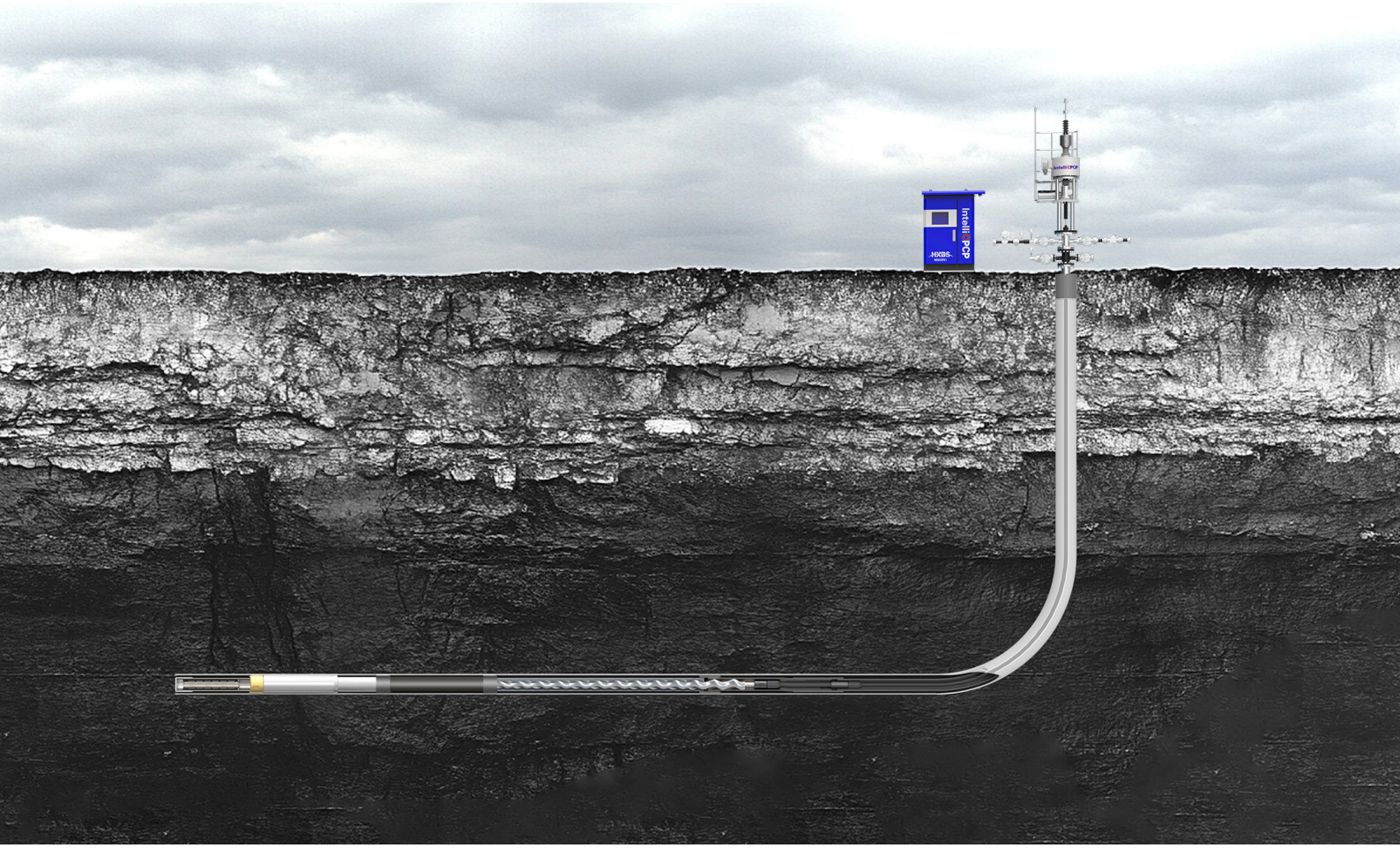

IntelliCPCP® Intelligent Conical PCP Artificial Lift System: Case Studies & Performance Evaluation Report

