IloT Supporting Enhanced Oil Recovery at Tatweer Petroleum

Tommy McKenzie – GM Field Development
Facts About Bahrain Field

- First Oil Well in Southern Arabian Gulf – Well # 1 started producing in 1932 at Jebel Al Dukhan
- Operated by Bahrain Petroleum Company (BAPCO)
- Started with a production of 9500 bopd
- Production reached a peak of 79,000 bopd in 1970
- After a steady decline, it had reached a low of around 26,000 bopd in 2009
- The field was producing 900 mmcf/d of non-associated gas in 2009
- Mature field, thought to be exhausted
- Tatweer Petroleum was established in 2009 to revitalize the field
Tatweer Petroleum – Brief Background

• Formed in 2009 to revive the Bahrain mature field
• To increase oil & gas production through use of latest enhanced oil recovery techniques
• Meet Bahrain’s future energy needs
• Develop Bahrain’s work force with world class technology & skills
Tatweer Shareholders

Nogaholding

- Business & Investment Arm of National Oil & Gas Authority (NOGA)
- NOGA is responsible for Regulation, Policy and Control of Hydrocarbon assets in the Kingdom of Bahrain

Occidental Petroleum

- International Oil & Gas Exploration & Production Company
- World-wide operations, specializes in Enhanced Oil Recovery (EOR)

Mubadala Petroleum

- International Oil & Gas Exploration & Production Company
- Subsidiary of Mubadala Development Company
Tatweer Petroleum – Targets

- Significantly increase oil production and gas deliverability capacity
- Apply EOR techniques to enhance production
- Drill hundreds of new wells
- Refurbish existing facilities & construct additional facilities
- Develop skillsets of Bahrain’s work force
- Align with Bahrain’s Economic Vision 2030
Tatweer Values

**People**
We will foster a passionate and inspired workforce by providing the opportunity to learn and advance in our performance-driven organization.

**Diversity**
Our cultural, business and technical diversity is our strength; we accomplish more as a team than as individuals.

**Health, Safety and Environment**
We strive to provide a safe workplace and are committed to the protection of the environment.

**Social Responsibility**
We earn the respect and trust of the stakeholder communities through partnerships and our actions.

**Integrity**
We are transparent and accountable for our actions.

**Innovation**
We deliver new and creative solutions to maximize the value of the Bahrain Field.
Challenges

- Tight deadlines to achieve milestones
- Limited time for construction & deployment of assets critical to meet milestones
- Field, wells & data sources spread over 150 sq. km
- Complex and dynamic terrain
- Field infrastructure does not support conventional methods of surveillance
- Contain capital costs
Challenges

- Virtually no automation in place at start
- Real time monitoring and optimizing processing facilities
- Accurate and timely measurement of production by well
- Surveillance of artificial lift methods
- Reporting thousands of data inputs daily
- Minimizing downtime
- Reducing maintenance and operations costs
Innovative Approach, the need of the Hour via Industrial Internet of Things
Tatweer Digital Canopy

Smart Oil Field Enabled by IIoT

- Mobile Drilling Rig
- CWE
- Video Monitoring
- Emergency Response
- Field Office
- CWE - Collaborative Work Environment
- Work Vehicle
- Central Control Room
- RTU, PLC
- PD
Well Head Surveillance System Architecture

Control Room
- Production Data
- Reports
- Analytics
- Diagnostics

Field
- Pressure
- Temperature
- Flow

IIoT Wireless Field Sensors

Radio

Gateway

Wireless Field Sensors
To complement the Digital Canopy in the field, Tatweer has implemented a robust BPM platform that further enhances both human centric and human to machine centric automations and process flows.

- 50 legacy or manual business processes were migrated to BPM platform in 2015.
- BPM implementation has reduced turnaround time, increased safety and vastly improved processes efficiency.
- BPM framework is helping develop horizontal workflows across multiple stand alone or disconnected systems.
Solution – What was achieved

- Wireless technology along with fiber optics transmits volumes of data daily
- Oil production was increased 70% (2015 rate is highest since 1975)
- Gas production capacity was doubled
- Operating cost decreased 30% after significant infrastructure growth
- Capital cost of adding new wells decreased each year
- Enhanced oil recovery techniques have been implemented
- Team members coordinate, solve problems and implement new ideas expeditiously
- Safety and environmental metrics improved significantly
Summary

- Increasing production had many challenges including start-up delays, cost, enhancing workforce skills, and HSE risks
- An automation strategy based on surveillance, analysis, and optimization can lower operating and maintenance costs, improve HSE performance, and increase production
- Implementing Wireless sensing for well surveillance assisted in overcoming the challenges
- “Can do” attitude of workforce utilizing automation and many other innovations has significantly increased Bahrain’s oil and gas production