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What SWCC has been doing about superconductivity

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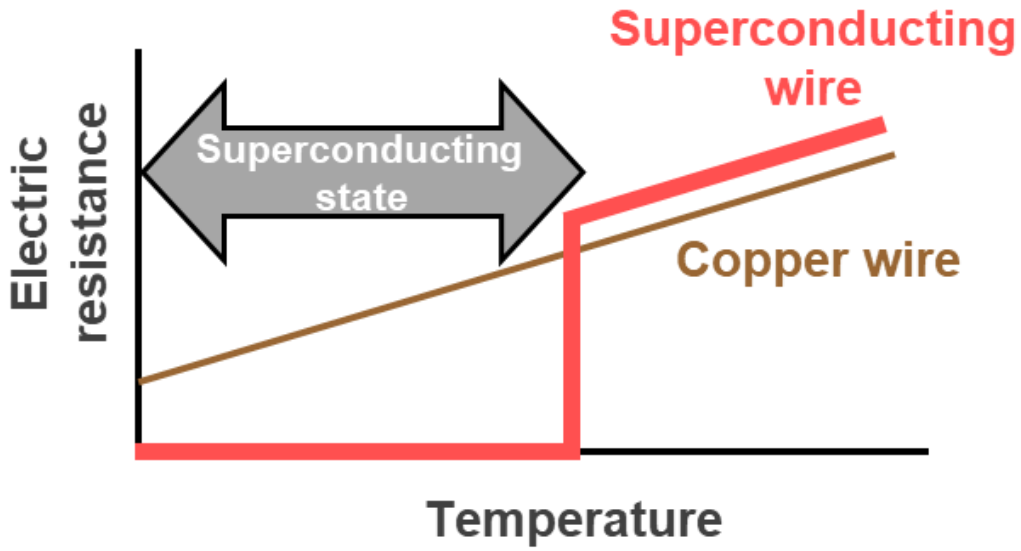
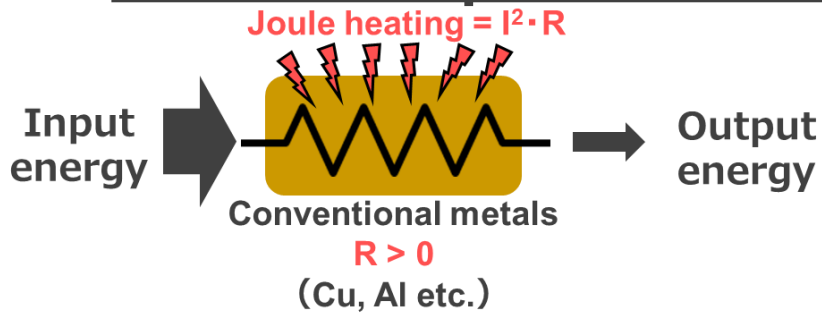
About Superconductivity

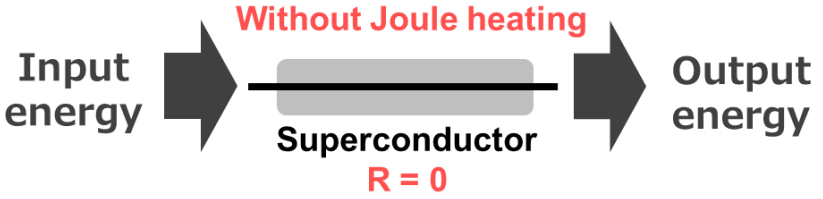
Electrical resistance becomes zero in an extremely low temperature environment !!

Zero electric resistance



Effect of superconductivity





Expectations for superconducting cables

Economic benefits from significant energy savings due to reduced power transmission losses

