

JGC Group

Current status of R&D program and business development on NuScale VOYGR™

Enhancing planetary health

【JGC Group】
JGC HOLDINGS CORPORATION
JGC CORPORATION
JGC JAPAN CORPORATION
JAPAN NUS CO., LTD



1928

Established



Total Group
Manpower

App. **9,500**

(EPC Business only)



Project
Record

20,000 projects

In over

80 countries



LNG market
share

48 Trains

more than **30%**



Net Sales

US\$ 5.5 billion

Fiscal Year 2023
(ending March 2024)



Overseas Sales
Ratio

Over **70** %

Fiscal Year 2023
(ending March 2024)

EPC Business



Energy Transition



Healthcare/Life Science



Industrial/Urban Infrastructure



Resource Recycling

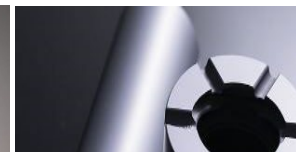
Functional Materials Manufacturing



Catalysts



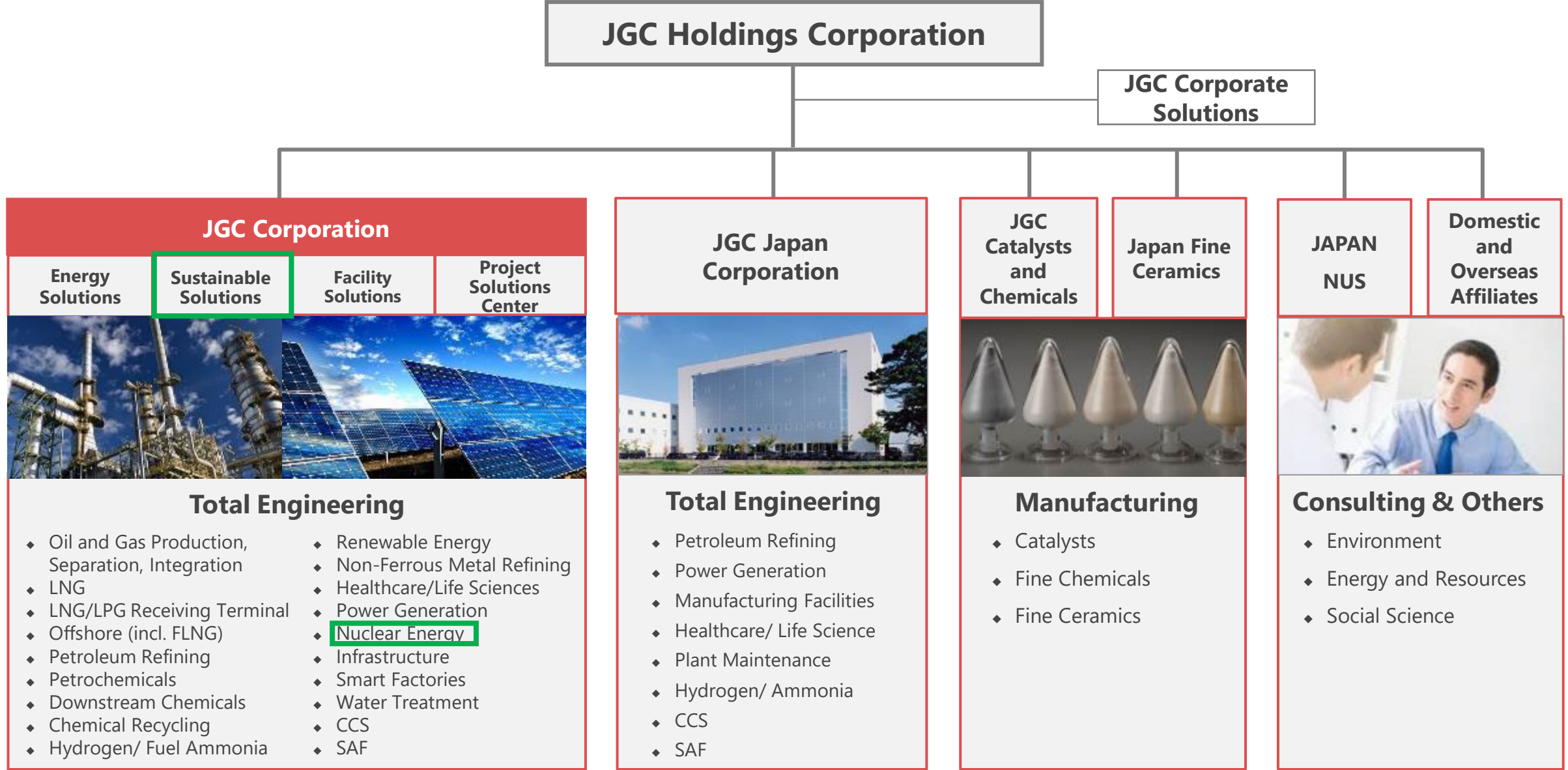
Fine Chemicals



Fine Ceramics

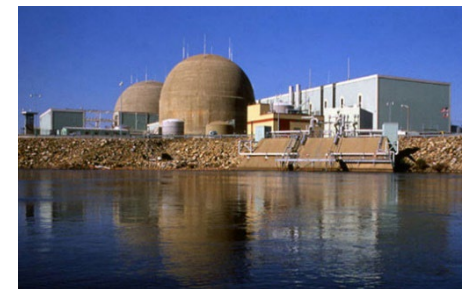
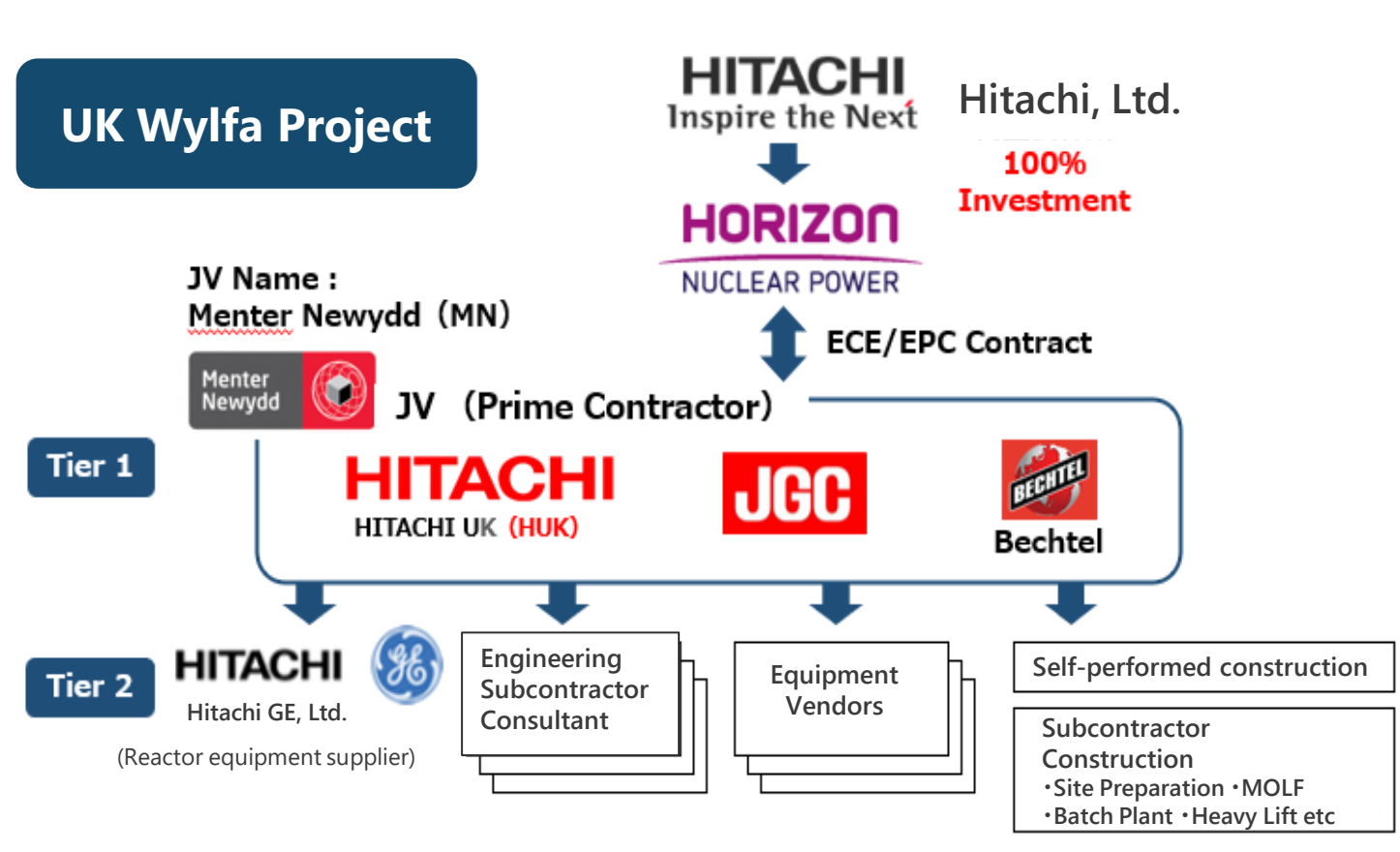
Energy and Environmental Consulting





JGC Group Achievements of nuclear projects

- Over 50 years experience in Nuclear field since 1970s
- Japan: Spent fuel reprocessing facilities, radioactive waste treatment · disposal facilities, Detritiation facilities
- Overseas: Participating in New Build project for Abu Dhabi (Proposal) and Wylfa Project in UK led by Hitachi.



