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Will Venezuelan extra-heavy oil be a significant source of petroleum in the next decades?

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HIGHLIGHTS

- We analyse the future unconventional oil production capacity of Venezuela.
- The study is based on operational capacity, investments capacity and future prices.
- The study indicates a production shorter than that predicted by the Venezuelan government.
- Venezuela can provide part of the marginal petroleum supply in the coming years.

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ABSTRACT

Unconventional oil resources are needed to complement petroleum supply in the next decades. However, given the restrictions that pertain to the production of these resources, this article evaluates the availability of Venezuelan unconventional oil for helping meet the future worldwide petroleum demand. Venezuela has the world's second-largest oil reserves, but the majority of it is unconventional extra-heavy oil from the Orinoco Oil Belt. The perspective of Venezuelan production, the ways in which PDVSA, the state oil company, will raise funds for planned investments and the future oil price predictions are used to assess Venezuela's ability to serve as a source of unconventional oil in the coming years. Findings indicate that Venezuelan crude oil will be increasingly able to provide part of the marginal petroleum supply at a level predicted in global scenarios but short of that predicted by the country's government. Operational difficulties and the effort to raise financial resources for the oil production in the Belt require urgency in overcoming difficulties. As conventional production in Venezuela will stabilise in the coming years and the country is dependent on oil production, Venezuela will rely on extra-heavy oil extraction to ensure increased oil production and the stabilisation of internal accounts.

1. Introduction

Unconventional oil resources are needed to complement world oil supply in the next decades. However, given the restrictions that pertain to the production of these resources, this article assesses whether Venezuela can provide a reliable source of unconventional extra-heavy oil.

The definition of conventional and unconventional oils is still not yet fully consolidated in the scientific literature, surely because it is a dynamic concept, which evolves with technology and the oil market. Hence, this paper considers as conventional oils those crude oils that can be produced under the current economic and technological conditions and the conditions expected in the near future (Babusiaux and Bauquis, 2007). Unconventional oil comprises deposits of greater density than water (heavy oil), viscosities in excess of 10,000 cP (oil sands), and occurrence in tight formations (oil shale). Ultimately, the distinction between conventional and unconventional resources is based on technology and economics (Greene et al., 2006). According to IEA (2011), unconventional oil includes extra-heavy oil, natural bitumen (oil sands), kerogen oil, gas-to-liquid, coal-to-liquid and additives. Unconventional oils have higher costs and lower quality and are exploited in remote or difficultly accessible areas (Szklo et al., 2008), although deep-water oil production (difficult access) is considered conventional in Brazil. There is no consensus in the literature on the definition of unconventional oil. However, it is appropriate to consider the extra-heavy oil produced in the Orinoco Oil Belt to be unconventional (Adelman, 2003a, b; Babusiaux and Bauquis, 2007; Campbell, 2002; Greene et al., 2006; IEA, 2011; Laherrère, 2001; Maugeri, 2012; Szklo et al., 2008).

Currently, Venezuela has the world's second-largest oil reserves (BP, 2011), the majority of it being unconventional extra-heavy oil from the Orinoco Oil Belt. The Venezuelan state oil company PDVSA (Petróleos de Venezuela, S.A.) is considered by *Petroleum*

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Intelligence Week (PDVSA, 2010) to be the fourth-largest company in the sector and responsible for the world's fourth-largest crude oil export volume (BP, 2011). Among the main importers of Venezuelan oil are the USA, China and India. Since Venezuela's production has higher growth prospects than domestic demand prospects, the country's export potential will be even larger in the future (PDVSA, 2011).

Conventional oil production in Venezuela should stabilise in the coming years. In addition, total Venezuelan production will be based on increased extra-heavy oil production from the Orinoco Oil Belt (PDVSA, 2011). Therefore, this paper aims to evaluate Venezuela's capacity to provide commercially viable oil in the coming years.

This question is part of a broader scientific discussion about the evolution of the global oil supply and the role of lower-quality oils or those extracted under less favourable technical and economic conditions in delaying the peak of the world oil supply. Thus, this article contributes specifically to a discussion in the scientific literature of the availability of the participation of unconventional oil in meeting the worldwide demand for petroleum.

Under this context, Laherrère (2003) questions whether there will be an energy source that can replace oil in sufficient quantity when oil production declines. According to Bentley (2002), although unconventional resources are large, the most important question concerning these resources is how many of the resources may become available as conventional oil production declines. Greene et al. (2006) state that there is uncertainty about the transition rate between conventional and unconventional oil.

According to Sorrell et al. (2010), a production peak of conventional oil is likely before 2030, and there is a significant risk of a peak even before 2020. However, there will only be a peak in the next two decades in the fuel supply associated with peak oil production if unconventional oil sources are not produced at a pace to offset this decline. For Adelman (2003a, b), it is possible that production will peak but not because of scarcity. Rather, production will peak because of political problems.

