

Donkerbroek Hemrik Development

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Hemrik gas treatment facility, a low cost solution to unlock marginal fields

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Donkerbroek 3 was drilled in 1991 and was deemed uneconomic. Tulip Oil drilled DKK-4 well in a small nearby undrained compartment and Hemrik 1 well in Akkrum field previously produced by NAM Akkrum field to capture remaining updip volumes. The plan was to combine three marginal accumulations into an economic development.

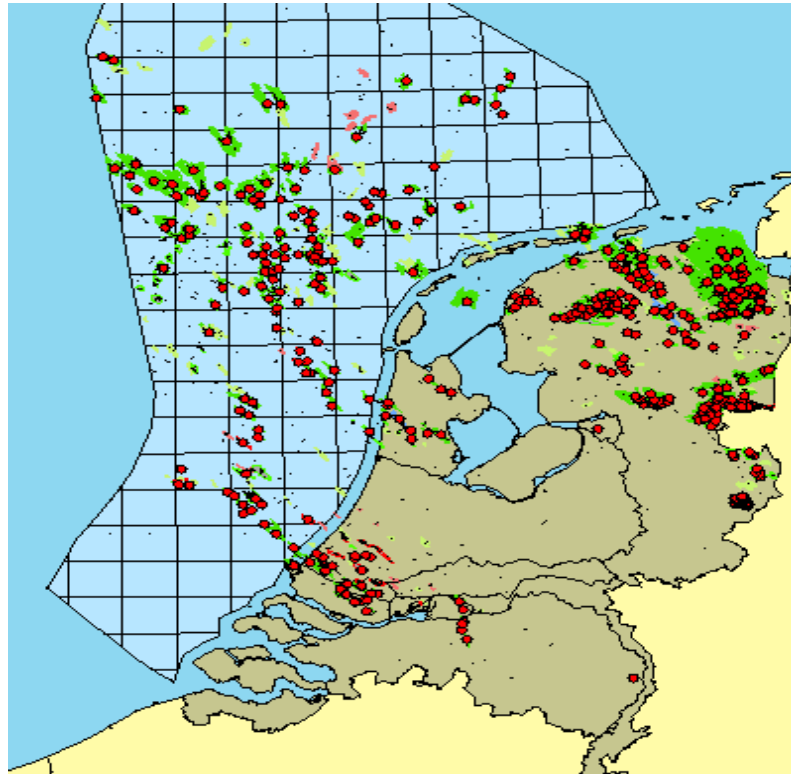
The challenge remained to build a treatment facility and connect the wells together and export the gas (24 km of pipeline required) at a low costs while safeguarding integrity and safety for the first production project for Tulip Oil.

At the height of the oil prices in 2014, Tulip in cooperation with Frames, HAK and other Dutch contractors designed and built the facility and pipelines, with first gas in 2015, a year later. The objective was to half the costs of what Tulip understood to be a state of the art facility nearby.

This presentation aims to share this journey with you, including the highlights and lessons learned, as low cost development seems to be a must have in today's world.

Objective

Design and construct facilities which represents a step change in the industry in order to enable development of stranded fields



Facilities

- Frames started detail Engineering end 2013
- Antea Group commenced civil construction Hemrik October 2014
- **Frames** as Main Contractor started delivery of Modules and construction of facilities Hemrik November 2014
- Support from Sub-Contractors Visser&Smit Hanab for piping and Imtech for E&I

Pipelines

- Antea Group started pipeline and civil Engineering late 2013
- A.Hak constructed 16 km pipeline in April-Sept 2014
- Tulip rehabilitated a 6 km NAM pipeline

Sales Contracts

- Gas Transport Services: Grid Connection Agreement
- GasTerra: Gas Sales Contract
- Reym: Water transport and disposal Contract

