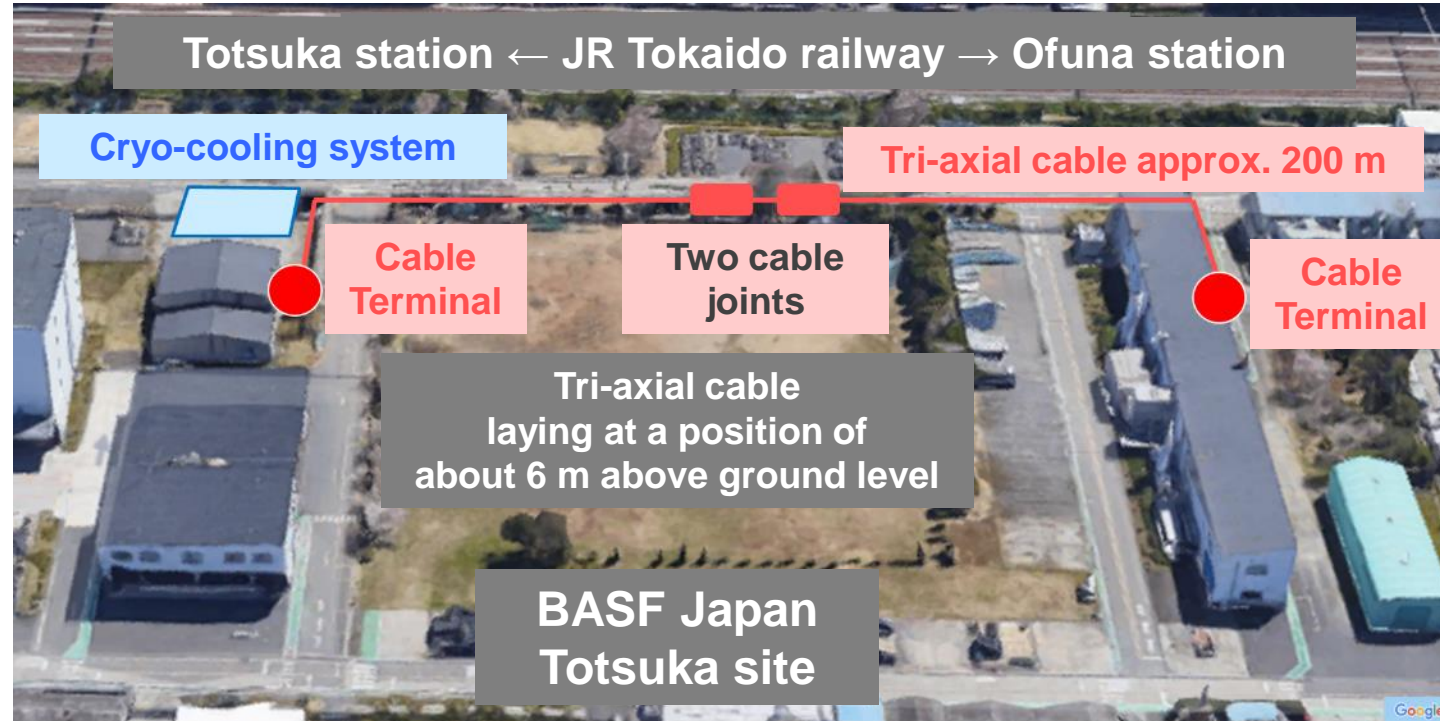


Details of Demonstration Test at Totsuka carried out by SWCC (Totsuka PJ)

Previous Cable installation Project (BASF Japan Totsuka site)



Source | Geospatial Information Authority of Japan

Bird's eye view

World 1st !!

Superconducting cable system with a total of four bends (two vertical and two horizontal) has been laid.

Target

Realization of
"low cost and high energy saving effect"
by using the existing refrigerant at a plant



World 1st !!

