APPENDICES

UPSTREAM INVESTMENTS ON THE GAS ROUNDABOUT?

EXPLORING THE CONTRIBUTION OF THE GAS ROUNDABOUT POLICY TO THE ATTRACTIVENESS OF THE DUTCH UPSTREAM INVESTMENT CLIMATE

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Public and private decision-making in multi-actor systems: a structured approach to integrate theories of the firm and policy analysis theories to support policy analysis, applied for the upstream natural gas industry

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Abstract
To thoroughly understand and analyze policies in multi-actor systems such as the natural gas industry, insight in both public- and private decision making is required. This article positions two possible approaches which can be used by policy makers and analysts to generate insight about the research domain of upstream investments: a scientific approach, based on analysis of the research domain, and a process approach, based on interaction with the actor-network to generate substance about their normative problem perceptions on the research domain. A structured and general approach to capture insights from any research domain is provided, and specifically applied for the natural gas industry. The “pluralistic theory of the firm” is developed. By developing the “Integrated Policy Framework,” insights from the process-perspective can be integrated with research-domain specific theories. The developed theory and framework can be challenged by application and further developed.

Keywords: Theoretical pluralism, Theory of the Firm, Investment decisions, Policy analysis, Upstream natural gas

1. Introduction
Decision-making occurs on multiple levels in both public and private environments. Both are often closely interrelated, especially in sectors with a high government involvement. This article will address the upstream natural gas exploration and production sector, where governments attempt to maximize the “natural wealth” for their citizens, and private oil firms attempt to maximize share-holder value by strategic investments and operations. For proper policy analysis it is elementary to “thoroughly” understand both modes of decision-making. Public decision-making shapes the development, deployment and performance of the institutional structures, regulatory regimes, policies and public-private interaction in the upstream natural gas sector. Decision-making by private oil firms determines their investment behavior, sales arrangements and other institutional structures. Both modes of decision-making are mutually dependent, as public policies facilitate private investments, and private investments are required to valorize the “natural wealth.” In addition to that, there is information asymmetry between the government and the oil firms, as both actors only have limited insight in the drivers for the counterparts’ behavior to e.g. make policy or investments. Despite this information asymmetry and the associated uncertainty, governments still have to decide upon policies to facilitate private investments, and policy analysts still attempt to analyze and evaluate these policies. To mitigate this information asymmetry, policy-makers can rely on different pathways to generate insight about private investments: ad-hoc bi-lateral or multi-lateral consultations, structural involvement of firms in the public decision-making process, learning-by-doing, or more scientific approaches to generate insights on the research domain of upstream investments.
This article is aimed to add to this dilemma by positioning two possible approaches which can be used by policy makers to generate insight about the research domain of upstream investments: a scientific-approach, based on analysis of the research domain, and a process-approach, based on interaction with the actor-network to generate substance about their normative problem perceptions on the research domain. Both aspects of policy-making can be used by policy analysts to analyze the policy. This article will start with the scientific approach, and will come back to the process-approach in a later phase. The scientific-approach requires policy makers and policy-analysts to acquire thorough insight into the investment-behavior of firms from a scientific theoretical perspective. How can such a perspective be developed? A first aim of this article is to explore for such a perspective in structured way.

An extensive amount of scientific literature attempts to examine the behavior of firms under the umbrella of the “Theories of the Firm” (Kanterelis, 2007). Dozens of theories provide different insights, all with their own focus, presumptions and applicability related to e.g. the firm’s boundaries, organization and existence. Some of these theories are complementary, some can be extended to each other, and others are rival theories. Examples are numerous and range from Neo-classical Economic (NCE) theories such as “Structure-Conduct-Performance” (SCP) (see Arnsperger et al, 2006), to Strategic Management theories such as the “Resource Based View” (RBV) (see Barney, 1991), and from the “Behavioral Theory of the Firm” (see Cyert and March, 1963) or the “Theory of the Entrepreneurial Firm” (see Langlois, 2005). Others are Original Institutional Economics (OIE) on the evolutionary process, power and the role of institutions (see Bush and Tool, 2001), or New Institutional Economic (NIE) theories such as “Transaction Cost Economics” or “Principal-Agent” (see Williamson, 1998). This abundance of theories does not provide the policy-makers and analysts with clear insight which of these “Theories of the Firm” can support their policy making or analysis from a scientific approach. In addition to that, how can insights from the process-approach be included in policy analysis?

This brings us to the central question of this article: “How can policies, aimed at contributing to upstream investments, structurally be approached and analyzed from a scientific- and a process-perspective?” First, this question will be answered from the scientific-approach. To answer this question, a systematic approach based on literature review will guide this exploratory study. Afterwards, the process-approach will be addressed.

Chapter 2 will provide theoretical considerations which can guide the exploration of a scientific-approach. The third chapter will start by developing the “Methodological Interactionistic Analysis Framework.” From out this framework, chapter 4 will derive the “Pluralistic Theory of the Firm.” Chapter 5 will put forward the need to combine scientific insight with insights which can be obtained from the process-approach. This will benefit both policy-makers and analysts. An “Integrated Policy Framework” will be developed in chapter 6. Conclusions and recommendations for further research will follow in chapter 7.

2. Developing a theory: theoretical considerations

Industry reports such as Wood Mackenzie (2000) suggest to perceive firm’s behavior as a production function, where firms make their investments based merely on net-present value (NPV) and expected monetary value (EMV). How does policy than relate to firm’s behavior? And how does this incorporate the specific nature of upstream investments, or difference between firms? The nature of upstream investments is characterized by many uncertainties, asset specificity and long time horizons (see Correljé and Groenewegen, 2006). For these and other reasons, many scholars have already argued to move beyond this paradigm on firm’s behavior, by describing the firm as an “institution” rather than a production-function (also see Helm, 2005; CIEP, 2006; Williamson, 1998).

2.1 The firm as an institution

North (1994) characterizes an “institution” as: “Human devised constraints that structure human interaction. They are made up of formal constraints, informal constraints and their enforcement characteristics. Together they define the incentive structure of societies and specifically economies.” (North, 1994: 360) Institutional analysis seems therefore elementary to answer this paper’s question. In order to develop and conduct such an “institutional analysis”, reference is made to Ostrom, who states that: “The study of institutions depends on theoretical work undertaken at three levels of specificity that are often confused with one another. The essential
foundations are frameworks, theories, and models. Analyses conducted at each level provide different degrees of specificity related to a particular problem.” (Ostrom, 2011:8)

2.2 Frameworks, theories and models: what’s the difference and how can we use them?

Ostrom (2011) describes that: “The development and use of frameworks are the most general forms of theoretical analysis. Frameworks identify the elements and general relationships among these elements that one needs to consider for institutional analysis and they organize diagnostic and prescriptive inquiry. They provide a general set of variables that can be used to analyze all types of institutional arrangements. Frameworks provide a metatheoretical language that can be used to compare theories. They attempt to identify the universal elements that any theory relevant to the same kind of phenomena needs to include […] Thus, the elements contained in a framework help analysts generate the questions that need to be addressed when they conduct an analysis.” Concerning theories, Ostrom states: “The development and use of theories enable the analyst to specify which elements of a framework are particularly relevant to particular questions and to make general working assumptions about the shape and strength of these elements. Theories make assumptions that are necessary for an analyst to diagnose a specific phenomenon, explain its processes, and predict outcomes. Multiple theories are usually compatible with one framework.” Lastly, models involve “making precise assumptions about a limited set of variables and parameters to derive precise predictions about the results of combining these variables using a particular theory. Logic, mathematics, game-theory models, agent-based models, experimentation and simulation, and other means are used to explore systematically the consequences of these assumptions on a limited set of outcomes. Multiple models are compatible with most theories.” (Ostrom, 2011:8) Therefore, policy analysts need a common framework and family of theories in order to address this article’s question. Models are too precise and detailed, and can be of use in subsequent phases of research and policy analysis.

To answer the question of this article related to the scientific-approach, it is required to develop such a common framework and deduce a family of theories from that framework. Policy analysts should therefore start to establish a common framework: “the metatheoretical language”. The subsequent step, deducing relevant theories from such a framework, is even more complicated. How can theories be selected and compared?

2.3 Methodologies of science

According to Groenewegen and Vromen (1996) a theory has two dimensions: issues and presuppositions or conditions. The issue that a theory addresses can be seen as ‘the aspect of the set of phenomena’ (Groenewegen and Vromen, 1996:373). For example, “Theories of the Firm” address issues such as the behavior and structure of firms. When “behavior and structures of the firms” are the issues that need to be explained or predicted by a theory in order to answer a particular research question, “Theories of the Firm” are relevant because it addresses these specific elements and relations among these elements. The second dimension relate to the conditions or presuppositions to which the theory subscribes, of which the “scientific methodology” is one of the most important. Issues can often be directly related or deduced from the framework, the conditions or presuppositions relate to the “research domain.”

Groenewegen et al. (2000) distinguish between three general types of “methodologies of science.” Firstly, “methodological individualism” explains (institutional, technical, economical or social) structures by emphasizing on “the individual”. Individuals are assumed to have specific characteristics like full rationality and follow clear rules to maximize profits or minimize costs. These characteristics are given and constant, that is to say that the characteristics of the individual do not change during the analysis due to the influence of changes in other parts of “the system” or “structures.” Secondly, in the case of “methodological holism” the explanation of individuals is reduced to the social whole: the “structures”. Social structures are created intentionally by individuals or emerge as unintended outcomes of their interactions, but according to the holistic approach the social structures have their own specific characteristics, which cannot be reduced to the characteristics of individuals. Groenewegen et al. (2000) describe that the two extremes of “methodological individualism” and “methodological holism” have been strongly criticized: there will often be interaction between individuals and structures. The environment has an influence on individuals and modifies their way of thinking, their norms and their values. The institutions in society create the habits of people and guide their behavior. Simultaneously the actors influence society through both their intentional and unintentional behavior. Actors perpetuate the institutions and give direction to the institutional dynamics. In short: the structures of society are both the
conditioning factor and the outcome of individuals. This perspective is referred to as “methodological interactionism.”

With regard to the dimension of “conditions or presuppositions”, a theory is ‘relevant’ to analyze a particular issue when the theories’ conditions or presuppositions correspond with the conditions or presuppositions in the actual research domain, or ‘real world’. Therefore it must be determined what the conditions or presuppositions are of the research domain “upstream investments”, in terms of the three described methodologies and other conditions or presuppositions, to determine which theories can be “relevant” apart from the issues they are concerned with.

After such an exercise, the policy analyst can still find himself with multiple theories. Groenewegen and Vromen (1996) respond to that: “If different theories can be relevant, the question arises as to how, in a pluralistic approach towards questions of economic organization, the different theories can be combined. […] How many of the identified hard-core propositions need any two theories (or series of theories) have in common with each other to belong to one and the same scientific research program? All of them? Or just a few of them? And must the shared propositions be exactly identical, or are some minor modifications allowed for?” (Groenewegen and Vromen, 1996:366) Their perspective towards “theoretical pluralism” provides useful insight to overcome and structure a situation where multiple theories can be “relevant.”

2.4 Theoretical Pluralism

Theoretical pluralism - in opposition to “theoretical monist (see Groenewegen and Vromen, 1996:371) - could be welcomed for a combination of a pragmatic and a principal reason. Groenewegen and Vromen (1996): “The pragmatic reason is that formulating an all-embracing, all-condition theory is infeasible. The principal reason is that any of these theories is applicable under different conditions. If some theories can be assumed to be applicable under different conditions, they can be said to be complementary. In combination these theories then can be said to give us a riches understanding of some set of phenomena than any of them does in isolation.” Furthermore, different theories may address different aspects of phenomena (issues). Such theories can also be seen as complementary rather than conflicting or supplementary [...] Theoretical pluralism should be embraced only if we think we have good reasons to believe that at least one of the theories gives a better account of the issues it was devised to address than any of the other theories that can be extended to this issue.” (Groenewegen and Vromen, 1996:373)

The considerations of the previous sections can therefore structurally guide identifying, comparing, selecting and combining theories as the theories must be assessed on their following characteristics:

- Issues addressed by the theories – deduced from the framework;
- Conditions under which the theories are applicable – deduced from the “research domain”;

With the constraints related to:

- Extendibility of the theories towards issues addressed by the other theories, when theories are combined which address different issues;
- Contradiction of the explanatory variables between combined theories.

The next chapters will conduct such an exercise for the case of upstream investment-behavior and decision-making of private oil and natural gas firms. Obviously, this structured approach to develop a scientific-perspective – combining perspectives from multiple authors – is widely applicable in any research domain. From a theoretical point of view, the first part of the research question is answered. Before the second part of the research question – related to the process-perspective – will be addressed, theoretical insights from this chapter will be applied to structurally develop a scientific perspective to analyze upstream investments and policy.

3. Development of the “Methodological Interactionistic” Analysis Framework

In line with Ostrom’s definition of a framework, this chapter will briefly elaborate on a developed framework (see figure 1) which can be used to analyze the contribution of policy to upstream investments, and can analyze investment-behavior of firms on the highest level of specificity. (Ostrom, 2005) This “methodological interactionistic framework” consists of all identified elements and general relationships among these elements that are needed to answer the research question of this article. The first objective of this framework is that is can be used to compare theories in the next chapter. A second objective of this framework is that helps to
formulate relevant questions for the analysis which can be addressed by the theories, in the application of the theory in the subsequent phase research.

The developed framework will be briefly described below. As indicated in figure 1, there are three levels containing different elements (green, blue and orange boxes), relations between the elements (A-H) and the possible contribution of policy to these elements (red boxes). The elements and relations among these elements determine firm’s investment behavior (middle black box).

![Figure 1: the “Methodological Interactionistic Analysis Framework” for upstream natural gas investment behavior and policy](image)

3.1 Contextual elements and relations

Technical, regulatory (or institutional) and economic elements and structures determine the context in which upstream investments take place (green box). For example, important technical elements are the size of the prospects and infrastructure availability, institutional characteristics refer e.g. to the formal institutions such as a Mining Act and a Gas Act, and economic elements relate to both upstream and midstream elements. Upstream economic elements are e.g. the access conditions and tariffs to platforms, midstream elements comprise e.g. the wholesale trading mechanism. These contextual elements are internally interrelated as “structures”, but more importantly have an effect on the macro and meso level of the framework.

Relation D indicates the relation between this context and the investment characteristics. Examples are the effect of taxes and, the availability of infrastructure and the availability of prospects on the investments characteristics. The other way around, investments have an impact on the context as for example new investments increase the availability of infrastructure. Relation E indicates the relation between the context and the contractual elements. This relation is substantiated by Williamson (1998) who describes how contracts (institutional arrangements) depend on formal institutions such as laws and regulation. The other way around, the institutional arrangements
structure the market to which the natural gas is sold. Policy might contribute to this context by for example establishing a certain fiscal regime or regulation.

3.2 Macro level: investment characteristics

The macro level concern the elements which determine the investment characteristics. The most important are the economic elements, determining the viability of the investment in terms of expected monetary value (EMV, see WoodMackenzie, 2000) or net present value (NPV). Associated with these economic elements are different sources of uncertainty which impact the viability of the investments. These uncertainties relate to market uncertainties (price and volume risks for selling the natural gas), technical uncertainties such as the possibility of success (POS) of an exploration drilling, but also infrastructural access and tariff uncertainty. Regulatory uncertainty is a third important dimension, as changes in tax-regimes can have an important impact on the viability of the investment. Besides the viability of the investment – in economic terms and associated uncertainties – also investment hold-ups determine the investment. These hold-ups can originate from different sources, such as permitting-issues due to public engagement, the required capital which might exceed the firms economic capabilities, contractual problems leading to postponement or hold-ups, or excessive market uncertainties. The sum of the economic, uncertainty and hold-up criteria determine the investment, and with that the attractiveness of the upstream climate (relation A).

These investment characteristics are interrelated to the context (relation D, see above) but also to the meso level (relation H). Contractual arrangements can mitigate uncertainties and hold-ups by e.g. granting a license or establishing a sales arrangement. Also, the size and type of the investment determines the most adequate contractual arrangement to govern the transaction, e.g. joint-venture structures. Relation F indicates the relation between the investment characteristics and the meso level: the firm characteristics. Different firms have different criteria for investments, and different possibilities to mitigate uncertainties or hold-ups. This is related to the characteristics of the firm, as a large firm (e.g. ExxonMobil) can more properly mitigate the uncertainty of a dry hole drilling within a large exploration portfolio, than a small firm which only has the financial capability for one or two annual projects. Also, the number of investments a firm is engaged with determines the behavior of the firm.

3.3 Meso level: contractual elements and relations

The meso level of the developed framework concerns the contractual characteristics related to the investment and operations. These contracts relate e.g. to the establishment of a joint-venture for license-request and operations (the JOA), contracts to transport and process the natural gas, contracts with suppliers, or the sales contracts with midstream buyers. These contracts determine a firm’s investment behavior as they determine the associated costs of establishing and safeguarding the contracts or transactions (relation B). In addition to that, the contracts determine the level to which uncertainties and hold-ups can be mitigated (relation H, see above). The type of contracts depend on the type of investment (relation H, see above), but also on the formal institutional context in which these contracts are established (relation E). Also, the behavior of the firm is constraint and enabled by the established contacts (relation G). The other way around, firm characteristics determine the possible or desired contract as some firms have more possibilities to establish an own commercial department, or engage as single operator in a license, than other firms. Policy might contributes to these contractual elements by means of certain regulations – as for example the Dutch “small-fields policy” (see Correljé and Odell, 2000).

