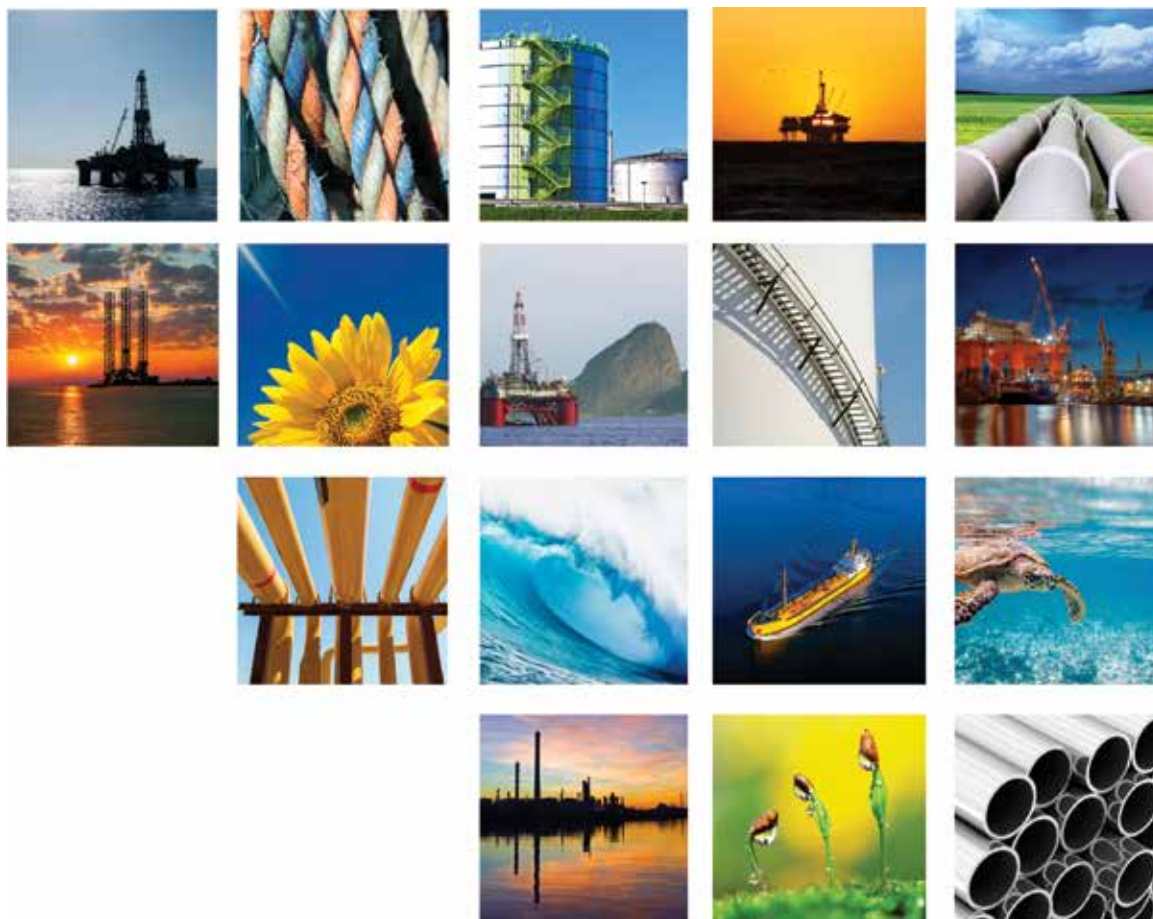


## Vision 2040

### Global scenarios for the oil and gas industry



# Understanding the next decades

The Brazilian oil and gas industry finds itself at a unique point in its history. With exploration of the pre-salt layer reserves, the country is preparing for an unprecedented jump in oil production. However, for our industry to realize this potential in full, a number of economic, social and geopolitical factors that influence the oil and gas sector globally need to be taken into consideration – as well as the technological and logistical challenges involved in extracting oil and gas from these reserves. It is necessary to understand how important variables such as global demand for fuel, the rise of alternative energy sources, climate change, regional conflicts impacts and economic development trends in different parts of the planet will influence the sector.

This study, prepared by Deloitte's Oil and Gas Center of Excellence (CoE) in conjunction with Monitor Deloitte, our strategy consulting practice, seeks to understand how all these (and others) uncertainties may alter the panorama of the industry through 2040.

I hope this study provides readers with relevant information on possible future scenarios for the sector.

Sincerely,





**Carlos Vivas**

Lead partner for Oil and Gas  
Industry in Brazil

“For our industry to realize this potential in full, a number of economic, social and geopolitical factors that influence the oil and gas sector globally need to be taken into consideration – as well as the technological and logistical challenges involved in extracting oil and gas from these reserves.”



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### Vision 2040 – Global scenarios for the oil and gas industry

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# Strategy to support decisions

The **Vision 2040 – Global scenarios for the oil and gas industry** study uses a time-honored Monitor Deloitte scenario preparation methodology to forecast a panorama of directions the sector may take in the next decades. Our expert consultants in this segment have analyzed the current context of the industry and the main factors that influence it, surveying the main trends that should most strongly direct the movement of the sector and also considering the various uncertainties that may impact the market.

In developing the scenarios, all the experience of our staff for strategy and the oil and gas industry was employed, composing scenarios that take economic information, geopolitical issues, demographic and social data and specific oil and gas industry factors into consideration.

Our methodology consists, primarily, of listing the main trends and, subsequently, collecting the critical uncertainties, which are the factors with the highest level of unpredictability. By crossing trends with uncertainties, scenarios – plausible narratives – for the time period in question are created. Finally, we

present a most probable vision from our point of view, called the “target-scenario,” which is detailed and quantified. We also include analyses of the Brazilian industry reality in the scenarios, with the appropriate contextualization, helping local competitors to understand the consequences of the movements described in the study.

This variety of information is treated with the already well-known skill of Monitor Deloitte, global leader in strategic consulting for corporate strategy development based on scenarios. The ability to understand the multiple variables that will determine the paths of the oil and gas segment is fundamental to long-term planning. We have the ability to understand the current scenario, apprehend which fundamental forces will act on this scenario in the next years and to support the industry in constructing multidisciplinary strategies.

Enjoy your reading.

**José Carlos Monteiro**  
Lead Client Service partner for Petrobras

“The ability to understand the multiple variables that will determine the paths of the oil and gas segment is fundamental to long-term planning.”



# How to read the study

Few areas of the economy are as volatile – literally and figuratively – as the oil and gas sector. The multiplicity of factors that influence the directions of the petroleum production chain is huge, making the task of preparing strategies and action plans a great challenge. Technological advances, supply and demand, prices, business models, sustainability, demographic change, armed conflicts and geopolitical disputes; these are just some of the variables that are likely to be on the horizon, year after year. And how does one map the changes the market will hold for its actors over a more distant future, in a segment with high production costs and long-term returns and in which long-term planning is essential?

There is no crystal ball for such a complex panorama. But there are scenarios: sets of hypotheses that, rather than predicting the future, describe a range of possibilities. They are projections prepared based on data that, studied

today, can enable companies to make better decisions. The scenarios emphasize descriptions of the external environment (instead of focusing on the internal context of companies). They employ narrative techniques that instigate consideration of unexpected situations and challenge common sense, but always maintaining plausibility. And, when well developed, they offer a guide that allows managers to recognize the changes that are coming and prepare for them in advance.

The scenarios combine information from three distinct environments. Data on social and economic changes, technological advances and geopolitical movements result from the **contextual** environment. Information on markets, clients, competitors, products, services and operations are compiled from the **industry** environment. And the **organizational** environment provides knowledge about the company that will use the scenario in its strategy. This set of data is combined with the trends – factors that will affect the future to a greater or lesser degree, and which are fairly certain to occur – and the critical uncertainties – factors that are considered to have the greatest impact and which are still subject to a higher degree of unpredictability. By crossing the information, trends and critical uncertainties, panoramas delineated by the scenarios arise, which can be used to develop and test strategies, generate innovative ideas, improve processes, mitigate risks and provide greater clarity for decision making.

This publication summarizes the scenarios that Monitor Deloitte delineated to respond to the following questions: what are the main uncertainties and trends in this context? How will these trends and uncertainties influence the future? What are the main implications of these scenarios for the domestic industry? In sum, what is the global context in which the Brazilian oil and gas industry will develop through 2040?

Oil and Gas Center of  
Excellence (CoE), located in  
Rio de Janeiro, Brazil



This scenario study is divided into four main parts: Trends, Critical Uncertainties, Scenarios and Our View.

**Trends** suggest expected directions for the industry. Understanding the **Critical Uncertainties**, factors for which there is a higher degree of unpredictability, is even more essential than the prior chapters, since the scenarios will be constructed based on the extremes of these critical uncertainties.

**Scenarios** describe the plausible narratives for the future in question, as well as the results and implications of the events described. Once again,

understanding the critical uncertainties is essential for development and understanding scenarios.

Finally, the traditional scenarios methodology, of a qualitative nature, receives a quantitative treatment that we call **Our View**, in partnership with Deloitte MarketPoint, to describe a distinct scenario using numeric indicators. This chapter can be read independently of the scenarios described previously, but it requires a good understanding of the initial chapters.

Have a good read,

**Eduardo Tavares Raffaini**

Lead Consulting partner for Oil and Gas industry in Brazil

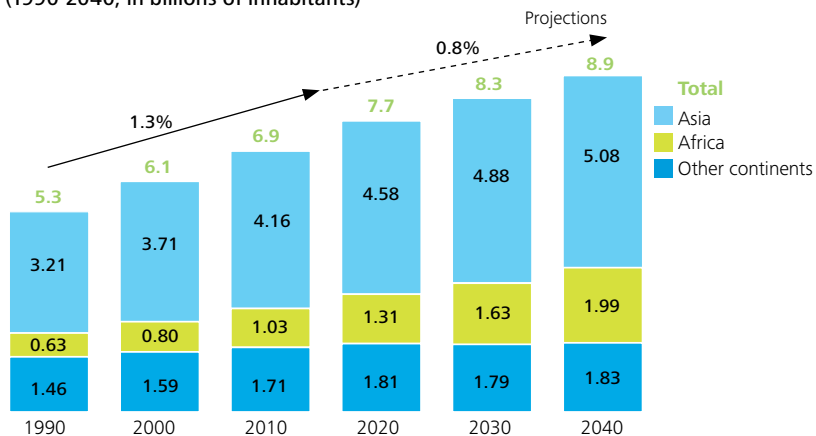
“[Scenarios] are projections prepared based on data that, studied today, can enable companies to make better decisions.”



