

The contribution of Black Sea oil & gas projects to the development of the Romanian economy

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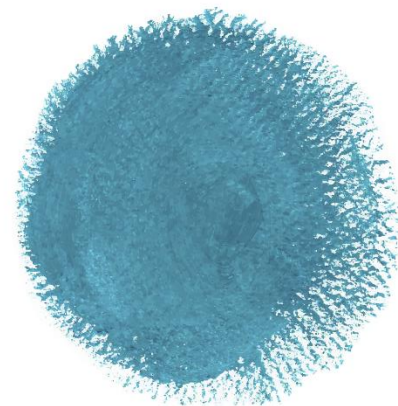


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List of acronyms



Bcm	Billion cubic meters
Bn	Billion
Boe	Barrels of oil equivalent
BOP	Balance of Payments
CAGR	Compounded Annual Growth Rate
CAPEX	Capital expenditure
cf	Cubic feet
CIT	Corporate income tax
GDP	Gross Domestic Product
EC	European Commission
ENTSO-G	European Network of Transmission System Operators for Gas
EU	European Union
EUR	Euro
G.D.	Government Decision
Km	Kilometer
Mboe	Million barrels of oil equivalent
Mil	Millions
Mil. mc.	Million cubic meters
MMBTU	Million British Thermal Units
MWh	Mega-watt-hour
OPEX	Operating expenditures
PIT	Personal Income Tax
RBSTA	Romanian Black Sea Titleholders Association
SSC	Social Security Contributions
toe	Thousands of oil equivalent
USD	United States Dollars
VAT	Value Added Tax

I. Executive summary

Objectives and acknowledgements

In Romania, one of the oldest oil and gas producers in the world, discussions and prospects related to offshore oil and gas activities were first initiated in 1967-1969 with the purpose of enhancing the national oil and gas production through potential offshore drilling and exploitation of the Black Sea continental platform. Consequently, in 1975, the first offshore drilling platform was installed, leading to the first Black Sea oil production, in 1987. Despite this relatively long history of upstream offshore activity in shallow waters, it was only in 2012, that the first deep-water discovery was made in the Black Sea, when Domino-1 well found an estimated of 42 to 84 billion cubic meters (bcm) of potentially recoverable gas, thus becoming the largest single discovery in the Black Sea, as of today.

Considering the potentially large gas reserves to become commercially exploitable should large scale investments be deployed in the Black Sea offshore upstream sector over the following years, it is only reasonable to take a closer look and carefully analyze not only the prospective oil and gas resources, but also the total potential economic growth and development that such investments would incur in the Romanian economy as a whole.

Thus, the present study, conducted independently by Deloitte to our best of efforts and available expertise, is aimed at estimating the overall economic benefits associated with large scale development of the Black Sea upstream sector. We are aware that the debate concerning the offshore developments in the Romanian economy is a topic of major importance for our society, mainly due to its undeniable impact on the Romanian economy and energy security but also owing to its particular complexity. In this context, the objectives of the study are as follows:

- ✓ Calculate the potential economic impact that offshore projects will have on job creation, state revenues and the overall macroeconomic indicators (output) of Romania;
- ✓ Examine and assess possible spillover effects that could be generated in affiliated sectors (e.g. infrastructure, chemicals and petrochemicals, gas-to-power sector, etc.) that could lead to further additional growth spread across the entire Romanian economy;
- ✓ Provide an objective, hard-facts based instrument to support with rational arguments any potential discussion or debate undertaken by various decision-makers concerning the Black Sea offshore upstream sector.

Moreover, the report provides a general overview and certain insights into the national context, as well as background information about the industry and key facts about the specifics of oil and gas production in Romania. The period covered by the report refers to the time span of 2000-2040, with some implications until 2060, but presented exclusively in the annex. The impact and benefits estimated in the report are based on the hypothesis of the investment volume presented in Chapter III of the document. At the moment, however, no final investment decision has been adopted by any titleholder of the Black Sea perimeters,

therefore, at the moment of this analysis, the investment volume remains a hypothesis and should be treated as such.


The input data was collected from publically available sources and Deloitte’s own private data and panels of experts, while the forecasts have been projected based on the historical data and our assumptions regarding the evolution of the offshore industry. Deloitte had no access to confidential data or information containing professional secrets, thus being in full compliance with the provisions of the Petroleum Law no. 238/2004, the Methodological norms of application of the Petroleum Law, approved by G.D. no. 2075/2004, Law no. 182/2002 concerning the protection of classified information and national standards for the protection of information classified in Romania, or any other applicable legislation.

The contents, analyses and conclusions contained in this report do not necessarily reflect the individual opinions of the participating experts. A wide range of sometimes opposing viewpoints and opinions were expressed, which made it possible to study in greater depth and contrast the fundamental issues covered by the study. A comprehensive overview of the methodology and statistical sets of data employed by the authors is available in the appendix of the document.

Key findings

Summarizing the results of the present study, large scale deployment of offshore domestic investments and production activities would produce wide-spread economic benefits for Romania, generating tens of thousands of new jobs and providing billions of dollars in additional tax revenues and national output. A summary of the future economic effects incurred over the period 2018-2040 is presented in Table 1.

Table 1 - Summary of estimated future economic effects 2018-2040

Summary of estimated future economic effects* 2018-2040	
Estimated offshore CAPEX	15.7 billion USD
Estimated offshore OPEX	6.5 billion USD
	
National Output	71.3 billion USD
Average annual number of employees throughout the period (Cumulated man-years)	30,605 (~ 703,915)
Total state revenues	26.0 billion USD
out of which royalty revenues	5.5 billion USD

**Note: Includes direct, indirect and induced impact (as resulted from applying the "Leontief" input output methodology, described in the appendix of this study) - cumulated for the period.*


Source: Deloitte analysis

The total state revenues of 26.0 bn. USD represent the cumulated amount for the 2018 – 2040 period (23 years), thus the yearly average is 1.13 bn. USD. This amount would be sufficient to cover approximately one quarter of the budget deficit for 2016.

The resulting estimates therefore show that each 1 billion USD invested in off-shore oil and gas upstream activities in Romania generates 3.0 billion USD in the Romanian GDP over the upcoming 23 years of production. Moreover, it contributes with 1.9 billion USD direct and indirect revenues for the Romanian state, as well as creates and/or maintains, in average, an annual number of 2,198 jobs in Romania over the entire period.

But the effect of successful upstream offshore developments would also spread to the midstream and downstream sectors (gas transmission and distribution) and other industries (e.g. chemical, petrochemical and gas to power), where close to 9 billion USD investments would be possible following the gas surplus and the economic competitiveness that it brings. These investments, in turn, would lead to the creation of approx. 42,000 jobs and maintenance of them up to 2040 and an estimated cumulated impact of 18.3 billion USD to state revenues, as well as almost 99 billion USD cumulated national output between 2020 and 2040, as presented in the table below.

Table 2 - Summary of estimated future economic spillover effects 2020-2040

Summary of estimated future economic spillover effects 2018-2040	
Estimated CAPEX	8.9 billion USD
	
National Output	98.9 billion USD
Average annual number of employees throughout the period (Cumulated man-years)	41,945 (~ 880,845)
Total state revenues	18.3 billion USD

**Note: Includes direct, indirect and induced impact (as resulted from applying the "Leontief" input output methodology, described in the appendix of this study) - cumulated for the period.*

Source: Deloitte analysis

Notably, those benefits would be achieved without any increase or any new direct government spending. On the contrary, increased output would boost national government budget, without incurring additional government expenditures. The benefits of such a stimulus should therefore be particularly attractive in the pursuit of bridging the gap with more developed/fast-moving EU countries. Moreover, the additional gas resources becoming commercially viable would help secure Romania's energy supply, as well as contribute to long-term decarbonization targets through the use of natural gas as elective transition fuel towards a low carbon economy and potentially contribute to the national infrastructure as well as other high added-value industries, such as chemicals and petrochemicals.

Our analysis is meant to be a reasonable, objective starting point for rationally discussing the economic benefits of potential large scale Black Sea oil and gas developments. Undoubtedly, heated debate might arise around the different parameters employed in the analysis. However, no amount of debate should undermine the simple reality that substantial development of the Black Sea upstream activities will indisputably provide valuable economic growth opportunities at a time when access to highly paid jobs and direct foreign

investments would certainly help Romania gain numerous competitive advantages among its regional and ultimately EU peers.

II. Current state of play

Short background of oil & gas production in Romania

Crude oil: Romania was the first country in the world to officially register an oil production, dated back in 1857 and followed two years later by the United States of America. The 1,960 barrels of oil produced then were refined in the only refinery in the world at the time, built in the city of Ploiesti, 60 km north of Bucharest.

Thanks to the advantage of an early market entry, Romania had along the way multiple "world's firsts" (Bucharest - first city with a public lighting system, based on kerosene; in Campina - the first school for "master driller"; first gasoline exporter, in 1900 etc.). With a built-up of know-how and experience in the sector, over the twentieth century the economy relied heavily on the oil and gas industry (even though in both World Wars many wells and refineries were destroyed and had to be rebuild).