3.4 Micro level: firm elements and relations

The micro level concerns elements of the firms such as the behavior, strategy, resources and capabilities. These elements are not only interrelated with the meso and macro level (relations F and G), but also determine the attractiveness of the upstream investment climate as such (relation C). As different firms have different resources (capital, knowledge, sales department etc.) and capabilities (tough gas drilling, shale gas fracking) the attractiveness of the upstream investment climate will always be relatively to their firm specific elements. For example, the same prospect can be attractive for firm A, but not for firm B because firm B has other investment requirements (NPV_i > X_n vs NPV_B > X_m,n), more possibilities for investments because firm B operates more internationally, or a higher overhead costs which requires larger projects. Policy might contribute to the behavior of firms by e.g. facilitating or stimulating cooperation and innovation – as this would change the behavior of firms.
3.5 Conclusion: a “methodological interactionistic” framework for analysis

The described “methodological interactionistic framework” identified the elements and relations among these elements which are relevant to answer this studies’ question. Insight is provided which elements determine a firm’s investment behavior, and how policy is related to those elements. This framework can therefore be used to select and compare theories in the next chapter.

As indicated by the framework, there are three levels which determine the attractiveness of the upstream investment climate. These levels are interrelated, as extensively described above. The most suitable “methodology of science” to build a theory on would therefore be “methodological interactionism”. This because the structures (contract structures on the meso level and market structures on the macro level) depend on the behavior of firms on the one hand, and the behavior of firms (on the micro level) depends on these structures on the other hand. Explaining the investment behavior of the firms merely from out the methodological holistic approach, or from the methodological individualistic approach (e.g. WoodMackenzie) would result in a less rich insight. Therefore, this framework is called the “methodological interactionistic framework.” The next chapter will decide which of these elements and relations among these elements are “particularly relevant” to answer the research question, and will develop a subsequent theoretical body.

4. Development of the “Pluralistic Theory of the Firm”

In line with Ostrom (2011), the developed “methodological interactionistic framework” will be used in this chapter to select relevant theories (4.1). These selected theories will be reflected upon, urging the need for a combination of the theories for a more “thorough” picture (4.2). Subsequently, the theories will be combined into the “pluralistic theory of the firm,” based on the guidelines described in 2.4 which were provided by Groenewegen and Vromen (1996) (4.3).

4.1 Selecting relevant theories: issues and assumptions

Porter’s Five Forces

A first relevant theory is Porter’s (1980, 2008) “Five Forces Theory,” because the theory addresses the macro-level issues of the framework (green elements and relations). The theory can make precise assumptions about the contextual elements and relate these to the attractiveness of the upstream industry (relation D and A of the framework). These assumptions are made according to the five forces: internal rivalry, threat of substitutes, entry barriers, power of buyers, and power of suppliers (see Porter, 1980, Porter, 2008). These forces do not only examine the economical elements – such as drivers which determine the NPV or EMV – but can also examine uncertainties and other relevant elements which determine the investment behavior of firms. Moreover, Porter’s theory can examine the contribution of policy to the competitive forces (Porter, 2008). Therefore, the theory is relevant based on the issues it addresses.

Apart from the issues Porter’s theory addresses, the relevance of Porter’s theory also depends on the assumptions made by the theory compared to the assumptions in the research domain. Porter (2008, 2009) states that the theory is applicable under the following conditions of the research domain: (i) methodological holism, (ii) firm’s investment behavior is the function of the institutional framework, and (iii) firms’ investment behavior is the function of industry and market structure. As described in 3.5, the research domain has the conditions of both methodological individualism and methodological holism. Porter’s theory would therefore be relevant, but not capable to explain and predict all of firm’s behavior “thoroughly”, as it overlooks the methodological individualistic character of upstream investments. The other three assumptions are present in the research domain, as described by the framework (see 3.1-3.4). For this research domain, it can be concluded that Porter’s theory is relevant as the assumptions of the theory correspond with the research domain of upstream investments.

Transaction Cost Economics

A second relevant theory is Transaction Cost Economics (TCE) (see Williamson, 1998). TCE can make precise assumptions about the contribution of policy to the meso-level, concerning contractual elements. By working out TCE’s transaction and governance attributes (see Williamson, 1998), it can be determined to what extent policy contributes to the behavior of firms. TCE is therefore relevant as it can examine the most important contractual
element of the framework (blue elements and relations), related to firm’s investment behavior, such as the establishment of joint-ventures and sales agreements of natural gas.

Based on Williamson (1996), the TCE theory is applicable when the research domain is characterized by (Williamson, 1996; Spanjer, 2009; Groenewegen and Vromen, 1996): (i) methodological individualism, (ii) asset specificity, (iii) opportunism, and (iv) contractual incompleteness. As elaborated above, the research domain is characterized by both methodological individualism and methodological holism. Therefore, the TCE theory is relevant but it is only capable to address part of the research domain. It is necessary to complement the theory with other theories, addressing complementary issues and the research domain from a holistic methodology.

Among others, Correljé and Groenewegen (2006), Reuster (2010), Spanjer (2008), Haase (2008) and Helm (2005) have extensively described the presence of the other three assumptions, or the relevance of TCE for analyzing investments in the upstream industry. In brief, asset specificity is an elementary characteristic of both upstream investments and operations. It is identified that there are three types of specificities present for upstream investments (site-, dedicated-, and physical asset specificity). Also opportunism is present. For this study, reference will be made to the two types of opportunistic behavior as identified by Reuster (2010). Firstly, deviations from joint-surplus maximizing within the terms of an existing agreement. This type of opportunism is especially relevant for analyzing the joint-venture structures (JOA and OvS). Secondly, enforcement of renegotiations and modifications of contractual terms in the case unexpected changes in market conditions evolve (Reuster, 2010:12). This form of opportunism is especially relevant for analyzing sales- and transport arrangements. Contractual incompleteness is the product of bounded rationality and uncertainty. As identified by other scholars (among others Hubbard and Weiner, 1986; Spanjer, 2008; Haase, 2009), the assumption of bounded rationality seems reasonable for the upstream industry. Also, there are many uncertainties associated with upstream investments and the sales of natural gas. These uncertainties can be of different nature. Examples are regulatory uncertainty, infrastructural uncertainty, technical uncertainty and market uncertainties, as described by the framework. For this research domain, it can therefore be concluded that TCE is relevant as the assumptions of the theory correspond with the research domain.

Resource Based View

A third relevant theory is Barney’s (1991) resource-based view (RBV) which suggests that it is firm specific differences that drive strategic investments and performance (Peng, 2008, Barney, 1991). Basically, the RBV argues that sustained competitive advantage derives from the resources and capabilities a firm controls that are valuable, rare, imperfectly imitable, and not substitutable. The RBV addresses the investment behavior of firms (issue), by making precise assumptions about the elements firm specific resources and capabilities of the framework. By applying the RBV theory, it can be explained why different firms differently judge the attractiveness of the upstream investment climate, according to their resources and capabilities. The RBV addresses the orange elements and relations (issues) of the framework.

Barney (2001a) elaborates that the RBV initially was positioned relative to the structure-conduct-performance (SCP) paradigm (Barney, 1991) The SCP paradigm, assuming that resources and capabilities are elastic in supply, was challenged by the RBV which points at the path-dependent element which result in limited elasticity in some industries (Barney, 2001:645). The core presuppositions of the RBV are (Barney, 2001a:649): (i) methodological individualism, (ii) resources and capabilities can be heterogeneously distributed across competing firms, (iii) differences in resources and capabilities can be long lasting, and that they can help explain why some firms consistently outperform other firms. As stated earlier, the research domain has the conditions of both methodological individualism and methodological holism. RBV theory would therefore be relevant, but not capable to explain and predict all firm’s behavior, as it overlooks the methodological holistic character of upstream investments. Resources and capabilities are indeed heterogeneously distributed across competing firms in the research domain. Examples of such resources are capital resources, infrastructural ownership resources, knowledge resources and capabilities to perform certain activities (e.g. fracking technologies). Also, these differences can be long-lasting. For the research domain of this study, it can therefore be concluded that the RBV is relevant on the basis of its presuppositions (see also De Haas, 2007).

4.2 Reflecting on the selected theories: the need to combine theories
To answer the question of this article, all relevant elements and relations from the framework must be addressed. As there does not exist a theory which takes into account all issues – as identified in the previous section – this article must develop a theory. The three identified and described theories above are found to be relevant as each of them addresses a relevant set of elements and relations (issues), and the assumptions of the theory correspond with the research domain. In general, all three theories address the issue of investment behavior of firms. However, not all relevant relations of the framework are addressed by the sum of the three theories. Insight concerning these relations (F, G and H in figure 1) can only be generated by combining insight from the theories. This potential synergy provides a first argument for combining the theories.

In addition to that, analyzing the contribution of policy to investment behavior of firms by some of the three theories would result in an incomplete picture of the “methodological interactionistic” research domain. The need to approach the research domain from such a interactionistic methodology provides a second argument for a combination of theories, instead of only applying one or two of the theories.

Apart from these two considerations, the individual theories also have other shortcomings. By combining theories, shortcomings of theories can be compensated – resulting in a more rich and relevant theory for analysis to answer the research question more thoroughly.

The main shortcoming Porter’s theory is that it assumes that parties (e.g. upstream producers and midstream buyers) do not interact. Another shortcoming is that it is not feasible to evaluate the attractiveness of an industry independent from the resources and capabilities of specific firms. Porter does not recognize this in his theory. As these two features – and other such as asset specificity – are not recognized by Porter, applying only Porter’s theory would result in an incomplete picture of the research domain.

A shortcoming of TCE is that it explains investment behavior only by putting the transaction central in the analysis. Although the transaction certainly can be an explaining phenomenon to some extent, upstream investments are taken on a much more variety of criteria. TCE does not place the investment hold-up stemming from safeguarding the transaction (and mainly behavioral uncertainty) relatively to other explaining variables such as environmental uncertainties (e.g. dry-hole uncertainty) which might be of other magnitudes, and on which governance arrangements have no effect. By establishing a more comprehensive set of explaining variables for a possible investment hold-up, the relative explaining power of TCE can be argued by comparing the transaction costs with other variables.

Lastly, RBV’s main shortcoming is also the limited scope of explaining investment behavior. Firms with similar resources and capabilities can come to other investment decisions when they, for example, establish different governance arrangements with other firms. The interaction between firms is therefore overlooked by the RBV.

Concluding, combining the theories would subscribe better to the methodological interactionistic nature of the research domain, incorporates all relevant elements and relations of the framework, gives synergies when insight from the three theories is combined, and it can be used to compensate shortcomings of the individual theories. Therefore, there is a strong need to combine the three theories. The next paragraph will attempt to satisfy this need. When the theories can be combined, chapter 5 will again reflect on the combined theory.

**4.3 Combining the theories: the ”pluralistic theory of the firm”**

*Extendibility*

Groenewegen and Vromen (1996) distinguish between extensible and non-extensible theories. “Non-extensible theories are theories that are not only silent on other issues, but that also cannot be brought to bear on other issues. Extensible theories are theories that can be brought to bear on other issues.” (Groenewegen and Vromen, 1996:374).

Both RBV and TCE share the assumptions of methodological individualism, and both theories are silent about the majority of conditions under which the alter theory is applicable. The stringent difference between the two theories is, however, the “unit of analysis”. Where the firm’s resources and capabilities is the central variable in the RBV theory which explains a firm’s behavior, the transaction is the explaining variable for the TCE theory. Both theories focus on different elements of the framework to address the same issue. Also, the RBV is relevant when the behavior of the firm is explained because firms act to maximize resources and capabilities, where TCE
is relevant when the behavior of the firm is explained by addressing elements aimed at minimizing transaction costs. The RBV can therefore not be extended to TCE. Conner (1991) and Mahoney (2001) discuss where the RBV stands relative to TCE. Mahoney argues that, in the line of Williamson (1975), resources and capabilities are being developed within a firm in superior ways to market contracts. This is not because of the absence of opportunism as Conner (1991) assumes, but because of a certain level of opportunism, and the subsequent governance forms as explained by TCE (Mahoney, 2001:654). Therefore, in line with Barney (2001) and Mahoney (2001), it is concluded that TCE cannot be extended to the RBV to that both theories are rather complementary because RBV is a theory of the firms rent and TCE a theory of the existence of the firm.

The RBV theories’ assumption of methodological individualism is hard to extend to Porter’s assumptions of methodological holism without drastically changing the assumptions of the RBV theory. These theories could maximally be combined. Where Porter focuses on external elements that explain and predict the behavior of firms, RBV focuses on internal firm-specific resources and capabilities that explain and predict the behavior of firms. Barney (1991) elaborates that both theories cannot be unified because the level of analysis is too different, and that both theories are complementary to each other. (Barney, 1991:100) Extending Porter’s theory of the firm to TCE or RBV is, as mentioned before, problematic because Porter departs from methodological holism. Also the methodological individualistic TCE cannot be extended to the methodological holistic theory of Porter.

Conflicts

There are two conditions which are different between the three relevant theories. The first is the difference between Porter’s theory and both RBV and TCE. The methodological holistic condition of the first theory and the methodological individualistic condition of the two latter. The second difference is the presupposition of the RBV that firms behave to maximize their resource and capabilities, where TCE explains or predicts the same behavior but assumes that this behavior is driven by minimizing transaction costs. This section will address whether these two categories of differences are contradicting or that these differences can be overcome within a pluralistic theory.

Groenewegen and Vromen (1996): “Theoretical pluralists cannot accept just any combination of theories. If theories, or their central claims, contradict each other, then their lasting co-existence is unacceptable to theoretical monists and pluralists alike. For accepting contradictions implies acceptance of "anything goes": all conceivable theories (including ones that are clearly nonsensical) are equally acceptable. Theories may conflict with each other, for example, in what is seen as the central explanatory variable for some given set of phenomena (issue).” (Groenewegen and Vromen, 1996:371)

So, because Porter’s theory addresses different phenomena to explain the same issue (firm behavior) relative to TCE/RBV, the theories are not conflicting. As the next section will point out, the fact that Porter’s theory and TCE/RBV differ in their methodology, makes them suitable candidates for a pluralistic theory of the firm because the research domain has the condition of methodological interactionism. With that, the research domain asks for either a theory which conditions methodological interactionism or a pluriform theory which takes into account both methodological individualism and holism for a richer understanding of the research domain than one of the two perspectives would create. Because TCE and RBV both address other categories of elements – both relevant to answer the research question according to the framework – and therewith different phenomena relevant to the same issue, the two theories are not contradicting each other but can be rather complementary.

Pluralism

Based on the issues and conditions of the theories, the table below presents the pluralism of TCE with the RBV theory and Porter’s theory (see table 1).

TCE is complementary with Porter’s theory because they both address the same relevant issue – firm investment behavior – but depart from different conditions, which are all relevant to make explanations of the issue within the research domain (see also Reuster and Neumann, 2009; Reuster, 2010 and Nickerson, 1997). TCE is complementary with Porter’s theory as both theories subscribe to different non-rival phenomena to explain the behavior of firms. Also RBV and Porter’s theory are complementary because of these arguments (see Barney, 1991; Lockett and Thompson, 2001; Mahoney, 2001; Combs and Ketchen, 1999). Combining the three theories
into one “pluralistic theory of the firm” is legitimate because the theories are complementary, non-rival and enrich the total understanding of the same issue.

Table 1: “pluralistic theory of the firm”

<table>
<thead>
<tr>
<th>Issues</th>
<th>Conditions</th>
<th>Same</th>
<th>Different</th>
</tr>
</thead>
<tbody>
<tr>
<td>Same</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Different</td>
<td></td>
<td>RBV</td>
<td>Porter</td>
</tr>
</tbody>
</table>

Concluding, the three theories can be combined into one new “pluralistic theory of the firm”. The next paragraph will reflect on this new theory by describing the added value, shortcomings and applicability. The need to integrate this scientific-approach with a process-approach for “thorough” policy analysis will be stressed in chapter 5.

4.4 Reflection on the “Pluralistic Theory of the Firm”

This “pluralistic theory of the firm” has several advantages compared to the individual theories. The created additional insight goes beyond the scope of the theory - meaning that the theory does not only address more issues, but addressing issues differently, namely with more eye for the interrelatedness. This is further explained below.

First of all, the pluralistic theory is capable to address the methodological interactionistic nature of the research domain. This creates additional insight in the contribution of policy to the attractiveness of the upstream investment climate. Secondly, this theory can be used to explain what policy makers might overlook, when they address the issue e.g. from a holistic methodology. This is enabled by the comprehensive and exploratory nature of the theory. Thirdly, the relations between the three levels of the framework (H, F, G in figure 1) - which are not especially dealt with by one particular theory - can be examined by this pluralistic theory of the firm. Explanations from one level can possibly also contribute to the understanding of the issue in another level. For example, insight from the micro-level (RBV) can help to explain issues on the macro-level (Porter). Therefore, the shortcomings of the individual theories (see 4.2) are compensated by the pluralistic theory of the firm as actor-interaction, firm-specific, and investment-specific characteristics can all be included in analysis.

This particular “theory of the firm” is applicable to research domains in which the same conditions are present as in the research domain of upstream investments, and when the central issue is concerned with the behavior of firms and policy. When the problem statement would be different (e.g. explain firms behavior on basis of internal organization, instead of related to policy), another framework would be constructed and other elements would be relevant. Therefore, this specific theory is not very general, and can merely be applied to other research domains which have the same conditions, to address the same kind of issues. The limitations of the theory will be stressed in the next section. Ultimately, the previous sections illustrated how the suggested – generally applicable – structural approach to develop a scientific perspective can be applied.

Partly, the research question of this article is answered. A structured approach to develop a scientific-perspective was provided in general (chapter 2), and this theoretical approach was applied for the research domain of upstream investments (chapters 3 and 4). The next chapters will attempt to answer the residual part of the research question: how is the process-approach related to the scientific-approach to policy analysis?
5. The need to integrate the scientific-approach with the process-approach

Where the previous three chapters provided a structured scientific-perspective to generate insight about the research domain for policy makers and analysts, this chapter will place the scientific-approach in perspective of the process-approach.

