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Learning from Development Projects NCS

November 2022

Helge Hatlestad

HSE in focus

Health

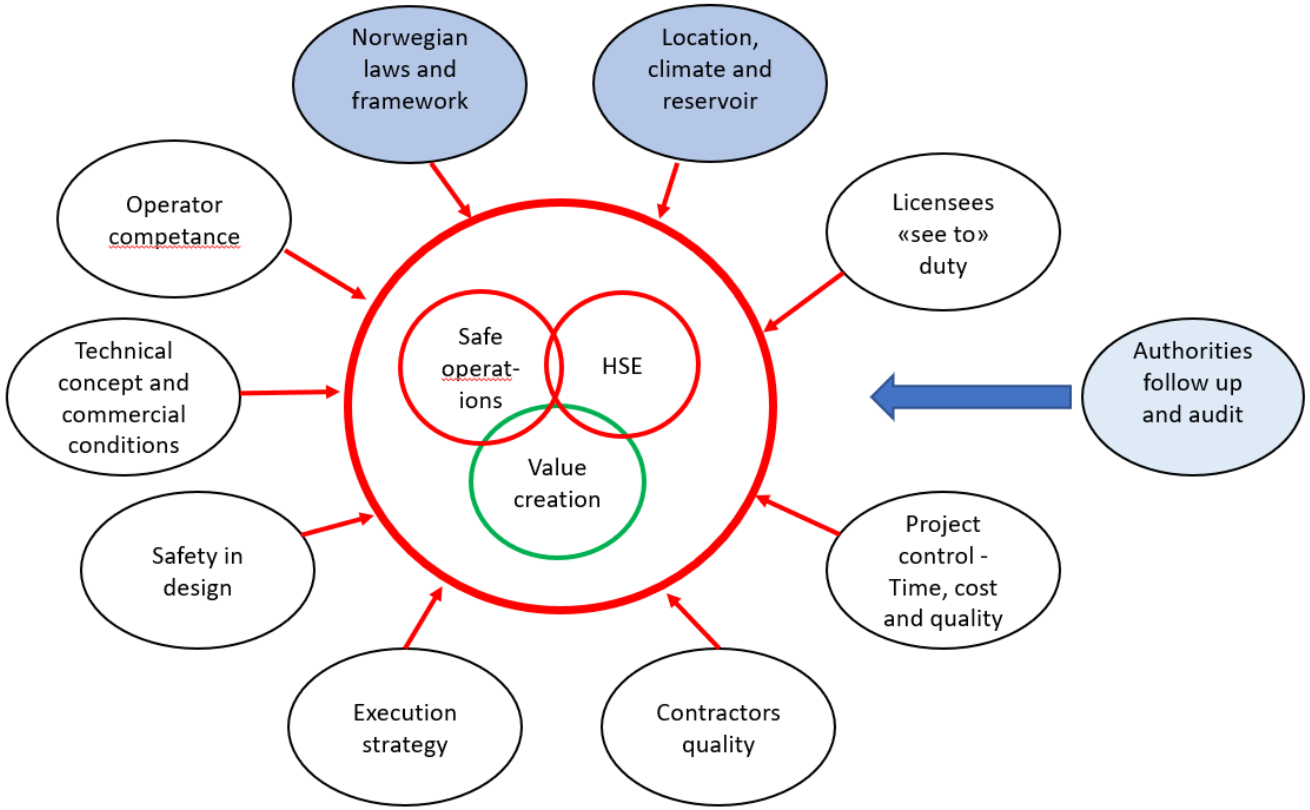
- Working environment laws and regulations to be respected
- The Norwegian laws and practice for involving the work force should be respected and implemented
- Requirements related to sound, ergonomics, handling of chemicals etc. to be understood and followed
- Workload to be within reason for all involved personnel

Environment

- Criteria for emissions to air and water to be respected and met

Safety

- Chosen technical solutions shall be within Norwegian requirements and regulations
- Major accidental risk – to be identified early and used as an important key control for managing the project
- The final facilities should be engineered and constructed in accordance with all specified requirements
- Project execution activities (onshore and offshore) should be performed in accordance with “Best practice”
- Preparation for operations including working procedures should be prepared in accordance with best NCS practice
- All working procedures to be respected and followed



