REVITALIZATION SCENARIOS FOR MARGINAL FIELD USING RESERVOIR SIMULATION

By

Mohamed Raafat Mohamed Mansour

A Thesis Submitted to the
Faculty of Engineering at Cairo University
In the Partial Fulfillment of the
Requirements for the Degree of

MASTER OF SCIENCE
In
GAS PRODUCTION ENGINEERING

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Under the Supervision of

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Title of Thesis:

Revitalization Scenarios for Marginal Field Using Reservoir Simulation

Key Words : Development Scenario optimization, Marginal field, Economic evaluation, and reservoir simulation

Summary: Marginal and mature field developments became the main target for most of petroleum investment. 3D reservoir simulation model was used to investigate the optimum technical and economic development scenario for Kareem reservoir; sand stone and depleted drive reservoir after more than 20 year of production. The study shows that drilling three development wells then applying gas recycling is the best development scenario under field capabilities. Also drilling a new exploratory well in an isolated area with initial pressure is recommended.

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Firstly, the praise and thanks be to Allah for finalizing this study. Secondly, I would like to express my sincere gratitude and appreciation to Prof. Abdel-Waly Abd-Allah, Prof. Eisaa Shokir and Dr. Hesham Bahaa for their supervision, support, humility and great experience in observing and reviewing this study.

Dedication

I would like to dedicate this thesis to soul of my parents for sacrifices, support, and devotion during their life. Also, I would like to dedicate this thesis to my wife (for her prayers, support, and enduring patience) and my lovely girls Sama, Mariam and Maram.
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Abstract

Development of mature and marginal field became the main goal in gas and oil industry to increase the world production against consumption. So many technologies are used to develop these types of fields with considering the cost impact. These technologies may include work over for existing wells, drilling new wells, applying secondary recovery (water flooding and gas injection) or tertiary recovery (steam flooding, miscible gas flooding, chemical flooding and etc…..).

This study is dealing with the future development of one of mature and marginal offshore fields in Gulf of Suez in Egypt. This offshore field is producing with primary recovery for more than 30 years under tough offshore conditions. The main objective of the study is to maximize the future production with minimum investment cost to attract the shareholders for future investment.

All the field reservoirs were reviewed and Kareem reservoir was selected for different development plans testing using reservoir simulation model and applying the best technical and economic scenario.

The available reservoir and wells data were prepared and were analyzed to get more understanding about reservoir and well performance. The static model of Kareem reservoir including geological and petrophysical modeling was built and was quality checked, and then this static model was used to build the dynamic model.

Kareem dynamic model was calibrated with pressure and production well data to be used for predication under different development scenarios. The applied development scenarios included work over for shut-in wells, drilling new wells, water flooding and gas injection in the producing areas and drilling new wells in isolated non-producing area. Then descend ordered the development scenarios according to the maximum estimated ultimate recovery and recovery factor.

Economic model was built to evaluate all the applied development scenarios based on gas, oil and water production profiles, actual economic control parameters and changeable oil and gas price.

The technical and economical evaluation of the applied development scenarios through twenty years of prediction concluded that drilling three new development wells then applying gas recycling scenario in producing areas is the best scenario and has additional reserve of 11.4 MMSTB as proved oil reserves and NPV of 440.1 MMUSD compared with NPV of 192.5 MMUSD expected from the do-nothing case. On the other hand drilling new exploratory well in the isolated non-producing area will add reserve of 4.66 MMSTB as probable oil reserves and NPV of 264 MMUSD over do-nothing scenario. The predicted NPV for the combination of these scenarios will be 566.6 MMUSD.

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