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Maximizing Production Profits: Optimizing Gas Lift Design in the Halfaya Oil Field

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Abstract

Gas lift is one of the most common artificial lift methods which is effectively utilized in the oil industry for enhancing production. However, proper gas allocation into wells can be challenging due to various limitations such as shortage in injected gas and economic considerations. Therefore, the current research is conducted to address the critical requirement to effectively distribute gas to maximize profits in the Halfaya Oil Field- Mishrif formation. Continuous gas lift is one of the most commonly used artificial lift methods. To enhance production rate, a sufficient amount of gas is injected into the production tubing at specific depths to reduce the liquid column pressure as each well has an optimal point for production in an oil reservoir. On the other hand, constraints of gas availability restrict achieving the optimal state of production. Such restrictions combined with economic limitations including high gas prices and compression costs, emphasized the necessity for optimal methodology to enhance oil production. Aside from the importance of the Halfaya oil field, there are limited relevant studies on artificial lifting methods specifically associated with the gas-lifting method used in this paper. Thus, the purpose of the current investigation is to propose a well-tested gas lifting design for oil production improvement. The approach combines the skill of the fmincon function built in MATLAB as an optimizer and the PIPESIM network model to create gas lift performance curves. This resulted in an oil production rate of 18860 STB/d, with a gas lift rate of 9.42 mmscf/d. Establishing such a systematic optimization process can manage the challenges of gas allocation in the Halfaya Oil Field towards maximizing production rates and ultimately increasing net profits.

Keywords: Gas lifting optimization; Net Profit; Halfaya Oil Field; Production Enhancement; MATLAB optimizer.

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1- Introduction

Continuous flow gas lift, a widely known procedure currently used in the petroleum industry as an artificial lift method. In an optimum scenario, it is desired to inject sufficient gas volume into individual wells to increase profitability. However, constraints related to gas availability can restrict the quantity of injected gas, indicating the importance of efficiently distributing gas within the gas lifting system [1, 2]. For this purpose, a strategy of increasing the total oil production rate while instantaneously minimizing the amount of gas volume is required to sustain the system [3]. The process of gas allocation usually follows two methodologies. The first one relates to developing an economic model to identify the optimal gas injection rate, where the cost of additional injection gas is equal to the profit gained from increased oil production [4]. The second method is based on the assessment of the available injection gas volume and then calculating the gas injection rate that has the highest amount of oil produced across many wells [5]. Gas lift operations can be affected by various factors including the rate of injected gas, injection pressure, the specification of gas compressor, and other facilities [6]. These factors represent a constraint that should be considered during the gas lift optimization process which is a challenging task.

Many gas lift optimization techniques have been used to enhance oil production and optimize the allocation of lift gas within certain limitation conditions [7]. One of the pioneering studies in this field was conducted by Rashid, et al. [8], who investigated the relationship between gas injection rate and the oil production rate. He named the term "gas lift performance curve" to describe the resulting graph, which is illustrated in Fig. 1. His study showed that the most efficient gas injection rate was a point at which the additional cost of gas injection equaled a specific percentage of the additional income gained at that gas injection rate. Redden et al. introduced a method to identify the most cost-effective strategy for gas allocation in wells using a continuous-flow gas lift technique. They developed a computer software program capable of performing gas distribution calculations, which was effectively applied in a Venezuelan field containing 30 wells [9]. Furthermore, Kanu et al. developed the "equal slope allocation" method for managing both unlimited and constrained gas supplies. Their research proposed the suggestion of an economic slope formula to distribute gas quantities at the optimal economic point for a set of wells [10]. Later, Dutta-Roy and Kattapuram applied sequential quadratic programming to analyze the optimization of gas lift and the interaction between wells sharing a common

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gas lift supply header [11]. In a similar line, Camponogara and Nakashima utilized dynamic programming to address the gas-lift optimization problem, providing valuable insight into maximizing production [12]. Ray and Sarker took a different approach by utilizing the Genetic Algorithm to optimize gas lift under constraints of limited lift-gas supply due to a compression facility shortage [13]. Furthermore, Epelle and Gerogiorgis conducted a study to optimize the Net Present Value (NPV) of the production system by considering various factors such as lift gas allocation, well controlling, and routing constraints [14]. The Net Present Value represents the combined value of revenue generated from oil and gas production, including the costs associated with the artificial lifts. It is important to ensure an adequate supply of lift gas to avoid fluid flowing through the production tubing, which can cause a reduction in production. Conversely, unrestricted gas-lifting in the production tubing can optimize oil flow rates and maximize production capacity [15].

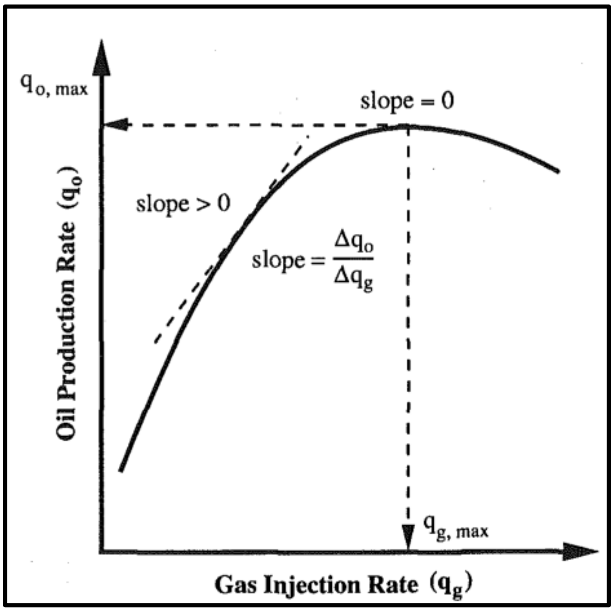

Fig. 1. A Typical Gas-Lift Performance Curve [16]

Many researchers have utilized various optimization approaches to enhance production from the Iraqi oil fields using the gas lift method. Al-Fatlawi et al. conducted a study on a giant Iraqi oil field to determine the best design for gas lift operations [1]. They developed a new model that accurately matched PVT data, calculated tubing pressure drops, analyzed changes in the productivity index, analyzed variations in wellhead temperature, optimized gas lift design, and identified the best value for injected gas rate and oil production. A study conducted by Mohammed et al. focused on a well in the Mishrif formation within the Nasiriyah oil field [17]. In this study, the gas-lift method was applied to identify the highly accurate correlation for calculating the pressure gradient along the well. Their approach is based on building a mathematical model and validating it using the PIPESIM software. A sensitivity was carried out through the study of decreasing reservoir pressure and increasing water cut to find the efficient role of the gas-lift method for elevated production rate to 3,198 STB/D at a pressure of 2,750 psi. Al-Juboori et al. proposed a strategy for enhancing oil production in the Buzurgan oil field by gas-lift method. Their model is based on a genetic algorithm optimization approach which was developed to optimally allocate gas injection rate to each well connected to the network for the entire field with the limited cumulative quantity of injected gas [3].

Discussing the possible use of the gas-lift method in the Noor oil field, Salh et al. conducted a study that examined the importance of the gas-lift technique in order to improve production in this field. Their model involved the continuous gas lift method which caused essential production improvement [18]. Al-Janabi et al. have conducted detailed research on the Buzurgan oil field, which has 43 wells with a cumulative production rate of 73,380 STB/day. The main focus of their research was on the creation of a gas-lift system throughout the whole field by using GA to increase the total production rate up to 187,759 STB/day while using a limited injection gas rate [19].

