

We have burned our boats

Arnfinn Grøtte, Domain Manager Digitalisation – D&W , FDP & ADME Data MESH

Driving the transformation of the E&P industry

Strategic alliances to reorganise the value chain

Digital transformation of core processes



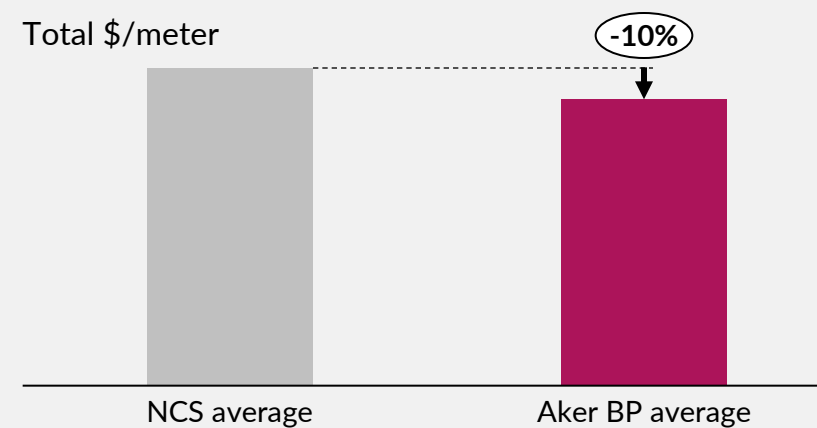
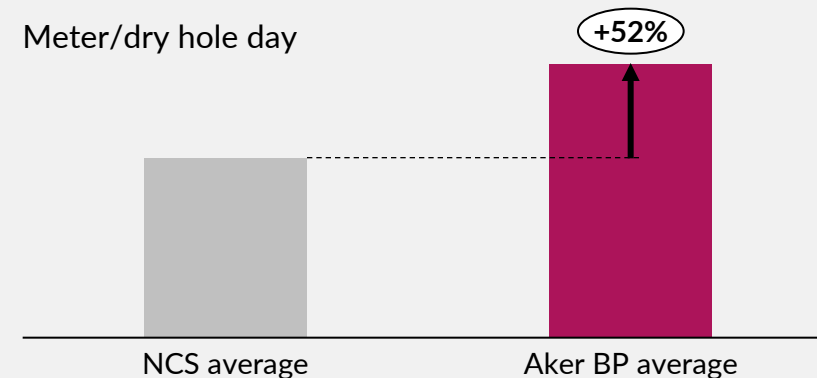
Transforming drilling performance

Enabled by digitalization and world-class alliance partners



Performance Benchmark from Drilling & Wells

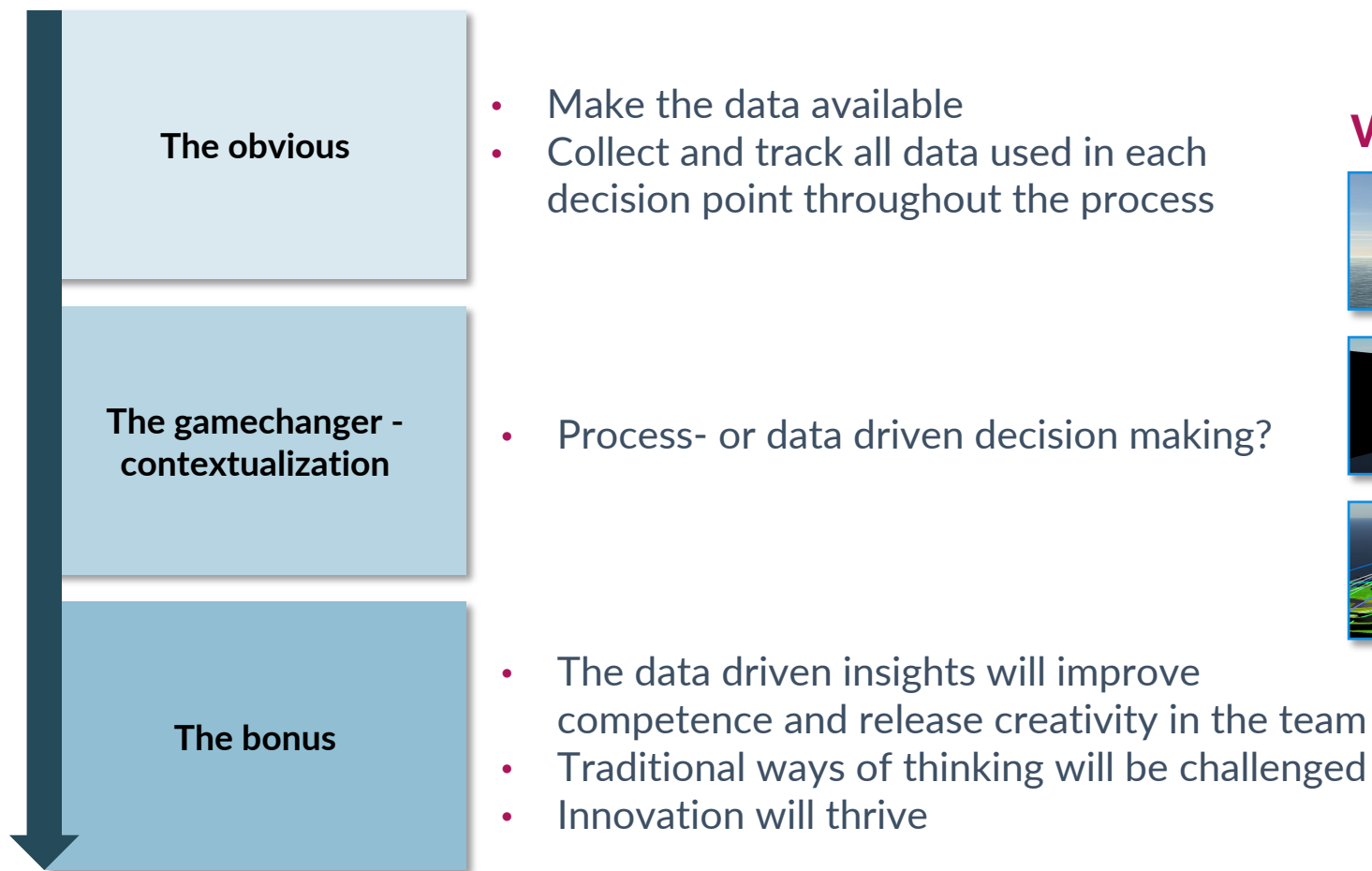
Rushmore benchmarking 2021-2022



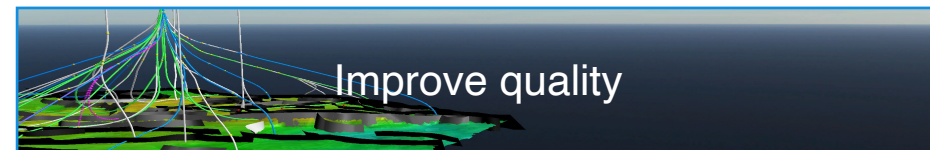
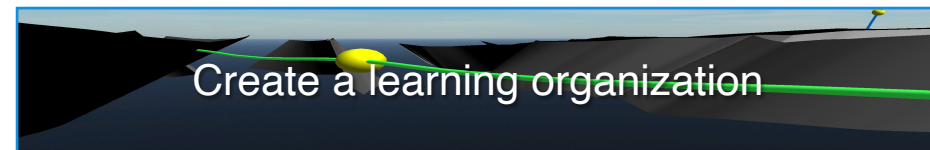
Source: Rushmore Reviews. All rights reserved. Extracted 06.07.2022. Search Criteria (Rig Type: Semi-Sub & Jack Up, Well Type: Development & Exploration, Year: 2021-2022, Hole Type: New Well & Slot Recovery, Is Multilateral: True & False, Is HPHT: False, Following areas: Norway, Total number of wells: 89)

Data driven work processes

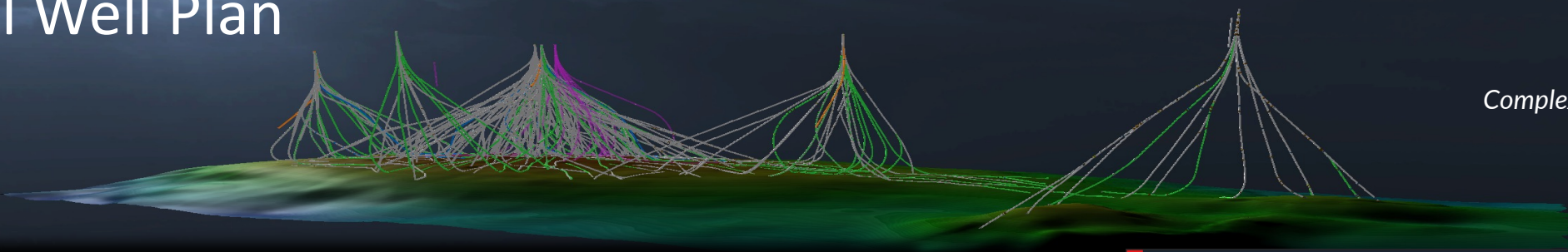
Remove silos and enable radical changes in how we design, plan & operate



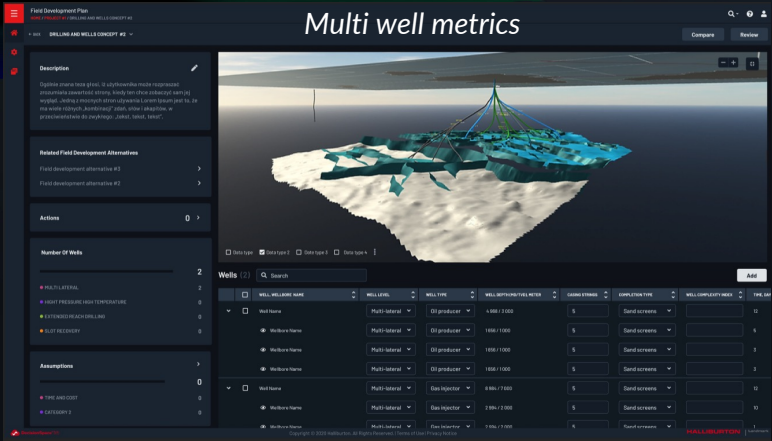
Value adding effects:



Digital Well Plan



Complexity



Assumptions

Total Time

Total Emissions

Recommendation

Risks

Total Cost

Economics

Digital Well Program® - Adoption

Empower your drilling teams to automatically generate technically and economically feasible drilling programs in a matter of few hours

