FY2019 SDGs · ESG Briefing

October 14, 2019

Today's Work, Tomorrow's Heritage SHIMIZU CORPORATION @ SHATTAL



SHIMIZU CORPORATION supports the Sustainable Development Goals

Program

- Opening Remarks
 Kazuyuki Inoue,
 President & Representative Director
- Initiatives of LCV Headquarters
 - —Aiming for a Resilient, Inclusive, and Sustainable Society— Kazuyoshi Nasuhara, Managing Officer, General Manager, LCV Headquarters
- Initiatives in Renewable Energy
 - -Targeting Full-scale Introduction of a Large Offshore Windfarm-Takeshi Sekiguchi, Executive Officer, General Manager, Engineering Headquarters
 - Potential for Use of Smart BEMS and Hydrogen as ecoBCP Yutaka Ishikawa, Sr. Managing Officer, General Manager, Technology Planning Division General Manager, Institute of Technology
- Investing in Space

Shinichi Takiguchi, Managing Officer, General Manager, Emerging Frontiers Div.

Closing Remarks

Koichiro Higashide, Executive Vice President & Representative Director

Opening Remarks

CREDO

The Analects and the Abacus

Eiichi Shibusawa, called "the Father of Japanese Capitalism," was invited to be an advisor to our company in 1887. We hold his work "The Analects and the Abacus," to be our credo: our timeless and unchanging business compass.

Management Principles

With devotion and a spirit of innovation, we work to create value that exceeds expectations and contribute to a sustainable tomorrow

SHIMZ VISION 2030



SHIMZ VISION 2030 Shimizu Group's Strategy Towards 2030

>> The Shimizu Group will create new value and contribute to a safe, healthy and sustainable future for everyone by transforming and challenging ourselves beyond construction and co-creating with diverse partners.



The Value Shimizu Provides

SHIMZ VISION 2030 The Value Shimizu Group Provides

We will contribute to the 17 SDGs (Sustainable Development Goals) by providing value through innovation

Realizing a resilient society

With the heightened risk of natural disasters such as earthquakes, super-typhoons and torrential rain, there is an ever-increasing need to protect lives and businesses.

Building strong and resilient infrastructure

Disaster prevention & mitigation technology

Extending the life of the built-environment

Disseminate ecoBCP*

* Facilities and urban development concepts that can effect both saving measures for normal operation (eco), and business continuity planning (BCP) for emergencies.

Realizing an **inclusive** society

With rapid changes such as aging, population decline and urbanization, the future requires a society where anyone can live safely and comfortably.

Urban development utilizing ICT

Provide built-environments that enhance health and well-being Use of universal design
 Expand the fields of human activity (to the oceans and space)



Targeted Goals





Realizing a sustainable society

As global warming, deforestation and environmental pollution become more serious, we must increase efforts to leave behind an bountiful earth for the next generation.

Use of sustainable energy

- CO₂ emissions reduction in all business activities
- Promotion of energy-saving, energy creation and ZEB (zero energy) facilities
- Conservation of the natural environment and biodiversity



SHIMZ VISION 2030 Towards the Achievement of our Vision

>> The Shimizu Group aims to be a Smart Innovation Company that creates new value through the integration of three innovations



Business Structure Innovation

 Diversify business models, accelerate global expansion, improve group management capabilities

Technology Innovation

- Develop advanced technology to respond to the mega-trends of the future
- Accelerate construction process technology development to increase competitive edge

Talent Innovation

- Promote working style reforms that will enable diverse talent to thrive
- Build knowledge/expertise through co-creation with others

SHIMZ VISION 2030 Target Revenue Structure

By evolving into a Smart Innovation Company, we aim to achieve consolidated ordinary income of ¥200 billion or higher in fiscal 2030. The composition of consolidated gross profit is 65% for construction, 35% for non-construction businesses. And by region, 75% domestic business and 25% overseas.



FY2030

Initiatives of LCV Headquarters

-Aiming for a Resilient, Inclusive, and Sustainable Society-

What is the LCV Business?

This business was launched in October 2017, based on the business concept of Life Cycle Valuation.

Life Cycle: Over the entire life cycle Valuation: Generating greater value

Shimizu's role is not only building facilities for customers. It also encompasses generating greater value over the facility's life cycle, according to the needs and wishes of the customer.

Description of the LCV Business

Shimizu increases the value and user satisfaction continuously throughout the lifecycle of buildings, infrastructures, and cities in order to build a sustainable future.



It links the BSP business, energy and infrastructure management business, and ICT and Smart business.

It enhances performance in saving energy, eliminating carbon emissions, and ensuring business continuity (ecoBCP).