In 1975, the first offshore drilling platform was set on position on the continental platform of the Black Sea. The first location, Well 1 Ovidiu East, had water depths of 84 m, while the platform was designed for maximum water depth of 90 m and maximum wave height of 12 m. The well reached a depth of 5,006 m and collected a sample rich in geological information, but there was not significant signs of oil. A second borehole was drilled in Midia block with another unsuccessful result. This has led to the third location, in XVIII Istria block. Called Lebada (the Swan), the field is in an area with water depths of 50 m, approximately 80 km N-E of Constanta. Here, crude oil was discovered in significant quantities.¹

Currently, around 8% of crude and condensate is produced offshore, whereas the rest comes from onshore². Crude oil production in 2016 was around 27 million barrels³, while total consumption exceeded 82 million barrels. At this rate of production, the proved reserved of the 330 million barrels⁴ belonging to OMV Petrom, the biggest domestic oil producer, will be sufficient for only another 4 years and 4 months.

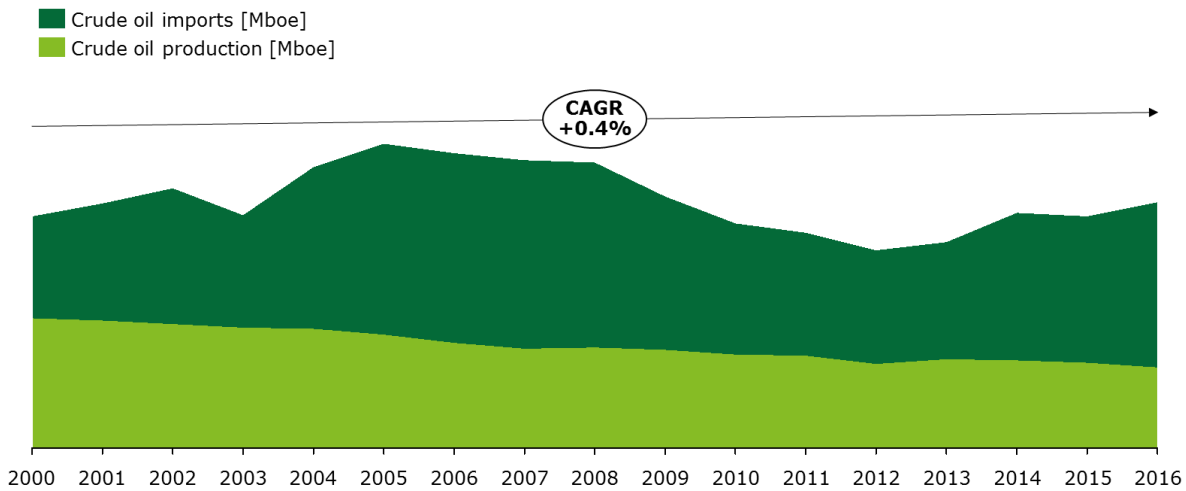
¹ Romanian Petroleum History, Petroblog

² OMV Petrom, Annual Report 2016, page 34

³ EUROSTAT, Complete energy balances - annual data

⁴ OMV Petrom, Annual Report 2016, page 37

Figure 1 - Crude oil historical consumption by source



Source: Eurostat

Natural gas: The first drill for gas began onshore, on February 9th, 1908 at Sarmasel (in Mures County) but, due to technical difficulties, it had to stop at a depth of 627 m. Following calculations, the explorers hypothesized that potassium-rich salt waters may be encountered at a depth of approximately 1000 meters. Another location was chosen, 2.9 kilometers further away. Thus, on November 26th, 1908, drilling started with the second probe. First emanations of gas were observed during the well drilling, at a depth of 122 meters and as the depth grew, it became increasingly violent. Eventually, the probe reached 302 m, the flow was measured to 1 mil. cm/ day and the gas pressure was estimated at 41 bar.⁵

Nowadays, it has a weight of 31% in domestic primary energy production⁶. Its significant share is explained by the availability of indigenous resources, by the reduced impact on the environment and by the ability to balance the electricity produced from variable renewable energy sources. The existing infrastructure for extraction, transport, underground storage and distribution is extended throughout the country. It is important to know that one of the components, the National Gas Transmission System (NGTS), has been designed in the '60s for carrying three times the current level of gas, to supply an oversized industry.

Although Romania has a relatively low dependence on gas imports, because of intensive exploitation since the beginning of the last century, the current onshore reserves are declining. The majority of sites are mature and fragmented, production per well, being one of the smallest in Europe.

In 2016, 8.7 bcm⁷ of gas were brought to surface locally and a remaining quantity of 1.3 bcm was imported to cover the national consumption. Under the Romanian soil are proved reserves of approximately 105.5 bcm⁸ of regular gas reserves (excluding reserves obtainable through fracking), only 10.5 times more than the consumption in 2016.

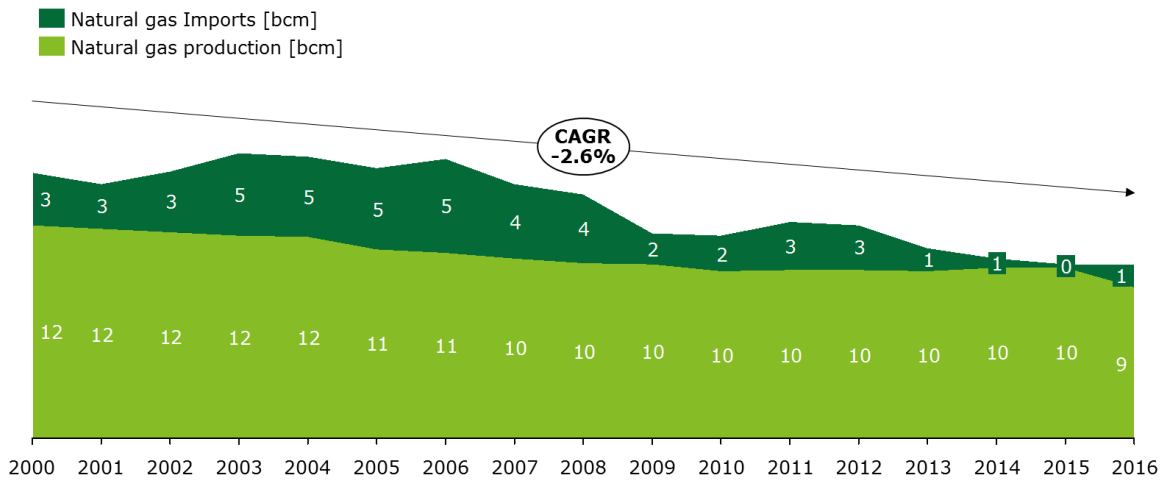
⁵ Romanian Petroleum History, Petroblog

⁶ EUROSTAT, Primary production of energy by resource, 2016

⁷ EUROSTAT, Complete energy balances - annual data

⁸ U.S. Central Intelligence Agency, The World Factbook, data for January 1st, 2017

Figure 2 - Natural gas historical consumption by source



Source: Eurostat

Considering the perspectives for the current onshore oil and gas fields, corroborated with those of oil and gas consumption, it results that without any alternatives Romania will become a net importer with a significant proportion of gas demand covered by foreign sources. For maintaining the current level of energy security or even to become a regional hub, the whole upstream sector has to adapt. The directions are three, but only the last one has the potential to reposition Romania in the regional energetic hierarchy:

1. Discovery of new onshore oil and gas reserves – the conventional onshore exploration and exploitation, especially deep reservoirs remains a potential solution for supplying oil and gas to the economy.
2. Developing onshore fracking – even if the theoretical oil and gas potential is significant (300 million barrels of shale oil eq., respectively 1,473 bcm of shale gas⁹), this activity meet vehement opposition from locals and environmental activists. In Romania, the shale gas exploration and production is banned, pending the outcome of European-level studies on the health, safety, and environmental aspects of shale gas development.
3. Exploiting the proven oil and gas reserves from the Black Sea – The Black Sea Basin has the potential to become one of the most significant natural gas producing areas in the European Union.