[United States of America]
Radioactive waste treatment facility

Link
<https://www.jgc.com/jp/projects/037.html>



[Japan: Aomori]
Vitrification Technology Facility

Link
<https://www.jgc.com/jp/projects/036.html>

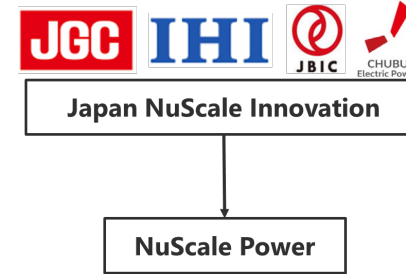


[Japan: Ibaraki]
Spent Nuclear Fuel Reprocessing Facility

Link
<https://www.jgc.com/jp/projects/035.html>

1. Investment in NuScale

- Established Japan NuScale Innovation(JNI) in the U.S.
- Investment by JGC in April 2021, by IHI in June 2021, by JBIC in April 2022.; Chubu Electric Power Company decided to invest in September 2023.
- JNI is **NuScale's second largest shareholder** after Fluor.



2. Execute SMR projects in the U.S.

- JGC collaborates with Fluor, a major U.S. EPC contractor, and execute SMR projects in the U.S.

3. Near term goal is to win NuScale SMR EPC contracts in the international market

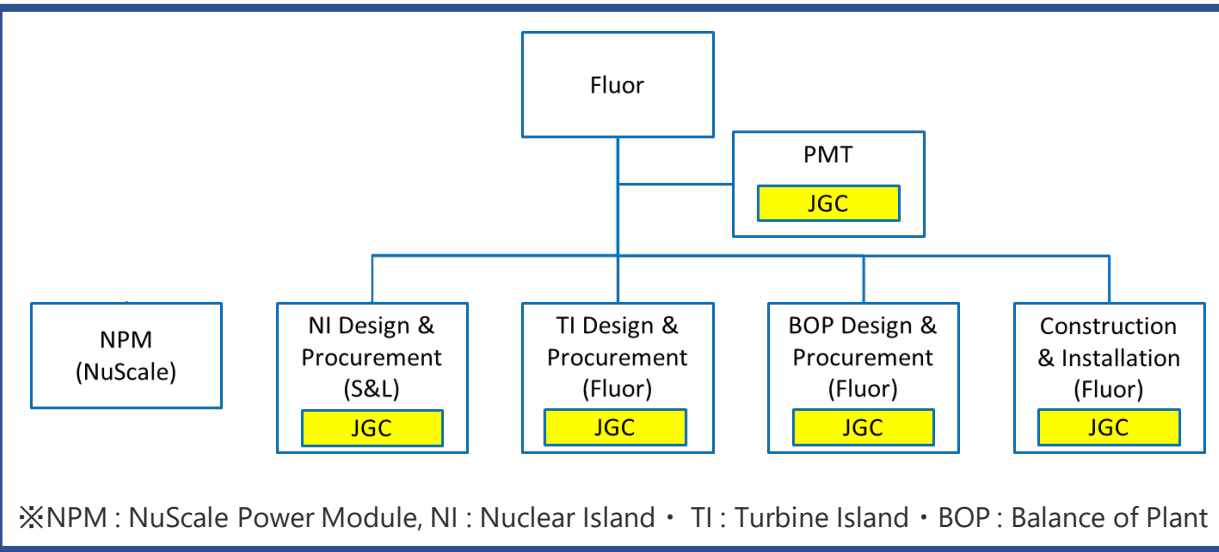
- North America and Europe lead the markets. Middle East, SE Asia and Africa will follow.
- Replacing Coal fired power plants, Load following operation with renewable energy, Generation of hydrogen & ammonia fuel, Desalination and Distributed power generation source

