



Netherlands Enterprise Agency

Energy sector analysis Senegal

Petroleum & gas

Commissioned by the ministry of Foreign Affairs

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ENERGY SECTOR ANALYSIS SENEGAL PETROLEUM & GAS



**by
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**Commissioned by the Netherlands Enterprise Agency
Ministry of Foreign Affairs**

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Table of Contents

Executive Summary	4
Resumé en Français	6
Abbreviations	8
Key stakeholders.....	10
Section 1- General overview	11
1. Introduction	11
2. Energy trends.....	13
3. Country profile.....	14
3.1 Demographic data	14
3.2 Political situation.....	14
3.3 Economic context.....	15
3.4 Education and employment	16
4. Senegal's oil and gas sector	17
4.1 Deep Offshore Sangomar Block.....	22
4.2 Tortue and Teranga	22
4.3 Other exploration activities	23
4.4 Energy mix.....	26
5. Legal and regulatory framework	27
6. Institutional framework.....	29
7. International treaties	31
8. Potential risks and attention points for resource-rich countries	32
8.1 The Dutch Disease	33
8.2 Local content	33
8.3 Environmental risks	35
9. Key support programmes.....	36
9.1 The World Bank	36
9.2 The African Development Bank.....	37
9.3 Support from the Netherlands	38
10. Synthesis and follow up	40
Section 2 - Business opportunities for Dutch enterprises.....	41
1. Upstream	41
2. Electricity sector	45
3. Renewable energy sector	45
4. Maritime Sector	47
5. Agriculture & fertilizers	48
6. Netherlands branch organisations.....	49

Section 3 Government-to-Government project proposals	50
Project 1 Subsurface data management capacity building	51
Project 2 Long term value optimization of fertilizer income for Senegal.....	52
Project 3 Enhancing Senegal’s local content policies	52
Project 4 Avoiding the Dutch Disease: Masterplan for promoting investments in the Senegal Agricultural sector	54
Project 5 Partnering in education	55
Project 6 Introduction of small scale LNG as fuel for the transport sector and as energy source for power generation and local industry in Senegal	56
 Key references	 58
Annex 1 Thematic Groups Donor Support.....	59
Annex 2 Business opportunities.....	61
Annex 3 Contact list	62

Executive Summary

For over 60 years Senegal has attracted the interest of oil and gas companies, yet Senegal's expectations of progressing petroleum production levels appeared slim at best. This picture changed dramatically when Cairn Energy announced two concurrent exploration successes in 2014, and even more so when Kosmos Energy announced two further gas discoveries in 2016. The discovered natural resources may help economic growth to accelerate and allow long-term aspirations to materialize by propelling Senegal into a newly industrializing, middle-income country by the year 2030. Petroleum exploitation activities, however, also present the country with formidable governance-, technical-, environmental- and social challenges, especially to ensure *inclusive growth* by effectively reducing poverty across the country.

The Senegalese government, through the Ministers of Energy as well as Environment have indicated to appreciate support to deal with these challenges. Accordingly, this report has a dual purpose:

- (i) to scope a minimum of three projects which may be undertaken by way of Government to-Government projects in support of the sustainable development of Senegal's resources, as well as,
- (ii) to facilitate identifying potential market opportunities for Dutch companies active either in the energy sector, in particular those providing goods and services for the sector's supply chain, or in complementary sectors, such as the maritime sector.

In section 1 of the report a country profile of Senegal is provided and key public- and private stakeholders listed. This is followed by an analyses of the profile, which then allows identification of key strengths and weaknesses as well as several attention points; programs undertaken or to be undertaken by the principal multilateral donor organisations are also presented. The strengths, weaknesses & attention points are summarized as follows:

Key strengths

- Geographically favourable location
- Stable democracy
- A president with a highly pertinent professional background
- Well elaborated strategy for the middle- and long term (Emerging Plan Senegal)
- COS-Petrogas: a competent trouble shooting organisation for the petroleum sector
- A comprehensive body of international treaties
- Member of the Extractives International Transparency Initiative (EITI)

Weaknesses & attention points

- A petroleum strategy as yet lacking
- Inadequate power generation and grid/availability
- Deficient infrastructure
- Poor business environment/little manufacturing
- Low overall productivity, especially in agriculture
- Lack of capacity/ poor education system
- Low human development index
- Inadequate tax base and collection
- Potential social unrest Casamance
- Mitigation environmental effects and climate change

In section 2 several market opportunities are identified as these are likely to emerge throughout the petroleum value chain. Opportunities in the petroleum sector shall accelerate drastically once a Final Investment Decision has been taken for one of the oil-and/or gas projects.

In section 3, six project proposals are presented based on the analysis and Senegal's needs. The projects are intended to be complementary to programs to be undertaken by donor – and/or multilateral organisations. Furthermore, the proposals are aligned with Dutch industry and knowledge institutes' expertise and niche competencies.

In selecting the proposals an open-ended approach has been followed by giving consideration to the fact that the oil and gas sector is a component of the larger national socio-economic configuration only. The sector can generate highly positive effects by increased revenues and the opportunity to create local employment opportunities, directly as well as indirectly through linked industries. However, negative effects may also occur, such as destabilising effects on the national economy and adverse social- and environmental effects. Therefore, it would seem worthwhile to also anticipate such negative effects with a view to mitigating these. In doing so Senegal's most important sectors, the agriculture- and fertiliser sector were integrated in the project proposals. The proposed projects are the following.

- 1- Subsurface geo-data management and capacity building;
- 2- Long term value optimization of fertilizer income for Senegal;
- 3- Enhancing Senegal's local content policies;
- 4- Avoiding the effects of the Dutch disease: Masterplan for promoting investments in the Senegal agricultural sector;
- 5- Partnering in education;
- 6- Introduction of small scale LNG as fuel for the transport sector and as energy source for power generation and local industry in Senegal.

Resumé en Français

Depuis plus de 60 ans, le Sénégal a attiré l'intérêt des compagnies de pétrole et de gaz, mais les attentes du Sénégal sur le progrès des niveaux de production pétrolière ont paru minces au mieux. Cette image a changé de façon spectaculaire lorsque Cairn Energy a annoncé deux succès d'exploration simultanés en 2014, et plus encore lorsque Kosmos Energy a annoncé deux autres découvertes de gaz en 2016. Les ressources naturelles découvertes peuvent aider la croissance économique à accélérer et à permettre des aspirations à long terme de se matérialiser en propulsant le Sénégal comme un pays industrialisé et à revenu intermédiaire à l'an 2030. Les activités d'exploitation du pétrole, cependant, présentent également au pays des défis formidables en matière de gouvernance, de technique, environnementale et sociale, en particulier pour assurer une croissance inclusive en réduisant effectivement la pauvreté dans tout le pays.

Le gouvernement sénégalais, par l'entremise des ministres de l'Énergie et de l'Environnement, a indiqué qu'il souhaitait un soutien pour relever ces défis. En conséquence, ce rapport a un double objectif:

- (i) afin de faciliter l'identification des débouchés commerciaux potentiels pour les entreprises néerlandaises actives soit dans le secteur de l'énergie, en particulier celles qui fournissent des biens et des services pour la chaîne d'approvisionnement du secteur, soit dans des secteurs complémentaires tels que le secteur maritime,
- (ii) la portée d'un minimum de trois projets qui peuvent être entrepris par des projets de gouvernement à l'administration à l'appui du développement durable des ressources du Sénégal.

Dans la section 1 du rapport, un profil de pays du Sénégal est fourni et les principaux acteurs publics et privés sont listés. Ceci est suivi d'une analyse du profil, ce qui permet d'identifier les points forts et les points faibles ainsi que plusieurs points d'attention; Les programmes à entreprendre par les principaux organismes donateurs multilatéraux sont également présentés. Les points forts, les faiblesses et les points d'attention sont résumés comme suit:

Forces principales

- Emplacement géographiquement favorable
- Démocratie stable
- Un président ayant une formation professionnelle très pertinente
- Stratégie bien élaborée pour le moyen et le long terme (Emerging Plan Senegal)
- COS-Petrogas mis en place: une organisation de crise de problèmes compétente
- Un ensemble complet de traités internationaux
- Membre de l'Initiative internationale pour la transparence des extractions (EITI)

Faiblesses et points d'attention

- Une stratégie pétrolière manque encore
- Génération d'électricité et grille / disponibilité inadéquate
- Infraction insuffisante
- Mauvais environnement commercial / petite fabrication
- Faible productivité globale, en particulier dans l'agriculture
- Manque de capacité / système éducatif nécessiteuse
- Faible indice de développement humain
- Base d'imposition et recouvrement inadéquats
- Environnement et changement climatique

- Trouble social potentiel Casamance

Dans la section 2, plusieurs opportunités de marché sont identifiées, comme elles sont susceptibles d'apparaître dans toute la chaîne de valeur du pétrole. Les opportunités dans le secteur pétrolier s'accéléreront drastiquement une fois qu'une décision finale d'investissement a été prise pour l'un des projets de pétrole et / ou de gaz.

Dans la section 3 enfin, six propositions de projets sont présentées en fonction de l'analyse mentionnée ayant établi les besoins du Sénégal. Les projets sont destinés à être complémentaires des programmes à entreprendre par les organisations donatrices et / ou multilatérales. En outre, les propositions sont alignées sur l'expertise et les compétences de niche de l'industrie et des instituts de savoirs néerlandais.

En sélectionnant les propositions, une approche holistique a été suivie en tenant compte du fait que le secteur du pétrole et du gaz est seulement une composante de la plus grande configuration socio-économique nationale. Le secteur peut générer des effets très positifs, mais peut également avoir des effets déstabilisateurs sur l'économie nationale. Par conséquent, il semble utile d'anticiper ces effets négatifs en vue de les atténuer. Ce faisant, les secteurs les plus importants du Sénégal, le secteur de l'agriculture et de l'engrais a été intégré dans les propositions de projets, comme suit.

- 1- Gestion des données géographiques et renforcement des capacités;
- 2- Optimisation de la valeur à long terme du revenu des engrais pour le Sénégal;
- 3- Améliorer les politiques de contenu local du Sénégal;
- 4- Éviter les effets de la 'maladie néerlandaise': plan directeur pour la promotion des investissements dans le secteur agricole du Sénégal;
- 5- Partenariat en éducation;
- 6- Introduction du GNL à petite échelle comme carburant pour le secteur des transports et source d'énergie pour la production d'électricité et l'industrie locale au Sénégal.

Abbreviations

AfDB	-	African Development Bank
BIT	-	Bilateral Investment Treaty
BP	-	British Petroleum
CGI	-	General Tax Code
CRSE	-	Commission de Régulation du Secteur de l'Electricité
CT	-	Corporate Tax
DH	-	Directorate of Hydrocarbons
EITI	-	Extractive Industries Transparency Initiative
E&P	-	Exploration and Production
EPC	-	Engineering, Procurement and Commissioning
EU	-	European Union
FDI	-	Foreign Direct Investment
FID	-	Final Investment Decision
FLNG	-	Floating Liquefied Natural Gas unit
FPSO	-	Floating Production Storage Offload unit
GATE	-	Gas Access to Europe
GDP	-	Gross Domestic Product
GHG	-	Greenhouse gas emission
GNI	-	Gross National Income
GTL	-	Gas-To-Liquids
GoS	-	Government of Senegal
HDI	-	Human Development Index
HSE	-	Health, Safety and Environment
IMF	-	International Monetary Fund
ILO	-	International Labour Organisation
IOC	-	International Oil Company
JOA	-	Joint Operating Agreements
LNG	-	Liquefied Natural Gas
LPDSE	-	Energy Sector Development Policy Letter
LPI	-	Logistics Performance Index
MEDER	-	Ministry of Energy and Renewable Energy Development
MER	-	Netherlands Commission for Environmental Assessment
NGL	-	Natural Gas Liquids
NGO	-	Non Governmental Organisation
NL	-	Netherlands
NOC	-	National Oil Company
ODA	-	Official Development Aid
OECD	-	Organisation for Economic Cooperation and Development
OMVS	-	Senegal River Basin Authority
OPEC	-	Organisation of the Petroleum Exporting Countries
PIU	-	Project Implementation Unit
PSC	-	Production Sharing Contract
PSE	-	Plan Senegal Emergent
PSI	-	Policy Support Instrument
SDG	-	Sustainable Development Goal
SENELEC	-	Société National d'Électricité du Sénégal
SME	-	Small Medium Entreprise
SOCOCIM	-	Entreprise Cimentière Sénégalaise

TPES	-	Total Primary Energy Supply
UN	-	United Nations
UNDP	-	United Nations Development Programme
WAEMU	-	West African Economic and Monetary Union
WEC	-	World Energy Council
WEO	-	World Energy Outlook

Petroleum	-	Oil and gas
Energy	-	Oil, gas and electricity
Electricity	-	Power

Measurements

BCM	-	Billion Cubic Meters
GW	-	Giga Watt
MW	-	Mega Watt
MMBbl	-	Million Barrels
TCF	-	Trillion Cubic Feet

Key stakeholders

Stakeholder	Role
President Macky Sall	President of the Republic
COS-Petrogaz	COS-Petrogaz is embedded within the Office of the President of Senegal and provides strategic guidance and oversees policies regarding hydrocarbon development and develops oil and gas policies and local content
Ministry of Energy and Renewable Energy Development (MEDER)	The Ministry of Energy and Renewable Energy Development
Petrosen	Petrosen is the national oil and gas company operating under the technical supervision of the Ministry of Energy and development
Senelec (Société National d'Électricité du Sénégal)	The state-owned enterprise holding a monopoly on electricity transmission and distribution
Ministry of Environment and Sustainable Development	Ministry of Environment
Cairn	UK oil company, exploration operator Sangomar block
Woodside	Australian oil company development operator Sangomar block
Kosmos Energy	US oil company, exploration operator Tortue block
BP	UK oil company, development operator Tortue block
African Development Bank	The African Development Bank (AfDB) Group mobilizes and allocates resources for investment and provides policy advice and technical assistance to support development efforts to spur sustainable economic development and social progress in its regional member countries
World Bank Group	The World Bank Group is a global partnership of five institutions working for sustainable solutions that reduce poverty and build shared prosperity in developing countries
EITI	EITI seeks to improve the governance of the extractives sector globally. The implementation of the EITI Standard takes place in EITI countries
Civil society	The aggregate of non-governmental organizations and institutions that manifest interests and will of citizens
Oxfam Senegal	Oxfam is an international confederation of 20 organizations working together with partners and local communities in more than 90 countries. It works around the globe to find practical, innovative ways for people to lift themselves out of poverty and thrive

Section 1- General overview

1. Introduction

Whilst Senegal has been attracting the interest of oil and gas companies for many decades, success was such that the expectations of progressing petroleum production levels appeared slim at best. This picture changed radically when Cairn Energy made two exploration successes in 2014, followed by two more gas discoveries by Kosmos in 2016.

Also in 2014 president Macky Sall's government adopted the Emerging Senegal Plan (PSE) as the country's new development strategy and economic policy reference framework. The Plan aims to ease structural bottlenecks to growth and facilitate private initiative by basic structural reforms. It targets Senegal to become a newly industrializing, middle-income country by the year 2035. To realize its full economic potential and achieving the PSE target, the country will be faced with formidable governance-, technical-, environmental- and social challenges. The overarching challenge it faces is not simply to generate economic growth, but *inclusive growth*, capable of effectively reducing poverty across the country.

The recent discoveries are likely to increase government revenues considerably and provide for the petroleum consumed in the nation, currently imported to the tune of 700 or 800 million Euro per year. Whilst final investment decisions for the petroleum exploitation projects still have to be confirmed, the discovered natural resources are anticipated to become a key factor in accelerating economic growth and help the country achieving the PSE's target by 2035. However, in addition to tackling existing internal issues, such as a low educational level, inadequate electricity provision and infrastructure as well as an unfavourable business climate, an extra challenge for the country is now to also develop and maintain an expanded sustainable energy policy and governance system capable of delivering such growth expectations.