Our study builds upon the existing science by presenting a gas lifting model that includes a mathematical optimization tool with the main objective of suggesting an efficient gas allocation strategy across the well network. The ultimate plan of this strategy is to achieve optimal gas distribution for each separate well, which leads to maximizing oil production. Furthermore, an economic analysis to determine the feasibility of applying gas-lift technology in the Halfaya oil field is performed as part of the study case.

Finally, through integrating the theory framework with applied scenarios, our study aims to prove the gas-lift method's capabilities of enhancing oil production, thereby improving the net profit of the Halfaya oil field.

2- Methodology

2.1. Well Model

In the gas lift technique, the gas normally is injected via the gas lift valves that are already set in the annuals. Therefore, building a well model is necessary to assess the gas lift system. Prior to model construction, it is important to define various good parameters required for the modeling process. These parameters include data such as reservoir pressure, temperature, drilling depth, inflow performance relationship, PVT data, tubing and casing data, perforation details, test points for determining the productivity index, and other fluid properties. The main properties used in this study for one well are listed in Table 1. These properties can vary from well to well. Once this information is gathered, a model schematic is created using the SLB PIPESIM optimizer, the steady-state simulator based on the nodal system analysis approach to simulate the production petroleum system. A MATLAB optimizer is then used to determine the optimal gas lift rate based on net profit using a polynomial fitted function. The well model construction involves inputting relevant well data, which is then calibrated to accurately represent the gas-lift performance in the field.

Fig. 2 illustrates the steps involved in constructing the well model and optimizing the gas-lift system in the Halfaya oilfield.

Table 1. Data Used in this Study

Reservoir Pressure, pai	3895
Reservoir Temperature, °F	210.2
Depth to mid perforation, ft	3356
Productivity index, STB/d/psi	7
Casing diameter (OD), in	7
Tubing diameter (ID), in	2.75
Case setting depth, ft	3666
Tubing depth, ft	3151

Fig. 2. Flow Diagram Well Model Construction and Gas-Lift Optimization in the Halfaya Oilfield

- PVT and Fluid Modeling for the Network

Building a fluid model for the field is another critical step to be carefully accomplished, especially when the current data is limited for all utilized wells. This might be achieved by using curve matching or averages in certain cases. In this study, the data was a challenge to obtain for all wells due to PVT data, which was only obtained for 5 wells. One method used to solve this is using the fitting method to determine the average values needed to construct the PVT model. It is important to note that all wells that were drilled in the same formation are not bonded by the same zones of production. Hence there are differences in the depth present in each drilled well.

Building a fluid model for the field represents a key step that should be carefully performed, practically when it deals with limited field data. In such cases, the curve fitting method or averaging the values is required to construct the model. In our case study, PVT data was available for only 5 wells. Therefore, a curve-fitting method was utilized to solve this problem. It is worth noting, that although the depth of the production zone is not the same, they produce from the same formation.

The fluid properties of the MB1 unit (main reservoir in the Mishrif formation) are listed in Table 2. These values represent the input data for PIPESIM Software, incorporated in the creation of the fluid model by using these data based on this data.

Table 2. MB1 Fluid Properties

Bubble point pressure (psi)	2765
GOR (Scf/STB)	629
Bob (STB/RB)	1.384
API	22
μ_{ob} (cp)	1.381
Bubble point pressure (psi)	2765
GOR (Scf/STB)	629

This study utilized the black oil fluid model, calibrated using the calibration constant method. This model is crucial in the petroleum industry for accurately predicting fluid behavior in reservoirs. When there is a discrepancy between measured values and those calculated using this model, a calibration constant can be employed to adjust the following calculations. It is common for actual measured values to slightly differ from those predicted by the model, making calibration necessary. In such cases, PIPESIM, a widely used software in the industry, calculates a calibration constant (Kc) based on known data for the property. This constant helps fine-tune the model to better match real-world conditions, improving the accuracy of predictions. The calibration constant (K_c) is calculated as follows:

$$K_c = \frac{\text{measured property}_{(T,p)}}{\text{calculated property}_{(T,p)}} \tag{1}$$

Then, K_c is used to calculate all the required properties, as follows:

$$\text{Calibrated Property} = K_c \times \text{PIPESIM Calculated Value} \tag{2}$$

The PVT properties that can be adjusted using this method include saturated and under-saturated oil formation volume factor, saturated and undersaturated oil viscosity, gas viscosity, and gas compressibility. After selecting the black oil correlation that best matches the measured data for each fluid property, this calibration concept was applied to calculate the PVT properties as shown in Fig. 2. Table 3 provides a list of the black oil correlations utilized in modeling the fluid behavior of the production network under study.

2.2. Gas lift Design

To design a gas-lift system in an oil well, completion factors including the tubing size and depth of each well should be considered. These factors are essential in selecting the most suitable valves during the gas lift design process. The valve design is focused on determining the optimal location for the process and unloading valves, which is identified by the pressure of the injected gas. This allows for the estimation of the pressures of opening and closing injection valves during the gas injection process. The gas lifting valve is considered the heart of the system, as it acts as a backpressure regulator that adjusts depending on the pressure difference between the injected gas and production pressures. They also maintain a fixed pressure on the downstream side by regulating the pressure on the upstream side. The gas lift design for one well analyzed in this study is shown in Fig. 4.

Moreover, the point of installation and the number of gas lift valves are essential design factors that should be carefully analyzed during the design process. An inefficient design could result in the installation of many unnecessary valves, some of which may not even be required. Thus, calibration should be precisely adjusted to optimize performance at the wellbore and enhance the artificial lift process for each well. The gas lift design involving the installation of injected gas valves with precise calibration is illustrated in Fig. 5.

