# Executive summary

## Background, conclusions and policy recommendations[1]

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## Background

Several factors contribute to the growing importance of the gas quality issue in the Netherlands:

- The introduction of LNG to our country means we are importing natural gas with a different composition than that which has traditionally been available from domestic and foreign sources.
- Domestic production of natural gas is gradually declining at both the Groningen field and our smaller fields.
- Decreasing supply from the smaller fields means we will be using increasing quantities of imported high-calorific-value gas (H-gas) to produce low-calorific-value gas (pseudo-G-gas).[2]
- Over time, the composition of H-gas available from Russia and Norway is also likely to change.
- New gases (such as biomethane or 'green' gas and, in the future, possibly hydrogen) are increasingly being injected into the natural gas network.

A significant part of the gas quality discussion focuses on the PE (propane equivalent),[3] the planned expansion of the acceptable Wobbe index range (which requires specific margins for safety and other reasons), and the rate of fluctuation in gas quality. There is also discussion regarding the acceptable concentrations of $CO_2$ (carbon dioxide) and $H_2$ (hydrogen), components that are primarily the result of injecting biomethane and other synthetic gases into the natural gas network.

The concern is that an increase in the share of H-gas in the network may increase the quantities of heavier hydrocarbons (such as ethane and propane; these determine the PE of the gas). As a consequence, the PE of the final G-gas mixture may display an upward trend. Adding large quantities of H-gas to the G-gas network may drive the PE above the currently accepted critical maximum of 5. The resulting risk of incomplete combustion can lead to safety concerns, as the emission of harmful flue gases such as CO (carbon monoxide) and NOx (the mono-nitrogen oxides) may rise to dangerous levels.

In consultation with GTS, the Dutch national gas transmission system operator, the Minister of Economic Affairs (EZ) concluded that the major quality indicators for Dutch low-calorific-value gas (G-gas) can remain unchanged through at least 2021 (the transition period). Toward that end, he posed requirements for both the Wobbe index and the PE. During the period through 2021, the PE of low-calorific gas in the Netherlands may not rise above 5. The government has also announced the quality specifications that low-calorific-value gas must meet after this transition period (see the March 2012 policy letter to the Dutch parliament [Kamerbrief]), so that all market participants, including consumers, have ample time to prepare for the changes. Once the requirements for gas appliances have been published in the Official Journal of the European Union (OJEU), the Dutch government will determine the date after which newly introduced gas appliances and equipment are guaranteed to work with the new low-calorific-value mixture (referred to as G+; see also part 4 of this study). Publication is expected in 2014. The government has also indicated that these appliances must be able to support the transition to high-calorific-value gas (H-gas), as it seems logical that the Netherlands will transition to the international H-gas quality standard at some point in the future, dependent on the Groningen field's remaining production capacity and other factors.

## Defining the research question

The question now is how to extend the transition period as far as possible beyond 2021 in order to make optimal use of the natural equipment replacement cycle, thereby minimising consumer expense without introducing additional safety hazards.[4] For the purpose of this study, we have translated this into the

[2] This study uses the terms G-gas, pseudo-G-gas and L-gas to refer to low-calorific-value gas. G-gas (so named for the Groningen field) is gas that meets the Netherlands' specific low-calorific-value standard; pseudo-G-gas is a G-gas equivalent produced by mixing nitrogen with high-calorific-value gas; L-gas is gas that meets the low-calorific-value standard for foreign customer countries. The primary difference between G-gas and L-gas is that the upper Wobbe index limit for L-gas is higher. In this study, these three gas specifications are sometimes used interchangeably for convenience, since they are essentially the same.

[3] The PE refers to the propane equivalent of the gas. In the Netherlands, the maximum acceptable PE for the G-gas market is set at a level of 5, subject to exceptions. Natural gas with a PE that is too high can increase the risk of carbon monoxide formation for certain gas appliances.

[4] See the policy letters dated March 28, 2011 and March 12, 2012.

following research question: Can the transition period be extended to at least 2030, and if so, how?[5]
Based on this question, this study explores the following issues:

a) During the period between 2021 and 2030, might the PE of gas on the Dutch market exceed 5, and if so, by how much and under what conditions? (Part 1)
b) Do the conclusions from part 1 change if the analysis is limited to specific regions of the country, and if so, to what extent? What policies can we develop to maintain the composition of low-calorific-value gas at the level of the transition period, in order to extend that period beyond the guaranteed term through 2021, and how should each of these policies be evaluated? (Part 2)
c) In the event the limits are exceeded, what obvious policies can we implement to remedy that excess and extend the transition period? (Part 3)
d) What are the potential effects of a different gas composition on the safe operation of gas appliances and equipment? (Part 4)

