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Norne 2030 – It ain't over till the fat lady sings

The Norne lifetime extension project aims to continue production beyond 2021[1]

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The Norne field has been producing since 1997, and in the original plans Norne FPSO was scheduled for shut down in 2014. Since then, the licenses in the area have developed several satellites fields which are tied in to the Norne FPSO. The production license has been extended to 2021 and the recovery factor on Norne main field is steadily approaching 60%. Two important factors to ensure life-time extension beyond 2021 are: sufficient remaining reserves and technical integrity of the Norne FPSO.

Norne Main Field

The Norne main field is at the tail of its production. In Figure 1 the production estimate from the first year of production is plotted together with the numbers from the revised national budget (RNB 2015).

The economical cut off was historically estimated to be in 2014. The main field is included in the plans for extending the Norne area life time, but without the satellite fields there would not be a sufficient volume base.

Satellites

The Norne FPSO is producing from four satellite developments in addition to the main field. Two oil and gas fields; Urd (2005) and Skuld (2013), and two gas/ condensate fields Alve (2009) and Marulk (2012). These satellites have contributed to the prolonged production from the Norne FPSO. From Figure 2 we see that volumes equivalent to the original reserves of the Norne field has already been produced.

The lifetime of Norne is extended through tie-ins, and the search for new tie-in candidates is an important activity to strengthen the business case for continued production beyond 2021.

Lifetime of FPSO

The design lifetime of the Norne FPSO is 25 years; hence prolonging the production license beyond the economical cut off of 2014 was achievable without major modifications to the vessel. In order to continue production beyond 2021 a reassessment of the FPSO's integrity is required. The Norne 2030 project has investigated several options for prolonging the life time of the FPSO.

1. Bring the FPSO to shore - upgrade and refurbish
2. Do all required upgrades offshore
3. Disconnect FPSO and produce remaining gas through sub-sea installations

The condition of the hull will dictate if the FPSO must be brought to shore (option 1). If the remaining reserves are mainly gas, then option 3 could be considered.

Volume base

Estimating reserves for a lifetime extension project involves different approaches. The work spans from developing tie-in candidates and IOR projects to estimating lifetime of existing wells. Oil volumes are particularly dependent on lifetime of existing wells.

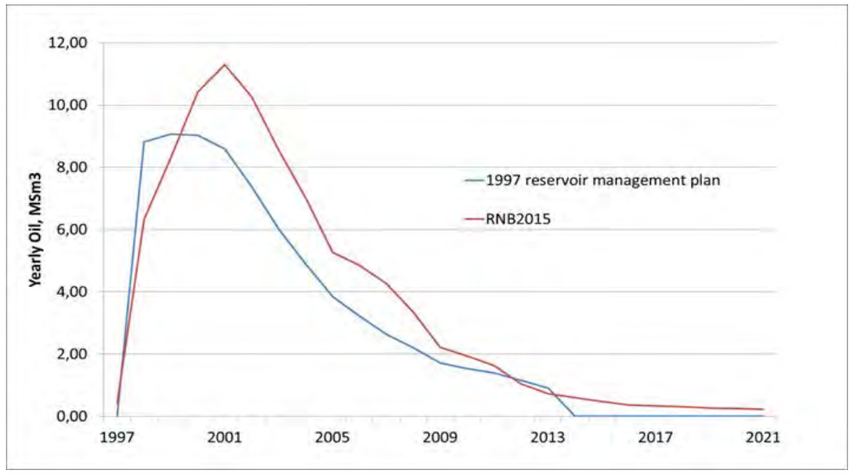

Figure 1: Production profiles showing predicted and actual production towards 2014 and predicted production from 2015

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The Future

Looking towards 2030, the aim is to reach 60% recovery on the main field. The field is already well into the tail production phase. The ambition of 60% recovery must be reached through implementation of new technology and new ideas. Currently Norne Petech is investigating the potential for subsea IOR e.g. subsea pumps, subsea separation and artificial lift.

In addition, Statoil has an ambition to develop competence and new technology to produce tight reservoirs. This development will be beneficial for Norne producing the last remaining reserves.

