

# Climate-Related Risk Management Report

Prepared in accordance with the recommendations of the TCFD



June, 2023

# 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

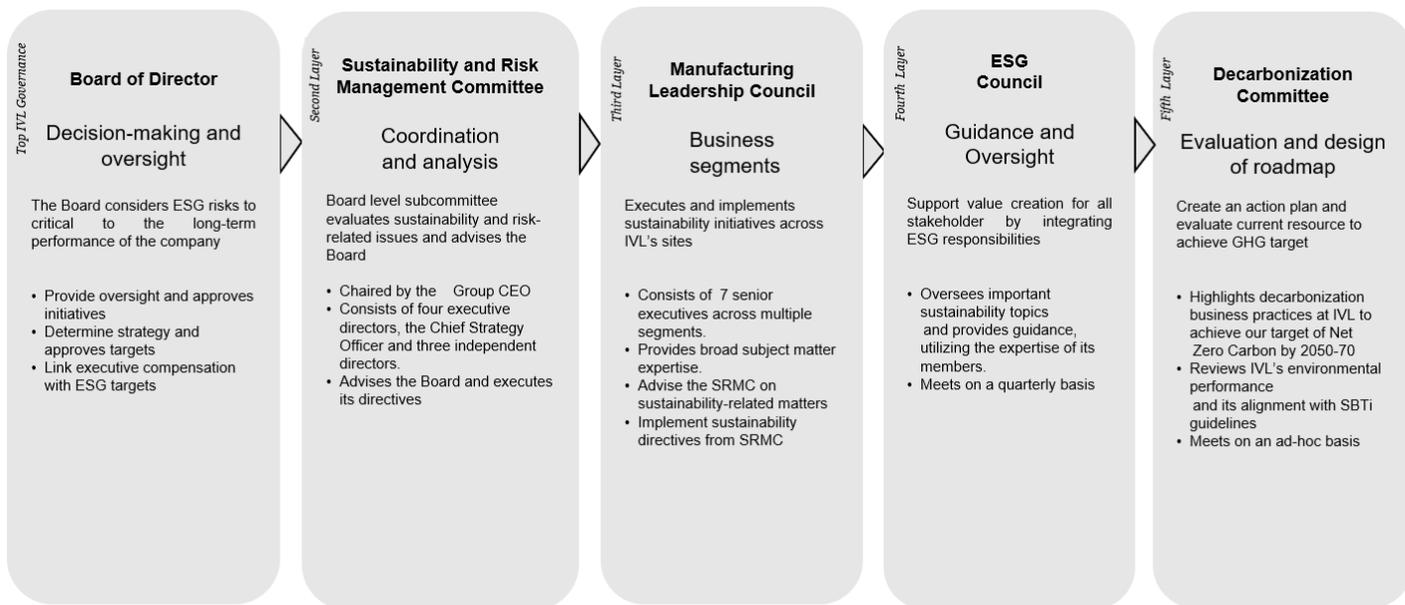
Indorama Ventures is one of the world's leading petrochemicals producers with a presence in 35 countries, 147\* manufacturing facilities, more than 30,000 employees (Including 4,460 temporary employees), and a consolidated revenue of US\$18.7 bn in 2022. We are committed to improving our sustainability performance and have established our targets as indicated in our Sustainability Report 2022. We see the circular economy as an important instrument in combating climate change and an opportunity to strengthen our recycling business globally. We expect to link our targets directly to climate science by working towards the Science Based Targets (SBT), with a commitment that was set in May 2022.

\*The Sustainability Report 2022 consists of data from 141 sites. Further details are provided in the full Sustainability Report 2022 (under "About this Report").

# 1. GOVERNANCE

## Organizational risk management structure

Figure 2: 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, along with business risk committees and risk champions play 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 is designed to support our business in applying risk management processes and techniques with increasing awareness, ownership and management of risks 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.

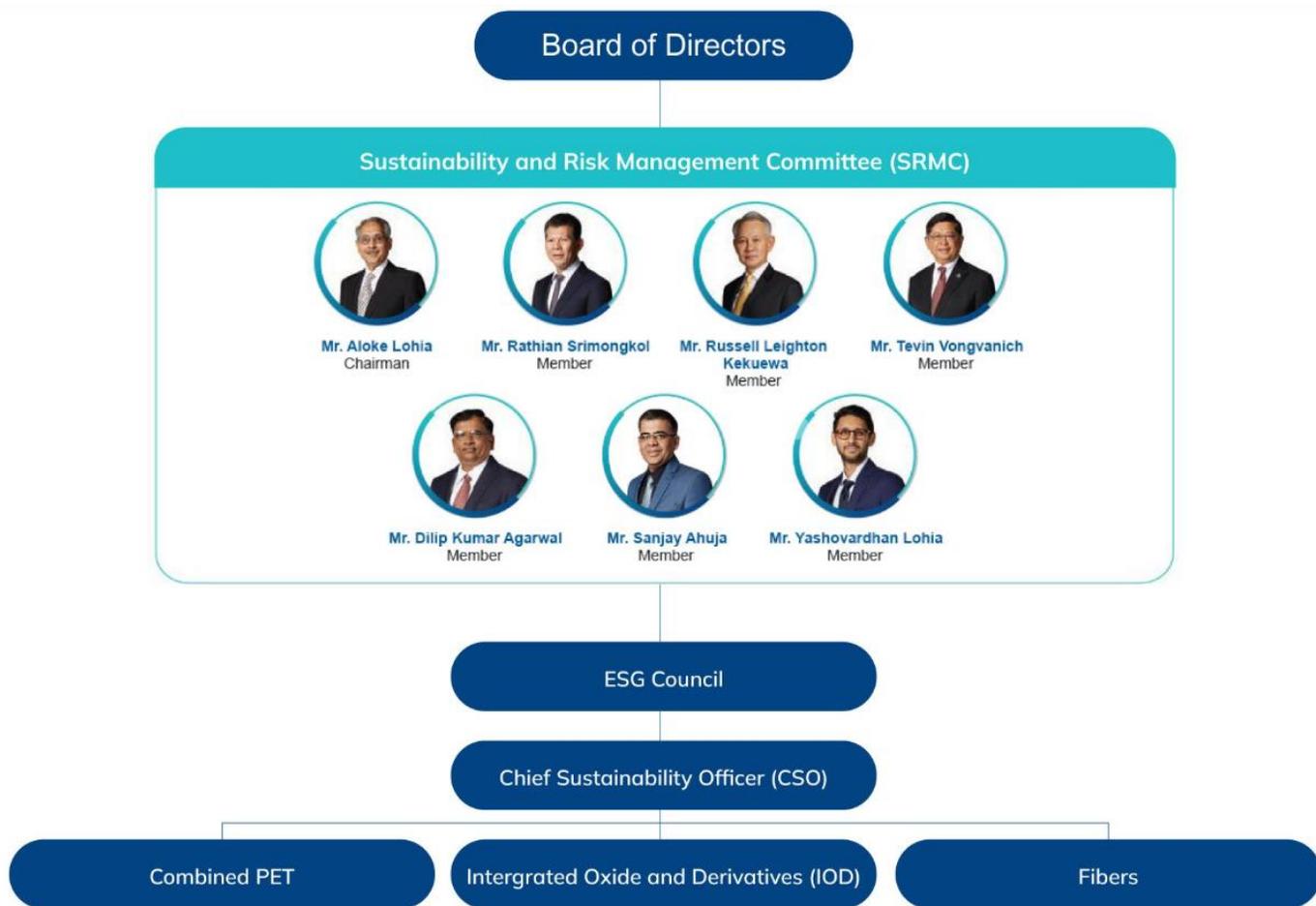
This also helps us to gain an understanding of the risks that can pose potential difficulties to our operations. We categorize business risks, operational risks, management risks, financial risks, and compliance and legal risks that cover our enterprise risk management as a whole. In addition, emerging 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 2022.

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

# 1. GOVERNANCE

## Oversight & decision-making

Figure 3: Sustainability Governing 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 Deputy Group CEO - Combined PET, IOD and Fibers businesses, Chief Strategy Officer, Chairman of ESG Council, and three independent directors. The Seven 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. More information on the individual members of the SRMC is available [here](#).

