



Combining wellbores with Multilateral technology - a way to reduce cost

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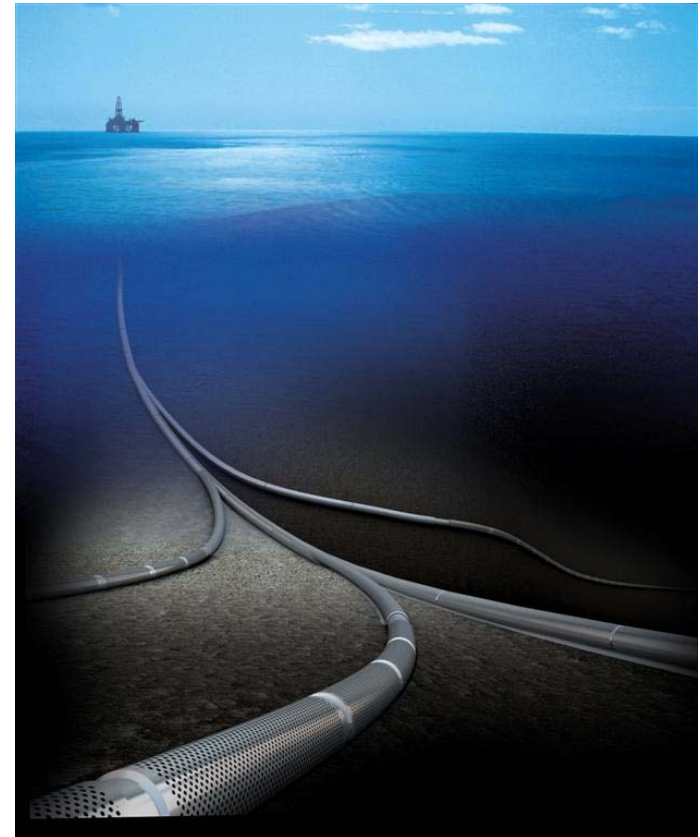
NFES one day seminar 04. November 2016

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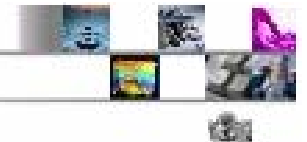


Outline

1. MLT Installation history in Norway
2. Field development savings
3. Combining Wellbores
4. Available junction systems
5. Success criterias
6. Summary



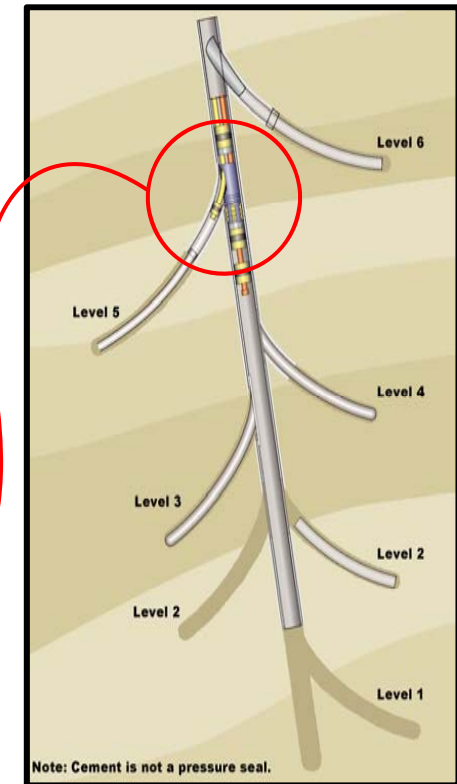
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Multilateral Technology Installation history Norway

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Troll Olje 9-5/8"		1	1		2	10	9	12	9	8	6	7	9	8	9	12	10	11	4	8	128
Troll Olje 10-3/4"																2	6	21	26		55
Grane 9-5/8"										2	5	3	4	4	4	3	1	2	2		30
Statoil Other fields	2	2					1	1	1		1	2	1	3	2	1	2	2	1		20
Other operators	1	1	1		1		1	1				4	2	3	2						17
Total	3	4	2	0	3	10	10	13	11	9	8	13	18	13	18	21	18	20	28	25	250

