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30 August 2018

Online at <https://mpra.ub.uni-muenchen.de/91375/>

MPRA Paper No. 91375, posted 13 Jan 2019 11:07 UTC

Cambodia's Oil and Gas Activities and Future Outlooks

A research article by Pohnneath Nguon

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This article aims to reveal studies on Cambodia's current activities in the oil and gas industry. The paper will be divided into three parts: 1) Distribution of oil and gas resources 2) Current Operations in the oil and gas industry and 3) Conclusion and discussion of the future of the industry.

I. Introduction

World Bank estimates Cambodia's economic growth to be at 6.9% per year for 2017 and 2018. With the growth of the economy being directly related to the level of energy consumption, the demand for energy in Cambodia is surging at a great rate [1].

Although it is long known that Cambodia is well-endowed with oil and gas deposit, so far, no production activities has taken place. This is due to the political challenges, lack of technical specialty as well as proper laws and regulations to govern the investments.

Sharp increases in the demand of energy will prompt Cambodia to look at an alternative model to fulfill its energy needs. While importing from Thailand, Singapore and Vietnam can sustain Cambodia's energy need in the short-run as oil prices are low, such model will not work in the long run.

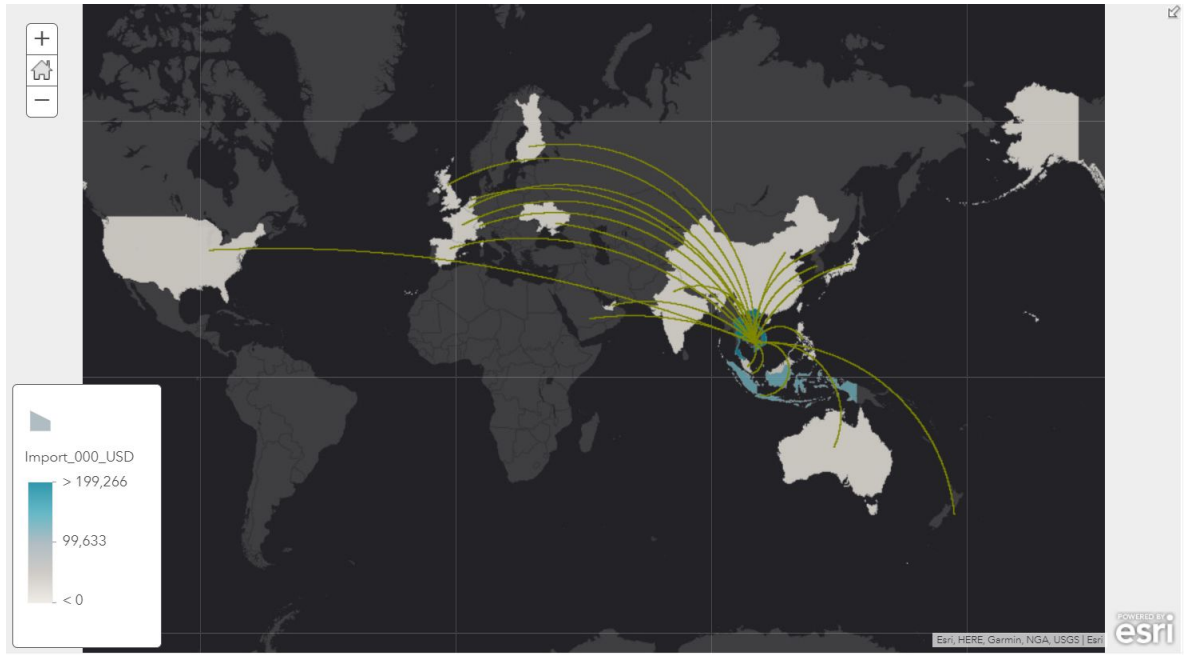


Figure 1 Cambodia Fuels Imports in 2016

Figure 1 shows the countries that Cambodia currently imports from, with the darkest color representing the highest import (in thousand USD) [14]. The link to the map can be found in the appendix.

Given this backdrop, the Cambodian government has actively been seeking development in the upstream sector. In August 2017, the government signed a production-sharing agreement with Singapore's KrisEnergy to develop Block A, one of the six blocks available for exploration [5].

With KrisEnergy's intend to produce oil in Cambodia in 2019, the next few years will be pivotal for Cambodia. From here, it can be safely assumed that it is natural progression to expect more international players to join in the development.

This paper aims to discuss upstream operations through the revelation of the current distribution and activities in Cambodia's oil and gas industry, and finally offer a concluding future outlook.

