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# Awaiting the Mexican Wave:

## Challenges to energy reforms and raising oil output

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OXFORD ENERGY COMMENT

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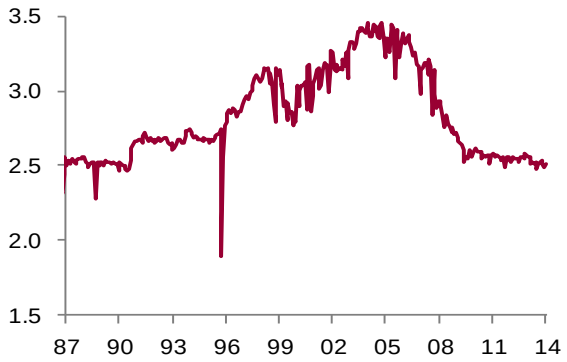
## Abstract

This comment analyses the potential impact of the proposed Mexican energy reforms in light of the current state of Mexican oil production. It identifies the main themes behind the reforms and evaluates the prospects for shallow, deepwater and shale resources, along with the midstream and downstream sectors. The comment notes that while Mexico offers significant opportunities, financial and political challenges will limit foreign investment until after 2016, thereby preventing any material impact on Mexican production or on global oil supplies until after 2020. The steep decline rates at existing fields and a beleaguered midstream and downstream sector, which are not tackled by the reforms, will also likely limit foreign investment.

## 1. Introduction

Mexico was once famed as the world's largest crude exporter and second largest crude producer, with output peaking at 3.4 million b/d in 2004, but is now struggling to maintain its current level of production. Currently, Mexican output is at just below 2.5 million b/d, and production is expected to trend lower, largely due to the sharp decline in output from the mature Cantarell complex and the now plateauing KMZ field. Production is declining despite the country's massive combined proved, probable and possible reserves - estimated at around 42 billion barrels of oil equivalent at the close of 2013. Mexico's falling production has resulted in annual crude export revenues falling from a peak of above $49.4 billion in 2011 to around $36.9 billion in 2014[1].

**Fig 1: Mexican crude production, million b/d**




Source: CNH

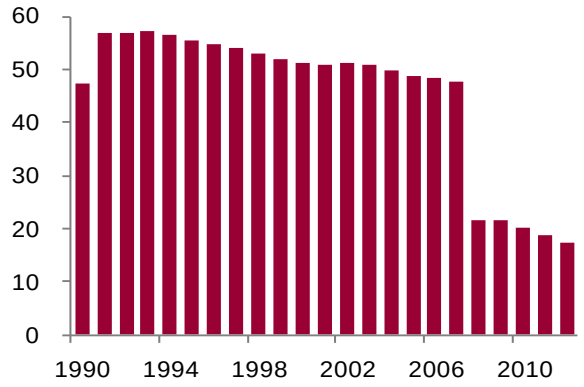
Ultimately, Mexico's main problem is that its oil basins have matured. Nearly 25% of production comes from fields in which over 65% of reserves have already been depleted, and over 45% comes from fields where more than 75% of reserves have been tapped. Overall, Mexico currently relies on mature fields for over 80% of its production[2]. The comparable figures from its North American neighbours are 47% in the US and 51% in Canada, with a global average of 55%. Pemex has been struggling to replenish its existing reserve base with proven crude reserves falling from 50 billion barrels as late as 2007 to 10 billion barrels in 2013 (see Fig 2). Although Pemex has increased its CAPEX spending fivefold over the last decade to nearly $25 billion in 2013, its reserves have fallen.

Mexico cannot replenish its reserves without Pemex increasing its investment in exploration and development. Independent studies suggest that to develop its potential reserves, Pemex will need some $830 billion in capital expenditures[3]. That seems almost impossible for a company reporting revenues of around $120 billion in 2013, and even more so when all its operating profits are transferred to the government via taxation. Over the past six years, Pemex has reported losses of $30 billion and has a net equity of -$14 billion[4]. To make matters worse, Mexico's oil reserves are becoming more expensive to exploit. As discussed below, Pemex has been successful in picking the low hanging fruit, the shallow water reserves. The areas with promise namely deepwater and shale are difficult and more costly to

[1] Pemex- Value of Crude Oil Exports, Energy Aspects calculations
[2] Pemex- Liquid Hydrocarbons Production
[3] BCG Focus: The promise of Mexico's Energy Reforms, April 2014
[4] Pemex Annual Reports, 2007-2013

access. Of Pemex's prospective reserves, well over three-quarters of them lie in deepwater and shale[5], both of which have significantly higher break-even costs—possibly more than double Pemex's current break-even cost.

