

## **Gas Lift Significantly Increases Asset Value in Platong Field, Gulf of Thailand**

Project Team Members – All are working in Platong Asset Team in Chevron Thailand Exploration & Production Limited and are SPE members.

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### Innovation Feature

The Platong field is located in Gulf of Thailand, 245 kilometers east of mainland Thailand. Wells are typically completed with cemented monobore 2.875" or 3.5" tubing and perforated at selected sands with commingled production. The geologic structure and stratigraphy leads to numerous small compartmentalized reservoirs resulting generally in depletion drive reservoirs that decline very quickly. As the completion strategy has to be low cost in order to achieve an economic hurdle rate and the initial strategy is to develop to be a gas field, a lot of existing oil wells do not have the artificial lift system in place. Without artificial lift, most of the oil wells usually cease flowing in 2-6 months. Therefore, an artificial lift is crucial to prolong the well life in Platong increasing reserves. Electric submersible pumps (ESP's) have been deployed on a limited basis due to high cost per unit and limited application. Gas lift is considered to be the most appropriate artificial lift for Platong and currently plays a very important role. Gas lift has evolved from in-situ gas lift by perforating gas sands in the well to gas lift using the sales compressors and a supply line to platforms that are severely gas deficient. With continuous development and innovation, Platong gas lifted production has been gradually increased from 10% in June 2008 to 50% of total field production in June 2011.

The subsurface challenge for gas lift mainly involves with the effort of cost reduction. Drilling and completion improvements from 2-trip to mono-trip gas lifted completion in 2008 reduces a rig time by ~1 day/well (from total ~7 to ~6 days/well). This innovative completion method has been described in the OTC and SPE literatures in 2004 and 2006, respectively. Converting the existing producers that are not equipped with gas lift mandrels was initially undertaken by installing coiled tubing gas lifted assemblies. This method was subsequently replaced with the installation of slickline run straddle pack-off gas lifted assemblies in 2010 at a cost saving of -73%. In terms of the production operation aspect, proper gas lift candidate selection process, excellent collaboration between office and offshore are the key components for the success.

Beyond the gas lift injection rate optimization, surface challenge is mainly related to the optimization of gas lift sources from the back pressure reduction systems, i.e. Remote Compressor (RC) and the mobile Well Unloading Unit (WUU). The RC functions in both back pressure reduction and provides high pressure gas lift gas to the producers. Several efforts have been put on RC unit optimization and modification to maximize gas lift rate, for example the RC inter-stage is modified to increase gas lift rate from 2 to 5 MMscf/d which resulted in the oil increase of +500 bopd/platform. Additionally, the RC have been modified to recycle gas on gas deficient platforms to preserve gas for gas lift – the gas is recycled and used for gas lift many times. In May 2011, modified WUUs that can provide high pressure gas lift were implemented to revive the platforms that do not have the RC to provide gas lift resulting in incremental oil of +1,000 bopd/platform. In July and November 2011, four main gas lifted platforms that are severely gas deficient were commenced gas lift injection from gas supply pipeline where gas source is supplied from the Central Processing Platform (CPP). RCs have been fully converted from gas lift type to back pressure reduction type to maximize production input capacity. Gas lift on those four platforms is currently producing 2,900 bopd with expectation to add reserves of ~2 MMstb of oil and ~2 Bscf of gas (Dec 2011).

A near real-time well monitoring dashboard to rapidly review key well data of multiple wells and key remote compressor parameters on one screen has been implemented. The data is directly linked from typical SCADA and is presented in one Excel table to allow engineers to review and optimize their responsible wells in timely manner.

With continued gas lift completion and operation innovations in both surface and subsurface, proper working process in place, sufficient gas lift trainings for all personnel, and excellent collaboration among cross-functional team, gas lift could significantly prolong the well life and certainly increase the recovery; as a result, enhance the asset value.

## Thai E&P Industry Impact and Value

Currently, completion with gas lift mandrel is the standard practice for completing all oil wells in Platong and gas lift plays an increasingly important role in Platong field. With continuous focus on various gas lift developments and initiations, the production from gas lifted wells has been gradually growing from 10% in June 2008 to 50% of total field production in June 2011, shown in Figure 1.

### Cost Reduction on Subsurface Gas Lift Completion –

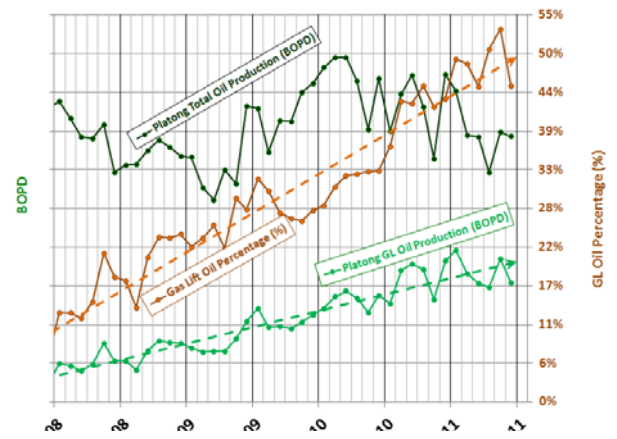
After 2008, the introduction of mono-trip gas lift completion has replaced 2-trip gas lift completion. This reduces rig time by ~1 day per well and represents a considerable cost saving against a development background of 50 to 100 wells per year. Another cost reduction has been implemented on converting non-GLM wells to gas lifted well. Initial attempt of installing coiled tubing gas lift proved technically successful but too expensive for field wide application. Where possible the alternative installation of slickline run straddle pack-off gas lifted (SPO GL) assemblies has proven success at approximately 1/3 of the cost since the installation unit is changed from coiled tubing to slickline unit.

