

ABSTRACT

The objective of this work is to quantify an option to delay the investment in an expansion of a natural gas pipeline transportation capacity, based on the uncertainties related to new gas supplies. Within the existing models to the option quantification, this work uses the binomial method.

In this work it is contextualized the natural gas industry, as well as the uncertainties related to the investment decisions in natural gas transportation infra-structure. Finally, there is an analysis of the results achieved in the quantification of the option analyzed *vis-à-vis* the cost associated to a compression station rental.

Introduction

One of the most characteristic aspects of natural gas industry is the specificities of its transportation assets, which are characterized by: (i) high investments, (ii) long-term for investment maturation and (iii) sunk costs existence.

The transportation assets infra-structure might be capable of attending, simultaneously, the large market oscillations and sustainable and long-term demand growth. This way, such assets are, in general, over dimensioned, i.e., designed in order to be easily expanded.

When pipelines are not capable of attending demand growth, they rapidly become a logistic restriction.

Such infra-structure assets, due to their over dimension and the impossibility of being divided, need a high initial investment, with a very long term maturation.

Another aspect that must be also considered is the existence of sunk costs, since natural gas pipelines are assets that cannot be reused in other sites. In other words, in case that the demand is lower than expected one, investors will not be able to reinstall the pipeline in other sites in a way to recover their investments, what generates an environment of uncertainty.

Context

In a scenario of uncertainties related to the natural gas supply sources in the future, not only in terms of localization, but also in terms of natural gas quantities available per supply source, it becomes difficult to choose the best logistics investment alternative, in order to transport natural gas from supply sources to market.

With this in mind, assuming high investments necessary to the installation or expansion of natural gas pipelines, it is appropriate to evaluate investment's alternatives that create a flexibility to change natural gas transportation capacity, from distinct supply sources.

The change in the natural gas quantity associated to a certain supply source can happen due to various reasons, such as: production capability lower than the originally foreseen and a project of LNG regasification that appear unfeasible or feasible. There are also situations in which it is known, previously, that, although the exploitation of a certain gas field is commercially feasible, due to the existing natural gas quantities, the production curve will decline in a few years and, therefore, it does not make sense the expansion of natural gas transportation capacity through assets' acquisition.

In all these cases, it makes sense to quantify the value of the option to delay investments related to natural gas transportation infra-structure, obviously, in the cases in which there is the possibility of such delay, what typically happens in pipeline expansions adopting compression increasing.

Proposed Scenario

In order to quantify the proposed option to delay, it is considered the following initial scenario:

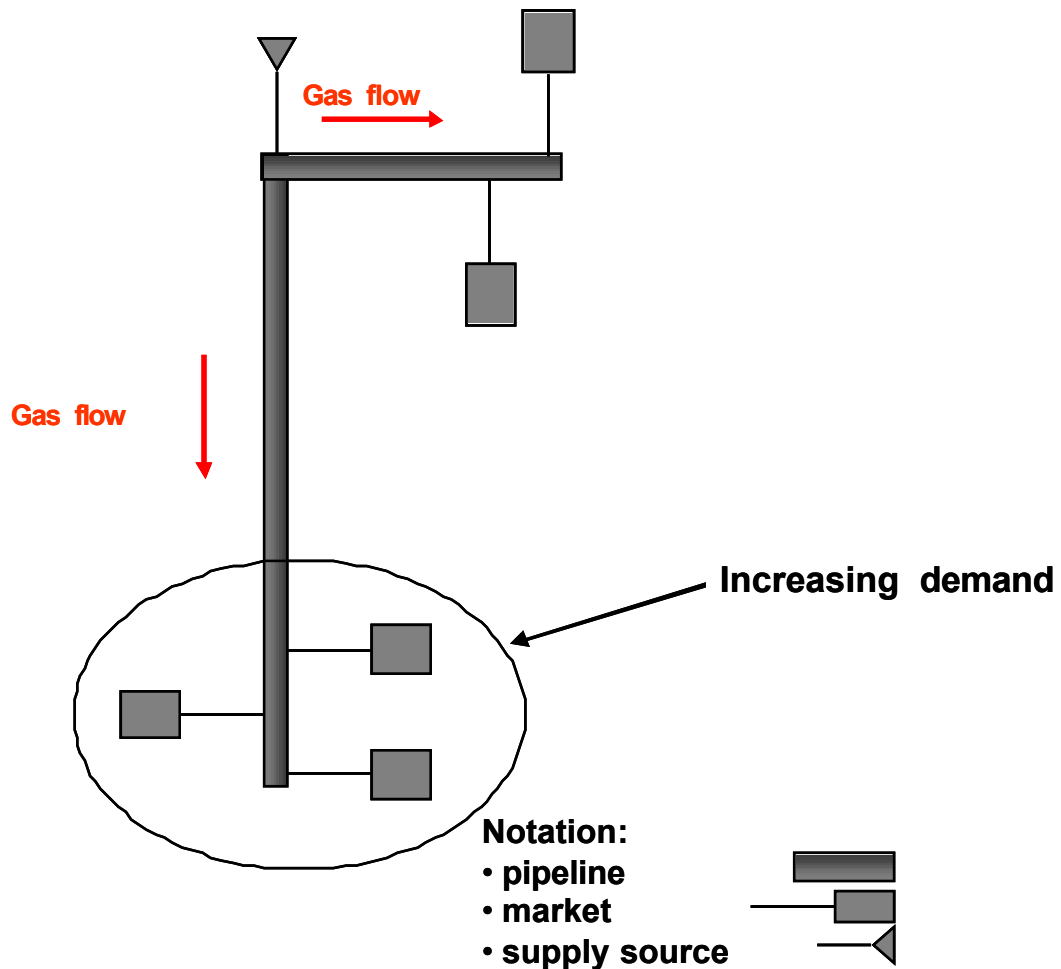


Figure 1: Proposed Scenario

There are two natural gas markets, one of them with a low growth rate, located close to the existing supply source, and another one with a high growth rate, distant of the existing supply source.

In order to attend the demand growth of the distant market, from the existing supply source, it would be necessary to expand the transportation capacity of the pipeline, what can be done with the installation of a new compression station, as presented below:

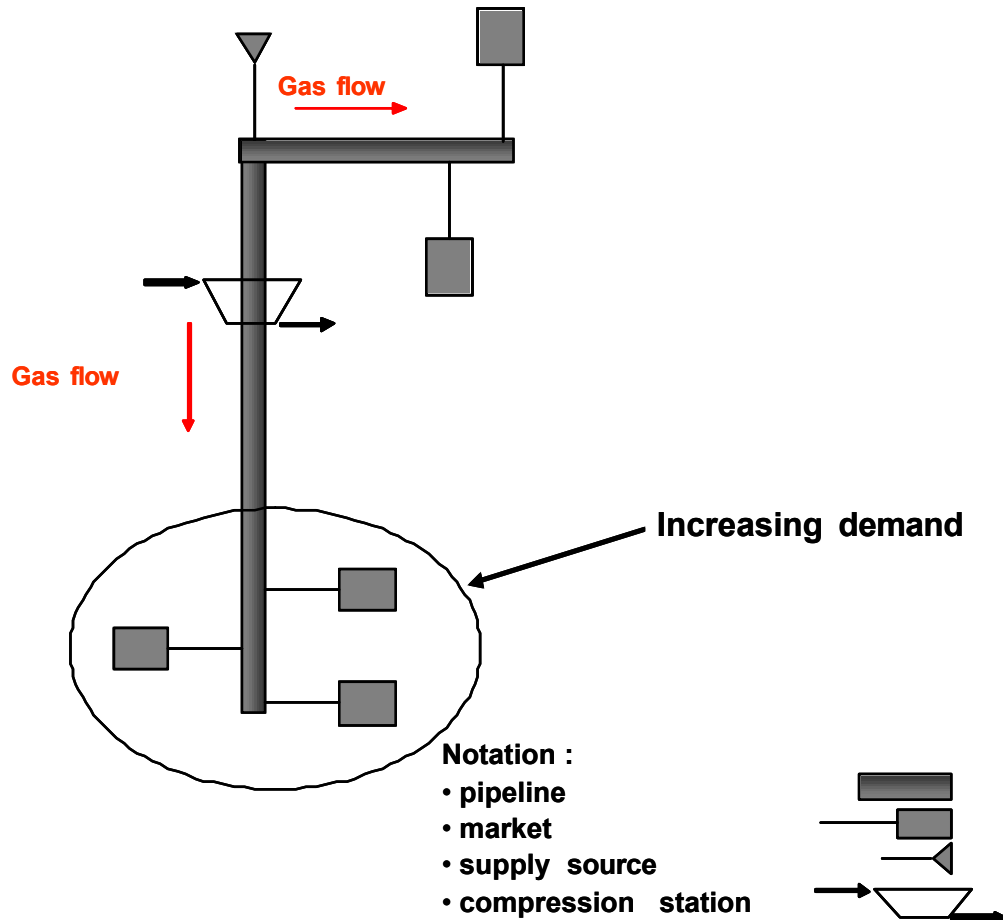


Figure 2: Scenario after expansion of transportation capacity

On the other hand, simultaneously to the studies related to the expansion of the transportation capacity, there are studies related to the implementation of an LNG regasification project close to the distant market. If implemented, the LNG project would imply the non execution of the transportation capacity expansion, since the distant market would be attended by the regasified LNG, enabling the production of the existing supply source to be used in the development of other market, as presented in the figure below:

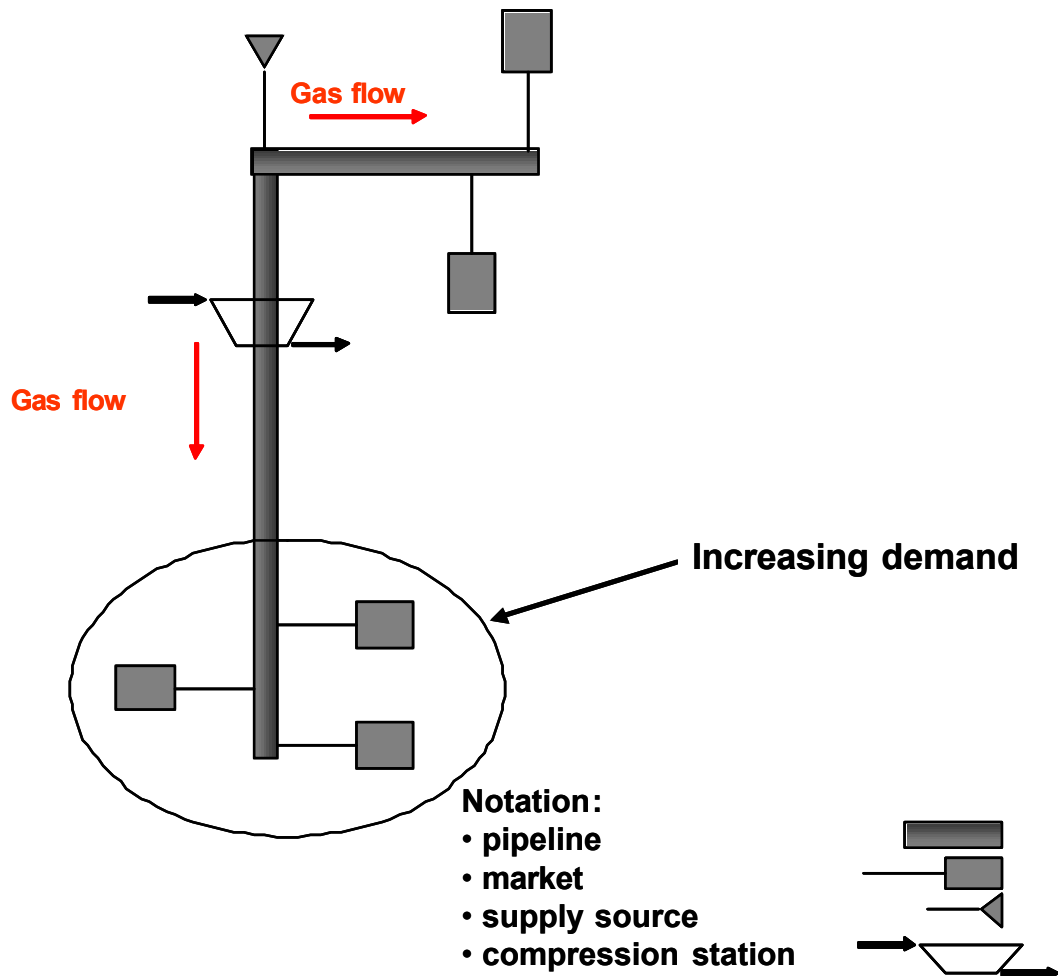


Figure 3: Scenario after the implementation of LNG project

In other words, in case of implementation of the transportation capacity expansion and, subsequently, the LNG project is executed, the investment in the transportation capacity expansion would be “lost”, since the pipeline operate with a low load factor.

Option Quantification

In order to quantify the option to delay, this work presents the features related to the alternative of transportation capacity expansion through assets’ acquisition, the corresponding commercial commitments, as well as the results to the shipper associated to the scenarios of occurrence or not of the LNG regasification project.

Taking into account the results above mentioned, it is possible to elaborate a two-stage model, used in binominal method, associated to the probability of the LNG

regasification project to happen.

Furthermore, the work presents the calculation related to the quantification of the option to delay using binominal method.

Conclusions

Finally, the conclusions related to the quantification of the option to delay are presented, emphasizing the evaluation of using a compression station rental approach instead of assets' acquisition.