In terms of oil-and gas project timing, the discoveries were made only relatively recently; the discoveries are in an appraisal phase and a first Final Investment Decision, sealing a project go-ahead still has to be made. At this stage, though it makes sense for Senegal to gear up for the upcoming challenges in anticipation of a positive outcome and to start contributing to the reinforcement of Senegal's energy sector.

The request has been made by the Senegalese authorities to learn from the Netherlands' experiences as well as from regional players such as Ghana, Mauritania, Algeria. The Ministry also articulated a desire to work with Dutch companies which have an excellent reputation to support the exploitation of Senegal's resources.

The purpose of this scoping study is first to provide the Dutch government with an understanding of the local context of the Senegalese petroleum sector with a view to determining and justifying capacity building and other interventions which could be undertaken to assist the Senegalese government with responsible and effective natural resource governance. More specifically, in such a way that exploitation of the oil and gas discoveries will contribute to socio-economic development, minimize detrimental impacts on the environment and take due consideration to the effects on the climate. A subordinate purpose is to provide Dutch companies with the necessary information on the most relevant policies and regulations for them to do business in the energy sector in Senegal.

The Netherlands' embassy in Dakar has offered the Government of Senegal to organise a workshop on how Strategic Environmental Assessment may facilitate the sustainable

development of Senegal's oil and gas sector. The workshop is intended to help strategic planning and decision-making processes become more transparent and inclusive and shall cover environmental-, social- and economic impacts and shall be held in September 2017. In anticipation of the results of the workshop subjects concerned were not considered for the projects.

Accordingly, this report, conceived from May until August 2017 for the Dutch embassy in Senegal, has the following dual purpose:

- (i) to scope a minimum of three projects which may be undertaken by way of Government to-Government projects in support of the Senegalese sustainable development of Senegal's natural resources, as well as,
- (ii) to facilitate identifying potential market opportunities for Dutch companies active either in the energy sector, in particular those providing goods and services for the sector's supply chain, or in complementary sectors, such as the maritime sector.

This report is sub-divided in three sections:

1. A country profile of Senegal and an overview of the public and private stakeholders involved in effective and responsible natural resource management and governance; including:
 - A general context, economic and petroleum developments, and a currently anticipated timeline for the major projects as well as policies, regulations and institutions.
 - A list of public and private stakeholders including their roles and interests in the developments, the policies and placed in the timeline.
 - A general description of the main challenges/risks for the Senegalese government during the petroleum life cycle.
 - Identification of the most important Senegalese policies and regulations in the petroleum sector.
 - A general indication of capacity building needs of the Senegalese government for the following 10 year period.
 - A basic, general description of opportunities for Dutch companies that are indirectly related to the exploration of oil and gas fields such as port facilities, infrastructure, safe food production, etc
2. Pertinent information for Dutch companies is provided on business opportunities and the most relevant policies and regulations for companies to do business in the petroleum sector in Senegal;
3. Six project proposals are provided on the basis of which the Dutch government can support the Senegalese authorities with sustainable development of Senegalese petroleum resources.

The main subject of this study is the upstream energy sector. Complementary sectors such as the power and maritime sectors have not specifically been addressed exhaustively, but do feature in this report, including in section 2 hereof.

The author of this report is Holle Energy, and was written by Armand E. Holle, assisted by Frédérique A. Holle. The study is based on desk study research and the consultant's participation in the Netherlands' Economic Mission to Senegal from May 17th to May 19th and a follow-up meeting on 23rd June. Furthermore, meetings were held with the mrs Hanneke van Hoof of RVO, the diplomatic delegation in Dakar, key stakeholders in Senegal and finally, industry- and public authorities' experts in the Netherlands were consulted.

2. Energy trends

The oil and gas sector is changing under the influence of global concerns about climate change and CO₂ reduction commitments. Whilst the era of oil and gas is likely to end before world reserves are depleted, for the time being fossil fuels remain indispensable as a transition fuel. In particular gas remains important as the least environmentally harmful fossil fuel. The International Energy Agency (IEA) expects production to remain stable for at least another two decades.

The energy sector and its technology suppliers may anticipate the following projections for the next decades:

- (i) Increase in global energy consumption, be it slower than before.
 - The western world's energy use stabilizes; and
 - emerging markets continue to portray strong growth in energy use.
- (ii) There will be a steady change in the energy mix.
 - The use of fossil fuels (and nuclear energy) will continue to grow;
 - electricity will gain in importance as an energy carrier, whereas
 - the use of renewables will show a stronger increase than the use of fossil fuels.

However, the cost price of sustainable energy should continue to decrease to facilitate this energy source's effective competition with fossil fuels. Some predictions assume that by 2030, bio- and solar fuels, hydrogen and biogas shall be level-headed replacements of oil- and gas products.
- (iii) Traditional oil economies are progressively integrating renewable energy solutions and companies in the oil- and gas sector are likely moving along.
- (iv) The collection and storage of CO₂ will be necessary to achieve the objectives of the Paris Agreement.¹

The implication of the foregoing predictions would seem that prospects for the exploitation of the recently discovered oil- and in particular gas- resources in Senegal, looks positive for the forthcoming decades. For the time being, Senegal's oil and gas reserves remain modest, compared to some of Africa's giants, such as Libya, Nigeria, Angola and Algeria.

Figure 1 Total proved oil reserves Africa

	At end 2015			
	Thousand million barrels	Thousand million tonnes	Share of total	R/P ratio
Algeria	12.2	1.5	0.7%	21.1
Angola	12.7	1.7	0.7%	19.0
Chad	1.5	0.2	0.1%	52.4
Republic of Congo	1.6	0.2	0.1%	15.8
Egypt	3.5	0.5	0.2%	13.2
Equatorial Guinea	1.1	0.1	0.1%	10.4
Gabon	2.0	0.3	0.1%	23.5
Libya	48.4	6.3	2.8%	306.8
Nigeria	37.1	5.0	2.2%	43.2
South Sudan	3.5	0.5	0.2%	64.9
Sudan	1.5	0.2	0.1%	39.2
Tunisia	0.4	0.1	*	18.6
Other Africa	3.7	0.5	0.2%	38.3
Total Africa	129.1	17.1	7.6%	42.2

Source: BP statistical review of the world energy 2016

¹ The Paris Agreement brought all nations into a common cause to undertake ambitious efforts to combat climate change and adapt to its effects, it charts a new course in the global climate effort.

Figure 2 Total proved natural gas reserves Africa

Total proved reserves NATURAL GAS				
	At end 2015			
	Trillion cubic metres	Trillion cubic feet	Share of total	R/P ratio
Algeria	4.5	159.1	2.4%	54.3
Egypt	1.8	65.2	1.0%	40.5
Libya	1.5	53.1	0.8%	118.0
Nigeria	5.1	180.5	2.7%	102.1
Other Africa	1.1	38.8	0.6%	53.9
Total Africa	14.1	496.7	7.5%	66.4

Source: BP statistical review of the world energy 2016

3. Country profile

3.1 Demographic data

Senegal's population is estimated at 15,3 million inhabitants, of which 43.5% lives in the country's cities. With a median age of 18.2 years, the population is young and is growing fast (2.9% per year); by 2030, Senegal is expected to be home to nearly 22 million people.

Gross National Income (GNI) per capita is below the sub-Saharan African average (USD 2,739 for Senegal, compared to USD 3,363), with men earning significantly more than women (USD 2,739 for men, USD 1,657 for women). Senegal is categorized as a country with Low Human Development. The country ranked 162 of 188 countries on the Human Development Index in 2016, which puts the country at a similar level of development as South Sudan and Afghanistan. More than half of the population suffers from multidimensional poverty², as measured by the UN (UNDP 2016). Health and education facilities as well as other public services such as access to drinking water are quite dense in the coastal areas, due to urbanisation, but become scarce in rural areas.

Electricity supply is a chief constraint for Senegal's socio-economic development. Frequent power cuts undermine business efficiency, while in rural areas in particular, residents do not have sufficient access to electricity and modern energy services.

3.2 Political situation

Senegal remains one of the most stable democracies in Africa. Since its independence from France in 1960 it has considerably strengthened its democratic institutions. Senegal was one of the first African countries to introduce a multiparty system, with the government recognising opposition parties since 1974. Despite a constitutional separation of religion and state, Senegalese politics has always had close links to religious leaders.

The political system of Senegal is based on the French model and concentrates a great deal of power in the presidency. Macky Sall was elected for president in 2012. The next presidential election is expected in 2019. Macky Sall is a geologist educated both in Senegal and France. He

² Multi dimensional poverty means multiple overlapping deprivations suffered by households in the 3 dimensions of education, health and living standards

was CEO of Petrosen (the national oil company) as well as Minister of Energy and thus understands the intricacies of the petroleum sector and is particularly well placed for leading the country under the circumstances.

A potential risk is posed by the Movement of Democratic Forces in the Casamance, that have since the 1980s, led a low-level separatist insurgency in southern Senegal. Several peace deals have failed to resolve the conflict, but an unofficial cease-fire has remained largely in effect since 2012.

3.3 Economic context

With its capital city of Dakar located on the western-most point of Africa, Senegal is a gateway to the continent. It has the fourth largest economy in the West African sub-region after Nigeria, Ghana and Côte d'Ivoire. It is an open economy with major trade flows to Europe and India. Senegal's Gross Domestic Product was USD 36.7 billion in 2015, and was expected to grow at a rate of 6.5% that year. Senegal's economy is largely natural resource-based. Key industries include the fishing sector, construction and mining, while tourism is a significant service sector and offshore oil and gas exploration is underway. Services account for 59% of GDP, industry for 24% and agriculture 17%.

Whilst agriculture accounts for 77% of labour force participation, it only accounts for 17% of GDP and agricultural products are among the country's main exports. For generations coastal communities have relied on fishing for their livelihood of which 95% consists of artisanal fishing. Senegal's fishing industry therefore remains one of the core contributors for the economy; it makes up 2.2% of the GDP, whilst more than 600,000 people work as fishermen or in related industries; 60% of the 450,000 metric tons caught annually are consumed locally.

Senegal's macroeconomic situation is volatile. Growth is expected to exceed 6% in 2016, while inflation remains low. The fiscal deficit has been declining steadily from 5.5% of GDP in 2013 and is projected to reach 4.2% of GDP in 2016. The current account deficit has narrowed and is projected to reach 6.5% of GDP in 2016, driven by lower oil prices and improved export performance.

The implementation of the first set of Emerging Senegal Plan (PSE) projects has helped move Senegal to a higher growth path, but sustaining this growth over the medium term requires steadfast implementation of reforms that would enable small and medium enterprises (SMEs) to thrive and attract Foreign Direct Investment (FDI) for globally competitive production. Continued efforts to increase the competitiveness of the private sector, including through making tax collection more transparent, lowering electricity costs and improving service distribution, as well as creating an environment where SMEs and FDI can contribute to broad-based growth, will allow the private sector to take the reins of growth over the medium term.

The authorities are committed to preserving macroeconomic stability. Efforts to increase revenue collection and rationalize public consumption have helped control budget deficits. However, these efforts need to be pursued with further vigilance, particularly with respect to the wage bill, a more transparent and fairer public-sector wage remuneration system and a more equitable and efficient collection of taxes, where tax expenditures are significantly reduced. Reforms to ensure everyone pays their fair share of taxes in a transparent system, should make it possible to raise more revenue, whilst removing tax disincentives facing SMEs and FDI in globally competitive activities.

Senegal remains at low risk of debt distress, but debt levels are rising, including for necessary investments, such as infrastructure and electricity. Increased non-concessional borrowing, including on the regional market, has raised the debt service burden on the budget. Maintaining its low risk of debt distress is predicated on sustaining the high levels of growth envisaged under the PSE while adhering to the planned fiscal consolidation path, which will require rapid progress in fostering private investment.

The long-term underperformance of the Senegalese economy reflects enduring structural constraints and persistent infrastructure gaps. The structural constraints arise from weaknesses in sector policies and the business environment, while infrastructure gaps also affect energy, transport, and communications. While macroeconomic policy has been adequate, limited fiscal space and strict monetary arrangements provide little room for spurring growth.

Improving the business climate has been a priority for the Government, and Senegal twice scored as a top reformer recently. However, the country still ranks in the lower tier of World Bank rankings for ease of doing business. Improving the country's competitiveness by addressing key real sector and infrastructure constraints is therefore an essential element in enhancing the ability of the economy to create productive livelihoods and employment opportunities.

3.4 Education and employment

Education is a major challenge in Senegal: while in sub-Saharan Africa, children on average attend school for 5.2 years, in Senegal that number is just 2.5 years (UNDP 2016). For girls, the number is even lower with an average of just 1.8 years. Children under 15 years of age represent more than 42% of the population, bringing the average age of the population down to approximately 22 years.

Young people represent 60% of job seekers. In an effort to change this situation, president Macky Sall proclaimed 2016 the "Year of Employment". The country has launched several initiatives to help the country provide trained and skilled workers for the labour market, concentrating on three priority industries of the Emerging Senegal Plan: horticulture, poultry farming, and tourism.

Besides the engineering training on geology and geophysics provided by the Institute of Earth Sciences of the Cheikh Anta Diop University in Dakar and specified staff training courses organised by companies distributing fuel and lubricant, no training courses are available in the country. Accordingly, COS Petrogaz has approached the Institut de Petrole in Paris to help establish a petroleum institute in Senegal. Furthermore, COS Petrogaz paid a visit to the UK, the base country of Cairn and BP and requested additional educational assistance for the petroleum sector.

Considering the major requirements for capacity building in country, in section 3, two capacity building proposals as a project proposal have been included. Project nr 1- Subsurface geo-data management and capacity building is a capacity building project for the petroleum sector proper. Project nr 5- Partnering in education, essentially is to make an assessment of possibilities for contribution by Dutch institutions in support of the Senegalese sustainable development of its natural resources.

4. Senegal's oil and gas sector

For over 60 years Senegal has attracted the interest of oil and gas companies. Whilst more than 140 offshore wells have been drilled since the 1950s, proven reserves remained very limited until recently. The country's expectations of progressing production levels accordingly appeared slim at best. This picture changed dramatically when Cairn Energy announced two concurrent exploration successes in the fourth quarter of 2014, complemented by Kosmos Energy's announcement of two gas discovery wells in the first quarter of 2016.

Owing to continuous promotion efforts over the past decades, the Ministry of Energy, supported by Petrosen, Senegal's national oil company, has been able to attract petroleum companies, small at first but recently larger, particularly since the promulgation of the 1998 Law, specifically designed to make exploration and exploitation more attractive and to give greater consideration to environmental issues.

Over the entire basin, only Gadiaga Field No. 2 on **the onshore Tamna block** was in production in 2014, with small natural gas reserves and production, at just 363 million and 41 million m³, respectively. In past years all gas was sold was delivered by pipeline to SOCOCIM, a cement producer and SENELEC the national electricity company.

Blue Box 1

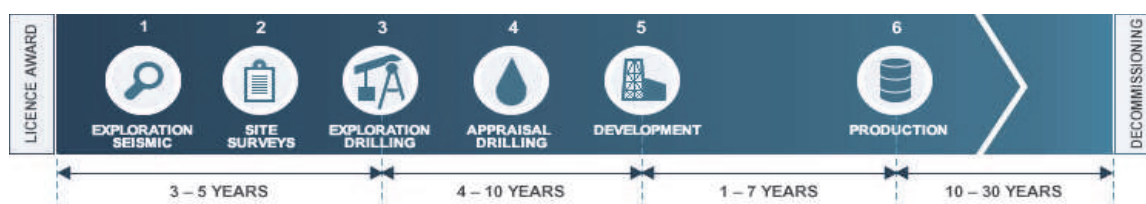
In the oil and gas industry, a farmout agreement is an agreement entered in to by the owner of a petroleum concession or production sharing agreement, called the "farmor", and another company who wishes to obtain a percentage of ownership of the asset concerned, called the "farmee", usually in exchange for services, such as a seismic survey or the drilling of one or more oil and/or gas wells.