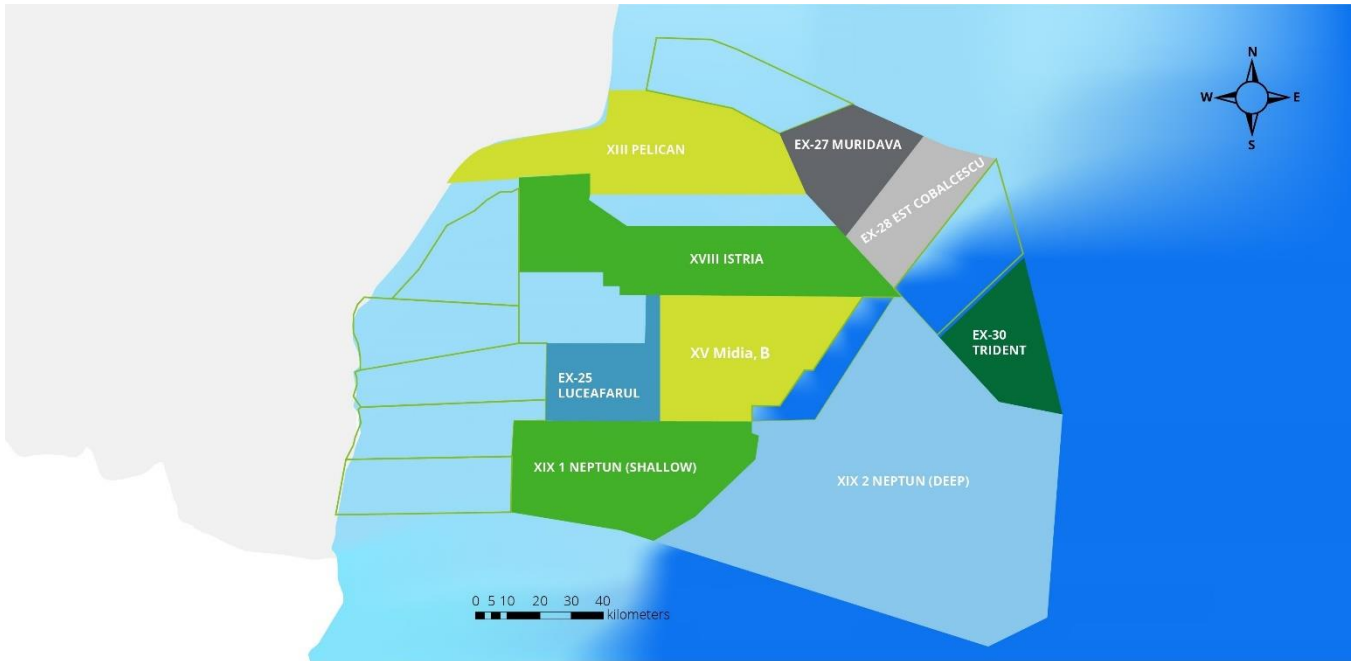
Offshore development overview

Romanian offshore area covers 22,000 square kilometers and reaches depths beyond 1000 meters.

The whole area is divided in blocks of different sizes, some of them being awarded to operators for exploration, development and exploitation activities.

⁹ Technically Recoverable Shale Oil and Shale Gas Resources: Other Eastern Europe, U.S. Energy Information Administration, 2015

Figure 3 - Black Sea exploration, development and exploitation perimeters



Black Sea exploration, development and exploitation perimeters

<p>XIII PELICAN 65% BLACK SEA OIL & GAS S.R.L. 20% PETRO VENTURES RESOURCES S.R.L. 15% GAS PLUS INTERNATIONAL B.V.</p>	<p>EX-25 LUCEAFARUL 50% PETRO VENTURES EUROPE B.V. 50% BLACK SEA OIL & GAS S.R.L.</p>	<p>XIX 1 NEPTUN (SHALLOW) 100% OMV PETROM S.A.</p>	<p>EX-27 MURIDAVA 80% S.C. PETROMAR RESOURCES B.V. 20% S.C. PETROMAR RESOURCES S.A.</p>
<p>XVIII ISTRIA 100% OMV PETROM S.A.</p>	<p>XV Midia, B 65% BLACK SEA OIL & GAS S.R.L. 20% PETRO VENTURES RESOURCES S.R.L. 15% GAS PLUS INTERNATIONAL B.V.</p>	<p>XIX 2 NEPTUN (DEEP) 50% EXXONMOBIL EXPLORATION & PRODUCTION ROMANIA Ltd. 50% OMV PETROM S.A.</p>	<p>EX-28 EST COBALCESCU 70% S.C. PETROMAR RESOURCES B.V. 30% S.C. PETROMAR RESOURCES S.A.</p>
			<p>EX-30 TRIDENT 88% LUKOIL OVERSEAS ATASH B.V. 12% SNGN ROMGAZ S.A.</p>

Source: Deloitte

Each offshore project has its own characteristics, based on the geology and other circumstantial factors. In comparison with onshore work, the offshore projects are considerably more expensive and involve long-term deployments. These two factors are the reasons why offshore projects are considered to be high-risk, especially in the first part of exploration.

The long period for implementation can also be an advantage, as offshore projects can be less sensitive to short-term fluctuations in oil prices than onshore developments.

The cost of the offshore projects can be influenced by a series of key drivers, such as the water depth, the well depth, the size of the field, the distance from shore and also the reservoir pressure and temperature.

According to market estimations, 40 – 50% of the capital expenditure for an average offshore project correspond to drilling and completion. These costs refer to exploration, development and production wells. Almost 50% of the drilling and completion costs refer to the leasing of rigs while the other 50% is allocated to equipment, logistics, engineering services and consumables.

For a major offshore project, approximately 80% of the drilling and completion costs are time sensitive. If a company can find ways to reduce the time for delivery it will account for a significant cost reduction. Drilling itself accounts for a much larger share of total well costs in offshore development than in onshore development.

Black Sea resource estimates based on current discoveries

Lebada East (production started in 1987), Lebada West (production started in 1993), Sinoe (production started in 1999), Pescarus (production started in 2003) and Delta (production started in 2009) fields in XVIII ISTRIA block are the oldest discoveries. Together, they accounted for 185 million barrels of oil, 8 million barrels of condensate and 48 bcm of gas. Due to their long history exploitation, the oil and condensate reserves are almost depleted, while the remaining gas resources are around 6 bcm, according to market reports.

In XV MIDIA A block, two relevant discoveries were made: Doina (in 1995) and Ana (in 2008). Together, they hold recoverable resources of 9.5 bcm of gas. The exploitation is expected to begin before 2020.

In EX-27 MURIDAVA, the exploration has shown possible quantities of 4.85 bcm of gas and 11.7 million barrels of oil.

The explorations in EX-28 EST COBALCESCU, EX-29 EST RAPSODIA, XV MIDIA B blocks did not show any commercially viable quantities to date.

In 2014, a small discovery was announced in Istria XVIII block, Marina field, with a production potential of 1,500-2,000 boe/day.

In March 2012, OMV Petrom S.A. and Exxon Mobil Exploration & Production Romania Ltd. (as Operator) announced that, through the Domino 1 well, part of XIX 2 NEPTUN (DEEP) block, recoverable resources estimated between 42 and 84 bcm of gas have been discovered.

In October 2015, Lukoil, PanAtlantic and Romgaz have announced the discovery of a field in EX-30 TRIDENT block. According to the seismic data and following the analysis of the data obtained during the drilling, the preliminary results indicate reserves that exceed 30 bcm of natural gas.

The inland transport infrastructure is able to support the current production. For the future peak natural gas production years, further investments are in progress. Eventually, the national transmission system will have approximately 10 bcm per year of natural gas intake capacity to the sea side, for connecting the shore with the rest of the transmission system.

Figure 4 - The National Gas Transport System – Transport corridors and major development projects



Source: Transgaz, Deloitte adaptation

III. Benefits of Black Sea oil and gas upstream development

Overview

The impact assessment takes into consideration sample projects referring to the exploration, development and production of offshore oil and gas (at Black Sea) based on the characteristics of the announced discoveries. These projects are estimated to be developed by oil & gas producing companies that operate concessions on the Romanian Black Sea territory and are expected to generate a significant impact in the national economy of Romania.

On the one hand, this impact can be quantified through analyzing the **scale of investments** including capital and operating expenditures (capital expenses including also decommissioning costs).

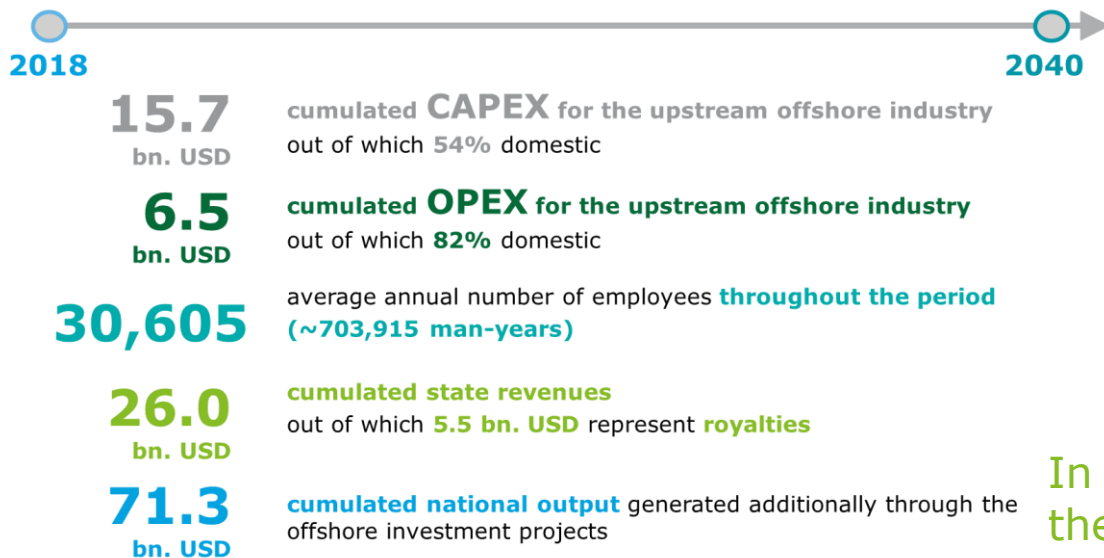
Moreover, **employment, state revenues and macroeconomic indicators**, (such as gross domestic product and balance of payments) can be measures of illustrating the direct, indirect and induced impact that offshore projects have on the Romanian economy and are used as part of this impact study. For more details related to what direct, indirect and induced impact imply, please check the "Methodological notes" section presented in the Appendix.