II. Distribution of Oil and Gas Resources

In order to further examine Cambodia's oil and gas activities, the starting point of discussion in this article will be the current distribution of oil and gas resources.

Overlapping Claims Area (OCA)

Spanning over more than 27000 square kilometers, the Overlapping Claims Area (OCA) has been an area of dispute for decades between Cambodia and Thailand. The area lies in the Pattani Basin, which is viewed to be highly prospective. Thailand has already extracted oil and gas from the Pattani Basin, while Cambodia has not [2].

Offshore Blocks

According to [2], for the purposes of oil and gas exploration, six Offshore Blocks (A - F) have been set out by the Cambodian Government.

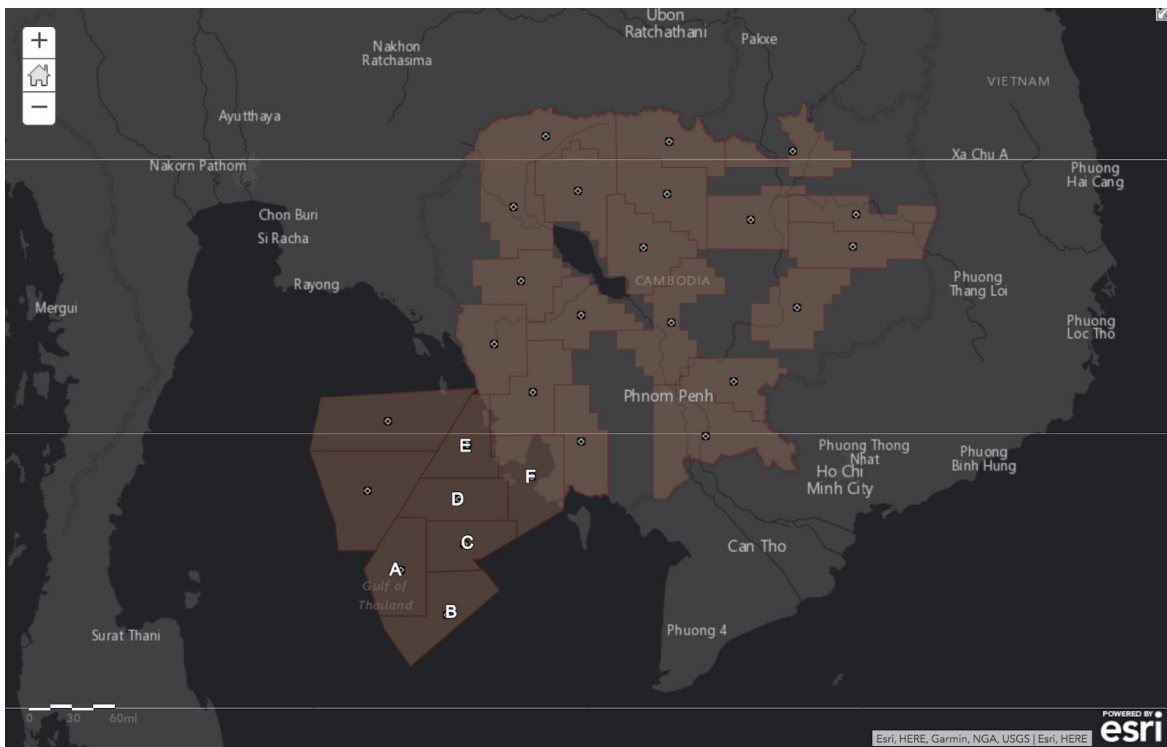


Figure 2 Oil and Gas Exploration Blocks

Figure 2 shows Blocks A - F reserved for oil and gas exploration off the Gulf of Thailand [12, 13]. The link to the map can be found in the appendix.

It is to be noted that this map, originally obtained from Phnom Penh Post, has been modified by the author in order to reflect the updated blocks of Cambodia's offshore oil and gas operations.

Block A:

Covering 6278 square kilometers, Block A is the most advanced in exploration and production plan. This area was awarded to Chevron Overseas Petroleum and Moeco in 2002. From 2005 to 2010, approximately 22 exploratory wells were drilled and commercial discovery was announced. In August 2014, KrisEnergy acquired Chevron's stake. Subsequently in October 2016, the singaporean company purchased Mitsui Oil Exploration 28.5% stake and GS Energy's 14.2 % stake. This gives KrisEnergy a total of 95% ownership of Block A, while leaving the Cambodian National Petroleum Authority with 5% stake. Production is expected to begin in 2019, depending on the fulfilment of certain requirements set down in the production-sharing agreement [5].

