AWS ENERGY SYMPOSIUM
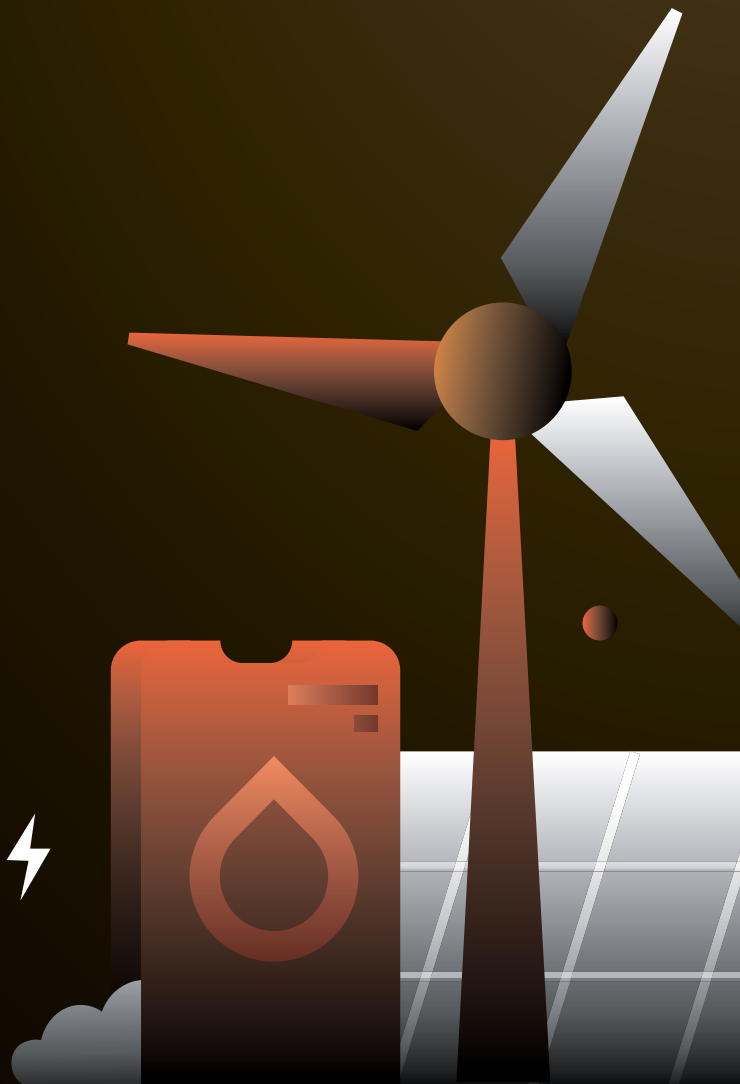
Houston,
May 5, 2022

softserve

OUR AWS EXPERTISE

SoftServe recently achieved the AWS Energy Competency status, recognizing our deep expertise and technical proficiency leveraging AWS cloud technology within the energy industry.

aws PARTNER Premier Tier Services

500+	**50+**	**40+**	**2**
AWS Certified Resources	AWS Certified Solutions Architects	AWS Professional Certifications	APN Ambassadors an elite group of AWS experts, with only 238 worldwide

WHY SOFTSERVE?

STABILITY	EXPERIENCE	TRUST
28+	**20K+**	**81 NPS**
Years of award-winning service	Complex project competed	Leads the industry

YOU-CENTRIC	RETENTION	EXPERTISE
100%	**90%+**	**500+**
Delivered on-site, remotely, or hybrid	Client retention (many for more than 20 years)	Oil and Gas Consultants and Engineers

FUELING THE FUTURE

A digital-first business model is fast becoming the standard for the energy and utilities industry.

The future of energy combines digital tools with geology, geoscience, and engineering data. Automation, sensors, digital twins, AI, drones—all reduce operating costs and help lower carbon footprints, which is crucial to surviving the present and thriving down the road.

