

## Presentation Title: Optimizing an unconventional field via RTPO Presenter(s): Joannah Otashu Alex Lymperiadis Kevin Wade ALRDC Gas Lift Workshop June 20-23, 2022





## Agenda

- Field & Solution snapshot
- Workflow
- Modelling & Optimization
- Challenges
- RTPO Dashboard
- Solution value









## Field and Solution Snapshot

#### Field

- 181 wells (130 150 active)
- Production
  - Condensate: 7,200 b/d
  - Gas: 180 MMscf/d
  - Water: 7,500 b/d
- Gas Lift, Natural, GAPL
- Unconventional field Delivered [RTPO]
- Data acquisition & validation system
- Automatic model update
- Automatic daily optimization
- Dashboard for:
  - Display of optimal set points
  - Input for scenario configuration





### Workflow Overview





### System architecture





#### gPROMS Process





6/28/2022



### **Integrated Asset Optimization**

#### **Production Network**

- 181 wells (130 -150 active)
- 10 Well pads
- Separator

#### Facilities

- Separation
- Compression —
- Condensate stabilization

#### Objective

- Maximize condensate

#### **Decisions:**

- Gas Lift rate
- Choke pressure drop
- Well Status
- # of parallel flowlines

#### Constraints

- Max total gas lift
- Max well gas rate —
- Min pipeline velocities
- Max total gas/water rates (equipment capacities) \_
- Max condensate RVP specification







### Challenge: Update field data

#### gPROMS Process Model:

- Configured to receive all field data
- Data collected by digital solution into SQL database \_
- SQL database updated at the onset of each optimisation or VLP generation
- Thus, model always contains latest field data when performing an optimization







## Challenge: Well Modelling – VLP Creation

#### For Gas lifted and Naturally flowing wells:

- gPROMS Process Model template created
- Template automatically populated with well data to model the well tubing from bottomhole to wellhead for each well
- Calibrated model to known well tubing pressure drop
  - Fitted well tubing pressure drop parameters to match field bottomhole pressure
- Produced well bore performance curves (VLP) via Global Sensitivity Analysis (multi-core module)







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## Challenge: Data Validation

#### Data from instrumentation can be "problematic"

- Out of range data ,i.e. negative water cut, etc.
- Within valid range but non-sensical, i.e. zero rates (see plots)

Any online solution needs to be robust enough to handle these conditions

## To avoid faulty measurements causing process model calculation errors:

- Sensible min and max values were set for all input data
- Logic was defined for action to be taken when data bounds were violated
- All data values were screened and logic followed before sending data to the model



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#### Challenge: Data Validation

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	5 Current Operation	Production	Water Rate	0	200	m3/d	shut-in well	report			Operating values: 0.4 - 65	
	6 Current Operation	Production	Gas Rate	0	300	e3m3/d	shut-in well	report			Operating values: 10 - 190	
	7 Current Operation	Production	FWHP	1800	6200	kpa g	report	report			Operating values: 2000 - 5920	
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	9 Current Operation	Production	FBHP			kPag						/
- 4	10 Current Operation	Production	Gas Lift Injection rate	0	40	e3m3/d	set = 0	report			Operating values: 0 - 20	
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- 3	13 Current Operation	Production	PAD pressure	2000	3500	kPag	report	report			Operating values: 2200 - 2850	
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	16 Current Fluid Analysis	Process conditions	Pressure	1900	4000	kPag.	set - average Pressure	set - average Pressure			Operating values: 2000 - 3500	
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	22 Optimization	WELL HEAD CHOKE	No more than	No less than	10000	kPa .	set = no less than	report				
	23 Optimization	Gas Lift	Keep fixed at	a	40	b/festa	set # 0	report				
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- 3	23 Optimization	Gas Lift	No more than	No less than	40	olm1/d	set = no less than	report				
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	27 Optimization	Production Constrains	Maximum Mixture Velocity		200	m/s	report	report				
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## Challenge: IPR Curves

- IPR curve data provided by customer •
- Nearby well fracturing caused increase in liquid rate, for which IPR gives FBHP < WHP •
- Solution: IPR curves were checked daily and adjusted, where necessary, based on FBHP obtained from the well simulation •





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## **Challenge: Velocities**

- Field needed minimum velocity in key pipelines to avoid slugging •
- Solution: # of parallel pipelines for all flowlines was included as a decision variable. If constraint violated, then 1 or more pipelines were closed. ۲







#### RTPO Dashboard – Login page







#### RTPO Dashboard – Real-time Schematic





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### RTPO Dashboard – Daily Optimization Results

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### RTPO Dashboard – What-if Optimization settings

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ll wellpad	•									Last updated on
onstrai	nts and Settings									
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Maximum Li	uid Rate (M3/D)			Not Used - define in s	eparator	Maximum Gas Rate (E	3m3/d)	Not Used -	define in separator	Maximum Gas Lift Gas injection (E3 850.00
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		Status	Shut-in?	Shut-in Allowed?			Well Head Choke			Gas Lift
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#### RTPO Dashboard – Well Settings/Inputs

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	ll level							R
<u>OW 10-14</u> ~								
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Bottom Hole (°C)		5 79	0	50	0.0457	_	-500 -	
00		47.7	0.43	50				
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#### RTPO Dashboard – Well optimal point

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<u>0W 02-12</u> ¥			
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iquid Rate (M3/d) 8.0498971282864 7.983369754129 7.7834175649858	FBHP (kPa g) 0 500 1000	FBHP (kPa g) 12,000 10,000	
iquid Rate (M3/d) 8.0498971282864 7.983369754129 7.7834175649858 7.4489181671229	FBHP (kPa g) 0 500 1000 1500	FBHP (kPa g) 12,000 10,000 8,000	
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iquid Rate (M3/d) 8.0498971282864 7.983369754129 7.7834175649858 7.4489181671229 6.9779595899311 6.3677746550157 5.6146415967609 4.7137418225123	FBHP (kPa g)           0           500           1000           1500           2000           2500           3000           3500	FBHP (kPa g) 12,000 10,000 8,000 6,000 4,000	
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Liquid Rate (M3/d) 48.0498971282864 47.983369754129 47.7834175649858 47.4489181671229 46.9779595899311 46.3677746550157 45.6146415967609 44.7137418225123 43.658960801147 42.4426103307111 41.0550380232558	FBHP (kPa g)           0           500           1000           1500           2000           2500           3000           3500           4000           4500	FBHP (kPa g) 12,000 10,000 8,000 6,000 4,000 2,000 0 0 10 10 10 10 10 10 10 1	





### Solution value to the Client

- Value recognized by operator from 12-month field test
  - 13% increase in condensate production
  - ~50% reduction in gas lift gas used (~\$3.9 M saving per year)
    - Operator bought most gas lift gas from 3<sup>rd</sup> party
  - Availability of an up-to-date model for immediate field re-optimization when upsets occur (e.g. compressor trip)
  - Better understanding of impact of planned changes

#### What-if scenarios explored:

- Gas/water/condensate constraints during maintenance
- Opening/closing pipelines
- New wells coming on-line
- Shutting down wells
- Lowering separator pressure
- Changing pipeline velocity limits









# Thank You ANY QUESTIONS?

