

# Climate-Related Risk Management Report

Prepared in accordance to the recommendations of the TCFD

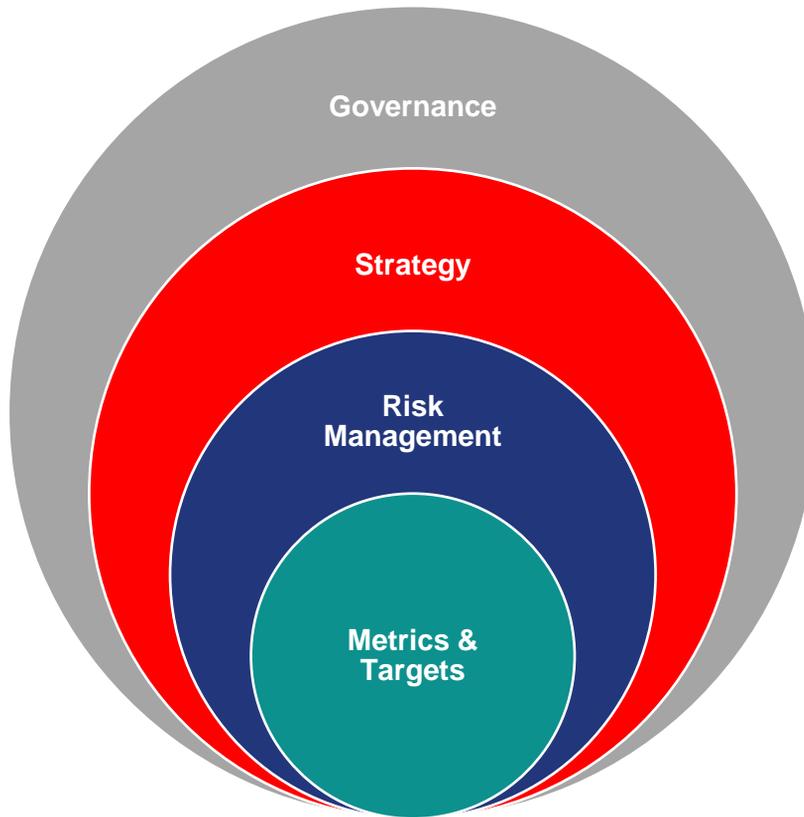


June 2022

# INTRODUCTION

## TCFD Reporting Framework

Figure 1: TCFD reporting framework overview



### PURPOSE

The chemical sector supplies a broad range of products that serve a range of markets and industries. The chemical sector is a large energy user and greenhouse gas (GHG) emitter, and faces risks associated with climate change and other sustainability issues. It is linked across entire value chains across almost all other industries, and is a key enabler of the low-carbon economy.

### ABOUT TCFD

The Task Force on Climate-Related Financial Disclosures (TCFD) was created in 2015 by the Financial Stability Board (FSB) to develop consistent climate-related financial risk disclosures for use by companies, banks, and investors in providing information to stakeholders. TCFD recommendations are globally recognized for climate-related risk management from the perspective of financial institutions.

TCFD recommendations serve as a global foundation for effective climate-related disclosures. IVL's disclosures are in line with the TCFD recommendations which enhance its consistency, robustness, and comparability. Our activities and contributions are detailed demonstrating how they

support each of the four frameworks. [IVL is a supporter of the TCFD recommendations](#) and has implemented core elements of recommended climate-related financial disclosures. The TCFD recommendations consists of four parts (Governance, Strategy, Risk Management, Metrics and Targets) which are explored in this report.

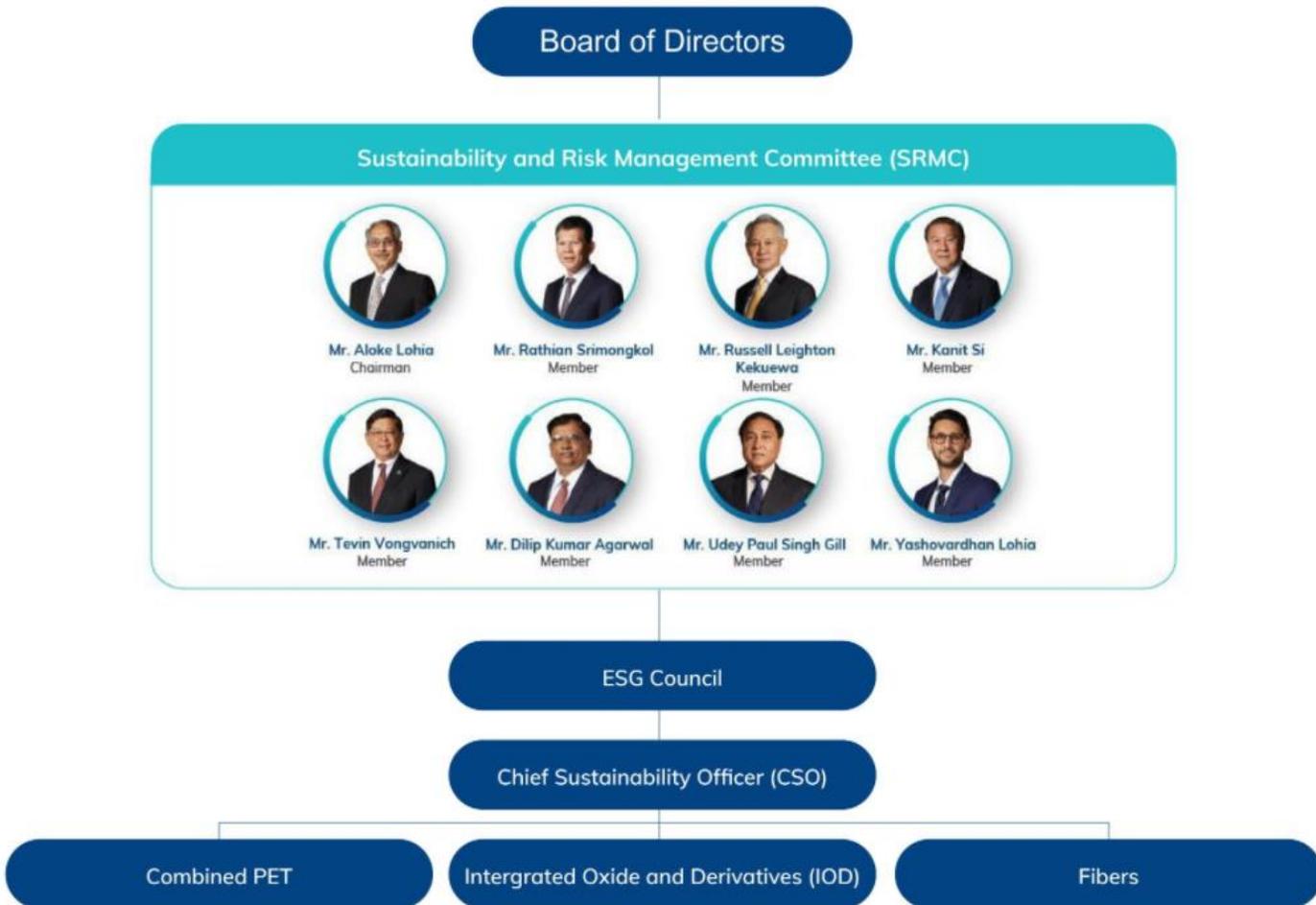
### ABOUT INDORAMA VENTURES

Indorama Ventures is one of the world's leading petrochemicals producers with a presence in 34 countries, 136 manufacturing facilities, 26,00 employees, and a consolidated revenue of US\$14.6bn in 2021. We are committed to improving our sustainability performance and have established our targets as indicated in our [Sustainability Report 2021](#). We see the circular economy as an important instrument in combating climate change and an opportunity to strengthen our recycling business globally. IVL has committed in June 2022 to set science-based emissions reduction targets (near-term targets), in line with the SBTi Criteria and Recommendations, submit them to the SBTi for validation and publish our approved targets, all within a maximum of 24 months.

# 1. GOVERNANCE

## Oversight & decision-making

Figure 2: Sub-committee structure



The Board of Directors provides oversight of and reviews climate-related risks and opportunities directly and additionally through the Sustainability Risk Management Committee (SRMC). The SRMC is one of three board sub-committees. The other two sub-committees are the Nomination, Compensation, and Corporate Governance Committee (NCCG) and the Audit Committee. The Audit Committee takes an active role in assessing the quality and reliability of sustainability performance reporting.

The SRMC, which meets quarterly, is chaired by the Group CEO and includes the CEO - Combined PET, IOD and Fibers businesses, Chief Strategy Officer, Chief Sustainability Officer, and four independent directors. The eight members of the SRMC work with all key functions of the organization including Communications, Risk Management, Strategy, Business Continuity Management (BCM), Environment, Health & Safety (EHS), and Sustainability in view of the broad and multidisciplinary nature of sustainability matters.

The SRMC approves and reviews the implementation of sustainability strategies including climate strategies, the implementation of sustainability initiatives including TCFD recommendations, scenario analyses, current and future physical and transitional risks, and plan the necessary measures to mitigate or eliminate these impacts.

