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Strengthening Marginal and Mature Field Ecosystems: Technology, Innovation, and Collaboration

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Maximising Recovery in a Deepwater Subsea Brownfield Gas Development through Integrated Real-Time Surveillance and Reservoir-Network Modelling

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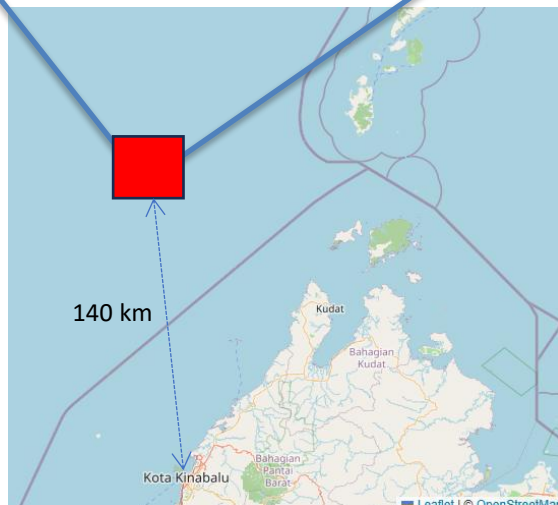
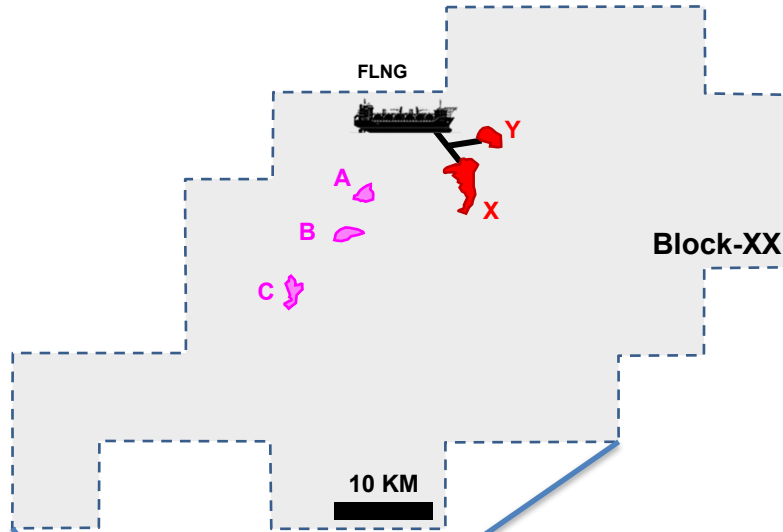
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Presentation Outlines

1. Asset Overview
2. Problem Statement
3. Integrated Real Time Surveillance and Digital Oil Field (DOF)
4. IPM Modules (Network - Reservoir)
5. Simulation Results
6. Conclusions

