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ICoSET
2017

International Conference on Science Engineering and Technology (ICoSET) and International Conference on Social Economic Education and Humaniora (ICoSEEH)
08 - 10 November 2017
Pekanbaru, Indonesia

ICoSET 2017 Partner and Support

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FOREWORD FROM CHAIR OF ICOSET & ICOSEEH UNIVERSITAS ISLAM RIAU

In the name of Allah, Most Gracious, Most Merciful

Assalamualaikum Wr. Wb,

Welcome to the International Conference on Science Engineering and Technology (ICoSET) and International Conference on Social Economic Education and Humaniora (ICoSEEH).

ICoSET & ICoSEEH 2017 has a theme "Sustainability Development in Developing Country". This forum provides researchers, academicians, professionals, and disciplinary working or interested in the field of Science Electrical Technology and Social Education Economy and Humaniora to show their works and findings to the world.

I would like to express my hearty gratitude to all participants for coming, sharing and presenting your experiences in this vast conference. There are more than 150 papers submitted to ICoSET & ICoSEEH UIR 2017. However only high quality selected papers are accepted to be presented in this event, so we are also thankful to all the international reviewers and steering committee for their valuable work. I would like to give a compliment to all partners in publications and sponsor ships for their valuable supports.

Organizing such a prestigious conference was incredibly challenge and would have been impossible without our outstanding committee, So, I would like to extend my sincere appreciation to all committees and volunteers from Chiba University, Saga University, Universiti Teknologi Mara, Universiti Utara Malaysia, Dayen University, Kyungdong University for providing me with much needed support, advice, and assistance on all aspects of the conference. We do hope that this event will encourage the collaboration among us now and in the future.

We wish you all find opportunity to get rewarding technical programs, intellectual inspiration, renew friendships and forge innovation and that everyone enjoys some of what in Pekanbaru-Riau special.

Pekanbaru, 8th November 2017

Dr. Evizal Abdul Kadir, M.Eng

Chair of ICoSET & ICoSEEH 2017

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FOREWORD FROM RECTOR
UNIVERSITAS ISLAM RIAU

It is our great pleasure to join and to welcome all participants of the International Conference on Science Engineering and Technology (ICoSET) and International Conference on Social Economic Education and Humaniora (ICoSEEH) 2017 in Pekanbaru. I am happy to see this great work as part of collaborations among Chiba University, Saga University, Universiti Teknologi Mara, Universiti Utara Malaysia, Dayen University, Kyungdong University. In this occasion, I would like to congratulate all participants for their scientific involvement and willingness to share their findings and experiences in this conference.

I believe that this conference can play an important role to encourage and embrace cooperative, collaborative, and interdisciplinary research among the engineers and scientists. I do expect that this kind of similar event will be held in the future as part of activities in education research and social responsibilities of universities, research institutions and industries internationally.

My heart full gratitude is dedicated to organizing committee members and the staff of Islamic University of Riau for their generous effort and contribution toward the success of the ICoSET & ICoSEEH 2017.

Pekanbaru, 8th November 2017

Prof. Dr. H. Syafrinaldi, SH., MCL

Rector of Islamic University of Riau

Pekanbaru, Indonesia

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TIME SCHEDULE

International Conference on Science Engineering and Technology (ICoSET) and International Conference on Social Economic Education and Humaniora (ICoSEEH) Pekanbaru, Indonesia, 08-10 November 2017

TIME	ACTIVITIES	PERSON IN CHARGE	VENUE
November 08, 2017			
08.00-08.30	Registration	Committee	Auditorium Rectorat 4th Floor
08.30-09.15	Opening Ceremony:	Committee	
	Quran Recitition	Committee	
	Indonesia Raya National Anthem	Committee	
	Speech of the Committee	Chairman of the committee **Dr. Evizal Abdul Kadir, ST, M.Eng**	
	Opening speech	Rector of Islamic Universty of Riau **Prof. Dr. H. Syafrinaldi, SH., MCL**	
	Performing Arts (Traditional Dance)	Committee	
09.15-09.30	Photo Session and Coffee Break	Committee	
09.30-12.00	Keynote speakers: 1. Prof. Dr. Shigeki Inaba: Professor of Agronomy. Agricatural Plant Science & Agricultural Economics. Saga University, Japan. 2. Prof. John Lee PhD, ME, MSc, BSc: President Kyungdong Global Campus Research, Kyoto University, Japan 3. Yohei Murakami, Ph.D: Center for the Promotion of Interdisciplinary Education	Moderator 1. Dr. Ujang Paman Ismail, M.Agr 2. Dr. Evizal Abdul Kadir., M.Eng 3. Arbi Haza Nst, B.IT, M.IT	
12.00-13.00	Lunch Break	Committee	3rd Floor
13.00-15.00	Parallel Session 1 Participants	Moderator	4rd Floor
15.00-15.30	Coffee Break	Committee	
15.30-17.30	Parallel Session 2 Participants	Moderator	
17.30-17.45	Closing Ceremony	Committee	

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TIME	ACTIVITIES	PERSON IN CHARGE	VENUE
November 09, 2017			
07.30-08.00	Re-registration	Committee	1st Floor
08.00-17.00	Siak Tour: 1. Istana Siak 2. Klenteng Hock Siu Kiong (Bangunan Merah) 3. Masjid Syahabuddin 4. Balai Kerapatan Adat		

