



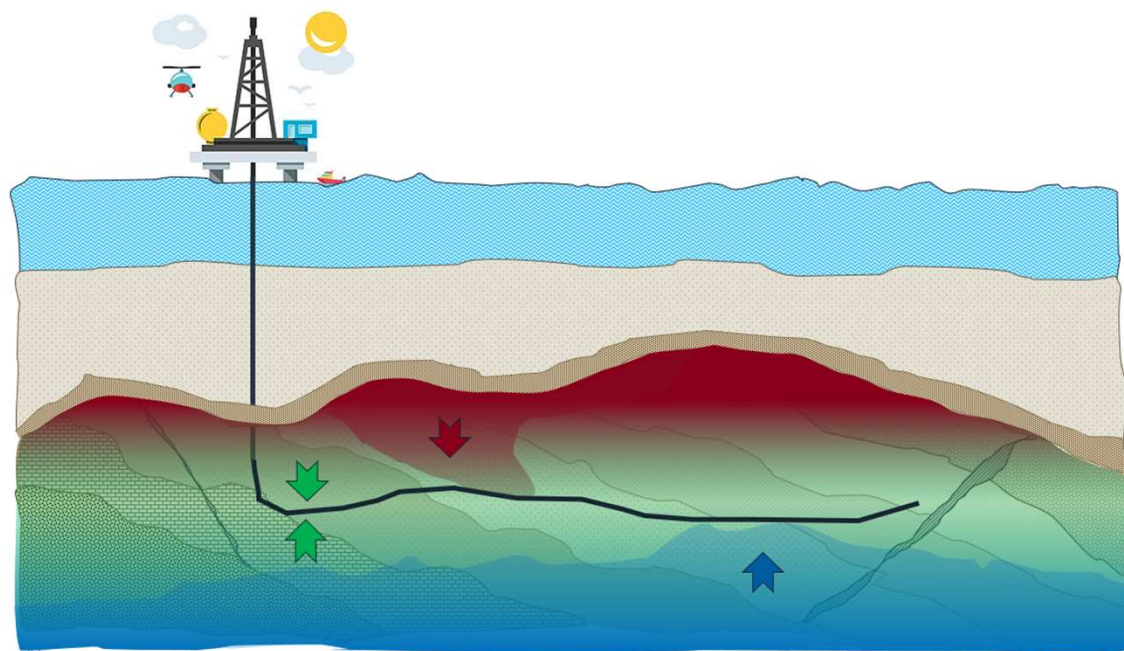
Development and deployment status on inflow control technologies

FORCE Webinar
February 7, 2024

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Presenter: Martin Halvorsen

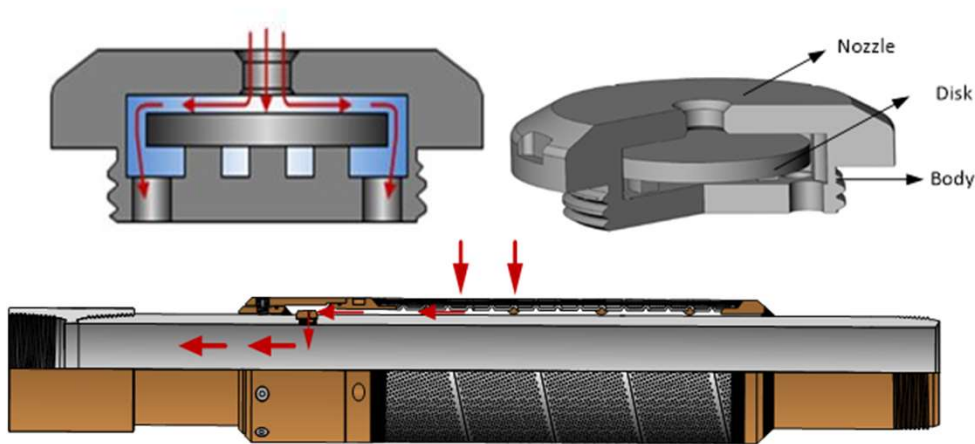
Outline

- Introduction
- Overview of AICD implementations
- AICD Field case
- New Electric ICD well concept
- Future plans and technology needs