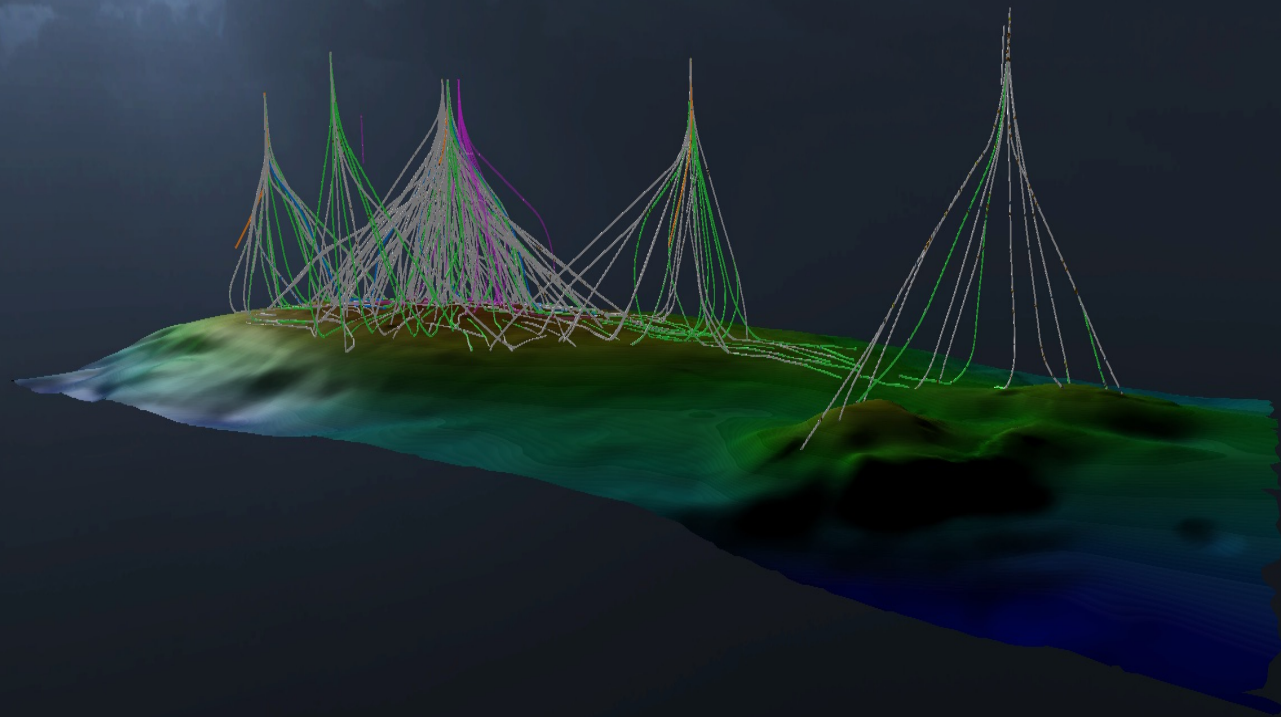
In Development \ Production



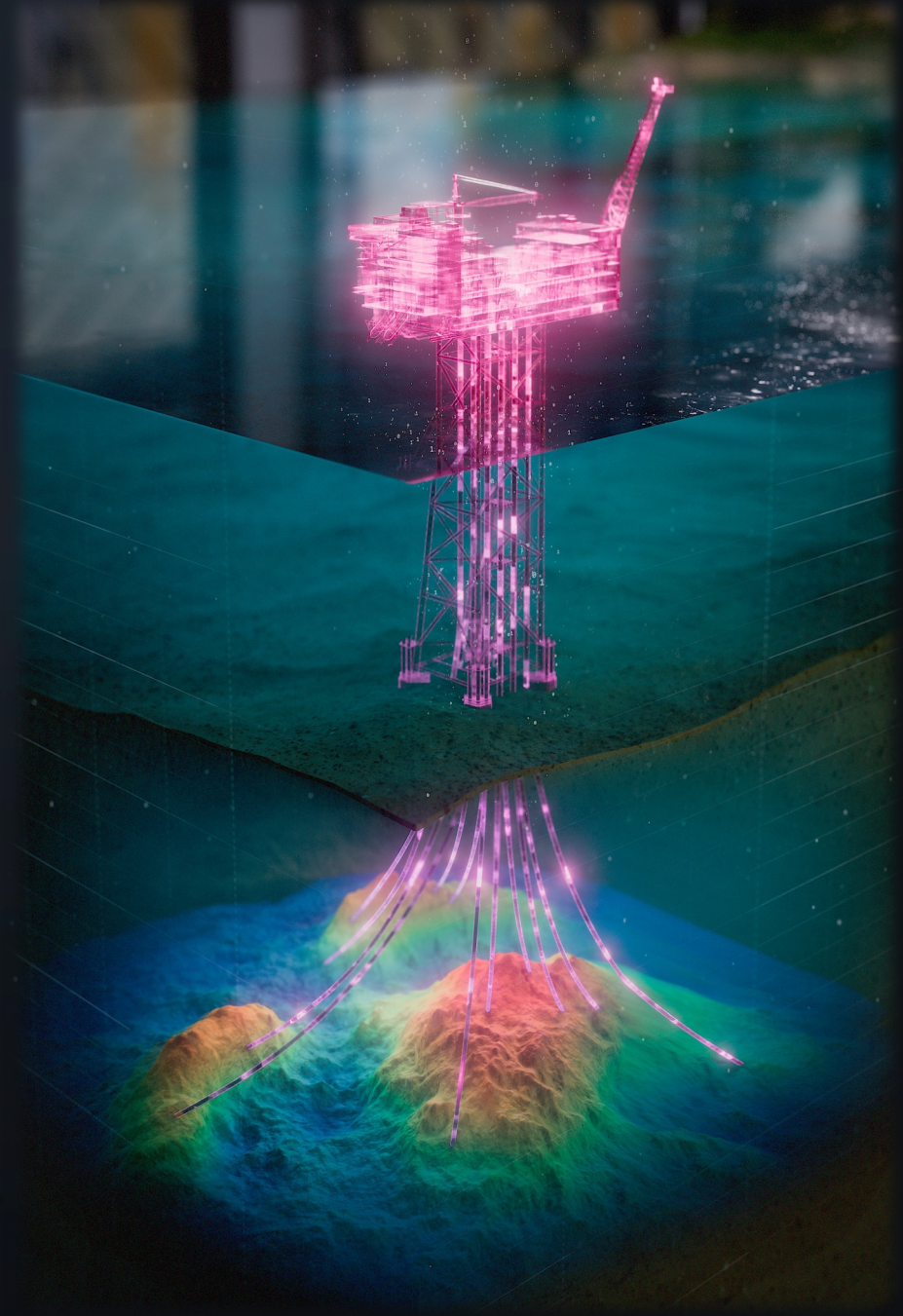
Q3,2023

Pipeline / POCs

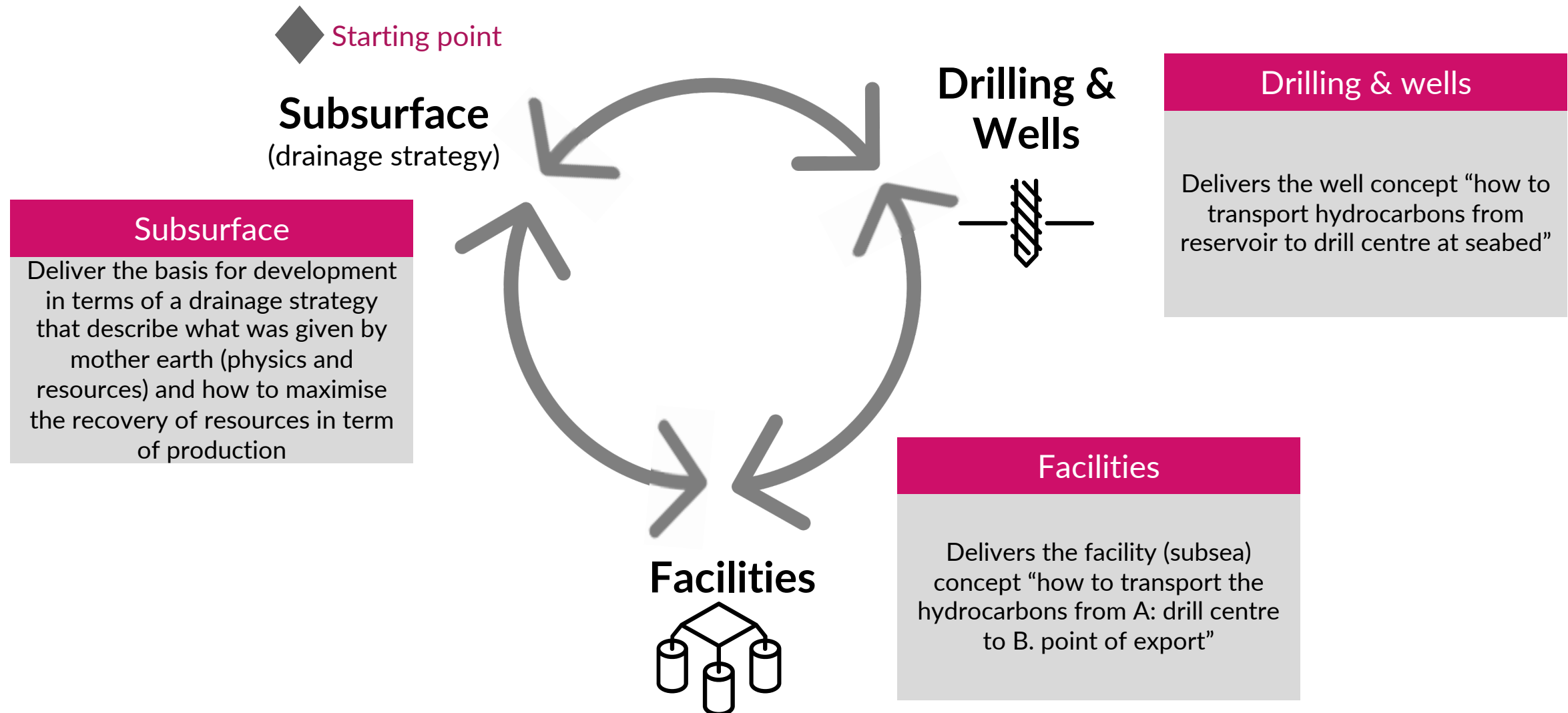




Field Development Planning

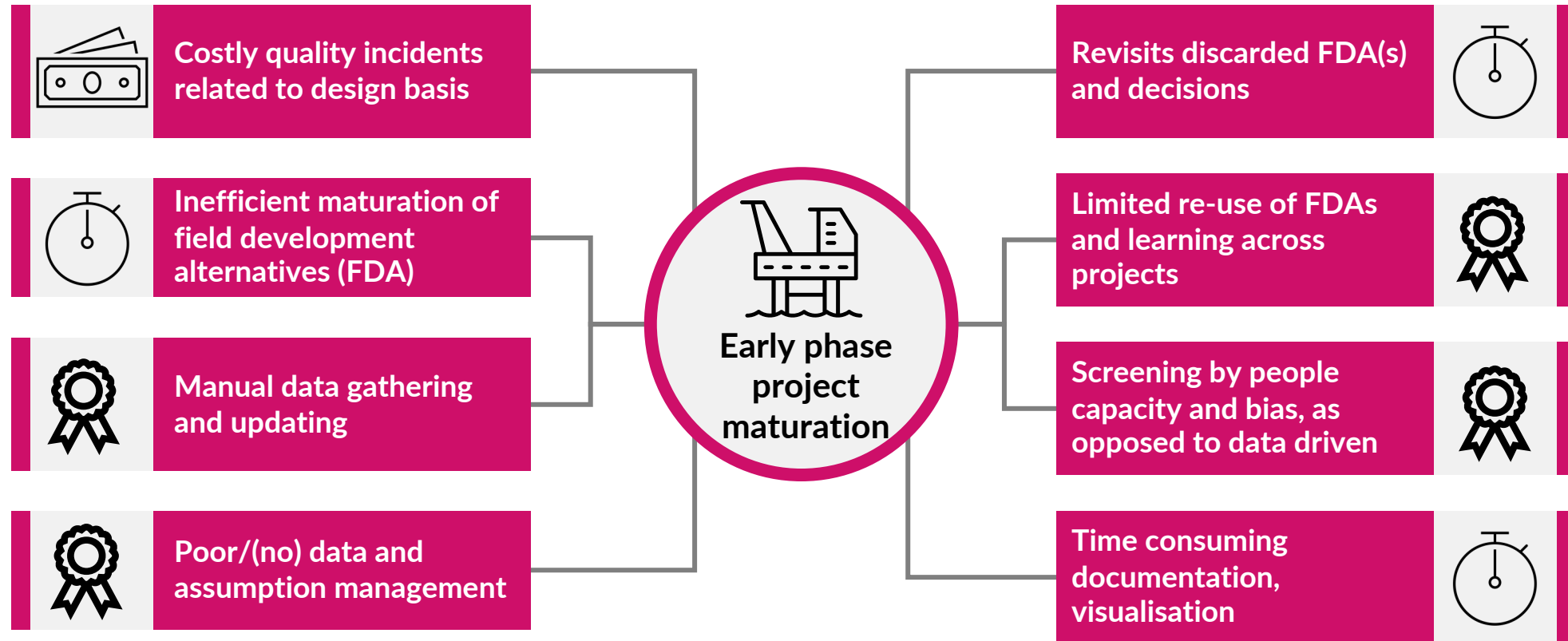


Drainage strategy, well design and facility design are all intercorrelated



In project maturation, we iterate and adjust the Drainage Strategy, facility concept and D&W concept to identify the FDA that optimise the value potential of the field

Our current pain points and identified root causes



The data we need for our analyses are scattered in various system and formats



Our analyses and reviews are manual, static and silo based in the different domains



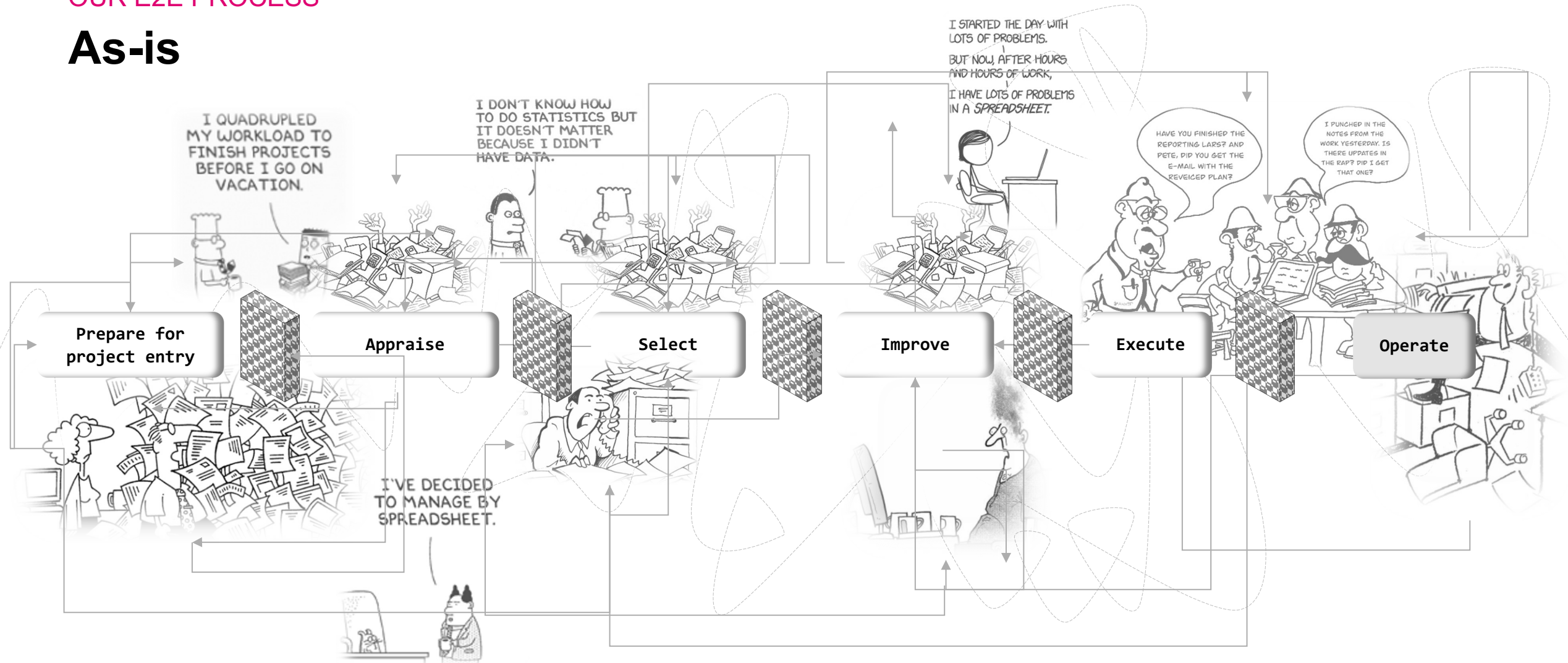
No revision history and transability in decision process



Power Point is our main tool for visualization and documentation during the concept maturation process

OUR E2E PROCESS

As-is



Summary of main current pain points (WHAT & WHY)

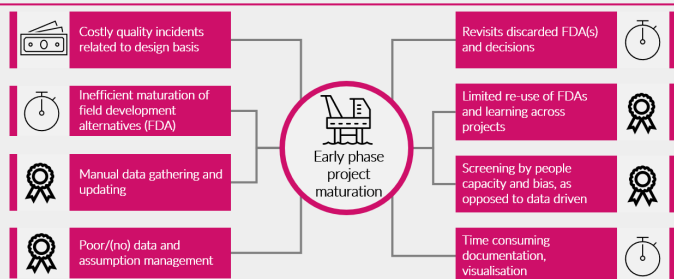
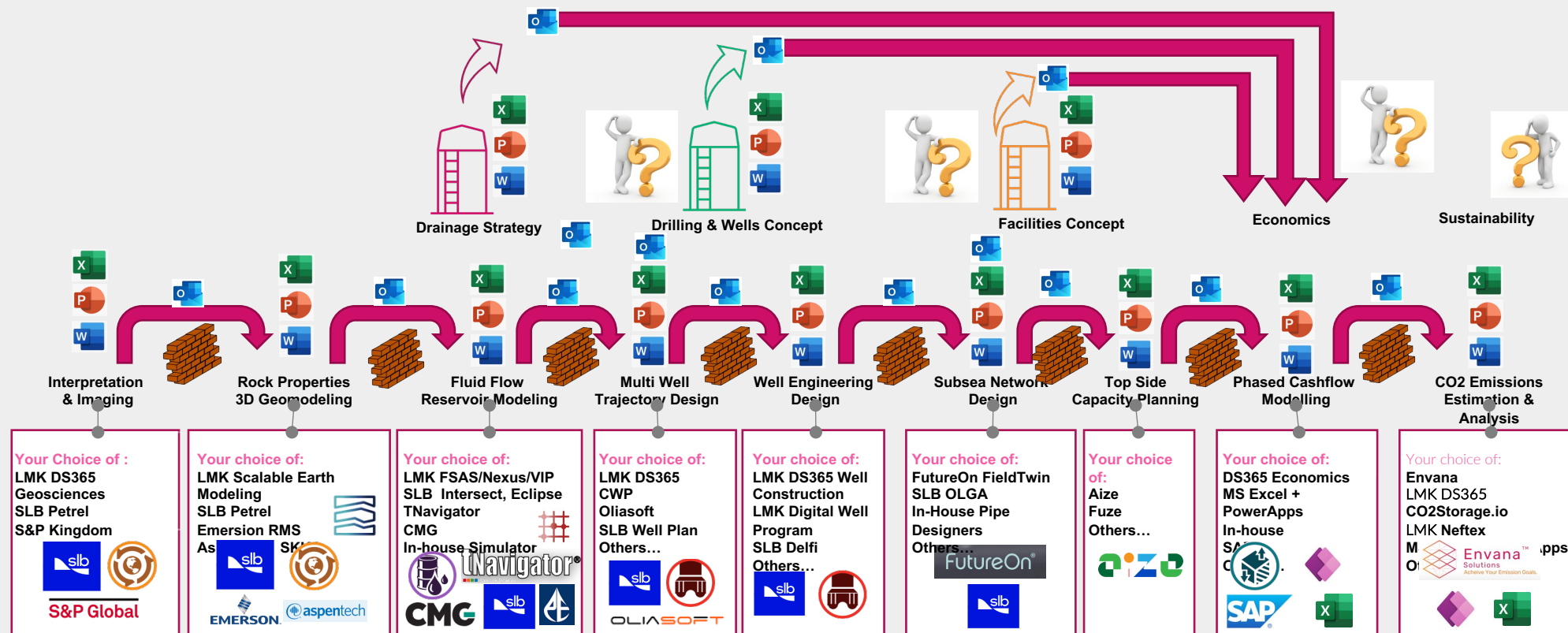
What: Tedious, manual, uncoordinated, administrative, working across 100s of different applications, undocumented with a lack of standardization characterizes the current process in Well Construction.