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	2	1002	Arbi Haza Nasution, Yohei Murakami, Toru Ishida	Similarity Cluster of Indonesian Ethnic Languages
	3	1007	Jaroji, Agustiawan, Rezki Kurniati	Design Self Service Software Prototype For Village Office Using Unified Modeling Language
	4	1009	Yoanda Alim Syahbana, Memen Akbar	Analysis Of Frame Loss Position Influence And Type Of Video Content To Perceived Video Quality
	5	1010	Apri Siswanto, Norliza Katuk, Ku Ruhana Ku-Mahamud, Evizal Abdul Kadir	An Overview of Fingerprint Template Protection Approaches
	6	1013	Yuniarti Yuskar, Dewandra Bagus Eka Putra, Tiggi Choanji, Ziadul Faiez, Muhammad Habibi	Sandstone Reservoir Characteristic Based on Surficial Geological Data of Sihapas Formation in Bukit Suligi Area, Southwest Central Sumatra Basin
Parallel Presentation 2 (15.30-17.30)	7	1015	Raisa Baharuddin, Selvia Sutriana	Effect of Maturity Level of Compost And Shallot Varieties to Growth and Yield in Peat Soil
	9	1019	Ida Syamsu Roidah, Dona Wahyuning Laily	Improving Family Revenues Through Role of Household Mother In Rejotangan District
	10	1026	Fathra Annis Nauli1, Jumaini, Diva de Laura	Relationship Between Adolescent Characteristic and Bullying Incidents At Private Junior High School In Pekanbaru
	11	1025	Husnul Kausarian, Batara, Dewandra Bagus Eka Putra, Adi Suryadi Evizal Abdul Kadir	Measurement of Electric Grid Transmission Lines as the Supporting of National Energy Program in West Sumatera Area, Indonesia through Geological Mapping and Assessment

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ROOM 2

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	2	1016	Sisca Vaulina, Khairizal, Hajry Arief Wahyudy	Factors Affecting Production of Coconut (*Cocos Nucifera* Linn*)* In Gaung Anak Serka District Indragiri Hilir Regency, Riau Province
	3	1004	Nur Khamdi, Muhammad Imam Muthahhar	Determining Sliders Position by Using Pythagoras Principle of 3-DOF Linear Delta Robot
	4	1005	Desti	Morphological Characterization of Nibung (*Oncosperma Tigillarium* (Jack) Ridl.) As Riau Province Mascot Flora
	5	1006	Novrianti, Ali Musnal, Hardi, Bop Duana A, Leovaldo P	Weight On Bit Analysis In Rate Of Penetration Optimization Using Bourgoyne And Young Method
	6	1008	Idham Nugraha, Febby Asteriani, Puji Astuti, Retno Sawitri, Firdaus Agus	The Effects of Tengku Agung Sultanah Latifah Bridge Toward Physical Development in Siak Sub Districts
	7	1003	Heriyanto	Efficiency Of Rubber People Production In Kampar Regency Of Riau Province
	8	1011	Ariyon, M, Nugroho, R. S.	Production Optimization Esp-To-Gas Lift In High Gor Case Using Well Simulator
	9	1014	Anas Puri	Effect of Safety Factors on The Calculated Deflection of 1-Pile Row Full Scale Nailed-Slab Pavement System Resting on Soft Clay Due to Concentric Loadings
Parallel Presentation 2 (15.30-17.30)	10	1017	Dody Yulianto, Dedikarni, Kurnia Hastuti, Juraiz Saputra	Utilization Of Palm Oil Waste With Polypropylene Matriks (Pp) Recycling On Particle Board Composite (Particle Board)
	11	1018	Tengku Idris, Nurkhairo Hidayati,	Profile of Habits of Mind Student of Biology Education Program Islamic University of Riau
	12	1020	Hermaini, Sugeng Wiyono, Anas Puri	Study Of Concrete On Rigid Pavement With Addition Scanfibre
	13	1021	Muhammad Ariyon	Energy Resource Development Strategy At Indragiri Hulu Regency Riau Province
	14	1022	Rosyadi, Agusnimar, Abdul Fatah Rasidi	Giving *Chlorella sp* with Different Amount for DevelopmenT *Moina sp*
	15	1023	Sri Ayu Kurniati, Welly Sampurno	Analysis Of The Competitiveness Of Farming Oil Palm People Bengkalis Regency In Mandau
	16	1027	Ernita, M. Noer, Sidik Arif Irawan	Green Beans Plant Response (Vigna Radiata L) On Liquid Organic Fertilizer (Lof) Nasa and NPK Compound Fertilizer
	17	1028	Darus, Hajry Arief Wahyudy	Analysis Of Human Resources Work In Production Activity Hydroponic Vegetables Commodity (Case Study: Technical implementation Unit of Agro Garden in Islamic University of Riau)

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24	1024	Suryanti, Sepita Ferazona	Learning Outcome Comparison In Biology Subject Between Problem Based Learning (Pbl) Method Applied And Guided Discovery Learning (Gdl) Method Applied At Class Xi Sman Pekanbaru Academic Year 2016/2017
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PRODUCTION OPTIMIZATION ESP-TO-GAS LIFT IN HIGH GOR CASE USING WELL SIMULATOR

Ariyon, M, Nugroho, R. S
Universitas Islam Riau

Abstract

Pressure depletion happens when the well is produced after a long time. This depletion will caused the increase of associated gas production. RSN field is well known field with high GOR. Electric Submersible Pump (ESP) is a kind of artificial lift which used in RSN field. Well performance in RSN field is decreased time to time because of increase of gas production. Gas production caused zero maag which disrupting performance of ESP. This gassy problem in RSN field can be solved by converting ESP to gas lift. Gas lift is an artificial lift which is suitable for high GOR field. Before converting to gas lift, field performance evaluation needs to be done for each wells (GOR, casing pressure, productivity index). After evaluation, optimization will be done by converting to gas lift. Gas lift design is generated by making sensitivity analysis with injection gas rate and well head pressure as variable. The last is economic analysis from the gas lift conversion. Based on the gas lift optimization in RSN#36, the previous oil rate is 4 bpd using ESP which is below the economic limit. The optimized oil rate is 13.1 bpd with 0.2 mmscfd gas injection rate and 100 psi of well head pressure with the gas injection cost is 200$/d. Pressure compression to reach 100 psi is 100$/d. The result is cumulative oil production for 4 years is 17.27 mstb and net revenue is 125.84$M.

