

## JGC Group's Value-Creation Mechanism

Ever since the JGC Group was founded with a mission of supporting the foundations of industry and society at large, we have achieved sustained growth through corporate transformation always one step ahead of the times, consistently enhancing our corporate value in a rapidly changing business environment. Here, we describe the Group's unmatched value-creation mechanism, look back at transformation that has honed supporting strengths, and examine each strength in detail.

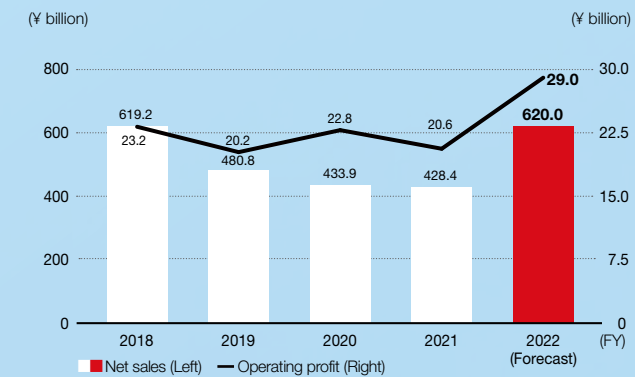
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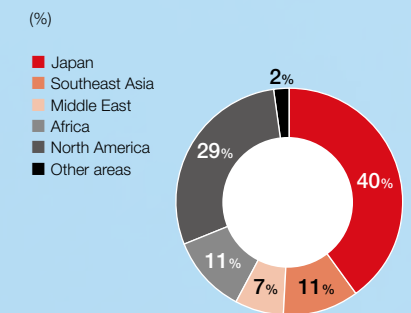
## JGC Group at a Glance

Through business focused on Total engineering and Functional materials manufacturing, the JGC Group is aiming to realize our purpose in “Enhancing planetary health,” and ensuring continued growth of corporate value.








Net sales and operating profit



New contracts by region (Fiscal 2021)



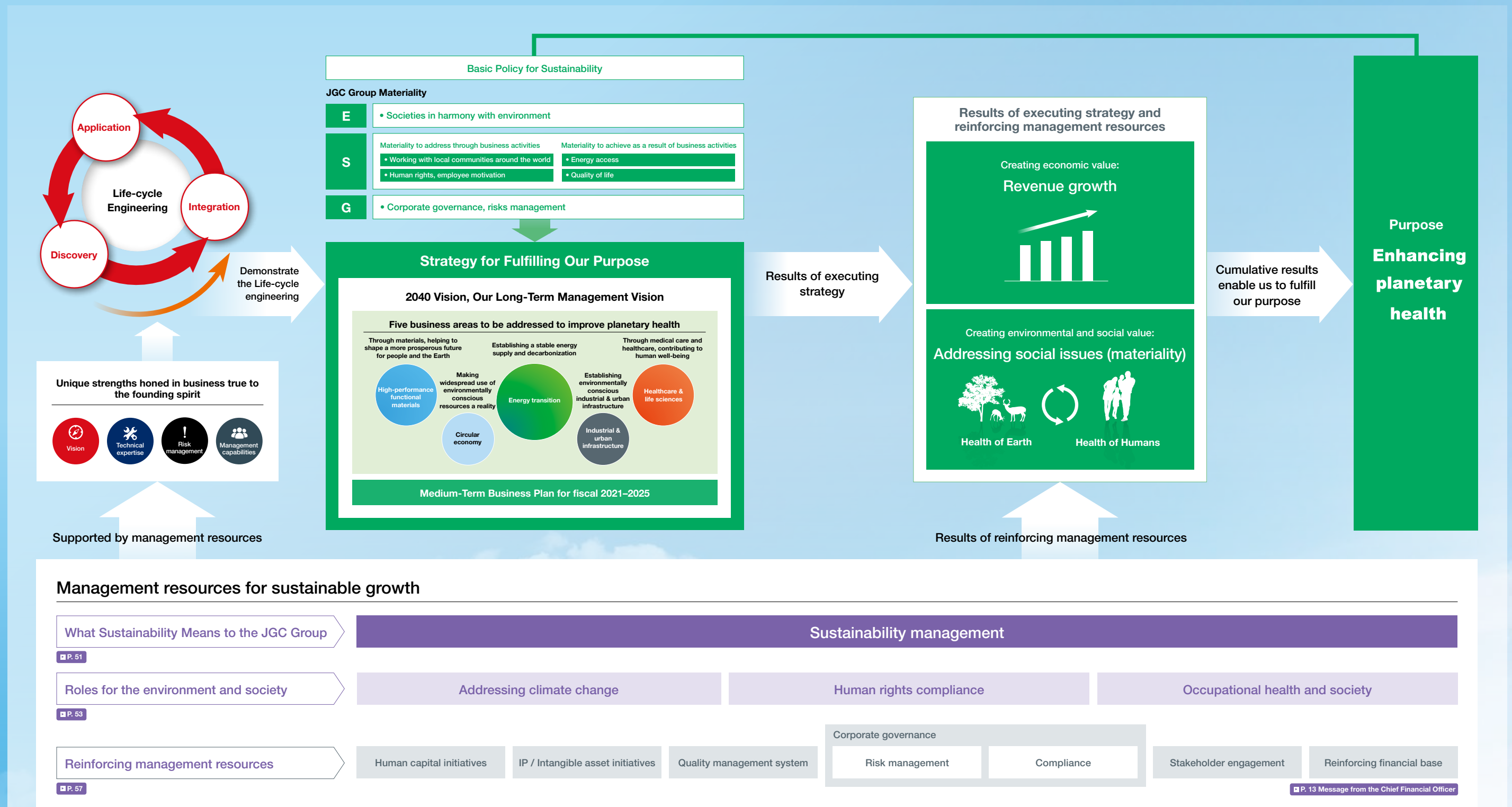
Breakdown of Sales (Fiscal 2021)