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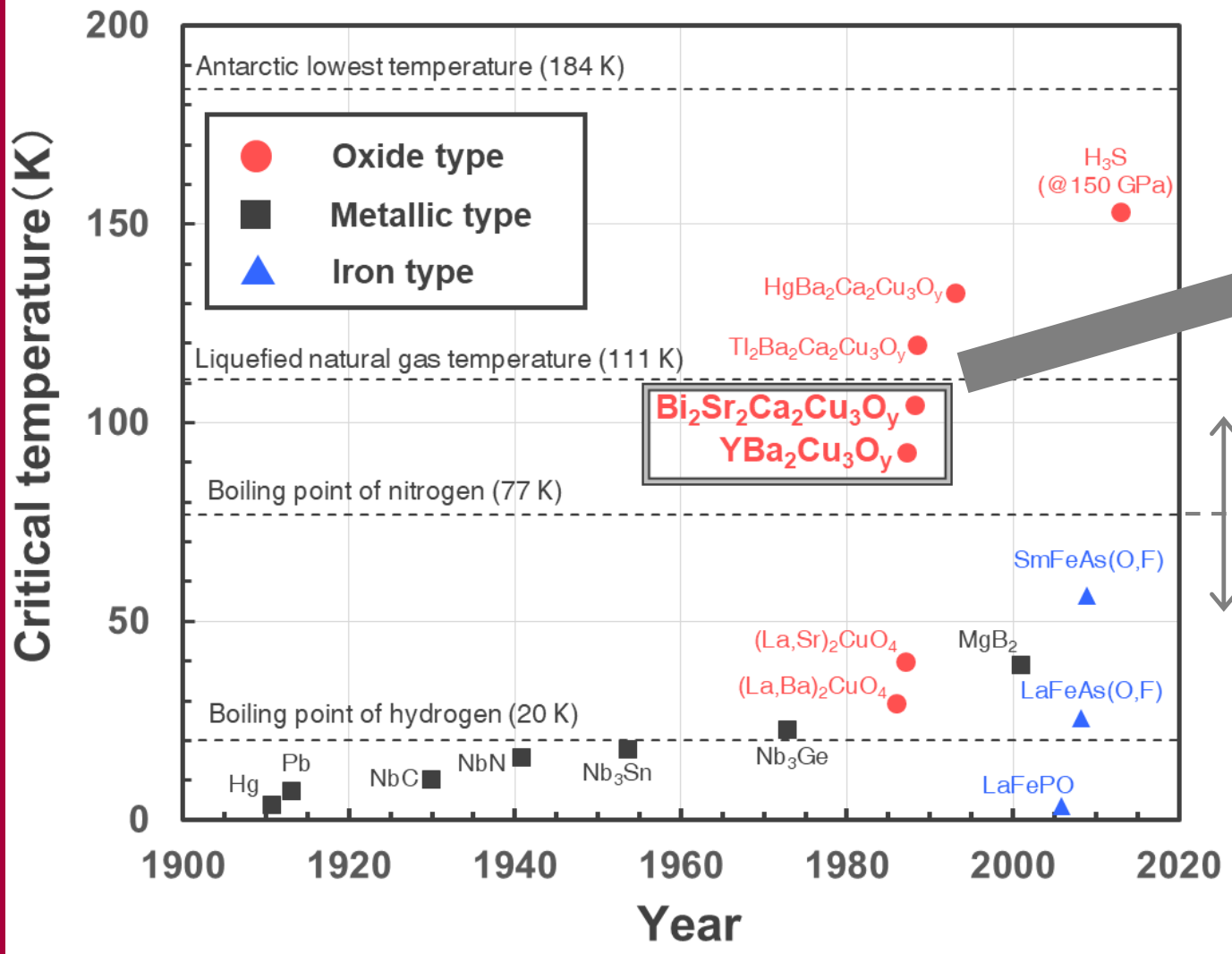
Types and history of superconducting materials



Advantages for practical use

- ✓ **Temperature** (lower cost refrigerant)
- ✓ **Materials** (non-toxic)
- ✓ **Condition** (not ultra-high pressure)

