

INCREASING ALWYN NORTH PRODUCTION BY A SIMPLE, LOW COST PROJECT

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AIMS OF PRESENTATION

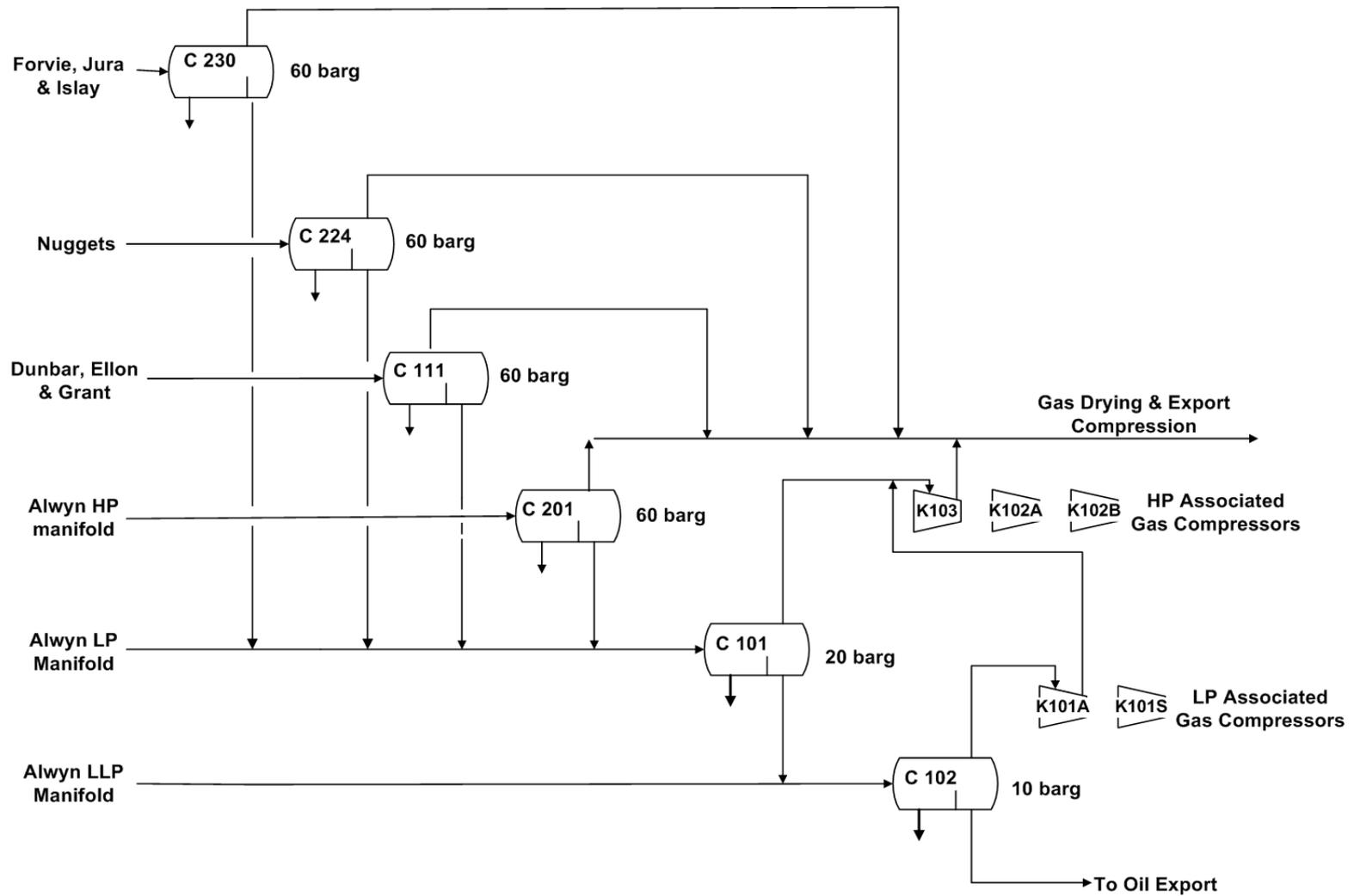
- Describe a low cost, easy to implement brownfield project with significant benefits.
- Explain some of the challenges, some unexpected.

