Project One ESIA

# TCFD CLIMATE CHANGE RISK ASSESSMENT

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## 1 PURPOSE

This document addresses Project One's compliance with the Equator Principles' requirements related to climate change.

## 2 SCOPE

INEOS Olefins Belgium will build and operate a new world scale ethylene plant in the port of Antwerp: Project One. This involves an Ethane Cracker (ECR) unit.

To start building this installation, extensive preparatory work is being done, addressing all the needed studies regarding environment, energy and safety. This preparatory work also includes applying for the needed permits, through an Environmental Impact Assessment (further: EIA) according to the European and Flemish 'm.e.r.' procedure. Additionally, financiers have requested that an Environmental and Social Impact Assessment (ESIA) process is conducted, considering that the Project will also comply with international standards, namely Equator Principles (2020) and IFC Performance Standards (2012).

One of the requirements of the Equator Principles (Principle 2: Environmental and Social Assessment) is to include a climate change risk assessment based on the TCFD climate physical risk and climate transition risk categories.

The international standards highlight the importance of assessing the risks and opportunities with respect to climate change. The impact from Project One on climate change as well as the resilience of the project against the consequences of climate change must be assessed. The latter is increasingly becoming important when assessing impact of investment projects.

Local regulations are also evolving and the current EIA for Project One already includes a discipline on Climate. The Equator Principles focus on the value chain in which the plant sits and requires an alignment with TCFD risk categories.

## 3 DEFINITIONS

Items found in this document which require definition are listed below:

| Item. | Definition |
|---|---|
| CBAM | Cross Border Adjustment Mechanism |
| CCUS | Carbon Capture, Utilisation and Storage |
| Cefic | European Chemical Industry Council |
| CEN | INEOS Climate and Energy Network |
| CGP | Chemical Grade Propylene |
| ECR | Ethane Cracker |
| EIA | Environmental Impact Assessment |
| EP | Equator Principles |
| EPA | US Environmental Protection Agency |
| ESIA | Environmental & Social Impact Assessment |
| ESMP | Environmental & Social Management Plan |
| ESMS | Environmental & Social Management System |
| ETS | Emissions Trading System |
| E&S | Environmental & Social |

| Item. | Definition |
|---|---|
| FI | Financial Institutions |
| FSB | Financial Stability Board |
| GHG | Greenhouse Gas |
| HVC | High Value Chemical |
| C4 | Butane and Butadiene |
| IEA | International Energy Agency |
| IFC | International Finance Corporation, a member of the World Bank Group |
| IFC PS | IFC's Environmental and Social Performance Standards define IFC clients' responsibilities for managing their environmental and social risks |
| IGGN | INEOS Group Guidance Note |
| IOB | INEOS Olefins Belgium |
| IPCC | Intergovernmental Panel on Climate Change |
| IPMT | Integrated Program Management Team (includes both IOB and Wood Group project experts, to manage the coordinated delivery of Project One) |
| NDC | Nationally Determined Contributions |
| PoA | Port of Antwerp |
| RCP | Representative Concentration Pathway |
| SHE&S | Safety, Health, Environment and Security |
| SBTi | Science Based Targets initiative |
| TCFD | Task Force on Climate-related Financial Disclosures |
| UNGP | United Nations Guiding Principles on Business and Human Rights |
| VLAIO | Flanders Innovation & Entrepreneurship (Vlaams Agentschap Innoveren & Ondernemen) |
| VLEC | Very Large Ethane Carriers |
| VMM | Flanders Environmental Agency (Vlaamse Milieumaatschappij) |

## 4 REFERENCE DOCUMENTS

All reference documents are listed and documented in paragraph 5

# 5 REQUIREMENTS OF THE FINANCIAL INSTITUTIONS

## 5.1 Equator principles

The Equator Principles (EP), formally launched in 2003, is a risk management framework, adopted by Financial Institutions (FI), for determining, assessing, and managing environmental and social risks in project finance. It is intended to provide a minimum standard for due diligence to support responsible risk decision-making by the FI. The Equator Principles have been recently reviewed and the new version has been adopted in July 2020.

In the new version of the EP, Climate Change is mentioned in Principle 2 (Environmental and Social Assessment):

"*The client is expected to include assessments of potential adverse Human Rights impacts and climate change risks as part of the ESIA or other Assessment, with these included in the Assessment Documentation. The client should refer to the UNGPs when assessing Human Rights risks and impacts, and the Climate Change Risk Assessment should be aligned with Climate Physical Risk and Climate Transition Risk categories of the TCFD*. "

A Climate Change Risk Assessment is required:

- *For all Category A and, as appropriate, Category B Projects, and will include consideration of relevant physical risks as defined by the TCFD.*
- *For all Projects, in all locations, when combined Scope 1 and Scope 2 Emissions are expected to be more than 100,000 tonnes of $CO_2$ equivalent annually. Consideration must be given to relevant Climate Transition Risks (as defined by the TCFD) and an alternatives analysis completed which evaluates lower Greenhouse Gas (GHG) intensive alternatives.*

EP "*Annex A: Climate Change: Alternatives Analysis, Quantification and Reporting of Greenhouse Gas Emissions*" defines the implementation requirements in terms of:

**Alternatives analysis**: The alternatives analysis requires "the evaluation of technically and financially feasible and cost-effective options available to reduce Project-related GHG emissions during the design, construction, and operation of the Project". For Scope 1 Emissions[1], the analysis should endeavor to ascertain the best practicable environmental option.

- The analysis should be guided by regulatory permitting process, where applicable;
- Projects in high carbon intensity sectors, should include comparisons to other viable technologies; and
- The documented evidence of technically and financially feasible and cost-effective options and justification on why the selected technologies were not selected should be provided.

**Quantification and Reporting**: EP defines the requirements for quantification and reporting of GHG emissions:

- It is required to quantify Scope 1 and Scope 2 Emissions[2] in line with the GHG Protocol. The national reporting methodologies can be used if they are consistent with the GHG Protocol;
- For projects emitting over 100 000 tonnes of $CO_2$ annually, it is required to report publicly on an annual basis on Scope 1 and Scope 2 GHG emission level and GHG efficiency ratio; and
- Public reporting requirements can be satisfied via host country regulatory requirements for reporting or environmental impact assessments, or voluntary reporting mechanisms such as the Carbon Disclosure Project, where such reporting includes emissions at Project level.

[1] Scope 1 Emissions are direct GHG emissions from the facilities owned or controlled within the physical Project boundary (Source: Equator Principles)

[2] Scope 2 Emissions are indirect GHG emissions associated with the off-site production of energy used by the Project (Source: Equator Principles)

**Climate Change Risk Assessment**: The assessment should address the following questions:

- What are the current and anticipated climate risks of the Project's operations?
- Does the client have plans, processes, policies and systems in place to manage these risks?

EP specifies that this assessment should also consider the compatibility with the host country's national climate commitments, as appropriate. For Project One this is realized through the EIA Climate assessment.

In addition to the requirements specified above, in 2020 EP has published an additional Guidance Note on Climate Change Risk Assessment[3] to support the understanding and implementation of the principles.

### 5.2 Recommendations of the Task Force on Climate-related Financial Disclosures

From the recognition that there are economic risks and opportunities inherent to the phenomena of changing climate, the Financial Stability Board (FSB) established the Task Force on Climate-related Financial Disclosures (TCFD) in 2015. The FSB cited the need for consistent, comparable, clear, and reliable corporate disclosure of climate-related information, based on the understanding that disclosures would support informed decision-making by investors, lenders, and insurers in allocating capital and underwriting risk.

By developing recommendations for disclosure, which the TCFD released in June 2017, the FSB aimed to ensure more stable, resilient markets over the medium and long term by facilitating a smoother transition—with less abrupt price adjustments—to a lower carbon and climate-resilient economy.

The TCFD structured its recommendations for disclosure around four thematic areas that represent core elements of how organizations operate: governance, strategy, risk management, and metrics and targets. These thematic areas are designed to interlink and inform one another:

- Governance – the organization's governance and climate-related risks and opportunities.
- Strategy – the actual and potential impacts of climate-related risks and opportunities on the organization's businesses, strategy and financial planning.
- Risk management– the processes used by the organization to identify, assess, and manage climate-related risks.
- Metrics and targets – the metrics and targets used to assess and manage relevant climate-related risks and opportunities.

These four core areas are supported by recommended disclosures and guidance. The key TCFD guiding documents include:

- Final Report: Recommendations of the Task Force on Climate-related Financial Disclosures[4],2017;
- Annex: Implementing the Recommendations of the TCFD, 2017[5];
- Technical Supplement: The Use of Scenario Analysis in Disclosure of Climate-Related Risks and Opportunities, 2017[6];
- Guidance on Scenario Analysis for Non-Financial Companies, 2020[7]; and

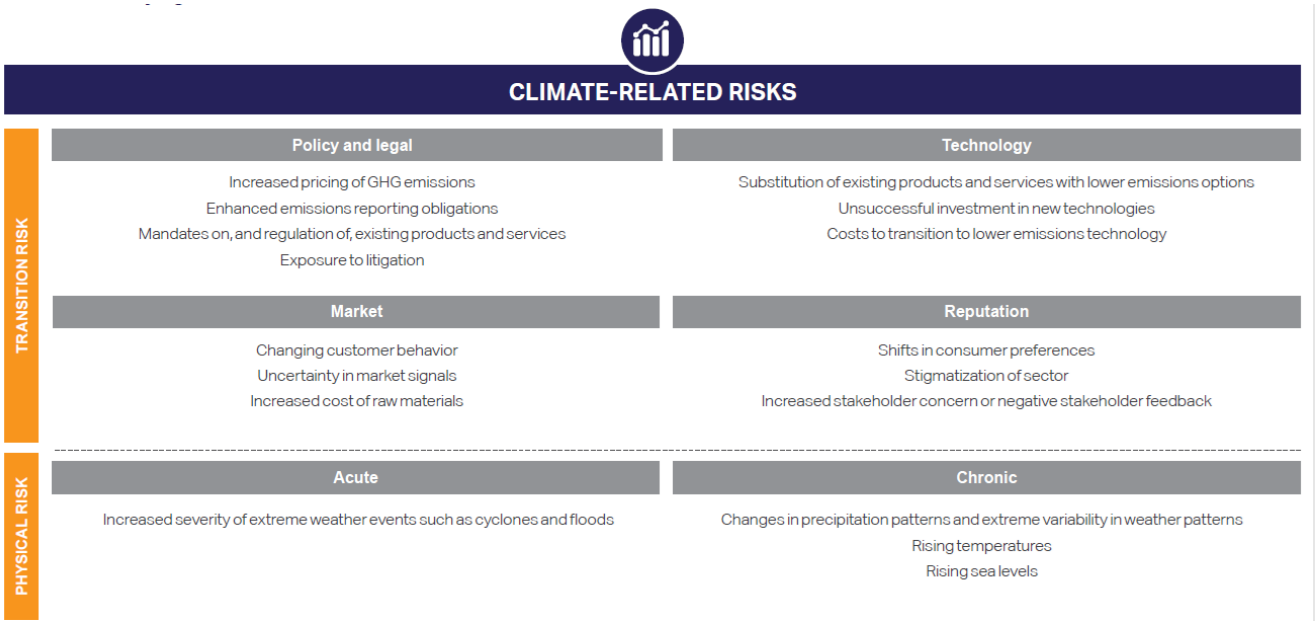
[3] CCRA_Guidance_Note_Ext_Sept_2020.pdf (equator-principles.com)
[4] https://www.fsb-tcfd.org/publications/final-recommendations-report/
[5] https://www.fsb-tcfd.org/publications/final-implementing-tcfd-recommendations/
[6] https://www.fsb-tcfd.org/publications/final-technical-supplement/
[7] 2020-TCFD_Guidance-Scenario-Analysis-Guidance.pdf (bbhub.io)

- Guidance on Risk Management Integration and Disclosure, 2020[8].

While TCFD provides a comprehensive framework for climate-related financial disclosures, in the context of the EP requirements, reference is only made to the TCFD recommendations for conducting a climate-related risk assessment: "*The Climate Change Risk Assessment should be aligned with Climate Physical Risk and Climate Transition Risk categories of the TCFD*".