Cambodia's Block A participating partners are listed as below [5]:

KrisEnergy (Apsara) Ltd. (operator)	71.25 %
KrisEnergy (Cambodia) Ltd. (operator)	23.75%
Royal Government of Cambodia	5.00%

Block B:

Covering 6347 square kilometers, Block B was awarded to PTT Exploration and Production, Singapore Petroleum and Resourceful Petroleum Ltd in 2015. In 2013, PTT's shares were acquired by Resourceful Petroleum Ltd. By far, findings have only revealed

non-recoverable oil deposits. In January 2016, the Ministry of Energy terminated the contract with RPL due to the lack of exploration progress [2].

Block C:

Covering 4521 square kilometers, Block C is licensed to Polytec Petroleum Hong Kong. The company is in the stage of acquiring seismic data [2].

Block D:

Covering 5296 square kilometers, Block D was awarded to Mirach Energy Limited with a 30 years production rights. The company conducted geological and geophysical surveys from 2006 - 2013 in order to identify potential oil reserves. By the end of 2014, the company had completed their environmental impact assessment as well as obtained exploration approval from the Ministry of Mines and Energy. Finally, in March 2016, it was reported that Mirach Energy Ltd's plans were being finalized in order to conduct exploration drilling followed by the approval by MME in order to extend exploration period permit until December 2018 [2].

Block E:

Covering 4828 square kilometers, Block E was originally licensed to Medco Energi, Kuwait Energy and JHL Petroleum. However, from early 2016, reports suggest that the block is no longer assigned to any company [2].

Block F:

Covering 5252 square kilometers, Block F was originally granted to Chinese National Offshore Oil Corporation, however shares were transferred to RPL in 2014. In January 2016, the Ministry of Energy terminated the contract with RPL due to the lack of exploration progress [2].

III. Current Exploration Operations

Due to the fact that Block A is found to be the most advanced in exploration and production plan, this section of the article will explore exclusively the operation phases done by KrisEnergy in the block [5].

KrisEnergy Operational Phases

Covering an area of 3083 square kilometers, Block A stretches over the Khmer Basin offshore Cambodia in water depths of 50 to 80 meters. The block is bounded to the east by the Khmer High, to the west by Narathiwat Ridge and to the south by the Kim Qui High [5].

Similar to the Thai, Malaysian and Vietnamese Basins, Block A is characterised by an early Paleocene phase of rifting with non-marine and lacustrine deposition, followed by a Neogene thermal subsidence phase with alluvial plain sedimentation. Due to the shallow water depths, developments are expected to result in relatively lower costs.

Geological characteristics such as age, types of source rock, type of reservoir rocks, structural trapping styles and the hydrocarbons that have been contained within the reservoir horizons through to the methods and types of production have been determined. In addition to 2D seismic data, three separate 3D seismic acquisition surveys have been undertaken, recording 865 square kilometers in 1994, 548 square kilometers in 1995, and 2658 square kilometers in 2003 [11].

The initial development in Cambodia Block A will be in the Apsara geological trend, and will require several phased stages due to the assessment of the reservoir performance.