ALWYN NORTH PLATFORM



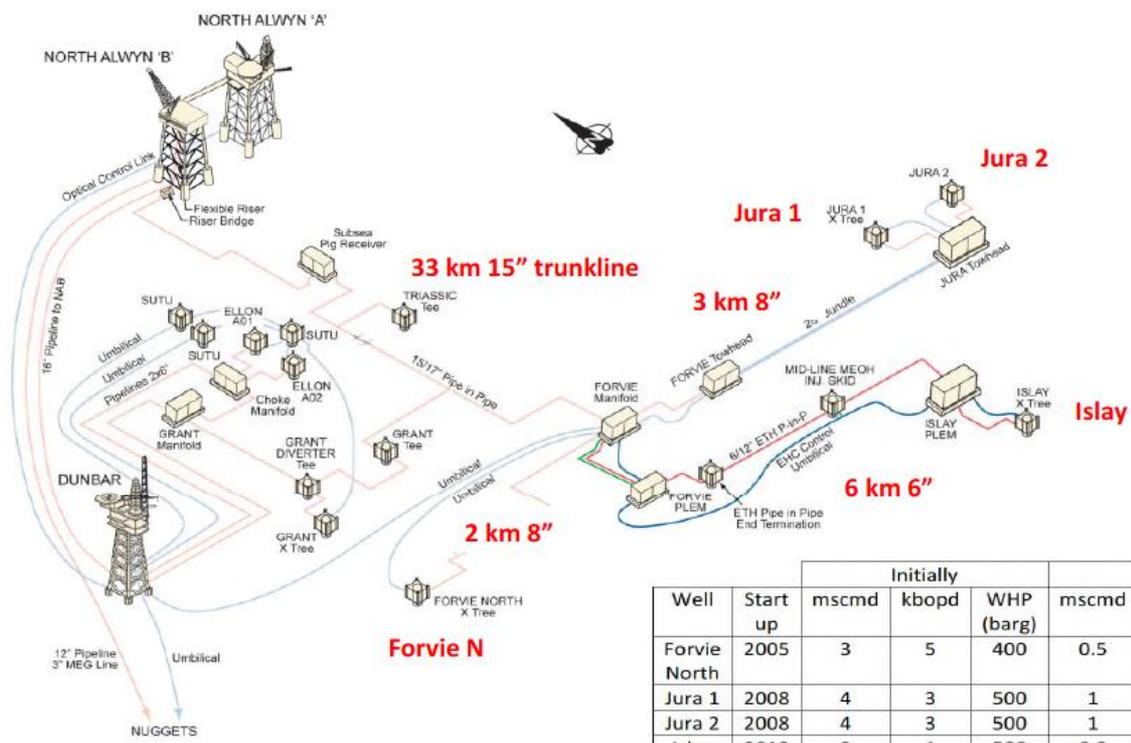
- Started production in 1987.
- Peak 160 kboed (mainly oil), now 50 kboed (mainly gas).
- In good condition.

ALWYN NORTH FLOWScheme (PRIOR TO FORVIE LP)



- Drive to reduce wellhead pressures in order to increase production.