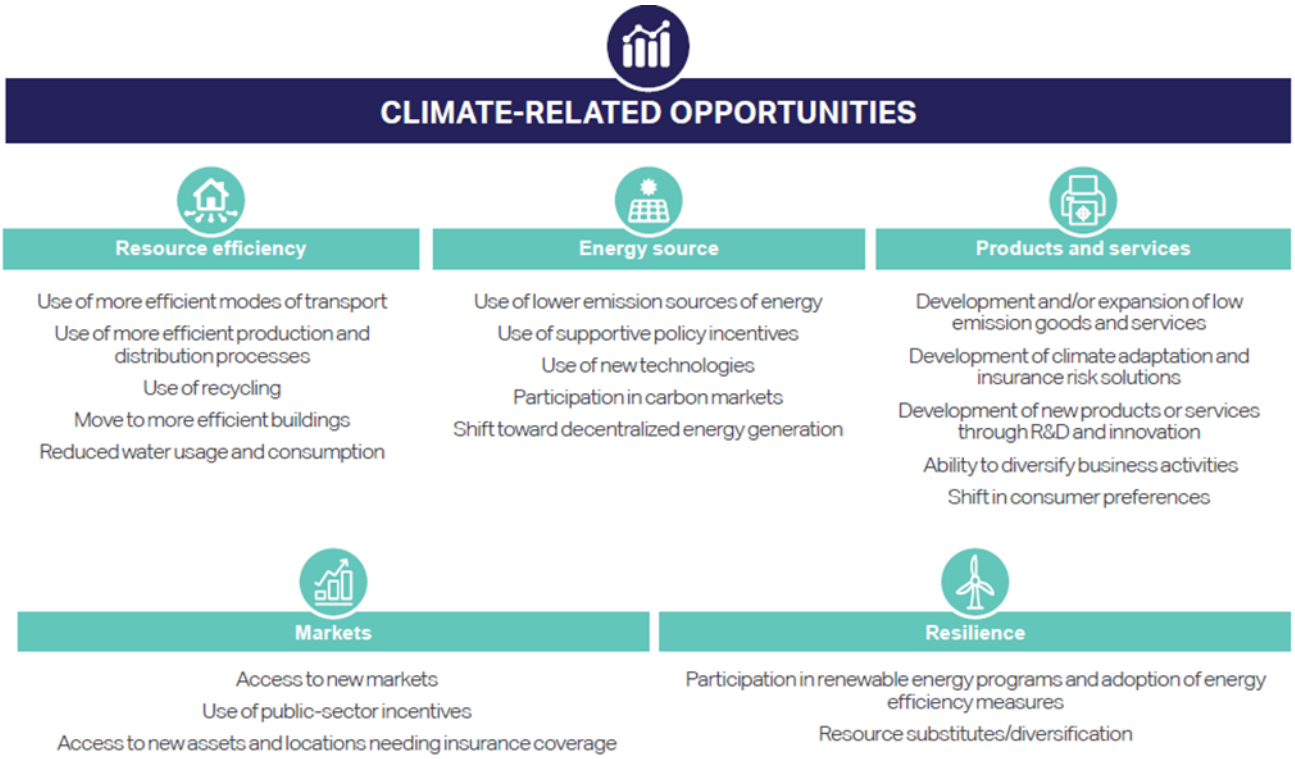
According to the TCFD risk assessment framework, climate-related risks are categorized into two major categories:[9]

- **Risk related to the physical impacts of climate change** - Physical risks: are event-driven risks such as storms, heavy rainfalls, or floods. Chronic climate change risks refer to longer-term shifts in climate patterns (e.g., sustained higher temperatures) that may cause sea level rise or chronic heat waves. Physical risks resulting from climate change can be acute; and
- **Risks related to the transition to a lower-carbon economy** - Transition risks: are related to the transition to a lower-carbon economy and may entail extensive policy, legal, technology and market changes.




Climate Related Risks as defined by the recommendations of the TCFD (source: WBCSD[10])

[8] 2020-TCFD_Guidance-Risk-Management-Integration-and-Disclosure.pdf (bbhub.io)
[9] WBCSD Redefining value program: Publication CEO guide to climate related financial disclosures
[10] WBCSD Redefining value program: Publication CEO guide to climate related financial disclosures




Climate Related Opportunities as defined by the recommendations of the TCFD (source: WBCSD[11])

### 5.3 Climate requirements according to the EIA AND Equator Principles

**TCFD Risk assessment:** The Equator Principles use a different framework than the EIA to identify Climate change related risks and opportunities. It refers to the TCFD risk assessment framework.

**Management system approach:** Project One's EIA complies with the current regulatory framework for the EIA, including climate change in the assessment process. The Equator Principles additionally require the definition of a management system approach (for example the definition and implementation of procedures to manage the identified risks and opportunities).

### 5.4 TCFD in the Chemical sector[12]

The chemical sector faces risks and a complex mix of challenges associated with climate change and other sustainability issues. However, many of the products it produces are critical in combatting climate change. Its

[11] WBCSD Redefining value program: Publication CEO guide to climate related financial disclosures
[12] TCFD Chemical Sector Preparer Forum, wbcsd 2019

actions will be vital in the global response to climate change, both through the sector's own operations and products, and the changes it catalyzes in other sectors.

The disclosure of climate-related financial information will assist stakeholders in assessing companies' readiness to respond to climate change and, consequently, in identifying the businesses that will remain resilient in the future.

For the sector in general, climate change risks include:

- new regulations and cap-and-trade systems are likely to increase the cost of production;
- climate-related physical risks could disrupt operations and supply chains; and
- shifting customer demands may drive portfolio changes.

At the same time, other sustainability trends affect the chemical sector, such as issues linked to water scarcity, product toxicity and waste. Chemical companies are under increasing consumer pressure to accelerate the transition to the circular economy by maximizing their efficiency with regard to emissions and use of scarce resources, enabling maximum durability of end products where appropriate, and by reusing and recycling existing molecules.

Climate change opportunities:

The chemical sector is also an enabler of the low-carbon transition both by its direct actions and use of products. The sector has significant opportunities to develop its activities and products and to minimize its carbon emissions in response to the ambitions of the low-carbon transition. Complex value chains and interconnections with many other industries mean that the chemical sector can leverage and enable significant opportunities that support the transition.

# 6 TCFD RISK ASSESSMENT PROJECT ONE

As mentioned before, the EIA chapter on Climate[13] already describes climate topics of Project One according to the EIA requirements and scoping advice from the Flemish authorities. The assessment below provides a summary of the climate related risks and mitigations according to the TCFD risk framework as required by the Equator Principles.

## 6.1 Physical risks [14]

Following the TCFD risks framework, physical risks resulting from climate change can be divided into event driven (acute) risks (such as droughts, storms, floods, heat waves and wildfires) and risks from longer-term shifts (chronic) in climate patterns (such as due to increased sea rise and longer-term temperature increase).

According to the Chemical Industries Association, weather and climate change resilience are important issues for chemical businesses because: [15]

- Chemical plants are very reliant on utilities, drainage and water supply infrastructure, which can be compromised by weather events.
- Many major hazard sites store and use significant quantities of hazardous substances. Weather-related events could lead to breaches of environmental permits or trigger major accidents, with potentially serious consequences
- On-site infrastructure tends to have long lifetimes, increasing their exposure to climate risks (because of exposure to the future as well as the current climate).
- The industry is globalized and therefore exposed to a wide range of impacts internationally.

Potential impacts caused by the extreme weather events (such as storm, heavy rainfall, droughts, heavy snow, heat waves) are:

- Disruption of production processes and site management conditions, leading to reduced performance or restrictions to maintenance works in the installations
- Disruption of supporting utilities and the transport network of raw materials, leading to potential business interruption, loss of productivity or rising costs
- Damage, degradation and maintenance implications to buildings, grounds, plant or machinery, sometimes with long-lead times for replacing key equipment
- Impact on health and safety of employees
- Impact on the demands and requirements of customers, insurers and investors

[13] Project One EIA Chapter Climate, 2020
[14] Seneviratne, S., Nicholls, N., Easterling, D., Goodess, C., Kanae, S., Kossin, J., ... & Reichstein, M. (2012). Changes in climate extremes and their impacts on the natural physical environment
[15] Chemical Industries Association (CIA), Safeguarding Chemical business in a changing climate, 2015

6.1.1 Acute Physical risks

6.1.1.1 Risks on supply of raw material

6.1.1.1.1 Risks in the extraction and transport of ethane

| Risk description | External mitigation actions: |
|---|---|
| Ethane is a by-product of natural gas production and its primary use is as a feedstock for the petrochemical industry.<br><br>The main identified inherent risks are:<br>○ Impact on the feedstock extraction sites in the US.<br>○ Impact on utilities, drainage, and water supply infrastructure that assets depend on<br>○ Hazardous substance spills or leaks.<br>○ Reduced ability to ship the feedstock from the US ports to Antwerp<br>○ Impacts on employee safety<br><br>Since the start of the ethane shipping business in INEOS Group in 2015, physical issues experienced due to weather (e.g. sink holes, deep freeze) have been limited and have not impacted feedstock supply to INEOS Group assets in Europe as a result of the mitigation actions described below. | Gas extraction sites, gas processing plants and transportation routes are designed to be resilient in terms of flooding and extreme weather events to ensure production of the feedstock (ethane) is not threatened. Ethane is moved across land via pipelines and thus is not exposed to “over the road/rail” risks.<br><br>Suppliers have established emergency plans, which are activated in close coordination with local, state and national/federal authorities, other businesses and transportation systems, along the path of the storms. In the USA, companies are well used to taking hurricanes into account when designing and building chemical facilities to be safe, such as by including hardened equipment, dikes and levees.<br><br>It is also recognized that the industry is globalized and exposed to a wide range of risks. The value chain of ethane feedstock has already shown resilience to different changes, such as regulatory pressures, pricing differences and infrastructure issues (pipeline network).<br><br>Internal mitigation actions:<br><br>During the supplier selection process suppliers are thoroughly evaluated before a contract is signed. This includes site visits, meetings with senior management and review of company safety performance and sustainability plans. In the process of finding new suppliers, there is a preference for contracts with larger, established suppliers that have a trustworthy reputation and have an interest in maintaining that reputation.<br>Supply is diversified across two major regions in the US, the Northeast and the Gulf Coast. The US has currently 3 ethane export terminals: 1 in the Northeast (Markus Hook) and 2 in the Gulf Coast region (Morgan’s point and Nederland). This creates diversification across different export terminals and related pipelines that feed those terminals. Thus, if any single pipeline or terminal becomes unavailable there are options to make up the supply at other points. Supply is further diversified among suppliers in different parts of producing basins thus spreading exposure across different producing and gathering infrastructures. Contracts exist with multiple major feedstock suppliers in the North East and Gulf Coast regions in the US.<br>A fleet of state-of-the-art ethane vessels will be used under long term charter which include Dragon class vessels and VLEC class vessels. This Fleet has already completed over 400 transatlantic ethane shipments. All vessels can fuel ethane and have flexibility to carry other products allowing for full optimization. Delays caused by weather conditions during sea transport are factored into calculations and adjusted as part of normal planning process. Mitigations include |

| | |
|---|---|
| | journey deviations to avoid forecast bad weather through the use of radar and other navigational aids. Over 4 years of ethane exports, the Fleet has been able to mitigate outages due to physical risks through its dual terminal and multiple supplier strategy. This includes regular fog events in the Gulf Coast, hurricanes in the Gulf Coast, freeze events in the Northeast and most recently Gulf Coast.<br>As the global ethane system grows more shipping flexibility is introduced in case of delays.<br>Project One is also the most economic and sustainable plant in Europe and will have priority on Feedstock supply.<br>Project One will include an on-site ethane tank that will allow up to 19 days to cover full production of the cracker |

6.1.1.1.2 Risks during transport of CGP (chemical grade propylene)

| Risk description | External mitigation actions: |
|---|---|
| The main inherent physical risk identified for supply of CGP via barges is a low water level in the Albertkanaal, Maas and Rhine. | The risks of climate change on the inland waterways is managed through authorities in Belgium, The Netherlands and Germany who will ensure robustness of the inland waterway system. This includes avoiding flooding and dealing with water scarcity through investments on the Albertkanaal, the Maas and the Rhine. However, due to climate change, low water periods will probably occur more often in the future and last longer. This could lead to temporary reduction of CGP supply during summer periods.<br><br>Internal mitigation actions:<br><br>CGP supply is not essential to the production of ethylene in Project One or for the economics of the project. The material impact of supply interruption is therefore negligible. |

6.1.1.2 Risks on supply of Utilities & port infrastructure.

6.1.1.2.1 Risks on Water supply

| Risk description | External mitigation actions: |
|---|---|
| Project One has a considerable water consumption. Therefore, the risk of water supply disruption for Project One needs to be assessed. | Several mitigation measures are taken within Flanders and Antwerp to fight against drought. These measures will ensure sufficient water supply for Project One:<br>○ In July 2020, the Flemish government launched its Blue Deal with more than 70 actions to prepare Flanders against drought and water scarcity<br>○ VMM, who coordinates the integrated water policy in Flanders, has published in Feb '21 its strategic plan for the water supply in Flanders[16] which includes a vulnerability analysis. This plan could have an impact on Project One when crisis situations such as extreme droughts arise. This emerging risk could impact the freshwater availability for Project One because domestic drinking water use is prioritized over industrial water use.<br>○ Water-link is the largest water supplier in the Antwerp area and responsible for 40% of the drinking water supply in Flanders today, with the Maas as the main water source. In view of increasing consumption and reduced water availability during droughts due to climate change, it has developed a strategic plan for water supply, including desalination and waste water treatment. In this way, Water-link can continue to guarantee security of supply in a sustainable and circular manner, and therefore will also ensure continuity in water supply for Project One.<br><br>Internal mitigation actions:<br><br>IOB have entered into an agreement with Water-link for the supply of city water, and demin water to Project ONE.<br>For a detailed description of these risks and mitigations on the water supply for Project One, please refer to the EIA Water and Climate disciplines. |

6.1.1.2.2 Risks on Energy supply

| Risk description | External mitigation actions: |
|---|---|
| Weather events can cause disruption of electricity and gas supply from the respective grids. | Power supply by Elia is being reinforced through the implementation of the Brabo Project in Antwerp. This extension of the high-voltage grid (380/150KV) in and around Antwerp is key to guaranteeing the future supply of electricity, both to Belgium in general and to the Port of Antwerp region. The Brabo project will also play an important role in upgrading Belgium's interconnection with the Dutch power grid.<br>On the natural gas supply: Belgium already has a highly developed natural gas network, with a solid internal infrastructure supplemented by interconnections with all neighboring countries, an LNG terminal in Zeebrugge and a storage facility in Loenhout. Fluxys continues to examine whether additional investments in the natural gas network are necessary. In this way, Fluxys can maintain its position as a natural gas hub in Central-Western Europe, additional demand and/or |