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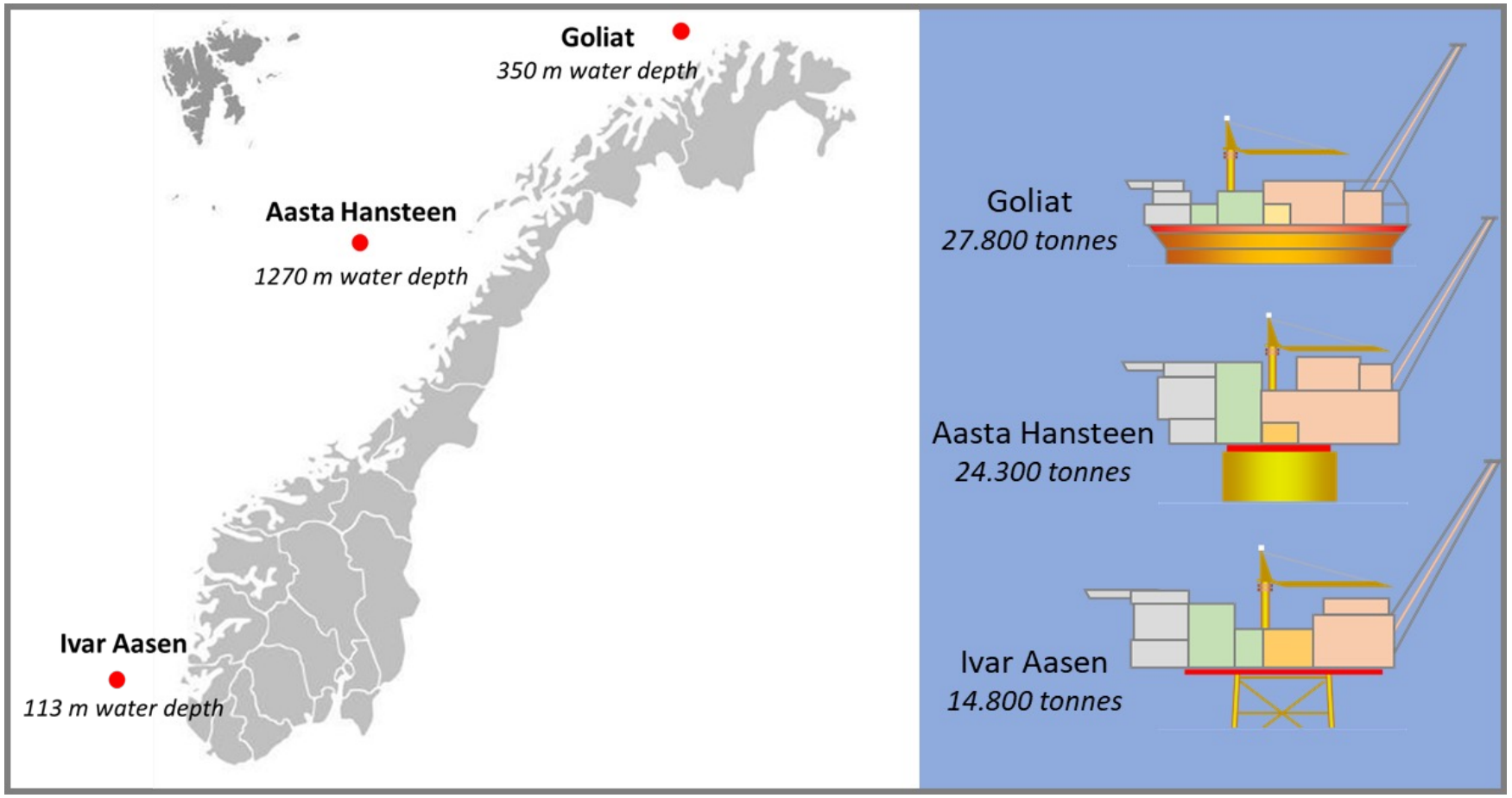
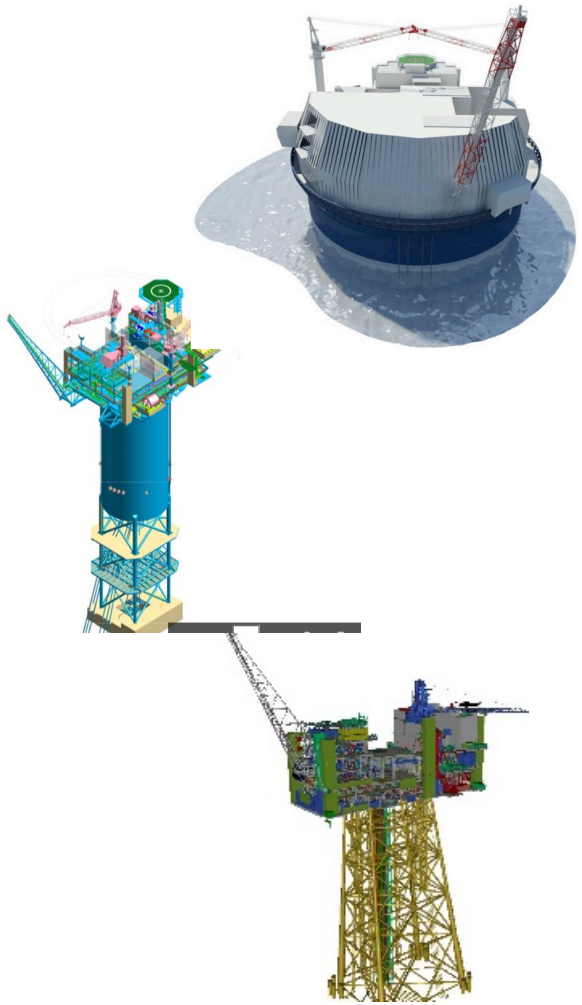
Project description