Demonstration test of a tri-axial cable
applied to an actual distribution network at a private plant

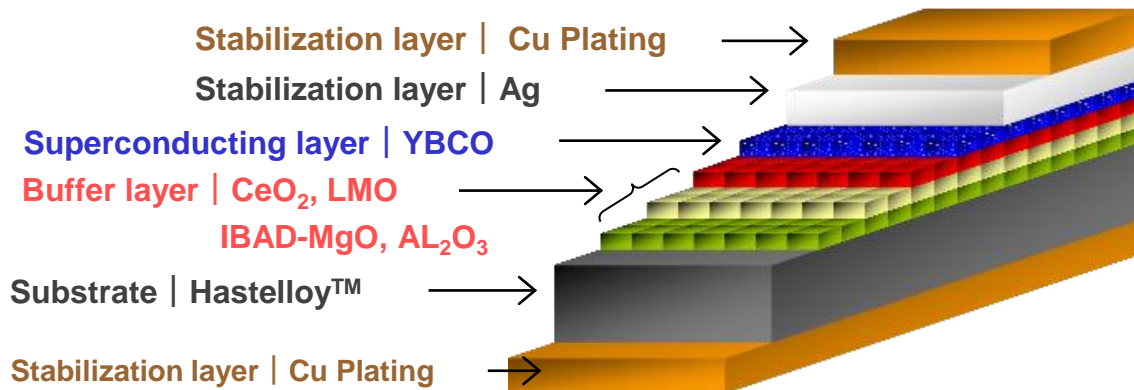
Coated conductors used for Totsuka PJ

Advantage of coated conductor

REBCO coated conductors are suitable for further spread to an industrial usage.

- ✓ Dissemination by compact cable with high J_c
- ✓ Possible further reduction of AC losses
- ✓ Future cost reduction

The structure of coated conductors used in this Totsuka PJ



Advantage of MOD process (our superconducting deposition method)


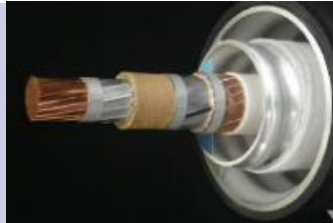

- ✓ **Equipment cost reduction**
due to non-vacuum process
- ✓ **Material cost reduction**
due to high material yield by coating process
- ✓ **Easy to change composition by adjusting liquid solution**