Updated November 2015

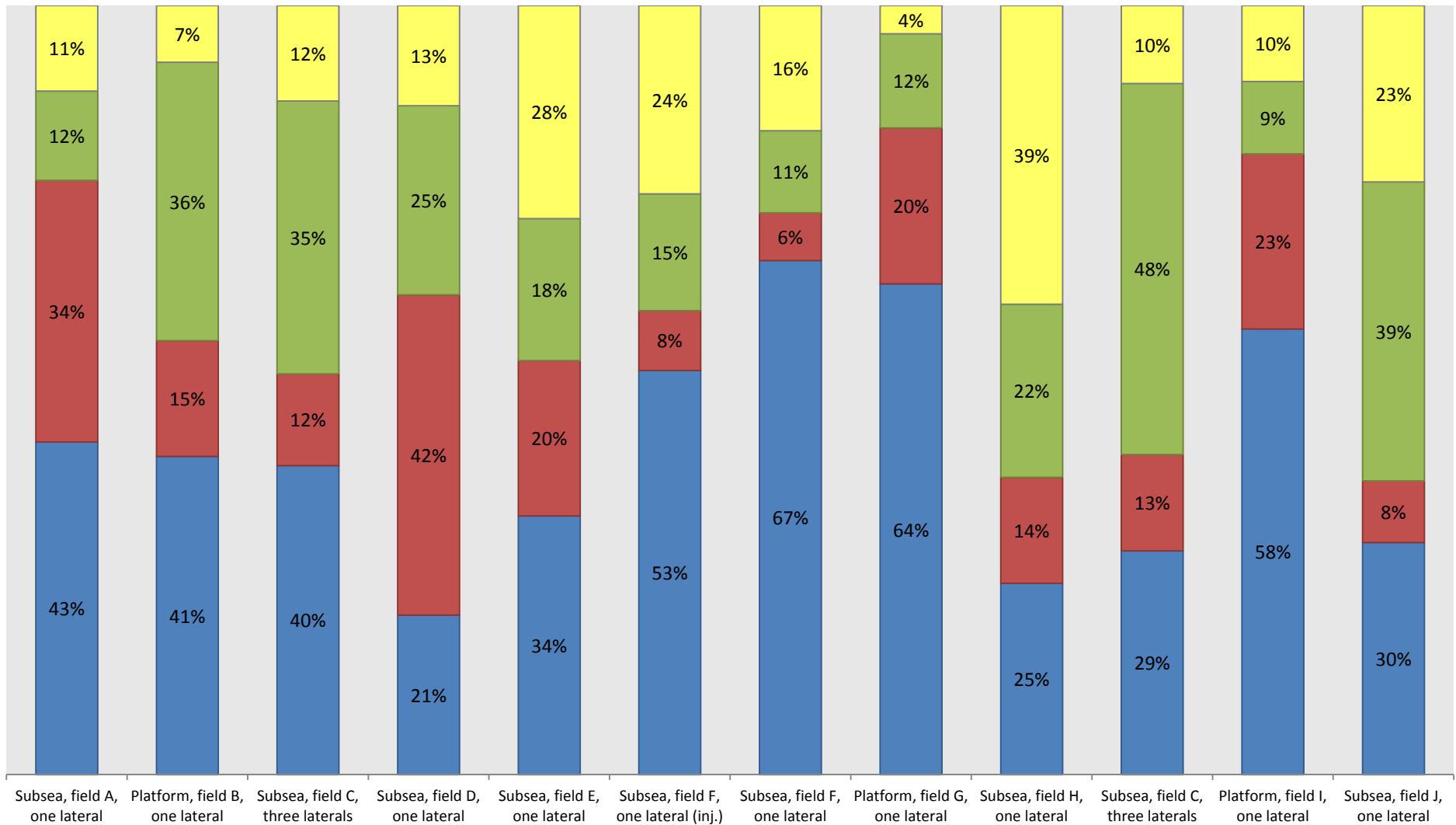


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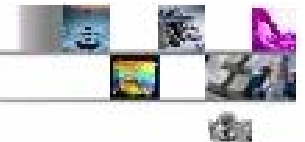


ML wells time distribution

■ %time until start of mainbore ■ %time for mainbore ■ %time to add lateral(s) ■ %time for completion

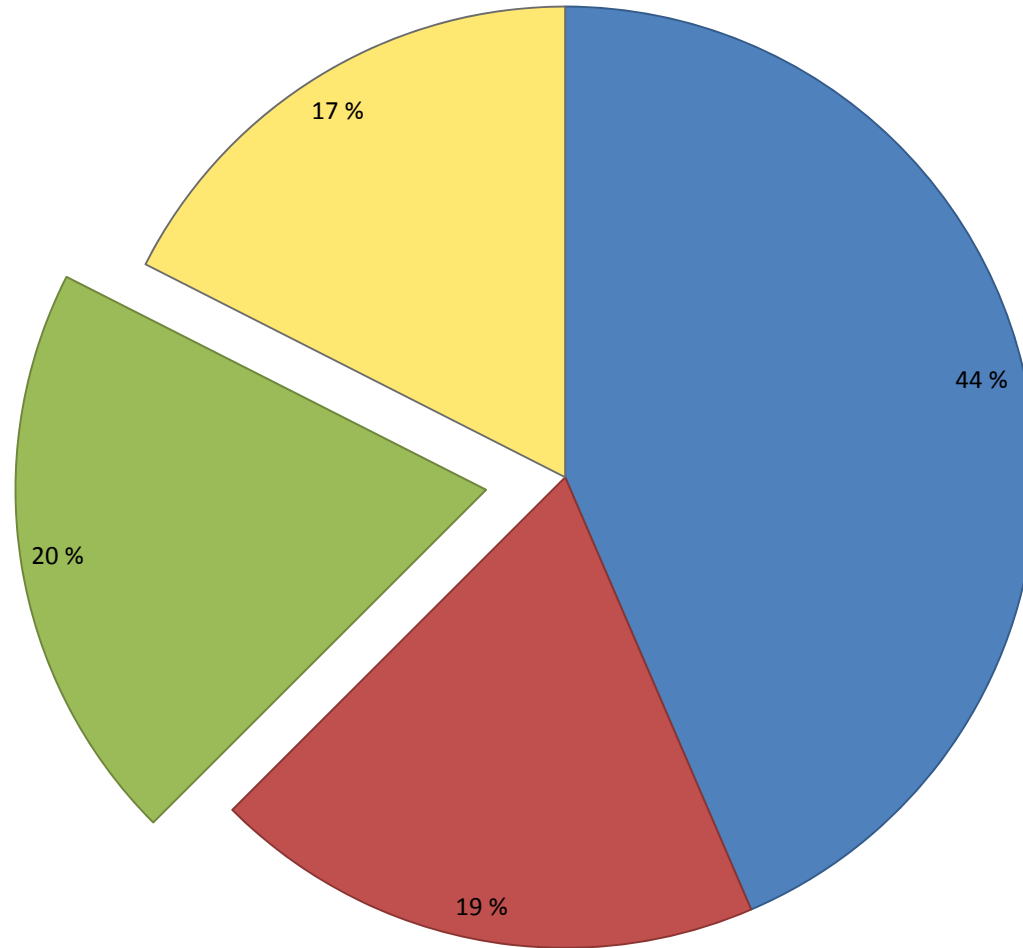


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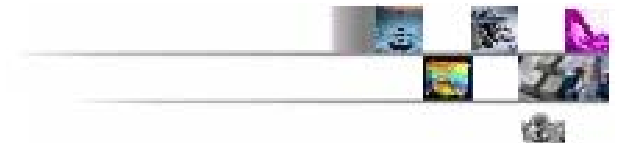