Blue Box 2

Oil and Gas Upstream Operations

A useful concept to understand the upstream industry is the petroleum life cycle model, that reflects all activities carried out in the discovery and production of oil or gas-fields. The concept can be visualized in different ways but the following straightforward representation indicates the time span normally needed for the different clusters of activities.

Figure 3 Petroleum life cycle



Since actual capital expenditures will start in the very first phase of the cycle, it is clear that all major oil and gas companies (IOC's) operate with stringent project management models and capital expenditure vetting. IOC's will normally contract out most activities at field level, from gathering seismic data to drilling the first exploration wells. The appraisal phase is a most critical phase where company experts first put together a static geological model to determine the original volume of gas

Blue Box 2 continued

in place. Next reservoir engineers will build and refine a dynamic model of the field to determine how it will behave under actual production conditions. A number of preliminary engineering conditions will also be mapped out, such as the distance to existing, or necessity of infrastructure, as the case may be. Decision-making in this phase is highly structured around a set of decision points. It is important to understand that any IOC will have different teams working at different prospective projects simultaneously. These projects are effectively competing with each other for capital allocation. Once the project team has been able to secure a positive final investment decision (FID), the actual development of the field will commence. A series of production wells will be drilled and a processing facility will have to be built, in support of field production operations.

Figure 3 shows the principal activities in the different planning and execution phases over the lifecycle of the project. New fields, so-called green fields will require much more investment in initial exploration and development work. For existing fields, so-called brown fields, or fields in the vicinity of existing infrastructure some of this work will not be required, and investments will therefore be commensurately lower. In later phases of the production process, due to the naturally occurring production decline, decisions will focus on increasing production and required maintenance. At the tail end of the life cycle, abandonment of the field and the associated costs of removing infrastructure shall increasingly become a serious cost consideration.

Any project will require a host of specialist services. In the exploration phase, there will be an urgent demand for specialist engineering services geologists and geo-physicists, seismic acquisition and interpretation and of course drilling expertise and operations. Later in the project, a very wide range of other specialist services will be needed, in particular construction (design, earthworks, building, heavy lifting). But also supply chain services, logistics and environmental services. All this work (up to 80% of the total contract value) will be carried out by the service industry, contractor companies that are entirely dependent on major oil and gas developments and have carved out a particular business niche for themselves.

Upstream activities at field level			
Green Field		Brown Field	
Exploration	Development	Production	Abandonment
seismic	engineering	operations	well plugging
exploration drilling	project mgt	maintenance	dismantling structures
marine support	production wells	field reviews	marine support
	site support	optimisations	soil cleaning
	site preparation & construction	structural maintenance	decommissioning of equipment & machinery
	process facilities	upgrading	
	fpso supplies	marine support	
	commissioning	minor mod's	

The LNG export chain

The midstream operations are often taken to include some elements of the upstream and/or downstream sectors. For example, the midstream sector may include natural gas processing plants that purify the raw natural gas as well as remove and produce elemental sulphur and natural gas liquids (NGL) as finished end-products.

LNG is produced when natural gas (predominantly methane) is cooled to a temperature of -162°C at atmospheric pressure and condenses to a liquid occupying about a 600th of the volume of natural gas. It is a process that is typically used in order to transport natural gas from a stranded and remote location of origin to a consuming region, where transportation by pipeline would prove uneconomic either because of distance (typically 1500km or more) or for technical reasons (e.g. the need to cross deep water). The process is very capital intensive, requiring substantial upfront investment. In order to prove economic, conventional onshore LNG projects therefore normally require a large gas resource (at least 10tcf) with the LNG produced generally being pre-sold to a reliable off-taker under long term (20 year) sales contracts, using an agreed price formula.

Importantly, as the major consuming markets of the Eastern hemisphere (China, India, etc.) shift from the use of fuel oil towards natural gas, demand for LNG is growing. By 2020, production is expected to stand at around 370 mtpa from over fifty facilities. Major producing countries include Qatar, Indonesia and Australia and in the future possibly also Senegal and Mozambique may be added to Nigeria as Africa's export country. The major IOCs involved in the production and marketing of LNG include Shell, Exxon, BP, Chevron and Total.

Conceptually, the LNG process is relatively straightforward. It involves a sequence of stages, which may be undertaken by one or more companies, dependent in part upon the extent to which they wish to be integrated across the 'LNG chain'.

These stages commence with the upstream production of gas either onshore or offshore, the gas being transported to a 'midstream' liquefaction plant (the equivalent of a large refrigerator), normally located on the coastline. Here the gas is processed to remove impurities such as water, carbon dioxide and hydrogen sulphide as well as any associated liquids and longer chain carbon molecules before being cooled by a series of compressors in a liquefaction facility. Once liquefied, the LNG is loaded into storage before being transferred to purpose built ships and transported to an LNG receiving terminal at the end market. Upon arrival, the liquefied gas will normally be loaded in an onshore storage facility where it will be held in liquid form before being passed through a regasification plant as, and when, it is required either for use in power generation by the dedicated customer, or for sale into the local grid.

LNG is a very capital intensive process requiring substantial upfront capital investment for the development of a typically sizeable resource base. As such the return profile from an LNG project is very different to that from a conventional oil or gas development, the internal rate of return on projects generally being relatively modest but the absolute potential for value creation very large and the development costs per barrel of resource relatively modest. Although improvements in technology and the ever larger scale of projects have seen the underlying cost per tonne of capacity decline over the past decade, industry cost inflation has resulted in a substantial rise in the costs of all elements of the chain, pushing the costs for a green field LNG development.

Conventional LNG projects involve an onshore liquefaction plant, where the raw gas is processed, liquefied and stored prior to loading onto LNG tankers for transport to overseas markets. However, for certain types of gas resource – be it because of scale or location – processing via an onshore facility is sometimes not viable, in which case a Floating LNG plant (FLNG) may be considered.

Blue Box 3 continued

Reasons why FLNG may be proposed as an alternative to conventional land based liquefaction facilities include:

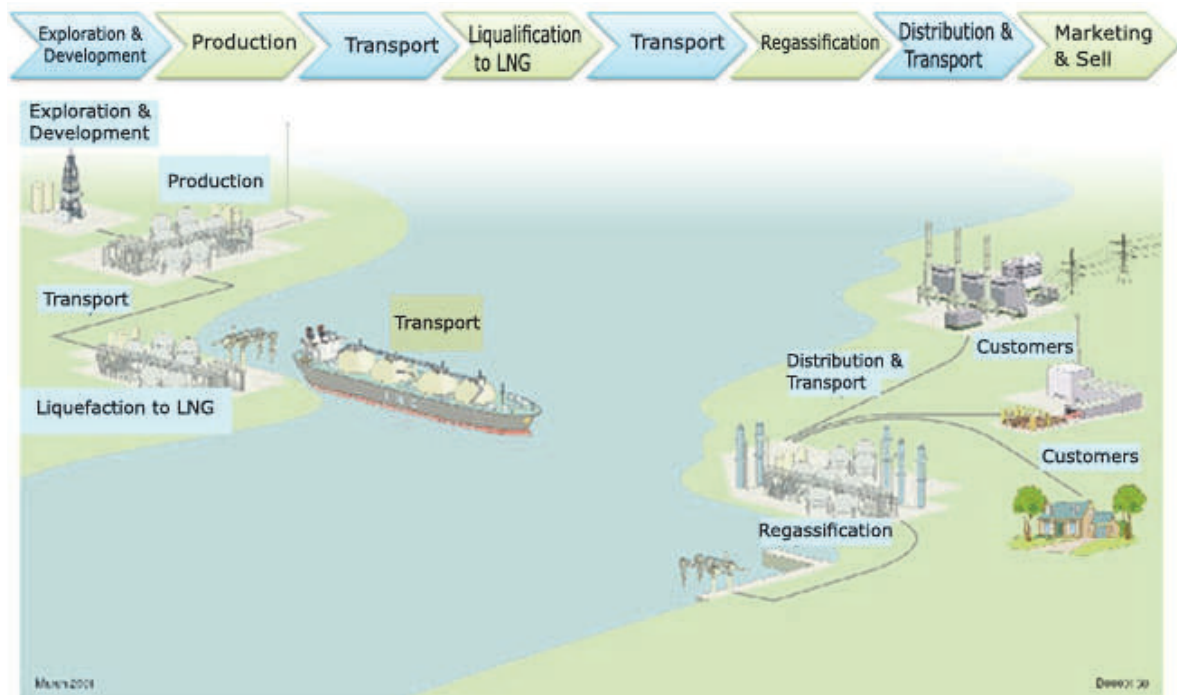
- *Potentially lower costs than conventional projects*
- *No requirements for trunk lines from offshore fields to an onshore facility as the FLNG vessel is anchored directly above the fields*
- *An ability to monetize remote or smaller fields that would remain stranded using conventional methods*
- *Potentially lower environmental impacts given no onshore plant footprint*

However, there remain several challenges to FLNG, including:

- *The technology is new, there are currently only few operating FLNG projects facilities.*
- *Technical challenges associated with liquefying gas on a moving vessel such as sloshing in storage tanks*
- *Limited economies of scale: FLNG cannot be expanded to multiple trains as easily as land-based*

In May 2011 Shell took the first final investment decision on its 3.6mtpa FLNG facility, Prelude. It is constructed in Korea by Technip and Samsung and shall be delivered in 2017. Prelude is one of the first commercially operating FLNG facilities, but FLNG is expected to become an increasingly significant basis for LNG production.

Figure 4 LNG value chain

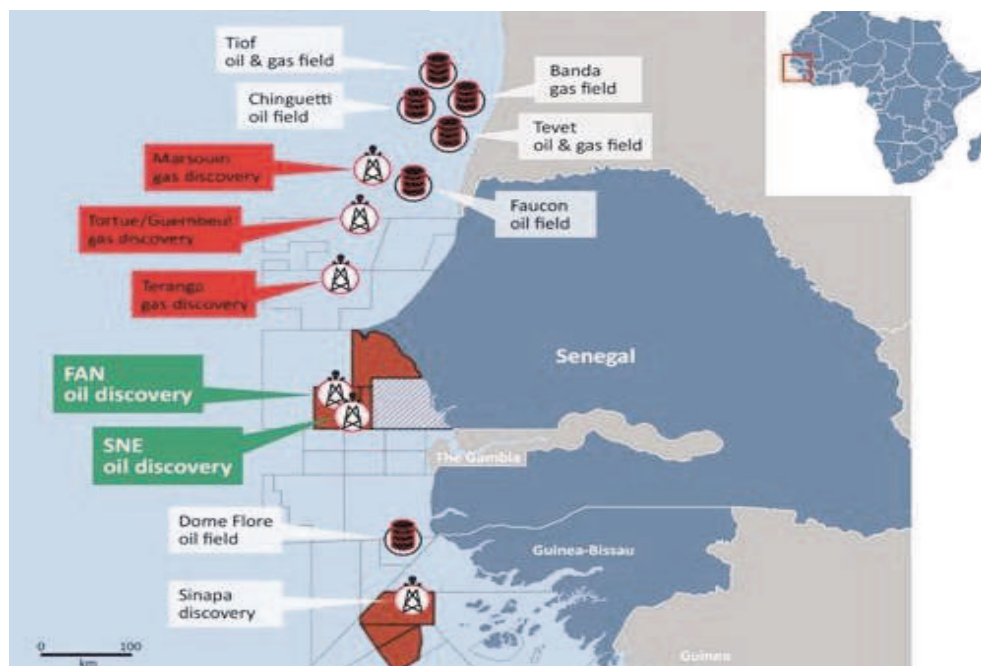


Current oil and gas activities

An overview of current oil and gas discoveries in the Senegal and Mauritania's waters is reflected below:

No	Block	Well	Operator	Partner	Oil / gas	Content	Phase	Remark
1	Sangomar Block	FAN-1 well	Cairn Energy PLC (40%)	Woodside (35%), FAR (15%), Petrosen (10%)	oil	330 MMBbl	Field Appraisal	Well depth 1430 metres
2	Sangomar Block	SNE-1 well	Cairn Energy PLC (40%)	Woodside (35%), FAR (15%), Petrosen (10%)	oil & gas	270 – 900 MMBbl oil and several Tcf gas	Field Appraisal	Well depth 1000 metres
3	Tortue and Teranga	Geumbeul-wells 1 & 2	Kosmos (60%)	Timis (30%) Petrosen (10%)	gas	15Tcf	Field Appraisal	Well depth 5000 metres Field inter connection Mauritania and Senegal
4	Grand Tortue	Teranga-1	Kosmos (28%)	BP (62%), Petrosen (10%)	gas	25-50 Tcf	Field Appraisal	Extending from Marsouin in Mauritania

Figure 5 Offshore oil and gas fields Senegal & Mauritania



4.1 Deep Offshore Sangomar Block

Late 2014, Cairn Energy PLC (40%, operator) in partnership with ConocoPhillips (35%), FAR (15%), and Petrosen (10%) made two major discoveries. First, the FAN-1 well, drilled to a water depth of 1,430 meters, reached a reservoir initially estimated to contain 330 Million Barrels (MMBbl) of oil; and second, the SNE-1 well, drilled to a water depth of 1,000 meters, reached a reservoir estimated to contain a range of contingent oil resources from 270 to over 900 MMBbl as well as several trillion cubic feet (Tcf) of gas, the characteristics of which have not been disclosed.

An appraisal campaign for the SNE discovery is still in progress, and included a 3D seismic analysis in 2015 and four delineation wells (SNE-2, SNE-3, BEL-1, and SNE-4) drilled in 2016. Further appraisal work is planned for 2017, including well testing. This campaign confirmed the high quality of the crude oil, the productivity of the wells as well as the likely development concept for the project (Floating Production Storage and Offloading – FPSO). In 2016, Woodside Petroleum Ltd agreed to acquire ConocoPhillips' interests in Senegal and agreed with Cairn to assume operatorship for the development of the project. In the Sangomar block, the concept for the development of SNE oil and gas resources still needs to be finalized and the appraisal program for FAN is to be developed.

Currently the anticipated timeline for the project is as follows:

Cairn / Woodside: Sangomar Oil & Gas Project

FAN/SNE discoveries	Appraisal	Concept Development	Field development plan	FID	First oil
2014	2016/17	2017	2018	2019	2021/23

4.2 Tortue and Teranga

In 2015, Kosmos (90%, operator) in partnership with the Mauritanian Hydrocarbons and Mining Resources Corporation – SMHPM, 10%) made a discovery in the Ahmeyim-1 offshore well in southern Mauritania close to the border with Senegal. In early 2016, Kosmos (60%, operator) in partnership with Timis (30%) and Petrosen (10%) reported another offshore gas discovery in Senegal in the Geumbeul-1 well located roughly five kilometer from the Ahmeyim-1 well. The drilling of the Ahmeyim-2 well confirmed reservoir continuity on both sides of the border. In May 2016, Teranga-1 was successfully drilled in Senegal. While the latter is not part of Tortue but of Grand Tortue, a larger inboard trend extending from Marsouin in Mauritania to Teranga in Senegal, may hold 25-50 Tcf of gas. However, the appraisal program for Grand Tortue will have to be completed before a thorough assessment of the nature and size of the reservoirs can be provided along with the specifications of the gas and its deliverability. Late December 2016, British Petroleum (BP) signed a farm-in agreement with Kosmos Energy to acquire a 62% interest, including development operatorship, of Kosmos' exploration blocks in Mauritania, and a 32.5% interest in Kosmos' Senegal exploration blocks. BP is planning to drill four additional wells and then decide on a project development concept this year in the hope of a Final Investment Decision (FID) by end of 2018, aiming for first production in 2021/22.

