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INCREASED PRODUCTION THROUGH BETTER UTILIZATION OF PRODUCTION SYSTEM BOTTLENECKS.

1. Background & Team
2. Concept & Technology
3. Main takeaways

A spin-off from the NTNU Center for Integrated operations

BACKGROUND

- **Solution Seeker AS** is a spin-off from the world leading NTNU Center for Integrated Operations (IO Center) and an internationally outstanding ICT research group at NTNU Engineering Cybernetics
- **Close industry interaction** with oil companies has been a key part of the IO Center approach to understanding the actual problems the industry faces
- The theoretical foundation of Solution Seeker technology is documented in more than **50 scientific publications, 20 Master's degrees and 5 PhDs** since 2007
- **Two patents** have reached national level with outstanding feedback and reviews



Executive Team

Bjarne Grimstad

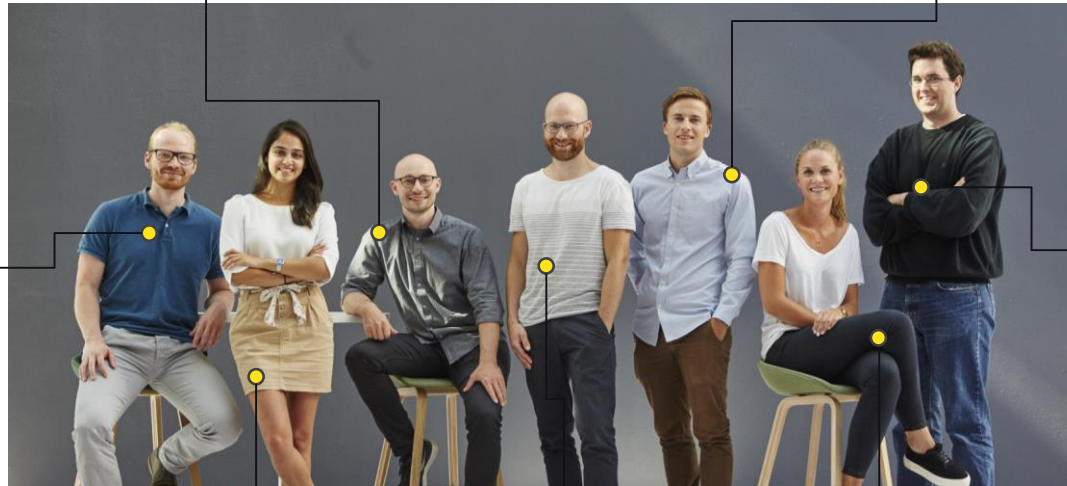
- PhD from NTNU Engineering Cybernetics.
- Previous experience from FMC Technologies
- Responsible for first principal modeling.

Vidar Uglane

- Msc. from NTNU Industrial Economics
- Experience as a consultant at McKinsey
- Responsible for following up and developing the pilot customers.

Anders Sandnes

- Msc. from NTNU Engineering Cybernetics with specialization in optimization.
- Responsible for technical development.



Inge S. Skrondal

- Msc. from UiO mathematics.
- Experience from ConocoPhillips on production data analytics.
- Responsible for data and parameter uncertainty assessment.

Sheri Shamlou

- Msc. from NTNU Industrial Economics with specialization in optimization.
- Experience as a management consultant at Arkwright.
- Responsible for project management and business development.

Vidar Gunnerud

- Solution Seeker CEO
- PhD from NTNU Engineering Cybernetics.
- Former manager for short-term production optimization at NTNU's center for integrated operations
- Experience as production engineer at the Statoil Troll field

Stine Ursin-Holm

- Msc. from NTNU Industrial Economics with specialization in optimization.
- Responsible for well test design and data analysis.

