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OPEC's Role in the Diversified Future Energy Market

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This paper, which is developed within the framework of political economy of petroleum starts by a brief reviewing of OPEC's policy instrument based on members' excess production capacities and quota systems for managing the global oil market. The basic shortcoming in modeling OPEC's economic behavior is then examined. The analytical framework used in this paper for speculations on the future role of OPEC in a diversified future energy market incorporates the impacts of the followings on expected OPEC's supply: Non-OPEC production potentials of crude oil, long-term supply of unconventional sources of crude oil and long-term potentials of production from renewable sources of energies. It is concluded that there are a number of evidences to support the scenario of continuity of the significant share of OPEC's crude oil production in the future diversified energy mix, hence enhancing OPEC's role in the management of global energy market.

Keywords: OPEC, Unconventional Sources, Renewable Sources, Expected Supply of Crude Oil.
JEL Classification: Q31, Q38, Q42, Q48.

1. Introduction

The Organization of Petroleum Exporting Countries (OPEC) was established in1960 with the prime objective of ensuring the interests of both producers and consumers in the global oil market. An examination of OPEC's behavior from a historical perspective reveals the fact that the policy instruments used by OPEC towards the realization of the aforementioned objective were mainly the followings:

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i. The excess production capacities in major producing member countries, particularly in the PG5, i.e., the Persian Gulf five major oil producers (I.R. Iran, Saudi Arabia, Iraq, Kuwait and the UAE).
ii. The quota system by which member countries are obliged to consider the upper limits for their oil production.

The existence of excess capacities does not only enhance the expected oil supply hence may adversely affect an upward movement in the price but may actually lower the price by increasing the oil supply. It was widely agreed among a number of key OPEC producers, and advocated strongly by Saudi Arabia, that the higher oil prices would encourage investments in non-conventional oil and renewables. OPEC, therefore, used its excess production capacity to stabilize the price around the level which thought to be conducive to the dominancy of OPEC's production in the management of the global oil market. It is shown in this paper that utilizing excess capacity as a policy instrument has increasingly become less effective due to a) disappearance of and/or shrinking excess production capacities in a number of OPEC member countries, and b) the increases in the price of crude oil observed prior the financial and economic crisis of September 2008 as well in recent months that the world economy is gradually recovering from the crisis.[1] Currently, the community of world petroleum analysts generally believes that the existing high level of prices is consistent with the market conditions basically due to the falling expected supply in the long-run. This would encourage investment programs in unconventional oil as well as renewable sources of energy.

The quota system as the second key policy instrument used frequently by OPEC with the objective of strengthening the price has also significantly lost its effectiveness due to the strong dependency of OPEC member countries to oil revenues in financing economic growth and development programs. This would either discourage OPEC to use this policy measure more often or may provide an appropriate background for reneging the established quotas.

The question we are addressing in this paper is that what is the future role of OPEC in market management under the conditions of diversified hydrocarbon energy market in which the production of unconventional and renewable sources of energy may become both

1. The price of the Brent exceeded $120 per barrel in August 2008, and over $130 in April 2011.

economically and technically feasible? We will deal with this question within the analytical framework of political economy of petroleum.

Regarding oil as a strategic commodity may add a political dimension to OPEC as an economic institution. Although political considerations are beyond the scope of this paper, the approach we have adopted in dealing with the aforementioned question may provide a suitable framework for analyzing OPEC's behavior from a political point of view. Moreover, this paper avoids frequent references to quantities and numbers, as much as possible, and instead focuses on the analytical and qualitative nature of the argument.

This paper is organized as follows: The basic shortcoming in modeling OPEC's economic behavior is discussed in section 2 where a broad classification of models on OPEC's economics behavior is also given. The analytical framework for speculations on the future role of OPEC in the global energy market is presented in section 3. The impacts of three key factors on expected OPEC's crude oil production, i.e., non-OPEC potentials for crude oil production, long-term unconventional oil supply and long-term supply of renewable sources are discussed in sections 4 to 7, respectively. Section 8 summarizes the significant of crude oil supply in the future development of global energy market, and finally section 9 provides concluding remarks.

2. The Basic Shortcoming in Modeling OPEC's Economic Behavior

Despite the fact that OPEC was established in 1960, no serious attempts towards a systematic economic analysis of OPEC had been made prior to the first oil shock in 1973. This was mainly due to the fact that prior to the first oil shock the world energy market never experienced a serious shortage of crude oil and hence did not regard petroleum as a strategic commodity. However, since then modeling OPEC's behavior based on mainstream economic theories has been an active field of research work, the basic models designed to explain OPEC's behavior are classified in Section 2.1, and an examination of their basic weakness is given in Section 2.2.