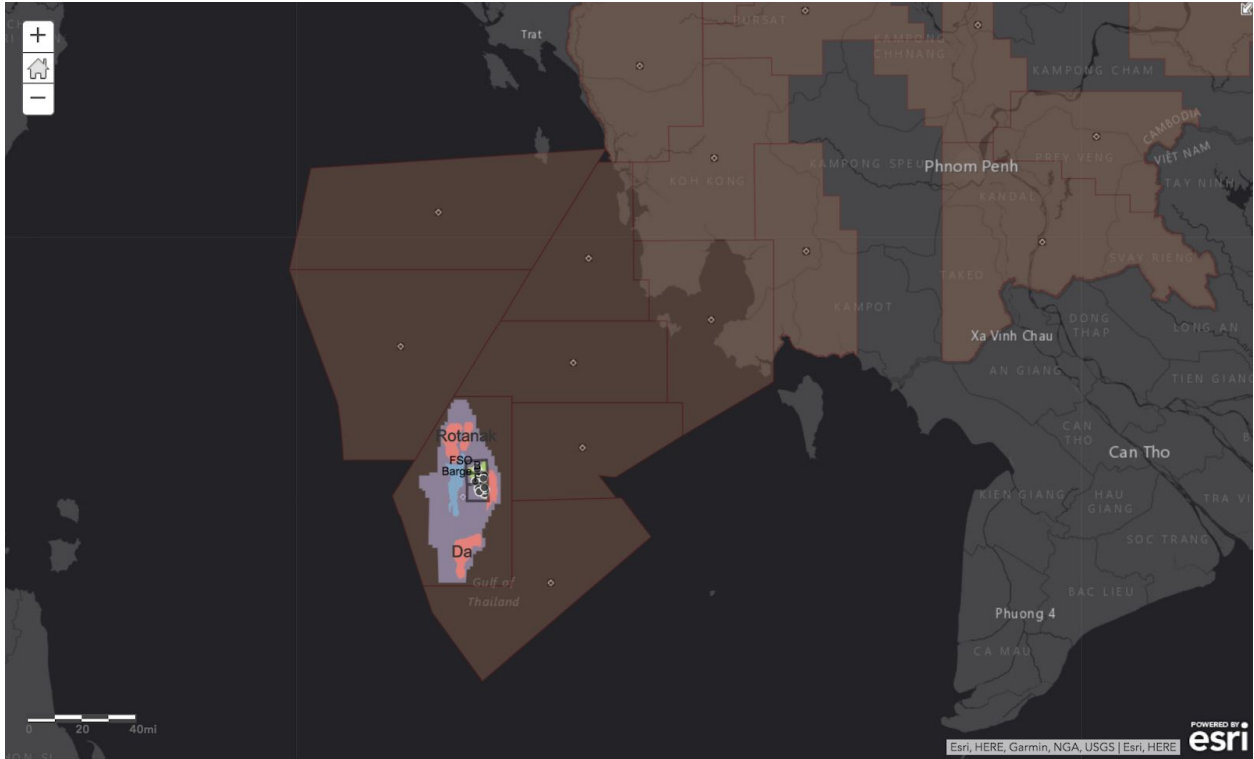


Figure 3 Block A's Phase 1

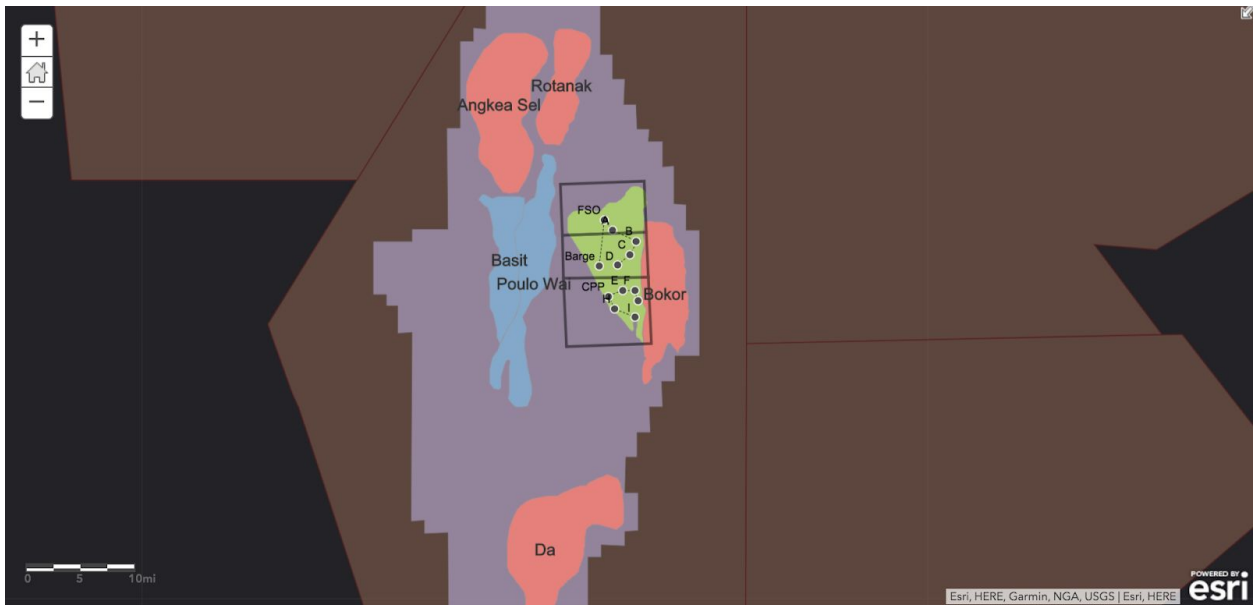


Figure 4 Block A's Phase 1

Figure 3 and 4 shows the phases 1A, 1B and 1C of KrisEnergy's development in Block A. The link to the map can be found in the appendix.

Phase 1A: comprises of approximately 20 wells from the A platform, which is the first producing platform to be installed in the Apsara Core Development Area. The phase 1A development is located in the North Apsara area, and consists of a single unmanned minimum facility 24-slot wellhead platform, Platform A, producing to a production barge capable of processing 30 000 barrels of fluid per day with gas, oil and water separation facilities on the barge. The oil will then be sent via a 1.5 km long pipeline for storage to a permanently moored floating, storage and offloading vessel from which sales lifting will take place [11].

