Market and regulatory overview of the North Atlantic Transmission One - Link project

AFRY

Contents

This report provides a market and regulatory overview of the North Atlantic Transmission One-Link (NATO-L) project

Context

— The North Atlantic Transmission One – Link (NATO-L) is a proposed multi-headed HVDC electricity interconnection project which would connect North-East America to the North Sea Area in Europe, designed to enable transatlantic electricity exchange and support shared decarbonisation and energy security goals.

— This report provides an overview of the market and regulatory landscape surrounding the NATO-L project. The report explores the strategic rationale, potential economic value, and key regulatory considerations for enabling transatlantic electricity exchange. The analysis highlights how NATO-L could support decarbonisation, energy security, and system resilience across both regions.

Report Content

The structure of the report is as follows:

MARKET AND REGULATORY OVERVIEW OF THE NORTH ATLANTIC TRANSMISSION ONE - LINK PROJECT

Conventions used:

— North-East America refers to East Canada and New England

— East Canada refers to Quebec + Atlantic Provinces: [Newfoundland and Labrador + Maritimes (New Brunswick, Nova Scotia, Prince Edward Island)]

— North Sea Area covers all transmission assets and connection points in the markets around the North Sea (Norway, Denmark, Germany, NL, Belgium, France, Great Britain)

— EU refers to European Union of 27 members

There are many potential benefits that the North Atlantic Transmission One – Link (NATO-L) could bring to the EU/UK and North-East America

Renewable integration and carbon reduction

- Enables large-scale import of low-carbon hydro from North-East America to complement North Sea Area wind and solar. Those resources are uncorrelated on both sides of the ocean.
- Absorb excess wind in the North Sea Area, reducing curtailment and negative prices
- Supports decarbonisation targets on both sides of the Atlantic

Increased competition to lower consumer cost

- Introduces a new source of low-marginal-cost generation into European markets
- Can help reduce wholesale price volatility and reliance on expensive gas (especially at peaks)
- Dry years in North-East America could lead to import from Europe (double resiliency)

Grid stability and operational services

- Potential to provide frequency and balancing support via HVDC technology
- Enhances system resilience through geographical diversification of supply

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Energy security and policy alignments

- Reduces reliance on politically sensitive or volatile supply chains
- Strengthens transatlantic energy cooperation and interdependence
- Position NATO-L as part of transatlantic energy and climate cooperation, aligning North Sea Area and North-East America policies on decarbonisation e.g. EU Green Deal, renewable integration, and energy security

Grid infrastructure

- Stimulates coordinated grid development and offshore integration
- Opens the door for future multi-terminal or meshed interconnection models
- NATO-L could leverage on the substantial international transmission investments being made through 2030s including offshore hubs
- NATO-L benefits from multiple possible connection points, potentially enabling widespread benefits

Critical regulatory and structural questions will need to be addressed to progress the NATO-L project which is the focus of this report

KEY REGULATORY AND COMMERCIAL QUESTIONS (NON-EXHAUSTIVE) THAT NATO-L WILL ADDRESS

- Which authorities would be responsible for approving the project (e.g., Canadian provinces or Federal Government, the European Commission and Member States, UK DESNZ, marine authorities)?
- Which regulators would oversee the project on each side (e.g., EU NRAs/ACER, Ofgem, Canada Energy Regulator, ISO NE)?
- How would dispatch and scheduling be regulated in the absence of a spot market price for a potential connection point?

- How would the project capture its monetary value (e.g., congestion income), and where would the main sources of economic value be expected e.g. imports/exports?
- How would the revenue model support investment?
- What type of existing revenue model can be leveraged and what would need to be bespoke, considering the uniqueness of the endeavour?

- Would the interconnector land in a North Sea Area onshore zone or in offshore hybrid zones? What are the implications of choosing an offshore versus onshore landing point? Would the project be developed as a point-to-point interconnector or as an offshore hybrid asset?

- How would capacity be allocated in the various Canadian provinces and/or New England and to which counterparties in the North Sea Area? Is there sufficient grid headroom on both sides of the connection to accommodate flows?