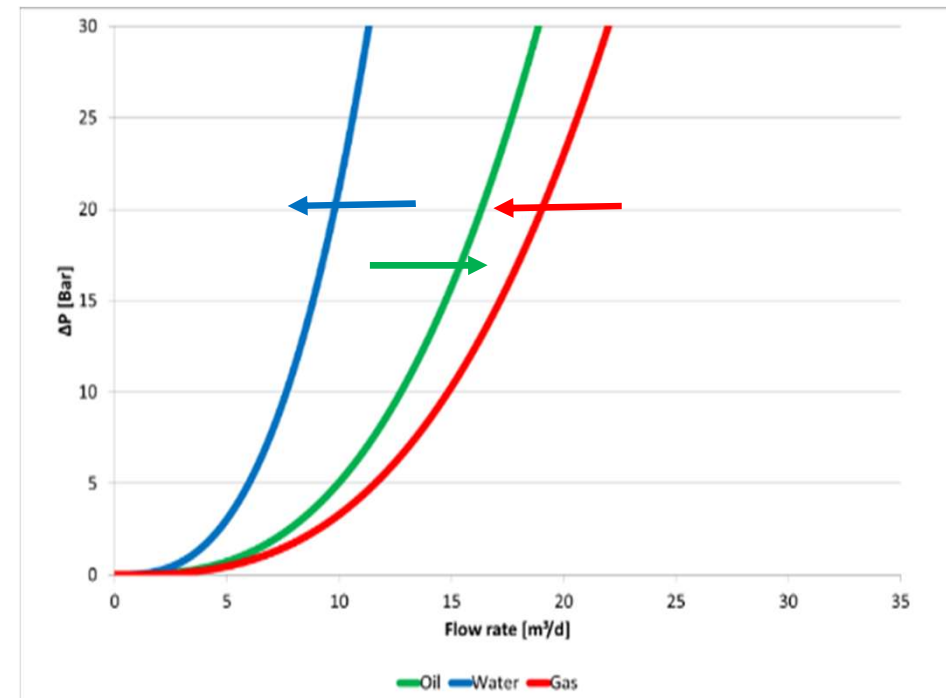


Autonomous inflow control devices (AICDs)