Asset Overview



Location

» 140 km Northwest of Kota Kinabalu, Malaysia

Fields

» Water Depth 500 – 1,500 meters

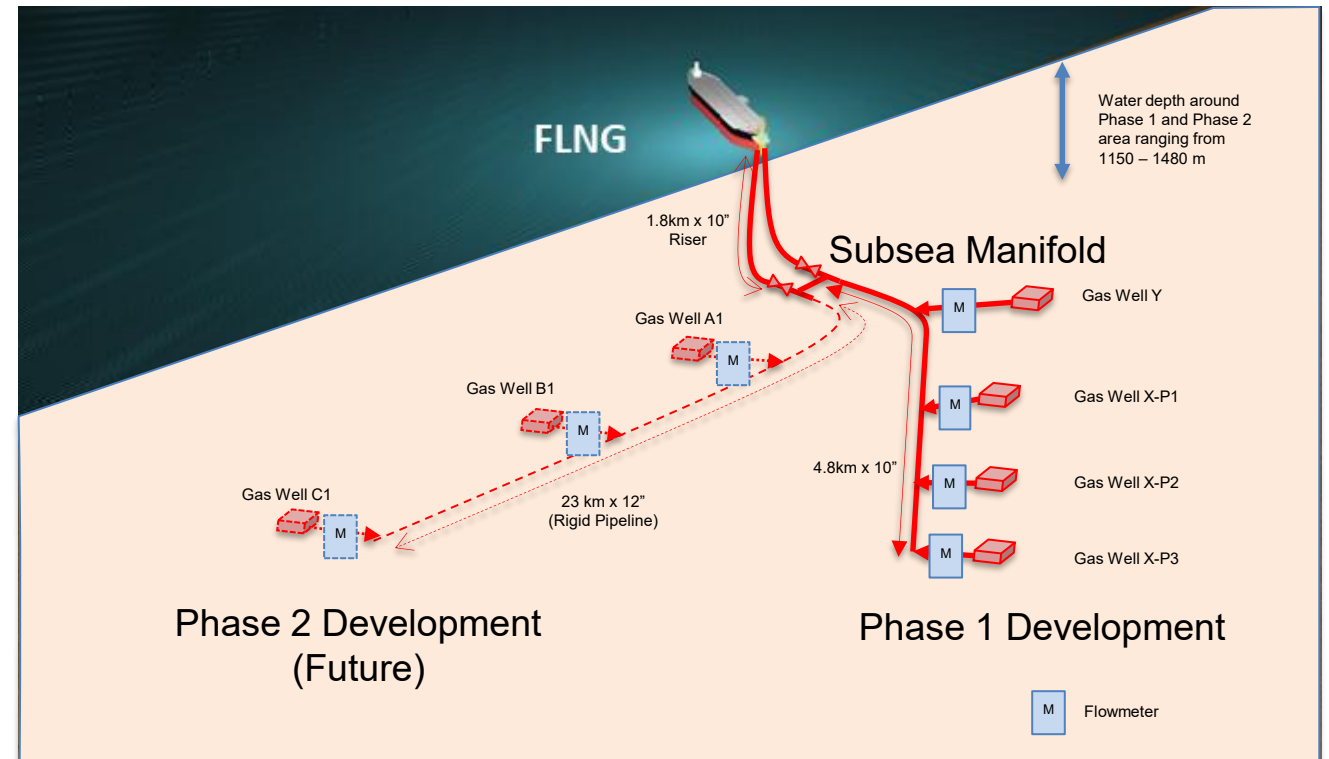
» 5 Dry Gas Reservoirs : **X - Y - A - B - C**

Overview of Development

» 1st Subsea Deepwater Gas Development Tie-Back to PFLNG in Malaysia

» **1st Phase Development** : **X & Y** (1st Gas in Feb 2021)

» **2nd Phase Development** : **A & B & C** (Expected 1st Gas in 2027)





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Problem Statement

- Challenges in managing Subsea operation
 - Managing production against flow assurance related issues – to know before its too late.
 - Limited opportunity fix faulty sensors in subsea production system i.e. pressure transmitter, flowmeter, etc.
- Communication between engineering disciplines – operation, production and subsurface.
- Field data & database scattered at various locations – field data, allocation data, daily production reports etc.
- Managing multiple reservoir models with several field development phases.