As mentioned above, the offshore projects have a significant impact on affiliated industries and the economy as a whole. The current chapter presents the impact that the future investments could have on the Romanian economy (2018-2040). Impact of the past investments (2000-2017) is briefly presented in the Appendix.

Specifically, the overall results of the current study are presented in the following figure:

Investments in offshore gas exploration, development and production are expected to generate a significant impact in the national economy of Romania

Figure 5 - Overview of the impact of the future offshore gas projects on the Romanian economy, 2018-2040



Source: Deloitte analysis

The cumulated value of the future expenditures on the offshore exploration, development and production was estimated at the amount of 22.2 bn. USD, out of which 15.7 bn. USD will be CAPEX and 6.5 bn. USD will be OPEX. From this total investments, 63% are expected to be domestic (54% in case of CAPEX, 82% in case of OPEX).

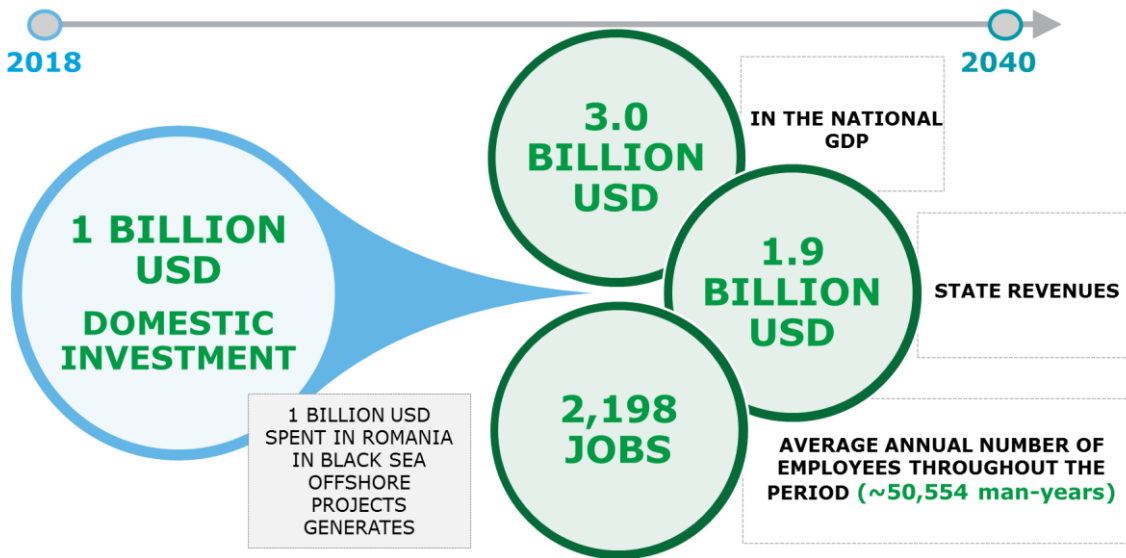
Moreover, the investments will sustain an annual average of 30,605 employees throughout the period, will generate 26 bn. USD additional cumulated state revenues and 71.3 bn. USD cumulated additional national output over the same period (2018-2040).

Overall, the results show that every 1 bn. USD that will be spend in offshore gas exploration, development and production leads to:

- The creation of an annual average of 2,198 full-time jobs that can be maintained between 2018 and 2040;
- An increased cumulated revenue in national budget of 1.9 bn. USD between 2018 and 2040;
- An increased cumulated GDP of 3.0 bn. USD between 2018 and 2040.

In the future, the 13.8 bn. USD cumulative domestic expenses will lead to an annual average of 30,605 employees throughout the period, a cumulated 26 bn. USD in state revenues and 71.3 bn. USD in national output

Figure 6 - Overview impact of 1 bn. USD spent in the offshore gas exploration, production and development, 2018 - 2040



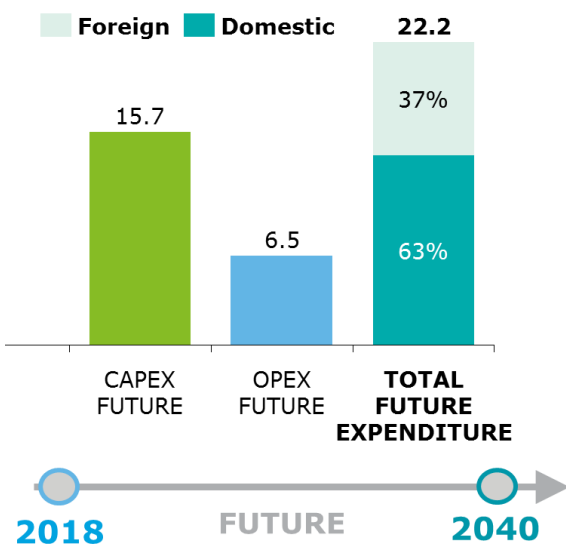
Source: Deloitte analysis

Scale of investments

The scale of investment can be assessed through measuring capital and operational expenditures for the exploration, development and production phases of a project life cycle. The capital expenditures take into consideration also the decommissioning costs at the end of the project life cycle.

The total expenditures projected for the future are presented in the Figure below.

Figure 7 - Total future investments in the offshore gas exploration, development and production, 2018-2040 [bn. USD]



The **domestic share** will account for **63% of the total future expenditure**

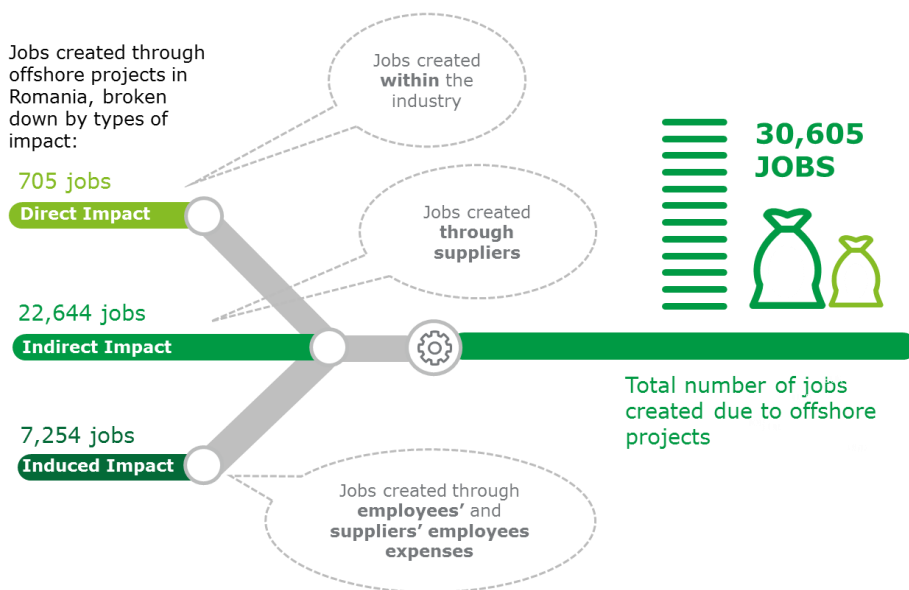
Source: Deloitte analysis

Significant expenses will occur in the development and production activity, which will represent 74.3% of the total future investments.

Impact on job creation

The estimations indicate that between 2018 and 2040, 705 jobs will be on average created and maintained annually directly through the offshore projects. These newly created jobs will indirectly sustain other 22,644 jobs offered by the suppliers of the title holders. Moreover, the impact induced through the expenditures of the title holders' and suppliers' employees will sustain additional 7,254 jobs in diverse industries and activities.

Figure 8 - Impact of offshore projects on the Romanian labor market, 2018 - 2040



Source: Deloitte analysis

30,605
jobs

This is the average annual number of jobs that will be created and maintained through the offshore projects.

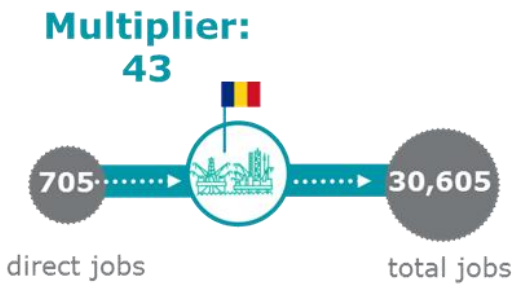
On average, the offshore projects will provide 705 direct workplaces, whereas they will generate **43** times more jobs on the Romanian labor force market. Overall, offshore projects will sustain 30,605 workplaces throughout the period in the national economy.