## Extension of the transition period is possible

Though we can only partially and qualitatively judge many of the policies that could be considered in order to extend the transition period, there are sufficient indications—considering all the information now available and the current state of affairs—to conclude that extension of the transition period for households to 2030 and possibly longer is technically possible. This will require a flexible mix of policies (see below).
There are five major factors that determine which policies will be required, when they will be required, and to what extent they will be required. These are as follows:

- developments affecting the composition of the H-gas that will be converted to G-gas/L-gas
- developments affecting the demand for G-gas/L-gas in the Netherlands, Germany, Belgium and France
- developments affecting the available sources for supplying these markets with gas from the Groningen field or through conversion
- developments affecting domestic and foreign storage capacity for the G-gas/L-gas market
- technical and social consumer developments that affect end-use equipment suitability for differing qualities of gas

## Monitoring is essential

A competent monitoring system is the first and most essential priority in developing a future-proof gas quality policy in the Netherlands. Effective monitoring is vital because some combinations of the factors listed above will require little to no intervention before 2030, while other combinations will require intervention as early as 2021. Given the lead times, this means our policies must be formulated and possibly adopted in advance. A satisfactory monitoring system will allow us to determine which policies should be implemented when and to what extent. This avoids unnecessary or premature policy deployment. We must therefore monitor the five major factors listed above, which determine the timing and magnitude of potential problems, to ensure that our policies are effective.

## Three policy types

It is clear that the intended extension of the transition period must be realised in a cost-effective way based on a flexible mix of policies. Based on the information currently available, we can distinguish three types of policies:

- policies that should be implemented in the short term (or that may already be active)
- policies that can be formulated in advance in case new information (such as developments in gas-market supply and demand) indicates the need to take additional measures
- other policies, specifically those that might best be deployed near the end of the transition period and those that fall outside the current policy framework and can only be adopted if circumstances

[5] This study does not address the effects that an extended transition period might have on the introduction of biomethane into the natural gas network. It is conceivable that this will require changes to the allowable gas composition specifications before the end of the transition period. To the extent this is true, it falls outside the scope of this study and we assume only partial adjustments will be required that will not affect the PE and Wobbe index issues on which this study is focused.

change appreciably.

The table below shows the policies relevant to each category.

| | **Policies to implement or formulate in the short term** |
|---|---|
| 1 | Mapping preferential flows in the GTS network |
| 2 | Rerouting H-gas |
| 3 | Creating operational agreements for Groningen and UGS Norg |
| 4 | Influencing foreign demand for G-gas/L-gas |
| 7 | Accelerating the introduction of $I_2$ (easily converted from G-gas to H-gas) |
| 10 | Influencing quality specification standards for gas appliances and equipment |
| 16 | Managing LNG terminal tanks |
| 17 | Defining appliance and equipment safety limits |
| | |
| | **Policies for possible future deployment** |
| 5 | Preventing growth in G-gas consumption by new domestic customers |
| 6 | Limiting G-gas consumption by larger existing customers |
| 9 | Requiring periodic safety inspections for gas appliances and equipment |
| | |
| | **Policies for the long term** |
| 8 | Introducing safety sensors where necessary to alert the user to hazards |
| | |
| | **Policies outside the current legal and policy framework** |
| 11 | Controlling the use of gas from storage facilities in the mixing process |
| 12 | Limiting H-gas injection from new small fields |
| 13 | Setting PE limits on H-gas intake points |
| 14a | Stripping H-gas at major entry points |
| 14b | Stripping H-gas at mixing stations |
| 15 | Discussing changes to H-gas specifications with suppliers |
| 18 | Locating and adopting internationally recognised consumer safety indicators |

*Short-term policies*

The following policy has already been adopted:

- To prepare for a possible transition to a different gas composition for the Dutch consumer G-gas market in 2030 or later, new gas appliance specifications must be drafted in the short term. Combined with the extension of the transition period through 2030 or later, this will make the switch to a new gas composition less intrusive, since the natural equipment replacement cycle will ensure that most appliances are prepared in time for that change. The government announced this policy in its March 2012 policy letter.[6] It is important that this policy will be continued.

The following additional actions may be advisable in the short term in order to extend the transition period and to acquire the necessary information to make that transition as cost-effective as possible:

- We need to sufficiently formulate policies to reroute gas flows in the GTS transport system in order to solve regional issues or avoid problems for Dutch small-volume consumers (policies 1 and 2 in part 2) so that we adequately understand their cost, effectiveness and lead times. Once we know that, we can shelve these policies until such time as they become necessary, taking into account their adoption and implementation lead times and the moment at which we expect the

[6] See the policy letter dated March 12, 2012.

problem to arise.