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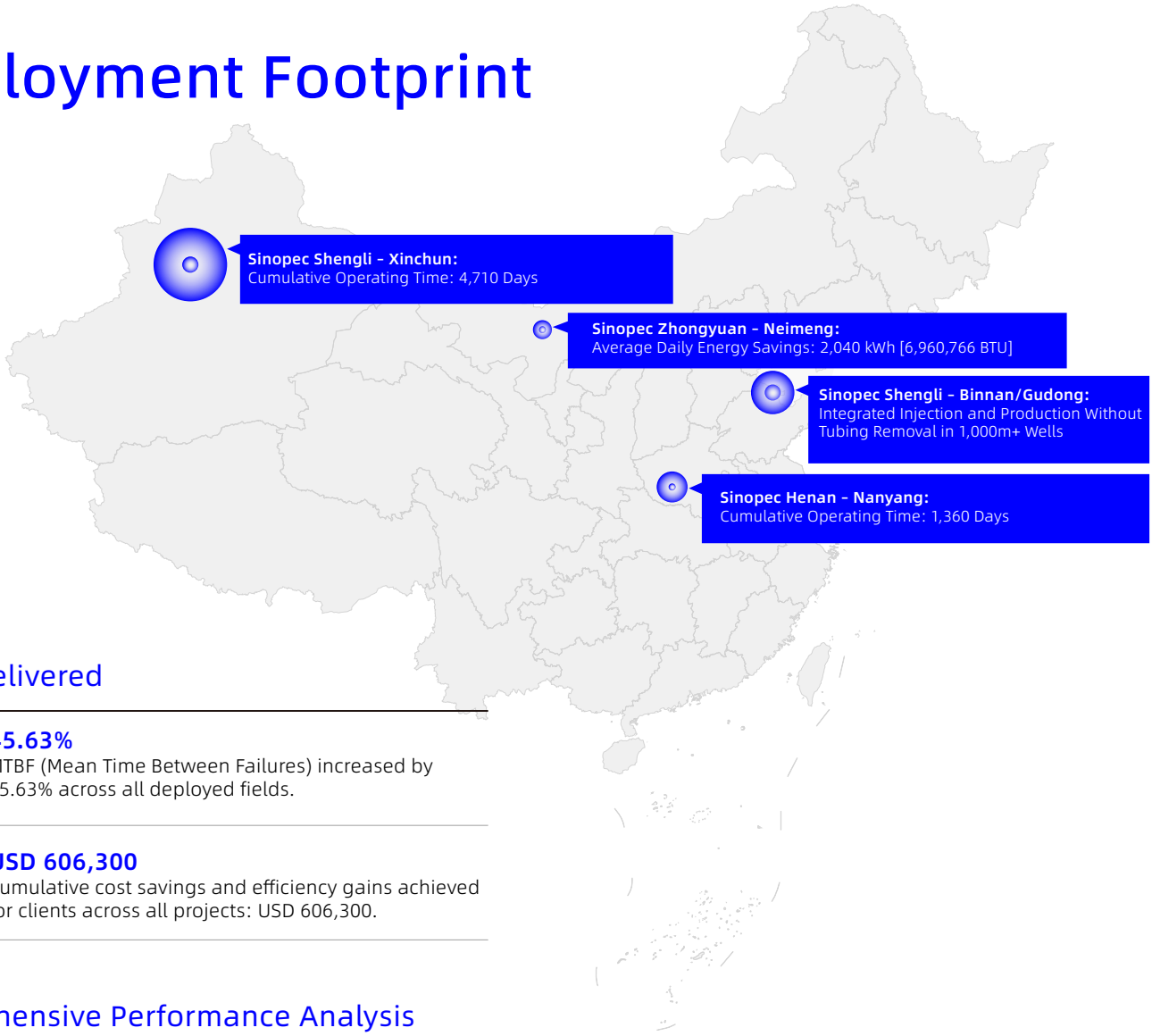
Deployment Footprint



Value Delivered

45.63%
MTBF (Mean Time Between Failures) increased by 45.63% across all deployed fields.