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Project characteristics

Common characteristics for the projects:

- Limited reservoir complexity og uncertainty
- Medium sized projects relative to capacity and facilities
- Non-complex processing facility
- Marginal value creation at investment decision (PDO)
- Upside potential for increased activity through further exploration in the surrounding area

Goliat

- Uncertainty related to Barents issues
- Pressure from external stakeholders
- Far from infrastructure
- Largest Sevan constructed
- Moderate technology qualification
- Operator without NCS experience
- EPCI at a Korean yard
- To optimistic schedule and cost estimates in the PDO

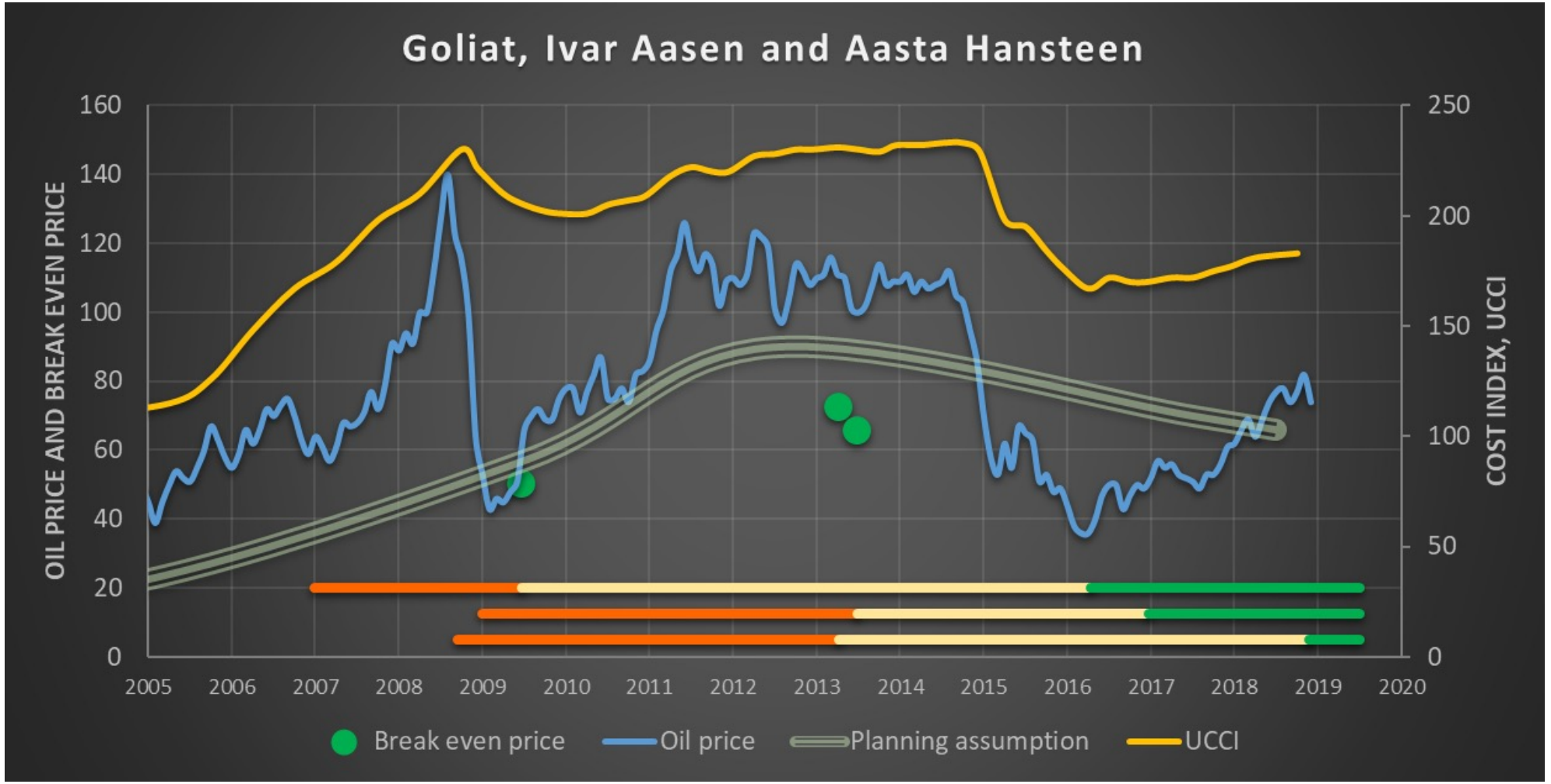