Advisors



Bjarne Foss (Prof. NTNU Eng. Cybernetics)

- **Board member and advisor on technical development**
- NTNU Board member, extensive knowledge on methods related to Solution Seekers's technology, and large industrial network
- Co-founder of Cybernetica and Cyberlab



Anders Aune (Key account mgr. NTNU TTO)

- **Chairman and advisor in business development and strategy**
- Extensive experience from managing technology startups, has been project manager of more than 80 commercialization projects in his time at TTO



Bjørn-Erik Dale (Managing director at Arkwright Norway)

- **Board member and advisor in business development and strategy**
- Experience with strategic and financial advisory for leading companies within oil and gas industry. This includes Schlumberger, Aker Solutions, Kongsberg Group, Siemens and National Oilwell Varco.



Arild Nystad (President of PetroManagement AS)

- **Advisor on oil and gas industry**
- Extensive international network within the oil and gas sector, including service companies, oil companies, and with the governments.
- Previously a recourse director in OD. Has been responsible for several PUD's on the NCS.

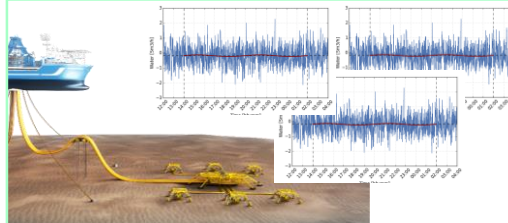
What is Solution Seeker good at?

Identifying optimization opportunities and potential for value creation



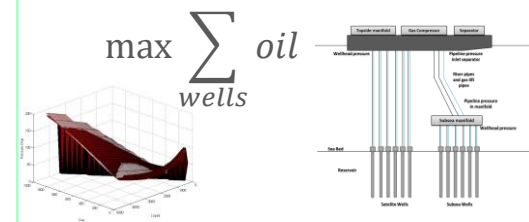
- Experience from identifying and formulating the optimization opportunity in a multitude of application areas
- Translating the optimization opportunity into potential for value creation and real gain for customers

Analysis of O&G production data



- Extensive experience in general data analysis and modeling
- Especially strong in the area of O&G production data and the application of tailored and efficient data analysis, filtering and aggregation techniques in order to draw out the essence in the data

(Simulator) optimization



- Several team members have written their Master's and Doctoral theses on this subject
- In-depth theoretical knowledge and practical experience in applying global optimization techniques to many of the process simulators on the market today

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O&G industry challenge: Utilization of data

Driver

Data explosion




Challenge

Utilization of data



Trend

Growth of predictive modeling



Stream of incoming production data

- Controls such as gas lift, choke settings etc.
- Resulting measurements such as pressure, temperature, rates, etc.
- Virtual measurements

Real-time qualities of the data are not fully exploited in operations

- Mainly trending (PI) and manual inspection
- Some “semi online” applications

Online, real-time production optimization

- Squeezing out more barrels by fine-tuning production settings given existing bottlenecks
- Dependent on continuously updated information