Höök et al. (2009) consider that the production of the globally most important production base (giant fields) will decline faster in the future. These researchers' conclusions note a growing challenge in petroleum production: the current decline in production with a prospect for a significant increase in the decay curve. Tsoskounoglou et al. (2008) indicate a projected peak before 2040 with a large possibility that this event will occur much earlier.

According to IEA (2011), a production peak will occur before 2035. In the New Policies Scenario, non-OPEC oil production will be in aggregate declines slightly over the period, from 50.8 mbd in 2015 to 47.7 mbd in 2035. As for the OPEC countries, the production will rise from 37.7 mbd in 2015 to 48.7 mbd in 2035, with Venezuela in a modest decline in conventional oil production until 2035. However, this Venezuela conventional decline is more than offset by rapid growth in unconventional, extra-heavy oil from the Orinoco Belt.

Also according to OPEC, a production peak will not occur before 2035. According to World Oil Outlook 2011, the production of non-Opec countries will grow over the period of reference case (which retains the principal that only policies that are already in place influence supply and demand patterns), from 55.3 mbd in 2015 to 60.5 mbd in 2035. For OPEC countries, the production rises from 37.8 mbd in 2015 to 49.4 mbd in 2035.

According to BP (2013), the high prices will support the expansion of oil supply until 2030, and not just for conventional sources, because of the development and deployment of new technologies across a range of energy sources is opening up new supply opportunities at scale. These figures are in line with projections of peak oil made by some experts based on optimistic data concerning URR – see Maggio and Cacciola (2012).

Bentley et al. (2007) note that calculations from a group of experts showed that total oil production would reach an estimated maximum between 1996 and 2020 and then decline. Some of these calculations refer only to conventional oil, whereas others refer to both conventional and unconventional oil sources. Forecasts by a second group indicate that the production limit will occur in 2020 or 2030. Additionally, these forecasts indicate that the reserves are sufficient for production to meet anticipated demand. This “business as usual” prediction does not indicate whether a limit on reserves is expected later. The analysis of a third group ruled out the possibility that a production peak will occur in the short and medium term and perceived no need to quantitatively review future oil production.

Although the view of the Cambridge Energy Research Associates (CERA) is not one of limitless resources, Jackson (2006) considers that there will be a production peak. However, before this peak, a plateau will occur, and the production volume will remain stable for one or more decades before a slight decline. According to Jackson, the world's undiscovered reserves or those reserves not yet fully exploited, including unconventional oil, are adequate to support a large increase in production before a plateau occurs.

Analysing current production and oil reserves, Watkins (2006) concludes that petroleum is economically more abundant today than in the last three decades, during which several inaccurate predictions of conventional oil scarcity were made. For Watkins, the current indicators on shortages do not provide data to support the claim that oil is entering a period of scarcity. Although Watkins states that the entry of new players, cost reductions and technological development can delay the downward trend of resources, he considers unconventional oils to be a widely available backup for which investment return can be sufficiently attractive.

However, Watkins's (2006) conclusion regarding the current abundance of oil is refuted by Bentley et al. (2007), who consider that an analysis, such as that performed by Watkins, based on data on 1P reserves (proven) is inadequate and results in a series of mistakes, e.g., the perception that oil forecasts were incorrect and that the petroleum reserves grew significantly because of technological developments. The proposal of Bentley et al. (2007) considers the need to use 2P reserves (proven and probable) in the analysis of resource availability. This type of analysis indicates that a peak in conventional oil production will occur in the next period.

Greene et al. (2006) state that a peak in conventional oil production is almost certain to occur and occur soon enough that the peak deserves serious, immediate attention. These same researchers noted that if the peak in conventional oil production has already been reached, the world is facing a drastic transition for which the world is ill prepared. If the peak is one or three decades ahead, it is too early to begin efforts to understand and prepare for the transition to other energy sources. In any case, even under an optimistic perspective, the peak in oil production is a serious subject. Additionally, Greene et al. (2006) state that if the consumption of fossil fuels continues to grow, a massive development of unconventional resources will be required and that the transition from conventional to unconventional oil will occur before 2030.

Campbell and Laherrere (1998) indicated that the oil production peak would arrive sooner, possibly within ten years (before 2008), which did not occur.

Laherrère (2003) updated the projections and found a decline in oil production by 2020, emphasising, then, that substitutes will be required on a large scale. Laherrere does not consider that renewable energy can replace oil on a large scale and claims that the quantities of synthetic oil derived from other sources are uncertain.

According to Jackson (2006), the demand for end products exceeds the production of conventional petroleum, which means