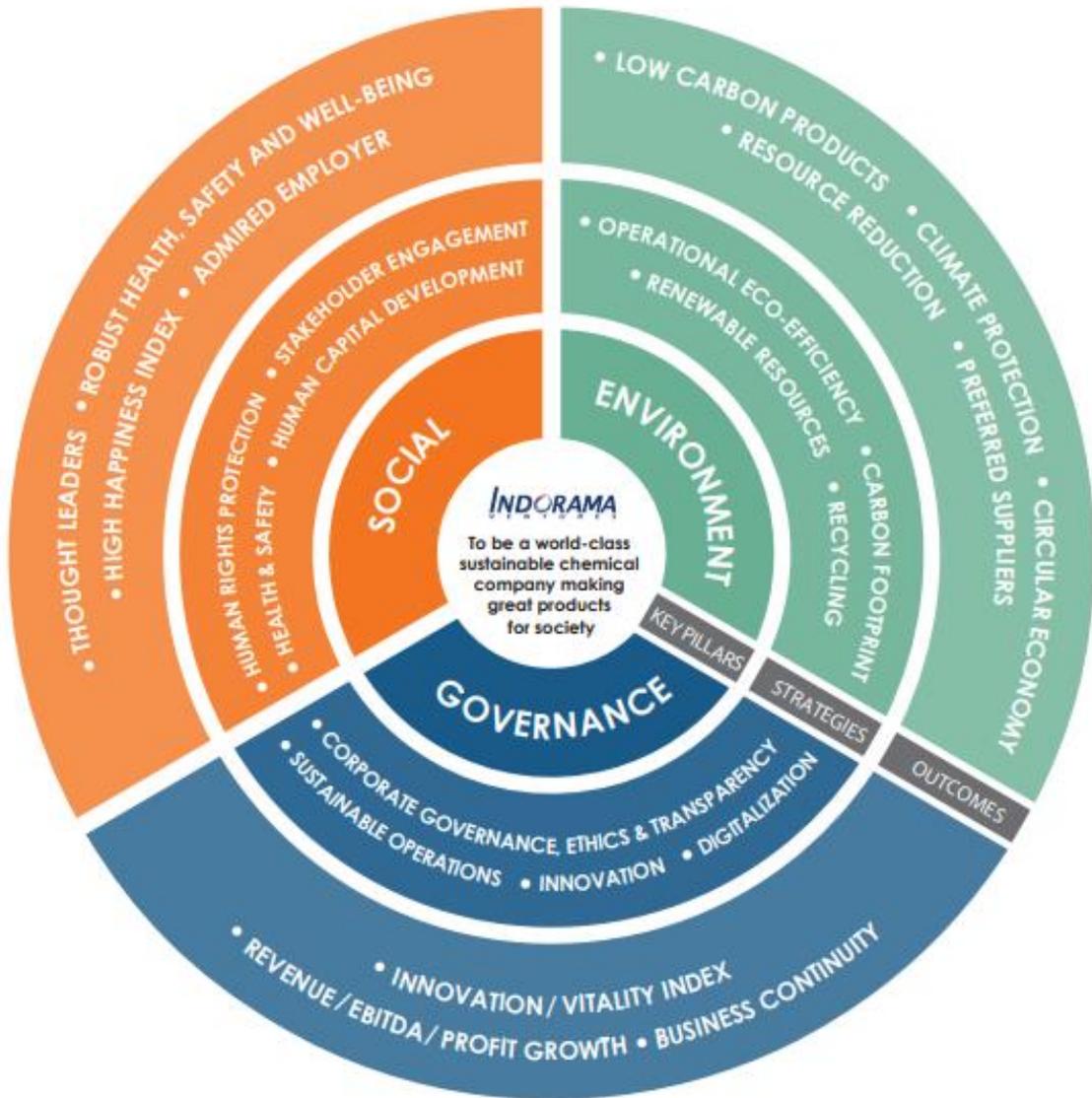
The SRMC approves and reviews the implementation of sustainability strategies including climate strategies, the implementation of sustainability initiatives including TCFD recommendations, scenario analyses, current and future physical and transitional risks, and plan the necessary measures to mitigate or eliminate these impacts. Restructuring is ongoing to integrate each department and foster greater collaboration within the broader risk structure.

The Decarbonization Subcommittee, composed of Chief Technical Officers (CTO) and Environmental Subject Matter Experts of each segment, was formed in 2021 to drive decarbonization initiatives at the segment and plant level. The subcommittee released a decarbonization Standard Operating Procedure (SOP), which standardizes financial guidelines for decarbonization projects and implements an internal carbon price (ICP) of US\$20/t. For non- EU-ETS sites, US\$20 ICP applies, while sites under EU-ETS utilize actual price.

## 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 physical risk and transition risk and their respective subcategories:

## 2. STRATEGY

### Climate-related risk management framework

#### Climate-Related Risks

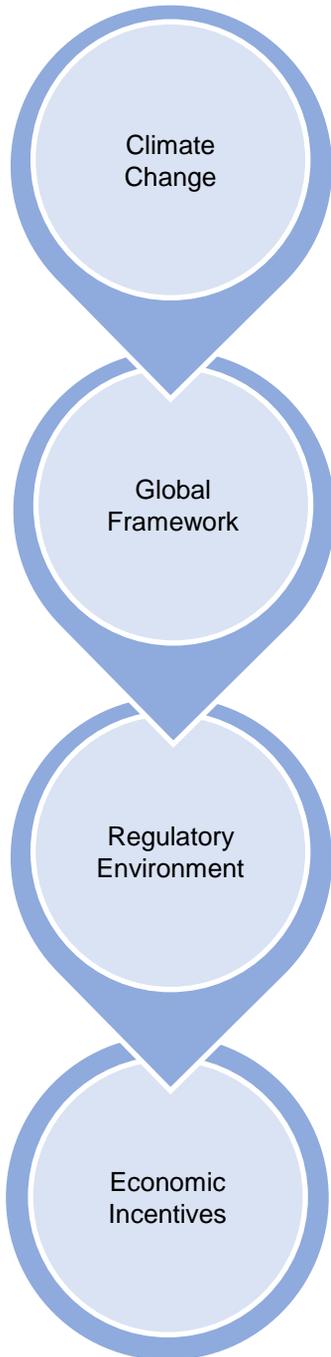
Transition Risk	Technology	Market
	<p><b>Medium-term (6-10 years)</b></p> <ul style="list-style-type: none"> <li>Higher costs from increased energy consumption</li> <li>Unsuccessful investments in new technologies</li> <li>Substitution of existing products with low emissions products.</li> <li>Widespread cybercrime and cyber insecurity</li> </ul>	<p><b>Medium-term (6-10 years)</b></p> <ul style="list-style-type: none"> <li>Changes in customers preferences from high carbon intensive to low carbon products</li> <li>Increased cost of raw materials</li> <li>Access to financing &amp; insurance increasingly affected by climate &amp; environmental risks</li> </ul>
	Policy and Legal	Reputation
	<p><b>Medium- and long-term (6-30 years)</b></p> <ul style="list-style-type: none"> <li>Increased operational costs due to changes in environmental legislation</li> <li>Implementation of cap-and-trade or carbon tax in jurisdictions in which the company operates</li> <li>Exposure to litigation</li> <li>Enhanced emissions reporting obligations</li> <li>Geoeconomic Confrontation</li> </ul>	<p><b>All time frames</b></p> <ul style="list-style-type: none"> <li>Global focus on plastic pollution</li> <li>Movements on fossil fuel avoidance</li> <li>Change in consumer preferences</li> <li>Increased stakeholder concern</li> </ul>
Physical Risk	Acute	Chronic
	<p><b>Medium- and long-term (6-30 years)</b></p> <ul style="list-style-type: none"> <li>Large-scale environmental damage incidents</li> <li>Natural resource crisis</li> <li>Natural disaster and extreme weather events</li> </ul>	<p><b>Medium- and long-term (6-30 years)</b></p> <ul style="list-style-type: none"> <li>Risk of sea level rise and riverine flooding for sites located in high-risk areas, rising mean temperatures.</li> <li>Changes in precipitation patterns and extreme weather variability leading to production disruption</li> <li>Biodiversity loss and ecosystem collapse</li> <li>Failure to climate change mitigation and adaptation</li> </ul>