		Segment	Covered Sectors	Typical Products and Services	Employees* (Total: 6,992)
<div> <div>Total engineering business</div> <div>88.2%</div> </div> <div> <div>Functional material business</div> <div>10.3%</div> </div> <div> <div>Other business</div> <div>1.4%</div> </div>	Total engineering business	JGC Corporation (Overseas business)	<b>Energy Solutions Sector</b> Engineering, procurement, and construction of plants and facilities in sectors such as LNG, CCS, refinery, chemicals, gas processing, crude oil and gas gathering, non-ferrous metal smelting, hydrogen, fuel ammonia, nuclear energy, etc.	 Floating LNG plant (Malaysia)	5,636
		JGC Corporation (Overseas business)	<b>Facility Infrastructure Solutions Sector</b> Engineering, procurement, and construction of infrastructure facilities focused on renewable energy power generation (solar, biomass, wind), battery energy storage, LNG / LPG terminals, waste power generation, pharmaceuticals and food factories, hospitals, airports, transportation infrastructure, water treatment, etc.	 Ammonia synthesis pilot project facility (Fukushima)	
	Functional material business	JGC Japan Corporation (Domestic business)	<b>Domestic Sector</b> Engineering, procurement, construction, and maintenance of plants and facilities for oil & gas, power generation, chemicals, pharmaceuticals and laboratories, healthcare (medical and welfare), renewable energy power generation, hydrogen / fuel ammonia, resource recycling, nuclear energy-related, etc.	 Solar power plant (Vietnam)	966
		JGC Catalysts and Chemicals Ltd.	<b>Catalysts and Fine Chemicals Sector</b> Development and production of catalysts used in petroleum refining, chemical, and environmental conservation and of fine chemical products used as materials in semiconductor, IT / electronics, optics, cosmetics, and other applications	 Oil refining catalysts	
		Japan Fine Ceramics Co., Ltd.	<b>Fine Ceramics Sector</b> Development and production of ceramic materials for semiconductor, automotive, telecommunications, industrial, medical, and aerospace applications	 Silica sol for anti-reflective film on flat-screen TVs	
	Other business	Main operating companies Japan NUS Co., Ltd. and other domestic / overseas Group companies	Energy and environmental consulting, other business	 Metal-matrix composites	390
					

\* As of March 31, 2022. Does not include JGC Holdings, employees (283) or temporary staff in each segment.

## Value-Creation Mechanism

The JGC Group has remained true to our founding mission of supporting the foundations of industry and society at large. Guided by materiality, we address social and industrial issues in a “Life-cycle Engineering” approach that applies our unique strengths to fulfill “Enhancing planetary health”—defined as the purpose of the JGC Group—and ensure continued growth of corporate value.





A History of the JGC Group

Unique Strengths Honed through Transformations

Taking on continuous evolution by anticipating coming changes guided by vision, has enabled JGC Group sustained growth even in turbulent business environments. Here we see how the Group has honed its unmatched competencies over the course of more than 90 years.

