

# HYDROGEN FORKLIFT

Impact Valuation Report



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### Interactive Guide

The Hydrogen Forklift Impact Valuation Report is available as an interactive PDF that includes features such as navigation to related pages and links to related webpages.



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# CEO Message

**HD Hyundai XiteSolution will position itself as a leader in the era of carbon neutral, unmanned, and autonomous driving, creating long-term value for its stakeholders.**

**We would like to express our sincere gratitude to our customers and stakeholders for their trust and support of HD Hyundai Xitesolutions.**

HD Hyundai XiteSolution is a business holding company that maximizes synergies between HD Hyundai Construction Equipment business companies and conducts its own businesses such as industrial vehicles and core functional products. HD Hyundai XiteSolution acquired HD Hyundai Construction Equipment's industrial vehicle(forklift) business in 2021 and is fostering it as a core business, and aims to grow into a total logistics solution company by investing in future business products such as autonomous driving-based unmanned forklifts and eco-friendly hydrogen fuel cell forklifts.

In particular, HD Hyundai XiteSolution is accelerating the development and deployment of hydrogen fuel cell forklifts as part of securing the hydrogen value chain, which is HD Hyundai's core future business. Starting in 2023, the company will participate in a demonstration pilot project for hydrogen forklifts, with the goal of completing the demonstration in various work environments by 2026 and commercialization in 2027. HD Hyundai XiteSolution conducted an Impact Valuation of hydrogen forklifts to determine the potential impact of their operation on society. The analysis was conducted using the EY Long-term Value methodology, which measures the tangible and intangible value delivered to stakeholders over the long term through the production and use of hydrogen forklifts.

HD Hyundai XiteSolution will position itself as a leader in the era of carbon neutral, unmanned, and autonomous driving, creating long-term value for its stakeholders.

We kindly request your continued interest and support.

Thank you.

CEO Young Cheul Cho



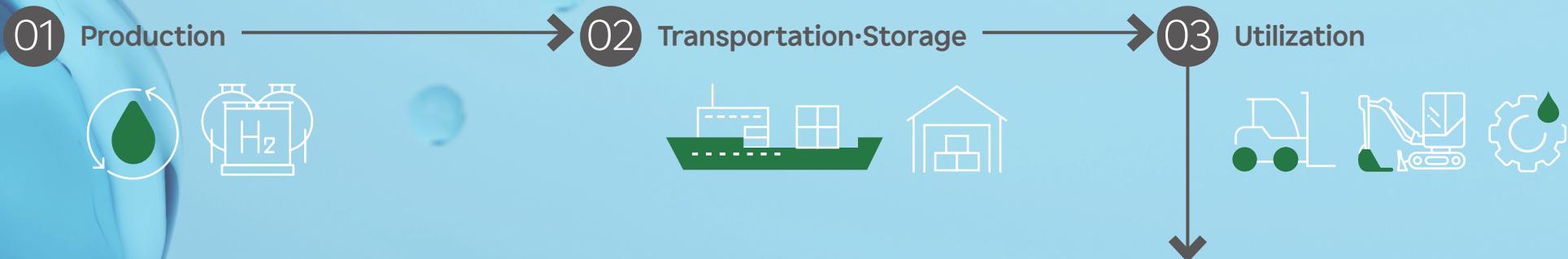
CEO Dong Wook Lee



# Vision for Hydrogen Economy

**“In the coming 50 years, we will create new growth momentum different from what we have seen.” - HD Hyundai-**

Finding new energy sources to mitigate the speed of climate has become a common challenge for humanity. Among various new energy sources, hydrogen is gaining global attention as a future clean energy source. HD Hyundai, in March 2021, declared its commitment to leading the hydrogen market by leveraging the capabilities of its group affiliates across the entire hydrogen value chain, from production to transportation/storage and utilization, through the 'Hydrogen Dream 2030 Roadmap'. HD Hyundai Construction Machinery Sector, we will take on the role of utilizing the hydrogen value chain by developing and commercializing fuel cell-based construction machinery such as hydrogen excavators and hydrogen forklifts, as well as hydrogen combustion engines.