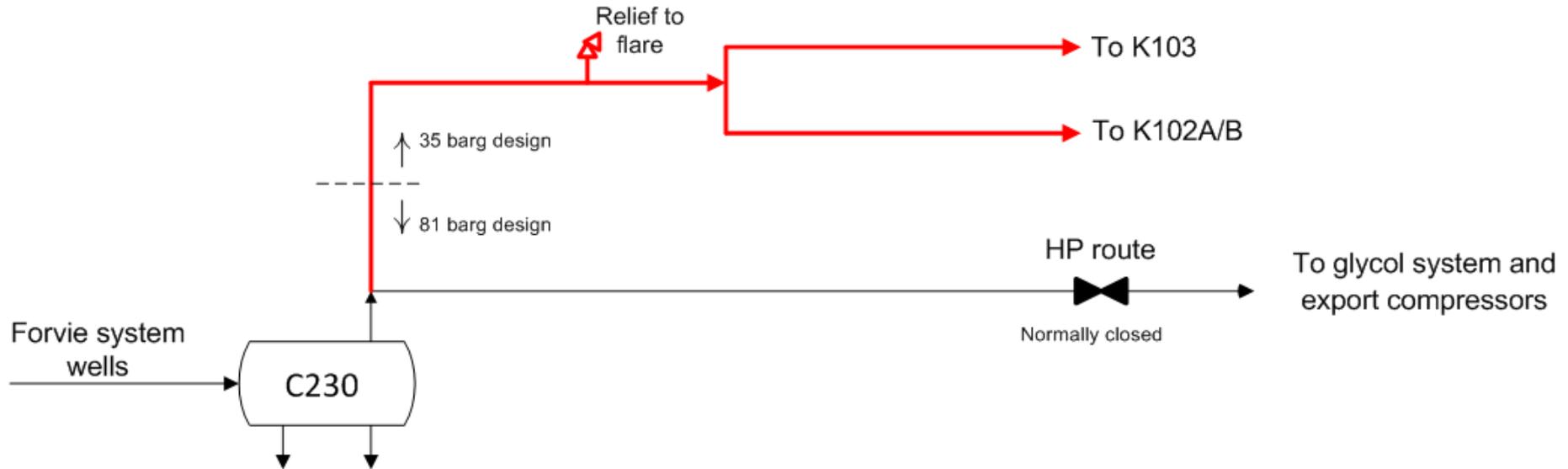
FORVIE SYSTEM



Well	Start up	Initially			Now		
		mscmd	kbopd	WHP (barg)	mscmd	kbopd	WHP (barg)
Forvie North	2005	3	5	400	0.5	0.2	50
Jura 1	2008	4	3	500	1	0.3	70
Jura 2	2008	4	3	500	1	0.3	70
Islay	2012	2	1	500	0.2	0.1	55

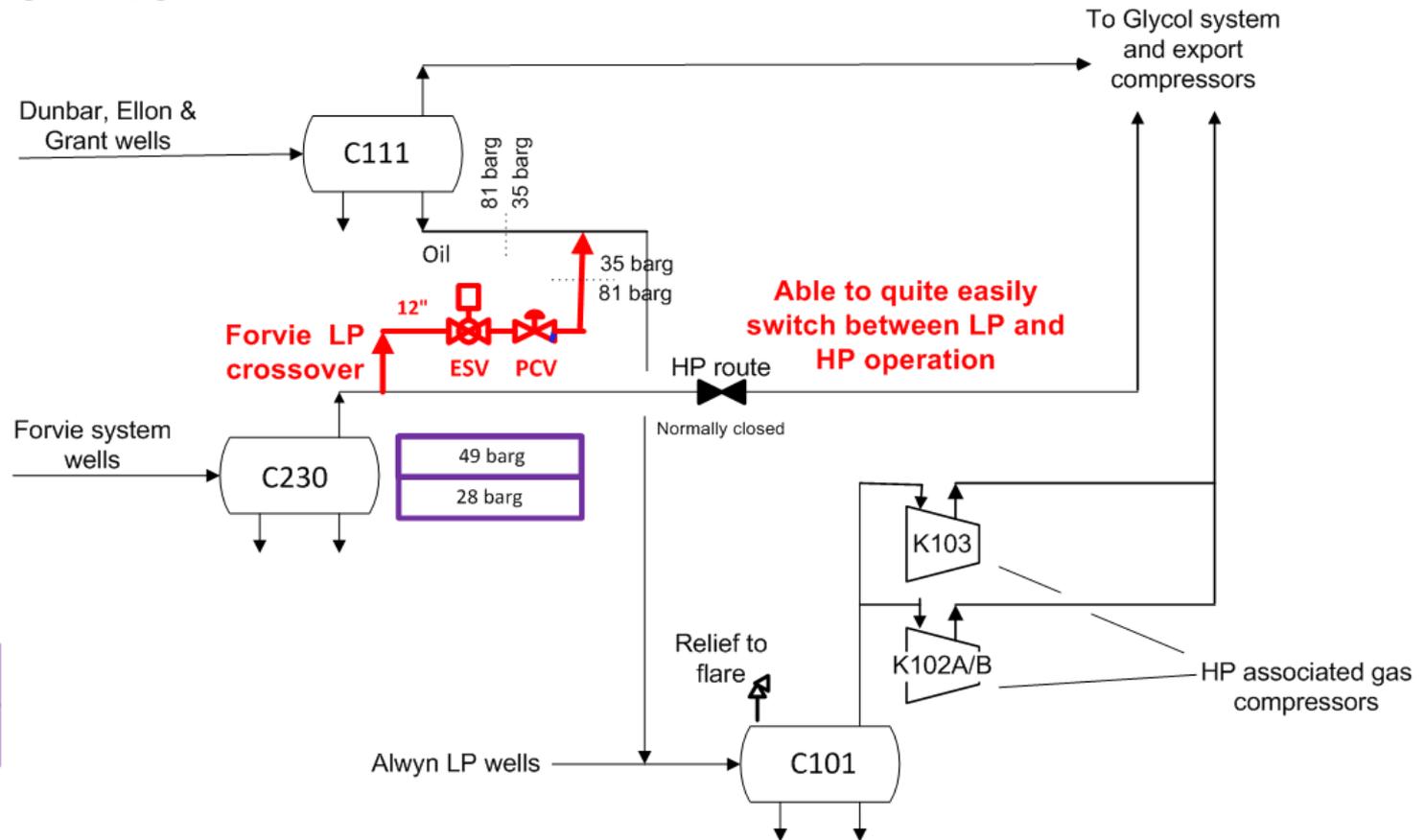
- Three gas condensate fields.
- Since start-up, wellhead pressures had been dictated by arrival pressure on Alwyn North (60 to 70 barg).
- These fields are well suited to reduced wellhead pressure because production is constrained by the wellhead pressure rather than by the tubing or pipeline and there are no water coning issues.