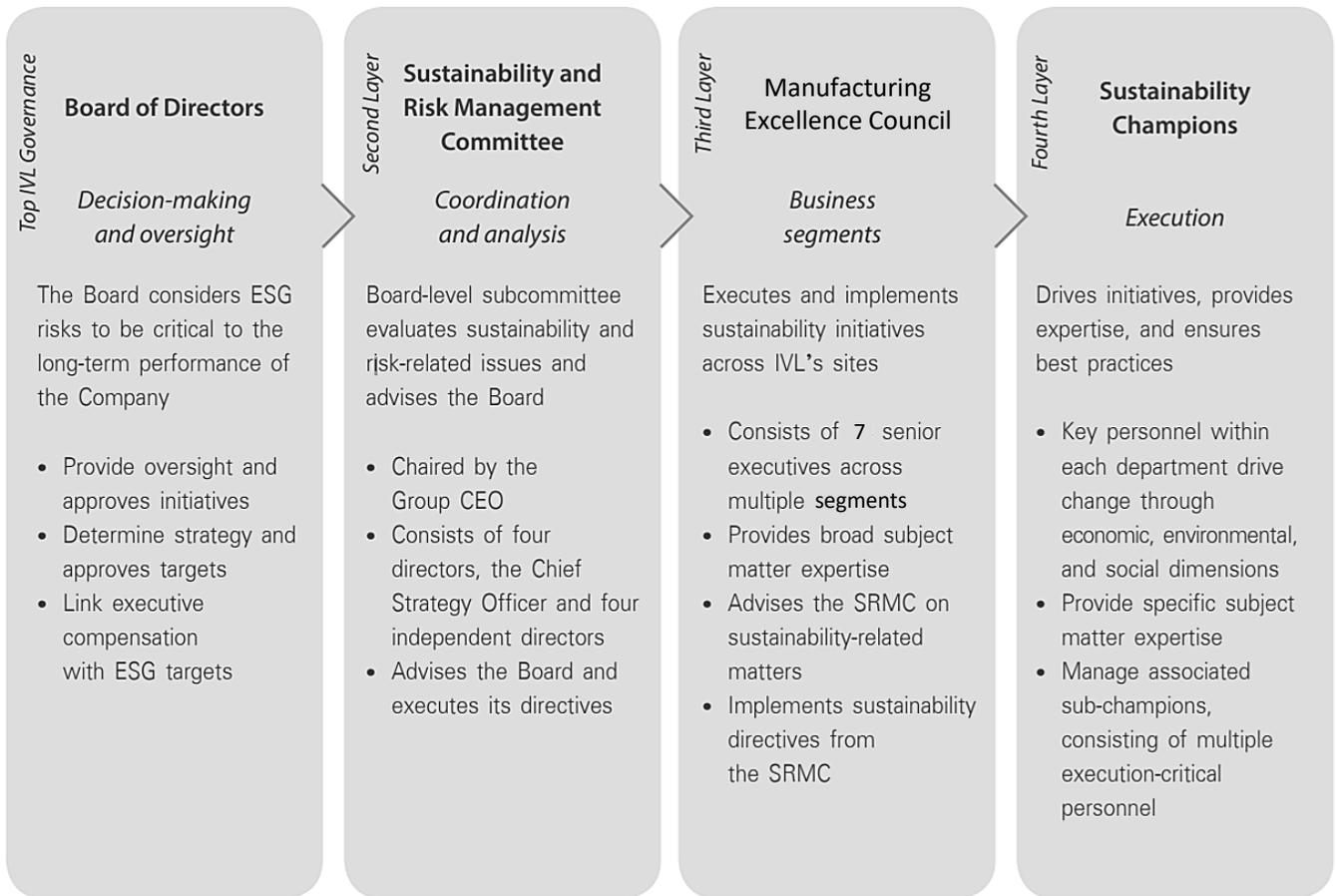
The Decarbonization Subcommittee, composed of subject matter experts of each segment, was formed in 2021 to drive decarbonisation initiatives at the segment and plant level. The subcommittee has implemented a decarbonization Standard Operating Procedure (SOP), which standardizes financial guidelines for decarbonization projects and implements an internal carbon price of US\$20/t.

More information on the individual members of the SRMC is available [here](#).

# 1. GOVERNANCE

## Organizational risk management structure

Figure 3: Climate-related risk integrated into existing risk management structure



IVL's risk management process is based on the Committee of Sponsoring Organizations of the Treadway Commission (COSO) framework and integrates climate risk into the risk management structure. An effective risk management structure provides strong support for risk management processes and their implementation. The Sustainability & Risk Management Committee (SRMC), a subcommittee of the Board, plays an important role in endorsing risk management throughout the organization which encourages the establishment of lines of authority, and the distinct roles and responsibilities of management and employees. Embedding risk champions as coordinators in enterprise risk management (ERM) is designed to support our business risk management processes and techniques leading to improved business performance.

We conduct a company risk assessment that allows any entity to obtain a holistic view of the risks it faces and allows management to identify these risks and capitalize on opportunities. We assess the potential impact and likelihood of risks. This covers the assessment and review of internal

and external risks, including global risks and other factors that may affect our operations due to increased business and international operations.

This also helps us to gain an understanding of the risks that can pose potential difficulties to our operations. We categorize business risks, operational risks, management risks, financial risks, and compliance and legal risks that cover our enterprise risk management as a whole. In addition, emerging risks are analyzed as they may develop or already exist but remain difficult to quantify and may have a high loss potential or a high degree of uncertainty. Additional information on "Risk Factors" and "Emerging Risks" are provided in our [Annual Report 2021](#).

While the tone of the organization at all levels is geared to risk management, other significant elements include our risk governance structure, corporate values, codes of conduct and ethics programs, policies and procedures, risk committee oversight activities and risk assessment processes

## 2. STRATEGY

### Climate-related risk management framework

Figure 4: IVL Sustainability Strategy framework



As part of our global corporate citizenship, we analyze and find opportunities to ensure that our sustainability efforts and measurable contributions are in line with climate science, and keeping a rise in global temperatures to well below 2°C with efforts to keep temperatures within 1.5°C by 2100 as per the Paris Agreement. We apply Climate Governance guidance from the World Economic Forum as a tool to help elevate the strategic climate debate and drive holistic decision-making that includes careful consideration of the links between climate change and business. Climate governance is the structure of rules and processes that IVL puts in place to ensure that we properly assess climate-related risks and opportunities, take appropriate strategic decisions on how to manage those risks and opportunities,

and report on relevant goals and targets, along with roles and responsibilities.

IVL identifies risks at the corporate and subsidiary levels around the world through integrated work processes and group-wide risk management, applying the enterprise risk management (ERM) framework using top-down and bottom-up approaches to anticipate any issues to mitigate their impacts in advance. They are identified through short-, medium-, and long-term timeframes. The climate-related risk management are analyzed through the perspective of (1) physical risk and (2) transition risk and their respective subcategories:

## 2. STRATEGY

### Climate-related risk management framework

#### Climate-Related Risks

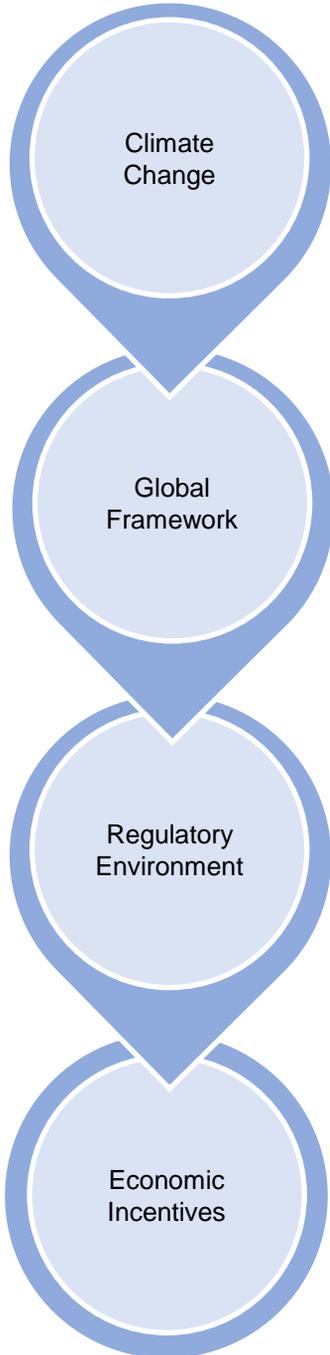
Transition Risk	<p><b>Technology</b></p> <p><i>Medium-term (3-10 years)</i>            Higher costs from increased energy consumption            Unsuccessful investments in new technologies            Substitution of existing products with low emissions products</p>	<p><b>Market</b></p> <p><i>Medium-term (3-10 years)</i>            Changes in consumer preferences from high carbon intensive to low carbon products            Increased cost of raw materials            Access to financing &amp; insurance increasingly affected by climate &amp; environmental risks</p>
	<p><b>Policy and Legal</b></p> <p><i>Medium- and long-term (3-20 years)</i>            Increased operational costs due to changes in environmental legislation            Implementation of cap-and-trade or carbon tax in jurisdictions in which the company operates            Exposure to litigation            Enhanced emissions reporting obligations</p>	<p><b>Reputation</b></p> <p><i>All time frames</i>            Global focus on plastic pollution            Movements on fossil fuel avoidance            Change in consumer preferences            Increased stakeholder concern</p>
	<p><b>Acute</b></p> <p><i>Medium- and long-term (3-20 years)</i>            Increased severity of extreme weather events such as cyclones, droughts, and floods</p>	<p><b>Chronic</b></p> <p><i>Medium- and long-term (3-20 years)</i>            Risk of sea level rise and riverine flooding for sites located in high-risk areas            Rising mean temperatures            Changes in precipitation patterns and extreme weather variability leading to production disruption            Impact of water stress on production</p>
	Physical Risk	

#### Climate-Related Opportunities

<p><b>Resource Efficiency</b></p> <p>Use of more efficient modes of transport            Use of more efficient production and distribution processes            Use of recycling            Building efficiency improvements            Reduced water usage and consumption            New technologies to reduce resource intensity in production</p>	<p><b>Energy Source</b></p> <p>Use of lower emission sources of energy            Use of supportive policy incentives            Use of new technologies            Participation in carbon markets            Innovative power purchase contract structures</p>	<p><b>Products and Services</b></p> <p>Development and expansion of low emission goods and services            Development of climate adaptation and risk solutions            Development of products or services through R&amp;D and innovation            Diversification of business activities            Shift in consumer and customer preferences</p>
<p><b>Markets</b></p> <p>Access to new markets            Use of public-sector incentives            Access to new assets and locations needing insurance coverage</p>	<p><b>Resiliency</b></p> <p>Participation in renewable energy programs and adoption of energy efficiency measures            Resource substitution, innovation, and diversification            Development and deployment of recycling technologies            Meeting and getting ahead of emissions and single-use plastics regulation</p>	

## 2. STRATEGY

### Climate-related risk impact on IVL



#### Physical and Ecological Effects

Climate change has severe and irreversible effects on the environment, ecology, and human health. The Intergovernmental Panel on Climate Change's (IPCC) detail these catastrophic effects including rising temperatures and sea levels, changing precipitation patterns, severity of extreme weather events, and the collapse of entire ecosystems. These effects may lead to food and water stress, resulting in famines, droughts, and human displacement.

#### Paris Climate Agreement (PCA)

The PCA is a landmark agreement adopted by nearly every nation in 2015 to address climate change and its negative impacts. The deal aims to substantially reduce global greenhouse gas emissions in an effort to limit the global temperature increase in this century to 2°C above preindustrial levels, while pursuing means to limit the increase to 1.5°C. There are commitments from all major emitting countries to cut their pollution and to strengthen those commitments over time.

