WELL PRODUCTION SERVICES

Surface Boosting Plants to Achieve Enhanced Oil Recovery (EOR)

by Bonatti Multiphase Pumping Systems

Bonatti | Well Production Services

Operating Worldwide as a Local Contractor

13 local companies

more than **75** years of experience

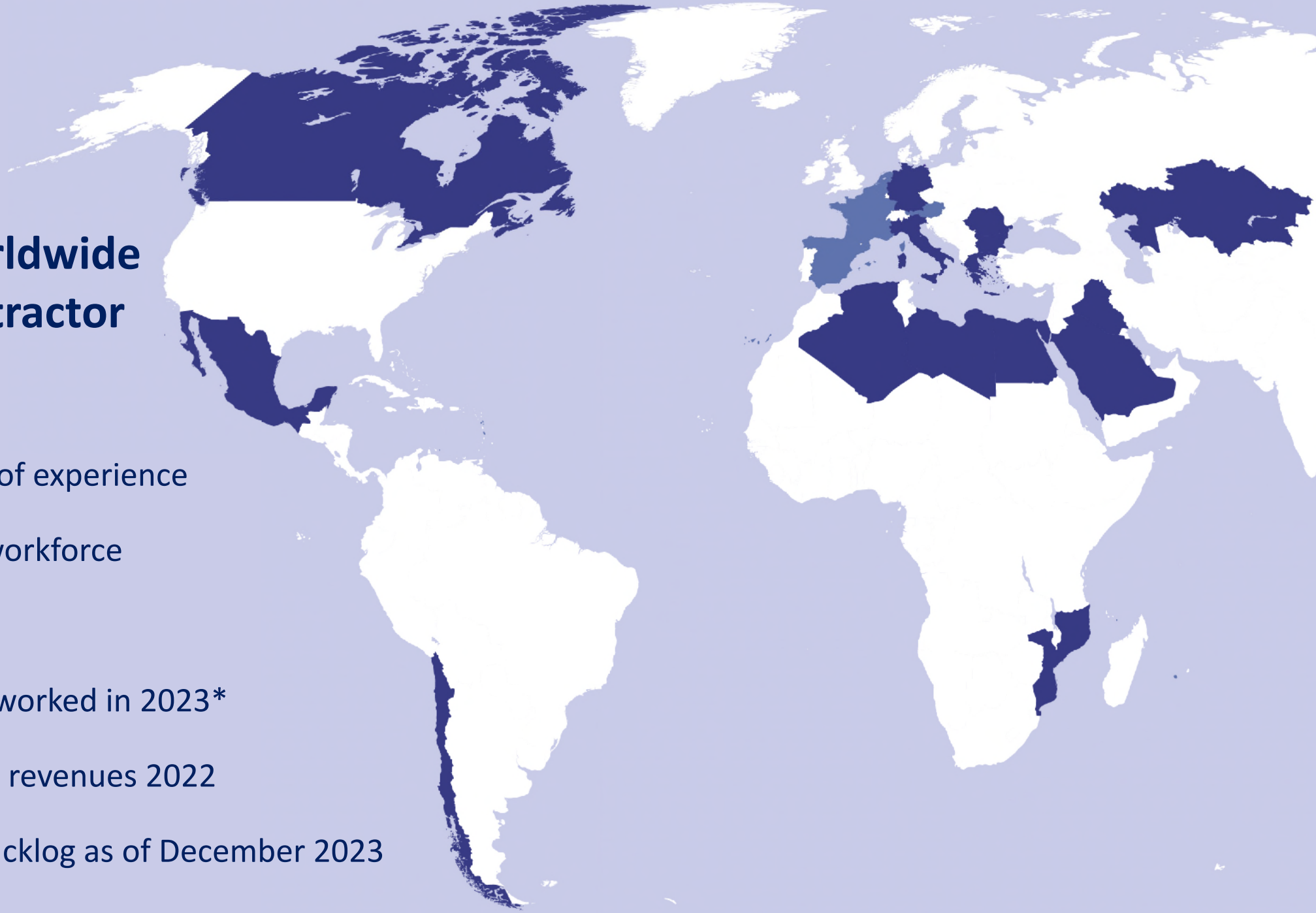
97% average local workforce

8,500 employees

18,200,000 hours worked in 2023*

700,000,000 euro: revenues 2022

3.9 billion euro: backlog as of December 2023



* provisional data

WHAT WE DO

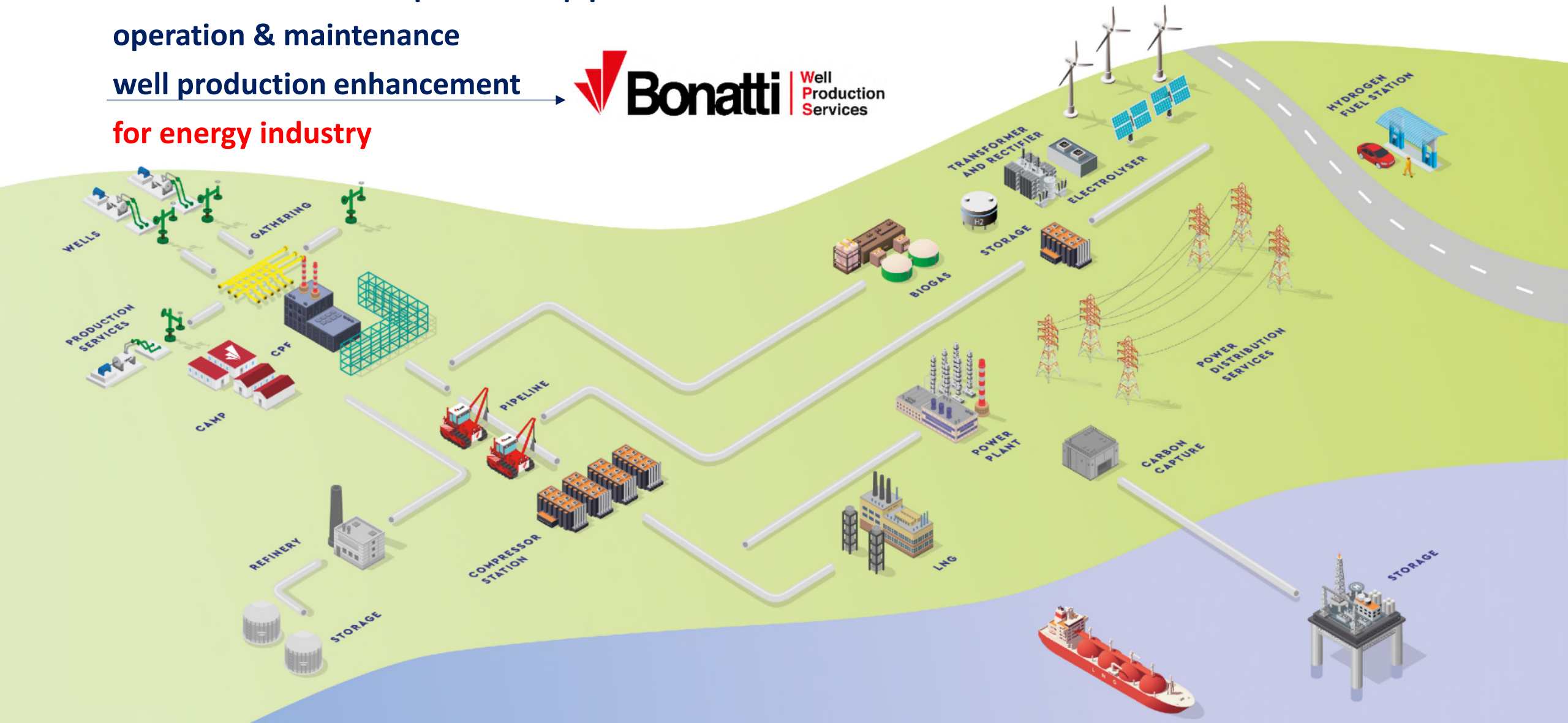
EPC & construction of plants and pipelines

operation & maintenance

well production enhancement

for energy industry

Bonatti | Well Production Services



OUR WELL PRODUCTION SERVICES

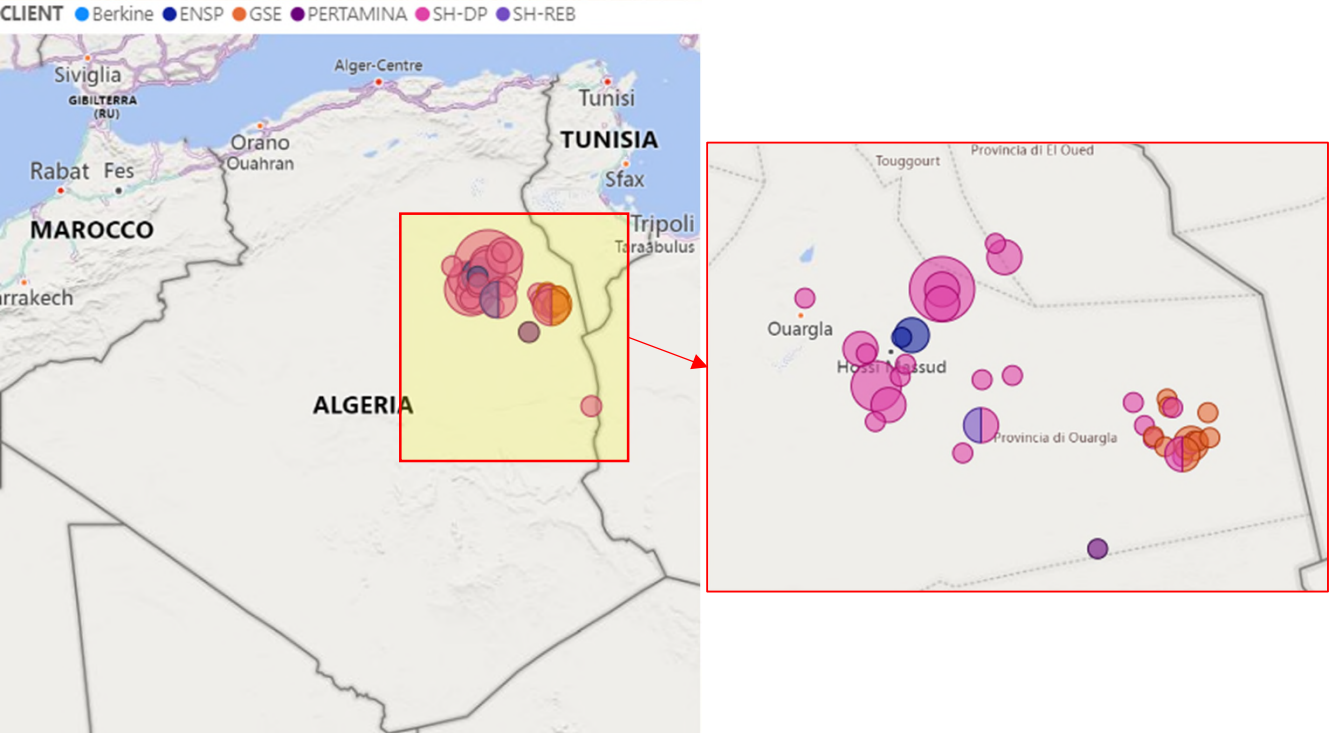
Well Production Services is offering surface & fast track rental solutions to enable Operators to increase production in the following cases:

- **REMOTE & MARGINAL WELLS**
- **GREEN FIELD**
  far away from terminals / **EPF approach**
- **BROWN FIELD**
  with high depletion rate
- **MANIFOLD/WELLS**
  with high back-pressure

Bonatti WPS offers
17 years experience
in Multiphase operations

combining water/chemical and injections and treatment skids

in detail



Multiphase pumping systems (53 units in operation)

ensuring 98,5% average uptime, applied both to Oil field & Gas Field in onshore applications. Offshore application can be implemented.

PERTAMINA

sonatrach

Eni

Anadarko Petroleum Corporation

OXY

OUR WELL PRODUCTION SERVICES

Using Bonatti WPS services
our Clients are producing

more than

200,000 BPD

and

8,000,000 Sm3/d of gas

from wells that otherwise
would have been shut-in.

UP to 99,9% GVF

WELL PRODUCTION SERVICES – KEY FACTORS

Well Production Service is able to replicate the same organization already present in Algeria and composed by:

- **Reservoir, petroleum and production engineering expertise**
  to support Client in identifying the well / network needs and implement the most suitable production solution
- **Technology leadership department**
  to select and customize the most updated market solutions in order to fulfil any Customer's production need
- **Project Management Team**
  implementing the selected solution, from concept design up to installation and start-up on site
- **In-house personnel for construction and commissioning**
  to minimize start-up time

WELL PRODUCTION SERVICES – KEY FACTORS

Bonatti WPS Team in Hassi Messaoud, Algeria

WELL PRODUCTION SERVICES – KEY FACTORS

Well Production Service offers full control of the whole service chain, thanks to fully dedicated TASK FORCE, composed by:

- **Skilled operation & maintenance team with dedicated facilities**

  ensuring 24/7 assistance for Screw / Pressure Cavity / Piston / Centrifugal pumps, Compressors and Treatment skids

- **Control Room with On-line monitoring system**

  based on satellite trasmission, giving in-time full remote control of operations

- **Bareshaft availability**

  to provide premium service minimizing production downtime

- **Multiple size of pumps hydraulics**

  allowing to cover wider range of Client well / network production profile and ensuring a wider operational flexibility

WELL PRODUCTION SERVICES

KEY FACTORS

MPP WORKSHOP

GENSET WORKSHOP

SPARE PARTS WAREHOUSE

WPS Facilities

EQUIPMENT WAREHOUSE
100M X 200M AREA

Central + Satellite Bases with:

- workshop for MPP & GenSets maint.
- warehouse for spares
- laydown area for MPP equipment
- Control Room for MPP monitoring

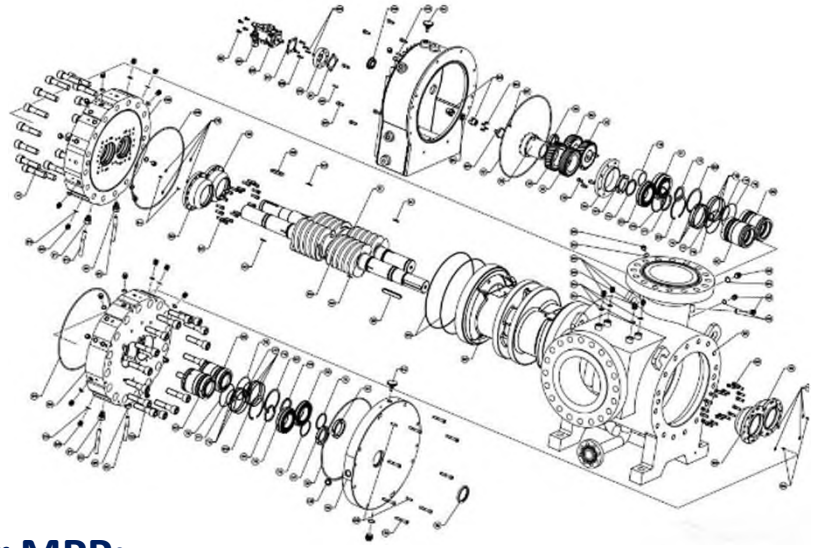
CONTROL ROOM

WELL PRODUCTION SERVICES

KEY FACTORS

Maintenance skills

- MPP intensive exploitation leads to higher maintenance intervention ratio (capital spares as rotors & liners become as consumables)



ROTORS

Average no. of intervention per MPP:

- **Rotor: 2 per year**
- **Liner: 1 per year**
- **Mech. Seals: 16 per year**

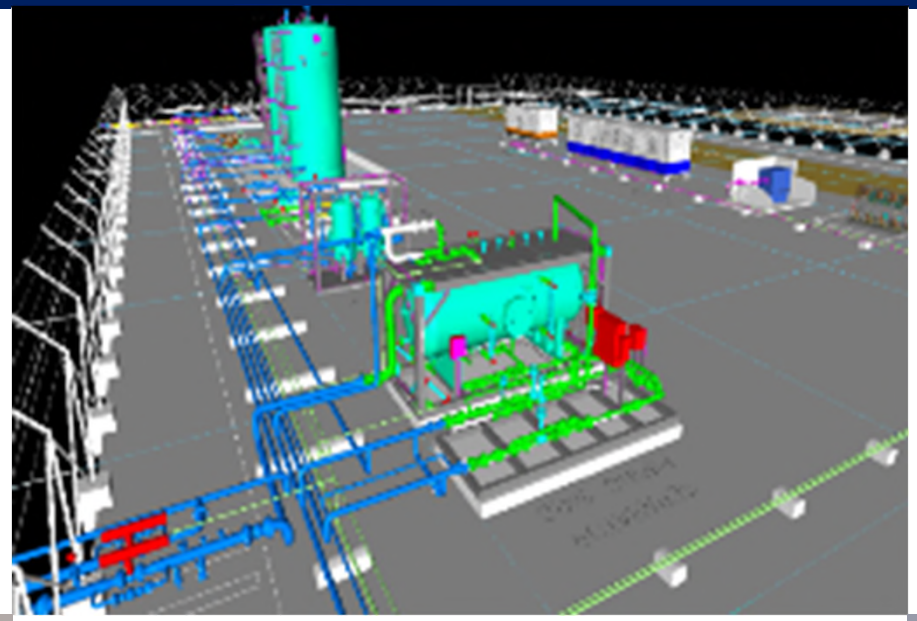
MECHANICAL SEALS

LINERS

WELL PRODUCTION SERVICES - TOTAL APPROACH

Engineering

- Reservoir & Petroleum analysis
- Plot Layout & 3D modeling
- Control philosophy
- Heat & Mass Balance
- Equipment Lists
- Process Data Sheets
- Detailed Engineering
- HAZID/HAZOP/SIL studies



