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Hitachi Energy

HVDC Technology- Leveraging JCM for Industrial Decarbonisation

Agenda

1 Joint Credit Mechanism (JCM)

2 About Hitachi Energy

3 HVDC- Sustainable solution with global footprints

4 HVDC Technology for a carbon-neutral future

Joint Credit Mechanism (JCM)

1

JCM Operations and impact of JCM Credits

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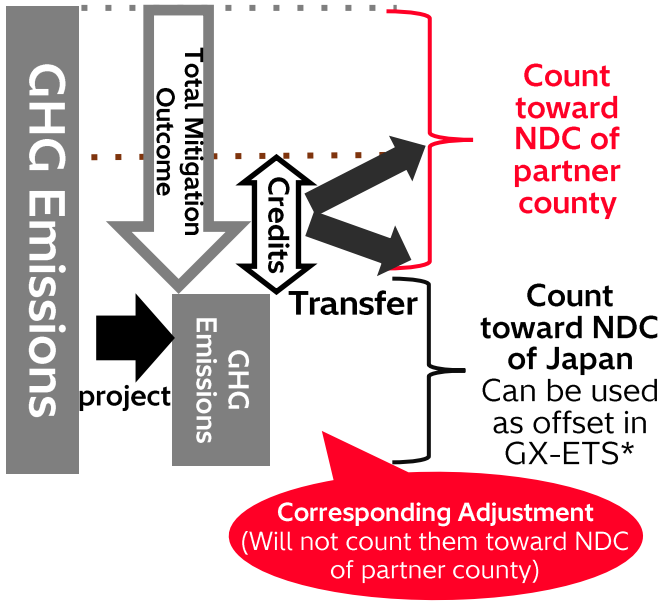
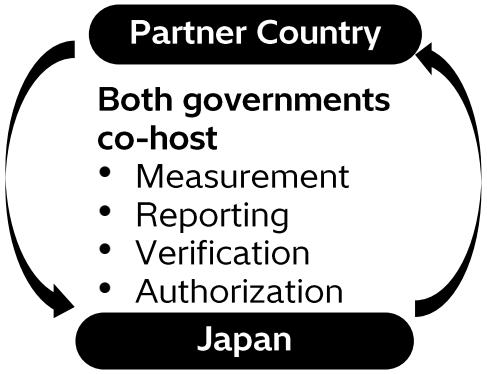
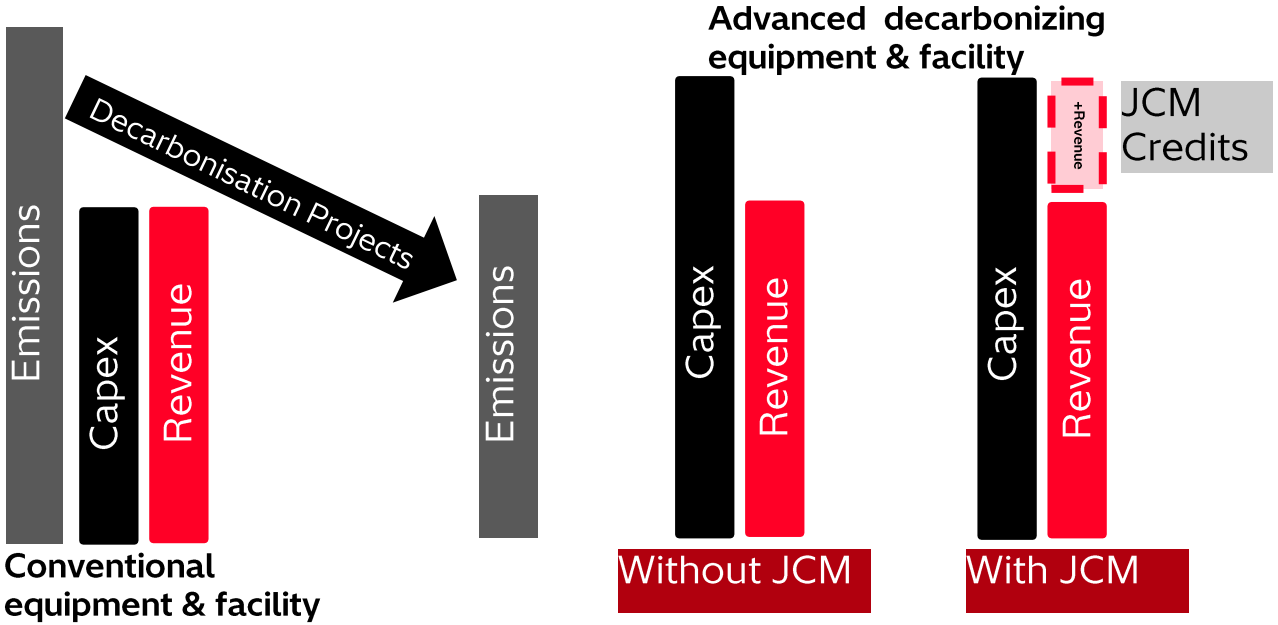
Mitigation outcome and its transfer