Average time distribution for an ML well with one lateral

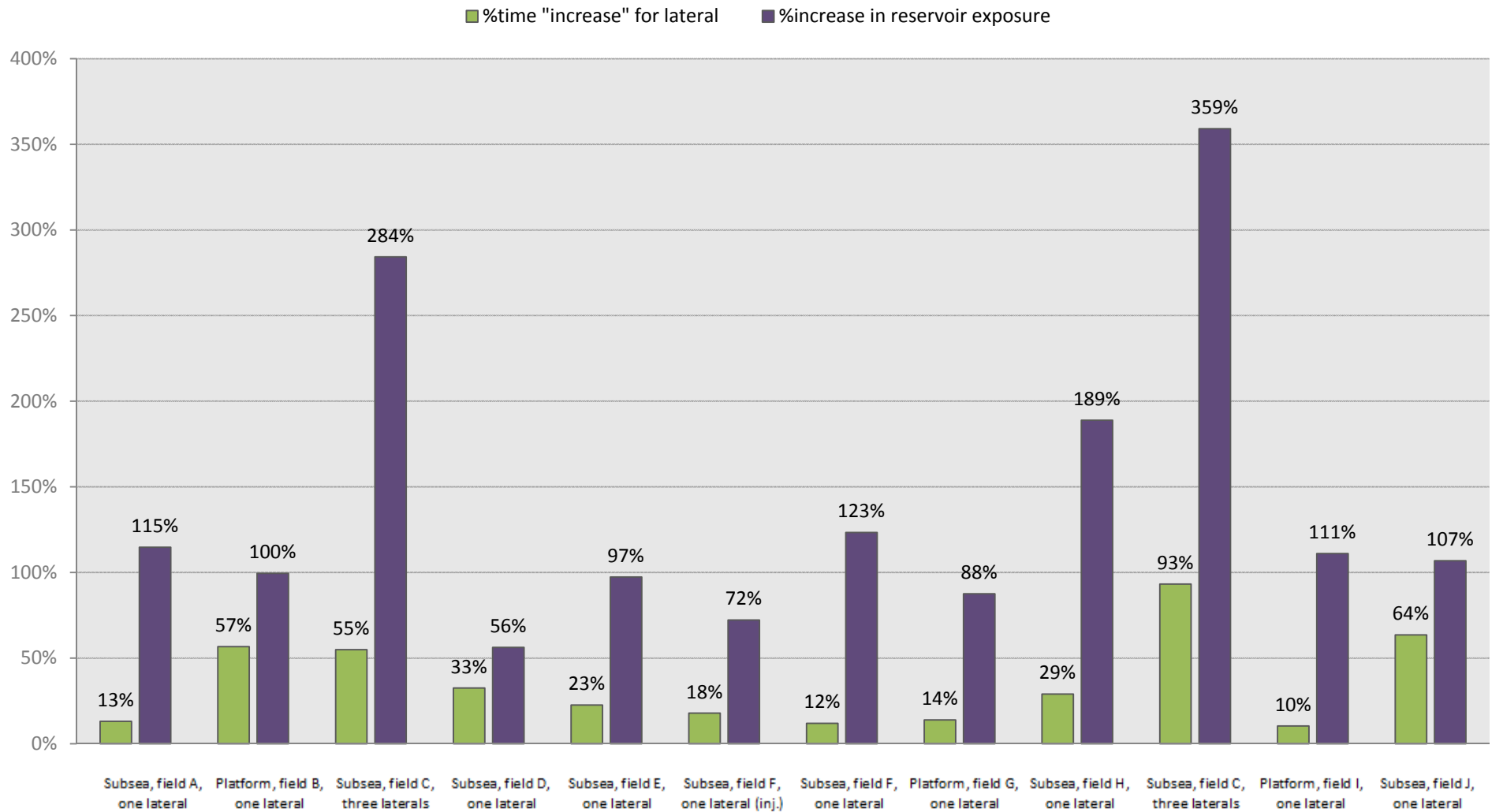
■ %time until start of mainbore ■ %time for mainbore ■ %time to add lateral(s) ■ %time for completion



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Increase in reservoir exposure vs. added time for including lateral(s)

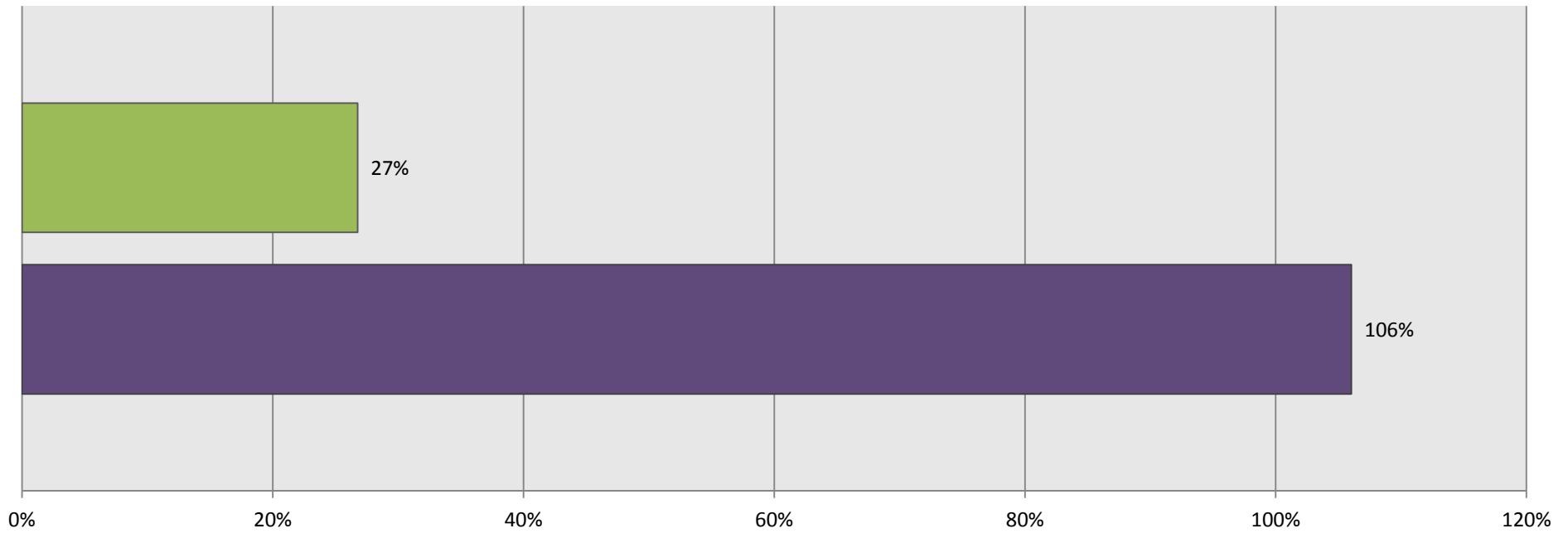


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Average values for increase in well construction time by adding a lateral section, and average overall increase in reservoir exposure gained by adding one lateral section.