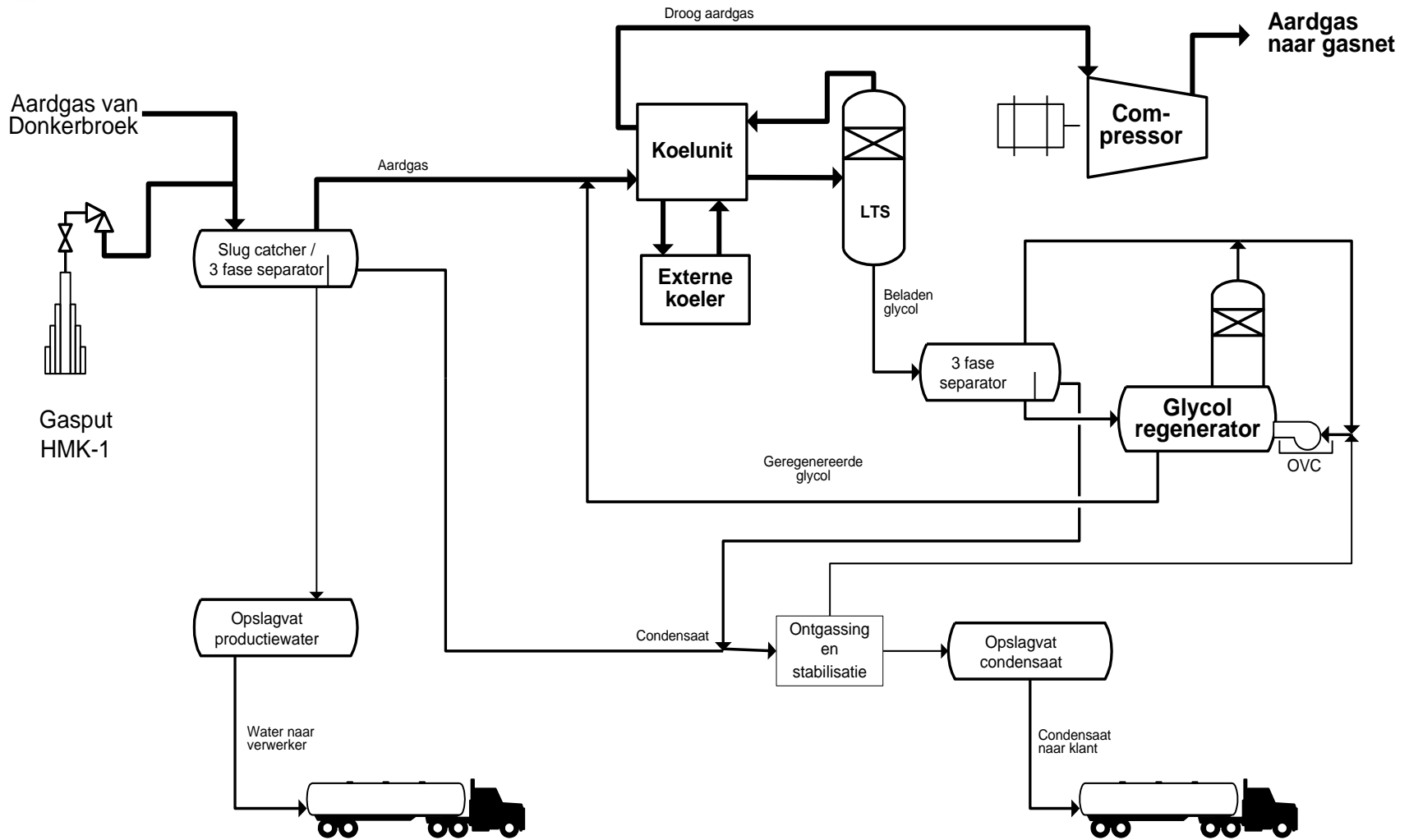
Permitting

- RHDHV: Environmental and building permits
- Versatec: Safety Case and support

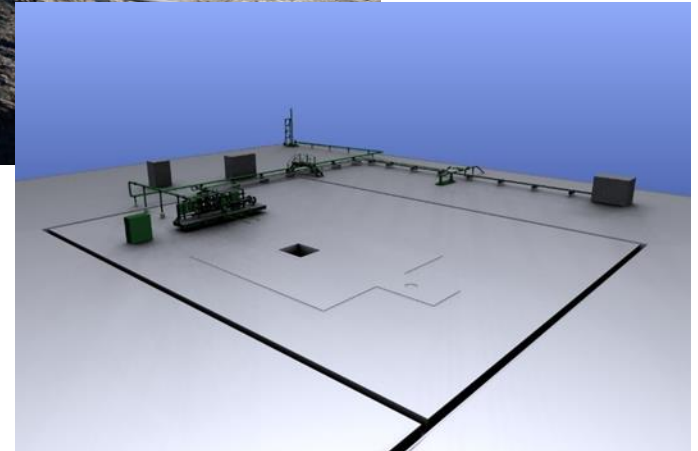
Wells

- DKK-03.
- New drilled HRK-01and DKK-04 by DrillTec





Development of a marginal field (3 wells, 2 plots)



How?


- Has to be Safe
- Sizing equipment in relation to the next cost step change and the expected production profile. Close integration with subsurface and economics.
- Use engineering judgment when taking design decisions!
- Minimise redundancy
- Make use of ullage in work portfolio of Contractors
- Share the objectives and create commercial alignment with carefully selected Contractors
- Design and select materials for a max 20 years design life
- Short decision lines during design/procurement and construction
- Accept lower redundancy but....
- Employ experienced multi skilled operational staff (Rene) in order to maintain an uptime of 99.8% so far

Most importantly create internal alignment: No over design, it's ok to feel uncomfortable, and everyone is clearly incentivised to create company value



- Unmanned -> low OPEX
- Gas treatment capacity 0,5 mill Nm³/day
- Outlet spec -8 0C water dewpoint, -3 0C HC dewpoint (Gasunie)
- Low Temp Separation with chiller (NH₃)
- Modular design, delivered by both Frames and others
- Engineering based on Industrial Standards and in compliance with PED (Pressure Equipment Directive, verified by Lloyd's))
- Main Treatment Plant (with 1 well) and satellite (2 wells)





The Donkerbroek and Hemrik Project: Working together to provide fast-track total plant solution

Trust is earned. It takes time and effort. At the Donkerbroek and Hemrik development project in The Netherlands, we worked intimately with our client, Tulip Oil, to provide a fast-track total plant solution for this marginal field development.