Enterprises that wish to remain competitive must leverage these technologies at scale and reimagine their operational strategies and business processes.

CLIENT SUCCESS STORIES

ML Optimizes High Pressure Gas Lifts
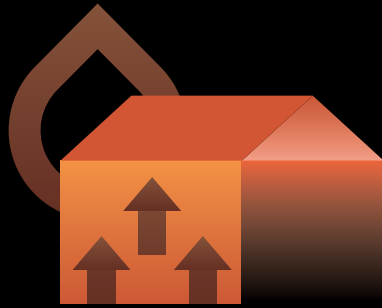
Discover how SoftServe and Laredo Petroleum optimize production and improve performance with machine learning and artificial intelligence.

Our client, Laredo Petroleum, is a leading energy company that focuses on the acquisition, exploration, and development of oil and natural gas properties. Operational efficiency and production optimization are among the key company's priorities.

Currently, Laredo Petroleum is investing in digital technologies to ensure asset integrity, reduce operating costs, and increase production rates.

Having the maximum amount of assets available directly influences the rate of production, and ultimately the revenue of energy companies.

To improve asset visibility, companies are supplementing their SCADA with secondary sensing networks. They are also centralizing data access to enable real-time field monitoring.

This provides production surveillance and optimization, where businesses can improve operational performance and optimize processes using assets diagnostics and

real-time monitoring by applying advanced analytics and machine learning.

Predicting suboptimal equipment performance and failures allows for preventive actions, lowers the cost of operations, and reduces deferred production.

Laredo Petroleum, AWS, and SoftServe collaborated on a Proof-of-Concept (PoC) project aimed at predicting anomalies and failures in Laredo's artificial lift compressors based on telemetry data analysis and machine learning modeling.

INTELLIGENT WELL DESIGN AND PROCESS

Focus Areas

| Well Performance & Economics | Smart Lift | Safety and Environmental Protection | Enhanced Monitoring and Remote Diagnostics | Automated Paperwork |

Phases of Work

MEASURE → OPTIMIZE → AUTOMATE

Objectively *measuring* ourselves and transparently *supporting* existing operations

Accelerating operations by *optimizing* decisions and processes

Automating appropriate decision-making and involve experts by exception

GOALS

IDENTIFY SHUTDOWNS CAUSED BY SYSTEM FAILURES

Shutdowns caused by failures could lead to system breakdowns or high costs of inactivity.

System shutdowns can also be caused by errors, such as when sensor values exceed certain thresholds.

PREDICT FUTURE FAILURES TO PREVENT SHUTDOWNS

ML algorithms can predict shutdowns before they occur.

If predictions suggest potential compressor failure, personnel could conduct additional checks.

To train ML algorithms, we need to prepare normal and pre-failure periods.

WHAT IS PREDICTIVE MAINTENANCE?

TEMPORAL DATA
Telemetry, machine conditions, working codes, etc.

EXTERNAL DATA
Weather conditions

STATIC DATA
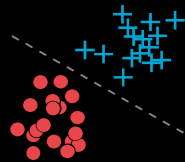Machine specification, operation attributes

FEATURES

- Business and process based
- Time windows
- Lag features
- Rolling aggregates
- Shift features
- Last error code encodings

FAILURE LABELS

Timestamps with failure events, associated codes, etc.

MACHINE LEARNING MODEL

PREDICTIVE MAINTENANCE VS. ANOMALY DETECTION

ANOMALY DETECTION

Used to detect abnormal events after they've happened.

Events are then analyzed to understand whether they signal

- an equipment failure
- incorrect behavior
- whether it reveals problems in the full process.

Anomalies can also indicate a standard process event, such as an equipment shutdown or process change.

