Brownfield Development

Revitalizing an oil and gas brownfield by standardizing and automating the workover candidate selection process

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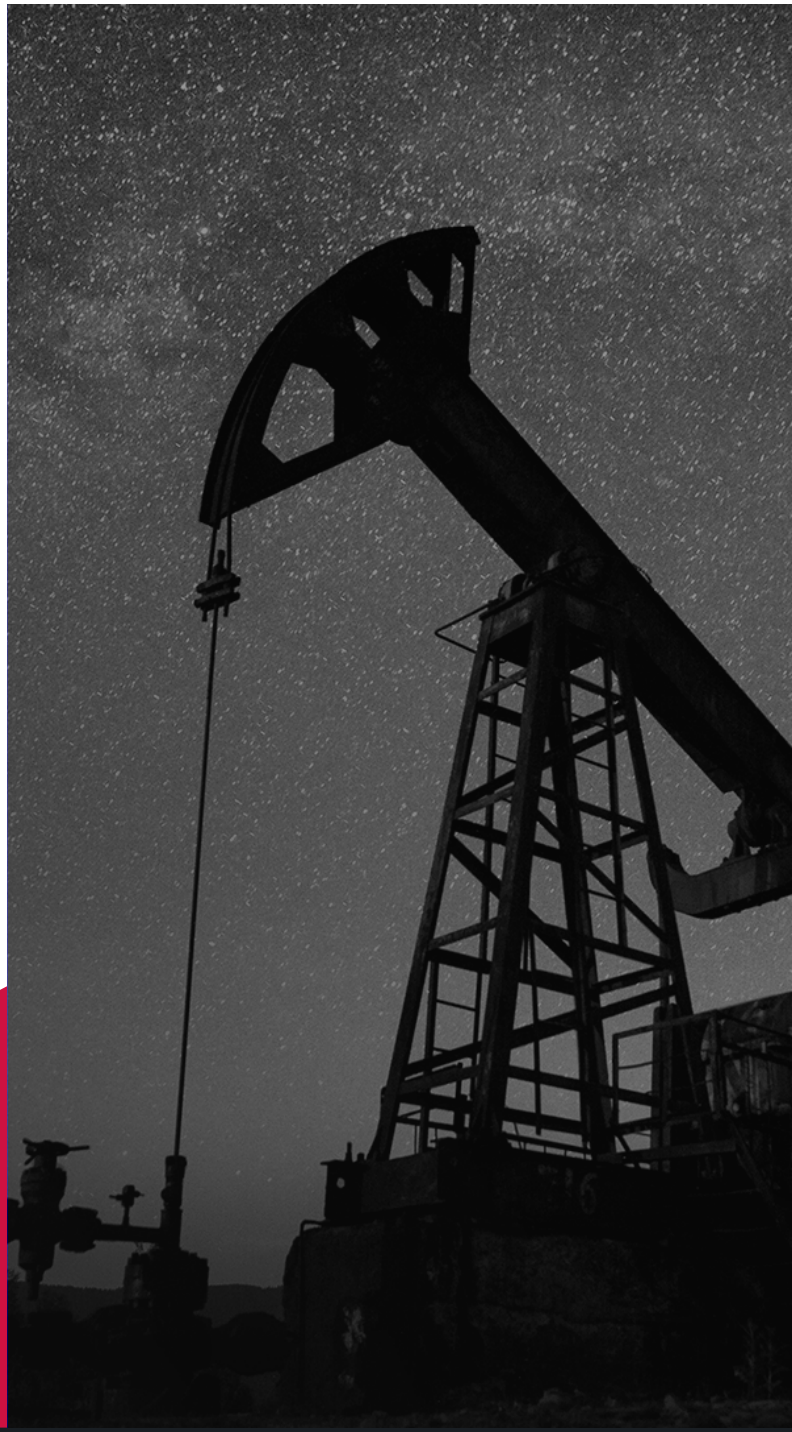
Using the PetroVisor™ platform, a European operator reduced project time by 85% and increased CAPEX efficiency by 77%

An onshore oil and gas company in Eastern Europe produced from 220 oil and gas brownfields containing around 20,000 wells. Of these wells, 10,000 wells were shut-in and waiting for potential abandonment or reactivation. From the remaining producers, each well was evaluated for workover potential three to four times per year through a series of manual well by well reviews. Seeking a method for automating the workover candidate selection process, the operator chose the PetroVisor platform for screening 500 shut-in wells to determine reactivation opportunities. A machine learning application within the platform was used to deliver a ranked list of candidates to improve oil and gas CAPEX efficiency and reduce risk. The platform integrated over 40 databases (including geologic, petroleum engineering and reservoir engineering) providing the operator with a digitized system of all well data for future use and cataloging. The project delivered a 70% reduction in time spent screening data, an 85% decrease in overall project time and a 77% increase in CAPEX efficiency.