USD 606,300
Cumulative cost savings and efficiency gains achieved for clients across all projects: USD 606,300.

Comprehensive Performance Analysis

Oilfield / Production Plant	Max. Bottomhole Temperature, °C [°F]	Crude Oil Viscosity at 50°C, mPa·s [cP]	Max. Sand Cut, %	Setting Depth, m [ft]	Well Deviation, °	Daily Liquid Production, m³/d [bbl/d]
Sinopec Shengli - Xinchun	260[500]	7,919	0.30	200[656]	72	25[182]
Sinopec Shengli - Binnan	320[608]	8,201	0.53	1102[3,615]	7	20[146]
Sinopec Shengli - Gudong	46[115]	200	0.02	1202[3,944]	6	21[153]
Sinopec Henan - Nanyang	260[500]	10,658	0.70	453[1,486]	21	23[168]
Sinopec Zhongyuan - Neimeng	62[144]	8,031	0.30	995[3,264]	66	28[204]

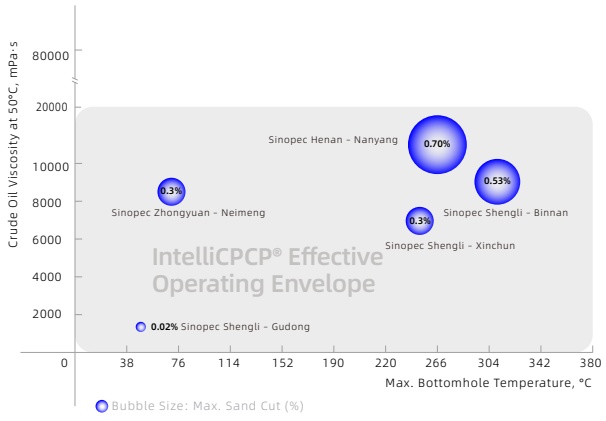


Figure A

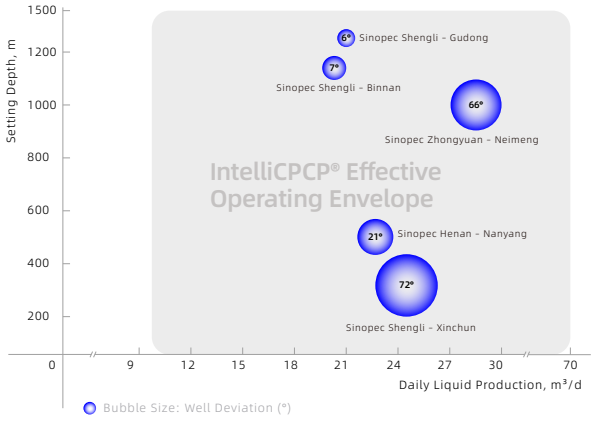


Figure B

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Application Case Studies

I. Thermal Recovery & Integrated Injection-Production

Oilfield / Production Plant:
Sinopec Shengli - Xinchun

Well Profile:
CSS (Cyclic Steam Stimulation) in Shallow, Highly Deviated Extra-Heavy Oil Wells

<500m, > 65 ° | Extra-Heavy Oil | CSS

Oilfield / Production Plant:
Sinopec Shengli - Binnan

Well Profile:
CSS in Medium-Deep Extra-Heavy Oil Wells

~ 1000m | Extra-Heavy Oil | CSS

Oilfield / Production Plant:
Sinopec Henan - Nanyang

Well Profile:
CSS in Shallow Extra-Heavy Oil Marginal & Low-Productivity Wells

<500m | Extra-Heavy Oil | CSS | Marginal Low-Yield Wells

II. Hybrid EOR & Anti-Corrosion Artificial Lift

Oilfield / Production Plant:
Sinopec Zhongyuan - Neimeng

Well Profile:
Combined CCUS and Electrical Heating Lift in Medium-Deep Highly Deviated Wells