2-1. A Broad Classification of Models on OPEC's Economic Behavior

The literature which has been developed so far on the economic analysis of OPEC's behavior can be grouped in two major categories,

i.e., OPEC acting as a cartel and as a non-cartel institution. The first category can further be sub-divided into the followings: i) OPEC as a monolithic cartel which assumes an integrated OPEC with non-competitive member producers. Non-OPEC producers which are also called fringe producers or price takers are assumed to produce in a competitive environment up to the level which equates their short-run marginal costs to the price set by OPEC. In addition, it is assumed that the price itself depends on the cost and supply structure of non-OPEC producers. OPEC is therefore considered to be a residual supplier.

The works of Salant (1976), Gilbert (1978), Pindyck (1978) and Griffin (1985) fall into this section. This approach has been refined by dividing OPEC member countries into two groups of *savers* (Saudi Arabia, UAE, Iraq, Kuwait, Qatar and Libya) who possess limited absorption capacities. Using Nash-equilibrium, Hnyilicza and Pindyck (1976) and Al-yousef (1988) have shown that the optimum price set by OPEC would significantly differ from the price obtained in the monolithic model.

Geroski, A. Ulph and D. Ulph (1987) have adopted slightly different approach by regrouping OPEC producers into four categories of Saudi Arabia, high absorbers producers, low absorber producers and fringe producers. They assume that the objective functions of producers depend upon their expected short-run profits, which in turn are functions of excess production capacities in each member countries. Al-Roomy (1987) used the same analytical framework but with different grouping of OPEC members, i.e., Saudi Arabia, other Persian Gulf producers, African producers and fringe producers. He showed that the variations in the price of crude oil cannot be explained by simple supply and demand functions.

A further dimension in the analysis of OPEC as a cartel is *the dominant producer model with Saudi Arabia as swing producer.* The works of Mabro (1975, 1991), Griffin and Teece (1982), Adelman (1982), Askari (1991) and Seymour (1992) can be classified into this category. In addition, Pindyck (1978) and Friedman (1983) have used the game-theoretic approach, and particularly the Nash equilibrium, in oligopolistic markets to analyze OPEC's behavior as a cartel.

As mentioned earlier, there are a number of research works which have examined OPEC's economic behavior from a non-cartel point of view. *The fiscal constraints* or *target revenue model* developed by

Ezzati (1976) and Adelman (1993) is a classical example of such contributions. In this approach, the domestic absorption capacity for investment is regarded as a determinant factor in planning the profile of oil revenues, hence conditioning the crude oil production profiles in OPEC member countries.

Treating OPEC as a player in a competitive market is another non-cartel approach to the analysis of OPEC's economic behavior. This approach which is developed by Salehi Esfahani and Cremer (1980) and McAvoy (1982) is based on the following two assumptions. The first assumption is that the price of crude oil in the global oil market depends on the conditions of supply and demand rather than being determined by Saudi Arabia as a swing producer or by OPEC as a cartel. The second assumption is related to the backward-bending supply curve, which implies that the production of crude oil in countries with massive reserves and low absorption capacities may adversely be affected by the upward movements in the price. The resulting decline in the production may in turn affect the price dynamics by providing a suitable background for a price surge. However, the price of crude oil in the long-run would depend entirely on the market conditions of supply and demand.

We may also refer to the *target capacity utilization model* (TCU) developed by Powel (1990), Suranovic (1993), among others, as a significant contribution in non-cartel approach to OPEC. It is assumed that the objective of OPEC member countries is to maximize the present value of the future streams of income derived from oil production and at the same time to stabilize the oil revenue profile, which is of prime importance in financing economic growth and development projects. The policy instruments available to achieve these objectives are i) adhering to relatively low prices for crude oil in order to avoid unnecessary income fluctuations, and ii) to increase the level of profit by pursuing the right policies of strengthening the price. The historical performance of OPEC demonstrates that the member countries are more inclined to apply the second policy.

More recently, Kaufmann (2008) have shown, using Granger causality, that by imposing production quotas and regarding the capacity utilization as a constraint in production profile, OPEC may exert its influence on the formation of crude oil prices. Using quarterly data for 8 member countries including Saudi Arabia, I. R. Iran, UAE, Iraq and Venezuela over the period of 1986- 2003,

Kaufmann has concluded that OPEC's decision on quotas has had profound effect on the price. Iraq and Kuwait are excluded from this field study due to the war conditions prevailing at the time.

