IEA High-Temperature Superconductivity (HTS) Workshop
"HTS Applications in the Power Sector"

Japanese HTS Projects - now and future

4th July 2017
Kawasaki

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Energy Conservation Technology Department

Outline

1. Introduction

- What's NEDO ?
- NEDO's R&D Projects on Superconductivity

2. NEDO HTS Project

- June 2016 - March 2021

What's NEDO ?

As Japan's largest public management organization promoting research and development as well as the dissemination of energy, environmental and industrial technologies, NEDO has a crucial mission to carry out.

Addressing energy and global environmental problems

– **Enhancement of Japan's industrial competitiveness**

Chairman: Mr. Kazuo Furukawa

Organization: Incorporated administrative agency under the Ministry of Economy, Trade and Industry (METI), government of Japan - Established in 1980

Location: Kawasaki City, Japan

Personnel: About 920

Budget : Approximately 129.8 Billion yen (2016 fiscal year)
(1.1 Billion US dollars)

NEDO's Technology Area

Basic Research → Technology Development → Demonstration

Renewable energy

Energy conservation

Electronics /ICT

Materials/nanotech

Energy storage

Water treatment

Smart community

Environment/ clean coal

Robotics

Bio/medical

NEDO's R&D Project on Superconductivity

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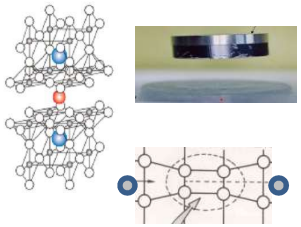
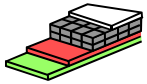
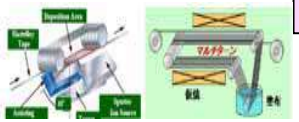
Fundamental Materials Science & Engineering

Fundamental Technologies for Superconductivity Applications Phase I, II
YBCO C.C. etc

Materials, Science & Processings

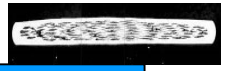






High J_c BSCCO Wire

MAGLEV



Reduction of Rare Earth Usage for Motors

Generator

Superconductive Generator Equipment(LTS) and Materials (Super-GM)

Superconducting Generator((SCG)

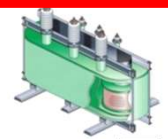
M-PACC
SMES, Cable(AC), Transformer, & C.C.

SMES

SMES system (LTS) Basic Technology

SMES system (LTS)

SC Power Network (LTS-SMES)



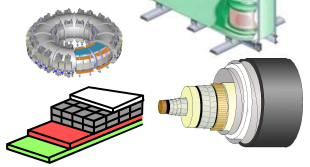
Power Device Applications

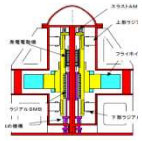
Flywheel

HTS Flywheel Energy Storage

SC Magnetic Bearing for FW

SC Power Network System (FW)





AC Power Device Cable, FCL, etc.

AC Power SC Equipment (Super-ACE)

Bi-Cable(AC) (Field Test)

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NEW NEDO HTS Project

"Project to Promote Commercialization of High-Temperature Superconductivity Technology"

Period: June 2016-Februrary 2021 5years
Budget:€68M (120yen/€　5years)
　　€12.5M (2016FY)

Targeted Scope :
Power Transmission & Magnet System

Development Items

1.HTS Power Transmission Development

(1) Commercialization Development of HTS Power transmission cable system

-AC system (2016 ~ 2018) TEPCO & …

-DC system (2016) I-SPOT

(2) Basic technology Development for applying transportation (2016 ~ 2020) Railway Technical Research Institute

2.High Magnetic Field Magnet System Development

(3) Technology Development of High stable Magnetic Field HTS Magnet system

(2016 ~ 2020) Mitsubishi Electric, AIST

(2016 ~ 2018) Furukawa Electric Industries

(4) Commercialization Development of HTS wire for High Magnetic Field Coil (2016 ~ 2018) Fujikura, AIST

Presentation from Japan

- "*Safety and Reliability verification tests for Superconducting Cables*", Takato Masuda, SEI
- "*HTS Railway Applications*", Masaru Tomita, Railway Technical Research Institute
- "*Development of High Stable Magnetic Field HTS Magnet System Technology*", Shoichi Yokoyama, Mitsubishi Electric
- "*Recent Progress of REBCO Coated Conductors at Fujikura*", Masanori Daibo, Fujikura Electric
- "*Present Status of Taiyo Nippon Sanso Neon Turbo-Brayton Refrigerator*", Shigeru Yoshida, Taiyo Nippon Sanso