■ %time "increase" for one lateral ■ %increase in reservoir exposure

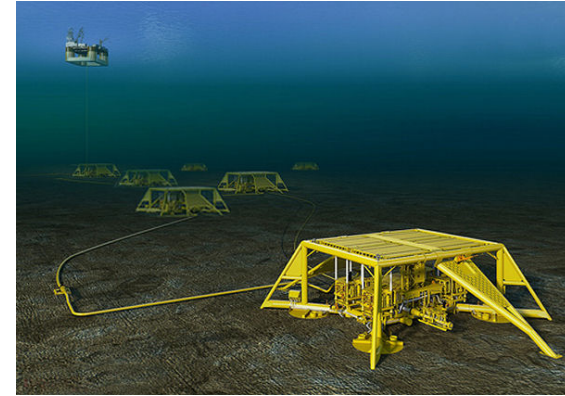


- An average time addition of 27% returns an increase in reservoir exposure of 106%

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Production results Troll

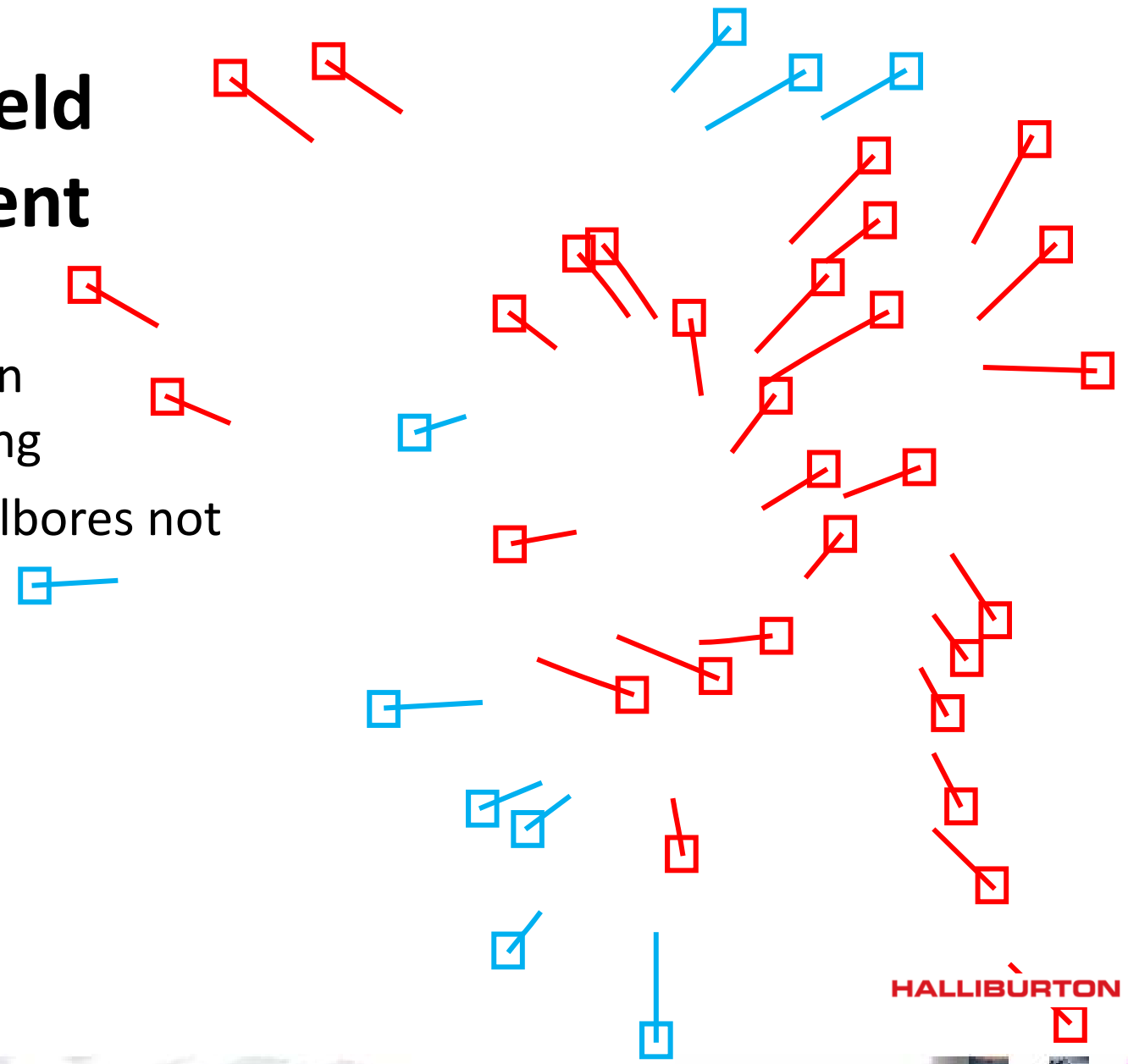


- Reserves (IOR) - 1800 mill bbl → 2700 mill bbl
- Production rate - Dual MLT well
- Cumulative production - Higher due to delayed water/gas break-through
- Reservoir exposure - High production rate at low drawdown (+17km)
- Construction cost - Less than 30% (D&C costs only)

