

# Maximizing Gas Monetization through Synergy Borderless between Pertamina EP and Pertamina Hulu Sanga Sanga

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## Abstract

PEP asset 5 should meet the contractual rate supply to PLN Tj. Batu at a minimum rate of 5 mmscfd. Nevertheless, PEP struggled to sustain production due to gas facility limitations, depending mainly on natural flow from gas wells to provide via line 39 km and minimum pressure 465 psig on PLN Tj. Batu. Gas production was not optimal based on reserve evaluation, with a recovery factor of just 36% from existing conditions. The minimum wellhead pressure must be reduced to maximize recovery from gas potential. It was initially intended to build a new compressor plant, which would drastically reduce the economics of gas monetization.

On April 2021, Pertamina decided to consolidate amongst various upstream business units which operate in Kalimantan; PEP and PHSS is consolidated under Zone 9. A group team from subsurface and surface facilities representatives of PEP and PHSS analyzed various upside potentials from consolidating these two assets by pursuing synergy to accelerate produce gas potential from NKL field Pertamina EP through PHSS facilities. The study has to fulfilled several requirements from each parties PEP, PHSS and PLN.

The primary method used was a borderless operation, which aligned the PEP and PHSS production systems as a single integrated system rather than several independent systems. Prior to synergy, NKL gas would flow onstream via the NKL gas plant and the existing 39 km trunkline via the Binangat line, with a minimum pressure of 465-565 psig on PLN Tj Batu. Since most NKL gas reservoirs are depletion driven, a compression system will be required. It is intended to create a new pipeline to divert the commercialization route through Lampake Station PHSS (150-200 psi), which would lower the estimated minimum wellhead pressure to 250 psig without installing a new compression system.

In September 2022, NKL gas began providing 5 mmscfd to PLN Tj. Batu for three years. Borderless synergy provides cost-effective development solutions, resulting in faster monetization and much-increased income for the Sangasanga area.

Keyword(s): Gas Monetization; Borderless Synergy; Efficiency; Integrated Surface-Subsurface; Acceleration; Pipeline; Idle Gas Potential

## 1 Introduction

Sangasanga field operated by Pertamina EP Asset 5 (PEP) is one of the mature oil fields in the onshore Kutei Basin, East Kalimantan. The field was the first operation since 1905 by NIHM. Sangasanga field has been known as one of the main oil producer fields since PEP takeover in 2008, as shown in Figure 1. In its development, it turns out that NKL structure also has gas potential in many small tanks, as shown in Figure 2, but unfortunately, it is not monetized due to a lack of gas facilities. PEP plans to produce gas from the NKL structure to increase the company's revenue.

PEP Asset 5 got approval Plan of Development from SKK Migas to monetize gas from North Kutai Lama (NKL) in 2018. Gas was delivered through gas plant NKL and existing line 39 km via Binangat line with a minimum pressure of 465 psig on PLN Tj Batu. This delivery scheme was used from 2018 -2020. Due to the depleted nature of NKL gas reservoirs, the usage of compressor was decided in 2020 to continue the gas supply, but an additional compressor required 1.5 years

In April 2021, Pertamina EP Asset 5 (PEP) and Pertamina Hulu Sanga Sanga (PHSS) PEP & PHSS both oil and gas producers, joined under Pertamina Hulu Indonesia Regional 3 Zona 9. These two assets are located very close geographically. Therefore, a potential opportunity to commercialize NKL gas with an integrated study between PEP and PHSS is possible. The study was to find an alternative solution that is fast and efficient to supply gas to PLN Tj. Batu through PHSS facilities.

The solution is to route NKL gas from PEP to PLN via PHSS facilities building a new pipeline route to PHSS. This effort is expected to reduce the wellhead pressure to 250 psig by diverting the commercialization route through Lampake station PHSS with pressure at Lampake station 150 psig. This solution removed the requirement for an additional compressor. NKL gas potential of 5 mmscfd will be distributed for 3 years, and forecast gas was conducted with a wellhead pressure of 250 psig.