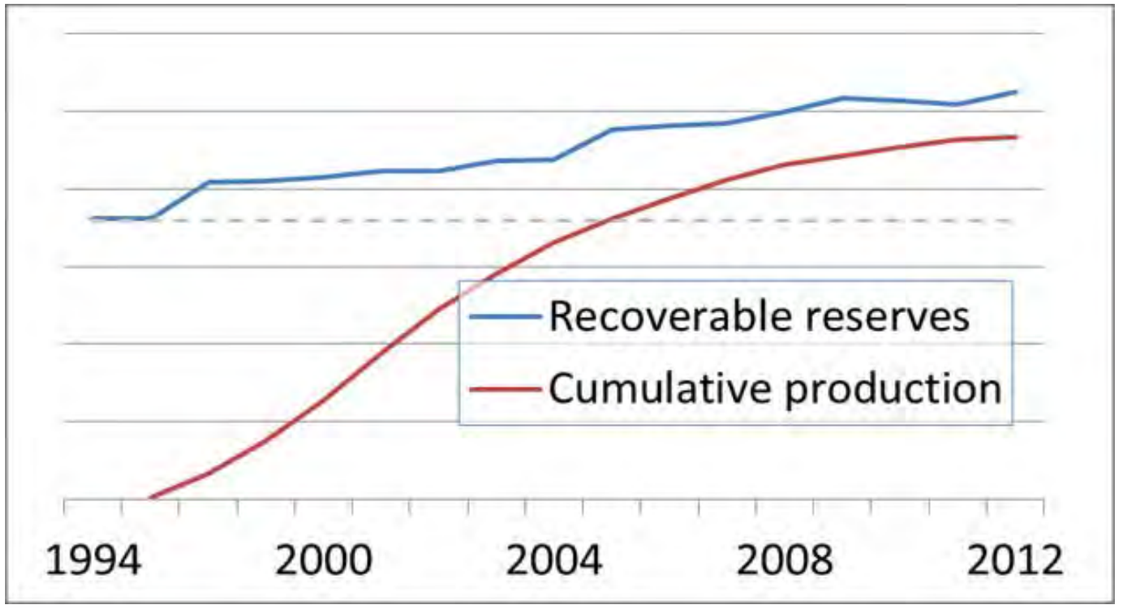

Figure 2: Increase in Norne reserves due to tie in of satellite fields

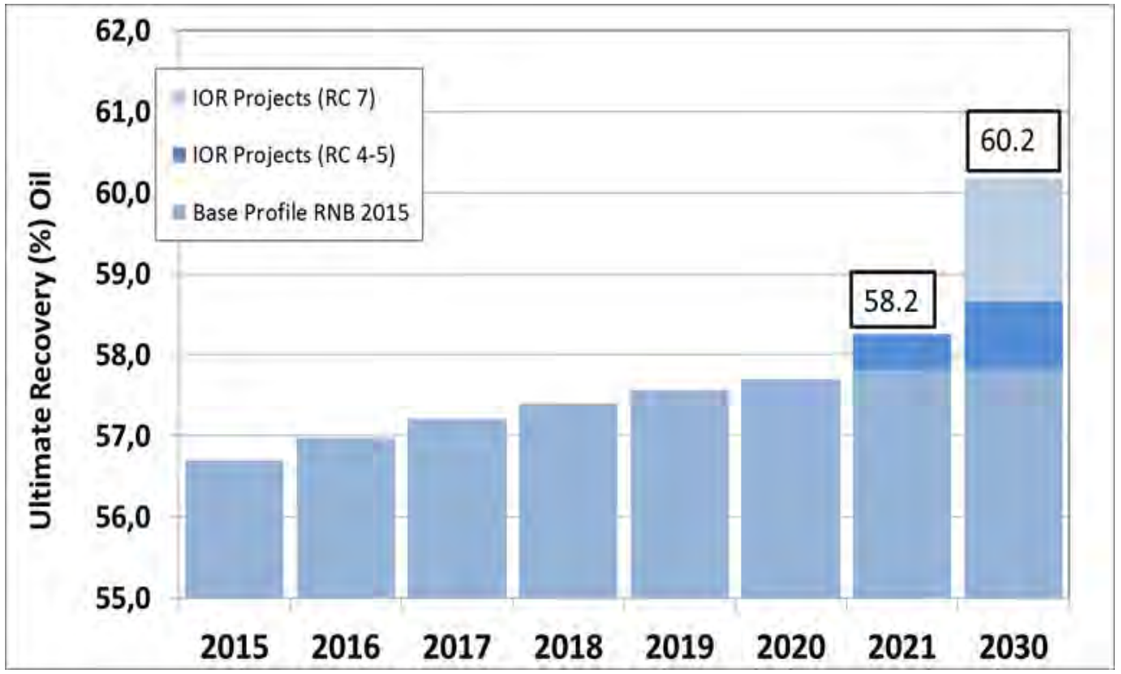

Figure 3: Recovery factor for Norne Main Field