**Fig 2: Mexican proven reserves, bn barrels**




Source: BP Statistical Review

## 2. The push for reforms

In an attempt to arrest production declines and unleash the potential of its deepwater and unconventional reserves, the Mexican government has introduced a new bill to open up its energy sector. The main features of the amended bill are:

- Amending articles 25, 27 and 28 of the Mexican constitution, which together define resource nationalism and restrict foreign investment in the oil sector;[6]
- Allowing license contracts based on royalty and additional payment to the state, profit-sharing and production-sharing contracts. Formal concessions would continue to be prohibited under the plan, reserves booking will be allowed;
- Different contract types will be chosen for specific projects (to offer more attractive concessions for high-cost or riskier blocks). Pemex will have preferential rights to bid for blocks—Round Zero;
- Greater autonomy from political influence for Pemex along with a restructuring of the firm to focus more on E&P;
- Creating a sovereign oil fund, modelled on Norway's fund, to channel part of the oil income into long-term savings and pensions. A trust controlled by Mexico's autonomous central bank would manage the fund, according to the bill;
- Comisión Reguladora de Energía (CRE) will regulate and manage contracting and concession in all midstream and downstream activities. Comisión Nacional de Hidrocarburos (CNH), the upstream industry regulator, will be the technical body charged with administering E&P contracting, running tenders, managing the technical database, alongside Secretaría de Energía (SENER), the Ministry of Energy, which will identify areas for E&P and oversee the technical design of the contracts.

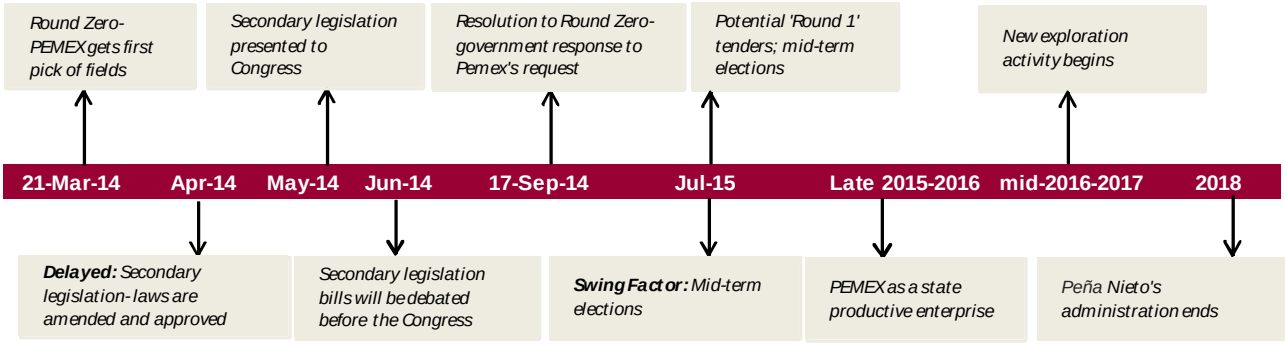
The 'Pact for Mexico', an initial allegiance between the three main political parties – the centre-left Partido Revolucionario Institucional (PRI), centre-right Partido Acción Nacional (PAN), and left-wing Partido de la Revolucion Democratica (PRD) - helped to make the initial reforms bolder and more

[5] Upstream-Mexico focus, March 2014
[6] English translation of constitution here: http://www.juridicas.unam.mx/infjur/leg/constmex/pdf/consting.pdf

attractive to foreign oil companies. They included production-sharing contracts, licences and the initiation of an oil fund to help manage oil profits. The swiftness with which the reforms have been passed indicates strong political will, and the government appears to be doing everything in its power to iron out any investor concerns (e.g. foreign oil companies are allowed to book reserves)[7] and avoid any potential pitfalls by learning from mistakes made by other LatAm countries such as Brazil (e.g. it will not be compulsory for Pemex to own a share in every licensed block).

The timeline below in figure 3 shows that the government is aiming to approve all new legislation and is making serious efforts to pass all the administrative changes before end of June 2014, and implement the reforms including holding one licensing round before the next political cycle (June 2015 mid-terms). Despite an almost three-month delay to the planned reform timetable, the government has now presented its secondary legislation (small print underlying the contracts) to Congress. The focus of the industry will be on the details covered in this legislation, as it will outline how the government is planning to use the constitutional changes to arrange the bidding rounds and the details of the contract terms. The reforms will also have implications for the organisation of Pemex and SENER - along with CRE and CNH - as introducing foreign competition requires a robust regulatory body to govern the system, but the reforms do not explicitly focus on this aspect. While contested by nationalists, the initial reforms have steadily passed through Congress and thus attracted interest from international oil companies, which is not surprising given Mexico's prospective reserves have the advantage of being direct extensions of commercially productive US formations, such as the Eagle Ford in Texas and deepwater Gulf of Mexico.

**Fig 3: Anticipated reforms timeline**




Source: Energy Aspects

The far-reaching nature of the energy reforms, which will end the monopoly of Pemex and allow for greater foreign investment, makes the path ahead fraught with difficulties - particularly as the pace of reform exceeds Mexico's ability to reorganise the energy industry. For instance, industry regulators are currently understaffed to handle the process of awarding contracts. In the US Gulf of Mexico[8] it takes 3-7 years from the time a licence is first awarded to the time of striking oil, despite the fact that this occurs under a much more stable fiscal and legal regime than in Mexico, with superior geological knowledge, a very well developed infrastructure and a strong, vibrant service sector. In this comment, we argue that the current energy sector reforms are not likely to have any material impact on Mexican production before the next decade and that Pemex's projections to grow production by 0.7 million b/d between now and 2018 are unrealistic[9]. Our pessimistic expectations are based on:

[7] Also the Mexican government seems to avoid imposing strict local-content requirements on investors in Mexican exploration and production, an issue that is of serious concern for foreign investors in Brazil.
[8] Bureau of Ocean Energy Management (BOEM)
[9] This view is even shared even within some official circles. Lourdes Melgar, the deputy-minister for oil and gas, when asked about Pemex's goal of raising output to 4m b/d by 2025, said it was 'very ambitious' and not shared by the energy ministry. The Economist, **Mexico's**

- Mexico's heavily declining production base and only a handful of new large fields coming online which are unlikely to be able to offset the declines in existing fields;
- The lack of 1P or 2P deepwater reserves. Mexico will have to compete with the likes of Brazil and Angola, which are also vying for investor attention, and potentially boast better-proven deepwater reserves compared to Mexico;
- The lack of foreign competition facing Pemex, which will continue operating in its shallow water assets. The inflow of private investment into deepwater and shale assets will also not have any spillover effects on Pemex in the form of higher efficiency through increased competition, which can be argued was one of the aims of initialising the reform;
- The lack of focus of reforms on the beleaguered midstream and downstream sector, which will weigh on the overall attractiveness of Mexico among foreign investors. About 40% of Mexico's pipeline systems are running at maximum capacity, giving rise to frequent bottlenecks.

## 3. Reforms in practice

The process for securing foreign interest in exploration blocks has already begun. Pemex will choose which fields it would like to keep in its portfolio for exploration and production first, in a process named 'Round Zero'. Pemex has requested 31% of total prospective resources, of which 74% are conventional fields, and 26% are in unconventional resources[10].The conventional resources requested include onshore oil and gas fields (from which Pemex is already producing), and its existing offshore fields in shallow water, deepwater fields in the Perdido play, and some development fields that produce extra-heavy oil. Due to the potential of the Chicontepec fields and the investment already poured into their development, Pemex has requested to keep some fields from the area that are already in production and will be commercially viable. Overall, this leaves 69% of resources open to future tenders for private investors (see Figure 4).

Pemex will need approval from SENER and CNH to continue operating these fields. Assuming that Pemex is allocated the lease, it can then decide whether to operate alone or in partnership with private investors. After Round Zero, the first round of tenders is likely to be held in mid-2015, and exploration is estimated to begin in late 2016. It is worth noting that not all the assets will be available for this first round. Deepwater assets will likely be kept for a longer duration, as their resource potential is further investigated by the regulators. Mexico's energy reform calls for PEMEX to hold a 20% participation interest in Gulf of Mexico projects; this same law may also apply for other transboundary situations.[11]

Pemex has a comparative advantage in shallow water production, where finding, development and lifting costs of crude are lower. However, since two-thirds of Mexico's major fields have matured and are in decline, Pemex needs to increase its exploration effort to replace this loss in output.

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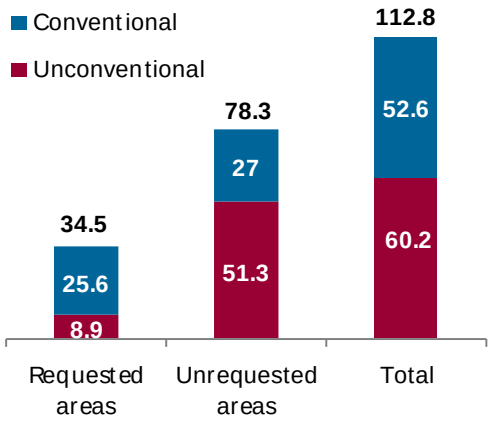
**energy reforms:** Putting flesh on the bones, 24 April 2014.

[10] Pemex- details on Round Zero; *http://www.ri.pemex.com/files/content/Pemex_SENER_Ronda%20Cero_i_140328.pdf*

[11] Gabriel Ruiz, partner in law firm Thompson & Knight LLP's Monterrey and Mexico City office

**Fig 4: Resources requested by PEMEX, bn boe**



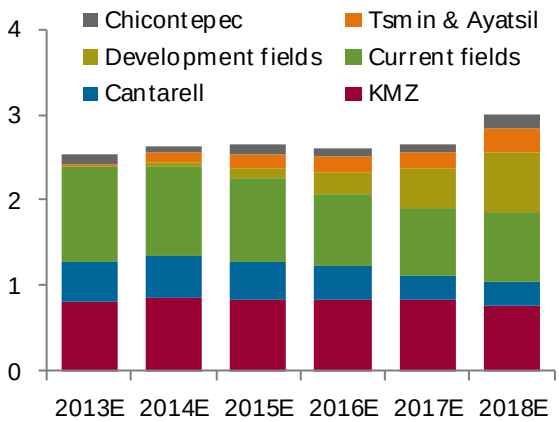

Source: CNH

The Round Zero process has enabled Pemex to keep its most profitable shallow water assets, and overall it has only asked for approximately 31% of its current assets, of which around 50% are in shallow water and 15% are in unconventional resources. This will be a mix of fields where Pemex is currently operating, and fields it has already explored and deems commercially viable. Without any foreign investment, and if Pemex were to solely produce from these fields, the national oil company will struggle to maintain its current production level. Production from the new fields in the KMZ complex and southern Tabasco region, called the Marine Light Crude Project, will not entirely offset the declines from the existing fields. Even with the opening up of the oil sector, arresting decline rates at the shallow water mature fields will be a difficult task, thus making the development of new fields important in stabilising production.