[16] VMM, Strategisch plan waterbevoorrading in Vlaanderen, 2021

| | |
|---|---|
| | displacement of demand can be met and new developments in the market can be anticipated (e.g. alternative transport fuels, power-to-gas, …).[17]<br><br>Internal mitigation actions:<br><br>Power and gas supply risks are being considered in the design and planning of Project One, including island mode. |

6.1.1.2.3 Risks on Port Infrastructure

| Risk description | External Mitigation actions: |
|---|---|
| The Port of Antwerp can be exposed to major acute climate related risks such as droughts, storms, floods, heat waves. | The Port is technologically mature and is designed to cope with climate related physical risks. The Port needs to comply with environmental legislation and has committed to contribute to protecting the climate. The Antwerp Port Authority signed an open letter, together with Belgian companies and members of academia, to strengthen the global response to the threat of climate change, in the run-up to COP21. In this letter the Port states its commitment to cope with the effects of climate change (climate adaptation) and build climate resilience. In addition, a study report from 2020 “System analysis accessibility Scheldt estuary and Scheldt ports “ from 2020 highlights the bottlenecks that will be treated in the coming years to ensure long term access.[18]<br>Therefore, it can be concluded that the risk for acute physical risks in the port are being managed and likely to be mitigated[19].<br><br>Internal mitigation actions:<br><br>The impact on operations because of issues with VLECs entering Port of Antwerp is also mitigated because of sufficient ethane storage capacity onsite. The ethane tank of Project One will have a capacity of 197.000 m³ for a daily consumption of the ECR of appr. 10.100 m³. Very Large Ethane Carriers (VLEC) with a capacity of appr. 95.000m³ will move ethane from the US to Antwerp. |

[17] Nationaal Energie- en Klimaat Plan van België 2021-2030
[18] Vlaams-Nederlandse Scheldecommissie, 2020: Systeemanalyse toegankelijkheid Schelde-estuarium en Scheldehavens
[19] Sustainable port of Antwerp, 2020

#### 6.1.1.3 Risks on Project One installations

| | |
|---|---|
| Risk description<br><br>Damage to installations: The Ethylene production installations, are relatively high structures that can be vulnerable to storm damage. | Mitigation:<br><br>The Project One installations are state of the art technology and acute physical risks, such as storm damage are considered in the design. More detailed info on resistance to extreme weather conditions of the assets is provide in EIA Climate chapter. |
| Risk description<br><br>Disruptions on plant operations, because employees are not able to reach the site or because maintenance activities must be cancelled for safety reasons. | Mitigation:<br><br>The minimum occupancy rate will always be ensured to guarantee safe operation of the installations.<br>There are also different alternatives to reach the site, even in case of flooded tunnels. The mitigation of these risks will also depend on public transport and road infrastructure. Major investment projects (like Oosterweel) are being implemented to improve the traffic around Antwerp.<br>Clear Safety procedures exist to manage safety issues and to shut down the plant in case of emergency. |

#### 6.1.1.4 Risks on transportation facilities for products and by-products

##### 6.1.1.4.1 Risks on Pipeline transportation facilities

| | |
|---|---|
| Risk description<br><br>Pipeline facilities could be affected by storms or flooding, causing damage to above-ground pipes or facilities and leading to temporary disruptions [20] . | Mitigation:<br><br>The Port of Antwerp is a well-developed industrial area and a major junction of the Western European pipelines. It has a good connection to a distribution network of pipelines, which can be considered as the safest, most reliable, and environmentally friendly way to transport ethylene. The pipelines provide connections to consumers and producers in Belgium and the surrounding countries.<br>The pipeline organizations need to comply with the latest environmental legislation and already consider the need for building climate resilience.[21]<br>Therefore the pipeline networks in Belgium, The Netherlands and Germany can be considered as very reliable and impact of residual acute physical risks is relatively low. |

##### 6.1.1.4.2 Risks on Inland waterways

| | |
|---|---|
| Risk description<br><br>Some by-products will be transported via barges to inland customers. Barges and waterways | Mitigation:<br><br>The sizing of the by-product storage capacity will consider several days of production in addition to the maximum export cargo size, to account for shipping delays: |

[20] Ruimtelijke Adaptatie, 2020: Ondergrondse Infrastructuur
[21] https://www.sustainableportofantwerp.com/en/content/protecting-climate

| | |
|---|---|
| could be exposed to acute weather conditions. For example, droughts followed by low water periods will occur more often in the future and last longer. This could lead to temporary reduction of C4 and Pygas (C5+) export during summer periods. | The risks of climate change on the inland waterways is managed through authorities in Belgium, The Netherlands and Germany who will ensure robustness of the inland waterway system. This includes avoiding flooding and dealing with water scarcity through investments on the Albertkanaal, the Maas and the Rhine. Barges will be of modern design to withstand consequences of severe weather conditions like storms. |

#### 6.1.1.5 Risks on downstream chemical plants

| Risk description | Mitigation: |
|---|---|
| The chemical companies who will use the products from Project One can also be affected by climate change, which could lead to a temporary reduced demand for ethylene or by-products from Project One. | This risk can be mitigated by assessing risk mitigation plans implemented by customers and communicated for example via their sustainability reports or during commercial discussions. |

### 6.1.2 Chronic Physical risks

Chronic physical climate risks include changing climate patterns, such as longer-term temperature increase and sea level rise, the proximity of these risks is typically on a longer time horizon. (beyond 2050)
The mitigation measures as described above for acute risks are also applicable for chronic risks.

#### 6.1.2.1 Rising Sea level [22] [23]

| Risk description | External Mitigation: |
|---|---|
| Effects from rising sea level can lead to flooding from storm surges, exacerbated in some places by the combination with higher discharge, as a result of increasing winter precipitation.<br>This could increase the risks for industrial operations and infrastructure that are situated in low lying areas close to coastlines, rivers or floodplains. Ports are among the areas at risk, | The Flemish government is implementing its Sigma Plan, a project that aims to reduce the risk of flooding around the Scheldt and its tributaries. In addition, a study report “System analysis accessibility Scheldt estuary and Scheldt ports“ from 2020 highlights the bottlenecks that will be treated by the authorities in the coming year to ensure long term access to the ports.[25] Therefore, it can be concluded that the risk for acute physical risks in the port are being managed and likely to be mitigated[26]. |

[22] Sources: klimaat.be and MIRA Climate Report 2015: on observed and future climate changes (VMM)
[23] Field, C. B. (Ed.). (2014). *Climate change 2014–Impacts, adaptation and vulnerability: Regional aspects*. Cambridge University Press.
[25] Vlaams-Nederlandse Scheldecommissie, 2020: Systeemanalyse toegankelijkheid Schelde-estuarium en Scheldehavens
[26] Sustainable port of Antwerp, 2020

| | |
|---|---|
| and therefore sea level rise is high on the agenda of all ports. [24]<br>The Scheldt river is the tidal river that connects the sea with the Port of Antwerp and with the hinterland of Flanders. Because of the connection to the sea the river is influenced by sea level rise and tides. Some temporary difficulties or time delays could arise for larger tankers (e.g. VLECs) to get through locks at certain moments. | |

#### 6.1.2.2 Droughts

| Risk description | Mitigation: |
|---|---|
| In hot and dry climates, such as in the extraction zones in the US, extreme hot weather can lead to wildfires because of extensive periods of drought. Especially electricity transmission infrastructure in the last few years has been the cause of large wildfires in the United States.[27]<br>But also natural gas operations could be temporarily disrupted.<br>Working conditions for the workforce in these climates can also have an impact on local production. For example, the higher chance of vector borne diseases resulting from temperature and precipitation changes.[28] | The same measures as for acute risks apply, such as diversification of the feedstock suppliers so that there is no dependence on one location when a disruption in one area occurs. Experience in similar chemical plants built in areas with extreme climate conditions like the Middle East or Texas show that these risks can be fully mitigated.<br><br>Therefore, it can be concluded that this risk for Project One is mitigated appropriately by suppliers and residual risk is negligible. |

### 6.1.3 Conclusions on residual physical risks

To conclude, the residual physical risks are relatively low because of the mitigating measures in place. Project One works with external organizations that manage upstream and downstream activities or infrastructures (pipeline networks, inland rivers, port infrastructure, etc.). The mentioned organizations and authorities are reliable organizations that follow the latest environmental legislation and have goals regarding climate resiliency.
Climate change risks will be further monitored and assessed periodically during Operations of Project One.

[24] UNCTAD, 2018: Climate change impacts and adaptation for ports - an overview of key issues and UNCTAD work
[27] 2011 Texas Wildfires: Common Denominators of Home Destruction
[28] Equator Principles, Guidance Note on Climate Change Risk Assessment, September 2020

## 6.2 Transition Risks

Transition risks are defined as risks which relate to the transition to a lower-carbon economy.
This transition will entail important policy, legal, technology, reputation and market changes that could be of impact on Project One and its supply chain.
Transition risks affecting the chemical sector include changes in carbon regulation, reputational risks and reduced demand for products due to changing customer behavior and emerging technologies[29]

### 6.2.1 Policy and Legal risks

Policy and legal risks concern policy and regulatory actions that seek to constrain the adverse effects of climate change or promote adaptation or transition; this includes:

- Increased pricing of GHG emissions
- Enhanced emissions reporting obligations
- Mandates on, and regulation of, existing products and services
- Exposure to litigation

Relevant policy and legal risks for Project One are driven by international, US, EU and Flemish regulations and agreements on climate change.
The paragraphs below intend to provide a more detailed view on the context and risks. The EIA Climate chapter also already contains a Life Cycle Thinking analysis that includes applicable policy and legal context.

#### 6.2.1.1 Paris agreement

The Paris Agreement is an international treaty and legal instrument that will guide the process for universally acting on climate change. It was at COP 21 in Paris, on 12 December 2015. The EU formally ratified the agreement on 5 October 2016, enabling its entry into force on 4 November 2016.
Governments agreed:

- a long-term goal of keeping the increase in global average temperature to well below 2°C above pre-industrial levels;
- to aim to limit the increase to 1.5°C, since this would significantly reduce risks and the impacts of climate change;
- on the need for global emissions to peak as soon as possible, recognizing that this will take longer for developing countries;
- to undertake rapid reductions thereafter in accordance with the best available science, so as to achieve a balance between emissions and removals in the second half of the century.

As a contribution to the objectives of the agreement, countries have submitted comprehensive national climate action plans (nationally determined contributions, NDCs).
In December 2020, the EU submitted its updated and enhanced NDC the target to reduce emissions by at least 55% by 2030 from 1990 levels.

#### 6.2.1.2 US policy and legal framework on natural gas extraction, processing and transport.

- Extraction and processing

[29] TCFD Chemical Sector Preparer Forum, wbcsd 2019

The source of ethane to be processed at the Project One site is a by-product of shale gas extraction coming from the American North East & Gulf Coast regions. In general, in the United States (US) natural gas is seen as an important transitional fuel to firstly phase-out coal and oil and support the transition to a carbon neutral economy:
"*Unconventional oil and natural gas play a key role in our nation's clean energy future. The U.S. has vast reserves of such resources that are commercially viable as a result of advances in horizontal drilling and hydraulic fracturing technologies. These technologies enable greater access to oil and natural gas in shale formations. Responsible development of America's shale gas resources offers important economic, energy security, and environmental benefits*." (US Environmental Protection Agency, EPA)
The EPA provided the necessary regulatory clarity and protection against risks in natural gas and shale gas extraction[30].

Natural gas, oil and coal are currently the most used fuels for electricity production, heat production and basic chemical production[31]. Natural gas has lower $CO_2$ –footprint than coal or oil. With shale gas, as one of the major natural gas sources in the US, it is expected that the new US administration will ensure continuity in shale gas extraction and therefore on the supply of ethane that is captured at the sites located in the US. Most policy changes are likely to impact reporting and emission control. US President Biden already ordered a moratorium on new oil and gas leases on federal land and water areas, which only account for less than a quarter of the total US oil production and much less for natural gas. And the freeze does not impact existing leases. He also announced that he is not going to ban fracking activities.

Over the years, since the start of shale gas extraction the large producers have considerably improved their operations in terms of higher extraction efficiency, lower use of chemicals, fully circular water use and reduction of GHG emissions. The current most important ethane suppliers for Project One are supportive to the 7 Golden Rules for shale gas extraction set by the IEA[32]. The implementation of these rules has resulted in the aforementioned improvements. Other benefits of following the 7 Golden Rules include less incidents and related litigation procedures. Moreover, part of the supplier selection procedure is to consider that suppliers have a clear sustainability plan and strong safety record.

Several US gas suppliers take additional and voluntary measures to further and faster reduce emissions. Examples of initiatives include ONE Future Coalition and the EPA Natural Gas STAR Program.

- ONE Future is a group of natural gas companies working together to voluntarily reduce methane emissions across the Natural Gas value chain, with a goal to lower emissions to 1% or less of total natural gas production by 2025 and to 0.36% for the gas production and gathering segment.
- EPA Natural Gas STAR Program provides a framework for Partner companies with U.S. oil and gas operations to implement methane reducing technologies and practices and document their voluntary emission reduction activities.

INEOS' largest current ethane suppliers - notably Range Resources, Antero, CNX and EQT - have joined one or more of these emission reduction programs and transparently report on results in their sustainability reports.