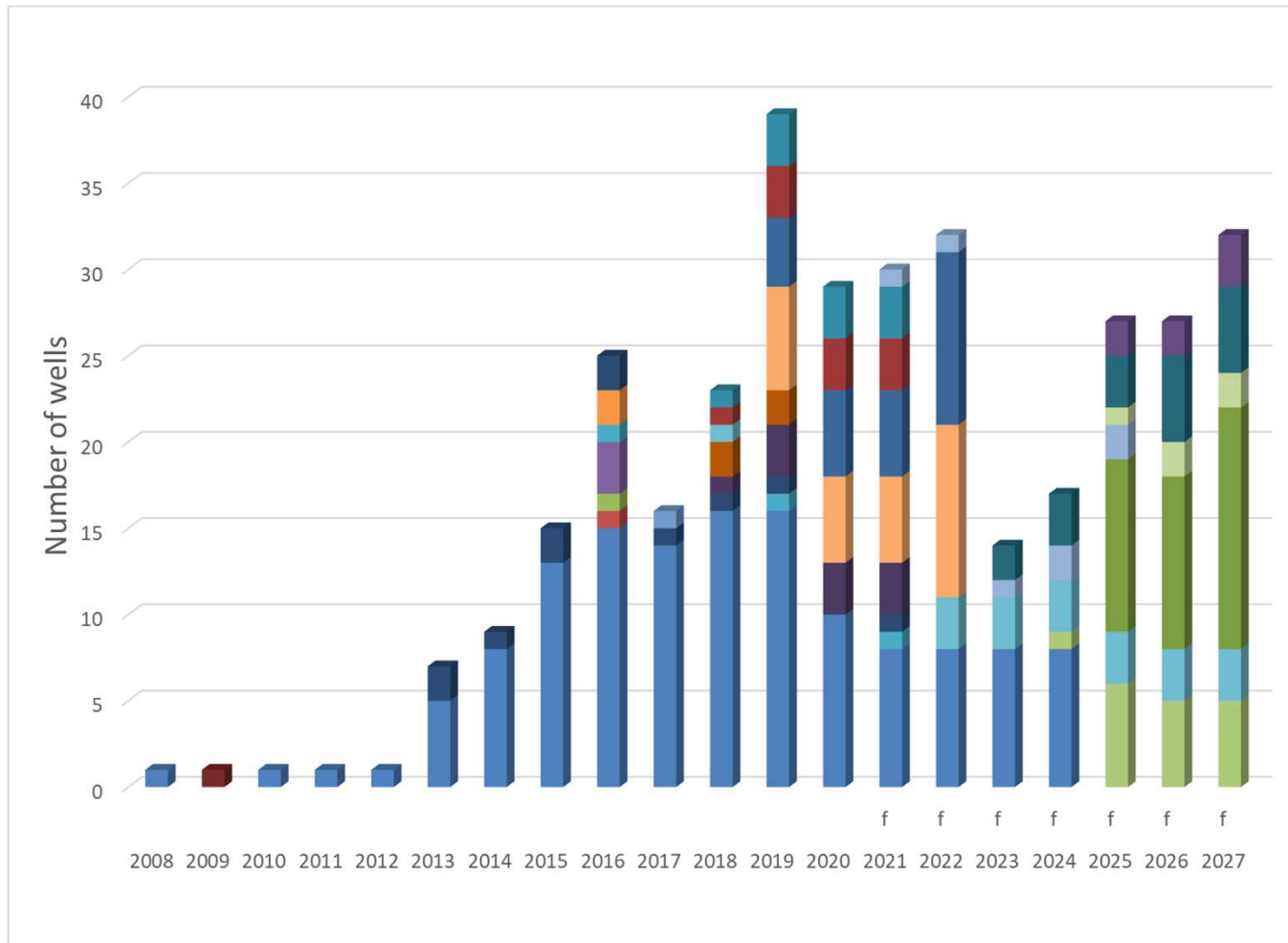
- Designed to choke back gas and water relative to oil
- Position of disk depends on fluid viscosity
 - Oil : maximum gap
 - Gas/water: minimum gap