## 4. Pemex's upstream outlook and likely shortfalls

Whilst current production is averaging around 2.5 million b/d, Pemex projects an ambitious ramp up in oil production to 3 million b/d by 2018 (see Figure 5). It is clear that Pemex acknowledges the continuing declines at its mature basins - in particular the mature Cantarell and KMZ complexes - though it remains unclear as to where the additional production will come from if production is to reach the 3 million b/d target.

**Fig 5: Pemex's production target, million b/d**

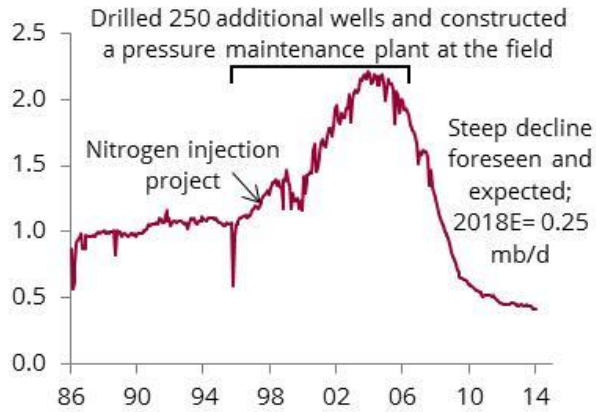



Source: Pemex

## 4.1 Shallow water outlook

Firstly, Pemex expects production from its current shallow water fields to decline by 0.3 million b/d (13%) by 2018, despite its expectations that the reforms will be implemented in 2015 and production increases from new fields will materialise from 2016 onwards. Mexico's production decline started with the fall in output from the Cantarell Complex, which is made up of four fields, of which the Akal field produces up to 90% of total output. After 1997, pressure at the fields began to fall and so Pemex employed EOR techniques (nitrogen injections—pumping gas underground at high pressure) to increase pressure at the fields and boost production. This increased flow rates by 60% during the first year[12], and progressively helped production rise to a peak of 2.2 million b/d in 2004.

**Fig 6: Cantarell production profile, million b/d**



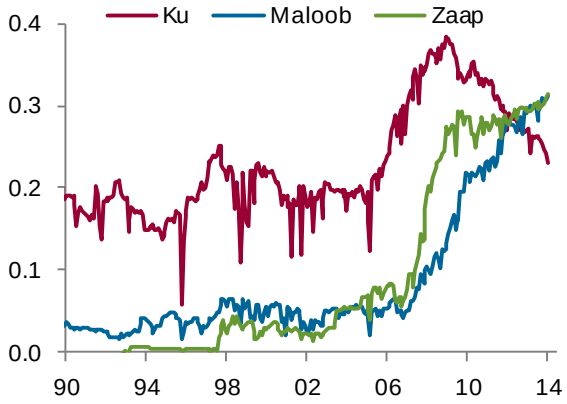

Source: CNH

However, this higher rate of extraction meant faster depletion of the field's reserves. Originally Cantarell was estimated to contain reserves of 35 billion barrels, of which now only a fifth remain, and production has now fallen to below 0.3 million b/d and will continue to do so in the coming years given Pemex's inability to arrest declines over the past decade.

The KMZ is located adjacent to the Cantarell Complex in the Bay of Campeche and was developed by Pemex in order to offset the declines at the supergiant Cantrell complex. In February 2009 KMZ production overtook that at Cantarell and thus became the highest producing field in Mexico. The KMZ, which produced a record high of 0.87 million b/d in 2013, therefore plays an integral role, producing a third of Mexico's oil production and helping to offset production declines from the Cantarell, as its blended crude quality is similar to that of Cantarell (API of 21°). Pemex has guarded against falling output at KMZ by using the same tactic as at Cantarell; nitrogen injections to increase pressure, resulting in a ramp up in production and a higher rate of extraction. Because of this, Pemex expects KMZ production to plateau at current levels of 0.85 million b/d until 2017. However, the first signs of decline at the field are already visible this year, with output in the year-to-date marginally down year-on-year. High uncertainty lies further ahead as decline rates are not known. An optimistic scenario will see Pemex arresting the declines through EOR and stabilising production rates. However, another possible scenario after 2017 is a major decline similar to that seen at Cantarell, which would have huge implications for overall Mexican oil production.