Transmission cable system（DC）

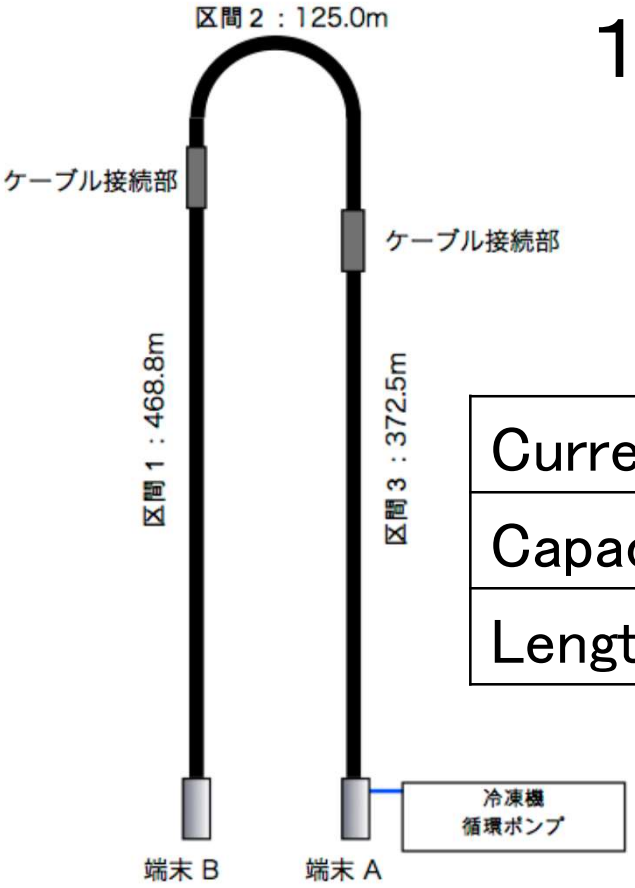
- Purpose:

1) Verify various characteristics using 1 km superconducting DC cable system in Hokkaido
2) summarize guidelines on design, construction, operation and maintenance

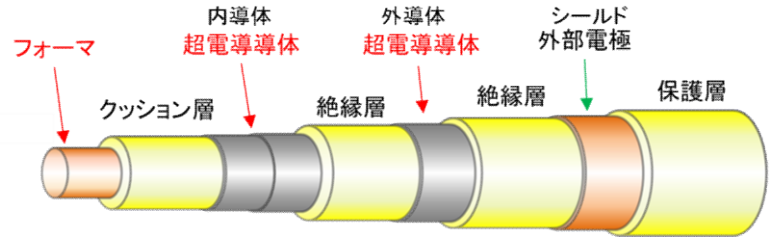
- Term: Jun 2016～ Feb 2017 (8 months)
- Budget: 200M yen （ Subsidy 50%)
- Member: I-SPOT(Chiyoda corp., Sumitomo Electrical Ind., Chubu Univ., Sakura Internet Inc.)
- Features:

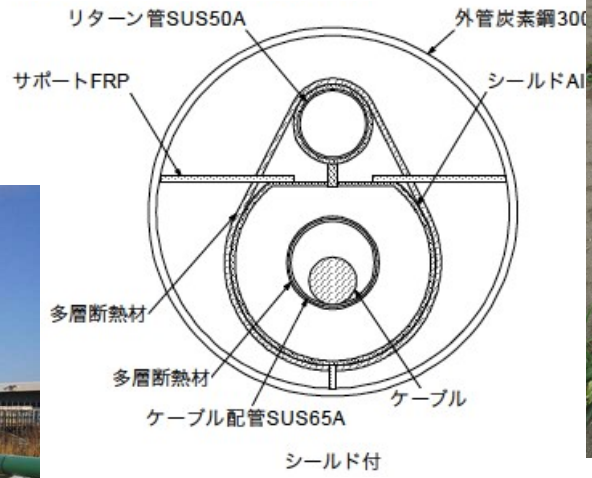
①Low heat penetration　Straight tube <1W/m
②Heat shrinkage　Helical deformation
③Multi-joints (two joints)

1km System outline



Current	2500A
Capacity	50MA
Length	1000m





heat penetration
<1W/m

Development Items and Targets

Category	Items	Subsidy From NEDO	Target	Contractor
HTS Power Transmission Development	①Commercialization Development of HTS Power transmission cable system (2016～2018)	50%	•Establishment of safety and evaluation standards for HTS cable system •Establishment of high efficient cooling system COP:>0.11, Inspection period:40,000h •DC power transmission : Establishment of design/operating guideline	Tokyo Power Electric HD, Sumitomo Electric Industries, Furukawa Electric Industries, Mayekawa MFG I-SPOT
	②Basic technology Development for applying transportation (2016～2020)	100%	•Establishment 2km long cooling system and demonstration cooler size : 2m^3 /kW, Pump:0.6MPa, Flow rate 50L/m •Establishment of design/evaluation/maintenance standard	Railway Technical Research Institute
High Magnetic Field Magnet System Development	③Technology Development of High stable Magnetic Field HTS Magnet system (2016～2020)	100%	•Imaging Demonstration of 3T Half size Magnet Coil system Magnetic Field uniformity <100ppm Magnetic Field stability <1ppm/h •Establishment design standard for 3T MRI coil shape, cooling ability, cryostat etc. •Technology Development of superconducting contact (<$10^{-12}\Omega$)	Mitsubishi Electric Advanced Industrial Science and Technology Furukawa Electric Industries
	④Commercialization Development of HTS wire for High Magnetic Field Coil (2016～2018)	100%	•Improvement of High Magnetic Field REBCO wire: Ave current density >400A/mm2 @30K, 7T •Ic deviation ((Ic ave.-Ic min.)/Ic ave.)< 0.15 for 1km long wire	Fujikura Advanced Industrial Science and Technology
		50%	•REBCO wire production rate > 50m/h	Fujikura

Contents and Period