Challenge

- **Very mature Eastern-European oil and gas brownfield**
- **First oil production was in 1896**
- **Current production is 170,000 boe/day**
- **The operator wanted to stabilize production declines through workovers of active wells**
- **Additional scope included shut-in well evaluation to determine possible production increases by bringing the most promising wells back online**
- **An efficient method was required to standardize the well review and workover candidate selection process**

The operator produced from an Eastern European oil and gas brownfield where production was in decline. Over 10,000 wells were shut in across 220 very mature brownfields, waiting for potential abandonment or reactivation. Options to increase performance were to either workover the well—treatment operations to repair or stimulate an existing well to restore or enhance production—or to re-drill, which constituted a large and somewhat risky investment. Examples of workover options included sand or scale removal, casing or tubing repair, replacing artificial lift equipment, acid stimulation and other similar processes.

The operator performed a workover candidate selection out of a pool of over 9,000 wells with manual well-by-well reviews, three to four times a year to select approximately 1,000 wells. Each review period took approximately three weeks per asset with a team of 10 people assigned. To add to the inefficiency, there was no standardized approach for comparing candidates from different assets, which meant the resulting candidate list could not be equally compared.

Another 10,000 wells were awaiting abandonment with a pilot initiative on 500 wells confirmed for reactivation potential. This inefficient process consumed over 20 man years of effort each year to complete all well reviews.

- **The candidate selection process for workover wells was very labor intensive, taking critical time away from engineering staff**
- **There was no standardized approach to the selection process**
- **An aging and shrinking workforce necessitated knowledge transfer from veteran workers leaving the industry to the next generation of engineers**

Objective

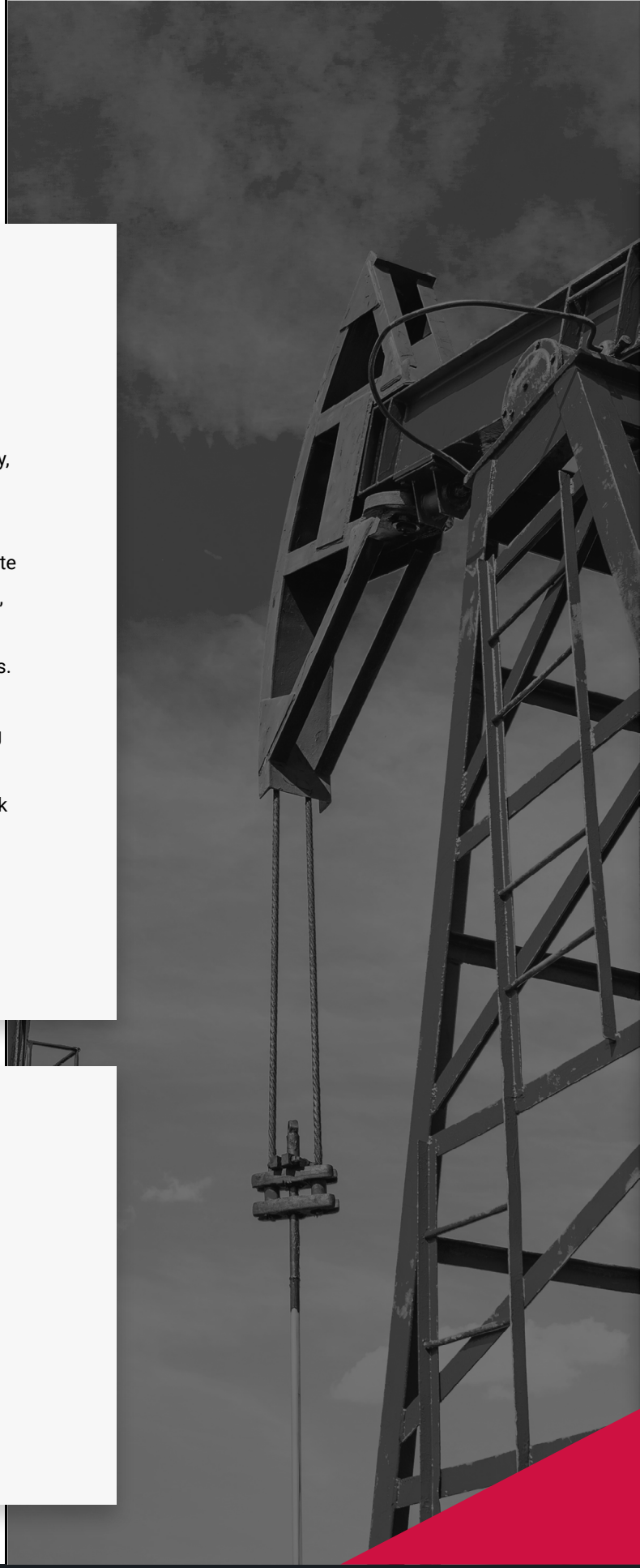
Increase decision making accuracy and speed