[12] The Linde Group- Enhanced Oil Recovery (EOR)

**Fig 7: KMZ production profile, million b/d**




Source: CNH, Energy Aspects

Against a backdrop of declining shallow water projects, there are some new additions such as *Ayatsil-Pit and Tsimin-Xux.* The 0.13 million b/d field Ayatsil-Pit is being brought online to be added to the KMZ complex by 2016. Though it is the biggest offshore discovery since 1980, it will not be sufficient to compensate for the declines at the much larger fields. Further problems may constrain production, as the crude from the Ayatsil has a high sulphur content, while Pemex will have to build isolated infrastructure in order to successfully export the crude stream. Meanwhile, the start-up of the new 0.14 million b/d Tsimin-Xux field next year will support output at the Tabasco field further, having already trebled since inception. However, Tsimin-Xux is a super-light oil field (API>45), largely comprising of condensates and NGLs, and will thus do little to offset declines in heavy production. These hydrocarbon accumulations will be critical in helping to partially offset recent declines at older assets such as Cantarell, but will be unable to offset the declines entirely. Furthermore, these additions will have implications for the country's crude slate. Declining heavy production at Cantarell and KMZ, set against growing light crude at the Chicontepec fields and super-light crude at the Tsimin-Xux offshore complex, make the marginal barrel lighter - just when the advent of US tight oils has made the marginal non-OPEC supply barrel lighter.

In short, oil production in shallow waters will continue to decline despite the planned reforms due to the small size of the new additions. The only major additions in the coming years are the Tsimin and Ayatsil fields. They are already being brought on-line and the associated construction of the Ayatsil-Tekel FPSO will continue to support surrounding fields in the KMZ complex, although challenges with crude slate from both these new fields will remain. Given the decline rates at the mature basin, overall production from these two fields will only partially offset the falls and a Cantarell-style decline at KMZ would see Mexico's production from shallow water fields decline at double-digit pace.

## 4.2 Deepwater outlook

So-called 'development fields' are a key growth area highlighted by Pemex, in terms of output addition through to 2018, and primarily include production from deepwater fields. The significant ramp up expected by 2018 is based on the available resource potential in the Gulf of Mexico. However, Pemex may have been rather hasty in predicting production growth of up to 0.69 million b/d. Pemex's annual reserves report records only three deepwater wells, and categorises the reserves as 3P. The fields were discovered in 2012, and now, two years later, are still being drilled for exploration purposes and have produced no meaningful output. Of course, this is compounded by Pemex's lack of expertise in deepwater development, and opening this up to the foreign companies with such expertise will speed up the process. However, given that the fine print of energy reforms will not be finalised until the end of 2014, the timeline for realising potential growth is rather optimistic.

**Fig 8: Main deepwater exploratory wells**

| Name | Year of dicovery | 3P reserves (mn bls) | Depth (m) |
|---|---|---|---|
| Trion 1 | Aug 2012 | 250-395 | 2438 |
| Supremus 1 | Sep 2012 | 125-150 | 4000 |
| Maximino 1 | May 2013 | tbc | 2950 |

Source: Pemex, SENER, Energy Aspects

The success of supermajors, particularly BP, Chevron and Shell, operating in the deep waters of the Gulf of Mexico encouraged Pemex to explore its own resource base near the US-maritime border. Exploratory drilling between 2007 and 2011 revealed four prospective deepwater plays: in the north, the Perdido play and Salina del Bravo provinces; and in the south, the Mexican Ridges and the Caternaco foldbelt. Initial drilling showed Perdido to be a light-oil play, whereas the Mexican Ridges turned out to largely be a gas play. Due to the attractive oil-gas price differential, Pemex eased its exploration activity in the Mexican Ridges in favour of accelerating activity in the Perdido play. Pemex has drilled only six deepwater wells since then and the resource base is estimated by Pemex to be at least 13 billion barrels. However, this reserves estimate (as of 2013) consists of 3P reserves, not 2P. Therefore, convincing operators to bid for 2P reserves will be difficult, especially that there is a lack of deepwater infrastructure and no certainty of super-giant fields in the Perdido play to date.

To encourage greater cooperation, in February 2012 the US and Mexico signed a Transboundary Hydrocarbon Agreement, which established a cooperative and legal framework for safely managing and jointly utilising transboundary reserves. This also ended the existing moratorium on exploration and production in the transboundary area. Pemex is now in the process of discussing development plans for the wells it has discovered. The talks concern whether it will be more beneficial to share existing infrastructure in the Gulf of Mexico with the help of its US counterparts, or alternatively build its own FPSO.

Overall, the lack of 1P or even 2P reserves mean that the contracting terms will need to be extremely attractive to encourage foreign company participation, which is hardly a given especially as Pemex holds a 20% participation interest in all deepwater projects and the lack of infrastructure that will raise the cost of production substantially.

## 4.3 Unconventional production outlook

An important group of unconventional fields is Chicontepec, which was discovered in 2007 and is located in northeast Mexico in the Tampico-Misantla Basin. The Chicontepec is not one field, but a continuum of 29 fields known as districts and spread over an area of 2,400 square miles across the states of Veracruz and Puebla. Mexico pegged high expectations on this asset as it accounts for around a third of Mexico's total reserves and was supposed to bridge the gap between its legacy assets declining and its new shale and deepwater discoveries coming online. So far Pemex has invested more than $4.5 billion into exploring the fields, having initially expected a ramp up to around 0.1 million b/d of production by the end of 2012[13]. However, extraction has been challenged by geological and technological difficulties: the highly-fractured and low-pressure state of the fields reduces recovery rates and requires the drilling of a large number of wells in order to extract oil on a large scale – something made still more difficult by the large area that the fields are in. Furthermore, the commercial appeal of the fields is reduced because of the financial outlays required to build missing infrastructure. These problems indicate that a sharp production rise from the Chicontepec fields in the near term is highly unlikely. Investment is needed to increase knowledge of the geology, which differs across the fields, and then to build takeaway capacity. In the Round Zero process Pemex has asked for some strategic