$$dP = f(\text{flow}, \text{viscosity}, \dots)$$



Implementations



SPE 159634
 SPE 180037
 OTC-27992
 SPE 195617
 SPE 210379



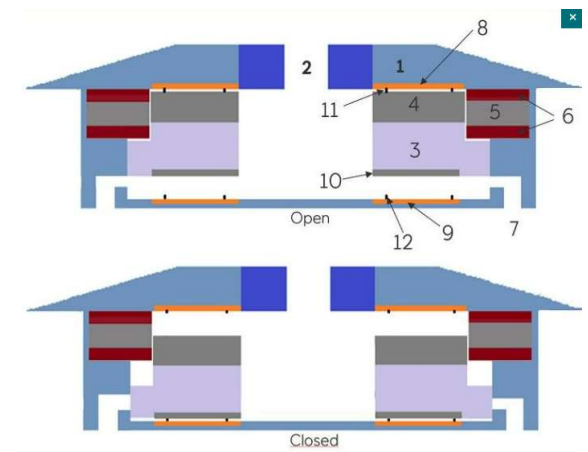
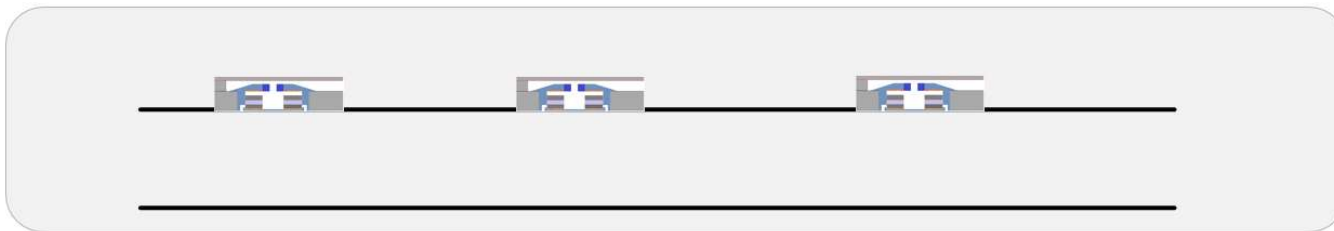
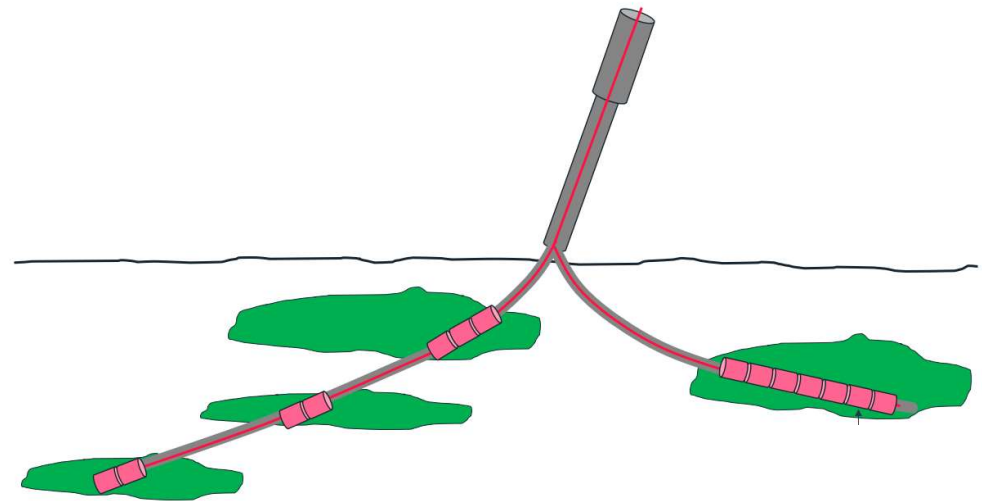
Concrete actions to develop the NCS:

- Drill 100 - 150 wells every year
- Drill 20 - 30 exploration wells every year and actively explore for gas
- Prolong the lifetime of more than 20 installations
- Cut our CO2 emissions through electrification and offshore wind
- Cut cost by continuing the improvement agenda
- Collaborate internally and externally to cut subsea-tieback cost and well cost
- Realise potential from digitalisation and technology
- Strengthen existing and build new competence



Electric ICD well concept

- Electrically operated valves in each screen - cable or powered tubing/screens
- Technology need: reaching more targets in one well increase production potential per well
- Important, since many of our new wells will be tied into existing infrastructure
- Interval Control Valves vs electrical ICD's
- Supplier collaboration - Co-innovate with partners. Develop solution together with business areas



