Cost-Benefit Analysis for a Pipeline Project

The Shannon Pipeline

PRESENTED TO

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PRESENTED BY

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THE Brattle GROUP

Agenda

The Project

The Cost-Benefit Analysis

The Economic Analysis

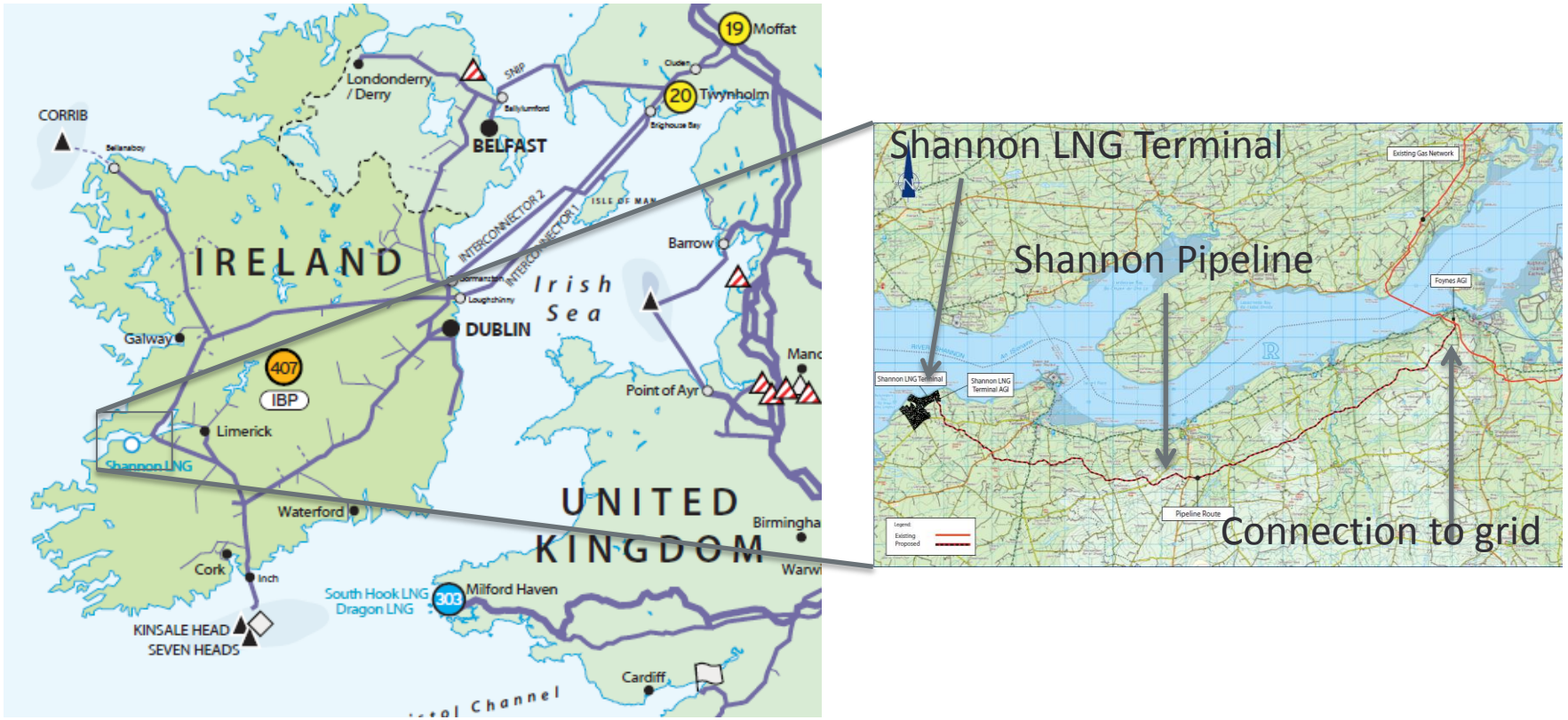
Lessons Learned

The Project

The Shannon Pipeline is a 26 km. 30” pipeline that will connect the Shannon LNG Terminal in Ralappane Co. Kerry to the Bord Gáis Eireann (“BGE”) transmission system at Foynes in Co. Limerick

- The Shannon Pipeline is a part of the Shannon LNG terminal project, which has been included in the list of Projects of Common Interest (“PCI”)
- The pipeline allows Third Party Access (“TPA”) while the LNG terminal does not;
- Building the pipeline before a decision has been made on the LNG terminal will allow connection to the gas grid of three towns that it is not otherwise economic to connect.