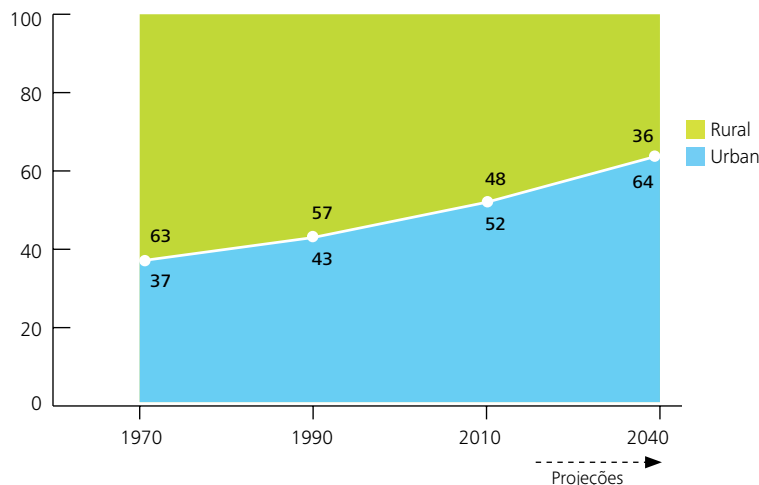
# Trends

Four trends were identified as determinant for the oil and gas industry when the years that separate us from 2040 are analyzed: increased energy demand due to social and demographic factors, increased energy efficiency, increased cost of oil extraction and growth of non-conventional natural gas production in North America. By analyzing each of these macro trends, the scenarios for the future become progressively clearer.

**Global population by continent**  
(1990-2040, in billions of inhabitants)



**Population Distribution**  
(1970-2040, percentage of inhabitants living in each area)



## 1. Increased energy demand due to social and demographic factors

The world will continue to demand more and more energy in the next years. Data from the World Urbanization Prospects study prepared by the United Nations Organization (UNO) in 2011 indicate that the global population will continue to grow at a pace of 0.8% per year from 2010 to 2040, jumping from 6.9 billion people in 2010 to close to 8.9 billion in 2040. And this population increase will be concentrated primarily in Asia and Africa, which will also be driving growing global urbanization. A larger population, by itself, indicates a growth in energy demand. And a larger contingent of urban inhabitants also necessarily implies an increase in energy consumption. It is interesting to note that it is only very recently – since 2009 – that the world has had more people living in cities than in the countryside. However, the UNO projections indicate that by 2040 the global urban population will be almost double the rural population.

## 2. Increased energy efficiency

In contrast to the increased energy demand due to population and urbanization growth, a trend of deceleration of this same demand appears due to technological advances that optimize energy use. The search for products – automobiles, household appliances, machines in general and electronic devices – that consume less energy is one of the major vectors of industrial innovation today. World Bank research reflects this: between 1980 and 2010, global Gross Domestic Product increased, but with 33% less consumption of energy. In other words, over 30 years, more wealth was produced with proportionally less energy. This is a direct function of successful efforts (of public and private initiatives) to improve energy efficiency.

The industrialized countries have, for the near future, well-defined targets for energy efficiency improvement. In the United States, legislation requiring production of automobiles that consume less fuel, effective for vehicles manufactured between 2017 and 2025, should generate reduced demand of up to 4 billion barrels of oil over the useful life of the

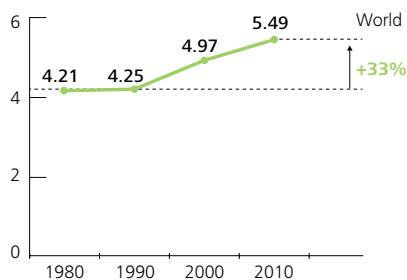


vehicles. In the European Union, the efforts to reduce emissions will require automakers to manufacture less polluting – and more efficient – vehicles. An 18% reduction in average consumption is forecast for 2017, and a 40% reduction by 2020, in comparison with the average consumption recorded in 2007.

### 3. Increased cost of oil extraction

On one side, demand will increase, with more people living in large cities. On the other, demand will fall, with machines and equipment in general using less energy. But another macro trend will have no offset: the increased cost of fuel extraction. Excluding Middle East reserves, most of the oil that remains to be exploited demands increasingly expensive and complex operations. The most significant reserves, concentrated in Venezuela, Russia and Canada, contain heavy oil or are located in tar sands, two complicating factors that increase the cost of exploitation. Russia, in particular, also faces large operating challenges in its operations in the Arctic (due to distances and the complexity of drilling on land and in the ocean). These difficulties are similar to those found in the Kazakhstan

**GDP per unit of energy used**  
1980-2011 (PPP GDP per kg of oil equivalent)

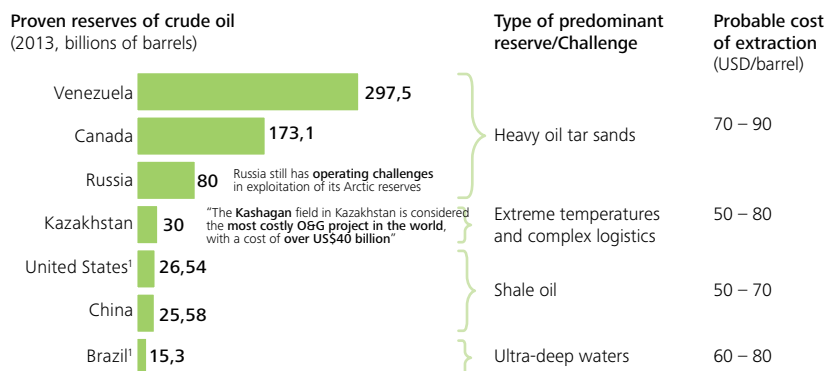


fields. In the Kashagan region, in the Caspian Sea, huge reserves have been confirmed, but the cost of extraction is equally high, given the climate difficulties, the institutional instability and the logistical deficiencies.

The United States and China combined hold proven reserves of crude oil that reach 53 billion barrels (according to 2013 data from the United States Department of Energy). In these countries, most of the reserves are in the form of shale oil that has higher production costs than do conventional reserves.

### Increased cost of oil extraction

The supply of oil outside the Middle East should come mainly from oil of difficult extraction and, therefore, be more costly, such as heavy oil, tar sands, shale oil and ultra-deep waters.



<sup>1</sup>2012 data for the United States and Brazil  
Source: EIA, ODAC, clippings, Análise Monitor

“Operations in the great frontiers with still unexplored oil reserves will have high development and production costs. There is no more ‘new and cheap’ oil.”

**Michelle Sampaio**, Consulting Director for Oil and Gas Industry in Brazil



Brazil will become an area of strong growth in oil production in the next years, due to exploitation of the vast pre-salt reserves. However, these reserves are found in ultra-deep offshore areas, close to 300 kilometers off the coast, with high production costs. The African west coast has a similar panorama.

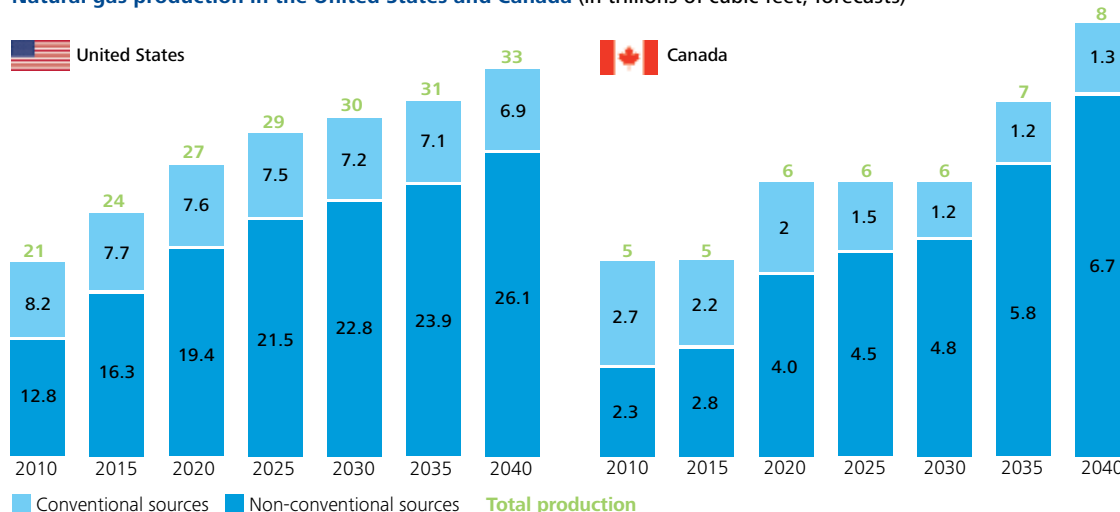
#### 4. Growth of non-conventional natural gas production in North America

Non-conventional sources of natural gas should continue to increase in importance in the U.S. and Canadian energy panoramas. United States Energy Information Administration (EIA) data support this macro trend, showing that in 30 years (2010 to

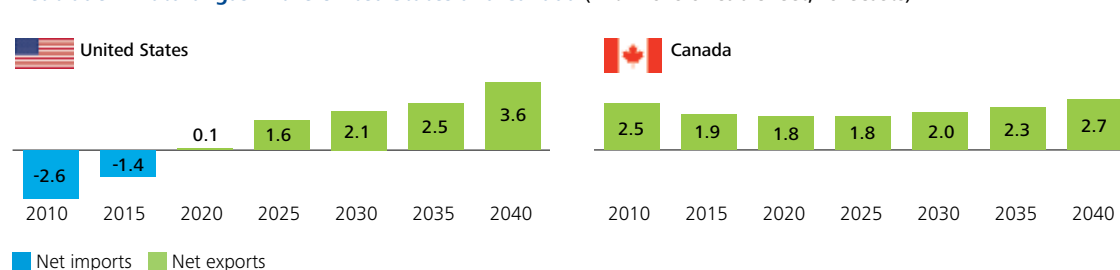
2040) the share of non-conventional gas in total natural gas production in the United States will jump from 61% to 79%. In 2020, the country should already be in a position to become a net exporter. In Canada, which is already an exporting country, the share of shale gas in total production will be even larger in 2040 (84%) than in the United States.

There will be growth in non-conventional gas production in other parts of the globe, but not on the scale seen in North America. For this reason, we include this growth outside of North America as an uncertainty and not a trend.

**Natural gas production in the United States and Canada** (in trillions of cubic feet, forecasts)



**Net trade in natural gas in the United States and Canada** (in trillions of cubic feet; forecasts)



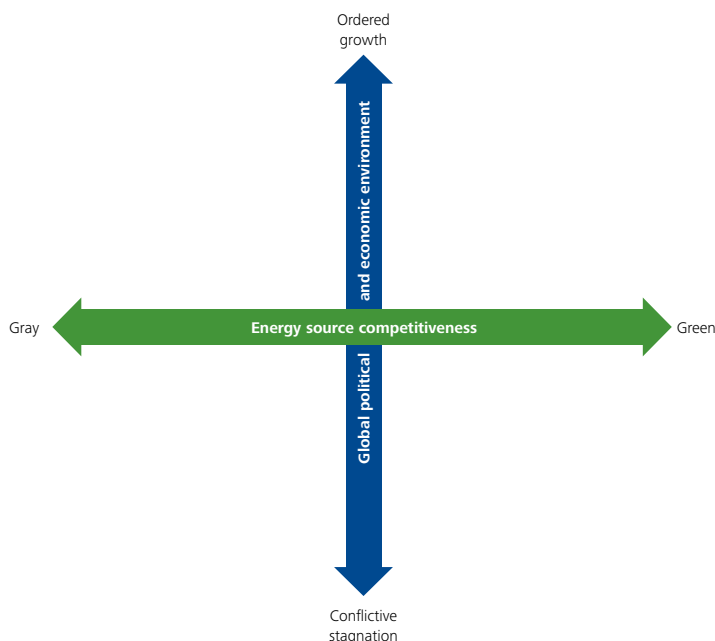
Source: EIA, Monitor Deloitte analysis

# The critical uncertainties

The critical uncertainties with regard to the future of the oil and gas industry can be divided along two main axes.

