, but could also include reducing project participants' risk exposure in the CCS value chain. The example given was a case in Norway in which the government agreed to act as the 'middle man', with responsibility for connecting CO_2 suppliers (emitters) with storage.

Most respondents did not identify specific concerns about the Rotterdam Nucleus case. However, one stakeholder commented that there was a need to show the scale of storage in the pilot case, as identifying certainty and growth in storage would be needed to attract industry investment. Here, again, the onus is placed on the government which "needs to show a plan for storage appraisal and how it will be rolled out".

3.4.4 Recommendations

Value Chain

From a contractual perspective, risk allocation must be considered within each phase of the CCS value chain (capture, transport and storage) as well as across the value chain. However, allocation of risk at a contractual level cannot be determined before understanding the business structures intended by government. And while the risks and liability exposures found in the storage phase seemed to be a greater concern for interviewees than the transport phase, it was generally acknowledged that appropriate risk transfer and coordination across the value chain are issues that governments need to address. This includes the need for clarity of governments' intended role in risk sharing, definition of the CCS business model and certainty of government-provided incentives (whether fiscally or though risk sharing).

Thus, it is recommended that the governments in the Rotterdam Nucleus case determine the commercial structures that will be the foundation of the CCS project. That is, how will risk be shared between government and the private project participants? For example, would it be the case that government acts as a 'middle man' as noted in the Norway example by one participant? And, if so, how would that work in an international project? Moreover, where the government acts as an intermediary or 'middle man' sovereignty waivers may need to be considered, in the event of a lawsuit against project parties arising from a fault (e.g., negligence) of a sovereign government. In addition, how would cost exposure be addressed for risks that are uninsurable, such as long term liability exposures of storage?[65] The terms and conditions of the contract would

[65] Behdeen Oraee-Mirzamani, Tim Cockerill and Zen Makuch, 'Risk Assessment and Management Associated with CCS' (2013) 37 Energy Procedia 4757.

be case-specific, but understanding what the business case would be is first required. It is noted that the UK is also considering the notion of shared risk and suitable commercial structures for CCS,[66] and as such, UK developments would be pertinent to development of the Rotterdam Nucleus pilot case.

Given the complexities of having multiple operators across the value chain in an international project, it may be that having one operator would be the simplest solution. Mitigating the risk an consequences of cross default exposures in a transboundary CCS project would need to be factored into structuring contract terms and conditions across the value chain, however, this could not be sufficiently considered until the business case is known.

Transport Contracts

With regard to a reference point for developing CO_2 transport regulation and contracts, the majority of interviewees saw the natural gas regime (contractual and regulatory) as the logical starting point. However, it was consistently noted by interviewees that CO_2 has different technical dynamics than natural gas which would need to be addressed, such as managing flow rate, quality, shut downs, supply, etc.

In addition, these issues would need to be considered from a transboundary perspective in which the basis for the transboundary contract would be influenced by the reference point at the national level (i.e., upstream natural gas pipelines as the contractual basis or something else, such as water). This is explored in section 3.6.2 below.

3.5 Issues at the Local Level of Energy Law and Policy

Public objection is not expected to be an issue for the Rotterdam Nucleus case. However, this does not negate the need to engage the public, and all research participants recognized the importance of public support and of having an engaged public.

3.5.1 Hypothesis 5 – Obtaining clarity of public support

Hypothesis 5 states that for the Rotterdam Nucleus case, the risk of public objections to the project are expected to be minimal, however, clarity of how public support will be achieved is important for investment certainty. All stakeholders agreed with the hypothesis statement, but opinions were mixed on steps recommended to achieve public support.

It was generally acknowledged that public support was critical for any CCS project, and understanding how that support could be achieved was important. Factors for public support were identified as the storage being offshore, that it would be in areas of existing infrastructure (and thus not impacting residential areas) and the role of CCS as a mitigation for climate change.

Here, the interviewer explored with the interviewees whether managing public engagement and gaining support was so important that it should be addressed in contract (with government and among project parties). Some comments, reflecting contrasting views on how gaining public support should be addressed include:

[66] Lord Oxburgh, 'Lowest Cost Decarbonisation for the UK: The Critical Role of CCS' (2016) (Report to the Secretary of State for Business, Energy and Industrial Strategy from the Parliamentary Advisory Group on Carbon Capture and Storage).