The close cooperation between Tulip Oil and Frames allowed us to cut lead time substantially, as well as focus our engineering capabilities on optimizing capital and operational costs. Ultimately, the installed costs per standard cubic foot were 40% lower than conventional operations.

As a Frames total plant solution, the work scope included a wide range of activities: project management; basic and detail engineering; procurement and subcontracting; manufacturing, inspection and shop testing; site construction and erection; pre-commissioning, functional test and startup; process tuning and personnel training.



Case 3

In addition, at Frames we worked under strict project delivery parameters, including a fixed number of labor hours and a final cost variance (15%) that was half of the industry norm.

The contract was awarded in 2013, and the first gas flowed in January 2015.

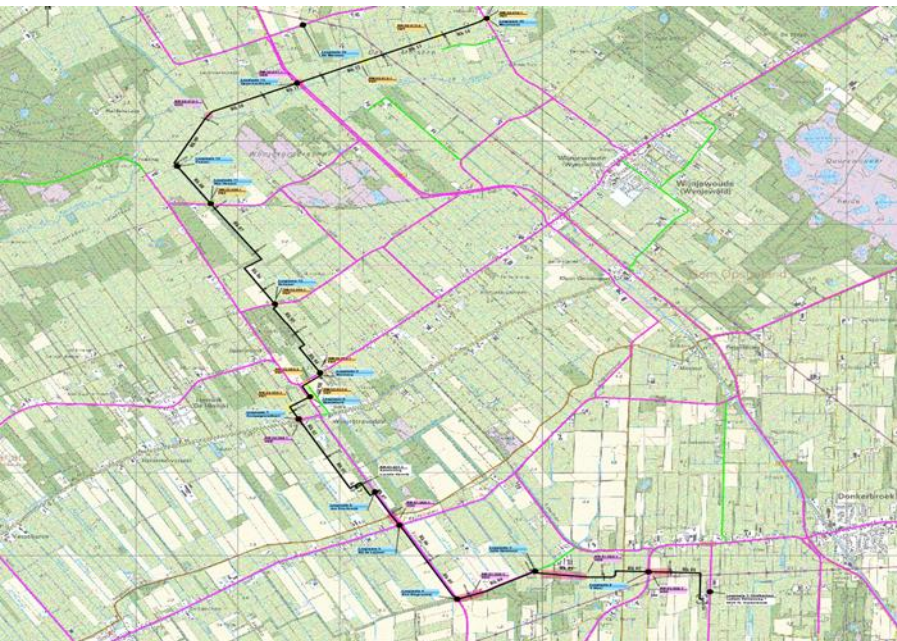
Thanks to the close working relationship between Frames and Tulip Oil, the project fast-tracked from the design stage straight into the project execution stage. The final investment was, indeed, within 15% of the target price. The plant has operated more than 7,200 labor hours without a lost time incident (LTI).

[Find out more about our total plant solutions.](#)



24 km Pipeline Trajectory by A.Hak

- 6 km 10" taken over from NAM
- 5 km 4" GRE for future water injection
- 5 km 4" flow line from satellite DKK to HRK
- 8 km 6" export line



- December 2014 Final Investment
- April 2014 Pipeline Construction
- November 2014 Installation modules and on site construction
- January 2015 Commissioning
- February 2015 First Gas – extended commissioning
- June 2015 “real” First gas

Overall cost Hemrik/DKK

2014

Facility + three well hookup/skids

Capacity

0.5 mln Nm³/d

CAPEX (including commissioning and owner's cost)

~9 mln €

Like for like comparison to benchmark (capacity/inflation/scope)

~45% cost reduction

Pipeline

4"/6"

16 km installed

Cost

~3mln €

Comparison to Benchmark

~30% cost reduction

Worked well

- 150k manhours without LTIs
- Incentivised Contract with cap on CAPEX uplift and Manhours, split the savings, sharp targets ->common vision
- Owners cost minimised by focusing on main Deliverables and one focal point (Albertus)
- Experienced multi skilled Ops Staff helped enormously to reach an uptime of 99.8%



Lessons learnt

- Condensate/gas ratio came 3x higher than expected. Condensate/Glycol separation system was too small and required an additional vessel for smooth operations
- Additional water tank was installed as operational requirements evolved
- Close integration during commissioning and troubleshooting key to fast resolution



Tulip's First Development in the Netherlands

Tulip Oil's first gas production from the Hemrik-01 well via the Hemrik Facilities on FEBRUARY 11th, incidents free, below budget and ahead of schedule!