#### Carbon Pricing

Carbon pricing covers 23% of global GHG emissions across 68 carbon pricing initiatives. These include 32 emissions trading schemes such as the EU ETS, and 36 carbon taxes which combined raised US\$84bn in 2021.

#### Emissions Regulation

Governments around the world are regulating the carbon content of products directly, such as through vehicle emission standards or through the proposed EU Carbon Border Adjustment Mechanism (CBAM).

#### Sustainable Finance

The increased popularity of sustainability-linked credit facilities and ESG-integrated equities have made access to financing directly dependent upon our carbon performance.

#### Customer Demand

Strong carbon footprint performance is now a competitive advantage due to both consumer awareness of climate issues and ambitious GHG target-setting by our customers.

#### Resiliency

Global regulations on GHG emissions will become stricter and customers may increasingly favor low-carbon products. Investing now will prevent disruption in the future.

## 2. STRATEGY

### Decarbonisation pathways

Conventional Pathways

#### Efficiency & Optimization

Proposed projects that seek to address resource intensity are classified as green projects. Sites regularly propose green projects, with new projects to be approved by the head office. IVL maintains a pipeline of green projects classified into approved, promising, and aspirational scenarios according to payback period and cost efficiency.

#### Natural Capital Solutions

Natural capital solutions compensate for each ton of GHG emitted by operations by ensuring that there is one ton less GHG in the atmosphere such as by funding additional renewables, forestry and wetland projects, or injecting it underground. IVL is exploring carbon credit issuance at recycling facilities and is exploring ownership structures for carbon offsetting projects to address residual emissions.

#### Energy Transition

IVL has implemented solar rooftops and is exploring switching from coal to low carbon-intensive energy sources. IVL is also exploring renewable energy purchases through Virtual Power Purchase Agreements (VPPA) which is expected to make up the bulk of our renewable energy procurement.

#### Recycling

Recycling addresses both emissions reduction and plastic pollution. Recycled PET (rPET) has significant environmental advantages over virgin PET both in terms of lower lifecycle carbon emissions and in addressing plastic pollution.

Supporting Activities

#### Supplier Engagement

A pilot supplier engagement program has been set up in 2022 which will seek to address IVL's scope 3 emissions by gathering product-specific carbon footprint data from suppliers and collaborating on emissions reductions.

#### Internal Carbon Pricing

Internal carbon pricing (ICP) is used in project finance assessments in some sites and we plan to introduce guidance and training to sites to accelerate the use of ICP.

New Technologies

#### Carbon Capture, Utilization, and Storage (CCUS)

Carbon capture, utilization, and storage (CCUS) is a family of technologies that directly removes carbon dioxide directly from the air from a high-intensity source such as a coal or gas power station. IVL is monitoring the development of CCUS technology and applicability to sites.

#### Renewable Natural Gas (RNG)

RNG is methane gas, chemically identical to fossil fuel natural gas but sourced from decaying feedstocks. Nearly all available RNG is siphoned off landfills, sewage treatment plants, or livestock manure ponds on large industrial farms. RNG can have significantly lower emissions than conventional natural gas.

#### Bio / Renewable Feedstock

IVL manufactures biobased PLA at the Trevira site in Germany and is exploring expanding this capability to other sites within the group. Biobased and biodegradable feedstock can have significant environmental advantages including a lower carbon footprint and can be industrially compostable.

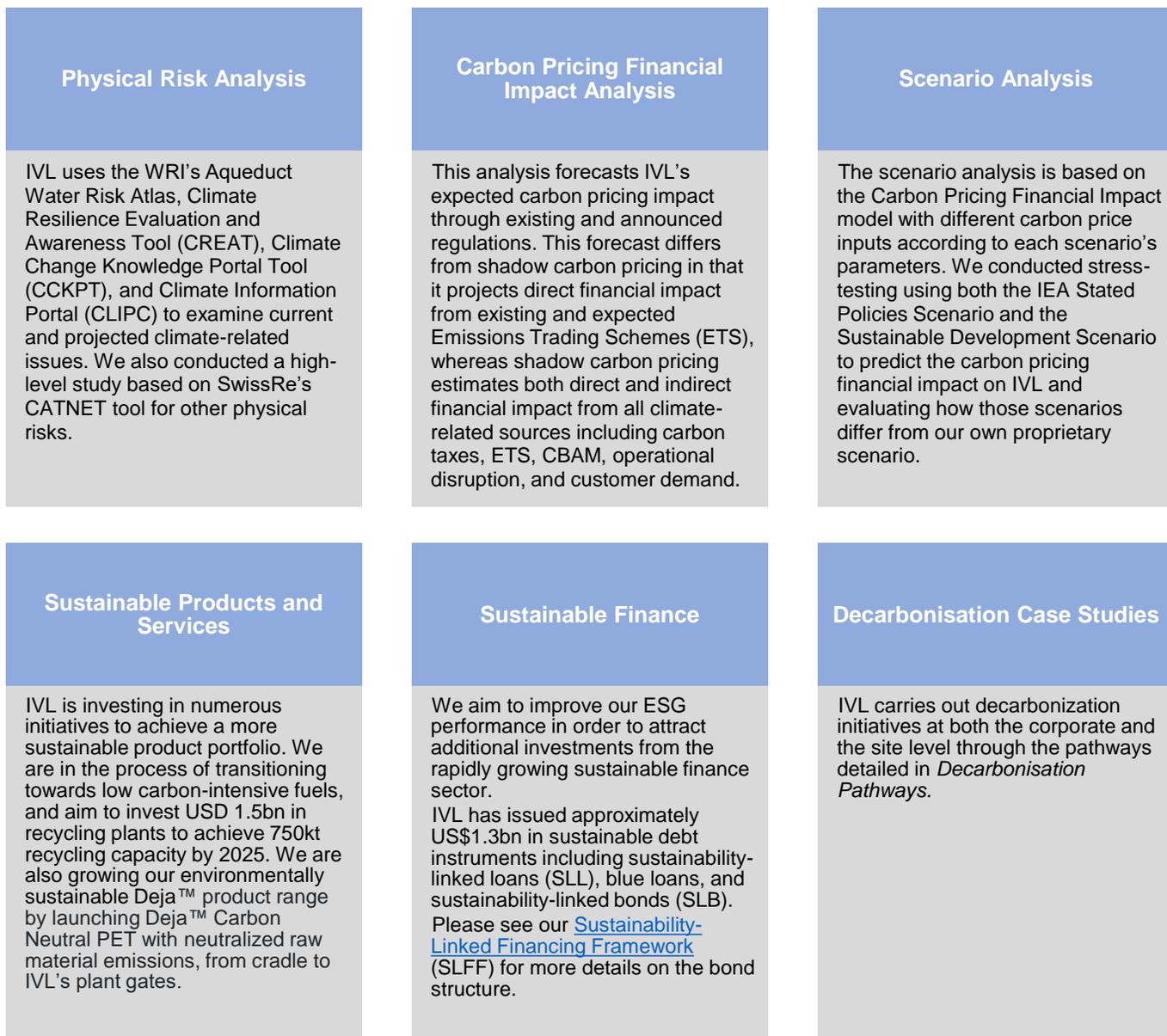
#### Green Hydrogen

Green hydrogen is produced by splitting water molecules into hydrogen and oxygen via electrolysis in which the process is powered by renewable electricity. We expect green hydrogen to play a central role in our decarbonization strategy as we forecast it to become cost competitive with natural gas within the coming decades as a result of the declining cost of renewable energy & electrolyzers, and the implementation of carbon pricing across more jurisdictions.

# 3. RISK MANAGEMENT

## Overview of climate risk management initiatives

Figure 5: Examples of IVL's climate-related risk management initiatives



IVL manages risks at the corporate and subsidiary levels around the world through integrated work processes and group-wide risk management, applying the Enterprise Risk Management (ERM) framework using top-down and bottom-up approaches. On an initial assessment, we identify risks and opportunities associated with climate change through the use of an ERM framework to anticipate any issues to mitigate their impacts in advance. Mapping is performed across the IVL asset portfolio to identify sites with high ESG risk. We then perform a targeted intervention to mitigate the identified risk.

Financial analyses are performed according to the scenarios underlying the above themes in order to see how they affect Revenue, Cost of Goods Sold, EBITDA. From the results and cost estimations, we communicate directly with plants to develop clear action plans and assign champions to coordinate with all plants and regularly report to management.

