Annex B1: BC fields update January 2016	1. Bergen Rotliegend 2. Bergen Bunter 3. Boekel Bunter 4. Groet Rotliegend 5. Heiloo Bunter 6. Schermer Rotliegend 7. Schermer Platten 8. Starnmeer Platten 9. Zuid Schermer Platten

1. Bergen Rotliegend

The Bergen Rotliegend field has been depleted by 3 wells Bergen-2, Bergen-3 and Bergen-4. From March 2005, the field has produced only from the latter 2 wells as Bergen-2 had been worked over in order to produce from the Bunter formation only.
Bergen-3 and Bergen-4 have a similar well configuration (completion and tubing), but whilst Bergen-4 produces at a very stable rate, starting from 2004 Bergen-3 showed problems with both sands and water and its production became unstable. Treatments such as the use of foam, soap sticks and sand bailing have been applied, but none of those resulted effective. Since April 2008, this well had been kept shut. As the Bergen-4 well can solely produce the remaining reserves , production from Bergen Rotliegend occurred almost only from Bergen-4 since 2008. Bergen-3 is produced for short periods when some extra capacity is needed.
Production from Bergen Rotliegend has been interrupted in the period between 2007 and 2014 for extensive periods when it was the only field requiring two stage compression in order to optimize the fuel gas consumption. Only when the electric three stage compression was installed (May 2014), the field was taken into continuous production again.

2. Bergen Bunter

In February 2005 the well Bergen-2, that originally produced from the Rotliegend formation, was worked over in order to allow production from the shallower Bunter formation.
The well produced from August 2005 until January 2007 (from the Bunter), when it started to water out. In order to restart the well, it has been water washed several times. It has also been lifted 2 times with nitrogen in order to re-establish natural flow. Both trials failed and the well is currently shut with no further plans for development.

3. Boekel Bunter

The Boekel-1 well was drilled in 1975 into a water bearing sand of the Rotliegend formation. In December 2005 the well was sidetracked into the shallower gas bearing Bunter formation, where a small reservoir was found (GIIP = 0.04BCM).
The field was put on production in May 2006 and was depleted by January 2007. Production from this well has been suspended. A small increase in pressure is seen and it may be possible to re-start the well to extract an additional few million m3 of gas at some point in time.

4. Groet Rotliegend

Groet Rotliegend is one of the biggest fields of the Bergen Concession. Its GIIP is 7.0 BCM. Depletion started in the early seventies when six wells were drilled: Groet 1-6. Two wells, Groet-2 and Groet-5, missed the target.
Groet -3 was drilled in water bearing part of the Rotliegend formation, and it has been side-tracked into Groet-3A. The well was on production until May 2001. In May 2006 the well was suspended and the Xmas-tree removed.
Production from Groet-4 and Groet-6 stopped in December 2001, due to excessive water production. Both wells were unsuccessfully plugged back with cement in order to stop water influx. Groet-1 (GRT-1) was drilled higher into the formation. This well showed tendency to salt deposition, and some sand production. To counteract the salt deposition it is water washed on a weekly basis since 2005. The field is connected to the BDF (Bergen Drying Facility). It is expected that Groet-1 will experience liquid loading on the short term. Therefore a tubing change out (smaller tubing ID) is considered in order to extend the lifetime of the well.

5. Heiloo Bunter

In 1978 a seismic survey revealed a large structure in the Bunter sandstone and Platten Dolomite. The Heiloo-1 (HLO1) well drilled this structure in 1965 and found the Bunter gas-bearing. In February 1982 the Heiloo-2 well was drilled and tested gas from a small compartment in the Bunter formation. The Platten Dolomite formation was found wet. The field was never connected to a pipeline and the wells were left suspended. The Heiloo-1 well was abandoned in 2010. Heiloo-2 is still suspended.

6. Schermer Rotliegend

The Schermer Rotliegend reservoir has been depleted by the wells Schermer-1 (SRM-1) and Schermer-4 (SRM-4).
Schermer-1 is a vertical well with dual completion allowing production from two different formations: Rotliegend and the shallower Platten. When the Rotliegend formation watered out in 2001 a plug was set to shut off that zone.
Production from Schermer-4, a horizontal well, stopped in 2002 because of excessive water production. Current RF is 75%, which is low compared to other fields producing from the Rotliegend formation (around 90%). The potential for a low-cost sidetrack to recover the remaining reserves in the top of the reservoir has been reviewed but declined as the presence of a partially active aquifer is suspected for this field.

7. Schermer Platten

The Schermer Platten field has been on production since 1992, when the well Schermer-1 was recompleted with dual completion, allowing production from the Rotliegend and Platten formation. Since 2003 the well showed unstable production, due to tendency to salt deposition and water production. Foam sticks have been applied leading to short term benefits. Since 2004 the well is water washed on a weekly basis. Due to high amounts of water the priority to produce the well is low. The well was used until 2014 to pig the Schermer line to remove the condensate liquids entering the same pipeline from PGI. Since that time and the lower suction pressure, due to the three stage electric compression, the well is being produced on optimized several days on several days off schedule. A workover to recomplete the well to reduce water production is under consideration.

8. Starnmeer Platten

The Starnmeer field produced from the Platten formation. Production started in November 2001 and after only a few months, water production became high (WGR = 200 m^3/MM Nm^3). In order to dispose the water produced from Starnmeer and from the neighboring field Zuid Schermer, a surface water separator was installed. From May 2003 to September 2003: the well Starnmeer-2-ST produced 7.2 MM Nm^3 of gas, whilst Zuid-Schermer-1 was temporarily used as water injector (disposing some 25 Km^3 of water). In October 2003, Starnmeer-2-ST would no longer lift water and the field was closed in. It served as water injector for the reopened Zuid-Schermer field for a short time. Remaining reserves have been written off. Cumulative production is 111 MM Nm^3 out of a possible maximum GIIP of 280 MM Nm^3. Reservoir pressure is 138 bar.
Starnmeer is currently used for water injection together with the Zuid-Schermer well.

9. Zuid Schermer Platten

Similarly to Starnmeer, the Zuid Schermer field produced from the Platten formation. Well Zuid-Schermer-1 was drilled in 1997 and produced from 2001 to 2003 via a pipeline to BDF, which was also used for Starnmeer gas evacuation. From an early stage of its production life, the well showed high water production. Treatment with gels in order to shut off the water production was unsuccessful. The well has been temporarily used as water disposal well from May to September 2003, disposing some 25 Km^3 of water from the Starnmeer field.
From October to November 2003 well Zuid-Schermer-1 was re-opened for gas production, whilst production water was injected into well Starnmeer-2-ST. In November 2003 Zuid-Schermer stopped production and reserves were written off. Zuid-Schermer cumulative gas production amounts 30.7 MM Nm^3 out of a GIIP of 110 MM Nm^3.
The Zuid-Schermer well is currently used as production water disposal well for the Bergen.

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