The Shannon Pipeline Project



Financing of the Project

Shannon LNG wishes to apply for a grant for the Shannon Pipeline. The criteria to get a grant are:

- The infrastructure allows for Third Party Access
- The project is not commercially viable without the grant
- The project specific cost-benefit analysis provides evidence of significant positive externalities
- The project has received a cross-border cost allocation decision or aims to provide cross-border services
  - ACER Guidelines for cross-border allocation decision provides that a cost-benefit analysis is required

The Cost-Benefit Analysis was carried out within the framework provided by the EntsoG consultation document

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The Cost-Benefit Analysis

Financial Analysis

Methodology to evaluate infrastructures proposed by the DG REGIO (2008)

- Discounted Cash Flow methodology ("DCF")
- Financial indicators to evaluate return on investment and on capital and financial sustainability
- Takes the perspective of the investors

Economic Analysis

Draft Methodology Proposed by EntsoG

- Quantitative measures
- Monetisation of the impact of the project using the "avoided cost approach"
- Qualitative measures
- Takes the perspective of society- tries to capture the externalities of the project

The Cost-Benefit Analysis - Implementation

Financial Analysis

Identification of the funding gap

- Available financing sources (equity and debt)
- Expected costs and revenues along the asset's useful life
- Financing sources required to make the project commercially viable

Assessment of project commercial viability

Economic Analysis

Identification of the interested area

Identification of major benefits

- Monetary savings
- Environmental benefits
- Increased security of supply
- Reduction in gas prices

Quantification of benefits

Focus

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Approach and Summary of Results

Pipeline on a Stand-Alone Basis

- Interested Area: Ireland
- Major benefits
  - Substitution of more expensive fuels with gas (avoided purchase and transportation costs)
  - Reduction in CO2 emissions from fuel substitution
- Positive net benefits
- Sensitivities
  - Fuel prices
  - Investment costs
  - O&M costs

Pipeline and LNG Terminal

- Interested Area
  - Ireland
  - Northern Ireland
  - Great Britain
- Major benefits
  - Increased security of supply
  - Reduction in import dependence (Ireland)
  - Positive impact on gas prices (marginal price reduction)
- Positive net benefits
- Sensitivities
  - Fuel prices
  - Investment costs
  - O&M costs

The Pipeline and the Terminal

Combining elements of the project

- SLNG is applying for a grant for the Shannon pipeline, not the terminal;
- However, the terminal has positive economic benefits, and the pipeline increases the chance that the terminal will be built and the benefits realized.
- Therefore we calculated the benefits for the terminal and credited the pipeline with a fraction of the benefits (5-10%).

Inputs

Variable	Pipeline on Stand-Alone Basis	Pipeline and LNG Terminal	Notes/Source
Time Horizon	22 years of operating life	22 years of operating life for the pipeline and 20 years for the LNG terminal	Takes into account difference in commissioning of pipeline and LNG terminal
Discount Factor	3.5%	3.5%	DG Regio
Calorific value	Gas, Coal, Lignite, Fuel Oil, Gasoil	Gas, Coal, Lignite, Fuel Oil, Gasoil	IEA, Energy Statistics Manual
Emission Factors (GHG)	Gas, Coal, Lignite, Fuel Oil, Gasoil	Gas, Coal, Lignite, Fuel Oil, Gasoil	Sustainable energy Authority of Ireland
Fuel's transportation costs	Transportation costs of gas, coal, lignite, fuel oil, gasoil to residential/commercial/industrial sector	Transportation costs of gas, coal, lignite, fuel oil, gasoil to residential/commercial/industrial sector	Jaspers/industry reports and studies
Other externalities	SO2, Nox, etc	SO2, Nox, etc	Jaspers/industry reports and studies
Market Share of Alternative Fuels	Coal, Fuel Oil and Gasoil for industrial/commercial/residential sector	Coal, Fuel Oil and Gasoil for industrial/commercial/residential sector	To be calculated for each country for which a substitution effect exists. Various sources.

Variable	Pipeline on Stand-Alone Basis	Pipeline and LNG Terminal	Notes/Source
Fuels and Carbon prices	Gas, Coal, Lignite, Fuel Oil, Gasoil, CO2	Gas, Coal, Lignite, Fuel Oil, Gasoil, CO2	IEA World Energy Outlook 2012. Prices for fuel oil estimated on the basis of historical data
Gas specific inputs (flows, average capacity and technical capacity)	N.A.	Naional production	National Regulatory Authorithy/TSOs/Infrastructure operators
		Underground storage	National Regulatory Authorithy/TSOs/Infrastructure operators
		LNG regasification terminals	National Regulatory Authorithy/TSOs/Infrastructure operators
		Storage capacity of LNG Terminals	National Regulatory Authorithy/TSOs/Infrastructure operators
		Entry/exit points (capacity)	National Regulatory Authorithy/TSOs
		Import	National Regulatory Authorithy/TSOs
Gas Market Input	N.A.	Peak gas demand	National Regulatory Authorithy/Ministry
		Average gas demand	National Regulatory Authorithy/Ministry
		Gas demand coverage	National Regulatory Authorithy/Ministry

A large amount of inputs from different sources is required

Analysis – Calculation of Avoided Costs (1/2)