Manufacturing & Construction

- Manufacturing
- Power generation
- Electrical Substation
- Instrument Air Generation
- Control room and Site facilities
- Mobilization
- Inter-mobilization
- Demobilization and Site restoring

Rental with O&M

- Operation & Maintenance
- 24/7 available crew
- In country Logistic
- Fast Track maintenance intervention
- Bare-Shaft exchange

WELL PRODUCTION SERVICES

CLIENT KEY ADVANTAGES

NO INVESTMENTS on Client's side
ONLY OPEX to cover the Service
as soon as the **PRODUCTION STARTS**

The O&G Companies CASH FLOW
is always positive

«One stop shop model»

Bonatti, as Service Provider, implements the full life cycle of the projects
(engineering, procurement, installation, start-up, maintenance and operation),
including spare parts, interface with production and reservoir engineers for production enhancement

Environmentally friendly approach with best HSE international practices

EQUIPMENT TECHNICAL DATA

MULTIPHASE PUMPING SYSTEMS

LOW TEMPERATURE APPLICATION	technology / main technical features *Fully Packaged solutions, with 3 standardized "sizes"*	HIGH TEMPERATURE APPLICATION
	SMALL SIZE *based on **progressive cavity pumps technology***	
Bonatti WPS lynx	Pump Flow: **from 73 to 190 Em3/hr (30KBBLPD)** Pump differential pressure: **from 20 to 60 bar** Gas Volume Fraction (GVF): **up to 95%** Pump Installed Power: **up to 160 kW** Min Suction Pressure: **2 bar** Max Suction Pressure: **85 bar**	Bonatti WPS fennec
	MEDIUM SIZE *based on **twin screw pumps technology***	
Bonatti WPS bison	Pump Flow: **up to 660 Em3/hr (100KBBLPD)** Pump Differential Pressure: **from 20 to 60** Gas Volume Fraction (GVF): **up to 100%** Pump Installed Power: **600 kW** Min Suction Pressure: **2 bar** Max Suction Pressure: **85 bar**	Bonatti WPS gazelle
	BIG SIZE *based on **twin screw pumps technology***	
Bonatti WPS mammoth	Pump Flow: **up to 2700 Em3/hr (400KBBLPD)** Pump Differential Pressure: **from 20 to 60** Gas Volume Fraction (GVF): **up to 100%** Pump Installed Power: **up to 2200 kW** Min Suction Pressure: **2 bar** Max Suction Pressure: **85 bar**	Bonatti WPS dromedary

All the systems are **remotely monitored by means of proprietary Monitoring System**

**Note: The "E" in front of the flow unit stands for "Equivalent" or in some cases called "Actual" flow, i.e. flow at suction pressure and temperature (when gas portion is compressed to "Suction" as opposed to "Standard").*

97% uptime
when installed with premium O&M package

99% GVF
treatable avg. max

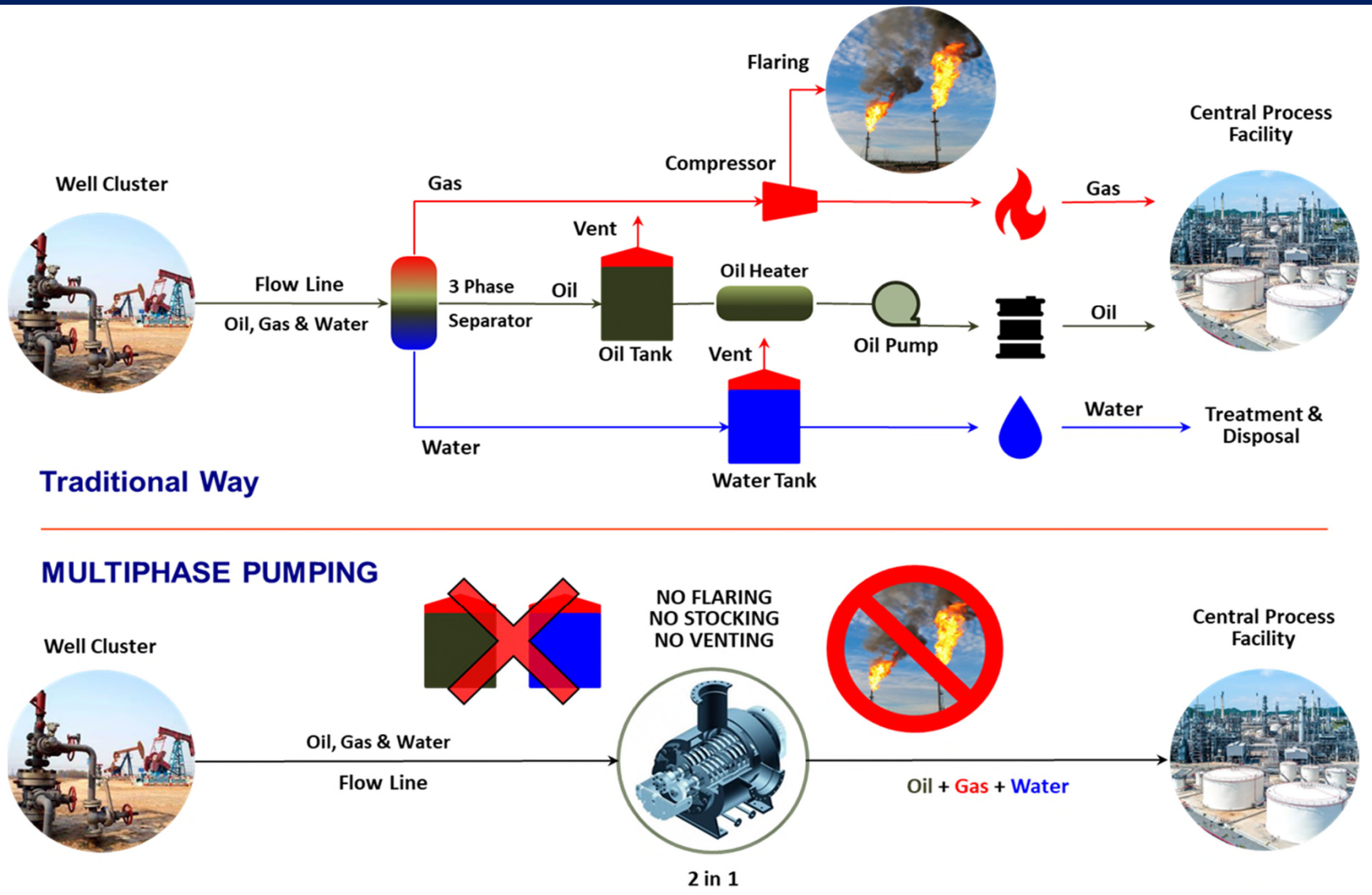
16 years
designing, constructing and operating MPPP

2 bars
min. suction pressure, outlet pressure according to client network (max 93 barg)

NO FLARING

MULTIPHASE PUMPING SYSTEMS

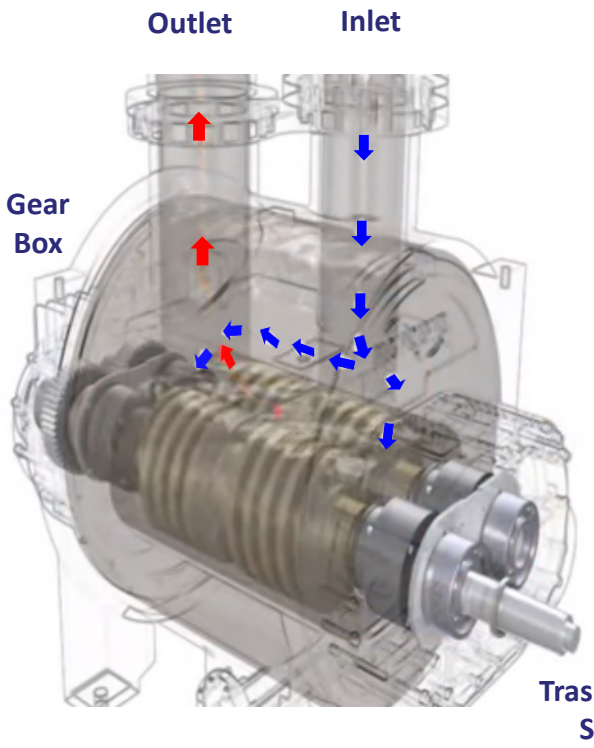
The Multiphase solution is able to replace Early Production Installation



MULTIPHASE PUMPING SYSTEMS

HOW MPP PUMP WORKS?

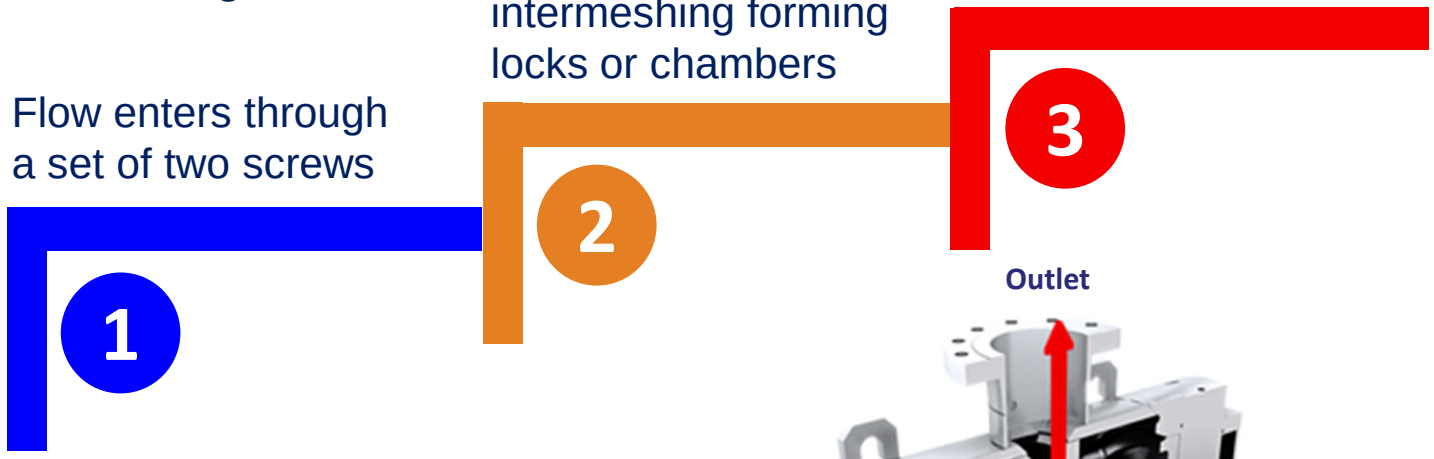
Pumps are used to transfer a volume of liquid (oil and water) and gas from inlet to discharge



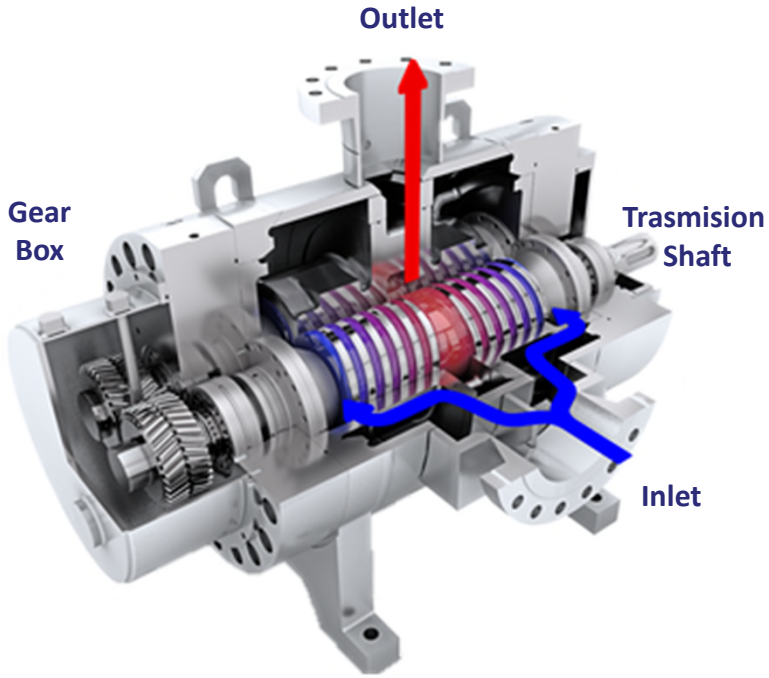
Flow enters through a set of two screws

The screws are intermeshing forming locks or chambers

Fluids are pushed out against downstream backpressure

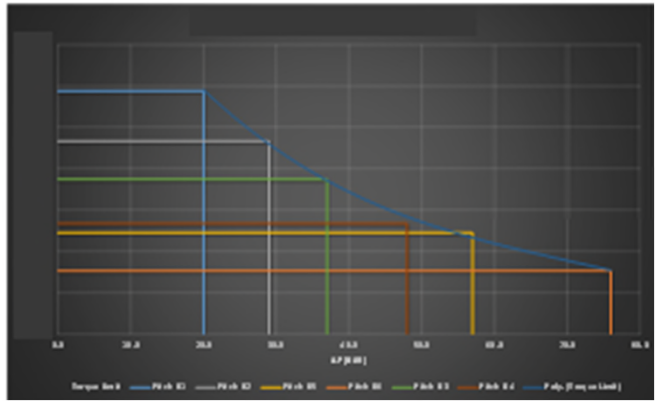


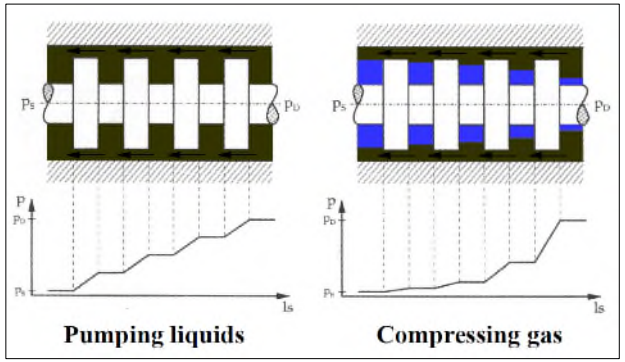
The assembly is designed to run without metal-to-metal contact

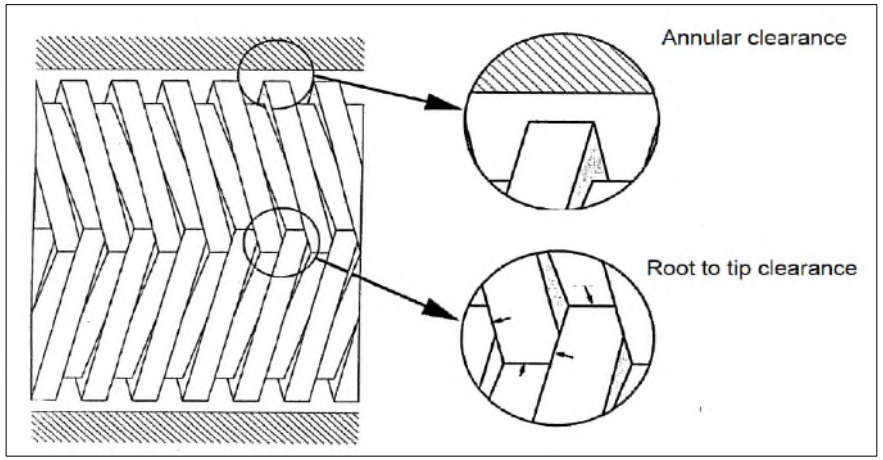


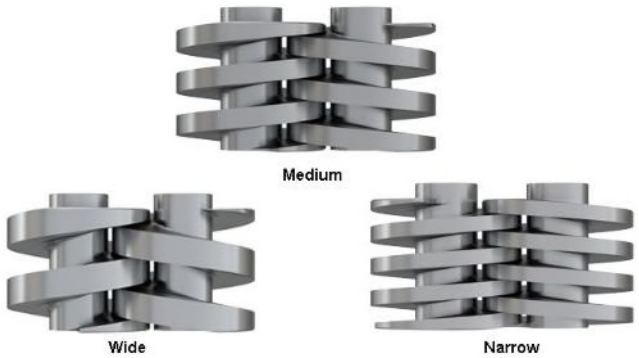
MULTIPHASE PUMPING SYSTEMS

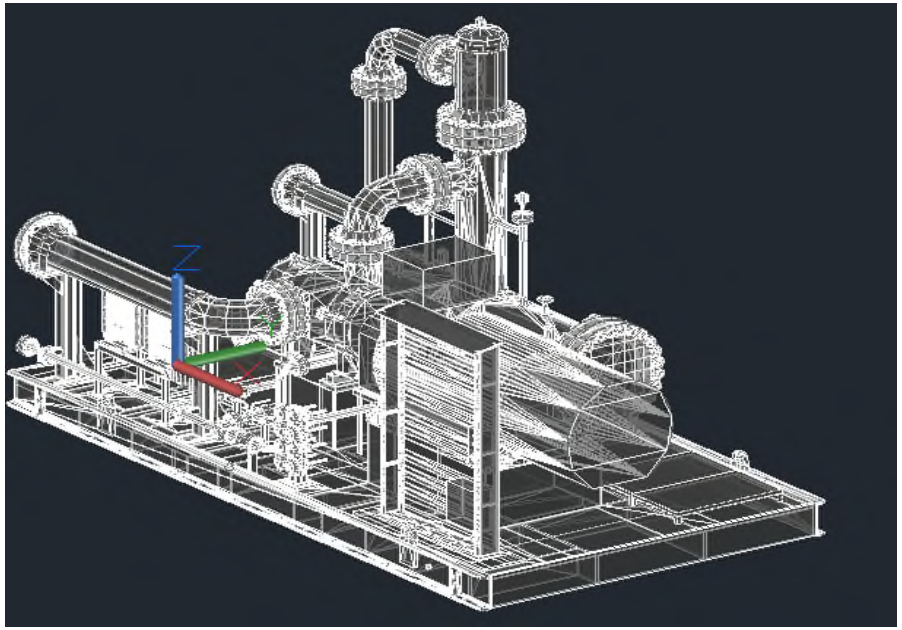
The Twin Screw technology allows high performance and wide range of flowrate and DeltaP