- Range Resources Corporation report in their annual sustainability reports the emissions with regard to the production of natural gas and has the target of net zero GHG emissions in 2025. For 2021 it reported a methane emission intensity of less than 0.02% of the produced volume of natural gas, coming from 0.09% in 2017. [33]
- Antero mentions methane emission intensity of 0.044% of natural gas produced its 2020 ESG report, based on the calculation as per ONE Future protocol, targeting 0.025% in 2025. [34]

[30] https://www.epa.gov/uog
[31] IEA, 2018: The future of Petrochemicals. Towards more sustainable plastics and fertilizers
[32] IEA, 2012: Golden Rules for a Golden Age of Gas.
[33] Range Resources, Corporate sustainability report 2020-2021, 48. https://csr.rangeresources.com/
[34] https://d1io3yog0oux5.cloudfront.net/anteroresources/files/Antero-Resources-ESG2020-vf.pdf

- EQT mentions methane emissions intensity below 0.04% in 2021, based on One Future protocol, and targets 0.02% for 2025. [35]
- CNX announced in their 2021 sustainability report a consolidated methane intensity of 0.04%[36].

The reporting practices of most important ethane suppliers for Project One are also recognized by “Asyousow”, the US non-profit leader in shareholder advocacy whose mission is to promote environmental and social corporate responsibility through shareholder advocacy, coalition building, and innovative legal strategies. Their publication “Disclosing the Facts 2019” ranks these 4 main suppliers among the best companies that disclosure key elements of their water management processes for hydraulic fracturing operations. Not only quantitative information about the impacts of company operations on water but also qualitative information about corporate policies and practices.
In addition, the 4 main suppliers also appear in Newsweek’s recent list “America’s most responsible companies for 2022”.

- Natural Gas and ethane transport

US natural gas is exported to Europe via LNG ships. Spain, UK, France, The Netherlands, Italy and Portugal currently import more US natural gas than Belgium[37].
Since 2016, the US has also been exporting its ethane via dedicated ethane ships to Europe, mainly to Norway, UK and Sweden.[38] There have been instances of regulatory rulings which can impact pipeline operations for temporary periods. The dual terminal strategy has allowed to mitigate these issues and maintain reliable supply to customers in Europe.

Ethane for Project One will be transported to the Port of Antwerp by state of the art VLEC (Very Large Ethane Carriers). The engines of these new ships can run on ethane, producing 25% less $CO_2$ and 99% less sulphur dioxide than ships on marine diesel or heavy fuel oil. The ships meet the strict Tier III emission requirements of the International Maritime Organisation (IMO).

In addition, INEOS Olefins Belgium closely follows the US policy and legal framework, as well as the sustainability reporting of the suppliers.

#### 6.2.1.3 EU and Flemish policy and legal framework.

Both EU and the Flemish governments support the Paris Climate Agreement and the goal to transform the EU economy from a linear to a circular economy and have translated the agreement into EU, resp. Flemish, targets and agreements.

##### 6.2.1.3.1 European Green Deal

At the international climate summit at the end of 2019 (COP25 in Madrid), the European Commission launched its ambitious "European Green Deal" plan. This plan aims to make Europe the first climate-neutral continent with zero net greenhouse gas emissions by 2050. It provides a roadmap with actions to boost the efficient use of resources by moving to a clean, circular economy and stop climate change, revert biodiversity loss and cut pollution.

Under the European Green Deal, the Commission presented in September 2020 an impact-assessed plan to increase the EU’s greenhouse gas emission reduction target to at least 55% by 2030.

[35] https://esg.eqt.com/environmental/climate-and-ghg-emissions/
[36] https://responsibility.cnx.com/assets/pdf/CNX-2021CR-Environmental.pdf
[37] https://www.eia.gov/dnav/ng/ng_move_expc_s1_a.htm
[38] https://www.eia.gov/dnav/pet/pet_move_expc_a_EPLLEA_EEX_mbbl_a.htm

At the end of December 2020, the European Council set a binding EU target of a net reduction of greenhouse gas emissions in the EU of at least 55 % by 2030 compared to 1990.

Project One emissions will be part of the European Emission Trading Scheme (ETS), which is the cornerstone of the European Union's drive to reduce its emissions. The system works by putting a limit on overall emissions from covered installations which is reduced each year. Project One will have to receive or buy emission allowances and will therefore be in competition with other installations. The ETS system provides a competitive advantage for low emitting installations in the EU market.

Sectors covered in the European Emissions Trading System (EU ETS) must have 43% $CO_2$ emissions by 2030 compared to 2005, and the EU Commission is proposing to further reduce to -61% by 2030 compared to 2005, as part of the 'Fit for 55 package' to align current laws with the 2030 and 2050 ambitions:
The increased ambition is to be achieved by strengthening the current provisions and extending the scope of the scheme. The proposal includes a.o.:

- include emissions from maritime transport in the EU ETS
- phase out free allocation of emission allowances to the sectors that are to be covered by the carbon border adjustment mechanism (CBAM)
- increase funding available from the modernisation fund and the innovation fund
- revise the market stability reserve in order to continue ensuring a stable and well-functioning EU ETS.

6.2.1.3.2 CBAM

CBAM is part of the proposed 'Fit for 55' package and aims to prevent - in full compliance with international trade rules - that the emissions reduction efforts of the EU are offset by increasing emissions outside its borders through relocation of production to non-EU countries (where policies applied to fight climate change are less ambitious than those of the EU) or increased imports of carbon-intensive products.
On 15 March 2022, the European Council reached agreement on the text that will form the basis on the CBAM. CBAM is designed to function in parallel with the EU's emissions trading system (EU ETS), to mirror and complement its functioning on imported goods. It will gradually replace the existing EU mechanisms to address the risk of carbon leakage, in particular the free allocation of EU ETS allowances.
Depending on the speed of the implementation of the Roadmap and EU key actions it might influence the timeline on establishing targets on alternative circular and/or biobased feed stock in the chemical industry.
Mitigation

Translation of the Green Deal into GHG emission reduction measures is expected to have a positive impact on the market position of the ethylene produced by Project One:

- the Project One installation will be the best performing ethylene production unit in Europe in terms of $CO_2$ emissions. Project One's $CO_2$ footprint will be less than half of the competing European steam crackers and it will therefore lower the benchmark of the ETS significantly such that the pressure on all other EU cracking installations to save $CO_2$ will increase and that highest emitting plants could even have to reduce production or close completely.
- Future CBAM is expected to have a higher impact on naphtha based producers in the EU, as they would pay a higher penalty compared to ethane based producers due to the higher level of Carbon dioxide emission associated with its production.

The ethylene produced in Project One will be sold to the market. The existing downstream plants in Europe are currently fed with primarily ethylene from European naphtha crackers, which are mostly outdated and have significantly higher specific $CO_2$ equivalent emissions than the new ECR from Project One. These installations can take the ethylene produced by Project One and reduce the $CO_2$ equivalent emissions of their products. For example, if the INEOS group's facilities were to use the ethylene produced in Project One, this would reduce the INEOS group's carbon footprint by approximately 2 Mton $CO_2$ eq/year.
In addition, because Project One uses a natural gas-based feedstock, unlike all other ethylene production plants in Europe that are oil-based, it can be considered as strategic in the future feedstock mix for chemical products in Europe.
A more detailed description of this mitigation can be found in the EIA Climate file.

6.2.1.3.3 EU Taxonomy

As part of the Green Deal and linked to the European Commission's aim to promote sustainable investment across Europe, the EU Taxonomy for environmentally sustainable activities was developed. The EU Taxonomy Regulation was published in June 2020 (EU Regulation 2020/852) and is a classification system, establishing a list of environmentally sustainable economic activities. The EU Taxonomy has six key environmental objectives:

- Climate change mitigation
- Climate change adaptation
- The sustainable use and protection of water and marine resources
- The transition to a circular economy
- Pollution prevention and control
- The protection and restoration of biodiversity and ecosystems

To be aligned with the EU Taxonomy, an eligible economic activity must make a 'substantial contribution' to at least one objective, 'do no significant harm' to all the others and satisfy certain minimum social safeguards. Technical screening criteria specific to each economic activity are used to analyse whether or not an economic activity is making a substantial contribution to a certain objective. In June 2021, screening criteria for the first two objectives, climate change mitigation and adaptation, were published in a first Delegated Act (applicable as of January 2022). The criteria for the remaining objectives are expected to be published in 2022.
Mitigation:
The core activity of the Project is aligned to the technical screening criteria and the "do no significant harm" criteria of the first Delegated Act of the EU Taxonomy, namely the substantial contribution to climate change mitigation for the manufacture of organic basic chemicals (high value chemicals ("HVC"): Ethylene), and complies with the minimum social safeguards set out in the EU Taxonomy. Alignment has been confirmed in a second party opinion by an independent expert.

6.2.1.3.4 Flemish Climate Strategy 2050

In the Flemish climate strategy 2050, Flanders recognises and endorses the need to limit global temperature rise to well below 2°C from pre-industrial levels, and to make efforts to limit the increase to 1.5°C compared to pre-industrial levels. For the ETS sectors, the Flemish Region subscribes within the context that Europe determines for these sectors with an increasingly tight emission space under the EU ETS and is committed to supporting companies towards a far-reaching switch to climate-changing production systems.

6.2.1.3.5 Roadmap study on carbon circular and low CO2 Flemish industry[39]

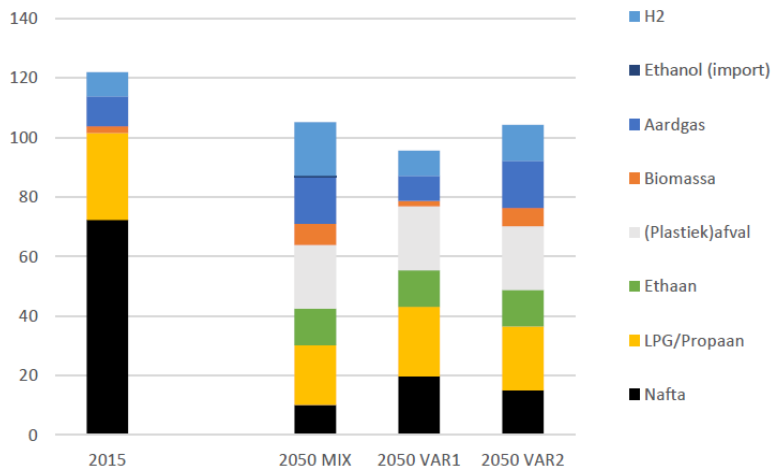
In a study "Towards a carbon circular and $CO_2$-poor Flemish industry" commissioned by VLAIO (2020), also in line with the Flemish climate strategy 2050, 4 themed transition paths were defined to achieve a carbon circular and $CO_2$-poorFlemish industry:

- the use of biomass (waste) as an energy and raw material,
- circularity, with mainly reuse of plastic,
- electrification and increased use of hydrogen (H2), and
- capture, storage and reuse of $CO_2$ (CCUS).

The study concludes that the future will be a combination of the four transition paths. There is no 'unique solution' to achieve a low-carbon circular and $CO_2$-industry. Betting on only one of the four transition paths is not enough, all four are needed.
Regarding the chemical sector, this Roadmap mentions the ambition to replace oil based (naphtha) feedstock by less polluting alternatives like natural gas based feedstock and by doing cracking in a different way, including

[39] Deloitte, Naar een koolstofcirculaire en $CO_2$-arme Vlaamse industrie, 2020

alternative raw materials like biomass, hydrogen, recovered plastics, and ethanol and methanol made from captured $CO_2$.




**Figuur 8 Evolutie feedstockverbruik per drager in het centraal verkenningsscenario en de twee varianten (Var1 en Var2) (in TWh)[21]**

The study also mentions the dependency on carbon capturing infrastructure and technology to meet the climate neutrality goals in Flanders. Capturing carbon, and either storing it or converting it into new products, is expected to play an important part in Flanders' strategy for 2050.
A more detailed overview on how Project One can be integrated into each of the 4 thematic transition paths is provided in the EIA Climate chapter.

#### 6.2.1.3.6 CCUS and Hydrogen developments in Antwerp

Flanders, as part of its Climate strategy 2050, is also committed to supporting CCS networks and CCU installations, and has the ambition to become a European frontrunner in hydrogen technology. Availability of connection to a $CO_2$ Hub, with storage or utilisation, or economic availability of hydrogen are important pre-requisites in the main options for Project One to further reduce its carbon footprint and to reach net-zero carbon emissions (see 6.2.1.4).
As one of the partners in the Antwerp@C consortium, INEOS Olefins Belgium fully supports this project and recognises CCUS as one of the paths to achieving net zero.

INEOS Olefins Belgium recently joined the Fluxys project to develop a hydrogen network with open access in Antwerp.