**Innovation on Surface Gas Lift Source –** Innovation on remote compressor interstage modification to increase gas lift supply capacity from 2 to 5 MMscf/d was executed successfully and resulted to an oil increase of +500 bopd/platform (see Table 1). Modifying the RC to recycle gas for G/L on gas deficient platforms to preserve gas saves the cost of sending a gas supply line from the CPP to provide G/L. Another initiative on surface gas lift source is the modification on typical well unloading unit. By installation of additional compressor, a unit is able to provide high pressure gas lift gas to unlock gas lifted oil reserves on gas deficient platforms. Figure 2 shows the result of +1,000 bopd from the first platform.

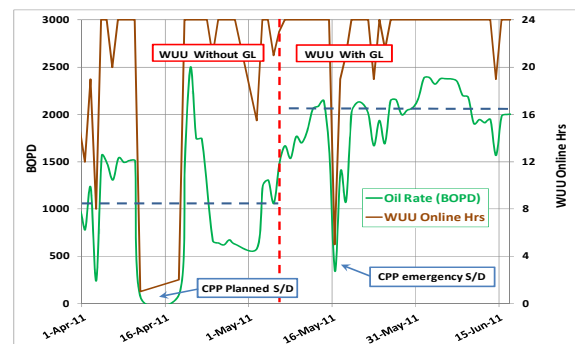
**Table 1:** The result of the pre- and post-RC interstage modification

Well	No GL (BOPD)	w/o Interstage Modification (Sep 15, 09)		With Interstage Modification (Sep 29, 09)	
		GL (MMscf/d)	BOPD	GL (MMscf/d)	BOPD
Well 1	0	0.67	138 (GL)	0.65	379 (GL)
Well 2	0	0	78	0.65	88 (GL)
Well 3	0	0	56	0.65	267 (GL)
Well 4	0	0.68	1765 (GL)	0.34	1745 (GL)
Well 5	0	0	45	0.31	166 (GL)
Well 6	0	0	82	0.30	101 (GL)
<b>Total</b>	<b>0</b>	<b>1.35</b>	<b>2,174</b>	<b>2.90</b>	<b>2,756</b>
<b>Oil Gain from Interstage Modification</b>					<b>582</b>

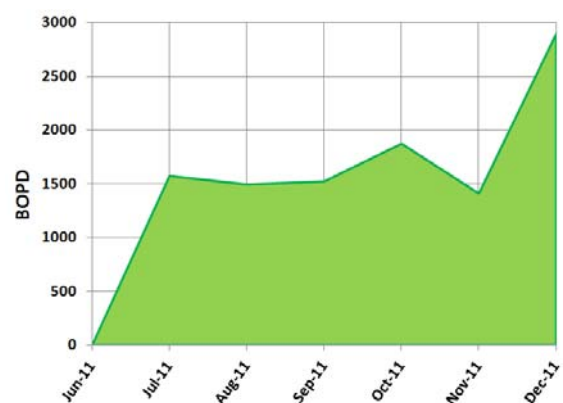
Through the cross-functional efforts, Platong has successfully commissioned gas lift injection from the pipeline laid from the CPP to four gas deficient platforms in 2011. Gas lift supply line eliminates utilization of gas lift from RC. Now the RCs have been fully converted from gas lift type to back pressure reduction type to maximize production input capacity. This gas lift supply line project is currently contributing 2,900 bopd (Dec 2011, see Fig 3) and is estimated to add reserves of ~2 MMstb of oil and ~2 Bscf of gas.



**Figure 1:** Growth of Platong gas lift production since 2008



**Figure 2:** Production plot of pre- and post-implementation of the well unloading gas lift unit



**Figure 3:** Oil production from gas lift supply line project

### Why should this project win the Thailand Annual E&P Award?

Gas lift has extremely enhanced Platong Asset value according to historical Platong gas lift development and production performance. During 2008-2011, Platong has been recovering oil from gas lift application for >14 MMstb or >27% of total field production. Gas lift is the key artificial lift in Platong field during the last four years and will be continued on. Currently, gas lifted oil production covers ~50% of total field production, which is gradually increased from 10% in June 2008 (Fig 1). This is a significant and vital achievement for Platong Field development and Chevron Thailand. Immense multi-disciplinary efforts from Platong Asset (Reservoir Engineer / Production Engineer / Earth Scientist), Drilling & Completion, Facility Engineer, and Operations personnel have been put on all gas lift development works, initiations, day-to-day operations, and knowledge transfer.

Due to small compartmentalized reservoirs in Platong field, the cross-functional team has been working on subsurface cost reduction to enhance project NPV by improving 2-trip to mono-trip gas lifted completion and replacing coiled tubing gas lift installation with straddle pack off gas lifted installation successfully. These help saving completion cost significantly. The surface gas lift improvement on the remote compressor interstage modification to increase gas lift discharge capacity significantly helps accelerating the oil production. Well Unloading Unit Gas Lift and the gas lift pipeline laid from central processing platform (CPP) also play a very critical role to unlock substantial oil reserves from gas deficient platforms. Although all of those gas lift projects are highly complicated, our multi-disciplinary team has worked together and put the highest efforts to achieve those targets and increase gas lift production safely. Those projects also outstandingly enhance oil recovery from Platong.

The team believes that there are still a lot of opportunities for us to improve and always seeks for new gas lift technology to either save more cost or increase production. Currently, we are still in the journey to maximize asset value in an aspect of gas lift utilization. Key components that make successful gas lift operation are good collaboration among multi-disciplinary team, proper working process in place, sufficient trainings for all personnel, and well-planned project to achieve target with zero incident. With the continued innovation, determination to improve operation to be more and more well-managed, gas lift would significantly enhance Platong asset value and finally benefit to the Kingdom of Thailand.