## HD Hyundai Construction Machinery sector, Hydrogen Products

**HD** HYUNDAI XITESOLUTION

- Hydrogen forklift



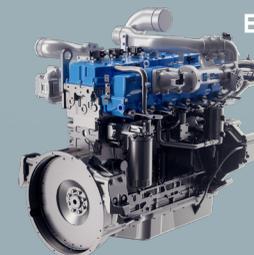
**HD** HYUNDAI CONSTRUCTION EQUIPMENT

- Hydrogen Excavator



**HD** HYUNDAI INFRACORE

- Hydrogen Engine



# Impact Valuation Overview

## Features of Hydrogen Forklift

Forklifts are used in a variety of industries, including warehouses, distribution centers, retailers, and construction sites, and play an important role in logistics and transportation. Small forklifts that are operated in indoor spaces such as distributors account for the majority of the electric forklift market as they do not emit noise and pollutants, but medium and large forklifts that are mainly operated outdoors are based on diesel engines. Recently, the need for zero-emission forklifts has been increasing to promote carbon neutrality and manage carbon emissions from the use of greenhouse gas Scope 3 products. In addition, the expansion of large logistics centers has increased the need for medium-sized forklifts to be used indoors, increasing the marketability of zero-emission forklifts.

HD Hyundai XiteSolution is developing small and medium-sized hydrogen forklifts by combining hydrogen fuel cell technology with forklift production technology of various specifications. A hydrogen fuel cell is a device that generates electric energy through the electrochemical reaction of hydrogen and oxygen, and is an eco-friendly energy technology that produces no carbon emissions in the process of generating electric energy and driving through a motor, and does not produce air pollutants or noise generated by internal combustion engines using fossil fuels. HD Hyundai XiteSolution unveiled a prototype of a 5-ton medium-sized hydrogen forklift in 2020, and is also working to develop a variety of small hydrogen forklifts by manufacturing a prototype of a 1.8-ton hydrogen forklift in 2021 and a 3.5-ton hydrogen forklift in 2022 and conducting performance evaluation. We aim to complete the demonstration pilot project by the end of 2026 and commercialize it in 2027.