### 6.2.1.4 Mitigation actions on policy & legal risks

#### 6.2.1.4.1 Paths to net-zero for Project One

The road to a climate-neutral future of Project One proceeds in stages. Project ONE is already making a fundamental difference today by making the most of the very best of today's technology. Project One ethane cracker is expected to emit less than half of the $CO_2$ per ton of HVC compared to the best EU steam crackers. Customers of Project ONE's ethylene can save 2 million tons of $CO_2$ emissions each year as they will no longer be dependent on the ethylene from more polluting facilities. An additional benefit of this performance is that Project One should lower the benchmark for steam crackers in the European emissions trading system, encouraging other players to invest more in sustainability or they will have to pay more in emission allowances. Project One will strive to achieve carbon neutrality which will be enabled by (amongst others) the development of hydrogen infrastructure in the local industrial area. Project One will strive to be carbon neutral within 10 years

of start-up and has built in the necessary flexibility to integrate other carbon reduction techniques as soon as they are mature and feasible:

1. Provide space in the design for a future carbon capture installation. If Project One would build and operate a carbon capture plant in the future using the amine absorption, which is currently the most common carbon capture technology, the hydrogen released in the process should first be separated and used as a clean fuel, to keep the $CO_2$ content in the Project One flue gas stream more concentrated and suitable for carbon capture. This opens an important perspective for the (re)use of $CO_2$ and hydrogen gas in the future in the Port of Antwerp. However, the hydrogen produced in the ECR will have to be replaced by purchased natural gas as fuel gas.

2. As an alternative to reducing the ECR's $CO_2$ emissions through carbon capture, the possibility exists of increasing the hydrogen content in the fuel gas to the ECR. This hydrogen may be purchased from a future hydrogen network in Antwerp. In this scenario it is envisaged that the methane produced in the process could be separated and utilized, for example in the regional natural gas network, thereby reducing the requirement for importing natural gas into the region.

3. A third option for Project One is using a combination of hydrogen fueling and electric furnaces. Also the use of electric furnaces requires that the methane produced in the cracking process to be separated and utilized. Electric cracker technology is currently not a proven technology.

More detailed info on the future possibilities of carbon capture, hydrogen fueling and/or electric furnaces for Project One is described in the EIA Climate chapter.

6.2.1.4.2 Mitigation actions on transport and distribution of products for/from Project One:

- Because of its strategic location, Project One can use an existing and reliable infrastructure of a dense piping networks for basic chemicals which span from Belgium (Antwerp) to the Netherlands (Rotterdam), and the chemical industry in Germany (Ruhr area and Frankfurt Area). The use of pipeline network ensures a safe and environmentally friendly way to transport Project One product.

- In addition to that, connectivity via barges and inland waterways ensures an additional infrastructure for bulk delivery of chemicals with also ensures a relatively low carbon footprint. The policy and legal framework for inland waterways is managed through authorities in Belgium, The Netherlands and Germany who will ensure robustness of the inland waterway system.

- INEOS Olefins Belgium will optimize the planning of the transportation of goods. To improve efficiency, the principle is applied to fully load the ships and to avoid traveling with empty barges.

6.2.1.4.3 Path to net-zero for INEOS Group

To achieve transition to a net zero economy the wider INEOS Group is taking concrete actions to create meaningful and measurable near and long-term reductions in its climate footprint, whilst at the same time positioning itself to take advantage of new opportunities offered by the evolving markets.

| ACTIONS | EXAMPLES |
|---|---|
| Continuous process optimisation | Target of 10% reduction in emissions compared to 2019 by 2025 and 33% by 2030<br>INEOS Group sites follow the continuous improvement principle of energy management systems such as ISO 50001, EMAS, ESOS and EBO. INEOS Group sites implement process |

| | |
|---|---|
| | optimisation through equipment upgrade, refurbishment and advanced process control. |
| Acquisition of renewable energy sources to run its operations | 205 MW of renewable wind power contracted with Eneco, Engie and RWE in 2021 and 2022 - equivalent to c. 3 million tonnes reduction over next 10 years. Part of this will be used by Project One |
| Development of clean hydrogen as fuel | INEOS Group, through its INOVYN business, is already Europe's largest existing operator of electrolysis and recently announced its intention to invest over €2 billion in green hydrogen projects in Europe - Europe's largest ever investment in electrolysis projects, first plants to be built in Norway, Germany, Belgium in the next 10 years with investment also planned in the U.K. and France<br>Development of Europe's first hydrogen powered barge for bulk liquid chemical transport |
| Capture and transfer, use or storage of carbon dioxide ($CO_2$) | A demonstration scale project to convert carbon dioxide into methanol using hydrogen is underway at Antwerp<br>INEOS Group participates in local carbon capture initiatives such as Antwerp@C, which is studying a carbon capture business case in Antwerp<br>INEOS Group is leading the Greensand Project to store carbon dioxide from Denmark in INEOS' Siri field in the North Sea |
| Use of recycled and bio-based feedstocks instead of fossil-based feedstocks | Waste wood derived biomass used to make bio-olefins in Koln cracker, for which a Roundtable on Sustainable Biomaterials (RSB) certification has been received.<br>Launched Biovyn™, world's first accredited bio-derived PVC, product achieves 90% GHG savings |
| Development of new recycling technologies to produce polymer products containing recycled plastic | Ranges of new styrenics and polyolefin products launched containing 50% or more recycled material have been launched<br>Several INEOS Group production sites in US and EU already received the ISCC PLUS certification, a sustainability certification for bio-based and circular (recycled) raw materials. Further certifications for other INEOS Group production sites are expected soon. |
| Investment in new assets to create step change in emissions | Project One in Antwerp will be Europe's most innovative and best climate-performing olefin complex.<br>Project One's cracker will emit less than half of $CO_2$ than the current best performing European similar plants for the same production, with a pathway to carbon neutrality |

These actions are also captured within roadmaps under development for each business and site.

In November 2020, INEOS Group committed to staying ahead of EU climate and energy targets in the drive to net zero greenhouse gas emissions across the businesses in Antwerp, including the Project ONE investment. The science-based commitment will contribute to the ambition of the Port of Antwerp by reducing $CO_2$ emissions, through real, verifiable and practical measures with a focus on at-source reductions.

The INEOS Group 2030/2050 climate action plan will focus on 6 emission reduction pathways:

1. Fuel switch: e.g. H2, biofuel, recycled, electrification
2. Feedstock switch: e.g. bio, waste, recycled, $CO_2$
3. Optimisation: e.g. efficiency improvements, circularity, digitalization
4. Carbon capture & utilisation
5. Carbon capture & storage
6. Offsetting: e.g. compensation, removals

### 6.2.2 Market risks

Market risks include shifts in supply and demand for feedstock, products and services in the chemical industry. This includes:

Changing customer behavior
Uncertainty in market signals
Increased cost of raw materials

The expected market transition in Europe will follow the political ambitions depending on the stimulation programs, legal framework, and consumer behavior.

#### 6.2.2.1 Feedstock market

- Fossil based feedstock

Project One will use natural gas-based ethane as feedstock, and in minor amounts on CGP (Chemical Grade Propylene). As explained before, low cost ethane has become available in large amounts in the US following the shale gas revolution and resulted in a revival of the US chemical industry since about 2010. This revival in the US, together with a similar evolution in the Middle East and Asia, has put the European chemical industry, and more specifically the ethylene production, in a competitive disadvantage. The outdated production facilities in Europe (the last cracker in Europe was built more than 25 years ago) cannot compete with the new installations built in North America, Middle East and Asia.

The low prices of gas-based feedstock, driven by US shale gas revolution, and the increasing environmental concerns on carbon emissions lead to a reduction in demand for coal and crude oil based feed stock in favor of natural gas based feedstock in chemical sector. This evolution is expected to continue in the short and medium term.

As the shift from coal and crude oil to natural gas is also ongoing in the energy sector, it is expected that the worldwide growing demand for natural gas is beneficial to the extraction and availability of ethane. [40] The speed of this transition to gas differs from region to region, but based on the gas development in the US, we can consider that ethane for Project One has a strong position in this transitional market. In addition, it will also contribute to a more balanced future feedstock mix in Europe in the coming decades.

- Alternative feedstock

The use of recycled or bio-based raw materials is gaining higher market share, however, these alternative renewable feedstocks, that could further reduce the carbon footprint, are currently not yet available in the volumes needed in the chemical industry.

[40] IEA, 2018: The future of Petrochemicals. Towards more sustainable plastics and fertilizers

Major industrial pilot projects implementing more renewable technologies are currently foreseen between 2030 - 2040 with first large industrial applications expected after 2040, as also explained in the Roadmap "Towards a carbon circular and low $CO_2$ Flemish industry" [41].

Some regions and countries, like Europe, South Korea, and Japan already have a strong development focus on reuse, recycling, and shifting to a more bio-based feedstock to mitigate climate change. Expectations are that, specifically for plastics, the share of products with a high percentage of recycled raw material will become relevant in the coming decades[42].

Current market predictions also expect virgin polymers to still have a strong market share in the future, especially to make up for the losses and quality reductions, that are inevitable during the recycling of post-consumer materials, and to accommodate the expected market growth. Virgin raw material are especially needed for production of chemical products in food and medical sector but will have to be produced with the highest carbon efficiency. Project One fits into this market view, in terms of feedstock selection, carbon efficiency, technology and infrastructure.

#### 6.2.2.2 Ethylene (& derivatives) market

Ethylene is a chemical building block and starting material (also called 'platform chemical') to produce a broad range of chemical products. The largest derivatives of ethylene and propylene are polyethylene and polypropylene, respectively, each accounting for nearly two-thirds of the global demand for their monomers.[43] The other main chemical intermediaries are ethylene oxide/ethylene glycol, and ethylene dichloride/vinyl chloride monomer.

In the EU the market of ethylene is about 20 Mtons/yr, mainly produced in naphtha crackers. Market studies show a growth in ethylene consumption in Europe.

More info on the ethylene (and derivatives) market are described in the EIA Climate LCT chapter.

#### 6.2.2.3 Mitigation actions on Market risks

- Feedstock

INEOS Group has been mitigating the market-related risk by having long-term contracts with several larger providers of ethane. Considering that the ethane cracker of Project One is only designed for processing ethane (and up to 20% propane) the use of alternative feedstocks will remain rather limited. Nevertheless, Project One installation could allow for future (partial) use of more circular or bio-based ethane or propane feedstock should this become commercially available in sufficient amounts.

Also, possibilities to increase hydrogen content in fuel gas for the cracker furnaces and auxiliary steam boilers could be considered in the future to further reduce $CO_2$ emissions. This hydrogen can come from renewable sources.

- Ethylene market

Project One will be strategically located in the Port of Antwerp within an existing industrial area already connected to major pan-European olefins pipelines enabling safe, efficient, environmentally-responsible and cost-effective distribution to customers in Europe.

[41] Roadmap "Towards a carbon circular and low $CO_2$ Flemish industry", 2020
[42] WEF, 2016: The New Plastics Economy. Rethinking the future of plastics
[43] IEA, 2018; Levi & Cullen, 2018

In Project One, ethylene will be produced through ethane cracking in the most efficient way and with the lowest GHG footprint in Europe, which puts Project One in a most competitive position in the market for the coming decades.

Even in case demand for ethylene would decrease in Europe or in case alternative production routes will become competitive, Project One will remain very competitive in Europe because of its high efficiency and low carbon footprint compared to all other current ethylene production plants in Europe. In these cases, other less efficient crackers should reduce or stop production first.

- Innovation

INEOS Group is investing in R&D to obtain feedstock via chemical recycling or bio-based feedstock. Examples are:

- Waste wood derived biomass used to make bio- olefins in Koln cracker used in Biovyn™, world's first RSB certified bio-derived PVC. Product achieves 90% GHG savings.
- Ranges of new Styrenics and Polyolefin products containing 50% or more recycled material have been launched.

More info on bio-based and recycling initiatives within INEOS Group can be found on the INEOS Group Sustainability website and in the Sustainability Report.
INEOS Group also increasingly invests in R&D, innovative pilot projects and knowledge sharing as well as considering the relevant future oriented skills during the selection of staff and employees. This contributes to creating a learning organization, which can anticipate market changes in olefin production. More info on the innovation and knowledge sharing within INEOS Group can be found in §5.1.1.

### 6.2.3 Technology risks

Technology risks include technological improvements that support the transition to a lower emissions economy and lead to demand shifts and market advantage for operators who adapt faster (e.g. carbon capture and storage, improved operating efficiency, reduced GHG emissions, optimized water use, etc.). This includes:

- Substitution of existing products and services with lower emissions options
- Unsuccessful investment in new technologies
- Costs to transition to lower emission technology

#### 6.2.3.1 Ethane extraction risks

As already explained before, ethane for the ECR will be largely produced as a by-product of the processing of unconventional natural gas or shale gas extraction. This natural gas revolution is a consequence of evolution in the extraction technology that combined horizontal drilling and hydraulic fracturing and as such opened new natural gas resources, especially in the US.

During the rapid expansion of shale gas in the early 2000, several environmental incidents occurred, and concerns raised with respect to the increased methane emissions, flaring and water pollution. Meanwhile the extraction, processing and transport technologies have considerably improved by using best available techniques (BAT), best available control techniques and low emission techniques. Stringently controlled operational environment that includes monitoring of all activities, emissions, production efficiency and the use of resources also enables the producers to report this data to authorities, communities, and clients. The EPA (US Environmental Protection Agency) provided the necessary regulatory clarity and protection against risks in natural gas and shale gas extraction[44].

Raw shale gas contains mainly methane but also some other organic compounds ('NGL', Natural Gas Liquids): ethane and propane are the most relevant. For technical, safety and economic reasons, part of the NGLs are removed from the natural gas. Initially, the excess of NGLs was flared as waste gas, which led to high direct $CO_2$ emissions. Since about 2012, the petrochemical sector in the US has started to use these NGL substances

[44] https://www.epa.gov/uog

more and more as feedstock for ethylene and propylene production, which resulted in a significant reduction of the $CO_2$ emissions through flaring.

Current design of extraction wells and housing has reduced leakages and production losses significantly. Improvement has been made on the treatment of production water. Treatment technologies enable almost 100% recovery of the water used and limit the freshwater intake related to the extraction processes of shale gas.