Results of anomaly detection are most valuable when carefully post-processed and interpreted by domain experts.
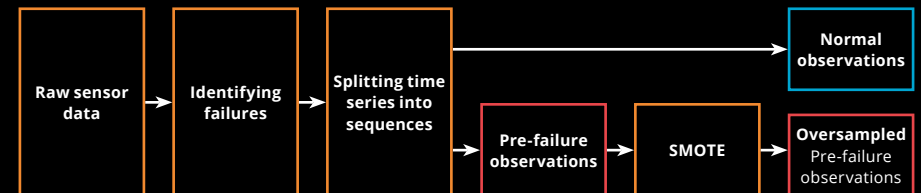
PREDICTIVE MAINTENANCE

Provides an understanding of when a specific component will most likely fail.

Enables companies to keep production running and avoid unexpected failures.

Predictive maintenance models can analyze all available data sources related to specific equipment such as:

- sensors data
- metadata (model, operator, component age, etc.)
- maintenance data
- and more

DATA PRE-PROCESSING PIPELINE

Raw sensor data → Identifying failures → Splitting time series into sequences → Normal observations

Splitting time series into sequences → Pre-failure observations → SMOTE → Oversampled Pre-failure observations
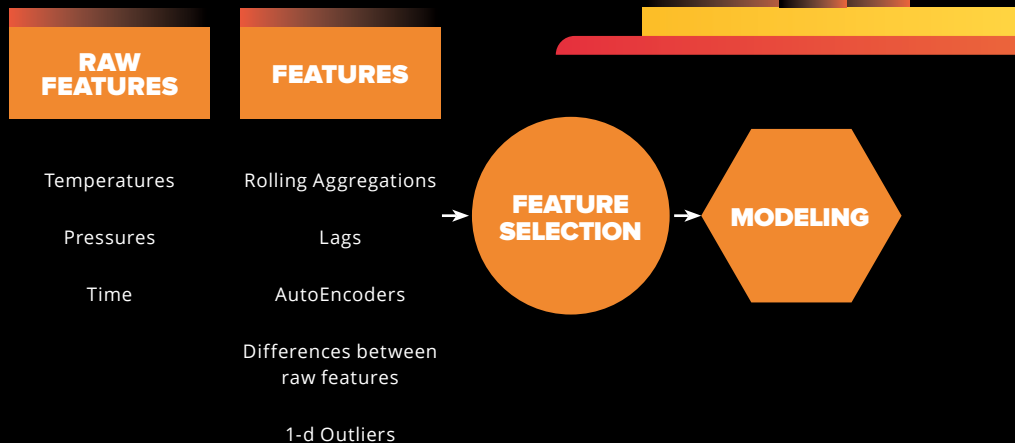
CHALLENGES

Optimization using the ML approach requires historical data variability, especially in control tags.

Without this data, optimization would be based on rules of physics and mathematics process models. Such models don't account for the specifics of the actual machine.

Performance is highly dependent on the data available, the data quality, and the predictive power.

SOLUTION ARCHITECTURE

RAW FEATURES	FEATURES
Temperatures	Rolling Aggregations
Pressures	Lags
Time	AutoEncoders
	Differences between raw features
	1-d Outliers

FEATURE SELECTION → MODELING

VALUE DELIVERED

Enhanced reliability
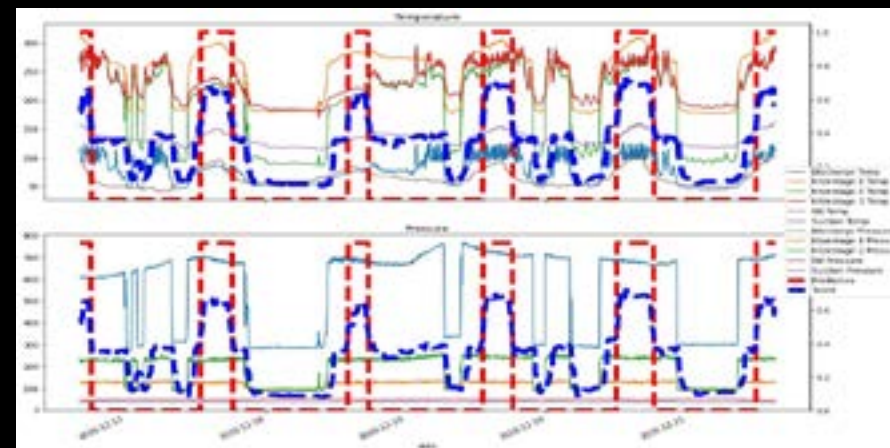
Increased production efficiency