The first refers to the global political-economic environment. What factors of the geopolitical panorama will have the largest impact on the oil and gas industry through 2040? Is the world headed toward a phase of global economic development and relative political stability? Or will we see the outbreak of conflicts in various regions, impeding the advance of the global economy? Where will the new crises and surges of industrialization come from?

The second axis deals with the competitiveness of energy sources. Today we see the contrast between fuels of fossil origin, in the case of the oil and gas industry, and those from renewable sources. Almost all productive activities are currently dependent on oil, but will this be the case in 2040? Climate change, the economic feasibility of alternative sources and technological advances will have an important role in this discussion.



## The global political-economic environment: conflictive stagnation or ordered growth

In the scenarios studied in this publication, the axis that encompasses the uncertainties with regard to the global geopolitical situation through 2040 has two extremes. On one of them, regional political tensions intensify, making trade difficult and reducing wealth generation. It would be a state denominated "conflictive stagnation." On the other end of the axis, a more pacific political environment creates conditions for a prolonged period of economic bonanza. We would have "ordered growth," with resumed integration of global markets, the establishment of new multilateral accords between countries and completion of the ongoing World Trade Organization (WTO) negotiations.

The oil and gas industry is strongly influenced by the geopolitical context. More stable times offer favorable conditions for supplying energy demand. In contrast, periods marked by wars and disputes can lead to drastic fluctuations in fuel supply and price. Relatively recent examples were the 1973, 1979 and 1990 oil crises – all with a strong political component, resulting in steep increases in the barrel price. Related to this, increased demand for energy generally accompanies economic growth cycles (which benefit from political stability), while periods of recession (which tend to occur during institutional turbulence) reduce demand.

"In countries with young democracies, such as those impacted by the Arab Spring, there is today a lot of geopolitical uncertainty, which impacts the oil and gas market."

Marcelo Soares, Manager at Deloitte Monitor

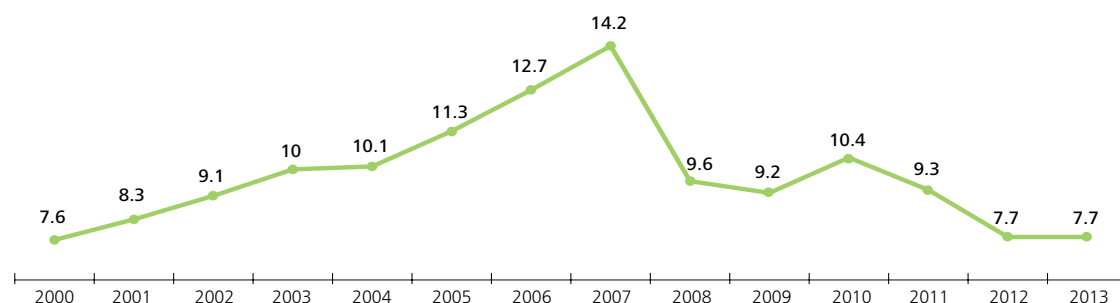
### Where the emerging countries are going

The economic development experienced in the last two decades by the emerging countries will take on new aspects from now on. China's growth rate is one of the main uncertainties for the next years (see graph below). With GDP growth rates exceeding 10% over the past decade, the Chinese economy drove high demand for raw materials and fuel. Since 2007, this velocity has been decreasing, leading sources like the BBC to create terms such as "anemic global demand" to label the consequent decline in imports necessary for Chinese growth. Understanding the extent of this "anemia" to the rest of the world is important for the oil and gas industry.

Another of the emerging Asian countries, India, may take on the role of global locomotive. The country's levels of economic growth in recent years were comparable to those of China, but it still needs to overcome an enormous deficiency in infrastructure that impedes greater acceleration (see graph below). Investments in education and public health are also essential. And therein lies another uncertainty: during this new cycle of infrastructure construction, how far will Indian capacity to invest in these sectors and again raise global demand go?

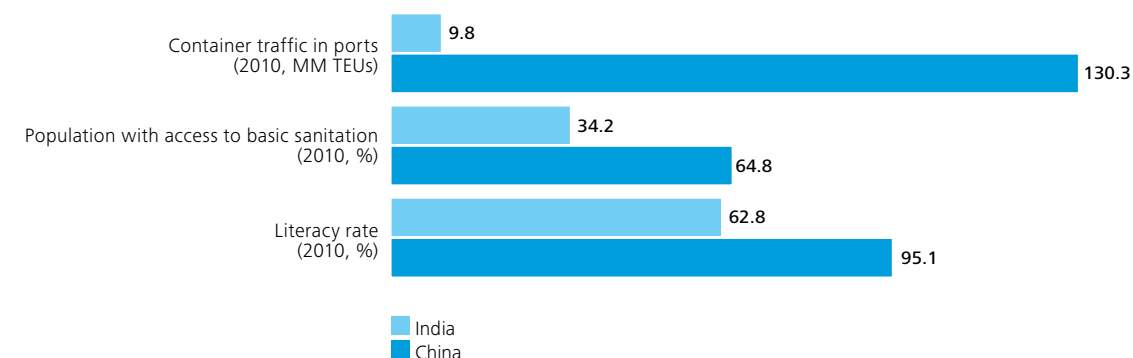
Some players appear as probable players in the block of emerging countries. They are economies

**Chinese Gross Domestic Product growth rate**  
2000-2013, Percentage of annual GDP growth



Source: World Bank; International Monetary Fund (IMF)

### Comparison of Indian and Chinese development and infrastructure indexes



that, together with India, could start a new cycle of global growth. In Latin America, Brazil, Mexico and Colombia. In Middle East and Europe, Turkey; and in Southeast Asia, Vietnam, Malaysia and Indonesia. All have the potential advantage of being close to large economic centers and having strong demographic growth, which contributes to the labor force, as well as the consumer market. However, just like India, all these nations need to remedy basic gaps in infrastructure and raise their levels of productivity.

#### A new global economic order

A number of complex interrelated factors can lead the world to a situation in which low economic growth would be a persistent and predominant reality (see graph at the side of the page).

The average aging of the global population as a whole – a trend of increased life expectancy common in practically all countries – causes pressure on the so-called dependency ratio for each nation. The dependency ratio is a mathematic relationship

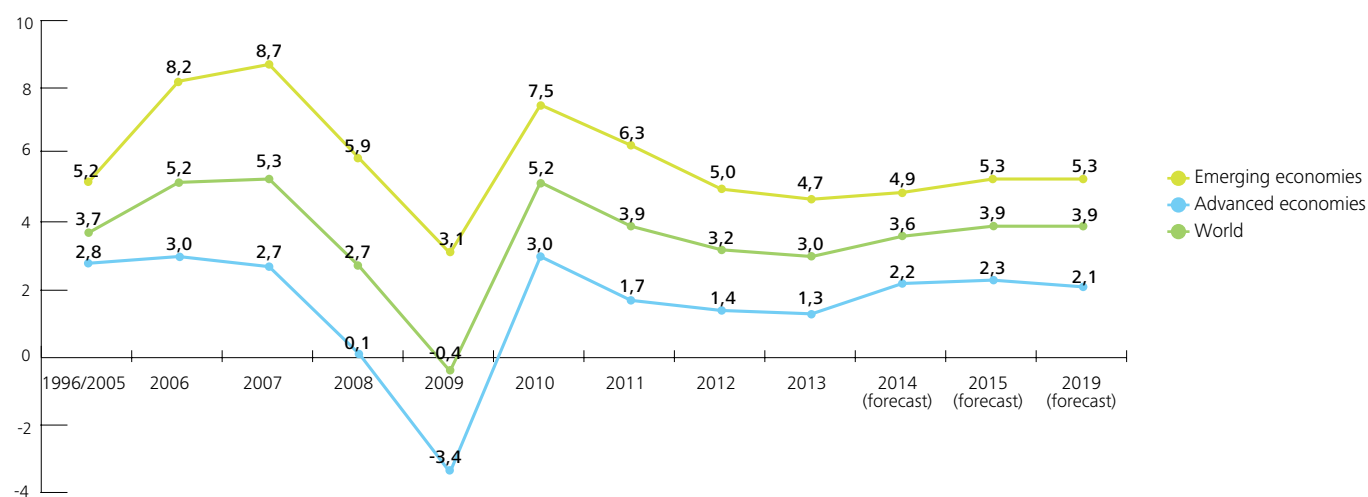
between the number of economically active people and the number of economically dependent people. A lower ratio – that is, a growing number of active people compared to a reduced contingent of dependent people – tends to signal better economic development conditions, the so-called demographic window of opportunity. It is a situation in many of the emerging countries, including Brazil.

For the main industrialized economies, the dependency ratio is increasing, which means that these countries have already passed through the demographic window of opportunity (see graph at the side of the page). At present, their population is aging and their demographic growth is declining, which represents a small workforce and a higher number of inactive people. Another factor of concern for the advanced economies is the persistence of high levels of unemployment, which, according to studies by the International Labour Organization (ILO), may reach historic records in the next years, without great perspectives for improvement in the short or medium term.

“Between 1950 and 2000, the Brazilian population quadrupled and became more concentrated in cities. Today, we are one of the countries aging most rapidly, and it impacts productive and energy sectors.”

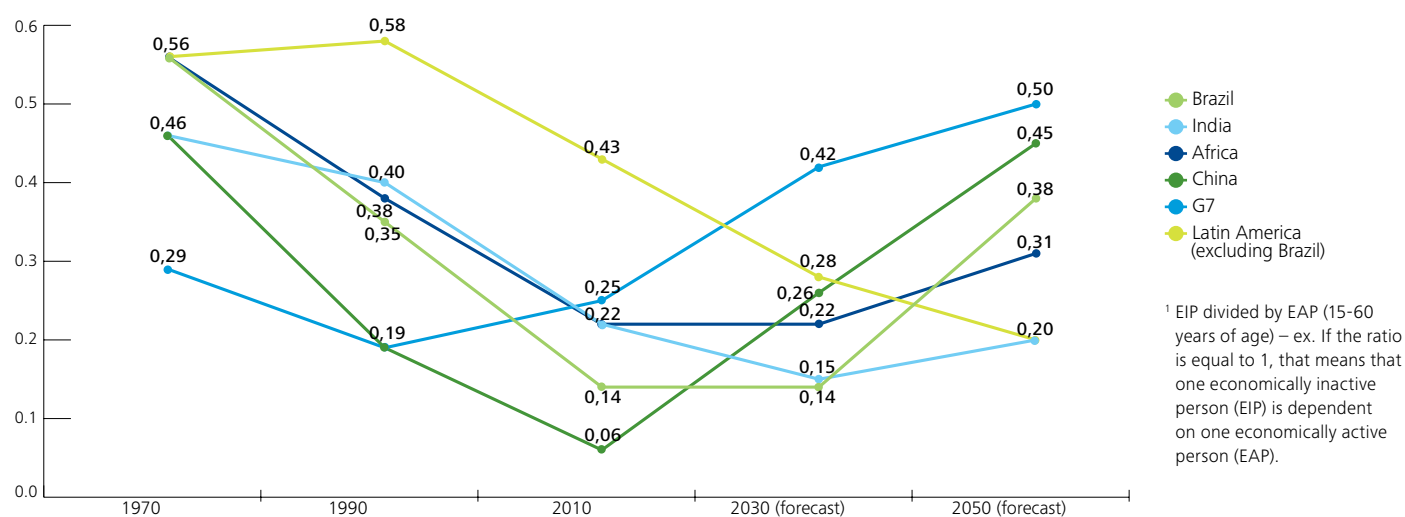
Rogério Rizzi, Monitor Deloitte

### Change in GDP (% year to year, constant values)



Source: IMF World Economic Outlook

### Change in the Dependency Ratio<sup>1</sup>



Source: UN Department of Economics and Social Affairs

“While the U.S. thinks about reducing its global geopolitical presence, several ‘players’ – Russia, Iran, China – are watching for opportunities that may arise for the oil and gas industry”

Fábio Carneiro, Senior Consulting Manager for Oil and Gas industry in Brazil

#### Social disturbances in young democracies

The last turn of the century brought with it a worsening of social tension in various emerging countries. The oil industry needs to monitor these movements with care since several of them are concentrated in countries important for the international oil and gas chain and may interfere with the normal flow of supply and demand for the fuel (see table below).