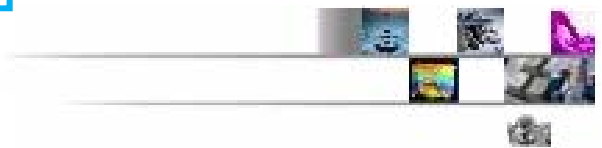


Random field development

- Huge efforts on project planning
- Combined wellbores not considered

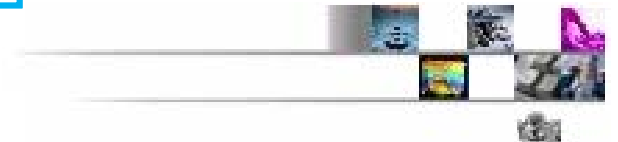
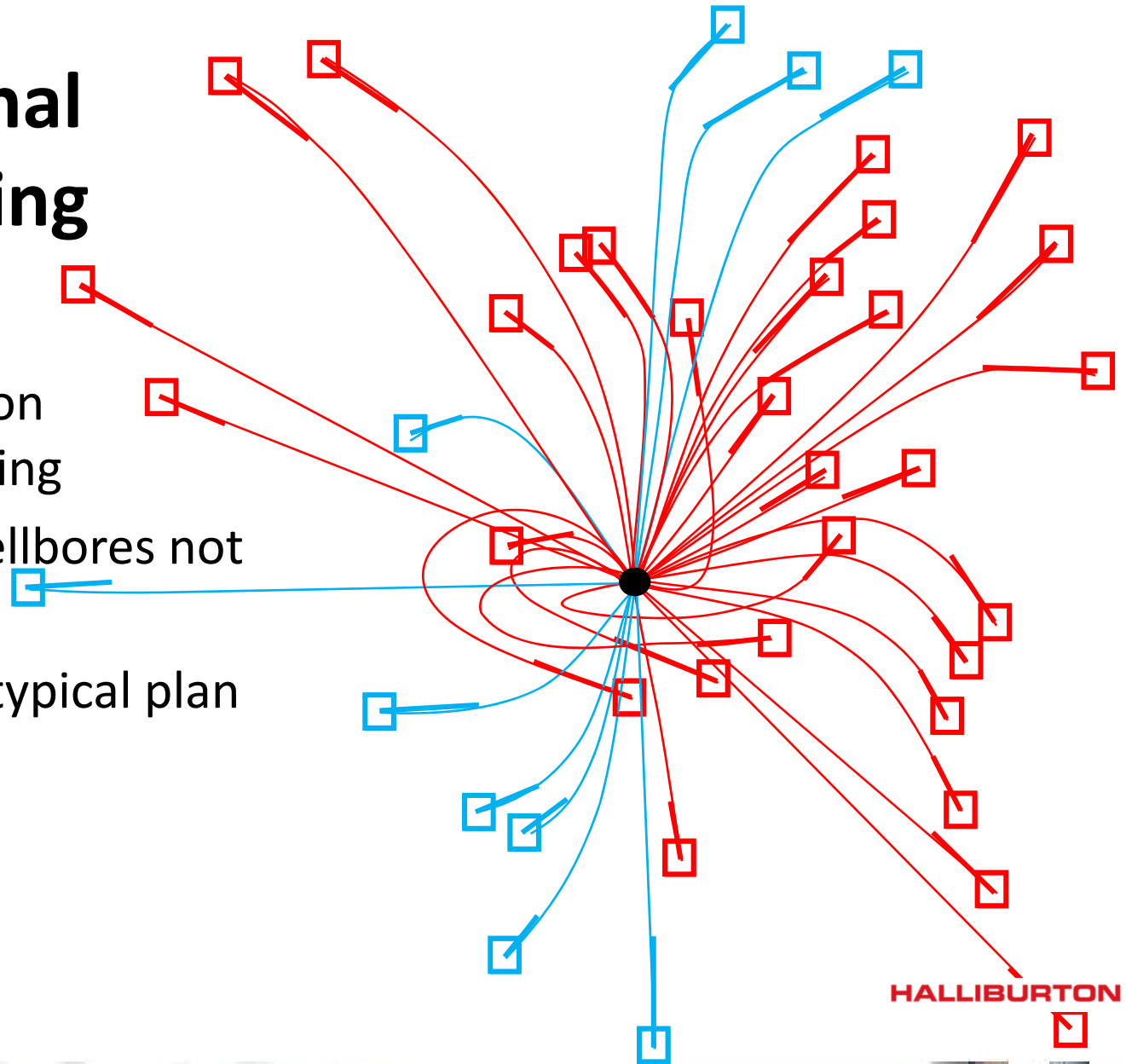


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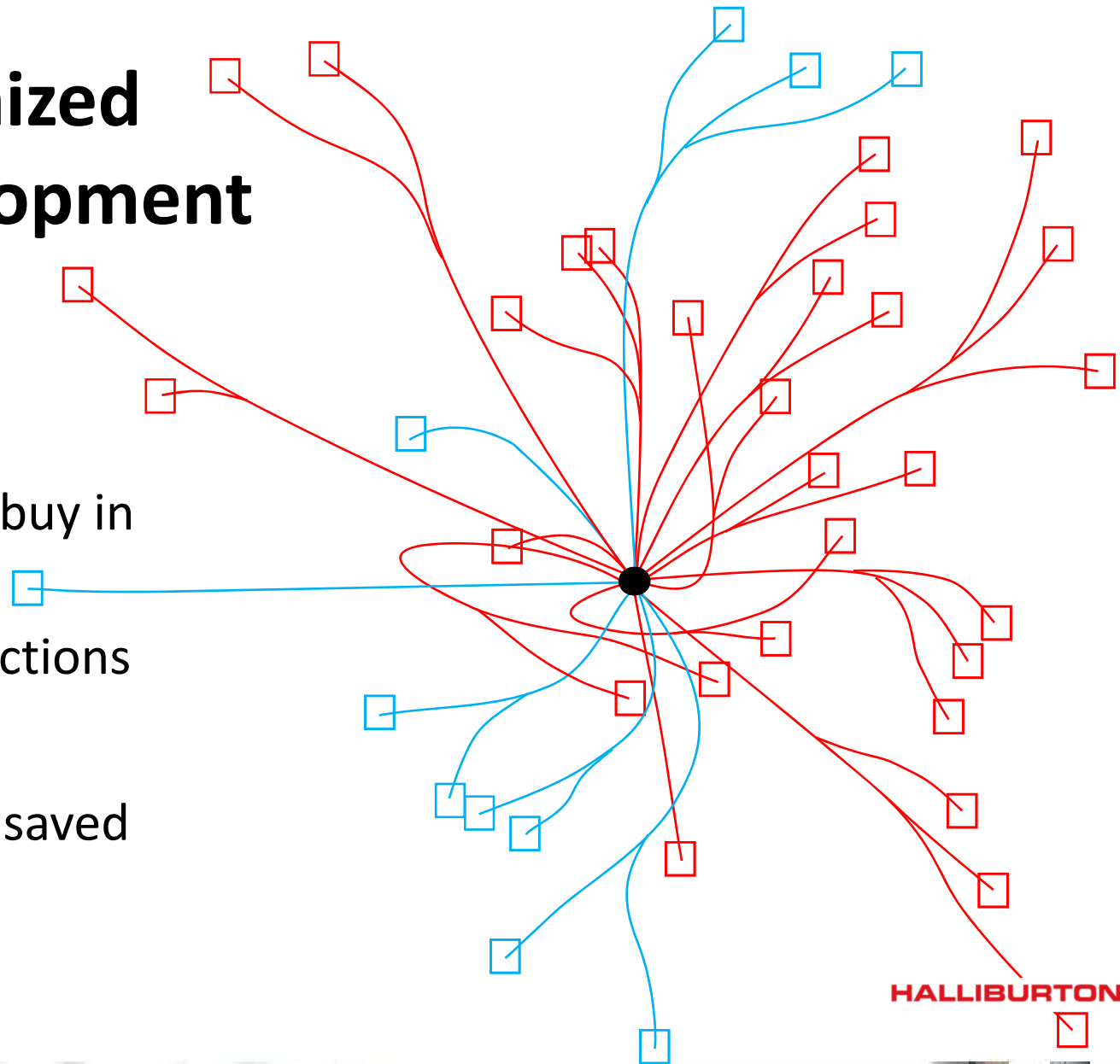
Conventional well planning