#### Climate-Related Opportunities

Resource Efficiency	Energy Source	Products and Services
<ul style="list-style-type: none"> <li>Use of more efficient modes of transport</li> <li>Use of more efficient production and distribution processes</li> <li>Use of recycling</li> <li>Building efficiency improvements</li> <li>Reduced water usage and consumption</li> <li>New technologies to reduce resource intensity in production</li> </ul>	<ul style="list-style-type: none"> <li>Use of lower emission sources of energy</li> <li>Use of supportive policy incentives</li> <li>Use of new technologies</li> <li>Participation in carbon markets</li> <li>Innovative power purchase contract structures</li> </ul>	<ul style="list-style-type: none"> <li>Development and expansion of low emission goods and services</li> <li>Development of climate adaptation and risk solutions</li> <li>Development of products or services through R&amp;D and innovation</li> <li>Diversification of business activities</li> <li>Shift in consumer and customer preferences</li> </ul>
Markets	Resiliency	
<ul style="list-style-type: none"> <li>Access to new markets</li> <li>Use of public-sector incentives</li> <li>Access to new assets and locations needing insurance coverage</li> </ul>	<ul style="list-style-type: none"> <li>Participation in renewable energy programs and adoption of energy efficiency measures</li> <li>Resource substitution, innovation, and diversification</li> <li>Development and deployment of recycling technologies</li> <li>Meeting and getting ahead of emissions and single-use plastics regulation</li> </ul>	

## 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) 5<sup>th</sup> Assessment Report (AR5) 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 ratified 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

As of April 2023, carbon pricing schemes cover 23% of global GHG emissions across 73 initiatives. This number includes 28 emission trading schemes and 45 carbon taxes. The overall carbon pricing efforts raised around US\$ 95 bn in 2022.<sup>[1]</sup>

IVL made carbon pricing payments of approximately \$23.3 m in 2022.

#### 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.

[1] World Bank Group "[State and Trends of Carbon Pricing Report 2023](#)"

## 2. STRATEGY

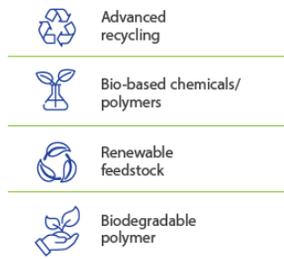
### Climate-related opportunities to IVL

IVL has a strategic focus to develop and implement the core foundations of our sustainable business that fit our Vision 2030 to invest significantly in recycling technologies and biomass feedstock. We are increasing portions of biomass feedstock with a commitment to achieving a cumulative investment of US\$ 4.7 billion by 2030 through an increase in our recycled feedstock to 23% (against IVL PET feedstock) and bio-based feedstock to 16% (against IVL external feedstock).

#### IDENTIFYING AND ADVANCING SUSTAINABILITY-LINKED TECHNOLOGIES AND INNOVATION THROUGH IVIH

##### Acting as a sustainable business incubator across:

In 2022, Indorama Ventures Investments & Holding (IVIH) was established with a mandate to achieve our Vision 2030 ambitions on advanced recycling and renewable feedstock and to achieve decarbonization and a circular economy.



##### Circular feedstock projects



With 30 additional projects identified and being evaluated.



#### Circular Feedstock

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**Target**  
Bio-based feedstock:  
**16%** against IVL external feedstock by 2030

**Performance**  
In 2022, IVL recorded **1.24%** against IVL external feedstock.

ALKEST LV 1400 is a readily biodegradable solvent derived from 100% natural raw materials. Its lipophilic properties enable improved interaction with oily soil, resulting in exceptional performance in cleaning and degreasing, particularly for I&I and household hard cleaning applications. In addition to its non-flammable profile, ALKEST.

ALKEST LV 1400 can be classified as a VOC exempt solvent according to the California Air Resources Board (CARB) and the United States Environmental Protection Agency (EPA) Safer Choice program

#### 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 bales 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.

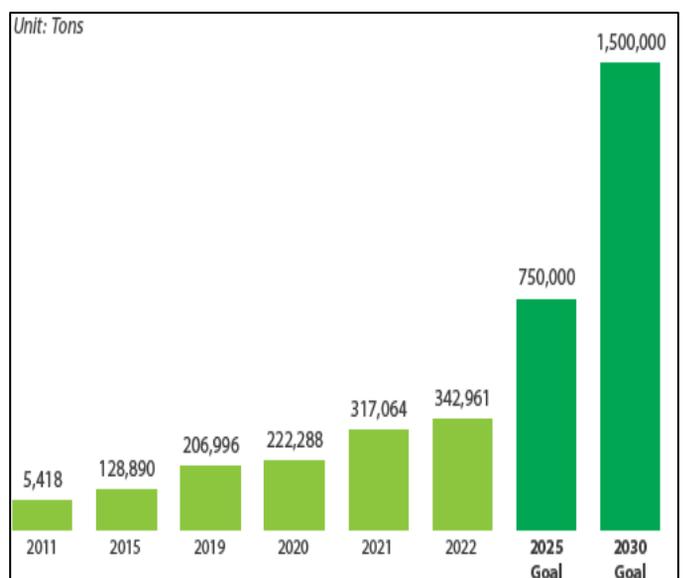
We have acquired proprietary knowledge of mechanical recycling and developed partnerships with innovative players to develop and test next-generation chemical recycling technologies.

- Acquisition of the Czech Republic-based PET plastic recycler, UCY Polymer.
- Co-investment in bio-recycled PET manufacturing plant, Carbios
- Successfully commissioned our first bottle-to-bottle recycling facility in the Philippines, "PETValue," with Coca-Cola.

Being sustainable in many ways, Texinov has developed insect-proof and compostable nets for farming. The fine knitted net called FILBIO®, produced by the French based company, not only protects crops without using pesticides with may be harmful to mankind or the environment, but also protects against hail, wind, and climate stress. Made with IVL's bio-based PLA, it is re-usable for up to three seasons.

Our IVL German sites in Bobingen and Guben produce PLA staple fibers and filaments, which are made from 100% renewable materials. PLA gives off significantly lower CO<sub>2</sub> emissions and has a much lower energy consumption during the production of the raw material.

**Figure 5: Path to 2030 Post consumer PET bale recycling target (kt)**



## 2. STRATEGY

### Decarbonization 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 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 plastic/ carbon credit issuance at recycling facilities and additionally 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 emissions reduction, dependency on fossil-based feedstock, 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

IVL Sustainable Supply Chain program launched in 2021. Supplier engagement to manage ESG Risks and share product carbon footprint information is on-going to estimate scope 3 emissions and enable scope 3 target-setting.

#### Internal Carbon Pricing

Internal carbon pricing (ICP) is applied in project assessments.

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 exploring the development of CCUS technology and its applicability to IVL operations.

#### 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. IVL is monitoring the possibility of using RNG in IVL operations.

#### Bio / Renewable Feedstock – Vision 2030

Decarbonizing our products through biomass IVL committed to invest US\$ 4.7 Billion in investments to increase biomass feedstock to 2.4 Million Tons which includes the investment in a natural alcohol plant which is part of the Oxiteno acquisition.