- Perhaps public support is such an important issue, it would not need to be contractually binding in project agreements, as project participants would do it as a matter of course.
- The GATEWAY project is a big development so clear public engagement would be required, and perhaps a more formal agreement would be good as it would enable transparency with the public which is a good thing.
- It would be difficult to put into a project contract (e.g., such as a condition precedent), as it could introduce contract uncertainty.

One interviewee (Category Industry), commented that there should be a recognition that public support is not the only issue here, but also that continued political support remains critical. This comment reveals another iteration of the need for consistent and clear government policy toward CCS.

In addition, an interviewee (Category Industry), citing the challenges of Barendrecht, commented that a scenario could occur where the Netherlands government is positive toward CCS, but there could be local resistance in the Rotterdam area. This resistance could be due to concern that the pilot case could open the door to onshore CO_2 storage in the Netherlands (as opposed to being an objection to the Rotterdam Nucleus case specifically).[67]

3.5.1.1 Recommendations:

Given the recognized importance of having public support and to minimize the risk of public objection, the project parties (both industry and government) may wish to document contractually how the public will be engaged. It is noted that environmental impact assessment (EIA) can be required (either automatically or by imposition) for certain CCS activities, including CO_2 pipelines, which would include public engagement, such as in the UK for instance.[68] While public engagement would be undertaken through the EIA process for pipeline installation, in absence of this or as a measure of additional assurance, the parties may wish to agree the strategy for these engagements contractually.

This contractual documentation of efforts to encourage public support could be made in an MOU or even in an enforceable contract. The difficulty of including this obligation in contract could be, as noted by one interviewee, determining whether the requirements have been met. As such, project parties may prefer to have the obligation in a non-binding agreement.

For the Rotterdam Nucleus pilot case, public support for the project would need to be gained in multiple locations. And, as noted by one of the interviewees, these are in areas where onshore CO_2 has been the subject of public opposition historically. While the pilot case entails offshore storage of CO_2, ensuring the public understands the intentions of the project could be essential, and messaging from both government and the project parties on this point could be necessary. The sway of public opinion may take time. Thus, the parties who would be involved in project

[67] For more information on the role of public support/opposition to CCS projects and research being explored by the GATEWAY project, see GATEWAY Deliverables 2.1 and 2.4 (led by Forschungszentrum Juelich GmbH).

[68] Meyric Lewis and Ned Westaway, 'Public Participation in UK CCS Planning and Consent Procedures' in Ian Havercroft, Richard Macrory and Richard B Stewart, *Carbon Capture and Storage: Emerging Legal and Regulatory Issues* (Hart Publishing 2011) 277.

development should undertake early public engagement. (UK and Netherlands governments in the base case, along with the Port of Rotterdam, and extending to Belgium and the Port of Antwerp, as well as operators along the value chain).

Yet, even with the suggestion of implementing a rational, contractual means to align parties in public engagement efforts, it is acknowledged that public opinion is not necessarily rational. Indeed, given the largely offshore and current corridor nature of the Rotterdam Nucleus, a lower profile approach (but not stealth) may be more successful. However, with the addition of the CAR Pipeline there may be issues with public participation in Belgium (See GATEWAY deliverable 2.1 for more information). It should be noted that the aim of the pilot case is to result in a PCI for a CO_2 transport project and a PCI aims to accelerate the planning approval process and consequently the stakeholder engagement process (see GATEWAY deliverable 4.2).

3.6 Hypothesis 6 – CCS Value Chain Integration

3.6.1 Integration of the CCS Value Chain

Hypothesis six states that integration of the CCS value chain will present liability concerns that the stakeholders will view differently. This hypothesis was not supported, as surprisingly, results revealed a general alignment among stakeholders with regard to liability concerns.

Key issues identified from discussions of this hypothesis included: liabilities of long term storage; difficulty of long term monitoring requirement under the CCS Directive; lack of a commercial business case for CCS; resolution of technical issues across value chain integration, including how it will be addressed legally and contractually. Perhaps the most common theme from discussion of this hypothesis was related to management of risks and liabilities across the value chain. As explained by one interviewee (Category Industry): It is vital that risk is *managed* across the chain and *not multiplied* across the chain.