JCM incentivizes Japan's investment in decarbonization projects as JCM credits revenue can improve profitability of projects



- The **JCM aims** to facilitate diffusion of, among others, leading low-carbon **technologies, equipment, machinery, products, systems, and infrastructure as well as implementation of mitigation actions between India and Japan.**
- **JCM is a carbon market tool** where **Japanese companies** and **government** cooperate with mitigation activities in partner countries (30 as of Today).
- Among total mitigation outcomes, both **governments (India and Japan) conservatively calculate, authorize and share JCM credits between the companies/countries** in proportion to their contributions, in line with **Article 6 of Paris Agreement**.
- JCM incentivizes **Japan's investment in decarbonization projects** bringing various benefits **including achievement of NDC and sustainable development.**

* GX-ETS started as a voluntary baseline-and-credit system during its first phase 2024 to 2025

Outcome from the lens of India and Japan

The Government of Japan launched **JCM Agency（JCMA) covering ALL the operation of JCM**:

- *One stop focal point for the JCM on behalf of Japanese government*
- *Implementation and facilitation of the JCM, including promoting JCM projects*
- *In charge for ensuring environmental integrity and transparency of the JCM*

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01 JCM adopted by 257 sectors till now

02 56% of these are related to renewable energy, followed by 34% for energy efficiency, making up the majority

03 More than 270 JCM projects with over 3 billion USD of investment

India

- Allocation of total mitigation outcomes is determined at Joint Committee
- Contribution include private & public, technical & operational contributions
- India will be ALWAYS able to count mitigation outcomes that is NOT issued as JCM credits

Japan

JCM credits acquired by Japan can be:

- Counted toward achievement of NDCs.
- Used for the achievement of companies' compliance targets under GX-ETS (will start in 2026)

About Hitachi Energy

2

About Hitachi Energy

HITACHI

~ 45,000 employees

90 countries with 200+ offices

~250 years' heritage combined

5,500 sales employees & field engineers

2,000 engineers & scientists in R&D

~ $13 billion USD business volumes

Four Business Units

Grid Automation	**High Voltage Products**
Grid Integration	**Transformers**

Customers

- Transport & Infrastructure
- Industry
- Utilities

Offering

- Services
- Software & Automation
- Systems
- Products

Geographies

- Asia, Middle East & Africa
- Americas
- Europe

HVDC- Sustainable solution with global footprints

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3

HVDC Network- Gateway to sustainability

Reduction of CO_2 emissions

01 **HVDC systems have lower electrical losses** over long distances compared to traditional AC systems **reducing losses**

02 **Integrates renewable energy sources** from remote locations to provide power to urban networks.

03 **HVDC provides resilient grid efficiency,** supporting the transition to a **sustainable and low-carbon energy system in India.**

04 HVDC lines require **narrower right-of-way corridors and fewer conductors** minimizing carbon footprints across the value chain

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HVDC Technology

High-Voltage Direct Current (HVDC) is a technology that enables the transmission of large amounts of power over long distances with high efficiency

Quick Facts

In some cases, for example when long water crossings need to be overcome, or when interconnecting asynchronous grids, HVDC is the only technical solution to connect power grids.

HVDC network paving way for a cleaner and sustainable tomorrow.