Aasta Hansteen

- Limited attention from external stakeholders
- Far from infrastructure
- New platform type (Spar with storage)
- Extensive technology development
- Experienced NCS operator
- EPC at a Korean yard
- Realistic plan and cost estimates in PDO

Ivar Aasen

- Familiar conditions/moderate waterdepth
- Close to infrastructure
- Traditional platform solution
- No technology qualification
- New operator (NCS and internationally)
- EPC at a Singaporean yard
- Realistic plan and an above average budget

Framing conditions and robustness



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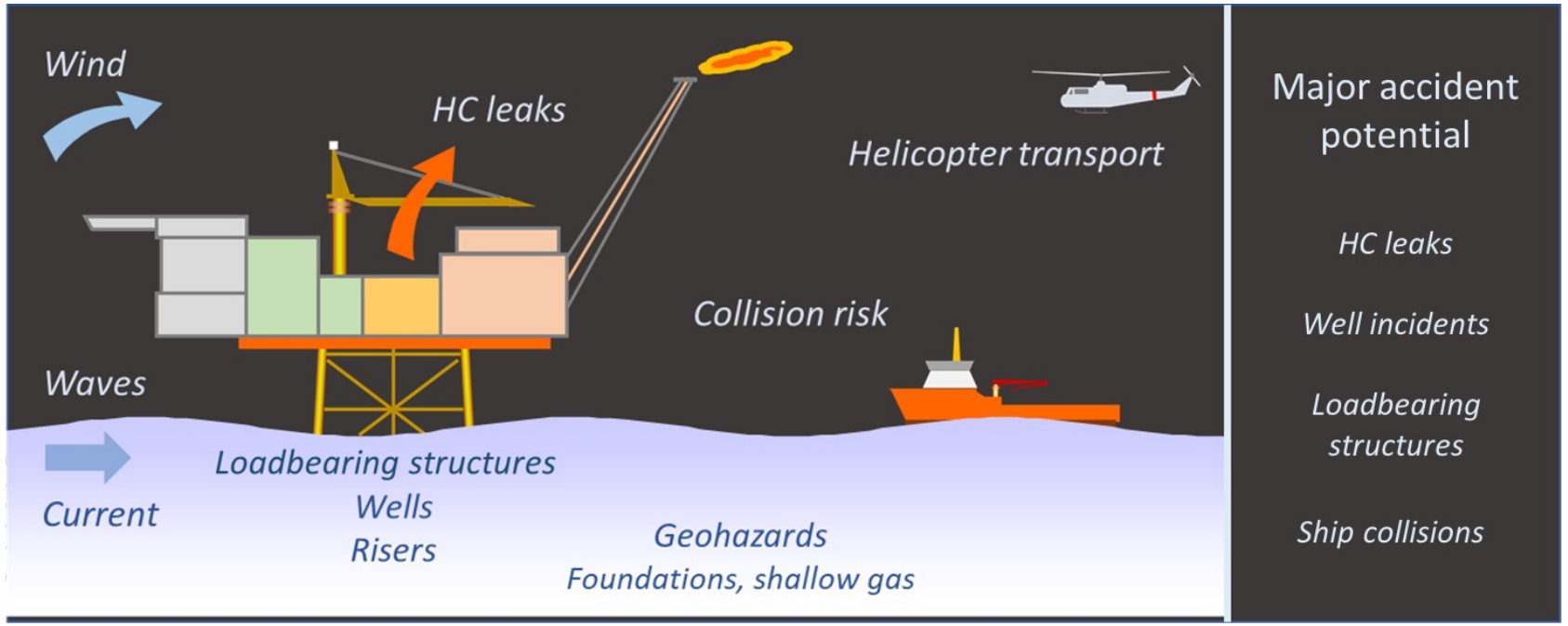
Safety in design – focus on major accident potential