superconductive state with the use of liquid nitrogen

superconductive state with the use of liquid helium

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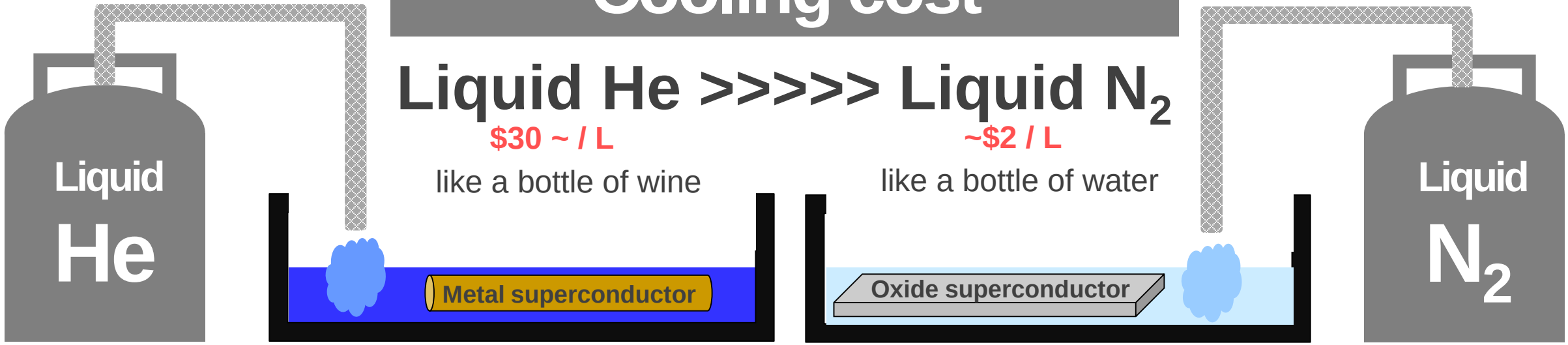
Cooling issue

Cooling cost

Liquid He >>>>> Liquid N_2

$30 ~ / L
like a bottle of wine

~$2 / L
like a bottle of water



Superconducting state using liquid nitrogen cooling, which is much more low cost than liquid helium, has become possible!!

When liquid nitrogen is used, the related equipment is cheaper as well.

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Examples of superconductivity in use

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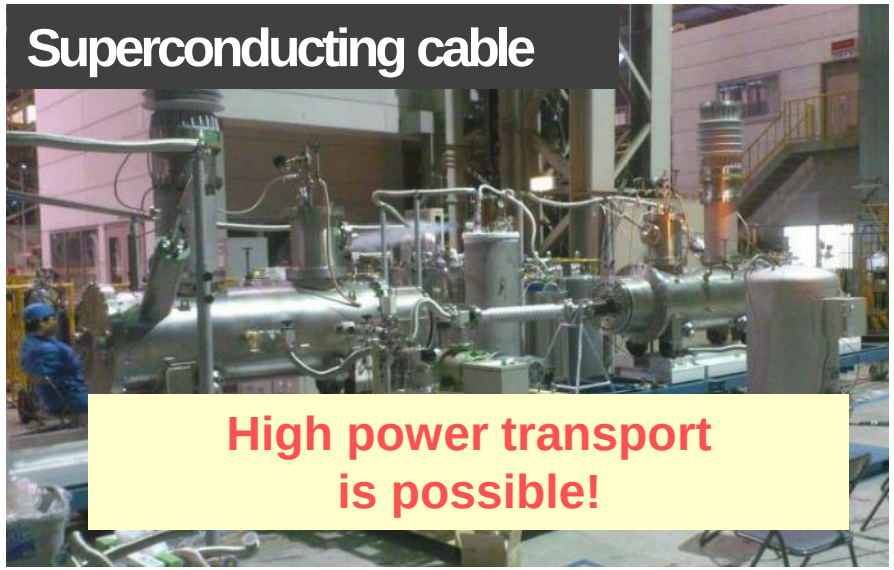
Zero electrical resistance!

Capable of transporting a large current

Large current transportation

Strong magnetic field generation

Superconducting cable



High power transport is possible!

MRI

High magnetic field generation is possible!

Maglev

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Advantage of superconductivity in cables

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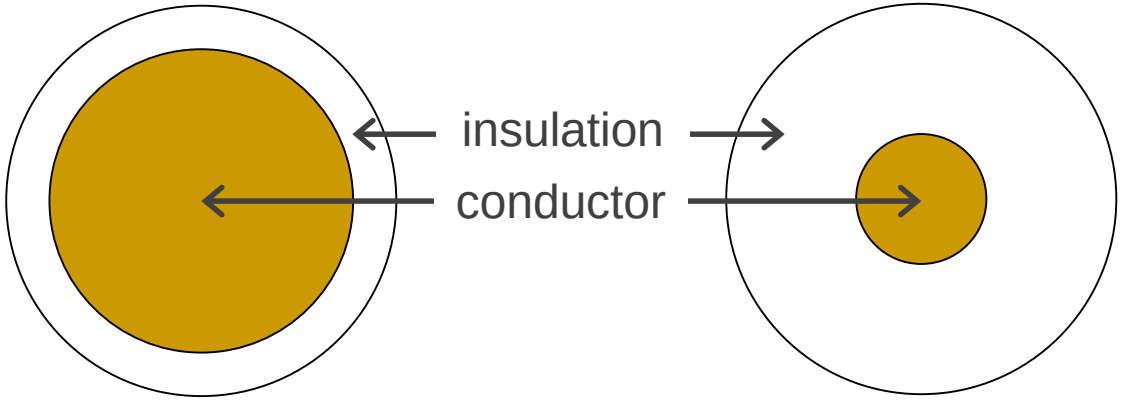
How to transport large amounts of power with conventional cables