## 2 Problem Statement

### 2.1 *Minimum wellhead pressure initial*

NKL gas reservoir consists of a small group reservoir with an average IGIP of about <0.5 bcf. Distribution of NKL gas to PLN Tanjung Batu began in December 2018, relying on natural flow from high-pressure gas wells. Gas non-asso from the well passes through the NKL Gas Plant to PLN Tj Batu for a total of 39.3 km. Based on the pressure profile illustration shown in Figure 3, the minimum required wellhead pressure is 630 psi. As a result, most of the gas wells cannot be produced continuously because they can no longer supply gas to PLN Tanjung Batu due to declining wellhead pressure as shown in Figure 4. A decreasing minimum wellhead pressure is required to maximize the gas potential.

## 2.2 *Reserve Evaluation*

Based on the reserve evaluation, NKL Gas Reservoir has reserves to produce 5 mmcf/d continuously. However, the potential reserves cannot be produced optimally due to high minimum wellhead pressure. Based on IGIP calculations using the Material Balance method shown in Figure 5, the Recovery Factor (RF) of 8 wells that have been produced are only around 36%, instead of 75%. Hence, further studies are needed on the surface facilities to optimize the well's recovery factor and produce potential gas reservoirs in medium and shallow zones.

## 2.3 *Initial Plan facilities*

In the supply agreement with PLN Tj Batu, the gas rate is five (5) MMSCFD with inlet pressure on PLN gas Turbine is 565 psig for 5 years. Depletion of the gas reservoir affected the supply rate to PLN Tj. Batu. In 2018-2020, the rate decreased from 5 MMSCFD to 1 MMSCFD, while the minimum required delivery pressure cannot be achieved. On January 1 2021, the gas supply was stopped and PLN Tj. Batu got another supply from another PSC. PEP Asset 5 needed a breakthrough to overcome this issue.

### 2.3.1 *New Program*

PEP Asset 5 Facilities team decided to have several additional projects, as shown in Table 1. Besides the main issue, several other supply issues are mentioned below that cost 4.3 MMUSD and 1.5 years of execution.

### 2.3.2 *Pros & Cons*

Since the depletion of gas wells was not predicted earlier, PEP Facilities cannot support this issue. Hence, an upgrade of facilities is required. Projects listed in Table 1 gave solutions to the issue. However, significant CAPEX was required, which eroded the project's economics.

## 2.4 *Pertamina Regroup*

In April 2021, Pertamina decided to regroup between several fields and major operators of Pertamina Upstream in Kalimantan; PEP Asset 5, PHSS, PHM, PHKT. PEP Asset 5 (PEP) and Pertamina Hulu Sanga Sanga (PHSS) joined under Pertamina Hulu Indonesia Regional 3 Zona 9.

### 2.4.1 *Geographic*

The operation area of PEP and PHSS is located in the same Sanga-Sanga Area shown in Figure 6. In some locations, the surface area is the same but different in depth right. This opened the opportunity for synergy and borderless operation. Borderless means cooperation between PSCs under Pertamina Hulu Indonesia Regional 3 Kalimantan, that is geographically close. The borderless vision is to operate leaner, cheaper, and faster with synergy in logistics, Subsurface, Drilling, Well Interventions, and Project & Operation that can increase value creation. Including the use of under-capacity facilities through the Facilities Sharing Agreement.

#### 2.4.2 *Operating Condition*

Existing PEP Sanga Sanga Facilities are mainly onshore oil processing, so developing facilities for gas commercialization requires a significant upgrade and compressor facilities are not standard equipment. On the other side, PHSS Facilities are mainly onshore gas processing, and several compressor facilities are already developed to support lowering on well to increase reserves and gas production, including pipeline facilities for gas commercialization.

#### 2.4.3 *Idle Capacity*

PHSS Facilities mainly have idle capacity especially in Lampake, Nilam and Badak areas, since the gas production is decreasing. Some compressors are running under capacity.