Given the large size of the resources and low international market price trends for LNG, the operator is seeking to develop the resource in phases. The first phase would be a low-cost solution meant to establish Senegal and Mauritania as producing countries in a timely manner. An innovative near-shore floating LNG (FLNG) concept is thus part of preliminary and screening studies.

A complicating factor in respect of the development of the petroleum systems is that these straddle the Senegal-Mauritania border, adding a complication to the development of the reserves and requiring a transboundary unitization agreement and – operations, involving cooperation and agreement by both, the petroleum authorities of Senegal and Mauritania. To some extent these circumstances are mitigated by the fact that Kosmos and BP hold rights in the contiguous blocks on both sides of the border. Fortunately Senegal and Mauritania are amenable to resolving the issue amicably, having concluded an MOU on the subject.

Currently the anticipated timeline for the project is as follows:

Kosmos / BP: Tortue-Teranga LNG Project at 10 Bln

Discovery	Reservoir Continuity	Appraisal	FID	First gas	Expansion
2014	Q2/2016	2017	Q4/2018	2021/22	2025/26

4.3 Other exploration activities

After Thierno Sall was sacked in May 2017 as Senegal’s Energy Minister by President Macky Sall, the latter has called for an “accelerated exploration programme”, with a particular focus on smaller players. Senegal’s Energy Ministry and Petrosen are challenging oil companies to meet their drilling obligations without delay, and the government has insisted to produce a bank guarantee if they expect to negotiate license extensions. The decision to impose bank guarantees in place of normal corporate guarantees may seriously disrupt the ability of smaller players to meet their obligations because getting a bank guarantee without full 3D data is difficult.

A (non-exhaustive) overview of current oil and gas exploration activities is reflected below:

No	Block	Operator	Partner	Oil / gas	Content	Remarks
6	Djiffere Block, Rufisque, Sangomar, Sangomar Deep	FAR (75%)	Trace Atlantic Oil Ltd	-	unknown	Exploration
7	Louga	T5 Oil & Gas (90%)	Petrosen (10%)	oil and gas	150 MMBbl oil and 1 tcf gas and	Exploration / on shore
8	AGC Shallow and Central	Oryx Petroleum (85%)	AGC (15%)	oil	192 and 367 MMBbl respectively	Exploration Dome Floor and Gea heavy oil discoveries
9	AGC Deep Block	Impact Oil & Gas AGC (20%)	Entreprise AGC SA (15%)	-	unknown	Exploration (technical evaluation)
10	Rufisque Offshore Profond Block	Total (90%)	Petrosen (10%)	-	unknown	Exploration

Other exploration activities in Senegal include FAR’s funding of a 3D survey in the **Djiffere block**, adjacent to the Rufisque, Sangomar and Sangomar Deep blocks in exchange for the farm-in option. FAR’s option agreement with a subsidiary of Trace Atlantic Oil Ltd. will earn it a 75% working interest in the Djiffere block by drilling an exploration well before July 31, 2018.

T5 Oil & Gas, which, through its acquisition of Blackstairs Energy Senegal, obtained a 10,000 square mile production sharing agreement in the **onshore Louga Block**. T5 holds a 90% initial working interest in the block, with the remaining 10% held by Petrosen. Two primary lead areas have been identified on the block, which could contain around 1 trillion cubic feet of gas and over 150 million barrels of oil, according to T5. The license period potentially runs to July 2020; the technical program for the block demands a range of exploration activities, including the acquisition of 683 miles of 2D seismic and the drilling of one exploration well in the first exploration period. The ongoing second exploration period expiring in July 2018 requires the drilling of one exploration well; if successful, the third exploration period runs until July 2020 and would require the drilling of two exploration wells.

Oryx Petroleum is conducting a variety of exploration activity in the **AGC Shallow and AGC Central blocks**, which are situated in joint petroleum exploitation zones established by Senegal and Guinea-Bissau. Oryx builds on the small Dome Flore and Dome Gea oil discoveries, dating back to 1967 and 1970. Participating interests in the license area are Oryx Petroleum (85%), and AGC (15%) and Oryx is the operator of the blocks. It has identified three structures in AGC Shallow on the basis of new seismic data in the region to complement shelf-edge plays in the deepwater AGC Central block, which were similar to those found on SNE's seismic data. The AGC granted a one-year extension to the initial exploration period, which now runs to October 2018. The light oil prospects identified in the AGC Central license area are initially estimated to contain a total of 367 MMbbl. Drilling of an exploration well is expected no earlier than 2018.

In the AGC Shallow block, Oryx has identified two play types in three structures for potential light oil exploration, initially estimated to contain a total of 192 MMbbl. Oryx is planning to drill a well in early 2018 in order to meet its drilling commitment for the first exploration phase.

Impact Oil & Gas AGC was awarded the **AGC Deep block license** in October 2014 and began its technical evaluation by purchasing legacy 2D and 3D seismic data; analysis suggests prospectively at various stratigraphic levels, similar to Cairn's discoveries. Following Woodside's 65% interest farm-in transaction, it assumed operatorship of the block; Impact will retain a 20% interest, with Entreprise AGC SA, an entity owned by Senegal and Guinea-Bissau, retaining 15%.

In May 2017 it was announced that Total signed two exploration agreements with the Republic of Senegal concerning deep and ultra-deep offshore areas. An exploration and production-sharing contract for the **Rufisque Offshore Profond block**, covering an area of 10,357 sq km. Total will operate with 90%, the remaining 10% held by Petrosen. Furthermore, Total will assess the exploration potential of Senegal's ultra-deep offshore and become operator of another exploration block.

Potential downstream activities

Blue Box 4

Once evacuated from the production site, both produced oil and gas have to be processed for transportation to markets. Crude oil then has to be refined in a refinery. If natural gas is transported it can either be transported by pipeline or liquefied and transported to overseas markets and or used for domestic purposes. With currently available information, the options reflected in the table below are the best possible predictions of potential future projects for Senegal.¹

1. This table is an adaptation of a document prepared by ICF International in 2012 for the World Bank in support of the Government of Mozambique's Natural Gas Master Plan. It identifies options for potential investment areas as these may be expected in future, once more certainty has been established concerning the oil & gas reserves. It was adapted by the authors to suit Senegal's particular circumstances.

Options	Sector	Reasoning
1	Oil	<ul style="list-style-type: none"> Crude oil is relatively easy to evacuate and be sold at the world spot market. Oil projects less investment in costly infrastructure and therefore are not dependant on long term off-take agreements making project financing easier
2	Liquefied Natural Gas (LNG) (export and domestic)	<ul style="list-style-type: none"> Without LNG export, offshore gas development is not likely to happen Long term contracts (20 yrs+) will allow for significant investments to occur Provides additional certainty to the government <i>On the back of LNG-export facilities domestic LNG opportunities may be developed (see proposals section 3)</i>
3	Project for the distribution of gas through pipelines	<ul style="list-style-type: none"> Enables consistency in the supply of gas and relatively low operational costs Enables the formation, in a sustainable manner, of industrial hubs across the country Provides necessary means to transport gas and enables the fulfillment of the fuel demand for different sectors: industry, transport, commercial and residential
4	Power plants	<ul style="list-style-type: none"> Availability of reliable electricity will generate significant opportunities for industrialisation and rural electrification Demand for electricity is rising significantly in Senegal, with inadequate supply at present Unlike other goods, “import” of electricity is limited Small-to-medium size plants, as well as large combine cycle plants, can be considered More analysis is needed to evaluate the competitiveness of gas against other resources, to assess transmission needs and understand export potential
5	Fertilizer (Ammonia/ Urea Project)	<ul style="list-style-type: none"> Considering Senegal’s export of phosphor, which is also a basic feedstock for the fertiliser industry, fertilizer plants take a position of special importance A fertilizer plant based on natural gas feedstock will reduce existing fertilizer imports The government’s strategies for the agricultural sector and the great international demand encourage investments in this area and a urea plant in Senegal may allow Senegal to become the distribution center for West-Africa <i>In general, additional analysis is needed to understand capital costs, impact of market price fluctuations, and regional demand in a competitive market for fertilizer and in general to design an optimal fertilizer country strategy (see proposals section 3)</i>
6	Gas to Liquids (GTL) (methanol or Fisher Tropsch)	<ul style="list-style-type: none"> Since methanol is the base material for a wide range of products used in almost all areas of modern life and adding some of the most value to natural gas, priority may have to be given to methanol projects For GTL the pathways (methanol and Fisher-Tropsch) are not differentiated, and more analysis is necessary to evaluate advantages and disadvantages of the two options

7	Liquid Petroleum Gas (LPG) Project	<ul style="list-style-type: none"> • Reduces Senegal's dependence on imported refined petroleum products • Replaces the more traditional fuels used in Senegal's domestic and commercial sectors (wood and coal); • Enables the penetration of natural gas to areas without pipelines
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4.4 Energy mix

Following an institutional reform in 1998, Senegal's electricity sector was split into three entities: Senelec, the national electricity company, the Agency for Rural Electrification (Agence Sénégalaise d'Electrification Rurale, ASER) and the Electricity Regulatory Board (Commission de Régulation au Secteur de l'Electricité, CRSE).

Like most other African countries Senegal has strongly increasing energy needs. Such needs come on top of an already existing energy deficit. In fact, Senegal's GDP growth has been hindered over recent years by frequent electricity outages causing a slowdown of the economic and manufacturing activities. According to local reports, outages have contributed to the closure of many small and medium-sized enterprises (SMEs) in the food processing, textile and tourism sectors. Larger companies are reporting declines in output averaging 30%. Moreover, electricity prices in Senegal are the highest of Africa.

These issues, along with relatively disappointing economic growth and as yet a lack of economically exploitable domestic fossil-fuel resources, mean current domestic power capacity stands at roughly 550MW for 15 million inhabitants, in addition to entitlement to a third of the 320MW generation capacity of the Manantali and Félou hydroelectric dams. (In comparison, the Netherlands has 28,000 MW and 17 million inhabitants.) Since late 2015, Senelec is no longer subsidized by the government due to low commodity prices, and its improved financial stability has boosted investor confidence in the sector.

To urgently meet the growing electricity demand, Senegal will turn to new coal and diesel generation. A 52MW diesel plant came online in mid-2016, followed by the 125 MW coal-fired Sendou power station is owned and operated by a consortium of companies headed by the Swedish operator Nykomb Synergetics in 2018. Other thermal stations, adapted to run on both diesel and gas once it becomes available will also be built in the next few years. Since 90% of Senegal's energy comes from imported heavy fuel, it is simultaneously committed to shifting from a diesel-based power generation to cheaper energy sources. In addition, Senegal has embarked on an aggressive effort to produce significant quantities of biofuels, initially to run electricity generation units, and has projects using sugarcane-based ethanol.

The country's generation capacity is forecast to reach 1.6GW in 2030 with an objective to move away from the dependence on heavy fuel and coal towards natural gas which has a much smaller carbon foot print. By 2025, Senegal is aiming to diversify its energy mix and respond to climate change by having renewable sources (excluding biomass) account for 15% of primary energy supply.

A consequence of a robust oil and gas sector involvement though carries the risk of compromising Senegal's commitments to the Paris climate agreement, under which it promised to reduce gas emissions by 21% by 2020. Renewable energy will therefore also play a substantial role in building a stronger energy sector. The first competitive tender for solar photovoltaic projects was launched in 2016 through the framework of the World Bank's 'Scaling Solar'

initiative. This has auctioned 100MW of solar capacity and the pre-qualification round closed in October 2016. The first two projects totalling 50MW were connected to the grid in early 2017. Furthermore, a 150MW wind project is also in the pipeline and will be built in stages from 2018 to 2020. If all goes well, some 465MW of solar and wind capacity will be built by 2020, according to Senelec.

Senegal's rural electrification program opens up the sector further to independent power producers, which can apply for a 20-year monopoly on generation, retail and distribution of electricity in Senegal's ten concession areas. Six of these concessions have already been allocated to companies including Electricité de France and Morocco's National Electricity Office (ONEE), and construction is underway in three. Furthermore, the market for small-scale solar home systems is also evolving in Senegal, with a number of foreign manufacturers selling products via distributors in the country.

The World Bank has included in its support program for the Senegalese government the development of an Energy Master Plan, providing for several scenarios of the optimal energy mix for Senegal.

5. Legal and regulatory framework

The policy framework for the oil and gas sector is set in the Energy Sector Development Policy Letter (LPDSE) adopted in October 2012, which has been integrated into the Emerging Senegal Plan. The LPDSE outlines ambitious objectives for improving the sector's performance in the medium to long term. Overall, the objective of the policy is to improve the reliability and affordability of access to modern electricity services in a sustainable manner by:

- (i) Ensuring energy security and increasing energy access for all;
- (ii) developing an energy mix combining thermal generation, bio-energy, and renewables and taking advantage of the opportunities flowing from regional interconnections to access low-cost hydropower;
- (iii) continuing and accelerating the liberalization of the energy sector by encouraging independent production and sector institutional reform;
- (iv) improving the competitiveness of the sector, to lower the cost of energy and reduce sector subsidies; and
- (v) strengthening sector regulation.

The LPDSE has four key objectives regarding the oil and gas sector, namely:

- (i) intensification of the promotion of the sedimentary basin;
- (ii) enhancement of the legal and regulatory framework;
- (iii) reinforcement of production capacities; and
- (iv) securitization of the capacities of storage conditions.

The current legal and fiscal framework for the upstream oil and gas sector is defined by the following laws:

- (i) Petroleum Code Law No. 98-05 of January 8, 1998;
- (ii) its Application Decree No. 98-810 of October 6, 1998; and
- (iii) Tax Law No. 2012-32 of December 31, 2012.

The Petroleum Code deals with upstream activities only (exploration and exploitation, including petroleum processing and transportation of production. The Code is relatively up-to-date,

concise (71 articles), and aligned with the main good practices for designing flexible petroleum laws in developing countries similar to Senegal when it was promulgated nearly two decades ago. The Code was specifically designed to make exploration and exploitation more attractive for international petroleum companies but also gave consideration to environmental issues.

The Petroleum Code empowers the Government to enter into upstream petroleum agreements of various types, including concession contracts and production sharing contracts (PSC), which was then a relatively new type of arrangement for the country and since 1998 has become the default scheme used for new upstream petroleum agreements in Senegal. The Code provides for petroleum operations to be performed directly by the state or in conjunction with third party investors either under a risk service contract or a production-sharing contract (PSC). The Ministry of Energy is the government agency responsible for implementing the upstream regime, but it is the state oil company Petrosen that enters into PSCs with the IOCs based on a model form production-sharing contract.

At the time, the existing regulatory framework for oil and gas in Senegal was drafted. Senegal was perceived as an oil province with uncertain prospectivity; attracting foreign investment thus was a primary objective. The recent exploration successes in Senegal, however, have put the suitability of the regulatory framework under scrutiny, both for the purpose of governance of the major scale investments to be made for development of the oil- and gas discoveries, as well as to accommodate the much-improved exploration appetite by the international petroleum industry.

According to information provided by the Petrosen, the 1998 Petroleum Code is currently under review to update tax provisions, strengthen the environmental provisions and add provisions concerning hiring local workers. This is consistent with the approach Senegal has taken in rewriting its Mining Code, which was enacted in November 2016. A further structural change may be an enhanced role for Petrosen in the oil- and gas licensing process.