- Through the concept development and selection phase, the potential for major accidents should be minimised
- Effective concept development, area lay out and separation of main functions reduces the possibility for escalation of accidents
- Through utilisation of best practice and quality control the possibility for accidents can be controlled and avoided

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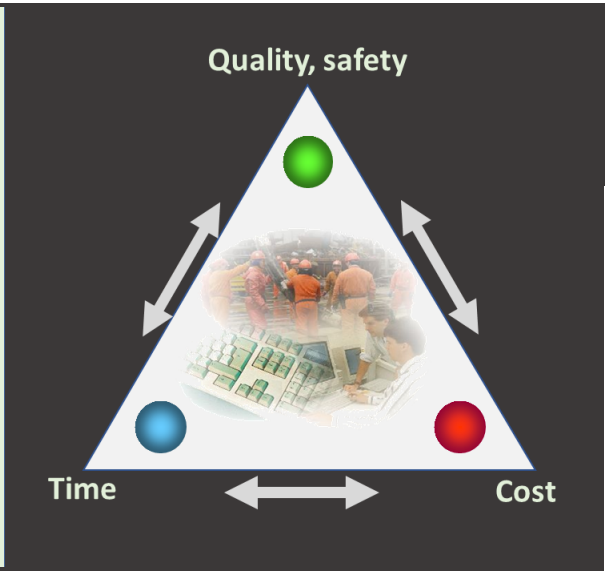
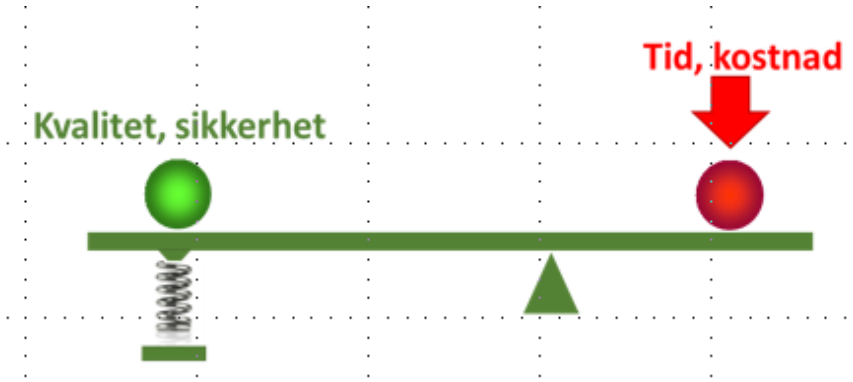
Control parameters in project development

- Development projects are controlled within an approved frame for cost, time and quality
- The frames could be more or less ambitious, but they have to be realistic. In all projects risk factors and unforeseen events can cause execution problems

Problem	Possible mitigation
COST	Use more time – *delay* Reduce scope – *simplify*
TIME	Use more resources – *cost* Reduce scope – *simplify*
QUALITY	Use more resources – *cost* Use more time – *delay*





- The development is continuously monitored and evaluated, and deviations should be mitigated if possible. Balancing of cost, time and quality is a challenge for all projects and should be thoroughly discussed in the execution strategy
- If the frames are unrealistic, it is difficult to find the balance and the project could easily loose control. To regain control it is some times necessary to change the frames during execution.