Why: High cost, reduced quality and efficiency. Lack of seamless, standardized processes, not supported by any digital ecosystem that should ensure dataflow & access, storage and utilization having all information available across the workflow. Could result in that the Production and reserve potential is not reached. Constant challenge to scale organization to fit marked and activity set.

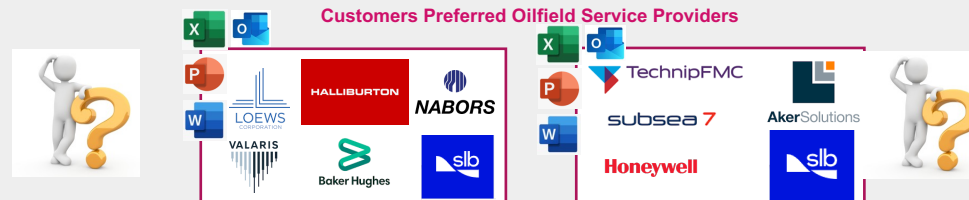
As-is state:

Our current pain points in tools and ways of working

1 2 3 4 5



Customers Preferred Oilfield Service Providers



Field Development Planning

FDP reduces lead time of a development project by enabling multidisciplinary collaboration through a data driven maturation and evaluation of field development alternatives [FDA's]

Alternative -1

Alternative -2

Alternative -3

FDA Centric Workflow = Casebook Centric Workflow

FDP provide a consistent overview of what Field Development Alternatives that is being matured in a field development project and the associated discipline data.

Through the definition of Field Development Alternatives; FDP maintains the relationship of how the 3 main discipline deliveries is combined to produce a viable Field Development Alternative (FDA).