2-2. The Basic Weakness in Modeling OPEC's Behavior: Backward Looking Approach and Uncertainties in Expected Development in Oil Market

We do not intend in this paper to critically examine the models presented in the previous section.[1] There are however a number of basic shortcomings common almost too all the available models. In what follows, we briefly refer to some of these weaknesses.

The research works done on modeling OPEC's economic behavior during the past four decades were mostly suffered from little or no considerations of technical and reservoir engineering aspects of oil and gas production. It is now agreed that reservoir management and enhanced oil recovery projects are critical factors in the determination of crude oil production profiles from oil fields. Hence, the arguments presented in modeling OPEC's economic behavior may appear to be sound theoretically but are proved to be practically weak due to the lack of strong connections with the real world issues in crude oil production. In fact, no distinctions were made between oil as a strategic commodity which is extracted from exhaustible resources under the specific conditions prevailing in hydrocarbon reservoirs and other commodities whose prices can safely be assumed to be a function of market conditions. More specifically, expected supply of crude oil tomorrow depends on the current investment which in turn is a function of the current and expected price of crude oil.[2] We may therefore conclude that many key factors in the production of crude oil, such as the rate of depletion, drive mechanisms, the ultimate recovery and the importance of secondary and tertiary recoveries, were almost ignored by the authors on modeling OPEC's behavior in the past.

The above argument does not overshadow the theoretical importance of the research work done in the economic analysis of OPEC behavior. It merely indicates a serious weakness existing in the research works done on this issue, which is a direct consequence of

1. See Ali Bagheri (2011) for a critical analysis of the available models developed to explain OPEC's behavior.
2. Other factors such as profit or tax may also be included.

little or no reference to technical feasibility of economic analyses and policy recommendations.

Another shortcoming of profound significance in modeling OPEC's behavior is that all such models which are developed during the past four decades are backward-looking in which the models are formulated on the past behavior of OPEC in the global oil market. These models are then expected to explain the past behavior of OPEC, hence unable to predict the future course of events. It appears therefore that this is structural shortcoming since OPEC's future behavior is truly a function of the future developments in the global oil market, which cannot satisfactorily be predicted using conventional econometric models or time-series analysis. A promising alternative approach, under the current conditions, is to carry out the analysis within the framework of the political economy of hydrocarbons, which can take into account the qualitative properties of national, regional and international oil and gas markets as well as the political conjectures associated with oil and gas as a strategic commodity. This is, in fact, the approach we have adopted in this paper.

3. Analytical Framework for Speculations on the Future Role of OPEC in the Global Energy Market

Arriving at any conjectures regarding the role of OPEC in the future development of global energy market necessarily requires firstly, a set of economic facts and assumptions and secondly, identification of the future course of developments in related markets for energy commodities which can be a substitute for crude oil as summarized below.

3-1. Economic Facts and Assumptions

A number of economic facts and assumptions, which are used in our analysis on the future role of OPEC in the global energy market are as follows:

1. The current competitive business environment will persist in the foreseeable future.
2. The price elasticity of crude oil with respect to supply variations is extremely high.
3. Investment programs by international oil companies for technological progress are price elastic.

4. The trend in the discovery of giant or super-giant oil fields will continue to decline.[1]
5. The aging of currently producing oil fields in most key producers with massive oil reserves is a real challenge in reservoir management. This would seriously condition the future course of production worldwide.
6. Investment in enhanced oil recovery programs aimed at increasing the level of proven reserves will remain a top priority in the 21st Century especially in key oil producing countries.
7. Investment for the development of alternative energy sources to substitute crude oil depends largely on the price of crude oil.
8. The current thirst for hard currencies necessary to fuel economic growth and development as well as securing the political stability particularly in certain key OPEC producers will persist in the foreseeable future.
9. OPEC key member countries, and particularly the PG5, are characterized by massive proven reserves, low drilling costs associated with relatively shallow reservoirs, much higher wellhead productivity and a much smaller number of producing wells as compared with non-OPEC producers, hence would benefit a comparative advantage in the global production of crude oil.
10. The prime concern of governments in major oil consuming nations and international oil companies is to ensure the security of supply, hence the diversification of their energy portfolios. The structural political and social instabilities in a number of major oil exporters would reinforce this concern.