#### 2.5 *Customer Point of View*

PLN Tj. Batu is a customer of PEP, PLN requires gas to operate a gas turbine to generate electricity. Existing Gas route from PEP to PLN Tj. Batu is shown in Figure 7. PLN Tj Batu received another gas supply in January 2021 shown in Figure 8. This new supply is better from PLN point of view because of two reasons: (1) it is less interruptible because it was provided from East Kalimantan Pipeline, which is the major gas Pipeline supply from several PSC to LNG Badak and Domestic gas in Bontang, (2) Existing PLN Tj Pipeline is used. PEP new solution needs to be more attractive than the current route.

### **3 Methodology**

A group of Subsurface and Surface Facilities from Zona 9 studied alternative Borderless operation solutions that can accelerate and efficiently supply NKL gas to PLN Tj. Batu.

#### 3.1 *Reservoir simulation*

A subsurface study was conducted to evaluate the existing conditions at the wellhead pressure constraint of 650 psi as the base case. The forecast results are shown in the Figure 9. The base case scenario shows that the gas wells cannot achieve a plateau rate of 5 MMSCFD due to high wellhead pressure constraints. Then a simulation is conducted using a pressure constraint of 250 psi at the wellhead (based on the estimated whp after optimization) in the Figure 10 that the improvement case can deliver a plateau production of 5 MMSCFD for 4 years condition.

#### 3.2 *Parties Requirement*

The method is to find a possible solution that satisfies requirements of all parties involved with the data facilities data on each parties. The summary of the requirements is shown in Table 2.





### 3.3 *Possible Routes, Facilities & Pressure Mapping*

Combination of facilities and pipeline existing map review of PEP, PHSS, PLN Tj. Batu and a study of pressure hydraulic calculation was performed to assess several route options for gas delivery.

### 3.4 *Revised Work Program*

Revisit the program listed in Table 1 to find a better program that fulfills several factors: (1) Synergy Borderless operation, (2) More Efficient, (3) More accelerated in execution time.

## 4 **Result & Discussion**

### 4.1 *Incremental Reserves and First Onstream*

Based on the simulation, after decreasing abandon wellhead pressure to 250 psi, the estimated RF can increase to around 76% from around 36%. There are additional reserves of 7.4 bcf. The characteristics of the NKL gas reservoir in the form of a depletion drive support conditions for the optimization of wellhead pressure. The lower setting of the minimum wellhead pressure, the recovery factor will increase.

### 4.2 *New Routes*

Figure 11 shows the new borderless solution route from PEP to PLN Tj. Batu through PHSS Facilities. This new route can solve the problem in section 2 and fulfill the requirement mentioned in section 3. The initial plan was gas from PEP Facilities flew to Gas Plant NKL to be compressed and distributed to PLN Tj. Batu via 39 km 8-inch Pipeline. A new and better plan is a gas PEP Facilities route to Lampake PHSS with a new 6 in trunkline of 3.7 km. This new trunkline will connect between PEP and PHSS facilities. Gas custody metering PEP relocated from PLN Tj. Batu to Lampake PHSS to get accurate gas rate measurement before combining with PHSS gas. After metered, gas was distributed to Nilam Central PHSS compressed together with PHSS gas and entered East Kalimantan Pipeline. Idle gas processing facilities in Lampake and Nilam PHSS used by PEP with Facilities Sharing agreement scheme.

### 4.3 *Revised Work Program*

Below Table 3 is a revised program that was modified from previously mentioned in Table 1 with a total cost decrease from 4.3 MMUSD to 1.1 MMUSD and 1.5 years to 9 months of execution time.

### 4.4 *Commercial Agreement*

A newly revised program was proposed and agreed upon by to PLN Tj. Batu and new commercial agreement discussed and finalized parallel with Facilities program execution.

### 4.5 *Commissioning of new Borderless operation solution*

PEP and PHSS had been successfully carried out the commissioning and supplying gas to PLN Tanjung Batu was conducted on September 19, 2022. The results of the facility synergy program were successfully

implemented. Based on observations, the plateau rate was successfully achieved at 5 mmcf/d, shown in Figure 12.