In the future, **every job created and maintained directly** through prospective offshore projects **will sustain a total of 43 jobs** in the Romanian economy

The number of jobs created would be sufficient to **hire all unemployed people** from the counties of **Constanta, Tulcea, Braila, Ialomita, Ilfov and a third of Galati**¹⁰ for the entire period

¹⁰ According to INS, "Unemployed people registered by categories of unemployment, sex, macroregions, development regions and counties", 2017

Figure 9 - Jobs multiplier, 2018 - 2040



Source: Deloitte analysis

Impact on state revenues

Taxes deriving from offshore projects of the title holders will significantly contribute to the national budget. For the period 2018–2040, cumulated state revenues generated through offshore projects will reach 26 bn. USD, CIT and SSC accounting for the greatest share of tax contributions. The results do not include potential revenues that the Romanian government could obtain additionally as shareholder of companies involved in offshore developments (e.g. OMV Petrom), representing dividends distributed annually as part of realized profit and, moreover, impact of state expenditures from the distribution of above-mentioned dividends.

Figure 10 - State revenues paid in the period 2018-2040 – total (direct, indirect and induced) effect, by type of taxes



Source: Deloitte analysis

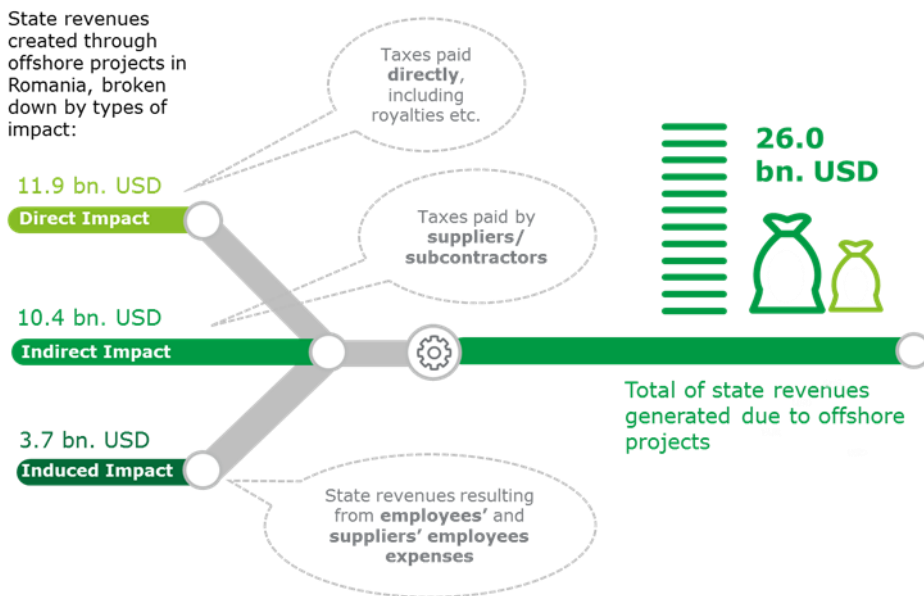
Overall taxes estimated to be paid by offshore developments in Romania will reach 26 bn. USD in the period 2018-2040

Tax contributions represent a direct support regarding state expenditures and facilitate budget tasks like development of infrastructure, education and health care.

The additional output, created jobs and higher wages that offshore projects generate will translate into higher tax collections and subsequently into an increase of public revenues.

The direct impact that offshore projects have on state revenues through tax contributions will amount to **11.9 bn. USD**. These contributions mainly consist of CIT and SSC paid by the title holders. **The indirect impact** will amount to **10.4 bn. USD**, primarily resulting from SSC, CIT and taxes on products. Additionally, an **induced impact** will also have an effect on the economy through the expenditures of the title holders' and suppliers' employees and will amount to **3.7 bn. USD**, predominantly consisting of SSC and taxes on products.

Figure 11 - State revenues paid in the period 2018-2040 – total (direct, indirect and induced) effect, by type of impact



Source: Deloitte analysis

26
bn. USD

This amount represents the cumulated state revenues paid through offshore projects in the period 2018-2040.

The expenditure of 1 USD in offshore upstream projects in Romania will result in 1.9 USD of state revenues.

With the total amount of state revenues generated by offshore projects, the current **Romanian health system** could be financed for **11 years**

The **yearly average of state revenues** would be sufficient to cover approximately **one quarter of the budget deficit for 2016**

Figure 11 - Multiplier effect for state revenues, 2018 - 2040



Source: Deloitte analysis

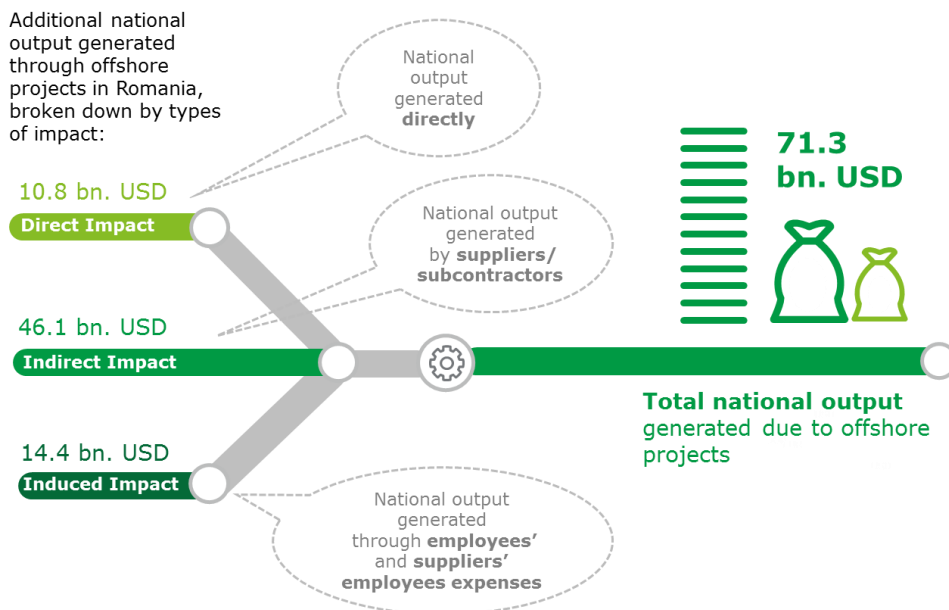
Impact on macroeconomics

Macroeconomic indicators such as national output and balance of payments provide valuable insights regarding the share that an industry has in the economy of our country.

The direct impact can be calculated through the activities associated directly to offshore projects, whereas the indirect impact is generated through suppliers and subcontractors that are engaged by the title holders. Finally, the induced impact is determined by the industry’s direct employees’ expenses, as well as the expenses of the suppliers’ employees in the national economy as a whole.

The figure presented below, captures the impact of the aforementioned investments on the Romanian national output.

Figure 12 – The impact on national output, 2018 - 2040



The additional amount of the national output would be sufficient to build almost **10,000 km of highways**

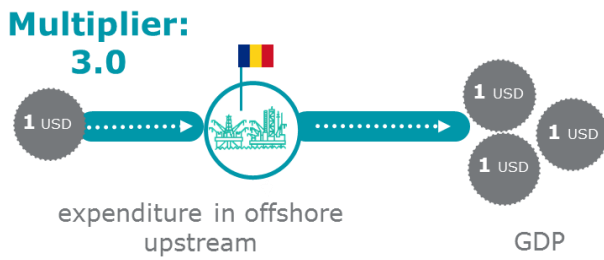
Source: Deloitte analysis

71.3
bn. USD

represents the cumulated national output generated additionally through the offshore investment projects in the 2018 – 2040 period.

The multiplier effect is an important aspect to be analyzed when assessing the impact of the GDP. As presented in the figure below, the multiplier for the GDP is **3.0**, which translates into an expenditure of 1 USD spent in offshore projects will generate 3 USD to the Romanian economy.

Figure 13 – GDP multiplier, 2018 - 2040



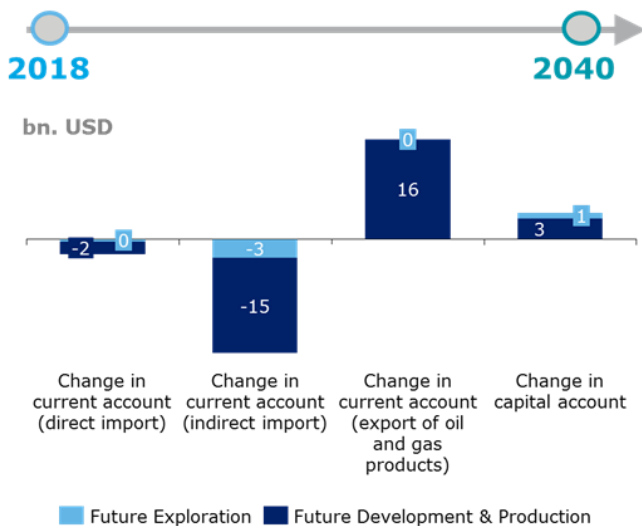
Every USD spent in offshore projects in Romania will generate a total of 3.0 USD in the Romanian GDP

Source: Deloitte analysis

Over the entire analyzed period, the impact on output is highest in the future development and production stage, when the projects are in the investment phase. However, the impact on output in the development and production phase could not be possible without the initial investments from the exploration phase.