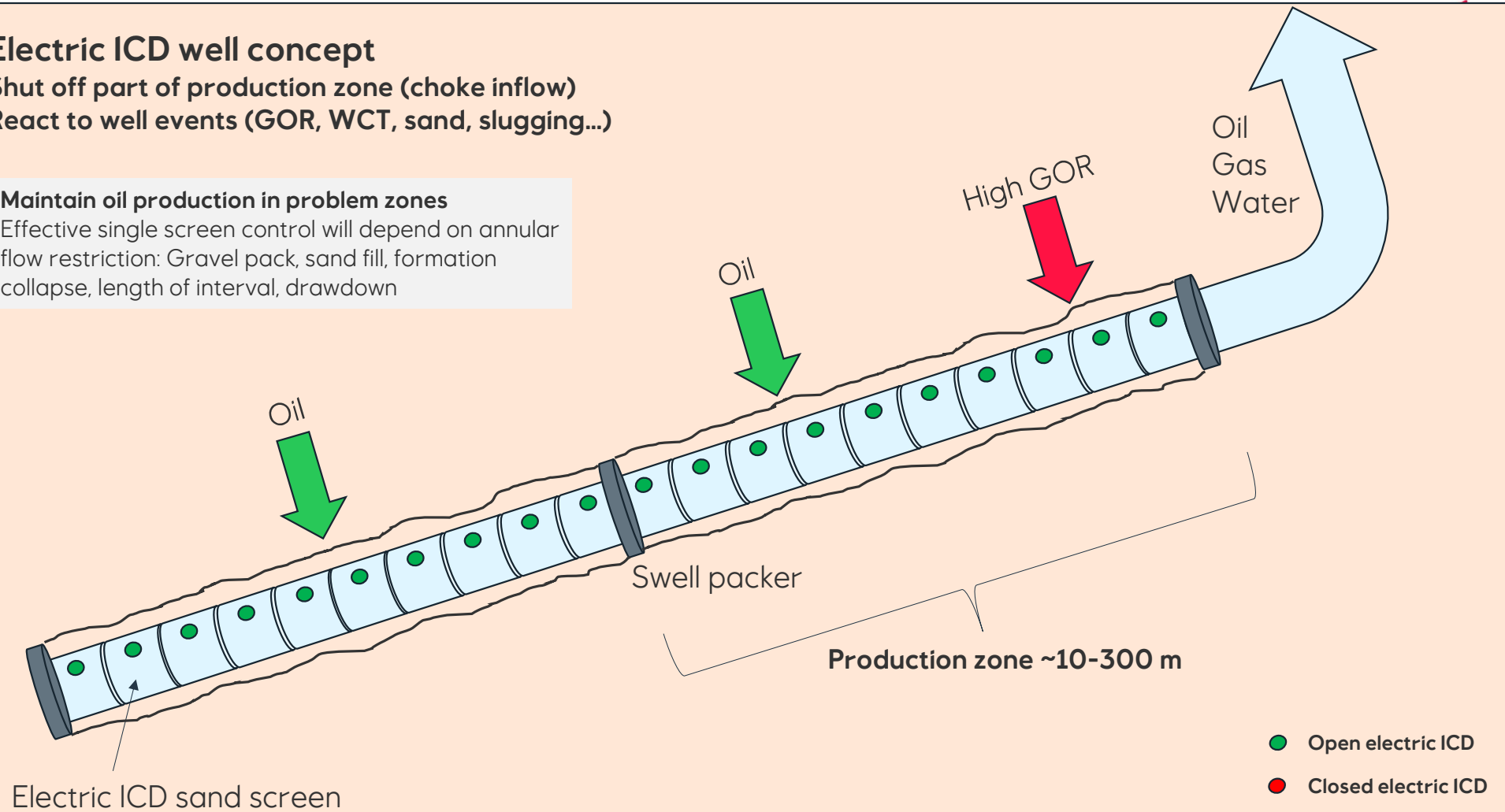
Electric ICD well concept

Shut off part of production zone (choke inflow)

React to well events (GOR, WCT, sand, slugging...)

