Agenda

- Introduction: Gas Lift Theory
- AutoBooST® Drivers
- AutoBooST® Innovative Concept
- What is AutoBooST®
- Technology Technical Specifications
- Different Setups and Success Stories
- AutoBooST® Data and Acquisition system
- Conclusion and way forward
- AutoBooST® technology Patent
• Gas is injected into the tubing.
• The injection of gas reduces the average density of the column of liquid in the tubing, reducing the pressure gradient required to lift fluids to surface.
• As the column of liquid in the tubing is lighter, the overall production rate increases as the well has been artificially lifted.
Gas lift – Challenges

Gas lift is recognised to be one of the most reliable form of downhole artificial lift methods, however the conventional gas lift methods has some challenges like:

- The gas lift surface network is expensive and complex to build.
- Single points of failure with large centralised compressors.
- Freezing of gas lift valves due to poor gas dehydration is common.
- Surface network is challenging to maintain
- 4 years+ to fully install.
The Drivers : AutoBooST®

- How do we use the gas lift principle on wells with no access to gas lift networks
- Can we help on low energy wells which cannot produce to existing production networks
- How can we re-start Wells as they are (with no or Minimum extra intervention).
- Can we monitor production in real time
- Can we combine production, well tests and compression proficiencies into a single engineered solution
Gas lift – AutoBooST®

- Gas lift moved to the well head.
- Multiphase boosting allows lower wellhead pressures & greater production.
- A simple and cost effective solution.
- Gas lift gas is “hot” so hydrate freezing problems are eliminated
- Quick to install: less than 4 days rig up time.
- System utilises existing wellhead connections.
- Remote multiphase metering and data transmission.
AutoBooST® Innovative Concept

- Low shear multiphase boosting system with gas lift capability in the vicinity of the well.
- Enhance well production in case of heavy columns.
- Compact and skidded equipment.
- Self powered using gas.
- Minimum or non-manned operation
- Prevent heavy GL investments for far away wells from production permanent facilities.
- Help validate GL efficiency before making the investments.
- Boosting the production while waiting for the final GL installations.
- Simple and cost effective for the Operator.
- Ease of mobilization, installation and demobilization.
- Mini Gas lift stations decentralized to well level.
Flow enters the 3 phases separator

Oil and Water are measured with the flowmeters and boosted to the production

Gas will be measured and sent to the compressor

The Boosted gas will be sent back to the GL injection point

The Well energy will be Boosted

The excess of gas will be sent back to the production

transmission.
AutoBooST® Typical Layout

• The fuel gas from the separator will power up the electrical power generator connected to the Caterpillar Engine
• Power Generator will supply electricity to:
  • Acquisition Cabin
  • Liquid pumps
  • Separator and Compressor Instrumentation
  • UPS system
  • Lightning
What does it look like?

Rapid Production Module
What does it look like?

Compressor Module
## AutoBoosT® Specifications & Improvement

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Units</th>
<th>MK I Package specs</th>
<th>MK II Package Specs</th>
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</thead>
<tbody>
<tr>
<td>Oil Flow</td>
<td>m³/hr (BOPD)</td>
<td>Up to 11 m³/hr (1660 BOPD)</td>
<td>Up to 11 m³/hr (1660 BOPD)</td>
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<tr>
<td>Water Flow</td>
<td>m³/hr (BWPD)</td>
<td>Up to 4.25 m³/hr (640 BWPD)</td>
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<td>Gas Export Flowrate @ 50 Barg without GL</td>
<td>Sm³/day</td>
<td>35,000</td>
<td>40,000</td>
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<td>Gas Lift Flowrate @ 120 Barg</td>
<td>Sm³/day</td>
<td>27,000</td>
<td>40,000</td>
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<tr>
<td>Gas Lift Flowrate @ 160 Barg</td>
<td>Sm³/day</td>
<td>21,000</td>
<td>35,000</td>
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<td>Gas Injection Pressure</td>
<td>Barg (max)</td>
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<tr>
<td>Suction Pressure</td>
<td>Barg</td>
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<td>2 to 25 / 40</td>
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<tr>
<td>Suction Temperature</td>
<td>°C</td>
<td>5 to 60</td>
<td>Up to 80</td>
</tr>
<tr>
<td>Gas molecular weight</td>
<td>kg/kmol</td>
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<td>18 to 25.5</td>
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<tr>
<td>Oil Density</td>
<td>kg/m³</td>
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<td>800</td>
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The AutoBooST package is built to the design codes below. Each package is CE marked so it can be used in multiple countries.