Cable structure for Totsuka PJ

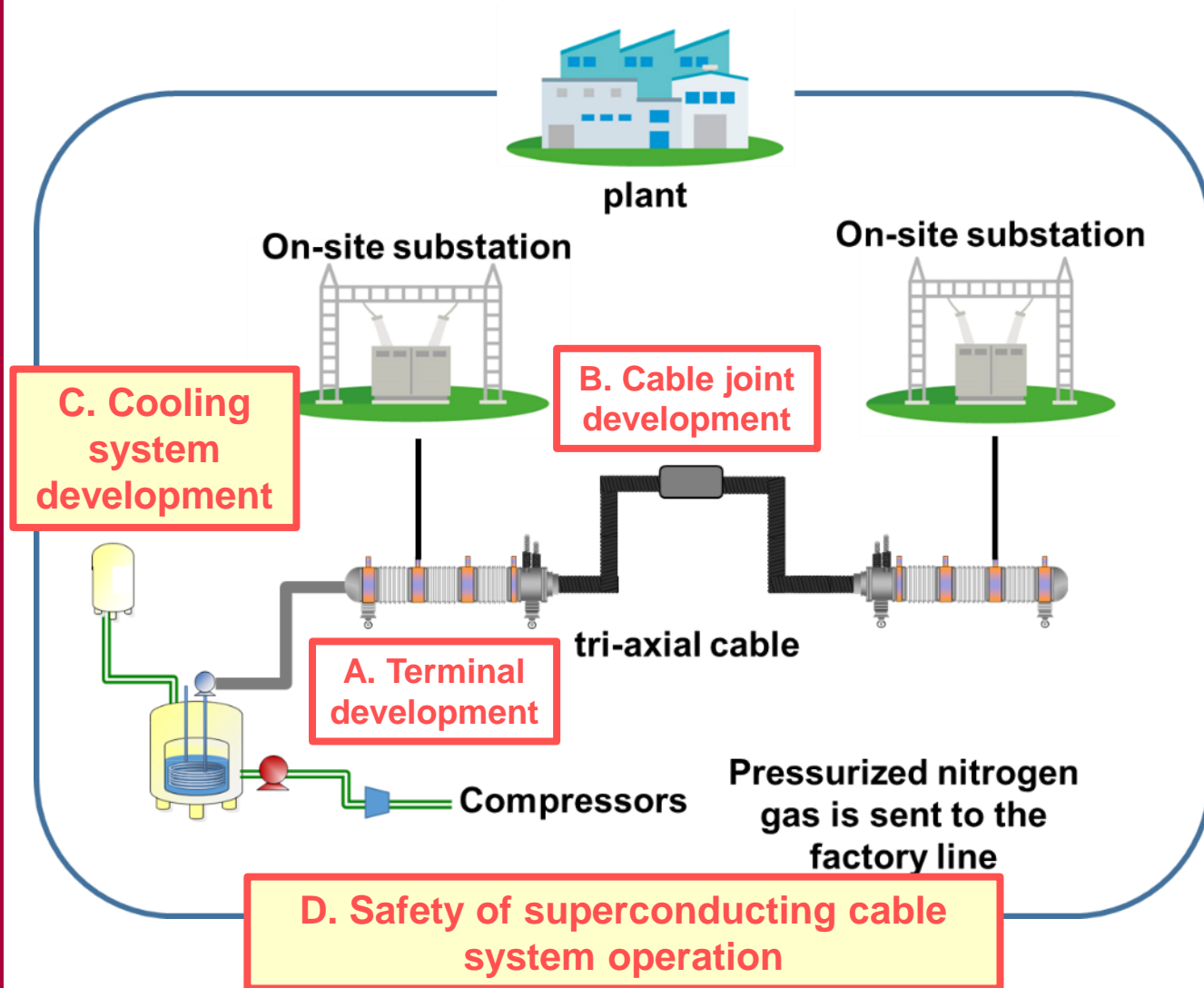
Advantage of tri-axial cable

- ✓ **compactness of the cable diameter** due to its simple architecture
- ✓ **low cost** due to possible LN₂ circulation cooling and simple terminal design

Types of superconducting cables

type	tri-axial cable	single-core cable	three-phase cable
structure			
advantage	<ul style="list-style-type: none"> • Less heat penetration and more compact size. 	<ul style="list-style-type: none"> • Simple construction • Easy to handle ultra-high voltage 	<ul style="list-style-type: none"> • Low heat leakage • single-core cable technology can be applied.
disadvantage	<ul style="list-style-type: none"> • Not suitable for high voltage 	<ul style="list-style-type: none"> • Large heat leakage and high cost *Due to the need for 3 lines for 3 phases 	<ul style="list-style-type: none"> • Larger than tri-axial cable

Items of the developed superconducting cable system



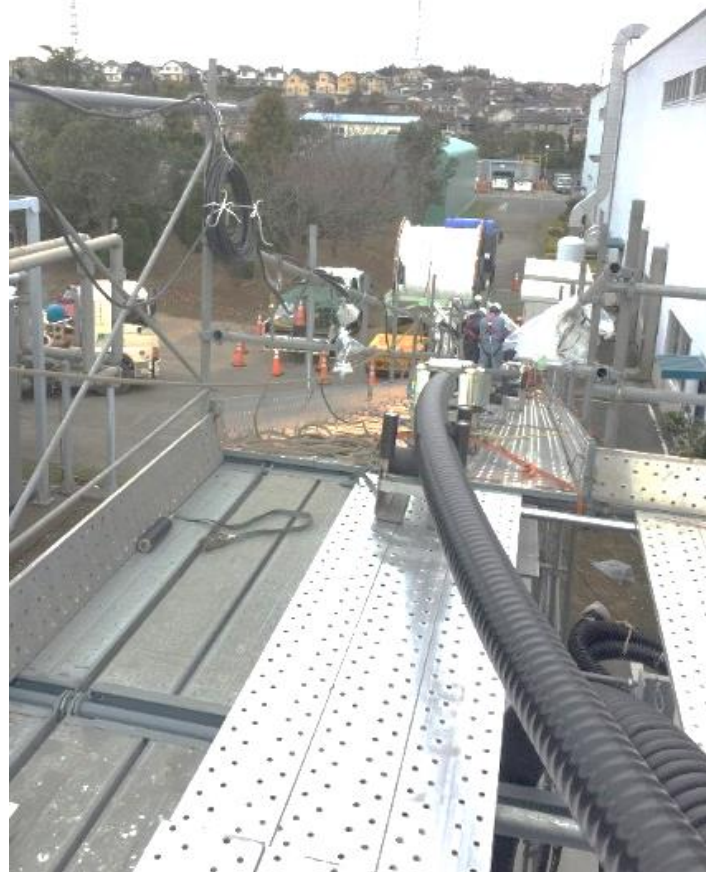
- Development of superconducting cable systems including power components**
- A. Terminal of the tri-axial cable
 - B. Cable joint with low-resistance for future cable extension
 - C. Designed for 10,000 hours of continuous operation sub-cooled **cooling system**
 - D. Centralized management by **monitoring system**