It improves health and comfort in the working and living environments (WELL), etc.

It uses **renewable energy**, **IoT**, and **AI** to meet the increasingly diversified and sophisticated needs of customers.

It provides comprehensive services and solutions, including participating and investment in businesses.

Description of the LCV Business



WELL services

Background

- People spend 90% of their time indoors and we need to recognize the importance of constructing building spaces that promote health and comfort.
- Personnel expenses account for 90% of office operating costs.
 We invest in people to improve the profit margin on our investments.
- The roles of buildings and workplaces in companies are changing.
- Facilities that provide a high degree of health and productivity increase real estate value.
- Health management, work style reform



Health, Wellbeing & Productivity in Offices

WELL Building

Buildings that take the health & wellbeing of users into consideration



Well-being

Good conditions (WELL) for physical and mental health (of employees)



An office with greater vitality

Promoting health, improving mental productivity, decreasing job turnover, etc.

WELL Certification

Evaluation of buildings and their interiors from the perspective of health and well-being



- The world's first system to evaluate buildings and their interiors from the perspective of the health and well-being of the building's users
- Shimizu participates in the alliance program of DELOS Living, LLC, the company that established the WELL Building Standard.
- WELL certification is awarded to **offices**, at the building, interior, core, and shell levels.
- The Version 2 (v2) pilot was announced in May 2018, enabling application to nearly all purposes.



President Inoue Shimizu Corp.

Paul Scialla CEO DELOS Living LLC



Application status (registered & certified)

WELL certification will expand in the future and the purposes for which certification is issued expand with the implementation of v2 at the end of 2018

- 3,462 properties in 55 countries (201 certificat ٠ 159 pre-certifications)
- Certifications in the U.S., UK, and China are expan and, in the future, will expand Japan and Southe Asia.
- The number of projects has ٠ quadrupled in the last year.



Silver





No. of months since certification began

end of 2018.		By Country (As	of July 2019)
		UK	1313
201 certifications,		U.S.A.	1028
		China	357
ina are expanding and Southeast		Australia	138
		France	87
WELL	WELL	Canada	70
GOLD 2017	PLATINUM 2027	Spain	58
r Gold Platinum By Building Type		Netherlands	57
		India	41
		Italy	40
		Poland	27
WELL v2	2385	Thailand & Mexico	21
Office	799	Sweden	20
Residential	194	Japan & UAE	19
Retail	32	Ireland	13
Education	19	Thailand	12
Community	17	Brazil	11
All projects in	17	Germany	10

- The market is expanding along with measures such as health management (Ministry of Economy, Trade and Industry), work style reform, and ESG-based real estate investment (Ministry of Land, Infrastructure, Transport and Tourism).
- Shimizu is providing consultations on obtaining certification and expanding services.
- We provide one-stop support for creating WELL work places.
- The number of certifications for enhancing value is growing for both new construction and renovations.



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Jakarta

C&S Gold

WELL Certification Examples ¹⁰DELOS Living LLC Head Office (Platinum)



WELL Certification Shimizu Corp. China Shanghai Office

Comfort 83 Thermal comfort via radiant system

Comfort 75 Internal noise (double glazed windows)

Air

Comfort 73 Ergonomics (Standing desks)

Geve Ala

88 Biophilia

18 Air quality monitoring & feedback

Guidance service (voice navigation system)

Things that are Difficult for Visually Impaired People



Information accessibility for visually impaired people has improved greatly over the past 30 years, and they are now able to access newspapers, textbooks, bank books, and other information they need to participate in the community. However, **it is still extremely difficult for them to enjoy the town**.

From Technical Development of a Voice Navigation System to Deployment



2020 Tokyo Olympics & Paralympics

To universal design

Inclusive community development SDGs

System diagram



Inclusive Navigation

Community development that enables everyone to live and move around with ease

- Inclusive navigation for visually impaired people, wheelchair users, baby carriage users, foreigners, general visitors, and others, according to their needs
- Voice navigation service via smartphone
- To facilities for the Olympics & Paralympics, public facilities, airports, hospitals, and stations
- Verified in COREDO Muromachi in Nihonbashi and in KITTE in JP Tower, and installed for practical use in Toyosu Civic Center





Expansion of Service Using Interior Location Information





Initiatives in Renewable Energy

-Targeting Full-scale Introduction of a Large Offshore Windfarm-

5th Strategic Energy Plan





Making renewable energy the main source of energy

Energy Mix (2030)









© Japan Wind Power Association

Global Offshore Wind Market





Windpower Monthly, Jan 2019

The Act on Promotion of Use of Marine Areas for Development of Marine Renewable Energy Generation Facilities



- On April, 2019 the Cabinet enforced the Bill for the Act of Promoting Utilization of Sea Areas in Development of Power Generation Facilities Using Maritime Renewable Energy Resources.
- On July, 2019 Ministry of Economy, Trade and Industry and Ministry of Economy, Trade and Industry announced Designated promising area into Promotion area.