Keywords : *Zero Maag, Injection Gas Rate , Gas Oil Ratio, Casing Pressure, Net Revenue*

1. INTRODUCTION

Rate which based on reservoir pressure is the first thing need to be concerned in oil production. Deliverability of productive formation is described from production rate. Reservoir fluid in pore mediums will flow if there is a pressure difference from side to side. Reservoir deliverability also affect the completion design and artificial lift which is used (Guo, Boyun; Lyons, William; Ghalambor, 2007).

The increase of age of the field, there will be more pressure depletion at the field. This

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depletion will cause associated gas produced to the surface. The selection of artificial lift is needed to solve this gassy case.

RSN field is well known high GOR field, but there's some field which still produce oil. Most of the wells in RSN field uses Electric Submersible Pump (ESP). RSN field average performance, which used ESP pump is decline time to time. This case also followed by the increase of associated gas production, which caused gas lock in ESP. This gas also cause zero maag which disrupting the performance of ESP.

ESP is sentrifuge pump, which run by electric motor. This motor designed to be submerged to the working fluid. The purpose is to avoid cavitation to the pump. This special designed pump used to several special cases, like to produce sludge and also to produce oil while drilling.

The gassy problem in RSN field need to be solved, the way is converting ESP to gas lift. Gas lift is the method used in high GOR reservoir by injecting gas through wellbore to lift fluid to the surface, in this case also used to fix well performance, which has high Productivity Index (PI) by considering the ESP performance to be converted to gas lift. Gas lift design is needed to optimize RSN field.

Gas lift is the method to produce fluid to the surface by injecting gas through tubing-casing annulus in several pressure and temperature (Ebrahimi, 2010). The main purpose is to produce expected oil rate through the decrease of well flow pressure gradient in the tubing.

The purpose of this research is to analyze the performance of RSN field, which used ESP to be converted to gas lift and optimize the well. Economic analysis is needed to make sure the job is feasible to be run.

2. METHODOLOGY

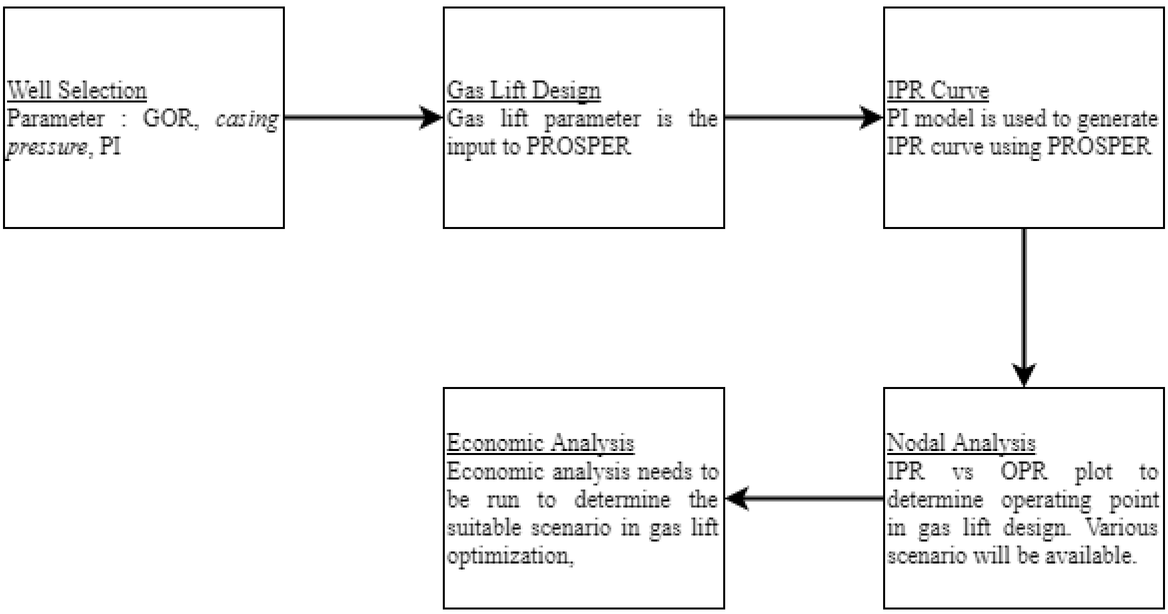

Figure 1 Research Methodology

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3. RESULT AND DISCUSSION

RSN Field Performance Evaluation and Well Selection

GOR is the main parameter in evaluating each well in RSN field. This is caused by RSN field has high average GOR which well known as high GOR field. One of well has 1190.3 scf/stb GOR. Figure 2 shown each GOR in several wells in RSN field

