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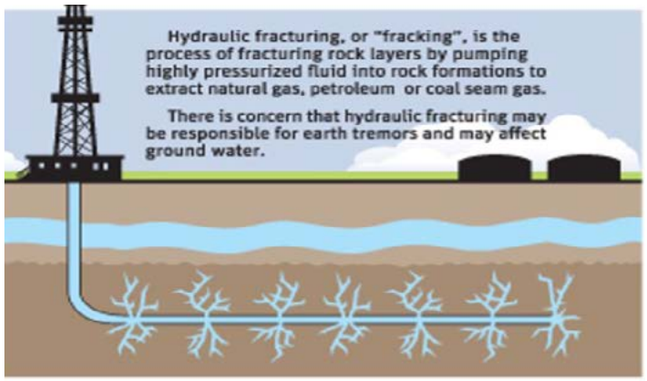
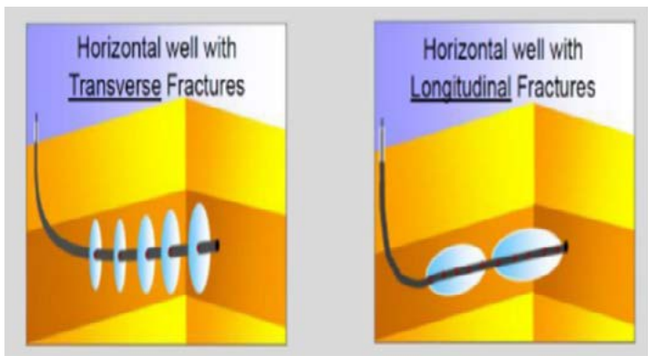
CAIRN

ABH RESERVOIR
A SUCCESS STORY OF TIGHT OIL DEVELOPMENT

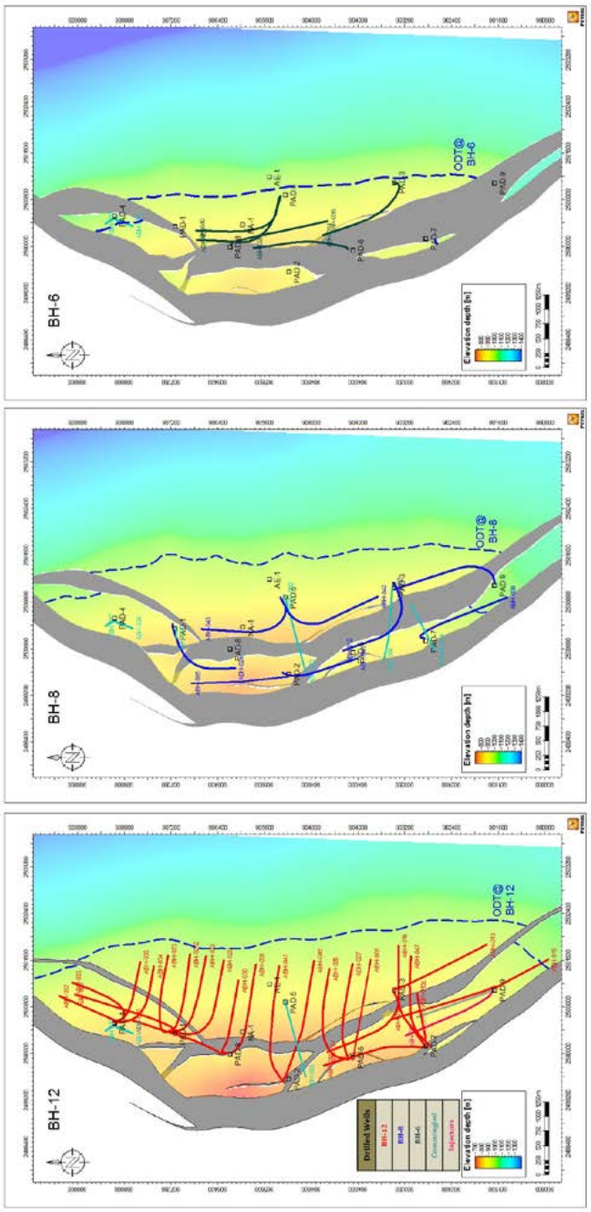
The Aishwariya Barmer Hill (ABH) field comprise of intercalated lacustrine reservoir of laminated high porosity (25-35%), low permeability (~1 mD) diatomite rocks of biogenic origin and claystones. The field is tilted fault block structure with number of gravity collapse faults impacting half of the field. The upper part of Barmer Hill (BH) from BH-12 to BH-6 constitute all the reservoir units. The lower part of BH is shale rich and is one of the dominant source rock in the area. In the field level as well as across the field, individual reservoir units like BH-12, BH-10, BH-8 and BH-6 show excellent lateral continuity which increased the confidence of placement of horizontal wells.