### Impact Valuation Product

#### 5ton Hydrogen Forklift



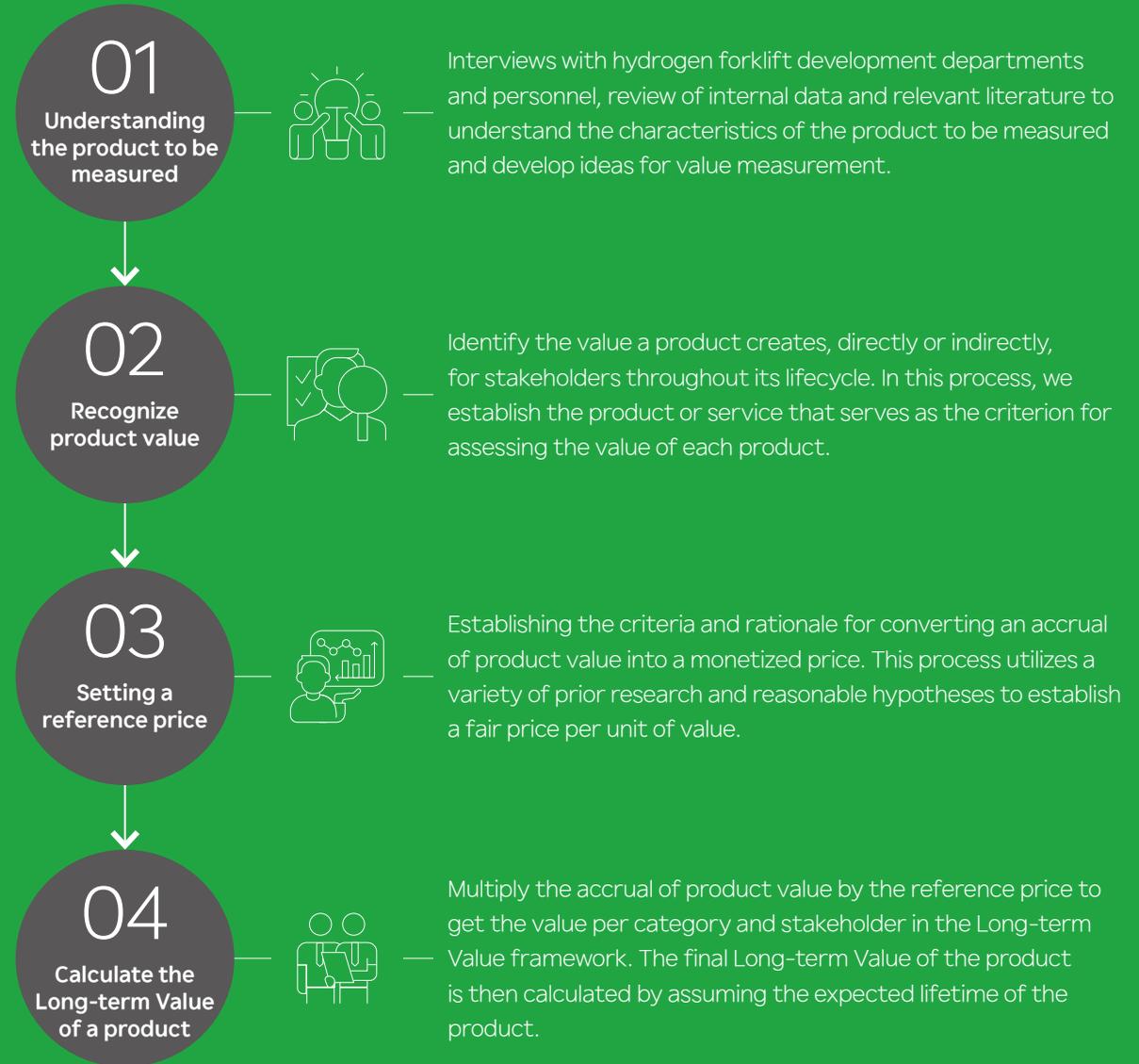
### Development Background



### Key Features

- 01 Zero-emission technology that utilizes power from the chemical reaction of hydrogen and oxygen
- 02 No emission of air pollutants such as NOx, fine dust, etc.
- 03 Significantly less noise than internal combustion engine products

# Impact Valuation Process for Hydrogen Forklift



# Impact Valuation Result

HD Hyundai XiteSolution conducted an impact valuation to identify the potential value of a 5-ton medium-sized hydrogen forklift. The value delivered to stakeholders by the hydrogen forklift was measured according to the EY Long-term Value Framework methodology, distinguishing it into 1) Customer value, 2) People value, 3) Societal value, and 4) Financial value. This assessment assumed that the hydrogen forklift would be utilized for 10 years<sup>1)</sup> after being sold. Customer value, People value, and societal value were measured in comparison to a reference point, which was a similar product, a diesel engine forklift. The LTV per hydrogen forklift was found to be approximately KRW 160 million. This can be estimated as the value provided to stakeholders by one hydrogen forklift sold and operated by HD Hyundai XiteSolution over a period of 10 years.

1) Assuming an 8-hour day and 46.8% uptime

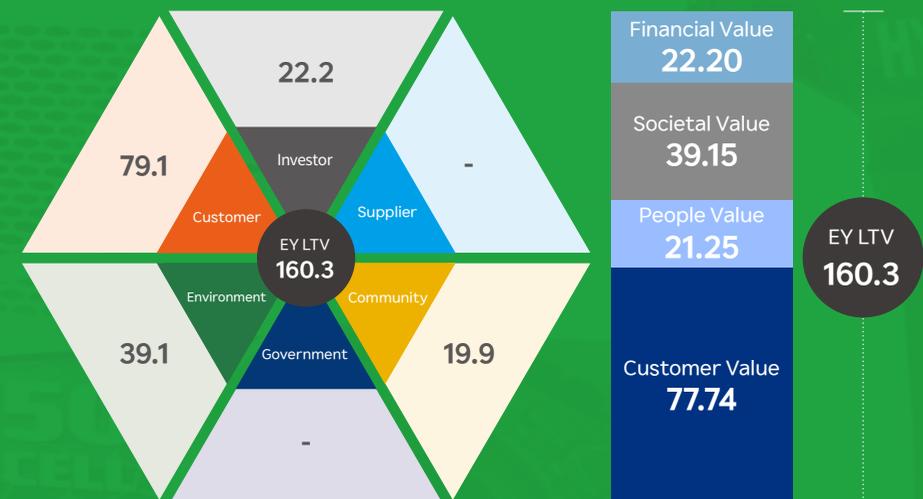
## Valuation Result

(Unit: KRW in millions)

Categories	Value Recognition	Customer	Community	Government	Environment	Investor	Supplier	Total
Customer value	Fuel cost savings	74.1	-	-	-	-	-	74.1
	Customer Scope3 emissions reduction	3.6	-	-	-	-	-	3.6
People value	Health benefits from Reduction in fine dust emissions	-	19.9	-	-	-	-	19.9
	Noise reduction	1.4	-	-	-	-	-	1.4
Societal value	GHG emission reduction	-	-	-	14.7	-	-	14.7
	Air pollutant emission reduction	-	-	-	24.4	-	-	24.4
Financial value	Increasing company profits	-	-	-	-	22.2	-	22.2
<b>Total</b>		<b>79.1</b>	<b>19.9</b>	<b>-</b>	<b>39.1</b>	<b>22.2</b>	<b>-</b>	<b>160.3</b>

(Unit: KRW in millions)

Each hydrogen forklift delivers approximately **160 million KRW** in Long-term Value to stakeholders



This measurement was conducted based on data managed by the company, utilizing national statistics, research findings, and other relevant sources. The monetary values used in the measurement may be subject to change based on new research results, and the completeness of the measurement results cannot be verified, so it cannot be considered as part of financial disclosure.