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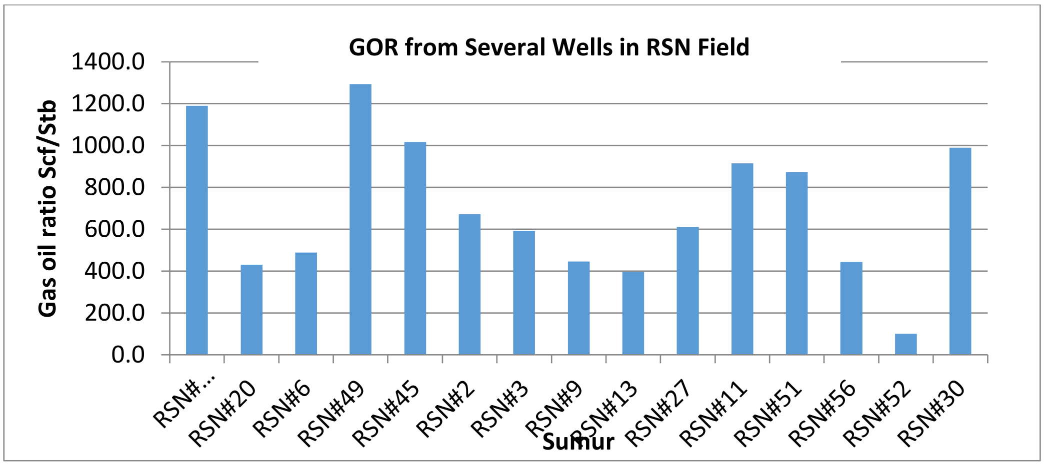

Figure 2 GOR in RSN Field

Can be seen that RSN#36 and RSN#49 has the highest GOR which is 1190.3 scf/stb and 1293.7 scf/stb. These wells can be made as candidate in ESP to gas lift conversion, besides GOR, Productivity Index (PI) and casing pressure is needed as parameter to select the suitable well candidate in oil rate optimization using ESP to gas lift conversion

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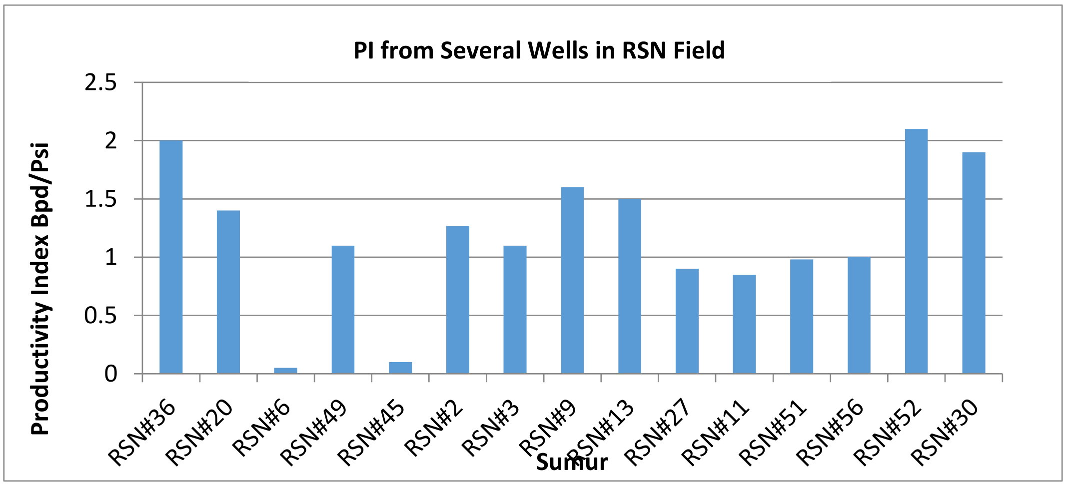

Figure 3 PI in RSN Field

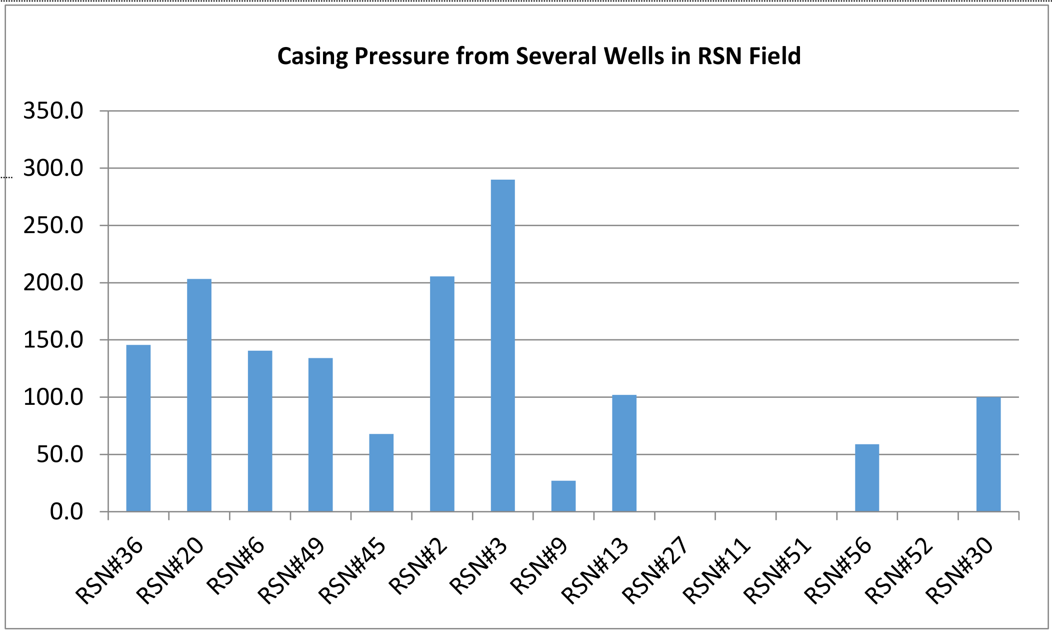

Figure 4 *Casing Pressure* in RSN Field

From these parameters (fig 2, 3, 4) RSN#36 is the suitable candidate to be converted from ESP to gas lift. This can be seen that RSN#36 has high GOR (1190.3 scf/stb), 2 bpd/psi of PI, and casing pressure is 145.6 psi. The high GOR and casing pressure will indicate associated gas when produced through ESP. When theres many associated gas produced in ESP, it will disturb the performance of ESP. High PI will show there is a big potention in reservoir deliverability to produce high oil rate to the surface. Conversion ESP to gas lift will be effective because the high existance of associated gas.