- Huge efforts on project planning
- Combined wellbores not considered
- Historically - typical plan
- Cost 24 BNok

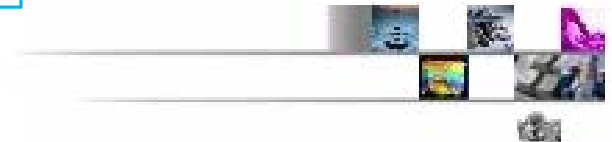


MLT Optimized field development

- Requires early buy in on technology
- 40 reservoir sections
- 20 slots saved
- 8.5 Billion Nok saved

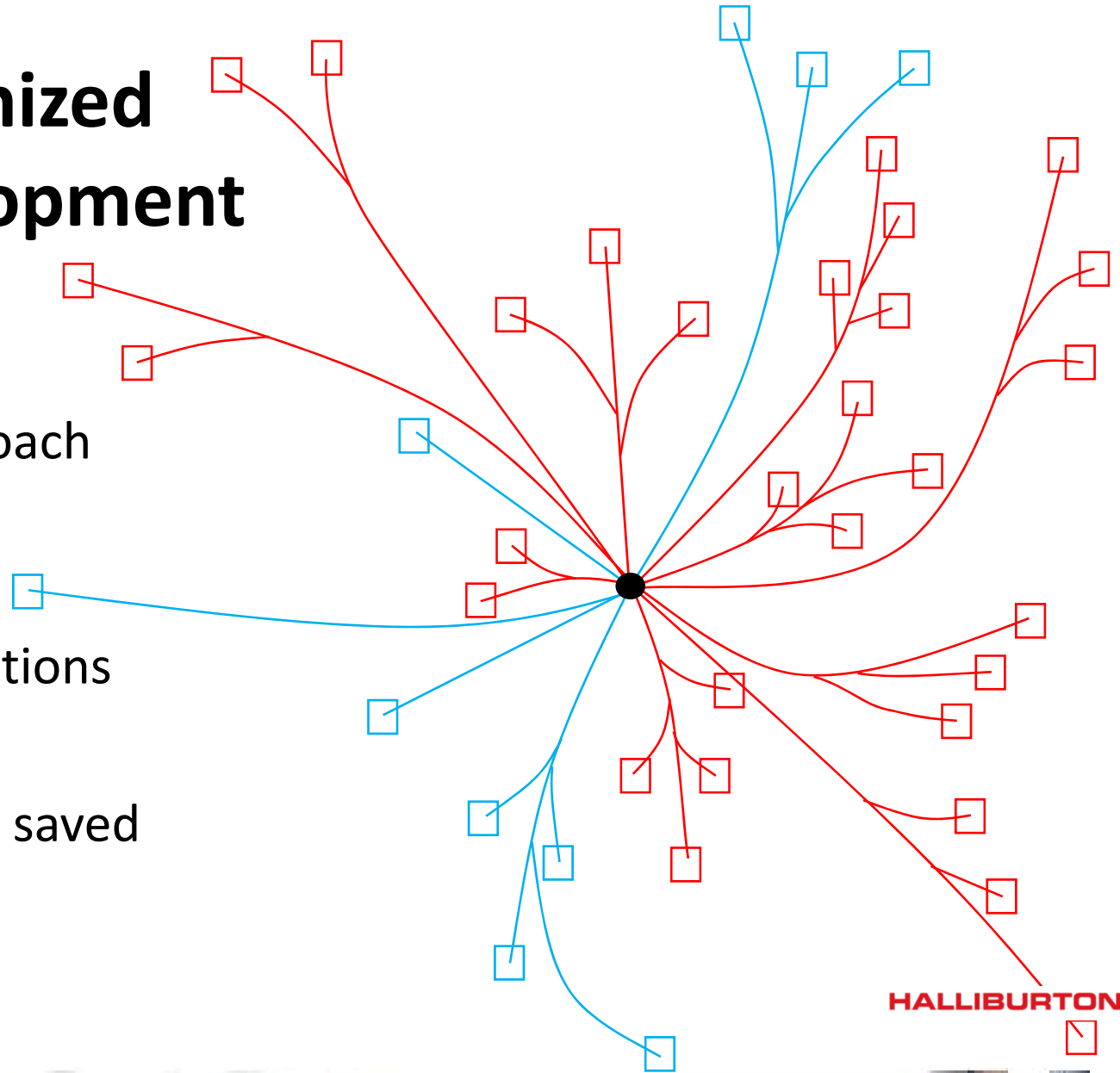


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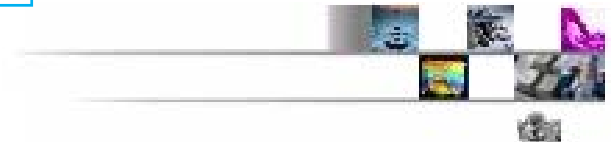