## 5 Conclusion

A group of Subsurface and Surface Facilities under Zone 9 has successfully solved issues of gas reservoir depletion and gas monetization with a revised program that maximizes borderless synergy between PEP and PHSS. The solution is faster and more economical than the previous decision before Pertamina Regroup. Synergy borderless is a proven initiative program that can bring value creation to Pertamina.

## 6 Recommendation

The borderless synergy initiative is most suitable for PSCs located geographically close to each other, enabling the creation of efficient business and operation models through cooperation between PSCs.

## 7 References

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## 8 List of Figures, Tables

### 8.1 Tables

Table 1. List of Additional Projects.

No	Projects	Objectives
1	Rental Very Low-Pressure Compressor, 2x5 MMSCFD, 2x100%	Increase supply rate and pressure
2	Rental Dehydration Unit	Decrease water content in gas
3	Supporting (Instrument Air, Flare, & Fire Protection)	support Operation & Plant Safety



4	Mob-Demob, Site Prep, Civil work, Installation	Install Rental Compressor Facilities
5	Upgrade Facilities in PEP Tj Batu area	Fix the integrity of several equipments
6	Relocate Gas Metering (Tj. Batu to Binangat Area)	Fulfil PLN Tj. Batu Request to use Existing Pipeline PLN Facilities

Table 2. Summary Requirement of All Parties.

No	Parties	Requirement
1	PLN Tj. Batu	<ul style="list-style-type: none"> <li>a. Uninterruptible gas supply</li> <li>b. Use existing Pipeline PLN Facilities</li> <li>c. The short duration of the solution schedule</li> </ul>
2	PEP	<ul style="list-style-type: none"> <li>a. Lower wellhead pressure (650 psi become 250 psi)</li> <li>b. Lowest CAPEX possible</li> <li>c. The short duration of the solution schedule</li> <li>d. Reliable Facilities</li> </ul>
3	PHSS	<ul style="list-style-type: none"> <li>a. Use under-capacity facilities</li> <li>b. PEP contribute to OPEX of idle capacity</li> </ul>

Table 3. Revised List of Additional Projects.

No	Projects	Objectives
1	Install new 6 in trunkline 3.7 km	Connect PEP - PHSS facilities
2	Relocate Gas Metering from Tj. Batu to Lampake	Measure PEP gas rate before combine with PHSS gas