~ 1000m, > 65 ° | Extra-Heavy Oil | CCUS | Electrical Heating

III. Medium-Deep Heavy Oil Cold Production

Oilfield / Production Plant:
Sinopec Shengli - Gudong

Well Profile:
Cold Production of Conventional Heavy Oil in Medium-Deep Wells

~ 1000m | Conventional Heavy Oil | Cold Production

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CSS in Shallow, Highly Deviated Extra-Heavy Oil Wells

Oilfield / Production Plant: Sinopec Shengli – Xinchun
Well Count: Batch Deployment in 11 Wells **Process:** Nitrogen-Assisted Cyclic Steam Stimulation (CSS)

Basic Well Data

Reservoir & Fluid Properties	
Crude Oil Density at 50°C, g/cm³ [lb/ft³]	0.97[60.56]
Formation Crude Oil Dynamic Viscosity, mPa·s [cP]	180,000
Degassed Crude Oil Dynamic Viscosity at 50°C, mPa·s [cP]	7,919
Comprehensive Water Cut, %	84
Sand Cut, %	0.3

Wellbore Profile Parameters	
Casing OD, in [mm]	7[177.8]
Tubing OD, in [mm]	3½[88.9]
Pump Setting Deviation Angle, °	63 ~ 78
Pump Setting Depth, m [ft]	160 ~ 200[525 ~ 656]
Artificial Bottomhole, m [ft]	368.74 ~ 567.12[1,210 ~ 1,861]

Core Challenges

- Sand sticking is exacerbated by the highly deviated well structure, limiting the setting depth of conventional rod pumps. Severe rod-tubing wear occurs, leaving marginal room for tubing string optimization.
- The light weight of the sucker rods during production leads to frequent rod float (slow rod descent), severely complicating late-stage production and restricting overall cyclic production capacity.
- Severe pump sticking and fluid leakage occur after resuming production post-steam injection, necessitating frequent well flushing and unsticking workovers.
- Wells require premature cycle switching for steam injection, which restricts overall production capacity and reduces the cyclic Oil-Steam Ratio (OSR).
- Affected by the overload induced by rod float, Type-5 pumping units operate under continuous fatigue, posing multiple safety hazards.

Solutions

- Upgraded the artificial lift technology by batch-deploying the IntelliCPCP® system across 11 wells within the block.
- Delivering superior value through the following core capabilities:
  I. Superior adaptability of the PCP to heavy oil, maximizing system efficiency in the late stages and extending the overall injection-production cycle.
  II. The all-metal FERROXIS™ stator and rotor ensure exceptional high-temperature resistance, enabling integrated injection and production without tubing removal.
  III. The conical structural fit of the stator and rotor allows for dynamic clearance adjustment and efficient sand-carrying production, significantly extending the pump inspection cycle (MTBF).
  IV. Built-in anti-sand burial and anti-reverse rotation mechanisms during shutdowns, anti-scaling capabilities post-steam injection, and automatic pull-up unsticking for sand-induced sticking.
  V. The Graspos™ Balancing Assembly, integrated with intelligent software algorithms, minimizes rod-tubing wear, enabling deeper pump setting in highly deviated profiles.

Results & Value Delivered

Reliability
Achieved an average MTBF (Mean Time Between Failures) of 2 years and 11 months, extending the MTBF by 325 days.

↑325d MTBF Extension

Production Gain & Efficiency
System efficiency increased by 23%.
Annual crude oil production per well increased by 221.38t [1,615.91 bbl] (liquid production increased by 99.27t [724.60 bbl]).
Water recovery rate improved by 4.52%, and the Oil-Steam Ratio (OSR) increased by 23.10%.