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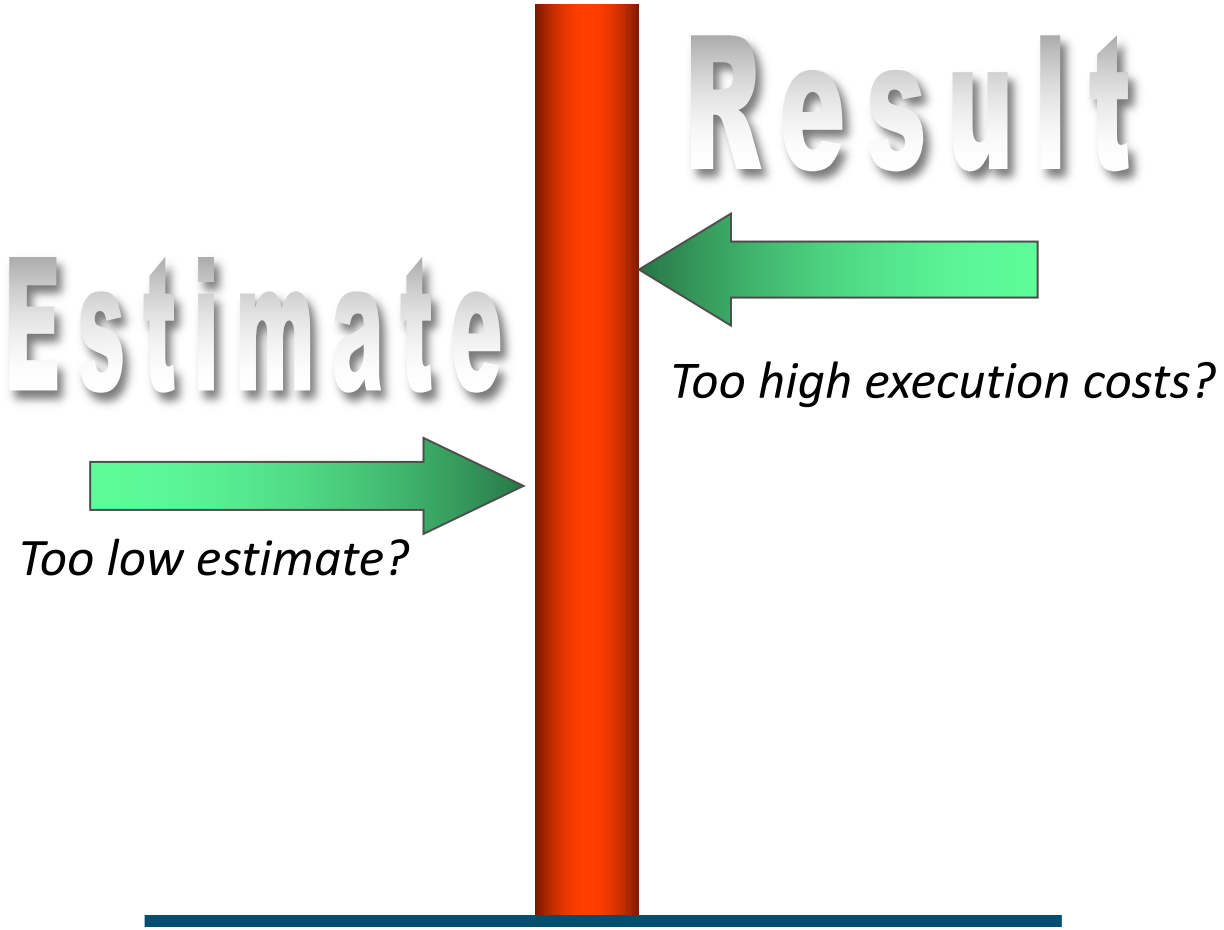
Cost over-runs

What is right and what is wrong?



It is the difference that makes the headlines!

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Conclusions

- Positive experiences from the three projects:
  - Fit for purpose concepts
  - Excellent safety in design and concepts
  - Over average results from drilling and well, subsea installations and marine operations
- On Goliat four main causes have been identified, resulting in 60 % cost overrun, 2,5 year time delay and lack of quality at start up of operations:
  - Lack of technical maturing at DG2 and DG3 (root cause)
  - Extensive change of execution and contractual strategies during execution
  - Allocation of EPCI responsibility to an contractor which at the time did not have sufficient capacity nor competence
  - The Eni project team never regained full control of the execution of the topside part of the project
- On Aasta Hansteen the complexity of the platform itself was under-estimated up front
- On Ivar Aasen the topside benchmarked with high cost - but drilling and well was top quartile
- Barriers against unwanted incidents and problems during the execution phase could be weakened with new and more unexperienced operators as well as licensees – possible mitigations are:
  - Close auditing of the operators competence and management system before sanctioning
  - Auditing that all requirements to operator and partners are fulfilled in the execution and operation phases
  - Strengthening of the authorities follow-up activities during execution

The ten commandments for project development

1. Excellent HSE results = optimal value creation
2. A high quality concept select process, independent of company political strategies, is the foundation for all future value creation (and for excellent HSE)
3. «The right level» of technical maturing and detailing at DG2 and DG3 combined with sensible use of new technology and solutions are key to a successful project
4. The project organisation must secure experience transfer and learnings and have a clearly defined responsibility, delegation of authority. A «one team» attitude is of essence
5. Early involvement of safety delegates and future operational personnel is decisive to the HSE quality for the end product
6. Project- and contractual execution strategies must be customized to the complexity of the project and to the capability of the market place (changes over time)
7. Prequalification for and evaluation of key contracts, must emphasise contractors execution capability, risk understanding and competence level
8. The operators project team must be competent within risk- and project management and control. The must be familiar with the content of the contract, contractors culture and attitudes and secure continuity in key positions (within contractor and own team)
9. Technical documentation and project reporting must be accurate and correct and available for own management, license partners and authorities at any time
10. Principles, criteria and responsibility for commissioning, hand over to operations and start up should be established early to secure a safe production start up