Maintain oil production in problem zones

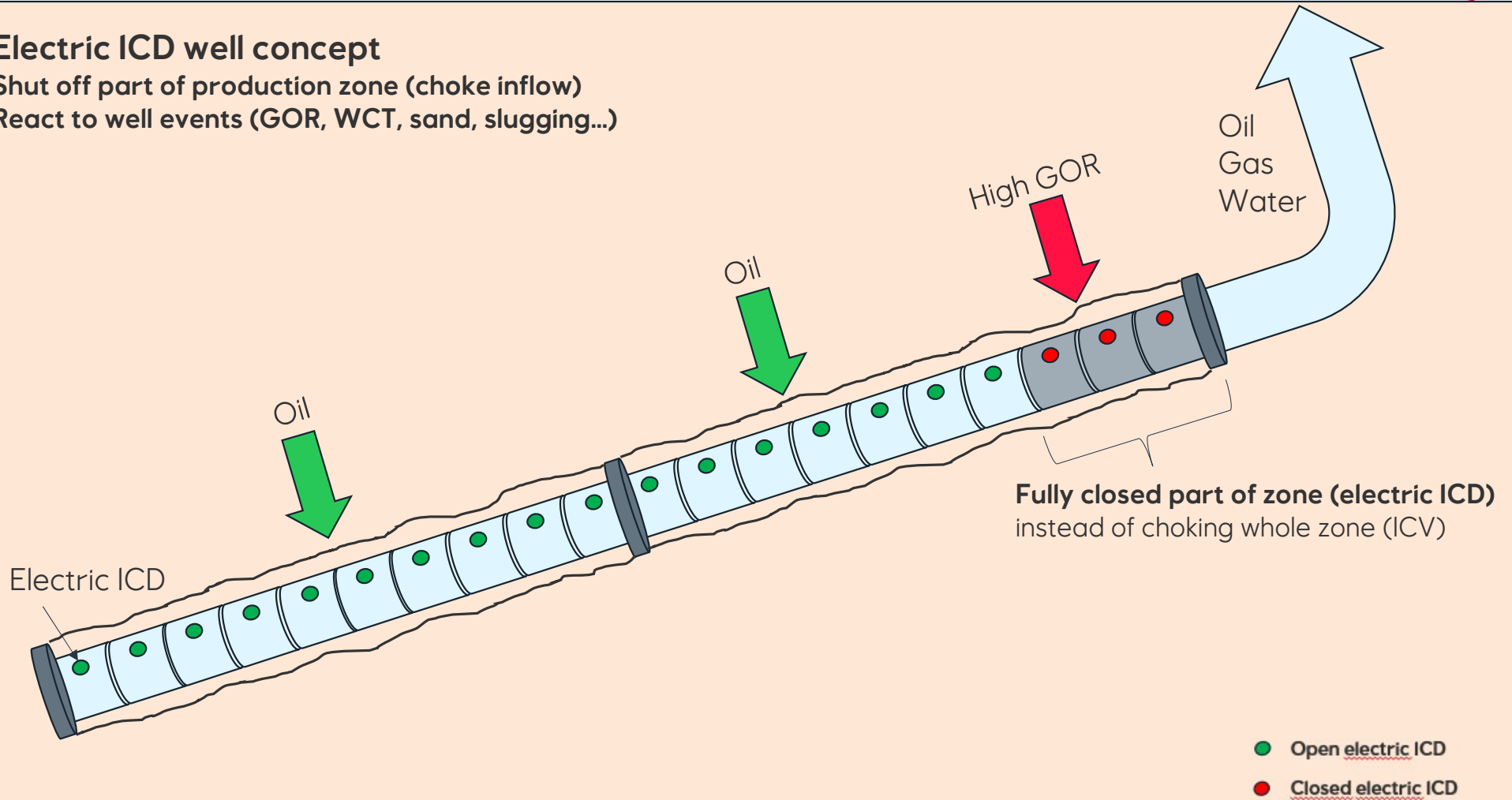
Effective single screen control will depend on annular flow restriction: Gravel pack, sand fill, formation collapse, length of interval, drawdown



Electric ICD well concept

Shut off part of production zone (choke inflow)