The “pluralistic theory of the firm” also has limitations for “thorough” policy analysis. Although the theory can contribute to explore and identify different variables, and make precise assumptions about these different variables, the many variables are, however, of different nature (e.g. “permitting”, “transaction costs of sales-arrangements”, “POS”). This makes it hard to “rank” or “compare” the relative contribution of these different variables, especially as these variables may originate from three different theories. A second limitation is that the operationalization of the identified variables of the theory is associated with normative perceptions concerning e.g. entry-barriers and the contribution of certain policy means to the behavior of firms in general. Working with this theory would therefore involve interviews, surveys or Delphi-panels to generate the required empirical information. This can be a limitation for the scalability and labor-intensity of working with this particular theory.

In line with the limitations of the “pluralistic theory of the firm,” it can be questioned whether analysis of the research domain from a merely scientific-approach is sufficient for comprehensively understanding and analyzing the policy and the research domain. This question originates from scholars such as Allison (1971) and Rittel and Webber (1973) who state that decision-making is not always based on rational approaches, derived from scientific analysis as implied by e.g. Drucker (1967) or Hoogerwerf (1998). This is caused by cognitive abilities and information asymmetries who limit rational and full-informed decision-making (Simon, 1997; Lindblom and Woodhouse, 1993), and the presence of mutual dependency of policy makers with the actor-network (De Bruijn and Ten Heuvelhof, 2008). As indicated in the introduction, decision making regarding natural gas policy is characterized by these phenomenon. Therefore, it is required to include politics in the policy analysis. This is referred to as the process-perspective to policy analysis. This perspective departs from the assumption that with policy-making on wicked problems (see Rittel and Webber, 1973) in a network of mutual-dependent actors and decision making characterized by information asymmetry, the regulatory regime – being the set of policy objectives, -instruments and -processes – strongly interacts with the nature of the actor network and the nature of the research domain. All these elements and relations among these elements are dynamic over time, and are related to the external context. The next chapter will present the “integrated policy framework,” which integrates both perspectives, elementary for “thorough” policy analysis.

6. The “Integrated Policy Framework”

Figure 2 below illustrates the “integrated policy framework”. This framework is established to add to the needs stressed in the previous section. Eventually, this integrated policy framework is aimed to structure future policy making and analysis by combining both scientific- and process perspectives. The framework will be described (6.1) and it will be stressed how it adds to the needs stressed in the previous section (6.2) and how it can be applied (6.3).

6.1 Elements and relations of the “Integrated Policy Framework”

The framework consists of 5 main elements, which together are named the policy context. These elements will be briefly described below.

The research domain

In this article the research domain is “the upstream natural gas investment climate.” In this general framework, the research domain can be any other as well. In general, any research domain can be characterized by structures, interactions and behavior of agents (Groenewegen et al, 2000). By applying the general approach of Ostrom, a specific framework (e.g. the methodological interactionistic framework in this research) can be developed to identify the elements and relations within the research domain. Also, the general approach of Groenewegen et al. (2000) can be applied to determine a suitable methodology to approach the research domain. When necessary, such a specific framework can be used to develop a theory (by using the general approach of Vromen and Groenewegen, 1996) or a model.
This first element of the integrated policy framework can be used to structurally determine the contribution of the policy to the research domain (relation 2) and the involvement of the actor network in the research domain (relation 3). This determines the extent to which the policy makers has autonomous power to influence the research domain, or to what extent they depend upon the actor network to realize their objectives. By linking the research domain to the problem perceptions of the policy maker and the actor network, the context and nature of the problem can be analyzed (see De Bruijn and Ten Heuvelhof, 2008). For example, the policy maker can hierarchically contribute to issues the research domain, or the policy maker depends on the actor-network to realize certain objectives.

![Diagram of the Integrated Policy Framework](image)

**Figure 2: the “Integrated Policy Framework”**

The nature of the actor network

The nature of the actor network can be characterized by its composition, closedness, variety, dynamics, etc. in line with the theory of De Bruijn and Ten Heuvelhof (2008). In addition to that, the dynamics of the actor network must be taken into account by the analyst. Also, the interaction of the actor-network with the external context must be included. This determines the involvement of actors in other arenas (also see De Bruijn and Ten Heuvelhof, 2008)

By extensively analyzing the actor network, the contribution of the different actors to the research domain can be placed in a dynamic perspective (relation 3); different behavior of different actors within this research domain (relation 3) and different problem perceptions of actors – depending on their characteristics – can be analyzed (relation 4).

The policy maker

The policy maker can be analyzed on his problem perception, relatively to that of the actor network (relation 4 versus 5). The actual decisions of the policy maker on the policy instruments (relation 1) can be evaluated on the extent to which those problem perceptions are aligned. By linking the policy maker to the external context, it can be explained how the decisions of the policy depend upon other drivers such as other ministerial-obligations, formal and informal institutions, other policy domains and the path-dependent nature of the policy maker towards the problem perception. It is elementary to understand the dependency of the policy maker on the actor-network to realize its objectives (relation 2 versus 3), as this can be a driver for a certain process design (relation...
either aimed at substance or support. Also, by linking the behavior of the policy maker to the external context, phenomenon such as framing or tagging can be explained (see De Bruijn and Ten Heuvelhof, 2008).

The decision making process

The decision for the policy maker upon a certain process (relation 6) can be evaluated upon the needs of the policy maker: generate (i) substance and (ii) support. Is the process suitable to (i) include the problem perceptions of actors into the policy trade-offs (relation 10 and 7)? Which problem perceptions are overlooked (alignment relation 5 and 10), and how can this be explained? Possibly, this can be explained by the process design (relation 6), which includes or excludes certain parties, or the external context of the policy maker. (ii) Is the process suitable to generate sufficient support to (a) engage in the process or create a sense of urgency (this can explain strategies such as framing). Or, (b) is the process suitable to influence the behavior of the actor-network (relation 9 and 3), or actually contribute to the (negotiated) content of the policy (relation 8)?

The actual policy.

Lastly, the actual policy can be analyzed on its contribution (relation 2) to the research domain. Also, it can be determined how the policy was developed. The policy can be the result of the decision making process (relation 8), or the behavior of the policy maker (relation 1). The latter must be placed in the perspective of the external context of the policy maker, as this allows the analyst to trace the objectives and instruments of the policy. Finally, it can be determined how the contribution of the policy (relation 1) corresponds with the problem perception of the actor-network (relation 4), are there any residual challenges? The existence of certain residual challenges can, in turn, be explained by the external context of the policy maker (the policy maker is aware of these challenges but decided not to address these, because of e.g. European antitrust or other ministerial-responsibilities) or the substance associated with the policy maker’s decisions (e.g. the process was insufficient to generate sufficient substantive insight about the challenges, or no sense of urgency was present).

6.2 Advantages of the “Integrated Policy Framework”

Structuring policy analysis according to the integrated policy framework, has certain advantages over applying the classical process-perspective (see e.g. De Bruijn and Ten Heuvelhof, 2008) or merely applying the scientific-perspective.

Firstly, the framework supports policy analysts to take into account the differences between various modes to policy making. Policies which are merely process-based (the policy depends completely on relation 8), merely hierarchical (the policies depends completely on relation 1) or hybrid modes can all be analyzed. This insight can be linked to the trade-off of the policy maker, as some policies require substance from the actor network (relation 7) when the problem perception of the policy maker is limited due to information asymmetry (relation 5). Also, the decided mode of policy making can be linked to the needs of the policy maker – being their dependency on the actor network to realize their objectives (relation 3 relatively to relation 2).

Secondly, the framework can be used to determine the contribution of the decision making process to the content of the policy (relation 8), and most importantly the contribution of the policy to the research domain (relation 2). This in opposite to De Bruijn and Ten Heuvelhof (2008), who remain limited to the criteria “have any problems been solved?”

Thirdly, the framework stimulates the analyst to study the actor-network more thoroughly, in relation to (i) the dynamics of the network, (ii) involvement of actors in other arenas and their power (external context), (iii) their different problem perceptions, and (iv) their involvement and behavior associated with the decision-making process. These aspects can explain the design of the decision-making process, the fairness of the process and the extent to which the policy contributes to the problem perception of those actors.

By analyzing the external context of the policy, certain phenomenon like path-dependent beliefs on the research domain and the interdependency with other policy domains can be taken into account. This is especially relevant to trace the contribution of the policy maker to the policy.

Also, the framework emphasizes on the normative insights which are required to operationalize insights from the research domain (relation 4). It illustrates how the involvement of certain actors with certain problem
perceptions (relation 6 and 10), can result in certain policy instruments (relation 8) or insight for the policy maker (relation 7).

Lastly, the framework supports to determine to which extent the policy changes the behavior of the actor-network (relation 3), derived from their involvement in the process (relation 9) or changes made to the research domain (relation 2 and 4).

6.3 Applicability

In general, the framework should be used as described by Ostrom (2005). It is a “metatheoretical language” which helps to structure the most relevant elements and relations between these elements to approach a policy problem. The framework should not be used prescriptive, but assists the policy analyst to link different disciplines (policy, economical, behavioral etc.) and supports the analyst to decide upon relevant theories for in-depth analyses.

**Applicability for policy analysts**

Policy analysts can use the framework to decide upon relevant theories for policy analysis and research-domain analysis. By identifying the context and nature of the problem (derived from the research domain in general, and the involvement of the actor network) and the content of the problem, the analyst can determine the most relevant policy analysis theory. For example, when the policy maker can hierarchically and fully-informed decide upon the policy to realize its objectives, and does not depend on the actor-network for support or substance, the project-approach to policy analysis is the most relevant. The theories of e.g. Hoogerwerf (1998) can be used to make precise assumptions about the most relevant elements and relations in such a case (only relations 1, 2, 5).

In addition to that, the framework supports the policy analyst to develop specific frameworks, theories or models to determine the contribution (process-approach) or effects (project-approach) of the policy to the research domain (relation 2). This development can be conducted along the general guidelines provided by Ostrom (2005), Groenewegen et al. (2000) and Groenewegen and Vromen (1996).

Moreover, when the context and nature of the problem requires a process-approach, the framework can support the analyst to analyze and evaluate (or monitor) the policy on the following criteria:

- **Decision making process: set-up (relation 6 and 10)**
  - Is the process set-up fair (see De Bruijn and Ten Heuvelhof, 2008: core-values, etc.)
  - Are all relevant actors included in the process?
  - Is the set-up (e.g. consultation/hybrid vs negotiation/classical process-design) aligned with the needs of the policy maker? (e.g. can it result in enriched substance, can it result in a negotiated problem perception, can it result in policy instruments or agreements)

- **Decision making process: contribution to the policy and actor-network (relation 7, 8 and 9)**
  - Does the process contribute to substance for the policy maker? (substantial learning)*
  - Does the process contribute to the behavior or problem perception of the actor-network? (substantial and positional learning)
  - Does the process contribute to the policy? (agreements between policy maker and actor-network on e.g. objectives or instruments)
  - Have long-lasting relations developed? (see De Bruijn and Ten Heuvelhof, 2008)

- **Policy: content**
  - What are the objectives of the policy, how are these objectives developed (relation 1 and 8) and what is the distinctness of these objectives?
  - What are the instruments of the policy, how are these objectives developed (relation 1 and 8) and what is the distinctness of these objectives?

- **Policy: contribution to the research domain (relation 2)**
  - What is the contribution of the policy to the research domain?
  - How does this contribution add to the problem perceptions of the policy maker and the different actors?
By elaborating on these criteria, and using the research domain, external context and actor-network as sources for explaining these criteria, the framework provided a structured approach to analyze and evaluate policies from both a process-perspective and a scientific-perspective more thoroughly.

Finally, the framework makes clear that insight from the research domain (e.g. by applying the pluralistic theory of the firm) requires the involvement of the actor network to operationalize these insights or to rank these insights for a comprehensive insight in the research problem.

**Applicability for policy makers**

The integrated policy framework can also be of use for policy makers. Firstly, it provides them guidelines how the contribution of policy (relation 2) to the research domain can be analyzed. Policy makers can use or develop a framework, theory or model as this can substantiate their problem perception (relation 5). Secondly, it can support their exploration for trade-offs which have to be made regarding the design of the decision-making process (relation 6). For example:

- **Information asymmetry**: do the policy makers have sufficient insight on the research domain to make substantiated decisions (relation 1 and 5)? Or is a process required to generate substance out of the actor network? (relation 7)

This is especially relevant when the policy-context is characterized by a variety of actors who all have normative problem perceptions. A process might add to the substance of the policy maker in general, but most importantly, the process can aggregate process perceptions and support the ranking or prioritizing of problem perceptions. A process can result in substantial and positional learning, adding to the information asymmetry. A combined approach can also be applicable. For example, when the policy makers have developed a theory to explore for the contributing factors of the policy to the research domain (e.g. pluralistic theory of the firm), they can decide upon a certain process which is aimed to operationalize these insights or rank these insights.

- **Dependency on the actor network**: do the policy makers have autonomous power to contribute to the research domain (relation 2), or is there a dependency on the actor network to realize the policy objectives (relation 3)

This might determine the mode of decision making process. When the policy maker depend upon the actor network, it might be required to negotiate on (certain aspects of) the policy content (relation 8). Also, it can be possible that the policy makers want to directly influence the behavior of the actor network (relation 9), by e.g. facilitate cooperation or private-collaboration as result of the decision making process.

The integrated policy framework is generally applicable to structure policy-analysis on wicked problems in research domains characterized by a multi-actor context. The main added value is that is incentivizes a policy analyst to address both the regulatory regime and the research domain. Still, policy analysis remains a tailored exercise, as developing a theory or model to determine the contribution of the policy to the research domain is case-specific. The integrated policy framework provides guidelines how a theory can be developed, as illustrated in chapters 2-4 of this article. Integrating a research-specific theory such as the “Pluralistic Theory of the Firm” with policy-context-specific insights from a process-perspective to policy analysis adds to the overall insights of the policy context and research domain as illustrated in this article.

7. **Conclusions and recommendations for further research**

This article aimed to answer the question: “How can policies, aimed at contributing to upstream investments, structurally be approached and analyzed from a scientific- and a process-perspective?” It can be concluded that investment-behavior of firms can be examined by developing a suitable scientific perspective, such as the “Pluralistic Theory of the Firm”. General guidelines – derived from Ostrom (2005) and Groenewegen and Vromen (1996) – were elaborated upon. These guidelines can structure such theoretical analyses in general. Out of these guidelines, the “Pluralistic Theory of the Firm” was developed as relevant theory to examine investment-behavior of oil firms, related to policy. To thoroughly relate this investment-behavior to policy, this study developed the “Integrated Policy Framework.” It was stated that a scientific-approach – such as the “Pluralistic Theory of the Firm” – must be integrated with insights from a process-approach. This enables an analyst to thoroughly analyze the research domain and the policy-context, by taking into account the decision-
making process, the external context, the actor-network, the research domain, the policy maker and factual policy, and the interdependency. Still, to operationalize the “Pluralistic Theory of the Firm,” and to thoroughly understand problem perceptions of actors, normative values are indispensible. It is up to the policy analyst to aggregate these normative values.

Further research can add to this paper by applying the “pluralistic theory of the firm” on a particular case in the natural gas sector. Also, applying the “integrated policy framework” on other research domains can further improve the theory and framework. The main challenge of this framework is to include normative values from the actor-network – by e.g. interviews, surveys or Delphi-panels. In addition to that, the framework can be used to explore for the most relevant elements of the policy context, but additional theories on (i) path-dependent beliefs of the policy maker, (ii) developments of the actor network, and (iii) the interaction of the policy context with other arenas and policy domains need further work. This article provided a structured approach to integrate the research domain to the policy context, by suggesting e.g. Ostrom’s (2005) and Groenewegen and Vromen’s (1996) approach. The framework can be further developed with structured theoretical approaches to analyze the three other mentioned elements of the framework.

