CHAPTER 2

JGC Group Value Creation

This chapter tells the story of the JGC Group, with highlights including historical growth, value creation, and the path to sustained growth.

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Accelerating Commercialization of **Environmental Technologies**



Business Innovation through Digital Transformation



JGC office in the 1950s

JGC STORY Growth Trajectory

JGC Group growth is driven by constant transformation and ceaseless diligence in adapting to changing times and a changing world.



Key Developments

1960 OPFC established

> 1962 Liberalization of crude oil imports in Japan

1973 First oil crisis, fourth Arab-Israeli conflict, floating exchange rates adopted

1985 Plaza Accord Iran-Irag War (ends 1988)

1980

econd oil crisis

1980s

1979

1987

Black Monday

1991 Gulf Wa

September 11 terror attacks 2003

2001

Asian financial crisis undermines regional projects Regional focus shifts to the

Middle Fast

¥258.8 billion

Irag War

1928

Founded as Japan Gasoline Co., Ltd. (currently JGC Holdings Corporation)

Founded to build and operate domestic refineries.

1930s-1950s

Full-scale EPC. start of catalyst production business

Services begin, with refinery and petrochemical plant constructions from the 1950s supporting rapid domestic economic growth. Production of catalysts used in the oil industry underway by the 1940s.

1960s

Concerted international expansion

Overseas expansion takes off, as JGC executes refinery construction projects in South America and moves into markets including China, Southeast Asia, and North Africa.

1970s

Earning a reputation as a world-class engineering firm

Awarded a series of orders in resource-producing countries for oil refinery, petrochemical, and gas-processing facilities: built the first LNG plant in Brunei. Start of environmental and energy consulting business.

Building a global network for project execution, diversifying operations

Globalization of project execution promoted as sudden yen appreciation reduces cost competitiveness. Ventured into life sciences sector and launched the fine ceramics production business



1990s

plants.

Overcoming crisis.

responding to an era of gas demand

Withstood a wave of global restructuring and realignment in

2000s

Business expansion driven by accelerated worldwide resource development

Energy demand expands in emerging countries. Higher sales engineering; responded to growing gas demand, and secured and profit through resource development projects for Middle a succession of orders for natural gas processing and LNG Eastern oil producers: now a world leader in the LNG plant industry







JGC Report 2020 21

Net sales by year (¥ billions)



2010s

Expansion of business segments and regions. adoption of a holding company structure

North American expansion capitalizing on regional advances in shale oil and gas development; power generation projects now reflect a commitment to offshore, thermal, and renewable energy. As of October 2019, JGC becomes a corporate group with a holding company structure, pursuing stable, sustained

Visit us online to learn more about JGC Group history.

growth from a multi-business portfolio.



https://www.jgc.com/en/about/history.htm

JGC STORY JGC Group Materiality

Six issues are positioned as materiality by the JGC Group and addressed to contribute to a sustainable society and achieve sustained corporate growth.

Progress in these six areas will be published in the Company's integrated reports and online, and we will review their sustainability and consider new materiality as needed in response to changes in macrotrends and our business.

Positioning as materiality

Issues positioned as materiality are viewed as a key element, fundamental in establishing management policies and conducting business. Through sound business activities, the JGC Group hopes to help solve social issues and create economic, social, and environmental value.

Six material issues >

Management policies Business activities

Output • Economic value Social value Environmental value

Process to identify materiality

Social issues to be addressed by the Group are selected through analysis of GRI guidelines, ISO 26000, SDGs, and other international guidelines and global macrotrends.

Six material issues that take precedence are determined from a comprehensive evaluation of priorities from the standpoint of society, stakeholders, and the company.

GOALS STEP 1 Based on SDGs and other guidelines, select social issues to consider

STEP 2

Evaluate priority for stakeholders

		Materiality	Related SDGs	Recognized Social Issues	
Е	Societies P.37 »	s in harmony with environment	7 AFFORMATIE AND CELAND DEFINIT AD PRODUCTION AD	 Reducing the environmental impact of fossil energy Promoting use of a greater share of renewable energy Protecting ecosystems, maintaining biodiversity Promoting development of products and technologies that help curb global warming 	
	Materiality to address	Working with local communities around the world P39 »	4 CULITY EDUCATION 4 COULTE 10 REDUCED 10 REDUCED REQUIRES 10 REDUCED 10 REDUCED 10 REDUCED 10 REDUCED 10 REDUCED 10 REDUCED 10 REDUCED	 Contributing to economic and industrial development in emerging markets Creating employment in emerging markets Supporting technology transfer and human resource development in emerging markets 	
S	through business activities	Human rights, employee motivation P40 »	5 EXDERY	 Promoting workplace diversity Promoting female hiring and strengthening skill-building Respecting human rights in all business activities 	
	Materiality to achieve as a result of business activities	Energy access P41 »	7 CLEAN DARRY 	 Meeting greater global energy demand Promoting wider use of renewable energy that contributes to sustained growth Enhancing productivity through greater global energy efficiency 	
		Quality of life P42 »	3 GOOD HEATH AND WELL-BEING AND WELL-BEING	 Responding to aging social and industrial infrastructure Promoting development of social and industrial infrastructure in emerging markets Improving global medical standards Making life more convenient and comfortable 	
G	Corporate governance, risks management P50 »		16 PEACE JUSTICE AND STRONG NSTITUTIONS STATE ST	 Strengthening and improving corporate governance Ensuring regulatory compliance in business activities Responding appropriately to corporate and business risk 	