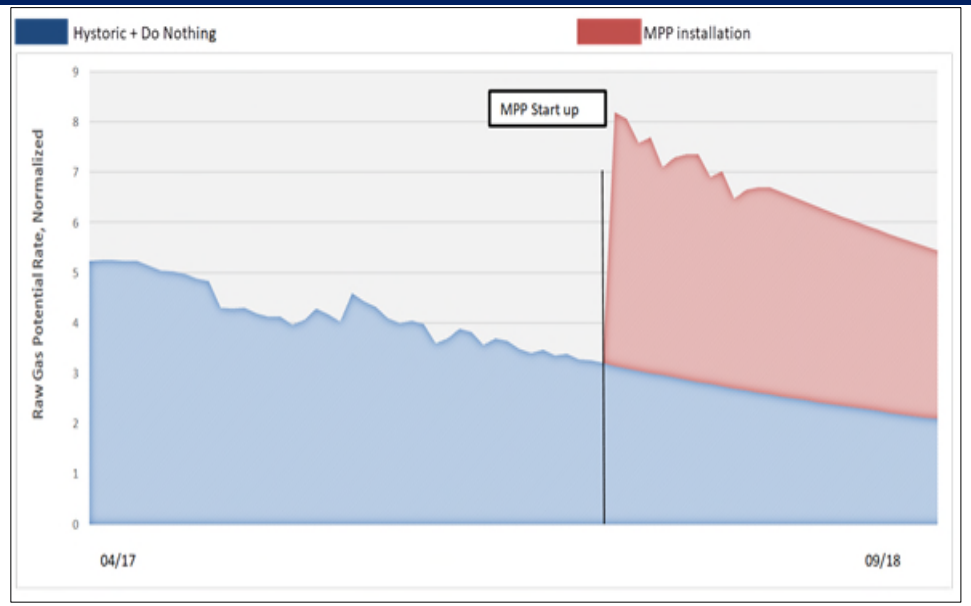


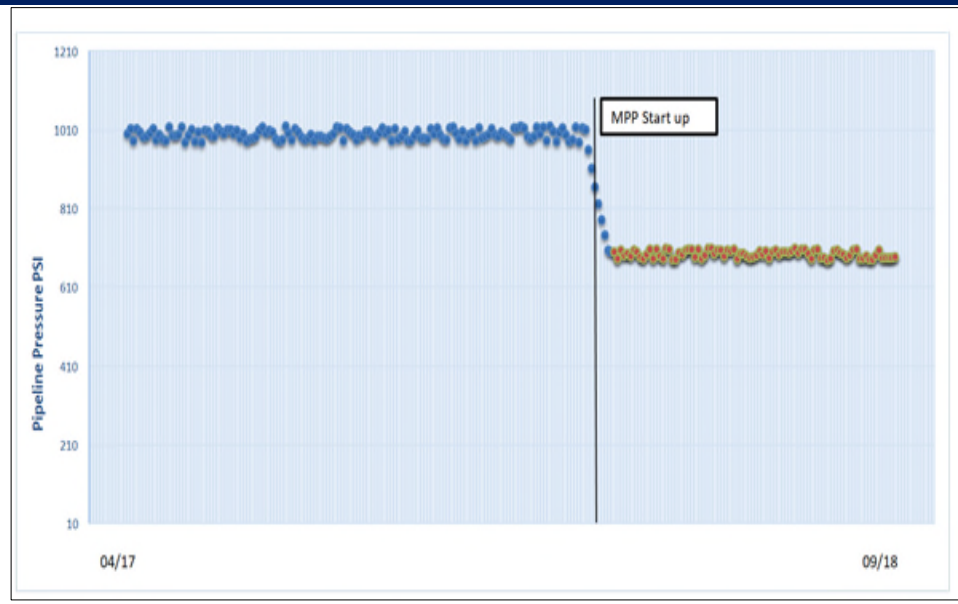


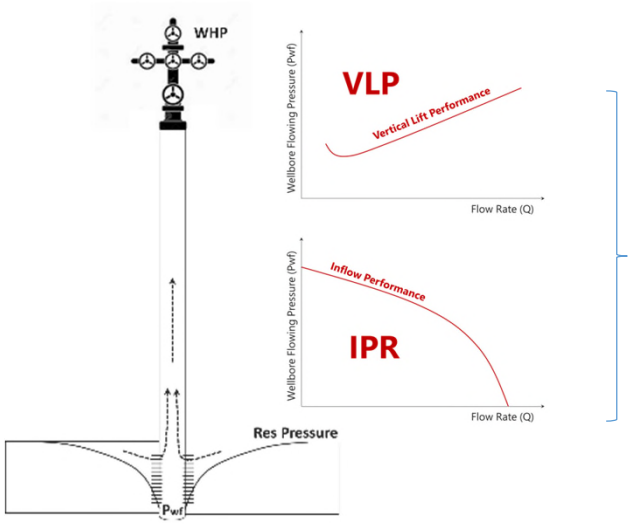


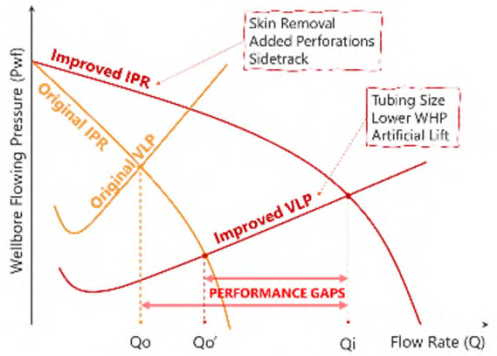
MULTIPHASE PUMPING SYSTEMS

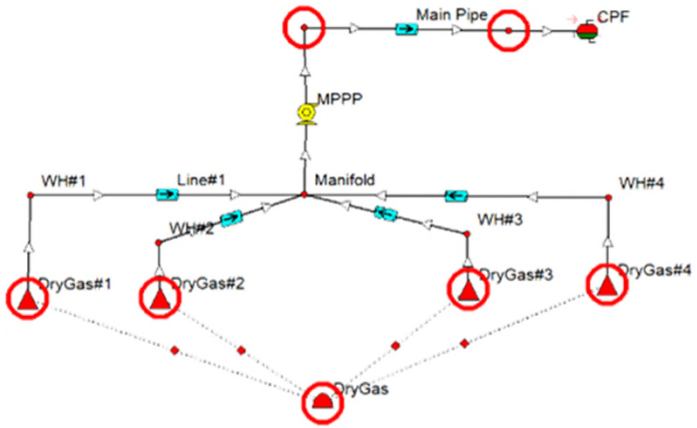
What is the result of the Multiphase Pump technology application?







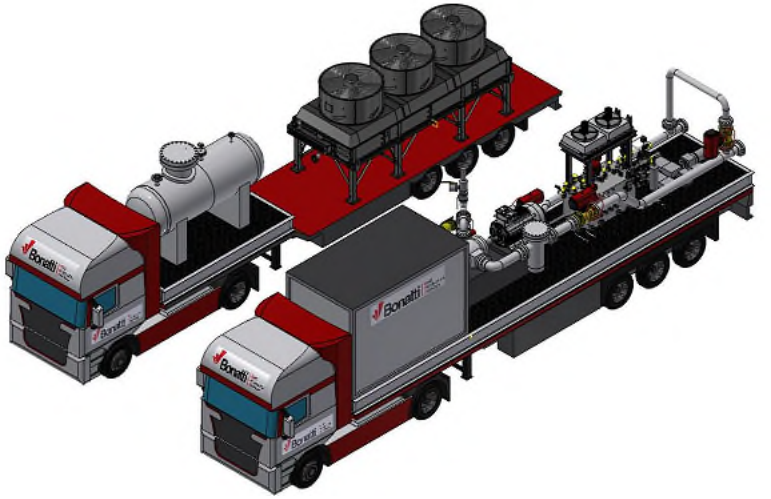




MULTIPHASE PUMPING SYSTEMS

TYPE I and TYPE II SIZE

skid-mounted equipment, complete also with control cabin.
Easy to be transported/moved from one site to another upon Client requests.



Suitable to work with GVF from 96% to 99%

Fully packaged solution.

- TYPE I and TYPE II Flow rate: **1.000 EBPD** (with low GOR) **up to 120.000 EBPD**
  up to 60bar Δp
- Min suction Pressure: **2 bar**
- Installed Power: **180 ÷ 750 kW**
- Available gas and diesel generators
- **Remotely monitored**


Bonatti WPS
fennec


Bonatti
WPS
gazelle
Bonatti
Bonatti


Bonatti
WPS
dromedary

MULTIPHASE PUMPING SYSTEMS

TYPE III SIZE

Multi-skid-mounted equipment, complete also with control cabin, customized solutions can be supplied.

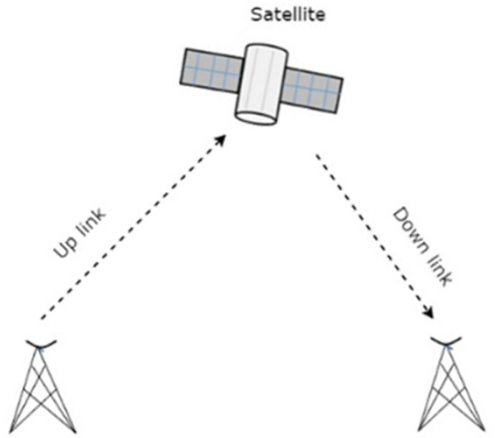
Suitable to work with GVF up to 99%
Fully packaged solution.

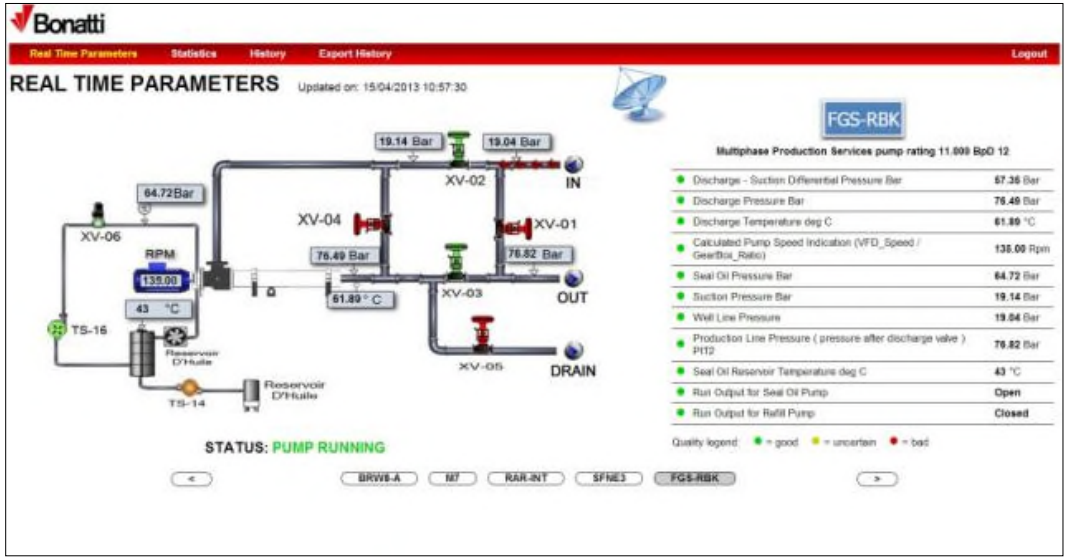
- Flow rates: **110.000 EBPD**
  up to 420.000 EBPD at 20 ÷ 60 bar of Δp
- Min suction Pressure: **2 bar**
- Installed Power: **till 2,5 ÷ 2,7 MW**
- Preferable on electrical grid connection
- **Remotely monitored**

WPS REMOTE MONITORING SYSTEM

Bonatti provide remote control & monitoring system both for Multiphase Pump and Chemical Injection systems with following main features:

- **all Bonatti WPS applications could be unmanned**
- **the local control system use a Satellite connection**
- **data in real time available for 24/7 monitoring of machines parameters**
- **machines can be remotely adjusted and/or shutted down**
- **data available worldwide for Clients and for Bonatti Parma HQ support team.**
- **system fully redundant (multiple servers and control rooms approach)**
- **all data are backed up continuously and confidentiality covered**

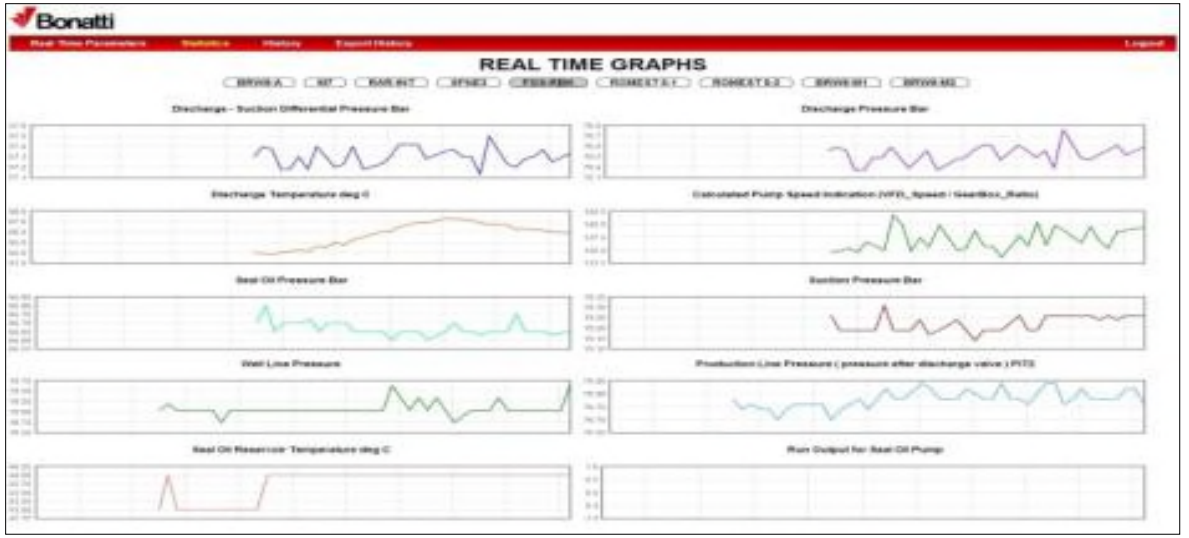


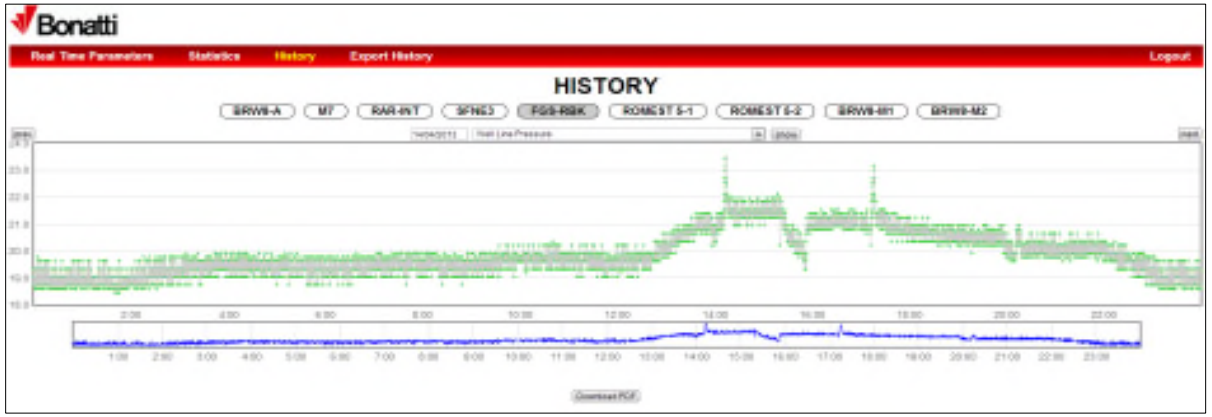


WPS REMOTE MONITORING SYSTEM

Easy Web specifications:

- **Easy and Secure, Easy navigation, and secure data transfer from server to server by VPN.**
- **Secure access available to the Customer, access by 2048 Bit certificate SSL**
- **Real Time Data update every 5 seconds for main signals**

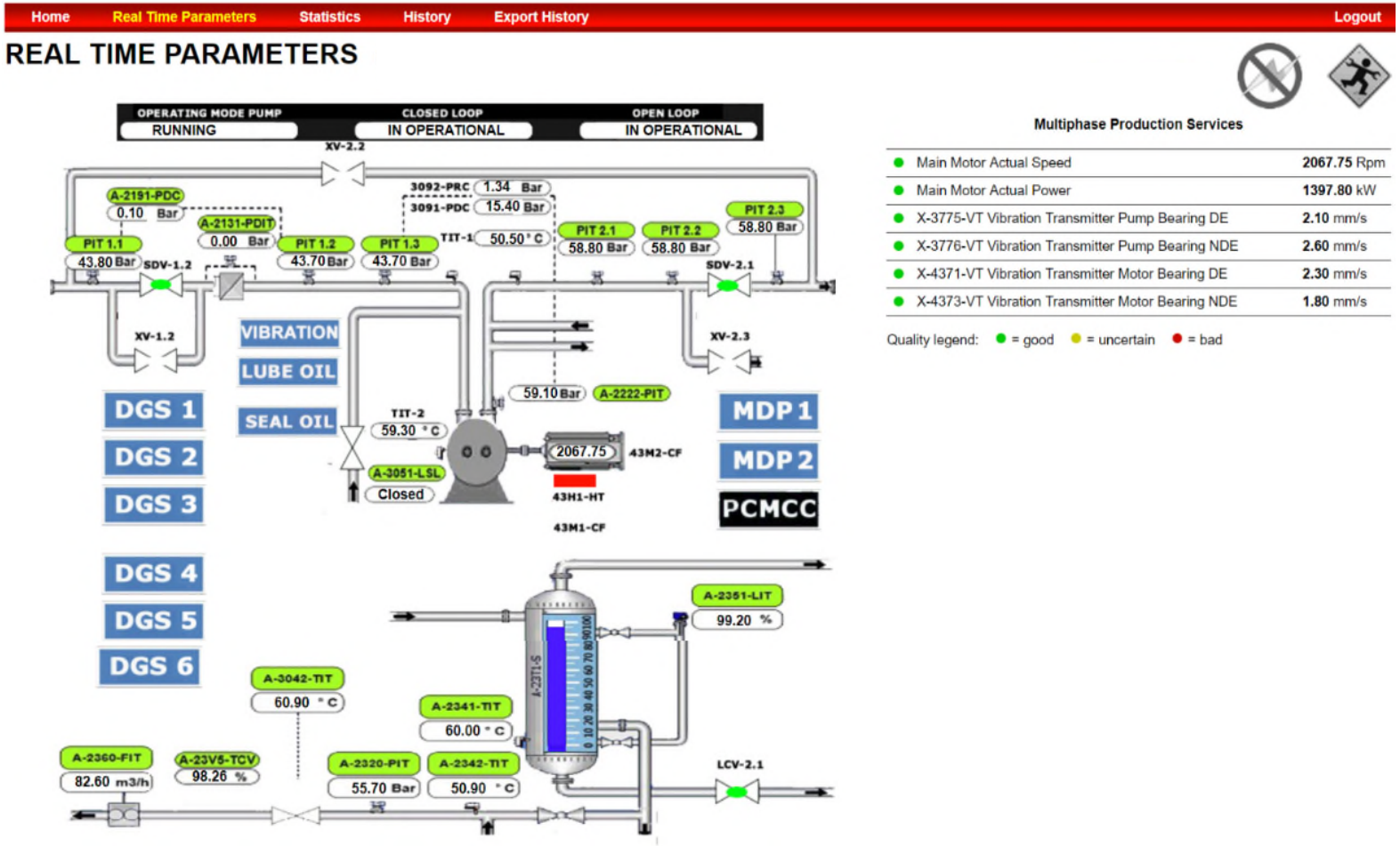




WPS REMOTE MONITORING SYSTEM

Actually, following installation are running under remote monitoring system:

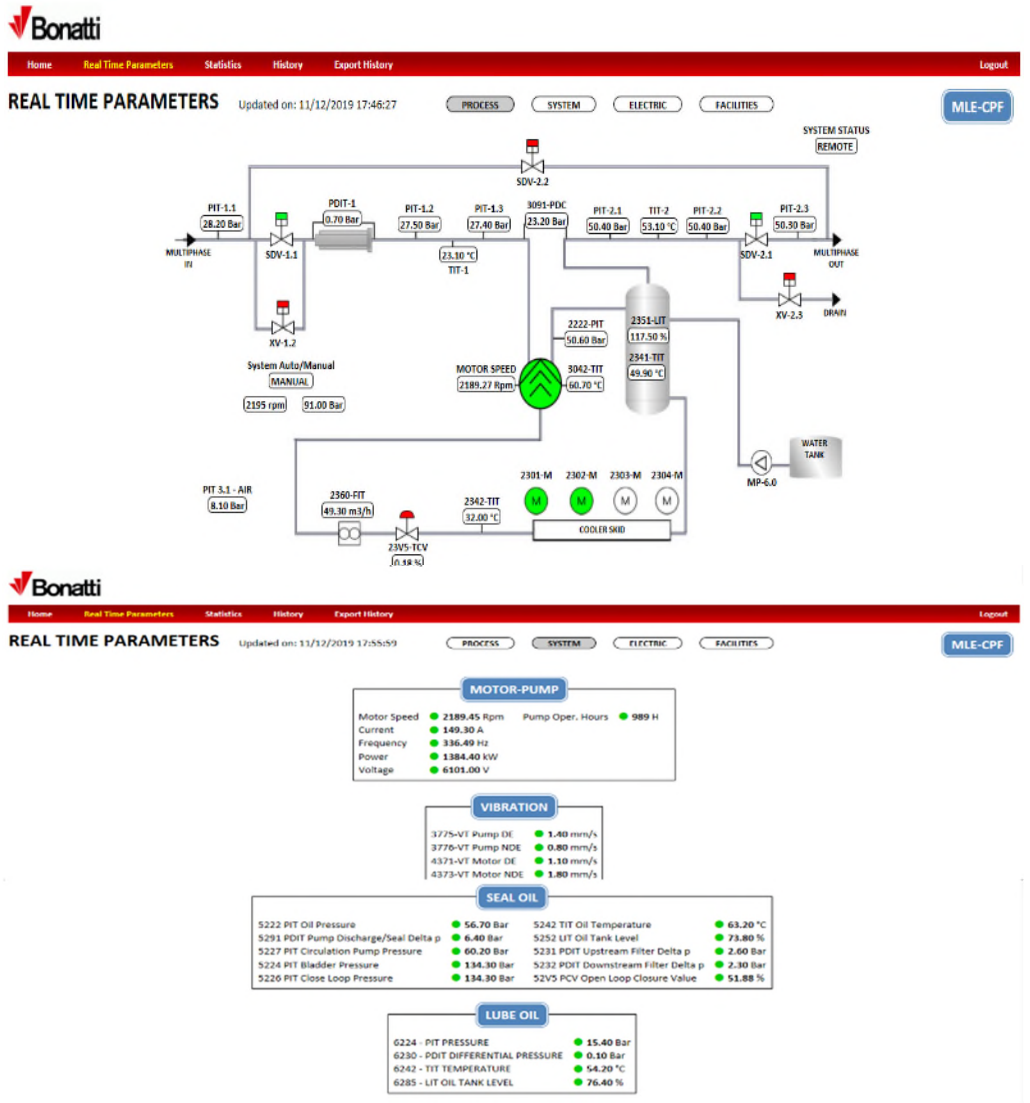
- **10 Type III MPP (Dromedary)**
- **23 Type II MPP (Gazelle)**
- **20 Type I MPP (Fennec)**
- **18 Chemical Injection skids**
- **3 Salt Dilution skid**



WPS REMOTE MONITORING SYSTEM

Different parameter can be acquired form remote monitoring system:

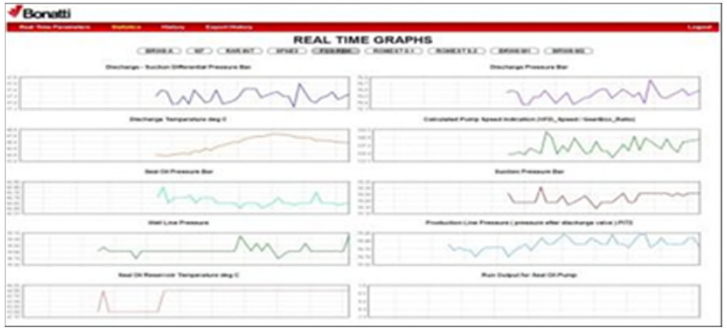
- **Equipment status (in operation or not)**
- **Pressure and Temperature**
- **Vibration and speed**
- **Liquids Level**
- **Current, voltage, power and frequency**
- **Actuated valve status**

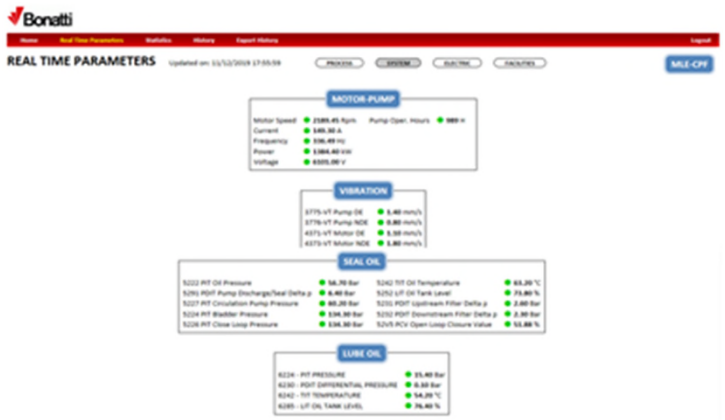


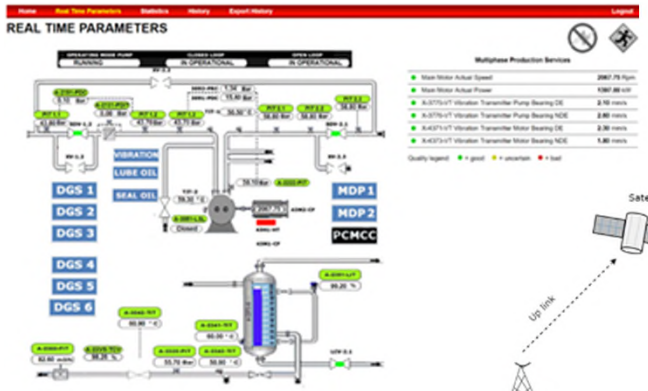
WPS REMOTE MONITORING SYSTEM

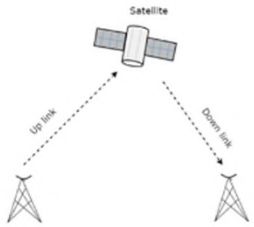
The WPS Remote Monitoring System can therefore be summarized in the following surplus values:

- ✓ **Increased security:**
  - ➢ Operating Sites can be unmanned
- ✓ **Increased production reactivity:**
  - ➢ 24/7 accessibility of data in real time or remotely at any time and anywhere in the world
- ✓ **Improvement of maintenance engineering:**
  - ➢ Possibility to carry out predictive maintenance according to the progress of the monitored parameters.
  - ➢ Minimization of troubleshooting times, by changing the plant operating parameters, that is, preventing unwanted shutdown equipment.
  - ➢ Greater deepening and global vision in failure and route cause analysis
  - ➢ Storage and analysis of operational parameter records and fault events









MPP SYSTEMS & WELL PRODUCTION SERVICES
MPP CASE HISTORIES

1. Wet Gas Boosting Application

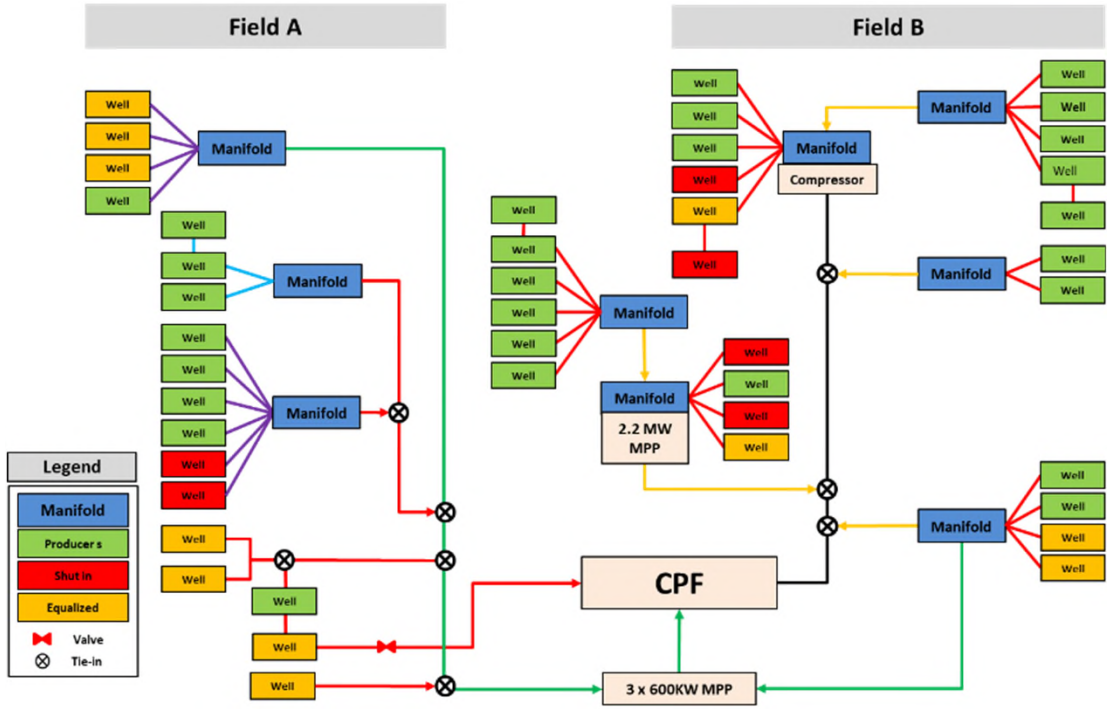
MULTI-PHASE PUMPING PLANTS – REAL CASE APPLICATION
WET GAS BOOSTING FIELD INSTALLATION

Operation challenges
- **99,9% GVF**
- Pressure fluctuation in the network
- Solids and sediment production from some oil and gas wells
- Harsh Ambient conditions

Several options already explored with no tangible benefits
- ESP
- Acid job
- Fracking
- Well stimulation

Operator needs
- **Production enhancement**
- Network stabilization
- Reduced down-time

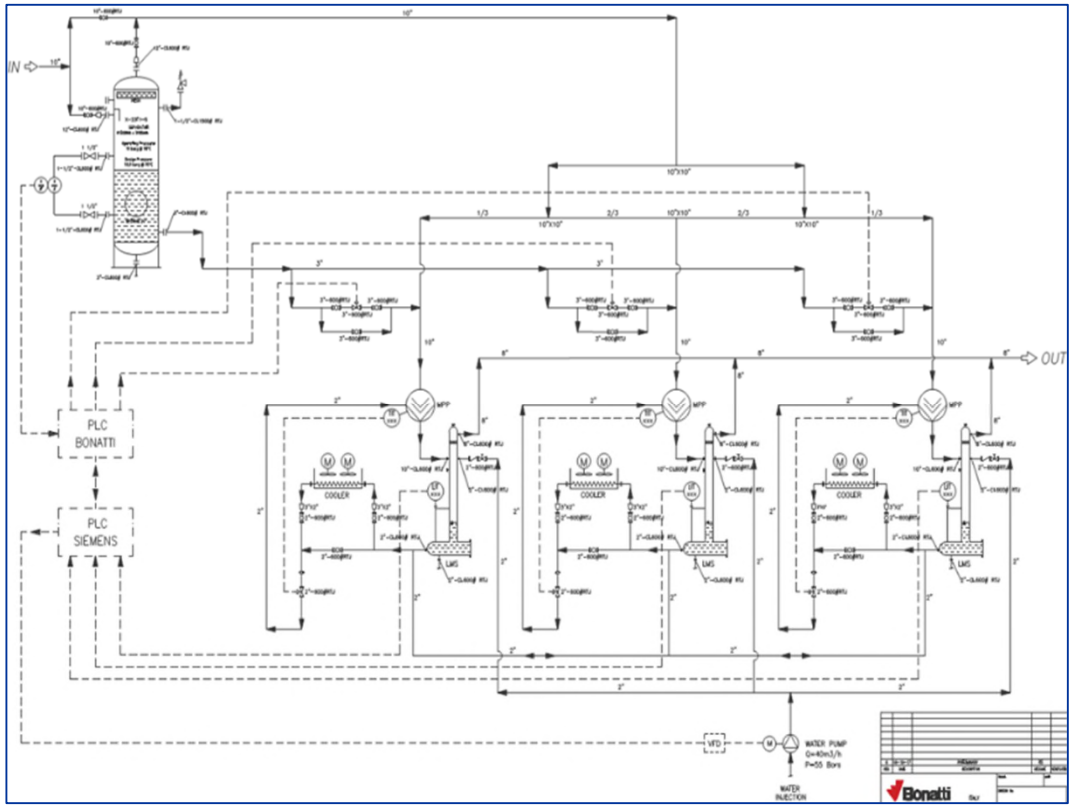
Solution: installation of surface Multiphase systems, designed to work with GFV=100%, to reduce network pressure at well heads