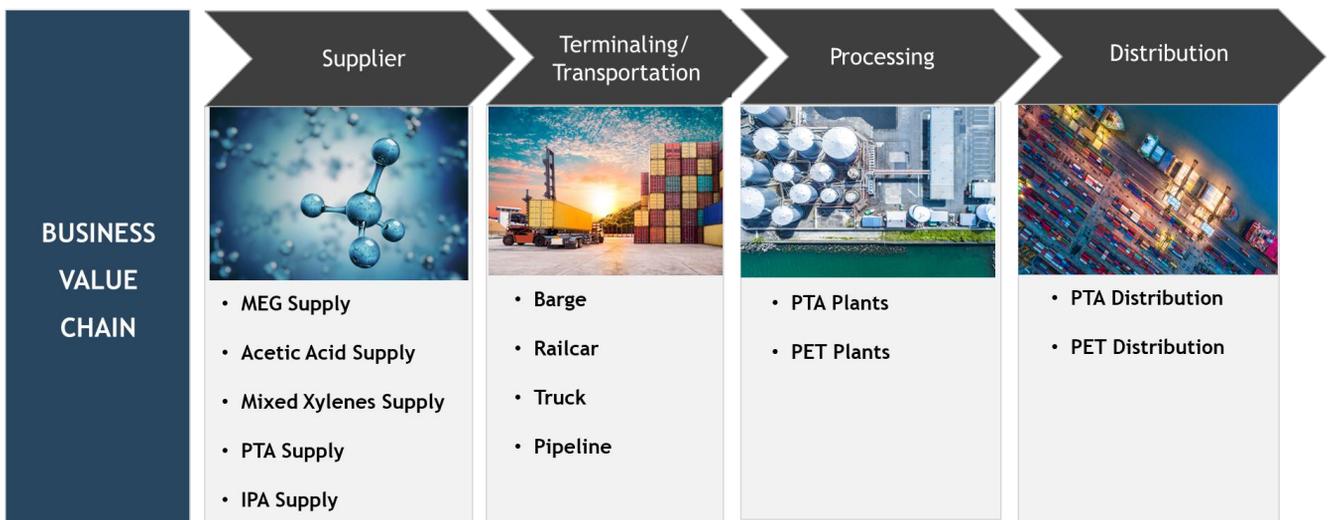
# 3. RISK MANAGEMENT

## Physical risk mitigation measures

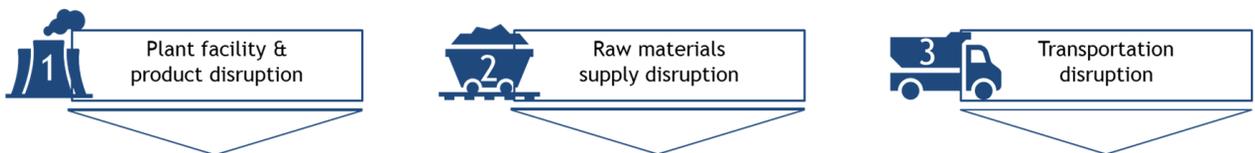
IVL created a BCM group with the mandate to implement Business Continuity Processes (BCP) in a phased manner across IVL. BCP will be introduced for mission critical business supply chain covering PET, PTA/IPA, and MEG. IVL is an integrated petrochemical company which involves sourcing, terminaling, manufacturing and distribution. The BCP is designed to cover disruption scenarios such as raw material disruption, plant disruption as well as transportation disruption. The recovery strategies are crucial for adding agility in our operations, effectively manage & quickly respond to supply chain disruptions.

Additionally, we have developed site-specific critical action plans to mitigate risks at sites historically subject to these risks and sites identified as high-risk according to the CATNET analysis. This physical climate related risk mitigation measures covers IVL's existing operations as well as new operations. For example, sites at risk of tornadoes and hurricanes have had underground bunkers installed which are able to shelter plant personnel during an incident and are equipped with critical supplies which can last up to several weeks. Sites subject to lightning strikes have had mitigation measures such as lightning rods installed, and sites subject to severe weather events have had backup generators installed. Additionally, a supply chain disruption action plan was developed which includes guidance for reduction in merchant sales, increased inventory of feedstock and fuels, and production optimization according to availability of materials.

### Overview of Integrated PET Value Chain



### Summary of recovery strategies



### Business Recovery Strategies Objectives

 Seasonal Recovery Strategies	 Product Standardization	 Central Inventory Management	 Supply Flexibility	 Collaborative Partnership
<ul style="list-style-type: none"> <li>• Safety stock required volume &amp; location</li> <li>• Lock-in key transportation capacity</li> <li>• Break bulk as an alternative transportation</li> </ul>	<ul style="list-style-type: none"> <li>• Standardize nomenclature/ names as well as product recipe formulation to reduce qualification time and increase flexibility to source from a wider range of customers</li> </ul>	<ul style="list-style-type: none"> <li>• List of critical spares and equipment, its location, potential providers</li> <li>• List of critical raw materials, volume and their locations</li> </ul>	<ul style="list-style-type: none"> <li>• Contract flexibility to enable rerouting of available raw material</li> <li>• Alternate supplier for key raw materials (MEG, PTA, AA)</li> </ul>	<ul style="list-style-type: none"> <li>• Faster resumption with readily available spare parts for critical equipment from suppliers, competitors &amp; customers</li> </ul>

### 3. RISK MANAGEMENT

#### Physical risk analysis

##### Windstorm

(millions USD)

50y Peak Gust	*as of May 2022 Locations	Business Interruption	Share Number of locations	
 High (50-60 m/s)	3	400	2.68%	
 Significant (40-50 m/s)	14	2,410	12.5%	
 Moderate (35-40 m/s)	5	860	4.46%	
 Moderate (30-35 m/s)	23	2,362	20.54%	
 Low (25-30 m/s)	27	3,573	24.11%	
 Low (20-25 m/s)	7	866	6.25%	
 Very Low (<20 m/s)	33	4,029	29.46%	
<b>Total</b>	<b>112</b>	<b>14,500</b>	<b>100%</b>	

##### Hailstorm

Hail Days (>2cm) per 2500 km <sup>2</sup> and Year	Locations	Business Interruption	Share Number of locations	
 High (0.6 - 0.8)	6	1,117	5.36%	
 Significant (0.4 - 0.6)	15	1,510	13.39%	
 Moderate (0.2 - 0.4)	13	588	11.61%	
 Low (0.1 - 0.2)	38	7,389	33.93%	
 Very Low (<0.1)	36	3,344	32.14%	
 No Data	4	552	3.57%	
<b>Total</b>	<b>112</b>	<b>14,500</b>	<b>100%</b>	

##### Tsunami

Return Period [years]	Locations	Business Interruption	Share Number of locations	
 No Data	12	2,320	10.71%	
 Outside	100	12,180	89.29%	
<b>Total</b>	<b>112</b>	<b>14,500</b>	<b>100%</b>	

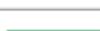
# 3. RISK MANAGEMENT

## Physical risk analysis

### Fluvial Flood

Return Period [years]	*as of May 2022 Locations	(millions USD)		Share Number of locations	
		Business Interruption	Number of locations		
 50 years	10	888	8.93%		
 100 years	10	756	8.93%		
 200 years	8	1,873	7.14%		
 500 years	6	744	5.36%		
 > 500 years	17	2,652	15.18%		
 Outside	61	7,587	54.46%		
<b>Total</b>	<b>112</b>	<b>14,500</b>	<b>100%</b>		

### Earthquake

MMI & PGA (g)	Locations	Business Interruption	Share Number of locations	
 Very High (0.401 - 0.550)	2	0	1.79%	
 High (0.291 - 0.400)	2	30	1.79%	
 Significant (0.161 - 0.29)	13	1,399	11.61%	
 Moderate (0.085 - 0.160)	13	1,894	11.61%	
 Low (0.046 - 0.084)	14	1,637	12.5%	
 Very Low (0.014 - 0.045)	39	4,932	34.82%	
 Negligible (< 0.014)	29	4,608	25.89%	
<b>Total</b>	<b>112</b>	<b>14,500</b>	<b>100%</b>	

### Wildfire

Months with burnt areas in 0.25deg grid (1995-2016)	Locations	Business Interruption	Share Number of locations	
 Very High (9)	1	200	0.89%	
 High (8)	5	280	4.46%	
 Significant (7)	8	1,832	7.14%	
 Moderate (6)	14	2,090	12.5%	
 Moderate (5)	10	739	8.93%	
 Low (4)	6	1,065	5.36%	
 Low (3)	6	584	5.36%	
 Very Low (2)	62	7,710	55.36%	
<b>Total</b>	<b>112</b>	<b>14,500</b>	<b>100%</b>	

# 3. RISK MANAGEMENT

## Physical risk analysis

### Tornado

(millions USD)

F2-F5 Tornadoes per 2500 km <sup>2</sup> and Year	*as of May 2022 Locations	Business Interruption	Share Number of locations	
Very High (> 0.75)	9	1,534	8.04%	
Significant (0.35 - 0.5)	2	355	1.79%	
Moderate (0.2 - 0.35)	8	2,412	7.14%	
Low (0.1 - 0.2)	16	1,559	14.29%	
Very Low (< 0.1)	20	2,567	17.86%	
No Data	4	240	3.57%	
No Observation	53	5,833	47.32%	
<b>Total</b>	<b>112</b>	<b>14,500</b>	<b>100%</b>	

### Lightning

Annual flash rate per km <sup>2</sup>	Locations	Business Interruption	Share Number of locations	
Very High (36-50)	2	82	1.79%	
Very High (26-35)	8	711	7.14%	
High (21-25)	17	3,046	15.18%	
High (16-20)	24	3,852	21.43%	
Significant (11-15)	14	1,666	12.5%	
Significant (7-10)	7	515	6.25%	
Moderate (4-6)	8	842	7.14%	
Low (1-3)	26	2,730	23.21%	
No Data	6	1,056	5.36%	
<b>Total</b>	<b>112</b>	<b>14,500</b>	<b>100%</b>	

### Volcano

Ash Thickness [cm], Return Period 475y	Locations	Business Interruption	Share Number of locations	
Moderate (2 - 5 cm)	1	281	0.89%	
Low (1 - 2 cm)	3	193	2.68%	
Low (0.1 - 1 cm)	2	0	1.79%	
No Data	106	14,026	94.64%	
<b>Total</b>	<b>112</b>	<b>14,500</b>	<b>100%</b>	

### 3. RISK MANAGEMENT

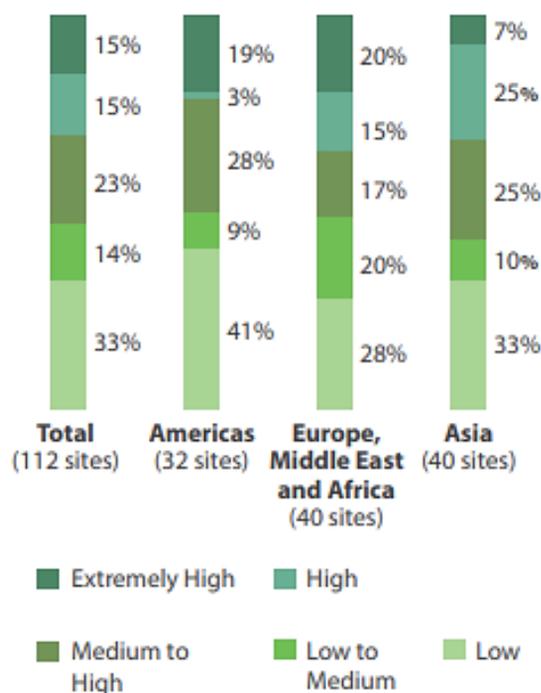
#### Water risk analysis

We manage our water responsibly, including water withdrawal and discharge, and seek continuous improvements in water management through the 3Rs. IVL is conscious of water risk and is demonstrating responsibility through our efficient water management stewardship. We focus on local water risk assessments and through follow-up, have an effective risk management system in place, and regularly assess our exposure to water related risks. We conducted a water sensitivity analysis using the AQUEDUCT Water Risk tool developed by WRI to identify water stress locations in 2021.