The so-called Arab Spring assumes special relevance in this context. Various countries in the Middle East and North Africa were hit by popular demonstrations, indicating dissatisfaction with the excesses and authoritarianism of groups in power. In 2009, large protests were organized in Iran (an important member of OPEC). In 2010 and 2011, a number of uprisings overturned the governments of Tunisia and Libya and caused considerable commotion in Syria and Egypt.

In 2013, the wave hit Turkey. Other countries, including ones holding large oil reserves, such as Saudi Arabia, Iraq, Kuwait and Bahrain, were also affected by disturbances.

Other developing countries outside the Middle East, but important to the industry, were subject to turbulence. Venezuela, a large Latin American producer, experiencing political turbulence for a decade, has suffered since 2013 from protests against the government, instigated by student leaders; the economic crisis and oppression of opposition parties are seen as the main reasons for the disturbances. A number of protests appealing for improvements in public services took place in June 2013 in Brazil. Thailand, one of the most dynamic economies in Southeast Asia over the last decade, has been experiencing a serious institutional crisis since 2008, including popular protests that were violently repressed by the government.

#### Protests around the world

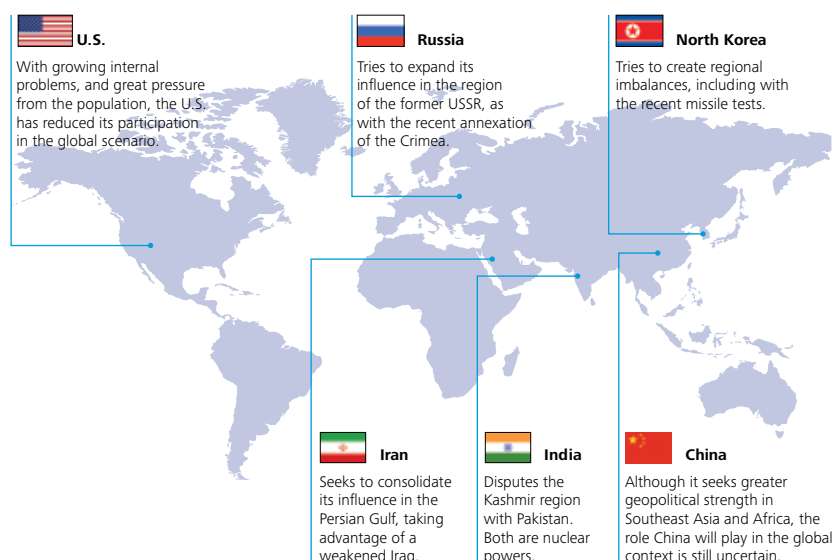
Month/year	Country	Disturbance
April 2009	Thailand	Protests against the government of Abhisit Vejjajiva that, according to the protests, was not democratically elected.
June 2009	Iran	Protests against the election results and for freedom of expression.
December 2010	Tunisia	Protests for the purpose of ending the current regime and political violence and for human rights.
January 2011	Egypt	Protests appealing for the end of the current regime, freedom of expression and more jobs.
February 2011	Libya	Protests to replace the Gaddafi regime with a democracy and for more human rights.
March 2011	Syria	Protests against the al-Assad regime and for human rights and democracy.
June 2013	Turkey	Protests in various cities appealing for human rights and premier Erdogan's exit from power.
June 2013	Brazil	Widespread protests for improved public services.
February 2014	Venezuela	Student protests against violence, hyperinflation, shortages of products and oppression of opponents.
October 2014	Hong Kong	Protests for greater popular participation in the next elections in a region controlled by China.

### Who will be the global police?

Unpredictability concerning to the geopolitical panorama takes on a new aspect when the global role of the United States is considered. Since the end of the Second World War, the U.S. has assumed the role of "global police," directly and indirectly

### Geopolitical conflicts

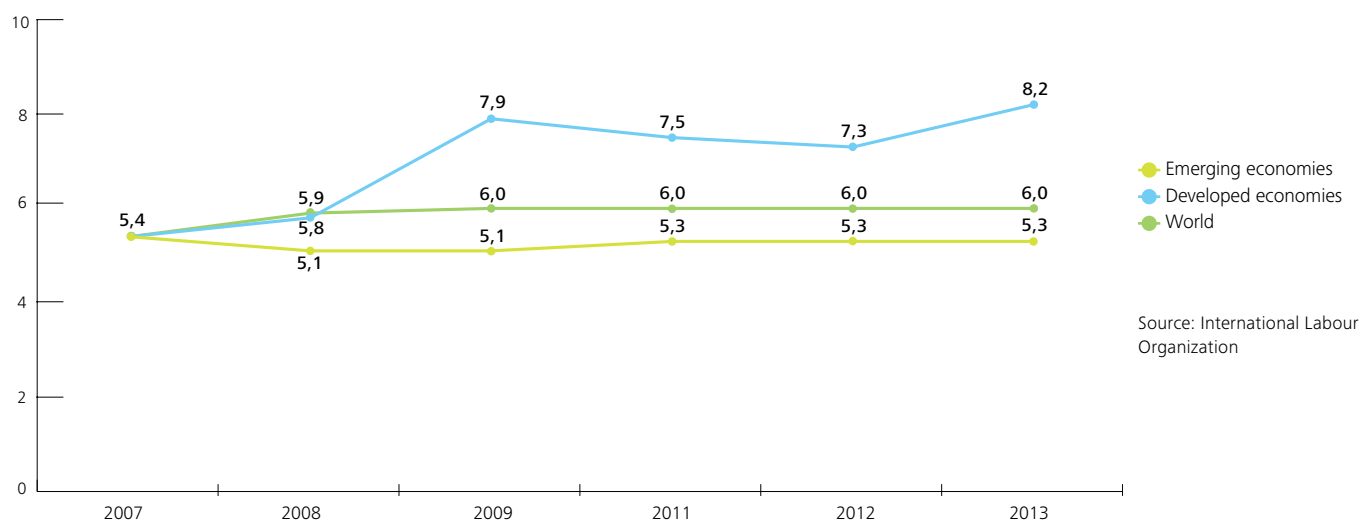
American disengagement in foreign matters, the ascension of China and regional territorial disputes may impact the future geopolitical panorama.



intervening in regional conflicts and putting economic and political pressure on other countries (see some geopolitical conflicts on the map to the side). It is not known whether this will continue to be the case in the next decades. The long involvement of the country's armed forces in conflicts abroad is being increasingly criticized due to the cost in resources, political strain and human lives. Domestically, it is still recovering from the 2007-2008 financial crises and dealing with debates on issues such as unemployment and public health. All this makes some analyses point to the possibility of a gradual withdrawal of the United States from the center of international politics.

If in the economic context, China is preparing to replace the United States as the largest global economy, in the geopolitical debate, a changing of the guard is less clear. The Asian country has been seeking to ensure its hegemony in Africa and Southeast Asia, but shows no signs of being willing to assume the role of global guardian. Uncertainty worsens due to persistent conflicts in neighboring countries such as India and Pakistan (who are disputing the Kashmir region) and the belligerence of its North Korean ally. On the threshold between Asia and Europe, Russia is trying to extend its influence over the countries of the former Soviet Union; the recent annexation of the Crimea and interventions in the Ukraine demonstrate this intention.

### Unemployment Rate (percentage of labor force)





“Wind energy has always been treated as a niche solution, but it is growing. Solar energy, on the other hand, is more efficient and technologically innovative. The main restriction to new sources continues to be their high cost.”

**Carla Rocha**, lead IT Advisory partner for Oil and Gas industry in Brazil

Still within the scope of regional turbulence relevant to the oil and gas chain, it is worth turning again to the instability in the Middle East. Iran seeks to emerge as the main geopolitical force in the region, taking advantage of the reduced influence of Iraq after the U.S. intervention and domestic instability in other countries caused by the Arab Spring. Israel continues, as in recent decades, to be in constant conflict with its neighbors; an ongoing source of regional tension.

#### **Competitiveness of energy sources: a grayer or greener future?**

The debate on changing the global energy matrix is intense and will become even more complex in the next years. Reduced consumption of more polluting fuels is indicated as necessary to mitigate the effects of climate change. With this, investments in alternative sources are gaining increasing strength. Examples of success are the development of the natural gas market in North America or the large base of vehicles with flex motors (that use ethanol or gasoline or a mixture of both) in Brazil. But despite recent advances, these new sources still have not completely proven their economic feasibility, still showing higher costs than oil and coal, as well as insufficient scale to justify their supply on a global basis. In addition, there is a lack of systematic policies to encourage adoption of these alternative energies. All this generates several uncertainties with regard to development of a new energy matrix, its acceptance and economic feasibility and the effects on the oil and gas market.

The axis developed around these issues points to two extremes. In a future we call “gray,” we would have an economy still dependent on conventional sources, with traditional fossil fuels still maintaining leadership in energy supply. On the other hand, at the “green” end of the axis, we would see alternative energies – renewable and less polluting – gaining a relevant role in the global matrix. In this panorama, a globalized natural gas market would also emerge, taking advantage of increased production in several parts of the world.

#### **Response to climate change**

Evidence of large scale climate change has become daily news in the media. Floods, melting of the polar cap, prolonged droughts, an increase in sea level and violent meteorological phenomena such as hurricanes and storms raise questions. What is the role of conventional fuel consumption in this story? How should global authorities react to these increasingly palpable threats?

Here, the uncertainty resides in the path to be taken. The Kyoto Protocol, which sought a global consensus on targets to reduce greenhouse gas emissions, expired in 2012; in the same year, the UN Conference on Climate Change agreed to extend the protocol to 2020. The conference also set 2015 for discussions on an accord that would replace the Kyoto Protocol, and which should include all countries in the world.