Projects delivered
Majority of projects over 60 years

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North America

- SunZia
- Intermountain Power Project (IPP)
- Châteauguay
- Champlain Hudson Power Express
- Maritime Link
- Quebec – New England Upgrade
- CU Upgrade
- Madawaska Upgrade
- Celilo Upgrade
- Highgate Upgrade
- Railroad DC Tile
- Oklaunion
- Mackinac
- IPP Upgrade
- Blackwater Upgrade
- Outaouais
- Sharyland
- Rapic City
- Cross Sound
- Eagle Pass
- Quebec – New England
- Pacific Intertie Expansion
- IPP Intermountain – Adelanto
- Pacific Intertie Upgrade
- Madawaska
- Highgate
- Chateauguay Upgrade
- CU project
- Square Butte Upgrade
- Eel River Upgrade
- Pacific Intertie
- Vancouver Island Pole 1 & 2
- Nelson River, Bipole
- EATL
- WATL
- Nelson River 1 & 2
- McNeill
- Lower Churchill
- Black Sea
- Trans Bay Cable
- Hudson
- Neptune RTS
- Lamar
- Celilo upgrade
- Sylmar East Valve
- Welsh 1995/2017
- Virginia Smith/Sidney
- Poste Châteauguay
- Square Butte
- Eel River
- Eddy County BtB
- Stegall BtB

South America

- Itaipu
- Rio Madeira Back-to-back
- Rio Madeira
- Brazil – Argentina
- Interconnection I & II
- Rio Madeira
- Melo
- Rivera HVDC Brazil
- Acaray

Africa

- Saudi-Egypt
- Caprivi Link
- Inga – Kolwezi Upgrade
- Cahora Bassa, Songo
- Apollo Upgrade
- Inga – Kolwezi
- Cahora Bassa
- Cahora Bassa
- Ethiopia – Kenya HVDC Interconnector

Europe

- Biscay Gulf 1,2
- SuedLink DC4
- Hornsea 3
- Dogger Bank C
- Shetland
- Dogger Bank A
- Dogger Bank B
- IFA2
- Nordlink
- North-sea Link
- Caithness – Moray
- Kriegers Flak Cgs
- Johan Svedrup
- Gotland Upgrade
- Kontek Upgrade
- Troll 1 & 2
- Troll 3 & 4
- Borwin 1
- Dolwin 1
- Dolwin 2
- Dolwin 5
- Åland
- Nordbalt
- Litpol Link
- East West Interconnector
- Sapei
- Valhall
- Norned
- Estlink
- Italy – Greece
- Tjæreborg
- Swepol
- Gotland Light
- Hällsjön
- Kontek
- Baltic Cable
- Fennoskan 1 & 2
- Dürnohr
- Skagerrak 1-3
- Skagerrak 4
- Gotland 1-3
- Konti-skan 1 & 2
- English Channel
- Borwin 3,5
- Konti-Skan 1 Cable
- SACOI
- Western HVDC Link
- EstLink 2
- COMETA
- BritNed
- Storebælt
- Moyle Interconnector
- Etzenricht
- Wien-Suedost
- Dürnrohr
- Borwin 2
- Dolwin 3
- Helwin 1
- Helwin 2
- INELFE
- Sylwin 1
- MONITA
- Italy-France

Asia

- Yanbu-NIC
- Mumbai city infeed
- Project Lightning
- Higashi-Shimizu
- Jeju 3
- Changji-Guquan
- Raigarh-Pugalur
- North East Agra
- Jinping – Sunan
- Hülünbeir – Liaoning
- Qinghai-Tibet
- Yunnan-Guangxi
- Lingboa Ii Extension
- Xiangjiaba – Shanghai
- Three Gorges – Shanghai
- Vizag Li
- Three Gorges – Guangdong
- Three Gorges – Changzhou
- Xiluodu-Zhexi
- Hami-Zhengzhou
- Lingzhou-Shaoxing
- Jinbei-Nanjing
- Jiuquan-Hunan
- Shanghaimiao-Shandong
- Ximeng-Taizhou
- Dianxibei-Guangdong
- Zhalute-Qingzhou
- Chapad
- Rihand-Delhi
- Gezhouba – Shanghai
- Vindyachai
- Sakuma
- Champa-Kurukshetra I/2
- Zhangbei
- Leyte-Luzon
- Buk-Dangjin-Godeok
- Jeju-Jindo
- Nindong-Shandong
- 3G-Shanghai 2
- GCCIA
- Lingbao 2
- China-Russia
- Sasaram
- Jeju-Haenam
- Chandrapur
- Nuozhadu – Guangdong
- Xiluodu – Guangdong
- Back-to-Back Bangladesh
- Mundra – Haryana
- Ballia – Bhiwadi
- Yunnan – Guangdong
- Guizhou – Guangdong II
- Guizhou – Guangdong
- East-South Inter connector II and Upgrade
- Thailand-Malaysia
- Tianshengqiao – Guangzhou
- Wudongde-Guangdong-Guangxi
- YU-E