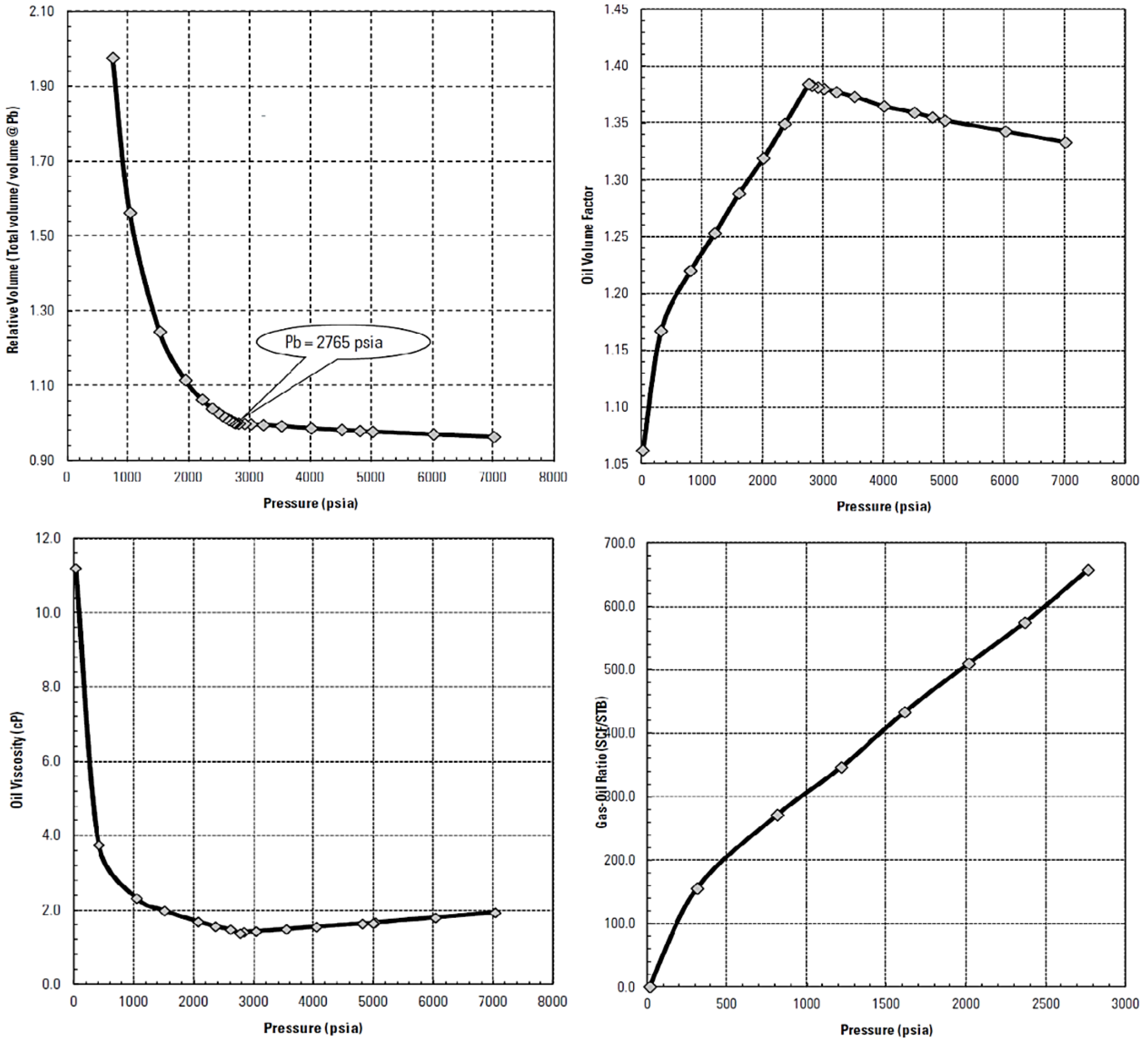

Fig. 3. PVT Properties for MB1 Unit

Table 3. Black Oil Correlations Were Used in Modeling the Fluid Behavior

Properties	Correlations
Undersaturated FVF	Vasquez and Beggs
Saturated FVF	Standing
GOR	Laster
Live oil viscosity	Chew and Connally
Dead Oil viscosity	Glaso
Undersaturated oil viscosity	Vasquez and Beggs

2.3. Network Model Construction

After constructing the model for a single well, the model for the full field can now be developed using the surface network feature as shown in Fig. 6. The model considers seven wells, five of which are deviated wells. It is worth mentioning that the gas lift technique was already applied to three wells. This model is constructed to determine the effect of implementing the gas lift method in enhancing the production and thus the net profit of these seven wells.

2.4. Gas Lift Optimization

The optimal gas injection rates for each well were calculated utilizing PIPESIM software and MATLAB Optimizers, resulting in enhancing the entire field profit. The process of gas optimization using PIPSIM software was constrained with a limiting gas injection rate of 10 MMscf/d per well and a total field injection rate of 20 MMscf/d as upper constrain values and with 0 MMscf/d as a minimum limit value. Then, gas lift performance curves (GLPCs) for each well were constructed according to the maximum constraint value (10 MMscf/d). GLPCs can be generated through simulations using a nodal system analysis approach or by collecting field data on gas injection and oil production rates. More detailed information about this method was described in our previous paper.

The net profit for each well in the network was performed utilizing the MATLAB Optimizer which is based on the MATLAB function (fmincon). This method employs the interior point optimization algorithm to minimize functions under constraints and is commonly used to solve linear and nonlinear convex optimization problems. By incorporating a barrier term into the objective function, the algorithm can prevent violations of inequality restrictions. This term guarantees that the optimal unconstrained value falls within the feasible space. Interior point methods are particularly effective when applied to large-scale problems with numerous design variables. Implementing these approaches into a mathematical program, such as MATLAB, is a relatively simple process. One example of utilizing MATLAB for optimization is by generating an objective function using high-order polynomial fitting of gas lift performance curves for individual wells. The optimization process of this method depends on GLPCs of a group of wells, where field data is fitted with a mathematical expression to enable computer processing of the curves. Although a second-degree polynomial is commonly used for this purpose, a new model (Eq. 3) is proposed in this study for better matching with the field data and improving the optimization process.

$$Q_o = c_1 + c_2 Qg + c_3 Qg^2 + c_4 \ln(Qg+1) \quad (3)$$

This model was developed through a linear combination of functions utilizing the best correlation coefficient with the available field data. The coefficients c_1, c_2, c_3, and c_4, are determined from the data by using the least square technique. This process is performed by exporting the GLPCS from PIPSIM and importing them into MATLAB for analysis. Fig. 7 illustrates the MATLAB built-in optimization window, where the objective function is generated through the high-order polynomial fitting of GLPCs for each well. Fig. 8 demonstrates the flow chart for this model.