#### 6.2.3.2 Alternative technologies in olefin production

The EU Green Deal and following climate legislation will further stimulate recycling of chemicals and use of bio-based feedstocks. However, alternative (renewable or bio-based) sources for ethane with a lower GHG footprint are currently not yet available on the market in sufficient volumes needed for Project One.

Amongst the alternative sources for olefin production, bioethanol as feedstock to make ethylene, is currently the most market ready alternative. To produce 1.5 million tons of ethylene at least 2.5 million tons of ethanol is needed. By way of comparison: sugar beets produce 5000 liters of ethanol per hectare or 3.95 metric tons of ethanol/hectare. In other words, 633 000 ha of sugar beet are needed to feed an ethane cracker to produce 1.5 million tons of ethylene. According to Statbel data[45], the Flemish Region had 625 000 ha of agricultural land at its disposal in 2020. This integral area would not be sufficient on its own and would mean that this land could not be used for food production, and therefore this technology is currently not viable.

Propane from biodiesel is already available in very limited amounts but could become a future alternative feedstock in Project One, up to max 20%.

Other possible sources including recycling of plastics or waste-to-chemicals are still not able to produce significant volumes for a competitive price.

INEOS Olefins Belgium strives to keep up with the technological developments which enable to improve production efficiency and sustainability. Developments related to plastic recycling, waste to chemicals, use of bio-based feedstock, etc. are closely followed through its internal innovation network (CEN).

Electric crackers, using renewable power, may also be a possibility to further reduce the carbon footprint in ethylene production. However, this technology is still in very early stage of development. Electric crackers will also produce methane and hydrogen like Project One. A separate use will have to be given for these products. Integration of Electric Furnaces, once technology is available, is one of the options in the path to net zero emissions for Project One.

All external electricity demand for Project One will be covered by this green electricity. Due to the import of green electricity, Project One's total emissions will decrease by approximately 8%.

Strong technological developments are still expected in terms of the CCS and CCU technologies as one of the main technologies to target net-zero emissions by 2050. Onsite, Project One will already foresee space for future carbon capture installation, will pre invest in pipe racks and will already reduce NOx to levels required in future carbon capture installations. Meanwhile, IOB will continue to improve along this line to further reduce $CO_2$-emissions and energy use.

The Roadmap “Towards a carbon circular and low $CO_2$ Flemish industry”, presented in November 2020, identified several transition paths towards climate neutrality and the most important transformations steps that could be feasible every 10 years up to 2050. The report considers how the industry might change, assuming the necessary technological developments fall into place. Ethane is part of the feedstock mix by 2050 presented in this study.

[45] https://www.vlaanderen.be/statistiek-vlaanderen/landbouw-en-visserij/landbouwareaal

#### 6.2.3.3 Mitigation actions on Technology risks

The INEOS Group decision to invest in the Project One was based on external and internal technological and market studies with respect to feedstock, products and derivatives.

By using state of the art technology, Project One cracker will be a game changer for the ETS benchmark and force all European oil-based crackers to further reduce their $CO_2$ .By reducing the current benchmark value for $CO_2$-emissions, several inefficient assets will be forced to reduce production or invest in emission reductions. In addition to the technology used for reduction of air emissions through combustion of hydrogen, also the optimized technology for heating and cooling within the process steps is an important aspect of Project One operations.

Project One has built in flexibility to integrate new technologies once they become economically available.

### 6.2.4 Reputation risks

Reputation risks concern changing customer or community perceptions of an organization's positive or negative impact on the transition to a lower emissions economy. This includes:

- Shift in consumer preferences
- Stigmatization of sector
- Increased stakeholder concern or negative stakeholder feedback

Project One's operations and main market area will be Northern Europe. These areas are strongly influenced by policy making of the EU and the growing awareness of the consumers on the impact of their actions.

The main reputation risks for Project One relate to: direct emissions, shale gas-based feedstock, end-product disposal, competitiveness of renewable or recycled feedstock, biodiversity, carbon footprint of end-products and IOB engagement towards climate neutrality.

As a responsible organization, growing interest from customers, the general public and other stakeholders drives the need to continuously improve sustainability disclosure practices.

Mitigation actions:

The main issues have already been treated in this risk assessment and will be included in the interactions with stakeholders. IOB will also inform the public on these topics through its dedicated Project One website.

Public disclosure of goals and performances in GHG emissions and use of natural resources, can have a positive influence on public opinion and thus reputation. Currently, INEOS Group publishes sustainability reports on its website.[46] Moreover, INEOS Group has been awarded an Ecovadis Gold medal, and continues to annually provide an Ecovadis submission. Current INEOS Group sustainability reporting does include reporting on GHG emissions following reporting standards like GRI.

Since 2021, INEOS Group is also a recognised respondent to CDP Climate Change questionnaire, to maintain transparency of climate strategy and to gain external validation for improvement initiatives. The CDP's disclosure platform provides the mechanism for reporting in line with the TCFD recommendations.

Reputation can be also influenced by interactions with local stakeholders, such as communities and neighboring companies. To that end, IOB is in close contact with neighboring companies, collaborates with Port authorities in developing carbon capture, invests in green energy supply, is part of several professional organizations, collaborates with universities, attends meetings with local communities (e.g. "burenraad"), informs through its dedicated Project One website, has set up a mobility strategy to ensure that employees can safely and efficiently reach their workplace, etc. Project One will also implement a grievance mechanism that can be used by external stakeholders to submit questions, requests or complaints.

[46] https://project-one.ineos.com

### 6.3 Conclusions on residual Climate Change related Risks

Based on the mitigation actions explained, the residual physical risks are estimated as very low.

- Extreme weather events will only have a temporary and limited impact on Project One in the port of Antwerp in Belgium.
- Risks on feedstock locations in the U.S and in downstream plants are mitigated as well.
- Risks on supply of water to Project One are being dealt with in the design of the project and through initiatives taken by authorities and suppliers.
- Effects of Sea level rise is being dealt with by the authorities.
- Long term impact of climate change risks will be further followed and monitored in the coming years to be able to timely anticipate.

The main transition risks are identified and taken into consideration.

- The Project One design guarantees the implementation of BAT and will therefore be able to withstand potentially stricter regulatory requirements in the short and medium term.

- Project One will be a market leader thanks to achieving a new industry benchmark in terms of production efficiency and emission reductions for HVC. More efforts to increase consumer (/and stakeholder) awareness regarding this aspect could further mitigate reputational risks.

- Current EU and Flemish policy is speeding up the efforts to reduce GHG emissions and stimulate circular initiatives. INEOS Group has a clear view on the current regulatory, market and technological context and contributes actively in different governmental programs and studies, coordinated via internal CEN network to discuss the implementation of the climate change initiatives. INEOS CEN is a group-wide network that operates across businesses for all climate and energy-related matters (CEN). The main objectives of the CEN network are related to sharing information and views, shaping actions and strategies. While working at policy and advocacy level, CEN supports onsite best practices, initiates new business opportunities, and promotes innovation. (see also Chapter 8: Systems in place to manage the climate-related risks and opportunities)

- In the short and medium term, consumers and other stakeholders expect an increasing transparency regarding the environmental impact of chemical products. These expectations will be addressed by improved sustainability reporting through alignment with the Global Reporting Initiative (GRI) framework. INEOS Group is already implementing increased sustainability reporting, which has been confirmed in the Ecovadis assessment. Specific mitigation efforts will be directed towards further engagement and communication with external stakeholders and timely anticipation on regulatory and market changes for products with a higher percentage of recycled and bio-based feedstock.

# 7 CLIMATE CHANGE SCENARIOS

## 7.1 Defining applicable climate change scenarios

This chapter presents the climate change scenario approach that is applied to the identified climate related risks and opportunities of Project One. The analysis provides a better understanding on how Project One value chain might be affected under different future climate change scenarios. To that end, the results of this analysis build on a range of hypothetical outcomes developed under a set of assumptions.
For identifying the scenarios, the approach provided in the TCFD technical supplement on scenario analysis [47] is applied. In this assessment publicly available scenarios are used that are developed by independent organizations such as the Intergovernmental Panel on Climate Change (IPCC) [48] and the International Energy Agency[49] (IEA). The scenarios fall into two categories: transition and physical.
The IEA provides transition scenarios that articulate different policy outcomes, such as the energy and economic pathways that lead to different levels of temperature increase. Transition scenarios typically present plausible assumptions about the development of climate policies and the deployment of "climate-friendly" technologies to limit GHG emissions. Transition scenarios focus on how policy and technology regarding energy supply and GHG emissions interact with economic activity, energy consumption, and GDP among other key factors.
The IPCC provides physical climate scenarios that start with a range of GHG emission concentrations that can articulate into different temperature ranges. The IPCC is known for providing regular scientific assessments on climate change, its impacts and future risks, and options for adaptation and mitigation. The IPCC scenarios are based on Representative Concentration Pathways (RCPs) emissions scenarios adopted by the IPPC to address potential risks and opportunities in terms of changes in weather and climate events that can occur on a short, medium, and long term.
Since the IPCC and IEA are using scenarios that can have transitional and physical consequences, this assessment for Project One takes both into account. Both considerations are complementary and required to consider the full implications of climate change and the resilience of Project One. Furthermore, the scenarios as provided by the IPCC are covering projections till the end of the 21st century. IOB will focus on the developments of the projections and what the possible consequences are for Project One on the short, medium, and long term.
In line with the recommendations of the TCFD this scenario analysis includes a 2°C scenario that lays out a pathway and an emissions trajectory that limits the average global temperature increase to a temperature range around 2°C. This 2°C scenario complies with the Paris Agreement and obliges governments to reduce GHG emissions. Since the value chain of Project One is global, Nationally Determined Contributions (NDCs[50]) need to be included due to the policy differences in countries. The central question in the scenario analysis is what the consequences are for Project One if the pathways for achieving the goals that limit the global warming at or below 2°C are met. Other scenarios that are relevant for Project One are a business-as-usual scenario, where governments fail to implement policy that limits temperature increase below 2°C.
In consideration of the collective effort to reduce $CO_2$ emissions a three-scenario approach is further defined (see the Table below).

*Table 4-1: Definition of the climate change scenarios used to estimate climate-related risks and opportunities*

| Scenario | Definition |
|---|---|
| **Scenario 1: <2 °C** | The Paris agreement is reached (steep transition). The global average temperature rise is limited to 1.5 – 2 °Celsius |

[47] TCFD, Technical Supplement, The Use of Scenario Analysis in Disclosure of Climate-Related Risks and Opportunities, 2017
[48] https://www.ipcc.ch/
[49] https://www.iea.org/
[50] NDC is a term used under the United Nations Framework Convention on Climate Change (UNFCCC) for reductions in greenhouse gas (GHG) emissions that all countries that ratified the Paris Agreement have committed to achieve.

| | |
|---|---|
| **Scenario 2: +3 °C** | The Paris agreement is partially reached. The global average temperature rise will reach 3 °Celsius (more severe physical impacts) |
| **Scenario 3: +5 °C** | The Paris agreement is not reached. The global average temperature rise will reach 5 °Celsius (physically devastating) |

This scenario approach has been adopted from the position paper of the CRO Forum[51], a group of professional risk managers from the insurance industry that focuses on developing and promoting industry best practices in risk management. In this position paper a comprehensive indication of the potential physical and transition risks for the different scenario approaches is given. Each of these scenarios have specific impact on the risk and opportunity assessment that is described in the previous paragraphs. It also provides a basis for a sensitivity analysis.

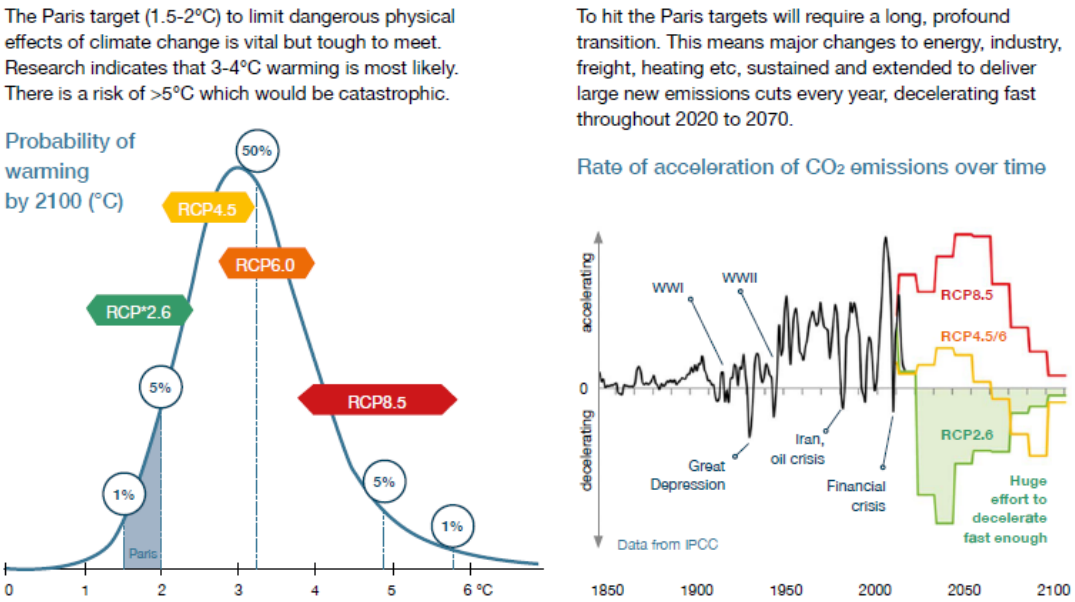



*Figure 7-1: Background information for different scenarios*[52]

Based on these figures above it seems logic to anticipate scenario 2 rather than scenario 1. The figure below shows what this means for the physical and transition risks. It is expected that the impact will be stronger on the physical aspects of climate change and a growing demand for risk management strategies specifically on the supply of raw materials, energy supply and natural resources (like water).