This tool helped us to evaluate changes in water demand, water supply, stakeholder risk, and regulations based on current and future conditions. It also enabled us to foresee changes to water risk forecasting in 2020, 2030 and 2040. These results have been analyzed and discussed during risk assessment committee meetings on a yearly basis to identify the necessary mitigation measures [2] and any meaningful initiatives for plants located in areas facing extreme water stress or significant risks to water usage.

**Figure 6: Water Stress Assessment**

(% of IVL's operations identified in water stress areas using the AQUEDUCT Water Risk Tool)



**Figure 7: Water Cost Projection and Cost of Shutdown**

Stress Level	#Sites	%Sites	Estimated Water Cost 2030 (USD)
Extremely high (>80%)	19	18%	3,909,522
High (40-80%)	14	13%	1,522,170
Medium-high (20-40%)	34	32%	13,186,316
Low - Medium (10-20%)	19	18%	7,018,159
Low (<10%)	20	19%	2,418,032
Arid and low water use	1	1%	28,916
<b>Total</b>	<b>107</b>		<b>28,083,114</b>

Note: Water cost in 2020 was US\$25.39m USD. 2030 figure of US\$28.08m is a 9.58% increase from 2020.

Stress Level	No. of sites	30-day shutdown	60-day shutdown	90-day shutdown
Extremely High	19	15.2	30.3	45.5
High	14	9.9	19.7	29.6
<b>Total (millions USD)</b>		<b>25.1</b>	<b>50</b>	<b>75.1</b>

Note: Financial impact estimated via loss of EBITDA from plant shutdown due to water shortage, based on 2021 water stress assessment

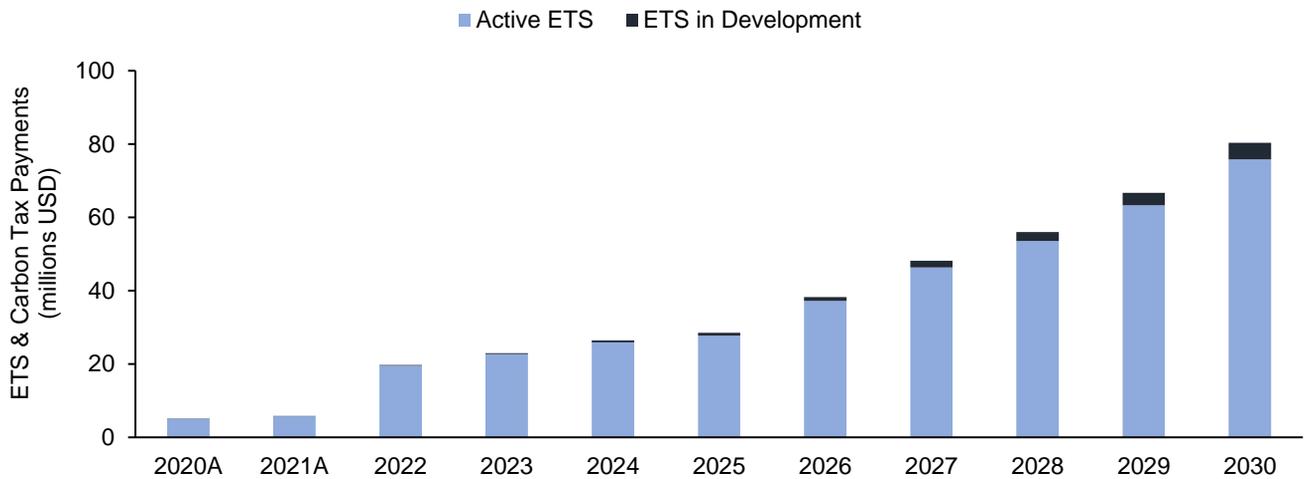
[1] Image sourced from [WRI Aqueduct Water Risk Atlas tool](#) based on 107 sites worldwide

[2] WRI (2019), [Setting Site Water Targets Informed By Catchment Context](#), WRI, Washington, D.C.

# 3. RISK MANAGEMENT

## Carbon pricing financial impact model

Figure 8: Estimated ETS payments at IVL-level 2020A-2030F

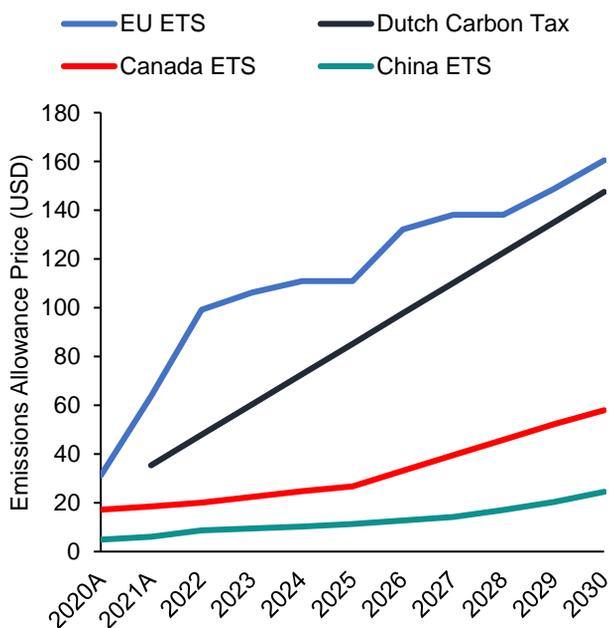


IVL also measures climate-related regulatory risks through financial impact modelling. The Carbon Pricing Impact Model (“model”) forecasts the annual payments IVL makes towards emissions trading schemes (ETS) worldwide. The results of the model indicates that IVL’s compliance costs are projected to increase from less than **US\$10m** over the previous decade to around **US\$390m** over the current decade, with **US\$15m** of the figure from new ETS expected to come into operation.

**The key inputs of the model include the following:**

- (1) Estimated scope 1 GHG abatement from decarbonization projects, with projects aggregated into 3 distinct scenarios (Approved, Promising, Aspirational)
- (2) ETS free allocation / cap reduction schedule
- (3) Emissions allowance price forecast
- (4) Estimated operational date, allocation methodology, and sector coverage for future ETS [1]
- (5) Overall IVL production to increase by 28% by 2030 from 2020 according to business plan, including expansions to existing sites, greenfield projects, and M&A

Figure 9: Emissions allowance price forecast



**The key assumptions of the model include the following:**

- (1) All sites making current ETS payments or with annual scope 1 emissions greater than 25ktCO<sub>2</sub>e and within an area covered by an ETS in the future may be subject to ETS payments
- (2) Free allocation remains at the level announced by regulators or at the level assumed for future ETS that have not disclosed a free allocation amount
- (3) Emissions allowance prices remain within acceptable bounds of the allowance price forecast [2][3][4][5][6].
- (4) Exchange rates remain constant

All information disclosed regarding the model are forward-looking, except for statements of historical fact. All forecasts, projections, and estimates have a high level of uncertainty including but not limited to (1) estimated emissions allowance prices, (2) estimated ETS coverage, structure, free allocation, operational dates, and (3) IVL emissions due to operational changes or mergers & acquisitions. Change in any variable’s value may materially impact model output.

The model is used to inform management decisions and provide site-specific carbon prices for use in project finance.

[1] Based on [International Carbon Action Partnership](#) (ICAP) materials and regulatory filings  
 [2] EU ETS price sourced from BloombergNEF forecast (retrieved May 2022)  
 [3] Dutch carbon tax based on active legislation  
 [4] Western Climate Initiative (WCI) based on ClearBlue scenario analysis and BloombergNEF forecasts.  
 [5] China ETS price forecast based on China Carbon Trading market report from JPMorgan and Refinitiv forecasts.  
 [6] Based on exchange rates as of May 2022

### 3. RISK MANAGEMENT

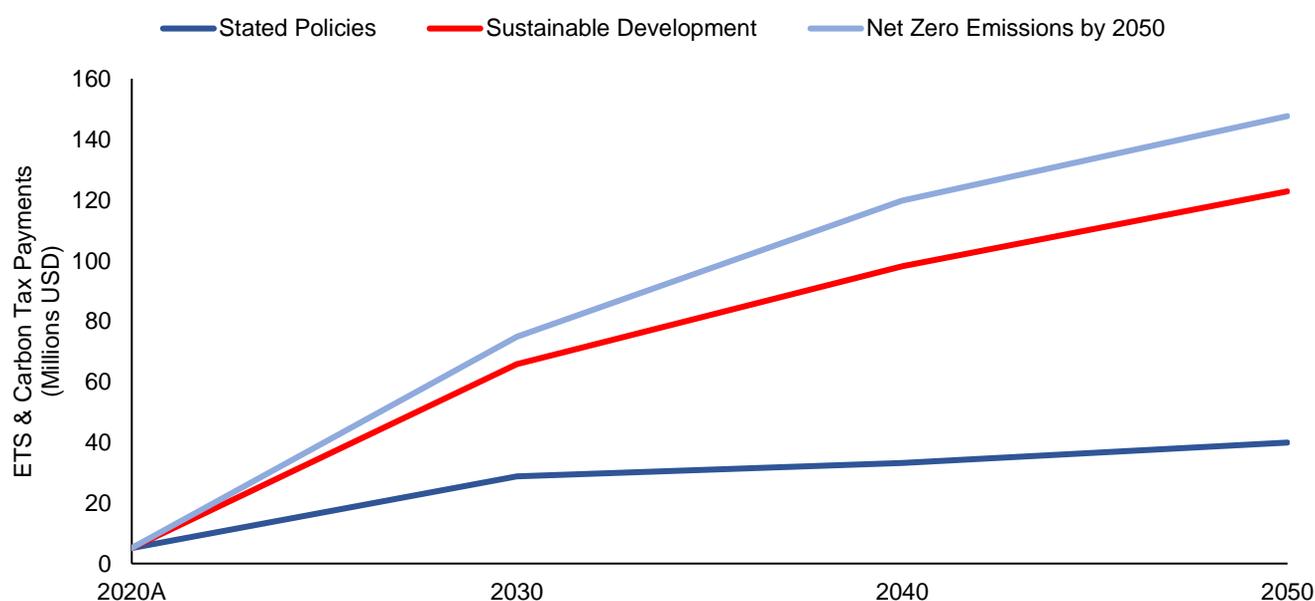
#### Scenario analysis

Figure 10: Scenario references (USD) [1][2]