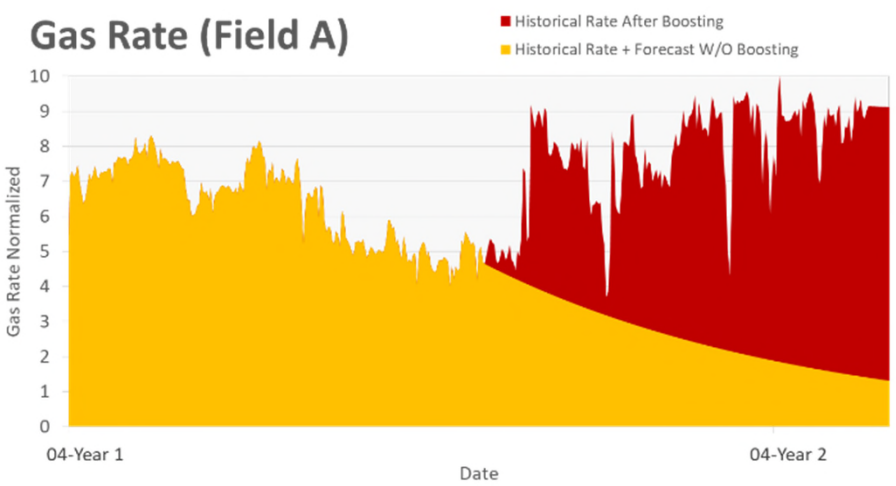
Installation Details

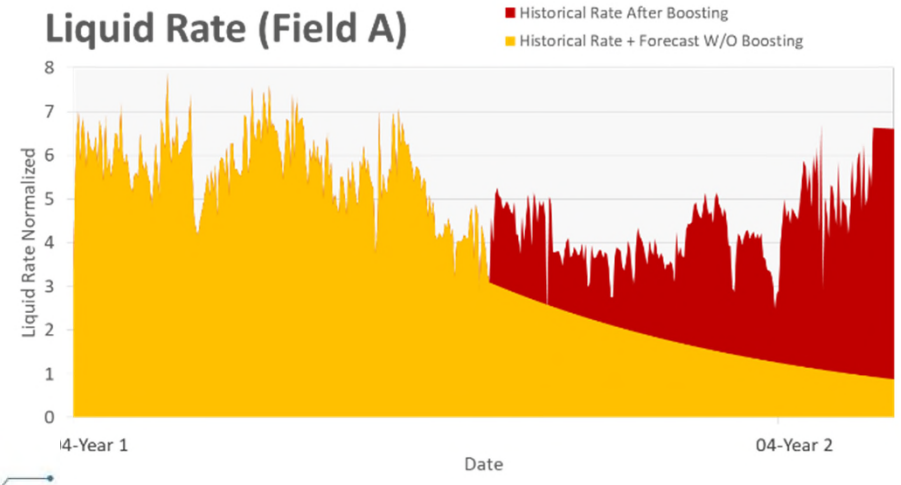
- Multiple systems installed in a production network
- **Different pumping configurations**: parallel (3x) and single arrangement
- Gathering the **production of a complex network** (gas/oil wells, manifolds, production pipelines)
- Manage slug flow a, 100% GVF and wet gas with no impact on the operations

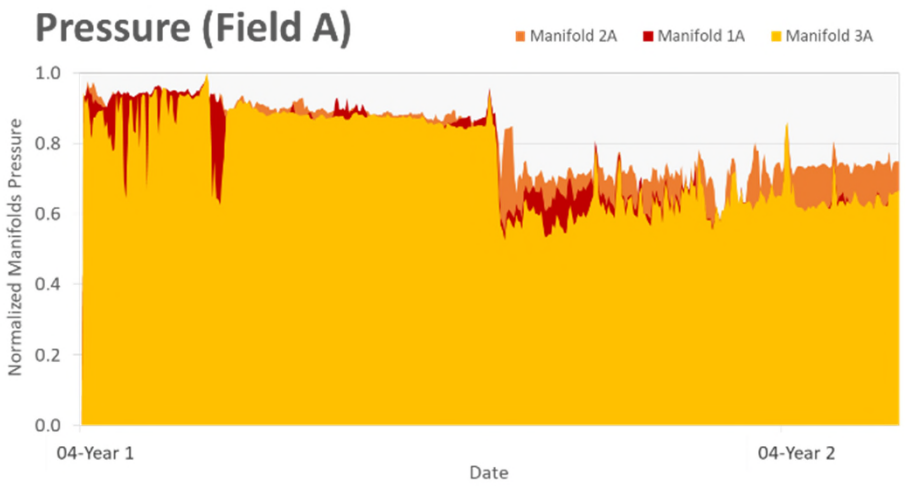
MULTI-PHASE PUMPING PLANTS – REAL CASE APPLICATION
WET GAS BOOSTING FIELD INSTALLATION - FIELD A

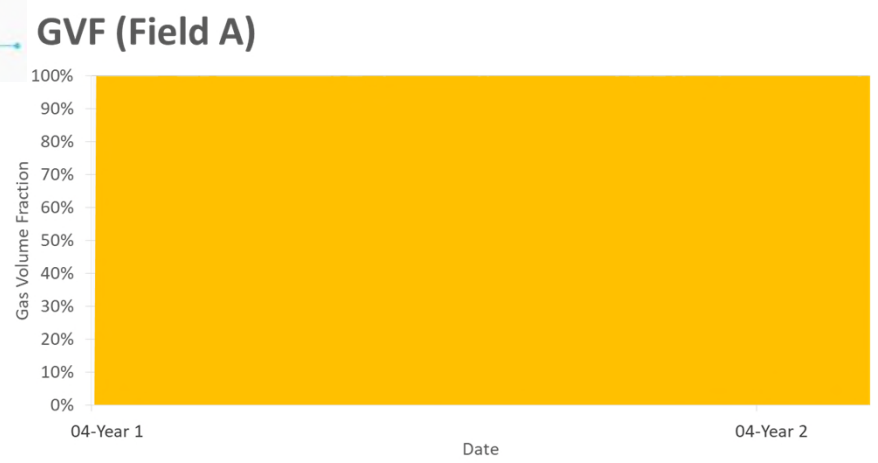


MULTI-PHASE PUMPING PLANTS – REAL CASE APPLICATION
WET GAS BOOSTING FIELD INSTALLATION - FIELD A RESULTS



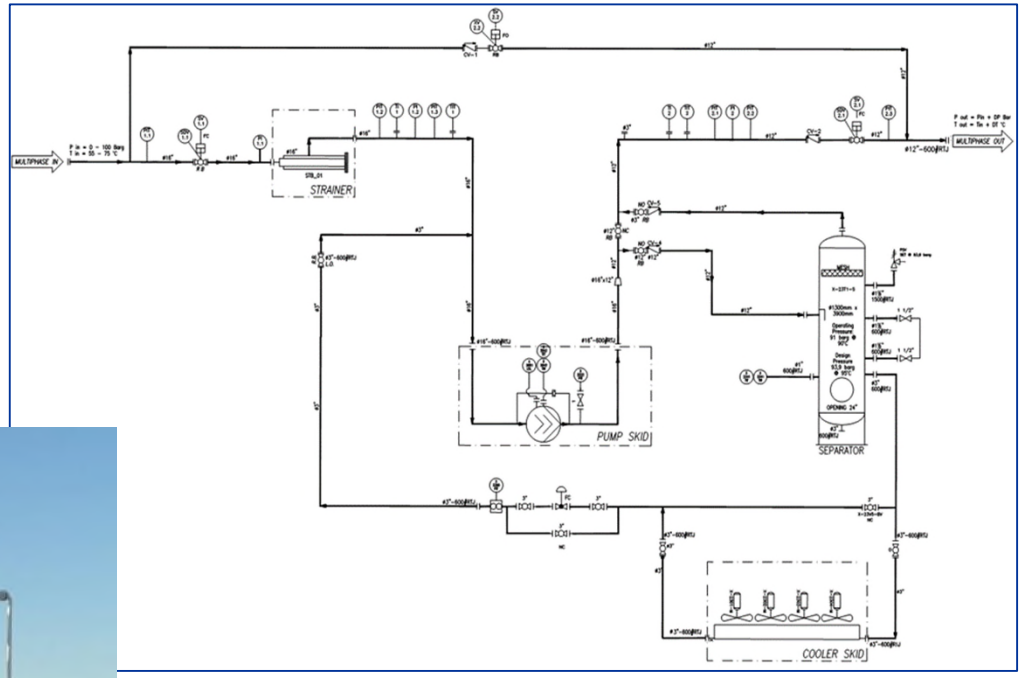




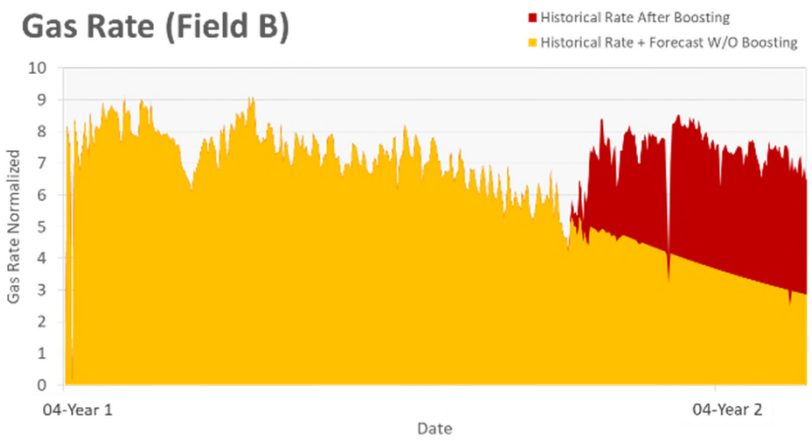


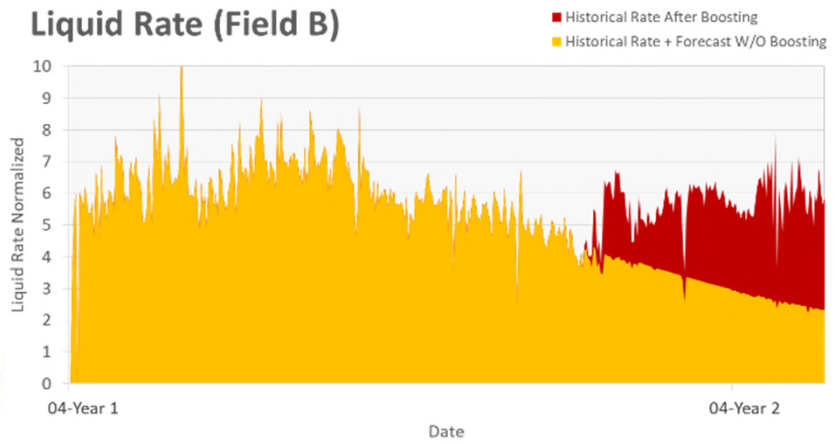
MULTI-PHASE PUMPING PLANTS – REAL CASE APPLICATION
WET GAS BOOSTING FIELD INSTALLATION - FIELD B

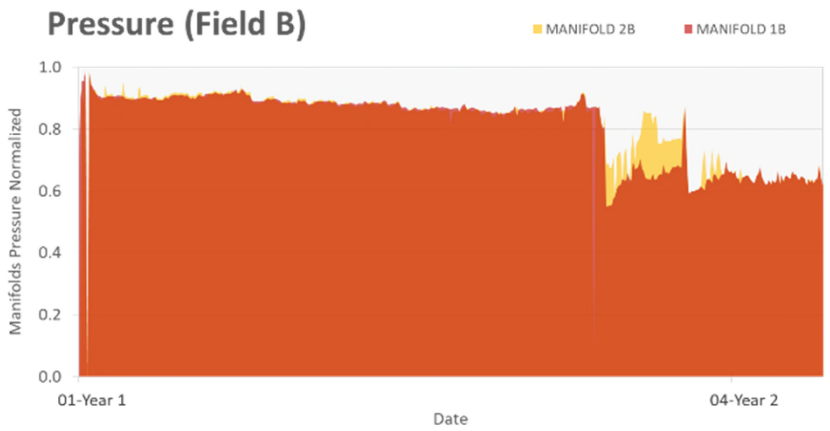
- Inlet manifold system for future pumps,
- Piping skid connections,
- Multiphase Twin Screw Pump skid,
- Cooler Skid,
- Downstream separator and external injection point,
- Electric Generators,
- Data transmission system.