Government subsidies for new energy sources are on the agenda, which may increase interest in (and encourage use of) solutions such as electric cars (see graph to the side), generation of wind energy and solar panels. The carbon capture and storage market – which seeks to reduce CO<sub>2</sub> emissions generated by large factories – is another possibility for mitigation. And one of the macro trends seen in the prior section, increased energy efficiency, also may have a role in this context, together with new techniques to reuse energy. Equipment that consumes less reduces demand, which helps reduce generation of emissions.




It is possible, however, that simply no initiative will be taken. The United States, one of the champions of per capita greenhouse gas emissions, never ratified the Kyoto Protocol. Other advanced economies, such as Canada and Japan, preferred to abandon the pact before its expiration. Doubts still remain about the real extent of industrial activity on climate change, which may justify a certain hesitation by governments and companies in adopting radical policies to cut emissions.

### Development of new sources

Use of alternative energies is already a reality in 2014. A reality, however, for few. Less damaging to the environment, the most promising alternative sources come up against the same obstacle: high production costs, a factor that holds back popularization and makes their large scale use uncertain (see table below). Wind energy demands large investments in infrastructure (wind turbines, collection and transmission centers) to get started. In addition, to become economically viable, the so-called wind parks need huge land areas. Solar energy also faces the barrier of high costs, complicated by an additional factor: low yield. In comparison with conventional sources, energy generated by solar panels costs three to six times more.

The case of electric batteries, an alternative developed for Otto cycle engine vehicles, has challenges and opportunities. Just as with wind turbines and solar panels, its cost is still higher in comparison with other conventional sources. Autonomy is low and the infrastructure to use them, which includes expansion of a network of recharging stations, is

### Barriers to development of clean sources of energy

 <b>Wind energy</b>	<p>High costs mainly due to high initial capital for construction of plants, as well as the need for large areas for implementation in order to make the operation economically viable.</p>
 <b>Solar energy</b>	<p>High cost of producing solar panels and relatively low yield, which, together, make the cost of the energy generated three to six times more expensive than that obtained from conventional sources.</p>
 <b>Electric cars</b>	<p>High cost of producing batteries, as well as the difficulty of making batteries capable of giving cars autonomy for long trips.</p>



### Luxury car sales in the U.S.

1<sup>st</sup> half of 2013, units sold

Tesla Model S	4,751
Mercedes Classe S	3,077
Lexus LS	2,860
Lincoln MKS	2,755
BMW Série 7	2,338

Source: Deloitte Review  
(Charging Ahead: Battery  
Electric Vehicles and the  
Transformation of an Industry)

still precarious. Other uncertainties lie in user safety, engine performance and questions of sustainability, such as correct disposal of batteries after the end of their useful lives. However, with popularization of smart grids, or intelligent energy transmission systems, the use of electric batteries may become progressively more advantageous. With the development of innovations and technologies that increase efficiency and, consequently, the autonomy of vehicles – the more visible example being Tesla Motors, of California – and government incentives for their use – subsidies or changes in legislation – electric automobiles may become more competitive.

### New powers in non-conventional gas

Shale gas is the type of gas found in sedimentary shale formations. Its exploitation is a proven success in the United States and Canada, which have large reserves. Other significant reserves are in China, Argentina, Algeria and Mexico. The question is whether the successful model established in North America can be copied in other parts of the world. A number of economic, geological and institutional requirements need to be met for this to occur.

An efficient non-conventional gas exploration, production and commercialization chain depends on formation of an experienced labor force, complemented by a well-developed service sector. To overcome the technological and operational challenges of extracting the resource, cooperation between industry, universities, laboratories and other centers of innovation is indispensable. The high costs of operations demand favorable credit and financing conditions. On their part, governments need to facilitate the involvement of private companies, passing more favorable legislation and creating opportunities for cooperation and tax incentives. Finally, establishment of an infrastructure for processing and distribution, making new consumer markets viable, is essential.

By 2040, a number of new competitors should join the United States and Canada in the market. China has announced a target of producing 100 billion cubic meters of shale gas per year by 2020. Argentina, which has the second largest amount of shale gas resources in the world, is already a base for multinational projects. In Mexico, which has the sixth largest global reserves, the end of the Pemex state enterprise exploration monopoly in July 2013 has prepared the way for foreign investments.

“Tesla is a reality: an electric car with high autonomy and performance. But it is still expensive, mainly due to the cost of producing its battery. Studies are underway on production of a popular model.”

Carlos Gagliardi, lead IT Consulting partner for Oil and Gas industry in Brazil

## A global market for natural gas?

It is possible to think about the expansion of an international natural gas distribution network, which would increase the relevance of the resource in the global energy matrix. In addition to gas pipelines and plants that connect some of the largest producing centers to foreign markets, several other large scale facilities are being constructed in the United States and Australia, increasing supply of the fuel (see table and map to the side).

There are some uncertainties regarding to this potential global market. Global production needs to increase in order to expand supply to consuming markets and possible barriers and specificities of each producing country need to be taken into consideration in export agreements. It is still necessary to evaluate the real competitiveness of liquefied natural gas (LNG) with other energy sources, based on the actual costs of liquefaction, regasification and transport. The role of the United States as an exporter also enters the equation. There are currently legal restrictions on the amount of gas the country can export. But today, with the approval of the Barack Obama administration, some large liquefaction facilities are under construction; when finished, they will be able to export natural gas to strategic markets in Europe and Asia.

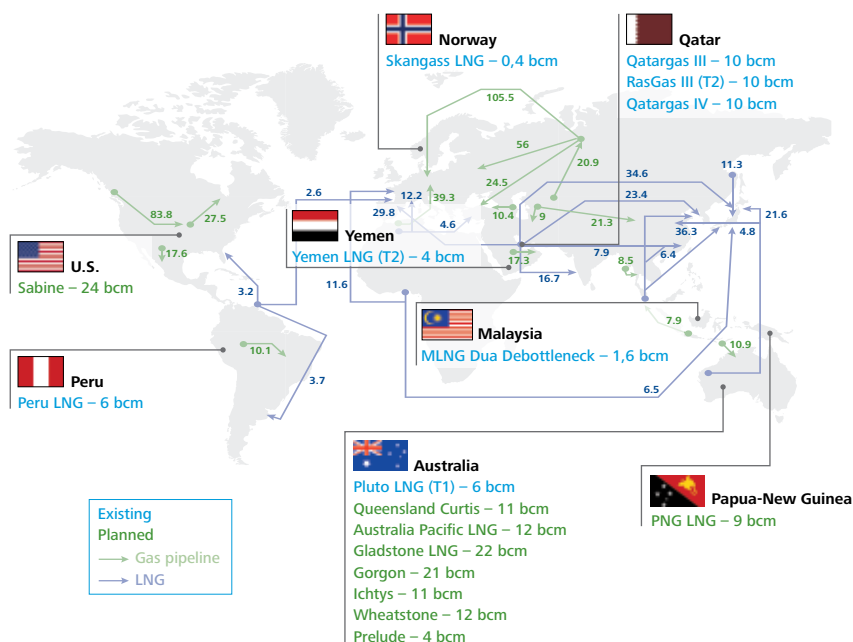
“The increase in GDP in last years was greater in developing countries than in developed economies, which could boost demand for energy in those regions.”

Eduardo Tavares Raffaini, lead Consulting partner for Oil and Gas industry in Brazil

## The expansion potential of natural gas in the world

	<b>Argentina</b>	The “Vaca Muerta” region contains the second largest global shale gas reserves, behind only China, and has received investments from players as diverse as Petrobras, ExxonMobil, Chevron and Shell.
	<b>Brazil</b>	Tenth in the world in shale gas reserves, Brazil has already auctioned non-conventional gas exploration and production blocks in the last round of the National Oil, Natural Gas and Biofuel Agency (ANP).
	<b>China</b>	With the largest shale gas reserves in the world, the Chinese government has set a target of producing 100 billion cubic meters by 2020, leveraging non-conventional natural gas sources.
	<b>Mexico</b>	A change in the constitution in July 2013 ended the monopoly of the Petroleos Mexicanos (PEMEX) state enterprise, for the purpose of attracting more investment. The country holds the sixth largest reserves of shale gas on the planet.

## Flow of natural gas world trade and location of main LNG plants (2012, billions of cubic meters)



“Increased gas production in North America has already begun to attract companies producing fertilizers and aluminum to the region.” **Rafael Delatorre**, Strategy Consulting director at Monitor Deloitte

#### The influence of traditional producers

Even in the face of so many uncertainties, the main oil producers in the world today can continue to exert decisive influence. The role of the member states of the Organization of Petroleum Exporting Countries (OPEC) and the recovery of Mexican production capacity are important factors to be considered going forward. OPEC forecasts indicate that member countries held, in 2012, close to 81% of known oil reserves in the world. Therefore, they should continue to be the largest suppliers of the resource. Even so, there are uncertainties with regard to behavior of the market. At many times in the past, OPEC has changed the normal course of supply and procurement, organizing export embargos or, inversely, “flooding” the market with oil (as occurred in December 1980), forcing the price to fall (see table below).

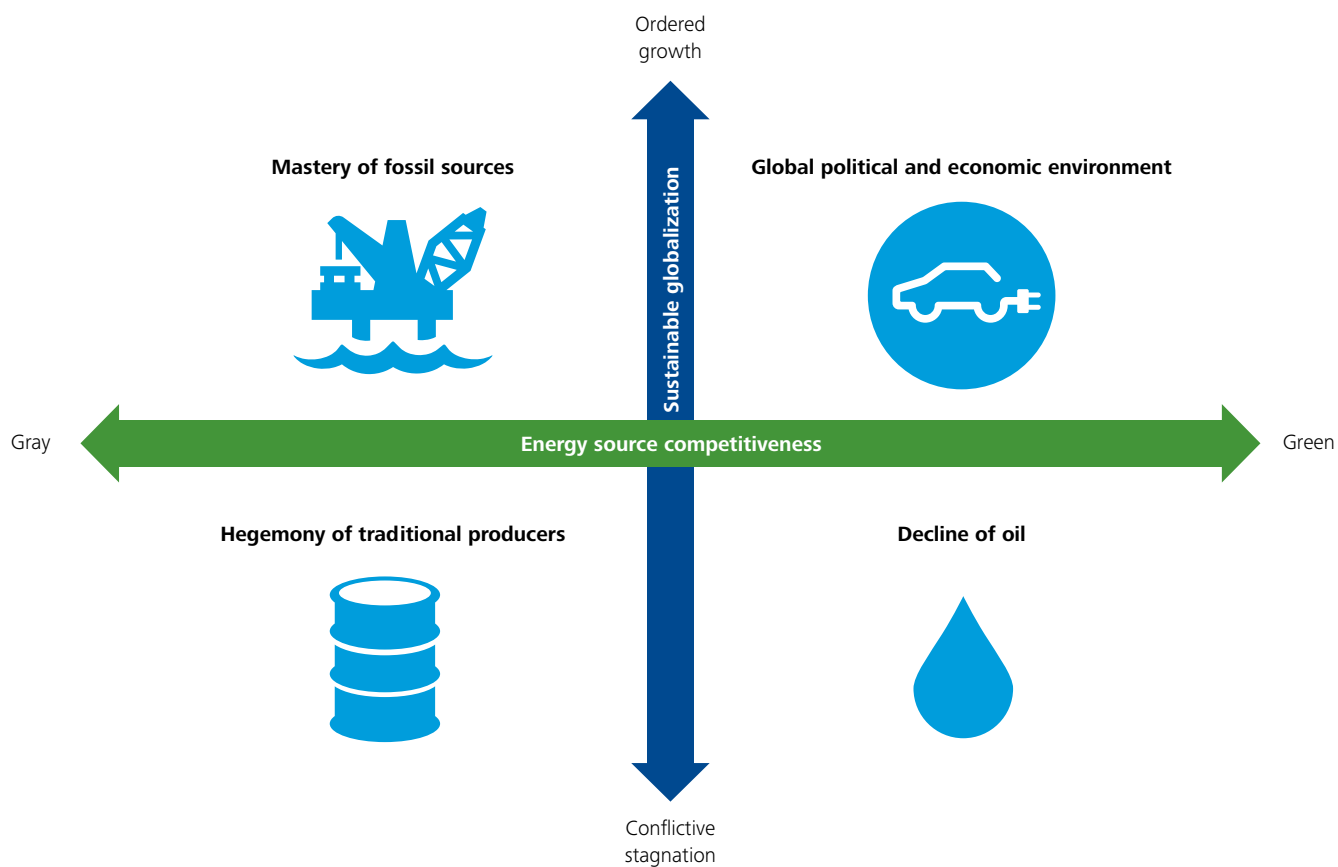
In Mexico, the recent change in legislation, ending the monopoly of the Pemex state enterprise, may make production more dynamic. The country is expected to produce 4 million barrels per day in 2025, making it the fifth largest global producer. It would be a reversal of the decline experienced over the last years; while in 2004 it was 3.4 million barrels per day, Mexico today produces 2.5 million. The new law on the oil and gas market also established the Mexican Petroleum Fund, which will administer the resources resulting from exploration. However, all this depends on a definitive change in the country’s constitution (which requires the support of the majority of states); the left-wing opposition has already announced that it will make efforts to reverse the announced changes.