As noted by one interviewee (Category Government), which reflects the continued optimism for CCS, “there is no particular issue [across the value chain] that cannot be overcome. There is the issue of liability and novelty of storage. This has to be tested and demonstrated that the project works and what the liability will be and then it will be accepted”. That is, once one commercial CCS project is in operation and the risks and liabilities are understood and experienced (that is, CCS is de-risked), then CCS will proceed.

Only one participant (Category Research) raised a specific concern about the liabilities of the capture phase and how they would flow across the value chain. But, this also reflects the acknowledgements elsewhere about the need to create a cohesive means of transferring risks/liabilities across the value chain.

3.6.1.1 Recommendations

The main observation from this hypothesis is that (as explored previously in this paper) clarity is required as to how the value chain will be integrated, as this will dictate the terms and conditions of contracts across the value chain. Thus, it is recommended governments in the Rotterdam Nucleus case identify what the business case for the project will be. That is, how much governments will be involved in risk sharing and the provision of investment incentives.

Unlike other CCS projects in operation (e.g., Snøhvit and Sleipner) in which the CCS value chain is based in one country and operated by one operator, the GATEWAY project is an international

project whose value chain will traverse state boundaries and may entail multiple operators across the value chain.. This introduces complexity in value chain integration that is not faced by domestic projects, and necessitates government coordination in the sharing of risks among private and public participants as well as incentives for project development.

This suggests that not only is public engagement important (as explored in Hypothesis 5) but also government engagements are important to enable international alignment for project delivery. Thus, it is recommended that governments of nations involved in the Rotterdam Nucleus case are engaged early to enable project success. And, as suggested by one interviewee (Category Industry), the European Commission could have a coordination role here.

3.6.2 Transboundary CCS and Value Chain

While the issue of the London Protocol prohibition was the primary discussion point with interviewees from an international law perspective (as testing Hypothesis 1), the countries of the Rotterdam Nucleus would need to agree means of managing the transboundary value chain of the project. This is a logical expansion of the discussions with interviewees regarding value chain integration risks (such as in Hypothesis 6 and Hypothesis 2), in which it was identified that government has a responsibility to de-risk the value chain. For example, one interviewee (Category Industry) gave the example of a project in Norway, in which the government accepted the risk of managing the middle portion of the CCS value chain (linking CO_2 suppliers with CO_2 storage).

3.6.2.1 Recommendation

Following from this logic, risk sharing among governments and private parties across the value chain in a transboundary scenario is not as clear cut. For instance, assuming government steps in to share risk, who would bear the risk for reduced CO_2 supply that would have effects across the value chain—Belgium or Norway? This would need to be established in an agreement between the Rotterdam Nucleus nations.

The Energy Charter Treaty (ECT) could serve as the basis for this agreement.[69] The ECT, is a multilateral treaty for energy cooperation, which has long been used for international pipeline agreements.[70] Application of the ECT to transboundary CO_2 transport via pipeline would concur with Hypothesis 3, which is the idea that natural gas transport provides the appropriate basis for the regulatory and contractual framework for CO_2 transport. With regard to the Rotterdam Nucleus, the United Kingdom, the Netherlands and Belgium are parties to the ECT.

3.7 Additional Issues

The inputs of interviewees were presented above to reflect the discussions had about each hypothesis. Yet, interviewees also shared insights beyond the issues explored in the hypotheses that could also be influential for the development of standard terms and conditions for CCS contracts in the future.

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[69] Energy Charter Secretariat, *Investment and Market Development in Carbon Capture and Storage: Role of the Energy Charter Treaty* (2009) <www.energycharter.org/fileadmin/DocumentsMedia/Thematic/CCS_2009_en.pdf>.
[70] International Energy Charter, 'The Energy Charter Treaty'(9 April 2015) <www.energycharter.org/process/energy-charter-treaty-1994/energy-charter-treaty/>.

For example, one interviewee (Category Industry) commented that each country is slightly different, but there is not a clear framework for identifying and determining storage networks. Another issue is the idea of water transport as a suitable regime for CO_2 transport. While this was mentioned in the context of Hypothesis 3, it was a point that was of interest to several interviewees when the idea was mentioned to them during the course of the interviews. It was mentioned that perhaps analogizing CO_2 transport to water could facilitate CCS becoming more accepted by the public, rather than people associating CO_2 to methane (the latter of which is an explosive gas).