Australia and Oceania

- Murraylink
- Directlink
- NewZealand 1
- NewZealand 2
- Broken Hill
- Inter-Island link Pole 3
- Basslink

Project executed by Hitachi Energy , project delivered by ALL other suppliers

HVDC Technology for a carbon-neutral future

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HVDC Interconnecting grids for a sustainable energy system

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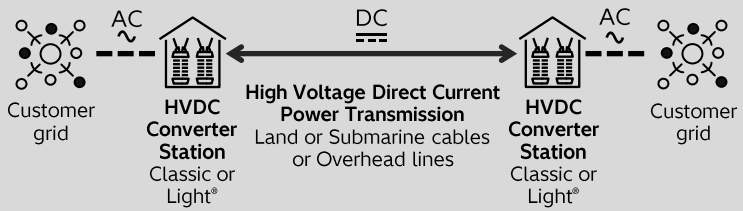
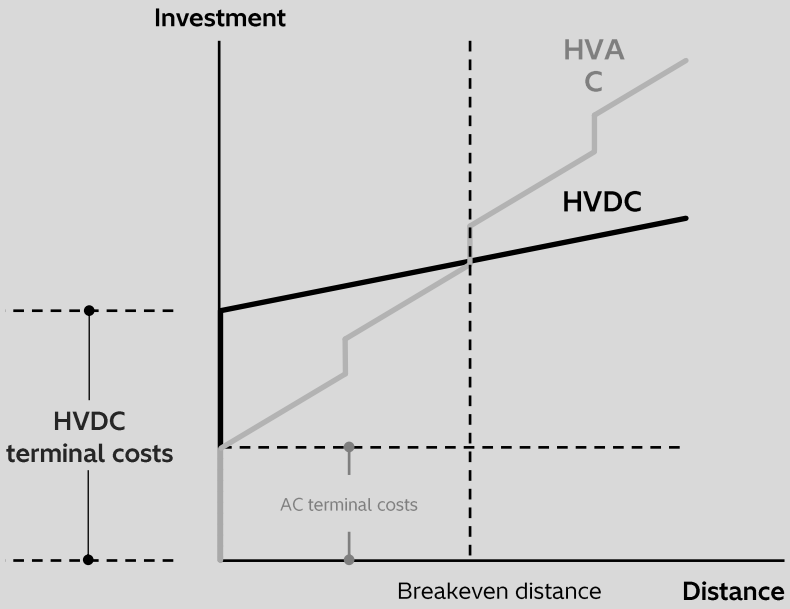




Lower losses

More power

Controlled power flows

More grid stability and flexibility

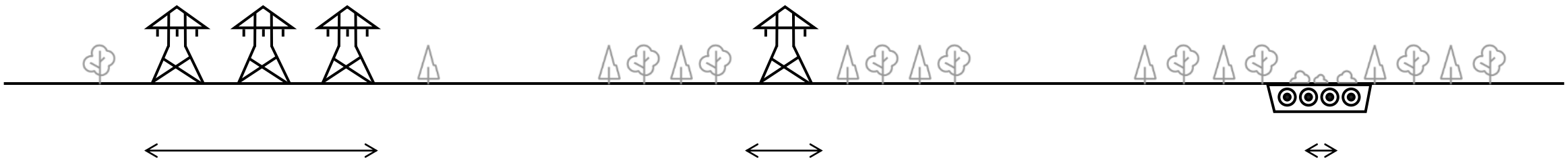
Smaller footprint

More sustainable

HVDC

The traditional advantages of HVDC vs HVAC

More power, less space



Land use with
AC overhead lines

Land use with
HVDC overhead lines

Land use with
HVDC Cable
(typical for 3 GW)