EXAMPLE

(+) Avoided cost to power generation	
Avoided coal costs	
Purchase cost	EUR/GJ
Transportation cost	EUR/GJ
D Capital and O&M costs	EUR/GJ
CO_2 emissions	EUR/GJ
Other externalities	EUR/GJ
Total unit cost	EUR/GJ
Total avoided cost	mEUR
Avoided lignite costs	
Purchase cost	EUR/GJ
Transportation cost	EUR/GJ
D Capital and O&M costs	EUR/GJ
CO_2 emissions	EUR/GJ
Other externalities	EUR/GJ
Total unit cost	EUR/GJ
Total avoided cost	mEUR

(+) Avoided cost to industry/commercial	
Avoided coal costs	
Purchase cost	EUR/GJ
Transportation cost	EUR/GJ
CO_2 emissions	EUR/GJ
Other externalities	EUR/GJ
Total unit cost	EUR/GJ
Total avoided cost	mEUR
Avoided fuel oil costs	
Purchase cost	EUR/GJ
Transportation cost	EUR/GJ
CO_2 emissions	EUR/GJ
Other externalities	EUR/GJ
Total unit cost	EUR/GJ
Total avoided cost	mEUR
Avoided gasoil costs	
Purchase cost	EUR/GJ
Transportation cost	EUR/GJ
CO_2 emissions	EUR/GJ
Other externalities	EUR/GJ
Total unit cost	EUR/GJ
Total avoided cost	mEUR

Analysis – Calculation of Avoided Costs (2/2)

(+) Avoided cost to residential	
Avoided coal costs	
Purchase cost	EUR/GJ
Transportation cost	EUR/GJ
CO_2 emissions	EUR/GJ
Other externalities	EUR/GJ
Total unit cost	EUR/GJ
Total avoided cost	mEUR
Avoided gasoil costs	
Purchase cost	EUR/GJ
Transportation cost	EUR/GJ
CO_2 emissions	EUR/GJ
Other externalities	EUR/GJ
Total unit cost	EUR/GJ
Total avoided cost	mEUR
(-) Cost of gas	
Purchase cost	EUR/GJ
Transportation cost	EUR/GJ
CO_2 emissions	EUR/GJ
Other externalities	EUR/GJ
Total unit cost	EUR/GJ
Total gas cost	mEUR
Economic Benefits	
Avoided fuel & transport costs	*(mln €)*
Avoided emissions	*(mln €)*

EXAMPLE

The net benefit is equal to the sum of avoided costs to the power, industrial, commercial and residential sector net of the cost to purchase and deliver gas and of the cost of gas emissions

Analysis – Calculation of Net Benefits

Pipeline (mln €)	[1]
Investment costs	
O&M Costs	
Taxation	
Replacement costs	
Residual value	
LNG (mln €)	[2]
Investment costs	
O&M Costs	
Taxation	
Replacement costs	
Residual value	
TOTAL INVESTMENT COSTS	[3]=[1]+[2]
Avoided fuel and transport costs	
Avoided emissions	
BENEFITS ON ROI	[4]
UK	
NI	
CROSS BORDERS BENEFITS	[5]
TOTAL BENEFITS	[6]=[4]+[5]
NET BENEFITS	[7]=[6]-[3]+TV
ENPV	*NPV di [7]*
ERR	*IRR di [7]*
B/C ratio	*NPV di [7] / NPV di [3]*

EXAMPLE

The net benefits of the project are equal to the sum of national and cross-border benefits net of all costs

Project specific indicators (net present value of net benefits, internal rate of return, ratio between costs and benefits) are used to assess the economic relevance of the project and to rank different projects

Calculation of Project Specific Indices

Calculation of project-specific indices has been carried out using formulae provided by EntsoG's draft methodology

- Available data allowed us to calculate the Daily Peak Exposure Index (EXP) for Ireland and Northern Ireland and the Import Dependence Index (IDI) for Ireland
- Other project specific indices (such as (N-1) indicator and the import route diversification index) discussed qualitatively on the basis of data and information provided by the national regulator and/or the Government

The major issue arising when calculating indices is the difference in data provided from difference sources which highlights the need to have a consistent database at EU level

Estimating Price Effects

- The LNG terminal will increase the supply of gas in the UK/Irish gas market, and increase the level of competition.
- We used a simple model of 'quantity' or Cournot competition, which gives the relationship between the market shares of the suppliers and the margin.
- We re-calculated the new lower margin with the SLNG terminal, and multiplied the price reduction by the expected demand to get the expected reduction in gas costs in Euros.

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Lessons Learned

Lessons learned

Implementation of the cost benefit analysis has highlighted several issues

- The costs of a project are obvious, but identifying all of the benefits can be difficult
- For example, Shannon LNG did not initially identify the customers switching from gas oil to natural gas as a benefit.
- But this turned out to be one of the most important benefits of the project
- As a result, the analysis crucially depends on fuels and carbon prices.

Lessons learned (cont.)

- Prices from international sources might be helpful for comparisons at EU system level, use of such prices might not be appropriate for specific projects and circumstances
- Cost-benefit analysis are not an exact science – the use of judgment cannot be avoided. A good knowledge of the economics of gas markets and infrastructures is required
- Capacity data for infrastructures (including technical capacity, average available capacity, load factors, etc.) have to be consistent at the EU level. The building of a EU database will help address this issue

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