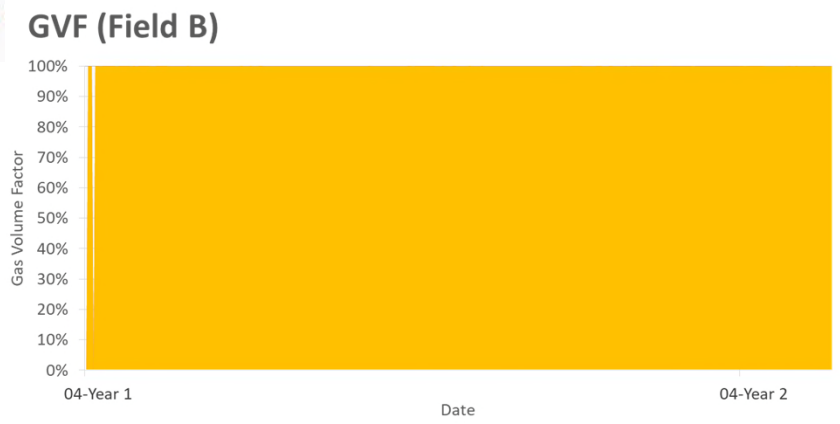


MULTI-PHASE PUMPING PLANTS – REAL CASE APPLICATION
WET GAS BOOSTING FIELD INSTALLATION - FIELD B RESULTS







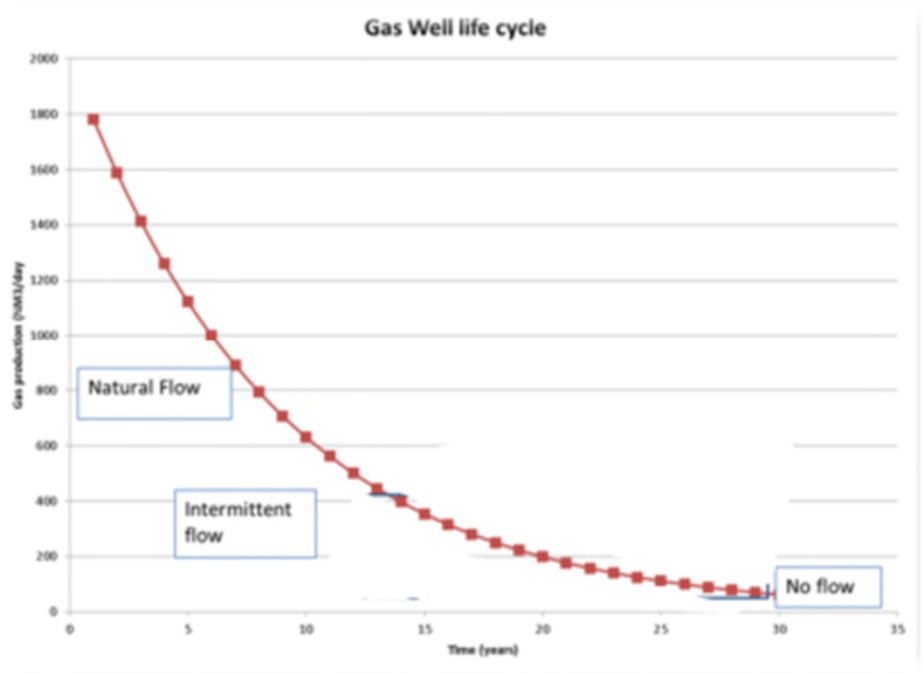


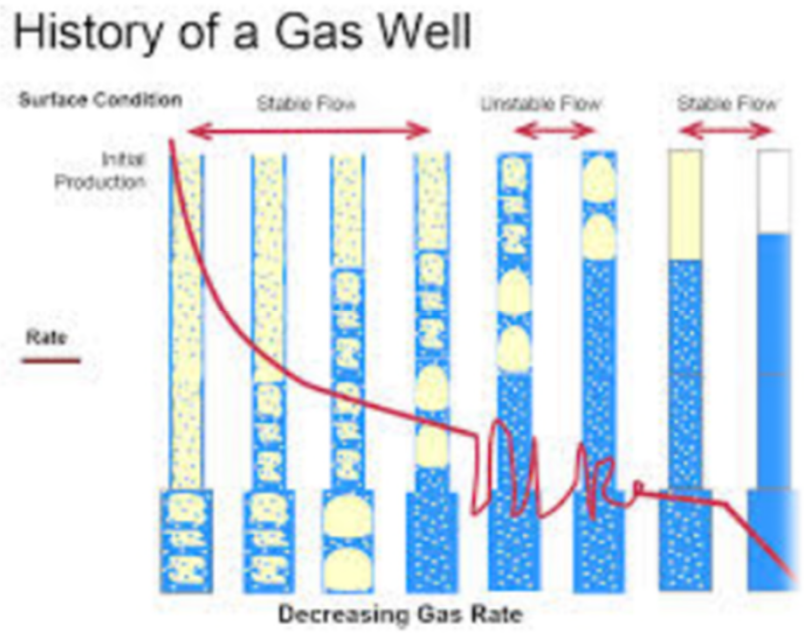
MPP SYSTEMS & WELL PRODUCTION SERVICES
MPP CASE HISTORIES

2. Gas Intermittent Well Application

MULTI-PHASE PUMPING PLANTS – REAL CASE APPLICATION
GAS INTERMITTENT WELL APPLICATION & WELL LIQUID LOADING EFFECT

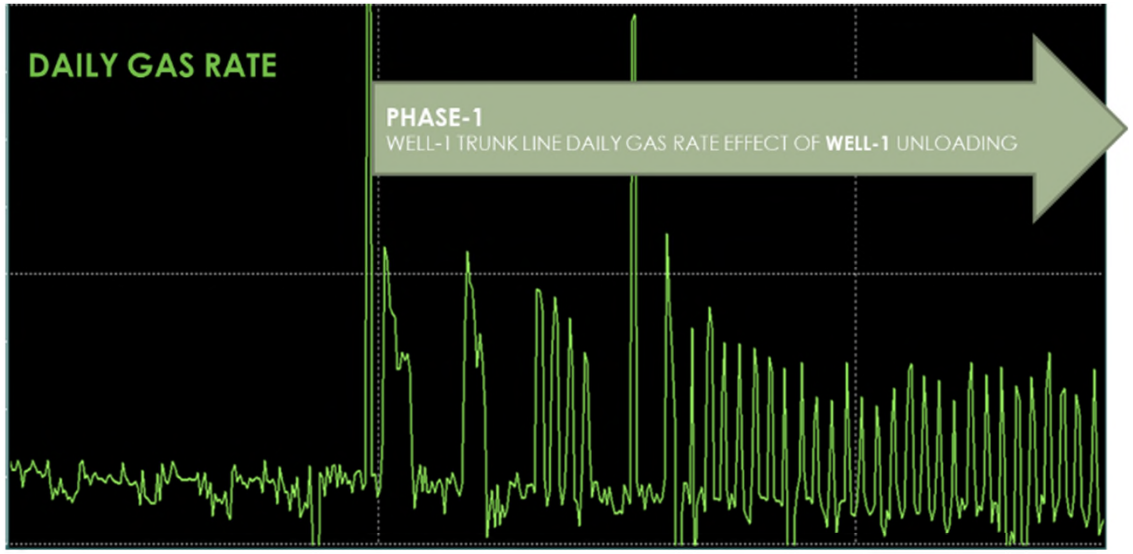
- **Liquid loading effect**: When gas linear flow rate is too low to transport fluids from the wellbore
- **Fluids Accumulate:** Increasing the hydrostatic pressure, due to the liquid level inside the wellbore, which eventually halt the production. This will be followed by a shut-in period, until sufficient pressure is built-up to unload the well.

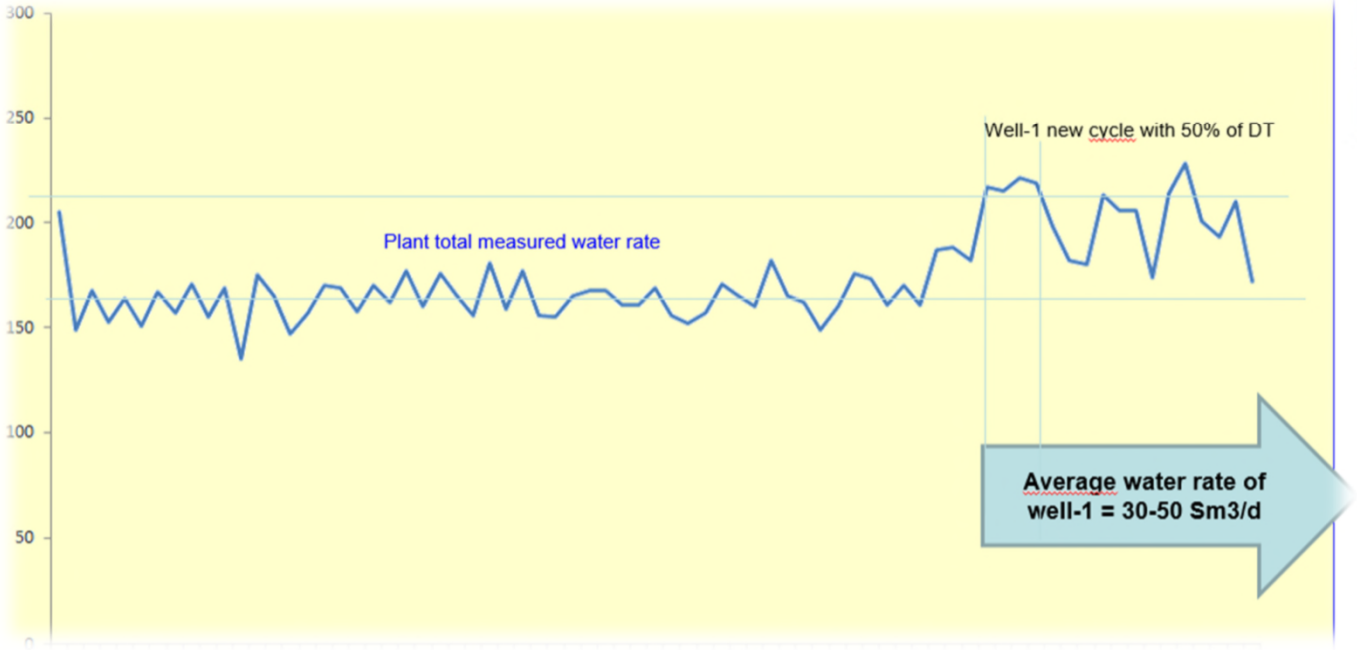




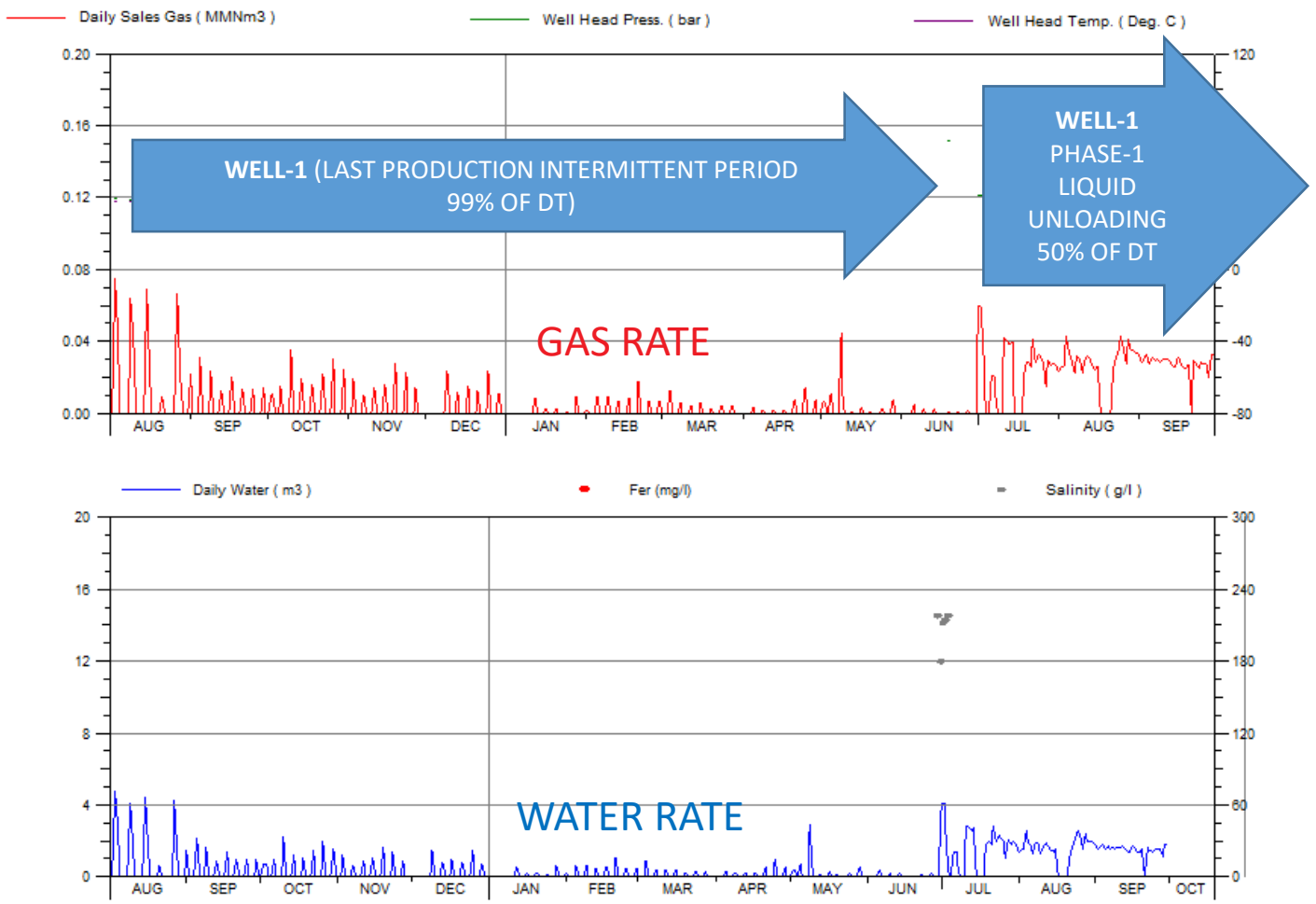
MULTI-PHASE PUMPING PLANTS – REAL CASE APPLICATION
GAS INTERMITTENT WELL APPLICATION & WELL LIQUID LOADING EFFECT

Well-1: liquid unloading test was undertaken to measure well performance and production potential to design the Multi-phase Pumping Plant.





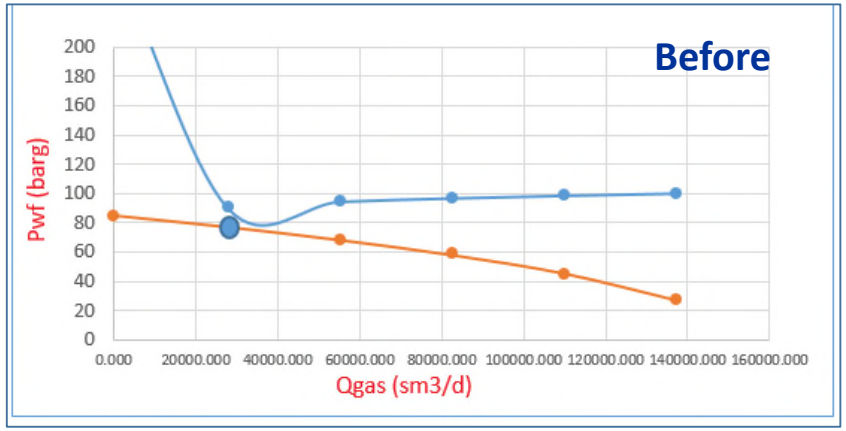
MULTI-PHASE PUMPING PLANTS – REAL CASE APPLICATION
GAS INTERMITTENT WELL APPLICATION & WELL LIQUID LOADING EFFECT



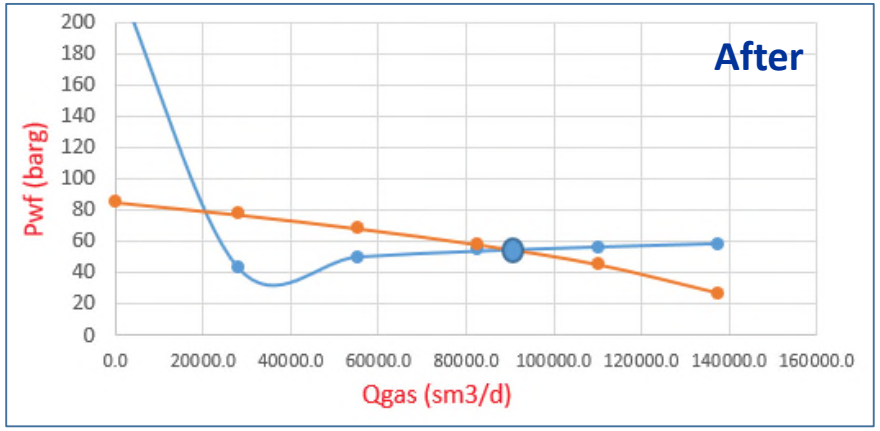
Well-1:

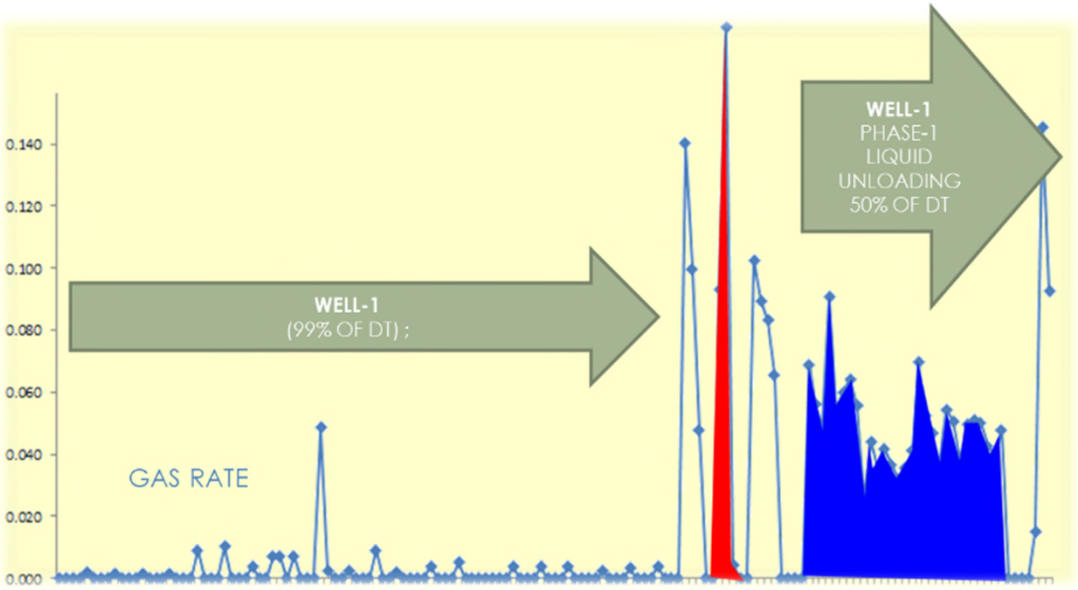
- Production tubing 4 ½
- Gas condensate reservoir
- Intermittent producer well due to liquid loading effect become stable after pump installation
- The well head flowing pressure was effectively reduced by 25 bar.