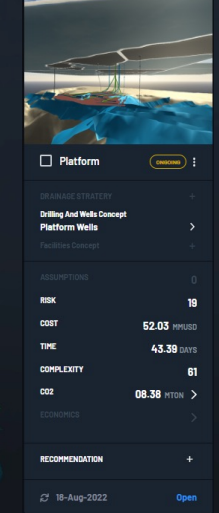
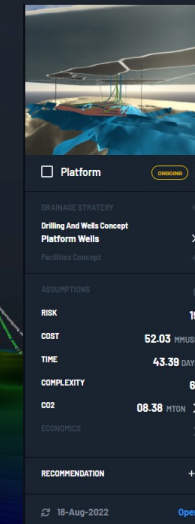
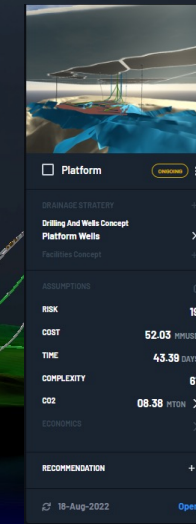
The FDA is constructed by aggregating design and engineering data from subsurface, facilities and D&W into defined dashboard and data deliveries referenced to as:

- A Drainage strategy
- A Facility
- A D&W concept

Alternative -1

Alternative -2

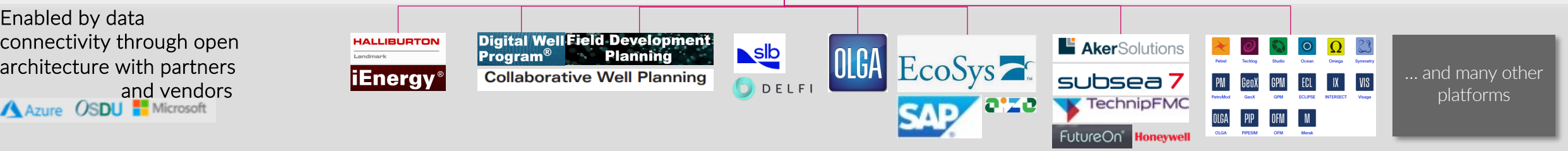
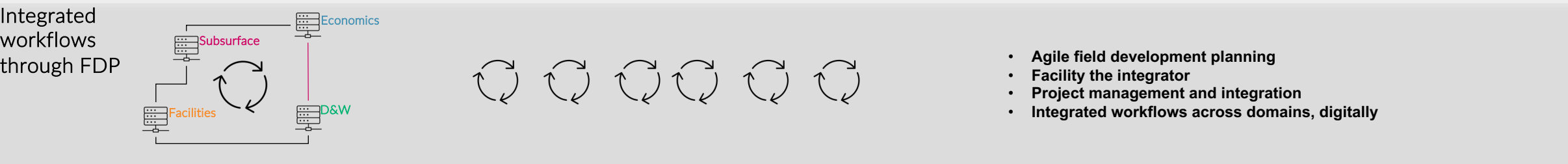
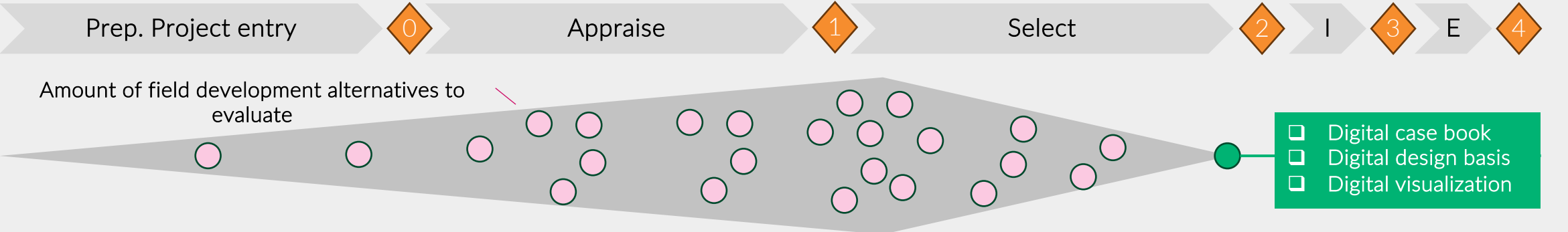
Alternative -3



FDA - comparison and optimisation

Field Development Planning

A data-driven framework that integrates all workflows and data across the end-to-end process for field development and agile asset management



To-be state:

A data-driven framework that integrates all workflows and data across the end-to-end process for field development and agile asset

1 2 3 4 5



Agile Field Development Planning

- Decision Gate
- Risk
- Assumptions
- Time Cost
- Data Lineage
- Team Accountability
- 3D Visualization



Drainage Strategy

Interpretation & Imaging

Rock Properties
3D Geomodeling

Fluid Flow
Reservoir Modeling



Drilling & Wells Concept

Multi Well
Trajectory Design

Well Engineering
Design



Facilities Concept

Subsea Network
Design

Top Side
Capacity Planning



Economics

Phased Cashflow
Modelling



Sustainability

CO2 Emissions
Estimation & Analysis

Value Stream Framework Interface

Agile Field Development Planning uses data mesh technology and OSDU Interoperability to digital connect customers toolbox to AFDP domain dashboards

Customers Existing Expert Technical Evaluation Toolbox Investments

Your Choice of :
LMK DS365 Geosciences
SLB Petrel
S&P Kingdom



S&P Global

ResX Ensemble Models +
Your choice of:
LMK Scalable Earth Modeling
SLB Petrel
Emersion RMS
AspenTech SKUA



EMERSON. aspentech

IRMA +
Your choice of:
LMK FSAS/Nexus/VIP
SLB Intersect, Eclipse
TNavigator
CMG
In-house Simulator



CMG

Your choice of:
LMK DS365 CWP
Oliasoft
SLB Well Plan
Others...



OLIASOFT

Your choice of:
LMK DS365 Well
Construction
LMK Digital Well
Program
SLB Delfi
Others...



SLB

Your choice of:
FutureOn FieldTwin
SLB OLGA
In-House Pipe Designers
Others...



FutureOn

Your choice of:
Aize
Fuze
Others...



Aize

Your choice of:
DS365 Economics
MS Excel + PowerApps
In-house
SAP
Others...



SAP

Your choice of:
Envana
LMK DS365 CO2Storage.io
LMK Neflex
MS Excel + PowerApps
Others

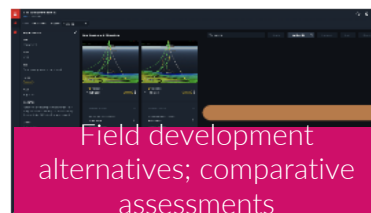
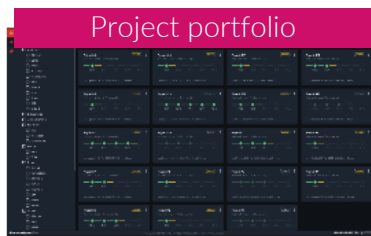


Envana

Customers Preferred Oilfield Service Providers



NOTE: Agile Field Development Planning uses OSDU Interoperability to digital connect customers toolbox to AFDP domain dashboards



Field development alternative



FDA COLLABORATIVE DASHBOARD



ECONOMICAL ROBUSTNESS



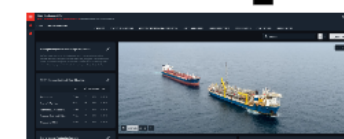
DRAINAGE STRATEGY



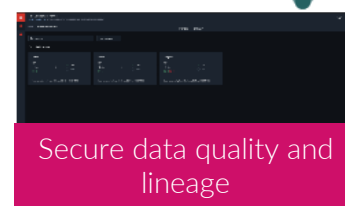
D&W CONCEPT



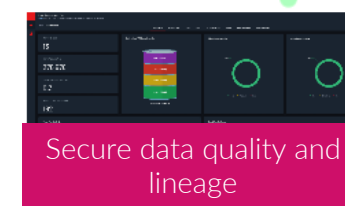
FACILITY CONCEPT



DATA OPS



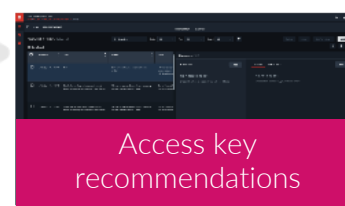
EMISSIONS



RISK



RECOMMENDATIONS



+++ additional complementary capability

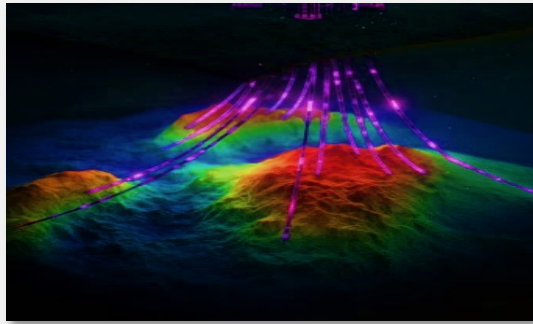


FDP – enabling radical change

The future is now! – D&W in production:



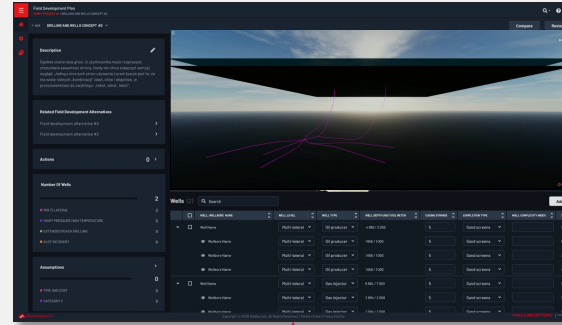
DecisionSpace



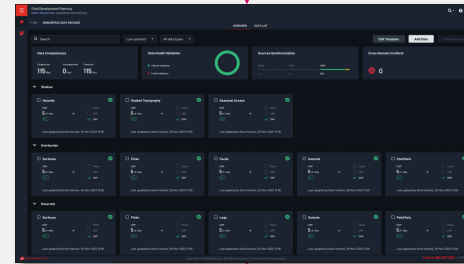
Return interpretation
set used (iSet)