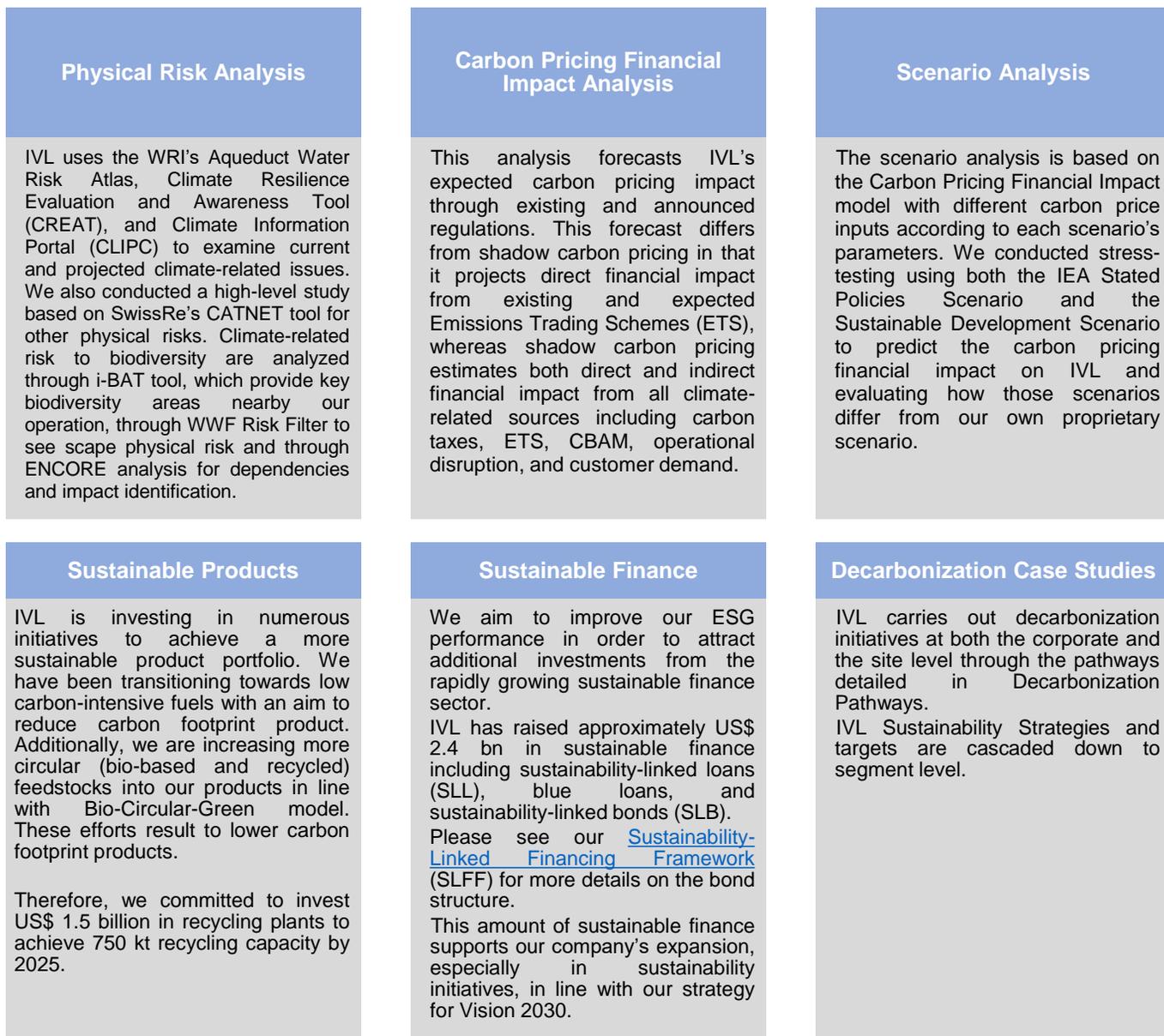
#### Green Hydrogen

Green hydrogen may play a significant role in decarbonizing industrial operations. IVL is monitoring the development of green hydrogen technology and its applicability to IVL operations.

# 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 analysis

##### Windstorm

50y Peak Gust	Locations	Number of locations	Share
 High (50-60 m/s)	4	2.84%	
 Significant (40-50 m/s)	17	12.06%	
 Moderate (35-40 m/s)	8	5.67%	
 Moderate (30-35 m/s)	29	20.57%	
 Low (25-30 m/s)	34	24.11%	
 Low (20-25 m/s)	10	7.09%	
 Very Low (<20 m/s)	39	27.66%	
<b>Total</b>	<b>141</b>	<b>100%</b>	

##### Hailstorm

Hail Days (>2cm) per 2500 km <sup>2</sup> and Year	Locations	Number of locations	Share
 High (0.6 - 0.8)	6	4.26%	
 Significant (0.4 - 0.6)	17	12.06%	
 Moderate (0.2 - 0.4)	14	9.93%	
 Low (0.1 - 0.2)	53	37.59%	
 Very Low (<0.1)	47	33.33%	
 No Data	4	2.84%	
<b>Total</b>	<b>141</b>	<b>100%</b>	

##### Tsunami

Return Period [years]	Locations	Number of locations	Share
 No Data	13	9.22%	
 Outside	128	90.78%	
<b>Total</b>	<b>141</b>	<b>100%</b>	

### 3. RISK MANAGEMENT

#### Physical risk analysis

##### Fluvial Flood (SR)

Return Period [years]	Locations	Number of locations	Share
 50 years	10	7.09%	
 100 years	15	10.64%	
 200 years	15	10.64%	
 500 years	6	4.26%	
 Outside	95	67.38%	
<b>Total</b>	<b>141</b>	<b>100%</b>	

##### Earthquake - Local Soil Conditions

475y Peak Ground Acceleration (g)	Locations	Number of locations	Share
 Very High (0.401 - 0.550)	4	2.84%	
 High (0.291 - 0.400)	10	7.09%	
 Significant (0.161 - 0.29)	11	7.8%	
 Moderate (0.085 - 0.160)	16	11.35%	
 Low (0.046 - 0.084)	31	21.99%	
 Very Low (0.014 - 0.045)	43	30.5%	
 Negligible (< 0.014)	19	13.48%	
 No Data	7	4.96%	
<b>Total</b>	<b>141</b>	<b>100%</b>	

##### Wildfire

Wildfire	Locations	Number of locations	Share
 Very High	1	0.71%	
 Significant	1	0.71%	
 Moderate	6	4.26%	
 Low	14	9.93%	
 Very Low	23	16.31%	
 Negligible	96	68.09%	
<b>Total</b>	<b>141</b>	<b>100%</b>	

### 3. RISK MANAGEMENT

#### Physical risk analysis

##### Tornado

F2-F5 Tornadoes per 2500 km <sup>2</sup> and Year	Locations	Number of locations	Share
 Very High (> 0.75)	11	7.8%	
 Significant (0.35 - 0.5)	2	1.42%	
 Moderate (0.2 - 0.35)	9	6.38%	
 Low (0.1 - 0.2)	19	13.48%	
 Very Low (< 0.1)	26	18.44%	
 No Data	7	4.96%	
 No Observation	67	47.52%	
<b>Total</b>	<b>141</b>	<b>100%</b>	

##### Lightning

Annual flash rate per km <sup>2</sup>	Locations	Number of locations	Share
 Very High (36-50)	2	1.42%	
 Very High (26-35)	8	5.67%	
 High (21-25)	34	24.11%	
 High (16-20)	27	19.15%	
 Significant (11-15)	16	11.35%	
 Significant (7-10)	7	4.96%	
 Moderate (4-6)	10	7.09%	
 Low (1-3)	31	21.99%	
 No Data	6	4.26%	
<b>Total</b>	<b>141</b>	<b>100%</b>	

##### Volcano

Ash Thickness [cm], Return Period 475y	Locations	Number of locations	Share
 Moderate (2 - 5 cm)	2	1.42%	
 Low (1 - 2 cm)	2	1.42%	
 Low (0.1 - 1 cm)	4	2.84%	
 No Data	133	94.33%	
<b>Total</b>	<b>141</b>	<b>100%</b>	

### 3. RISK MANAGEMENT

#### Physical risk analysis

##### Landslide

Landslide	Locations	Number of locations	Share
 Moderate	1	0.71%	
 Low	11	7.8%	
 Very Low	43	30.5%	
 Negligible	86	60.99%	
<b>Total</b>	<b>141</b>	<b>100%</b>	

##### Storm Surge

Return Period [years]	Locations	Number of locations	Share
 50 years	8	5.67%	
 100 years	2	1.42%	
 250 years	1	0.71%	
 500 years	1	0.71%	
 1000 years	1	0.71%	
 Outside	128	90.78%	
<b>Total</b>	<b>141</b>	<b>100%</b>	

##### Pluvial Flood (SR)

Return Period [years]	Locations	Number of locations	Share
 50 years	7	4.96%	
 100 years	3	2.13%	
 200 years	5	3.55%	
 500 years	8	5.67%	
 Outside	118	83.69%	
<b>Total</b>	<b>141</b>	<b>100%</b>	

### 3. RISK MANAGEMENT

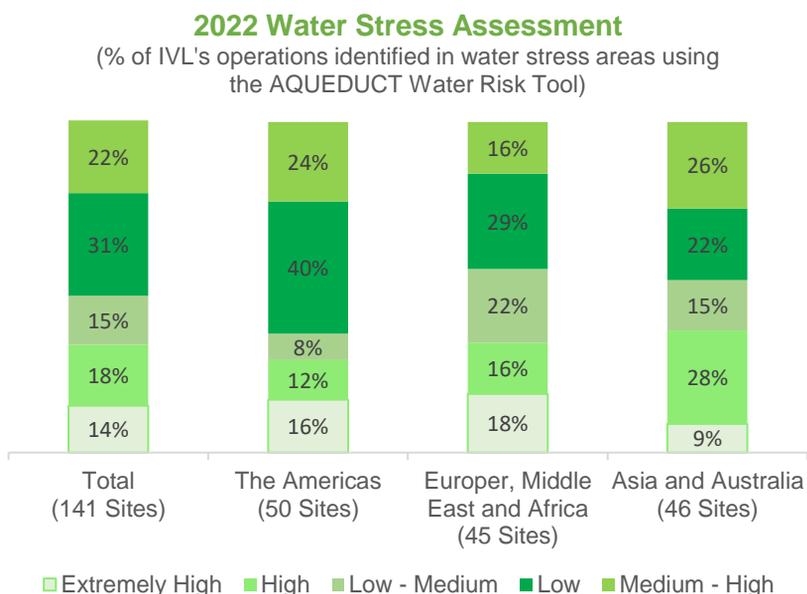
#### Water risk analysis

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 2022.