#### Global crises that have elevated the price of oil over the last 40 years

Year	Crisis	Impact on the price of a barrel of crude oil
1973	OPEC countries approve an embargo of exports to the United States and other countries that supported Israel during the Yom Kippur War.	An increase from US\$3 (October 1973) to US\$ 12 (March 1974)
1979	A drastic reduction in Iranian production after the overthrow of Shah Reza Pahlevi.	An increase from US\$ 15.85 (April 1979) to US\$ 39.50 (April 1980)
1990	Iraq invades Kuwait	An increase from US\$ 17 (July 1990) to US\$ 36 (October 1990)

# Global oil and gas scenarios for 2040

The intersection of the axes of critical uncertainties, coupled with the trends that will affect the future outlook of the industry, allows creating four plausible scenarios for the oil and gas sector in the coming decades.





# Scenario 1

## Sustainable globalization

In this scenario, relative geopolitical stability favors economic growth and trade cooperation between countries. With high demand, new alternative sources of energy, finally economically viable, would add to the supply of conventional fuels. It is a scenario in which ordered growth in the geopolitical axis and a green future in the axis of competitiveness between energy sources predominate.

The bonanza would be driven by the emerging countries with favorable demographic conditions. India would replace China as the “motor” of the world, with its investments in infrastructure. Mexico, Indonesia, Malaysia, Vietnam, Colombia, Brazil and Turkey would come in second, demanding raw materials and energy to support their growth. At the global level, regional tensions would cool, promoting the progress of World Trade Organization rounds and multilateral agreements. With fewer armed conflicts, economies would gain room to develop and exchange goods and services.

In response to climate change, there would be greater demand for renewable and clean energy sources. Electric cars and solar and wind energy generation would become more popular thanks to technological innovations and public policies of institutional support. The commitment to CO<sub>2</sub> emission reduction targets would increase, with more countries actively working to reduce their own problems of CO<sub>2</sub> pollution and emissions. The carbon credits market would become more relevant, including in the emerging economies.

Finally, the new global liquefied natural gas (LNG) market, supported by the production boom in the United States, Australia, China, Argentina and the east coast of Africa, would take off. LNG would be seen as a viable and more sustainable substitute for oil, with lower costs and less environmental impact, including for meeting growing demand for electricity required by large fleets of electric cars, finally viable in terms of autonomy, performance and cost.



### The effects of sustainable globalization on Brazil

Brazil's great potential to generate alternative energies – wind, biomass and solar – could be exploited, with proper incentives and adequate regulatory frameworks – to supply energy demand and replace the use of less sustainable thermoelectric plants. The country has a tradition of decades of use of biofuels, since the times of the Pro Álcool program; technological innovations and more competitive prices (including for natural gas) could provide this type of resource to industries that still depend significantly on oil and its derivatives, such as those in the chemical and plastic production segments.

Brazil would also have major opportunities to invest in a cleaner matrix, betting on expansion of engines powered by ethanol or biofuel and on the incipient (but increasingly promising) fleet of electric vehicles. The replacement of oil would be strengthened by expanded use of natural gas, which, taking advantage of a mature global market, a good infrastructure network and large supply, would become a more interesting alternative both economically and environmentally.





## Scenario 2

# The decline of oil

In this scenario we would see a decline in the importance of oil in the global energy matrix. It would be a world in which alternative energy sources would gain impetus, with a lower demand for oil due to lower economic growth, combined with technological innovations and advances in alternative sources. The preponderance on the geopolitical axis would be at the conflictive stagnation end, maintaining the green hypothesis on the competitiveness of energy sources axis.

China would even further slow its development and other emerging countries capable of creating a new wave of dynamism would not appear. In the advanced economies, internal crises and recession would impede a return to growth. All this would lead to global stagnation, with a fall in energy demand and prioritization of cheaper sources. It is an opportunity for the LNG market. With lower costs (due to expansion of infrastructure and technological advances) and high supply (considering the United States as an exporter and increased production from countries such as Australia, China, Argentina, Tanzania and Mozambique), natural gas would become an increasingly viable and present alternative.

Natural gas is also cleaner than oil and this is an important component in the scenario. With growing concern about climate change, the international community would unite to create a context more

favorable for alternative fuels. Legislation restricting emission of pollutants would be strengthened, including in emerging countries, and the carbon credits market would consolidate. With this, we would see oil lose relevance in the energy matrix.

In the geopolitical context, the cooling of internal and external conflicts would be another complicating factor for economic development. Protests and institutional crises in the Middle East, Latin America and Europe would worsen and “contaminate” other regions.



### The effects of oil decline on Brazil

With lower demand for oil and an increased supply of natural gas, the trend would be for prices of both commodities to fall. And if the price falls too much, extraction of the Brazilian pre-salt oil would become economically unviable. If the gas option becomes viable, the resource could assume functions performed today by oil, as a raw material for several industries and as fuel. Therefore, it would be necessary to expand the current infrastructure of the sector, in Brazil and in all of Latin America.

On the environmental front, ethanol and biofuel would dominate the automobile market, with growing participation of electric cars. Energy generation could find in biomass and the resumption of the nuclear program alternates to hydrocarbons, also improving the carbon credits balance.



## Scenario 3

# The hegemony of traditional producers

Politically, this scenario is similar to that of number 2: political tensions in several corners of the world would not decline and China and other emerging countries would continue to stagnate, which would contribute to a fall in global demand. The difference would be that the countries that today dominate the oil and gas market would continue to exercise power in 2040, with oil firm and strong in the global energy matrix. It would be a scenario in which the hypothesis of conflictive stagnation would combine with the gray extreme of the competitiveness of energy sources axis.

Even facing the effects of increasingly evident climate change, there would be no global movement to replace oil with other sources. Low economic growth would deter significant investment in alternative energy source technology and restrict the ability of governments to grant subsidies or establish regulatory frameworks that could negatively affect economic growth; consequently, solutions such as electric cars and solar energy generation would not be established on a large scale.

A global recession would delay formation of a global LNG market. A lack of resources for exploration and construction of necessary infrastructure (liquefaction and regasification plants, gas pipelines) would not allow countries such as China and Argentina to take full advantage of their reserves. The gas market

would continue to be restricted to current producing regions (such as the U.S.), which would attract energy-intensive industries from other regions of the world.

With LNG less competitive than non-conventional oil sources and other alternative or renewable energy sources, oil would maintain its relevance. The OPEC countries would continue to control global supply, relatively immune to regional political tensions.



### The effects of the hegemony of traditional producers on Brazil

If the prices controlled by OPEC continue at a low level, this could impair exploitation of the pre-salt reserves. With the economic viability of the pre-salt in doubt, the country could return to being a net importer of fuel. Oil and gas exploration plans would have to be revised by operators in this context. In its search for competitive oil and gas reserves for exploration and production, the Brazilian industry would turn to other Latin American countries, such as Argentina, Bolivia, Peru and Mexico. In the absence of a global supply of LNG, there could be an exit of companies that are significantly dependent on the resource. These companies would migrate to countries – such as the United States – where supply of the resource is more reliable and inexpensive.

These changes would aim in a redefinition of directions for the Brazilian oil and gas segment. Reduced demand and increased supply would drive prices down and create an adverse scenario. Management adjustments, cost cutting and a greater emphasis on operational efficiency would become the order of the day.



## Scenario 4

# Dominance of fossil sources

In the fourth scenario, the geopolitical axis would again tend toward ordered growth, with competitiveness of energy sources leaning toward the gray end. Alternative energy vectors would not be established as viable options and natural gas would not be commercialized through a global market. With this, sources of fossil origin would multiply, which would combine with conventional oil and gas exploration to supply growing demand from the emerging economies.

As in the first scenario, investments in infrastructure would make India the locomotive of the global economy. Dynamism would also appear in industrializing emerging countries, especially those with favorable demographic conditions (Mexico, Indonesia, Malaysia, Vietnam, Colombia, Brazil and Turkey, with young and growing populations). Global political stability would provide a solid base for international cooperation, greater global exchange of goods and services, and a resulting acceleration of global GDP growth.

With heated demand, conventional oil production would continue high, but new fossil sources would appear in the panorama. Non-conventional oil (tight and shale oil) would gain impetus in the United States and contribute to a more than 50% increase in the country's production by the end of the 2040 decade. The operating challenges of exploring in deep waters and inhospitable regions, such as the Brazilian pre-salt and the Arctic continent, would be overcome, providing more supply to the market. Multinational expansion of oil companies in emerging countries (China, Brazil and India) and local operation of the

United States majors would be relevant movements. In addition, coal would continue to be important in the global energy matrix.

The abundance of oil would impede alternative sources from becoming really competitive. Electric cars, solar panels and wind generators would remain expensive and complex options, without great significance. The supply of natural gas would not change much in comparison with today. The resource would continue to have competitive prices in producing regions, but would not form a global market. There would be reduced international supply, with continued limited United States exports and production difficulties in Africa, Asia and South America. The cost of extracting and processing LNG would continue high.



### The effects of the dominance of fossil sources on Brazil

With high oil prices, pre-salt extraction would become economically more interesting. Brazil would become a net exporter of fuel. The Brazilian success would make the country a target for foreign investment; Chinese and Indian companies would become more involved in subsequent rounds of exploration block auctions.