3-2. Alternative Sources of Supply as Substitutes for OPEC's Crude Oil

As mentioned earlier, the analysis of the role of OPEC in the future global energy market necessarily requires an examination of the potentials for energy commodities which can be used as substitutes for crude oil. There are a number of areas of concern as listed below:

1. Non-OPEC's expected potentials for crude oil production

1. See Peter J. McCabe (1998) for a study of the future supply of fossil fuel including undiscovered recoverable sources.

2. Expected production from non-conventional sources of crude oil in non-OPEC as well as OPEC member countries. These include heavy and extra heavy oil, oil shales and oil sands.
3. The future trend for the production of renewable sources of energy.

Our analysis in the following sections is based on the forecasts provided by OPEC Secretariat, International Energy Agency (IEA) and the US Energy Information Administration (EIA). This paper will focus on general results.[1]

4. The Impact of Non-OPEC Potentials for Crude Oil Production on OPEC

The key non-OPEC producers, which are considered in this paper and are expected to possess any potentials for crude oil production in the long-run (2030, 2035) are the UK, Norway, Russia, Canada, Brazil and Mexico. Table 1 provides medium-term forecasts for the crude oil and NGL[2] as provided by OPEC's base-scenario forecasts.

Table 1. Medium-term Non-OPEC Crude Oil Supply and NGL

(mn bbls daily)

Country	2009	2010	2011	2012	2013	2014
Brazil	2	2.2	2.3	2.4	2.5	2.6
Canada	1.9	1.9	2	2	2	1.9
Mexico	3	2.9	2.8	2.8	2.7	2.7
Norway	2.3	2.2	2.1	2.1	2	1.9
Russia	9.9	10.1	10.1	10.1	10.2	10.3
UK	1.5	1.3	1.3	1.3	1.2	1.2

Source: *World Oil Outlook*, OPEC, 2010.

As table 1 shows that the medium-term production profiles of crude oil in Mexico, Norway and the UK are declining while Brazil and Russia are expected to increase slightly their production and Canada would remain steady at around 2 million barrels daily.

The long-term production profile for non-OPEC crude oil production depicts similar picture. Table 2 presents long-term forecasts of crude oil production in the six non-OPEC producers as predicted by EIA. Note that the figures given in the table represent

1. For detailed analysis, see Bagheri (2011).
2. Natural Gas Liquids (NGL)

hydrocarbon liquids which consist mainly of crude oil, condensate and NGL.

Table 2. Long-term Non-OPEC Supply of Hydrocarbon Liquids

(mn bbls daily)

Country	2015	2020	2025	2030	2035
Brazil	2.8	3.6	4.1	4.7	5.5
Canada	1.8	1.7	1.7	1.6	1.6
Mexico	2.1	1.6	1.3	1.4	1.5
Norway	1.8	1.5	1.4	1.3	1.3
Russia	9.5	9.8	10.6	11.8	12.8
UK	0.8	0.6	0.6	0.6	0.6

Source: *International Energy Outlook*, EIA, 2010.

The supply of hydrocarbon liquids in Canada, Mexico, Norway and the UK shows a downward trend during the period ending 2035 while that of Brazil and Russia will increase. It should be noted, however, that the supply increase in Brazil and Russia will partly be offset by the decline in the production profiles in Canada, Mexico, Norway and the UK, hence leaving a net increase of supply would hardly be significant as with regards to the global surge in demand for hydrocarbon liquids.

Bagheri (2011) provide serious doubts on the accuracy of the estimated figures for non-OPEC supply in the long-run by examining the proven reserves in the six key non-OPEC producers as well as their historical production profile. More conservative estimates would suggest that the increase in non-OPEC supply would reach the level which may just compensate the increases in the expected demand in the aforementioned six non-OPEC producers. However, on the basis of the published data in Table 2, we may conclude that both in the medium and long-terms, the increase in non-OPEC supply of crude oil will not be strong enough as to weaken the significance of OPEC' production in the global supply of energy mix.

5. The Impact of Long-term Unconventional Oil Supply on OPEC

Unconventional sources of oil usually incorporate heavy oil, extra heavy oil, natural bitumen, oil shales, oil sands and tar sands. As reported by IEA (2010), the world's total volume of oil shales in place exceeds 3500 billion barrels, out of which more than 3000 billion barrels are deposited in the US and over 290 billion barrels in Russia.