[13] Reuters- Mexico regulator slams Pemex Chicontepec plans

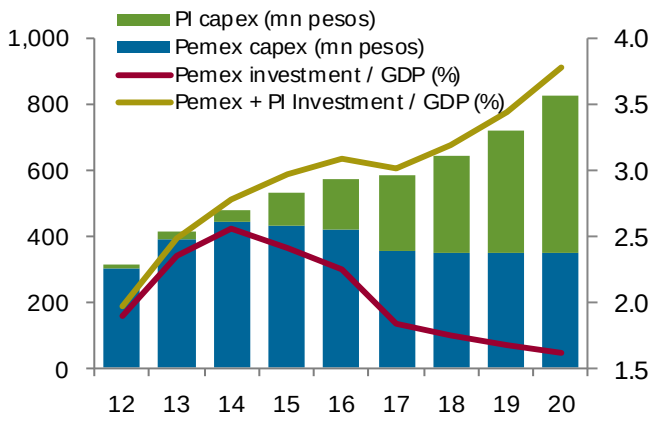
fields where it is already operating with partners. If Pemex is unable to form partnerships following the implementation of the energy reforms, then this resource will remain largely untapped.[14]

Pemex also predicts further unconventional growth in tight oils. Mexico's shale resources are estimated to be around 60.2 billion barrels— the eighth largest in the world—of which 53% is tight oil, situated in the Tampico-Misantla and Veracruz basins[15]. Shale has potential due to its proximity to the US border and the successfully tested overlapping basins at Eagle Ford and Woodford. This may be advantageous if the energy reforms go through, as success in these basins by Mexico's US counterparts will make exploring shale in Mexico attractive, given the right incentives. Due to the lack of resources, Pemex has found shale drilling largely out of reach and is planning to drill only 10 shale wells this year. Foreign involvement may help in some growth materialising from these onshore basins, but the lack of infrastructure and drilling resources is likely to be the key drawback. This issue is beyond the scope of the currently proposed energy reforms.

## 4.4 Overall outlook

Perhaps the biggest issue with Pemex's forecasts is its assumptions on foreign investment. Whilst Pemex's CAPEX will rise to 2% of GDP by 2017, it expects that private investment will come in at a higher rate and reach 3% of GDP. This is unrealistic, as the reforms are yet to pave the way in gaining the interest of the investor community, let alone boosting production so early. Pemex's charts and the analysis depicted below should therefore be taken with a pinch of salt, as they are based on the most optimistic scenario—i.e. that the energy reforms will pass and then private investment will flood in.

**Fig 9: Expected E&P spending post-reforms**

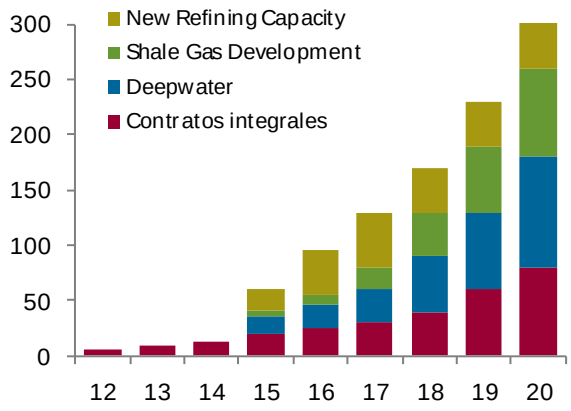



Source: Pemex, Marcos y Asociados

Fig 10 meanwhile depicts a more realistic outlook[16]. Private investment is only expected to start trickling in next year, before increasing more than fivefold during the five-year period to 2020. This will be led by investment in deepwater projects, followed by shale and finally some in refining capacity. However, Mexico's beleaguered refining sector is hardly an attractive proposition for foreign companies, especially given its proximity to the US Gulf Coast, which has access to much cheaper feedstock (see the section on 5.1 Refining Outlook).

[14] Elsewhere, production at the mature Abkatún-Pol Chuc and Samaria-Luna fields is dropping and will continue to do so; any new fields that have come online since last year have been too small to compensate for the loss in output from the larger fields.
[15] Pemex's estimates: *http://www.reuters.com/article/2014/02/27/mexico-shale-idUSL1N0LV2QO20140227*
[16] Marcos y Asociados estimates