HVDC technology can save up to 50% of land usage

Climate Impact of HVAC vs HVDC Including Losses

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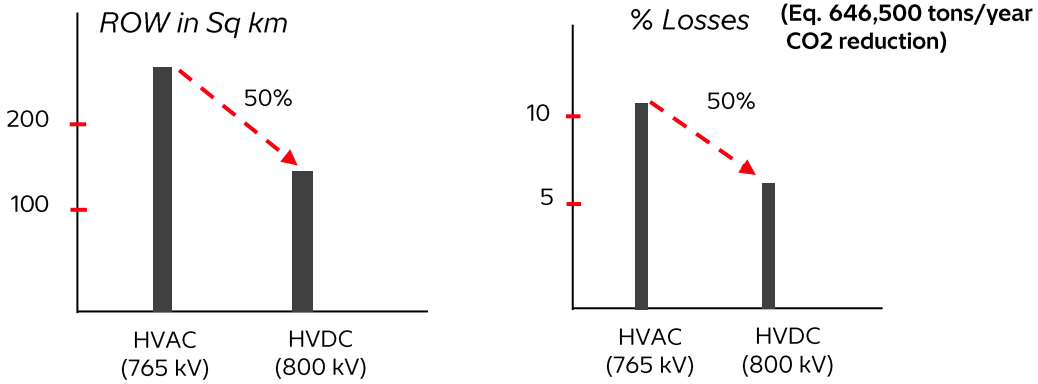
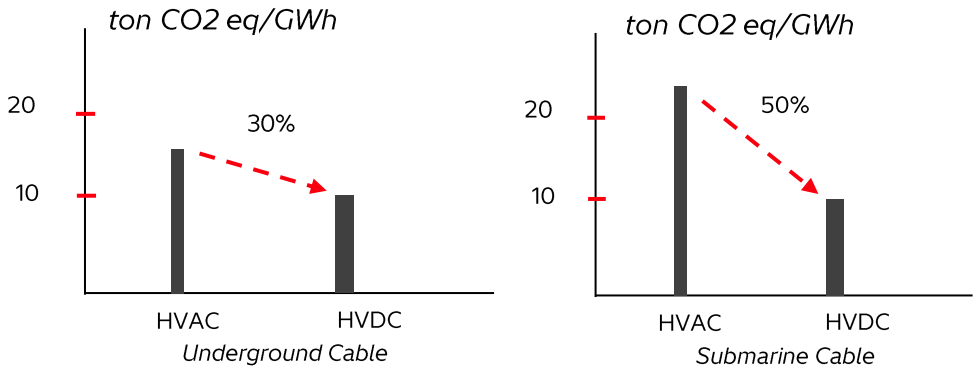
Typical 6 GW HVDC ~1700 kms Overhead Transmission



Typical 1 GW HVDC Cable Transmission



HVDC technology enabling Carbon Neutral future

Todays' HVDC applications and technologies

Shaping the grids of the future

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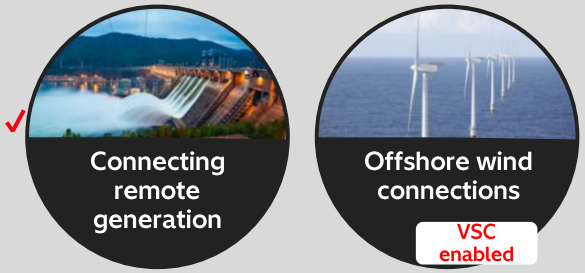

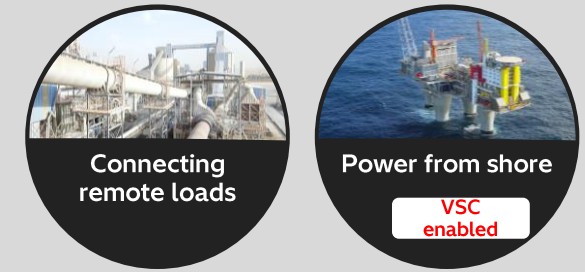

✓ India and SAS region

LCC (HVDC Classic) 150 – 12,000 MW

VSC (HVDC Light®) 50 – 3,600 MW

HVDC technology enables:

- Remote renewable integration by long-distance transmission
- Inter-connecting grids for energy exchange and grid security
- Efficient and compact solution for mega-city infeed

HVDC Light® technology in projects

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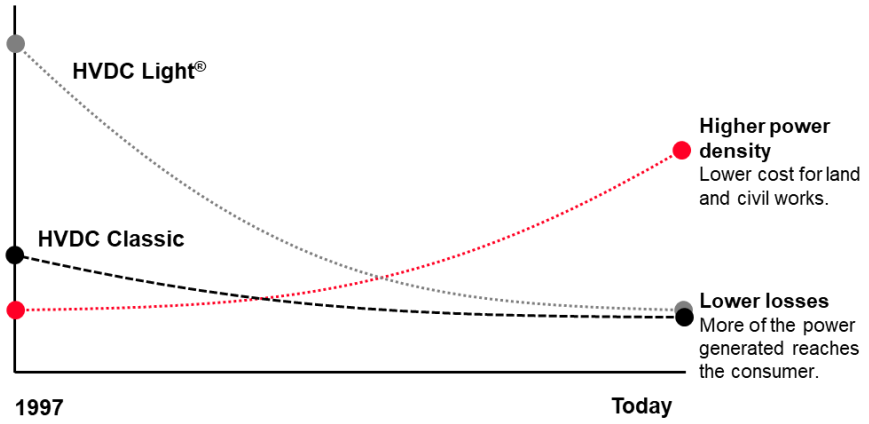
Selection of projects



*Selection of few project references along HVDC Light history

North-East Agra

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Customer
Powergrid Corporation in India Ltd

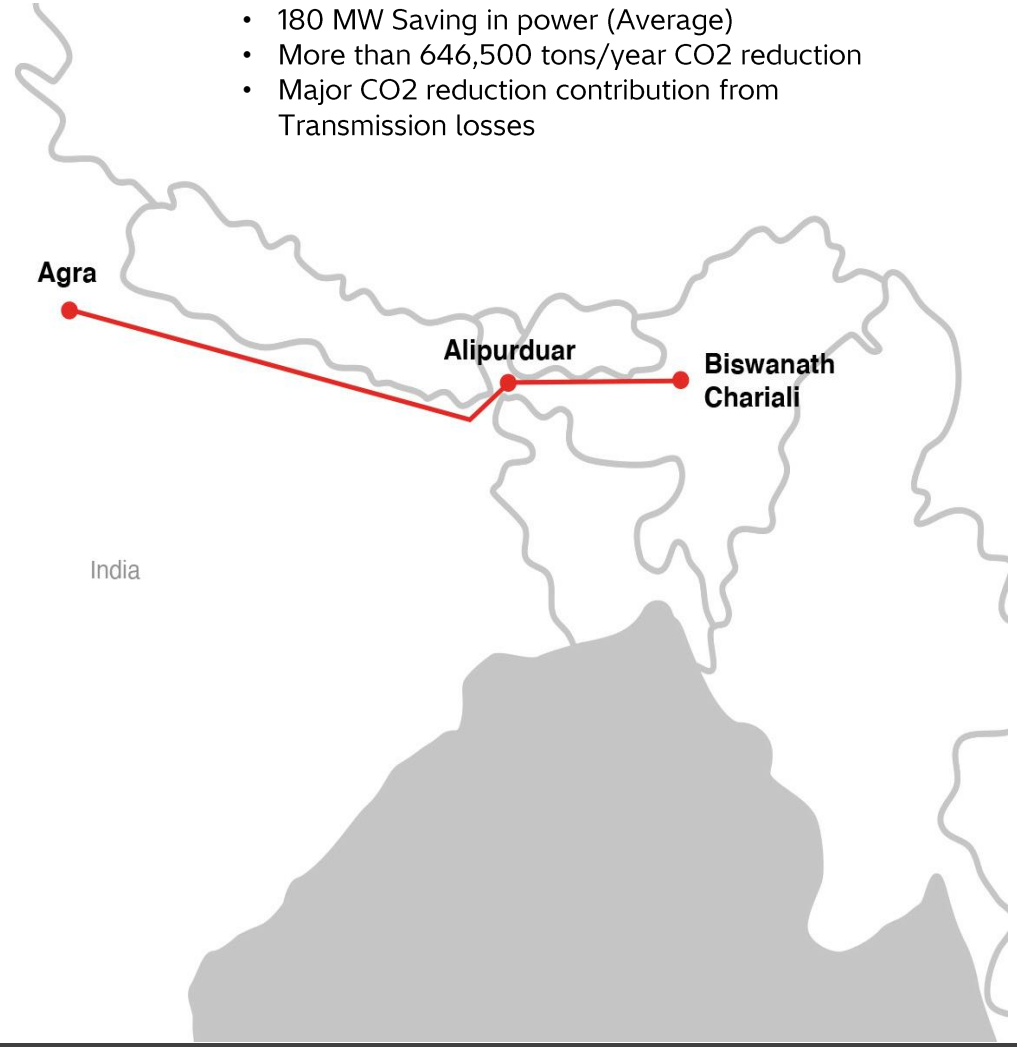
Customer needs
- Transmission of 6,000 MW hydropower from the north-eastern parts of India to the region of Agra – over 1,700 km