↑221.38t Annual Crude Oil Increase

Energy & Resource Savings
The injection-production cycle was extended by an average of 6 days, reducing annual steam injection by 310.82t.
Comprehensive power consumption was reduced by 37.5%.

↓310.82t Annual Steam Savings

>>Comprehensive Economic Benefits: Achieved comprehensive annual cost savings and efficiency gains of USD 56,355 per well.

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CSS in Shallow Extra-Heavy Oil Marginal & Low-Productivity Wells

Oilfield / Production Plant: Sinopec Henan – Nanyang
Well Count: Pilot Deployment in 2 Wells **Process:** Nitrogen-Assisted Cyclic Steam Stimulation (CSS)

Basic Well Data

Reservoir & Fluid Properties	
Crude Oil Density at 50°C, g/cm³ [lb/ft³]	0.967[60.37]
Formation Crude Oil Dynamic Viscosity, mPa·s [cP]	10,658
Degassed Crude Oil Dynamic Viscosity at 50°C, mPa·s [cP]	2,480
Comprehensive Water Cut, %	85.7
Sand Cut, %	0.7

Wellbore Profile Parameters	
Casing OD, in [mm]	7[177.8]
Tubing OD, in [mm]	3½[88.9]
Pump Setting Deviation Angle, °	21
Pump Setting Depth, m [ft]	453[1,486]

Core Challenges

- During late-stage production, as the produced fluid temperature declines, high-viscosity crude experiences severe pump intake difficulties. This shortens the low-temperature production window and significantly reduces the Oil-Steam Ratio (OSR).
- Severe rod-tubing wear limits the average sucker rod lifespan to less than 1.5 years.
- Sand-induced pump sticking.
- Inability to achieve integrated injection and production without tubing removal using the existing tubing string.

Solutions

- Upgraded the artificial lift technology by conducting a pilot deployment of the IntelliCPCP® system in 2 wells within the block.
- Delivered superior value through the following core capabilities:
  I. Superior adaptability of the PCP to heavy oil, maximizing system efficiency in the late stages and extending the overall injection-production cycle.
  II. The all-metal FERROXIS™ stator and rotor ensure exceptional high-temperature resistance, enabling integrated injection and production without tubing removal.
  III. The The conical structural fit of the stator and rotor allows for dynamic clearance adjustment and efficient sand-carrying production, significantly extending the pump inspection cycle (MTBF).
  IV. Built-in anti-sand burial and anti-reverse rotation mechanisms during shutdowns, anti-scaling capabilities post-steam injection, and automatic pull-up unsticking for sand-induced sticking.

Results & Value Delivered

Reliability
Achieved an average MTBF (Mean Time Between Failures) of 2 years and 1 month, extending the MTBF by 477 days.

↑477d MTBF Extension

Production Gain & Efficiency
System efficiency increased by 11.76%. Annual crude oil production per well increased by 132t [963.50 bbl] (liquid production increased by 264t [1,927.01 bbl]). Water recovery rate improved by 14.51%, and the Oil-Steam Ratio (OSR) increased by 58.03%.

↑132t Annual Crude Oil Increase

Energy & Resource Savings
The injection-production cycle was extended by an average of 7 days, reducing annual steam injection by 107.58t. Specific power consumption per 100 meters of fluid lift decreased by 10.34%, and comprehensive power consumption was reduced by 30%.

↓107.58t Annual Steam Savings

>>Comprehensive Economic Benefits: Achieved comprehensive annual cost savings and efficiency gains of USD 32,436 per well.

