

# **Superconducting Power Transmission**

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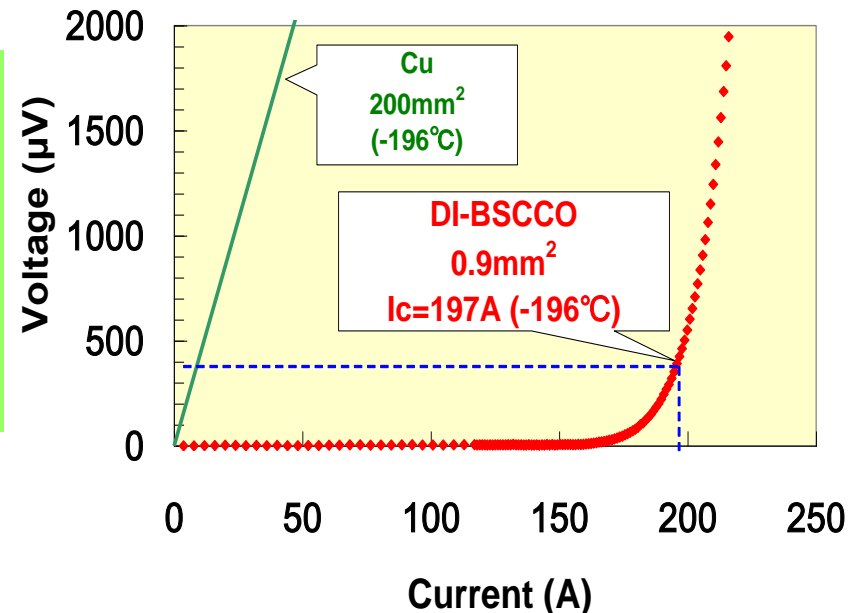
# What is Superconductor ?

## No Electrical Resistance

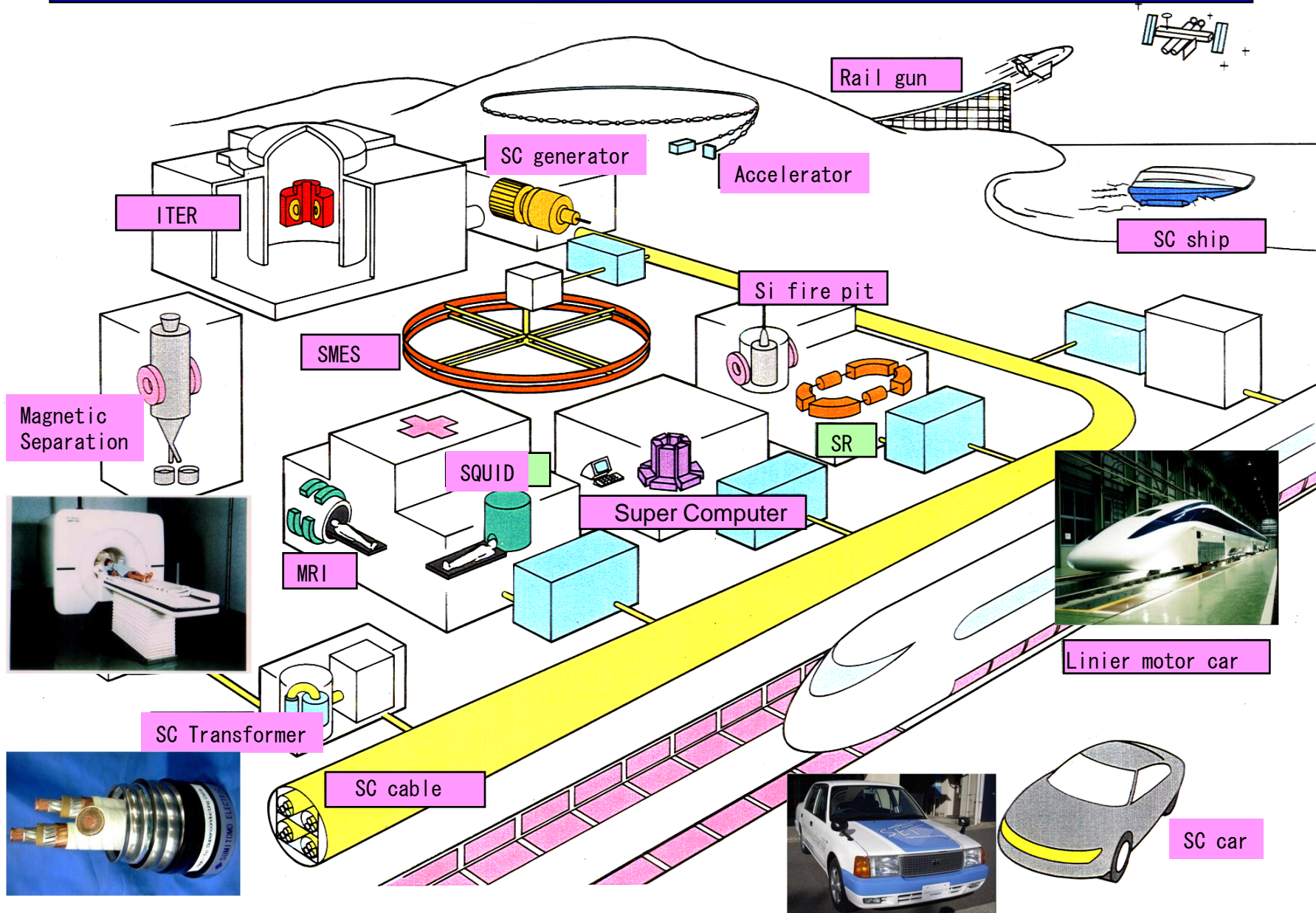
below the critical temperature, current and magnetic field