CWP session

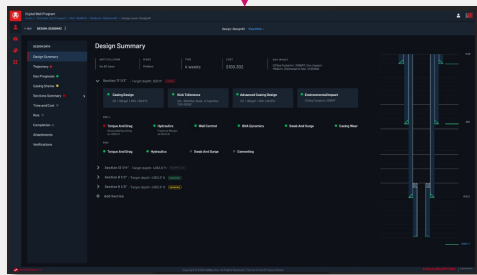
FDP



DataOps

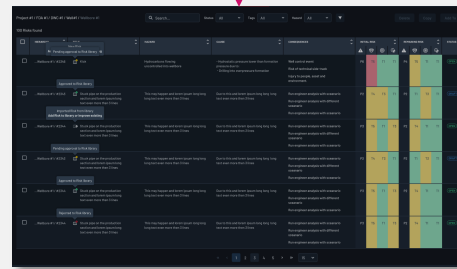


Perform Well Design
Return Key Parameters



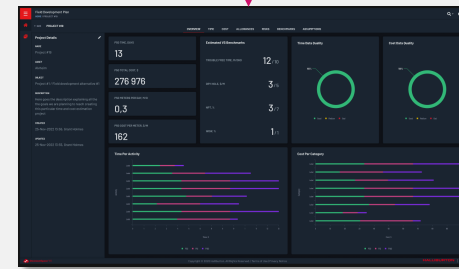
DWP

Add and handle Risk
On Project, FDA,
DWC or Wellbore



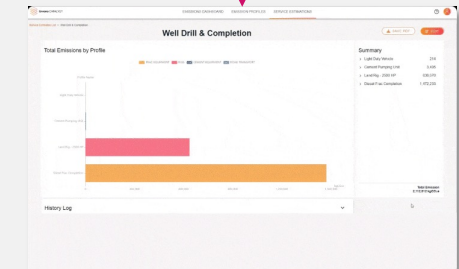
RISK MODULE

Estimate
Time&Cost



TIME&COST

Calculate
Emissions



Envana



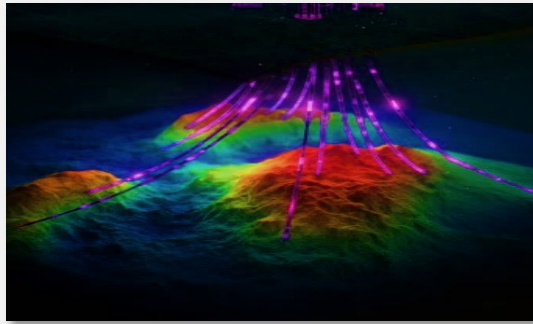
HALLIBURTON

informatiQ

FDP – enabling radical change

The future is now! – D&W in production:

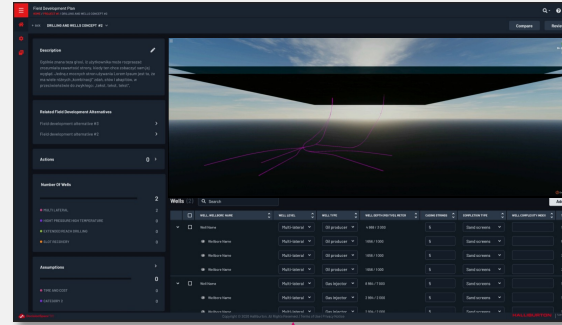
DecisionSpace



Return interpretation
set used (iSet)

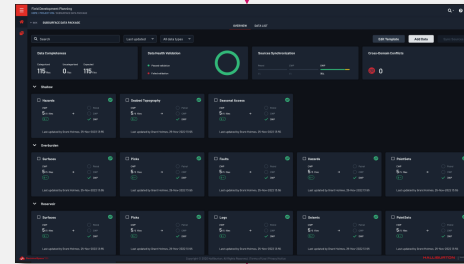
CWP session

FDP

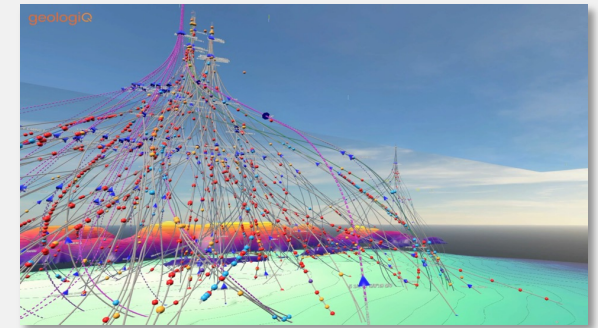


- Key Metrics
- Assumptions
- Uncertainties
- Data Lineage

DataOps

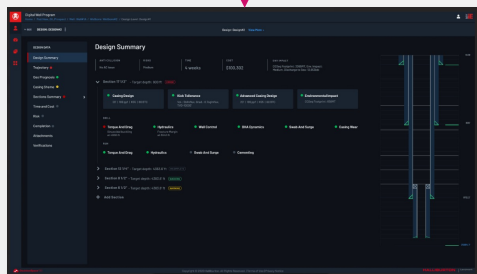


GeologiQ



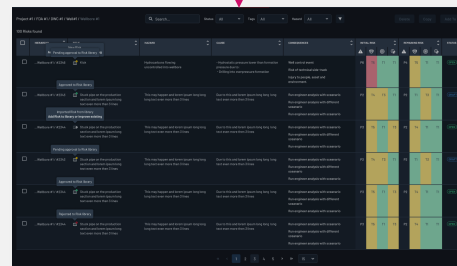
Open in Context

Perform Well Design
Return Key Parameters



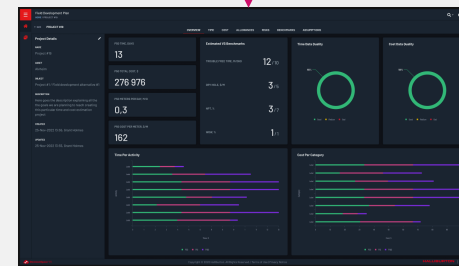
DWP

Add and handle Risk
On Project, FDA,
DWC or Wellbore



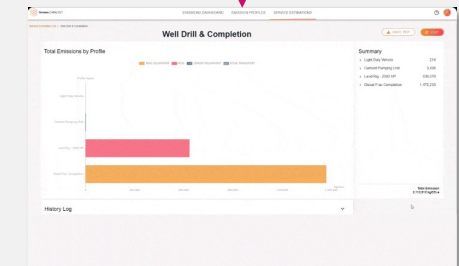
RISK MODULE

Estimate
Time&Cost



TIME&COST

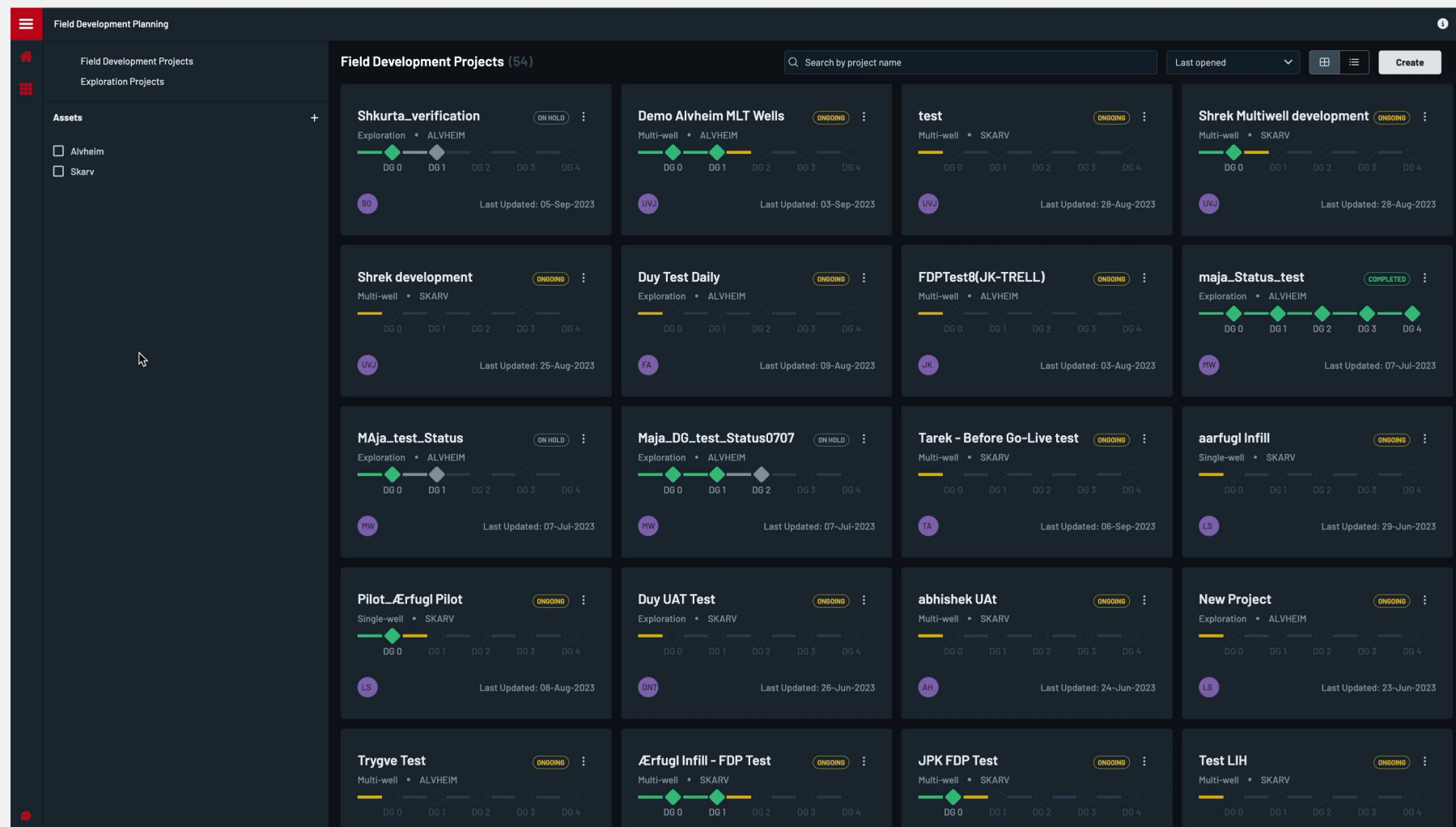
Calculate
Emissions



Envana

FDP Asset Project overview

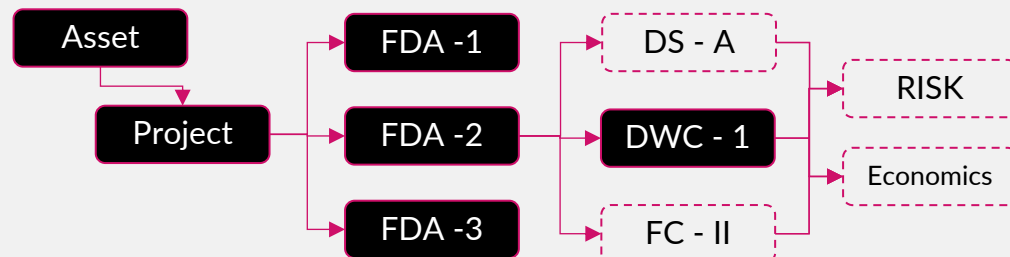
- Giving your asset full control and overview of your project portfolio through the asset lifetime.
- Each project status is tracked
- From each project card you can navigate down to each BU deliverable
- User can track progress, monitor status and of course create new projects.