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 2022, 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 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)[1]



**Table: Water Cost Projection and Cost of Shutdown**

Stress Level	# Sites	% of sites	Estimated Water Cost 2030 - US\$ million
Extremely High (>80%)	20	14%	6.75
High (40-80%)	26	18%	6.12
Medium - High (20-40%)	31	22%	10.14
Low - Medium (10-20%)	21	15%	0.95
Low (<10%)	43	31%	11.39
<b>Total</b>	<b>141</b>	<b>100%</b>	<b>35.35</b>

Note: Water cost in 2022 was US\$ 32.12 million. 2030 estimate of water cost (US\$ 35.25 million) is a 9.13% increase from 2022.

Stress Levels	No. of sites	30-day shutdown	60-day shutdown	90-day shutdown
Extremely High	20	30.14	60.29	90.43
High	26	51.78	103.55	155.33
<b>Total (US\$ millions)</b>	<b>46</b>	<b>81.92</b>	<b>163.84</b>	<b>245.76</b>

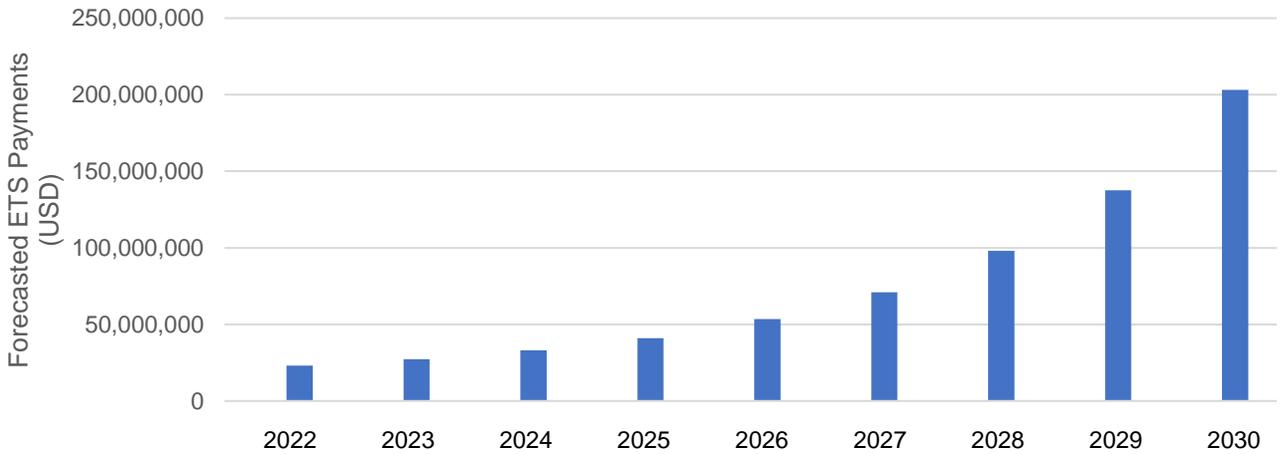
Note: Financial impact estimated via loss of EBITDA from plant shutdown due to water shortage, based on 2022 water stress assessment

[1] Image sourced from [WRI Aqueduct Water Risk Atlas tool](#) based on 141 sites worldwide

# 3. RISK MANAGEMENT

## Carbon pricing financial impact model

Figure 7: Estimated ETS payments at IVL-level 2022A-2030F

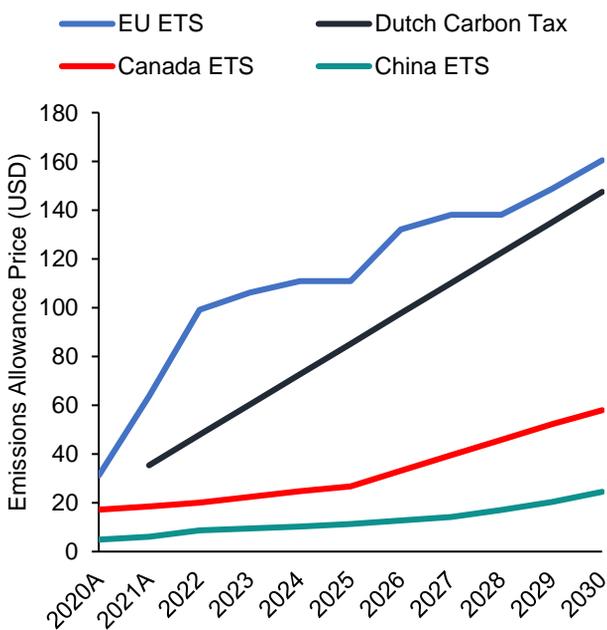


IVL also measures climate-related regulatory risks through financial impact modelling. The Carbon Pricing Impact Model (“model”) forecasts the annual payments IVL makes towards emissions trading schemes (ETS) worldwide. Indorama paid approximately US\$ 23.3 million in compliance costs for carbon pricing globally and is expected to pay around US\$ 53 million by 2025 according to our forecasted model.

**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) Intensity projections based on 2022 intensities and budgeted production volumes.

Figure 8: 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 2023)

[3] Dutch carbon tax based on active legislation

[4] Western Climate Initiative (WCI) based on ClearBlue scenario analysis and BloombergNEF forecasts.

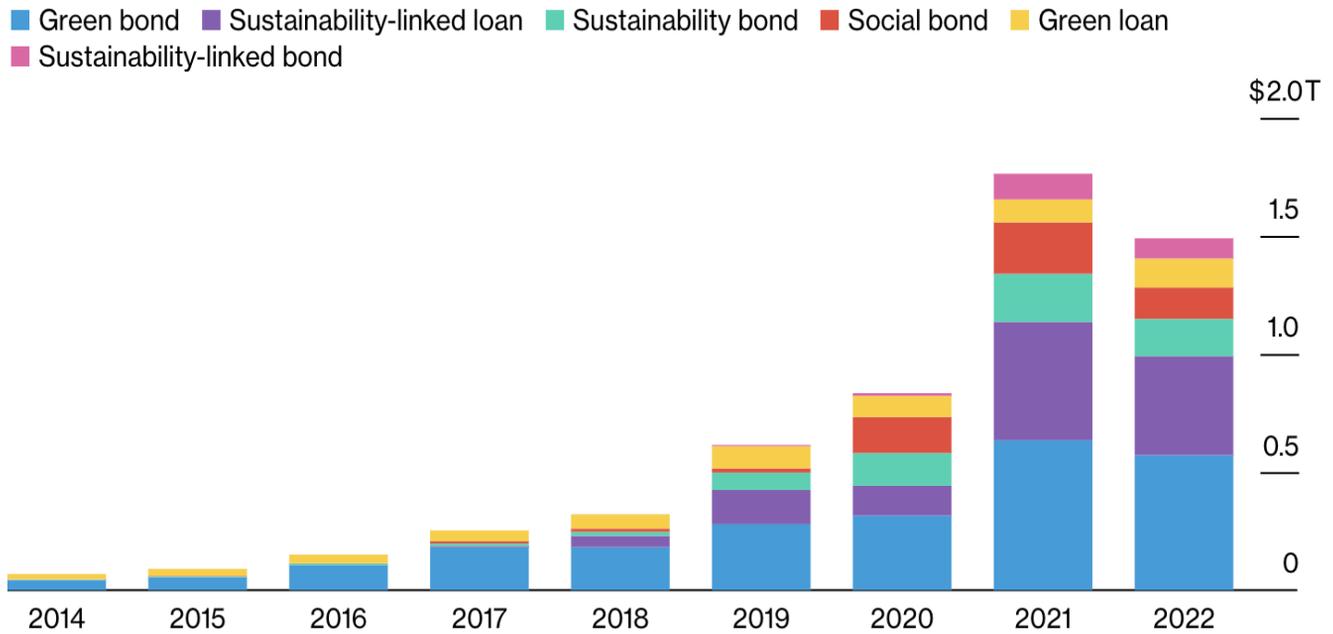
[5] China ETS price forecast based on China Carbon Trading market report from JPMorgan and Refinitiv forecasts.