**No Joule heating**  
**Large Current conducting**  
**High current density**  
**High magnetic field**

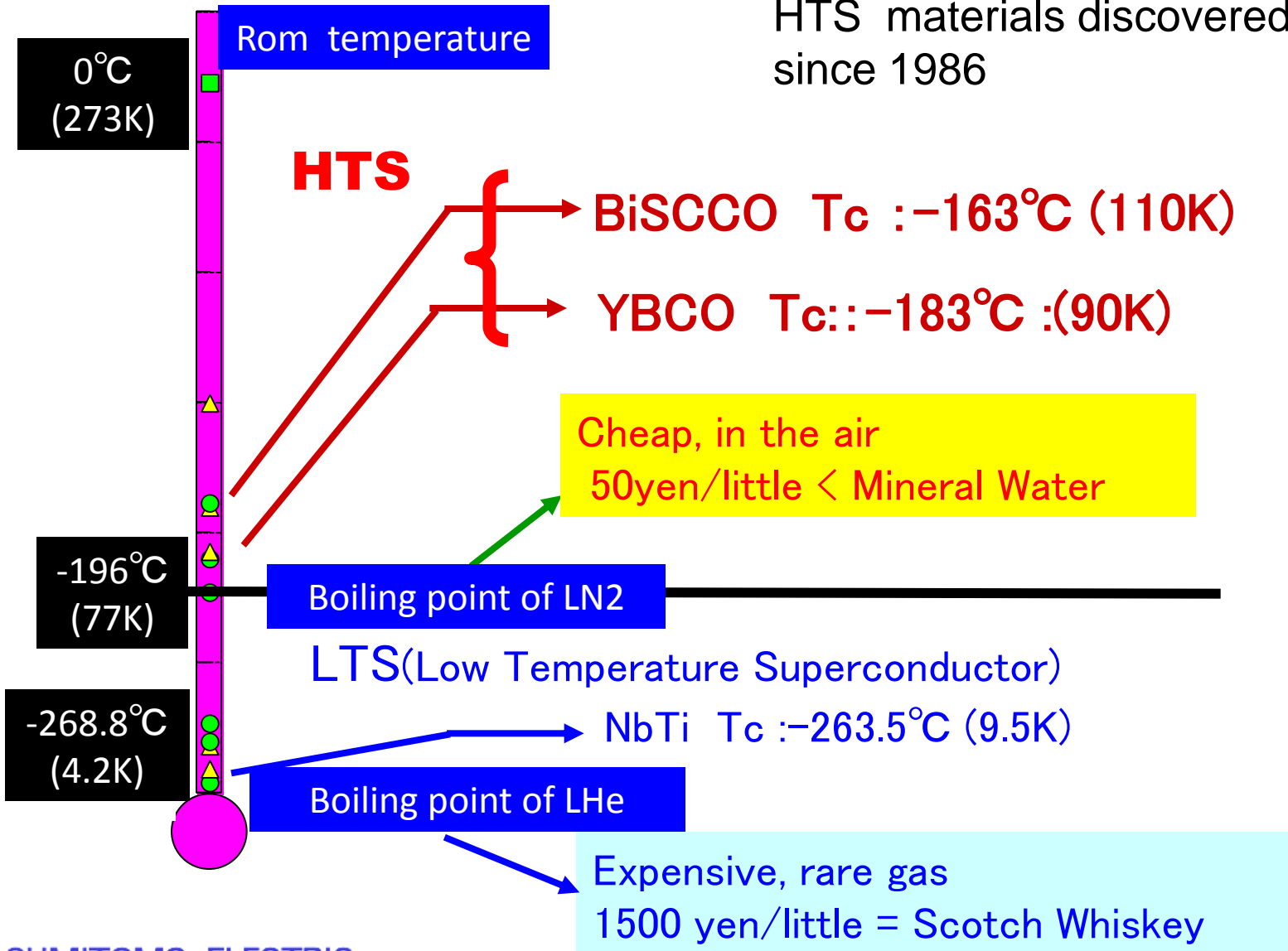


# Application with Superconductors



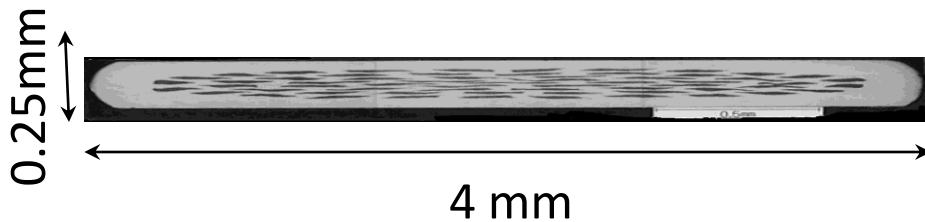
# High Temperature Superconductor

HTS materials discovered since 1986



# Development of BSCCO wires

$\text{Bi}_2\text{Sr}_2\text{Ca}_2\text{Cu}_3\text{O}_x + \text{Ag Sheath}$