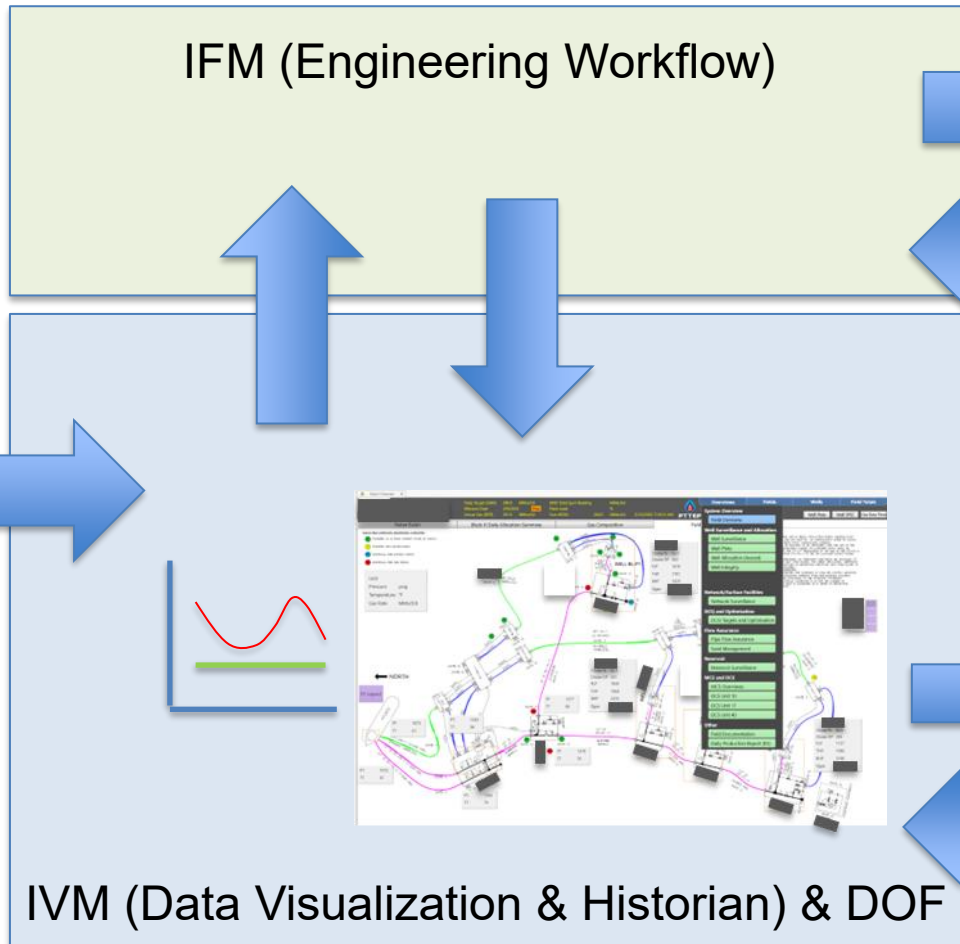


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DOF Data Flow – Centralized data source