MLT Maximized field development

- Change in approach
- Slight wellbore adjustments
- 40 reservoir sections
- 25 slots saved
- 10.5 Billion Nok saved

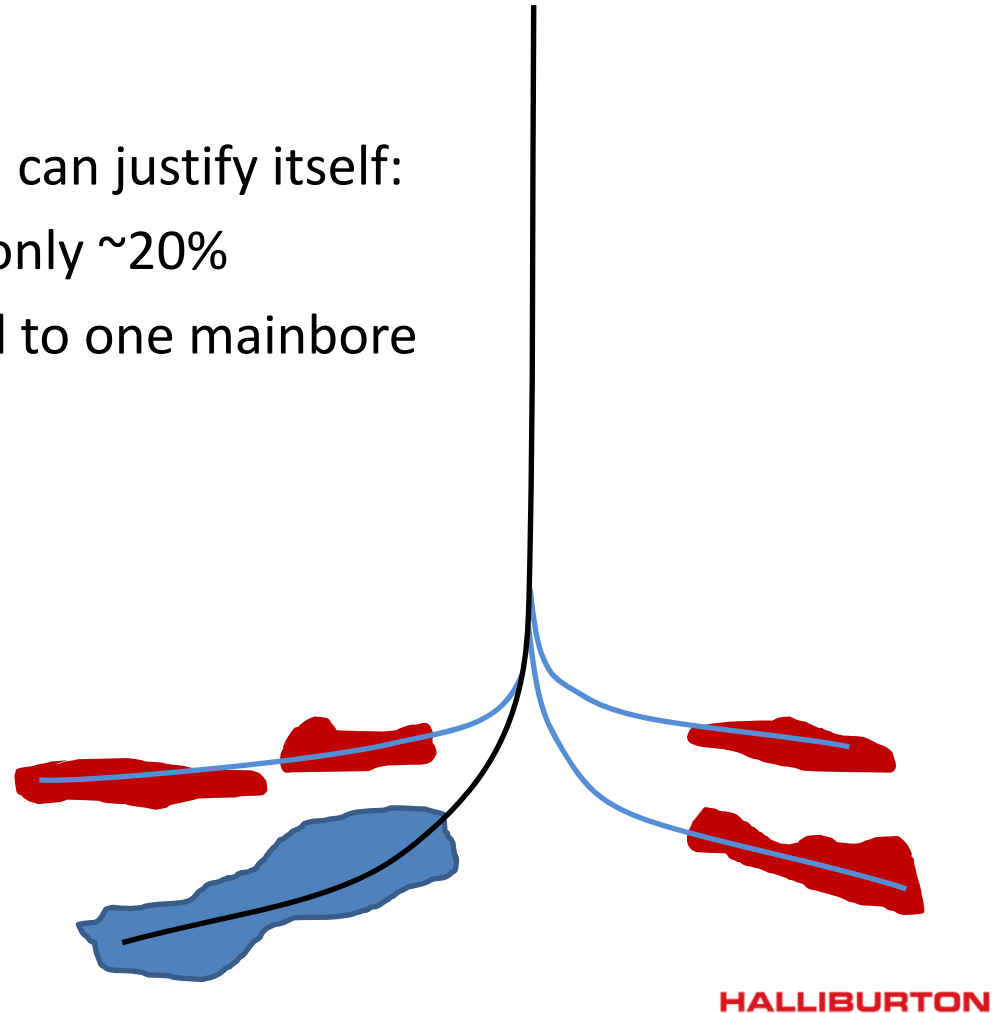
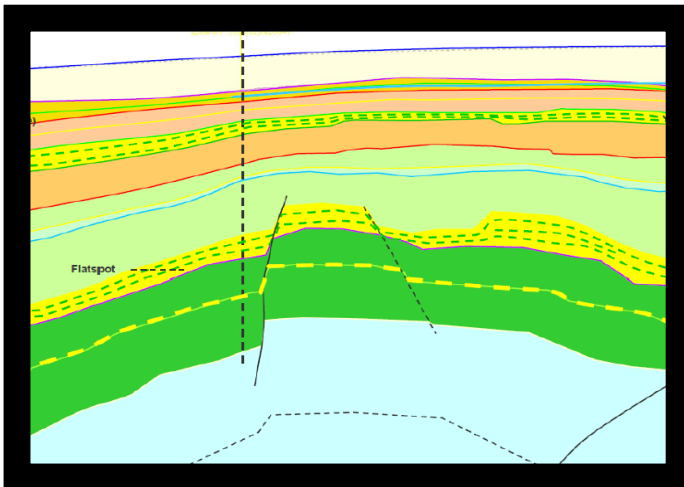