FDA – Field Development Alternative

Maintain Overview

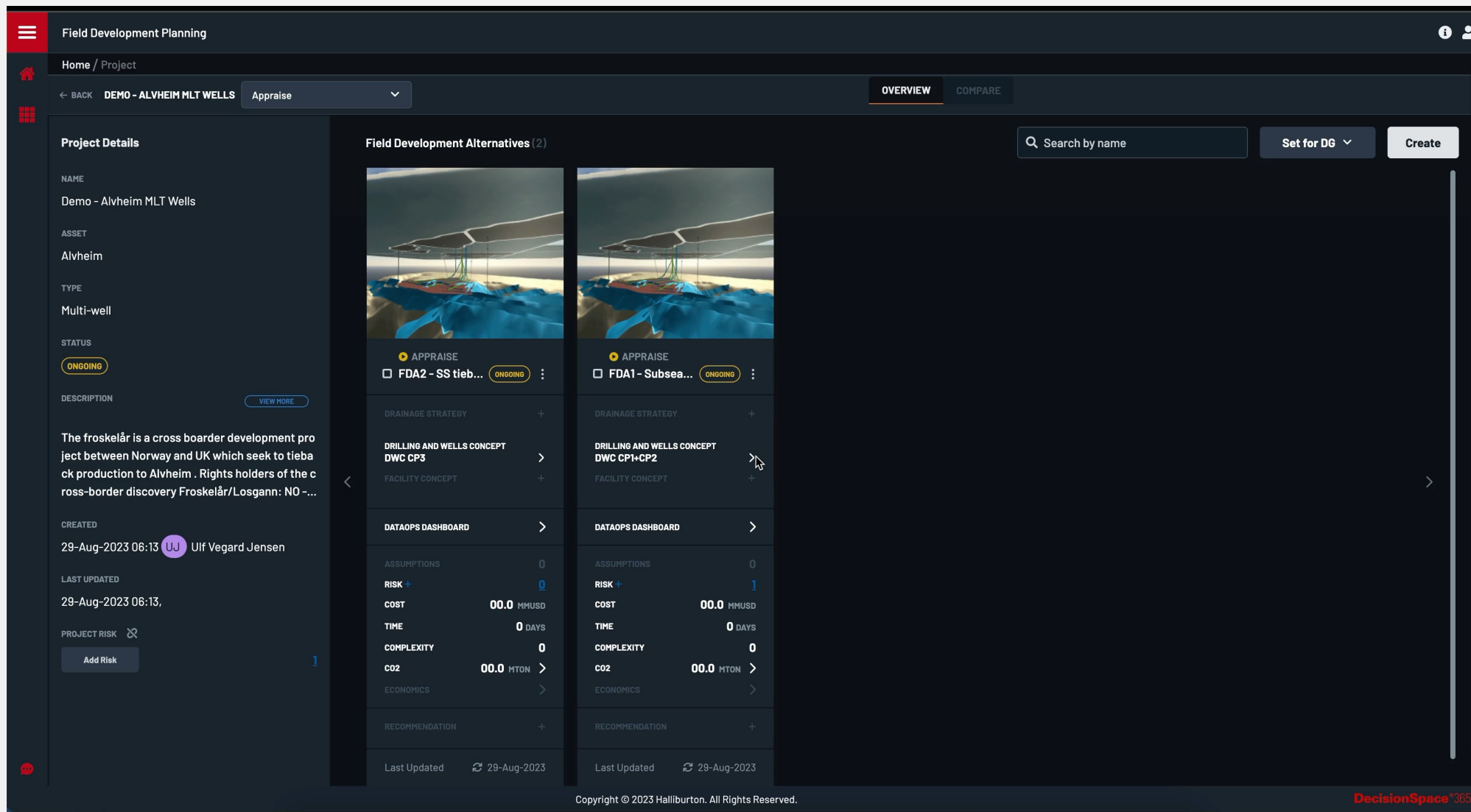
- FDP provide a consistent overview of which Field Development Alternatives that is being matured in a field development project and the associated discipline data.
- Through the definition of Field Development Alternatives; FDP maintains the relationship of how the 3 main discipline deliveries is combined to produce a viable Field Development Alternative (FDA).
- The FDA is constructed by aggregating design and engineering data from subsurface, facilities and D&W into defined dashboard and data deliveries referenced to as a:
 - A Drainage strategy (DS)
 - A Facility concept (FC)
 - A D&W concept (DWC)



FDA1 PREPARE Dual MLT wells	FDA 3 PREPARE Trilateral and Singel wellbore	Singel Trilateral PREPARE One well solution
DRAINAGE STRATEGY + >	DRAINAGE STRATEGY + >	DRAINAGE STRATEGY + >
DRILLING AND WELLS CONCEPT DWC 1 - CP1+CP2 >	DRILLING AND WELLS CONCEPT DWC - Singel + Trilateral >	DRILLING AND WELLS CONCEPT DWC - CP3 >
FACILITY CONCEPT + >	FACILITY CONCEPT + >	FACILITY CONCEPT + >
DataOps >	DataOps >	DataOps >
Complexity 74.5	Complexity 428.33	Complexity 1,234.0
Time, days 110 >	Time, days 103 >	Time, days 89 >
Cost, M USD 400 >	Cost, M USD 390 >	Cost, USD 250 >
CO2, ton 264.0 >	CO2, ton 369.0 >	CO2, ton 369.0 >
Risk 40 >	Risk 45 >	Risk 35 >
Economics >	Economics >	Economics >
RECOMMENDATION This is the preferred version for the ...View	RECOMMENDATION +	RECOMMENDATION +
Last updated: 03-Sep-2023 06:35	Last updated: 04-Sep-2023 05:40	Last updated: 03-Sep-2023 07:40

FDA overview to Drilling&Wells Concept (DWC)

- Each FDA contains a Drilling&Well Concept (DWC)
- DWC's can be used in multiple FDA's
- A DWC consist of Wells & Wellbores from DWP (Primary designs)
- FDP orchestrates
 - Risk
 - Time & Cost
 - Offset Wells
 - CO₂ emissions
 - Complexity



The screenshot displays the 'Field Development Planning' (FDP) software interface. The left sidebar shows 'Project Details' for 'Demo - Alvheim MLT Wells', including asset name, type (Multi-well), and status (ONGOING). The main area shows 'Field Development Alternatives (2)' with two columns for 'FDA2 - SS tieb...' and 'FDA1 - Subsea...'. Each column displays a 3D visualization of the well layout and a table of metrics including Risk, Cost, Time, Complexity, CO2, and Economics. The bottom of the interface shows the 'Last Updated' timestamp as 29-Aug-2023.

Field Development Planning

Home / Project

← BACK DEMO - ALVHEIM MLT WELLS Appraise

OVERVIEW COMPARE

Search by name Set for DG Create

Project Details

NAME: Demo - Alvheim MLT Wells

ASSET: Alvheim

TYPE: Multi-well

STATUS: ONGOING

DESCRIPTION: [VIEW MORE](#)

The froskelår is a cross boarder development project between Norway and UK which seek to tieback production to Alvheim . Rights holders of the cross-border discovery Froskelår/Losgann: NO -...

CREATED: 29-Aug-2023 06:13 UJ Ulf Vegard Jensen

LAST UPDATED: 29-Aug-2023 06:13,

PROJECT RISK: [Add Risk](#)

Field Development Alternatives (2)

FDA2 - SS tieb... (ONGOING)

DRAINAGE STRATEGY: +

DRILLING AND WELLS CONCEPT: DWC CP3 >

FACILITY CONCEPT: +

DATAOPS DASHBOARD: >

ASSUMPTIONS: 0

RISK: 0

COST: 00.0 MMUSD

TIME: 0 DAYS

COMPLEXITY: 0

CO2: 00.0 MTON >

ECONOMICS: >

RECOMMENDATION: +

Last Updated: 29-Aug-2023

FDA1 - Subsea... (ONGOING)

DRAINAGE STRATEGY: +

DRILLING AND WELLS CONCEPT: DWC CP1+CP2 >

FACILITY CONCEPT: +

DATAOPS DASHBOARD: >

ASSUMPTIONS: 0

RISK: 1

COST: 00.0 MMUSD

TIME: 0 DAYS

COMPLEXITY: 0

CO2: 00.0 MTON >

ECONOMICS: >

RECOMMENDATION: +

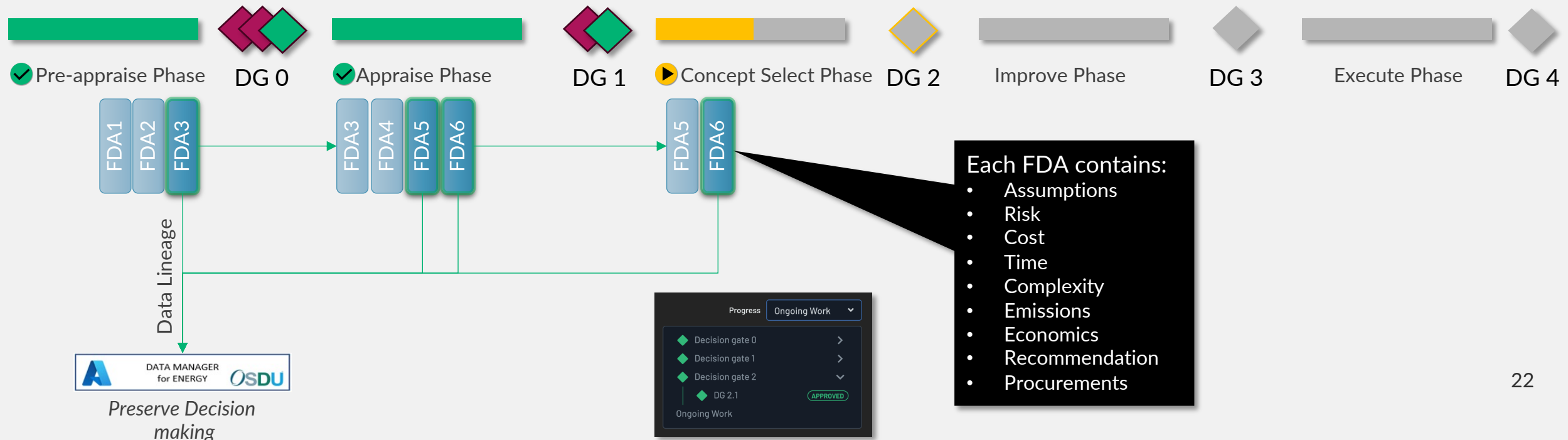
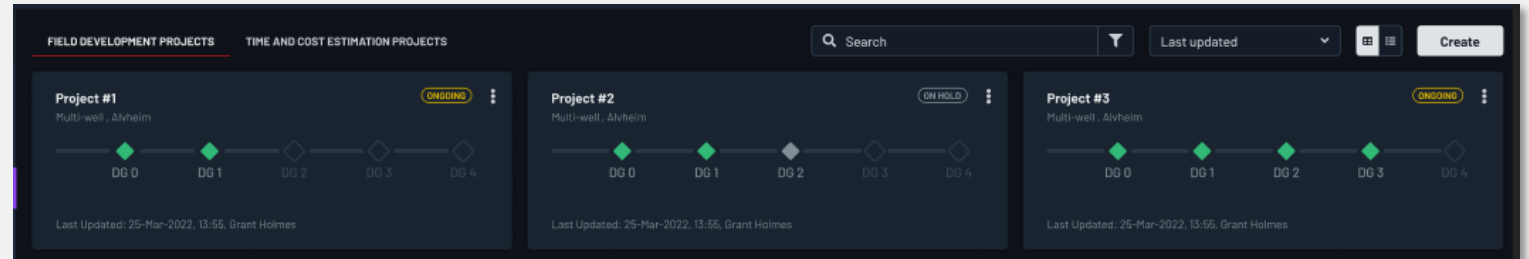
Last Updated: 29-Aug-2023

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FDP – Securing Data Lineage

FDP captures and aggregates the key deliverables related to any FDA (Field Development Alternative)