## 8.2 Figures

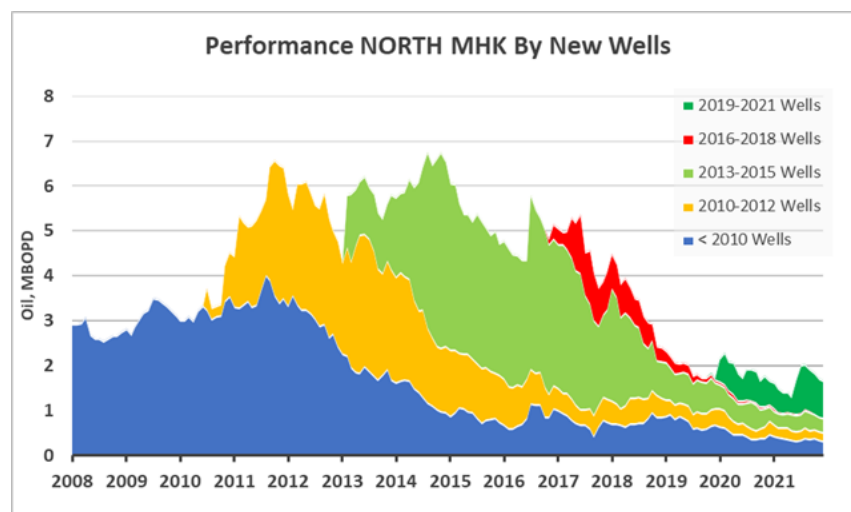


Figure 1. UMHK Production Profile

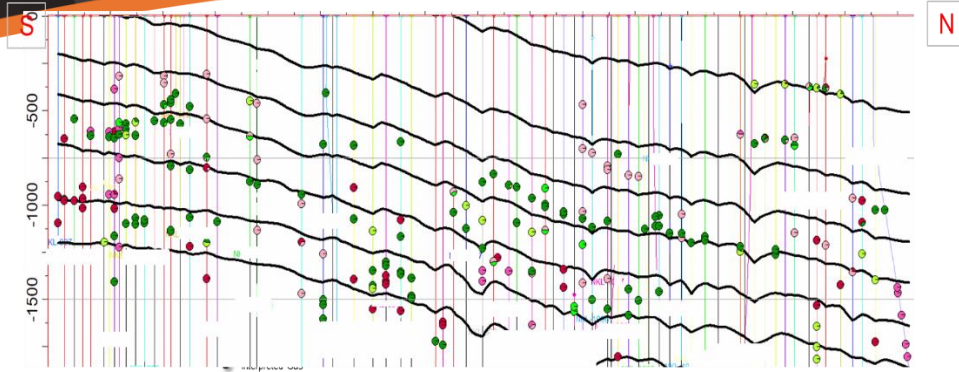


Figure 2. NKL Structure Potential

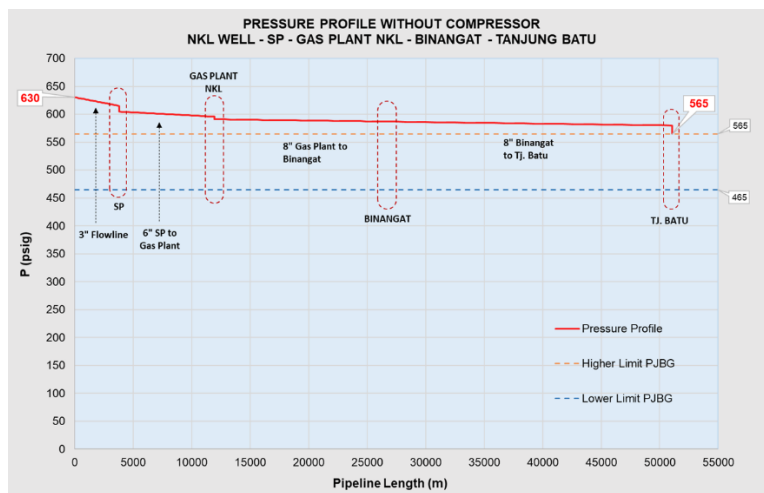


Figure 3. Pressure Profile NKL Gas Well PEP to PLN Tj. Batu

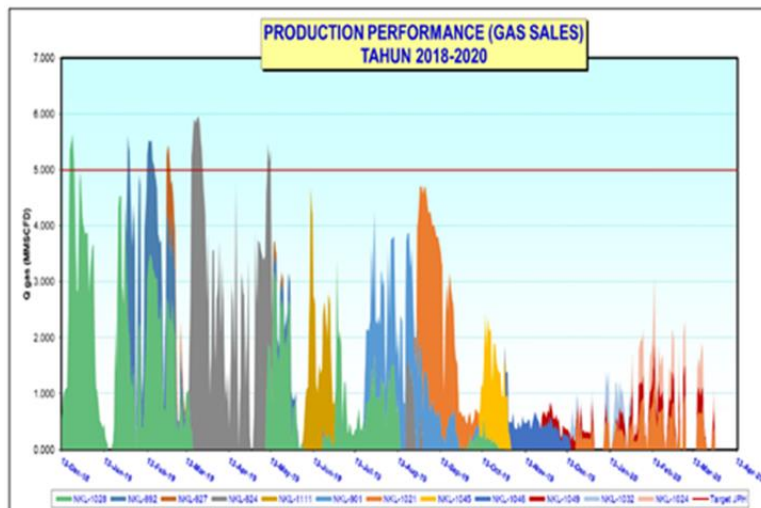