Improved ROI

Better business decision making using dashboards and visual explanations of optimization algorithms

MODEL PREDICTION EXAMPLE
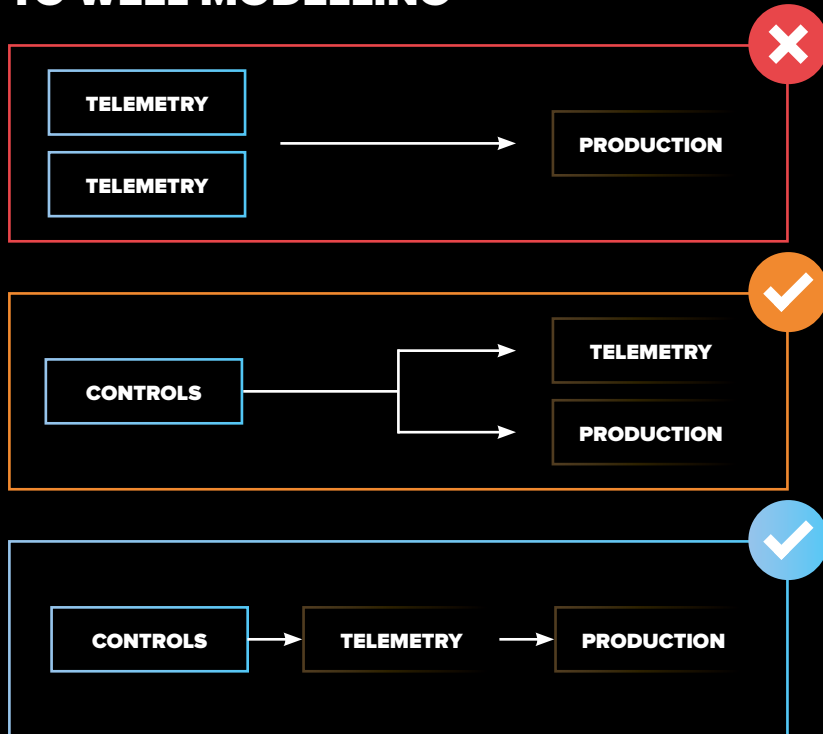
AI-Powered ESP Optimization

Electrical Submersible Pump-operated wells play a strategic role in Laredo Petroleum's digital transformation strategy.