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CSS in Medium-Deep Extra-Heavy Oil Wells

Oilfield / Production Plant: Sinopec Shengli – Binnan
Well Count: Pilot Deployment in 1 Well **Process:** Cyclic Steam Stimulation (CSS)

Basic Well Data

Reservoir & Fluid Properties	
Crude Oil Density at 50°C, g/cm³ [lb/ft³]	0.961[59.99]
Degassed Crude Oil Dynamic Viscosity at 50°C, mPa·s [cP]	8,201
Comprehensive Water Cut, %	83
Sand Cut, %	0.53

Wellbore Profile Parameters	
Casing OD, in [mm]	7[177.8]
Tubing OD, in [mm]	3½[88.9]
Pump Setting Deviation Angle, °	7
Pump Setting Depth, m [ft]	1102[3615]
Artificial Bottomhole, m [ft]	1405[4610]

Core Challenges

- Inability to perform cycle switching between injection and production without tubing removal. The heavy weight of the insulated tubing poses high operational risks.
- Rod pumps are prone to slow rod descent (rod float) in the late stages of the injection-production cycle, complicating late-stage operations and restricting the realization of cyclic production capacity.
- Severe fluid leakage leads to low system efficiency, constraining overall well productivity.
- requent cycle switching limits well productivity and reduces the cyclic Oil-Steam Ratio (OSR).
- Conventional surface facilities require frequent maintenance.

Solutions

- Upgraded the artificial lift technology by conducting a pilot deployment of the IntelliCPCP® system in 1 well within the block.
- Delivered superior value through the following core capabilities:
  I. Superior adaptability of the PCP to heavy oil, maximizing system efficiency in the late stages and extending the overall injection-production cycle.
  II. Enables integrated steam injection and production without tubing removal.
  III. The conical structural fit of the stator and rotor allows for dynamic clearance adjustment and efficient sand-carrying production, significantly extending the pump inspection cycle (MTBF).
  IV. Supports remote monitoring and automatic parameter tuning (e.g., automated pump efficiency optimization). The highly integrated surface facilities require a smaller footprint and significantly reduce maintenance frequency.

Results & Value Delivered

Reliability
Operated continuously for 54 days with zero failures.

Production Gain & Efficiency (54-Day Pilot)
System efficiency increased by 25%.
Daily crude oil production per well increased by 74.58%
(liquid production increased by 20.04%).
Water recovery rate improved by 9.01%,
and the Oil-Steam Ratio (OSR) increased by 179.33%.

↑179.33% OSR Increase

Energy & Resource Savings (54-Day Pilot)
Comprehensive power consumption reduced by 39.52%.

↓39.52% Energy Savings

>>Comprehensive Economic Benefits (54-Day Evaluation): Projected to achieve comprehensive annual cost savings and efficiency gains of USD 21,633 per well.

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Combined CCUS and Electrical Heating Lift in Medium-Deep Highly Deviated Wells

Oilfield / Production Plant: Sinopec Zhongyuan – Neimeng
Well Count: Pilot Deployment in 1 Well **Process:** Electrical Heating + CCUS

Basic Well Data

Reservoir & Fluid Properties	
Crude Oil Density at 50°C, g/cm³ [lb/ft³]	0.965[60.24]
Degassed Crude Oil Dynamic Viscosity at 50°C, mPa·s [cP]	8,031
Comprehensive Water Cut, %	89
Sand Cut, %	0.3

Wellbore Profile Parameters	
Casing OD, in [mm]	5[127]
Tubing OD, in [mm]	3½[88.9]
Pump Setting Deviation Angle, °	66
Pump Setting Depth, m [ft]	995[3,264]

Core Challenges

- Utilizing electrical heating to assist conventional pumping units results in high power consumption and elevated operating costs.
- Inability to perform cycle switching between injection and production without tubing removal, leading to low heat utilization efficiency.
- Wellbore temperature fluctuates with the fluid inflow rate. At lower temperatures, crude oil viscosity surges, hindering pump intake and resulting in low fluid production rates.
- Severe rod-tubing wear leads to shortened pump inspection cycles (MTBF) and necessitates frequent maintenance.