Founding

Founded for oil refining and sales, anticipating future demand

External environment, social needs

- Increasing motor vehicle use and demand for cheap gasoline
- Oil poised to become the main source of energy

It was in 1923 after a historic earthquake that motor vehicles started to take off in Japan, but more gasoline had to be imported to meet rapid demand. Entrepreneur Masao Saneyoshi saw Japan's future growth linked to domestic production of gasoline. What caught his attention was a more economical production method used with heavy oil that was acclaimed in the United States: the Dubbs cracking process of Universal Oil Products Co. (UOP) in Chicago. After repeated negotiations with UOP, Masao Saneyoshi acquired all patent and licensing rights for the Dubbs cracking process. In 1928, this process formed the basis for a new company he founded for oil refining and sales—Japan Gasoline Company, the predecessor to the JGC Group.

Expansion into engineering

Business model transformation using acquired process technologies

External environment, social needs

- Oil market crash from the Great Depression
- Growing demand for aviation fuel

The first refinery was planned for construction in Otsu (now Izumiotsu), Osaka, but local opposition and the domestic oil market crash following the Great Depression the previous year put an end to these plans in 1930. Business was then supported by licensing the Dubbs cracking process and patents on isooctane production to domestic oil refiners while venturing into aviation fuel plant design and construction by applying licensed process technologies to become Japan's first engineering firm. JGC also diversified business models at this time by taking on production of oil refining catalysts, our first foray into functional materials manufacturing.

Japan's first engineering contractor

Establishment of EPC business model

External environment, social needs

- Bedrock for postwar recovery: oil and petrochemical industry
- Easier project management for clients

Domestic refiners resumed production about five years after the war, bringing JGC back into plant engineering and construction for the oil industry. At the time, plant construction generally involved submitting orders of each aspect of EPC to separate contractors, which made project management quite inconvenient for clients. But after Idemitsu Kosan awarded JGC a lump-sum EPC contract for their Tokuyama Refinery in 1956, Japan's first large-scale "grassroots" refinery project was complete in just 10 months. Through this project, JGC established the management capabilities needed to execute each phase from design to procurement and construction consistently, becoming the country's first general contractor. And through delivery of many other refineries and petrochemical complexes that enabled Japan's rapid economic growth, JGC has established and refined plant design technologies for these facilities.

Unique strengths honed through transformations



**Advent of the age of oil**  
At a time of great industrial restructuring in the 1930s, JGC anticipated the leading role oil would play as an energy source in Japan.



**Process technologies**  
Current JGC Group technical expertise developed from knowledge and proficiency in essential refining process technologies.



**From refining to engineering business**  
Setbacks in the oil refining business were overcome to venture into the engineering business.



**Refinery design technology built up through design and construction for aviation fuel**  
Familiarity with process technologies enabled full-scale design and construction of oil refineries.



**Key role of oil and petrochemical industry in Japan's rapid growth**  
JGC participated in new construction plans for oil refineries and petrochemical plants.



**Establishment of integrated project management**  
Attained the status of a general contractor, managing entire projects from design to procurement and construction.

Pick up

Key JGC Group techniques and technologies

Process Design

Oil refineries that turn crude oil into products such as gasoline operate under high temperature and pressure. Design of the crude oil distillation process calls for extremely sophisticated core design technologies of the JGC Group.

Project Management

To complete plants on time, on budget, and at the level of quality required, we employ methods to rationally and scientifically control a variety of resources, including technology, human resources, materials and equipment, funds, and information.

Catalyst Production

Original core technologies for catalyst production are applied in nanoparticle (colloidal particle) preparation, alignment control, nano pore control, and macro structure control.



## A History of the JGC Group

### Expansion into overseas markets

#### Reinforcing risk management, building a project management system

##### External environment, social needs

- Decline in domestic refining, petrochemicals industry
- Rapid yen appreciation

#### Confronting overseas project risk

As investment in domestic oil refining and petrochemical production peaked, the JGC Group set its sights overseas to develop new markets. Expansion initially targeted areas including South America, North Africa, the Middle East, Asia, and Oceania, and by 1970 more than half of all orders were from outside Japan. By the 1980s, a level that had stood near 10% in the late 1960s regularly surpassed 80%. But with the expansion came severe environmental conditions; linguistic, religious, and cultural differences; a dearth of construction companies and experienced workers in developing economies; and many other forms of overseas project risk. Managing and overcoming these risks was no ordinary task, and many costly lessons were learned in the early years. Risk management was strengthened through each of these experiences, and by the 1980s, the Group had established a reputation as a reliable engineering firm that completed plants on time with the quality required.