INITIAL CONCEPT FOR FORVIE LP



- Large capacity relief valve and 12” line to HP flare to protect HP/LP interface. Requires HP flare shutdown.
- Difficult 12” diameter piping run and tie-in to K102A/B one deck below C230 due to piping congestion.

SELECTED OPTION

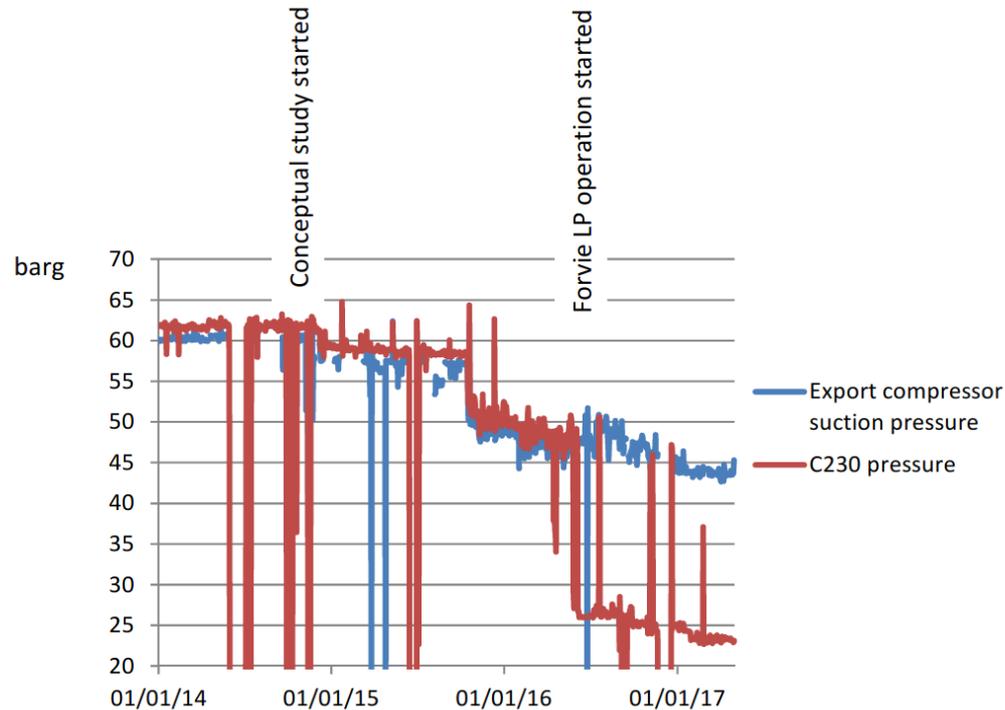


- Selected after detailed conceptual study.
- Crossover only about 30m of 12 inch piping as C230 and C111 are located close to each other on the same deck.
- Able to use C101 relief system to protect HP/LP interface.