Production Analysis RSN#36

Table 1 Last Production Data RSN#36

Well	GOR (scf/stb)	Casing Pressure (psi)	Oil Rate (Bopd)	Gas Rate (Mcfd)	PI (STB/Day)
RSN#36	1190.3	145.6	4	73.09	2.0

Before optimization, need to be known that RSN#36 has low oil rate, 4 bpd of oil rate is below average economic limit (5 bpd) but 73.93 mcfd gas production which is high. This data can be seen in table 1. Comparing to economic limit 5 bpd, this well is not profit enough to be produced. From GOR, PI, and casing pressure, this well has big potential to be optimized by converting from ESP to gas lift.

From amp chart, RSN#36 has high gas production so, when this well is still produced using ESP it will be disturbed by

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associated gas and the oil rate will be depleted.

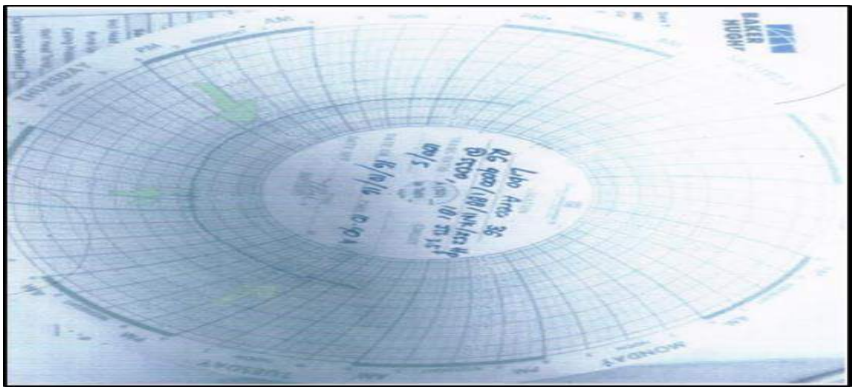

Figure 5 Amp Chart Result in RSN#36

Based on figure 5, the ampere which is obtained from troubleshooting. This figure shown theres a curren regular current which shown by arrow mark, this current formed circle which indicates gas production or gassy well (Roosa, S, 2011).

Gas Lift Design in RSN#36

Table 2 Gas Lift Input

Depth	5778	ft
QL	1500	Stb/h
Tubing Size	2.5”	Inch
Reservoir Pressure	2309	Psi
Well Head Pressure	246	Psi
Gas Liquid Ratio	800	Scf/Stb
Specific Gas Gravity	0.6	Sp Gravity
PKO	1000	Psi
PSO	900	Psi
Well Flow Pressure	2034	Psi
Well Flow Temperature	301.79	F
Surface Temperature	288	F

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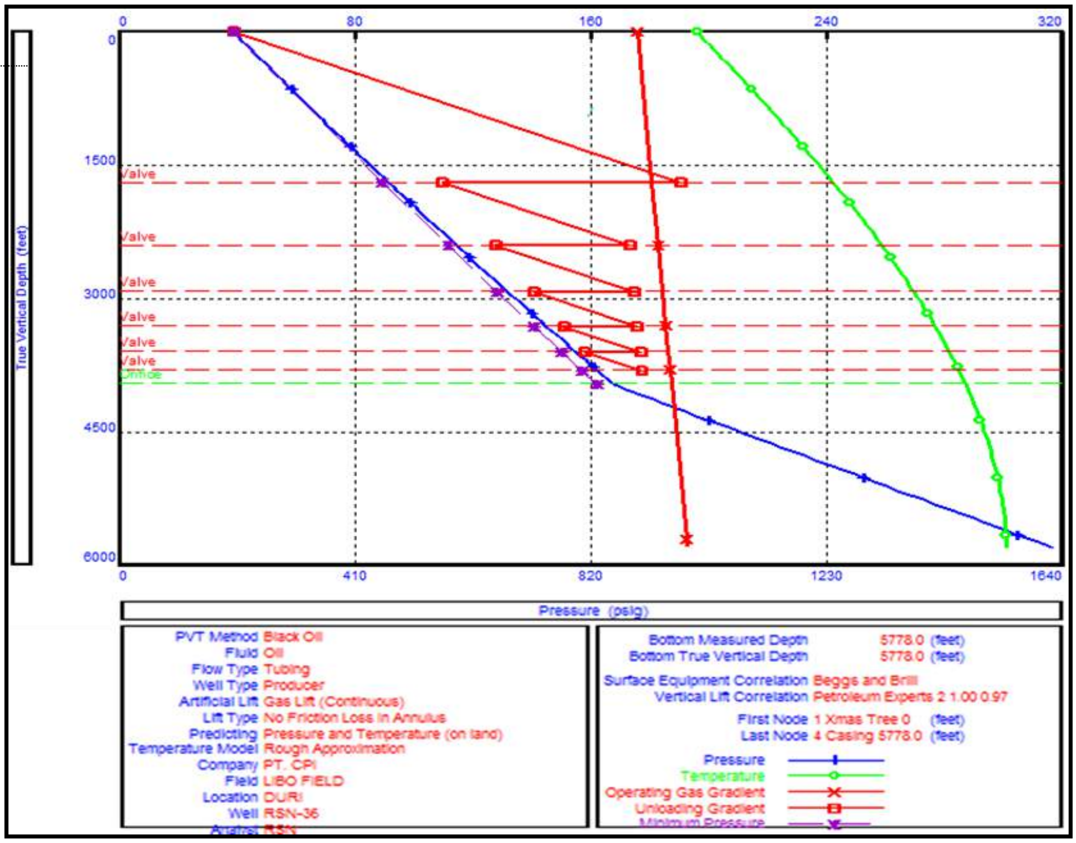