Preparation of cable for demonstration test

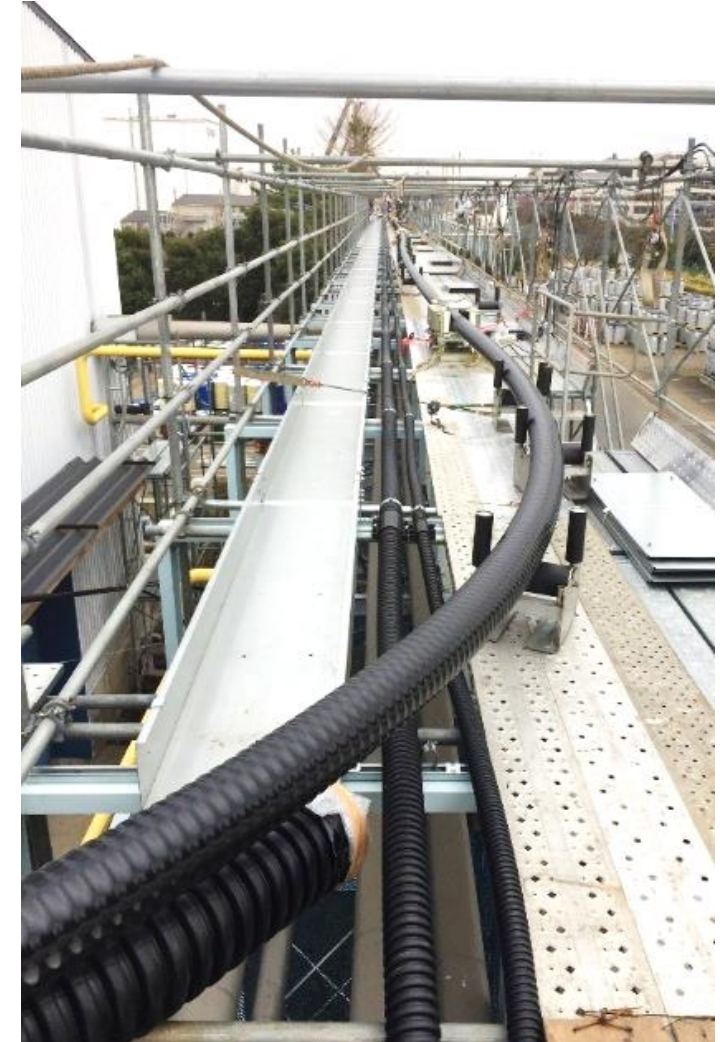
Creating for the Future



Before cable laying



Cable rising area during cable laying



Cable at 6 m height above ground during cable laying

Preparation of terminal for demonstration test

Creating for the Future



Terminal
of power transmission side



Terminal
of power receiving side

Compact design with 3-phase terminals on coaxial!!

Preparation of joint for demonstration test



Cable joint
assembly situation



Cable joint
Installation situation

Compact design with coaxial low-resistance cable joint!
Enables future cable extension!