[6] Based on exchange rates as of May 2023

# 3. RISK MANAGEMENT

## Sustainable finance

Figure 9: Sustainable debt issued (\$tn) 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 S&P Global.

# 3. RISK MANAGEMENT

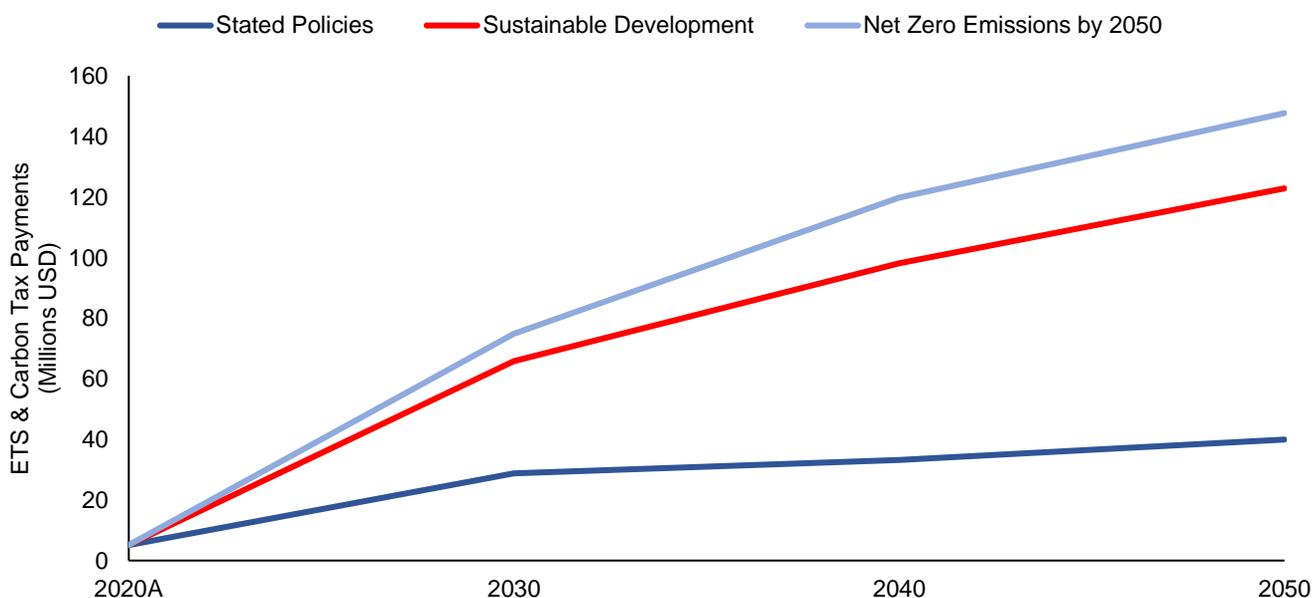
## Scenario analysis

Figure 10: Scenario references (USD) [1]

Scenario	Scenario Description	2030 Impact	2040 Impact	2050 Impact
<b>IEA <u>Stated Policies Scenario</u> (STEPS)</b>	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.	US\$ 28.8 M	US\$ 33.3 M	US\$ 39.9 M
<b>IEA <u>Sustainable Development Scenario</u> (SDS)</b>	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.	US\$ 65.8 M	US\$ 98.2 M	US\$ 122.9 M
<b>IEA <u>Net Zero Emissions by 2050</u> (NZE)</b>	Narrow but achievable pathway for the global energy sector to achieve net zero CO <sub>2</sub> 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.	US\$ 74.9 M	US\$ 119.8 M	US\$ 147.7 M

Note: IVL made Carbon pricing (Carbon Tax + ETS) payments of approximately US\$ 23.3 M in 2022.

Figure 11: Scenario analysis



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

# 3. RISK MANAGEMENT

## The Global Business Continuity Program

As Indorama Ventures is a leading chemical business group having presence in diverse region of the world, IVL's climate-driven risks are a key focus of our Business Continuity Management Program (BCMP), which is aligned with i.e., ISO 22301:2019 (Business continuity management systems).

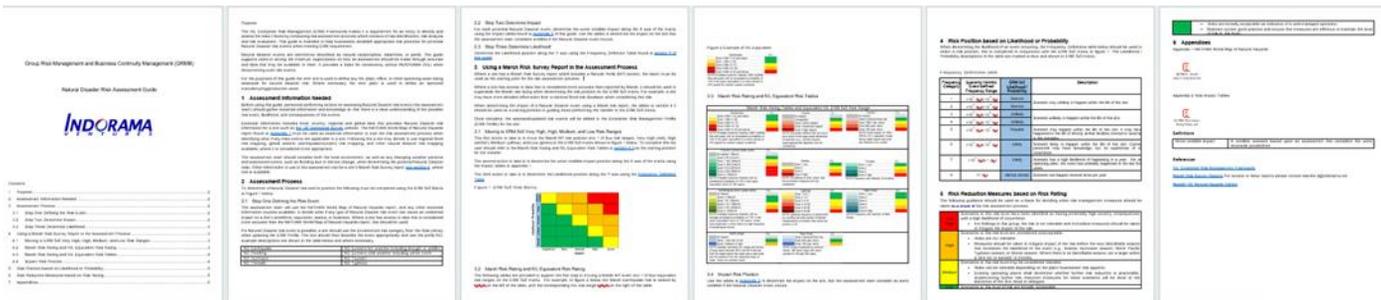
The program includes but is not limited to assessing the impact of extreme weather events to the business, which we recognize as becoming more prevalent due to change in weather patterns. These events can

- have an adverse impact to raw material supply including increases to raw material costs.
- have a negative impact on transportation and infrastructure we rely on.
- reduce the output of manufacturing processes and in extreme cases cause a shutdown.

Through our Business Continuity Management Program, we deliver continuity strategies to deal with these types of events including drought, extreme weather, flooding etc. and the disruptions they have on our operations. These efforts include but are not limited to the following

1	2	3	4	5	6
Product Standardization (name/grade)	Seasonal Stock Buffering	Alternate Suppliers & Flexibility	Diversify Transportation Modes & Expand Warehousing	Production & Sales Transfer	BCP Development & Exercising
Flexibility to source & reduce customer qualification time	Prevent shortages of key raw materials and finished goods during predictable seasonal weather events	Provide alternate sourcing options and flexibility to reroute materials during disruption	Enhance logistics availability & capacity during disruption	Inter & intra-regional transfer strategies capitalizing on the global IVL network	Availability of, & familiarity with BCPs guiding responses to disruptions & continuous improvement
					

In support of the businesses that are participating in the Business Continuity Management Program, Indorama Ventures has produced a dedicated Risk Assessment Guide fully focused on extreme weather events to ensure our assessment outcomes are aligned with key partners globally.



IVL's Natural Disaster Risk Assessment Guide focuses on extreme weather events to ensure our risk assessment process and any related risk management outcomes are aligned with key partners globally. Along with this new guide to further support our businesses, the Indorama Ventures Business Continuity Management Program includes dedicated guidance for businesses to proactively notify leaders where an extreme weather event is predicted to impact any manufacturing plants and offices, leading to activation of contingency planning where possible to reduce the potential impact.