Reflections and learning

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Same challenges for 50 years

Common characteristics Yme, Goliat og Martin Linge

- Maturing at DG2 and DG3 not meeting requirements. (Design basis not frozen, equipment not properly defined, limited space on topside etc)
- Marginal value creation
- Contracting strategy not fit for present market
- Arrogant HQ did not listen to local employees
- Inactive partners
- Lack of NORSOK competence (operator and contractor)
- Huge carry over scope/ lack of trustworthy documentation from construction yard
- Lack of sufficient quality control at construction yard
- An operator which lost control

NPD report 2020 – Six main themes

Analyse av investeringsutviklingen på kontinentalsokkelen 1999 (Kaasen utvalget)

- Optimistic/ unrealistic schedule and cost estimates effected by the NORSOK optimism
- Major changes in technology/ immature FEEDs
- Contracting strategy not fit for present market

NPD report 2013 – Projects on NCS after 2000

- Lack of quality in Planning phases
- Prequalification activities not thorough enough
- Contracting strategy not fit for present market
- Operator project follow up not up to standard

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Reflections

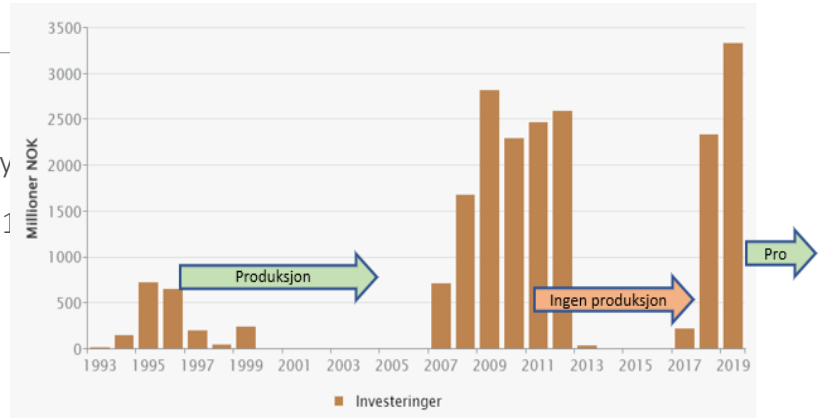
Yme 1,2,3:

Negative value creation for Norway

Investing until 2021

Prod. Start 4Q 21

Ongoing problems

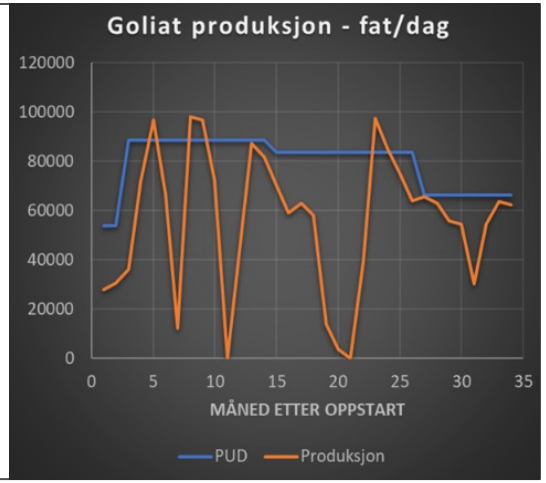


Recommendations:

- Do not pass DG2 (or DG3) without the required maturement (most important for marginal projects)
- Contracting strategy to fit present market
- Important to perform a proper prequalification which means securing that the contractor is qualified for the actual contract
- The Operator must at any time have control over all interfaces and consequences of approved changes for all parts of the project and react when problems occur
- The Operators organisation must secure sufficient capacity and quality of personnel
- Do not start production before the facilities quality is confirmed

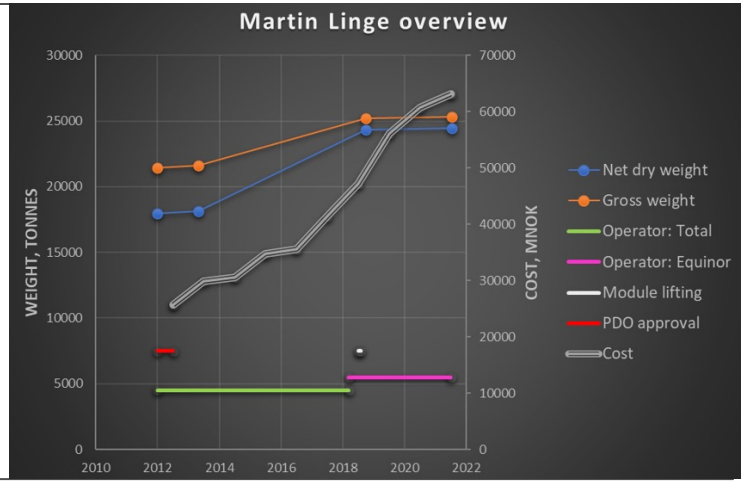
Goliat

1. Should have brought less work offshore
2. Too early start up versus hook-up and system completion
3. Eni should utilised their local employees competence