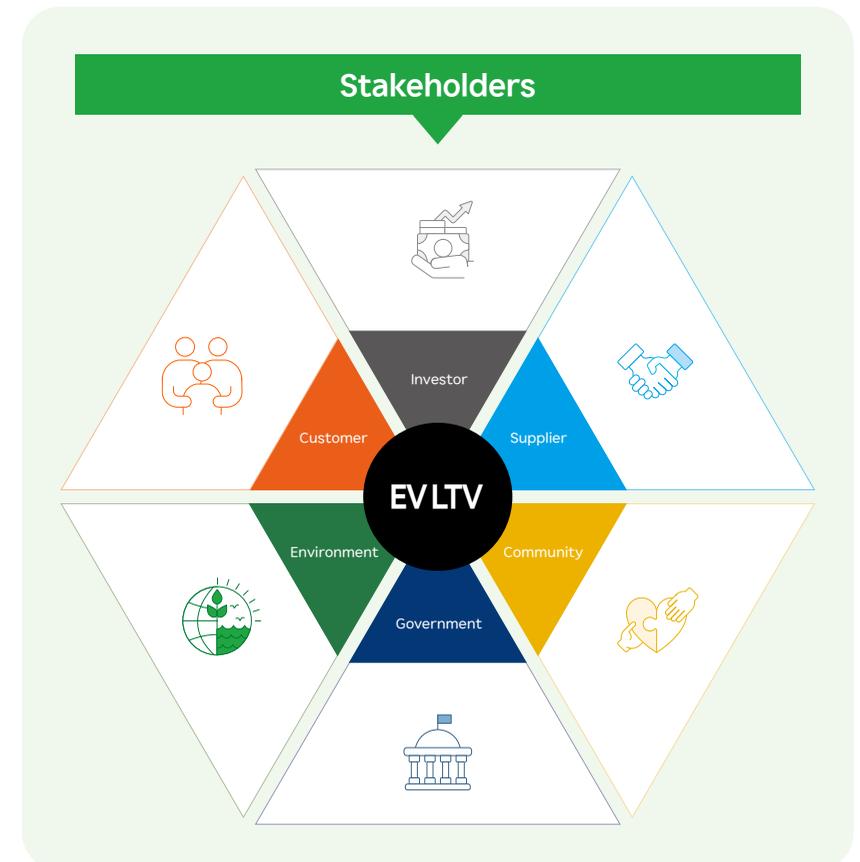
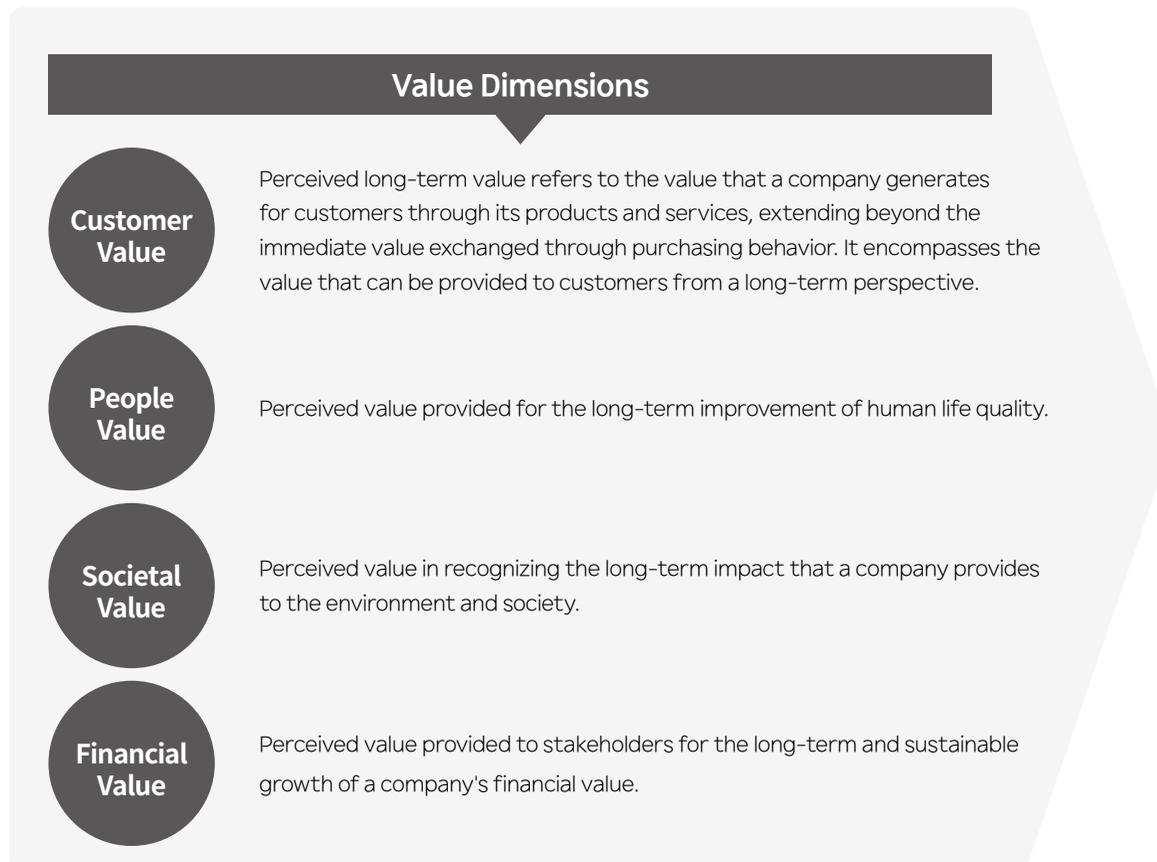
# Impact Valuation Calculations and Rationale