Since the promulgation of the 1998 Code, around 20 Production Sharing Contracts have been signed, of which 14 were effective at the end of 2015. These are based on the model PSC issued by decree. The upstream petroleum fiscal regime is provided for in the Petroleum Code and the general tax legislation of Senegal, in particular the General Tax Code (CGI).

In early 2012 Senegal announced its intention to become a member of the Extractive Industries Transparency Initiative (EITI) and thereafter has taken a number of important steps to gain membership. In early 2013, it established a multi-stakeholder group to implement the principles and criteria necessary to comply with the requirements of the EITI. It has established a Parliamentary Network on Transparency to use EITI information and to provide input to Senegal's multi-stakeholder group deliberations. In September 2016, Prime Minister Mahammad Boun Abdallah Dionne announced the publication of 10 PSCs as part of the country's application for EITI candidature, whilst in October 2016, the 2014 Senegal EITI Report was issued.

Local content requirements are also expressly included in the Petroleum Code and must be reflected in Petroleum Contracts. The relevant undertakings relate to:

- Giving preference to local companies for construction, supply and services contracts, provided they offer equivalent conditions of quality, price, quantity and delay;
- Hiring priority skilled local employees; and
- Establishing an annual training programme for local employees.

These local content obligations apply to both contractors and sub-contractors.

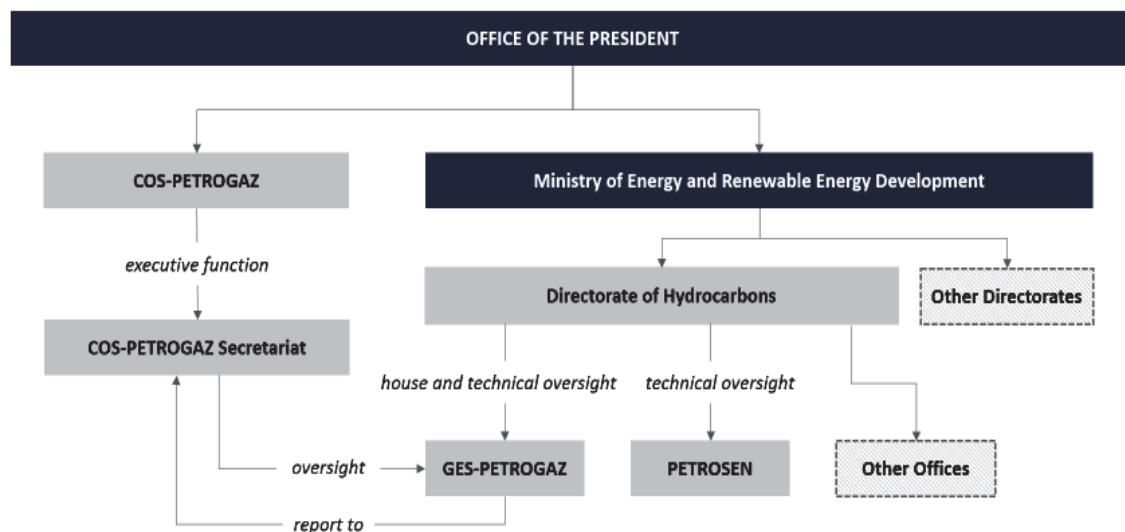
The positive signs that the Government of Senegal is committed to developing the legal and regulatory framework governing the oil and gas sector may help the country to make the most of the recent highly promising geological finds made in the region. Support is provided by a tailor-made World Bank programme.

6. Institutional framework

Late 2016 President Macky Sall announced a series of structural and institutional reforms for the oil and gas industry, including the establishment by Presidential decree of the Comité d’Orientation Stratégique du Pétrole et du Gaz (COS-Pétrogaz). COS-Pétrogaz is a policy steering committee and shall be dealt with below.

Until the creation of COS-Petrogaz in 2016, the Ministry of Energy and Development of Renewable Energy was the only entity responsible for the oil and gas sector. The upstream oil and gas arms of Ministry of Energy are the Directorate of Hydrocarbons (DH) and Petrosen, the National Oil Corporation of Senegal, which was created in May 1981 with a state participation of 99%. The Ministry of Energy ensures the implementation of the laws promulgated by the President of Senegal with respect to both onshore and offshore oil and gas exploration and production activities, hydrocarbon imports, exports, and marketing as well as crude oil refining, transportation, storage, and petroleum products distribution.

The current institutional roles and responsibilities in the upstream oil and gas sector are reflected in the following diagram:



President of the Republic

Under the Petroleum Code, the President’s role in the oil and gas sector consists in:

- Awarding and renewing exploration licenses or authorizations (by decree)
- Awarding temporary production authorizations (by decree)
- Awarding and renewing concessions or authorizations (by decree)
- Approving oil and gas exploration and production contracts, including PSCs (by decree).

The Ministry of Energy and Development of Renewable Energy

The Ministry is the supervising entity responsible for the implementation and monitoring of the Government's policy for the oil and gas sector. Based on the Petroleum Code, it is responsible for oil and gas sector operations and is tasked with the following mandate:

- a. Protecting certain areas of the country from oil and gas operations (by executive order);
- b. Awarding prospection authorizations (by executive order);
- c. Authorizing construction works for oil and gas transportation (by executive order);
- d. Opening up oil and gas exploration areas to competition;
- e. Accepting or refusing applications for petroleum exploration areas; and
- f. Signing petroleum agreements, including PSCs, following Ministry of Finance's recommendations of financial and fiscal terms.

PETROSEN

PETROSEN is a public limited company created in 1981 operating under the technical supervision of the Ministry of Energy. It is an instrument of Senegal's implementation of oil and gas policy. PETROSEN is active in the upstream, midstream, and downstream oil and gas sectors. In upstream oil and gas, its mission is to evaluate the country's hydrocarbon resources, promote the development of these resources by international oil companies, oversee petroleum development, and monitor contract compliance. PETROSEN is thus in charge of the preparation and negotiation of all petroleum conventions and PSCs, which are signed by Ministry of Energy and the petroleum companies. PETROSEN is entitled to a contributing participating interest in any exploitation project in a range of 10% up to the maximum rate stipulated in the conventions or PSCs (generally 20%). To that end, it is a signatory to all Joint Operating Agreements (JOA) entered into with the petroleum companies. In the downstream oil and gas sector, PETROSEN is a strategic stakeholder in the refinery process.

COS-PETROGAZ

In October 2016, the Government established by decree the COS-PETROGAZ to provide strategic guidance as well as define and oversee policies regarding hydrocarbon development. COS-PETROGAZ is embedded within the Office of the President of Senegal. Specifically its key roles and responsibilities include defining, monitoring, and verifying the implementation of the national oil and gas policy, implementing programmes for the development of hydrocarbon projects; approving local content, mobilizing funds and ensuring that good governance practices are followed.

COS-PETROGAZ has been effective since December 2016. It is headed by the President of Senegal, and includes key cabinet members, including Ministry of Energy. It is managed by a Secretariat created in November 2016 and composed of a Permanent Secretary and an Adjunct Secretary, who have already been appointed.

GES-PETROGAZ:

The October 2016 Decree also created a Project Implementation Unit (PIU), Unité d'Exécution et de Gestion (GES-PETROGAZ), housed in the Ministry of Energy. The latter takes charge of the day to day coordination and management of all technical assistance project activities in the oil and gas sector, as well as the implementation of all relevant decisions by the Ministry of Energy and COS-PETROGAZ.

Other Ministries and agencies involved in the oil and gas activities include the Ministry of Environment and Sustainable Development, Ministry of Fisheries and Maritime Economy, the

Ministry of Health and Social Action, the Attorney General, the Ministry of Justice, the Ministry of Economy, Finance and Planning, the Ministry of Agriculture and Rural Equipment, the Ministry of Industry and Mines, the Ministry of Infrastructure, Land Transport and the opening up, the Ministry of Higher Education and Research, the Ministry of Education, the Ministry of Commerce, Informal Sector, Consumption, Promotion of Local Products and SMEs, the Treasury and Senelec among others.

7. International treaties

Within the international community Senegal is a responsible member, being party to all major treaties regarding financial, legal, labour, Human Rights and environmental matters, including relevant treaties pertinent to the oil and gas sector. The treaties include:

- The Sustainable Development Goals (SDGs), the Senegalese Authorities organized a workshop to launch preparation of the national strategy for the prioritization and implementation of the SDGs, including SDG 7 on affordable and clean energy.
- Senegal's constitution (2001) affirms the country's support of and adherence to a number of key international human rights conventions and declarations, including the Universal Declaration of Human Rights (1948), United Nations (UN) Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW) (ratified 1985), the UN Convention on the Rights of the Child (ratified 1990), and the African Charter of Human and Peoples' Rights (1981).
- In addition, Senegal has ratified a number of central UN environmental conventions, including the UN Framework Convention on Climate Change (ratified 1994), the Convention on the Conservation of Migratory Species of Wild Animals (1988), the Convention on Biological Diversity (1995), the Ramsar Convention on Wetlands (1977), the UN Convention to Combat Desertification (1995) and the Convention on the Illegal Trade in Endangered Species of Wild Fauna and Flora (1977).
- Senegal also adheres to the Basel Convention for Controlling Transboundary Movements of Hazardous Wastes and Their Disposal (1993), the Stockholm Convention on Protecting Human Health and the Environment from Persistent Organic Pollutants (2004), & the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals & Pesticides in Int Trade '01.
- Senegal is a member state of the International Labour Organization, and has ratified all eight of the International Labour Organization's (ILO's) fundamental conventions: Freedom of Association and Protection of the Right to Organise Convention, Right to Organise and Collective Bargaining Convention, Forced Labour Convention, Abolition of Forced Labour Convention, Equal Remuneration Convention, Discrimination (Employment and Occupation).
- The Minimum Age Convention and the Worst Forms of Child Labour Convention. It has also ratified the International Convention on the Protection of the Rights of all Migrant Workers and Members of their Families (1999).
- Senegal submitted its application to become a Candidate Country of the Extractives Industry Transparency Initiative (EITI) in 2013. It published its first report (covering 2013) in October 2015, and with the submission of its next report in October 2016, hopes to become an EITI- Compliant Country.

- In addition to the above, Senegal is a member of the African Union (AU), the Economic Community of West African States (ECOWAS), the West African Economic and Monetary Union (WAEMU), and the Organization for the Harmonization of Business Law in Africa (OHBLA). Senegal's membership in these organizations commits the country to upholding relevant international policies on the extractive industries.
- The country is also signatory to the Cotonou Agreement, which provides reciprocal duty-free access to EU markets for African, Caribbean and Pacific country export.

8. Potential risks and attention points for resource-rich countries

The resource curse, also known as the paradox of plenty, refers to the failure of many resource-rich countries to benefit fully from their natural resource wealth, and for governments in these countries to respond effectively to public welfare needs. While one might expect to see better development outcomes after countries discover natural resources, resource-rich countries tend to have higher rates of conflict and authoritarianism, and lower rates of economic stability and economic growth, compared to their non-resource-rich neighbours. In fact, according to an analysis performed by the McKinsey Global Institute, almost 80% of resource-driven countries have below-average levels of per capita income. Studies have shown that low-income countries are more vulnerable to the so-called 'resource curse' challenges.³

Some of the potential risks resource-rich countries are prone to are highlighted in blue box 5; this now seems an area to take into consideration also for Senegal.

Blue Box 5

Potential risks for resource-rich countries include

- *Democracy and social problems: Governments are more responsive to their citizens and are more likely to transition to democracy when government spending is reliant on citizen taxation. When countries collect large revenues from natural resources, they are less dependent on levying taxes on citizens, and thus citizens feel less invested in the national budget. In addition, the point-source nature of the extractive industries often creates challenges when trying to balance the needs of people. It is recommended that civil society organisations (such as Oxfam Senegal) are included in the process. Furthermore special attention needs to be paid to tax base and tax collection*
- *Conflict: Natural resources can provoke and sustain internal conflicts as different groups fight for control of the resources. The volatile Casamance region may benefit from special attention.*
- *Inefficient spending and borrowing: The amount that governments collect in resource revenues can change drastically from year to year because of changes in commodities prices and production. Governments often get trapped in boom-bust cycles where they spend on legacy projects when revenues are rising and then must make painful cuts when revenues decline. Resource-rich governments have a tendency to over-spend on government salaries, inefficient fuel subsidies and large monuments and to underspend on health, education and other social services*
- *Patriarchy and gender-based challenges: Natural resource wealth seems to disproportionately impact women. It is recommended that women are included to a substantial degree in the capacity building programmes*
- *Limited government capture of benefits: In some cases, only a small share of the production value of the resource stays in the country. One explanation is that many fiscal regimes, rules about how to split the profits between companies and governments, fail to compensate the state and communities for depleting their resources and related environmental damage or loss of livelihood*
- *Weaker institutional development: it is argued that institutions are weaker in resource-rich countries because it is easy for elites to capture or take large sums of cash. Senegal has relatively strong democratic institutions, yet special attention needs to be paid considering the presence of strong elite and lobby groups in the country*

8.1 The Dutch Disease

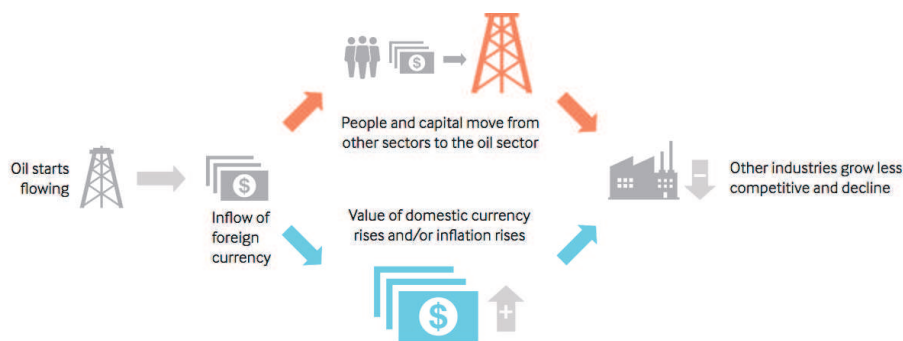
Oil and gas wealth is distinct from other types of wealth due to the large upfront investments, long production timeline, site-specific nature, scale, price and production volatility and non-renewable nature. Another leading cause how these special characteristics of natural resource revenues create additional challenges, includes the so called ‘Dutch disease’. The term was coined in 1977 by The Economist to describe the decline of the manufacturing sector in the Netherlands after the discovery of the large Groningen natural gas field in 1959.

The Dutch disease refers to the relationship between the increase in the economic development of a specific sector, like the petroleum sector and a decline in other sectors like the agriculture or manufacturing sector. A sudden large increase in natural resource revenues can hurt other important sectors of the national economy, particularly the manufacturing, or in the case of Senegal the agriculture sector, by causing inflation or exchange rate appreciation and shifting labour and capital from the non-petroleum sector to the petroleum sector; the impacts can be felt for decades.

These impacts can be mitigated if the country has the absorptive capacity to transform resource revenue inflows into tangible investments, such as agriculture, roads and electricity; the government uses resource revenues to make investments in the economy that generate non-petroleum resource sector growth; or alternatively, if the government would place a portion of its resource revenues in foreign assets.

This problem is the subject of one of the proposed projects, Section 3, Project 4- Avoiding the effects of the Dutch disease: Master plan for promoting investments in Senegal’s agricultural sector.

Figure 6 Dutch Disease



8.2 Local content

Industries in the extractives sector have always recruited and sourced goods and services locally. A typical example would be the hiring of drilling crews locally, where for a number of manual jobs, few qualifications are required beyond physical fitness and normal work discipline. However, in a world with increasing requests for local content and mounting external pressure to absorb further responsibilities for improved local social- and economic impact, governments and companies have begun to look for new approaches to local content.