Summary results obtained from the demonstration test

Local installation support

- ◆ A cable of approximately 200 m in length **was bent at four locations and laid at a height difference of 6 m**
- ◆ **Established low-resistance cable joint technology to enable cable extension**

Cooling

- ◆ Maintained circulating cooling with liquid nitrogen for about one year, including a height difference of 5 m above ground level
- ◆ **Maintenance of stable liquid nitrogen cooling for about one year, despite extreme heat** (effective use of monitoring system)
- ◆ Accident-free and maintenance-free operation of the pump was achieved

Energy saving effect

Assumption | 1 km of superconducting cable is applied in a large-scale power utilization plant of 30 MW or more that already has nitrogen or hydrogen refrigerant

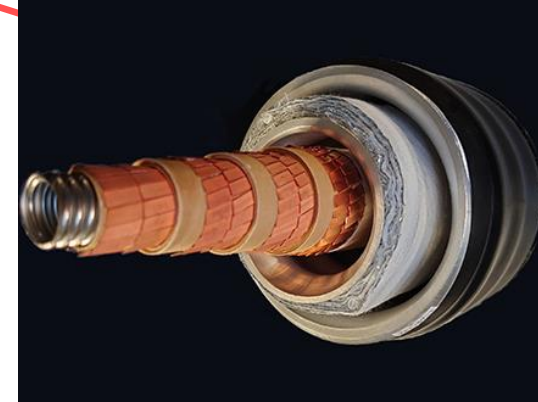
- ◆ Power transmission loss **Reduction of 95% or more**
- ◆ CO₂ emission reduction **554 tons**

Superconductivity system technology that SWCC can provide

Manufacturing of Coated Conductors



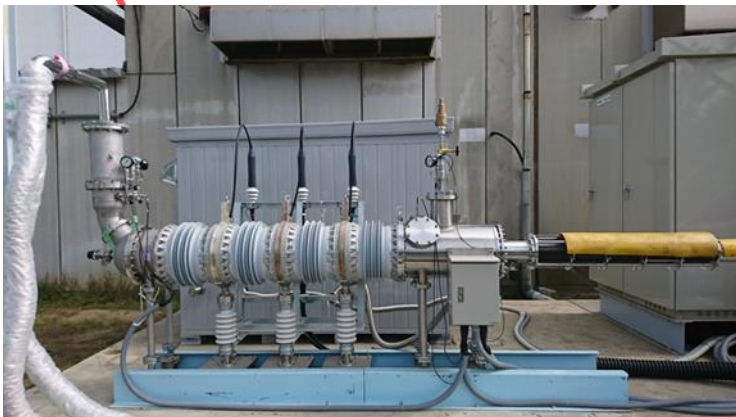
Superconducting cableization (tri-axial cable)



Smart Grid

using superconducting cable system

Creating for the Future



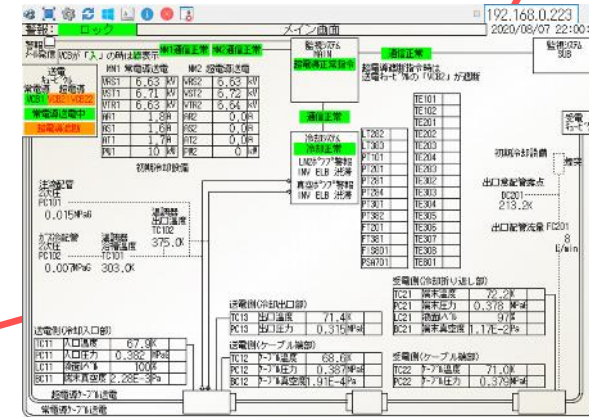
Terminal of the tri-axial cable



Cable joint



Cooling system



Monitoring system

PR-related – movies -



✓ **NEDO news release, December 6, 2021,
“The world first trial, completed a demonstration test to install the
superconducting cable.”**

※site by Japanese



✓ **NEDO news release, November 11, 2020,
“World's first installation of tri-axial superconducting cables in a
private plant.”**

PR-related – Web posting -



✓ NEDO news release, December 6, 2021,
 “The World’s First Demonstration Test to Install a Tri-axial Superconducting Cable System into a Commercial Plant Grid Completed”



※site by Japanese
 ✓ NEDO news release, June 12, 2019,
 “World's first demonstration test of tri-axial superconducting cable to be started at a private plant”



※site by Japanese
 ✓ NEDO news release, November 11, 2020,
 "World's first installation of tri-axial superconducting cables in a private plant.”

**Creating for a sustainable decarbonized society
through the widespread use of superconducting cable systems**



**Expanding the "Circle of Trust"
in a Decarbonized Society by integrating
existing technologies and superconductivity**