Unit length 1500m

Critical current >200A  
current density > 200A/mm<sup>2</sup>

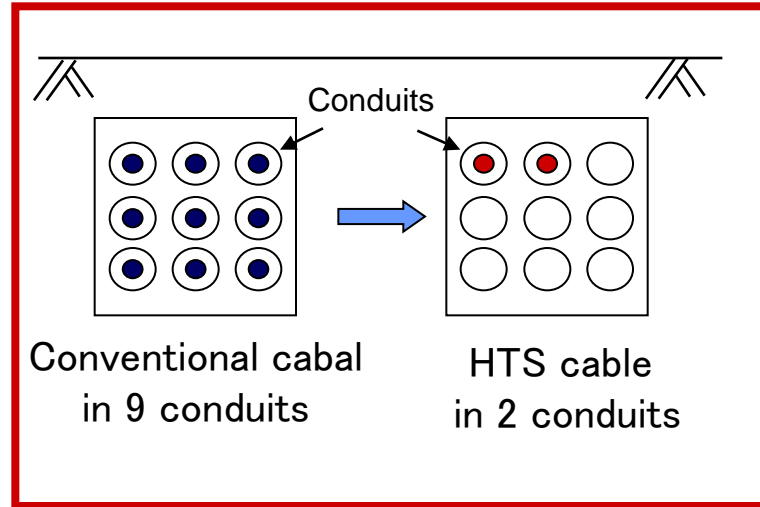
→200 times of Cu

Flexible, High mechanical strength

# Merit of Superconducting Cable

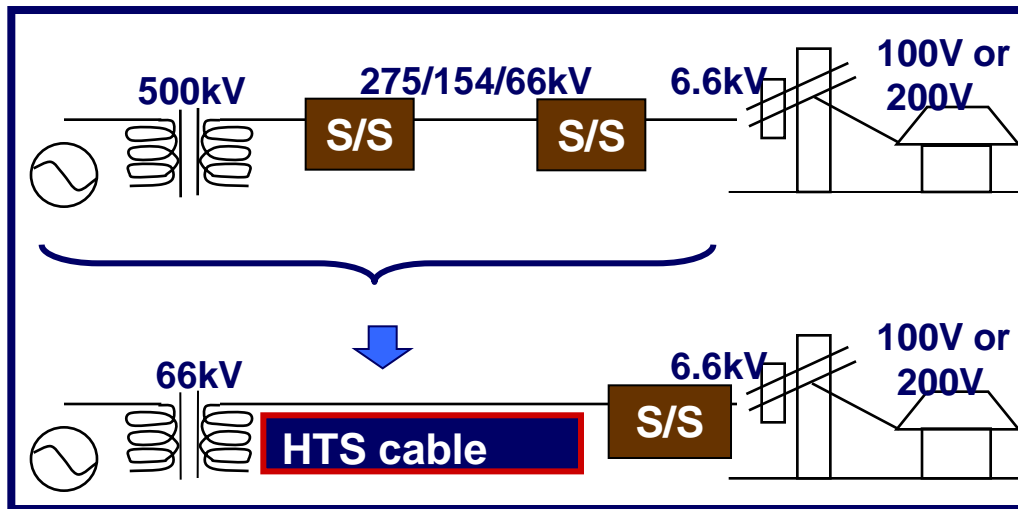
**Large Capacity**  
**Compactness**  
**Small transmission Loss**