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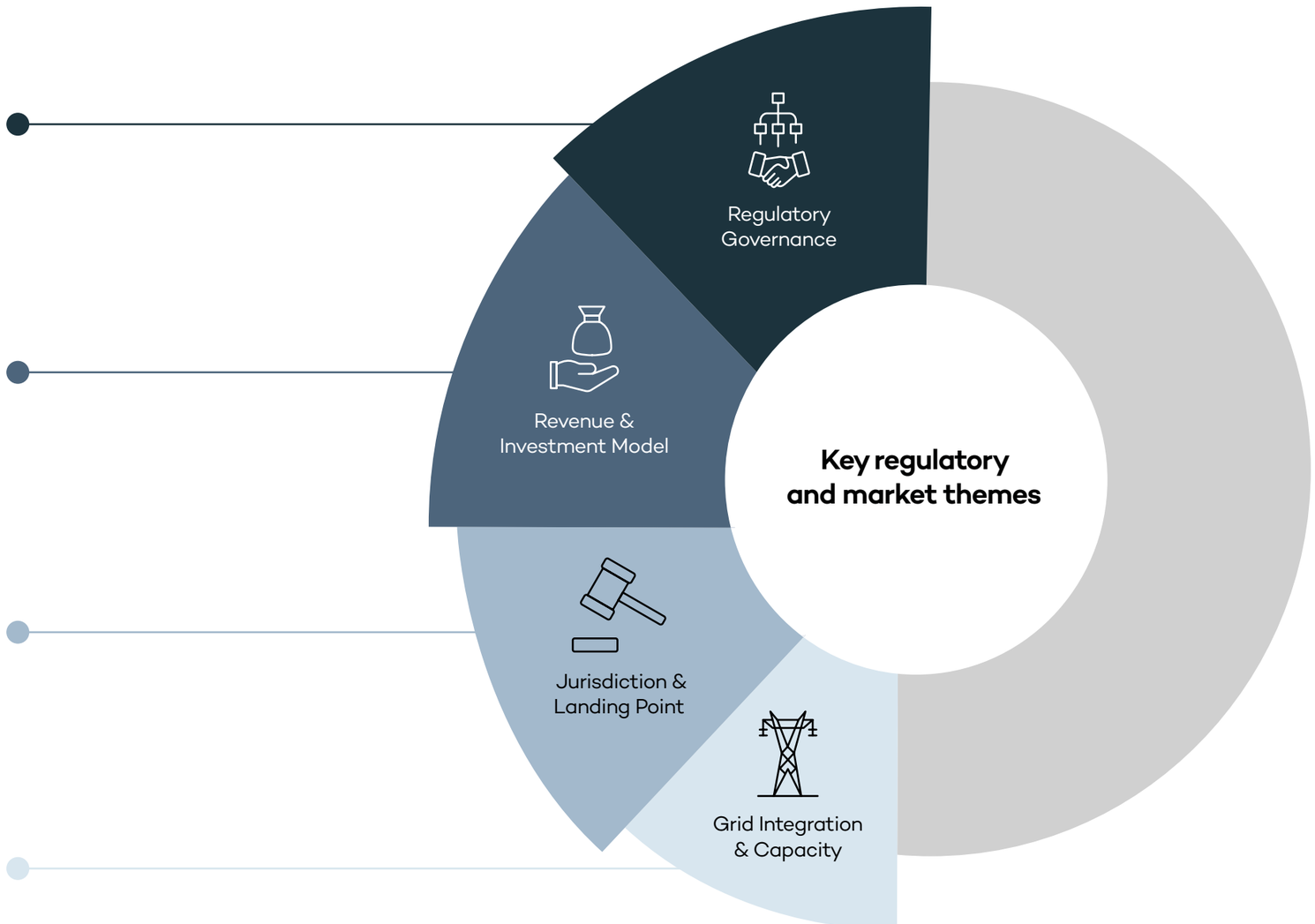
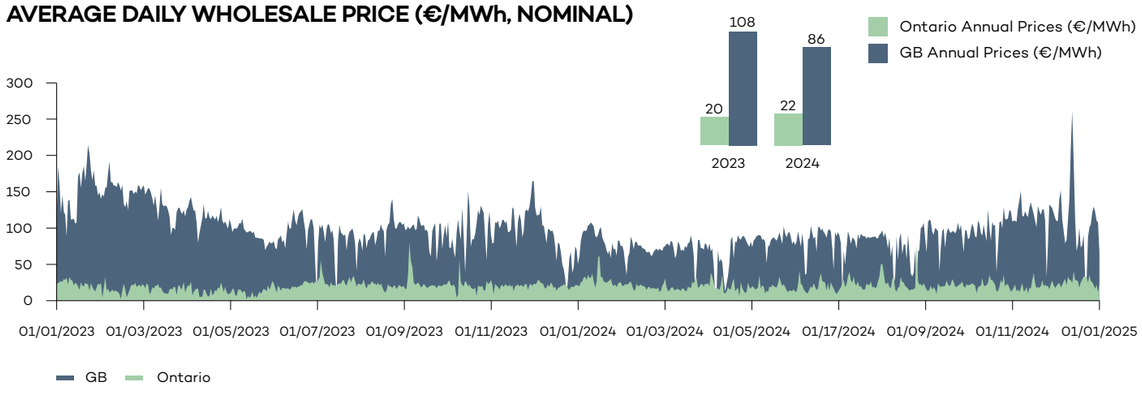