Future schedule

- 1. The Prime Minister is to prepare a draft proposal for basic policies to promote the utilization of maritime areas for the development of power generation facilities using renewable maritime energy resources, and in response, the Cabinet is to approve the policies through a Cabinet Decision.
- 2. The Minister of Economy, Trade and Industry and the Minister of Land, Infrastructure, Transport and Tourism are to hold discussions with the Minister of Agriculture, Forestry and Fisheries, the Minister of the Environment and other officials and to have interviews with councils and other associations with stakeholders as members, and based on the results, the two ministers are to designate maritime areas as targets of promotion projects and formulate guidelines for the collection of applicants capable of developing appropriate facilities and for the licensed use of the maritime areas.
- 3.Applicant businesses are to submit to the two ministers an action plan concerning their intended use of maritime areas.
- 4. The two ministers select the applicant who has submitted the most appropriate plan based on an examination of the details including the final intended price of electricity, and certify the plan.
- 5. The selected business is to file an additional request for certification under the Feed-in Tariff (FIT) scheme* utilizing the details of the certified plan. In response, the Minister of Economy, Trade and Industry is to certify the applicant under the scheme.

Note: The FIT scheme refers to the Act on Special Measures Concerning Procurement of Electricity from Renewable Energy Sources by Electricity Utilities.

6.The selected business is to request permission for the exclusive use of target maritime areas under the certified plan. In response, the Minister of Land, Infrastructure, Transport and Tourism is to issue permission to the business for a period not exceeding 30 years from the date of the permission.

Selection of Areas to Promote Windpower in/ Promising Areas





Increase in Size of Offshore Wind Turbines (Trend in Europe)





 Wind turbines for offshore windfarms in Europe are increasing in size for profitability: 8 MW or more

 As wind turbines increase in size, components are getting larger and much heavier.

Increasing Size of Wind Turbines



A work ship (SEP) is necessary for secure construction of large wind turbines.

- Crane capacity (lifting weight & height) ►
- Carrying capacity •
- Oceanic conditions in Japan

* SEP: Self-Elevating Platform



Construction of a SEP



Construction of a SEP ship to perform construction of large offshore windfarms

- The hull of the ship is jacked up above sea surface and construction is performed without being impacted by waves.
- Has the world's largest <u>crane capacity</u> and <u>carrying</u>
 <u>capacity</u> to handle the installation of large wind turbines of 8 to 12 MW or greater.
 - Capable of carrying all components for seven 8MW turbines or three 12 MW turbines
 - Crane capacity: 2,500 t (lifting height: 158 m)
- Self-propelled ship capable of operating on the high seas
- Ability to operate in the long period waves that are characteristic of the Pacific Ocean
- $\cdot~$ To be completed in October 2022





Construction of Offshore Windfarm







Potential for Use of Smart BEMS and Hydrogen as ecoBCP

Shimizu Group' s Strategy Towards 2030



••• The Value Shimizu Provides •••

Earthquake Response Framework



Earthquake Response Technology



Seismic hazard



Earthquake motion



Liquefaction



Tsunami



Seismic isolation



Earthquake resistant ceilings



Vibration control damper



Building seismic response monitoring



Liquefaction Mitigation



Tsunami countermeasures



Seismic intensity mapping



Assessing degree of damage

ecoBCP



Smart BEMS

Shimizu Corporation Institute of Technology



Operation & management with Shimizu Smart BEMS Operation & management with Multi-building Smart BEMS

Smart BEMS and ecoBCP





Use of CO2-free hydrogen in Smart BEMS

[Hydro Q-BiC]



Merits of Hydrogen Use



Hydrogen Storage Methods

Hydrogen storage in metal hydride = Optimal for use in buildings

Storage method	Compression	Liquefaction	Metal hydride	МСН	Ammonia
Related laws & regulations	High Pressure Gas Safety Act Fire Service Act Building Standards Act		High Pressure Gas Safety Act Fire Service Act Few regulatory	Fire Service Act Building Standards Act	Poisonous and Deleterious Substances Control Act Fire Service Act
Volume	\bigtriangleup	\bigcirc	© Compact	\bigcirc	Ø
Weight	Ø	Ø	×	\bigtriangleup	\bigcirc
Energy loss	\bigcirc	\bigtriangleup	© Little energy los	s O	0