If executed effectively, local content offers an opportunity for the extractive industry to meet business requirements by local sourcing and job creation while maximizing socio-economic impacts, incentivising growth and competitiveness of local businesses, stimulating wider regional development and increasing household incomes of local workers. Examples of supply opportunities are identified in the table below.

Sector	Supply opportunities	
General services	<ul style="list-style-type: none"> • Accommodation • Basic professional services (e.g. legal and accounting) • Catering • Cleaning and laundry services • Forestry and environmental services • Landscaping and gardening • Logistics and warehousing • Mailing and courier services • Personnel agencies • Pest control • Printing and photography • Security • Translation services • Transportation services 	
Construction and trades	<ul style="list-style-type: none"> • Air-conditioning maintenance • Carpeting and floor coverings • Civil works maintenance • Earthworks • Fencing and paving • Low-voltage electrical maintenance • Painting and corrosion protection • Road marking and signage • Roofing and waterproofing • Sewerage, stormwater and drainage • Simple mechanical maintenance • Small vehicle maintenance • Telecommunications and data systems • Waste recycling and management 	
Goods (wholesale, distribution, manufacture)	<ul style="list-style-type: none"> • Appliances and electrical goods • Automotive parts • Cleaning supplies • Construction supplies and hardware • Food supplies • Fuels, lubes and greases • Furniture and fixtures • Laundry equipment • Machined tools and spare parts • Office equipment and stationery • Small motor vehicles • Uniforms 	

A major dilemma to be faced though is the difference between project planning before a Final Investment Decision (FID) is made and actual project execution thereafter. Project planning documents may contain thousands of lines of action items and the timely delivery of quality equipment and materials on the critical path is of the highest priority for successful and timely project delivery. Critical path considerations and the overarching pressures to meet the project's overall deadline, more often than not, result in local content aspirations being pushed down the priority ladder after FID, in order to meet project deadlines of crucial importance.

Local businesses and, if applicable, their foreign joint venture partners, that have not adequately anticipated a positive FID, will face a situation where they cannot deliver timely the required goods and services, meeting the rigorous demands of the industry. On the other hand, the risk does exist that a positive FID is postponed as a consequence of which local companies and their joint venture partners, that did make investments in training and business processes, may see the anticipated return on investment being diluted. A very common scenario is that local businesses 'sit on the fence' awaiting the outcome of major investment decisions. This, however, must be considered the business risk of an entrepreneur. Conversely, if the entrepreneur is not ready with preparations, many opportunities will be missed in the early years of project execution, because the project train has left the station.

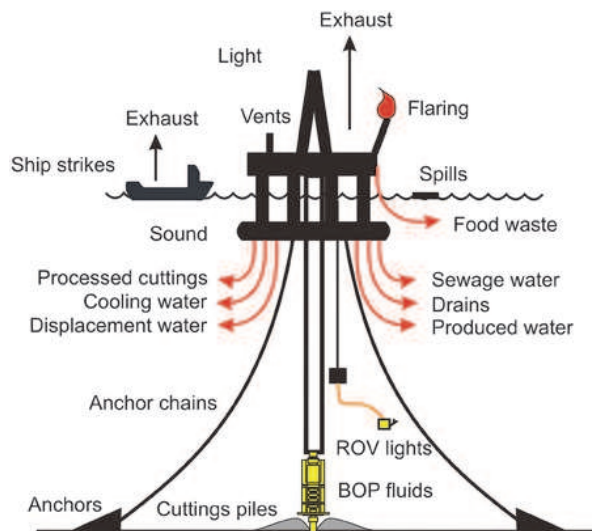
Considering the country's demographic structure and unemployment rates, increasingly rigorous local content requirements may be expected in the future. In anticipation of such developments, for the industry it is suggested that opportunities for direct and indirect services as defined and if targeting a long term presence may indeed best be pursued by joint venture arrangements with qualifying local enterprises, if only to be ahead of the pack and taking advantage of the currently existing, still relatively lenient regime. The effectiveness of these alliances can be boosted by focusing on the imperatives of relevant IOC procurement processes.

Local content is a complicated issue for authorities to tackle because it is complex and has a wide range of effects, but of major importance for a country like Senegal. Accordingly, in order to support the Senegalese authorities, this issue has been selected for one of the proposed projects: Section 3, Project 3 - Enhancing Senegal's local content policies.

8.3 Environmental risks

Exploration and exploitation of oil and gas resources could have positive economic implications, but also comes with considerable challenges throughout the life cycle. Environmental impacts arising from petroleum activities can be broadly grouped into two: (i) ecosystems, and (ii) human, socio-economic and cultural. Upstream (offshore) operations which result in environmental challenges include seismic acquisition, drilling and development activities as well as production and transportation activities. According to Petrosen, the 1998 Petroleum Code is currently under review to strengthen the environmental provisions in Senegal.

Figure 7 Environmental risks



Seismic acquisition can lead to acoustic emission whereas drilling operations require a large volume of fluids to circulate through the well at elevated temperatures with some potential of these fluid being discharged to the environment. Drilling discharge affects marine environment, including fishing activities which is the major occupation among the Senegalese coastal communities and can affect coastal areas.

Sources of emissions associated with oil development activities, can be grouped as follows (E&P Forum/UNEP, 1997): (i) Flaring, venting and purging of gases; (ii) Combustion processes from diesel engines and gas turbines; (iii) Fugitive gases from loading operations and losses from process equipment; (iv) Airborne particulate from burning sources, such as well testing and soil

disturbance during construction and vehicular traffic. The principal emissions accompanying flared gas contain toxic by products such as methane and benzene, and also generate carbon dioxide, carbon monoxide, volatile organic carbons, sulphur dioxide, nitrogen sulphide and nitrogen oxide. Some of these gases contribute to global warming, whereas sulphur gases and carbon dioxide contribute to the formation of acid rain, which is detrimental to soil.

Atmospheric emissions are the subject of concern to both industry and national governments due to its negative effect on climate. Discharges from oils and gas installations include produced water, process water, sewerage, sanitary and domestic wastes, and spills and leakages (E&P Forum/UNEP, 1997). These discharges arise from the drilling of exploration wells and, subsequently, the production of crude oil. The composition of produced water is potentially toxic to marine waters. Oil tankers, underwater pipelines, offshore oil drilling rigs and coastal storage facilities can accidentally release crude oil into the ocean, and a significant portion of the ecosystem, both offshore and onshore. Over the years, the petroleum industry has witnessed oil spills that have caused considerable ecological damage.

The Netherlands' embassy in Dakar has offered the Government of Senegal to organise a workshop in September 2017 on how Strategic Environmental Assessment may facilitate the sustainable development of Senegal's oil and gas sector. It is intended to help strategic planning and decision-making processes become more transparent and inclusive and shall take environmental-, social- and economic impacts into consideration.

9. Key support programmes

Through its Plan Senegal Emergence, Senegal yielded much trust within the international community. Many donor countries and multilateral organisations are supporting Senegal. An overview of the donors and respective programme themes can be viewed in Annex 1. Three donors are highlighted in this chapter, respectively the World Bank, the African Development Bank and the Netherlands.

9.1 The World Bank

The World Bank provides a \$29 million development aid credit to Senegal to strengthen the country's institutional capacities to negotiate complex agreements in the extractive industries. This technical assistance from the World Bank will help ensure Senegalese oil and gas development projects take place in an environment conducive to private sector investments aligned with the public interest.

Actively engaging with citizens throughout the process will also be critical to ensure inclusive development and promote transparency and accountability from both the government and the oil and gas industry. The proposed technical assistance will therefore strengthen the government's capacity to engage effectively with citizens and other key stakeholders on issues relevant to gas and oil development projects.

The World Bank program has five components:

A - Support to hydrocarbon project negotiations (USD 10 million)

- i. Develop optimal concepts for LNG development in Grand Tortue and Sangomar based on the government's growth strategy and operators objectives and constraints;
- ii. Delineation and estimation of the transnational gas resource area, which should be unitized, based on reservoir modeling;
- iii. Unitization Agreement articulating how the Government of Senegal, the Government

of Mauritania and the operators would jointly develop the cross-border resource in a sustainable way;

iv. Identification of financing structure and sources of funds for National Oil Company's (NOC's) share of oil and gas development.

B - Enhancement of the fiscal, legal, regulatory and policy framework (USD 2 million)

i. Appropriate strategic and legislative documents developed for government adoption as follows:

- Master plan for oil and gas development
- Oil and gas sector policy
- Petroleum accounting review
- Decree Law and midstream agreements for Tortue development and other supplemental legal and fiscal provision as needed

C - Capacity building to support hydrocarbon project negotiation and execution (USD 6 million)

- i. Enhanced capacity to implement the fiscal, economic, legal, regulatory and policy framework governing future oil and gas sector developments
- ii. Direct project beneficiaries trained including females

D - Information / communications campaign to engage citizens (USD 1 million)

- i. Increased capacity for stakeholder and citizens' engagement in the petroleum sector
- ii. Fragility assessment developed
- iii. Communication strategy developed
- iv. Strategic Environmental and Social Assessment developed
- v. Direct project beneficiaries trained including females

9.2 The African Development Bank

The African Development Bank (AfDB) has several significant programmes in Senegal as well. While renewable energy will be prioritized by the AfDB, fossil fuels will remain an important part of the overall energy mix, as is the case with several developed economies, with the AfDB financing state of the art technology to minimize emissions.

The overall objective of the Senegal Country Strategy Paper (2016-2020) is to contribute to the achievement of inclusive, green and sustainable growth whose spin off effects will benefit all segments of Senegalese society. The following two pillars were carefully selected:

Pillar 1: Support to agricultural transformation; and

Pillar 2: Strengthening of production and competitiveness support infrastructure (energy and transport).

The AfDB has launched a New Deal which on Energy for the whole of Africa, which is built on five inter-related and mutually reinforcing principles:

- (i) raising aspirations to solve Africa's energy challenges;
- (ii) establishing a Transformative Partnership on Energy for Africa
- (iii) mobilizing domestic and international capital for innovative financing in Africa's energy sector;
- (iv) supporting African governments in strengthening their energy policy, regulation and sector governance; and
- (v) increasing AfDB's investments in energy and climate financing.

The AfDB's energy strategy, central to implementing the New Deal, focuses on seven areas, which are:

- (i) setting up an enabling policy environment,
- (ii) transforming utility companies for success,
- (iii) dramatically increasing the number of bankable energy projects,
- (iv) increasing the funding pool to deliver new projects,
- (v) supporting ‘bottom of the pyramid’ energy access programs, particularly for women,
- (vi) accelerating major regional projects to drive integration and
- (vii) rolling out waves of country-wide energy ‘transformations’.

The AfDB will implement these priorities through a series of flagship programs such as Independent Power Producer procurement, power utility transformation, an early stage project support facility and related catalytic programs, mobile payment initiatives, and a regional project acceleration program. For instance, the AfDB approved loans for the Kounoune Power Station and the Sendou power plant besides several private infrastructure projects such as the Expansion of the Dakar container terminal, the Dakar-Diamniadio toll highway and the new Blaise Diagne International Airport.

9.3 Support from the Netherlands

Senegal was a development cooperation partner of the Netherlands’ until mid-2011, but this relationship was phased out in 2015. Currently the focal point of relations is economic development. Senegal will still be able to rely on private sector instruments, such as

- the Infrastructure Development Facility: work is currently under way on a number of projects in Senegal, aimed at sustainable water management (Senegal River Basin Authority, Casamance River) and sustainable electricity generation in rural areas;
- the Private Sector Investment programme;
- the Matchmaking Facility.

In past decades the development relationship with Senegal focused on the environment. Between 2012 and 2014, the Netherlands has provided support to the Ministry of Environment and to various environmental NGOs, such as the local bodies of the International Union for the Conservation of Nature (IUCN), the World Wide Fund for Nature (WWF), Wetlands International and the African NGO Environment and Development Action in the Third World. Dutch efforts in this area were transferred to the European Union.

The Dutch Embassy has been actively involved in sponsoring multiple activities, including a study for the identification of agricultural opportunities, doing business in Senegal, the drafting of a national port master plan, which fits the overarching program “Emerging Senegal” and is based on development of primary and secondary ports, as well as a short-sea shipping opportunity (cabotage) study and last, but not least, this very study to identify business opportunities in the petroleum sector, as well as the identification of potential government projects for the support of sustainable development of Senegal’s oil and gas sector.

Through the West African Regional Marine and Conservation Programme, the Netherlands has indirectly contributed to the sustainable management of ecosystems (for instance fish stocks) off the coast of Senegal. Furthermore, through the Senegal River Basin Authority (OMVS), the Netherlands has contributed to the management of the cross-border Senegal river. The states that shore this river depend on it for electricity, drinking water and irrigation. The OMVS is engaged in water management, aquatic weed control, water quality monitoring and river transport development together with the Rivierenland water authority, the Port of Rotterdam and Rijkswaterstaat.

To mitigate the potential environmental effects of the petroleum sector, the Netherlands’

embassy, on behalf of the Netherlands Commission for Environmental Assessment (MER), have offered to the Government of Senegal to organise a workshop in September 2017 to discuss how Strategic Environmental Assessment may facilitate the sustainable development Senegal's oil and gas sector. The Strategic Environmental Assessment aims to help strategic planning and decision-making processes become more transparent and inclusive. It is intended to take all impacts on sustainable development into consideration, environmental-, social- and economic. To that end, it is envisaged that all relevant stakeholders will be invited for the workshop and an assessment of environmental programmes will be developed on the basis of the workshop results.

10. Synthesis and follow up

The key conclusions derived from the above analysis are summarised in the two tables below, which also address programmes addressing the issues concerned, including programs proposed in section 3 of this report.

No	Key strengths
1	Geographically favourable location
2	Stable democracy
3	A president with a highly pertinent professional background
4	Well elaborated strategy for the middle- and long term (Emerging Plan Senegal)
5	COS-Petrogas: a competent petroleum sector trouble shooting organisation
6	A comprehensive body of international treaties
7	Member of the Extractives International Transparency Initiative (EITI)

no	10 key weaknesses & attention points	Programmes
1	A petroleum strategy as yet lacking	Included in WorldBank programme
2	Inadequate power generation and grid/availability	Included in African Development Bank and GIZ/PERACOD programme
3	Deficient infrastructure	Included in African Development Bank programme
4	Poor business environment/little manufacturing	Included in PSE programme
5	Low overall productivity, especially in agriculture	Included in PSE programme and section 3 project 2 and 3
6	Lack of capacity/ poor education system and local content	Included in PSE and EU programme and section 3, project 1, 3 and 5
7	Low human development index / local content	Included in World Bank programme and section 3 project 5
8	Inadequate tax base and collection	Included in World Bank programme
9	Potential social unrest Casamance	Included in PSE, AfDB, EU programme
10	Mitigation environmental effects and climate change	Included in EU programme (MER and NL opportunity), section 3 project 6 ⁴

⁴ Environmental projects not included in view of the MER workshop where project assessments shall be made.

Section 2 - Business opportunities for Dutch enterprises

In this section the business opportunities available in Senegal as these may be identified are reviewed. The following sectors may be distinguished,

- 1 - Upstream
- 2 - Electricity
- 3 - Renewables
- 4 - Maritime
- 5 - Agriculture and fertilizer

The section shall be followed with a listing of sources where further information may be obtained.

1. Upstream

The recent discoveries seem to be heading towards commerciality and therefore the development of oil projects in Senegal is likely, although this still has to be confirmed by final investment decisions. An LNG export project would be conditional for offshore gas development to happen.