Model Catalogue

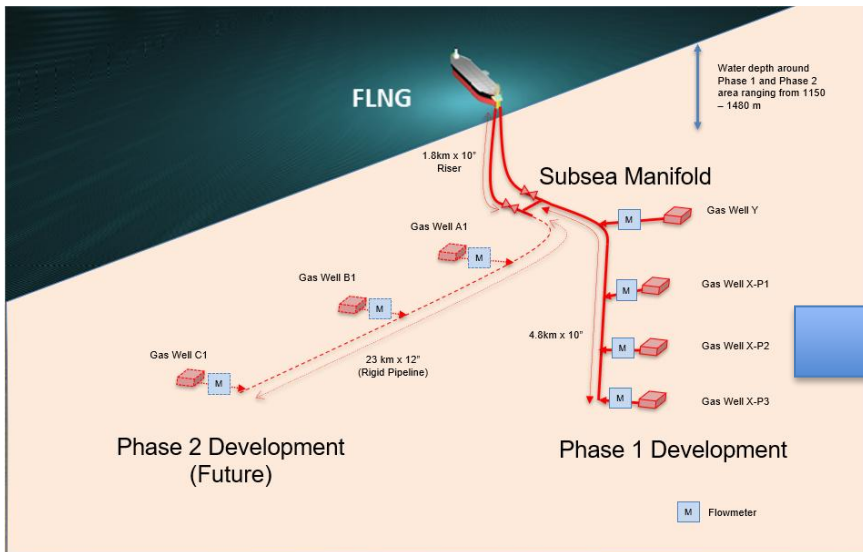


Well Model,
Surface Network Model,
Material Balance Model

Check-In/Out, copy



End User

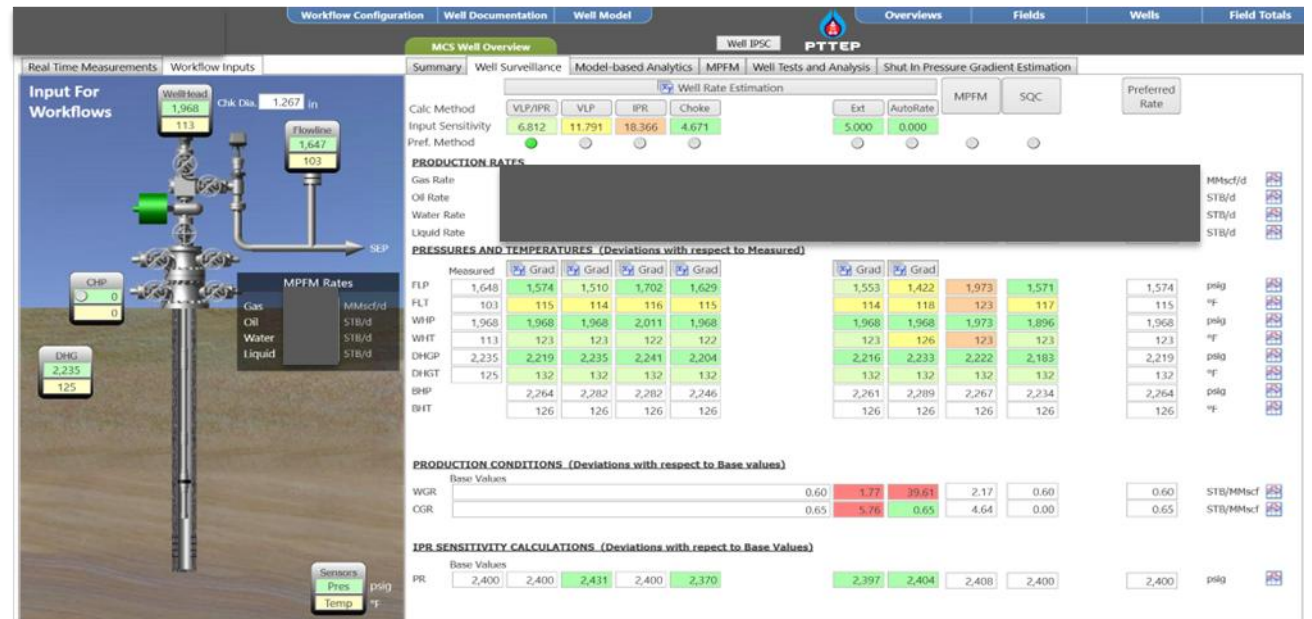
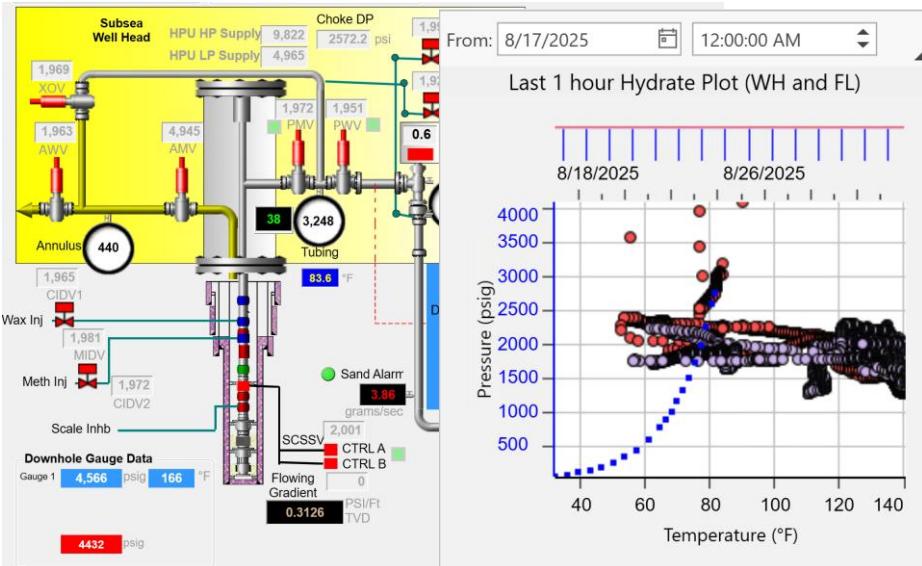