Legend:

- ©: Excellent
- \bigcirc : Good
- **∆: Fair**
- x: Poor

Joint Research with AIST



Joint Research Points

Phase 1 Establish Technology

- Storage method suitable for use in buildings: Metal hydride
- Housing for metal hydride :
- Renewable energy that uses hydrogen:

Hydrogen storage tank Optimal energy control



Metal hydride

Phase 1 Establish Technology

Developed an original Metal hydride that is not classified as a hazardous substance under the Fire Service Act

Typical alloy





Ignites and is classified as a hazardous substance

Metal hydride (original)



Does not ignite and is not classified as a hazardous substance

Reduces cost by not using rare earth metals

Hydrogen storage tank

Phase 1 Establish Technology

Storage in/near a building without requiring licensed personnel

Operating temperature: 20 to 50°C

Optimal storage expertise with two kinds of tanks Medium-sized high-performance tank (10 Nm³ x 4, equivalent to 66 kWh)

> Large general-purpose tank (40 Nm³, equivalent to 66 kWh)



Optimal Energy Control

Phase 1 Establish Technology

Expansion of Smart BEMS



Investing in Space

Missions of the Emerging Frontiers Division

From "land" to "sea"



From "the Earth" to "space"



Expand the human activities from "land" to "sea" and from "the Earth" to "space," and contribute to sustainable development of the Earth and human kind.

Space Development and Satellite Data Analytics

History of Space Development

In 1987, we began research and technology development of the various space infrastructures to support human activities in the extreme environment of space.



In recent years, roles of the government and the industry have changed. Technological innovation has resulted in a rapid paradigm change and the era of active private sector investment in space has arrived.

It is now the time to expand from the conceptualization and R&D stage to commercialization.







- 1. Small Satellite Launch Services [Investment & Participation in SPACE ONE]
 - The creation of smaller satellites through technological innovation has resulted in a rapid increase in the number of small satellites used.
 - The diversification of small satellite missions has increased the need for dedicated launches.

We invested in SPACE ONE Co., Ltd., a company in the small rocket launching business, as Shimizu's first challenge in the space business.



1. Small Satellite Launch Services [Targeting First Private-sector Launch Site Construction in Japan]





Kushimoto, Wakayama-Pref., was selected as a launch site for SPACE ONE small launcher.



Launching service scheduled to begin in FY2021



The launch site "Spaceport Kii" is roughly three hours from Kansai International Airport and two hours from Nanki-Shirahama Airport (by road).

2. Satellite Data Analytics [Difference Between Optical & Radar (SAR)]



Optical: Cannot see through clouds or at night

SAR: Can see clearly through clouds or at night

SAR: Synthetic Aperture Radar

2. Satellite Data Analytics [Applications and Solutions]

Provide solutions focused on **sustainability** and **resilience** for the industries and governments that will support the smart cities and infrastructures of the future.

- Infrastructure construction & monitoring of fraud
- Optimization of urban/infrastructure plans
- International standardization of project



Infrastructure development & investment



Smart cities



- Monitoring of key infrastructures during disaster
- Rescue activities/recovery support
- Environmental protection/monitoring



Disaster prevention & mitigation



Rescue operations



- Forecasting of economic indices (e.g., export volume)
- Forecasting/benchmarking of company performance



Asset management & logistics



Renewable energy



- 2. Satellite Data Analytics [Investment in Small SAR Satellite Business]
- Create big data through high-frequency observations of wide areas using small satellite constellation.
- Rapid progress in the data science area made sophisticated data extraction possible.
- Make a strategic investment in Synspective, the small SAR satellite constellation operation and analytics company, that took over the human resources and technologies of the Cabinet Office ImPACT program, and build a new satellite data information platform.
- We aim to develop value-added information products using Shimizu's proprietary technologies.

SAR (Synthetic Aperture Radar)



* StriX-a, the first verification satellite scheduled for launch in 2020

2. Satellite Data Analytics [Overview of Synspective, Inc.]

Synspective, Inc. (Synthetic Data for Perspective)

The company has secured **¥10.9 billion** in cumulative financing over the one year and five months since it was founded. (As a space start-up company, this represents the fastest growth in the world, and the largest in Japan.)

Build a constellation of small SAR satellites that makes highfrequency observations possible, sell the data obtained from that constellation, and use the data to provide solutions. Shimizu aims to be an Integrated Space Company(i-SC) that provides both tangible and intangible services ranging from launching small satellites to acquisition and analysis of satellite data and to construction of infrastructure on the lunar surface. We plan to achieve this through joint partnerships and strategic investment in promising startups.



Integrated Space Company(i-SC) Concept