Replace for conventional space



**Simplification of transmission system**

Because of large Power transmission with Lower voltage

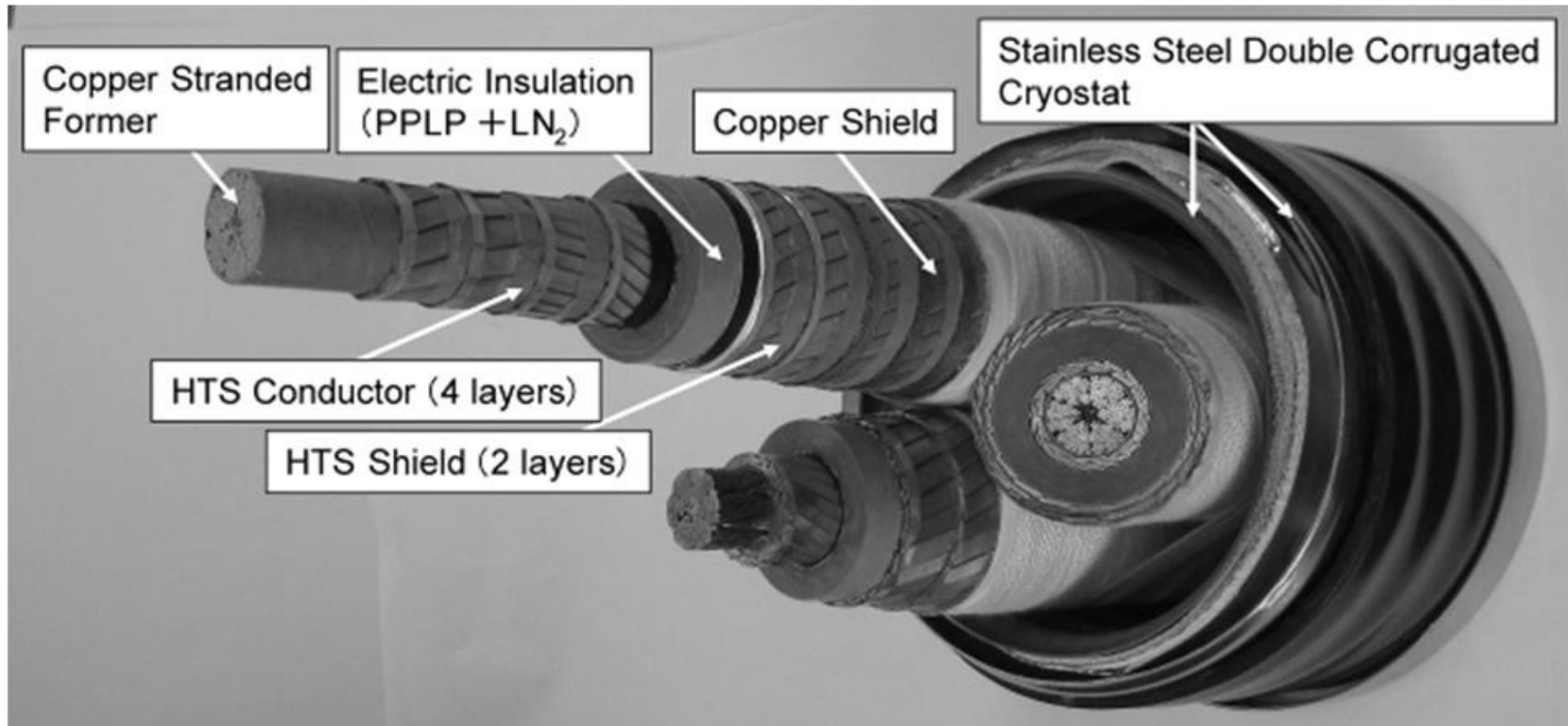


- Decrease expense of civil work
- Decrease facility cost
- Lower transmission loss

# Cable Structure

## ✓“3-in-One” Type HTS Cable

Three cores are housed in one cryostat.