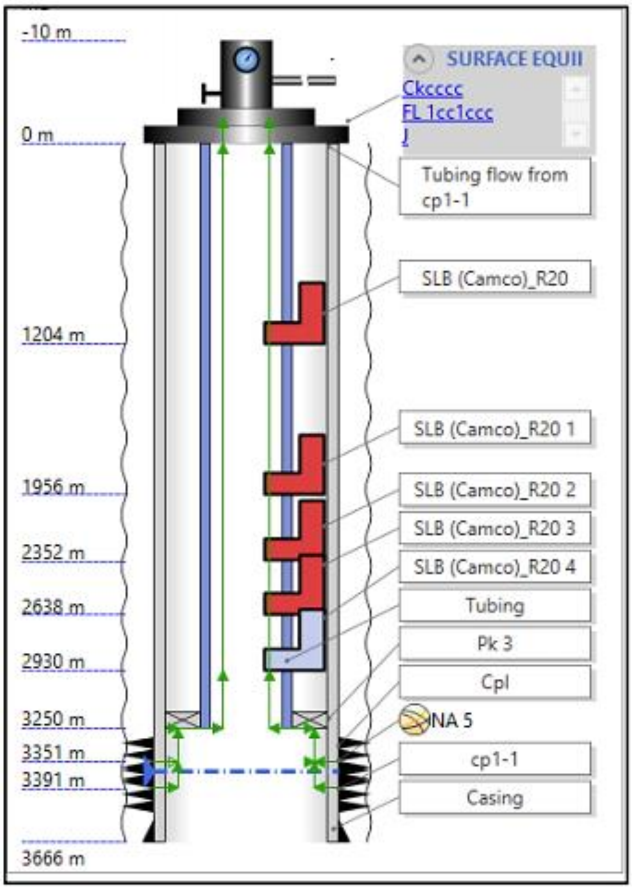

Fig. 4. Gas Lift Design for One of the Wells within the Halfaya Oil Field

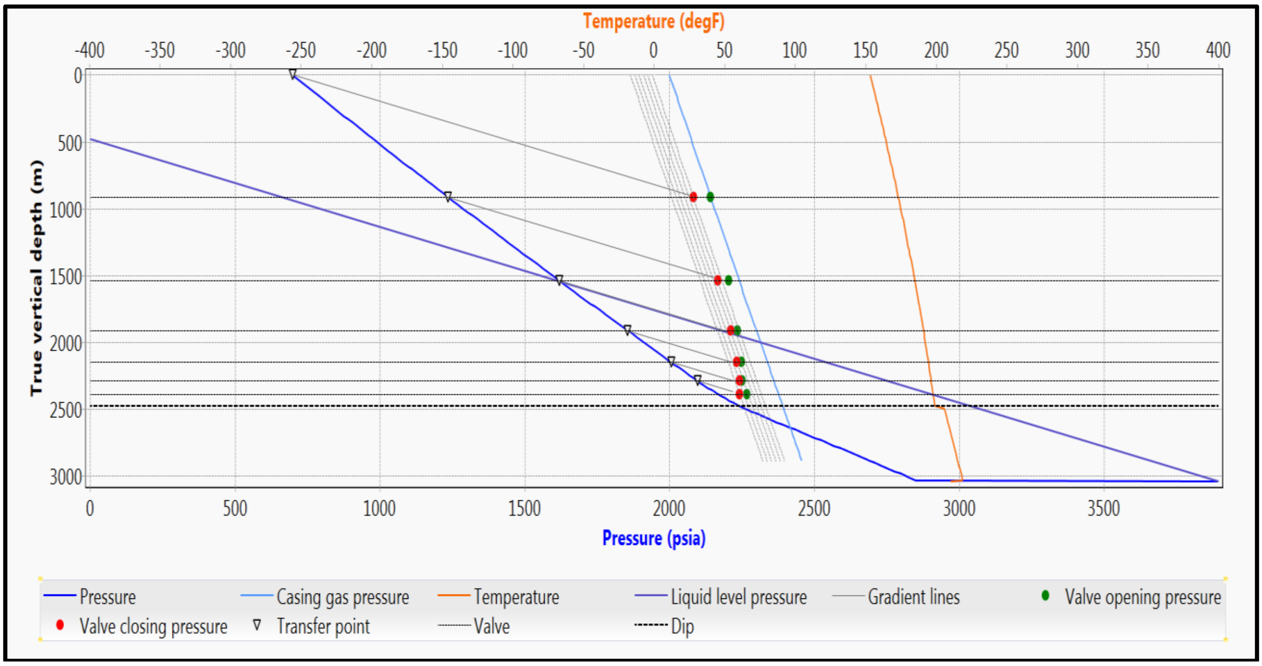

Fig. 5. Gas Lift Design Including the Activated Gas Lift Valves

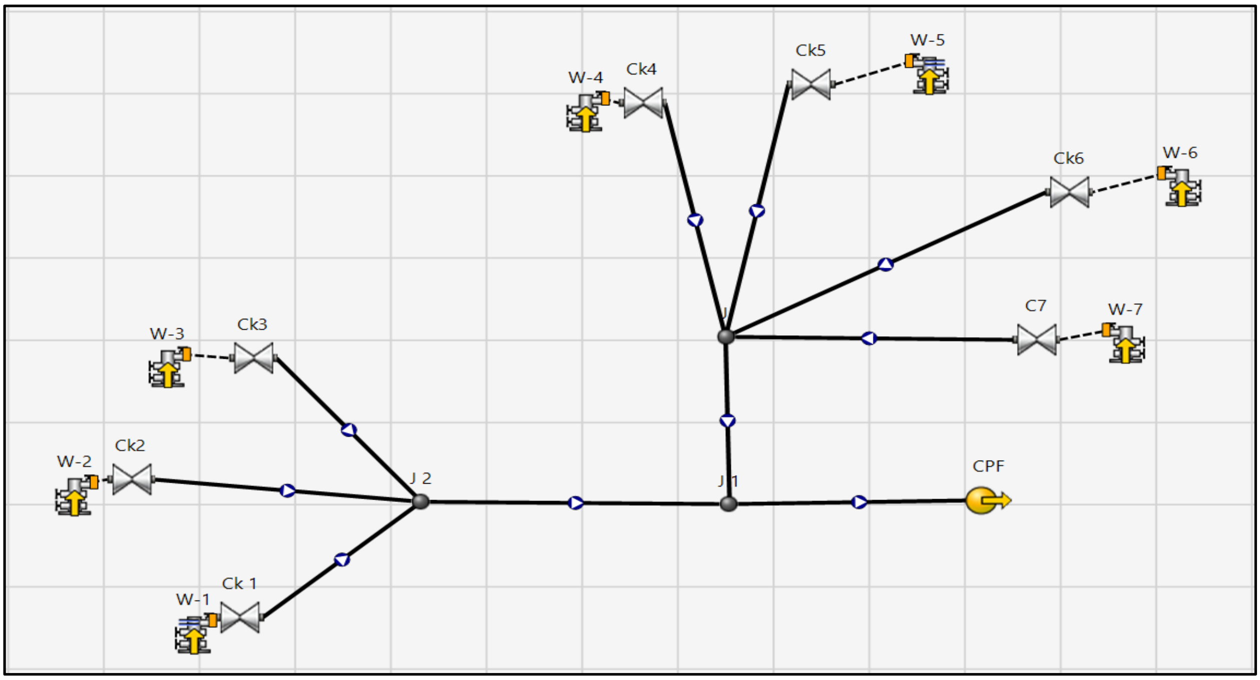

Fig. 6. The Field Network Model for Seven in the Halfaya Oilfield

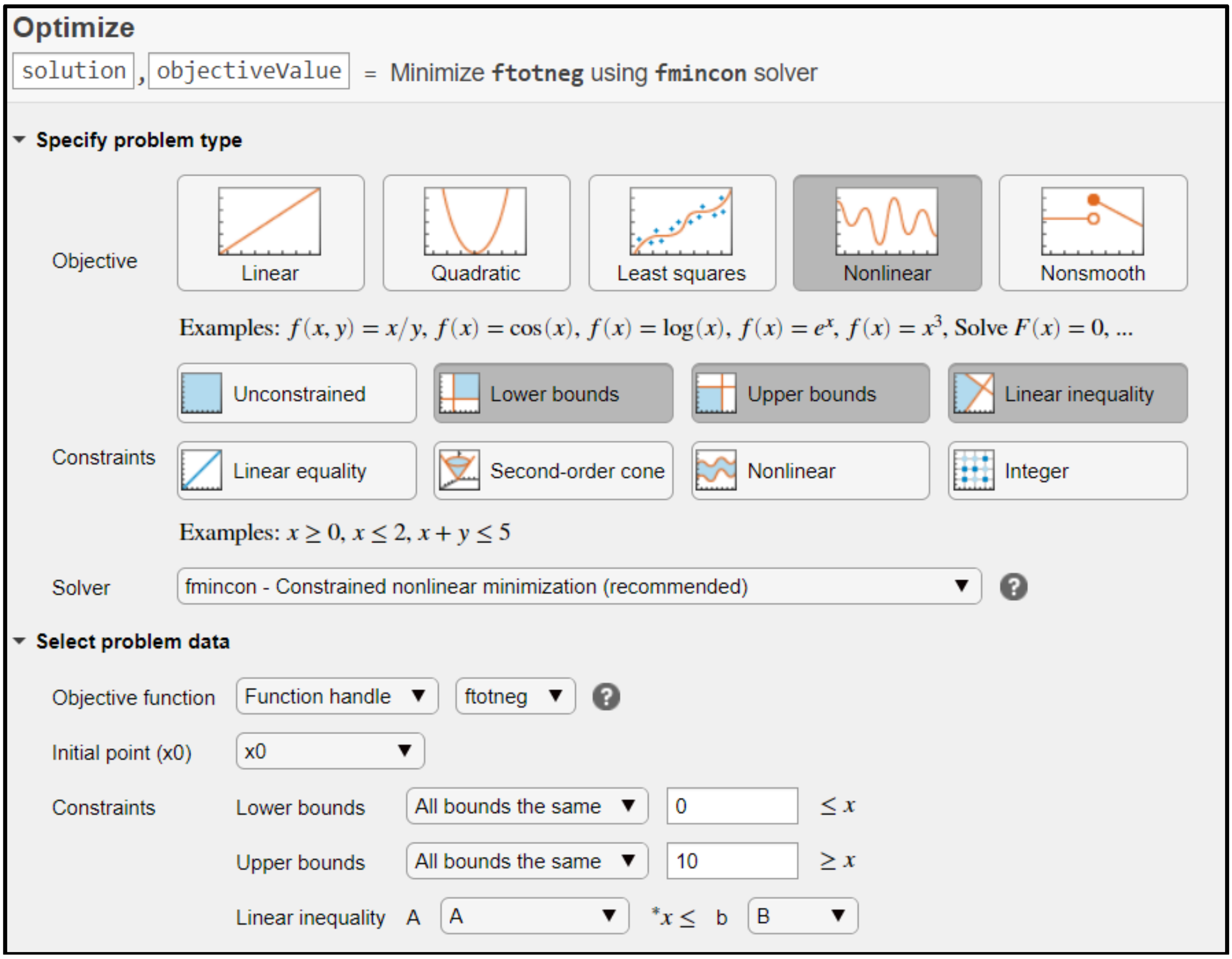

Fig. 7. MATLAB Oil Rate Optimization Task

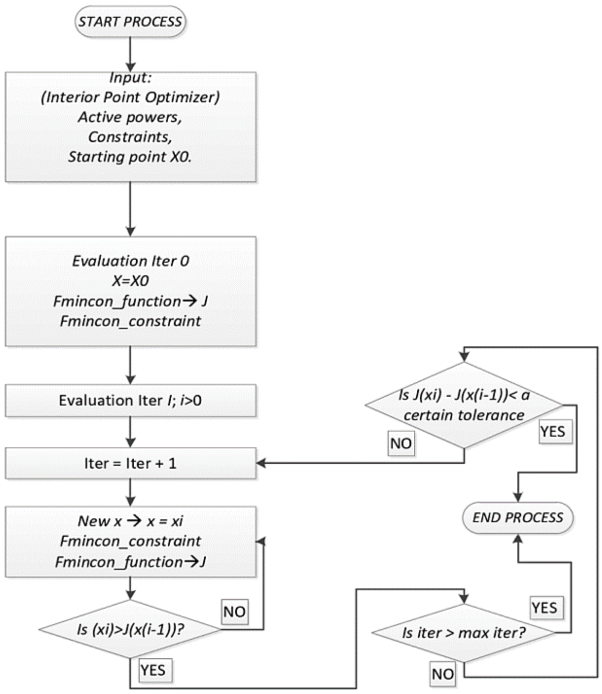

Fig. 8. Flow Chart for the Optimization Process Using Fmincon MTLAB Function

3- Results and Discussion

3.1. Determination of the Optimum Surface Injection Pressure and Rates

The gas-lifting efficiency of the wells was calculated using the SLB.PIPESIM software, based on the specified surface injection pressure and target injection gas rate (Qgi). The analysis included sensitivity records for the gas-lift response, covering a range of six different injection gas rate values and three different injection pressure values. Fig. 9 to Fig. 12 illustrate the results obtained from analyzing the gas lift response in the SLB.PIPESIM software for the Halfaya wells.

Based on the data presented in Fig. 9 and Fig. 10, the optimal gas lifting injection rate and pressure are determined to be 4 MMscf/d and 3000 psi, respectively. This conclusion is supported by the maximum oil production achieved through gas injection, as illustrated in Fig. 11 and Fig. 12. It is worth noting that the scenario with an injection pressure of 4000 psi has been excluded from consideration, as the incremental gain in oil production is minimal when compared to the gas lifting case with an injection pressure of 3000 psi. Furthermore, it is important to consider the cost implications associated with increasing the injection pressure.

3.2. Base Case

As previously mentioned, the installation of a gas lift will increase the number of produced wells in the network by allowing fluids to be produced at pressures above their bubble point. By utilizing the PIPESIM network simulation model, a comprehensive evaluation can be conducted on the entire network before and after installing the gas lift, allowing for a full simulation of the impact of