**Fig 10: Expected private investment, mn pesos**




Source: Marcos y Asociados

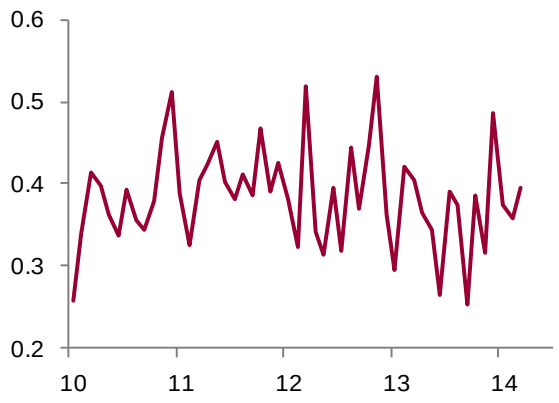
In short, the above discussion suggests that before 2020 it is unlikely that we will witness a sharp increase in production from Mexico for the following reasons:

- The new additions in the Tabasco fields, as well as increased output from 450 marginal fields, will simply help to offset the declines at the mature basins in the Bay of Campeche and southern Mexico and not add to overall output. Although Pemex will continue bringing new shallow-water fields online, their relatively small size means they will be unlikely to push Mexican production back to its former peak. In fact, a further downside risk to this production may come from the extent of decline at KMZ, which if it falls as dramatically as Cantarell did, has the potential to wipe out all the gains in production accruing from the marginal fields. That said, the impact from marginal fields could be substantial should foreign investment be allowed in this area. Pemex, for instance, has already managed to triple output from smaller fields by investing just $100 million. Therefore, if successfully exploited and invested in, these marginal fields could add around 0.4-0.7 million b/d till 2020. Successful foreign partnership will be key for this.
- Mexican deepwater reserves are not nearly as impressive as those of Brazil, Angola or even the US Gulf of Mexico, while the lack of infrastructure only makes the prospects of investment less attractive. Initial drilling suggests that the deepwater plays are light oil or gas plays, which will do little to offset declines in Mexico's heavy output. Given the surge in onshore light crude output and increased activity in the US Gulf of Mexico, which is a far more fiscally and legally stable environment, the terms of investment will need to be extremely lucrative for companies to materially increase production from Mexican deepwater reserves.
- Tight oil production growth is likely to be hindered by the lack of infrastructure and drilling resources, something the reforms do not address. The unconventional Chicontopec basin does offer some prospect but extraction has been challenged by technological difficulties—so post-reform partnerships will be needed to realise the full potential.

## 5. Midstream and downstream outlook

The biggest drawback of the proposed reforms is not necessarily about how short it falls of introducing the right level of competition for Pemex. Rather it is the lack of detail for tackling issues in the midstream and downstream sectors. In particular, the reform does not address the issues plaguing the midstream, as the assets will continue to remain under the control of the Mexican government. The current state of infrastructure requires billions of dollars of investment, but without ownership of the midstream assets, much-needed foreign investment may not materialise and may well slow the pace of foreign upstream investment as well.

**Fig 11: Gasoline imports, million b/d**




Source: Pemex

**Fig 12: Diesel imports, million b/d**


Source: Pemex

## 5.1 Refining outlook

Mexico has six refineries that process around 1.54 million b/d which is almost 1 million b/d less than domestic production. Despite having the lowest crude extraction costs relative to its peers ($6.84 vs industry average costs of $11.23), Pemex's refineries made a net loss of $6.5 billion last year[17]. This is because the refineries are plagued with problems: they have aged and no new refineries have been built since 1979; they are inefficient, operating at around 72% capacity utilisation, and ill-equipped to handle Mexico's heavy crude. Moreover, Pemex's refineries are significantly more energy intensive, less efficient in distillate yield and prone to more maintenance downtime. Only three of its refineries have deep conversion technologies that allow for the production of gasoline from low-quality crude. These issues stem from the political challenges faced by Pemex, which lacks budget autonomy, meaning that any profits made from the upstream are spent either in taxes and royalties to the treasury or on subsidising domestic fuel costs. This diminishes overall profits and leaves Pemex with little money to spend in the upstream exploration sector and improve the efficiency of its refineries.

As a result, the refineries are largely in the same state they were when initially brought online in the 1960s-70s to produce fuel oil for power generation. At times Pemex has had to slow refinery operations as it has not been able to market its fuel oil quickly enough. This continues to be a problem for Mexico, as it produces too little of much required gasoline, causing it to import a third of its domestic consumption from the US—by firstly exporting its crude to the Gulf Coast refiners, then importing gasoline and diesel back from them at international prices. Indeed, from 2000 to 2013 Mexican gasoline imports increased at an annual average rate of 13% and diesel at 10% as domestic demand was fuelled by favourable demographics, rising living standards and subsidies. These imported products are then sold domestically at subsidised prices, further weighing on Pemex's finances.

The biggest problem with the current reforms is that their full impact on the downstream does not even come through till 2020. Opening up the downstream will always be politically challenging and, despite the dismal state of the refineries, the government's proposed reforms are extremely slow. In fact, it will not be until the current president's term is over that the refining sector will be fully open to foreign investment. Part of the reason for the delay could be to retain the option of freezing gasoline and diesel prices ahead of the elections in case international prices spike. But, this politically motivated move means that Mexico's beleaguered downstream sector will not really benefit from the planned reforms until after 2020.

