



Tight Gas

Panel Discussion:

"Is there an optimal strategy for the development of tight gas reservoirs?"

Jaap Breunese – TNO

Jan Dirk Bokhoven – EBN
Hilbrand Graven – Gaz de France
Simon Haddad – Total E&P
Sami Haider – Fracture Technologies
Jan van Herk – SodM
Johan van Luijk – NAM
Bill Rossen – TUD
Peter Veenhof – Wintershall

Tight gas Fields in the Netherlands

Report of the Panel Discussion (16:00 – 17:00 Hrs)

The workshop was concluded by a panel discussion, led by Jaap Breunese (TNO), to find common ground among the audience how to get to “the Prize”.

Panel members:

Hilbrand Graven - Gaz de France Nederland

Simon Haddad – Total E&P

Sami Haider – Fracture Technologies

Jan van Herk - SodM

Johan van Luijk- NAM

Bill Rossen – TUD

Peter Veenhof - Wintershall Noordzee

The discussion was structured in three themes:

A) Problem definition

B) Tackling the problem (*to understand, exploration, role of government*)

C) Recommendations (*Information, development options, incentives*)

Below a summary of the discussion is given.

A) Problem Definition (definition, scope, timing)

To get a feeling for the main issues 3 votes were held by Jaap Breunese:

1. Vote on **definition** of “Tight Gas”. How many present believe in a technical definition (e.g. cutoff in mD or in Kh/p) and how many believe in a commercial definition (e.g. depending on gas price, rig rate ...). *Votes were 3 for technical and 50 for commercial respectively.*

The supporters of a permeability or productivity definition stressed that a permeability of 0,1 mD was to low for defining tight reservoirs offshore in the Netherlands.

2. **How large** is the size of the prize? The audience believes that the recoverable volume lies somewhere between *50 and 200 Bcm*.
3. How many believe there is still room for **tight gas after 2020**, when most conventional fields will be empty? The majority of the audience (> 30) believe this there are still possibilities to develop tight fields after this date.

Commercial issues - Development options

Vella Narayen (Total): As a comment on the volumetric estimate of the tight gas reservoir volumes of *50 and 200 Bcm*, it was remarked that this is only a number that refers to a resource base. Currently such volumes can generally not be called reserves. Much more work has to be done to make production of gas from tight reservoirs feasible.

Remark Peter Veenhof (Wintershall): Shouldn't we ask ourselves "*what is the price?*" Whatever we do, the project economics will always be a balance between productivity increase and cost reduction. The presentations today have shown that, especially with rising cost in the current market, it is difficult to reduce costs. We need 'financial stimulation' on top of 'technological stimulation'.

B) Tackling the problem (Understand, exploration, role of government)**Understanding**

Q: Jaap Breunese: So what are the major hurdles that are holding us back?

- A: Bill Rossen: Our **lack of knowledge** concerning the causes for tight reservoir formation:
 - *Diagenesis*
 - *Heterogeneity*
 - *Condensate banking* etc.

Q: Jaap Breunese: Then is it a *fundamental* lack of knowledge that is holding us back?

A:

- Yes it is fundamental! Something is blocking flow to the well but often we are unable to distinguish between the causes correctly.
- *There is sufficient info on tight fields available world-wide, however it is not detailed or relevant enough to be applied in the Netherlands.*
- Operators in the Netherlands still have some catching up to do, because developments in other areas are more advanced. But it is not always easy to use the experience from other areas in the North Sea area.

Exploration and appraisal

Q: Jaap Breunese: Isn't tight gas development just as risky as ordinary exploration?

A:

- Wouter d'Engelbronner (Wintershall): *Risk in TGR is MUCH more important than in exploration.*
With TGR you may risk loosing more money than with one (or two) dry exploration wells.
- Josef Shaoul (Pinnacle): Yes this is true! In Europe well cost + stimulation cost are much higher than in the US. Even when you reduce stimulation cost, you are still facing the drilling of an expensive million Euro well, laying a pipeline and installing a platform. Just reducing stimulation cost won't enhance your project economics. Other measures are required.