Table 2 is parameters in gas lift design. To convert ESP to gas lift, gas lift design needs to be done in RSN#36 using PROSPER software. These parameters is the input to the software. This can be done when the PVT input already matched.

Figure 6 Gas Lift Design using Prosper in RSN#36

From figure 6 can be concluded that the depth of RSN#36 is 5778 ft. Using gas lift completion design, there are 7 injection valve which can be seen in table 3. From the figure, the Point of Injection is 3947.61 ft.

Table 3 Injection Valve

Valve Type	Measured Depth (Ft)
Valve 1	1687,94
Valve 2	2394,06
Valve 3	2915,4
Valve 4	3300,33

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Valve 5	3584,53
Valve 6	3794,36

After the completion design is done, IPR curve will be made to determine the operationg point using nodal analysis. Nodal analysis is generated using IPR vs Outflow Performance Relationship (OPR) plot so, the sensitivity can be run with injection gas rate and well head pressure as the variable. Various Scenario will be made based on these variables so, the optimum injection gas rate and well head pressure can be determined to produce optimum oil rate in gas lift.

Table 4 IPR Curve Input Data

Parameter	Value	Unit
Depth	5778	Ft
PI	2.0	STB/Psi
Static Pressure	2309.189	Psi
Well Flow Pressure	2034.667	Psi
Bubble Point Pressure	2176	Psi
Well Flow Temperature	301.7996	F
Separator Pressure	100	Psi

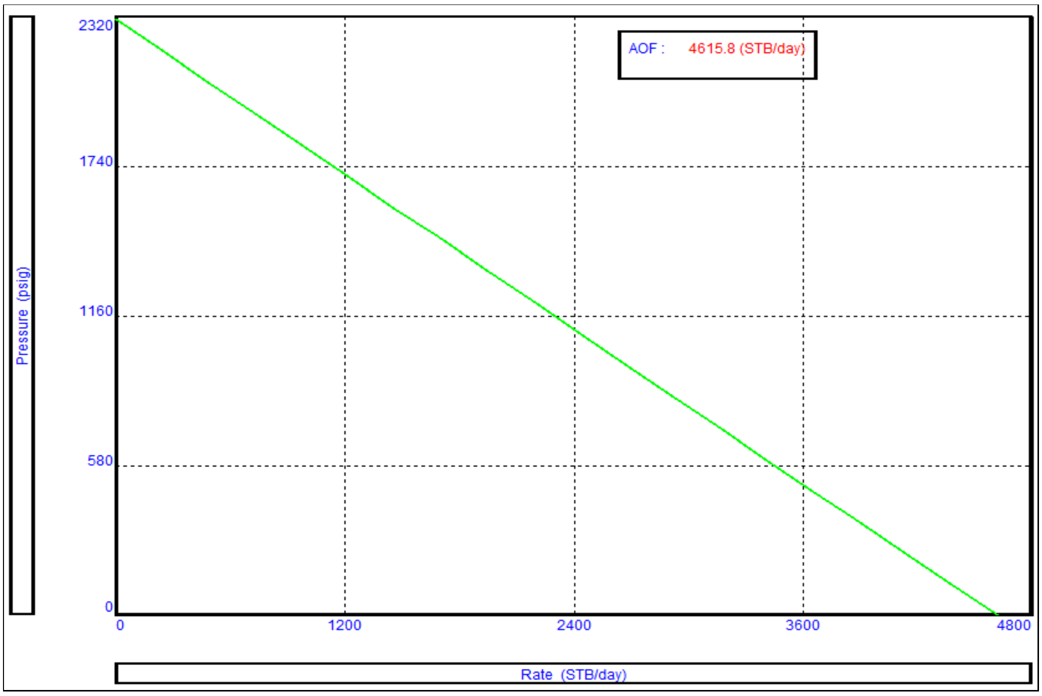

Figure 7 IPR Curve from RSN#36

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IPR curve generated and simulated from table 4 data. After running, can be seen in figure 7 that Absolute Open Flow (AOF) is 4615.8 STB/day whcich shown the maximum fluid rate can be produced from RSN#36 is 4615.8 STB/day. To determine optimum rate from RSN#36, nodal analysis needs to be done by seeing the intersection from IPR vs OPR curves with gas rate interval from 0 to 1 mmcfd and well head pressures are 100 psi, 246 psi and 300 psi so, the sensitivity can be seen to the oil rate.