New and in-service wells that run on ESP need constant monitoring and tuning of operating parameters to achieve high efficiency and production targets.
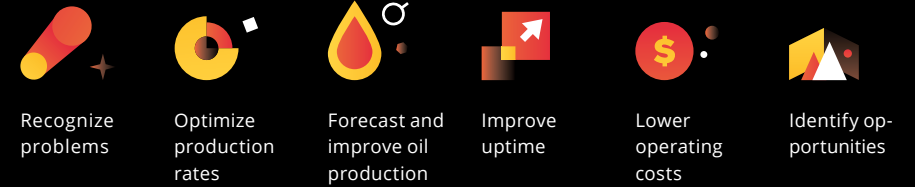
Laredo wanted to create an AI-based solution for ESP optimization that will automatically recommend ESP operating parameters, give the ability to visualize all the necessary data, and have a way to leave feedback, input limitations, and operating constraints.
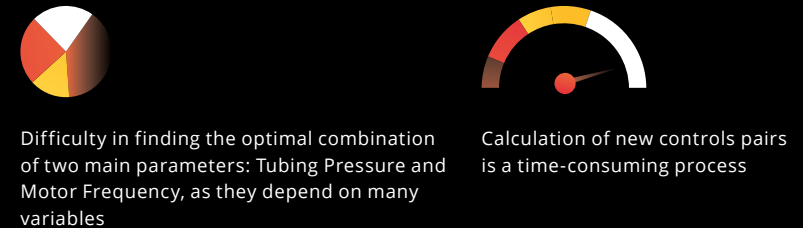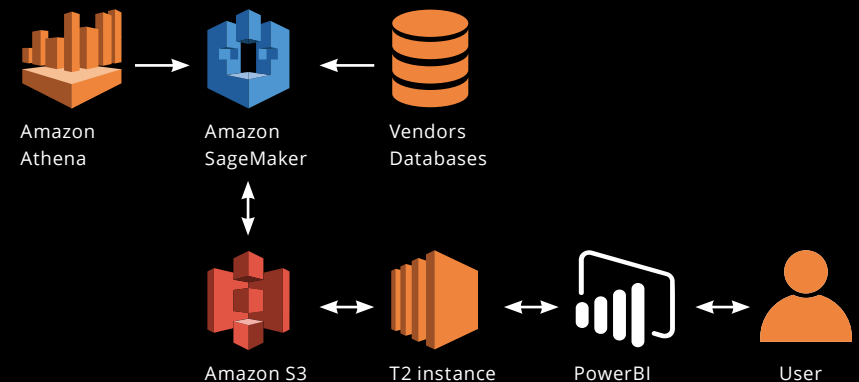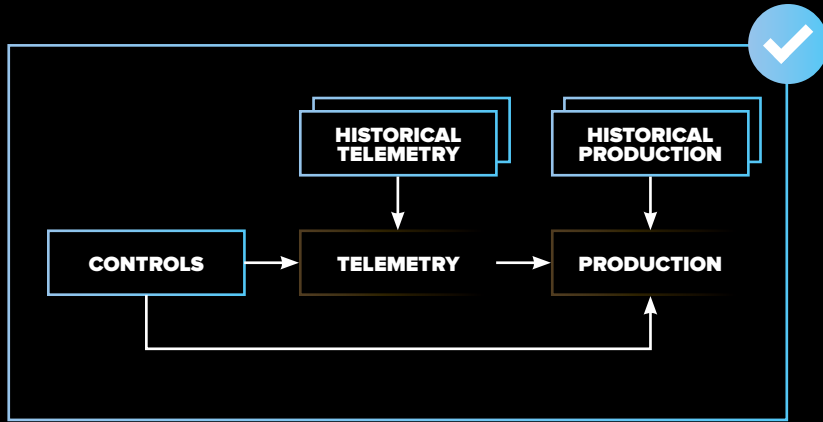
SOFTSERVE'S APPROACH TO WELL MODELLING

GOALS

Recognize problems

Optimize production rates

Forecast and improve oil production

Improve uptime

Lower operating costs

Identify op-portunities

CHALLENGES

Difficulty in finding the optimal combination of two main parameters: Tubing Pressure and Motor Frequency, as they depend on many variables

Calculation of new controls pairs is a time-consuming process

SOLUTION ARCHITECTURE

Amazon Athena

Amazon SageMaker

Vendors Databases

Amazon S3

T2 instance

PowerBI

User

HISTORICAL COMPONENT FOR TELEMETRY AND PRODUCTION

VALUE DELIVERED

Real-time dashboards provide summary statistics, forecasts, and parameter recommendations

Improved decision making with real-time data

Reduced downtime and better maintenance practices

Highly flexible and adaptable for a variety of ESP systems
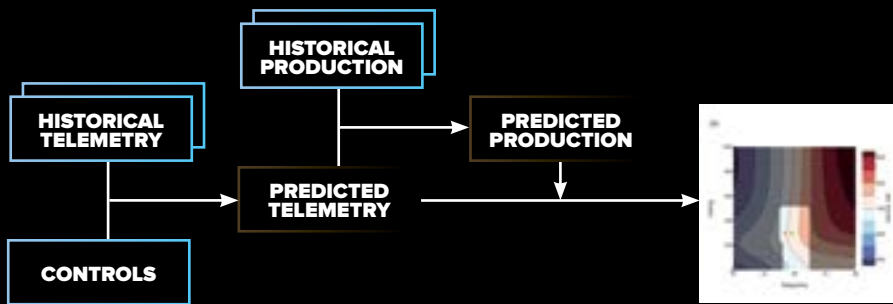
Lowered operating costs