4. Involvement in METI-subsidized projects

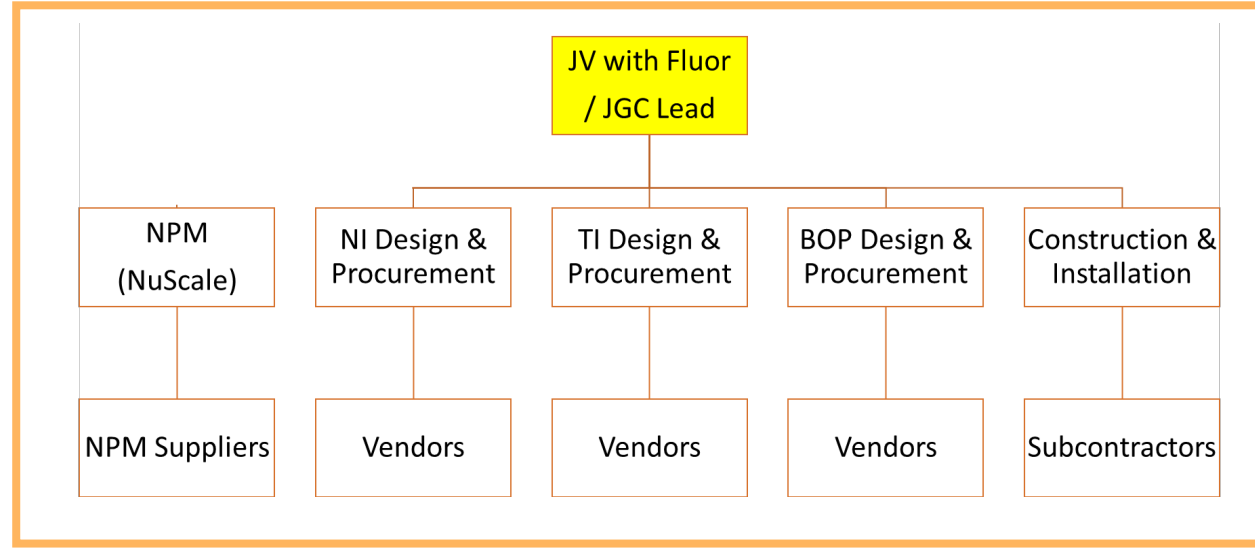
- Involvement **NEXIP** in consortium with JGC/IHI/NuScale from 2019
- Participate in the **Nuclear Industry Infrastructure Enhancement Project** from 2023
- Provide technical development support and infrastructure enhancement for overseas NuScale technology demonstration and EPC project execution.

JGC's work scope in NuScale SMR EPC

1 North America: Fluor leads EPC as a prime contractor.
JGC dispatches engineers and support to procure materials in TI/BOP



2 Middle East: JGC/Fluor JV leads EPC
Southeast Asia & Africa: JGC leads EPC



3 Comprehensive experience in JGC-Fluor JV cooperation



Ethylene Plant
Period : 2013~2018
Place : Texas USA
USGC Ethylene Project - U.S.A.