# Overview of Yokohama project

## Purpose

Verifying the reliability and stability of HTS cable operation in a real grid

## System Target

66kV/200MVA, 3-in-One, 250m






## Verifying items in Operation

Reliability and stability for one year operation  
System controllability for load fluctuation  
Monitoring and alarming system,  
Maintenance method

## Project period

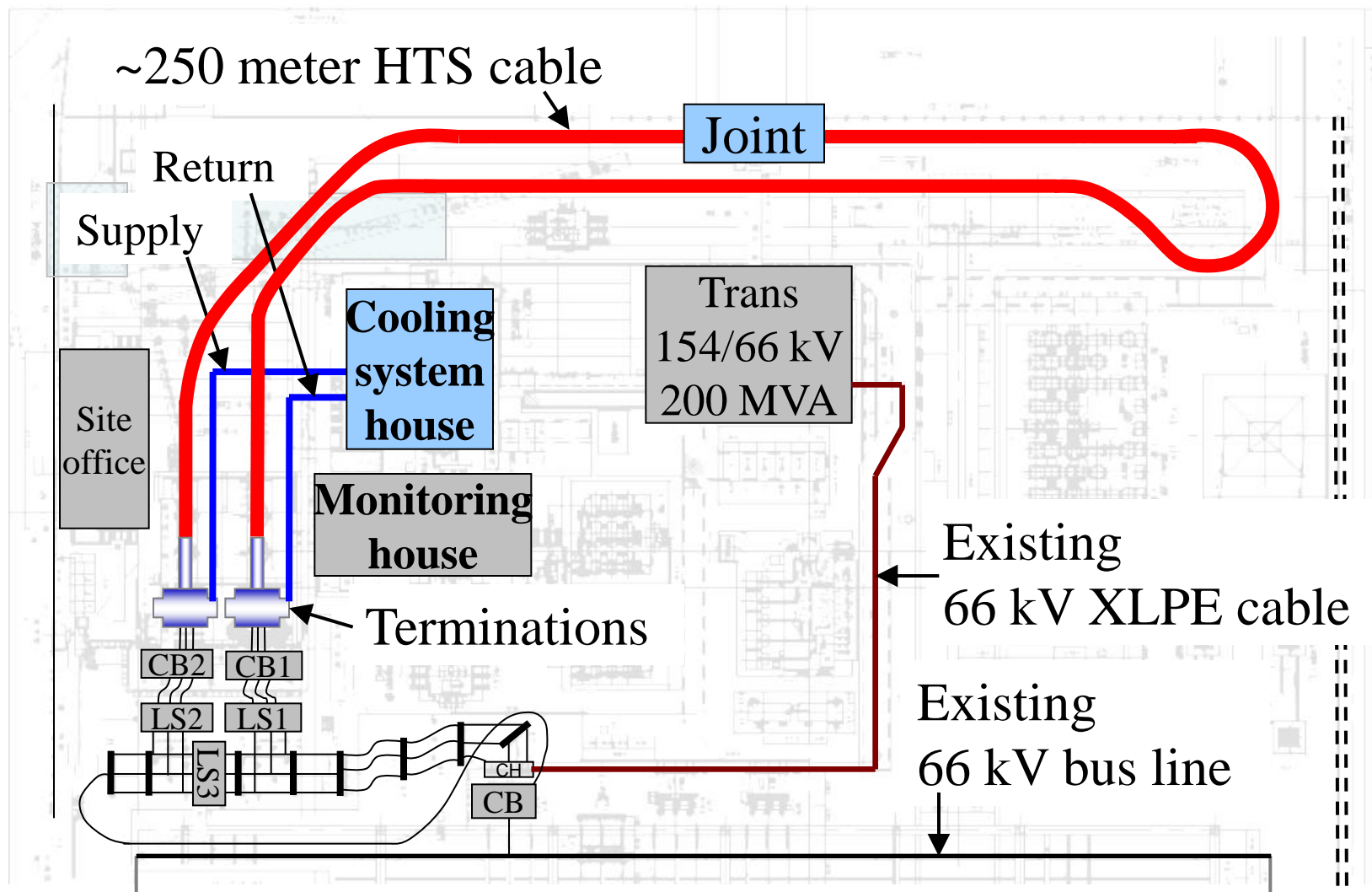
July 2007 ~ March 2014



 <b>SUMITOMO ELECTRIC</b>	HTS cable system design, manufacture and installation
 TOKYO ELECTRIC POWER COMPANY	Host Power Company (provides an actual power grid)
 <b>MAYEKAWA</b>	Cooling system design, manufacture and installation
 経済産業省 Ministry of Economy, Trade and Industry	 NEDO Project funding and management