The operator was motivated to streamline the workover candidate selection process to improve efficiency and drive down the time required from an increasingly-strained engineering staff. The asset teams within the company performed candidate selection differently, leaving no opportunity to standardize or automate. By developing a consistent selection process, the engineering staff could focus only on the high ranking, most opportunistic well candidates and eliminate the tedious, time-intensive task of manual well selection. A scalable, repeatable, and integrated machine-learning-based solution was needed to free engineering time to focus on high-value opportunities.

- Implement enterprise-wide standardization through automating screening logic
- Automate data analytics and knowledge sharing to enable quick re-ranking of workover candidates
- Provide a method for reviewing all wells, including the shut-in wells, to identify previously overlooked opportunities

Streamline candidate identification

- Increase production and maximize recovery from existing wells before abandonment
- Reduce the engineering effort required per well due to the current manual well-by-well review
- Manage a frequently-changing opportunity list resulting from multiple re-rankings throughout the year
- Maximize return from the mature environment, improving well economics by reducing evaluation time



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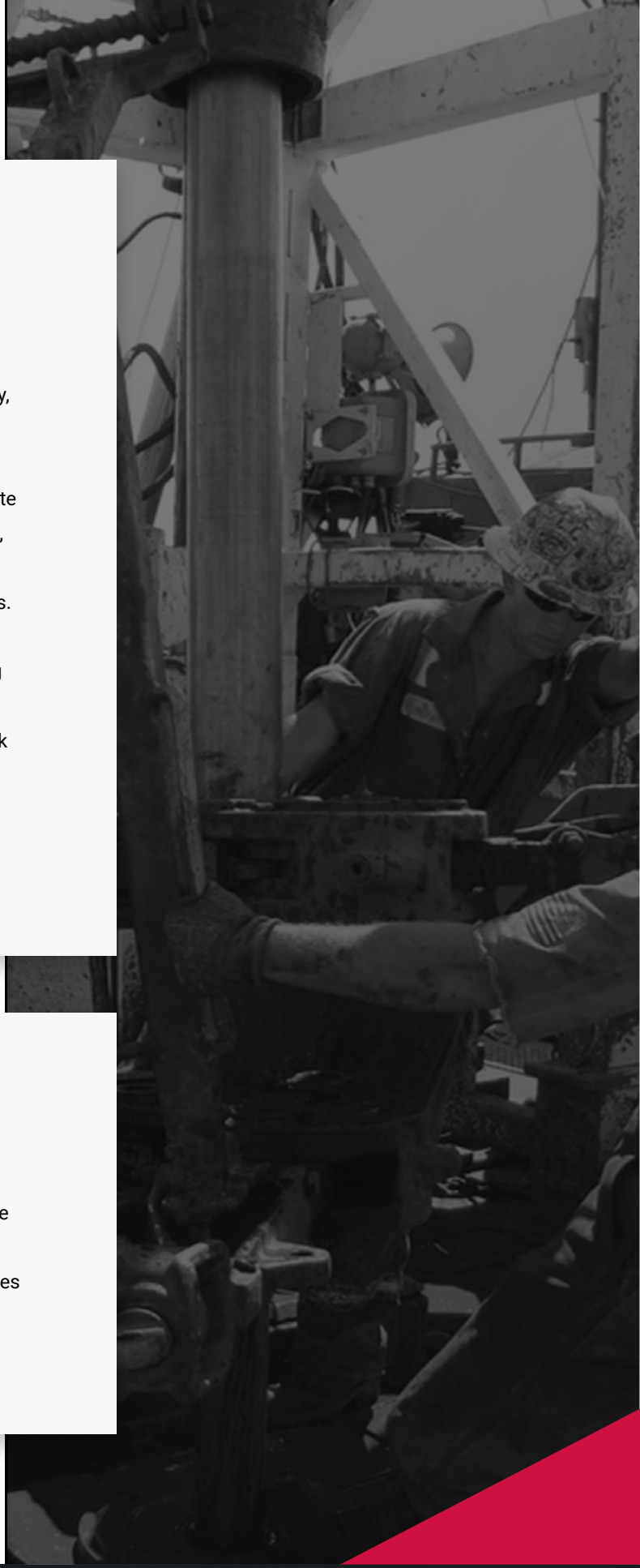
Improve CAPEX efficiency