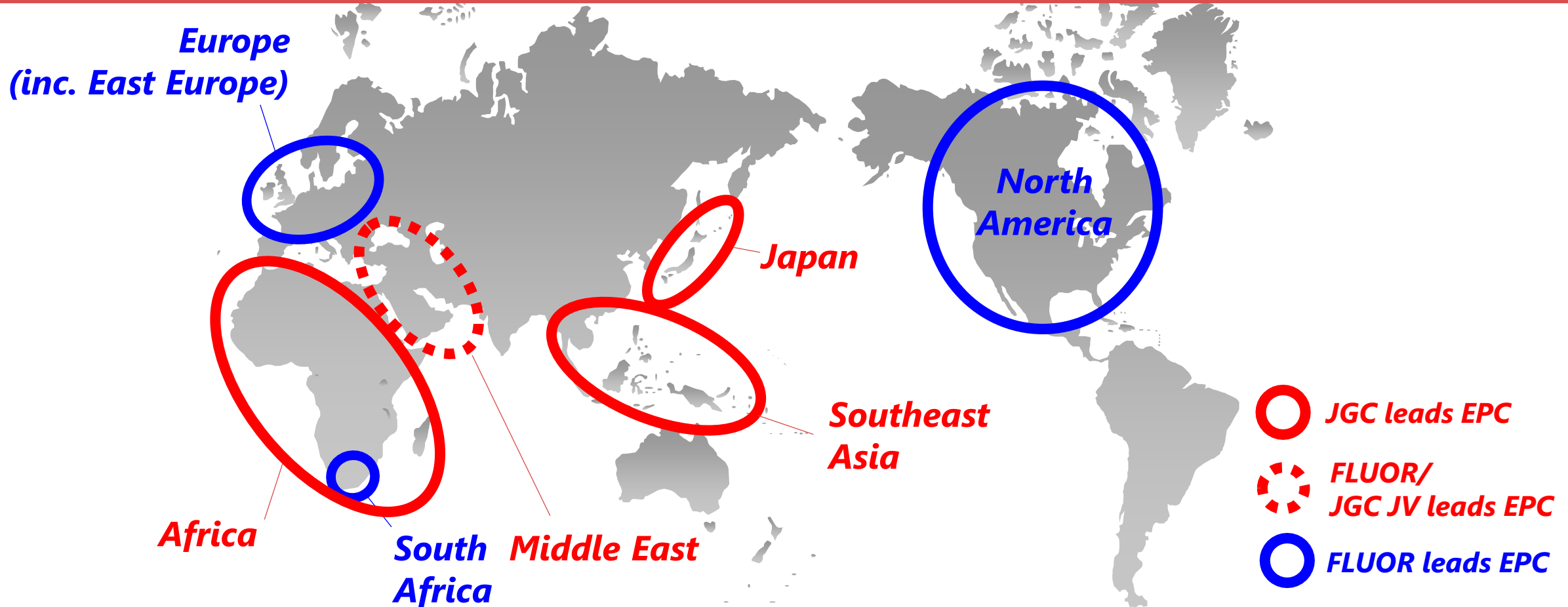


LNG Plant
Period : 2018~Ongoing
Place : British Columbia Canada
LNG Canada

JGC | FLUOR BC LNG JV
PRIME CONTRACTOR TO LNG CANADA




Regional strategy for NuScale SMR business

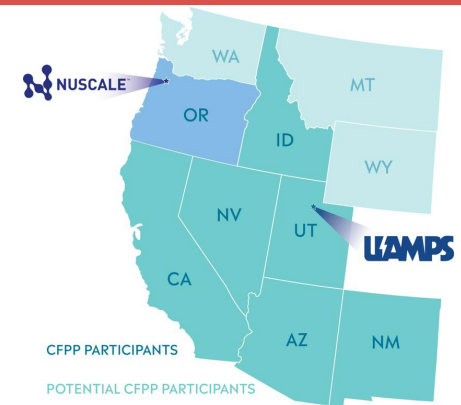
- BCA defines scopes of work and the structure of the partnership
(Fluor to lead EPC in North America, Europe and S. Africa/ JGC to lead Asia and Africa)
- Regions are appointed according to each entity's experience and dominance
- 2020's : JGC gains experience in N. America,
2030's and beyond : JGC leads EPC in the appointed region.



Achievements of the U.S. Project [CFPP]

■ Through the design, preparation for COLA application, and cost estimation, the LCOE target (\$89/MWh) was achieved, but CFPP, the first SMR project in the U.S., was cancelled in November 2023 because it did not meet the target for power sales.

Project Name	Carbon Free Power Project (CFPP) 
Plant owner	Utah Associated Municipal Power Systems (UAMPS) 
Location	Idaho National Laboratory 
Reactor type	NuScale VOYGR-6 (77MWe x 6 = 462MWe)
EPC Contractor	Fluor



Year	Achievement
2015	CFPP initiated; *DOE \$16.6M support for COLA application preparation
2020	U.S. Department of Energy Approves \$1.355B Support for CFPP
2022	Long Lead Item Order
2023	LWA (Limited Work Authorization) filed with the NRC Project cost (AICE Class2) Estimation completed, COLA application preparation completed

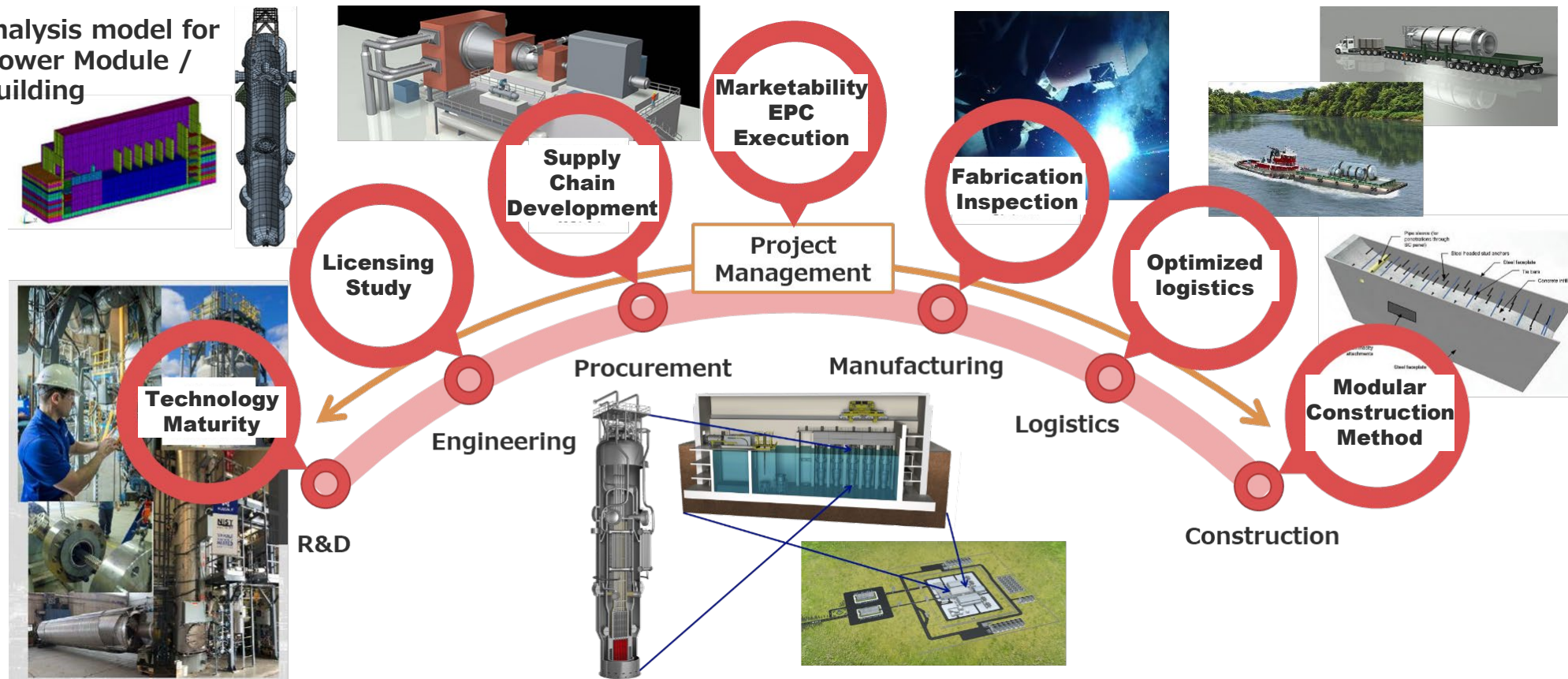
*COLA: Combined Operation Licensing Application