Scenario	Scenario Description	2030 Impact	2040 Impact	2050 Impact
<a href="#">IEA Stated Policies Scenario (STEPS)</a>	Business-as-usual without new climate policies. The Stated Policies Scenario reflects the impact of existing policy frameworks and today's announced policy intentions. The aim is to hold up a mirror to the plans of today's policy makers and illustrate their consequences for energy use, emissions and energy security.	\$28.8m	\$33.3m	\$39.9m
<a href="#">IEA Sustainable Development Scenario (SDS)</a>	An additional scenario referenced in WEO-2021 is the Sustainable Development Scenario (SDS). As a "well below 2 °C" pathway, the SDS represents a gateway to the outcomes targeted by the Paris Agreement. Like the NZE, the SDS is based on a surge in clean energy policies and investment that puts the energy system on track for key SDGs.	\$65.8m	\$98.2m	\$122.9m
<a href="#">IEA Net Zero Emissions by 2050 (NZE)</a>	Narrow but achievable pathway for the global energy sector to achieve net zero CO2 emissions by 2050, with advanced economies reaching net zero emissions in advance of others. This scenario also meets key energy-related United Nations Sustainable Development Goals (SDGs), in particular by achieving universal energy access by 2030 and major improvements in air quality. The is consistent with limiting the global temperature rise to 1.5 °C without a temperature overshoot.	\$74.9m	\$119.8m	\$147.7m

Note: IVL made carbon pricing payments of approximately \$5.1m in 2020

Figure 11: Scenario analysis



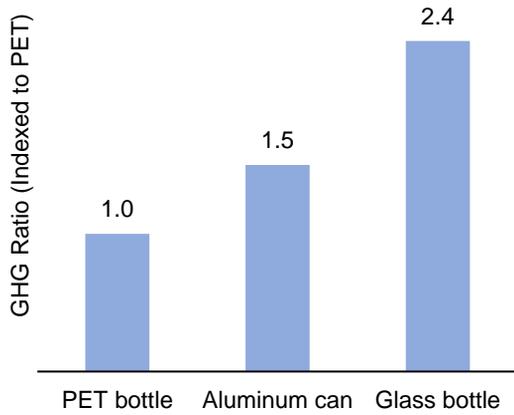
[1] [Table of reference for climate scenarios](#), UNPRI (2021)

[2] [World Energy Model](#), IEA (2022).

# 3. RISK MANAGEMENT

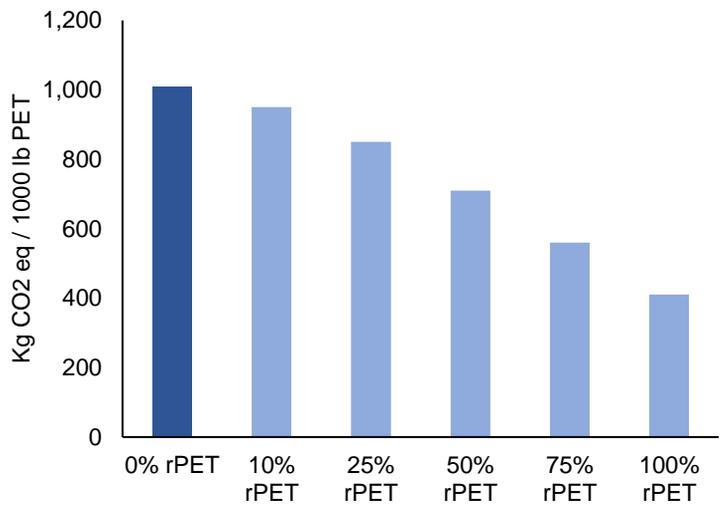
## Sustainable products & services

**Figure 12: GHG emissions comparison between packaging materials**



Note: Based identical container volume, PET = 1X; [1][2]

**Figure 13: GHG emissions comparison between rPET blends**



Note: Based on LCI of PET with varied %Virgin PET / rPET

Recycled PET (rPET) has significant environmental advantages over virgin PET both in terms of lower lifecycle carbon emissions and in addressing plastic pollution. PET is a fully recyclable material that when recycled that can have lower lifecycle emissions than virgin PET and other materials. Our recycling strategy is focused on strengthening our capability to increase recycling rates globally, contributing to a circular economy, and ensuring a fully closed loop. We will build on our leadership position as the largest virgin PET producer and remain a leader in rPET.

We are actively working with the European Union to reduce plastic waste as part of their Single Use Plastic Directive and intend on remaining at the forefront of recycling plastic waste and adopting business models that reinforce circular processing.

As a leading recycler in Europe, North America and Asia, we have a competitive advantage in rPET with 30 years of recycling expertise and strong partnerships across the circular value chain.

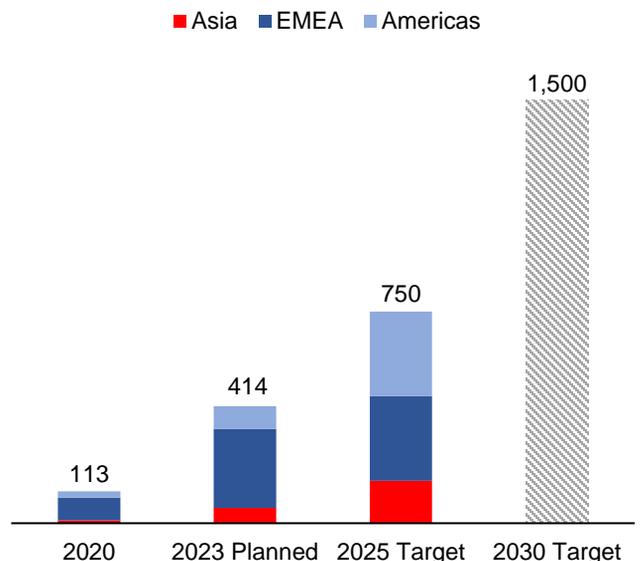
### Recycling Capacity Expansion

We are increasing our investments in recycling plants and committed **US\$1.5 billion** to build the recycling infrastructure needed globally to close the loop, encouraging the end-use of recycled PET and delivering a circular economy for beverage packaging. We have committed to increasing annual PET input to **750,000 tons by 2025 and 1.5 million tons by 2030** and are working with several industry partners to achieve a circular economy for sustainable plastics.

We have acquired proprietary knowledge of mechanical recycling and developed partnerships with innovative players to develop and test next-generation chemical recycling technologies.

IVL currently has 15 recycling plants worldwide, with 4 acquisitions/JVs in 2020: IVSSF (USA), IVSSB (Brazil), IMP Polowat (Poland), and a greenfield PETValue JV (Philippines).

**Figure 14: Path to 2030 rPET target (kt)**



[1] Based on Lifecycle Inventory Analysis, which includes total energy, raw material, air and water emissions and total solid waste produced from cradle-to-disposal/recycling of product

[2] Source: Converse & Woodmac / Euromonitor; Franklin Associates, Cleanmetrics Corp; Goldman Sachs GIR

[3] Source: NAPCOR, Franklin Associates Promoting and Protecting the PET Package report

# 3. RISK MANAGEMENT

## Sustainable products & services

Figure 15: Deja™ brand launch materials

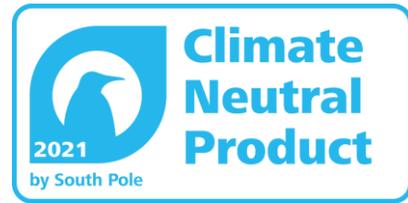


Through its **Deja™** global, sustainable ingredient brand, IVL is differentiating itself in the marketplace by offering a performance-led suite of sustainable solutions that helps its customers to achieve their sustainability targets, while also responding to end consumers' demand for transparency and environmental responsibility.

Figure 17: Deja™ product range

	<b>Deja™ rPET Flake</b> 100% Post-Consumer Recycled Flake
	<b>Deja™ rPET Pellet</b> 100% Post-Consumer Recycled Pellet
	<b>Deja™ rPET Filament Yarns</b> 100% Post-Consumer Recycled Polyester (rPET) Performance Filament
	<b>Deja™ rPET Staple Fibers</b> 100% Post-Consumer Performance Fibers
	<b>Deja™ Carbon Neutral Pellet</b> Fully neutralized raw material emissions from cradle to our plant gates

Figure 16: Deja™ product carbon neutrality verification and labelling carried out by South Pole



**Deja™ Carbon Neutral** PET pellet is the latest innovation under IVL's **Deja™** global brand offering as the world's first certified carbon neutral PET pellet solution. It is a significant addition to the growing **Deja™** portfolio, which includes sustainable PET, rPET, polymer and fiber range of products available across flake, pellet, fiber and filament ingredients. **Deja™ Carbon Neutral** PET pellet has been sustainably produced throughout its supply chain and helps environmentally conscious companies to achieve their sustainability targets by lowering their Scope 3 GHG emissions. IVL's unique access to recycling sources through its own global supply chain ecosystem means it can power sustainability and support customers that are aiming to close the loop.

**Deja™ Carbon Neutral** is a PET proposition with neutralized raw material emissions, from cradle to IVL's plant gates [1]. It comes with an independently verified carbon neutral certification of compliance from globally established providers. Through a partnership with South Pole, a leading project developer and provider of global climate solutions, IVL offsets unavoidable carbon emissions through projects that help transform lives and protect the environment. IVL currently supports three projects through the purchase of high-quality carbon offsets for **Deja™ Carbon Neutral**, an example of which is shown below:

**Safe Community Water Supply, Rwanda**

	 <p><b>1 NO POVERTY</b></p>	 <p><b>6 CLEAN WATER AND SANITATION</b></p>
	 <p><b>13 CLIMATE ACTION</b></p>	 <p><b>15 LIFE ON LAND</b></p>