Field sensors
+
External databases
(Avocet, P2, PI)

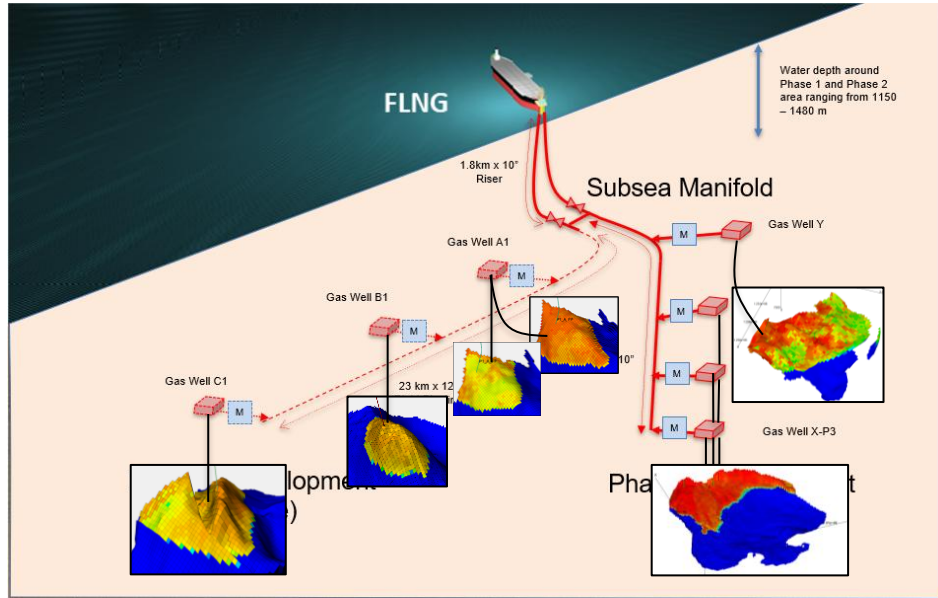


Field Surveillance & Digital Oil Field DOF

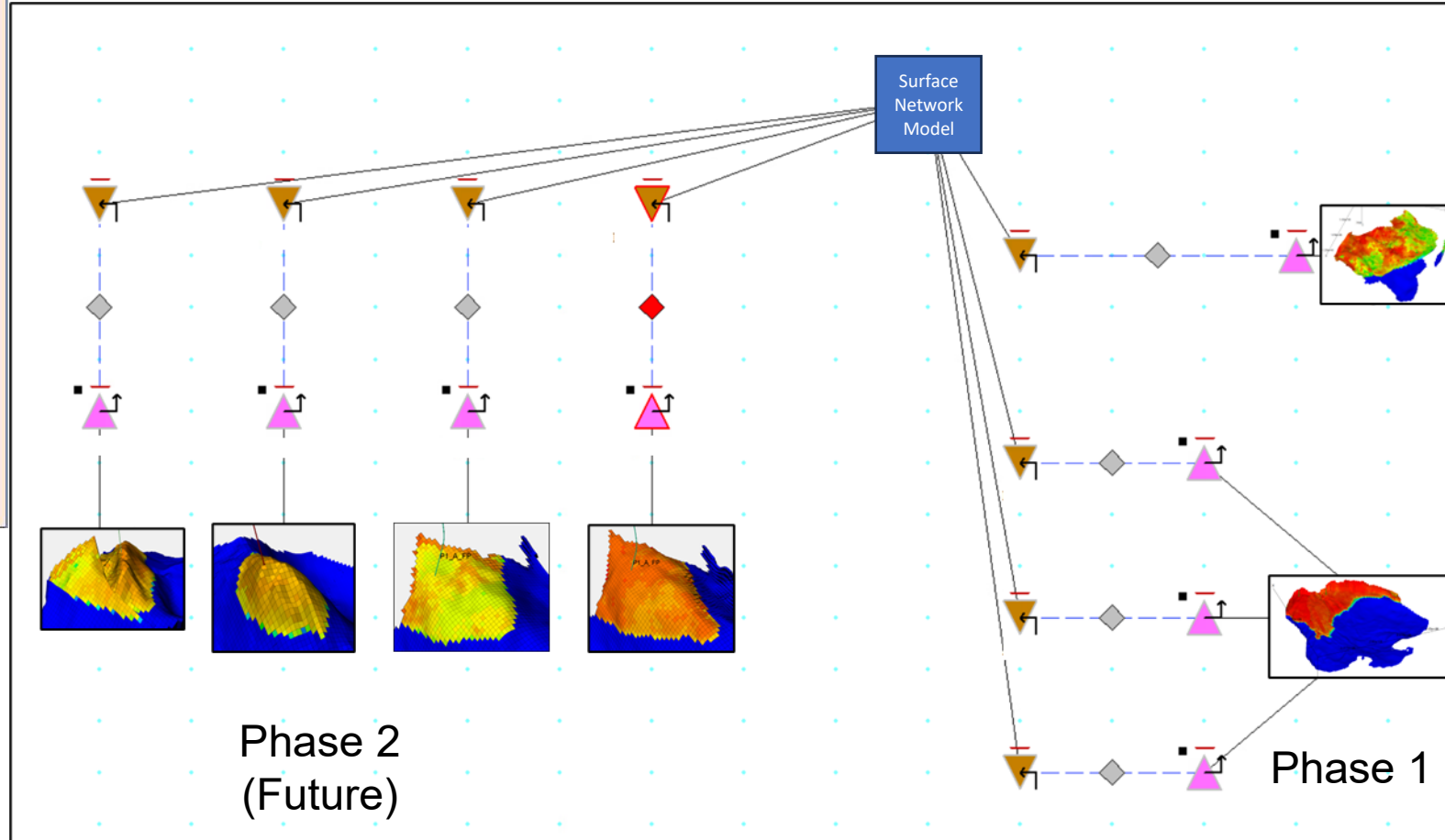
- Field monitoring is done via Real Time field surveillance enhanced using Digital Oil Field capability to allow engineers to have insight on more extensive information.
- Real Time operating condition i.e. at wellhead is mapped against hydrate curve for offshore crew to make quick decision independence of onshore support.
- Faulty flowmeter or pressure transmitter reading are replaced using calculated number from DOF.