Value Recognition	Measurement Methods	Monetization base price	Monetization reference price sources
Fuel cost savings	Ratio of FC product fuel efficiency (12.9 km/kg) to diesel engine fuel efficiency (3 km/L) based on heavy-duty trucks	<ul style="list-style-type: none"> <li>· Diesel price: KRW 1,783/L</li> <li>· Hydrogen price: KRW 4,000/kg</li> </ul>	<ul style="list-style-type: none"> <li>· Diesel prices: December 2022 average</li> <li>· Hydrogen price: 2030 projected price from the Ministry of Trade, Industry and Energy's Hydrogen Economy Revitalization Roadmap</li> </ul>
Customer Scope3 emissions reduction	Comparable (diesel) CO <sub>2</sub> eq emissions x carbon credit trading price	· Carbon credit trading price: KRW 16,000/ton	· KAU22, as of Dec/29/22
Health benefits from Reduction in fine dust emissions	Comparable (diesel) PM2.5 emissions x Health benefits of reducing PM2.5 emissions	· Health benefits of reducing PM2.5 emissions: KRW 0.214 billion/ton	· A Study of the Effects of Particulate Matter (PM2.5) Emissions on Respiratory Disease, Last updated, Youngsoo Lee, 2015
Noise reduction	Comparable (diesel) noise x Noise Environmental Price	· 70~74 DB or more Environmental Price : 103euro	
GHG emission reduction	Comparable (diesel) CO <sub>2</sub> eq emissions x Social Cost of Carbon	· Social Cost of Carbon : 51USD/ton	· Social Cost of Carbon, EPA, USA
Air pollutant emission reduction	Comparable (diesel) air pollutant emissions x Eco-cost per air pollutant	<ul style="list-style-type: none"> <li>· CO Eco-cost : 0.24396Euro/kg</li> <li>· NOx Eco-cost : 6.3638Euro/kg</li> <li>· PM10 Eco-cost : 7.98Euro/kg</li> <li>· PM2.5 Eco-cost : 35Euro/kg</li> <li>· VOC Eco-cost : 0.0102168Euro/kg</li> </ul>	· Eco-costs emissions 2022 V1.1, TU Delft (2022)
Increasing company profits	Estimated product price (3x comparable products) x Sales operating margin	· Operating margin on sales: 7.4%	· Standards for Special Purpose Machines, Industrial Research Institute (2021)

# EY Long-term Value Method

The value of a company, product, or service is not just the value described in its financial statements. Value comes in many different forms and perspectives, and both tangible and intangible values need to be measured and managed in line with a company's strategic priorities. EY Long-term Value recognizes the limitations of current market approaches to value measurement and aims to explain the long-term value of companies, products and services through the measurement of intangible and non-financial values. The EY Long-term Value methodology can be applied to the measurement of value creation across a company's operations and to the measurement of specific products and services. The Long-term Value measurements in this report are for a specific product (hydrogen forklifts), and the results are illustrative of the product being measured and do not affect the calculation of corporate value or the value of other products and services.





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