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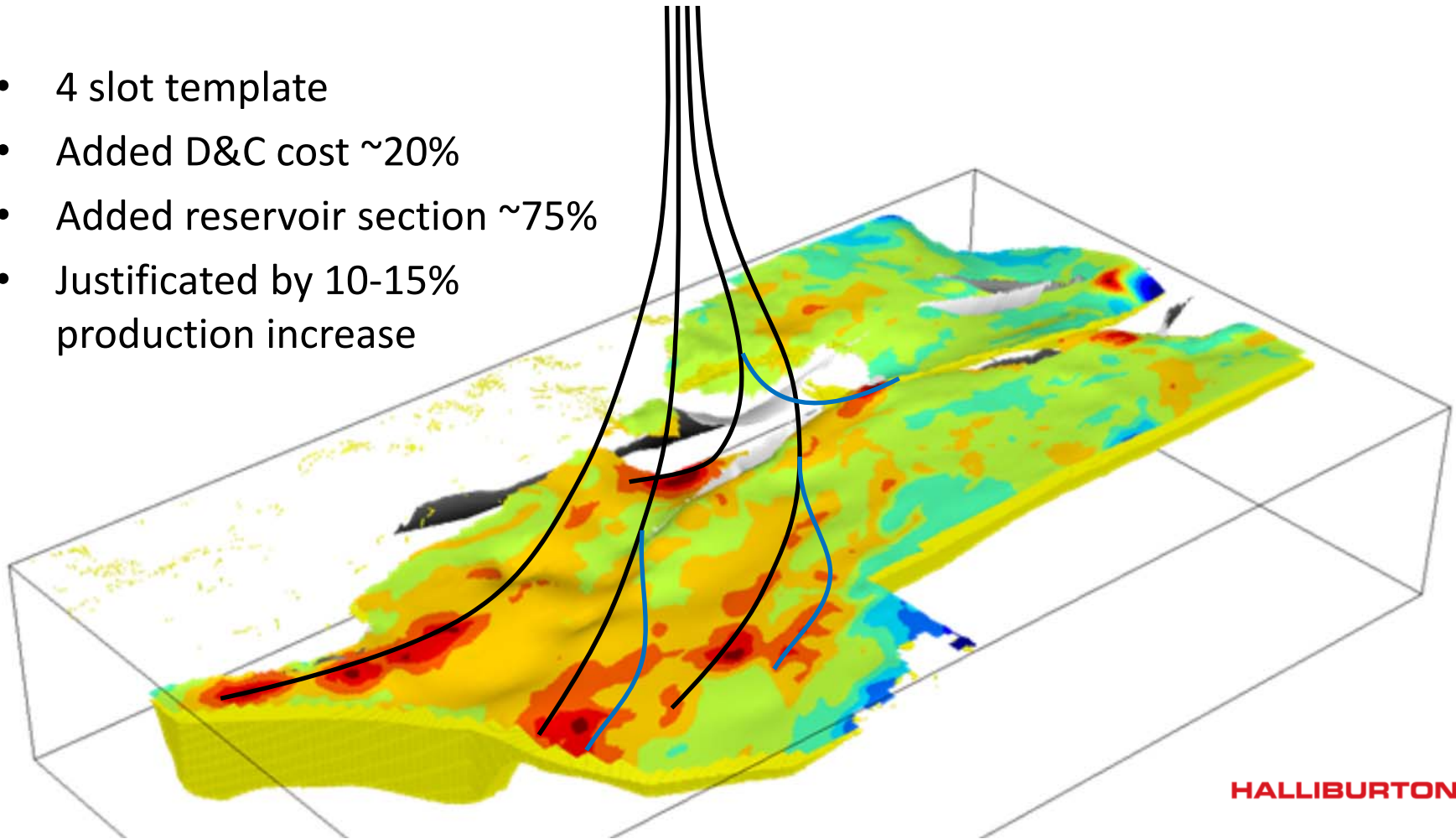
Target Selection

- If mainbore reservoir section can justify itself:
- Lateral contribution need is only ~20%
- Several laterals can be added to one mainbore



Target Selection

- 4 slot template
- Added D&C cost ~20%
- Added reservoir section ~75%
- Justificated by 10-15% production increase

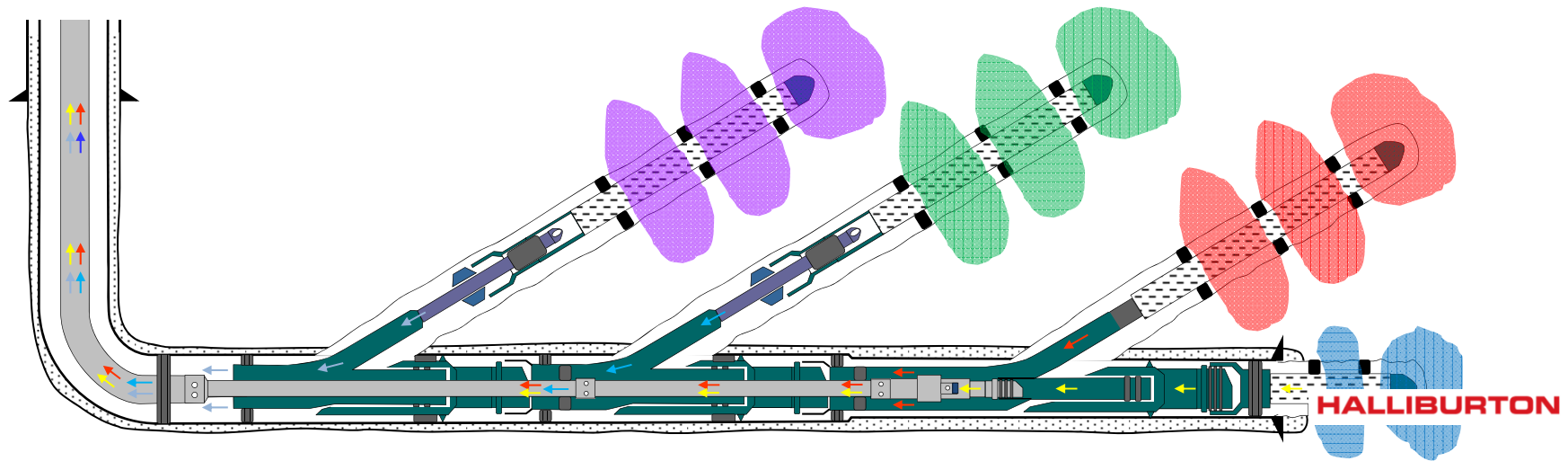


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Today's MLT solutions

- Commingled flow
- High Pressure systems
- Gravel packed lateral
- Inflow control of unlimited numbers of laterals



Success Criterias – focus areas

- Early commitment
- Thorough planning
- Preparation for unknown reservoir conditions
- Dedicated personnel
- Open communication
- Continuous operations

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Summary

- Existing Technology - +280 junction NCS
- Increased reservoir exposure
- Earlier plateau production
- Increased cumulative production
 - Reduced drawdown → improved drainage
- Reduced environmental impact
- 70% cost saving



“If you always do
what you’ve always done,
you’ll always get
that you’ve always got.”

Henry Ford

Thank you!

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NFES - Norwegian Formation Evaluation Society