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## Appendix 1: Actor Analysis

### Upstream Actors:

<table>
<thead>
<tr>
<th>EBN (see 1.4): Problem owner</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Brief description</strong></td>
<td>EBN is the state-participant in almost all exploration and production activities in the Netherlands. The Mining Act obliges license holders of exploration and production rights to ask EBN to take part in the Agreement of Cooperation (OvS)</td>
</tr>
</tbody>
</table>
| **Role in Gas Roundabout Network** | Advice EL&I on upstream investment climate  
Participate in OvS  
Share-holder GasTerra (40%) |
| **Ownership** | EL&I (100%) see [www.ebn.nl](http://www.ebn.nl) |
| **Objective** | Maximize utilization of Dutch subsurface and contribute to sustainable Dutch energy provision |
| **Attitude towards Gas Roundabout** | Positive when it positively contributes to objective and actively sets right regulatory regime and actively facilitates upstream investments |
| **Power towards Gas Roundabout** | Big constructive power as advisor of EL&I: advise on gas roundabout policy  
Big constructive power as participant in OvS (eagle-eye capabilities)  
Constraint by public task |
| **Interest towards Gas Roundabout** | High, possibility to put upstream on the policy agenda |

<table>
<thead>
<tr>
<th>Oil Firms (large, medium, small)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Examples</strong></td>
<td>Large (NAM, Total, ExxonMobil), Medium (Wintershall, Gdf, TAQA, Centrica), Small (ONE, Tullow, NPN, Vermilion, Smart, Tulip oil, etc.)</td>
</tr>
<tr>
<td><strong>Brief description</strong></td>
<td>Active in license as operator of non-operator (NOV). Request for license, invest, operate in exploration and production activities</td>
</tr>
<tr>
<td><strong>Role in Gas Roundabout Network</strong></td>
<td>Execute E&amp;P activities and contribute to objective EBN, and EL&amp;I Problem and solution streams looking for support of NOGEPA, other oil firms, EBN and EL&amp;I</td>
</tr>
<tr>
<td><strong>Ownership</strong></td>
<td>Public (stock exchange shareholders), Private (Privately owned by individual shareholders or private equity firms)</td>
</tr>
<tr>
<td><strong>Objective</strong></td>
<td>Maximize shareholder profit</td>
</tr>
<tr>
<td><strong>Attitude towards Gas Roundabout</strong></td>
<td>Neutral</td>
</tr>
<tr>
<td><strong>Power towards Gas Roundabout</strong></td>
<td>High constructive power</td>
</tr>
<tr>
<td><strong>Interest towards Gas Roundabout</strong></td>
<td>Low, it is not clear how it will contribute to their objectives</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>Investors in E&amp;P activities</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Example</strong></td>
<td>Dyas, Lundin, Marathon Oil, etc.</td>
</tr>
<tr>
<td><strong>Brief description</strong></td>
<td>NOV in joint-operating agreements (JOAs), and with that financially involved to partner operator (oil-firms)</td>
</tr>
<tr>
<td><strong>Role in Gas Roundabout Network</strong></td>
<td>Finance JOAs and license-holders</td>
</tr>
<tr>
<td><strong>Ownership</strong></td>
<td>Public (stock exchange shareholders), Private (Privately owned by individual shareholders or private equity firms)</td>
</tr>
<tr>
<td><strong>Objective</strong></td>
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<td><strong>Attitude towards Gas Roundabout</strong></td>
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<td><strong>Power towards Gas Roundabout</strong></td>
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</tr>
<tr>
<td><strong>Interest towards Gas Roundabout</strong></td>
<td>Low, it is not clear how it will contribute to their objectives</td>
</tr>
<tr>
<td><strong>Private infrastructure owners and operators (off-shore)</strong></td>
<td></td>
</tr>
<tr>
<td>---</td>
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</tr>
<tr>
<td><strong>Example</strong></td>
<td>Transmission (e.g. NOGAT-joint venture consisting of EBN and other oil firms and investors), Pipelines and platforms (oil firms)</td>
</tr>
<tr>
<td><strong>Brief description</strong></td>
<td>Owner and operator of off-shore infrastructure, setting tariff, decide on extend, abandon and invest, determine access conditions</td>
</tr>
<tr>
<td><strong>Role in Gas Roundabout Network</strong></td>
<td>Enable license holders (oil firm(s) and possible other JOA-partner NOVs) to connect their production to the market.</td>
</tr>
<tr>
<td><strong>Ownership</strong></td>
<td>Private (oil firms) and EBN partly only for transmission infrastructure</td>
</tr>
<tr>
<td><strong>Objective</strong></td>
<td>Maximize share holder profit EBN: maximize tie-in conditions for prospects and existing reserves</td>
</tr>
<tr>
<td><strong>Attitude towards Gas Roundabout</strong></td>
<td>Neutral</td>
</tr>
<tr>
<td><strong>Power towards Gas Roundabout</strong></td>
<td>High constructive power</td>
</tr>
<tr>
<td><strong>Interest towards Gas Roundabout</strong></td>
<td>Low, it is not clear how it will contribute to their objectives</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>State Supervision on the Mines (SodM)</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Brief description</strong></td>
<td>Advice ministry on HSE, social responsibility and operations of new and existing license-holders’ activities</td>
</tr>
<tr>
<td><strong>Role in Gas Roundabout Network</strong></td>
<td>No particular role</td>
</tr>
<tr>
<td><strong>Ownership</strong></td>
<td>100% EL&amp;I</td>
</tr>
<tr>
<td><strong>Objective</strong></td>
<td>Ensure that extraction of natural resources occurs on a social responsible way</td>
</tr>
<tr>
<td><strong>Attitude towards Gas Roundabout</strong></td>
<td>Neutral</td>
</tr>
<tr>
<td><strong>Power towards Gas Roundabout</strong></td>
<td>Low</td>
</tr>
<tr>
<td><strong>Interest towards Gas Roundabout</strong></td>
<td>Low</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>TNO Subsurface</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Brief description</strong></td>
<td>Non-profit Dutch institute focused on applied science such as the sub-surface</td>
</tr>
<tr>
<td><strong>Role in Gas Roundabout Network</strong></td>
<td>Advices EL&amp;I and EBN on subsurface Distribute and build knowledge and data on subsurface, possibly to assist license holders</td>
</tr>
<tr>
<td><strong>Ownership</strong></td>
<td>Privately independent company, under TNO-Act</td>
</tr>
<tr>
<td><strong>Objective</strong></td>
<td>Perform applied sciences as Dutch institute</td>
</tr>
<tr>
<td><strong>Attitude towards Gas Roundabout</strong></td>
<td>Neutral</td>
</tr>
<tr>
<td><strong>Power towards Gas Roundabout</strong></td>
<td>Medium, can support oil firms</td>
</tr>
<tr>
<td><strong>Interest towards Gas Roundabout</strong></td>
<td>Low</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>NOGEPA (Dutch Association of Oil and Gas Exploration and Production companies)</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Brief description</strong></td>
<td>Represent oil- and gas firms active in the Netherlands</td>
</tr>
<tr>
<td><strong>Role in Gas Roundabout Network</strong></td>
<td>Represent oil firms, but also facilitate collaboration between firms. Advice oil firms on operations and other issues. Advice EL&amp;I on Dutch Mining Climate</td>
</tr>
<tr>
<td><strong>Ownership</strong></td>
<td>Association, owned by members (all oil firms in the Netherlands)</td>
</tr>
<tr>
<td><strong>Objective</strong></td>
<td>Efficient, safe and environmental-friendly extraction of Dutch oil and gas resources</td>
</tr>
<tr>
<td><strong>Attitude towards Gas Roundabout</strong></td>
<td>Neutral</td>
</tr>
<tr>
<td><strong>Power towards Gas Roundabout</strong></td>
<td>High, many possible roles to facilitate investments and cooperation, advise ministry</td>
</tr>
<tr>
<td><strong>Interest towards Gas Roundabout</strong></td>
<td>Low</td>
</tr>
</tbody>
</table>
### Governmental Actors

#### Dutch Ministry of Economic Affairs, Agriculture and Innovation (EL&I, formerly: EZ)

<table>
<thead>
<tr>
<th>Brief description</th>
<th>Dutch ministry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Role in Gas Roundabout Network</td>
<td>Responsible for setting and conducting the gas roundabout policy and organizing the platform</td>
</tr>
<tr>
<td>Ownership</td>
<td>-</td>
</tr>
<tr>
<td>Objective</td>
<td>Actively facilitate investments, setting the right regulatory regime (related to gas roundabout): Secure supplies of natural gas on a European and national scale while maximizing the value of the Dutch gas industries’ competitive advantages</td>
</tr>
<tr>
<td>Attitude towards Gas Roundabout</td>
<td>Positive</td>
</tr>
<tr>
<td>Power towards Gas Roundabout</td>
<td>High</td>
</tr>
<tr>
<td>Interest towards Gas Roundabout</td>
<td>High</td>
</tr>
</tbody>
</table>

#### Dutch Local Governments

<table>
<thead>
<tr>
<th>Brief description</th>
<th>Dutch provinces and municipalities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Role in Gas Roundabout Network</td>
<td>Responsible for permitting</td>
</tr>
<tr>
<td>Ownership</td>
<td>-</td>
</tr>
<tr>
<td>Objective</td>
<td>Minimize burdens of infrastructural and E&amp;P projects for citizens</td>
</tr>
<tr>
<td>Attitude towards Gas Roundabout</td>
<td>Neutral (NIMBY)</td>
</tr>
<tr>
<td>Power towards Gas Roundabout</td>
<td>High</td>
</tr>
<tr>
<td>Interest towards Gas Roundabout</td>
<td>Low</td>
</tr>
</tbody>
</table>

#### European Commission DG Energy

<table>
<thead>
<tr>
<th>Brief description</th>
<th>European Directorate General</th>
</tr>
</thead>
<tbody>
<tr>
<td>Role in Gas Roundabout Network</td>
<td>Developing a European energy policy which aims at the creation of an internal liberalized gas market in the European Union.</td>
</tr>
<tr>
<td>Ownership</td>
<td>-</td>
</tr>
</tbody>
</table>
| Objective | The Directorate-General aims at (EU Commission, 2011):  
  - Fostering sustainable energy production, energy transport and consumption.  
  - Providing European citizens and businesses with competitive and technologically advanced energy services.  
  - Creating the necessary framework for continuous and secure energy supply for the benefit of consumers and businesses in the European Union at affordable and competitive prices, including through international relations. |
| Attitude towards Gas Roundabout | Positive as it will contribute to Single European Gas Market |
| Power towards Gas Roundabout | Low for upstream, as this is a state’s sovereignty |
| Interest towards Gas Roundabout | High |

### Midstream Actors

#### Gasunie

<table>
<thead>
<tr>
<th>Brief description</th>
<th>European gas infrastructure company</th>
</tr>
</thead>
<tbody>
<tr>
<td>Role in Gas Roundabout Network</td>
<td>Facilitate transport of natural gas and green gas in the Netherlands and Germany</td>
</tr>
<tr>
<td>Ownership</td>
<td>100% Dutch Ministry of Finance</td>
</tr>
<tr>
<td>Objective</td>
<td>Ensure a strong Dutch position on the natural gas market</td>
</tr>
<tr>
<td>Attitude towards Gas Roundabout</td>
<td>Positive</td>
</tr>
<tr>
<td>Power towards Gas Roundabout</td>
<td>High</td>
</tr>
<tr>
<td>Interest towards Gas Roundabout</td>
<td>High</td>
</tr>
<tr>
<td>GasTerra</td>
<td>Dutch company active in worldwide trade and supply of natural gas</td>
</tr>
<tr>
<td>------------------------------</td>
<td>------------------------------------------------------------------</td>
</tr>
<tr>
<td>Role in Gas Roundabout Network</td>
<td>Largest buyer of upstream gas in the Netherlands</td>
</tr>
<tr>
<td></td>
<td>Largest trader on Dutch gas hub</td>
</tr>
<tr>
<td>Ownership</td>
<td>25% Shell, 25% ExxonMobil, 40% EBN, 10% EL&amp;I</td>
</tr>
<tr>
<td>Objective</td>
<td>Maximize share-holder value</td>
</tr>
<tr>
<td></td>
<td>Perform public tasks as stated in the Gas Act (small-fields policy)</td>
</tr>
<tr>
<td>Attitude towards Gas Roundabout</td>
<td>Positive, gives new opportunities</td>
</tr>
<tr>
<td>Power towards Gas Roundabout</td>
<td>High, as large trader and buyer of upstream gas</td>
</tr>
<tr>
<td>Interest towards Gas Roundabout</td>
<td>High</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GTS</th>
<th>Dutch transmission system operator (TSO)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Role in Gas Roundabout Network</td>
<td>Responsible for the management, operation and development of the gas transport system in the Netherlands</td>
</tr>
<tr>
<td>Ownership</td>
<td>100% Gasunie</td>
</tr>
<tr>
<td>Objective</td>
<td>Independent provision and implementation of gas transmission services for the benefit of a properly functioning liberalized gas market</td>
</tr>
<tr>
<td>Attitude towards Gas Roundabout</td>
<td>Positive</td>
</tr>
<tr>
<td>Power towards Gas Roundabout</td>
<td>High</td>
</tr>
<tr>
<td>Interest towards Gas Roundabout</td>
<td>Positive</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>APX-ENDEX</th>
<th>APX-ENDEX is one of Europe’s most experienced energy exchanges, operating spot and futures markets for electricity and natural gas in the Netherlands, the United Kingdom and Belgium.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Role in Gas Roundabout Network</td>
<td>APX-ENDEX is also actively working on integration of the gas markets and has become the major European gas exchange. Based on its position as the most experienced and most liquid gas exchange in Europe by trading on three gas hubs (TTF, NBP and Zeebrugge), APX-ENDEX aims at creating an integrated gas market for Europe</td>
</tr>
<tr>
<td>Ownership</td>
<td>TenneT (Dutch electricity TSO 56.1%), Gasunie (20.9%), Elia (Belgian electricity TSO 20%) Fluxys Europe (Belgian gas TSO 3%)</td>
</tr>
<tr>
<td>Objective</td>
<td>APX-ENDEX facilitates the development of liberalized and integrated energy markets in Northwestern Europe by providing an efficient, transparent and secure electronic trading environment for the trading of electricity and natural gas</td>
</tr>
<tr>
<td>Attitude towards Gas Roundabout</td>
<td>Positive</td>
</tr>
<tr>
<td>Power towards Gas Roundabout</td>
<td>High</td>
</tr>
<tr>
<td>Interest towards Gas Roundabout</td>
<td>High</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Midstream buyers (non-GasTerra)</th>
<th>Traders of natural gas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Examples</td>
<td>Shell midstream, Centrica midstream, Gazprom, E.ON, etc.</td>
</tr>
<tr>
<td>Brief description</td>
<td>Buyers</td>
</tr>
<tr>
<td>Role in Gas Roundabout Network</td>
<td>Private (vertically integrated with upstream oil firm or independent trader) or state-owned</td>
</tr>
<tr>
<td>Ownership</td>
<td>Maximize share-holder profit</td>
</tr>
<tr>
<td>Objective</td>
<td>Positive, gives them more opportunities</td>
</tr>
<tr>
<td>Attitude towards Gas Roundabout</td>
<td>Positive, gives them more opportunities</td>
</tr>
<tr>
<td>Power towards Gas Roundabout</td>
<td>High, together they determine features of hub</td>
</tr>
<tr>
<td>Interest towards Gas Roundabout</td>
<td>High</td>
</tr>
</tbody>
</table>
### Dutch Antitrust Authority (NMa)

<table>
<thead>
<tr>
<th>Brief description</th>
<th>Dutch competition regulator</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Role in Gas Roundabout Network</strong></td>
<td>Regulate network (of GTS) and market</td>
</tr>
<tr>
<td><strong>Ownership</strong></td>
<td>Independent</td>
</tr>
<tr>
<td><strong>Objective</strong></td>
<td>Efficient competition</td>
</tr>
<tr>
<td><strong>Attitude towards Gas Roundabout</strong></td>
<td>Positive, more efficient and transparent than oil market structure</td>
</tr>
<tr>
<td><strong>Power towards Gas Roundabout</strong></td>
<td>High, setting tariffs</td>
</tr>
<tr>
<td><strong>Interest towards Gas Roundabout</strong></td>
<td>High</td>
</tr>
</tbody>
</table>

### Other infrastructure (storage, conversion, LNG facilities) owners, investors and operators

| Examples | Vopak (LNG-terminal GATE), TAQA (Bergermeer gasstorage), Vattenfall (gasstorage Zuidwending), etc. |
| Brief description | Owners, operators and investors of infrastructure required for the gas roundabout |
| **Role in Gas Roundabout Network** | Invest and operate in the physical gas hub |
| **Ownership** | Private |
| **Objective** | Maximize share-holder value |
| **Attitude towards Gas Roundabout** | Positive, gives them opportunities |
| **Power towards Gas Roundabout** | High constructive power, execute the policy |
| **Interest towards Gas Roundabout** | High, depending on possible gains |

### Retail and Downstream Actors

#### Utilities

| Examples | RWE, Vattenfall, Eneco, etc. |
| Brief description | Buyers on whole-sale market and sellers to end-users |
| **Role in Gas Roundabout Network** | Active on virtual hub |
| **Ownership** | Private or state-owned |
| **Objective** | Maximize share-holder value |
| **Attitude towards Gas Roundabout** | Neutral |
| **Power towards Gas Roundabout** | Low |
| **Interest towards Gas Roundabout** | Neutral |

#### Distribution System Operators (DSOs)

| Examples | Enexis, Liander, etc. |
| Brief description | Responsible for the management, operation and development of the gas distribution system in the Netherlands |
| **Role in Gas Roundabout Network** | Accommodate green gas |
| **Ownership** | Public |
| **Objective** | Independent provision and implementation of gas distribution services for the benefit of a properly functioning liberalized gas market |
| **Attitude towards Gas Roundabout** | Neutral |
| **Power towards Gas Roundabout** | Low |
| **Interest towards Gas Roundabout** | Low |
### End user (large and small consumers)

**Examples**
- Large (TATA steel), small residential users

**Brief description**
- End-consumer of natural gas

**Role in Gas Roundabout Network**
- End-consumer

**Ownership**
- 

**Objective**
- Affordable, sustainable and secure supply of natural gas to meet their needs

**Attitude towards Gas Roundabout**
- Neutral

**Power towards Gas Roundabout**
- Low

**Interest towards Gas Roundabout**
- Low

### Relations within the Gas Roundabout Actor-Network

Diagram showing the relationships between various actors in the gas roundabout network, including layers and processes such as regulation, economic layer, and physical layer.
APPENDIX 2: GOVERNMENT INVOLVEMENT IN THE DUTCH UPSTREAM NATURAL GAS SECTOR AND THE “GASGEBOUW”

The following is adapted from Mulder and Zwart (2006) pages 19-23. The role and involvement of the Dutch government will be described, and the institutional structure of the “Gasgebouw”.

Policy goals and instruments

The discovery of the huge Groningen field at the end of the 1950s led to the formulation of the Dutch gas policy which has been largely unchanged over the past 40 years. Generally, the aim of the gas policy is to maximize the contribution of the gas fields to the Dutch economy (see e.g. EZ, 1976). In many documents published by the government in the past decades, the aim of the gas policy is expressed in terms of resource management. In EZ (1979), the government stresses the importance of gas policy to reduce risks in the supply of energy. In EZ (1984), the government formulated as key goals of the gas policy: “continuity in supply, optimal use of domestic resources and diversification of energy use”. In its 3rd White Paper on Energy Policy (EZ, 1996), the government states that the gas policy is directed at securing national supply. In its more recent paper (EZ, 2004a), the government concludes that the policy objective is to maintain the level of mining activity at the same high level for the coming fifteen years, maximizing the total recovery of natural gas. In EZ (2004), the government formulates three major targets of the gas policy: security of supply in the long term, reliability of supply in the short term and environmental effects of energy production. Encouraging domestic production is seen as an effective measure to raise the long-term security of supply. As the swing capability of the Groningen field is seen as a major component in guaranteeing a reliable supply in the short term, managing that capability is viewed to be important for the short-term reliability of gas supply. From a global environmental point of view, domestic production of gas is viewed to be preferable above imports as “environmental criteria applicable to gas production are less strict in countries such as Russia. Moreover, when gas is transported over large distances, part of it is lost because of leakages.”