# 3. RISK MANAGEMENT

## Sustainable finance

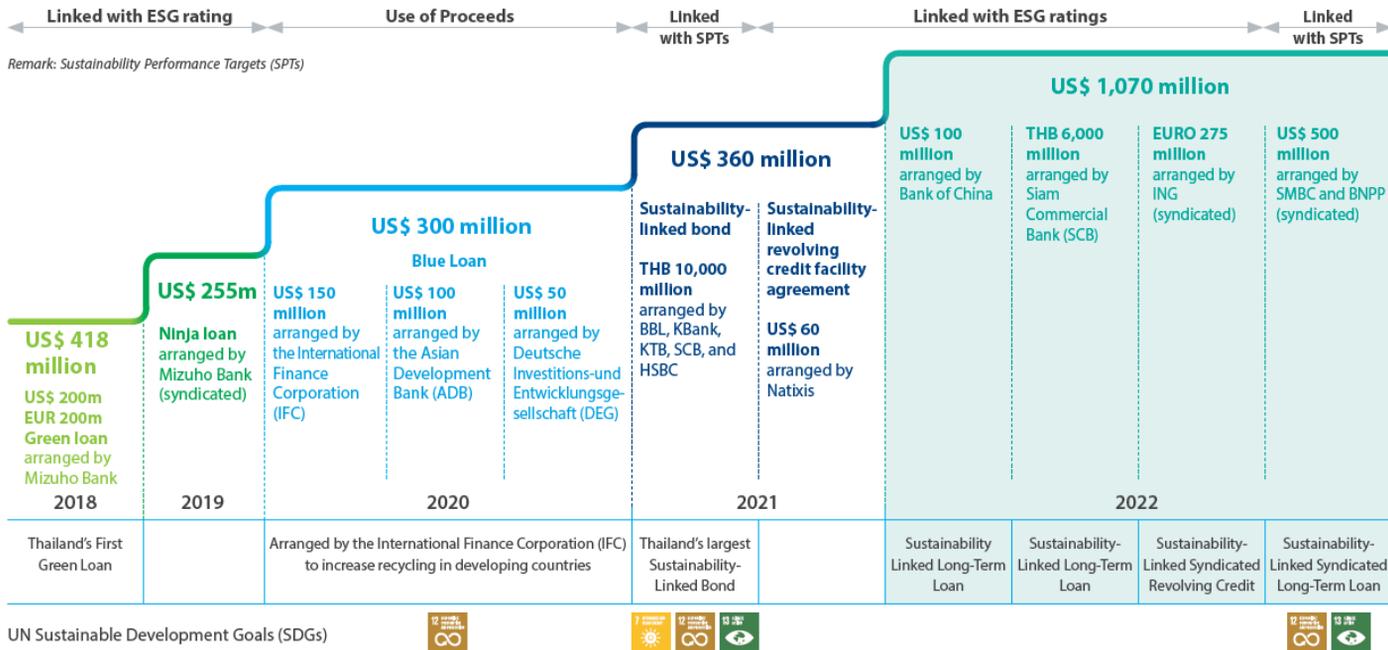
### SUSTAINABLE FINANCE

The sustainable financing supports our company's expansion in line with our strategy for Vision 2030, which takes Environmental, Social, and Governance (ESG) factors into account.



**TOTAL US\$ 2.4 billion**

(2018–2022)



#### IVL's leadership in sustainable finance

IVL is a global leader on ESG integration and has secured around US\$ 2.4 billion in sustainable financing as of Dec 2022. Our 2022 highlights include:

1. A term loan facility for US\$ 100 million arranged by Bank of China linked to IVL's ESG rating.
2. A sustainability-linked long term loan facility for THB 6 billion arranged by Siam Commercial Bank linked to IVL's ESG rating.
3. A sustainability-linked long term loan facility for US\$ 500 million arranged by Sumitomo Mitsui Banking Corporation, BNP Paribas, and five other banks and linked to our GHG intensity reduction and post-consumer PET bale input.
4. A sustainability revolving facility for EUR 275 million arranged by Bangkok Bank, ING, Luminor, HSBC, ABN, and SCB linked to IVL's ESG rating.

# 3. RISK MANAGEMENT

## Decarbonization case studies

### Generating Solar Energy at our Sites

Thailand



IVL's site in Lopburi, Thailand commissioned an additional 1.44 MWp solar rooftop in 2022. The total capacity of the solar rooftop is now 6 MWp, leading to an approximate annual reduction of 4,800 tCO<sub>2</sub>e in GHG emissions..

Thailand



In partnership with Glow, Indorama Petrochem Limited (PTA) completed the installation of ground-mounted and rooftop solar panels at the site in 2022, with a total capacity of 2.96 MWp. The solar panels are expected to generate 4,500 MWh/year, contributing to an annual reduction of 1,800 tCO<sub>2</sub> in GHG emissions



Thailand



In 2022, Petform (Thailand) Limited in Nakhon Ratchasima installed a new solar plant with a capacity of 586 kWp, contributing to an annual reduction of 351 tCO<sub>2</sub>e in GHG emissions.

China



Performance Fibers Kaiping (PFK), one of IVL's facilities in Guangdong, commissioned solar panels with a capacity of about 1 MWp in August 2022. An additional 4 MWp was completed in January 2023, leading to an approximate electricity generation of 5 million MWh/year and an annual reduction of 3,500 tCO<sub>2</sub>e in GHG emissions.

### Liquefied Natural Gas-Based Heating System (Thailand)

Indorama Polyester Industries in Nakhon Pathom, Thailand achieved a significant milestone in their sustainability journey by commissioning a liquefied natural gas (LNG)-based thermic fluid heating system to replace the original coal-fired system. This marks their first step towards phasing out coal at their site, resulting in an annual reduction of 5,212 tCO<sub>2</sub>e in GHG emissions and an expected overall 6% carbon savings this year

# 4. METRICS & TARGETS

Figure 19: IVL's Sustainability Targets

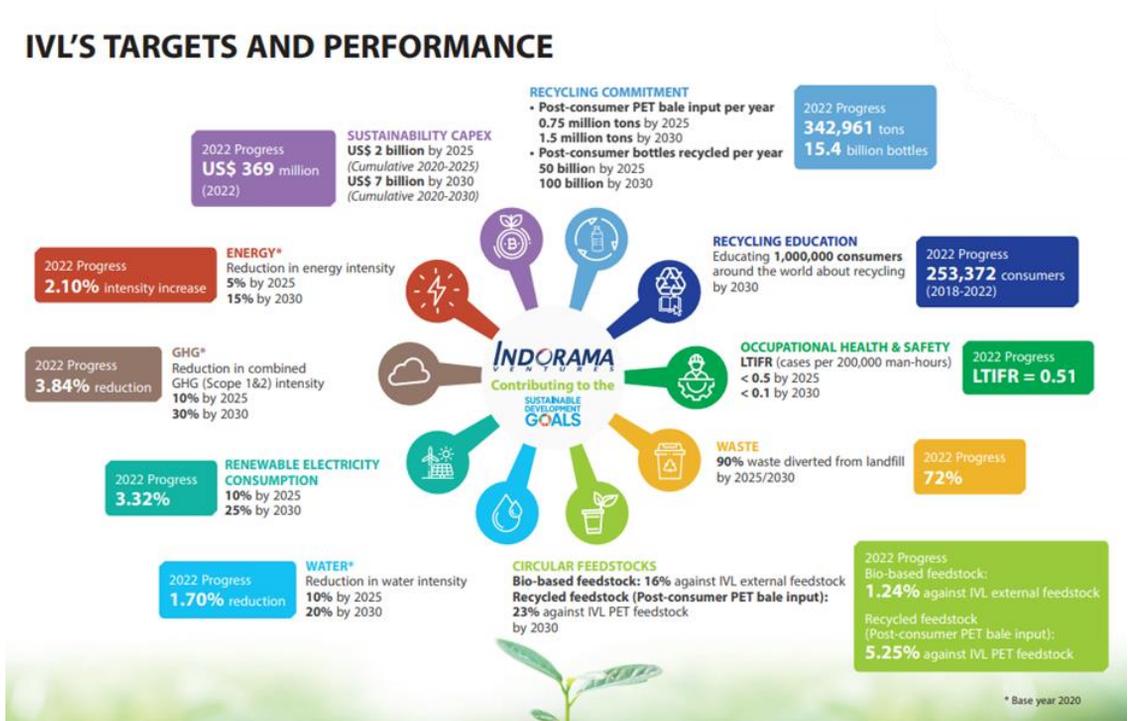


Figure 20: IVL Decarbonization Strategy Towards Net zero

## DECARBONIZATION



Key decarbonization pathways to achieve net-zero targets by 2025 and 2030



### Decarbonization Strategy Towards Net Zero



#### Decarbonization Playbook

The purpose of this playbook is to give guidance on working process, different decarbonization technologies, and how to implement projects and initiatives addressing GHG emissions and decarbonization.

On 31 May 2022 IVL has committed to set Science-based Targets.

We have more than 900 Green projects that support the pathway of our GHG emissions and energy reduction targets for 2025 and 2030.