Q: Jaap Breunese: So if there is a big difference between discovered tight gas and exploration, with TGR being less favorable, then how about exploring for tight gas?

A:

- *Nobody really tries to look for Tight Gas. It just happens to you.* Permeability cannot be predicted using the current technology. After drilling you find you are suddenly exposed to poor reservoir quality.
- Sami Haider: Yes, TGR development is equivalent to conventional exploration risk. But what numbers to put into your cash flow calculations on which you base your developments? What productivities and production profiles to use?

Q: Jaap Breunese: How about exploring for tight gas? Appraisal?

- Peter Veenhof : *To characterize a tight field you need a lot of data* (cores, GWC, gas quality etc.). This may require a costly extra appraisal well and it would be desirable to have a long duration test.

Developing a TGR therefore mostly requires more wells. It was remarked that in tight gas fields there is also a higher risk for compartmentalization.

- Then if you are exploring in TG territory, shouldn't we always drill a near vertical pilot hole followed by a horizontal exploration well? In case you encounter a TGR you have both the data and the productivity?
Peter Veenhof mentioned the recent drilling of a rather tight gas accumulation (in this case a carbonate) with first a pilot hole, then a horizontal well with still uncertain geological outcome because old well data was ambiguous. The way one has to assign risks, tight gas development looks like exploration.
- Johan van Luijk: In this context *the lack of disclosure of information on drilling and developing TGR's stands in the way of learning from each other.*

Q: Jaap Breunese: How about exploring for tight gas? Seismic

- Wim van Soest (BPNE): The only way forward is to try to concentrate on the "best" parts of the reservoir. We should use all geophysical techniques available (Spectral decomposition, 3d VSP etc.) to predict facies characteristics.
- Remark Jos Okkerman (NAM): But in TGR the problem is found on a pore scale and geophysical methods don't have such a detailed resolution. *That will not work.*

Role of the government

Q: Jaap Breunese: Major hurdles that are holding us back?

- Hilbrand Graven: We should understand the fundamental difference between the production profile of a low permeability field and that of a conventional Dutch

field. The long tail of such field makes the tight gas generally unattractive in the current tax environment.

- Sami Haider: Disinterest for certain license areas is clearly demonstrated when a license block changes hands 3 times.
The government needs to do something to make the business case for small independents much more favorable.

C) Recommendations (information, development options, incentives)

Q: Jaap Breunese: So finalizing this discussion, how do the panel members think we can get to “The Prize”?

Research and information

- A: Bill Rossen:
 - Team-up your research!
 - Start JIP’s! Works great in the US.

We realize that university research projects take a little longer. But the output usually is a solution to your problems and you also invest in your own future staff.

- A: Sami Haider: Yes we should start a European JIP on TGR. Concentrate the knowledge and experiences.

Remark of Johan van Luijk: “*The lack of disclosure of information on drilling and developing TGR’s stands in the way of learning from each other*” is important for the kind of information that is made available to interested parties by the government.

Development options

- A: Jos Okkerman (NAM):
Focus on “Minimal Facilities”.

Also force the gas buyers to accept the gas from the TGR without DCQ or gas-quality restrictions. Then we don’t need large and costly gas treatment or compressor/booster equipment on our platforms and we can make-do with small facilities.

Fiscal/Royalty/Gas sales contract relief for gas from tight reservoirs

Q: Jaap Breunese: So what are the major hurdles that are holding us back?

A:

- To make Tight Gas Fields economical government incentives are required (accelerated depreciation, state participation). But in order to qualify for such tax measures a clear definition for “Tight Gas Fields” is necessary.

- Germany already knows such a system, but it is felt that such a system would be difficult to enforce in The Netherlands. It would require operators to “prove” that they qualify for special tax benefits and who will be the judge of that?
- Tight fields produce slowly and therefore have a long lifespan and long write-offs. Could something be done to promote tail-end production (Note JL: This is also valid for many conventional gas fields, not just tight gas).

Closing Remarks Jaap Breunese:

Re-instatement of the “Depreciation At Will” fiscal rule for operators in the Netherlands is being looked into. But guidelines for its application still need to be defined.

The NOGEP (Dutch operators) organization is also studying on measures for marginal fields in general.