We could see an increase in the domestic non-conventional gas industry. The country has the tenth highest reserves of shale gas in the world and development of local production would supply consumers who do not have access to natural gas from other parts of the globe. The consequent increase in supply of fuel would heat up the infrastructure of the sector; the network of gas pipelines and the complex of processing units would expand, accompanying the increase in demand for the product.

# Deloitte MarketPoint base case

## Production forecast through 2040

Considering the four scenarios of the prior section, the Monitor Deloitte study indicates a “target-scenario” that presents similarities to those previously outlined. To present forecasts of oil and gas prices and production through 2040, our vision is based on the hypothesis that fossil fuels will continue to be the main energy source for the world. In this scenario, a global natural gas market will begin to consolidate due to the convergence of LNG prices and infrastructure construction. Alternative sources will be used in niches in the first years, and will slowly gain scale over the forecast period.

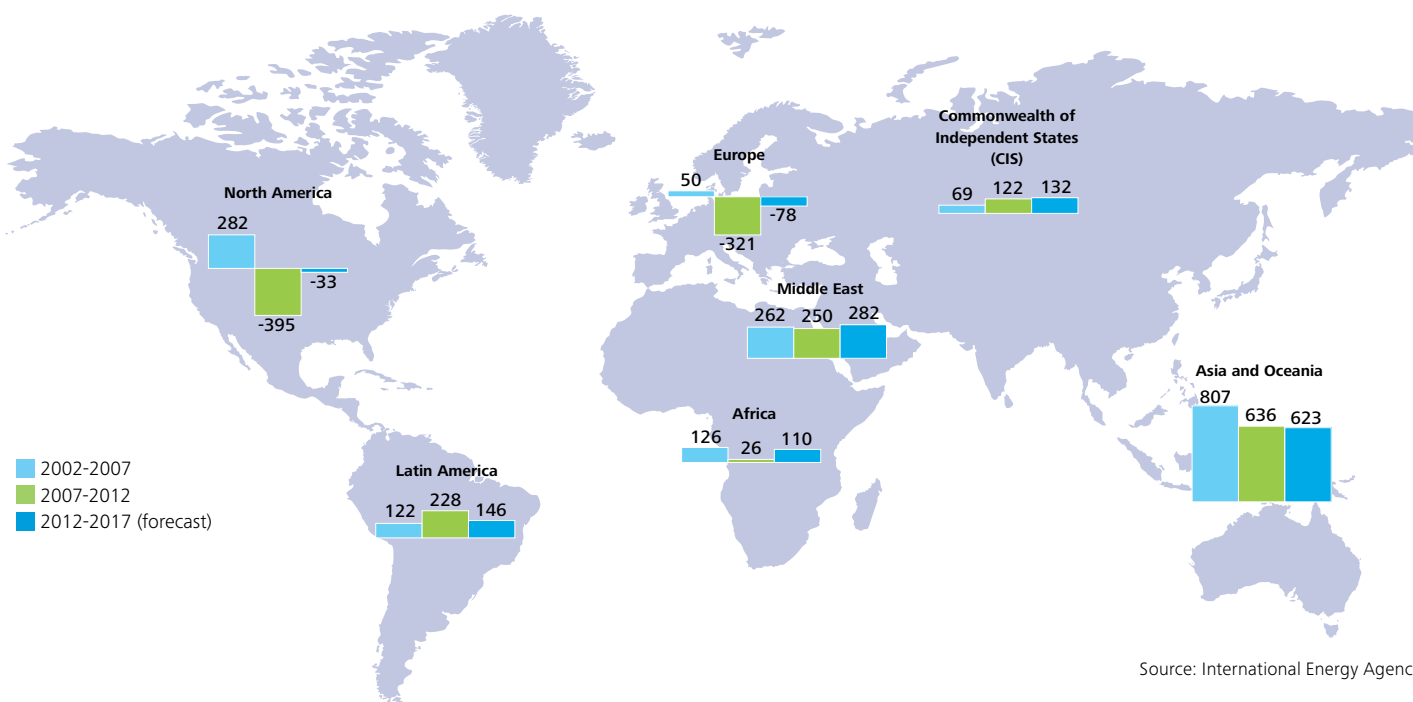
In the geopolitical sphere, the scenario predicts that armed conflicts and disputes between countries will remain regional, without attaining global scale. This will contribute to an acceleration of the economy and increased energy demand. New trade agreements will be signed, World Trade Organization rounds will be resolved more quickly and collaboration between the

different economic blocks will grow. The United States will maintain its geopolitical hegemony, however in a clearly multipolar world.

Some emerging economies, such as India, Mexico, Indonesia, Malaysia, Vietnam, Colombia, Brazil and Turkey, will lead global growth, assuming an increasingly significant role. India, accelerating investments to address its infrastructure gaps, will take the place of China as the great “motor” of global development. What these countries have in common is young and growing populations. With higher levels of economic growth, these countries, together with the Middle East, will also drive higher energy demand (see map below).

The supply of oil will continue to be abundant, but with prices (high) still under the control of OPEC (see graph to the side) It is predicted that the member countries will account for 47% of global oil production in 2038. This pressure on prices should force the

**Average increase in global oil demand between 2002 and 2017 (millions of bpd)**



Source: International Energy Agency

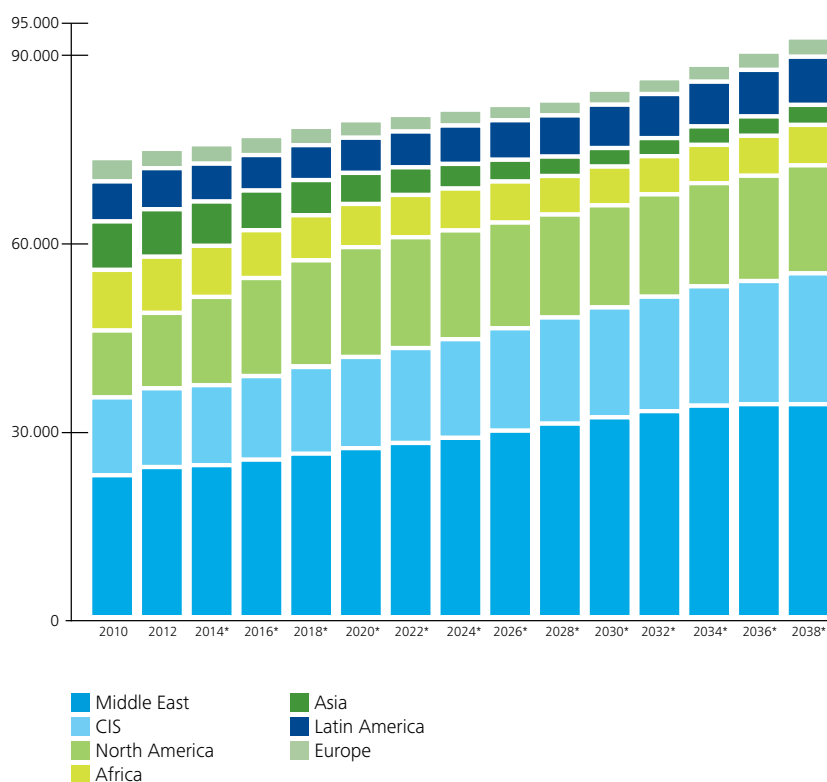
exploration of non-conventional reserves. Both shale oil, in the United States, and ultra-deep water production (Brazilian pre-salt, Arctic, Gulf of Mexico, West Africa, especially in Angola) will gain impetus. Offshore exploration of gas hydrates – crystalline ice formations containing gas molecules – will begin to appear, at the end of the evaluated period, as an economical alternative for gas supply.

The trend to form a global LNG market will solidify, with Australia – which has been investing significantly in plants and gas pipelines – taking leadership among exporting countries. With regard to alternative and renewable sources, there will be no generalized dissemination due to the lack of competitiveness as a consequence of abundant conventional resources. However, used initially in niche applications, alternative sources will, over the years, increase their participation in the market – even replacing part of the current coal demand, which should lose significance in the energy matrix.

#### Trends for global oil and gas production

The base case predicted by Monitor Deloitte assumes that global demand for oil will reach 100 million barrels per day in 2040. Global production of crude oil should grow at an average rate of 1% per year; the OPEC countries should exceed this average, with annual production growth around 1.4%. This will allow the entity to increase its share of global production from the current 42% to 47% by 2038. As the main trend, there will be an increase in production by countries in the Middle East and Caspian Sea, as well as by Russia and the nations of the former Soviet Union. Production should fall in Africa and Asia; in South America, the growth forecast is the same as for the OPEC countries (1.4%).

**Forecasts of global oil production by region**  
(millions of barrels/day)



\* Deloitte MarketPoint forecast

Source: Deloitte MarketPoint World Oil Markets and EIA

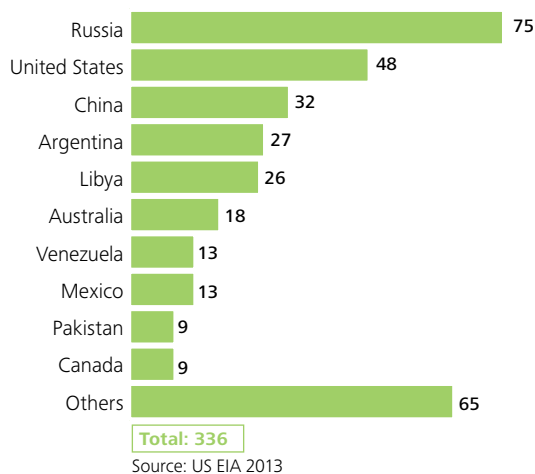
“China, Mexico, Argentina and Brazil may rise as powers in the production and export of natural gas in coming decades.”

Jim Garland, senior manager at Deloitte MarketPoint

Between 2014 and 2030, it is estimated that Latin American oil exports should triple, driven initially by Brazilian pre-salt reserves and, over the next decade, by increased participation of Venezuela and Mexico. In other countries, such as Colombia and Peru, production should also grow, but without major impact on the regions exports.

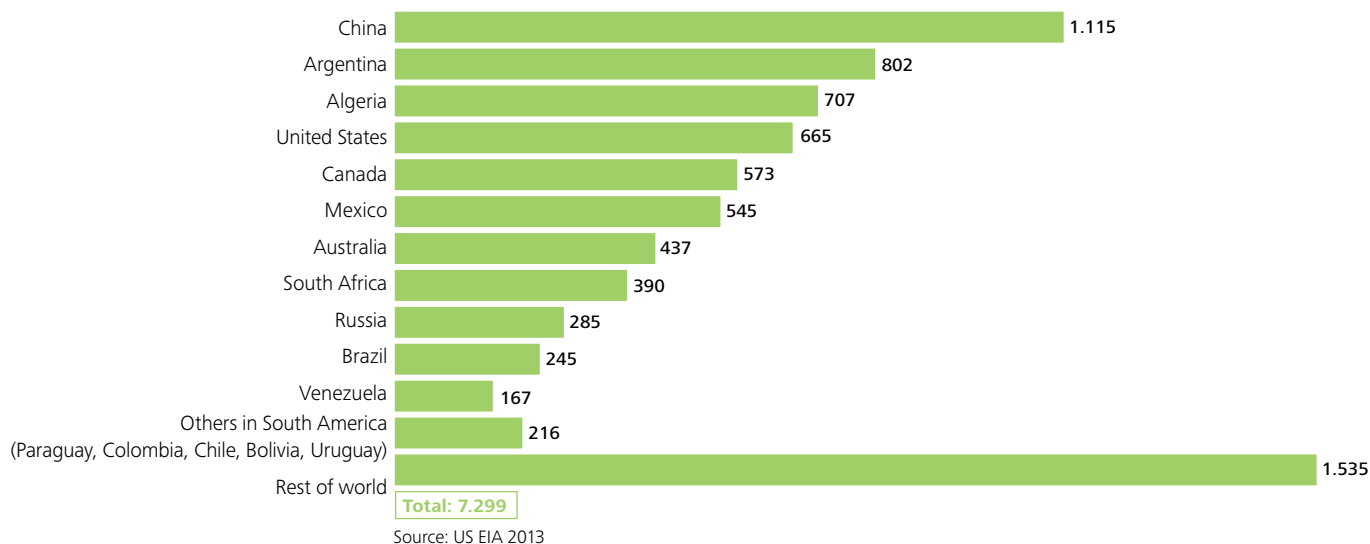
The United States would reach a peak of 10 million barrels per day in 2020. Growth of oil and gas production extracted from non-conventional reserves will reach its peak at this time. Increased production from Gulf of Mexico field and extraction of oil from tar sands in Canada will contribute to raise total North American production, making the region the global leader in energy production in the next decades.