- FDP Project Gate & Phase management
- Capability of maintaining an overview of key changes in a project from one Decision Gate to the next.
- Project DG Version Management

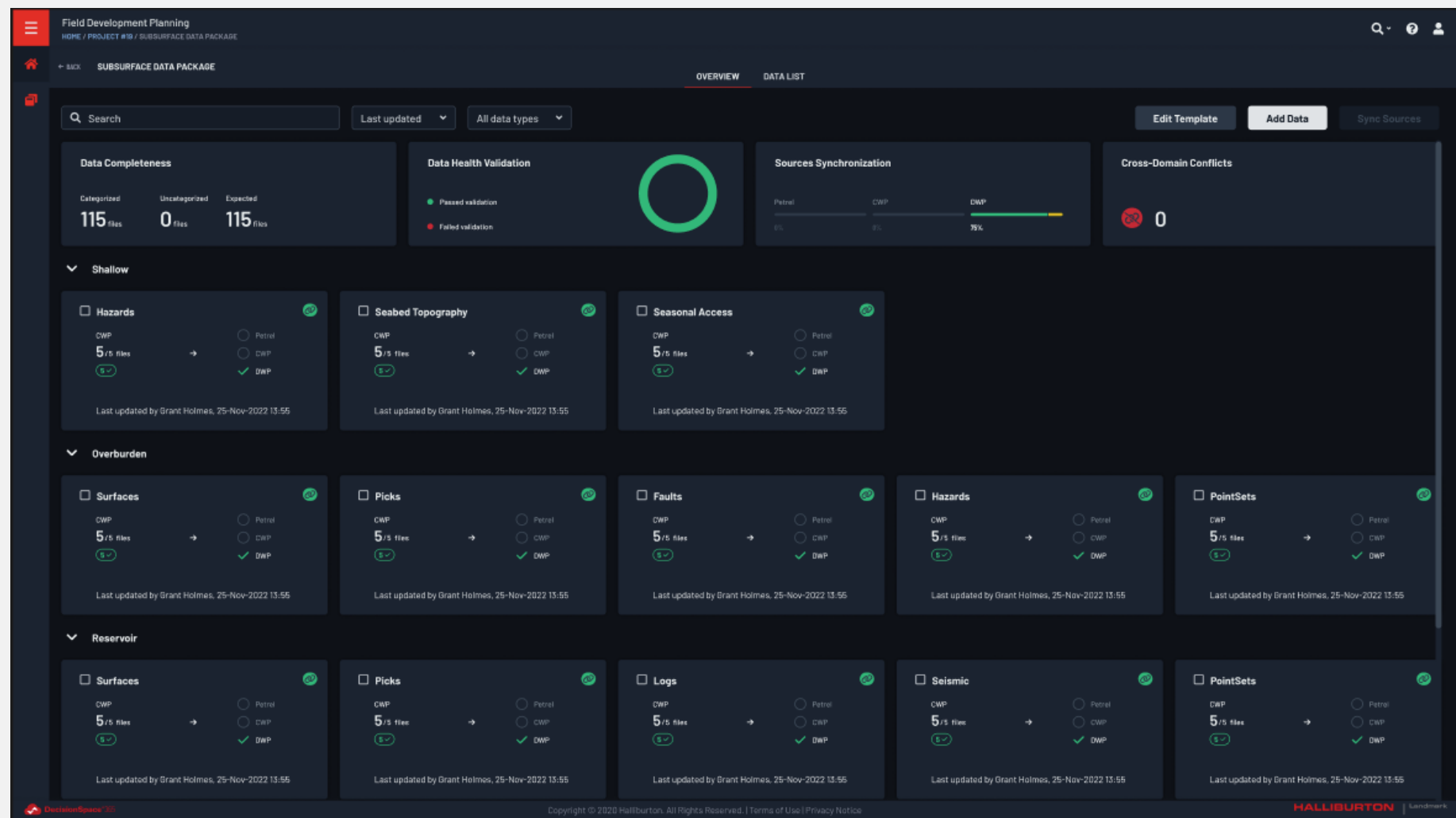


DataOps Dashboard

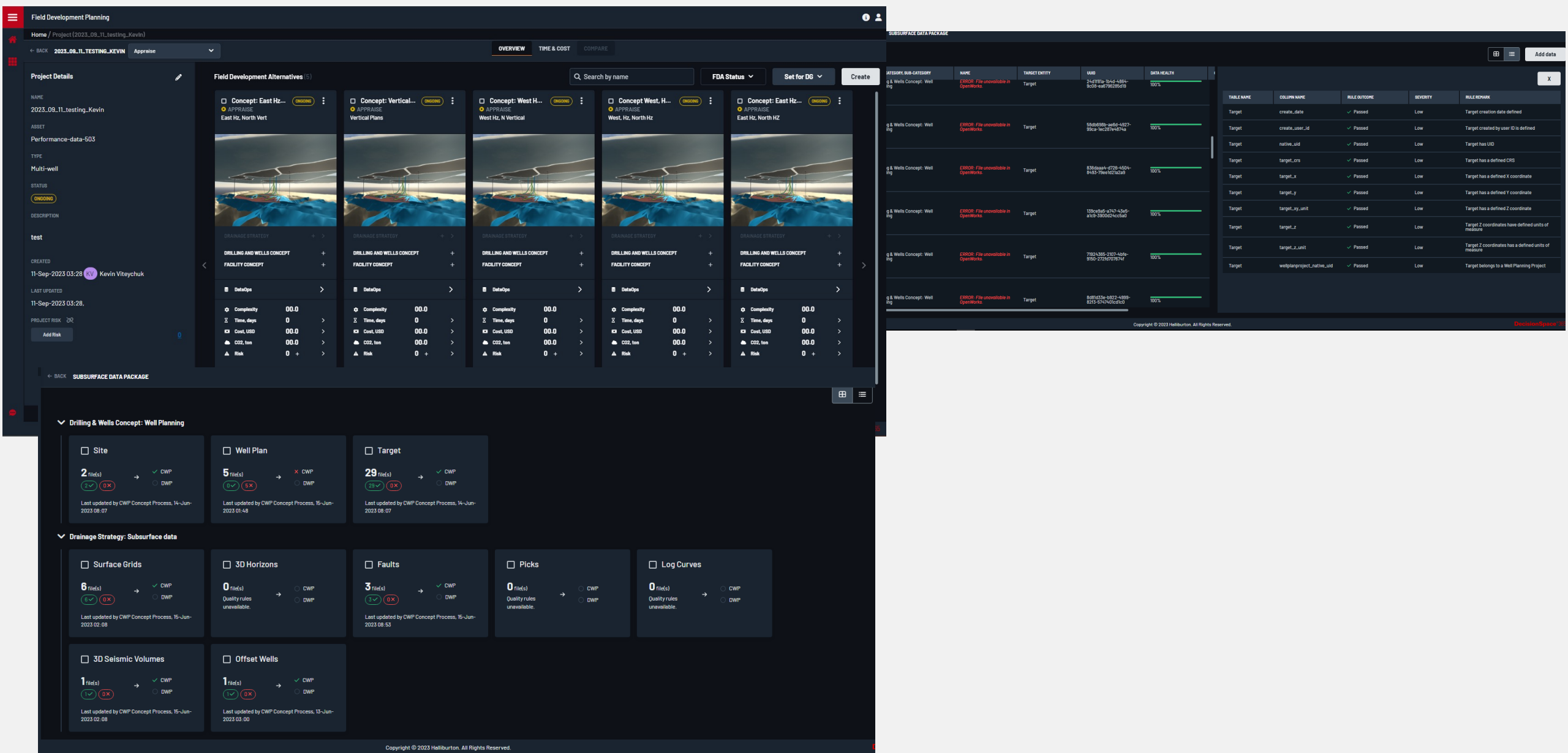
Focus

- Data Management & QC for CWP workflow
- Maintain overview of what data is used for what FDA's
- Prepare CWP session in FDP
- Initiate CWP session from FDP
- Concept creation widget for the collaborative planning (CWP) workflow
- Project FDA DG Version Management for data and designs (continued)

DataOps Dashboard of Subsurface Data Package; Selection & synchronization of data to verify data integrity



DataOps: Data Product Driven Approach to FDA Management



Interoperability

FDP orchestrates seamless interoperability between applications (Landmark & 3rd party)

- Allowing AkerBP to choose which applications to use in each step of the engineering process

- Current setup

- Landmark

- DSG – Well Planning
 - DWP – Well Engineering
 - Risk
 - Time&Cost

- InformatiQ

- GeologiQ
 - Offset Analyzer

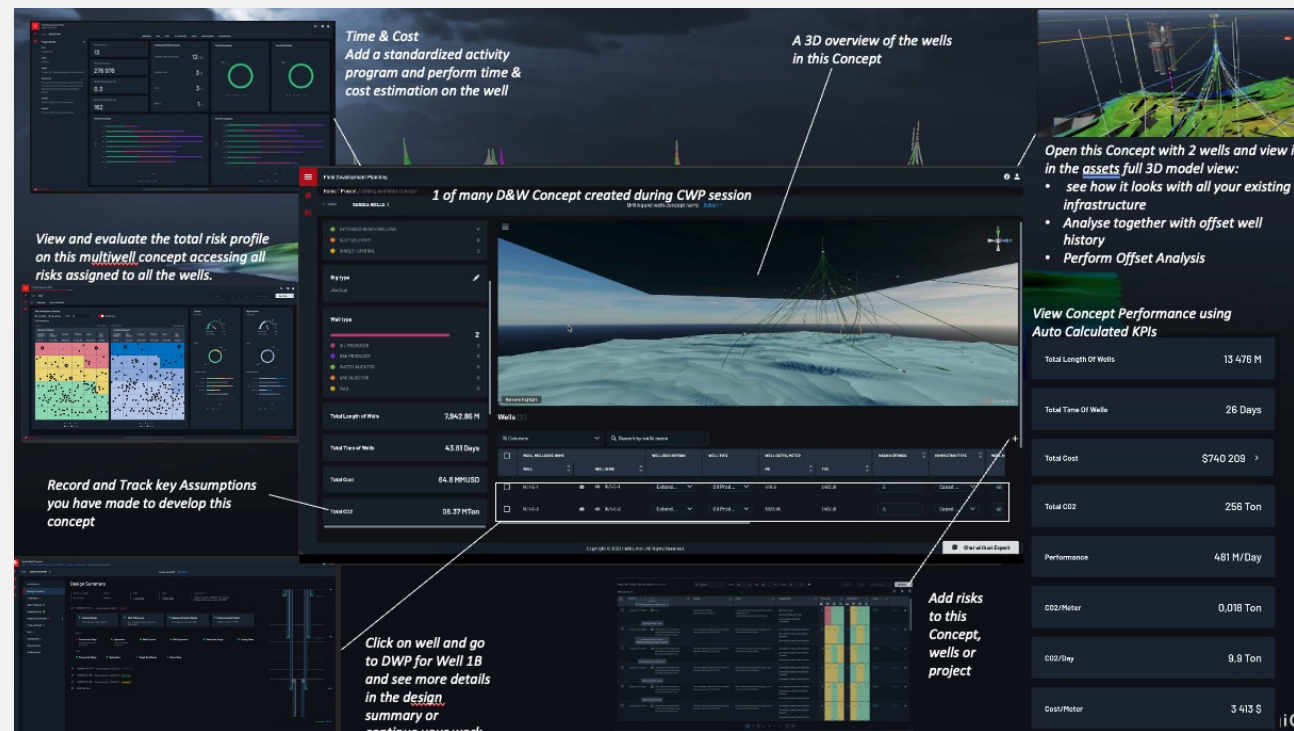
- Envana

- CO2 emission calculator

- SLB

- Studio
 - Petrel

- FuturOn – Field Twin



- Push notifications sendt from FDP DataOps when changes made

Interoperability example – 3rd party

Launch in context

- GeologiQ is a “Field Digital Twin” with all the offset data
- Allows the user to open up a DWC in context and analyse all the offset information in the area
- Synced with EDM and OpenWorks through DSIS

The screenshot displays the GeologiQ Field Development Planning (FDP) interface. The top navigation bar includes a hamburger menu, the title 'Field Development Planning', and user information. Below this is a breadcrumb trail: 'Home / Project / Drilling And Wells Concept'. The main content area is divided into a left sidebar and a central 3D visualization area.