Martin Linge

1. Equinor secured safe and effective operations
2. Rosenberg added to the cost level
3. Covid added to the time schedule



- ✓ All three projects had marginal value creation at DG3
- ✓ Projects with marginal economy needs to be even more thoroughly planned and tightly controlled during execution

- ✓ Only Yme has a negative value creation for Norway
- ✓ Goliat and Martin Linge were saved by high oil and gas prices
- ✓ Goliat and ML should created MORE value for owners and society

Requirements for an operating company

- An implemented high quality Management System
- An implemented system for internal quality control
- Clear requirements to competence and experience for key project positions
- Ensure continuity in key project positions
- Define and agree the projects mandate, organisation and responsibility early
- Real involvement of work force and operations
- Never deviate from requirements at DG2 and DG3
- Plan and control all technical qualification
- The execution strategy must consider both the existing market and internal competence
- Thorough prequalification processes are key
- Contract evaluation must include all important issues
- Important to utilise technical personnel in procurement follow up
- Ensure Contractors training in HSE standard and quality standards (NORSOK etc.)
- Early identification of project risk with mitigating actions and programmes
- Challenges and deviations must be reported to licence owners on a regular basis
- Ensure control with all project interphases
- The Management of Change system must identify all important consequences
- Preparation for operation and facilitation of work processes must be started before concept select
- Requirements to level of documentation must be included in all contracts
- Definition of responsibility split between project and operations must be understood and adhered to
- Avoid deviations from start up requirements

The main rule in operations: Stop production if safety is at stake

Requirements to partners and the industry

The partners in the licence are responsible for:

- Ensure that the operators management system is adequate and implemented
- Clarify and approve the projects mandate, organisation and delegation of authority as early as possible
- Establish common plans in the licence for reviews, QA/QC activities, approvals for both the planning and execution phases
- Ensure that DG2 and DG3 are not approved if required quality isn't in place (commercial as well as technical)
- Be active in sharing experience from other licences and own operatorships
- Give support to the operator if needed to close competence gaps
- Evaluate the quality and realism (time and cost) of all proposed commercial and technical solutions
- Avoid that time and cost issues jeopardise quality
- If partners have gaps in own competence, utilise competent consultants
- Ensure that the operator meets all agreed HSE requirements and quality requirements
- Ensure that all required safety systems are functioning before production start

The contractor industry is responsible for:

To deliver the products and services as specified in the contract regarding quality, time and price. Possible improvements area:

- Strengthening HSE awareness and competence within own staff
- Continuous improvement of work operations and methods
- Deliver at time, cost and quality through good working processes and sufficient QC
- Be realistic in the bidding phase with respect to offered capacity and competence
- Discuss with and assist the client in rectifying and correcting errors by the operator

Conclusion: Busy times ahead of us

Consequences of the tax package:

- 25 – 30 projects plan to submit a PDO by end 2022
- Schedule driven -> Not all projects will be sufficiently matured at DG3
- NPD/ Ptil have limited capacity to check the documentation from all projects
- The Norwegian supplier market has limited capacity which could result in delays, cost overruns and lack of quality in delivered products in the years to come
- Limitations in qualified personnel at all levels will result in lack of control and qualified follow-up both within the operators and the contractors organisations

Possible consequences of the Ukrainian war:

- More costly and delayed deliveries on some materials and equipment
- Disturbance through the entire «Supply chain»

Suppliers and main contractors:

Construction yards:

- 70 – 80 % of the peak manning will be hired from outside the yard
- Indirect manhours versus direct manhours will increase from 40% to 100%
- The productivity has been decreasing the later years and will possibly continue to decrease with increased scope
- Delays in sub-deliveries will add to the problem
- The high level of activity will result in some delays and cost increases

Engineering contractors:

- Will struggle to get qualified manning in sufficient quantities

Other main deliveries:

- 100 – 150 (?) wells with subsea templates, wellheads, flowlines, umbilical's, risers etc. etc.

Risk management is key to project success