#### Technically recoverable shale oil reserves (billions of barrels)



Shale oil and gas reserves will gain prominence in the next years (see graphs to the side). Russia, the United States and China head the list of countries with the largest reserves of non-conventional oil. China, Argentina and Algeria have the most promising reserves of shale gas. There are, however, great challenges to be overcome for gas extraction. There are environmental risks involved in the process of hydraulic fracturing and in handling of water; legal uncertainty in certain regions and uncertainties with regard to the business environment; and deficiencies in labor, infrastructure, services and technological solutions.

#### Technically recoverable shale gas reserves (Tcf)



“The global population will continue growing and this will be one of the most important drivers of the energy demand growth forecasts, together with actions to promote energy efficiency.”

**Rogério Toscano**, Information Technology diretor for Oil and Gas industry in Brazil

Establishing themselves as exporters of natural gas, the North American countries should seek markets that pay better prices. The trend is to ship Gulf of Mexico production to Asia, creating an LNG route linking the Atlantic and Pacific by expansion of the Panama Canal. Starting in 2017, it is predicted that large supplies of LNG will hit the market, as a consequence of planned growth in demand of 2.6% per year. The same year, Australia should assume leadership of exports of the resource, passing Qatar as the largest global LNG exporter. Increased participation of the United States in the market indicates that North America will be the next large global source of LNG. This rise will coincide with a production decline in Europe (due to environmental restrictions and low geologic potential) and the appearance of new suppliers in eastern Africa (especially Mozambique and Tanzania), Venezuela and Iran. All this will lead to doubling of the natural gas liquefaction industry's global capacity, with total production reaching 70 billion cubic feet per day in 2038.

For the United States to strengthen as an exporter of natural gas, it will be necessary to resort to the energy reserves the country legally needs to maintain. There is an imbalance between supply and demand, resulting from excess energy generation capacity due to slow economic growth and the absence of additional

demand. With substantial growth of reserve margins, available natural gas will be ready for export. In our model, the U.S. legal framework will be changed to allow export of hydrocarbons. The suppression of thermoelectric coal plants should also be considered: over the next 10 years, more than 30 GB supplied by thermoelectric coal plants will be withdrawn from the grid, making room for wind generators and, starting in 2030, also for generation based on natural gas.

In South America, by 2025, Argentina will lead demand for natural gas. In spite of its high geologic potential and having a developed consumer gas market and a relatively effective gas transport infrastructure, Argentine production of shale gas will still be incipient. The country will be a large importer of Bolivian LNG gas through the middle of the 2020s, when domestic shale gas projects will begin to gain scale. Brazil should be the main consumer of natural gas in the region, with regular increases in domestic production and rising LNG imports starting in 2034. Venezuela will also be an important LNG supplier starting in 2025, taking advantage of good prices and its reserve base, exporting mainly to Asia (as will Chile). Some large Venezuelan offshore gas fields, especially in the Mariscal Sucre project fields, will begin operation in the next years and start to export LNG by the middle of the 2020s.



# The Brazilian megaprojects (and other challenges)

By **Ricardo Savini**, associate consultant of the Oil & Gas Center of Excellence of Brazil

Brazil has an ambitious goal for the next decades: expand its oil production from 2 million to 4 million barrels per day (bpd). Few regions of the world have experienced this “jump” and reached a level of 4 million bpd. Venezuela experienced a jump in the 1950s, reaching 3.5 million bpd. Saudi Arabia, with excellent geologic conditions, was able to rapidly increase its production in the 1960s. The North American sector of the Gulf of Mexico was able to raise its production from 2 to 4 million bpd in the 1970s and 1980s, at a slower pace due to the dispersal of its offshore reserves. The countries of the North Sea were able to pass from 2 to 4 million bpd in the 1980s and 1990s, with a first growth cycle in the British sector and a second in the Norwegian sector.

The discovery of immense reserves in the pre-salt region, carbon reserves located below the thick salt layer in the Campos and Santos basins, will allow Brazilian hydrocarbon production to grow in a sustained way. Some giant fields above the salt layer (post-salt), in siliciclastic turbidite reservoirs, also require investment in production development. For this, capital investment **megaprojects** are being established in deep and ultra-deep waters. There are at least 15 billion barrels to be developed in the Marlim, Roncador, Parque das Baleias and Mexilhão fields (post-salt); in the pre-salt, there

are the Lula, Cernambi, Sapinhoá, Franco and Libra fields, among others. These large pre-salt fields were discovered in front of the two largest consuming centers of the country, 300 kilometers from the Rio de Janeiro metropolitan area and 400 kilometers from the São Paulo metropolitan area, where some of the country’s largest refineries are located, facilitating logistics and distribution. The logistical challenges are substantial, with platforms located 300 kilometers off the coast. As are the technical challenges of producing from reservoirs that are seven kilometers in depth, under a two kilometer salt layer. All this involves large difficulties for drilling wells. But this complexity is being overcome with much technology and ingenious logistical solutions.

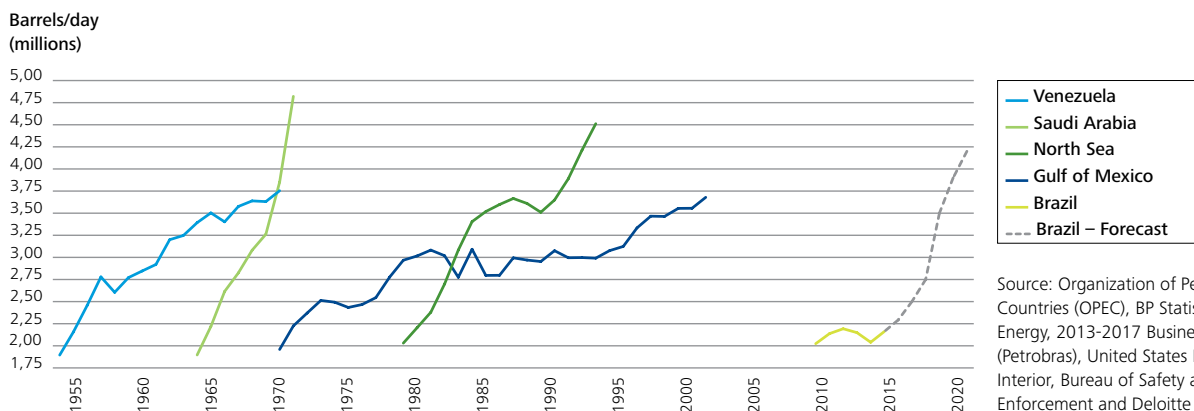
**Non-conventional reservoirs** should begin to have increasingly greater influence. The country has the tenth largest reserves of this type of gas, with potential found in various sedimentary basins. The National Oil, Natural Gas and Biofuels Agency (ANP) already included blocks with shale natural gas potential in the round of auctions held in November 2013. An obstacle to taking advantage of this resource is the lack of distribution infrastructure. This can be solved using the gas to generate electric energy that would be used by the integrated distribution

system – with national reach. The replacement of thermoelectric plants that use oil or coal by others using gas in remote regions, particularly in the Amazon, would represent a gain in energy efficiency and environmental benefits.

Another challenge is in **revitalizing mature fields** that have passed their peak production and today produce much water. With adequate investments in facilities that allow handling large volumes of fluids (oil, gas and water), reactivation of wells applying modern techniques to stimulate reservoirs and the drilling of new wells, it is possible to extend the useful life of fields in the Recôncavo (in Bahia), Sergipe-Alagoas and Potiguar land basins. There are also mature offshore fields, particularly in the Campos basin. For these fields, which have been in production for decades, to again reach their historic production peaks, it will be necessary to apply specific mature field development strategies, focused on gaining production scale and using technologies appropriate for this type of field. Revitalization of these fields, with a lower cost per barrel than the offshore megaprojects, can invigorate the regions where they are located, especially in the Brazilian northeast, bringing jobs and income to regions that were slowly losing economic relevance in the last decades.

## The highlights of each period

Over the next decade, Brazil can enjoy the same oil production growth experienced by other regions of the world over the 20th century. This growth was recorded, among other places, in Venezuela in the 1950s, Saudi Arabia in the 1960s, the Gulf of Mexico (American sector) in the 1970s and the North Sea in the 1980s.



Source: Organization of Petroleum Exporting Countries (OPEC), BP Statistical Review of World Energy, 2013-2017 Business Management Plan (Petrobras), United States Department of the Interior, Bureau of Safety and Environmental Enforcement and Deloitte PetroView

# Our credentials

## Global leadership in consulting

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“[Deloitte] leverages its broad portfolio to serve its clients and has a higher ratio of implementation to consulting services when compared with its peers.” **Gartner**

“Worldwide, Deloitte is viewed as a ‘well-known brand that delivers quality services,’ according to client feedback.” **IDC**

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Deloitte stands out for its ability to help its clients solve the most complex problems, from strategy through implementation. We are distinguished by our ability to execute the recommendations we make, helping clients operate in their current markets, as well as where they want to be in the future. Providing this type of value requires the ability to integrate a wide range of talents and skills – in human capital, strategy, operations and technology – aligned with the specific needs of diverse sectors of industry, business and organizations.

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### **A Center of Excellence in the Heart of the Industry**

With the objective of supporting companies in the oil and gas segment in Brazil, Deloitte developed the Oil and Gas Center of Excellence (CoE), located in Rio de Janeiro. This is the first Deloitte Center of Excellence in Latin America. The CoE's function is to integrate the multidisciplinary work for which Deloitte is already recognized in this industry, expanding and making possible the solutions offered to the companies that operate in the sector. This synergy will allow clients to benefit from a multidisciplinary and highly specialized operation, both for the local and global markets. Deloitte has more than 2,500 professionals specialized in the O&G sector, distributed in 13 Centers of Excellence (CoE) around the world, providing consulting, advising and auditing services to the largest companies in the sector. In Brazil, we have more than 400 professionals dedicated to the Oil & Gas sector.

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