There are not reliable estimates for the volume of proven or ultimate recoverable oil shales. However, the available estimate for the US recoverable reserves stands at over 1000 billion barrels, which appears to be an exaggerated figure.

Similar argument holds for the reserves of heavy oil and natural bitumen. Again, on the basis of IEA (2010), the world's total deposits of natural bitumen and heavy oil exceeds 5000 billion barrels, out of which more than 2000 and 1300 billion barrels are deposited in Canada and Venezuela, respectively. The ultimate recoverable reserves are estimated at only 170 and 60 billion barrels in Canada and Venezuela, respectively.

There are uncertainties as with regards to the best available technologies to recover oil from these unconventional sources. The available technologies include Cyclic Steam Stimulation (CSS), Vapor Extraction (VAPEX), Cold Heavy Oil Production with Sands (CHOPs), Steam Assisted Gravity Drainage (SAGD) and Mining Methods. Since these technologies are still developing, more reliable estimates for recoverable reserves will become available in the future.

Table 3 provides medium and long-term supply on unconventional sources of crude oil as reported by IEA (2010). Note that the estimates are given under three scenarios: current policy scenario (CPS), new policy scenario (NPS) and the 450 scenario (450 S). The difference among these scenarios lies in various constraints regarding environmental concerns. In fact, these constraints would become more severe as we move from CPS to NPS and further to 450 S.

Table 3. Medium and Long-term Supply of Unconventionals

(mn bbls daily)

	2008	Current Policy Scenario		New Policy Scenario		450 Scenario	
		2020	2035	2020	2035	2020	2035
Canadian Oil Sands	1.3	2.8	4.6	2.8	4.2	2.5	3.3
Venezuela Heavy Oil	0.4	1.3	2.3	1.3	2.3	1.3	1.9
Oil Shales	0.0	0.1	0.5	0.1	0.3	0.1	0.2
CTL	0.2	0.4	1.6	0.3	1.1	0.3	1.0
GTL	0.1	0.3	1.0	0.2	0.7	0.2	0.5
Others	0.4	0.7	1.0	0.6	0.9	0.6	0.6
Total	2.3	5.5	11.0	5.3	9.5	5	7.4

Source: *World Energy Outlook*, IEA, 2010.

Table 3 reveals the fact that as environmental concerns progressively increases through NPS and 450S, the expected total supply of unconventional sources of crude oil decreases from 11 million barrels daily in the current policy scenario to 9.5 and 7.4 million barrels daily, respectively. Hence, we may conclude that the long-term supply of unconventional sources, albeit significant, may not seriously affect the share of OPEC's conventional crude oil supply in the global energy mix. Particular attention should be given to the fact that Venezuela, an OPEC member country, possesses the largest deposits of heavy and extra heavy oil and will stand as a key producer of unconventional sources in the year 2035.

It is interesting to note the wide discrepancies amongst the estimates of the world total unconventional deposits reported by various independent researchers in this field. This would shed greater doubts on the estimated supply of unconventional sources given in Table 3. A number of references deserve mentioning. The model proposed by Edwards (1997) to estimate the deposits of heavy oil in Venezuela, oil sands in Canada and oil Shales in the US indicates that the daily production of these unconventional sources will amount to over 25 million barrels in 2100. Koppelaar (2005) reports that the maximum achievable production of unconventional sources will not exceed 12.5 million barrels per day. Soderbergh, *et al* (2007) estimates the daily production of natural bitumen in Canada at 6 million barrels daily in 2040, while Caruso (2005) gives the doubtful figure of 22 million barrels for the daily production of Canadian natural bitumen in 2050, which will increase to 112 million barrels daily in 2078. Mohr an Evans (2010) provide an estimate of 18 to 22 million barrels daily production of unconventional sources in the period 2076 to 2084, which under different assumptions will amount to doubtful figures of 134 and 241 million barrels daily during the same time interval.

6. The Impact of Long-term Supply of Renewable Sources of Energy on OPEC

Renewable sources of energy consist mainly of hydro electricity, biofuels, solar, wind, geothermal and tidal energies. OPEC's estimates of medium and long-term production of renewable sources are presented in Table 4.

The significance of the expected supply of biofeuls can clearly be seen in Table 4, which together with a sharp increase in the supply of other renewables (particularly solar and wind energies), constitute the biggest shift in the supply of renewable sources in the 2030. This may appear, in absolute volume, as a serious challenge to OPEC's share of crude oil production in the total energy mix in the long-run. However, an examination of relative shares does not support this argument as we will explain in the following section.