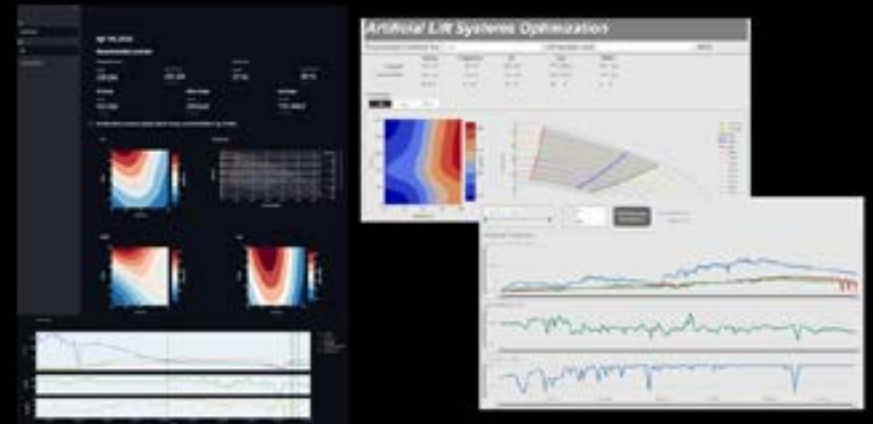Scaled to 100+ wells in mere months

High accuracy in oil, gas, and water production predictions

Initial pilot estimated an additional ~400 BBL across 29 test wells. It's now reached >800 BBL with only a few wells.

SOLUTION: FINAL RELATIONSHIP GRAPH

SOLUTION DASHBOARDS

CASE STUDIES

AI-ENABLED CORROSION DETECTION FOR AMERICAN BUREAU OF SHIPPING

SoftServe developed a comprehensive, data-driven inspection system for marine and offshore structures, identifying corrosion and other issues to reduce manual efforts and increase inspection operation safety.

INCREASE EFFICIENCY AND CUT COSTS USING MACHINE LEARNING FOR SEISMIC DATA INTERPRETATION

With state-of-the-art computer vision algorithms and 3D modeling, this American energy corporation and prominent oil company saved time and money when assessing seismic activity.

MACHINE LEARNING MODEL IMPROVES OIL RIG UPTIME

This machine learning solution predicts valve failures on oil rigs and at factories. By proactively scheduling maintenance, the company can significantly increase it's uptime and save money.

DEMOS

AI-POWERED OPERATIONS & DOCUMENT MANAGEMENT

Accelerate your company operations with an AI-powered document management solution. Extract actionable insights from unstructured company data in seconds and search for all necessary equipment and facilities information, related images, schematics, graphs in one single solution.

AUTOMATING OFFSHORE FACILITY VISUAL INSPECTION

See how to build an end-to-end AI solution for visual inspection, making it easier to detect corrosion, coating breakdowns, pipeline leaks, cracks, and structural and equipment defects.

AUTOMATE SEISMIC DATA INTERPRETATION

The SoftServe Energy AI team created a solution that automates seismic data interpretation by extracting geologic structures.

AI & ML FOR WELL DATA PROCESSING AND LITHOFACIES PREDICTION

Discover how SoftServe engineers can automate the process of geophysical well log data processing and lithofacies prediction.

THANK YOU

We would like to thank you for visiting our booth today at the AWS Energy Symposium.

Please do not hesitate to contact us if you have any questions or feedback that you would like to share.

We hope you enjoy the event, and we look forward to seeing you again soon.

The SoftServe team

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