Integrated Asset Modelling using Gap model from DOF



6 TNavigator models are coupled into Gap network model using Resolve.

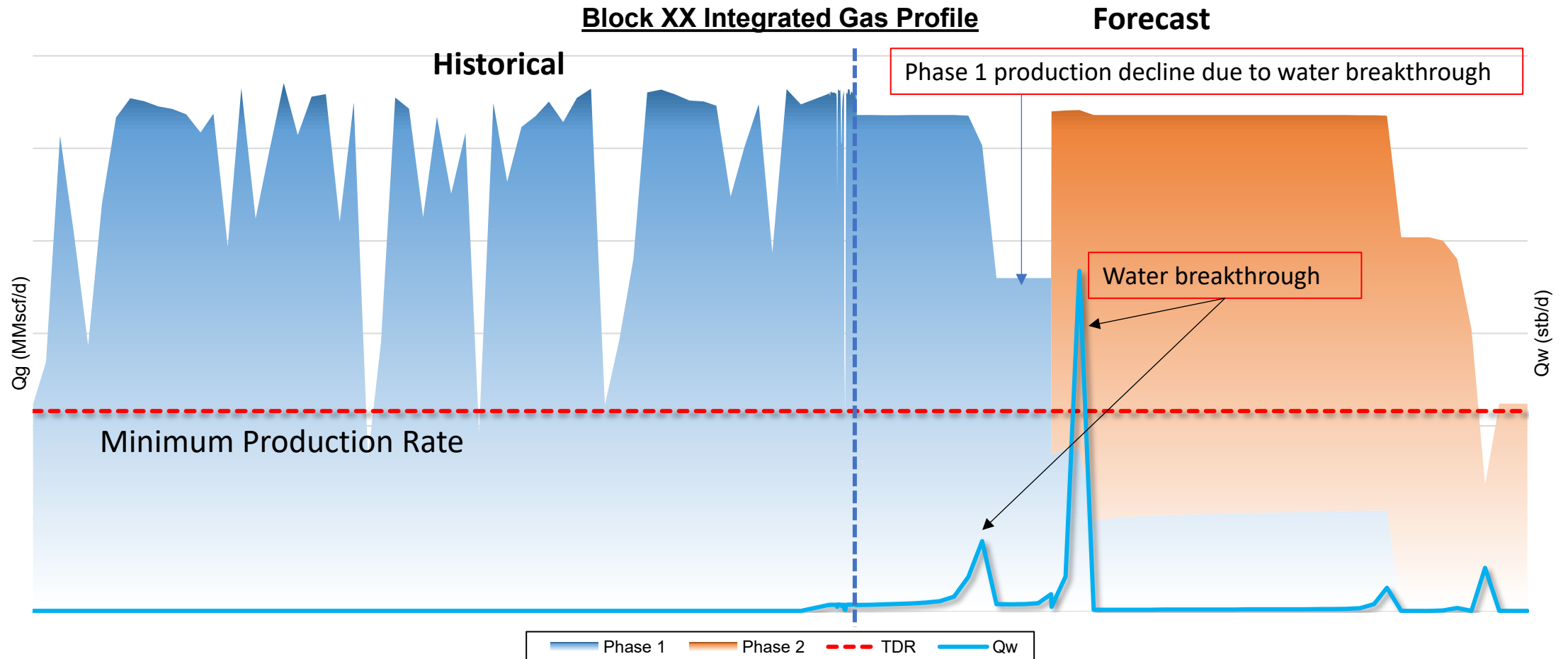




Benefit of IPM for Asset Production Forecast

1. Resolve is an agnostic simulation coupler - Forecast can be run directly using multiple client models either same type numerical reservoir model or in combination of different softwares.
2. Resolve as overall simulation controller managing all schedule related parameter not only for network model, but also reservoir parameters via 'IPM Token' features - Schedule event can be designed across client models
3. Flexibility to run forecast such as
 - Backpressure debottlenecking from topside.
 - Single or dual riser mode and its impact between Phase 1 and Phase 2 wells.
 - Turn Down Rate – requirement downstream process and flow stability in long vertical risers.
 - Delaying water breakthrough / prolong well life with maximum water production per well is 250 BWPD based on Flow assurance limitation.
4. The client models can be validated individually prior to IPM forecast run by respective engineer which particularly useful for Phase 2 development study – new subsea facility tie-in to existing production facility.
5. Updated models can be shared across organization by storing in Model Catalogue

Simulation Results





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Conclusions

Centralized system such as IVM DOF may provide efficiency in managing data from various disciplines

- Single point data access– Production allocation, PBU/PTA result, offshore chemical & sampling report, Well Integrity report via IVM.
- Allow for automation of Dashboard for management and working level such as Production Target
- helps in making quick decision process especially for offshore crew to mitigate flow assurance

IPM approach improves modelling workflow and model continuity between client models - eliminate the intermediary steps and assumptions. This allows asset team to successfully:

- Run different scenarios with changing 2nd phase FGD with quick turnaround.
- Different scenarios are performed by considering the dynamic interactions between encroaching water contact and regulated target gas rate per well.
- Surface network model also allows for interactions between the different fields, wells and backpressures.
- Evaluate and select the best production scenario for planning and budgeting.