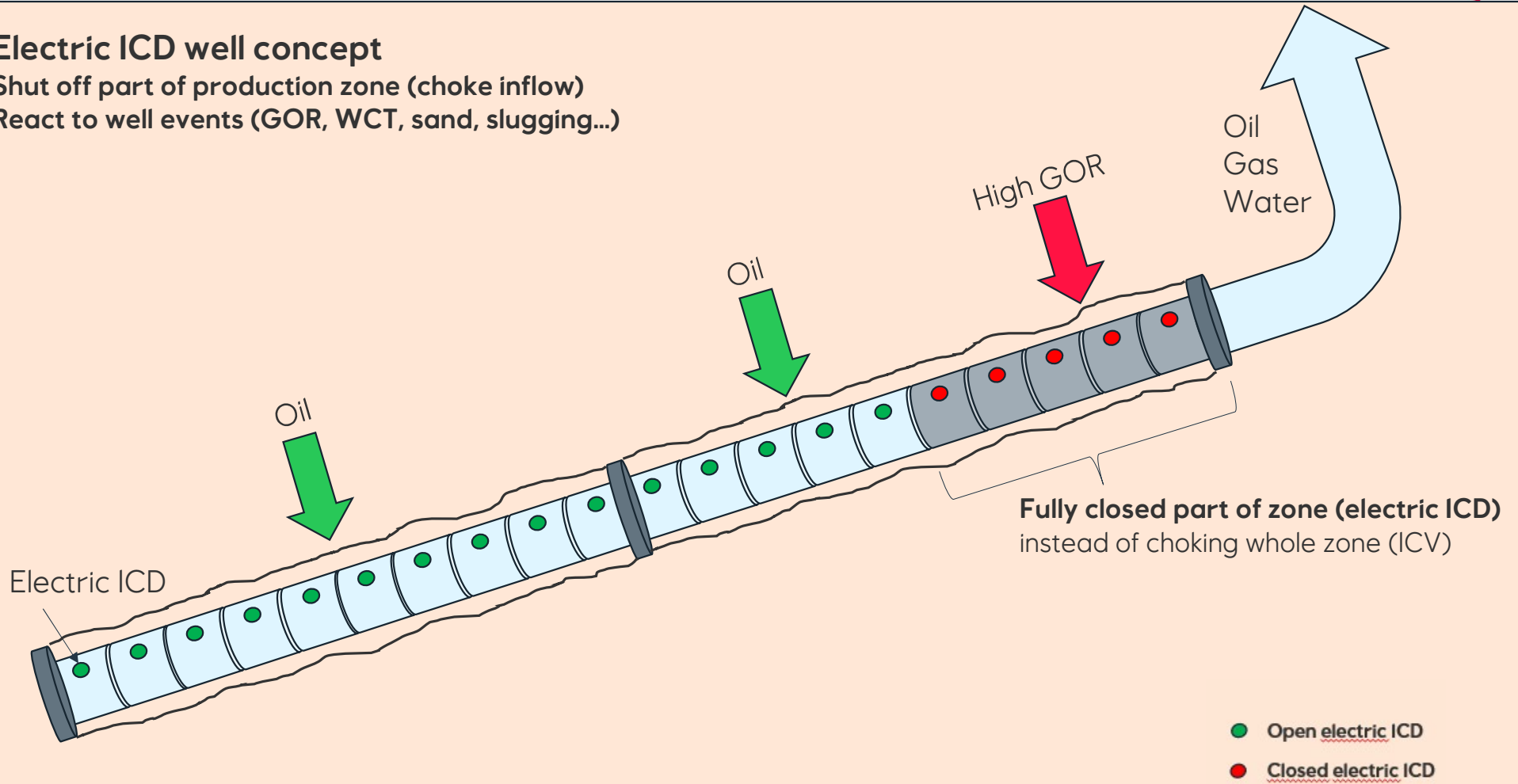
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Electric ICD well concept