Source: Staff research | Michelle Houlden graphic

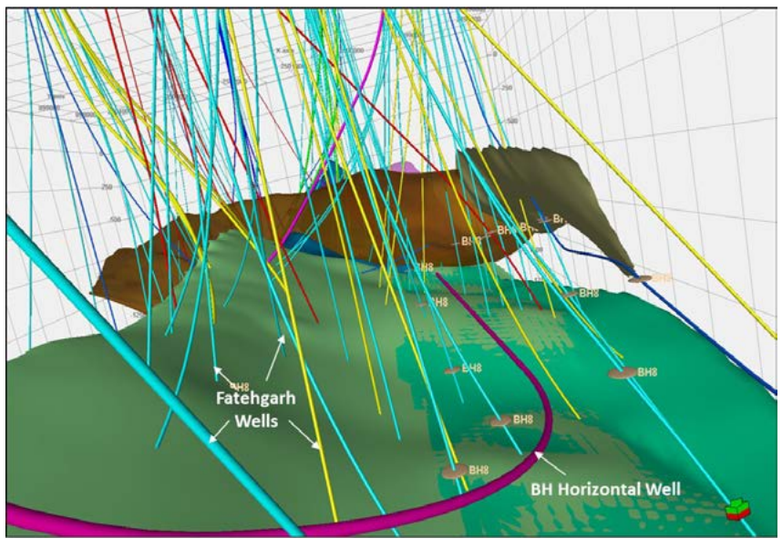


ABH Development with Longitudinal as well as Transverse Horizontal wells with multi Stage Hydraulic Fracturing



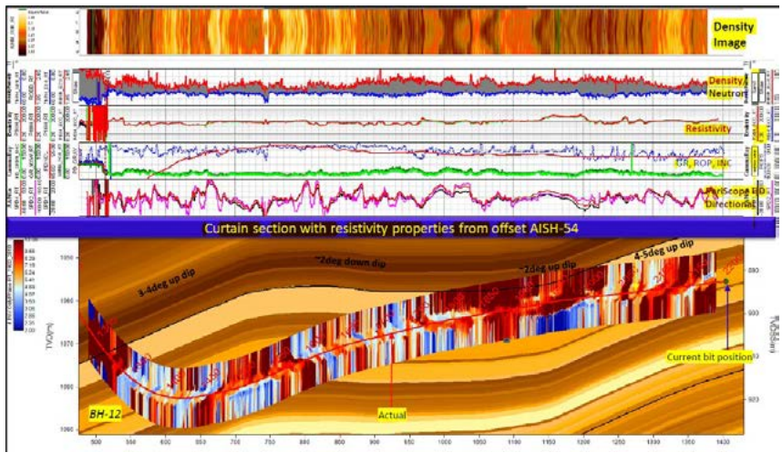
ABH Development with Longitudinal as well as Transverse Horizontal wells with multi Stage Hydraulic Fracturing

After a successful appraisal campaign with seven wells (three vertical and four horizontal) where horizontal well productivity was found almost three times better than the vertical well, the field has been developed with another 39 producer wells, among which 37 are horizontal. This is one of the largest horizontal well drilling campaign of India. The well completion has been designed to facilitate effective and efficient hydraulic fracturing. Hydraulic Rod Pump (HRP) is being used to efficiently lift the well fluid with smallest surface foot print requirement.



Example of 1 horizontal section steered (in purple) keeping a safe distance from the existing Fatehgarh wells

Steering 41 horizontal wells with lateral lengths of more than 1000m within the structurally complex reservoirs in a tilted fault block was exceptionally challenging. Steering the wells within the Barmer Hill unit with complex geo-mechanical settings and collision risk of more than 100 existing wells of the underlying Fatehgarh reservoir was achieved by meticulous planning and proactive decision making coupled with use of advance geo-steering tools. Well



Example of real time well steering depending on the changing structure throughout the km long lateral section

placement with average seismic imaging quality and geo-steering within a very low resistive contrast lithology was a commendable achievement.

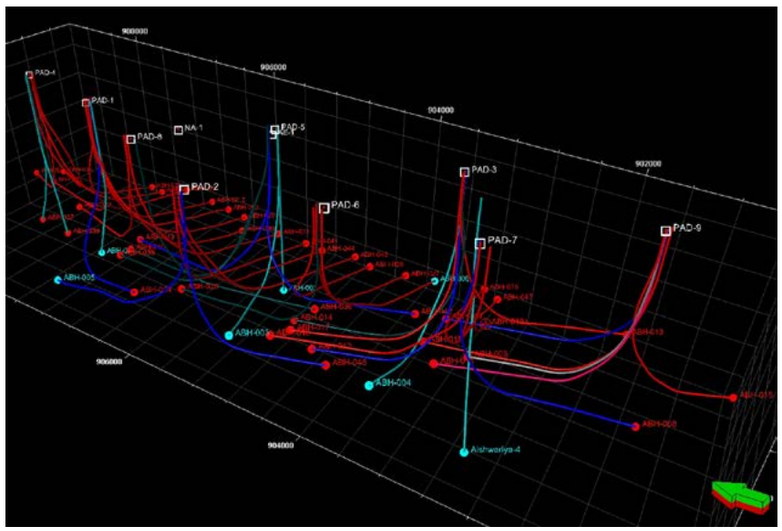
In this campaign four wells were drilled with the reservoir lateral length of above 1300m, where longest being the 1384m. In subsequent drilling campaigns, 8 additional wells have been drilled in this field.