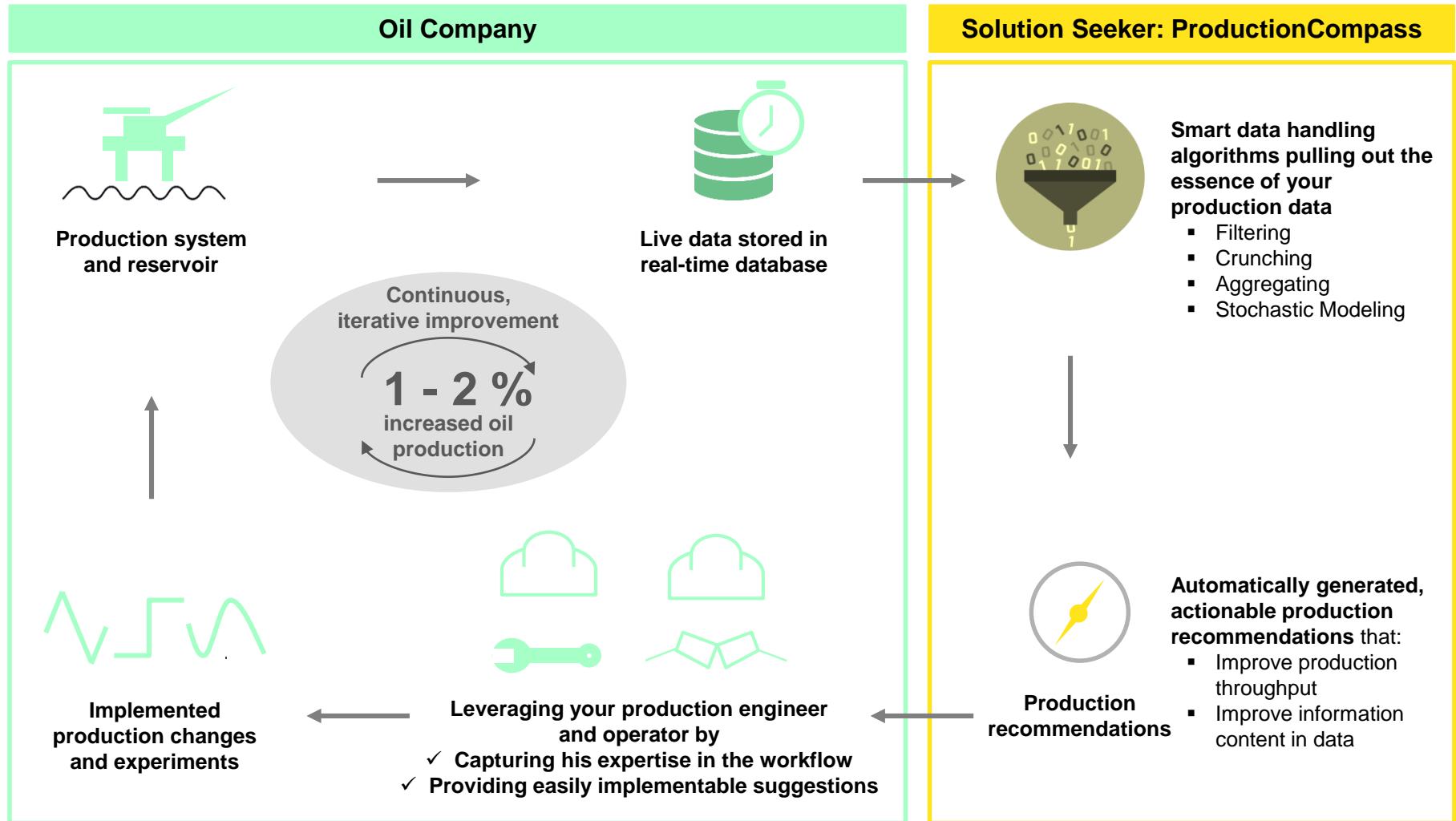
Daily production optimization from a workflow perspective



It is the human-computer interaction and “collaboration” that enables high quality decisions

- Production Engineer: knowledge and experience
- Leveraging the strengths of each side

Data-driven daily production optimization is sustainable



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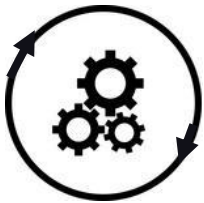
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Main takeaways

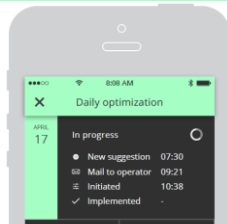
ProductionCompass

Simplified, automatic



- Automation is the key to obtain a sustainable daily production optimization workflow
- Simplification enables automation

Condition based optimization



- Algorithms always running in the background
- Notification when there is a potential to produce more

Leverage production engineer



- Require inputs and assessments that are aligned with production engineer experience and expertise

Optimize subsystems



- Technology that enables optimizing on subsystems if necessary

Machine learning



- Data-driven modeling with inherent learning and continuous improvement

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THANK YOU.

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