In order to reach these goals, the government uses a variety of instruments. The major components of the Dutch gas policy are the close relationship between government and private firms, coordination of production and supply. This results in three types of measures being implemented (see table 1.1). In the next sections, we elaborate on each of these types.

<table>
<thead>
<tr>
<th>Type of measure</th>
<th>Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ownership</td>
<td>Participation of the State in exploration and development activities</td>
</tr>
<tr>
<td></td>
<td>Participation of the State in Gasunie Trade and Supply (T&amp;S)</td>
</tr>
<tr>
<td></td>
<td>and, since recently, full ownership of Gas Transport Services (GTS) through its parent company N.V. Nederlandse Gasunie</td>
</tr>
<tr>
<td>Regulation</td>
<td>Guaranteed offtake of small fields gas by Gasunie Trade &amp; Supply</td>
</tr>
<tr>
<td>Financial instruments</td>
<td>Fiscal measures</td>
</tr>
<tr>
<td></td>
<td>Other financial measures</td>
</tr>
</tbody>
</table>

Government measures regarding gas production (Source: Mulder and Zwart, 2006:20)
Ownership

The government participates in (almost all) mining activities via Energie Beheer Nederland (EBN), a 100% state firm. The ‘Maatschap Groningen’, which manages the production from the Groningen field, is owned by EBN (40%) and NAM (60%) which is a 100% subsidiary of Shell and Exxon (see figure 1.1).

Structure of the gasgebouw (Source: Mulder and Zwart, 2006:21)

The concession to exploit the Groningen field was exclusively given to NAM. The Maatschap Groningen is obliged to sell the gas to Gasunie Trade & Supply, which is a joint venture of EBN (40%), the Dutch state (10%), Shell (25%) and Exxon (25%). Gasunie, exclusively responsible for trade and transport, has recently been split into two separate companies: Gas Transport Services (or N.V. Nederlandse Gasunie), which is in charge of transport of gas, and Gasunie Trade & Supply. The former is now fully owned by the State, while the latter still is a joint venture of the Dutch State, EBN, Shell and Exxon.

The State, via EBN, also participates in offshore as well as onshore mining activities. EBN has a 40 or 50% participation in all small-fields exploration and production projects. This participation reduces the risks for gas firms as it enables them to have a more diversified portfolio of projects.

Regulation

Until recently, as said above, the coordination of production and supply was realized through the government authority to annually approve long-term (25 years) plans submitted by Gasunie regarding total gas supply as well as export and import volumes, and to approve exploration and production activities of other gas firms. The state also regulated the gas prices through the ‘market-value’-principle as basis for the sale of gas (see e.g. Correlje et al., 2000). This principle states that the price of gas is to be set at the maximum level not giving consumers an incentive to substitute to another fuel. Consequently the principle enables the government to skim a significant part of the consumer surplus. As different groups of end-users have different substitution possibilities, different price levels resulted. Generally, gas prices were linked to oil products, and hence, to the oil price. Above this price, Gasunie has been able to charge an additional price as reward for flexibility in its supplies.
The introduction of competition in the European natural gas market has changed this kind of state involvement in production and trade. Gasunie Trade & Supply is not obliged anymore to annually submit long-term production and supply plans while gas prices are now determined by market forces. In long-term contracts, future gas prices can still be linked to other energy prices, but spot market prices of gas are increasingly becoming important as reference price in such contracts.

The state is still involved in production and supply decisions through the Small-fields policy. “The essence of this policy is that small fields are produced in preference to the Groningen field” (EZ, 2004). This aim is pursued by two policy measures: the offtake guarantee and a cap on production from the Groningen field. According to the offtake guarantee, Gasunie Trade & Supply is obliged to buy all gas offered from small fields against “reasonable conditions and at market prices” (EZ, 2004). This offtake guarantee is meant to reduce costs as well as uncertainty of offshore projects and, hence, to encourage the level of offshore mining activities. Related to the offtake guarantee of Gasunie Trade & Supply is the obligation for the transport system operator, Gas Transport Services, to “ensure that gas from small fields can be taken up in the gas transport system”

The cap on Groningen production is meant to conserve its swing capability which is needed by Gasunie Trade & Supply to offer the offtake guarantee (EZ, 2005a). Until recently, production from the Groningen field was indirectly restricted through a ceiling of 80 billion m3 on total Dutch gas production. The difference between this level and the actual small-fields production determined the cap on Groningen. As small-fields production is expected to decline in the (near) future, the indirectly determined cap on Groningen would rise and, hence, the flexibility capability of this field would decline earlier which, in turn, is claimed to raise costs of smallfields production. This decline will partly be compensated by additional investments in the so called Groningen system, which includes the Groningen field and storage facilities (see EZ, 2005a). Nevertheless, a ceiling on Groningen production is viewed to be necessary to secure the future availability of flexibility. The abovementioned indirect ceiling has been replaced by a specific cap on Groningen which is formulated in terms of a maximum average annual production over a period of five years (EZ, 2005a). Over the period 2006-2015, Gasunie Trade & Supply is allowed to take 425 billion cubic metres from the Groningen field, which is an average annual cap of 42.5 billion cubic metres.

Financial instruments

Another group of government measures affecting the gas industry are financial instruments consisting of tax measures and other financial measures. The tax measure directed at the mining industry is the corporation tax which is the profit-related tax applicable to all corporations. This tax generated approximately 30% of total government revenues from the gas industry in the past twenty years (see figure 1.2). The non-tax financial measures comprise a number of measures, notably royalties, payments on the state’s shares in EBN (100%) and Gasunie Trade & Supply (10%), and petroleum tax. The royalties, which are a lump-sum tax independent on size of revenues, are only charged for onshore fields. As EBN is a 100% state firm, the government receives EBN’s total profit. The share of the state in the profit of Gasunie Trade & Supply is subject to a threshold and the so-called “rule of additional returns of Groningen gas”12. The profits of Gasunie Trade & Supply depend on the difference between the purchase price, i.e. the price paid to the Maatschap Groningen for the delivery of gas, and the selling price, i.e. the price received from the buyers of gas. Profits up to the threshold of 36.3 million euro are paid to the shareholders as dividend (see Annual Report of N.V. Nederlandse Gasunie, 200413). Profits above this threshold are distributed between the Maatschap Groningen and the Kingdom of the Netherlands according to the above rule of additional returns on Groningen gas. The higher the difference between the purchase price, which is an internal transfer price, and the selling price, which is the market price, the higher the share of the state in the profit of Gasunie Trade & Supply. According to AR (1999), this share varies from 66.67 to 95%.” (Mulder and Zwart, 2006)
APPENDIX 3: EXPLORATION AND PRODUCTION “VALUE CHAIN”

The E&P value chain can be seen on 4 layers: the physical layer, the economical layer, the institutional layer and the actor layer:

Successful exploration and appraisal

Unsuccessful exploration and appraisal:
* Dry Hole (no gas)
* Technically, institutional and/or economically not viable (stranded field, contingent resource)

Institutional Layer:

License applicant(s), become License holder(s) after next phase

Actor Layer:

License holder(s) after next phase

Figure: E&P Value Chains
APPENDIX 4: THEORETICAL DECISION MAKING MODELS

RATIONAL ANALYTICAL PERSPECTIVES (E.G. DRUCKER) VS POLITICAL PERSPECTIVES (E.G. ALLISON, LINDBLOM AND WOODHOUSE, DE BRUIJN AND TEN HEUVELHOF)

Allison places the political perspective contrarily to the rational or analytical perspective to decision making, as it is discussed in the previous section (Allison, 1971:162). The political perspective does not agree with Drucker’s assumptions of one single decision maker, complete information and a univocal preference structure (Drucker, 1967). Lindblom and Woodhouse (1993) extend Simon’s (1994) proposition that cognitive abilities limits rational decision making. They state that there are also other limits to rational policy analysis because it is too slow and too costly, it is fallible, it cannot tell us conclusively which problems to attack and it cannot resolve conflicts of value of interests (Lindblom and Woodhouse, 1993:22). Lindblom and Woodhouse: “analytical policy making is inevitably limited and must make room for politics.” (Lindblom and Woodhouse, 1993:22) Another limitation to rational decision making in the presence of networks (De Bruijn and Ten Heuvelhof, 2008). A network is characterized by many different actors with different power, instruments, interests and objectives, but these actors are dependent on each other.

The political perspective to decision making describes how decisions are taken in reality, rather than how they should be ideally taken. This perspective takes into account a network of multiple actors, with different preferences, interests, perceptions and expectations. Moreover, decision making is seen as a continuous process. Literature has provided four models of political decision making.

LINDBLOM’S (1959) SCIENCE OF MUDDLING THROUGH

A first model for political decision making is based on Lindblom’s ‘science of muddling through’ (1959). Lindblom (1959) states that public administrators disagree about values and objectives in complex situations (Lindblom, 1959:226). These differences of values cannot be easily overcome by ranking them, or by letting the majority decide (Lindblom, 1959:227). Moreover, because means and ends are not distinct, means-end analysis is often inappropriate or limited (Lindblom, 1959:226). With that, means often determine the goal. To prevent agreement about fundamental values, agreement is only required for ‘marginal’ values. Lindblom suggests that decisions should be taken about marginal values, with small steps and mutual adjustments. This will result in an acceptable decision (Lindblom, 1959). Disadvantages of this model is that there is a short-term focus, and that this model – and incrementalism in general - is perceived as conservative by Etzioni (1989):”Incrementalism advocates moving not so much toward a goal as away from trouble, trying this or that small maneuver without any grand plan or sense of ultimate purpose.” (Etzioni, 1989: 123)

ETZONI’S (1989) MIXED SCANNING

The second model is based on this criticism, and is referred to as ‘mixed scanning.’ Etzioni (1989): “Mixed scanning involves two sets of judgments: the first are broad, fundamental choices about the organization’s basic policy and direction; the second are incremental decisions that prepare the way for new, basic judgments and that implement and particularize them once they have been made. Thus mixed scanning is much less detailed and demanding than rationalistic decision making, but still broader and more comprehensive than incrementalism – and less likely to be limited to familiar alternatives.” (Etzioni, 1989:124)

KINGDON’S (1995) STREAMS MODEL

A third model for political decision making is the ‘streams model’ of Kingdon (1995). This model is based on streams of problems, parties and solutions. These three streams co-exist most of the time independent of each other, but can come together and form a ‘window of opportunity’ or ‘policy window’ for decision making. With that, solutions may look for problems which make decision making different from problem solving. Kingdon (1995): “The policy window is an opportunity for advocates of proposals (or ‘policy entrepreneurs’) to push their pet solutions, or to push attention to their special problems. Policy entrepreneurs must be prepared, their pet proposals at the ready, their special problem well-documented, lest the opportunity pass them by.” (Kingdon, 1995:165)
A last model for political decision making is the ‘rounds model’ or Teisman (1992). Van Bueren et al, 2003) build on that and elaborate that “the process that develops during a policy game can be analyzed by distinguishing a number of rounds, which can be characterized by impasses and breakthroughs. In each round actors explore problems and solutions and look for opportunities to reach a joint decision. This is far from simple: conflicts of interest and attempts to avoid the risks involved in collective action may result in impasses, and these impasses can lead to the termination of the game. Then again breakthroughs may occur, which give the game new impulses and result in a crucial decision.” (Van Bueren et al, 2003:195). Decision making in rounds is closely related to management in networks (De Bruijn and Ten Heuvelhof, 2008) and process management (De Bruijn et al, 2003).
APPENDIX 5: HISTORICAL OVERVIEW OF THE GAS ROUNDABOUT POLICY

Based on an extensive study on all policy publications and governmental reports relating to the gas roundabout policy this appendix will establish an overview of the gas roundabout policy.

2002: MADRID FORUM AS A PRELUDE FOR THE GAS ROUNDABOUT CONCEPT?

The prelude of the gas roundabout policy, which was officially introduced in 2006, was the (still ongoing) liberalization of the European gas industry. A large number of legislative, regulatory and policy initiatives have been proposed to liberalize Europe’s gas and electricity market (see Honére and Stern, 2007). Basically, the liberalization process is aimed to solve market failures and create perfect competition in the midstream and downstream parts of the European natural gas value chain (Spanjer, 2008:82). The upstream part of the natural gas value chain, present in only a few member states, remained sovereign. Spanjer (2008) states that the adoption of the Electricity and Gas directives signal the dismantling of the managed and integrated market structure into one that ultimately should develop into a genuine internal energy market (Spanjer, 2008:82). For this internal free market to develop, there are three conditions which must be met: 1) free and non-discriminatory access to the essential facilities (pipelines, storages, etc.) 2) free competition among suppliers and 3) the ability for consumers to choose freely between suppliers. These conditions are intended to be met by a) market opening, b) introduction of third party access to the system and c) unbundling of potentially competitive activities and non-competitive activities (Spanjer, 2008:89). The First (98/30/EC) and Second (2003/55/EC) Gas Directives focused on these aspects. Given some structural failing of the first two directives (COM, 2007:529), the Third Gas Directive (2007/73/EC) was adopted to further resolve issues of market opening, ownership unbundling, third party access and more with the aim to create an single internal European gas market.

Madrid forum: gas hubs as intermediate steps towards a single European gas market

During the Madrid Forum (2002), a road map towards this internal European gas market was published. The high-level objectives are (Madrid Forum, 2002 in Spanjer, 2008:103):

- Real supply-side competition;
- Contractual flows becoming decoupled from physical flows in many locations;
- Entry-exit tariff arrangements for access to transmission networks;
- Liquid hub-based trading;
- A robust and comprehensive regulatory framework; and
- Effective mechanisms for investments in cross-border infrastructure.

The long-term objective of the internal natural gas market can be stated as “effective competition delivering real benefits for gas consumers throughout the EU; a stable regulatory framework facilitating efficient levels of investment; secure supplies; choice; and gas suppliers able to market their services to all consumers across the EU. This vision also now includes the availability of new sources of gas supply to Europe, notably LNG.” (Madrid Forum, 2002; ERGEG, 2005:6 in Spanjer, 2008:103). Spanjer (2008) concludes that the specific characteristics of Member State gas markets and consequent differing starting-points have been acknowledged by the road map. Basically, an intermediate step of creating effective regional gas markets is based on liquid hub-to-hub trading as important precondition for the development of an internal gas market, because a hub facilitates gas trade via bilateral contracts and exchanges (Spanjer, 2008:103). A hub can be seen as an intersection of pipelines creating a central place where gas can be traded. Hubs also facilitate spot gas markets, where gas can be traded and delivered instantly or at short, intra-day, notice. Spot markets allow the market to clear by enabling producers of surplus energy to locate available buyers for this energy, negotiate prices and deliver gas to the consumer. This greatly facilitates a competitive market (Spanjer, 2008:103). The regional gas markets are geographically segmented, each with a lead regulator. An example is the Northwest European gas region, comprising the Netherlands as lead regulator, Belgium, France, Ireland, UK, Germany, Denmark, Sweden and Norway (Spanjer, 2008:104 citing ERGEG website). The Commission distinguished between physical hubs, as
Zeebrugge (Belgium) and Eurohub (the Netherlands and Germany), and virtual hubs as the BEB (Germany) and the TTF (the Netherlands) (Spanjer, 2008:105). The development of these regional initiatives and market integration in general, is being monitored by The European Regulators’ Group for Electricity and Gas (ERGEG), the advisory group to the European Commission on internal market issues. They state that “market integration has not yet developed sufficiently, indicated by, for example, the existence of price differences, regional monopolies, legal differences between Member States, and persistent cross-border congestion between Member States.” (CEC: 2008:3) Spanjer (2008): “The intermediate step of developing regional markets will require the right steps being taken to unlock sufficient liquidity at European hubs and a number of outstanding issues being addressed. After liquid and well-functioning regional gas markets have developed, these should be linked together to create a single European gas market” (Spanjer, 2008:108) The Commission’s list of investment priorities comprises of infrastructure investments, in order to ensure the free movement of gas volumes between Member States (IEA, 2008b:31). Spanjer (2008): “Gas networks are therefore at the heart of a well-functioning European internal gas market. As a result, in order to materialize its internal market vision, the Commission’s trans-European energy networks program identifies the missing links in Europe’s energy networks and formulates priority investment projects which are considered essential to develop the European energy market” (Spanjer, 2008:106) Examples are the Northstream and Southstream transmission pipelines, LNG-terminals and the development of underground gas storages (UGS).

2005: AER-report: introduction of the gas roundabout concept for the Netherlands

Three years later, the Dutch advisory board for energy (AER) also elaborates on the drivers for the development of the European natural gas market in their 2005 rapport. They state that: 1) Relations with gas exporting countries (e.g. Russia), 2) a proper investment climate for gas infrastructure (e.g. pipelines, LNG-terminals) and 3) diversification of EU-imports, are the three most important criteria for the development of a European natural gas market. Ultimately, a single European gas market gives a proper bargaining position against the oligopolistic producers, and makes Europe competitive against its competitors for this natural gas (e.g. USA and Asia) (AER, 2005:8).