Illustrative value: the past years suggest strong price differences between North-East America and North Sea Area (using GB and Ontario as proxies)

AVERAGE DAILY WHOLESALE PRICE (€/MWh, NOMINAL)



— The prices shown represent the historical average day-ahead values for Ontario and Great Britain, expressed in the GB time zone and converted into euros. The lines capture the average daily prices, while the blocks in the top right corners highlight the average annual values. These two markets are used as proxies to illustrate the differing market dynamics between North-East America and the North Sea Area.

— Comparing GB prices in 2023 and 2024 with Ontario prices (converted into euros) reveals a pronounced price spread, with GB prices consistently higher. This reflects Europe's elevated price environment and its reliance on gas-fired generation as the marginal technology. The correlation coefficient, shown in red and calculated in the equivalent time zone, indicates virtually no correlation between the two hourly market prices, driven by differences in time zones and generation mixes.

— Hypothetically, if NATO-L were to be connected today between these two proxy markets, assuming no price impact with congestion income based on the hourly price spreads for a 6GW interconnector, annual revenues of €3–5 billion (nominal) could be expected from the direction North-East America to the North Sea Area, with negligible revenues currently on the other side in a typical year.

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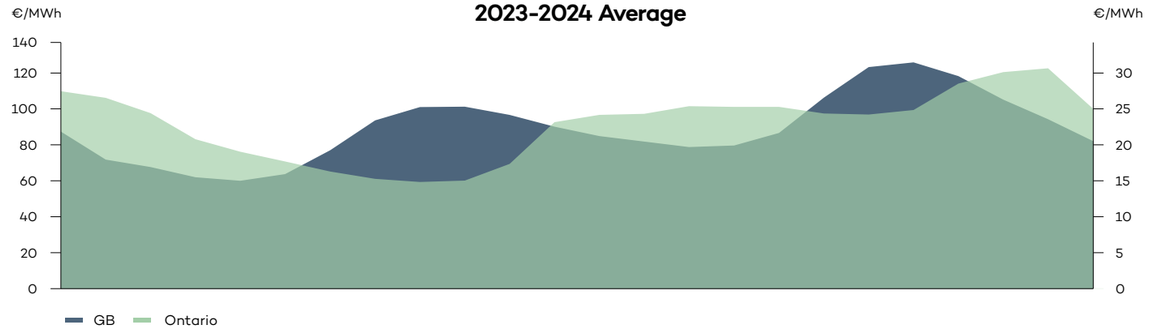
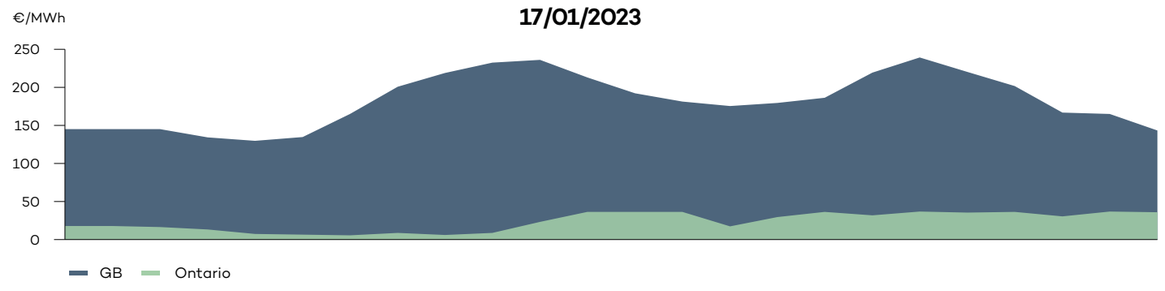
On an hourly level, structural differences and complimentary in price shape can be observed between North-East America and the North Sea Area