- Vessels: ASME VIII & 2014/34/EU
- Pumps: API 676 Positive Displacement Rotary Pumps
- Hazardous Area Classification: ATEX Zone 2
- Relief valves: API 520 Sizing, Selection and Installation of De-pressuring Systems
- Valves: API 6D
- Heat Exchangers/Air coolers: ISO 13706: 2001 (API 661)
• Most wells are eligible for AutoBooST.

• Ideal wellhead surface pressure is 7 to 15 barg

• The minimum pressure required at the wellhead is 4 barg.

• Ideally wells need to be equipped with gas lift valves however if not, gas lift capabilities can be added easily using coiled tubing or perforating tools deployed through wireline.

• No investment needed.
Targeted Wells

• Wells with not enough energy for the oil to arrive at the central processing facilities, both through artificial gas lift and multiphase wellhead boosting.

• Wells which have intermittent production profiles where the operator has to switch on/off to recover production. AutoBooST will maintain continuous flow.

• Areas where the customer has decided not to install a traditional “large” injection network due to uncertainties.

• Low energy / idle oil wells are the best candidates for the technology.

• Minimum intervention on low producing wells.
• Wellhead pressure is below line pressure.
• Well does not flow.
• Production = 0 BPD

Example: Low Energy Well
The AutoBooST package also serves as a highly efficient multiphase pump, so low pressure wellheads can be boosted in pressure to export into an export line which is at a higher pressure compared to the wellhead.
AutoBooST®: Early Production Facility

- High pressure gas export
- High pressure oil export
- A much quicker, more flexible and easier to install system than a conventional EPF
• IPS have successfully built and tested two AutoBooST packages (MKI and MKII).

• The AutoBooST package is a wellhead based gas lift system with multiphase boosting capabilities

• First wells were successfully tested with AutoBooST in Algeria where IPS signed an alliance agreement with Expro.

• Results exceeded expectation, oil production from the trail well was increased from 2.4 m³/hr (380 BOPD) under natural flow conditions to 11.7 m³/hr (1650 BOPD) under hot gas lift conditions when operating with AutoBooST.

• Second Unit was active in Eastern Europe and now operating in Algeria.
Success Story : Detailed Results

- 60 hr test at 16mm choke size. Flow increase up to 11.7 m3/hr (1766 BOPD).
- Further testing is still being conducted, but it is likely that at larger choke sizes, higher flows are possible.
Acquisition System : Local System

Acquisition Software for Monitoring & Reporting

Fully Automatic HMI for controlling
Acquisition System: Remote Monitoring

Web Portal for remote monitoring

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<th>Description</th>
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<tr>
<td>WHP</td>
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<tr>
<td></td>
<td>Stage 1 Discharge Pr</td>
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<td>Stage 3 Discharge Pr</td>
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<td>Final Discharge Pr</td>
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<td>Compressor Oil Press</td>
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<td>Fuel Gas Pressure</td>
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Conclusion: Continuous Development

- Easier Rig Up
- Modular Approach
- Layout improvements for greater operational flexibility.
- Demands included AB applications and Multiphase pumping requests
- Business Model: Start up at Reduced costs (3 days), Followed by a contractual agreement. A win-win focused on long term partnerships
Conclusion: Pictures from the Desert
Conclusion: Pictures from Eastern Europe
Conclusion & Way Forward

- IPS is proposing a new automated AL concept.
- Operators will financially engage only in case of success
- Experience proved technology works
- Used to verify / confirm GL is successful
- Real time data and using on multiple wells are an additional features

Way Forward:

- Full process automation with minimum personnel
- Implementation of Artificial Intelligence for Gas lift optimization
Bringing low energy wells back to production

- Zero flaring
- Multiphase boosting (low shear)
- Gas lift gas generation
- Easily road transportable
- In-line well test
- Instant EPF
- Self powered using gas – No diesel!
- Multiphase production metering
- Remote data provision
- Rapid deployment

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EU Approval granted – June 2021

Electronic Filing Receipt

Acknowledgement of receipt

We hereby acknowledge receipt of your request for the processing of an international application according to the Patent Cooperation Treaty as follows:

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