However, they advise that: “the Netherlands should choose its own course in this perspective, because of the unique producing character” (AER, 2005:9) comprising of four elements (AER, 2005:86): a) The Netherlands is one of the few European gas-producing countries. b) The Dutch reputation and name in the natural gas world. c) The well-developed state of the Dutch natural gas infrastructure and, 4) the available technological- and commercial experience. Because of this unique extra ‘Dutch dimension’, “the European and Dutch stakes and objectives are not always aligned. Especially not in a transition phase.” (AER, 2005:26) AER advises the Netherlands to further extend its current position by developing:

- A strong purchasing function: Position the Netherlands as a strong buyer on the world market and as contracting partner for infrastructure-projects to attract gas for the European market. This function is mainly of importance for areas where private oil companies struggle to get access to exploration licenses (AER, 2005:10,87);
- A strong production function: Maximize production and ‘strategic reserve’-function of the Groningen field, ensuring supply security and flexibility (AER, 2005:10,87) and maximize the production from small fields (AER, 2005:92);
- A Gas hub function: Position the Netherlands as trade and transport hub of the Northwest European market (AER, 2005:10,87).

By extending the unique Dutch position, it mitigates future security of supply issues and secures a sufficient diversity in imports. The AER addresses two important drivers for the future of the Dutch natural gas value chain, stemming from the three latter mentioned positions. Firstly, the future of the Gasgebouw which is at stake due to the liberalization. It suggest that the Dutch government should sustain its position is GasTerra and that the production from Dutch resources should be optimizes (AER, 2005:12). The Production Platform of Groningen should remain in place, as is the Small Fields Policy. This because GasTerra is a company which can strongly contributes to the three objectives of the Dutch position. Secondly, the available market- and
infrastructural condition of the Netherlands give opportunities to develop the Netherlands as natural gas hub. This driver stems from the increasing need for new gas imports on a European scale (AER, 2005:13).

Concluding, the agenda of the European Commission is shared by the AER (2005) with regard to the drivers and development of the Dutch natural gas value chain. A European perspective is elementary for the development of the Dutch natural gas value chain. Also, the positioning of the Netherlands as trading and transport hub in Northwest Europe is recognized and recommended by the AER. However, the unique position of the Netherlands results in a situation where the Dutch policy agenda (as recommended by the AER) deviates from the European policy agenda and adds the three unique ‘Dutch dimensions’ to the national policy agenda.

**2006: DUTCH VISION ON THE GAS MARKET BY EL&I**

Around 2006, two mayor ‘game changers’ occurred in the international gas market. First, in January 2006, a conflict between Russia and Ukraine resulted in a disruption of natural gas supplies. This created a strong ‘sense of urgency’ towards security of supply. Secondly, the development of shale gas reservoirs in the USA rapidly grew, making them less dependent on LNG imports. This resulted in large intercontinental price differences and distorted the development of the LNG market. In his 2006-letter to the Dutch parliament, former-minister of Economic Affairs Mr. Brinkhorst presented his ‘Vision on the Dutch gas market,’ incorporating these changes, and the AER rapport (2005) (EZ, 2006).

Brinkhorst provides the first definition of the gas roundabout: “Due to two important Dutch developments (1) production in decline, more imports, need for more flexibility, and 2) the presence of favorable infrastructure, knowledge, geography and geology), the Dutch consumer and economy will benefit from investments in natural gas projects and a better European integration of the Dutch gas market. New flows of natural gas, to which value can be added by specific Dutch conditions, will result in economic activities like transport, trade and associated services like storage. By attracting and distributing these new streams, also a contribution to security of supply on the long-term is provided. This is how the Netherlands can develop itself as gas roundabout of Europe.” (EZ, 2006:3) Brinkhorst elaborates on his ‘vision on the gas market’ by the following 9 action points, which can be segmented in two categories (EZ, 2006:5):

- **Contributing to the European Liberalization and establishment of a strong Single European gas market (e.g. Madrid Forum, 2002, EZ, 2006:4), which will attract sufficient gas from diversified sources to a Single European gas market with a free movement of gas (EZ, 2006:1):**
  - Implementation of existing European directive for security of supply;
  - Contribute to the development of the Northwest European gas market (midstream, trade);
  - Stimulate natural gas trade, together with DTe (the antitrust and regulatory authority for the Dutch energy markets) (midstream, trade);
- **Valorizing the ‘Dutch dimension’ (e.g. AER, 2005, EZ, 2006:3):**
  - Stimulate investment climate for transport capacity, together with surrounding countries (midstream, transport);
  - Ministerial arrangement to regulate and stimulate LNG investments (midstream, transport);
  - Stimulate investments in gas storage, for example by adjusting Mining Act (midstream, storage);
  - Continue small-fields policy (upstream);
  - Stimulate upstream investments of national importance by applying ‘Rijksprojectenprocedure’ (upstream, licensing procedure);
  - Actively approach new upstream companies for investments in Dutch acreage (upstream).

Brinkhorst concludes that the ultimate goal is a liquid Northwest European gas market with a strong position for the Netherlands in that market. “By striving for a strong European gas market, as stated by the Commission, the overall European market-function must be improved. Furthermore a strong political European presence in the global natural gas market is required to attract the desired levels of natural gas to the European market. Moreover, because Dutch competitive advantages, a regulatory climate, and efficient market functioning, a proper investment climate will be safeguarded. Ultimately, this will strengthen the position of the Netherlands.” (EZ, 2006:13)
2008: The Gas Roundabout as ‘Icon’ of Dutch Energy Policy by EL&I

Brinkhorst’s vision of the gas roundabout was positioned as an ‘icon of Dutch energy policy’ in 2008 (EZ, 2008:45). The gas roundabout was newly defined: “The physical gas infrastructure, with all national and international economic activity and knowledge development around it, is referred to as the Gas roundabout. The gas roundabout is a hub, like Schiphol and the Port of Rotterdam, contributing to security of supply because an open and well-functioning gas market attracts large gas producers. The gas roundabout also adds to the Dutch economy, because value will be created along the entire value chain. Examples are transport, storage, quality conversion, trade, financing and innovation. The 2008 Energy-reaport does not provide a specific policy-agenda for the Gas roundabout, but provides a policy agenda for the broader policy aspect ‘access to the energy sources,’ segmented in two categories:

- Optimal utilization of Dutch resources: (i) Adjustment of the Mining Act to stimulate the use of licenses. (ii) Financial stimulating measure to produce from marginal fields (EZ, 2008).
- Strengthen the European gas system: (i) Regulatory relief for midstream players to stimulate midstream investments abroad (Gasunie). (ii) Negotiating the future of GasTerra and Gasgebouw. (iii) Establishment of Gas roundabout consultative platform. (iv) Gasplatform working-program to stimulate market integration and –functioning, interconnections and security of supply. (v) Financial stimulating measures for gas storage, e.g. cushion-gas regulation. (vi) International exposure and positioning of Gas roundabout. (vii) Regulatory relief (rTPA-exemptions) for LNG investments.

The Gas roundabout concept is mentioned as part of the second category. Up until that point, the gas roundabout concept was already mentioned in annual reports of the main involved companies in the Dutch natural gas value chain, as presented in the figure below. This indicates that the Gas roundabout set-off as an important policy concept.

However, because no unambiguous definition of the Gas roundabout was given, the Minister of Economic Affairs was asked to provide a clear Gas roundabout strategy by the Dutch parliament (motion of Ten Hoopen c.s. on 28-10-2008).

EBN is the state participant in exploration and production activities. Gasunie is responsible for investments in infrastructure. GTS is the Dutch transmission system operator. The Dutch state is the sole shareholder of the three mentioned actors. Lastly, GasTerra is the largest natural gas trader, in which the Dutch government also has a direct share of 10% and an indirect share of 40% by EBN.


At the end of 2009, the report “The Netherlands as a Northwest European gas hub” was presented by the ministry of Economic Affairs, comprising of two parts (EZ, 2009, see also Kamerbrief Gasrotonde). Firstly, an overview of the gas roundabout definition, scope, strategy and the actions undertaken so far was provided. The second part discusses the biggest challenges and the associated action points to mitigate these challenges.

Gas Hub rapport 2009: Formalization of the Gas roundabout policy

The rapport defines the gas roundabout is a “function of the Dutch natural gas value chain” (EZ, 2009:6), and that the Gas roundabout strategy must be seen as a package of sector-wide investments, enabling this function (EZ, 2009:6). It is desired that the Netherlands positions itself in a situation in which:

- Significant investments by native and foreign parties in the Dutch gas sector and infrastructure are made, enabling gas-flows to supply the Dutch demand and generate value by the transit gas-flows (2009, p.3);
- Sufficient gas storage capacity is constructed, contributing to the security of supply and the flexibility (2009, p.3);
- A liquid gas market has evolved, with sufficient supply, transparent and stable prices (2009, p.4) with the necessary condition to generate the price-index for other Northwest European markets (EZ, 2009:9);
Diversification of the Dutch gas mix is accomplished, with Dutch gas, import gas and green gas (2009, p.4);

A strong and innovative gas industry contributes to the economy, employment and the Dutch situation as ‘gas country.’ (2009, p.4).

The Gas roundabout strategy is placed in a European context, and as part of a more broad objective to ensure a secure energy supply to the Netherlands with proper investments and economic activities and innovations (EZ, 2009:7), anticipating to the shift from exporter to importer (EZ, 2009:2). The Gas roundabout position must result in an enforcement of the national market, with more players and associated opportunities for innovation, export, and valorization of knowledge. In the report, it is acknowledged that multiple European hubs will arise and will work together (EZ, 2009:4). Numerous developments have already contributed to this position, e.g. the LNG GATE-terminal, interconnectivity investments, liquidity development of spot-market TTF (EZ, 2009:7).

Initial Gas roundabout agenda

The 2009 rapport formulated three main challenges for the development of the Gas roundabout. The first challenge is to timely meet the needed transport capacity (EZ, 2009:8). Regulation and investments in infrastructure and interconnectivity must mitigate this challenge. The second challenge is to realize a desired level of flexibility and investments in gas storages (EZ, 2009:10), by means of regulation and tariff-settings, and by means of adjusting the Mining Act. The third challenge is to diversify the supply of natural gas on the longer term, in order to have security of supply when Dutch production levels have declined (EZ, 2009:12). “Maximum utilization of the national resources (Groningen and small-fields) is an important aspect of the Gas roundabout. The ongoing role of GasTerra as buyer of the small-fields gas as part of the small-fields policy is therefore essential.” (EZ, 2009:12) From out these challenges, the initial agenda of the Gas roundabout strategy was established (EZ, 2009:14-16):

- Establish a consultation platform, together with the private sector, to identify stimulation measures, and discuss initiatives and strategic issues;
- Improve market functioning and integration North-west European gas market, by developing the TTF and by increase international cooperation and coordination;
- Maximizing Dutch resources, by maximizing exploration and production. Creating a proper mining climate;
- Stimulating of investment climate for companies to invest, by for example setting the right regulatory regime;
- Gas diplomacy, bilateral and multilateral;
- International entrepreneurship, stimulating foreign direct investment in the Netherlands and Dutch investments abroad;
- Enforcement of the knowledge infrastructure;
- Monitoring security of supply, by means of the yearly GTS rapport “Voorzieningszekerheid Gas.”

2010: The Economic Impact of the Gas Roundabout

The above identified strategy was quantified by consultant of Brattle in 2010 (Brattle, 2010). They analyzed the current contribution of the Dutch gas sector to the economy, performed a SWOT-analysis on the strategy and they quantified the benefits of the strategy to the Dutch economy. Brattle perceives the Gas roundabout strategy as “Capitalize existing gas industry and skills, and sustain the Dutch position in the European gas industry beyond the life of the existing fields. This will result in increased competition and security of supply, create employment and make a significant contribution to the Dutch economy.” (Brattle, 2010:5) Brattle did not address all of the identified 8 agenda points, but generalized the Gas roundabout strategy agenda to the following assumptions in their SWOT-analysis of the strategy (Brattle, 2010:40).

- Transit gas flows: Because the TTF will be the preferred trading point, a lower amount of LNG will be imported in the UK, resulting in additional export to the UK of 7.9 bcm/y. Russian gas flows through
the Netherlands instead of through Germany to France and Belgium, adding a total of 7.9 bcm/y (Brattle, 2010:65). These additional gas flows must be accommodated by sufficient investments in the infrastructure, adding to €1 billion over 5 years;

- LNG imports: Expansion of the LNG-terminal GATE to 16bcm and a second LNG terminal in Eemshaven, adding a total of €1.1 billion;
- Storage and flexibility: Establishment of one additional storage facility: €0.6 billion;
- Gas trading: Annual growth rate of the TTF of 30% until 2020, compared to ‘business as usual’ growth rates of 10% until 2015, adding €0.2 billion over the period 2010-2020.
- Research and development (R&D): additional R&D income from intellectual property royalties, adding €1.5 billion over the period 2010-2020.

Brattle calculated two scenarios: a base-case scenario and a Gas roundabout scenario. The difference between these scenarios is substantiated for the economic impact on transit, storage, LNG and trade, but not for the economic impact on upstream investments (Brattle, 2010:64-67). It was assumed that 15 additional conventional exploration wells will be drilled annually in the Gas roundabout scenario, adding 230 bcm over 30 year (Brattle, 2010:64). The different assumptions of the scenario’s result in a positive impact on the Dutch economy, as presented in table 1 below. An additional €9.5 billion will be spend over the period 2010-2020, resulting in a total added value for the Dutch economy of €21.4 billion over the period 2010-2020:

<table>
<thead>
<tr>
<th>Sector</th>
<th>Final demand (£million)</th>
<th>Total output (£million)</th>
<th>Job years (direct)</th>
<th>Job years (economy wide)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upstream</td>
<td>4.925</td>
<td>11.093</td>
<td>27.250</td>
<td>68.383</td>
</tr>
<tr>
<td>Transport</td>
<td>1.000</td>
<td>2.307</td>
<td>5.944</td>
<td>14.743</td>
</tr>
<tr>
<td>LNG</td>
<td>1.094</td>
<td>2.523</td>
<td>6.501</td>
<td>16.122</td>
</tr>
<tr>
<td>Storage</td>
<td>550</td>
<td>1.269</td>
<td>3.269</td>
<td>8.108</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>1.549</td>
<td>3.418</td>
<td>11.253</td>
<td>23.761</td>
</tr>
<tr>
<td>TTF (trade)</td>
<td>225</td>
<td>448</td>
<td>835</td>
<td>2.275</td>
</tr>
</tbody>
</table>

Table: Economic impact of the gas roundabout (Brattle, 2010)

2010: CONSULTATIVE PLATFORM: IDENTIFYING INSTRUMENTS TOGETHER WITH THE INDUSTRY

In 2010, the Gas hub consultative platform functioned as a forum for the Dutch government and the gas industry to align and discuss new initiatives and strategic issues, related to the Gas roundabout. The platform stated that the Gas roundabout is a Northwest European artifact in which the Netherlands has an opportunity to position itself in a leading role (EZ, 2010: 5). The platform was divided in four working groups, each with their own theme: 1) The role of gas in the energy mix for Northwest Europe, building forth on different energy outlooks. 2) Development of the Northwest European gas hub, and positioning of the Netherlands within this gas hub. 3) The Dutch mining climate. 4) A shared communication strategy, addressing public engagement, communication and stakeholder management. The platform distinguishes between the midstream parts of the Gas roundabout – comprising of the focus areas: infrastructure and tariffication, cooperation and coordination in the gas market, international diplomacy and promotion of the gas hub and valorization of knowledge – and the upstream part of the Gas roundabout, focused on the Mining Climate (EZ, 2010:14).

The Gas Hub Consultative platform suggested instruments which should be considered by the roundabout policy to improve the upstream investment climate. Firstly, coordinated technological enables (e.g. hydraulic fracking, well deliquification, nitrogen injection) which are applied on a cooperative basis between public and private stakeholders. Examples are the national ‘upstream technology research development and deployment’ program, or the ‘championing’ of best-practices by NOGEPA. The second instrument is coordinated, industry driven and government driven financial enablers. The first addressing a reduction of capital- and operational expenditures, by cooperation and coordination (e.g. sharing of resources). The latter financial enabler is addressing fiscal measures by the Dutch government (EZ, 2010:24). The third instrument concerns social enablers, addressing public acceptance.
It can be concluded that this consultative platform functioned as an important method to generate tangible measures and instruments for the Dutch government. The scope of the Gas roundabout policy was also part of the discussion: a broad perspective to the future of natural gas and the Netherlands, in a Northwest European context.

2011: Gas roundabout as a ‘top-sector’ by EL&I

In 2011, the Dutch government elaborated on the Gas roundabout as a strategy where the focus on the Dutch natural gas value chain will be shifted from production oriented towards more related to production, transit, storage, trade and innovation. The Gas roundabout was positioned as a ‘modern industry policy’ and ‘energy is economics,’ strongly focusing on the competitive advantages of the Dutch natural gas industry, and innovation (EZ, 2011a:3). Some recommendations of the Gas hub consultative platform are embedded in the 2011 Energy rapport. Moreover, enforcing the Gas roundabout is an important focus area of the broader ‘top-sector’ policy, being the Dutch ‘industry policy’ (EZ, 2011a:16). Enforcing of the Gas roundabout, by the Gas roundabout policy, comprises of the following policy aspects:

- Production level of small fields 30 bcm in 2030, by implementing a fiscal measures, fallow acreage and R&D-programs (EZ, 2011a:17).
- Facilitate gas storage, by regulatory- and permitting relief (e.g. the ‘Rijkscoordinatierelieging’) (EZ, 2011a:18).
- Optimizing and enforcing transport capacity, by improving interconnectivity and bi-lateral regulatory agreements concerning transmission system operators (EZ, 2011a:18).
- Enforce knowledge development, by further extending the knowledge position of the Netherlands. This is done by supporting knowledge institutes (e.g. EDI, EDGaR, CIEP) and innovation-contracts (see below) (EZ, 2011a:19).
- Enforcing the Gas roundabout by the trading role of GasTerra. The future strategy is GasTerra is stated to be: “important for the presence of a strong trading partner on the Gas roundabout.” (EZ, 2008; EZ, 2009) GasTerra’s services, products, coordinating function of both the Groningen- and the small fields, and the potential contribution of GasTerra to security of supply and the Dutch economy is of mayor importance (EZ, 2011a:19).