# Layout in Asahi Substation



# Superconducting System in Yokohama



Cable in Conduit



Joint

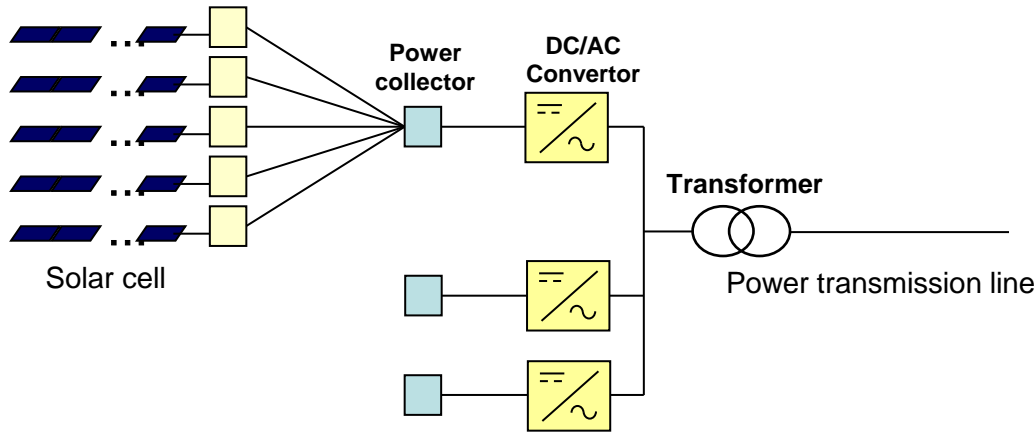


Termination

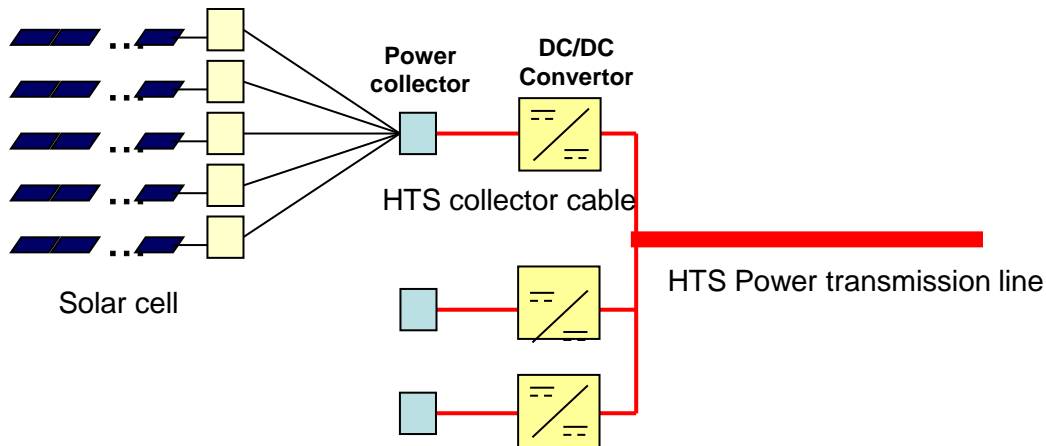


Cooling system station

# Superconducting Power Transmission for Solar Power System



**(a) Conventional system**



**(b) New system with HTS line**

## Merit of a new system

- Decrease of number of collector cable  
Downsize transmission line  
→ Decrease civil work
- Eliminate transformer  
→ Decrease facility cost
- Lower transmission loss

## Considering Subjects

- HTS line should be always cooled, even if solar cells make no generation in rain or at night.
- Economical Benefit should be estimated in consideration of power capacity, line length, operation rate, Maintenance cost and so on.

# Merits in Atacama Desert

**Sunshine time is the most in the world.**

→ **~30% operation rate of solar cell**  
**(cf. 12% in Japan)**

**Gentle Wind in all season**

→ **Decrease accident of facilities and easier maintenance**

**It is expected that the World first demonstration of HTS power transmission line with long length line (km) for Solar Power system.**