BENEFITS / COST / IMPLEMENTATION

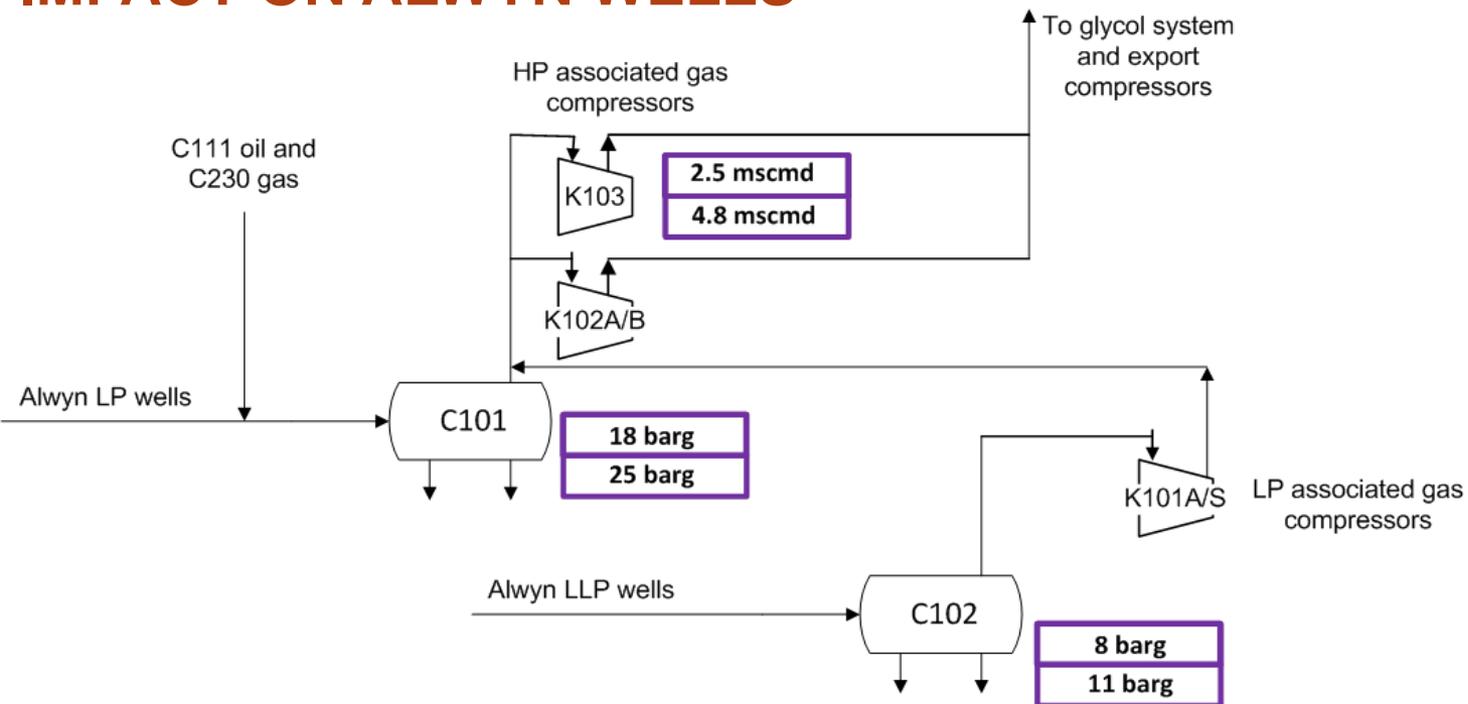
- Net increase in production of about 2 kboed. Includes Islay delayed switch to cyclic production.
- About £2.5 million CAPEX.
- 18 months from start of conceptual study to start of LP operation.
- Retaining the study phase contractor (Xodus) throughout the project helped the transition from the study to the project phase.
- Through careful assessment and testing have been able to operate HP associated gas compressors at higher capacities.
- No negative impact on plant uptime.
- Ability to switch quite easily between LP and HP operating modes has proved valuable.

IN COMPETITION WITH EXPORT COMPRESSOR OPTIMISATION



- Operations reduced export compressor suction pressure as export flowrates reduced.
- The project's incremental reserves were reducing as the project was being developed.
- Now believe unable to go below 40 bar export compressor suction pressure without an expensive modification to its seal oil system so the two projects are complementary.