Our response
- Turnkey 6,000 MW ±800 kV UHVDC system
- Multiterminal – three converter stations

Customer benefits
- Low losses – 6 %
- 8,000 MW converter capacity, providing redundancy for loss of one converter with retained transfer capacity

Year
2017

- 50% Reduced losses
- 180 MW Saving in power (Average)
- More than 646,500 tons/year CO2 reduction
- Major CO2 reduction contribution from Transmission losses



HVDC Classic converter stations

Bipole multi-terminal solution

System capacity of 6,000 megawatts (MW) 1,700 km link

The world's first multi-terminal UHVDC transmission link, enabling efficient transmission of Hydro Power

India HVDC Transmission projects – Green Energy Corridors

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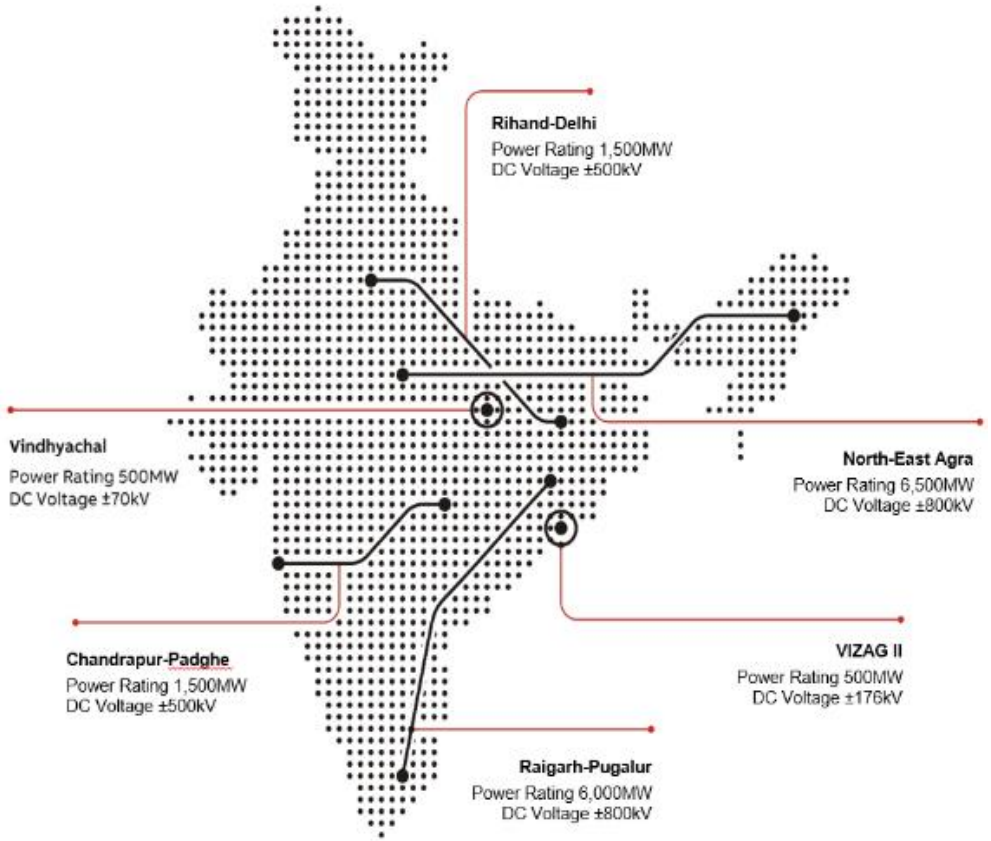