High



Group Initiatives

- Construction of Fossil Energy Plants with a Lighter Environmental Footprint
- Construction of Renewable Energy Plants
- Protecting rare plants and animals near construction sites
- Producing environmentally beneficial products in volume and pioneering environmental technology business
- Construction of plants and facilities in emerging markets
- Promoting procurement in emerging markets
- Training and educating engineers in emerging markets
- Promoting measures that encourage workplace diversity
- · Expanding the personnel system accounting for opportunities and skill-building for women
- Ensuring thorough respect for human rights, including in supply chains
- · Construction of various types of energy plants in regions worldwide
- Promoting wider use of renewable energy
- Making energy plants more efficient and reducing energy consumption
- Conducting maintenance business for social and industrial infrastructure
- Construction of various infrastructure facilities in Southeast Asia
- · Construction of pharmaceutical plants and medical facilities
- Development and production of functional materials for electronics, everyday products, and more
- Continuing to strengthen corporate governance and ensure efficacy
- Being thorough about compliance policies, strengthen related activities
- Practicing thorough risk management



JGC STORY Value Creation Process

Applying ample management resources and strengths in each segment for maximum economic, environmental, and social value and solutions to social issues.



Corporate Philosophy **JGC Way**

JGC STORY JGC Group's Business

JGC Group creates economic, social and environmental value through mainly two business models: Total Engineering (in Oil & Gas and Infrastructure segments) and Functional Materials Manufacturing.

Total Engineering Business >>

The plants and facilities developed through projects support client business of all kinds. We work with clients from early on, in the initial planning stages of feasibility studies (FS) and front-end engineering and design (FEED). After projects are complete, operations and maintenance services are also available. This ensures that throughout the life cycle of plants and facilities, clients can get the most from their business.



Covered Sectors

Oil & Gas

Plants and facilities used for crude oil/gas gathering, gas-oil separation, offshore, LNG and gas processing, oil refining, petrochemicals, chemicals, and others

Infrastructure

Plants and facilities used for renewable power generation, LNG/LPG terminals, waste power, non-ferrous metal refining, pharmaceutical manufacturing plants, hospitals, airports, and others

Representative Product and Service







Solar power plants

Pharmaceutical plants



Functional Materials Manufacturing Business >>

Through R&D, planning, production, and sales in this business, JGC Group offers an array of catalysts, fine chemicals, and fine ceramics that enhance the value of our customers' operations in many applications.

Sequence of business operations R&D Marketing

Covered Sectors

Catalysts Catalysts used in oil refining and petrochemicals, Semiconductor, IT, electronics, optical, and

chemicals and environmental protection

Fine Chemicals cosmetics materials

Representative Product and Service



FCC (fluid catalytic cracking) catalysts

Silica Sol for HDD polishing

Consulting Business >>

Our Consulting business spans intelligence and research, field research, analysis and evaluation, and reliability and risk assessment in environmental, energy, resources, and social sciences fields. In this broad range of consulting services, we apply extensive experience and proven technology to help find solutions to diverse issues faced in Japan and around the world.

LNG plants





JGC STORY Roadmap to the Sustainable Growth

Core Competencies

Technical Expertise

Project Execution Capabilities

Organizational Strengths

Solution Proposal Capabilities

Ability to Respond to Changes

Open-minded Corporate Culture

The JGC Group pursues further growth through contributions toward a sustainable society.

The JGC Group is currently establishing 2040 Vision, a long-term vision that will inform the next medium-term business plan beginning in fiscal 2021. Based on creating shared value, the vision will guide us in efforts to transform current business while addressing urgent social issues on the path to sustainability, as we promote exploration of new business areas in the context of our core competencies to take on these social issues.





Transforming Ex Significantly more competitive, from an in	tisting I Inovation ir	
Exploring Net		
Business Segme	ents Envisio	
Low-carbon / Decarbonized Engineering Focusing on segments that combine fossil energy with low-carbon technologies, such as CCS	Funct Carbo Enviro Contrib micropla carbon	
Responding to expanded resource recycling, such as plastic and other waste	New E Focusing and new ammoni	
Infrastructure, Industrial Innovation Meeting greater demand for construction of advanced water, transportation, and other infrastructure and smart factories	Health Respond life expe	

Sources

*1 UN"World Population Prospects 2019"
*2 UN"World Population Ageing 2019"
*3 IIASA"Water Futures and Solution 2016"
*4 BP"BP Energy Outlook 2019 edition"
*5 0ECD"Strategic Transport Infrastructure Needs to 2030"