- We should inform relevant foreign parties (including customers, TSOs and regulators) about the Netherlands' declining G-gas production (policy 4).
- We can also implement policy 3 in the short term; specifically, operational agreements can be made between NAM, GTS and GasTerra to accommodate any remaining short-term fluctuations in composition through the targeted use of gas from the Groningen field and the UGS Norg storage facility. These agreements can ensure not only that situations calculated to approach acceptable limits do, in fact, stay within those limits, but also that situations calculated to slightly exceed the maximum PE remain under control.
- We should systematically investigate what the various categories of gas appliances can actually handle in terms of gas specifications. This involves research that will form a partial basis for determining the potential consumer gas quality problem in the Netherlands in terms of size, risks and social impact (policy 17).
- We should follow or even actively participate in the development of a European standard for H-gas. It is important that the Netherlands is ready to adopt this standard in the near future, so that the exchange of H-gas with Belgium and Germany can continue unimpeded. We must also investigate the effects this European H-gas standard may have on limiting the PE problem for Dutch households (policy 10).
- A final and obvious short-term action item is to draft operational agreements between GTS and the GATE terminal regarding LNG tank management (policy 16).

### *Policies for possible future deployment*

The policies we can formulate now to address potential future issues involve the following:

- attempting to convert domestic large-volume customers' facilities from G-gas to H-gas (policies 5 and 6)
- introducing periodic safety inspections for high-risk (and possibly other) categories of gas appliances (policy 9)

### *Additional policies*

Once we have implemented policy 9, we can consider the following initiative:

- An action to remove any remaining hazards for older equipment still in use. For example, in the final years of the transition period old appliances with higher-than-average safety risks could be rejected or required to have sensors installed to detect harmful gas emissions (policy 8). Realistically speaking, such a policy could only be implemented in 2025 or even later, to avoid saddling residential consumers with prohibitive expenses.

Should the proposed policies turn out to be less effective or feasible than expected[7]—due to the cost effectiveness of measures intended to extend the transition period—we can adopt other, complementary policies such as setting a maximum on the PE of injected gas or introducing strippers.[8] In that case, it seems most logical to first consider placing concrete limits on the PE of imported gas. Clearly, we must carefully weigh the costs and benefits of any such policy (in particular, the amount by which it will extend the transition period).

## Limited information on the costs and benefits

This report does not go into detail on the costs of the various policies. We will need to further specify these during subsequent monitoring in order to achieve the right mix of policies appropriate to the current

7 After all, the effect of policy 1 depends on the physical circumstances and what is physically possible; in any case, it requires investments into infrastructure. The effect of policy 2 is equally dependent on the physical circumstances and on the particular characteristics of the physical gas flows. The effect of policy 3 depends on the results of talks between the TSO and the G-gas storage operators. Finally, the effect of policy 4 depends on the success of international negotiations and discussions.

8 A stripper is a facility that can remove heavy hydrocarbons from the gas.

situation. There is even greater uncertainty regarding the benefits of the proposed policy mix beyond achieving policy goals, in particular maintaining current gas consumption safety margins and possibly even avoiding the need for a two-stage transition toward an H-gas regime. Regarding policies 1 and 2, however, GTS has already indicated that these may potentially extend the transition period by five years under specific circumstances (see also part 2, page 16). It seems reasonable that the need for additional nitrogen capacity to guarantee the desired G-gas supply level will decrease as a result of the policies in the mix that limit gas demand. Here, too, additional calculations will provide greater clarity on the extent of the potential benefits.

## A committee to manage the monitoring process

Regarding the procedure targeting continuous safety surveillance for the G-gas segment of the market in light of fluctuating quality, we propose the creation of a gas quality monitoring committee. This committee would be charged with periodically—say, once every two years—recalibrating the scenarios based on the latest information and adjusting the optimal policy package based on developments in supply and demand. The committee would also be charged with issuing periodic advice on policy.

## Conclusion

We are convinced that, in the absence of unexpected or unforeseen developments in the gas market, the transition period can be extended to at least 2030. To achieve that goal, we must do the following:

- monitor market developments
- further define our policies and determine their costs
- further refine the mix of policies using new insights
- in the years leading up to 2030, prepare consumers for the transition to the new G-gas specification or to H-gas.
- The parties that participated in this study should also be involved in the monitoring process. It is essential that additional stakeholders and experts be involved in the final step, that of transitioning consumers to the new gas composition.