[17] Houston Chronicle, quote by Roger Ihne, Deloitte

Although the reforms make all logistical activities available to private and foreign investors, including the freedom to use non-Pemex brands, the losses accumulated by the sector and state of the refineries make it a very unattractive proposition for foreign investors. Economically, Mexico would be better off closing its refineries and importing from the US, but this is not politically realistic. Still, the reforms may force Mexico to streamline the downstream sector and make the existing refineries more efficient by forming joint ventures (JVs), which could give Mexico access to foreign capital. Pemex does control 50% of the b/d Deer Park refinery in Texas, but to replicate the same success within its own borders is impeded by higher feedstock prices (natural gas, electricity and crude oil), which means that right across the border the USGC refineries will always remain a far more attractive investment option.

Another approach may be to improve its domestic operations—i.e. spend billions in expanding and modernising the refineries to US standard, by adding FCCs, hydrocrackers and cokers, with further investment to add environmental upgrades. Cokers, in particular, will be absolutely crucial for Mexican refineries to be able to utilise all the unwanted fuel oil that will increasingly remain in surplus. Since Mexico does not have this sort of capital to invest, one option could be for Mexico to offer attractive JV contracts to private contractors who can build new refinery units. However, this remains a largely untested model due to complications of conflicting interests between the private operator and Pemex. The operator will have an incentive to increase runs to raise profits (especially in a market which is already short gasoline), whereas Pemex will want to keep runs in check to stabilise domestic product prices.

The options above are faint hopes for Mexico's refining industry, which is unlikely to receive substantial private investment as the competitive nature of the industry and an excess of refining capacity globally means that refining is currently an unprofitable business - unless it is in the US, which profits from utilising cheap feedstocks.

## 5.2 Midstream outlook

Perhaps the biggest headache for Mexico's downstream sector is its infrastructure. While certain areas remain underutilised, others are completely saturated. Pipelines, transport, storage and distribution networks are all inadequate to meet Mexican demand which rose by nearly 12% between 2002 and 2012. This is despite the recent sharp decline in fuel oil demand due to weaker economic growth and more natural gas imports from the US. About 40% of Mexico's pipeline systems are running at maximum capacity, giving rise to frequent bottlenecks, yet there has been no investment in new pipelines in the last decade. Instead, Mexico has relied heavily on road transportation, despite costs being around 6-13 times higher and thus raising oil product transportation costs by around 5% compound annual growth rate (CAGR) since 2003[18]. Replacing these beleaguered midstream assets has become a priority.

The retail sector also suffers from similar lack of investment and while private participation is allowed, it is limited to private franchises in a controlled market. The Selling of off-spec gasoline is a rising concern for instance, with rising car sales demanding a huge investment in the retail sector. Mexican auto sales have been on a stellar growth path, notwithstanding the downturn in 2014 due to a weakening economy. 2013 saw new vehicle sales pass 1 million units, up by 7.7% y/y and the Ministry of Energy forecasts the trend of rising vehicle demand will continue and that gasoline demand could increase by nearly 70% by 2025[19]. New capacity and investment in gasoline refining, distribution and sales will therefore be needed to meet growing domestic demand, unless subsidy reforms are carried out.

Theft of gasoline from pipelines is also a growing issue in Mexico, with various newswires reporting that an estimated 1,500 illegal siphons were found in 2012 compared to 400 in 2009. The system allegedly loses 5-10 thousand b/d of oil due to theft. Consequently, investing in gasoline storage infrastructure has also been limited. The average OECD gasoline inventory cover is 31 days, while in Mexico it is as

[18] BCG Focus: The promise of Mexico's Energy Reforms, April 2014
[19] SENER, Mexican Ministry of Energy

low as five days average for premium and non-premium gasoline combined and three days for diesel, with the forward cover dipping to less than one day at times during peak seasons.[20]

## 6. Conclusions

While the recent energy market reforms will have transformative and enduring effects on the Mexican oil sector and may offer many opportunities for foreign private investors, many challenges lie ahead and some of the intended objectives of the energy reform may not materialise, at least not as fast as the government and some market analysts are predicting. Foreign private investment into the upstream may flow at a slower rate than currently anticipated by Pemex or the government. The biggest drawback of the legislation is the lack of detail for tackling the current state of the midstream and downstream sectors, which face deep-seated challenges, while the current state of pipelines, storage capacity and refineries offers little attraction for private investment. The full opening up of the downstream sector is not until 2020 (i.e. past the current government's tenure), while the midstream is largely ignored in the current scope of reforms. This may well slow the pace of foreign upstream investment as well. Furthermore, improving the performance of Pemex through subjecting the national oil company to higher competition may not materialise, as Pemex will continue operating in its shallow water assets and face little competition from foreign companies in other areas. A key uncertainty remains as to how far the government will go to safeguard Pemex from foreign competition, while some political uncertainty also remains, which could deter foreign investment. The opposition party (PRD) has not only left the 'Pact for Mexico', but has also raised a public campaign against the energy reforms which may result in a referendum during the mid-term elections in June 2015. This has the potential to hinder any progress made and prevent the energy reforms going forward. These factors combined with high declines rates in mature fields suggest that it may not be until the next decade that the current energy sector reforms have any material impact on Mexican production and on global oil supplies.

[20] BCG Focus: The promise of Mexico's Energy Reforms, April 2014