➔ JGC dispatched 9 engineers to Fluor, including a Deputy Project Director and Engineering Manager. Contribute to projects and accumulate SMR EPC execution capabilities.

Overall activity for NExIP

Japanese entity including JGC, IHI and related supply chains are involved in R&D program for NuScale VOYGR™ through METI Subsidized project “NExIP (Next Energy x Innovation promotion)”. In this program, Safety, Economical study as well as Feasibility and competitiveness study for NuScale VOYGR™ has been conducting aiming for future deployment to the Asian region considering involvement of Japanese supply chain in terms of nuclear industries.



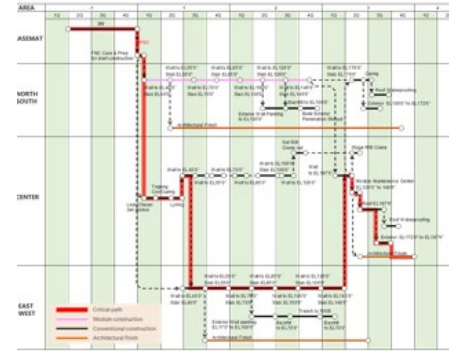
SMR Project: METI Subsidized

Developed capability and foundation for SMR EPC execution with support from the Ministry of Economy, Trade and Industry (METI)

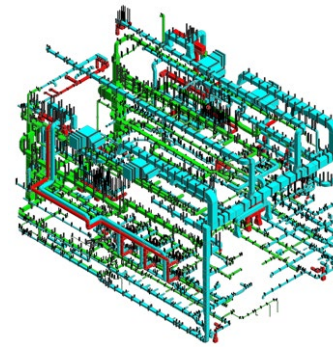
Nuclear Energy× Innovation Promotion (NEXIP)

JGC, IHI, NuScale, and Japanese companies conduct feasibility studies and technology demonstrations of NuScale SMR.

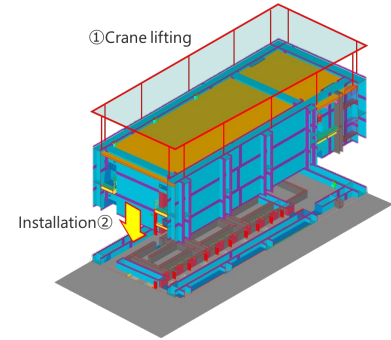
- Feasibility study of modular construction method for NuScale SMR reactor building
- Study of hydrogen production using NuScale SMR
- Establishment of a quality assurance system in compliance with U.S. nuclear quality assurance requirements
- Development of SMR plant EPC project management system, etc.



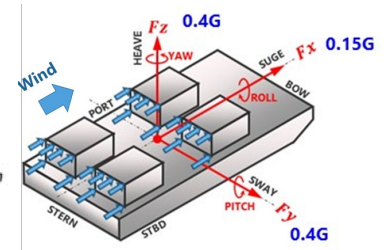
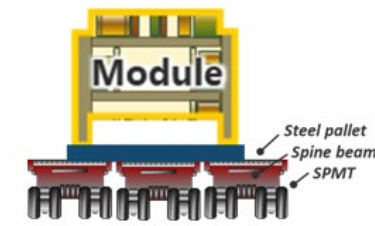
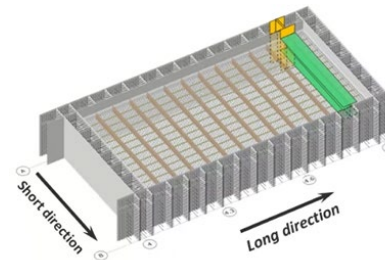
Construction Process