One interviewee observed there seems to be a new line of thinking in the industry of moving away from large scale developments toward smaller scale, with this being a more effective means of delivering CCS. The example given was the ROAD project, which contemplates a smaller storage capacity, resulting in the project entering into the post-operations maintenance phase sooner and thereby demonstrating the actual risks of this phase. The use of smaller scale projects could then allay concerns by stakeholders (including insurers, financiers, etc.) and enable CCS to finally be developed in the EU. And these correspond directly with the aims of the GATEWAY project, which is to provide a ***replicable*** pilot case that can be utilized around Europe to develop over the long-term a CO_2 transport network.

A consistent theme was the need to understand the government's business structure for CCS (both for the GATEWAY project and other projects) in order for risk allocation to be determined. As explained by one interviewee (Category Industry), cross chain risk is a potential issue, but it would depend on how project is funded (not an issue if government funds project).

4 RESULTS AND CONCLUSION

This paper explored the key risks and liabilities that may be faced in the GATEWAY pilot case, the Rotterdam Nucleus, including expansion via the CAR pipeline scenario, as well as in transboundary CCS projects in the EU. As energy law issues are considered at the levels of international, national and local law and policy, the key risks identified reflected matters at each of these levels. Following discussions with interviewees, recommendations were made for means of potentially addressing these key risks going forward.

The role of government cannot be understated. Government has a role in resolving the restriction of the London Protocol, in defining risk sharing between government and private parties and in incentivizing CCS development. The European Commission, could also have a role in delivering transboundary CCS by encouraging Member States to resolve the London Protocol Article 6 restriction. As noted earlier, the IEA is due to release an update on the London Protocol Article 6 issue in 2017. This may give further suggestions for acceptable means to overcome the restriction and to encourage international CCS activity.

The results of the analysis (as informed by the literature review and research participants' inputs) are presented below. Table 5 below presents how the key issues could be addressed through MOUs and contracts. As noted in section 3.2, where parties seek certainty on how these risks could and would be addressed before investment is undertaken or binding contracts are signed, parties may wish to enter into MOUs. Then, the outcomes and risk allocation could be subsequently memorialized and defined in binding contracts.

Table 5. MOU and Contractual treatment of risks.

Level of Law	Issue	Parties	Category		Comment
			MOU	Contract	
International	London Protocol	National governments	☑	☑	This contemplates treaty level action between governments. The understanding of the parties for how they will engage other contracting parties or how the parties will resolve the London Protocol article 6 restriction could be set out in an MOU. Resolution of the issue could be the result of bilateral or multilateral agreements.
	London Protocol	National governments and project operators (storage and international pipeline)	☑	☑	An MOU between governments and parties could provide a level of certainty for project participants and clarity of the intended actions of governments to address the London Protocol limitation issue. In contract, the parties could include resolution of the London Protocol as a condition precedent.
	Transboundary Transport of CO_2 and Value Chain Integration	National governments	☑	☑	Where CO_2 is transported across borders, nations will have to agree the terms and conditions for the international pipeline. The Energy Charter Treaty could be a logical starting point for drafting these frameworks, and setting out the expectations of the parties in an MOU could be useful to structuring the negotiations.
National	Financial incentives and uncertainty	National governments and project parties	☑	☑	Project parties may wish to include the government's incentive obligations in the MOU and the licence (contract). Incentives could be project financial incentives (e.g., subsidies) or even risk incentives (e.g., the

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Level of Law	Issue	Parties	Category		Comment
			MOU	Contract	
		Between project parties			government accepting certain risks such as acting as the 'middle man' with responsibility for linking CO_2 suppliers with storage operators).
	Leakage – risk exposure from storage	Between project parties	☑	☑	Governments could provide limitations of liability for project parties in law. Where this is not achieved, the project parties would need to agree the allocation of liabilities in contract, with the MOU providing the roadmap for contract negotiations. Liability limits would need to accord with corporate legal requirements.
	Liability risks-transportation	Between project parties	☑	☑	In the absence of government defined value chain structures, much of this will be conjecture (i.e., whether operatorship will be bundled or unbundled, etc.). Clarity of the government's business model is required.
Local	Public Support	National governments and project parties Between project parties	☑	☑	Project parties could agree the actions/conditions for public engagement and support and document in MOU. Whether the obligation is included in a contract will depend on the level of risk the parties wish to accept, as some parties may be concerned about the enforceability or measurement of the obligation. However, given the recognized importance of the obligation, the parties may wish to include it in the non-binding MOU and begin addressing the public engagement requirement before commercial contracts are signed. For the CAR Pipeline extension, the Flemish region of Belgium would need to be engaged in the first instance. See deliverable 4.1 for discussion on Belgium and issues at local/regional levels).