each well on the others. After installing 7 production wells with gas lifts, the network experienced a noticeable increase in the production rates of all wells. The total oil production has elevated from 13347 to 18332 STB/D, achieving an average increase percentage of around 30%. This increase is illustrated in Fig. 13, which compares the oil production rates before and after gas lifting implementation in wells W-1 to W-7. Table 4 presents detailed information about the production rate before and after gas lift installation.

3.3. Gas Lift Optimization

The PIPESIM and MATLAB Optimizers were utilized to determine the optimal gas lift injection rates for each well in order to maximize total oil production.

3.3.1. PIPESIM Optimizer

The GLPCs were generated for the entire network and each well individually based on the gas-lift system design and the network model construction. Fig. 14 and Fig. 15 illustrate the optimization efficiency by demonstrating an increase in oil production rate to 18814 STB/d with a lower value of the injected gas rate of about 7.56 MMscf/d in comparison to this value in the base case. Notably, it is important to identify the optimum gas injection rate point as shown in Fig. 14. To the left of this point, the reduction in gravitational pressure drop outweighs the pressure drop increase due to the friction. Conversely, to the right of the optimum point, the increase in frictional pressure drop surpasses the decreased pressure drop due to the gravitational effect. This shows the essential role of gas lift optimization in maximizing efficiency and performance production operations.

3.3.2. MATLAB Optimizer

The MATLAB optimizer utilized the MATLAB function (fmincon) for minimization under constraints. This built-in optimization tool generates the objective function through high-order polynomial fitting of GLPCs for each well. The evaluation of the MATLAB function (fmincon) versus the number of iterations is shown in Fig. 16, which indicates that the converged solution of this method is slightly higher than that of the PIPESIM optimizer. However, a higher gas rate indicates better performance than that of the genetic algorithm.

