World Business Council for Sustainable Development

Measuring the impact of carbon avoiding solutions in the energy sector: *A Case Study*

Hitachi Energy's HVDC (High-Voltage Direct Current): Efficient long-distance power transmission for carbon-neutral energy systems

→ *18 million tons of CO_2*

avoided by 1200 MW offshore wind project connected by HVDC in the next 20 years

Source: Hitachi Energy

Hitachi Energy's HVDC system transmits offshore wind power serving more than *1.5 million households annually* with renewable energy

Capturing avoided emissions *— assessment details*

- → **Functional Unit:** kWh
- → **Impact:** 213.2 gCO_2 / kWh
- → **Time Period:** forward looking for lifetime of grid connection (20 years)
- → **Scope:** United Kingdom
- → **System Boundaries:** Renewable energy source to grid connection point, including lifecycle emission of energy source and HVDC.

Scan me *to learn more*

See also the sustainability report of Hitachi for more information on HVDC and Avoided Emissions:
https://www.hitachienergy.com/sustainability/sustainability-reporting-center
https://www.hitachi.com/sustainability/download/

The Business-As-Usual Scenario

- → The United Kingdom's electricity grid, originally built to connect electricity generated in power stations from fossil fuels, such as coal from the North and Midlands of England and South Wales.
- → In the past years, gas has played an important role in providing most of the electricity across the United Kingdom, but high zero-carbon ambitions are driving significant technology changes.
- → The emission factor used is based on the most recent overall UK grid based on IEA Emission Factor.

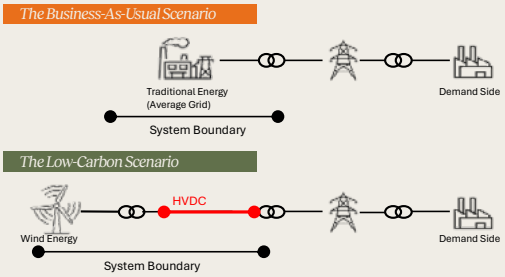
Source: Hitachi Energy

The Low-Carbon Scenario

- → Integration of a 1200 MW offshore wind farm into the energy system via HVDC connection.
- → VSC (Voltage Source Converter) -based HVDC enables transmission through submarine cables with minimal losses, facilitating the integration to the grid of massive offshore wind farms.
- → Reduces offshore substation footprint through simplified design.
- → Provides critical grid support functions like black start capability, enabling rapid power restoration after widespread outages.
- → Hitachi Energy's HVDC technology efficiently transmits large volume of energy over long distances.
- → By connecting remote renewable energy sources, HVDC helps lower CO_2 emissions compared to fossil electricity sources, contributing significantly to the transformation and flexibility of the energy system.

How It Works

System boundaries



Lifecycle emissions of the renewable energy generation (based on NREL data) and HVDC connection* included in the system boundary.

Through the integration of renewables supported by HVDC, power generators reduce Scope 1 emissions, transmission operators and consumers reduce Scope 2 emissions and manufacturing companies like Hitachi Energy reduce Scope 3: cat 11 emissions through a cleaner energy mix.

WBCSD Avoided Emissions Eligibility Gates

☑Gate 1 (Climate Action Credibility) ☑Gate 2 (Climate Science Alignment) ☑Gate 3 (Contribution Legitimacy)

Environmental and Social Side Effects

HVDC enables efficient long-distance transmission of renewable energy, improving resource diversity and overall system reliability. Large-scale infrastructure projects may have temporary impacts on local communities during the construction phase. Compared to AC (Alternating Current), HVDC tends to have a smaller environmental footprint in terms of electromagnetic fields, land use, visual impact, and noise pollution.

Third-Party Verification

Calculated internally

*The lifecycle emissions of HVDC are disclosed here