Figure 4. Production Performance 2018-2020





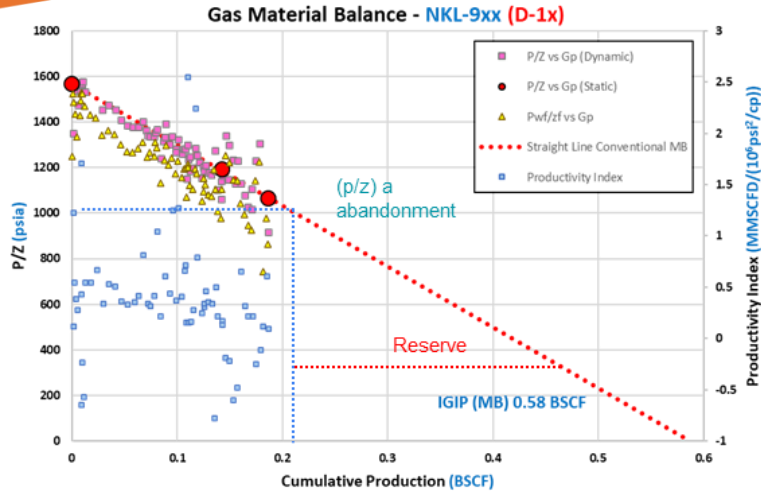


Figure 5. P/Z Material Balance NKL-9xx

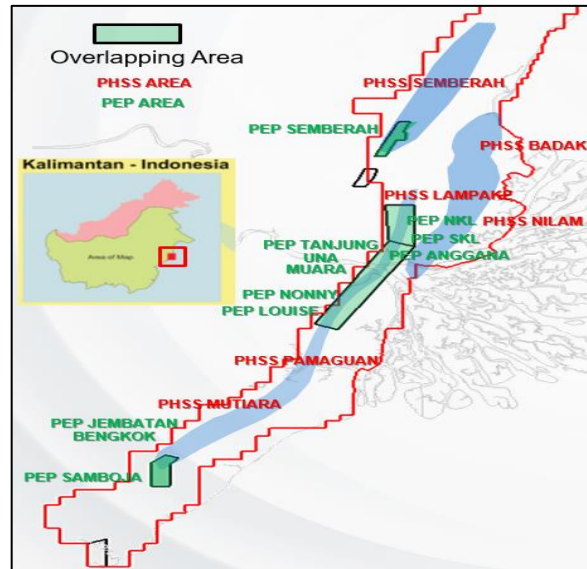


Figure 6. The operation area of PEP and PHSS

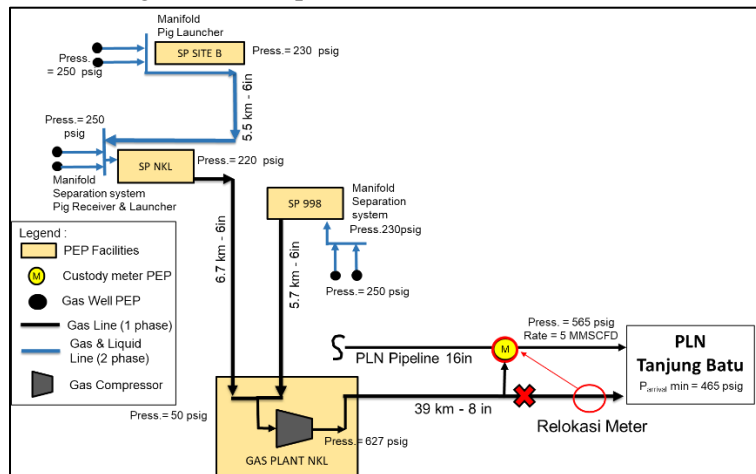


Figure 7. Existing Planning Gas route from PEP to PLN Tj. Batu