Platform A is strategically located in order to provide access to all potential well locations in order to maximize access to the oil resources and the potential resource accessed by future platforms [11].

Phase 1B: designed to drill wells from the future B, C and D platform locations in the Apsara Core Development Area. These platform locations are envisaged to be tied back to Platform A through pipelines approximately 5 km long [11].

Phase 1C: will be the appraisal drilling and potential development of six platforms that are anticipated to fully develop the entire Apsara geological trend on the southern region of the trend. Five wellhead platforms would be built similar to those employed in Phase 1A and 1B, while the sixth will act as a central processing hub platform for the southern section of the Asara area. The central processing platform would process fluids transported from the five other wellheads before sending crude oil to the FSO vessel [11].

Platform Contingency

According to [11]:

- All contingent resources associated with Platform A are sub-classified as development pending and are contingent upon the issuance of the production permit as well as the annual review done by Netherland, Sewell & Associates, Inc. (NSAI).
- All contingent resources associated with Phase 1B (B and C platforms) are subclassified as development unclarified and are contingent upon 1) KrisEnergy's

decision to proceed with Phase 1B based on Platform A's performance and 2) Issuance of the production permit from the government.

- No contingent resources for Platform D in Phase 1B plans.

Block A Exploration Summary

Within the original outline of Block A, 27 exploration wells have been drilled to date, of which 13 encountered oil with approximately 3 and 138 feet of net oil pay. Of this 13, 8 wells were oil and gas discoveries while two wells were gas discoveries with high carbon dioxide content. Six of these wells were drilled on the Apsara Trend, where 4 individual sand reservoirs in 2 of the wells were subjected to production tests and each flowed from 410 and 860 barrels of oil per day [5].

IV. What is Next?

The Future of Block A

Outside the Block A license area outside of Apsara development area, there are six additional geological trends that suggest the potential for oil and gas discovery and development. Additional exploration, of course, depends on the performance of Phase 1 of Apsara developments. However, given successful execution of Phase 1, further potential exploration and appraisal activities include:

- Phase 2: Development of oil accumulations in the Poulo Wai and Basit Trends [11].
- Phase 3: Development of oil accumulations in the Angkea Sel, Rotanak, Bokor and Da Trends [11].

The Future of Cambodia's Oil and Gas Industry

Block A will be the pivotal point for Cambodia to move towards becoming an oil-producing country. Given that success is achieved from the execution of the project, future development, both onshore and offshore, is expected to be facilitated. This is predicted to be due to both the trust and enthusiasm from stakeholders that is naturally built from successful project execution.

However, in order for Cambodia to improve their prospects for future developments in oil and gas, there needs to be a future implementation and clarity on the legal and fiscal frameworks. Oil companies expect degrees of certainty surrounding the economic and legal terms surrounding their projects.

Research suggests Cambodia to embed fiscal terms in sector-wide legislation, as this would ensure that there are no future discrepancies between law and contracts as was the case with Block A contract and the Law on Taxation. Specific fiscal provisions are beyond the scope of this article [6].

V. Acknowledgements

At Esri, I have tremendously grown, both professionally and personally. Therefore, I would like to express sincere gratitude to Esri Indonesia for this great opportunity to intern at the head office, as well as learn about ArcGIS technology. Beyond this, I would like to extend my gratitude to my mentors, Miss Arsha and Mr. Anto who have taken out precious time in order to teach me. I highly cherish the opportunity to especially train on ArcMap with Miss Arsha. Thank you to Mr. Valdi and Mr. Keenan for their support, and everlasting enthusiasm in the office. Last, but not least, I would like to extend my deepest thanks to Miss Widi and Miss Regina for supervising me from even before the internship began all throughout to when I finish.

While this article encompass my main research topic for the internship, the full article on all the simulations and analysis that I have done throughout the internship can be found here: goo.gl/qGMOew.

This internship at Esri has been a great step forward for both my personally and technical development. With that said, I sincerely look forward to utilizing the skills that I have acquired here in the future.

VI. Citations

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VII. Appendix

[1] Cambodia's Fuel Imports Map

<https://smartcommunity.maps.arcgis.com/home/item.html?id=f1e10b3959e9410ab3edcf92812765a0>

[2] Cambodia's Offshore Exploration Blocks Map

<https://smartcommunity.maps.arcgis.com/home/item.html?id=d953dc2cc9134b8ba651c82f3cd84d2c>

[3] Cambodia's Block A Phase 1 Map

<https://smartcommunity.maps.arcgis.com/home/item.html?id=576d511e46f84e459057e9732dbbffd>