The key to unlocking such reservoirs is to put propped hydraulic fracture to optimise the reservoir coverage and hence maximise the area drained per well successfully. In order to achieve the same BroadBand Precision (BBP) technology of Schlumberger was deployed wherein the sand face is completed with BBP sleeves allowing focused and pinpoint fracture initiation at the well bore. The lower completion is cemented which further ensures good zonal isolation between these frac sleeves. Coiled Tubing (CT) assembly is used to open the frac sleeves before the job and the inflatable multi-set packer provides necessary zonal isolation from the previously fracced stages. This intelligent combination has helped in pin pointed frac initiation and in maximizing

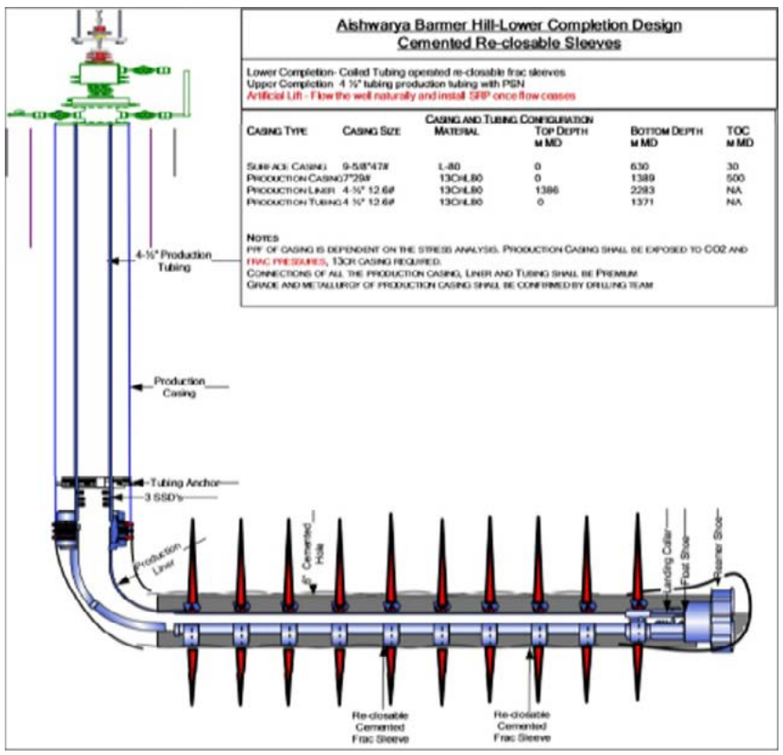
frac efficiency with as high as 8 frac stage pumped/day. Overall more than 450 frac stages were placed in the reservoir.

Aishwariya Barmer Hill is the first Tight Oil development of Cairn Oil & Gas, Vedanta Ltd., and the company is working towards putting more wells to increase the recovery from the field.

Apart from the depletion production, technical feasibility of water flooding and implementation of other Enhanced Oil Recovery (EOR) techniques are being evaluated.



Pad Development of ABH field with underlying Aishwariya Fatehgarh Reservoir



Multi Stage Hydraulic fracturing completion design with HPU to lift produced fluid with minimal footprint.

EXPLORE INDIA WITH CAIRN

Cairn Oil & Gas, part of Vedanta Limited, is India's largest private oil and gas exploration and production company, contributing about a quarter of India's domestic production. With a world-class resource base, Cairn has an interest in 62 blocks in India spread over 60,000 square kilometres with gross 2P (Gross Proved Plus Probable Reserves) and 2C (Gross Contingent Reserves) of 1.4 bn boe.

Cairn has producing assets across Rajasthan, Andhra Pradesh, Gujarat, and Assam, and has spearheaded several technological innovations with high-reward prospects, over the last 30 years of its operations. The company has a vision to contribute 50% of domestic production, executing one of the largest exploration projects in India across its diversified portfolio comprising conventional and unconventional projects such as Tight Oil & Gas, Deep & Shallow Water, ASP and CBM, reinstating the faith in the country's hydrocarbon potential.

Cairn is committed to achieving Net Zero by 2030 by prioritising environmental resilience and is driving transformative social impact at scale. It has become the first Indian company to sign the United Nations Environment Programme's methane reporting and reduction initiative – OGMP 2.0.

30 YEARS OF ENERGISING INDIA

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