Table 4. Medium and Long-term Supply of Renewables

(mn bbls oil equivalent)

Source	2010	2020	2030
Hydro	5.8	7.3	9.0
Biofuels	9.2	12.9	17.5
Other Renewables	1.5	3.2	6.8
Total	16.5	23.4	33.3

Source: *World Oil Outlook*, OPEC, 2010.

7. The Significance of OPEC's Crude Oil Supply and its Role in the Future Development of Global Energy Market

The role of OPEC in the diversified future energy market can best be analyzed by calculating the shares of OPEC's production of crude oil in the expected global energy mix. Table 5 summarizes the argument.

Table 5. The Future Share of OPEC's Crude Oil Production

(mn bbls oil equivalent daily)

	2010	2020	2030	Share in Total (%)		
				2010	2020	2030
Crude Oil	80.4	89.9	97.6	35	32.7	30.2
OPEC	29.3	33.2	38.7	12.8	12.1	12.0
Non-OPEC	51.1	56.7	58.9	22.2	20.6	18.2
Coal	66.2	80.1	92.1	28.8	29.2	28.5
Natural Gas	52.1	64.5	79.1	22.7	23.5	24.5
Nuclear	14.7	16.9	20.7	6.4	6.2	6.4
Hydro	5.8	7.3	9.0	2.5	2.7	2.8
Biofuel	9.2	12.9	17.5	4.0	4.7	5.4
Other Renewables	1.5	3.2	6.8	0.7	1.2	2.1
Total	229.9	274.8	322.9	100	100	100

Source: *World Oil Outlook*, OPEC, 2010.

There are two critical points regarding the figures in Table 5. The first point is related to the massive proven reserves in OPEC member

countries, which together with the low cost structure of production imply that the reported estimated volumes of OPEC's supply are likely to have the least uncertainties when compared with non-OPEC production profiles (conventional and unconventional sources plus renewable sources and biofeuls).

The second point is concerned with the fact that OPEC's production shares in the total global energy supply demonstrate a steady state with slight variations around 12 per cent. The non-OPEC shares, however, declines from 22 per cent in 2010 to 18.2 per cent in 2030. These figures incorporate the doubtful increase in expected unconventional production in non-OPEC producers. Without a massive increase in the production of natural gas (from 52.1 million barrels of oil equivalent daily in 2010 to over 79 million barrels in 2030, or equivalently, from 22.7 per cent in 2010 to 24.5 per cent in 2030), the world will experience a considerable gap between supply and demand for energy.

The above argument implies that the share of OPEC's future supply would play an important role in securing adequate expected global supply of energy. However, maintaining OPEC's share at similar figures beyond 2030 would appear to be a serious challenge facing reservoir engineers in OPEC member countries unless massive programs of enhanced oil recovery (EOR) are implemented.

Any possible decline in OPEC's share should be compensated by an increase in the production of unconventional and renewable sources whose economic feasibilities depend upon appropriate increase in the price of crude oil. From an intertemporal point of view, it follows therefore that OPEC's current practice of depleting its low cost high quality reserves towards a scenario in which the production of unconventional sources may become economically feasible should be accompanied by complementary policies aimed at securing the interests of future generations in OPEC's member countries.

There are at least two possible policy options: Firstly, investing heavily on technological advances in exploration, development, implementing EOR programs and production of unconventional sources particularly heavy and extra heavy oil. This may be achieved through closer cooperation among OPEC member countries from one hand and long-term collaborations with international oil companies (IOC’s) based on mutual investment in R&D programs from the other

hand. The role of OPEC Secretariat in achieving this objective will be of profound importance.

Secondly, massive investment expenditures in OPEC member countries are required to make oil and gas industries as the leading sectors in national economic development. This objective may be realized through member countries active participations in joint investment programs in various branches of oil and gas industries in view of making large markets and accumulated technical, economic and financial knowledge. The active role of OPEC Secretariat is again a prerequisite.

8. Concluding Remarks

Our analysis in this paper using the potentials of crude oil production in non-OPEC key producers as well as the long-term unconventional oil supply and the potential supply of renewable sources of energy indicate that OPEC massive proven reserves may ensure the continuity of its significant role in the management of global oil market in the foreseeable future (2035). Closer co-operations amongst OPEC member countries particularly in providing investment opportunities in hydrocarbon industries as well as constructive technical and financial collaborations with international oil companies are the prerequisites for the success of OPEC in the future diversified future energy market.

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