3D Model



Mock-up Test



Module structure study

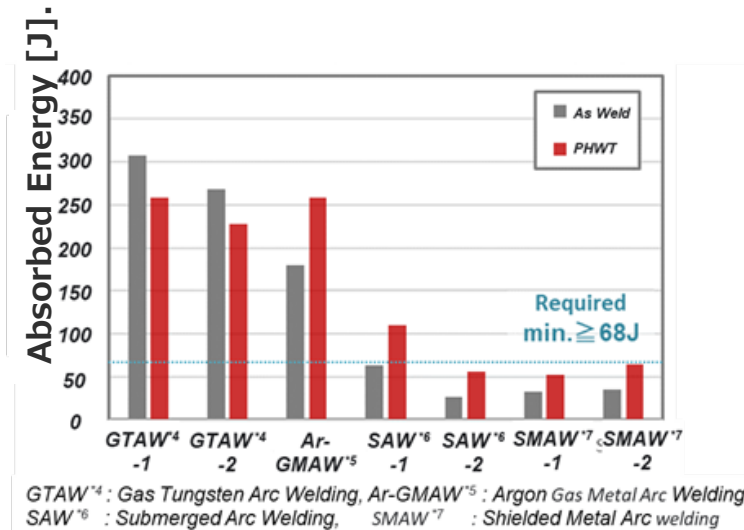
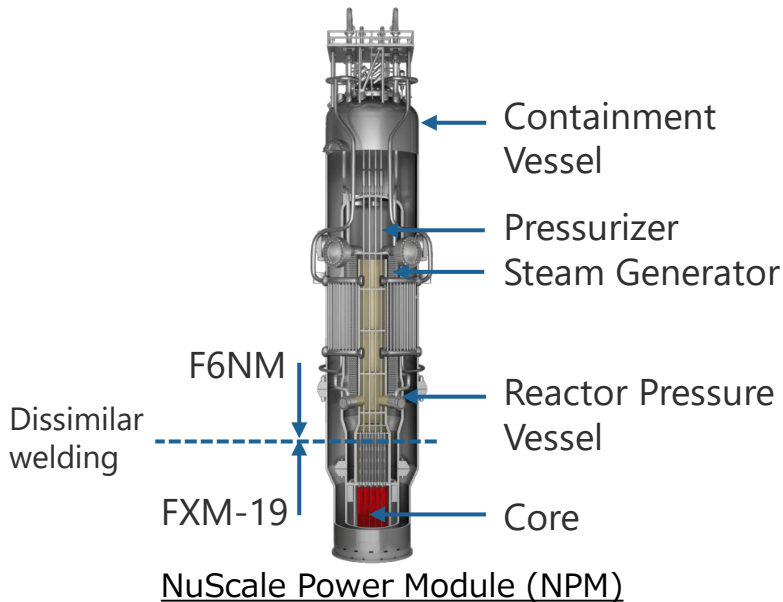
Development of reactor building module construction method

Development of Highly Efficient Welding Process Technology for Containment Vessel

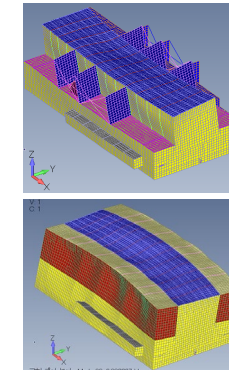
- ✓ Develop GMAW technology for stable welding under 100% Argon, achieving TIG-like high toughness and efficiency for martensitic (F6NM) and dissimilar materials (F6NM + FXM-19).
- ✓ Develop high-efficiency joint welding processes aimed at improving throughput for the mass production of NuScale SMRs.

Enhancement of Seismic Safety for VOYGR™

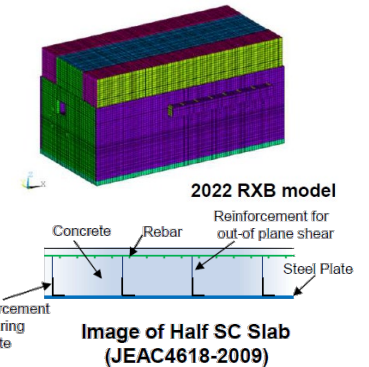
- ✓ To meet Japanese standards, VOYGR™ must withstand seismic forces twice those of U.S. standards.
- ✓ Perform seismic analysis and consider building reinforcement solutions to comply Japanese standards.