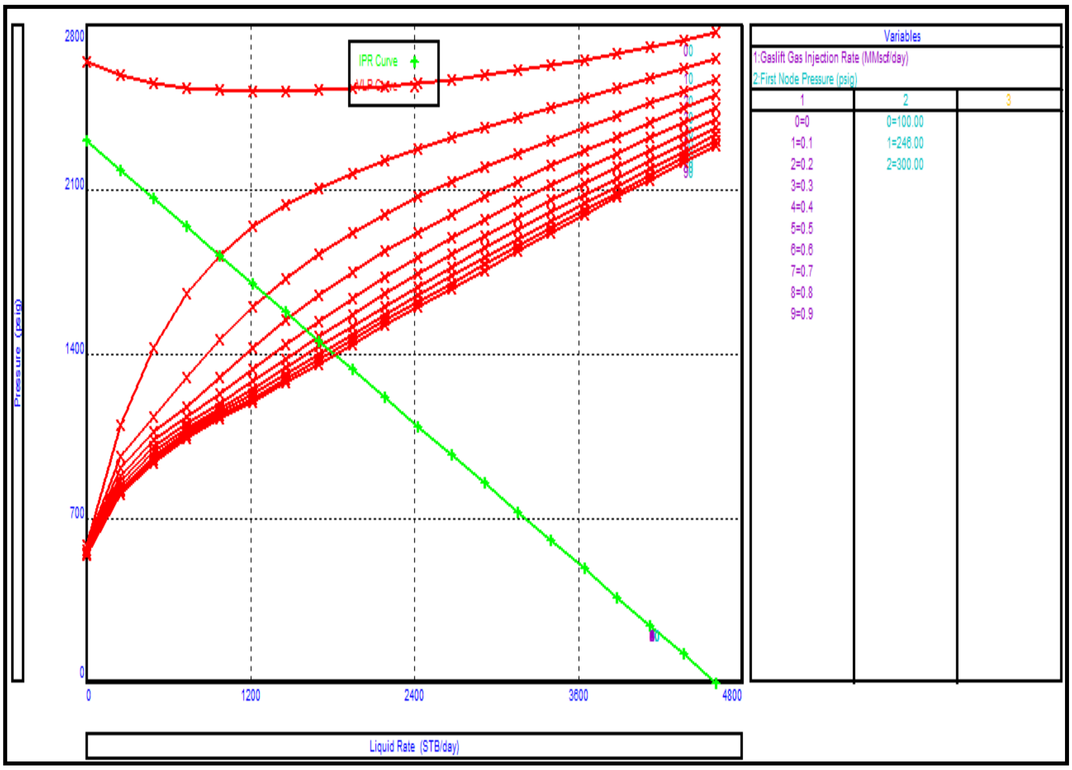

Figure 8 IPR vs OPR Curve in RSN#36

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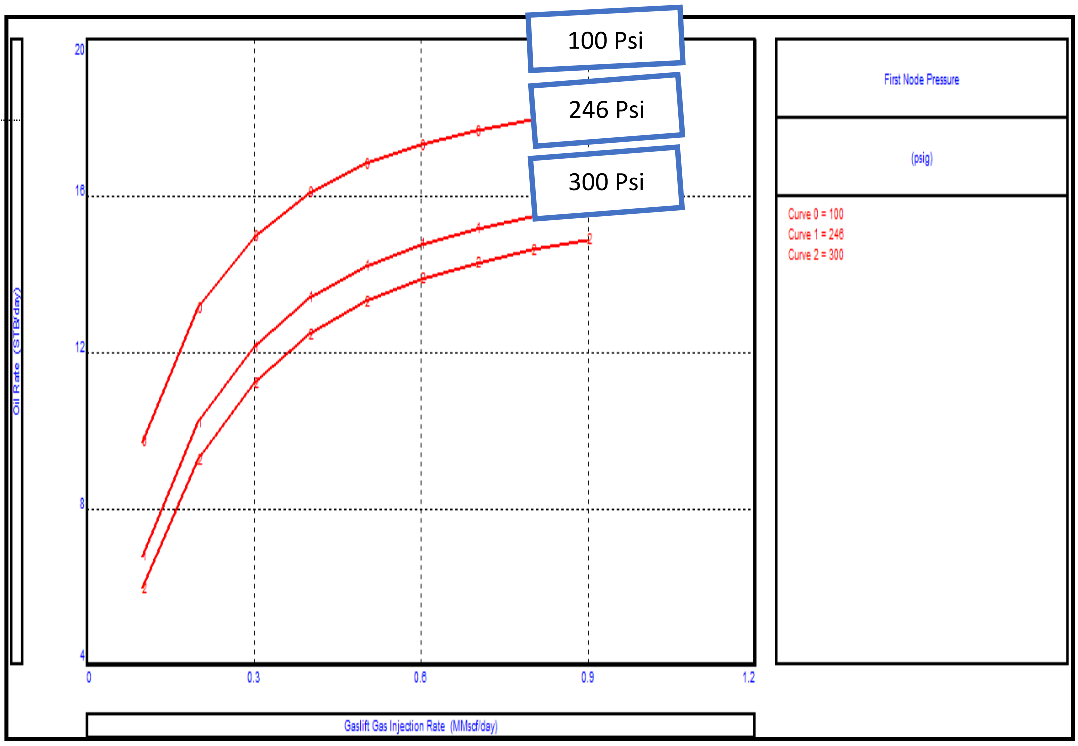

Figure 9 Well Head Sensitivity in RSN#36

Figure 8 and 9 shown nodal analysis from inflow and outflow from RSN#36 using gas lift. When the gas incetion rate is 0, there is no intersection with IPR curve (figure 8), so it cleared that RSN#36 need gas injection to optimize oil production. From sensitivity whcich simulated in figure 9 can be concluded in table 5 for each well head pressure and gas injection rate will produce various oil rate for each scenario