3.4. Economic assessment (Net profit Evaluation)

The economic assessment of applying gas lifting methods requires a complete idea about the application needed for this technique. Thus, the operational (OPEX) analysis and capital investment (CAPEX) research are necessary to fully understand the economics of the two methods used in this study. The economic assessments were performed by calculating the Net profit using the following equation:

$$\text{Net Profit } = \sum_i^n \left[q_{oi}(p_o - c_{op}) + (p_g \times q_g) - (q_{wi} \times c_w) - (Q_{gi,inj} \times c_{g,inj})\right] \quad (4)$$

The following assumptions were considered in these calculations [19, 20]:

- Oil Price = 70$/STB.
- Gas Price = 5500$/MMscf.
- Cost of water disposal = 1 $/bbl.
- Operational Gas Lift cost = 3500$/MMscf.
- Operational cost for every STB of oil = 8 $/STB.

Applying Eq. 4, the PIPESIM case yields a net profit of $1,205,199 per day, while the MATLAB case results in a net profit of $1,201,624 per day. Although the quantitative results support the qualitative conclusion, it remains uncertain if the current solution is the most optimal in terms of net profit. The net profits optimization performance plot is illustrated in Fig. 15. The optimizer shows a convergent profit of 1,206,394 $/d which corresponds to a production rate of about 18,797 STB/d with a gas lift rate of 6.86 MMscf/d. Despite the lower oil rate of this solution, it is considered optimal since the reduction of the gas lift rate increased the project's profit.