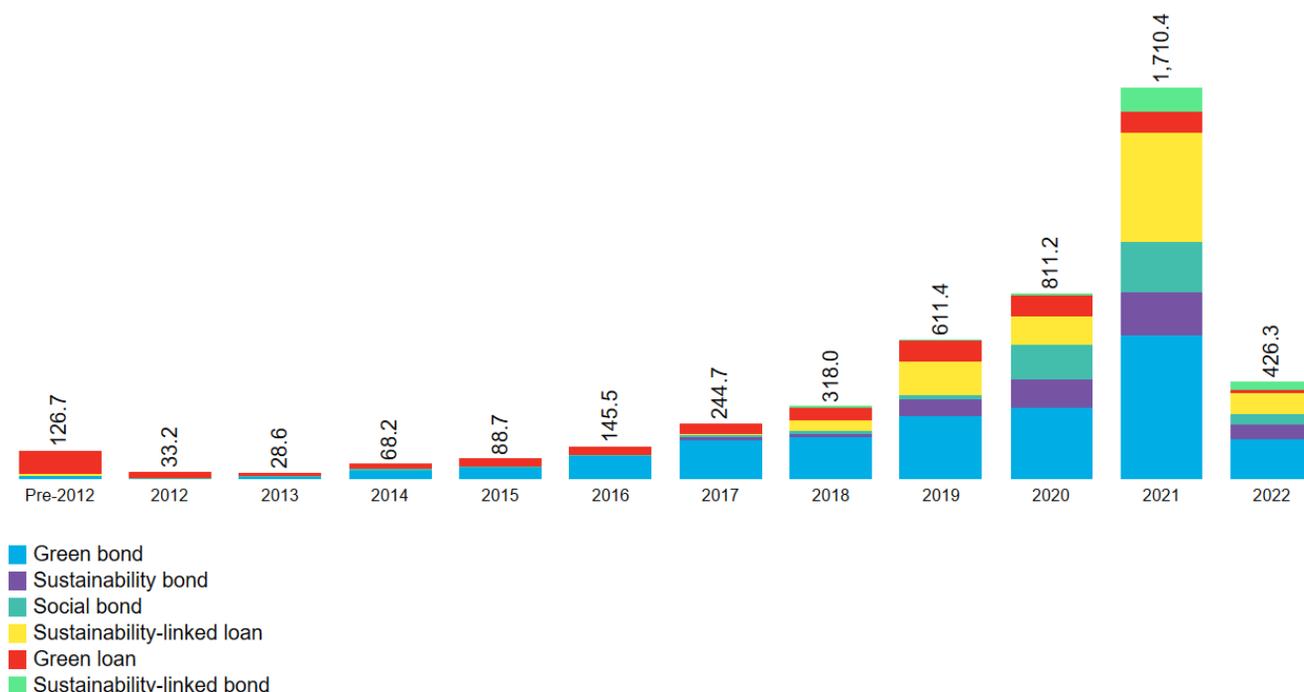
*Lack of safe water, along with poor sanitation and hygiene, is among the greatest causes of poverty in Africa. Without access to clean drinking water, breaking the poverty cycle is incredibly difficult. The [Rwanda Safe Water Project](#) both provides local communities with clean water and reduces CO2 emissions.*

[1] Lifecycle Inventory Analysis carried out in conjunction with Environmental Resources Management (ERM) with verification carried out by First Environment in the case of Alphanet. Carbon neutrality verification carried out by South Pole.

# 3. RISK MANAGEMENT

## Sustainable finance

Figure 18: Sustainable debt issued (\$bn) by instrument type (May 2022)



Source: BloombergNEF

Sustainable finance represents a significant opportunity for IVL, with many multinational lenders and asset managers becoming signatories to the UNPRI (United Nations Principles for Responsible Investment) and UNPRB (United Nations Principles for Responsible Banking). Financial institutions are integrating ESG into the investment process.

A company that is lagging in this area could face the risk of being outmaneuvered by companies that have positioned themselves more favorably with eco-friendly or green products/services, may not be in a position to attract green loans, low cost funds, ESG investors.

IVL regularly performs gap analyses on identified ESG risks based on data provider metrics and industry experts in order to drive improvements in the risk profile of the company and secure more favorable credit terms. ESG data used in the gap analysis was sourced from the largest ESG data providers with active relationships with financial institutions including MSCI, Sustainalytics, ISS, and RobecoSAM.

### IVL's leadership in sustainable finance

IVL is a global leader on ESG integration and was able to secure US\$1.3 billion in sustainable financing, which includes:

1. Thailand's first green loan from Japan's Mizuho Bank for both USD 200m and EUR 200m linked to IVL's ESG rating
2. A syndicated ESG loan for USD 255m arranged by Mizuho Bank linked to IVL's ESG rating
3. A blue loan for USD 300m for use in increasing recycling in developing countries, arranged by the International Finance Corporation (IFC). Sources of funds are as follows:
  - International Finance Corporation (IFC): USD 150m
  - Asian Development Bank (ADB): USD 100m
  - Deutsche Investitions-und Entwicklungsgesellschaft (DEG) USD 50m
4. A Sustainability-Linked Bond (SLB) for USD 300m equivalent, tied to 3 KPIs: (1) 10% GHG intensity reduction by 2025, 750kt recycling by 2025, and 25% renewable electricity by 2030. Please see the [Sustainability-Linked Financing Framework](#) for more details.

# 3. RISK MANAGEMENT

## Decarbonisation and physical risk case studies

### Alphapet critical incident response facilities



Alphapet USA has installed a hurricane & tornado shelter which is designed with withstand winds of up to 250mph with supplies rated to last two weeks. Additionally the plant has installed two sets of backup generators, alongside two flywheel UPS units and standard UPS batteries. In the event that the complete electrical backup is inoperable, a diesel cooling water pump was installed.

### GT Apollo Project - New Cogeneration Plant at IVI, Tangerang



PT Indorama Ventures Indonesia installed new gas turbine plant with downstream TOH & HRSG system. The concept is to install a gas turbine for power generation while using waste heat for HTM heaters for process heating, steam generation & chilled water generation all using waste heat. The new cogeneration plant consists of gas turbine for power generation, thermal oil heater, steam generation, ABS & hot water chillers.

The installation of the new gas turbine is expected to have the following effects:

- Existing HTM heaters are stopped & used for hot back up
- No natural gas consumption in HTM Heaters
- Reduction in power consumption (2.3 MW) & utilities cost
- Stoppage of electrical turbo chillers, auxiliary HTM FD fan for natural gas heaters
- 23% reduction in carbon footprint

### PETValue recycling JV in Philippines



Coca-Cola Beverages Philippines, Inc. (CCBPI), the Bottling arm of Coca-Cola in the country, and Indorama Ventures signed a joint-venture agreement to establish [PETValue](#), the largest state-of-the-art, bottle-to-bottle recycling facility in the Philippines. PETValue will ensure that used PET plastic bottles that are 100% recyclable, and therefore not “single-use,” are given new life and used again and again within a circular economy. The plant’s projected capacity is 30,000 MT/year of flakes which will recycle almost two billion plastic bottles with an output of 16,000 MT/year of recycled PET resin in the first phase. A second extruder will subsequently be installed to consume the remaining quantities of flakes.

### Renewable Electricity Supply from Solar Modules



Indorama Polyester Industries (Nakhon Pathom), Thailand, or IPI – N, a wholly-owned subsidiary of the Company, demonstrated its green credentials by installing photovoltaic modules for captive solar power generation on the roof of their facility. These high efficiency modules have a capacity of 840 kilowatt peak (kWp) and can generate an estimated 1,173 MWh per year. The advantages from this inexhaustible energy source are clear from a financial and environmental perspective, as they provide an annual electricity cost-savings of roughly USD 122,000 with a reduction in CO2 emissions of 560 tCO2e/year. They were installed and started operating in July 2019. Total electricity generated in 2019 was 565,327 kWh which reduced 270 tons of GHG emissions. It reduced energy consumption from other conventional sources by 2,035 GJ and contributed to electricity cost-savings of USD 58,788. IPI – N’s photovoltaic modules are an important step in reducing utility costs and greenhouse gas emissions.