2011: Progress rapport of the gas roundabout by EL&I

Two years after the 2009 publication, a progress report was published by the Dutch Ministry of Economic Affairs. The rapport stated that the gas roundabout in the period 2009-2011 resulted in big economic and security of supply improvements in the overall gas sector. This because an increasing amount of trade, transport capacity, diversification by the LNG-terminal and storage (EZ, 2011:1). The report also stated that the gas roundabout has no owner, nor a predefined goal or finish (EZ, 2011:1). The objective of the gas roundabout is to ensure that the Netherlands can maximize its competitive advantage in the gas sector (EZ, 2011:2). Individual companies, executing individual projects, implement the gas roundabout strategy to their own vision and commercial support, contributing to the objective of the gas roundabout. The government has a stimulating role for these companies, but there is no single actor in charge, nor is there a hierarchical relationship for decision making or guidance (EZ, 2011:3). The rapport provides an overview of the activities which are performed in the period 2009-2011, linked to the initial 8 agenda points of the gas roundabout policy:

- Together with the industry, the Consultative Platform resulted in tangible measures to stimulate the Gas roundabout policy (EZ, 2011:14);
- By adjusting the Dutch Gas Act, the Dutch low-calorific and high-calorific markets are merged, a market-based balancing regime was implemented, the tradability of natural gas was improve, and the interconnectivity capacity was improved (EZ, 2011:5). This stimulated the market functioning and – integration of the Northwest European gas market. Moreover, the TTF emerged to a significant virtual trading hub (EZ, 2011:6).
• Fiscal measures (investment allowance for marginal fields), a covenant (Fallow Acreage) and a permitting adjustments are three measures which contribute to turning the decline of small-fields production (EZ, 2011:7);

• Investments related to the gas roundabout must be segmented in legally obliged investments by system operators (with a set tariff by the NMa, the Dutch antitrust and regulatory body), and market-based investments (e.g. GATE-terminal). Infrastructural projects have been realized (e.g. North-South route pipeline, Zuidwending gas storage, GATE-terminal), regulatory adjustments have been made (e.g. GTS (TSO) tariffs, EBN’s authority to participate in gas storage projects) (EZ, 2011:14);

• Gas diplomacy resulted in visits to multiple countries (e.g. Russia, Brazil) (EZ, 2011a:15);

• To support international entrepreneurship, multiple visits Dutch firms to foreign investors are arranged (EZ, 2011:16).

• Enforcement of the knowledge infrastructure was realized by organizing multiple meeting and supporting different knowledge institutes (EZ, 2011:16);

• Security of supply was monitored by means of the yearly GTS rapport “Voorzieningszekerheid Gas” (EZ, 2011:16).

This agenda was amended on several points, which was the result of the 2011 Energy rapport. Firstly, Shalegas plays an important role in the ambition of the Dutch government to maximize the Dutch resource recovery (EZ, 2011:17). Secondly, enforcement of the knowledge infrastructure is made tangible by means of innovation-contracts (see below). The Gas roundabout is seen as a ‘top sector’ and ‘carrier of innovation’ (EZ, 2011:18). Thirdly, the role of GasTerra in the Gas roundabout is made more explicit, as suggested by the Energy rapport (EZ, 2011:19). A fourth amendment of the initial Gas roundabout policy agenda is related to the privatization of Gasunie. Moreover, new agenda points are Green Deals, stimulating the injection of biologically produced methane in the grid, implementing European regulation to enhance the functioning and transparency of the internal market, allowing private funding of TSO and DSO (EZ, 2011:4).

2012: INNOVATION CONTRACTS FOR THE GAS ROUNDBOUTCUT BY EL&I

In 2012, the Dutch Ministry formalized the ambition to enforce the competitive advantage and innovation of the Dutch economy by selecting nine prominent industries, which were named ‘top sector.’ One of these top sectors is ‘energy’. Each top-sector published ‘innovation-contracts,’ being a covenant between the Dutch government (comprising of multiple departments and ministries) and private companies to jointly finance innovation-programs with the objective to strengthen these ‘top-sectors’ (EZ, 2012:7). One of these innovation-contracts was ‘gas,’ which was segmented in other ‘innovation-contracts,’ namely: green gas (50% of budget), upstream gas (18% of budget), LNG (15% of budget), Power to gas and gas to electricity (11% of budget), social embedding (3% of budget) and market-functioning or Gas roundabout 2.0 (2% of budget) (EZ, 2012:14). A total amount of €475 million was budgeted for all the innovation activities and studies over the period 2012-2016, of which €221 million was contributed by private parties (EZ, 2012:6).

The innovation-contract ‘resources: upstream gas’ has the aim to support the 30/30 ambition by developing and deploying innovative exploration and production technologies (EZ, 2012:4). Moreover, the innovation-contract is aimed to stimulate innovative economic activities, to support the international competitiveness of Dutch firms and to realize a “Human Capital Roadmap” (EZ, 2012:22). The innovation-contract is segmented in three programs: mature fields, new fields and tough gas, stranded fields (EZ, 2012:23). With regard to mature fields, the focus is on extending the lifetime by studies to production and reservoir management and infrastructure (EZ, 2012:24). The effect of innovation on exploration and production is based on the Norwegian program OG21 (EZ, 2012:25).

The innovation-contract Gas roundabout 2.0 is aimed to prepare actors in the gas market, and the society as a whole, for the gas market of the future. This innovation contract states that this is aimed to: “keep the strong international position of the Gas roundabout.” (EZ, 2012:5) In the ‘gas market of the future’, gas is the enabler of renewable energy resources and there is a big demand for storage, transport capacity and flexibility (EZ,
The innovation-contract state that: “These future developments have an effect on the function of Netherlands, being the Gas roundabout of Northwest Europe, and the associated gas market. Where the current market is aimed at delivering commodity, the gas market of the future will be focused on transport capacity and flexibility. Trade will shift from bilateral long-term to short-term trade on liquid markets.” (EZ, 2012:32) The innovation-contract is segmented in five elements. Firstly, market-functioning, focused on research to the development of liquid European gas markets. Secondly, the organization of the European gas market, focusing on the governance of gas markets (e.g. TSOs and regulators in different hubs). Thirdly, organization of the market players, which is focused on the effects of this changing market on new market entrants and existing incumbent traders. A fourth element concerns integration, competition and antitrust on the European gas markets. Lastly, the investments of DSOs to facilitate ‘green gas’. (EZ, 2012: 34)

**2012: THE NEED, USE AND RISKS OF THE GAS ROUNDABOUT REVISED**

The Dutch Chamber of Audits (CoA) heavily criticized the gas roundabout policy. The scope of the study was related to one aspect of the policy: investments by Gasunie in the German grid, and by EBN in gas-storage Bergermeer. It was concluded that no supporting studies or policy theory was ex ante developed to build the gas roundabout policy on. Also, no alternatives were compared with this policy, which is culpable because the policy objectives could possibly also be realized by other means (e.g. renewable energy, or higher imports). No ex ante cost-benefits analysis was performed, and future developments of the gas market were not mitigated ex ante. The report heavily criticized the lost investments of publically-owned Gasunie in the German grid. Also the provision of information to the Dutch parliament is lacking, and the public values were not properly incorporated in the investment decisions by the state-participants Gasunie and EBN.
Appendix 6: Fallow Acreage Benchmark UK-The Netherlands

Regulation UK, by DECC
DECC (Department of Energy and Climate Control, established in 2008) is a British government department concerned with energy and climate concerns.

For more information see:
http://www.decc.gov.uk/ for DECC
http://og.decc.gov.uk/assets/og/bo/regulatory/fallowacreageinitiative.pdf For Fallow Acreage

Fallow Acreage UK
The Fallow process is an ongoing collaborative initiative to ensure UKCS licenses are optimally worked to maximize economic recovery of oil and gas. In particular it places pressure on licensees to deliver activity on old licenses where companies have not been active for some considerable time.

Agreed under the PILOT banner, the Fallow Initiative was launched early 2002. There are essentially two processes - one for Blocks and one for Discoveries. Both processes work under the same principle of ensuring licensees either work the assets in a timely manner or divest to others who have the desire and ability to move activity forward.

The basic process involves Blocks or Discoveries becoming ‘Fallow’ if the licenses were awarded in the 1st to 19th Round and the initial term (normally 6 years) has expired and there has been no drilling, dedicated seismic or other significant activity for a period of three years. Assets in which current licensees are doing all that a technically competent group with full access to funding could reasonably be expected to do are classed as Fallow A and are allowed to be retained under annual review. Assets where licensees are unable to progress towards activity due to misalignment within the partnership, a failure to meet economic criteria, other commercial barriers, or a combination of these, will have their assets classed as Fallow B. These are then presented as Fallow B on the DECC website and are given a period of time (normally one year for Blocks and two for Discoveries) during which licensees are free to market the assets or develop activity plans. Failure to deliver an activity plan leading to a drill or drop decision (by either current or entering licensees) within the defined time period will normally result in the relinquishment of the block or discovery. Such acreage would then become available in future license rounds.

DECC recognizes the process is voluntary on the part of industry and in this respect will administer the process in a fair and reasonable manner. Where companies feel their case has not been fully understood or the rules are not being applied properly or are producing an unreasonable outcome, then such concerns will be open for review with senior DECC officials.

Revised Guidance has been prepared and agreed for both Blocks and Discoveries and is available on the DECC web site http://www.og.decc.gov.uk/UKpromote/fallow/fallow_assets.htm

In January 2011 the twelfth release was published, adding 16 new Fallow Blocks and 3 new Fallow Discoveries to the list. Sixteen Fallow Discoveries remain on the release list from 2002-2010, bringing the total number of Fallow Discoveries now on release to 19. The next release of fallow blocks and discoveries will be put on the DECC website in January 2012.
**RESULTS, BASED ON DECC WEBSITE:**

<table>
<thead>
<tr>
<th></th>
<th>Fallow Blocks</th>
<th>Fallow discoveries</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fallow definition</strong></td>
<td>No significant activity for 3 years, annual cycle. Published on website</td>
<td>No significant activity for 3 years, annual cycle. Published on website</td>
</tr>
<tr>
<td><strong>Relinquished</strong></td>
<td>1 year</td>
<td>2 Years</td>
</tr>
<tr>
<td><strong>Number of blocks/discoveries declared fallow 2002-2012</strong></td>
<td>507</td>
<td>180</td>
</tr>
<tr>
<td><strong>Number of relicensed blocks</strong></td>
<td>211 (total relinquished:507, so 42%)</td>
<td>Assumption: also 42% of the fallow blocks will be relicensed (probably more). So this is 76 discoveries</td>
</tr>
<tr>
<td><strong>Wells drilled (2002-2012)</strong></td>
<td>122 exploration wells (57% of all relicensed blocks)</td>
<td>38 appraisal wells (on 76 discoveries = 50%)</td>
</tr>
<tr>
<td><strong>New seismic</strong></td>
<td>17 surveys (8% of all relicensed blocks)</td>
<td>11 surveys (on 76 discoveries = 15%)</td>
</tr>
<tr>
<td><strong>New production or development plans approved on previously fallow blocks</strong></td>
<td>33 (15% ..)</td>
<td>42 (of 76 = 55%)</td>
</tr>
</tbody>
</table>

Activities (total) on UK in 2011:
- Off-shore: 14 exploration wells (28 in 2010), 28 appraisal wells (34 in 2010), 122 production wells.
- On-shore: 13 exploration wells (8 in 2010), 0 appraisal wells (1 in 2010), 11 development wells (12 in 2010)
- Exploration and appraisal: 42 (2011)
- Production: 133
- Source: DECC website

**BENCHMARKED FOR DUTCH CASE:**

History and scope: see 2.2.3

Biggest difference with UK:
- Non-binding agreement;
- No commission who reviews the licenses (Ministry is re-active to industry)

Assumptions and other differences between the UK and the Netherlands:
- The average block size in the Netherlands is bigger than the average block size in the UK (233 square km against 543 square kilometer (Johnston, 2008)).
- The average prospect size in the UK is higher than in the NL (4.2 bcm UK 2.2 bcm NL)
- In the UK there is no marginal investment allowance, therefore the number of fields which could be produced could be even higher. More research is needed to substantiate this.
- Conclusion: it is assumed that the [positive impact marginal investment allowance] = [negative impact smaller prospect size] so no additional correction factor was add.
- The regime in the UK is not voluntary, the results in the Netherlands will probably be lower therefore. Therefore the table below presents the “potential upside of Fallow Acreage, when applied comparable to the UK case.”
- Probably the number of contingent resources which are drilled for is higher than 42%. But no information was available to substantiate this.
- Of the additional reserves by exploration, could also be re-licensed. Therefore it is a cumulative process. This is not included in the calculates. When 22% of the additional reserves (77 bcm) will be declared fallow, and 55% will be developed. This would add more to the production but is not taken into account explicitly.
Benchmarked results for the period of 9 years (as in the UK case):

<table>
<thead>
<tr>
<th></th>
<th>Fallow Blocks</th>
<th>Fallow discoveries</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Exploration licenses</td>
<td>Production licenses</td>
</tr>
<tr>
<td>Fallow definition</td>
<td>Voluntary</td>
<td>Voluntary</td>
</tr>
<tr>
<td>Relinquished</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Number of prospects/fields</td>
<td>320 (of total 1449, so 22% of prospects are fallow)</td>
<td>Assumption: also 22% of the contingent resources will be declared fallow. Total is 159 bcm (EBN, 2012:8), average size is 2.0 bcm (EBN:2012:13). So potential: 22%*80 fields = 18 fallow fields</td>
</tr>
<tr>
<td>potentially fallow</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potential for relicensing (42%)</td>
<td>134 relicensed exploration blocks</td>
<td>7 relicensed fields</td>
</tr>
<tr>
<td>Additional exploration/appraisal wells</td>
<td>(57% of total relicensed exploration blocks) 77</td>
<td>(50% of all relicensed fields) 3</td>
</tr>
<tr>
<td>Additional seismic surveys</td>
<td>(8%) 10</td>
<td>(15%) 1</td>
</tr>
<tr>
<td>New production or development plans</td>
<td>(15%) 20</td>
<td>(55%) 4</td>
</tr>
<tr>
<td>Contribute to</td>
<td>Exploration</td>
<td>Unlock contingent resources</td>
</tr>
<tr>
<td>Additional reserves</td>
<td>77 wells * POS 50% * 2.0 bcm average size = 77 bcm (of which the most will be contingent? Only 1.4 will be developed in the UK case)</td>
<td>nvt</td>
</tr>
<tr>
<td>Additional bcm produced</td>
<td>Average prospect size is 2.0 bcm * 20 = 40 bcm in 9 years</td>
<td>Average prospect size is 2.0 bcm * 4 = 8 bcm in 9 years</td>
</tr>
</tbody>
</table>

Activities (total) NL:
- Exploration and appraisal: 15 (2011)
- Production: 45 (2011)
- Source: see below, EBN, 2011

(EBN, 2010; EBN, 2011; EBN, 2012)

https://www.og.decc.gov.uk/fields/fields_index/ukcs+field+information+listed+by+operators/ukcs+field+information+listed+by+operators.htm
APPENDIX 7: OVERVIEW OF OPERATORS IN DUTCH UPSTREAM INVESTMENT CLIMATE

The Dutch operator landscape changed over the period 2004-2011. In brief, the most important changes will be listed below, separated for exploration and production activities and for on-shore and off-shore activities. This distinction is important because exploration and production activities are significantly different in their nature. The data is derived from the nlog-database (see www.nlog.nl)

“EXPLORATION LICENSES” 2004-2010: LARGE INCREASE IN MARKET-SIZE, -CONCENTRATION AND -SHARE DISTRIBUTION DUE TO THE EMERGENCE OF NEW, SMALLER OIL COMPANIES

Both the total licensed area (from 40.000 square kilometer in 2004 to 55.000 square kilometer in 2010) and the number of licenses increased (from 28 in 2004 to 55 in 2010) (NLOG, 2012; EBN, 2012:29). There are three drivers for this increase. Firstly, the interest in exploration for unconventional gas prospects emerged on-shore. Secondly, there was a large 3D spec seismic survey performed by Fugro in unexplored areas. Thirdly, the correlation between the oil-price (correlation factor: 0.86) was evident over the past ten years. These developments had a positive impact on the total market-size of exploration activities in the Netherlands, in terms of licenses and total licensed acreage (EBN, 2012:29).

Apart from the market-size, there was also a shift in the market concentration and market-shares. First, the amount of operating firms tripled from 6 in 2004 to 17 in 2010. In 2004 the majority (92%) of the exploration licenses was operated by large incumbent oil companies and middle-sized oil companies (e.g. NAM, Wintershall, Chevron). In 2010, all large oil companies gave up their exploration efforts (from 34% in 2004 to 0% in 2010), which was taken over by smaller oil companies (e.g. ONE, Dana, total from 8% to 51%). So, this set of new, small companies both applied for new licenses (green-field projects) and take over existing licenses from oil majors (brown-field projects).

Off-shore, we see that 75% of the medium companies prefer a JOA with other parties, compared to only 60% of the small companies. Still, the majority of all licenses is operated by a JOA consisting of multiple parties (69% in 2010, compared to 81% in 2004). Moreover, the number of NOV’s in the JOA’s without experience in operating grew significantly over the period 2004-2010.