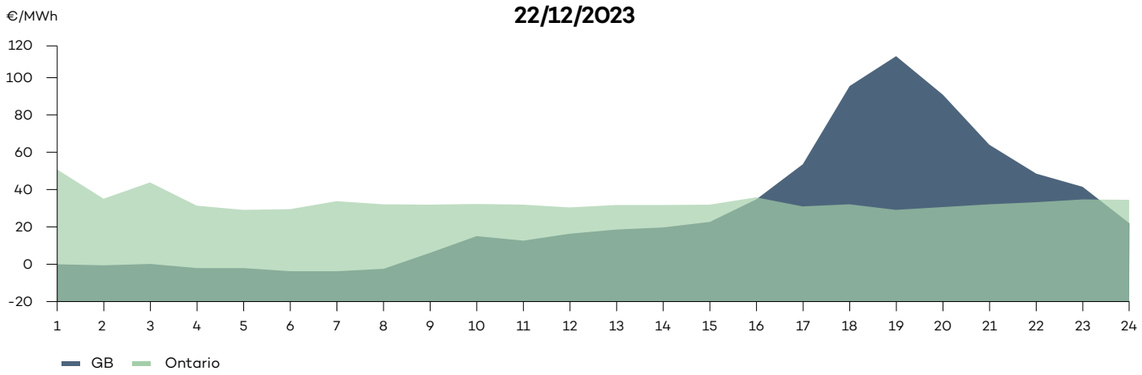
GB - ONTARIO WHOLESALE AVERAGE PRICE OVER DIFFERENT PERIOD AND DAYS (€/MWh, NOMINAL)



— The graph shows the 2023-2024 daily average price shapes for GB and Ontario with different scales i.e. GB on left axis and Ontario on the right axis; the "normalisation" effect, ignoring the price levels, shows structural different price shapes due to time differences between the two zones with the morning and evening peak in the North Sea Area corresponding to lower prices in North-East America.



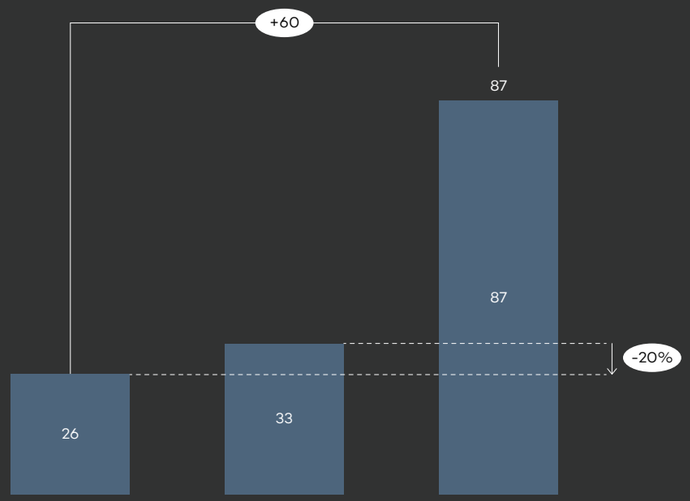
— Days like the 17th January 2023 reflect a high demand combined with low wind output in Europe where prices are set by gas power plants resulting in significantly higher prices than Ontario prices; imports from East Canada with cheap hydro from NATO-L could hugely benefit the consumer in the North Sea Area in these periods.



— Days like the 22nd December 2023 capture high renewables outputs across Europe resulting in negative prices due to excess renewables in the morning but also higher prices in the afternoon; the excess renewable energy could be used in the morning to charge pump storage hydro power in North-East America, with a potential change of direction of the flows in the evening, highlighting the opportunistic value of a bi-directional cable.

In the future, NATO-L would be supported by a strong complementarity in both markets and a potential significant price signal

ROUGH ESTIMATED WHOLESALE PRICE 2030-2035 (€/MWH, REAL 2023)



— Assessing wholesale electricity prices in Canadian provinces is challenging due to the absence of spot markets (Ontario is often used as a proxy); instead, water values are typically determined by the opportunity cost for Hydro-Québec reservoir owners of exporting to neighbouring markets.