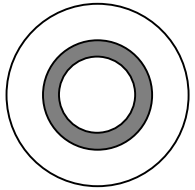
Electric power = current × voltage



Increase
cross-sectional area
of conductor
(higher current)

Increase
the insulation
cross-sectional area
(higher voltage)

Superconducting cableization



No increase necessary
in conductor and insulation
cross-sectional area
(High current and low voltage)

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SWCC's superconducting technology

Coated conductor

(Y-based superconducting wire)

- MOD process YBCO
- nPAD-YBCO®

Superconducting Current lead

Superconducting Cable system

from **Coated conductor Development** to

Higher contribution to society

Superconducting Cable system Development

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Main National Projects in Japan in which we have participated

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FY1999~2014
~ mainly as material R&D ~

1999 ~ 2002
Research and Development of Fundamental Technologies for Superconductivity Applications (Phase 1)

2003 ~ 2007
Research and Development of Fundamental Technologies for Superconductivity Applications (Phase 2)

2008 ~ 2010
Materials & Power Application of Coated Conductor (M-PACC Project)

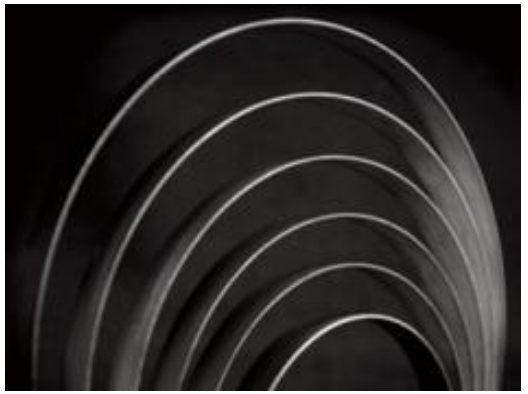
2010
Establishment of iSTERA

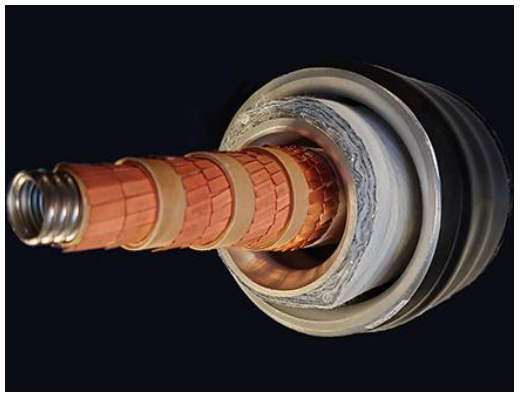
2013 ~ 2014
High Temperature Superconducting coil development
~ Development of Medical Devices and Systems for Advanced Medical Services ~

FY2015~
~ mainly as cable R&D ~

2015
2015 ~ 2016
2016
2017 ~ 2018
2019 ~ 2021
Strategic Innovation Program for Energy Conservation Technologies

2019 ~2021
2022~2023
Practical application project





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Previous Superconducting cable Projects and Future vision

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Medium-Term Management Plan → **Change SWCC 2022** | **Change & Growth 2026**

FY2016~2017	FY2018~2022	FY2023~2026
1st Step	**2nd Step**	**3rd Step**

Single-core cable @ Tianjin PJ

Tianjin PJ

Third Party Accreditation Organization (KEMA) Certified
2016.6.21

Tri-axial cable @ Type test（Aichi Factory）

Type test

Tri-axial cable @ Demonstration test（BASF Japan）

Small scale Demo.

Totsuka PJ

Business scale

Commercial basis

Large scale Demo.

XXX PJ

Cable spec

※Depends on customer's request

Voltage 200 V ~ 11 kV

Current 200 ~ 3000 A

Refrigerant LN_2

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

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

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