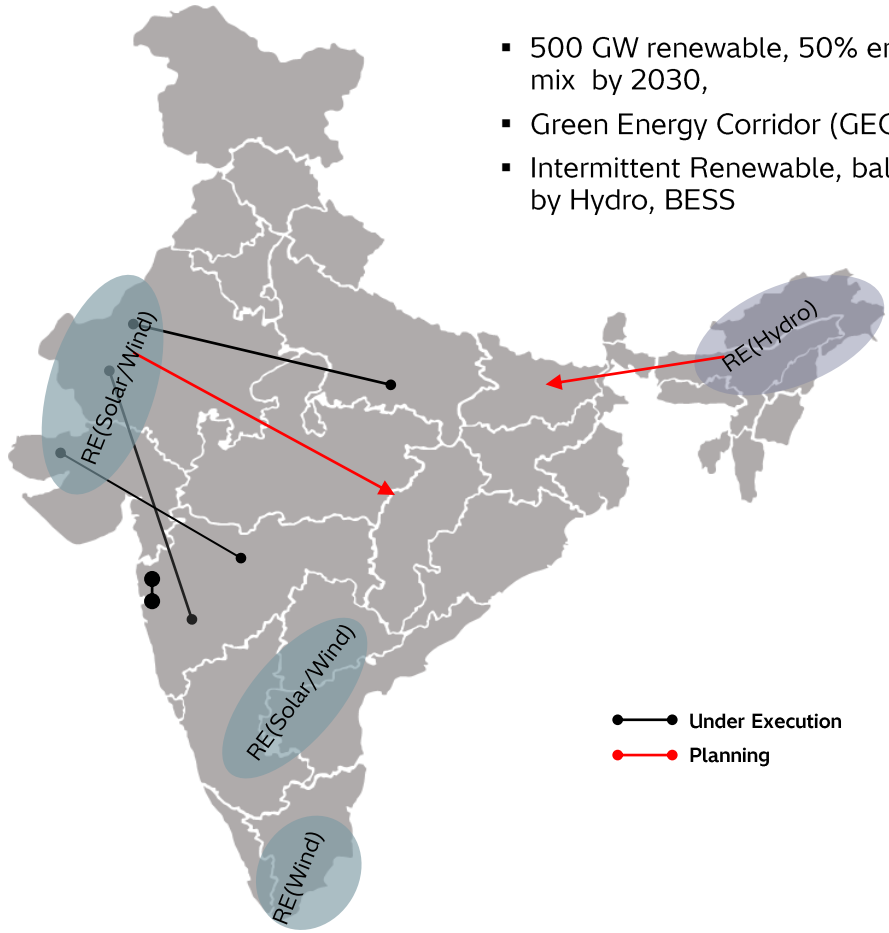
50% of HVDC Projects – by Hitachi Energy



Future HVDC Projects

- 500 GW renewable, 50% energy mix by 2030,
- Green Energy Corridor (GEC)
- Intermittent Renewable, balanced by Hydro, BESS



HVDC Transmission is a key enabler for a Carbon-neutral Energy System

High-voltage direct current power transmission

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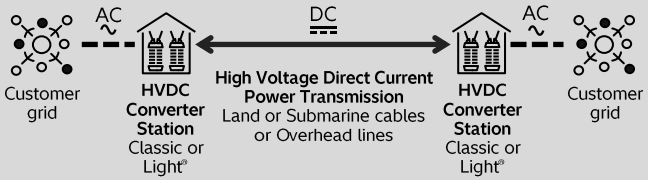

We pioneered it...

...enabling more than 150GW of HVDC worldwide

- Low losses, more power
- On air, underground, undersea to connect and dispatch renewables
- Full controllability to enhancing grid flexibility and reliability
- Compact and sustainable solution

HVDC technology compliments JCM credit requirements

HVDC technology helps to decarbonize the energy ecosystem