Several specific economic developments in the energy sector, maritime- and agricultural sector (the latter also as a consequence of the energy sector) present opportunities for Dutch companies, including by cooperation with Senegalese companies and governmental actors.

An aggregation of possible related business activities likely to be generated if an offshore oil and/or LNG export project would be developed, include the following key industrial sectors:

- Civil works and dredging
- Drilling-and drilling related services
- Engineering and consultancy services
- Fabrication, construction & modification
- Health, safety, environment and QA/QC services
- Inspection, maintenance & repair, hook up & commissioning services
- Materials and equipment suppliers/manufacturers
- Personnel services, training & education
- Pipeline & offshore installation activities
- Research & development activities

These opportunities are generally well known by the companies and their branch organisations concerned.

In the matrix below the various service activities necessary during the various phases of the petroleum life cycle are shown, providing potential future business opportunities in Senegal.

Services	Exploration	Development	Production	Oil & Gas Treatment & LNG	Transport & Storage	Refining	Petrochem.	Primary Distribution
Geophysical Services	Acquisition of Seismic Data, Data Processing, Imaging of Reservoirs, Management of Data							
Drilling Services	Land Contract Drilling, Offshore Contract Drilling, Directional Services, Mud Logging							
Reservoir Services	Logging While-Drilling (LWD) , Wireline Logging, Production Testing Services							
Well Services	Coil Tubing Services, Well Servicing , Rental & Fishing Services							
Downhole Pumping	Downhole Pumping Services							
Completion Services	Casing & Tubing Services , Coating and Piping, Completion Services							
Engineering & EPC				Engineering, Procurement, Construction and Construction Management		Technology Licensors		
Erection & Trade Works				Upstream Erection & Civil Works	Erection & Civil Works (Pipelines, Depots, Jetties &Terminals)		Erection & Civil Works (Refineries and Processing Plants)	
O&M Services				Facilities O&M, Maintenance, Ship & Rig Maintenance, Dry-Docking				
Logistics	Aviation, Land Transportation Services, Operations Support Vessels, Heavy Goods Transport, Catering							
Utilities	Fuel, Steam, Power, Water Supply and Treatment, Industrial Gases							
Other Services	Auditing and Certification, inspection, Surveying, Hot-Tapping & Freezing, HSE Services, Consulting			Inspection, Vetting, Piggling				

Source: World Bank data.

Source: World Bank data.

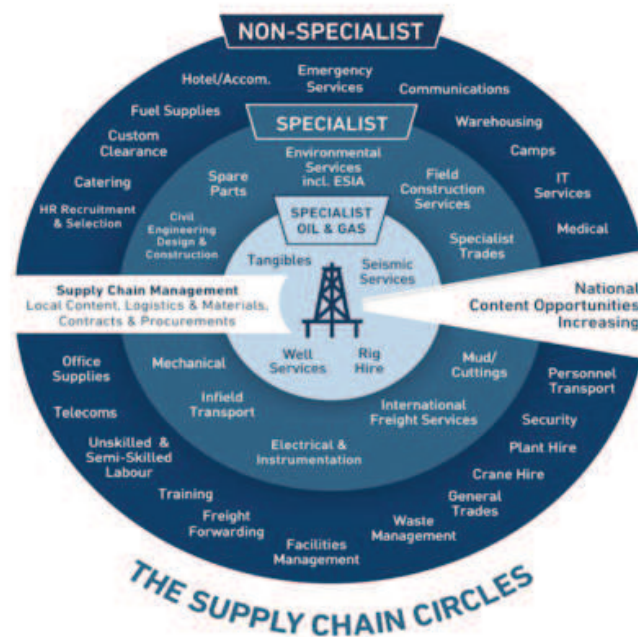
A similar matrix table representing goods which may be required over the life cycle is as follows:

Goods	Exploration	Development	Production	Oil & Gas Treatment & LNG	Transport & Storage	Refining	Petrochem.	Primary Distribution
Subsea Equipment	Wellheads , Sub-surface Safety Valves, Compressors, Meters, Separators, Risers, Umbilicals							
Downhole Equipment	Casing Hardware, Completion Equipment , Drilling tools, Wireline Logging Tools, Perforating Systems							
Tubular Goods	Drill Pipe, Casing, Tubing, Manifolds							
Rigs, Platforms & FPSOs	Land Rigs, Offshore Fabrication, Vessel Conversions, Rig Equipment, Unit Manufacturing			Steel Structures, Production Topsides		Steel Structures		
Rotating Equipment				Compressors, Blowers, Turbines & Pumps				
Static Equipment				Surface Equipment, Columns & Exchangers	Transport Pipes, Tanks	Columns & Exchanges (e.g. Reactors, Vessels)		
Pipes, Valves & Fittings				Pipes, Valves & Fittings				
Electrical Equipment				Transformers & Switchboards, Drive Motors, Cables				
Instrumentation & Control	Sub-surface Sensors, Surface Production Monitoring (e.g., Separators, Multi-phase Flowmeters)			Control Systems & Valves, Instruments & Analysers				
Fluids & Chemicals	Drilling & Completion Fluids, Upstream Specialty Chemicals			Catalysts & Additives				
Other Materials	Corrosion protection, Insulation, Coating & Painting							

Source: World Bank data.

Figure 8 Supply chain circles

When considering the service from the perspective of the supply chain to be covered during the production cycle, these may be sub-divided with decreasing stringency in expertise, as follows: (i) core exploration and & production technical (E&P), or 'specialist services' (ii) 'direct services' and (iii) 'indirect services', as detailed in the diagram below.



A tendency exists to equate the petroleum industry exclusively with activities represented in the innermost circle of core E&P technical, or 'specialist services', possibly because in this area contracts with the highest value will be awarded. Typically, seismic- and drilling contracts fall in this category, as well as major Engineering, Procurement and Commissioning (EPC) contracts. Contracts would normally have a minimum value of tens of millions of dollars and the value of major EPC contracts may be in the hundreds of millions. As a consequence, policy makers tend to focus excessively on these areas, but such contracts, represent a wide range of high risk activities, requiring advanced levels of expertise. Only a very small group of international highly specialised contracting companies will be able to compete for these contracts. Whilst local companies are by and large unaware of the technical requirements and should recognise that these services are beyond the realm of their expertise, such Core Technical Services may offer a very limited number of opportunities for only a few specialized Dutch companies, such as Fugro.

In view of the foregoing 'direct services' and 'indirect services' are accessible to a wider circle of competing companies, be it local or international. These services are generally technically less complex and may for certain services sometimes also be consumed in other sectors of the economy. Therefore, these services maybe considered most suitable for partnerships. Moreover, if these represent goods and services which are also consumed in other sectors, this may represent a useful starting point for joint venture companies to contribute their experience with the rigorous demands and standards of the petroleum industry and subsequently expanding in other sectors of the economy. In Annex 2 some additional business opportunities are listed.

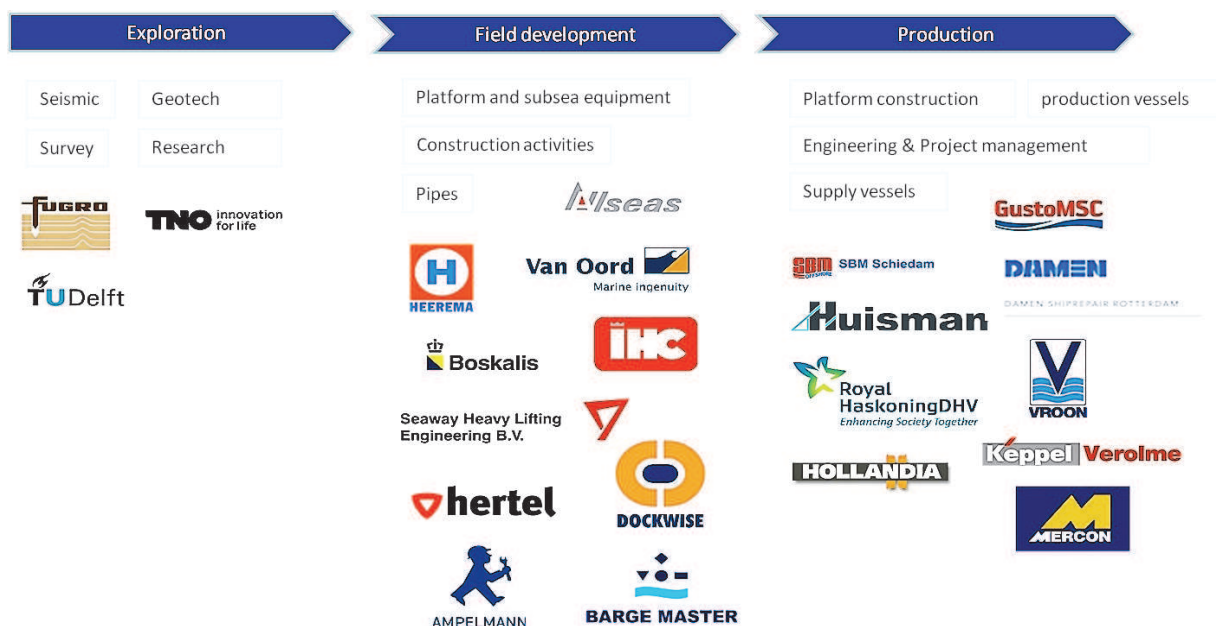
Some core or specialist services, such as pipeline- and infrastructure construction, have a potential for co-development locally. Dutch companies may identify opportunities, in particular in activities where there are serious concerns regarding local ability to meet international standards, such as those of the American Petroleum Institute or Oil and Gas Contractors. Realistically speaking, opportunities for Dutch businesses will fall in the following categories:

Front-end engineering
Detailed engineering and design
Project management services
Pipeline technology

Dutch companies may also be able to identify opportunities for direct or sub-contracting in the area of direct services:

Project Cargo;	Engineering and Environmental Consulting
Site Preparation	Construction & Installation
Heavy Haul/ Heavy Lift	Piping
Waste Water Systems and RO	Electrical & Instrumentation work
Hazardous Waste Disposal/Treatment	Mechanical and civil work
QA/QC	Access/Scaffolding
Coating & Insulation,	Blasting
Fireproofing	Inspection services
HVAC	Mud/Cuttings
Health & Medical Support;	Procurement of Materials and Equipment

The (non-exhaustive) table below depicts current Dutch industry participants in the oil and gas supply chain.



Cost-pressures will typically drive a demand for the following indirect services to be sourced locally and may offer opportunities for Dutch companies particularly by contributing in joint venture partnership focused on supplier development:

IT services	Waste Management
Telecoms	Freight Forwarding
HR / Training (HSE /Technical)	Custom Clearance
Camps / accommodation	Food processing and marketing
Security technology	Agriculture and horticulture
Facility Management	Flood protection water management

The consultants analysed further downstream industries that may emerge on the back of the expected hydrocarbon boom in order to ascertain to what extent these would potentially offer viable business opportunities for the Dutch industry: the electricity-, renewable energy -, maritime -, agriculture - and fertiliser sector.

2. Electricity sector

Senegal's GDP growth has been hindered over recent years by frequent electricity outages causing a slowdown of the economic and manufacturing activities. With high energy costs constraining economic growth and competitiveness, Senegal has developed plans to expand power production from 500 MW to 1500 MW while diversifying energy sources to cheaper sources including coal, gas and renewable sources. Senegal has ambitious plans to increase energy access. Potential business opportunities for Dutch companies therefore include power generation systems and equipment, such as gas turbines.

In the late 1990s Senegal became one of the first countries in Sub-Saharan Africa to introduce private sector participation in the electricity industry. The first independent power producer (IPP) was General Electric/GTi, operating a 52 MW combined cycle oil-fired power plant. IPPs face numerous challenges such as variations in the quality of fuel delivered, grid instability and other technical difficulties which have reduced output from their plants. The Senegalese government remains committed to relying on private-sector investment to close the shortfall in supply.

Senegal is committed to shifting from a diesel-based power generation to cheaper energy sources. Senegal has thus put an option on the coal technology. The 125 MW coal-fired Sendou power station is owned and operated by a consortium of companies headed by the Swedish operator Nykomb Synergetics. The project was co-financed by the FMO from the Netherlands.

3. Renewable energy sector

Potential for renewable energy generation in Senegal

Resources	Sites	Potential
Biomass	Tambacounda Kolda, Ziguinchor	331.3 million m ⁵
Hydro	Senegal and Gambia rivers	1 400 MW
Solar	Countrywide	1 800 kWh/m ² /year, Direct Normal Irradiation 2 000 kWh/m ² /year, Global Horizontal Irradiation
Wind	Great coast areas	4- 6 m/s

Senegal has strong potential for renewable energy generation, most of it untapped. Hydropower has been partly exploited and solar PV has been used in new mini-grids and to retrofit existing ones. Wind has good potential and biomass is abundant owing to the amount of organic waste produced by the agricultural sector.

in parts of the country. Biomass resources, such as agricultural waste (approximately 3.3 million dry tonnes of agricultural residues) and agribusiness by-products (rice husks, bagasse, peanut shells, cotton stalks, etc.) have potential uses in on-grid and off-grid electricity generation. The estimated generating potential is 2,900 Gwh.

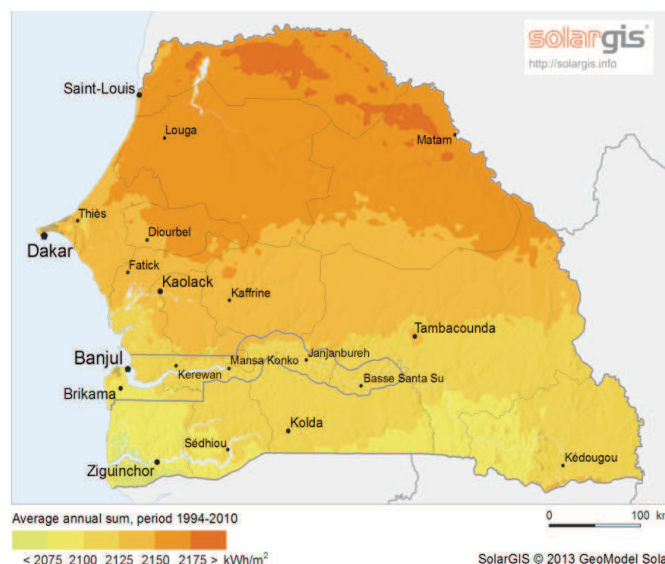
Furthermore, Senegal has embarked on an aggressive effort to produce significant quantities of biofuels, initially to run electricity generation units, and has projects using sugarcane-based ethanol.

Hydro

The Senegal River has significant hydroelectric potential which is estimated at 1,200 MW. Senegal's total potential for large hydro on the Senegal and Gambia rivers is put at around 1,400 MW of which there is currently only 260MW is exploited with the Manantali plant that benefits several countries.

Solar

The country has significant solar energy resources. Solar irradiation is above 2,000 kWh/m²/year for Global Horizontal Irradiation across most of the country, with the average global daily irradiation calculated at 5,43 kWh /m²/day which gives excellent prospects for photovoltaic projects as well as for the use of solar thermal technologies. The falling prices of PV panels and system components make solar an attractive solution, particularly if the costs of the alternatives – imported oil products – are high. There are no official data on the capacity of installed PV systems. Since purchasing power is relatively low, PV systems are only rarely bought by private individuals. The market opportunities will depend on the creation and expansion of national and international promotion programmes.



Wind

There is good wind energy potential along Senegal's Northern coastline between Dakar and Saint Louis. In a study carried out by the Senegal Meteorological Service, wind velocities of 5.7-6.1m/s were observed in the 50km coastal strip between the two cities. So far, this resource has not been exploited and more data needs to be collected. According to certain estimates wind power could account for as much as 70% of Senegal's renewable energy generation capacity.