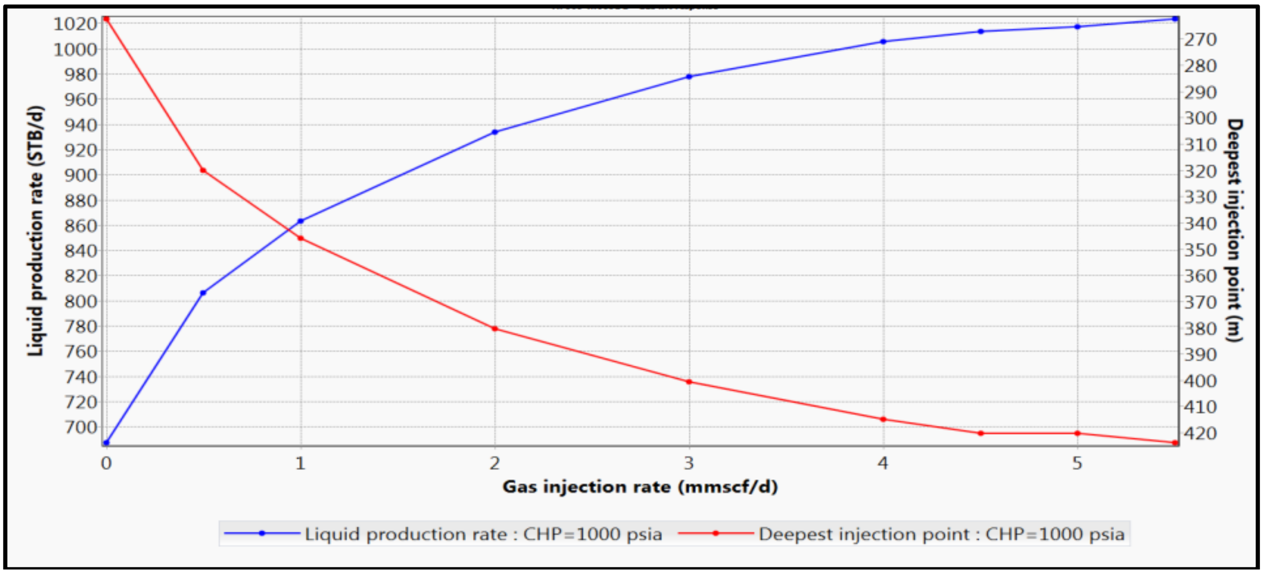

Fig. 9. Gas Lifting Response Plot for W-6 at Injection Pressure1000 psi

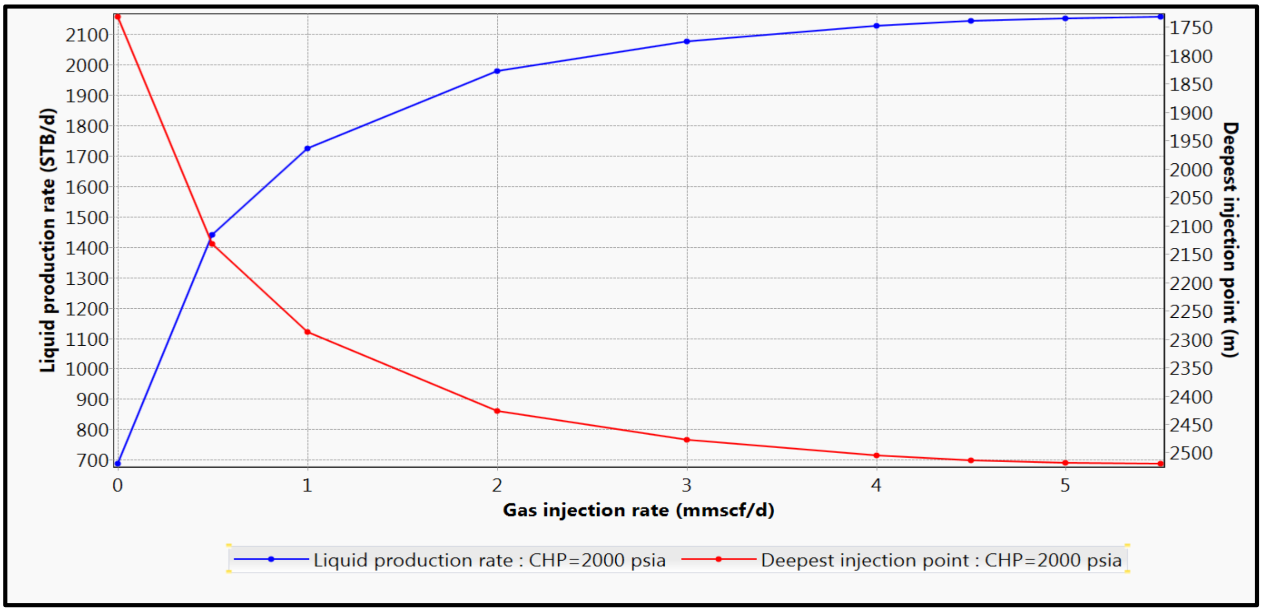

Fig. 10. Gas Lifting Response Plot for W-6 at Injection Pressure 2000 psi

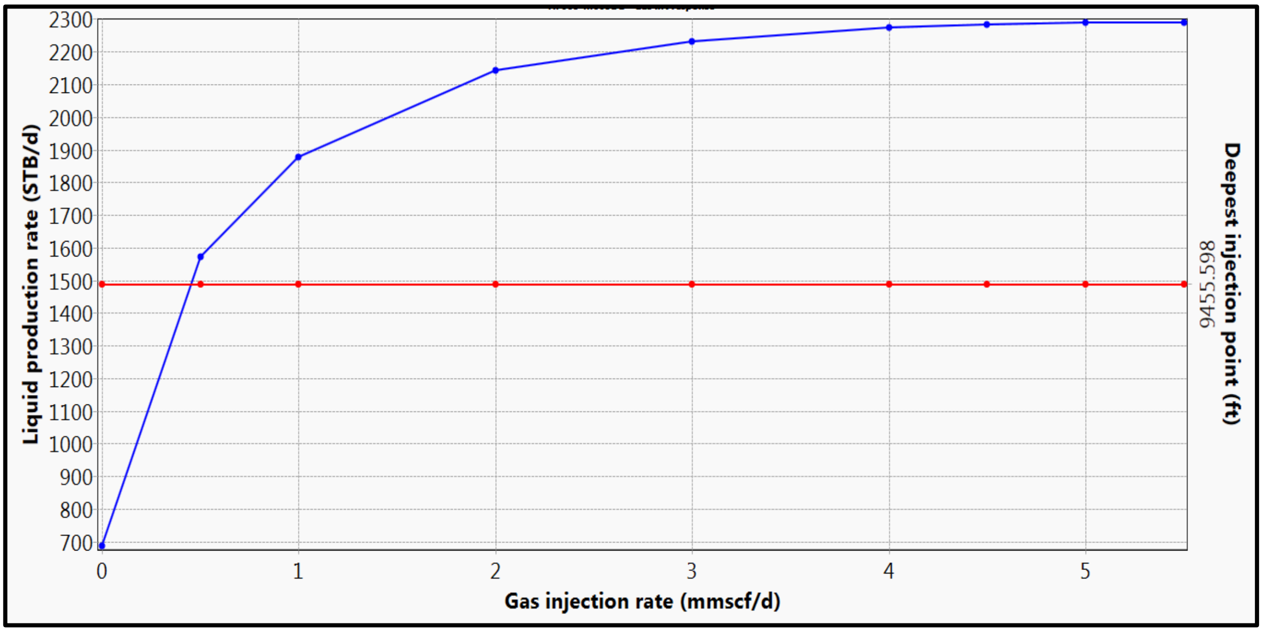

Fig. 11. Gas Lifting Response Plot for W-6 at Injection Pressure3000 psi

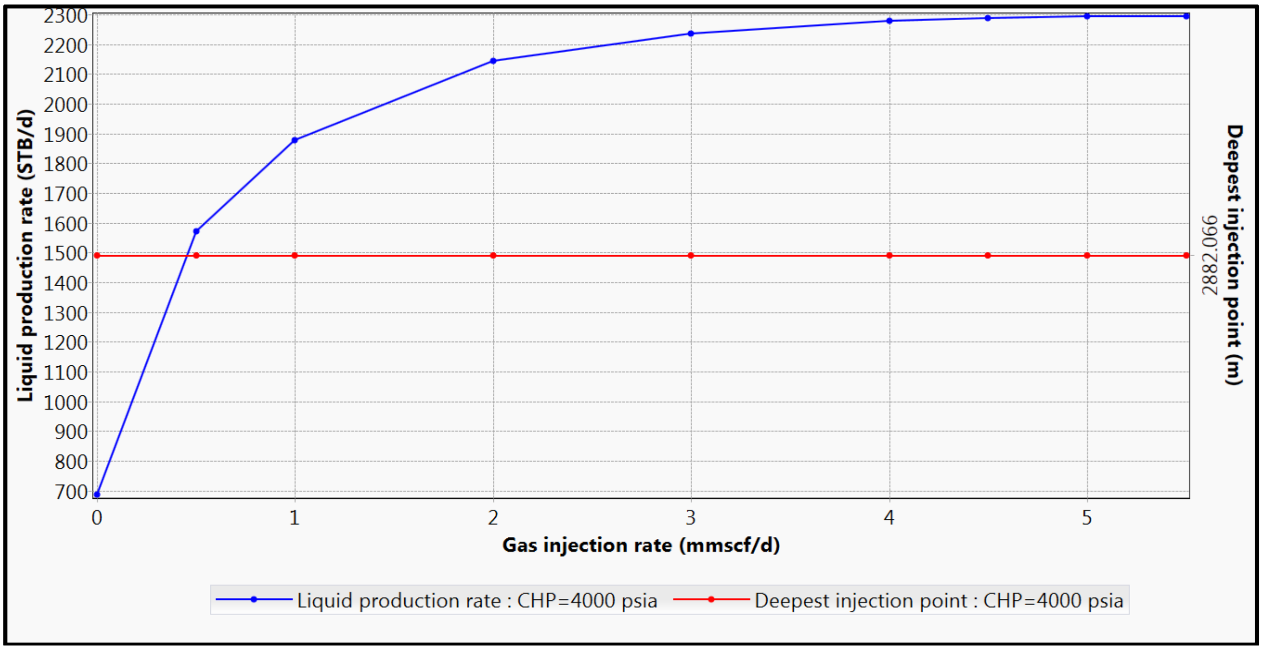

Fig. 12. Gas Lifting Response Plot for W-6 at Injection Pressure 4000 psi

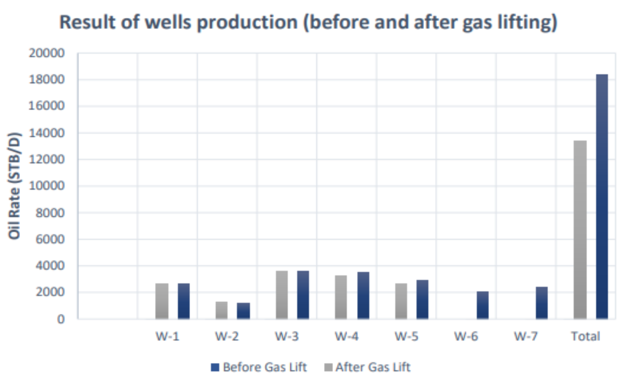

Fig. 13. Comparison of Oil Flow Rates for Wells W-1 to W-7 (before and after Gas Lifting)

Table 4. Oil Production Rates for Wells W-1 to W-7 (before and after Gas Lifting)

Well Name	Before Gas-Lift Design	After Gas-Lift Design	
	Oil rate (STB/d)	Gas lift rate (MMscf/d)	Oil rate (STB/d)
W-1	2630	1	2681
W-2	1262	1.193	1216
W-3	3554	0.7655	3564
W-4	3256	5	3535
W-5	2640	3	2929
W-6	0	3	2053
W-7	0	1	2365
Total	**13347**	**14.96**	**18332**