Table 5 Oil Rate Based on Injected Gas and Well Head Pressure

Injection Gas (MMSCF/D)	Oil Rate (STB/D)		
	Pwh 100 (psi)	Pwh 246 (psi)	Pwh 300 (psi)
0	0	0	0
0.1	9.7	6.8	6
0.2	13.1	10.2	9.3
0.3	15	12.2	11.2
0.4	16.1	13.4	12.5
0.5	16.8	14.2	13.3
0.6	17.3	14.8	13.9
0.7	17.7	15.2	14.3
0.8	18	15.5	14.6
0.9	18.2	15.8	14.9

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1	18.4	16	15.1

From table above can be seen that using 1 mmcfd gas and 100 psi of well head pressure will produce 18.4 STB/day of oil. This is the highest value from each scenario from sensitivity which is made. This opinion need to be strengthened using economic analysis if using 1 mmchd gas which produce 18.4 STB/day of oil is the most economical scenario

Economic Analysis fron Gas Lift Scenarios in RSN#36

Using economic parameters, gas injection cost is 100$/day and oil price is 50$/bbl can be calculated net revenue and gross revenue for each scenario

Table 6 Economic Analysis from 100 Psi Scenario

Gas Injection (MMSCF)	Prod oil (STB/D)	Oil Sale Revenue ($/d)	4 Years NP	Gross Revenue	Net Revenue ($)
0.1	9.7	485	12.79	639.64	347.64
0.2	13.1	655	17.27	863.85	425.84
0.3	15	750	19.78	989.14	405.14
0.4	16.1	805	21.23	1061.67	331.67
0.5	16.8	840	22.15	1107.83	231.83
0.6	17.3	865	22.81	1140.80	118.80
0.7	17.7	885	23.34	1167.18	-0.814
0.8	18	900	23.73	1186.96	-127.03
0.9	18.2	910	24.00	1200.15	-259.84
1	18.4	920	24.26	1213.34	-392.65

Table 7 Economic Analysis from 246 Psi Scenario

Gas Injection (MMSCF)	Prod oil (STB/D)	Oil Sale Revenue ($/d)	4 Years NP	Gross Revenue	Net Revenue ($)
0.1	6.8	340	8.96	448.41	192.91
0.2	10.2	510	13.45	672.61	271.11
0.3	12.2	610	16.09	804.50	257.00
0.4	13.4	670	17.67	883.63	190.13
0.5	14.2	710	18.72	936.38	96.88
0.6	14.8	740	19.51	975.95	-9.54
0.7	15.2	760	20.04	1002.32	-129.17
0.8	15.5	775	20.44	1022.11	-255.38

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Gas Injection (MMSCF)	Prod oil (STB/D)	Oil Sale Revenue ($/d)	4 Years NP	Gross Revenue	Net Revenue ($)
0.9	15.8	790	20.83	1041.89	-381.60
1	16	800	21.10	1055.08	-514.41

Table 8 Economic Analysis from 300 Psi Scenario

Gas Injection (MMSCF)	Prod oil (STB/D)	Oil Sale Revenue ($/d)	4 Years NP	Gross Revenue	Net Revenue ($)
0.1	6	300	7.91	395.65	176.65
0.2	9.3	465	12.26	613.26	248.26
0.3	11.2	560	14.77	738.55	227.55
0.4	12.5	625	16.48	824.28	167.28
0.5	13.3	665	17.54	877.03	74.03
0.6	13.9	695	18.33	916.60	-32.39
0.7	14.3	715	18.85	942.98	-152.01
0.8	14.6	730	19.25	962.76	-278.23
0.9	14.9	745	19.65	982.54	-404.45
1	15.1	755	19.91	995.73	-537.26

From 3 tables above can be seen that using 0.2 mmscfd gas injection rate will give the highest revenue, even 1 mmscfd of gas injection rate will give negative revenue. From each scenarion can be concluded in table 9 that using 0.2 mmscfd injection rate is the optimum gas injection rate with 100 psi well head pressure.

Table 9 Economic Analysis 0.2 mmscfd Scenario

	Injeksi Gas 0.2 MMscf/D		
Gas Injection(MMSCF/D)	Pwh 100 (psi)	Pwh 246 (psi)	Pwh 300 (psi)
Oil Sale Revenue ($)	655	510	465
4 Years NP	17.27	13.45	12.26
Gross Revenue (M$)	863.85	672.62	613.26
Net Revenue (M$)	425.85	271.12	248.26

From table above, using 0.2 mmscfd gas injection rate and 100 psi well head pressure will give high oil sale revenue which is 655M$ with net revenue is 425.85M$ for 4 years.

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4. CONCLUSION

Based on the oil rate and ESP to gas lift conversion can be concluded:

1. RSN#36 has high GOR, 1190 scf/stb, 2 STB/d PI and 145.6 psi casing pressure. These parameters are important to prove this well is suitable for ESP to gas lift conversion with good PI.
2. From optimization ESP to gas lift conversion in RSN#36, the optimum operating point is 0.2 mmscfd gas injection rate and 100 psi well head will give 1314.4 STB/d liquid rate and 13.1 STB/d oil rate with the valve will be pointed at 1687.94 ft, 2394.06 ft, 2915.4 ft, 3300.33 ft, 3584.53 ft, 3794.36 f, and the Point of Injection located at 3947.61 ft.
3. From economic analysis with oil price is 50$/bbl, net revenue is 425.84M$ from 0.2 mmscfd and 100 psi scenario.

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