Solutions

- Upgraded the artificial lift technology by conducting a pilot deployment of the IntelliCPCP® system in 1 well within the block.
- Delivered superior value through the following core capabilities:
  I. Superior adaptability of the PCP to heavy oil, reducing the reliance on electrical heating and thereby lowering overall energy consumption.
  II. Enables integrated injection and production without tubing removal.
  III. The conical structural fit of the stator and rotor allows for dynamic clearance adjustment and efficient sand-carrying production, significantly extending the pump inspection cycle (MTBF).
  IV. Supports remote monitoring and automatic parameter tuning (e.g., automated pump efficiency optimization). The highly integrated surface facilities require a smaller footprint and significantly reduce maintenance frequency.

Results & Value Delivered

Reliability
Operated continuously for 117 days with zero failures.

Production Gain & Efficiency (54-Day Data)
System efficiency increased by 37%.
Daily crude oil production per well increased by 13.09% (liquid production increased by 12.72%).

↑37% System Efficiency Increase

Energy & Resource Savings (54-Day Pilot)
Average daily power consumption reduced by 2,040 kWh [6,960,766 BTU], with comprehensive power consumption reduced by 97.14%.

↓2040KW·h Daily Power Consumption Reduction

>>Comprehensive Economic Benefits (117-Day Evaluation): Projected to achieve comprehensive annual cost savings and efficiency gains of USD 18,358 per well.

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Cold Production of Conventional Heavy Oil in Medium-Deep Wells

Oilfield / Production Plant: Sinopec Shengli – Gudong
Well Count: Pilot Deployment in 1 Well

Basic Well Data

Reservoir & Fluid Properties	
Crude Oil Density at 50°C, g/cm³ [lb/ft³]	0.927[57.87]
Degassed Crude Oil Dynamic Viscosity at 50°C, mPa·s [cP]	200
Comprehensive Water Cut, %	82
Sand Cut, %	0.02

Wellbore Profile Parameters	
Casing OD, in [mm]	7[177.8]
Tubing OD, in [mm]	3½[88.9]
Pump Setting Deviation Angle, °	6
Pump Setting Depth, m [ft]	1202[3,944]

Core Challenges

- Sand-induced pump sticking.
- Heavy rod string lifting loads.
- Normal production remains unsustainable even after the application of chemical drag-reducing agents.

Solutions

- Upgraded the artificial lift technology by conducting a pilot deployment of the IntelliCPCP® system in 1 well within the block.
- Delivered superior value through the following core capabilities:
  I. The conical structural fit of the stator and rotor allows for dynamic clearance adjustment and efficient sand-carrying production, significantly extending the pump inspection cycle (MTBF).
  II. Built-in anti-sand burial and anti-reverse rotation mechanisms during shutdowns, and automatic pull-up unsticking for sand-induced sticking.
  III. Supports remote monitoring and automatic parameter tuning to optimize pump efficiency automatically, enabling unmanned onsite operations.

Results & Value Delivered

Reliability
Achieved an average MTBF (Mean Time Between Failures) of 4 years, extending the MTBF by 1,202 days.

↑ 1202d MTBF Extension

Production Gain & Efficiency (54-Day Data)
System efficiency increased by 21.22%.
Average daily crude oil production increased by 108.14%, and average daily liquid production increased by 76.47%.
Annual crude oil production per well increased by 394.35t [2,878.47 bbl] (liquid production increased by 2,145t [15,656.93 bbl]).

↑ 394.35t Annual Crude Oil Increase

Energy & Resource Savings (54-Day Pilot)
Specific power consumption per 100 meters of fluid lift decreased by 55.4%, and comprehensive power consumption was reduced by 45.45%.

↓ 45.45% Comprehensive Power Savings

>>Comprehensive Economic Benefits (117-Day Evaluation): Projected to achieve comprehensive annual cost savings and efficiency gains of USD 87,320 per well.

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