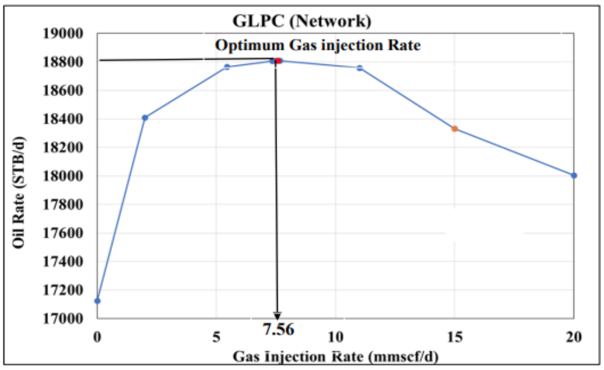

Fig. 14. GLPC for the Entire Network Constructed by the PIPESIM Optimizer

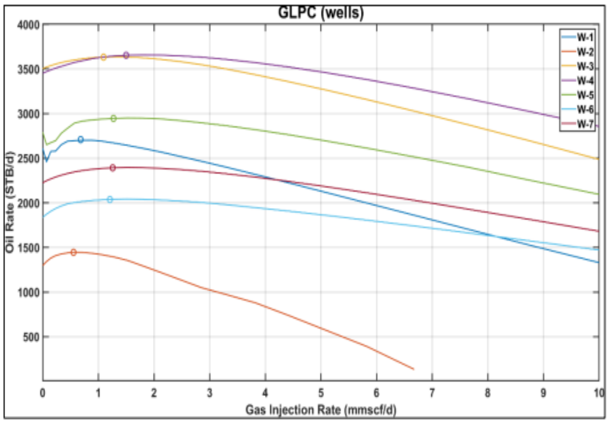

Fig. 15. GLPCs for W-1 to W-7 Generated by the PIPESIM Optimizer

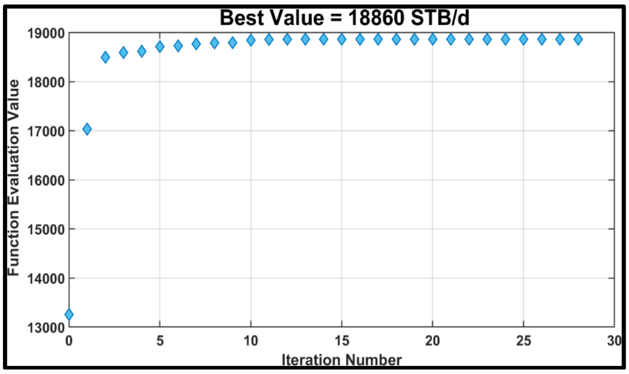

Fig. 16. Function Evaluation Value vs. Iteration Number Generated by MATLAB

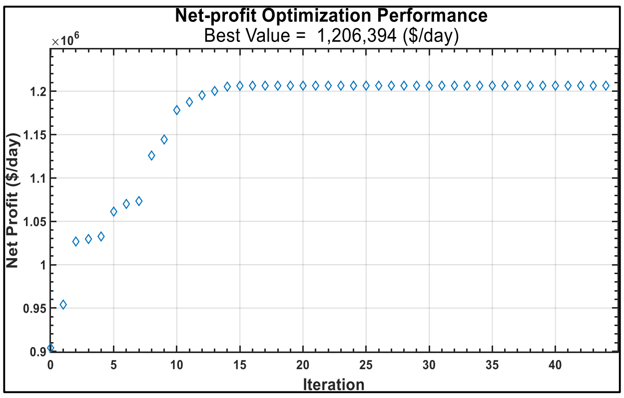

Fig. 17. Net-Profit Optimization Performance

4- Conclusions

The main focus of this work is analyzing the gas lift optimization for the Halfaya oilfield to enhance oil production efficiency from 7 wells in this field. The production efficiency was evaluated using PIPESIM software and the MATLAB optimizer as a developed technique. This evaluation incorporated sensitivity results for several injection rates at different injection pressure values. The results showed the optimal gas lift injection rate was 4 MMscf/d at the optimal pressure value of 3000 psi, resulting in an increase in oil production. In addition, the gas lift setting in these 7 wells led to a noticeable increase of around 30 % in the total production rate. Further evaluation of gas lift optimization was performed by PIPESIM and MATLAB optimizers. The results demonstrated an increase in production rate to 8814 STB/d with a lower gas injection rate compared to the base case. Along with this, the MTLAM optimizer, using the Fmincon function, showed a slightly higher converged solution than the PIPESIM optimizer, identifying good performance at a high injection gas rate. Finally, an economic evaluation was performed for the system net profit assessment based on the CAPEX and OPEX analysis. The PIPSIM case resulted in 1,201,624 $/ day, while the MATLAB function gave a 1,201,624 $/ day. Thus, additional optimization using the MATLAB function is suggested to identify the most efficient results regarding the net profit.

Nomenclature

n	The Number of Wells
q_{oi}	Rate of Oil Production (STB/day)
q_g	Rate of Gas Production (MMscf/day)
q_{wi}	Water Production Rate (STB/day)
$Q_{gi,ing}$	Lifting Gas Injection Rate (MMscf/day)
p_o	Price of Oil ($/STB)
c_{op}	Operational Costs for each STB of oil ($/STB)
p_g	Gas Price ($/MMscf)
c_w	Cost of water disposal ($/STB)
$c_{g,ing}$	Cost of lifting gas injection ($/MMscf)
GLPC	Gas Lift Performance Curve
GLV	Gas lifting valve
CPF	Central Provident Fund
PK	Packer
CPL	Well Completion

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تحسين الأمثل لصافي الربح لأبار التي تنتج بالرفع بالغاز لتكوين مشرف لحقل حلفايا النفطي

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الخلاصة

يعد الرفع بالغاز أحد أكثر طرق الرفع الاصطناعي شيوعًا والتي يتم استخدامها بشكل فعال في صناعة النفط لتعزيز الإنتاج. ومع ذلك، قد يكون تخصيص الغاز المناسب في الآبار أمرًا صعبًا بسبب قيود مختلفة مثل النقص في الغاز المحقون والاعتبارات الاقتصادية. لذلك، تم إجراء البحث الحالي لمعالجة المتطلبات اللازمة لتوزيع الغاز بشكل فعال لتحقيق أقصى قدر من الأرباح في حقل الحلفاية النفطي – تكوين مشرف. يعد الرفع المستمر بالغاز أحد طرق الرفع الاصطناعي الأكثر استخدامًا. ولتعزيز معدل الإنتاج، يتم حقن كمية كافية من الغاز في أنابيب الإنتاج على أعماق محددة لتقليل ضغط عمود السائل حيث أن كل بئر له نقطة مثالية للإنتاج في مكمن النفط. ومن ناحية أخرى، فإن القيود المفروضة على توافر الغاز تحد من تحقيق الحالة المثلى للإنتاج. وشددت هذه القيود، جنبًا إلى جنب مع القيود الاقتصادية بما في ذلك ارتفاع أسعار الغاز وتكاليف الضغط، على ضرورة اتباع منهجية مثالية لتعزيز إنتاج النفط. بصرف النظر عن أهمية حقل الحلفاية النفطي، فان هناك عدد محدود من الدراسات ذات الصلة حول الرفع الاصطناعي في هذا الحقل النفطي والتي تتعلق على وجه التحديد بطريقة رفع الغاز المستخدمة في هذه الورقة. وبالتالي، فإن الغرض من البحث الحالي هو اقتراح تصميم رفع الغاز تم اختباره جيدًا لتحسين إنتاج النفط. يجمع هذا النهج بين مهارة وظيفة (fmincon) في برنامج MATLAB Optimizer وPIPESIM Software لإنشاء منحنيات أداء رفع الغاز. نتائج البحث اكدت زادة بمعدل إنتاج نفط قدره ١٨٨٦٠ برميل/يوم، مع معدل رفع غاز قدره ٩,٤٢ مليون قدم مكعب/يوم. إن إنشاء عملية التحسين المنهجية هذه يمكن أن يؤدي إلى إدارة تحديات تخصيص الغاز في حقل الحلفاية النفطي نحو زيادة معدلات الإنتاج إلى الحد الأقصى وزيادة صافي الأرباح في نهاية المطاف.

الكلمات الدالة: الرفع الاصطناعي، تحسين رفع الغاز ، صافي الربح، حقل حلفاية، هندسة الانتاج.