MULTI-PHASE PUMPING PLANTS – REAL CASE APPLICATION
GAS INTERMITTENT WELL APPLICATION & WELL LIQUID LOADING EFFECT



WELL-1 IPR/VLP
with Multi-Phase Plant

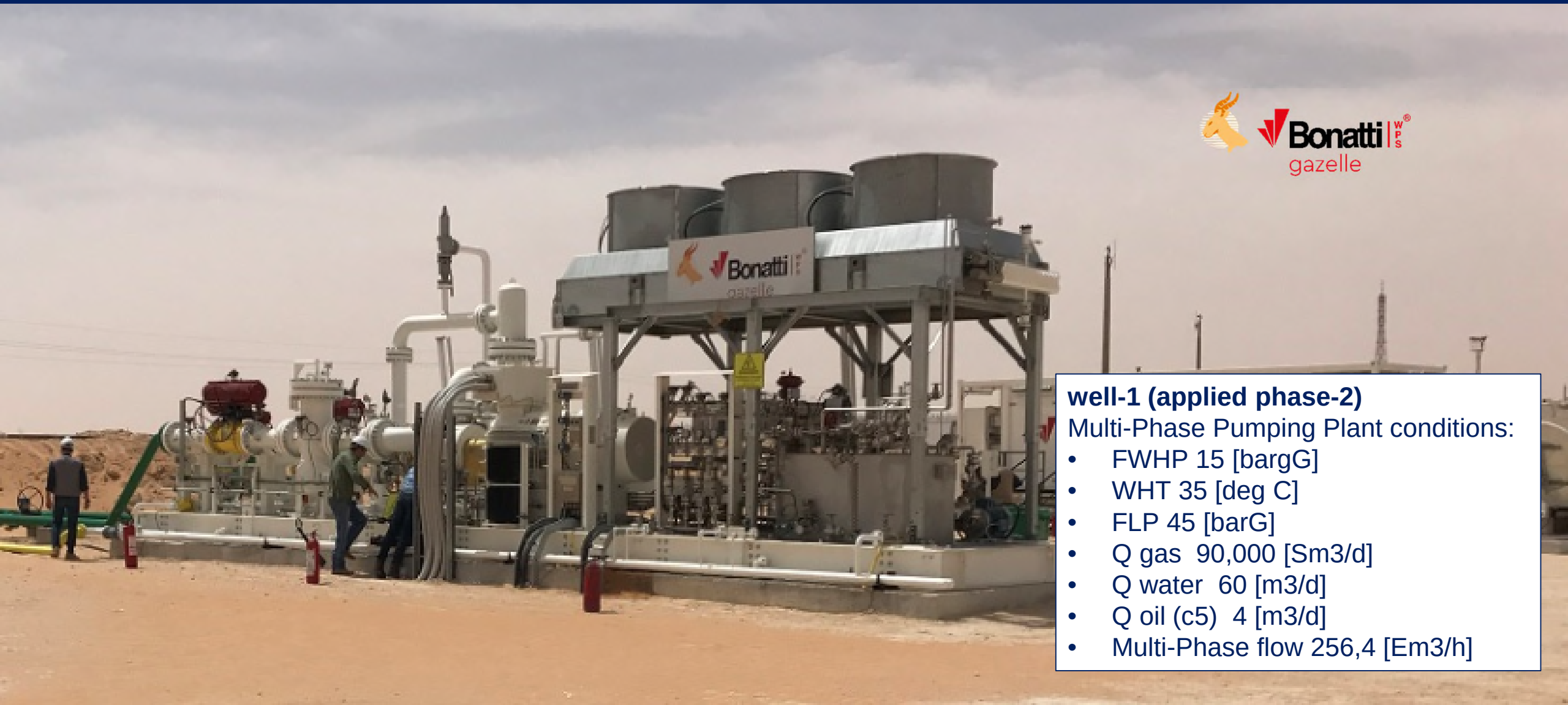




Multi-Phase Plant conditions:

- **FWHP 15 [barG]**
- WHT 35 [deg C]
- **FLP 45 [barG]**
- **Q gas 25,000 → 90,000 [Sm3/d]**
- Q water 60 [m3/d]
- Q oil (c5) 4 [m3/d]

MULTI-PHASE PUMPING PLANTS – REAL CASE APPLICATION
GAS INTERMITTENT WELL APPLICATION & WELL LIQUID LOADING EFFECT



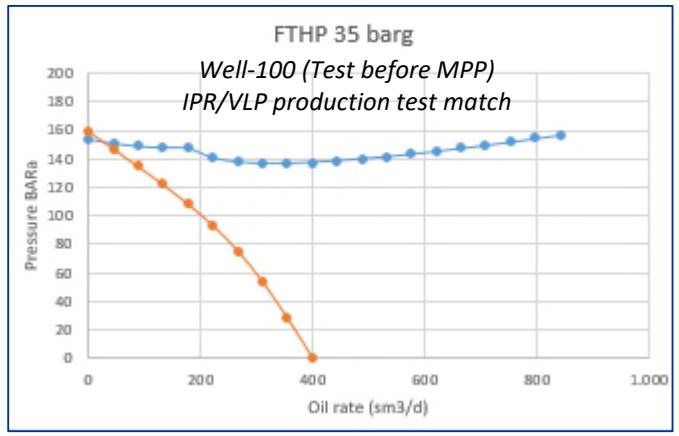
well-1 (applied phase-2)
Multi-Phase Pumping Plant conditions:

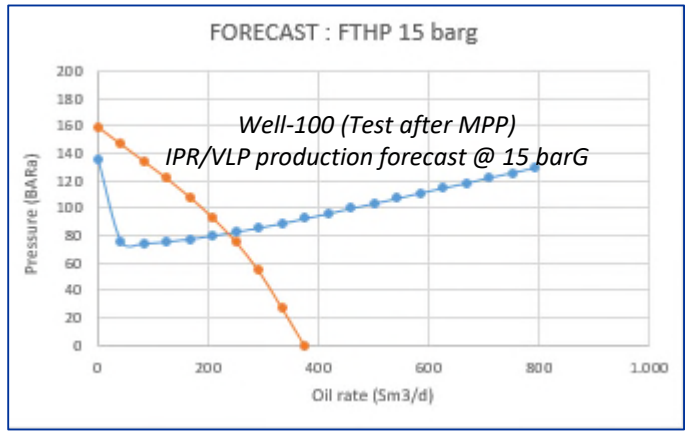
- FWHP 15 [bargG]
- WHT 35 [deg C]
- FLP 45 [barG]
- Q gas 90,000 [Sm3/d]
- Q water 60 [m3/d]
- Q oil (c5) 4 [m3/d]
- Multi-Phase flow 256,4 [Em3/h]

MPP SYSTEMS & WELL PRODUCTION SERVICES
MPP CASE HISTORIES

3. Black-Oil Well Application

MULTI-PHASE PUMPING PLANTS – REAL CASE APPLICATION
BLACK-OIL WELL APPLICATION





Well-100 (production test results before MPP installation)

- **FTHP 35 [barG]**
- WHT 20 [deg C]
- WC 10 [%]
- Total Gor 846 [scf/STB]
- Oil gravity 46 [API]
- Static Reservoir pressure 160 [barA]
- **Q oil 25 [Sm³/d]**
- Q water 5 [Sm³/d]
- **Q gas 4.026 S[m³/d]**
- No artificial lift

Well-100 (production test results after MPP installation)

- **FTHP 15 [barG]**
- WHT 51 [deg C]
- WC 15 [%]
- Static Reservoir pressure 160 [barA]
- **Q oil 237 [Sm3/d]**
- Q water 42 [Sm3/d]
- **Q gas 35.600 [Sm3/d]**
- Draw-Down 45 [%]

Production GAIN (after MPP installation)

- **Oil + 210 [m3/d] = + 1.320 [BOPD]**
- **Gas + 31574 [Sm3/d] = + 1,12 [MMSCFD]**

MULTI-PHASE PUMPING PLANTS – REAL CASE APPLICATION
BLACK-OIL WELL APPLICATION

Well-100 (production after MPP installation)

- FTHP 15 [barG]
- WHT 51 [deg C]
- FLP 37 [barG]
- WC 15 [%]
- Q oil 237 [Sm3/d]
- Q water 42 [Sm3/d]
- Q gas 35600 [Sm3/d]
- Multi-Phase flow 2800 [Em3/d]

WELL PRODUCTION SERVICES

SALT DILUTION, WATER INJECTION & CHEMICAL INJECTION FACILITIES

SALT DILUTION FACILITIES

Bonatti's salt dilution system allows the dilution of the salt solution contained in the oil by injecting high pressure water mixed with chemicals into the well, avoiding the crystallization and accumulation of salt, which can cause clogging of the well's pipelines.

To perform this task, Bonatti has in its fleet different kind of models that can be installed based on client's needs and well requirement:

- *Chemical injection station*
- *Mobile chemical injection Mega-Skid*
- *Mobile chemical injection mini-skids*

CHEMICAL INJECTION STATION (TYPE-P)

The "TYPE-P" chemical injection station is installed where high pressure water-chemical mixture needs to be injected into large number of wells simultaneously.

Technical data:

- Chemical dosage Pump flow rate: up to 33 liter/hr

- Chemical injection Pressure: up to 300 bar

- Design temperature: -5°C +80°C

- Design pressure: 363 bar

- Diesel engine: 100kVA

- Remotely monitored

- Remotely operated (VLR)

- Data acquisition system

MoC: water line C.S

Chemical line S.S

CHEMICAL INJECTION STATION (TYPE-P)

"TYPE-P" chemical injection station is installed where high pressure water-chemical mixture needs to be injected into large number of wells simultaneously.

The main features of the "TYPE-P" chemical injection station are:

- ***High pressure water filtration unit composed of:***
  - ***no. 2 basket strainers (one running and one stand-by) having filtration grade of 10microns***
  - ***manual valves ,***
  - ***pneumatic valves,***
  - ***pressure transmitters, safety valves etc.***
- ***Chemical dosing unit composed of:***
  - ***no. 6 chemical tanks (1000 liter each) equipped with level indicators,***
  - ***no. 12 dosing pumps. N° 2 serving each tank (one running and one stand-by),***
  - ***no. 6 chemical agitators,***
  - ***no. 6 flow transmitters,***
  - ***no. 6 calibration pot,***
  - ***valves, pressure transmitters, safety valves etc.***
- ***N°1 Static Mixer***
- ***N° 4 water distribution manifold skid (n° 5 fingers each) quipped with flow transmitters***
- ***N° 1 control cabin equipped with Ac , air compressor room, toilet for operators***
- ***N°2 diesel generator 100kVA (one running and the other as back-up)***
- ***N°1 diesel tank for generators***

<u>Chemicals are provided by client</u>

CHEMICAL INJECTION STATION (TYPE-P)

Finger Manifold SKID

Chemical tanks

Static mixer

Filtration Skid

CHEMICAL INJECTION STATION (TYPE-EA)

The "TYPE-EA" chemical injection station is installed where high pressure water-chemical mixture needs to be injected into large number of wells simultaneously.

<u>Technical data</u>:

- Chemical dosage Pump flow rate: up to 30 liter/hr

- Chemical injection Pressure: up to 300 bar

- Design temperature: -5°C +80°C

- Design pressure: 330 bar

- Diesel engine: 110kVA

- Remotely monitored

- Remotely controlled (VLR)

- Data acquisition system

<u>MoC</u>: water line C.S

Chemical line S.S

CHEMICAL INJECTION STATION (TYPE-EA)

The "TYPE-EA" chemical injection station is installed where high pressure water-chemical mixture needs to be injected into large number of wells simultaneously.

The main features of "TYPE-EA" chemical injection station are:

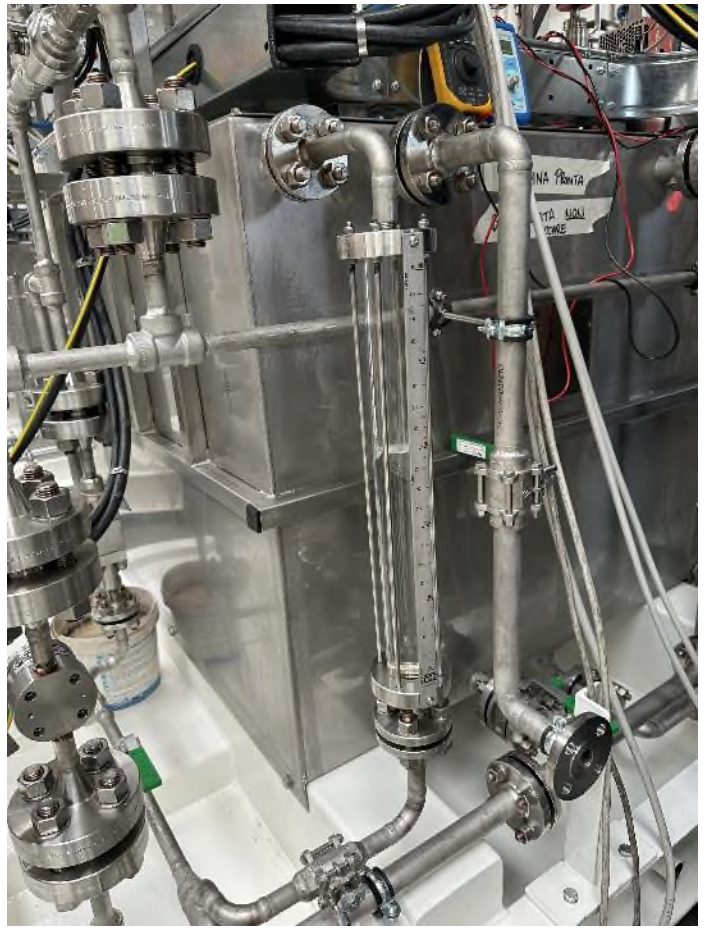
- ***no. 1 High pressure water filtration skid composed of:***
  - ***no. 2 cartridge strainers (one running and one stand-by) having filtration grade of 2microns***
  - ***manual valves,***
  - ***pneumatic valves,***
  - ***pressure transmitters, safety valves etc.***
- ***no. 4 Chemical dosing skids, each skid composed of:***
  - ***no. 1 chemical tank (1000 liters) equipped with level indicators,***
  - ***no. 2 dosing pumps (one running and one stand-by),***
  - ***no. 1 chemical agitator,***
  - ***no. 1 flow transmitters,***
  - ***no. 1 calibration pot,***
  - ***valves, pressure transmitters, safety valves etc.***
- ***no.1 Static Mixer***
- ***no. 4 water distribution manifold skid (no. 5 fingers each) quipped with flow transmitters***
- ***no. 1 control cabin equipped with Ac , air compressor room, toilet for operators***
- ***no.2 diesel generator 100kVA (one running and the other as back-up)***
- ***no.1 diesel tank for generators***

<u>Chemicals are provided by client</u>

CHEMICAL INJECTION STATION (TYPE-EA)

Chemical dosing skid

Calibration pot



CHEMICAL INJECTION STATION (TYPE-EA)

Finger Manifold SKID

Filtration Skid

MOBILE SALT DILUTIONMEGA SKID (TYPE-C)

The "TYPE-C" mobile mega skid is a skid-mounted complete water injection plant easily transportable from one site to another.

<u>Technical data</u>:

- Chemical dosage Pump flow rate: up to 20 liter/h

- Chemical injection Pressure: up to 400 bar

- Water Piston pump flow rate: 30 lit/min

- Design temperature: -5°C +80°C

- Operating pressure: up to 600 bar

- Diesel engine: 100kVA

- Remotely monitored

- Remotely controlled (VLR)

- Data acquisition system

<u>MoC</u>: water line C.S

Chemical line S.S

MOBILE SALT DILUTIONMEGA SKID (TYPE-C)

With this type of installation, the injection is generally done into a single well therefore no high-pressure manifold skid is foreseen.

The main features of the "TYPE-C" chemical injection mega skid are:

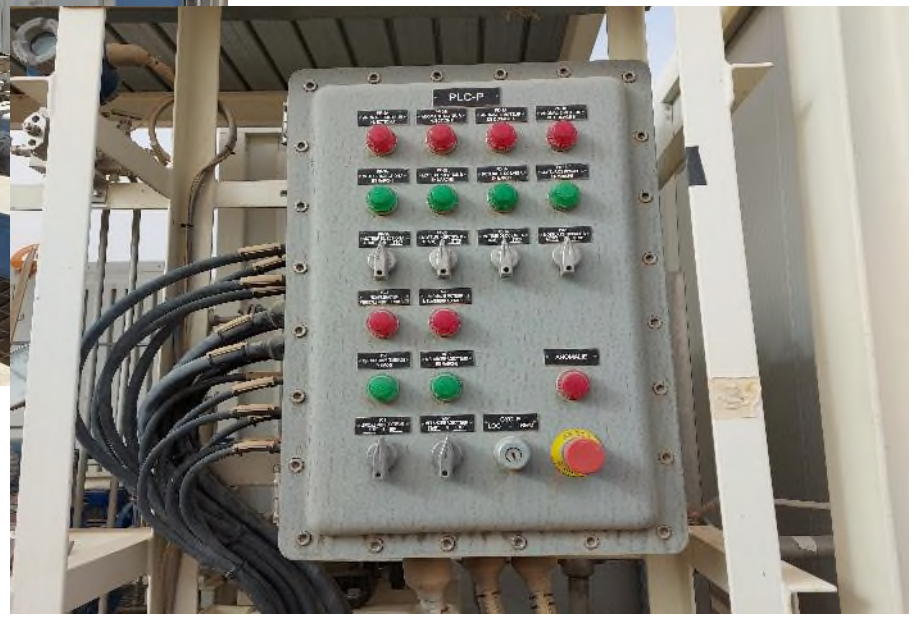
- ***no. 1 water booster pump***
- ***no. 2 cartridge strainers (one working – one standby)***
- ***no. 1 Chemical dosing unit composed of:***
  - ***no. 1 chemical tank (1000 liter each) equipped with level indicators,***
  - ***no. 2 dosing pumps(one running and one stand-by),***
  - ***no. 1 chemical agitator,***
  - ***no. 2 flow transmitters,***
  - ***no. 1 calibration pot,***
  - ***valves, pressure transmitters, safety valves etc.***
- ***no. 2 high pressure water pumps for water injection into well***
- ***no. 1 control cabin equipped with Ac***
- **** no. 1 filtration system***
- **** no. 2 diesel generator 100kVA (one running and the other as back-up)***
- **** no. 1 diesel tank for generators***
- **** no. 1 water tank of 50m3***

(*) To be agreed with client

<u>Chemicals are provided by client</u>

MOBILE SALT DILUTIONMEGA SKID (TYPE-C)

High pressure piston pump.