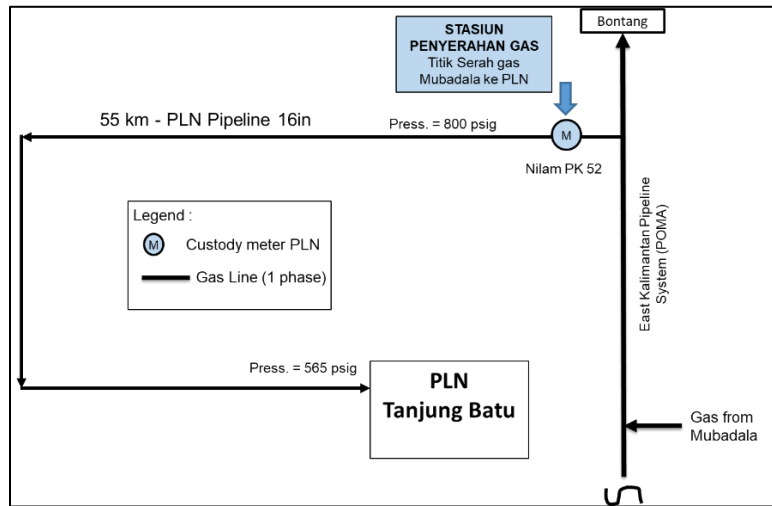


Figure 8. PLN Tj Batu other gas supply Scheme

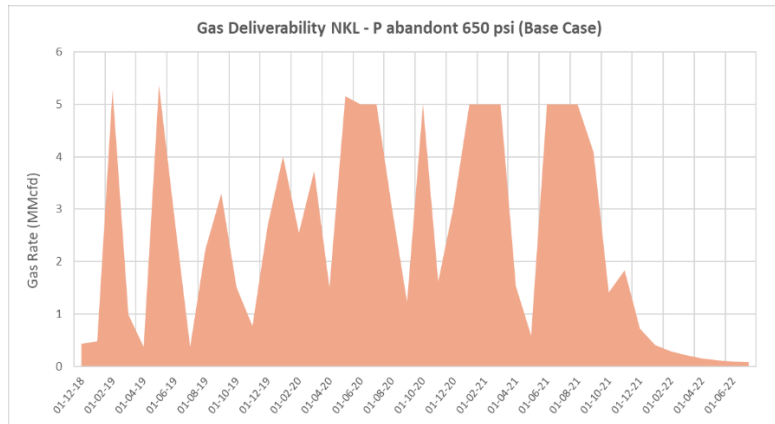


Figure 9. Gas Del with Pressure Abandont 650 psi (Base Case)

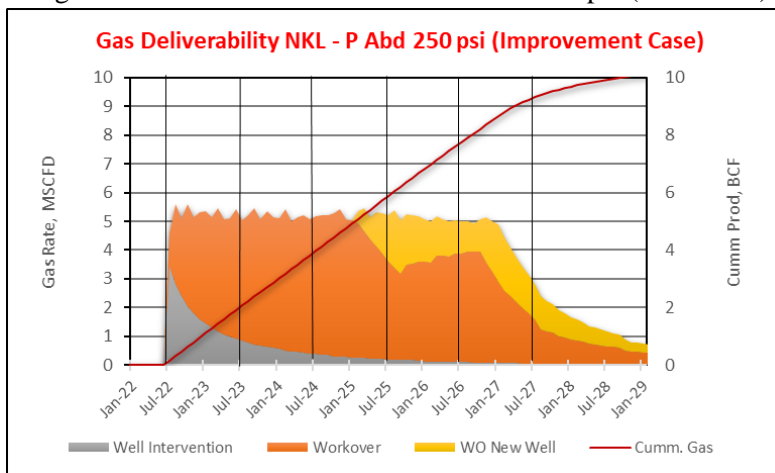


Figure 10. Gas Del with Abandont Pressure 250 psi (Improvement Case)