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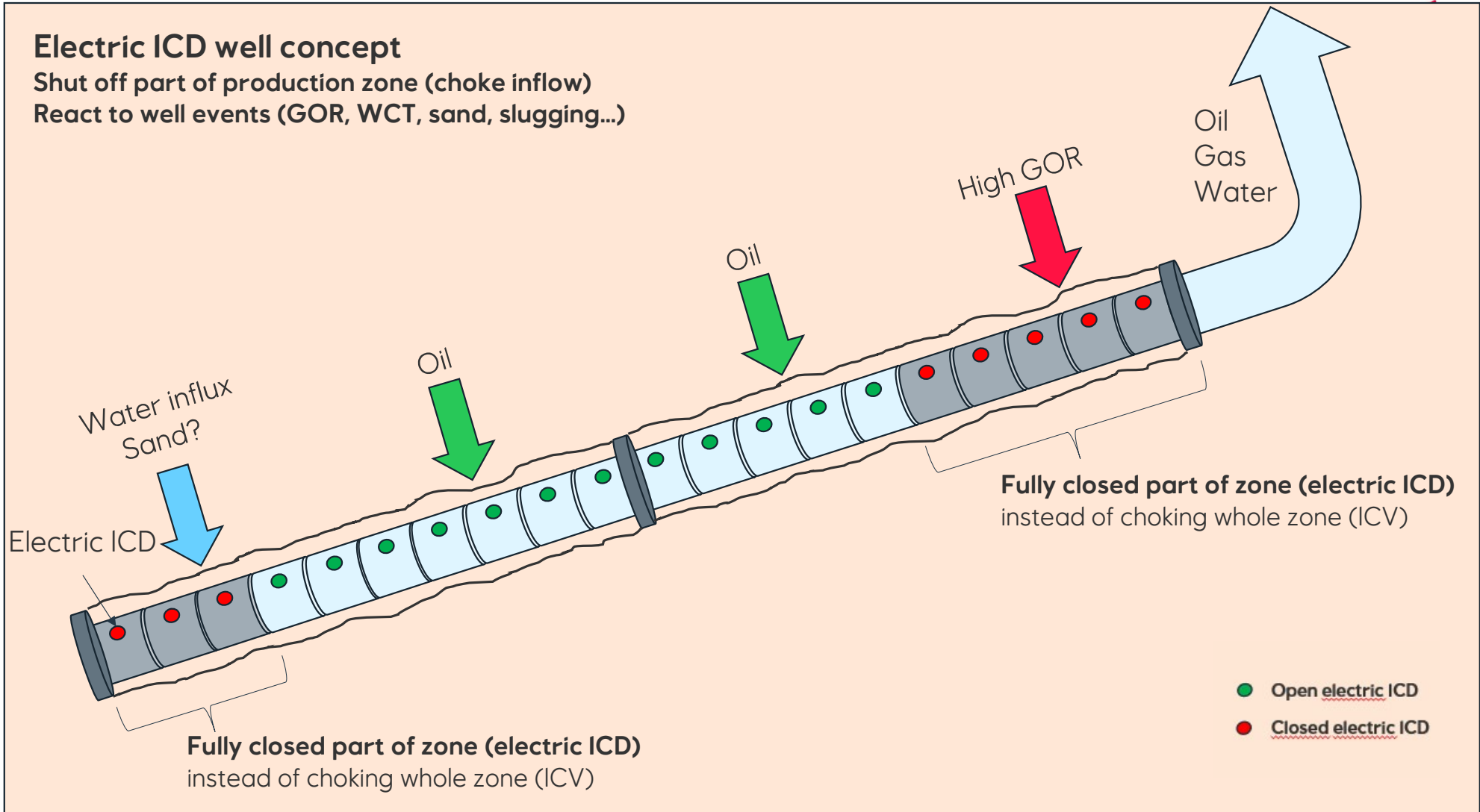
React to well events (GOR, WCT, sand, slugging...)



Electric ICD well concept

Shut off part of production zone (choke inflow)

React to well events (GOR, WCT, sand, slugging...)



Future plans

- Technology needs
 - Water shut-off in gas producers (low viscosity contrasts)
 - Increase performance, flexibility and reduce well cost
 - Efficient verification methods
 - Technology need: reaching more targets in one well

- New technologies – Operator/supplier collaboration
 - New AICDs and continuous improvements of existing AICDs
 - Wireless technology
 - Retrofit solutions
 - Electrical ICD well concepts



Huge investment in new test rig at Herøya

Equinor's research center in Herøya Research Park is receiving 130 million NOK for a new major expansion. "Best day at work ever."



A new research rig is being built next to Equinor's existing multiphase rig at Herøya. Here, Erik Lunde, manager of Equinor's lab and test facilities, and Tor Kjetilby, task lead in flow assurance, are in front of today's multiphase rig and the R&D Rigship, built in Herøya Research Park in 1992.



Thank you!

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