This list of items is high level and not comprehensive. This is due, in large part, to the fact that the commercial structure of the GATEWAY project is not yet defined. As noted previously in this document and as expressed by interviewees, the business case and commercial structures of CCS projects need to be specified. That is, understanding of the risk sharing between government and industry as well as the operation of the value chain (whether operation of the value chain will be segmented or bundled) is required to enable drafting of specific contract terms and conditions. However, it should be noted that some issues in relation to CCS (see Hypothesis 3 discussion) are similar to natural gas pipelines and hence Table 5 above identifies those issues that are specific to CCS (and CO_2 transport).

At this early stage of the GATEWAY project, without clarity of the commercial structures and business case for the CCS value chain, recommendation for specific terms and conditions and contract structures is premature. However, this paper sets out contractual mechanisms by which the key risks could be addressed should the GATEWAY project or other transboundary CCS projects proceed. And so, this paper can serve as an early roadmap and be replicable in terms of how these legal issues are analysed for other potential CCS (and specifically, CO_2) projects.

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The powerful aspect of this paper is that it includes the opinions and experience of senior stakeholders in the CCS industry, including researchers, government and industry. Further research will be valuable in this area once government action on CCS has progressed, and update recommendations to reflect government decisions on risk allocation and commercial structures.

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APPENDIX 1- ABBREVIATIONS

Abbreviation	Meaning
CAR Pipeline	CO_2 Antwerp to Rotterdam Pipeline
CCS	Carbon capture and storage
CO_2	Carbon dioxide
ECT	Energy Charter Treaty
EIA	Environmental Impact Assessment
EPC	Engineering Procurement and Construction
EU-ETS	European Union Emissions Trading Scheme
MOU	Memorandum of Understanding
PCI	Project of Common Interest

APPENDIX 2: LIST OF PARTICIPATING ORGANISATIONS

The following organisations participated in the research interviews. We are grateful for their contributions to this research.

- European Commission
- Gjensidige group
- IRIS
- Oil & Gas UK
- Rotterdam Opslag en Afvang Demonstratieproject (ROAD)
- Shell
- Statoil
- Summit Power
- TAQA
- UK CCS Research Centre (UKCCSRC)

APPENDIX 3: STAKEHOLDER ENGAGEMENT

This deliverable was completed with the following three points of stakeholder engagement.

(1) The legal issues at international, national and local levels were discussed with GATEWAY expert project team members at GATEWAY project meetings over the first 18 months of the project.

(2) Stakeholder Meeting 1 – the initial presentation to stakeholders was held in Brussels in November 2015. Work Package 3 (the legal analysis) was highlighted and was discussed. Feedback from the stakeholders was incorporated into the analysis for this deliverable.

(3) Having updated the research analysis for this deliverable from Stakeholder Meeting 2 and subsequent GATEWAY Project Meetings – a further presentation to stakeholders was made in September 2016. Again, the legal analysis from Work Package 3 was highlighted and discussed. Feedback from the stakeholders at this meeting was incorporated into the analysis for this deliverable.

Stakeholders who were present at both meetings include:

Stakeholder Meeting 1 – November 2015	Stakeholder Meeting 2 – September 2016
AdeB	CCSA
BP International Limited	CCSA / ZEP Secretariat
CCA association	E3G
E3G	EU CCS Network
European Commission, DG Energy	European Commission, DG Energy
Global CCS Institute	Global CCS Institute
Heidelberg Cement	Global CCS Institute
Maasvlakte CCS Project CV	Group Technology BP
National Grid	Maasvlakte CCS Project C.V.
Netherlands Enterprise Agency	Shell
Norwegian Research Council	Statoil
Shell	Sustainable Decisions Ltd
Statoil	TAQA
TAQA	ZEP
The Crown Estate	
University of Edinburgh	
ZEP	