— Hydro reservoirs have a unique offering as low carbon flexible generation that contrasts with intermittent generation such as wind and solar, but the potential is limited to the natural resources available (e.g. Norway, Switzerland). Hydro-Québec operates with significant surplus capacity for most of the year, with tighter periods generally occurring overnight in the North Sea Area when excess capacity is also available.

— As the North Sea Area markets decarbonise their economies, a significant amount of excess RES is expected on the system at times, which could be absorbed by flexibility means such as cross-border interconnectors. However, European interconnectors often face challenges from high correlation in renewable output and demand and periods of low or high regional prices. A long-distance East-West HVDC link would enable stronger complementarities between Northeast America and the North Sea Area.

— This excess RES from Europe could be monetised on a merchant basis, as its near-zero marginal cost provides an attractive opportunity for Eastern Canada to preserve hydro reservoir levels. Conversely, Eastern Canada is expected to face future dry years, during which surplus RES from the North Sea Area would play a key role in ensuring security of supply.

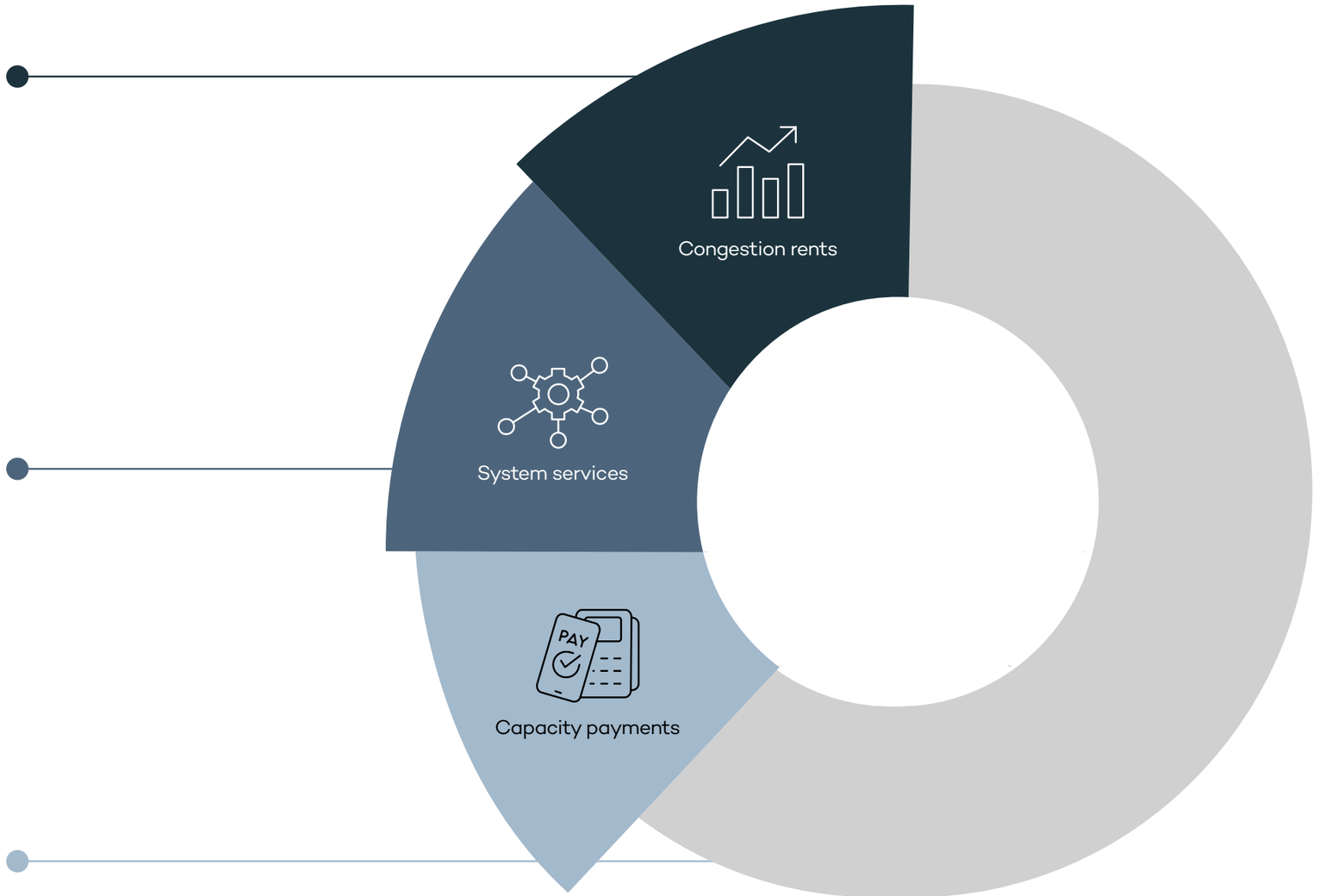
In European markets, interconnectors derive value from spot market congestion rent, supplemented by system services and capacity payments