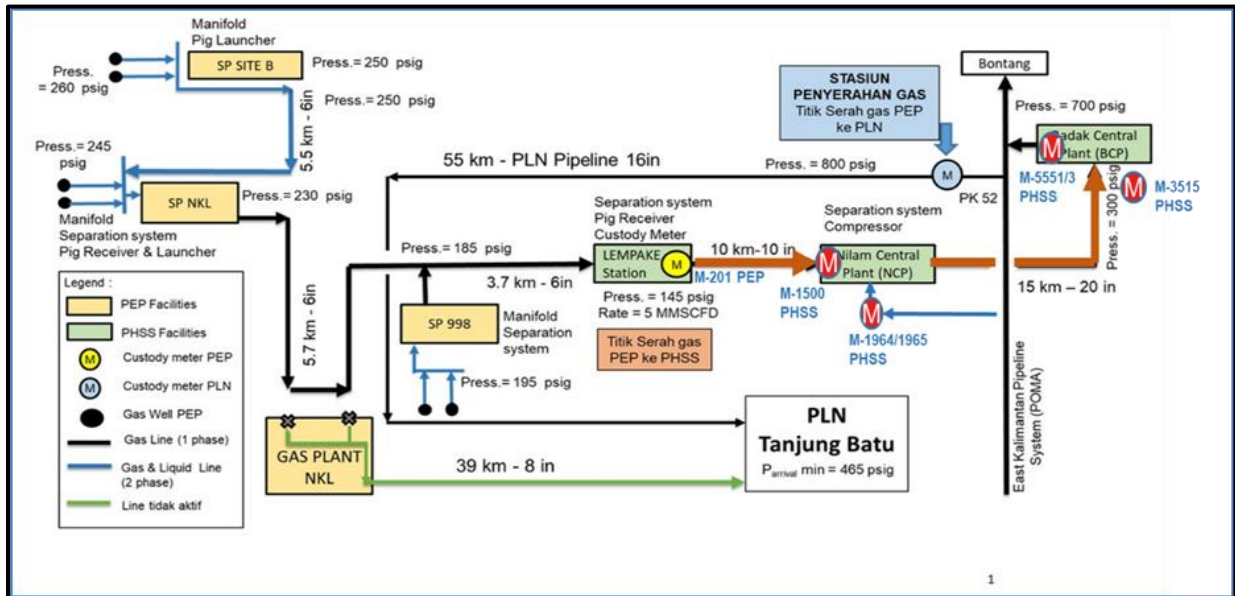


Figure 11. New Borderless Solution Route PEP to PLN Tj. Batu through PHSS Facilities.

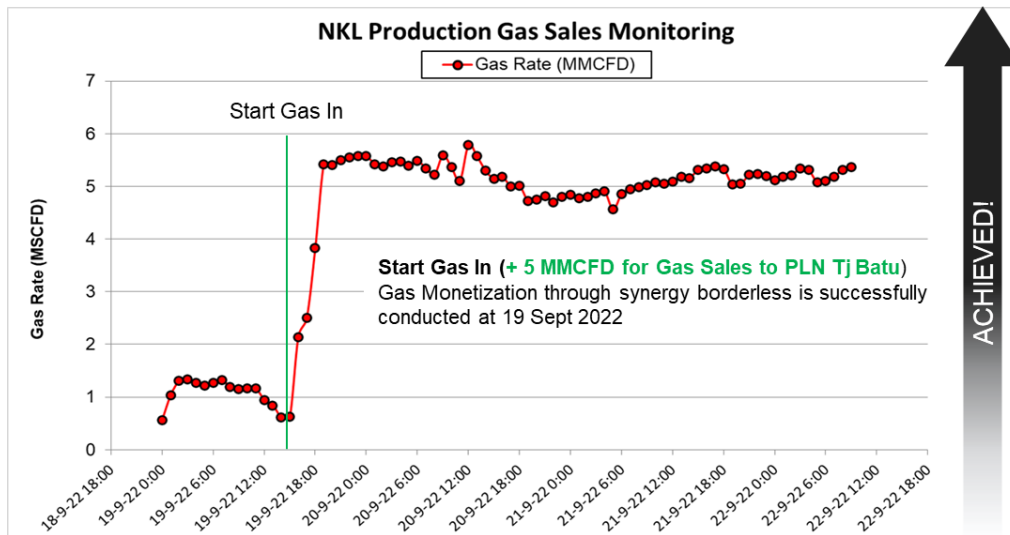


Figure 12. NKL Gas Rate via New Route