%6 UN"World Urbanization Prospects 2018"
%7 World Bank Group"What a Waste 2.0"
%8 UNEP"Emissions Gap Report 2019"
%9 McKinsey & Company and Ocean Conservancy "Stemming the tide:Land-based strategies for a plastic-free ocean" Business

ss Areas

ned*

tional Materials Supporting on Reduction and Conserving onment

buting to greater EV/HV demand, lastic alternatives, and other forms of n reduction and decarbonization

Energy

ng both on conventional renewable energy w areas of energy, such as hydrogen and nia

ncare, Life Sciences

nding to global population growth, longer pectancy, and higher medical standards



Highlights

Accelerating Commercialization of Environmental Technologies

Recognizing how firmly established the trend toward building sustainable societies has become, the JGC Group regards environmental business in particular as a priority segment. We focus on our own environmental and other technologies, drawing on collaboration with corporations and universities that maintain and develop other advanced technologies, to promote building new business. To accelerate this development, the Sustainability Co-Creation Department was established on October 1, 2019, under direct supervision of the president.



Sustainable Society as Envisioned and Pursued by the JGC Group



New Energy

Promoting Use of CO₂-free Ammonia as a Hydrogen Energy Carrier

In efforts toward a low-carbon society, we can anticipate expanded use of hydrogen energy, which does not emit CO₂ during combustion. However, many commercial challenges remain. From an economic standpoint, for example, large-scale and highly efficient conversion to an energy carrier for transport is needed. In collaboration with AIST, the JGC Group is promoting establishment of technologies to commercialize hydrogen energy. One facet is developing new catalysts and processes to synthesize ammonia (which does not emit CO₂ during combustion) using hydrogen produced from renewable energy as a raw material.

Using Ammonia as a Hydrogen Energy Carrier



Low-carbon / Decarbonized Engineering

Carbon Separation, Capture and Reuse

Working with NGK INSULATORS, the JGC Group has developed high-efficiency CO₂ separation and capture technology using DDR-type zeolite membranes. Large-scale field testing is underway in the United States. Use of these techniques - separation and capture of CO2 from associated gas during crude oil production, or removal of CO2 during natural gas refining-helps promote CO2 recycling as well as development of energy resources with lower environmental impact. Gas processing costs are also reduced through this technology, which requires less energy to remove CO2. To meet increasing energy demand, the technology will be applied in the development of challenging natural gas fields with high concentrations of CO2



DDR-Type Zeolite Membrane (Source: NGK INSULATORS)



Recycling

Gasification Chemical Recycling of Plastic Waste

Plastic recycling is being promoted in response to global waste issues, with marine plastic pollution often cited as an example. In conjunction with Ebara Environmental Plant, Ube Industries, and Showa Denko, the JGC Group supports gasification chemical recycling that applies the Ebara Ube Process (EUP) to gasify waste plastic and convert it to synthetic gas that can be used in synthesis of chemicals such as ammonia or olefins.



Business Innovation through Digital Transformation

Currently making great strides, digital transformation (DX) is expected to shake up many areas of industry and society in the future. DX is actively promoted by the JGC Group, both to introduce innovation in existing businesses such as Total Engineering and to expand business models.



Innovation in executing projects

IT Grand Plan 2030: Future Vision and Roadmap for Total Engineering Business

The JGC Group established the IT-based project management technologies for Total Engineering Business in the 1970s, and continuously refined it over time. Currently, the JGC Group is taking on technical innovation for project execution and project management in line with IT Grand Plan 2030. The plan describes our future vision for this business, as enhanced by DX that is expected to evolve rapidly, and serves as a roadmap for attaining this vision. By 2030, we aim to complete projects twice as fast with onethird the current manpower.





JGC Group Value Creation

Innovation in executing projects

Enhancing Productivity, Creating added Value

A focus for the JGC Group is building our own DX-based advanced work packaging (AWP) system for further innovation in project execution in Total Engineering Business.



Based on overall optimization that the JGC Group has pursued for some time under a construction-driven approach to project execution, we have moved ahead in developing a Data Hub system for central management of related information and are now building our own AWP system applying these approaches. Expressing project progress visually and forecasting progress more accurately will be possible, and in addition to higher productivity from lower costs and earlier delivery, building the Digital Twins which replicate and visually express projects as a whole will enable us to create added value.

Exploring new business areas

Providing Digital Solution Services

The JGC Group is also engaged with digital solutions addressing technical challenges faced by our clients. Innovative, DX-based technical services provided by the JGC Group in Total Engineering Business include development of Airlize LNG technology package service for stable operation and higher productivity of air-cooled LNG plants, as well as integrated maintenance service (INTEGNANCE) for domestic oil refineries and petrochemical and chemical plants.

🛞 INTEGNANCE

Integrated maintenance and safety services

Support for aging facilities, corrosion/damage monitoring, risk assessment and support in international safety compliance. human resource development, skill shortage strategies, digitalization and automation, catalyst/chemical remaining life estimation, renovation project support

Data-driven



Exploring new business areas

Pioneering New Fields with DX

Applying DX in the JGC Group's Total Engineering Business and Functional Materials Manufacturing Business will enable us to provide services that are more value-added than ever before. By linking the Group's core and digital technologies, we are actively pioneering new business fields as well as working more efficiently in existing businesses.