“PRODUCTION LICENSES” 2004-2010: INCREASING NUMBER OF SMALL COMPANIES PRODUCE AN INCREASED NUMBER OF LICENSES

The total amount of production decreased over the period 2004-2010. Production from the small companies doubled, production from medium companies increased from 27% in 2004 to 36%, and the production by the large companies decreased.
This is caused by the transfer of production assets and licenses by the large companies to smaller companies, as is shown in the figure below:

Although the market size decreased, there was an increase in market concentration as the number of companies operating a production license increased from 8 in 2004, to 15 in 2010. Also the distribution of market share between the large, medium and small companies made a shift, as is shown by the figure above. Given the exploration shift, this shift in production is expected to continue. Small companies bought production assets from large companies (brown-field projects) and brought new reserves into production (green-field projects). Concluding, more companies are operating more production licenses. Also with production, a number of small companies entered the actor-field. The preferred modes of governance did not change significantly over the years. Knowledge transfer slightly increased, caused by the growing number of oil companies in a JOA.

**CONCLUSION**

The first upstream shift concerns the changing operator landscape. As indicated in the table below, it must be concluded that small operators are gaining market-share on the expense of the large companies. On top of that, the markets of both exploration and production are getting bigger in size, and are becoming more concentrated. Moreover, companies tend to explore more individually, which reduces the possibility of sharing knowledge and assets.
"PRODUCTION” 2004 - 2010
On-shore, the incumbent producer (NAM) represents 90% of the market-share but the total producers increased from 3 to 5 over the last 6 years.

The total off-shore production declined. However, the 4 biggest producers lost market share (99% to 89%) to a big new group of small operators (from 7 to 12 operators in 6 years).

There was more production by (existing or new) regional (GdF, ONE, Centrica) or specialist (Chevron, shallow) companies.
APPENDIX 8: “PILOT” AND “STEWARDSHIP” UNITED KINGDOM

PILOT

About oil and gas in the UK and DECC

The UK oil and gas industry has been the largest sector of industrial development throughout the past four decades. It continues to support more than 400,000 jobs and contribute around £8 billion a year to the Exchequer. UK production remains central to UK energy supplies. DECC is responsible for licensing, exploration and regulating oil and gas developments on the UK continental shelf, working with the oil and gas supply chain, and regulating the environmental aspects of the industry including decommissioning. DECC aims to maximise the economic recovery of oil and gas from the UK’s oil and gas reserves, taking full account of environmental, social and economic objectives.

About Pilot

PILOT (formerly the Oil and Gas Taskforce) facilitates a unique partnership between the UK Oil and Gas Industry, and government. They cooperate to deliver quicker, smarter and sustainable energy solutions to secure the long-term future of the UKCS and ensure full economic recovery of our hydrocarbon resources.

The aim of PILOT has been to:

- focus on delivery of actions that will improve the competitiveness of the UK oil and gas industry
- deliver the PILOT 2010 vision, which will contribute to the longer term security of energy supply
- promote continued dialogue between government and industry

PILOT began life as the Oil and Gas Taskforce, which was created to find ways to deal with high oil prices and only expected to last for six months. It met once a month during that period. The model worked well and as the oil price recovered, other challenges emerged. The group was then tasked with working on a range of significant issues affecting the prosperity and viability of the UK basin. After the initial period the taskforce was renamed ‘PILOT’ and it now meets twice a year. It is chaired by the Secretary of State for Energy & Climate Change and includes around 13 industry representatives as well as representatives from relevant government departments.

The taskforce’s objective was to create a climate for the UKCS within which to retain its position as a pre-eminent and active centre of oil and gas exploration and production. It also aimed to maintain the UK contracting and supplies industry at the leading edge in terms of overall competitiveness. PILOT has since brought forward a number of successful initiatives and delivered results to improve UK competitiveness.

PILOT subgroups

A number of subgroups were formed, with a wide remit to consider actions on individual topics. This process of engagement has worked well. It has created a sense of involvement from the whole industry as issues have moved forward. The original subgroups were set up to look at:

- competitiveness
- innovation and technology
- skills and training
- regulation licensing
- fiscal issues
- environment and sustainable development

PILOT approach

Central to the approach has been the generation of what is a novel way of cooperation between industry and government: they work in partnership to deliver a stronger performance, sustaining jobs and developing services and technologies the market needs. Companies are encouraged to collaborate on non-competitive issues and look for new ways of working to make a brighter future for all.

PILOT has been highly successful and many of the projects have evolved into the key organisations fundamental to the UKCS today. The Industry Technology Facilitator was initiated by one of the strategic groups looking to improve the flow of new technology to the market, while LOGIC (Leading Oil and Gas Industry Competitiveness) was created by PILOT to stimulate supply chain collaboration and improve competitiveness. Initiatives such as Vantage POB, Masterdeed, IMHH and standard contracts were brought together under LOGIC.

To maintain the early momentum, there has been recognition of the need to reinvigorate PILOT. We continue to face challenges that have not become any easier, and it is important to maintain the alignment of all stakeholders working towards the same vision of maximising all opportunities from the North Sea.

Vision of PILOT

Maximizing the recovery of the UK’s remaining oil and gas resources is vital to the continued energy security and prosperity of this country. It is estimated that these resources could approach 20 billion barrels of oil equivalent. Through industry and government, PILOT advances initiatives directed at reducing cost, eliminating barriers and maximizing the effectiveness of resources, to bring about a future that could still see the industry meeting half the country’s oil and gas needs.

It is timely for PILOT to move away from prescriptive targets and create a new roadmap for the future of the basin with the overall vision of maximizing recovery of our hydrocarbon reserves in an economic and environmentally sustainable manner – a road map that will ensure we can anticipate and act on the issues the next 10 years will bring. It will articulate the direction of travel over a period of time with milestones identified for all proposed working areas and a possible ‘final destination’ for achieving an outcome in each area. We will also define what areas PILOT can impact on and which of those should be an industry or sectoral solution.

The PILOT Share Fair

The PILOT Share Fair is the annual flagship event for the Supply Chain. The event is organised by Oil & Gas UK[External link] (The UK equivalent of NOGEPA) and held each November. The PILOT Share Fair is central to the Supply Chain and continues to grow with a record breaking 1000+ delegates attending last year. The PILOT Share Fair provides the latest UK oil and gas business opportunities where major oil and gas players unveil their 18 months forward plans for projects in the North Sea. This event provides delegates with the opportunity to:

- Learn how to do business with companies active in the UKCS
- Find out key points of contact
- Take part in one-to-one discussions with potential clients
- Network with hundreds of industry colleagues
- Learn more about the Supply Chain Code of Practice

PILOT achievements

An important aspect of PILOT’s work has been to improve the way we do business in the UK. There are a number of areas we have been able to impact on using a collaborative approach, with members putting aside their individual business interests to work for the good of the industry. PILOT has had many successes in the past ten years of innovative and collaborative work. These include:

• Attracting new players and global investment – a diverse range of new players entered the basin, which has led to the development of more small fields and technology. A range of new companies and operators have entered the market.
• Fallow initiative – this has stimulated activity by placing still prospective acreage into the hands of companies that want to develop it.
• Access to infrastructure – companies are able to negotiate with pipeline owners, etc, for access. This has helped enable subsea tiebacks to infrastructure hubs, although there are still ongoing challenges in this area.
• Stewardship – initiative to critically analyse the potential of each producing asset.
• Technology development – working to foster innovation and facilitating the development and implementation of new technologies. This led to establishment of the Industry Technology Facilitator.
• Skills – the industry workforce has increased by 100% throughout the life of PILOT, and oil and gas academy OPITO was established following work in PILOT.
• Exports – there has been a higher level of exports from the industry than anticipated and Subsea industry renowned across the world.
• Investment – levels of investment in the basin exceeded expectations, including rising capital investment in the current economic climate.

**PILOT membership**

Industry membership of PILOT comprises industry stakeholders able to make a significant commitment to PILOT and represent a broad spectrum of views rather than just those of their company or group. This includes eight members of the board of Oil and Gas UK, and around five independent members – all industry leaders at a managing director / chief executive level. The forum is chaired by the Secretary of State for Energy and Climate Change and vice chaired by a Minister of State for Energy and Climate change. Also involved are representatives from key government departments and the Scottish Government, the Secretary of State for Scotland, and officials from HM Treasury and HSE, as well as a trade union representative. Membership is reviewed every two years. DECC’s Oil and Gas Industry Development team provides the secretariat to PILOT.


**Stewardship**


Initiated by PILOT (a task-force consisting of the UK government and industry members), Stewardship was introduced with the aim to realize the full economic potential of the brown-fields (the fields which already being produced), by incentivizing maximum investments and production efficiency.

In essence, good stewardship comes down to two key factors:

- That asset owners consistently do the right things to identify and then exploit opportunities, and that
- Assets are in the hands of those with the collective will, behaviours and resources to achieve this.

DECC (the UK governmental department of energy and climate, responsible for licensing of exploration and production on the UK continental shelf) will need to be satisfied, however, that the Field Development Plan and Management Plan address all the recoverable reserves of a field and do so over a long enough time period. DECC will therefore carry regular reviews of the performance of producing oil and gas fields and, where concerns over the quality of Stewardship are identified, engage the Joint Venture (JV) partners in discussions on improving their Stewardship to an acceptable level. Where a serious shortfall in stewardship is identified, the Stewardship process provides a framework for improvement including, where necessary, the use of DECC’s licence powers to require the JV to undertake economic development or to require a change of operator.

This Stewardship review process is carried out annually, and consists of a number of stages (see the figure below). The process also incorporates an annual review of Production Efficiency in UKCS developments.
This was initiated after the concern that some fields where not begin invested in to their full economic potential because of capital constraints, people constraints, materiality of benefits, partnership misalignment of the shadow of decommissioning.

Results:

About 10% of the fields are annually selected for a detailed review. Selection on basis of indicators (production efficiency, well utilization, investment, reserve replacement, seismic studies) below average.

Possible performance improvements: (1) JV development and improvement plan by: additional resources or focus, JV realignment, sole risk of one of the JV members, 3rd party investment or divest (2) In case of absence of appropriate improvement proposals: license power to require economic investments or replacement of operator.

An annual growth of 15-25% in expenditures on brown fields, additional drillings, improvement of operations (unplanned plant losses -25%)

Linked to other initiatives: near field exploration potential (NFP) and Fallow process.

APPENDIX 9: “OG21” NORWAY

OG21 is a Task Force established to help the petroleum industry to formulate a national technology strategy for added value and competitive advantage in the oil and gas industry. The objective is to develop a more coordinated and focused approach to research and development throughout the oil and gas industry. The initiative has received strong support from the industry. The OG21 national technology strategy for the petroleum industry focus on:

- Sustained profitability in the Norwegian petroleum industry and resource optimization on the Norwegian Continental Shelf (NCS)
- Increased technology and knowledge exports by exploiting the competitive advantages and internationalization of the Norwegian service and supply industry.

The national technology strategy represents a consensus-based approach to the industry’s views of the most important and urgent issues to be addressed by research and technology development.

Implementing the strategy

The purpose of the OG21 strategy is to align the various stakeholders to a common direction and understanding regarding technological challenges as well as technological opportunities. This will ensure a coordinated national effort in research, development, demonstration and commercialization.

The Role of OG21

OG21 acts as a catalyst for change and cooperation between key stakeholders. OG21 consist of a board established by the MPE and a secretariat reporting to the board. OG21 monitors and highlights new industry trends and swiftly brings them to the attention of its participants. OG21 influences the allocation of resources by advising the MPE who in turn use the Research Council of Norway’s petroleum related R&D programmes to implement the technology strategy. This model secures a link between basic and applied research, via pilot demonstration and qualification to commercialized products.

The Technology Target Area groups (TTA) remain a key in the implementation of the OG21 strategy. Their work enables efficient and focused technology- and knowledge development. Based upon this strategy, OG21 has revised the TTA structure, reduced the number of groups and focused on the following four themes:

- Energy efficient and environmentally sustainable technologies
- Exploration and increased recovery
- Cost-effective drilling and intervention
- Future technologies for production,
- Processing and transportation

The establishment of a holistic strategy for Carbon Capture and Storage is to be done in cooperation with Energy21. Implementing the OG 21 strategy will depend on cooperation with relevant organizations such as OLF, Federation of Norwegian Industries, Intsok, the Research Council of Norway and Innovation Norway. The main instrument to present the strategy to the different parties will be the OG 21 Forum. The OG 21 Forum brings together operators, researchers and the authorities to meet and discuss technological challenges. OG 21 is also arranging seminars for discussion of the strategy and how to close identified gaps. OG 21 is also playing an active role in promoting awareness of the types of education needed in the industry. The Technology Target Area teams will detail the OG21 strategy into sub-strategies that give clear prioritizing of technology needs. Each Technology Target Areas addresses the whole value chain, from education to R&D, incl. piloting. TTA members are from universities, research institutes, supply industry, oil companies and, where appropriate, the authorities. Each TTA will use the strategy themes and the priorities that OG21 has developed, to identify gaps that need to be closed. Their expertise will be used to define sub-strategies within the overall focus areas. Special emphasis will be placed on cooperation between the TTAs to develop integrated solutions. This will
require enhanced inter-disciplinary communication. The TTA groups will arrange workshops/seminars where the strategy is presented to the whole petroleum cluster.

The role of the Government

Public funding should primarily focus on education, basic science, long-term technology development and the stimulation of technology pilots. Short-term challenges will to a larger extent be the responsibility of the industry. The funding should focus on the fundamental research element of the value chain and provide risk reductions for important technologies that otherwise might not be developed and matured. Governmental engagement is important to stimulate research and develop high levels of competence is executed in Norway. Without incentives the industry may go abroad with their research activities. Increasing international competition makes it necessary for the Government to show a long-term commitment and through that, provide support to the supplier industry based in Norway.

Sources:


## Appendix 10: Overview of Interviews

<table>
<thead>
<tr>
<th>Date</th>
<th>Institution</th>
<th>Name and function</th>
<th>Subject</th>
<th>Quoted/ Agreed</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-2012 – 8-2012</td>
<td>EBN</td>
<td>Various interviews, among others: <strong>Board:</strong> - Miss M. Tillij (director corporate affairs) - Mr. T. Starink (director asset management) - Mr. B. Scheffers (director technical department) <strong>Other:</strong> - Mr. G. Noble and Mr. E. van Ewijk (asset managers) - Mr. C. van Langen and Mr. P. de Vries (business controlers) - Mr. S. de Jong, Mr. E. Wellenstein and Mr. D. Smith (commercial advisors) - Miss A. Smaling and Miss P. van Staalduinen (legal counsel and assistant) - Mr. H. Koster and Mr. J. Lutgert (senior members technical department) - Miss F. Jansen (facility engineer) - Mr. J. van Elten (strategy advisor)</td>
<td>Various subjects, among other: - Upstream investment climate - Operators in the Netherlands - Dutch upstream industry in general, role of government - Upstream investments and operations - Sales of natural gas</td>
<td>No/-</td>
</tr>
<tr>
<td>29-3-2012</td>
<td>NOGEPA</td>
<td>Mr. B. van Mannekes (Secretary General)</td>
<td>Upstream investments and gas roundabout policy in general</td>
<td>Yes/Yes</td>
</tr>
<tr>
<td>25-4-2012</td>
<td>EL&amp;I</td>
<td>2 EL&amp;I Officials (senior policy advisors)</td>
<td>Gas roundabout policy</td>
<td>Yes/Yes</td>
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<tr>
<td>29-5-2012</td>
<td>GasTerra</td>
<td>Mr. S. Schuit and Mr. J. Wempe (senior and junior business analysts)</td>
<td>Sales of natural gas, small-fields policy</td>
<td>Yes/Yes</td>
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<tr>
<td>29-5-2012</td>
<td>Wintershall</td>
<td>Mr. R. Hoogstra (senior business advisor)</td>
<td>Wintershall’s upstream investments and operations – gasrotonde and the Dutch upstream investment climate</td>
<td>Yes/Yes</td>
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<td>18-6-2012</td>
<td>Centrica</td>
<td>Mr. F. Weir (business manager)</td>
<td>Centrica’s upstream investments and operations – gasrotonde and the Dutch upstream investment climate</td>
<td>No/No</td>
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<td>21-6-2012</td>
<td>ONE (Oranje Nassau Energie)</td>
<td>Mr. A. Emke (technical director)</td>
<td>ONE’s upstream investments and operations – gasrotonde and the Dutch upstream investment climate</td>
<td>Yes/Yes</td>
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<tr>
<td>26-6-2012</td>
<td>NOGEPA</td>
<td>Mr. J. Peters (new Secretary General)</td>
<td>Dutch upstream investment climate</td>
<td>Yes/Yes</td>
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<td>17-7-2012</td>
<td>EL&amp;I</td>
<td>EL&amp;I Officials (senior policy advisor; responsible for platform gasrotonde)</td>
<td>Gas Hub Consultative Platform</td>
<td>Yes/Yes</td>
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<td>26-7-2012</td>
<td>Tullow</td>
<td>Mr. J. Rietra (country manager)</td>
<td>Tullow’s upstream investments and operations – gasrotonde</td>
<td>No/No</td>
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<tr>
<td>Date</td>
<td>Company</td>
<td>Contact Person</td>
<td>Topic</td>
<td>Notes</td>
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<td>10-8-2012</td>
<td>NPN (Northern</td>
<td>Mr. N. Tielens (country manager)</td>
<td>NPN’s upstream investments and operations – gasrotonde and the Dutch</td>
<td>Yes/Yes</td>
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<td>Petroleum</td>
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<td>upstream investment climate</td>
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<td>Nederland)</td>
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<td>30-8-2012</td>
<td>Vermilion</td>
<td>Mr. N. Wallace (general manager)</td>
<td>Vermilion’s upstream investments and operations – gasrotonde and the</td>
<td>No/-</td>
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<td>Dutch upstream investment climate</td>
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<td>11-9-2012</td>
<td>EL&amp;I</td>
<td>2 EL&amp;I Officials (senior policy</td>
<td>Gas roundabout policy</td>
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<td>advisors)</td>
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