Maximizing budget dollars is important in marginally-economic brownfields, especially in an environment of low oil prices. CAPEX efficiency is paramount in these conditions. Operators that automate tasks and standardize processes with a combination of machine learning, physics and knowledge can determine the best opportunities for workovers and make the most out of a limited budget.



Candidate Selection Process

The PetroVisor platform was chosen to help the operator consider numerous parameters to determine high-value workover well candidates. Inputs to the system include current and past production data, wellhead pressure and temperature and reservoir data such as saturations, permeability, porosity, oil in place, density, viscosity and nearby well performance. In complex projects like this one PetroVisor engineers work with the client to identify and import relevant data into the PetroVisor risk scoring workflow, then adjust weighting parameters to optimize the output. The screening process identifies workover candidates based on NPV calculation and predicted workover potential (the difference in the production forecast with or without working over the well). A seven-step evaluation process was determined in collaboration with the client engineers for each field, then automated in PetroVisor to screen the well candidates.

1. The PetroVisor platform screens and proposes candidates based on reservoir engineering screening logic
2. A reservoir engineer verifies the candidate and production forecast
3. A production technologist verifies the well optimization proposal and cost estimate
4. The PetroVisor platform performs economic calculations for each well
5. A production technologist establishes a detailed well optimization program and cost estimate
6. Economic calculations are run again and updated
7. The PetroVisor platform provides a ranked list of workover candidates based on well economics

The PetroVisor platform allows operators to aggregate and integrate data from all data sources into one platform. Through open integration, this agnostic platform extracts data from legacy business databases and systems and integrates that data into an open architecture data hub that is highly-scalable and flexible, either cloud-based or on-premise. Through data aggregation, the PetroVisor platform conducts a multi-functional analysis on the reservoir and production using artificial intelligence and machine learning. These analytics are continuously run and leverage real-time data to improve decision making in a fraction of the time.

- Highly-tailored solution includes an interactive and customizable dashboard
- The automated process can be executed whenever necessary to update the list of selected candidates
- The process considers the performance of offset wells which was not previously considered with the manual method
- Production problems such as water coning, behind casing flow, liquid loading and sand production are automatically detected in both producing and shut-in wells
- The operator is provided with a ranked list of candidates allowing engineers to focus on the top, most productive opportunities.

Results

Using the PetroVisor platform, the operator was able to improve oil and gas CAPEX efficiency in the brownfield as a percent of spend by 77% in two years. Man hours spent evaluating workover well candidates each year were reduced by 85% from 20 man years per year down to three man years. The operator expanded the use of the PetroVisor platform to include 20,000 total wells and now evaluates 200,000 candidates monthly using only two people.

- Using the PetroVisor platform the operator realized a 70% decrease in time spent screening data, an 85% decrease in overall project time and benefitted from a 77% increase in workover well CAPEX efficiency.
- The top 1,000 candidate wells for workover with the highest NPV were identified including a cost estimation based on the costs of previously performed jobs.
- An automated review process can be executed on demand or on pre-determined intervals to select the best workover well candidates and gain faster approvals.
- 30% of shut-in wells emerged as candidates for workover where previously none were considered.
- The operator has an up-to-date system for all current and legacy data including a better architecture, more streamlined system, an integrated, ‘single version of the truth’ with data available for all disciplines - managers, production engineers and reservoir engineers.
- Real-time performance monitoring and feedback to further validate the candidate selection process for the next group of workover wells.