On-board local JB

Calibration pot

MOBILE SALT DILUTIONMEGA SKID (TYPE-C)

Chemical tank with agitator

Instrumentation

Diesel generator

MOBILE SALT DILUTIONMEGA SKID (TYPE-A)

The "TYPE-A" mobile mega skid is a skid-mounted complete water injection plant easily transportable from one site to another.

<u>Technical data</u>:

- Chemical dosage Pump flow rate: up to 25 liter/h

- Chemical injection Pressure: up to 12 bar

- Water Piston pump flow rate: 30 lit/min

- Design temperature: -5°C +55°C

- Operating pressure: up to 600 bar

- Diesel engine: 100kVA

- Remotely monitored

- Remotely controlled (VLR)

- Data acquisition system

<u>MoC</u>: water line C.S

Chemical line S.S

MOBILE SALT DILUTIONMEGA SKID (TYPE-A)

With this type of installation, the injection is generally done into a single well therefore no high-pressure manifold skid is foreseen.

The main features of the "TYPE-A" chemical injection mega skid are:

- ***no. 1 water booster pump***
- ***no. 2 cartridge strainers (one working – one standby)***
- ***no. 1 Chemical dosing unit composed of:***
  - ***no. 1 chemical tank (1000 liter each) equipped with level indicators,***
  - ***no. 1 dosing pump,***
  - ***no. 1 chemical agitator,***
  - ***no. 2 flow transmitters,***
  - ***no. 1 calibration pot,***
  - ***valves, pressure transmitters, safety valves etc.***
- ***no. 2 high pressure water pumps for water injection into well***
- ***no. 1 control cabin equipped with Ac***
- **** no.1 filtration system***
- **** no.2 diesel generator 100kVA (one running and the other as back-up)***
- **** no.1 diesel tank for generators***
- **** no.1 water tank of 50m3***

(*) To be agreed with client

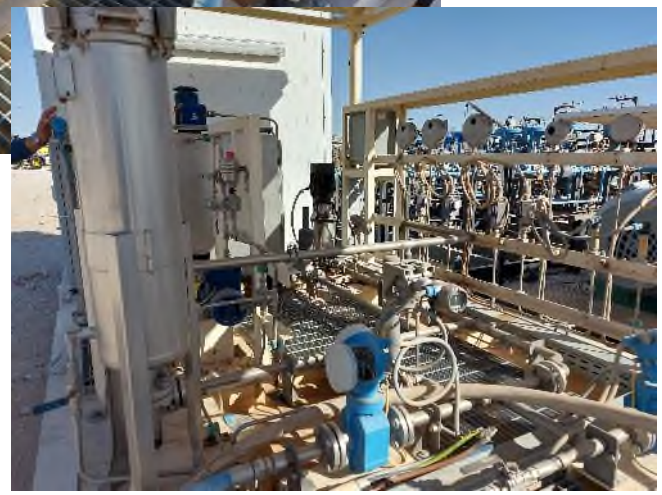
<u>Chemicals are provided by client</u>

MOBILE SALT DILUTIONMEGA SKID (TYPE-A)

Strainers

Chemical tank

High pressure water pumps



Flow meter

MOBILE SALT DILUTIONMEGA SKID (TYPE-O)

The "TYPE-O" mobile skid is a skid-mounted chemical injection mini plant easily transportable from one site to another.

<u>Technical data</u>:

- Chemical dosage Pump flow rate: up to 5 liter/h

- Chemical injection Pressure: up to 600 bar

- Design temperature: -5°C +80°C

- Operating pressure: up to 400 bar

- Diesel engine: 110kVA

- Manual control

<u>MoC</u>: Stainless Steel

MOBILE SALT DILUTIONMEGA SKID (TYPE-O)

With this type of installation, the chemical is generally injected into pressurized water pipeline provided by client.

This system is a completely manual configuration, therefore can be operated by client's personnel (after receiving training from Bonatti's staff).

The main features of the "TYPE-O" chemical injection skid are:

- ***no.1 chemical tank of maximum 500 liters capacity***
- ***no.1 Chemical dosing pump:***
- ***Valves, instrumentations and safety devices***
- **** no. 1 control cabin equipped with Ac***
- **** no.2 diesel generator 110kVA (one running and the other as back-up)***
- **** no.1 diesel tank for generators***

(*) To be agreed with client

<u>Chemicals are provided by client</u>

MOBILE SALT DILUTIONMEGA SKID (TYPE-O)

Multiple installation

Single installation

Flow rate regulator

WATER INJECTION FACILITIES

- *Bonatti's water injection systems are used to inject water into wells to increase their internal pressure, stimulating the production especially in terms of oil recovery.*
- *To perform this task, Bonatti has in its fleet different kind of models that can be installed based on client's needs and well requirement:*
  - *Pump type TW 708*
  - *Pump type TW 600*
  - *Pump type PMST50S*
  - *Pump type PMH100/9A*

HIGH PRESSURE WATER INJECTION PUMPS

The high-pressure water pumps are used to inject water into wells to increase their internal pressure, stimulating the production especially in terms of oil recovery.

Technical data:

Diesel engine driven

Pump flow: up to 33 m3/hr

Pressure: up to 350 bar

Diesel engine: 600HP/440kw

Remotely monitored

HIGH PRESSURE WATER INJECTION PUMPS

PUMP TYPE TW 600:

Diesel engine driven

Nominal flow rate – 33mc/h

Maximum allowable working pressure – 350bar

PUMP TYPE TW 708:

Diesel engine driven

Nominal flow rate – 60mc/h

Maximum allowable working pressure – 150bar

HIGH PRESSURE WATER INJECTION PUMPS

PUMP TYPE PMST50S :

Electric engine driven – 110kw

Nominal flow rate – 50mc/h

Maximum allowable working pressure – 63bar

PUMP TYPE PMH100/9A :

Electric engine driven – 350kw

Nominal flow rate – 144mc/h

Maximum allowable working pressure – 68bar

GAS BOOSTING, GASJACK AND GAS LIFT

GAS COMPRESSOR - Low Pressure and High Pressure

The Scope of this section is to provide to Client the status of the market research that Bonatti WPS is performing for equipment able to be used for “fast track” production solutions both for Gas and Oil wells and network development and enhancement.

Technology considered in this market research:

- **Reciprocating Compressors driven by Gas Engine**

Are available different sizes of boosting compressors, with gas engine and with electric motor.
The treatable flow rates vary between 0,2 and 1 MMSCM/D. Pressure is expressed in bar.

Delivery time on site are based on OEM/Vendor availability and normal transportation time and might be modified due to market conditions.

BONATTI is able to propose the procurement, installation and start-up with the following options:

- ***EPC + O&M solution with separate contract***
- ***Rental with O&M (36 months minimum period)***

GAS BOOSTING, GASJACK AND GAS LIFT

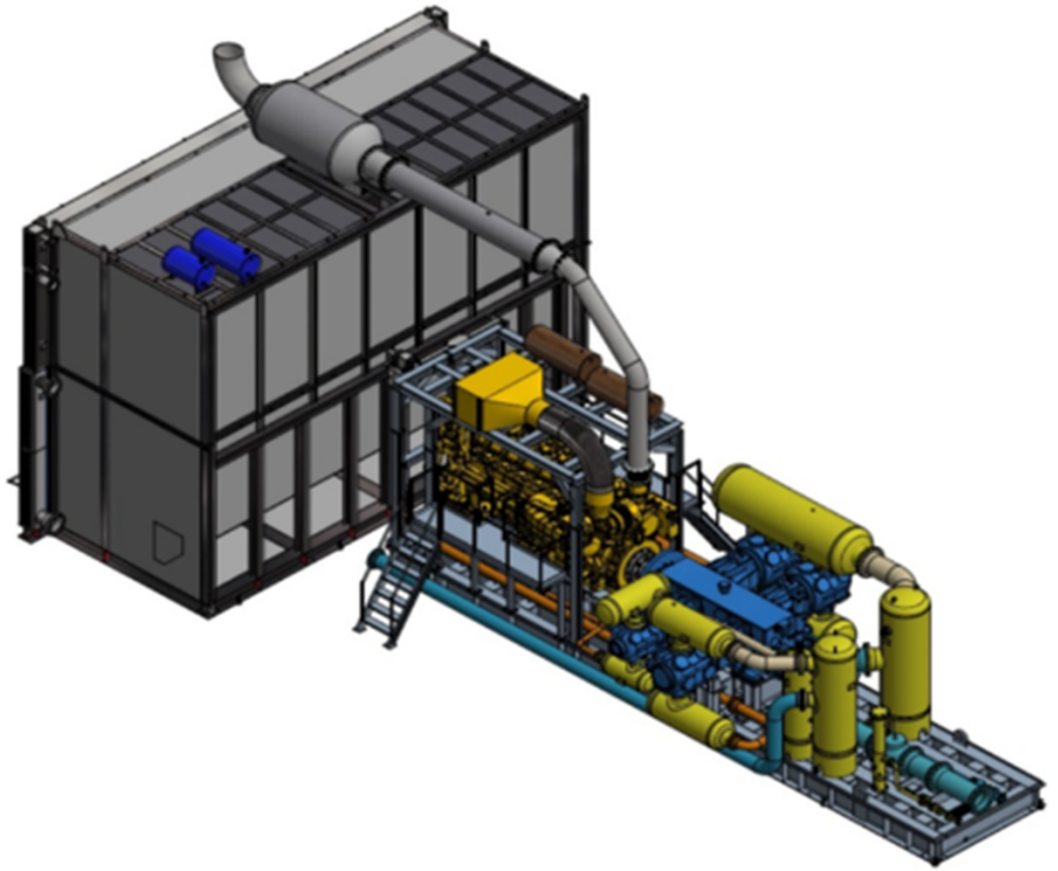
Bonatti decided to enlarge their fleet of Well Production Services in Algeria with no. 2 units of gas- compression having the following characteristics:

⇒ **Main range of application:**

- Gas Flowrate = 200.000 SCM/D
- P_{in}= 1,5 bar – P_{out}= 35 bar

⇒ **Main features:**

- Reciprocating gas engine-driven compressor
- Main power = Waukesha - 1,2MW
- Suction pressure: 1,5 barg – 23 psig
- Discharge pressure: 35 barg – 505 psig
- Total Inlet Flow: 0,2 MMSCMD – 7 MMSCFD
- N° 3 stage with n° 4 cylinders
- Compressor rated speed = 1200 rpm
- Compressor nominal ratio = 23

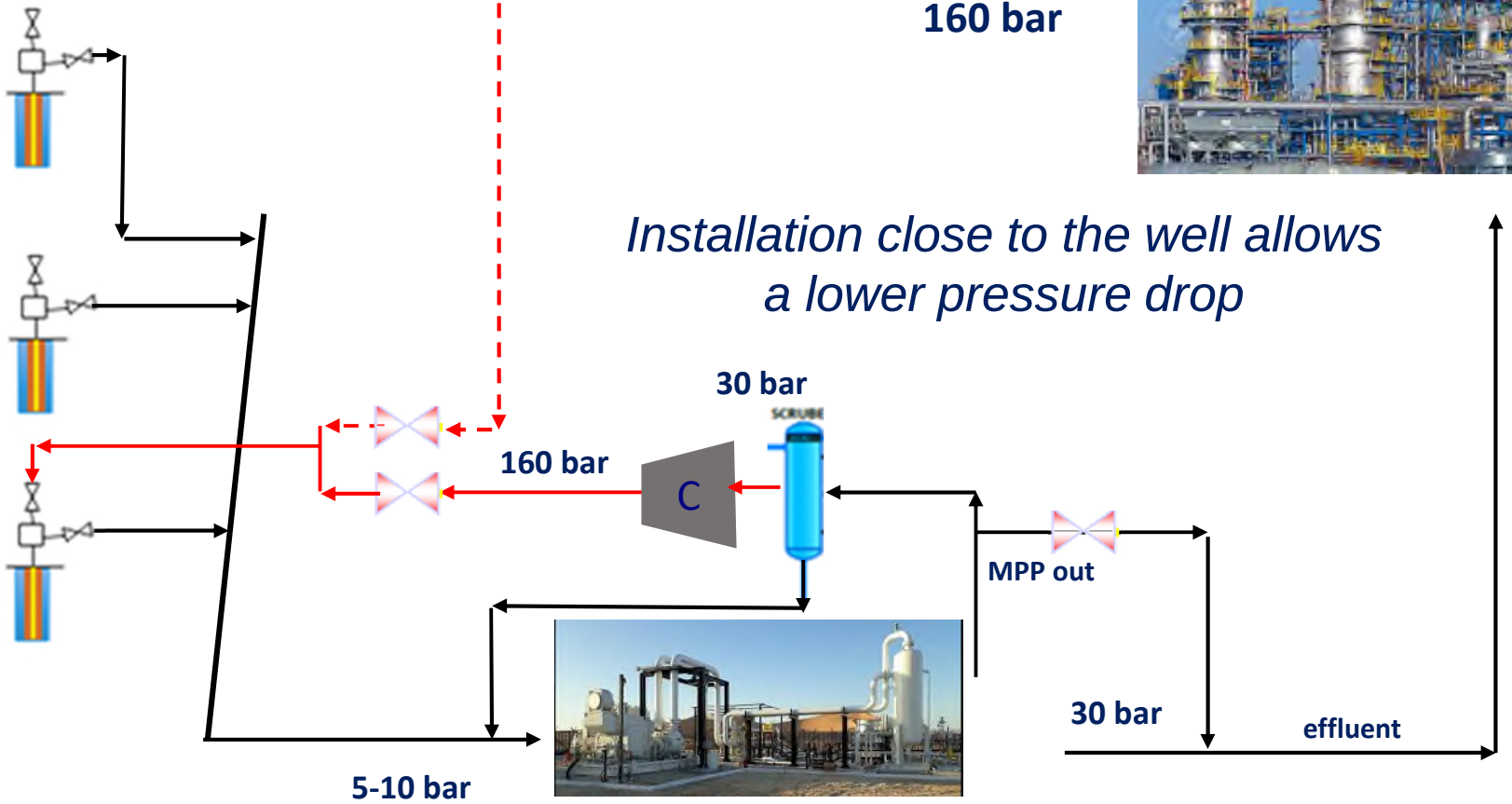


GAS BOOSTING, GASJACK AND GAS LIFT

GAS LIFT combined with MPP application

Gas-lift 160 bar

Installation close to the well allows a lower pressure drop

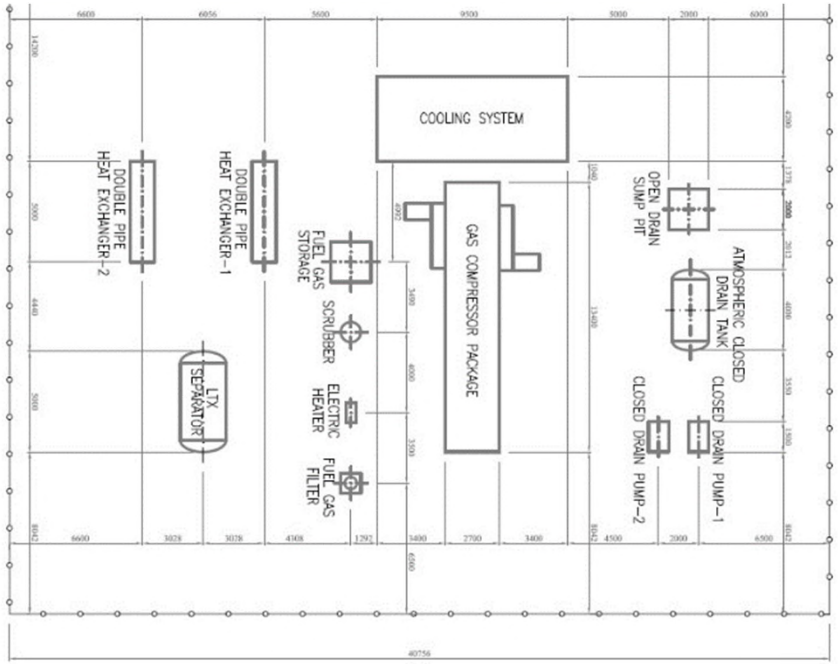


FLARE GAS RECOVERY SYSTEM AND VRU

FGR Main goal: flared gas cutting with both fuel gas and semi-stabilized condensate production

The system is connected directly to the flare pipeline (with Tie-In connection if possible or Hot-Tap).

Dedicated design based on client specifications and selection of equipment with fast mobilization and installation: gas compressor, gas cooler, condensate separation and treatment, auxiliaries.



CONCLUSIONS

Bonatti Well Production Service division is able to provide a wide range of services in support of oil and gas production under highly flexible scheme (on rental or acquisition basis).

The proposed services cover a wide range of operations coming from multiphase pumping, to the reinjection of fluids in the reservoir, to oil and gas pre-treatment up to energy recovery systems.

In order to better illustrate the various services offered and focus attention on those most interesting please visit:

CONTACT US

DISCOVER OUR SERVICES

or select: BONATTI Youtube Channel

Bonatti also provide maximum availability to study real cases and/or to propose solutions to operating problems encountered and suggested by the Client.

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