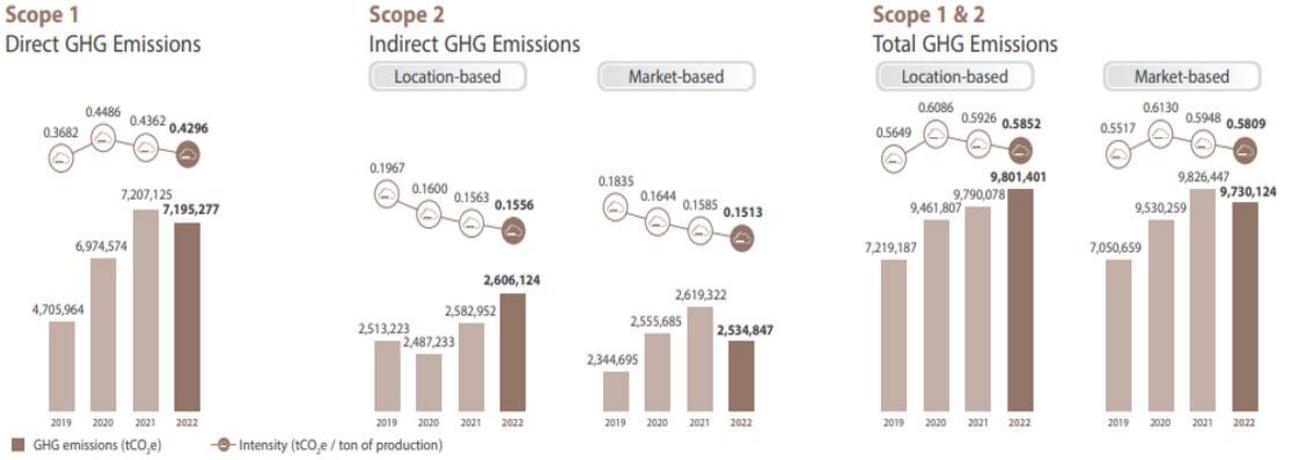
Since 2020, we have been a signatory to the TCFD and have adopted its framework to continuously monitor and adapt our actions as well as to report our climate-related financial disclosures.



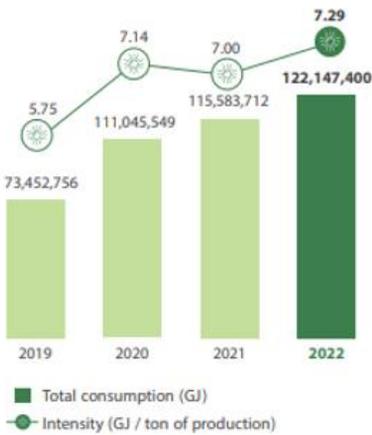
Achieved a B Rating in CDP's Climate Change Assessment, which is higher than the Asia regional average of C, and higher than the Chemicals sector average of B-.

# 4. METRICS & TARGETS

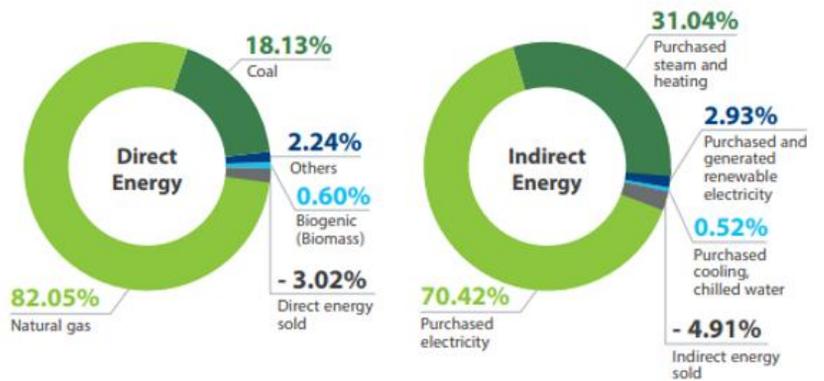
Figure 21: IVL GHG and energy performance for 2019-2022



## Total Energy Consumption

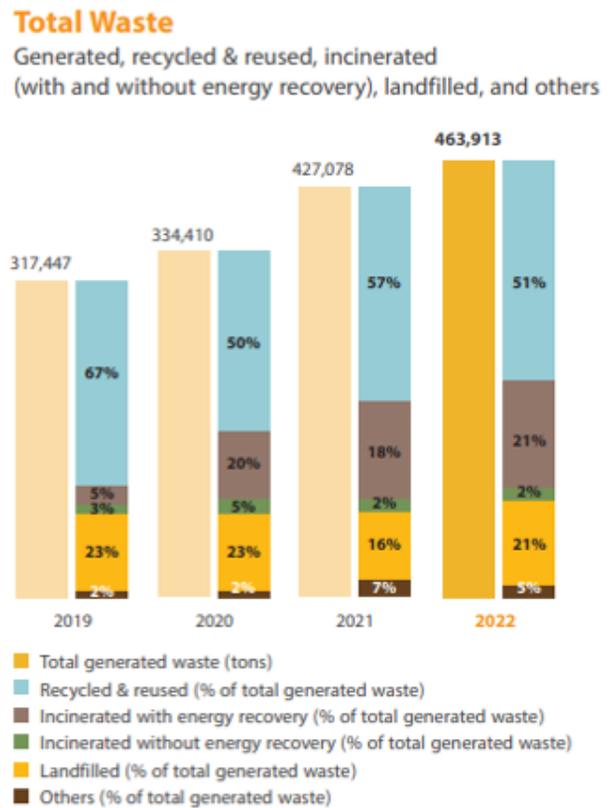
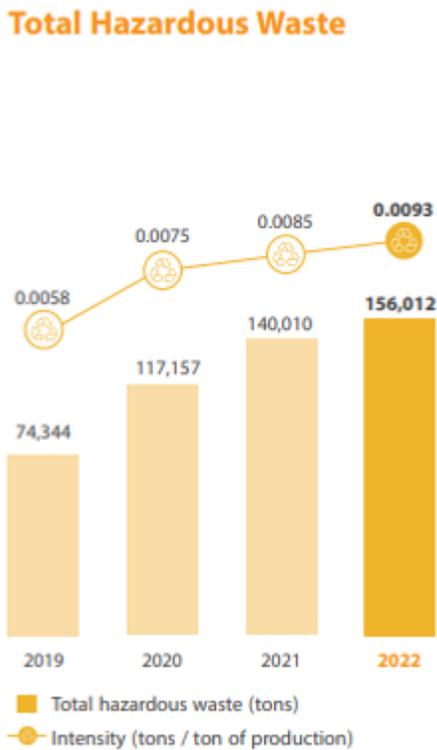
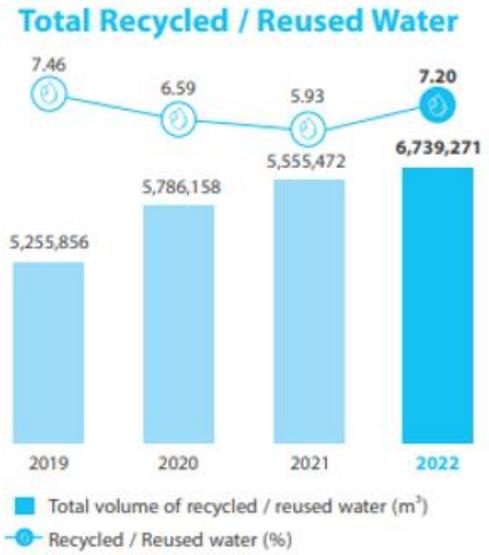
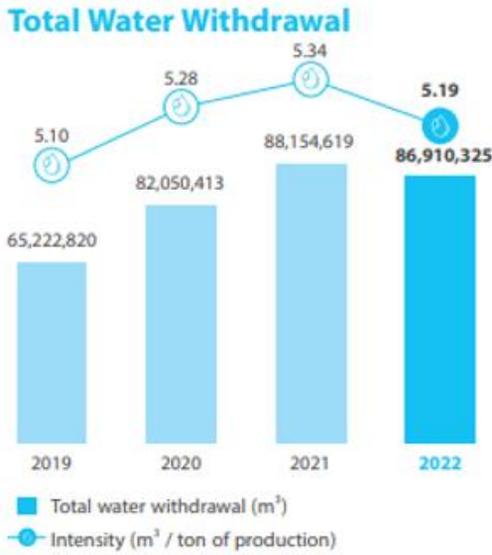


## Overall 2022 Energy Breakdown



# 4. METRICS & TARGETS

Figure 22: IVL Water and Waste performance between 2019-2022



# 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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