When assessing the impact on output it is also important to focus of the evolution of the balance of payments, as illustrated in the figure below.

Figure 14 – Balance of payments, 2018 – 2040, [bn. USD]



Source: Deloitte analysis

On average, the impact of the offshore sector on the balance of payments is zero considering the share of imported equipment and services as well as future revenues from gas exports.

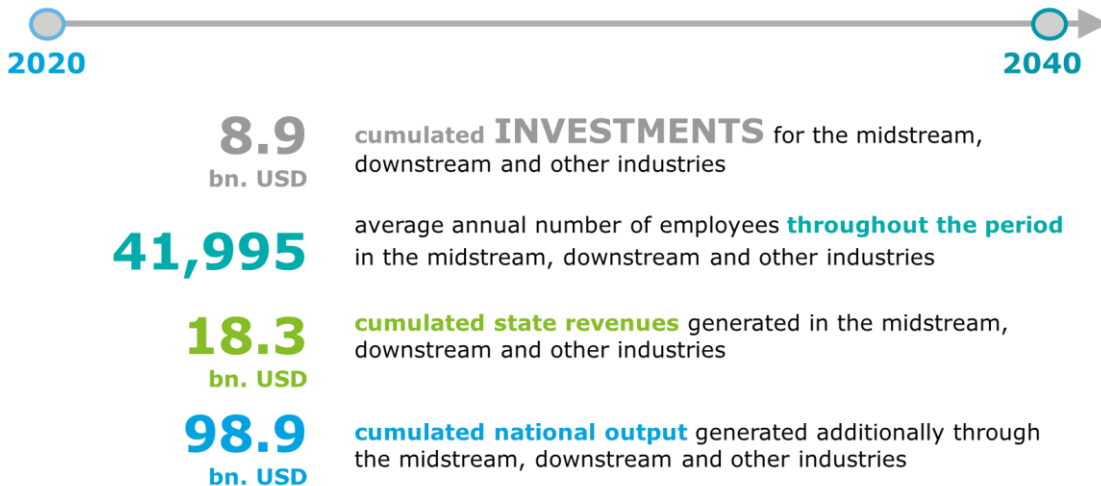
Spillover effects

The Black Sea gas development should unlock multiple opportunities in other Romanian industries, generating their recovery to past record achievements or new products and services for the economy. Our scenarios, based on both public and private investors' agenda, have focused mainly on the assumption that part of the Black Sea gas could be marketed following the:

- ✓ Development of the natural gas transmission network (as planned by Transgaz in its 2018-2027 Development Plan);
- ✓ Development of the natural gas distribution network (at least 1 mil. households that currently secure heating via biomass switch to gas, between 2020 and 2030);
- ✓ Replacement/development of highly efficient gas-fired cogeneration units (that supply more than 1 mil. customers through centralized district heating systems);
- ✓ Rehabilitation and development of key chemical and petrochemical assets.

The results below reflect the vast reach of gas as a fuel for industries and products that have a consistent contribution to the value chain of any developed economy. For example, petrochemicals are used to manufacture thousands of products people use every day ranging from everything made of plastic, medicines and medical devices, cosmetics, and including just about everything else from furniture to transportation. Petrochemicals are derived from ethane, propane, butane and other hydrocarbons extracted from crude oil and natural gas liquids.

Figure 15 - Overview of the impact resulted from the spillover effect on the Romanian economy, 2020-2040



Source: Deloitte analysis

IV. Conclusions

The main goal of this independent study was to calculate a possible impact of the offshore oil & gas activities on the Romanian economy using an international methodology to assess it. The study estimates the national economic direct, indirect and induced effects that can be expected from large scale development of the Black Sea upstream activity. The analysis calculates the economic impact and output associated with the production phase, but also the economic effects of the exploration and development phases, thus leading to an overall cyclical pattern. Since exploration and development entail a great deal of economic activity and infrastructure expansion, their contribution to increase economic growth and provide jobs should be accounted for in addition to the long term actual production that adds significant public revenues for years to come.

Thus, over 2018–2040, the Black Sea developments are estimated to contribute approximately 71.3 billion USD to the Romanian national output and over 700,000 jobs man-years, many in high-paying professional career fields. This economic growth will have also generated around 26 billion USD in total tax revenues, out of which over 5.5 billion USD royalties.

Given the essential usage of gas in many added-value industries (such as chemical and petrochemical), the spillover effect of the offshore developments could bring approx. 9 billion USD investments in midstream, downstream and other industries, which will add another 99 billion USD to the national output and more than 18 billion USD to state revenues between 2020 and 2040, not to mention cca. 42,000 jobs created and maintained throughout the period. Those revenues could potentially be employed by the government to support the national health, social and or educational system and eventually finance infrastructure projects that will contribute substantially to Romania's overall development. In addition, the availability of increased gas resources would trigger certain competitive advantages and spillover effects in certain midstream and downstream sectors, such as gas transmission infrastructure, chemicals and petrochemicals, as well as gas-to-power.

To sum up, investment and development of large-scale projects in the Black Sea will lead to sustainable economic growth, with subsequent direct, indirect and induced effects on jobs, taxes and national output, thus significantly contributing to the economic welfare of the country, but also to its energy security and transition towards a low-carbon economy. Moreover, jobs in the offshore upstream sector are highly paid and generate significant added value, while large scale development of offshore projects will drive know-how and technology transfer to Romania, thus stimulating the development of a whole eco-system around the offshore industry, which in turn will increase national overall competitiveness and long term development prospects.

“On the Romanian Continental Plateau, only a small part of the hydrocarbon reserves have been discovered, huge reserves being undiscovered yet”¹¹

¹¹ Ion Moroşanu, “The hydrocarbon potential of the Romanian Black Sea continental plateau” in Romanian Journal of Earth Sciences, vol. 86 (2012), issue 2, p. 91-109

V. Appendix

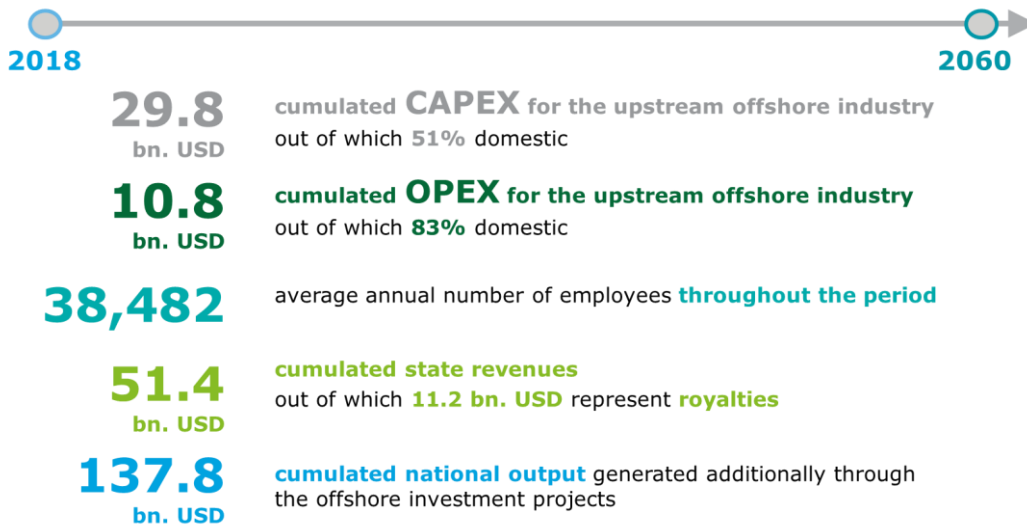
Long-run potential development

The Romanian scientific literature indicates that “the western part of the Black Sea Basin is one of the most promising hydrocarbon-bearing areas in the SE Europe” (Ion Moroşanu). Capitalizing on the development stage of the industry at the 2040 horizon, with the related experience, know-how and existing infrastructure, a further development scenario – aimed at capturing full economically recoverable reserves potential – has been drafted.

For this scenario the implementation of additional projects was taken into consideration so that a higher share of the Black Sea existent potential is included. This scenario foresees a production of over 300 bcm from 2018 until 2060. According to multiple sources, the Black Sea basin holds reserves of over 600 bcm (Purvin & Gertz, 2011).

This long-term potential looks at the successfully developed projects in the Romanian Black Sea continental shelf beyond 2040 and up to 2060.

Figure 16 – Overview of the impact of the future offshore gas projects on the Romanian economy, 2018 - 2060



Source: Deloitte analysis

40.6
bn. USD

represents the cumulated investments for the upstream offshore industry in the long-run potential development scenario. This amount cumulates CAPEX investments of **29.8 bn. USD** and OPEX investments of **10.8 bn.**

USD. The domestic share will account for 59% of future expenditure due to the maturing and development of the local industry.