#### Globalization of project resources

As more projects were executed overseas from the 1970s, fluctuations in the global economy inevitably shook the JGC Group. The world's adoption of floating exchange rates in 1973 put an end to the fixed ¥360/U.S. \$1 exchange rate, and events such as the second oil crisis in the late 1970s and the Plaza Accord in the mid 1980s triggered a steep appreciation in the yen. For a company that had mainly used Japanese resources for EPC in initial expansion, these conditions undermined the competitiveness of orders and profitability of project execution. In response, the Group began a concerted effort to globalize EPC resources in the late 1970s. Regional engineering subsidiaries were established, international procurement offices set up, and a global resource management system constructed, among other steps to forge a project execution framework more resistant to foreign exchange risks.

#### More advanced project management

In this period when risk factors had multiplied, the JGC Group also focused on establishing methods of rationally and scientifically controlling complex projects outside Japan. An original project management system formally introduced in Kuwait refinery upgrading in the 1980s, in conjunction with resource globalization, earned the Group a reputation as an international engineering firm and the capabilities to prove it. To this day we continue to improve the system, which has become more sophisticated with advances in IT.

### Expansion of business areas

#### Committed to entering growth industries and promising fields

##### External environment, social needs

- Fluctuation of the global economy, resource markets
- Emergence of new fields and industries

Concerted expansion overseas was always accompanied by the goal of cultivating fields beyond oil, petrochemicals, and other energy business sensitive to global economic fluctuations, with stable management and income smoothing in mind. As we continued to target emerging growth industries and promising fields for new business, we applied process engineering technology (cultivated through energy and chemical plants); broadly applicable detailed design technology for mechanical, architectural / civil, electrical, and structural analysis engineering; essential characteristics of engineering itself (creating new functionality by integrating and organizing various core technologies for a purpose); and project management capabilities. The EPC business grew to include nuclear power in the 1960s. In the 1980s, these services were expanded to life sciences applications such as pharmaceutical production, healthcare applications such as hospitals, and industrial infrastructure such as non-ferrous refining. And in the 2000s, the JGC Group anticipated the trend toward global environmental conservation

and cultivated renewable energy and CCS sectors. LNG in particular, which we pioneered in the 1970s by applying the low-temperature technologies used at ethylene plants, has grown considerably to become our main sector. Meanwhile, we have also diversified our business models. Examples include environmental / energy consulting and functional materials manufacturing of fine ceramics as well as applying nanotechnologies developed for catalyst business originally started in the 1940s, fine chemicals.



#### Unique strengths honed through transformations



##### Global energy market trends

A trend that emerged in the mid-1960s was for oil-producing countries to develop their own resources. Soon, the JGC Group set its sights on markets such as South America, North Africa, and Southeast Asia as the next areas for expansion.



##### Establish risk management capability for overseas projects

Establishing a thorough risk management system in all aspects became essential to ensure steady revenue from overseas projects with much greater uncertainty.



##### Advanced project management system

At the heart of JGC Group management capabilities lies an original project management system for rationally and scientifically controlling project resources.



##### Interdisciplinary application of energy plant process engineering, further expansion

Business area expansion has been possible by applying technical expertise gained in designing energy plants—used in applications such as nuclear power, pharmaceuticals, nonferrous refining, and renewable energy—to design plants and factories in other promising areas where this expertise is relevant.



#### Pick up

#### LNG plant engineering and construction

Technical expertise on liquefying natural gas is essential, but besides this only a few EPC contractors worldwide can match the Group's project execution capabilities for timely completion of large-scale LNG projects. We have more than a 30% share of the global LNG construction track record.



#### Pick up

#### Pharmaceutical plant engineering and construction

The JGC Group is behind the design and construction of more than 600 facilities involved in pharmaceutical production. We meet needs in this manufacturing area promptly, as drug discovery methods grow more diverse and sophisticated from small-molecule drugs to biopharmaceuticals to new modalities.



# Four unique strengths supporting “Life-cycle Engineering”

Ever since JGC was founded in 1928, the Group has continued to grow through corporate transformation. The transformations built up four strengths that continue to drive a unique “Life-cycle Engineering” approach and sustained growth for the Group.