# 4. METRICS AND TARGETS

Figure 19: IVL sustainability targets

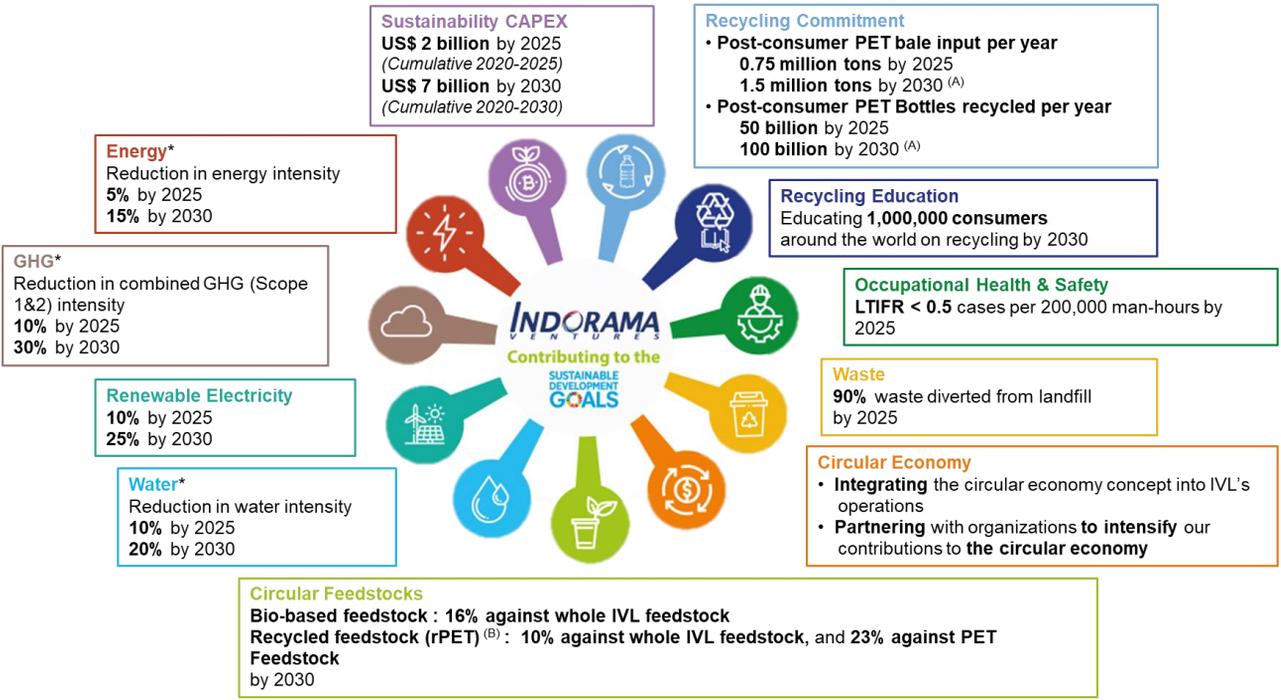


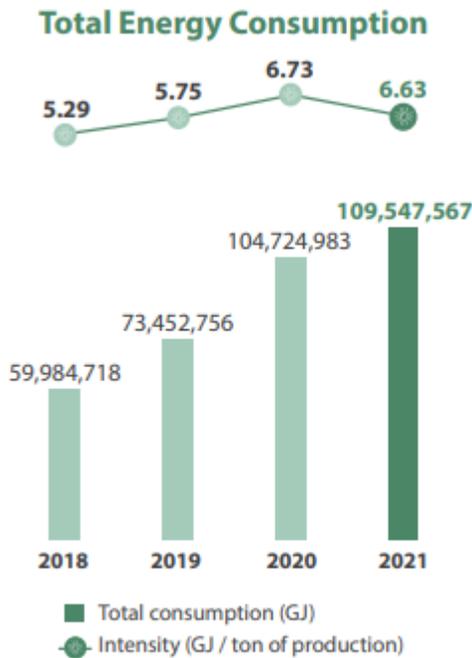
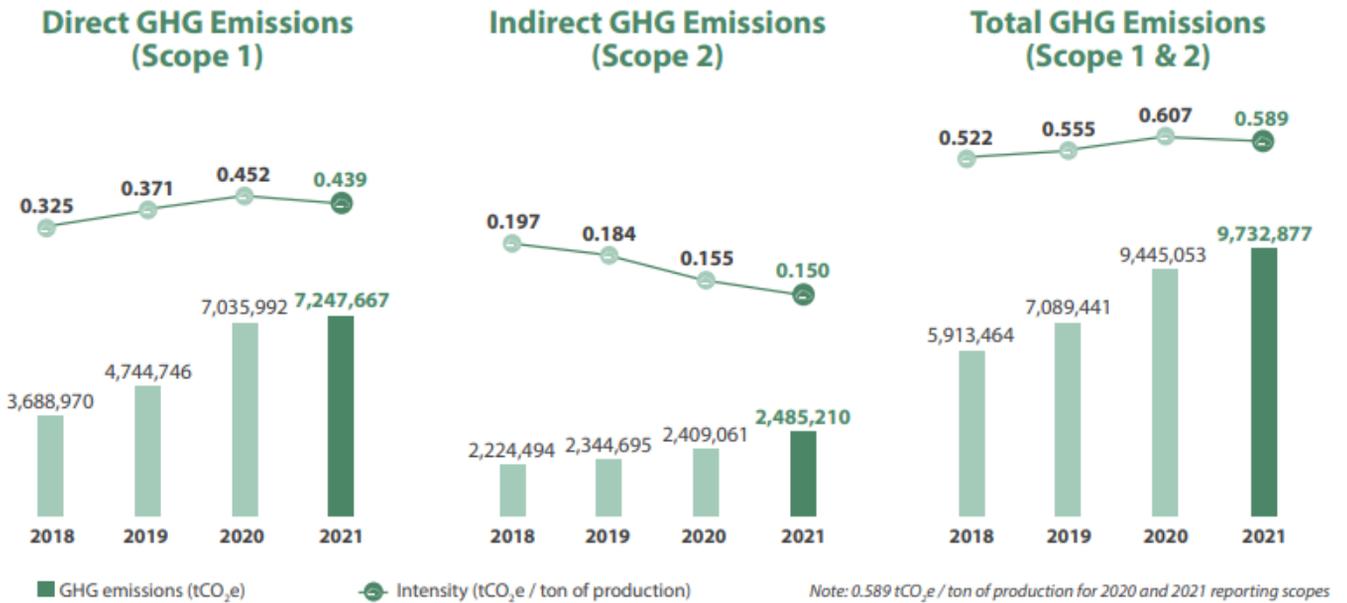
Figure 20: IVL carbon neutrality ambitions



[1] See disclosure on climate-related metrics and targets in the [Sustainability Report Executive Summary 2021](#)

# 4. METRICS AND TARGETS

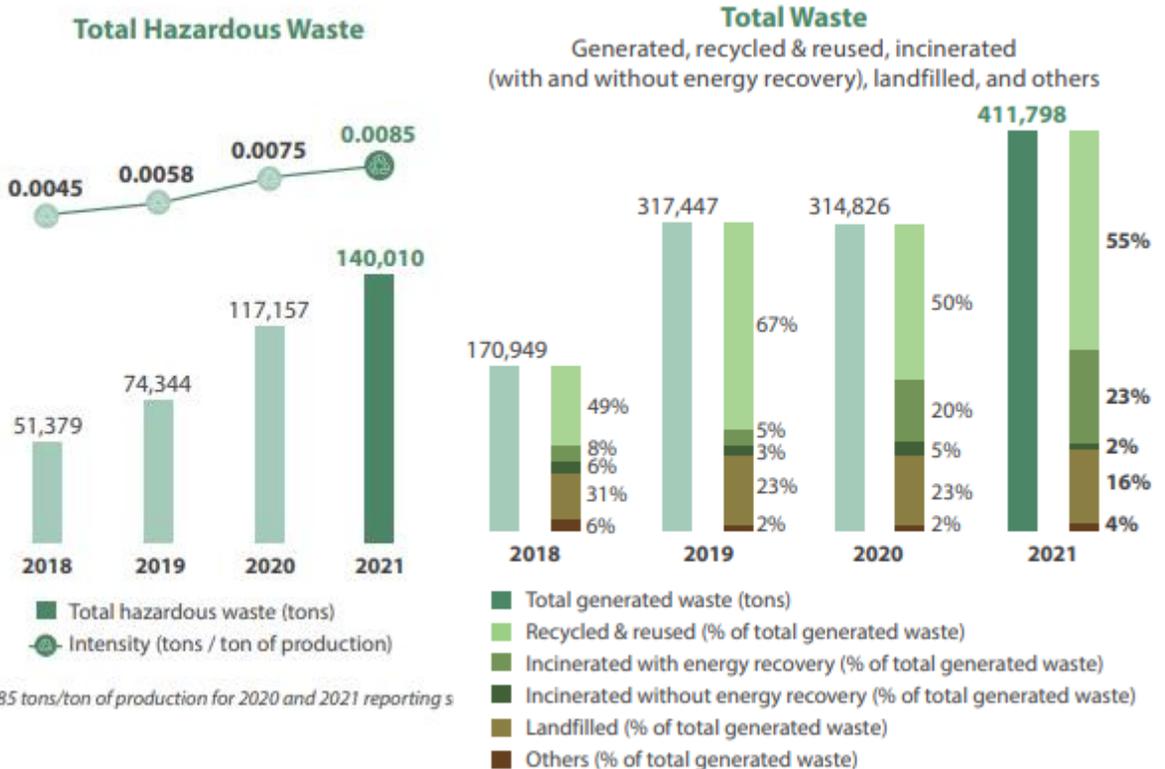
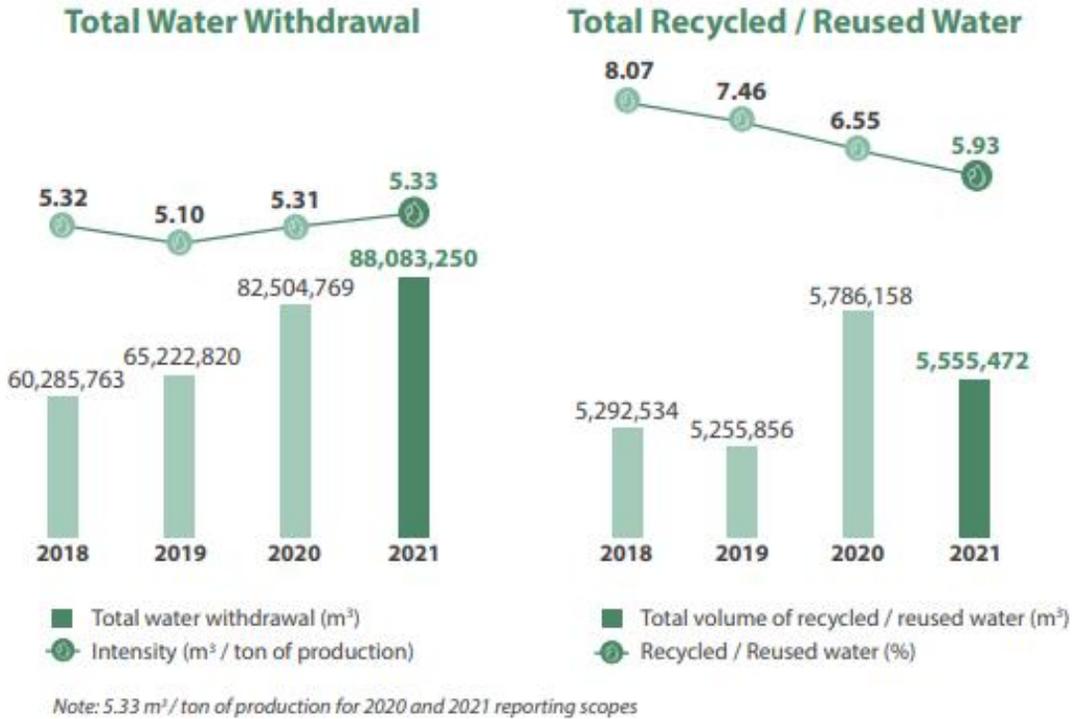
Figure 21: IVL GHG and energy performance for 2021



Note: 6.64 GJ / ton of production for 2020 reporting scope and 6.63 GJ / ton of production for 2021 reporting scope

# 4. METRICS AND TARGETS

Figure 22: IVL water and waste performance 2021



# DISCLAIMER

## Forward-Looking Statements

This Climate-Related Risk Management Report contains 'forward-looking statements' - i.e. statements relating to our projected future performance. These statements can be identified through the use of language such as 'aim', 'believe', 'estimate', 'expect', 'goal', 'intend', 'may', 'plan', 'target', 'will' and other similar terms. Forward-looking statements offer investors and other stakeholders important insight into our vision and how we believe our strategy sets us up for long term success. In their nature they also include making some assumptions in the future business environment or wider which may affect our ability to deliver on our targets.

For example, shifts in legal and regulatory frameworks, national fiscal complexities which can affect our ability to compete effectively, unforeseen economic and social challenges in the countries in which we operate, etc. There is therefore a degree of uncertainty inherent within forward-looking statements which readers are asked to accept when assessing the information provided therein. Investors are cautioned not to place undue reliance on any such forward-looking statements, which speak only as of the date they are made. IVL undertakes no obligation to update any forward-looking statements, whether as a result of new information, future events or otherwise.



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