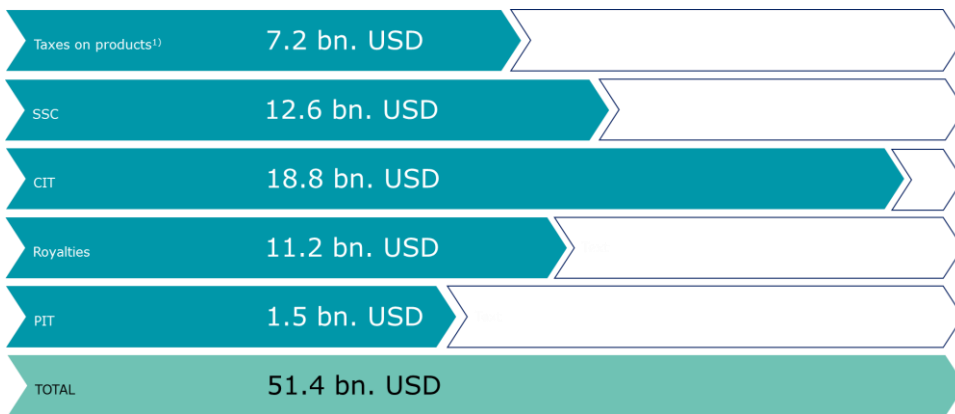
The above mentioned investments will generate and maintain throughout the period an annual average of **38,482** full time **jobs**, out of which 766 generated

Up to 2060, a **40.6 bn. USD** expenditure will generate an annual average of **38,482 employees** throughout the period, cumulated amounts of **51.4 bn. USD** state revenues and **137.8 bn. USD** in national output

directly by the upstream offshore industry, 28,442 indirect jobs created through suppliers and 9,274 induced jobs created through employees' and suppliers' employee's expenses. In the future, every job created directly through future offshore projects will sustain a total of 50 jobs in the Romanian economy.

The state revenues to be generated by offshore projects will reach **51.4 bn. USD**, out of which 24 bn. USD represent the direct impact. Every USD spent in offshore projects in Romania will generate 2.1 USD state revenues, including royalties and other taxes.

Figure 17 – Overview on the types of taxes, 2018 - 2060



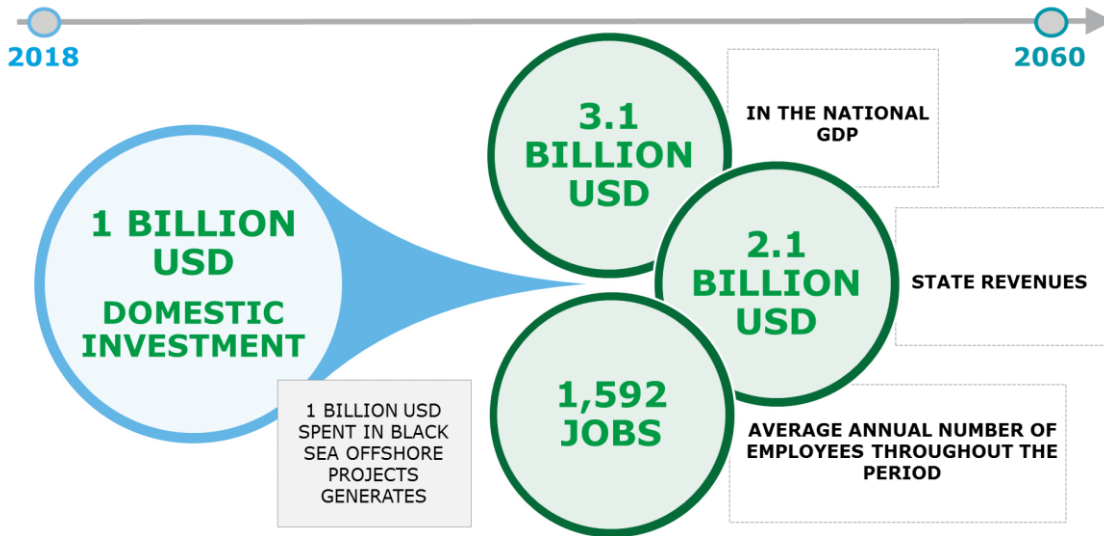
Source: Deloitte analysis

From the total amount of cumulated state revenues, 11.2 bn. USD represent royalties.

The impact on national output is cumulated to **137.8 bn. USD**, generated additionally through the offshore investment projects, while the direct impact represents 20.9 bn. USD. The indirect impact calculates additional 89.1 bn. USD to national output and the induced impact computes 27.8 bn. USD. Related to the multiplier effect, every USD spent in offshore projects in Romania will generate a total of 3.1 USD in the Romanian output.

Analyzing the big picture of the impact of the long-run potential development scenario, the results show that **every bn. USD** spent domestically in offshore gas exploration, development and production will generate an average of **1,592** full time **jobs** and maintain them up to 2060, an increased cumulated revenue of **2.1 bn. USD** in the national budget and an increased cumulated national GDP of **3.1 bn. USD**, as illustrated in the figure below.

Figure 18 – Overview of the impact of 1 bn. USD spent in the offshore gas exploration, production and development, 2018 - 2060



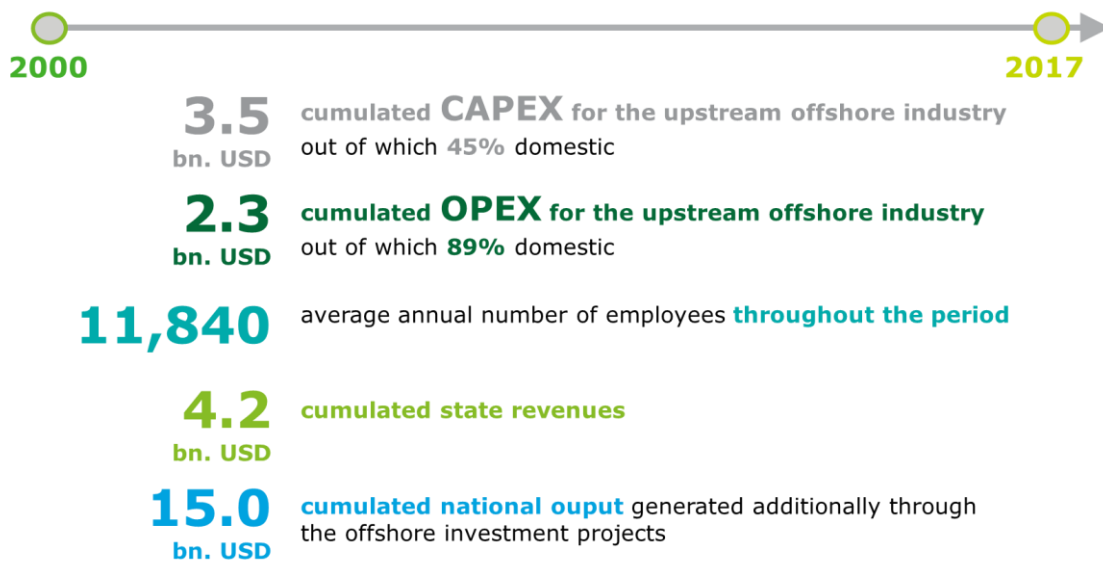
Source: Deloitte analysis

Comparing the long-run potential development scenario with the basic scenario, the impact of spending 1 bn. USD is similar. The number of jobs generated in the expansion scenario is expected to be lower than in the basic scenario due to lower number of employees – determined by the increased degree of automation of the industry between 2040-2060.

Economic contribution of past offshore activity (2000-2017)

In order to assess the impact of the investments in the future, it is essential to have an overview of the impact in the past. In order to assure accurate collection of existing data and in order to have a solid background for future projections, considering at the same time availability of the data, the analysis started with the year 2000.

Figure 19 - Overview of the impact of the past offshore gas projects on the Romanian economy, 2000-2017



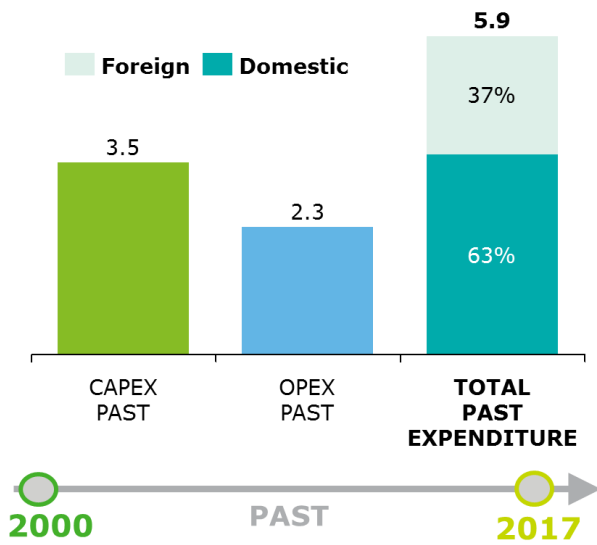
Source: Deloitte analysis

Scale of investment

The scale of investment of a typical offshore project can be assessed through measuring capital and operational expenditures for the exploration, development and production phases of a project life cycle.

The total expenditures for the period 2000-2017 are presented in the Figure below.