TRADITIONAL INTERCONNECTOR BUSINESS MODELS

- Spot market congestion rent accounts for the majority of interconnector revenues. Congestion rent describes the transfer value that accrues to ICs as a result of spot prices differing between the markets at either end of the IC.
- Some of this capacity is sold on forward markets typically on yearly and monthly products, resulting in a degree of forward revenue security for some portion of congestion rent revenues, which underpins the investment.
- The details of how capacity is utilised varies depending on the nature of the market (e.g. capacity on GB-continental Europe ICs is allocated explicitly and nominated by the capacity holders, capacity between continental ICs is allocated implicitly by the market and the flow is determined by the prices).

- System services can be provided by interconnectors, but exactly which services can be provided differs from market to market and on the technology chosen
- System services are typically a relatively small contribution to the revenue stack, particularly compared to congestion rent.

- In some specific markets (e.g. GB, SEM, France), interconnectors can directly participate and receive capacity payments.
- Capacity payments can, particularly for ICs connecting the Irish SEM and GB, represent a very healthy revenue stream e.g. between €100/kW and €200/kW for some assets.
- The low correlation between system scarcity in NE America and North Sea Basin markets does allow for a significant contribution to reliability in both markets



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There are many ‘route to market’ options for interconnectors; we consider a fully merchant, fully regulated and a hybrid model

Ownership options for interconnectors in Europe - Regulatory frameworks allow different ownership options and potential returns for private investors in correlation with risks and benefits involved. We illustrate three models below, many variants are possible

Fully Merchant

- Financed privately and operated on a non-regulated basis, built and owned by the private sector
- Primary revenue source is congestion rent, which increases with price differentials and market volatility between connected markets
- Typically seek exemptions from EU rules on third-party access, allowing the sale of long-term capacity rights; exemptions are time-limited and may be partial
- Remain subject to regulatory oversight, including licensing, system operator coordination, and compliance with technical and safety standards
- Developers bear the full investment risk while retaining all upside potential

Fully Regulated

- Interconnection included in TSO’s Regulated Asset Base (RAB) alongside onshore transmission
- TSO’s build, own and operate interconnectors and recover all sustained costs, including a regulated ROI using price control arrangements
- Revenue use is controlled under certain obligation criteria
- There are obligations towards ownership unbundling
- Third party access must be granted
- Underwritten by the consumer through their contribution to regulated network charges

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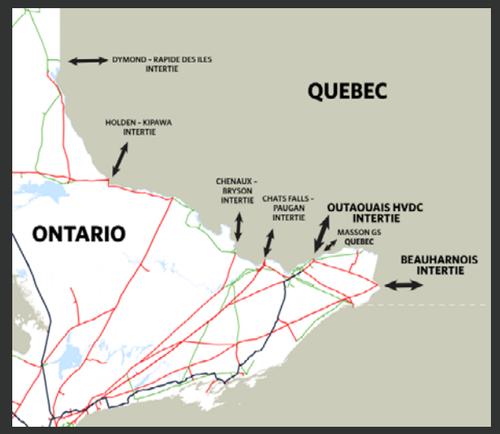
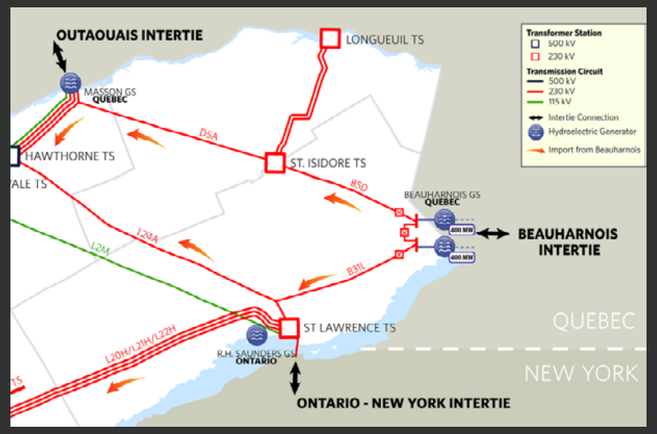
Hybrid e.g. Cap & Floor (C&F)