Left Sidebar:

- Description:** Reference Case: Three well scenario from CP1 & CP2. 1 x tri-lateral and 1 x bi-lateral from CP1. Single Bore from CP1.
- Number Of Wells:** 3
- Rig Strategy:** (with edit icon)
- Well Type:**
 - OIL PRODUCER: 6
 - GAS INJECTOR: 0
 - WATER INJECTOR: 0
 - GAS PRODUCER: 0
 - WAG: 0
- Total Length of Wells:** 26,457.3 M

Central 3D Visualization: Shows a 3D model of a wellbore system with multiple lateral branches extending from a central vertical shaft, set against a blue sky and ocean background. A coordinate system (x, y, z) is visible in the top right corner.

Wells (3) Table:

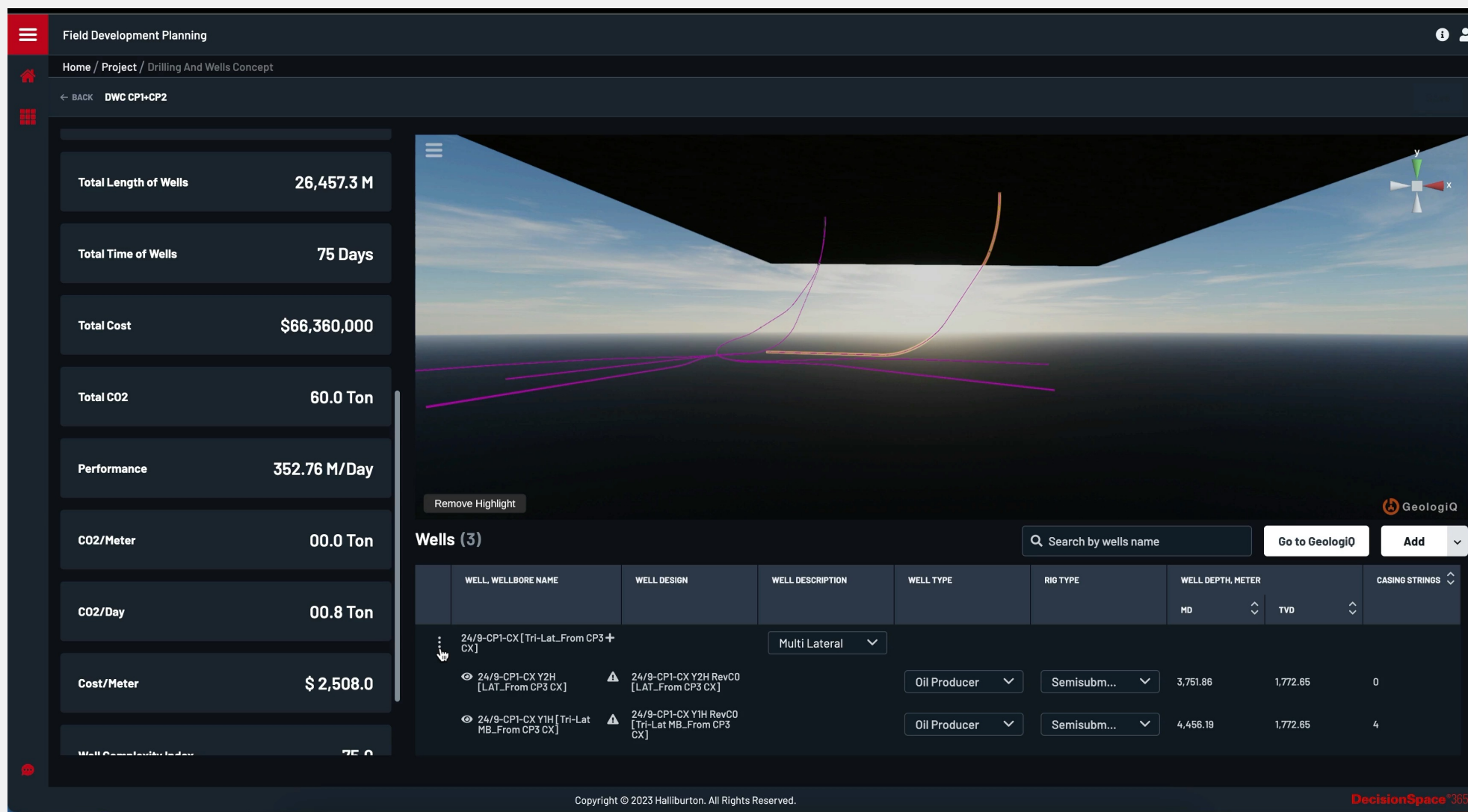
	WELL, WELLBORE NAME	WELL DESIGN	WELL DESCRIPTION	WELL TYPE	RIG TYPE	WELL DEPTH, METER		CASING STRINGS
						MD	TVD	
⋮	24/9-CP1-CX [Tri-Lat_From CP3 CX]			Multi Lateral				
👁	24/9-CP1-CX Y2H [LAT_From CP3 CX]	⚠️ 24/9-CP1-CX Y2H RevC0 [LAT_From CP3 CX]		Oil Producer	Semisubm...	3,751.86	1,772.65	0
👁	24/9-CP1-CX Y1H [Tri-Lat MB_From CP3 CX]	⚠️ 24/9-CP1-CX Y1H RevC0 [Tri-Lat MB_From CP3 CX]		Oil Producer	Semisubm...	4,456.19	1,772.65	4

At the bottom of the interface, there is a copyright notice: 'Copyright © 2023 Halliburton. All Rights Reserved.' and a 'DecisionSpace' logo with the number '365'.

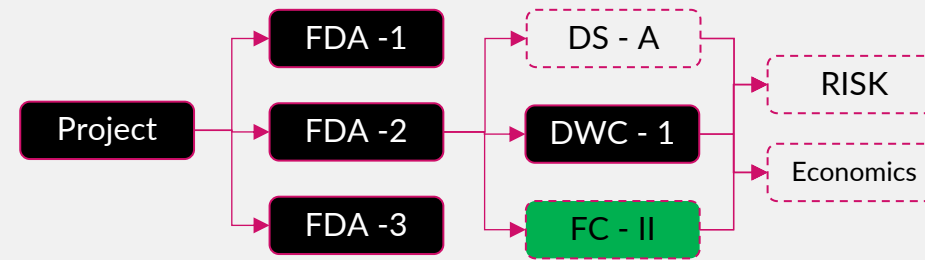
Interoperability example – DWP

DWC wellbores are designed in DWP

- Wellbores defines as PRIMARY will be available in FDP
- From FDP the design process can be initiated by a click



FDP pipeline– Facilities

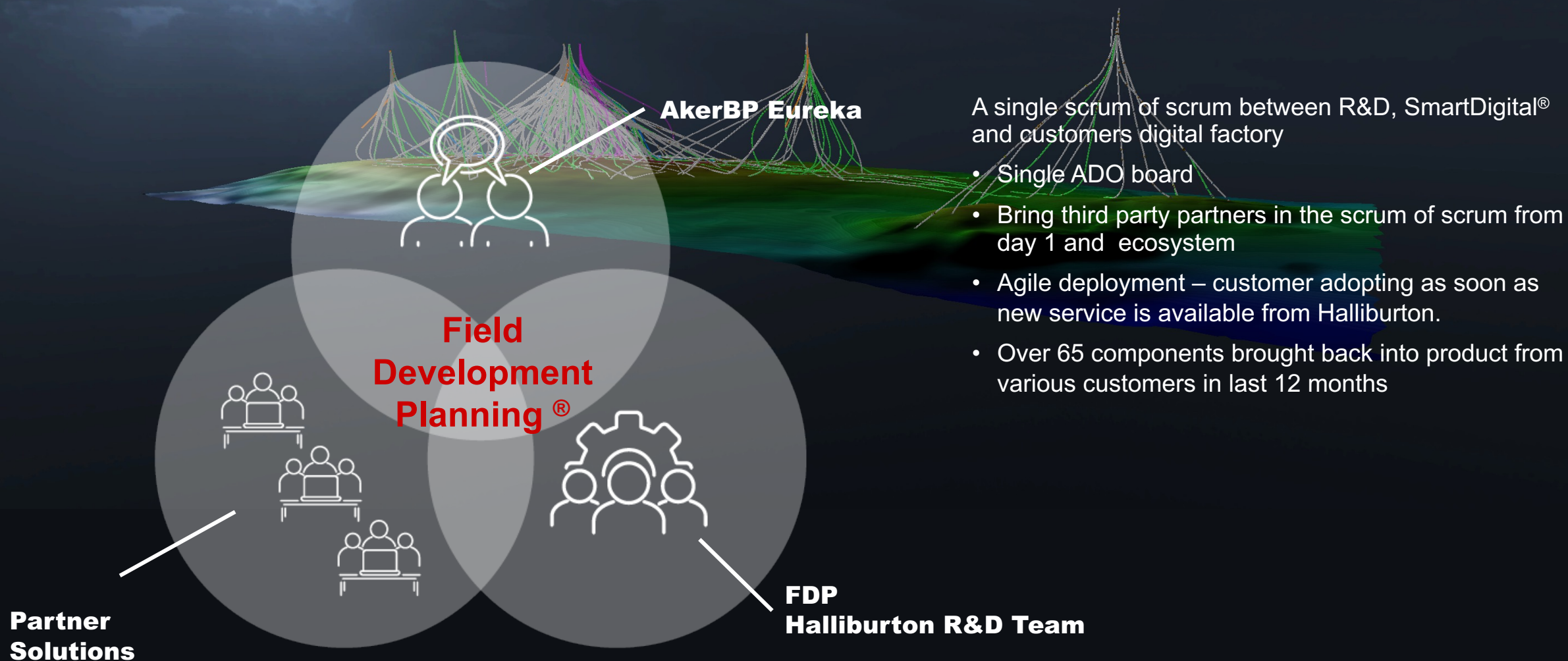


Facilities input to each FDA will be aggregated in FDP

- Interoperable with 3rd party
- Aggregating concept designs and key metadata into FDP
- Supporting the entire design process



One Team – Increasing pace of innovation





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