Figure 20 - Total past investments in the offshore gas exploration, development and production, 2000-2017 [bn. USD]



Source: Deloitte analysis

As shown in the figure above, the total past expenditure for offshore gas projects accounted for **5.9 bn. USD** between 2000 and 2017. Domestic expenditure from the total expenditure accounted for 63%. Past capital expenditures amounted 3.5 bn. USD for the past offshore projects, while this value will increase considerably in the years to come, namely accounting to 15.7 bn. USD in the base scenario. Out of the 3.5 bn. USD capital expenditures for the past offshore projects, 45% represent investments in the Romanian economy and this percentage will increase to 54% between 2018 and 2040 as a result of local economic development. For operating expenses, the past value accounted to 2.3 bn. USD in the period 2000-2017 and will increase to 6.5 bn. USD for future projects (2018-2040).

Job creation

As pointed out in chapter III, every job generated directly by future offshore projects will sustain 43 jobs on the Romanian labor market over the entire period, while every job created directly through offshore projects in the past in Romania has sustained a total of 16.9 jobs in the Romanian economy. Overall, an average annual number of 11,840 jobs have been created by past offshore projects throughout the period 2000-2017.

Concerning direct employment, the impact assessment of future projects showed that 705 direct jobs will be generated, while in the past, 702 direct jobs have been created. Moreover, in the past years, 8,237 indirect jobs have been generated and maintained by suppliers and subcontractors throughout the period, whereas for future projects, indirect employment will amount to 22,644 jobs. Regarding the induced employment, 2,900 jobs have been created through past projects, whereas future projects will generate 7,254 induced work places in the Romanian economy. The numbers above are also presented as an average per year throughout the 2000 – 2017 period.

State revenues

The impact assessment for future offshore projects showed that every USD spent in offshore projects in Romania will create state revenues of 1.9 USD. In the period 2000-2017, one USD generated state revenues with a value of 1.1 USD. Overall state revenues amounted to **4.2 bn. USD in the past** and to **26 bn. USD** for future projects.

The direct impact that offshore projects had on state revenues in the past amounted to 1.2 bn. USD, whereas future projects will generate 11.9 bn. USD in direct tax contributions, mainly consisting of royalties and CIT paid by the title holders. The indirect impact on state revenues, predominantly resulting from SSC, CIT and taxes on products amounted 2.2 bn. USD in the period 2000-2017, compared to future indirect impact on state revenues amounting to 10.4 bn. USD. The induced impact on state revenues arises from the title holders' and suppliers' employees' expenses effected in the economy. These contributions are predominately constituted of SSC and taxes on products and amounted to 0.8 bn. USD in the past years, while they will amount to 3.7 bn. USD in the future.

Macroeconomics

National output and impact on GDP

For the past 18 years, broken down by types of impact, the directly generated national output summed up to 2.2 bn. USD. The national output generated by suppliers and subcontractors, which is an indirect impact, totaled 9.7 bn. USD. The national output generated through employees' and suppliers' employees' expenses was 3.1 bn. USD. On the other hand, between 2018 and 2040, the direct impact is 10.8 bn. USD, indirect 46.1 bn. USD while induced 14.4 bn. USD. Compared to the prior period, the average annual spending will increase due to more activities, especially in deeper waters.

Every USD spent in offshore projects in Romania between 2000 and 2017 generated 2.0 USD in the overall economy (GDP). For the future, the multiplier will increase to 3.0, due especially to rises in the indirect impact.

Set of assumptions

- ✓ Stable fiscal regime was considered throughout the period, valid at the time of titleholders agreements execution (following the provisions of the current version of the draft law for the necessary measures for implementing the oil operations by the titleholders related to offshore oil perimeters);
- ✓ Offshore gas production of ~ 170 bcm for the 2018 – 2040 period;
- ✓ The corporate income tax rate considered from 2018 onwards is 16%;
- ✓ VAT rate considered was the one applicable according to the latest Romanian Fiscal Code. Effective rate of taxes on products (VAT and excise duties) were estimated, based on the latest data available from EUROSTAT, at 12.5% of the national gross value added. This rate was considered constant for the future;
- ✓ Average royalty rate considered for deep water explorations was 13%, while for the shallow water explorations was of 12%;
- ✓ Foreign exchange rate: historical as provided by the National Bank of Romania; for 2018-2040 as provided by the Economist Intelligence Unit, Country Report: Romania, March 2018;
- ✓ Gas sale price: until 2020 as the one from European Commission (PRIMESC Model – Reference Scenario); from 2020 onwards was considered at around 304.8 USD/1,000 cm (246.2 EUR/1,000 cm);
- ✓ Over the entire future period, on average, 35% of the gas output resulted from Black Sea upstream activities will be exported, while the remaining 65% will be used to cover declining onshore production, as well as increased consumption from downstream and other industries;
- ✓ Social contributions were considered according to the data from the latest version of Romanian Fiscal Code, kept constant between 2018-2040:

Current (2018)			
Contribution	Employee 's contribution [%]	Employer's contribution [%]	Total contribution [%]
Special work conditions			
Pension	25%	8%	33%
Health	10%	n/a	10%
Work safety contribution	n/a	2.25%	2.25%
Income tax (applied on the remaining income after deducting all the other percentages)	10%	n/a	10%

Conversion table	
1 MWh	= 94.28 cm
1 bcm	= 35,687,347.87 MMBTU
1 toe	= 6.84357 boe
1 toe	= 1.11 thousand cm
1 cf	= 0.029 cm

Methodological notes

Input-Output Methodology

Any economy – whether analyzed through a national or global prism - contains of sectors and industries, which are interrelated with each other. Within these sectors and industries there are companies whose operations both depend on and influence other companies and economic agents. In order to analyze the socio-economic impact of a selected industry, one has to therefore use a methodology, which considers these flows, and demonstrates how outputs of many different industries serve as inputs to other industries, and in consequence generate value added, employment, and incomes in the economy.

Wassily Leontief, an economist who in 1973 has received a Nobel Prize for his achievements, first captured such interdependencies within the United States economy. Since then, such tables – called symmetric Input-Output tables - have been created for almost all countries, by national statistical offices, using data from the national accounts. These tables, when compared with financial data on expenditures, revenues, salaries and taxation from a selected industry or companies within a sector, serve as a powerful tool to demonstrate socio-economic impacts.

Using a model based on the Input-Output table for the Romanian economy and input data from the industry, the following types of impacts offshore projects create in Romania were calculated:

Direct impact, which effects the activities of the producing offshore companies.

Indirect impact, which is related to the offshore oil & gas production companies' business transactions with their suppliers. The project's initiators' purchases of goods and services from Romanian suppliers generate business for these suppliers, enabling them to sustain jobs and generate revenues. But the effects don't end there – direct suppliers (1st tier) have their own suppliers (2nd tier) etc. whose production due to the initial impulse from the offshore projects also increases, creating a ripple effect in the economy. These effects, including all rounds of transactions, are effectively taken into account in the model used.

Induced impact, which is a consequence of an additional impulse, created in the economy through spending of the industry's employees and spending of employees of the 1st and 2nd tier suppliers. This impulse, which is manifested through effective demand, is then reflected in an increase of output in the economy, and translates into additional jobs and revenues.

The scale of direct, indirect and induced impact is presented in relation to 3 key metrics:

National output – the total value of goods and services produced within a country's borders. It includes also intermediate consumption.

Employment – measured in terms of headcount and including all job types i.e. employed and self-employed in Romania, calculated as a yearly average during the periods 2000-2017, 2018-2040, respective 2018-2060. The number of man-years is calculated by multiplying the average annual number of employees by the total number of years.

State revenues – fiscal impacts of royalties, Corporate Income Tax, taxes on products (VAT and excises), Personal Income Tax and Social Security Contributions.

Geographical Scope

The study focuses on quantification of the offshore oil & gas projects' impacts on the national economy of Romania.

Therefore, purchases of goods and services from foreign vendors were excluded from the calculations of indirect and induced impacts, as they do not have an impact on national employment, output or state revenues.

Input Data

The analysis was created using public data and Deloitte's own private sources of information and panels of experts, while the forecasts have been projected based on the historical data and our assumptions regarding the evolution of the offshore industry.

Timeline

The report refers to the period 2000-2040, with some references to the horizon of 2060, which we do not consider, however, for the purpose of this Study.

Limitations of the model

The model used is limited by the accuracy and completeness of national data as well as the publication dates of national input-output tables which are quite difficult for national statistical offices to keep current (the most recent symmetric input-output tables for Romania were published in 2013, with prices for 2010, source: Eurostat). In order to compensate for the discrepancy between the input-output tables and the current year the latest figures are deflated based on national inflation rates since the year of the table's publication. This assumes the ratios of purchases between sectors in the economy remained at similar levels to the base year offering a static representation of the economy.

The model assumes that all compensation paid to employees is entirely spent, due to the difficulties in accounting for personal expenditure for employees of each sector.

In a wider regard other limitations of Input-Output models include an inability to accurately account for finite resources or the effects of economies of scale.

Despite the limitations of the methodology and data, the model is able to provide a general representation of the offshore projects' impact on affiliated sectors and the economy as a whole.

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