[51] The Heat Is On–Insurability and Resilience in a Changing Climate, January 2019. The CRO Forum indicates its report "relies heavily on the [IPCC] for data and charts, drawn from SR15 and AR5 working papers.
[52] The Heat Is On–Insurability and Resilience in a Changing Climate, January 2019. The CRO Forum indicates its report "relies heavily on the [IPCC] for data and charts, drawn from SR15 and AR5 working papers.

| Warming by 2100 | | <2 °C | | 3 °C | 5 °C |
|---|---|---|---|---|---|
| **Physical impacts** | | 1.5 °C | 2 °C | | |
| Sea-Level Rise (cm) | | 0.3-0.6 m | 0.4-0.8 m | 0.4-0.9 m | 0.5-1.7 m |
| Coastal assets to defend ($tn) | | $10.2tn | $11.7tn | $14.6tn | $27.5tn |
| Chance of ice-free Arctic summer | | 1 in 30 | 1 in 6 | 4 in 6 (63%) | 6 in 6 (100%) |
| Tropical cyclones: | Fewer (#cat 1-5) | -1% | -6% | -16% | Unknown |
| | Stronger (# cat 4-5) | +24%* | +16% | +28% | +55% |
| | Wetter (total rain) | +6% | +12% | +18% | +35% |
| Frequency of extreme rainfall | | +17% | +36% | +70% | +150% |
| Increase in wildfire extent | | x1.4 | x1.6 | x2.0 | x2.6 |
| People facing extreme heatwaves | | x22 | x27 | x80 | x300 |
| Land area hospitable to malaria | | +12% | +18% | +29% | +46% |
| **Economic impacts** | | | | | |
| Global GDP impact (2018: $80tn) | | -10% | -13% | -23% | -45% |
| Stranded assets | | Transition: fossil fuel assets (supply, power, transport, industry) | | Mixed: some fossil fuel assets mothballed, some physical stranding | Physical: uninhabitable zones, agriculture, water-intense industry, lost tourism etc |
| Food supply | | Changing diets, some yield loss in tropics | | 24% yield loss | 60% yield loss, 60% demand increase |
| Insurance opportunities | | New low-carbon assets and infrastructure investment (e.g. CCS) | | Increasing demand to manage growing risks | Minimal: recession, tensions, high and unpredictable risks |

*Figure 7-2: Three scenario approaches and potential physical and economic impacts*[53]

## 7.2 Physical and transition risks in the context of climate change scenarios

This chapter provides an analysis of how different scenarios can potentially affect the risk assessment results. Global warming below the 2 °C would mean that radical and sustained economic and societal changes are necessary to meet the targets. Over the last years climate models show that the warming cannot be kept below this level because of the greenhouse gas emissions. The IPCC concluded in 2018 that it's technically possible to limit global warming to 1.5 °C, but a tremendous and large-scale transition is necessary that is limited by economic, institutional, and socio-cultural barriers. National pledges, such as NDC are not enough to reach this goal. E.g., to achieve the 1.5 °C global warming, emissions need to be reduced by 33-50 % in the next 12 years, which would cost around 2 trillion dollars a year. Furthermore net-zero $CO_2$ emissions need to be

[53] The Heat Is On–Insurability and Resilience in a Changing Climate, January 2019. The CRO Forum indicates its report "relies heavily on the [IPCC] for data and charts, drawn from SR15 and AR5 working papers.

achieved by 2050 [54]. Based on these projections it is more likely that the global warming is heading towards a +3°C or +5°C scenario.
Looking at time scale (short, medium, and long term) the physical climate related risks are likely to be similar for all the scenarios in the short term. If the current scenarios are followed, the global temperature is likely to increase by 1.5℃ by 2030-2040. A wide variation in physical outcomes arise after that period and are subject to the actions that are taken. The period 2020 – 2030 is critical for taking action to meet or exceed Paris targets as there is a wide range of possible policy paths, which alter how extensive and orderly transition activity is.

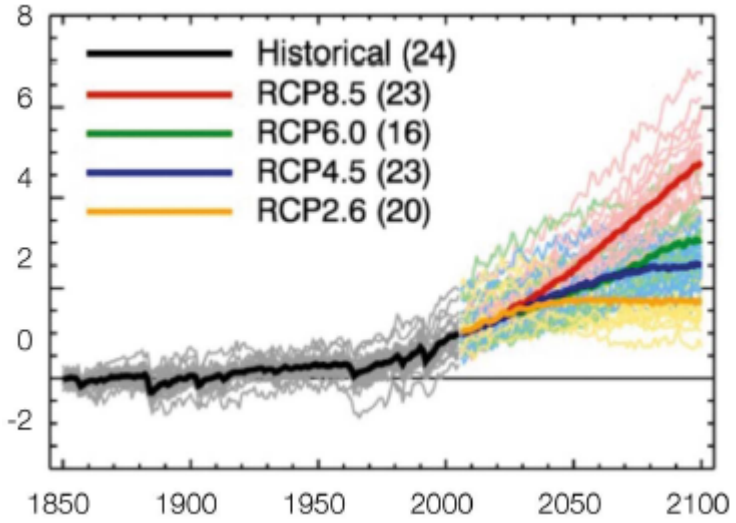



*Figure 7-3 Range of °C increase for each RCP[55]*

Transition risk arises from attempting to avoid significant and transformational long-term physical risks from climate change. Transition risks are also likely to be a key source of near-term economic impacts, assuming enough action is taken to reduce emissions. This type of risks can best be managed by making the necessary policy changes in an open and coordinated way internationally, and by the timely preparation by institutions. The sectors and activities most exposed to transition risks are those that extract and produce fossil fuels and those that emit large volumes of GHGs.
It is stated in the CRO Forum position paper that in order to have a realistic expectation of achieving the under 2°C scenario, drastic policy measures are needed, such as:

- An agreed carbon price of up to $100 per tonne across all leading nations to incentivize rapid transition.
- A wide range of other policies, similar to those set out in the 2018 NCE report[56].
- Stopping new fossil fuel development and redirecting subsidies to transition priorities.
- Rolling out CCS or forestation on a huge scale.

All these measures would have a strong political and legal impact. Latest EU agreements show a political will to move to this direction, but still leaves a lot of uncertainties in the proximity of these actions.

**Scenario 1: <2 °C**

[54] IPCC, 2018: Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [V. Masson-Delmotte, P. Zhai, H. O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J. B. R. Matthews, Y. Chen, X. Zhou, M. I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, T. Waterfield (eds.)]. In Press.
[55] The Heat Is On–Insurability and Resilience in a Changing Climate, January 2019. The CRO Forum indicates its report “relies heavily on the [IPCC] for data and charts, drawn from SR15 and AR5 working papers.
[56] The New Climate Economy, The 2018 report of the global commission on the economy and climate

If the goals of the Paris agreement are reached the climate change would be limited and current climate conditions would remain with temperature raise under 2 °C. The achievements Paris Agreement targets are vital to limit the dangerous physical effects of climate change, however they are challenging to meet. To hit the Paris targets a long and wide transition that would impact all elements of society is necessary. The expected changes would impact the energy, industry, freight and a wide variety of other sectors.
However, even if the Paris Agreement targets are met, physical risks could still arise and lead to increased flooding, droughts, and storms. Also, it is expected that extreme downpours and fluvial flooding may increase in many areas. For example, in Eastern North America and Europe, which are susceptible for flood damage. In the Project One context this means that heatwaves are likely to increase in North America and Europe. Also, the increased warming and droughts are already related causing wildfires in the (western) U.S. This can lead to the increased physical risks for the extraction sites of shale gas in Texas. Also, sea level rise requires low lying and coastal areas, such as in the United States and the Port of Antwerp to implement adaptation measures.
The physical risks that are defined in the previous chapters would not change significantly if the Paris Agreements are met, since they take into account the current information on the physical effects of climate change.
To meet the Paris agreement targets rapid action and increasing efforts are necessary to mitigate emissions, which is expected to lead to a rise in transition risks. The actions and policy changes to achieve the targets have more significant impact on the transition risks for Project One under the <2 °C scenario.
Since the design of Project One is already considering these changes the operations are expected to not be susceptible for these risks. On the other hand, supplier's shale gas extraction sites are likely to be impacted more heavily by transition risks since they extract and produce fossil fuels. The results of the current risk assessment, which are based on existing policies, would change if more stringent policies and actions are needed to reach the Paris Agreement goals. In that case a fundamental change in the business model would be needed to transition to a low carbon economy.

**Scenario 2: +3 °C**

Research indicates that 3-4°C global warming is still very likely.[57] The scenario corresponds to the IPCC RCP 4.5 and RCP6. In this scenario it is expected that GHG emissions would steadily grow, the median temperature is likely to increase by 3.0 °C in 2100 and sea level rises between 0.4m and 0.9m.
In case of this scenario, the physical risks would be similar as for the 2°C scenario but with a greater severity. In this scenario the physical risks have a heavier impact on property, industry, infrastructure, and health. For example, heatwaves are likely to affect three times as many people, extreme rainfall is three times higher as is the sea level rise. These developments would lead to higher expenses for damage and disruption or adaptation measures. Also, societal consequences are likely to develop, such as mass migration from low-lying coastal cities in developing countries, which could affect the world economy. Developments, such as mass migration could disrupt global trade and value chains and affect economic performance. In the Project One context the physical effects would arise after 2030-2040.
While the physical risks are greater in the +3.0 °C scenario, the transition risks are lower but not entirely avoided. Emissions need to be reduced but not to the same extent as in scenario 1.
When considering scenario 2 "+3 °C" the risk assessment results would be lower for the transition risks, because of lower impact. On the contrary the physical risks and the impact for Project One is likely to increase. Especially the proximity of the risks would be 'sooner'. Since the physical effects are expected to arise after 2040, these effects are likely to be manageable.

**Scenario 3: +5 °C**

The scenario +5 °C corresponds to the IPCC RCP 8.5 and is in line with the current trend. This would mean continuous growth in GHG emissions, an increase in median temperature of 4.5 °C in 2100 and a sea level rise with a maximum range of 1.7m.
The physical risks as described in the previous paragraphs would become more extreme. Heatwaves could be 10°C higher in various regions in comparison with the current extremes. Also tipping points and feedback loop effects become the most likely in this scenario, for example the decline of the Greenland ice-cap that leads to a

[57] The Heat Is On–Insurability and Resilience in a Changing Climate, January 2019. The CRO Forum indicates its report "relies heavily on the [IPCC] for data and charts, drawn from SR15 and AR5 working papers.

7m sea level rise. The social and political effects are also likely to be greater than scenario 2, which means more mass migration, collapse of sectors and major effects on the global economy.
The transition risks would be avoided in this scenario since it is the most 'business-as-usual' scenario. Therefore, when considering scenario 3 "+5 °C" the transition risks, impact of those risks would be lower for Project One. On the contrary, the physical risks and the impact for Project One is likely to increase. Especially the proximity of the risks would be 'sooner'. The red line in figure 7-3 shows that RCP 8.5 already show major effects in the period 2030-2050, which means that in the life span of Project One physical effects are likely to occur and may impact the value chain. Since the physical effects are expected to arise after 2040, these effects are likely to be manageable thanks to the time available to prepare for the changes.

### 7.3 Conclusions

This scenario-based analysis provides a better understanding how Project One might be affected under different future states related to the climate change scenarios developed by IPCC and acknowledged by the IEA. It also provides a basis for understanding the sensitivity of the risk assessment results in relation to variables that are linked to uncertainties around the further development of physical and societal conditions.
From the time scale perspective (short, medium, and long term) the physical climate related risks are likely to be similar for all the scenarios in the short term.
If the current path is followed the global temperature is likely to reach 1.5℃ by 2030-2040 and scenario 2 (3-4°C global warming) would become very likely. A wide variation in physical outcomes arise after that period and are subject to the actions that are taken. These physical risks are mostly already acknowledged and considered in the design of Project One and its logistics. The global concern of the risks has prompted a global policy and legal action to ensure that the climate change is slowed down. Moreover, businesses are responding by looking into the measures to ensure that production sites are climate change proof.
Transition risk arises from attempting to avoid very significant and transformational long-term physical risks caused by climate change. Transition risk is likely to be a key source of near-term economic impacts, assuming enough action is taken to reduce emissions. The sectors and activities most exposed to transition risks are those that extract and produce fossil fuels and those that emit large volumes of GHGs.
Based on the above and assuming that it is more likely that the global warming is heading towards a +3°C, it would mean increasing the likelihood for the identified transition risks, resulting in the higher priority in terms of mitigation. To that end, the mitigation measures for Project One should focus on setting a target-based strategy on the GHG emissions and energy use, including monitoring and reporting. The recent efforts by IOB towards this direction set a basis for further risk mitigation.

# 8 SYSTEMS IN PLACE TO MANAGE THE CLIMATE-RELATED RISKS AND OPPORTUNITIES

This chapter provides an overview of the management systems in place related to climate change risk and opportunity management.