F6NM Welds Charpy impact test



Building reinforcement planning



Coupled seismic analysis model

High seismic building study

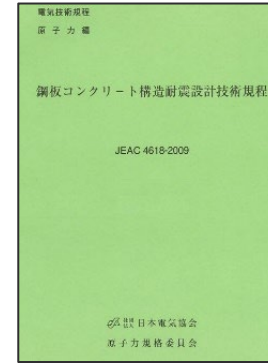
SMR Project: METI Subsidized

Developed capability and foundation for SMR EPC execution with support from the Ministry of Economy, Trade and Industry (METI)

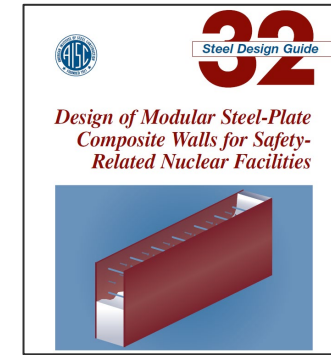
Nuclear Industry Infrastructure Enhancement Project

In cooperation with Japanese nuclear power supply chain, aim to realize rational construction and maintain and develop construction technology.

- Demonstration to apply the Japanese Steel Composite (SC) module construction method to structures in SMR reactor buildings.
- Development of automatic welding technology for SC module construction method

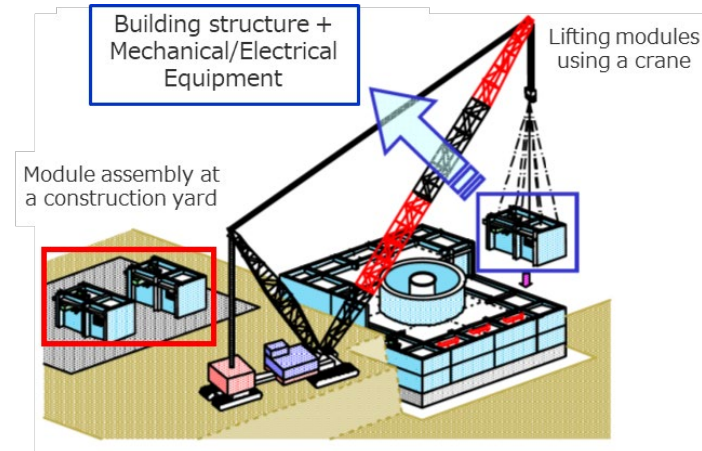


JEA 4618-2009
Technical Provisions for Seismic Design of Steel-Plate Concrete Structures (2009)

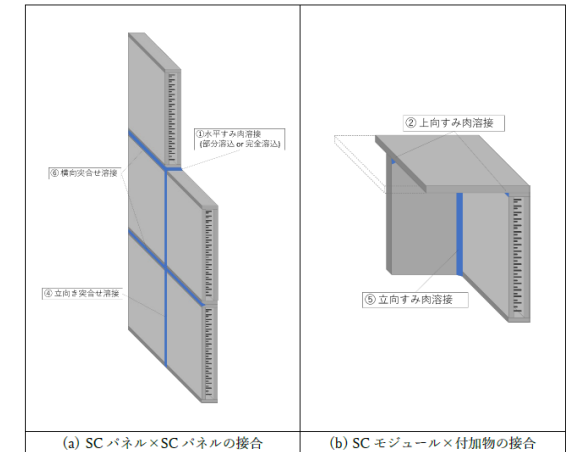


AISC DESIGN GUIDE 32:
Design of Modular Steel-Plate Composite Walls for Safety-Related Nuclear Facilities(2017)

Comparison between Japanese and American code



Concept of modular construction method



Development of welding technology

Potential market of VOYGR™

With the worldwide growing needs for the decarbonization and the energy security, many potential clients are considering introducing VOYGR™ especially in North America and Europe. Potential clients are not only utility companies but also chemical companies and mineral resource companies.

- Public electric utility
- Washington, USA

MOU

Confidential MOUs

- Leading clean power producer
- Ontario, Canada

MOU

- Commercial nuclear power producer
- Canada

MOU

- Canada's only private sector nuclear power producer
- Ontario, Canada

MOU



- NuScale SMR paired with wind to produce power & H₂
- U.K.

MOU

- Jordan Atomic Energy Commission
- Jordan

MOU

- Energoatom
- State-owned nuclear power producer
- Ukraine

MOU

- Kozloduy Nuclear
- Bulgaria

MOU

- State-owned utility
- Czech Republic

MOU

- S.N. Nuclearelectrica
- State-owned utility
- Romania

MOU

- Getka Group & UNIMOT SA
- Poland
- Coal plant refurbishment

MOU

- KGHM Polska & Piela Business Engineering
- Coal refurbishment & process heat
- Poland

MOU



JNUCE

Go green with safe nuclear energy

JGC Corporation
Nuclear Energy Division
jgc.nuclear@jgc.com