- Tries to encourage private investment into interconnectors by striking a balance between commercial incentives and risks
- C&F was initially specific to GB; other countries, e.g., Ireland/Norway have investigated this regime
- Ireland has awarded a version of the C&F to GreenLink to provide a consistent approach
- Revenue is market dependent based on sales of interconnection capacity, but within a regulated band provided by cap and floor
- Capacity availability is critical. Dipping below 80% forfeits the floor
- A +/- 2% incentive on the cap for higher availability levels (~97%) is also available
- Provides balance between commercial incentives and risk mitigation for developers
- The floor covers OPEX, and debt accrued due to financing of the project

Hydro-Québec regulatory framework differs from Europe and mainly relies on long-term contracts with guaranteed volumes and prices

EXISTING INTERCONNECTORS





- ~8 GW of interconnection capacity, primarily with:
  - Northeast U.S. (e.g. New York, New England, Vermont)
  - Ontario and New Brunswick (Canadian provinces)
- Key interconnectors (or interties) include:
  - HQ–Phase II (1,200 MW to Massachusetts via NEPOOL)
  - Champlain Hudson Power Express (1,250 MW under construction to NYC)
  - Highgate and Northern Pass

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REVENUE MONETISATION

- Mainly from long-term contracts offering guaranteed volumes and prices
- Supplemented by merchant trading when market prices exceed opportunity cost
- Capacity payments in U.S. capacity markets (e.g. ISO-NE Forward Capacity Market) in some cases
- Renewable Energy Credits (RECs) may be bundled depending on contract structure and jurisdictional recognition of Hydro as low-carbon

ROUTES TO MARKET

- Long-term bilateral Power Purchase Agreements (PPAs) with U.S. utilities:
  - Fixed-price or indexed contracts (e.g. 20-year PPA with New York State Energy Research and Development Authority [NYSERDA])
  - Provides price certainty and steady revenue
- Export sales into U.S. wholesale power markets (ISO-NE, NYISO):
  - Via merchant trading of surplus energy
  - Allows price arbitrage and load balancing across regions
  - Domestic sales to Quebec market remain dominant but stable

NATO-L must bridge a North-Sea Basin market-based regime with North-East America contract-driven system to ensure a viable route-to-market

NORTH SEA AREA POTENTIAL FRAMEWORK

- Well-defined electricity market structures with:
  - Spot markets (day-ahead, intraday, balancing)
  - Price signals and volatility that can be monetised via merchant or regulated models
  - Established regulatory frameworks for interconnectors (e.g. OFGEM's cap & floor, EU's congestion revenue allocation)
- Market coupling in the North Sea Area allows price arbitrage and trading
- Clear system operator access rules and route-to-market mechanisms (e.g. CfDs, PPAs, trading, capacity markets)

NORTH-EAST AMERICA FRAMEWORK

- No spot electricity market in some markets; prices are not set through real-time market mechanisms
- Vertically integrated monopoly e.g. Hydro-Québec controls generation, transmission, and exports
- Long-term bilateral contracts dominate – no market-based price discovery
- No market coupling with the North Sea Area, requiring bespoke cross-border trading and regulatory cooperation
- Export regulation and public interest review required by both federal (Canada) and provincial authorities

IMPLICATIONS FOR NATO-L

- Asymmetry in market design between endpoints challenges conventional merchant models
- Limited access to merchant trading on the Canadian Province end, affecting monetisation flexibility
- Jurisdictional and regulatory fragmentation increases complexity for revenue certainty and financing
- Hybrid and tailored solution seems to be to most likely option

NATO-L is supported by strong economic signals, with a tailored route-to-market solution needed to accommodate the project's complexity

Strong economic signal

- Due to the different time zones, capacity mix and low correlation for renewables generation, there is a very strong price signal case between North-East America and any North Sea Area market.

Market structure asymmetry

- North Sea Area has liberalised spot markets; some North-East American markets operate under a vertically integrated utility model with no spot price signals.