## 8.1 Project One climate-related risk and opportunity management approach

The Table below provides an overview of the already existing processes and systems in place that are related to the management of the identified climate-related risks and opportunities for Project One. An overview is provided based on the key areas as defined in by the TCFD: governance, strategy, risk management, and metrics and targets. It is important to highlight that Project One adheres to both policies and procedures that are applicable at INEOS Group level as well as those developed specifically for Project One. The subsequent sub-chapters provide more detailed description of the INEOS CEN network, and Project One risk and opportunity management procedure.

*Table 8-1 Overview of climate-related risk and opportunity management approach*

| Key areas (TCFD) | Guiding questions (TCFD) | Management approach elements |
|---|---|---|
| **Governance** | Board's oversight of climate-related risks and opportunities | INEOS CEN (Climate & Energy network) has been established in order to support onsite best practices, initiate new business opportunities and innovation.<br>The network is managed by Group head of Energy and Innovation. CEN is sponsored by CEOs and directors of various INEOS businesses, with Group Director for Corporate Affairs and Communications being the ambassador and Non-Executive Director being chairman. |
| | Management's role in assessing and managing climate-related risks and opportunities | At the INEOS Group level, management is informed about climate-related issues through INEOS CEN network, which shares relevant information with all INEOS business via weekly monitoring mails, monthly reviews, and an annual meeting.<br>At Project One level, the roles and responsibilities in assessing and managing risks and opportunities (not specific to climate change) are defined in the Risk and Opportunity Management Plan. |
| **Strategy** | Climate-related risks and opportunities over the short, medium, and long term | A general description of the specific climate-related issues arising in each time horizon is provided in this document (Chapter 6).<br>A more detailed view on physical and transition risks for Project One is described in chapter 6. |
| | Impact of climate-related risks and opportunities on organization's businesses, strategy, and financial planning | Project One Risk Management Plan defines a process to identify impact on project's schedule and budget.<br>IOB has also established a Sustainability Protocol with the Port of Antwerp to align the sustainability strategy with its key partner. |
| | Resilience of the organization's strategy, taking into consideration different scenarios | The results of scenario analysis are provided in this document (Chapter 6) |
| **Risk management** | Processes for identifying and assessing climate-related risks | At INEOS Group level, emerging regulatory requirements, policies are monitored through the CEN network. |

| | | |
|---|---|---|
| | | At Project One level risks and opportunities (not specific to climate change) are identified based on the process defined in the Risk and Opportunity Management Plan and registered in the centralized risk and opportunity register.<br>A methodology for assessing climate-related risks and opportunities, including definition of short, medium and long term, is provided in this document (Chapter 6). |
| | Process for managing climate-related risks | At the Project One level risk and opportunity management process is defined in the Risk Management Plan |
| | How process for identifying, assessing, and managing climate-related risks is integrated into the organization's overall risk management | There is no climate-specific risk registry at Project One level, risks are integrated into relevant domains, such as legal, economic, technological. |
| **Metrics and targets** | Metrics used to assess climate-related risks and opportunities in line with its strategy and risk management process | The metrics used to assess climate-related risks are described in this document (Chapter 6). |
| | GHG emissions of the Project and the related risks | GHG emissions throughout the different project phases are estimated in the EIA climate chapter.<br>Emissions will be monitored based on the $CO_2$ monitoring plan |
| | Targets used by the organization to manage climate-related risks and opportunities and performance against these targets | INEOS Group has established commitments, with the support of SBTi, for its operations in Antwerp to become Carbon Neutral by 2050 through implementing a range of reduction measures across all INEOS sites in the Port of Antwerp, Belgium. |

## 8.2 Project One Risk and Opportunity management framework

The overall framework for identifying climate related risks and impacts for and from Project One relies of four main sources:

- INEOS Group policies and procedures
- Project One procedures,
- the EIA and permitting process, and
- the reports and procedures defined in the context of the ESIA.

### 8.2.1 INEOS Group policies

At the corporate level, INEOS Group has developed the INEOS Group Guidance Notes (IGGNs). The purpose of the IGGNs is to collate best practice (internal and external) on specific topics that have caused Safety, Health or Environmental concerns within INEOS.

### 8.2.2 Project One Risk and Opportunity identification and assessment approach

INEOS Project One complies with the policies and procedures developed at the corporate and project level. A set of Project One management documents has been developed by the Integrated Programme Management

Team (hereafter 'IPMT'). The management documents include a number of philosophies, procedures, specifications, standard drawing and templates.
The Project One's risk and opportunity management approach is defined in the IPMT procedure[58] Risk Management Plan. Risk management in this context is related to risks for the project.
In terms of risk and opportunity identification, the aim of the identification is to create a list of possible events that could either negatively (risk) or positively (opportunity) impact the objectives of the project. In this context any stakeholder within Project One could identify a risk or opportunity, at any time during the project lifecycle.
The process of risk and opportunity management is understood of a process of following steps:

- Risk Planning:

At the project outset the risk management plan is developed and the risk management system that hosts the risk register is implemented. The Board and the Project Managers are responsible for establishing the context for their respective domains. The program and project execution plans will define the scope of each project, its objectives and success criteria, the project's boundaries, interactions, deliverables, baselines and timescales, responsibilities and any assumptions, constraints and exclusions.

- Risk Identification:

The Risk Manager will coordinate the risk identification process and recommend the techniques for identification of the risks that affect project execution and or successful project delivery.
Risk identification may take place:

1. On an ongoing basis as part of the regular risk reviews,
2. On an ad-hoc basis, when a subject matter expert identifies and raises a new risk,
3. Or via dedicated risk workshops, planned around key milestones such as the beginning of project stages, the start of construction or commissioning.

- Risk Assessment

The IPMT Risk Management Plan Assessing includes approaches for qualitative and quantitative methods to assess likelihood and impact to enable the project to prioritise risks and determine the required level of agreement and endorsement.

- Risk Response

The objective of this step in the risk management process is to develop and implement actions that effectively manage all risks identified in the risk register. To accomplish this objective, the Risk Manager/Champion will support the Risk Owner in developing action plans that are Specific, Measurable, Achievable, Reasonable, and Time bounded.

- Monitor and Control

The risk manager is to deliver an effective monitoring system with clear Key Performance Indicators (KPIs) and accountabilities, in order to ensure that risk mitigation measures are progressing to plan.

- Closure and Learning

Once all actions have been completed and the risk can no longer affect the project, the risk can be closed out. A well-documented, evidence-based risk close out statement, recording the actual activity helps to provide a historic record and evidence for future audits and provide knowledge that could benefit P1 and future INEOS projects.

- Process improvement

The Project One risk management process is subject to an external audit as well as to an annual internal review as part of the continuous improvement process.
The risk management process is coordinated by the risk manager. The process is facilitated through a risk management software and results are recorded in an online risk register.

[58] Note: internal INEOS Olefins Belgium procedure, confidential

### 8.2.3 EIA risk and impact assessment approach and summary of results

The EIA process was performed in accordance with the Belgian (EIA/m.e.r.) procedure, which is aligned with the European Union legislation and is a legal-administrative procedure that requires to study, discuss and evaluate environmental impacts in a scientifically sound manner from an early stage in the decision-making process of a project.
In terms of the impact assessment, the EIA process considers the following elements[59]:

1. Baseline scenario:

A description of the current state of the environment in and around the area of the project, and the likely evolution thereof without the implementation of the Project. This description includes the development of studies on the environmental aspects potentially impacted by the Project. For Project One, the baseline studies include the following aspects:

- Noise;
- Air;
- Soil;
- Water;
- Mobility;
- Biodiversity;
- Landscape, archaeology and architectural heritage;
- Human Health, and
- Climate.

2. Effects (impact) on the environment:

The significance of the effects is assessed in the EIA. The criteria to evaluate the significance of the effects on environment are defined in each case separately and take into account both the characteristics of an impact and the values (or relevance) associated with the environmental issues affected into account.

3. Cumulative effects:

Can arise from the interaction between different projects in the same area or the interaction between the various impacts within the project. Effects of the existing industrial and port activities around the Project One site are part of the reference situation. Where relevant, the effects of the existing industrial and port activities around the Project One site are also addressed.

4. Assessment of alternatives:

Alternatives to the Project are described and compared, with a justification of the final selection of alternatives, including location, technologies, etc.

The EIA process[60] requires for Project One to define measures to avoid, prevent, reduce or offset any identified significant adverse effects on the environment are described in the EIA Report. These measures are commonly referred to as 'Mitigation Measures', with the exception of the last action, offsetting, which can be considered to be a Compensation Measure.
The EIA report includes different measures for addressing significant impacts assessed during the impact identification phase.

[59] Based on the requirements outlined in: https://ec.europa.eu/environment/eia/pdf/EIA_guidance_EIA_report_final.pdf

[60] Based on the requirements outlined in: https://ec.europa.eu/environment/eia/pdf/EIA_guidance_EIA_report_final.pdf

8.2.4 ESIA risk and impact assessment approach and summary of results

Considering that Project One must also comply with international Environmental & Social standards from Financial Institutions, an Environmental and Social Impact Assessment (ESIA) process is conducted based on the Equator Principles (2020) and the IFC Performance Standards (2012).
Due to the difference in the scope of assessment between EIA (Belgian m.e.r. requirements) and ESIA (based on international requirements), some additional E&S assessments have been performed to complete the ESIA, especially:

Environmental:
- impact on ecosystem services
- climate change risk assessment based on the TCFD framework.

Social:
- intangible cultural heritage and other social impacts, and
- human rights in the supply chain.

The Environmental and Social Management Plans (ESMPs) outline the measures required to mitigate the risks and impacts that have been identified and assessed in the context of the ESIA.

ESMPs defined in the context of ESIA include:
- Biodiversity program;
- Working Conditions program;
- Occupational and Community health and safety program; and
- Security program.

## 8.3 INEOS Climate and Energy network (CEN)

Since 2012, INEOS has a group-wide network that operates across businesses for all climate and energy-related matters (CEN). The main objectives of the CEN network are related to sharing information and views, shaping actions and strategies. While working at policy and advocacy level, CEN supports onsite best practices, initiates new business opportunities, and promotes innovation.
CEN is governed by a steering group. The network is sponsored by CEOs and directors of various INEOS Group businesses. CEN also benefits from regional information sharing through the country leads. The network currently has over 1000 members across the INEOS Group.
Via participation in associations such as Cefic (European Chemical Industry Council), via representation in industry councils and consortia, or through key contacts with officials, CEN aspires to play an active role in the climate & energy debate.
The network shares relevant information with all INEOS businesses, via weekly monitoring mails, via monthly calls with CEN Steering group, in annual meetings and via an internal document library. Next to this, updates from CEN are also shared at the half-yearly meetings with all business CEOs. Every year, the CEO of each INEOS business ensures the compliance of each of their manufacturing sites with INEOS Group's highest operational and financial standards.
The topics addressed by CEN include emissions, energy efficiency, resources, oil and gases, electricity, renewables, sustainability, innovation, policy, advocacy and more. The topics are further discussed in dedicated issue-specific teams and elaborated in the document library. Progress can be tracked via monthly updates of the CEN work plan.

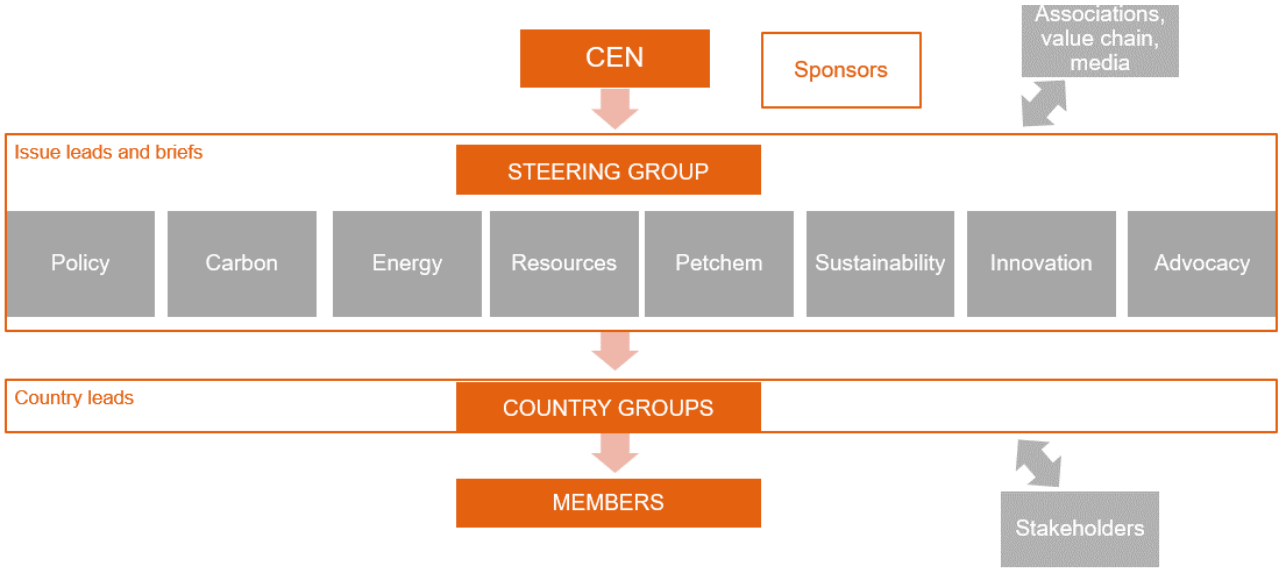



*Figure 8-1: CEN organizational structure*