IMPACT ON ALWYN WELLS



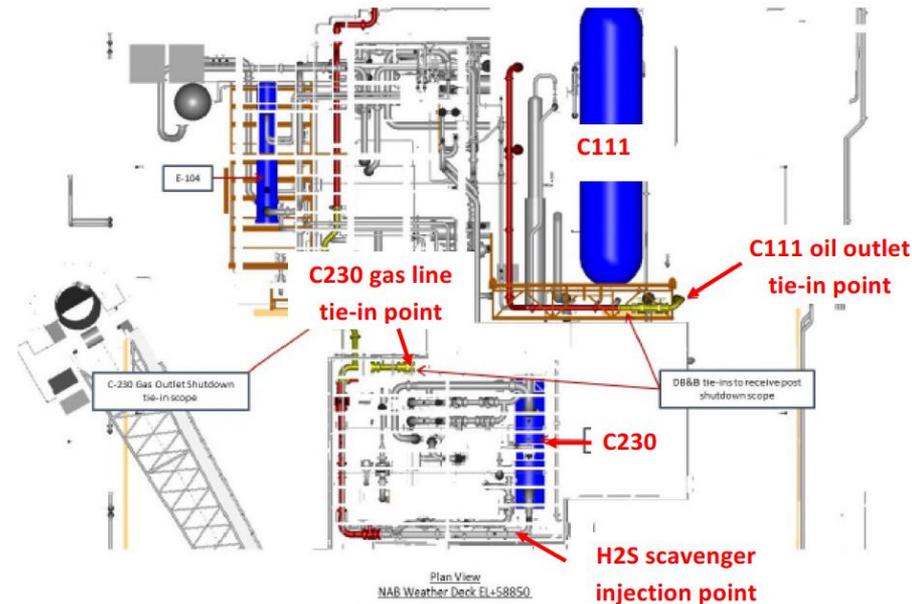
Just before Forvie LP
Just after Forvie LP

The Alwyn wells were producing very well prior to Forvie LP operation starting due to the low C101 pressure with the low HP associated gas compressor flowrate.

These wells produced significantly less, especially at the start of LP operation. The wells routed to K101A/S suffered particularly. There was a concern that one or more of these wells may die due to LP operation but this did not occur.

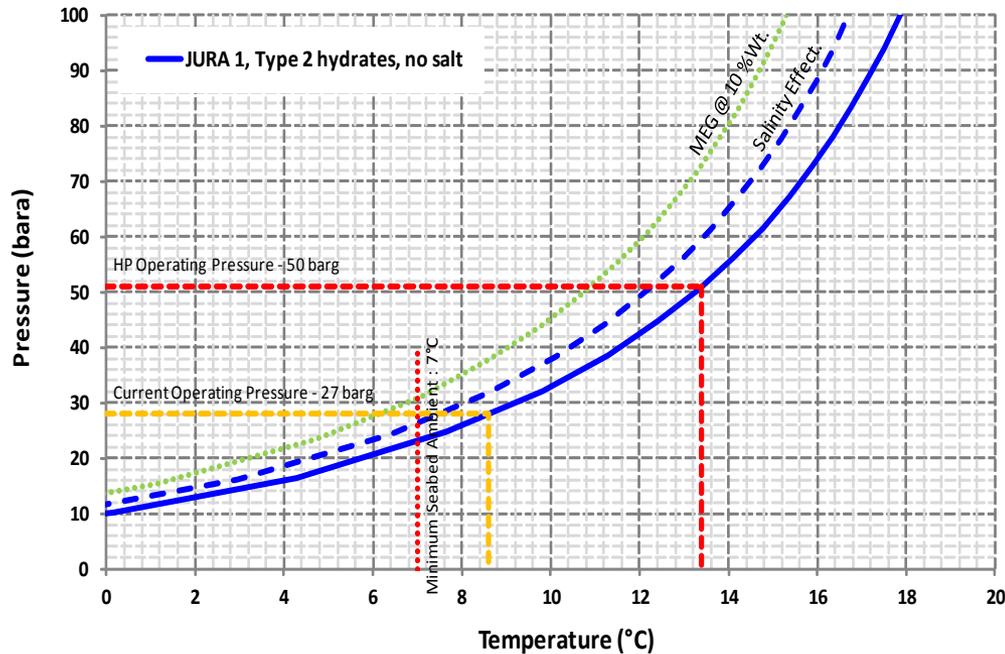
Brownfield projects are often a compromise.

INCREASED H2S SCAVENGER CONSUMPTION



- Big increase in H₂S scavenger consumption when switched to LP operation in order to keep export gas on spec.
- Think that due to a combination of insufficient residence time for C230 scavenger to act (only about 50m piping from scavenger injection point to Forvie system gas stream mixing with C111 oil) and stripping of further H₂S by the gas from the oil in the C111 oil line.
- Mitigated by installing atomiser on existing scavenger injection point and installing a new injection point.

EASIER LONG TERM HYDRATE MANAGEMENT



- At present monoethylene glycol injected as hydrate inhibitor when start up wells.
- Expected to need continuous injection in later field life with lower arrival temperature due to lower flowrate. Potentially new MEG storage tanks and injection pumps would be required.
- But LP operation keeps the fluids outside the hydrate region for the remainder of the Forvie system life.

FUTURE LOW COST PROJECTS