Revenue mechanisms need tailoring

- Conventional merchant models would likely not apply; CfDs, PPAs, or regulated schemes may be needed which would depend on direction and jurisdiction.

Bi-direction cable brings benefits and complexities

- Stakeholders have pushed for two-way capability that brings value to both connected zones e.g. use of the cheap North-East American hydro, support during dry years from North Sea Area excess renewables, with added market and regulatory complexity.

Regulatory coordination is critical

- Any viable solution will require early engagement with regulators and market actors across North-East America and North Sea Area, and a high-level stake holder engagement.

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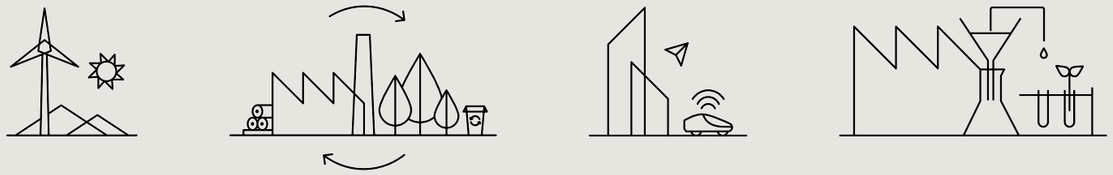
AFRY GROWTH DRIVERS



Clean Energy | Bioindustry | Infrastructure | Food and Life Science

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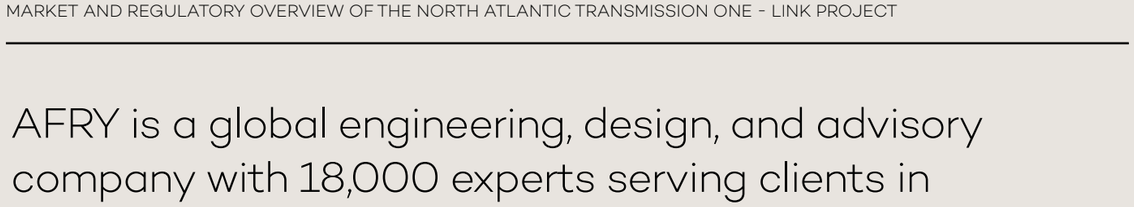

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AFRY AT A GLANCE

EMPLOYEES GLOBALLY
~ 18,000

NET SALES
~ € 2.3 bn

NUMBER OF COUNTRIES WITH OFFICES
> 50

NUMBER OF COUNTRIES WITH PROJECTS
> 100

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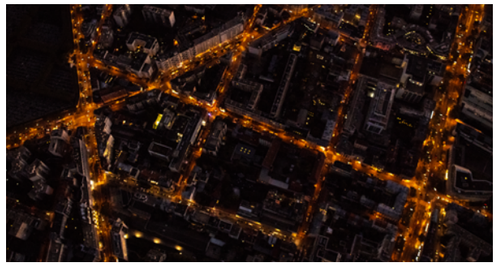
Combining deep technical knowledge with strong management consulting capabilities, AFRY has a unique competence offer

ENGINEERING

— AFRY's Transmission & Distribution experts support clients in addressing the challenges of a changing power sector

— We offer simulations of transmission grids, feasibility studies and conceptual and basic design for substations and HVDC systems as well as complete engineering services for HV cables and lines



Planning & Development

— Network planning

— Feasibility studies

Design & Tendering

— Conceptual and basic engineering

— Detailed design and technical specifications

Project Execution

— Project management, site supervision

— Quality and security management

— Full installation services, commissioning

Advanced Technologies

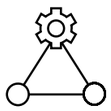
— HVDC systems

— Smart grid technologies

MANAGEMENT CONSULTING

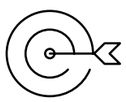
— AFRY Management Consulting offer deep strategic, organizational, technical and regulatory understanding of the power grid and the system operator business

— We see grid operators as key players in the green transition and offer a broad spectrum of services



Strategic advice

— We help companies present in the energy and power markets to analyse and evaluate strategies and business opportunities for continued development and growth.



Market analysis

— We assist companies with market development and attraction assessments, and public authorities with market design.

M&A & transactions

— We help owners, investors and financiers to analyse and evaluate infrastructure and energy related companies and assets (Due Diligence).

Operational transformation

— We support clients to improve performance through re-organization, optimization and transformation.

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