Policies

An overview of key applicable policies is provided below.⁵

Title	Year	Policy Type	Policy Target
Renewable Energy Law	2010 (December)	Regulatory Instruments, Regulatory Instruments>Codes and standards>Sectoral standards, Policy Support	Multiple RE Sources, Multiple RE Sources>Power, Multiple RE Sources>All
Senegalese National Biogas Programme Phase I	2009	Economic Instruments>Direct investment>Infrastructure investments, Economic Instruments>Fiscal/financial incentives>Grants and subsidies, Policy Support>Institutional creation	Bioenergy>Biomass for power, Bioenergy>Biomass for heat
2007-2012 Special Programme for Biofuels	2007	Economic Instruments>Direct investment>Infrastructure investments, Policy Support>Institutional creation	Bioenergy>Biomass for power, Bioenergy, Bioenergy>Biofuels for transport

4. Maritime Sector

The map below clearly demonstrates that Dakar is strategically located and currently represents a most important commercial gateway for the greater West African region. In fact, so far the maritime sector has been the driving force behind the PSE. Yet, a number of developments require Senegal to continue to develop its capacity and potential. Such developments include:

- the opening of the new Panama Canal, which will change the overall routing of container movements,
- competition for the new deepwater terminal in the Port of Lomé,
- construction of the West African transport corridors towards sub-Saharan Africa.

⁵ Source: 2016 Organisation for Economic Co-operation and Development/International Energy Agency (www.iea.org) and International Renewable Energy Agency (www.irena.org), IRENA



A priority for the country was the drafting of a Port Master Plan at the national level which was sponsored by the Netherlands' embassy in Dakar. The plan fits the overarching "Emerging Senegal" program and is based on the development of ports, including by:

- Expanding the most important port facilities in the greater Dakar region, the 'Port de Future' outside the congested metropolis of Dakar, in the direction of Bargny near the industrial zone and the new airport.
- Improvement and development of secondary ports in Saint Louis, Kaolack and Ziguinchor,
- Ensuring adequate access by roads, railway lines and waterways, including river dredging and river ports
- Short-sea shipping opportunity cabotage trade between Dakar and Cabo Verde.⁶

5. Agriculture & fertilizers

More than 70% of the population is dependent on agricultural production for subsistence. At the same time, a large part of food products is imported and a lot of the production does not reach the market due to logistic barriers. Peanuts, sugarcane, and cotton are important cash crops, and a wide variety of fruits and vegetables are grown for local and export markets.

It is important to invest in and develop other sectors of the economy to avoid the effects caused by the Dutch Disease; in Senegal the agricultural sector considering its importance for the country and its population.⁷ In the Netherlands there is much expertise and technology on conservation, certification, transport of agricultural products, that the Dutch private sector could export to Senegal.

Furthermore, key commercial opportunities can be identified in the agricultural sector, including: agricultural/ farming equipment, expanded irrigation systems, post-harvest handling systems, storage and silo facilities.

⁶ For more information see Business Opportunities: Maritime Sector Royal HasKoning DHV <https://nabc.nl/uploads/content/files/Business%20Opportunities%20Maritime%20-%20Royal%20Haskoning%20for%20Senegal.pdf>

⁷ See paragraph 8.1 and section 3 project 4

A market study has been performed for the Netherlands' embassy, which provides detailed insights of the present opportunities for Dutch companies, knowledge institutes and governmental actors.⁸ There is potential for the Embassy to support the sector by supporting companies to produce for the local and international market, promoting private investment in logistical services and quality in Senegal (conservation, certification, transport), and supporting Senegalese companies to (prepare) to export to the Netherlands, Europe and West Africa, facilitating the modernization of the agricultural sector and facilitating business contacts.

Another development which could be expected as a result of the emerging gas-industry is the construction of a fertilizer plant. Such a plant might give a boost to the country's agricultural production, since currently - rather paradoxically- all fertilizer used in country has to be imported. Accordingly, a project has been included in Section 3, "Project 2 - Long term value optimization of fertilizer income for Senegal".

6. Netherlands branch organisations

The following organisations may be approached by Dutch enterprises potentially interested in opportunities in Senegal's energy- and other sectors, identified in this survey.

- 1) *IRO*, the Association of Dutch Suppliers in the Oil and Gas Industry and Offshore Renewable Industry has a *member-list which can be made available* by Mr Tjerk Suurenbroek from the IRO at Boompjes 40, 3011 XB Rotterdam, The Netherlands.
- 2) *FME* is the Dutch employers' organisation in the technology industry. It has 2,200 affiliated companies active in the fields of manufacturing, trade automation and maintenance in the metal, electronics, electrical engineering and plastics sectors. In aggregate, its members account for one-sixth of all Dutch exports. FME has 60 affiliated trade associations. Every two years, FME issues an Energy Guide that includes profiles from Dutch suppliers in the oil and gas sector and suppliers in the sustainable energy sector. FME's Energy Cluster convenes technology companies, knowledge institutions, clients and financiers and helps technology companies from various sub-sectors identify and seize opportunities. Its *Energy Guide is available online*, but guides are also taken on missions and international exchanges and are distributed under Dutch embassies abroad.
- 3) *DGTA*, the Dutch Gas Turbine Association is the sector association for the gas turbine industry in the Netherlands. The aim is to strengthen the technological, commercial and labour market position of this industry.
- 4) *NABC*, the Netherlands-African Business Council is an organisation with over 300 Dutch companies. The NABC promotes commerce in Africa by providing Dutch companies with the tools they need to succeed in the various regions and markets across the continent. A selection of companies from relevant categories from the NABC membership list can be requested at NABC.

⁸<https://www.rvo.nl/sites/default/files/2017/01/Studie%20Agrarische%20Sector%20Senegal%20LED15DAK01.pdf>

Section 3 Government-to-Government project proposals

In this section 3 [shortened for publication purposes] six project proposals are presented [for Dutch-Senegalese cooperation]. The projects are based on the analyses provided in this report as well as the preferences expressed by Senegalese authorities. Also, the projects concerned are intended to be complementary to those of other donor countries and multilateral organisations.⁹ Finally, the projects are aligned with the Dutch institutions- and industry expertise and niche competencies.

Selection of the projects followed sequential steps as follows: initially a long-list was prepared by the consultant on the basis of suggestions contained in the project terms of reference, desktop research and information provided by Senegalese authorities, which was then discussed with the Netherlands' embassy in Dakar. The short-list resulting from the discussion at the embassy was subsequently reviewed and discussed by the consultant with several representatives of Senegalese authorities, including of Petrosen and the Economic, Social and Environmental Council in order to establish prioritized preferences by the authorities, which were then integrated in the list and reviewed with the ambassador and his staff. In the discussion at the Conseil Economique, Social et Environmental, it transpired that the issue regarding avoidance of "the Dutch disease" appears to be of interest to President Macky Sall.

At the time of initiation of this project, a particular project for facilitation of the sustainable development of Senegal's oil- and gas sector had been initiated. The Netherlands Commission for Environmental Assessment (MER) organizes a high level workshop to discuss how Strategic Environmental Assessment may be implemented in Senegal; the workshop is due to be held in September 2017. The MER-project and its workshop outcome to be anticipated was the reason not to include any projects specifically addressing environmental issues.

Otherwise, the selection of the project proposals is characterised by an open-ended approach for pertinent subjects. Whilst the oil- and gas sector is very important indeed, it is only a component of the country's larger national socio-economic configuration. The sector can generate highly positive-, but also strongly destabilising effects on the national economy. In addition to typical oil- and gas related issues, it would therefore seem worthwhile to also anticipate such potential negative socio- economic effects with a view to mitigating these. The agriculture- and fertiliser sectors are of eminent importance for Senegal's economy; around 70% of the population is dependent on agriculture and phosphor mining contributes substantially to the country's export. Since natural gas can also serve as a feedstock for the fertiliser industry, such aspects have been integrated in the project proposals.

The proposed projects are the following:

- 1- Subsurface geo-data management and capacity building;
- 2- Long term value optimization of fertilizer income for Senegal;
- 3- Enhancing Senegal's local content policies;
- 4- Avoiding the effects of the Dutch disease: master plan for promoting investments in the Senegal agricultural sector;
- 5- Partnering in education;
- 6- Introduction of small scale LNG as fuel for the transport sector and as energy source for power generation and local industry in Senegal.

⁹ See annex 1

If some form of priority had to be introduced, the projects may be sub-divided in three categories in order of urgency, as follows: (i) projects 1, 2 and 3; (ii) projects 4 and 5; and (iii) project 6. Finally, a further project may be added as follows: donors have made the assessment that the Senegalese government should increase with vigilance efforts to pursue more equitable and efficient tax revenue collection, whereas tax expenditures should be significantly reduced. Reforms should ensure that everyone pays their fair share of taxes in a transparent system, making it possible to raise more revenue, whilst removing tax disincentives facing SMEs and FDI in globally competitive activities. In view of this assessment, an additional purely Government-to-Government support project of considerable importance may be added: the “tax & revenue collection project”, identified in the original long list referred to above. Petrosen confirmed the importance of this issue regarding the petroleum sector.

Project 1 Subsurface data management capacity building

Project title	Subsurface Data Management Capacity Building
Problem Statement	<p>Systematic access to subsurface data is of major importance in assisting Senegal’s Ministry of Energy and Renewable Energy Development (MEDER) and the Société Nationale des Pétroles du Sénégal (Petrosen), when it comes to managing the country’s assets and helping to attract exploration and development activities. The data, partly acquired through costly seismic surveys, is used for modeling and interpreting the subsurface allowing for defining resource locations and estimating size.</p> <p>Such knowledge provides the government of Senegal and the industry stakeholders with vital information for future investment, sector planning, and risk reduction. Analysing and interpreting the data can lead to new resource discoveries and improve the chances of investment for the development of fields.</p> <p>In their joint role as the country’s regulator for the O&G industry, Petrosen and MEDER require operators to provide data for analysis and interpretation in order to make sound resource assessments and actively promote exploration. Lack of efficient subsurface data management can hinder the (re-)use of this data and so hamper further exploration efforts and the efficient development of resources.</p> <p>Petrosen has requested assistance in building additional capacity to design, build and maintain an efficient data management system.</p>
Project Objectives	<ul style="list-style-type: none"> • Support Senegal’s regulatory function (Petrosen and MEDER) with subsurface data storage and management for effective use for analysis and interpretation • Provide a purpose-built data management system, in consultation and collaboration with Petrosen and MEDER, training relevant staff ineffective data management procedures • Establish a strong working relationship between experts concerned and the Senegalese government institutions in view of future investment opportunities for the Dutch private sector

Project 2 Long term value optimization of fertilizer income for Senegal

Project Title	Long term value optimization of fertilizer income for Senegal
Problem Statement	<p>Senegal disposes of two types of raw materials for fertilizer production. As planned up to today these raw materials (phosphate rock, and natural gas) are/will be gained from the subsoil, and shipped abroad for sales. Little value is added into this processes.</p> <p>Alternative to the processing, shipping and sales of LNG, could be the transformation of the natural gas into</p> <ul style="list-style-type: none"> - ammonia and from there into urea, and or - methanol <p>given the current perspective of an overcapacity of LNG for the coming 5 – 7 years, it is estimated that the margin obtained per energy unit (\$/MMBTU) sold in the form of ammonia, urea and of methanol will <u>be some 4 – 6 times higher, than the margin per energy unit to be made on LNG.</u></p> <p>Senegal produces currently some 800 kt rock phosphate per year. Up till 1998 there existed a phosphoric acid production as well as a complex fertilizer production. The latter ceased production and in the early 2000's a new phosphoric-acid/sulphuric acid plant was set up. The cadmium content of phosphate rock in Senegal is rather high. Given the desire to reduce the Cadmium (and other heavy metals) over the agriculture fields, this item will be an essential condition in the future for phosphate rock producers.</p> <p>Depending which study one reads, there seem to be a common understanding of a peak phosphorus production anywhere between 2034 and 2075. Contrary to oil there is no replacement for the element phosphorus in the agriculture. Thus the strategic question can be raised, whether to stimulate rock phosphate production on the short term or to slow down production until times of world scarcity, in the meantime producing fertiliser on the basis of natural gas.</p>
Project Objectives	<p>The project as proposed may:</p> <ul style="list-style-type: none"> • offer an indication of additional value to be created with the construction and operation of a complete nitrogen phosphorus and potassium fertilizer production site • A stimulate a re-evaluation of Senegal's fertilizer policy • Establish a strong working relationship between experts concerned and the Senegalese government institutions

Project 3 Enhancing Senegal's local content policies

Project Title	Enhancing Senegal's local content policies
Problem Statement	Benefitting from Senegal's nascent oil and gas sector

	<p>Senegal is set to become West Africa's next energy producer with offshore discoveries of 25-50tn cubic feet of gas reserves on the border with Mauritania and oil discoveries of over projected reserves of 473m barrels.</p> <p>Now that these world-scale discoveries have been made, operators are working on finalizing the appraisal of the oil and gas resources and defining the project development concepts, as required before they can make a Final Investment Decision (FID). The Government of Senegal is preparing itself for negotiations towards FID and laying the foundations for the sector's contributions to the economy.</p> <p>With oil and gas discoveries come expectations of local content. Foreign capital in oil and gas producing countries has historically driven investment and employment. To obtain the greatest benefit for their economies, governments have actively intervened and defined local content policies, measures and targets.</p> <p>For the Government of Senegal, being a relatively new player in the oil and gas sector, it is important to understand the challenges and pitfalls of local content policies.</p> <p>Firstly, the lack of a clear strategy and regulatory framework may ultimately hinder local content development. Local content policies should be viewed in a holistic way, within the wider policy context of a country's or region's long-term economic and social development plans. Hence, it is important that the Senegalese government is directing private sector led initiatives that fit their Emerging Senegal Plan (PSE, 2014–2035) that was adopted by the Government in 2014 and their five-year Priority Action Plans (PAP), the first of which covers 2014–2018.</p> <p>Secondly, in practice, local content policies do not always achieve the intended results. For instance, the technological complexity and with it the required skill set of workers and suppliers cannot be matched with the often limited capabilities of the local economy. Also, the accreditation and high standards with regard to Health and Safety and process/procedure driven nature in the hydrocarbon supply chain are not always an easy hurdle to take for local businesses.</p> <p>Thirdly, implementing local content policies is a complex challenge that can only be addressed with a common understanding and shared objectives among stakeholders. This requires:</p> <ul style="list-style-type: none"> • Early engagement and collaboration among stakeholders, and involves cross-sectoral, national, regional, local, and cross border considerations. • Continuous industry-wide collaboration and multi-stakeholders involvement.
Project Objectives	<p>The objective is to work with key stakeholders to design effective and efficient local content policies for the oil and gas supply chain that will stimulate broad based development, not only creating economic but also social and environmental impact.</p>

Project 4 Avoiding the Dutch Disease: Masterplan for promoting investments in the Senegal Agricultural sector

Project Title	Masterplan for promoting investments in the Senegal Agricultural sector
Problem Statement	<p>In Senegal, offshore oil and gas exploration is currently underway which opens prospects for further economic development on the country. The on-going major energy projects in Senegal that focus on infrastructure development of oil and gas: the Kosmos/BP gas project aiming for first gas in 2021/22 and Cairn/Woodside oil project, which eventually may result in the revenues that are sufficient to re-direct towards agriculture. In fact, using oil and gas revenues to invest in other industries is vital to avoid the ‘Dutch Disease’. A large increase in natural resource revenues can hurt other sectors of the economy, particularly agriculture and export-based manufacturing, by causing inflation or exchange rate appreciation and shifting labour and capital from the non-resource sector to the resource sector.</p> <p>In Senegal, agriculture accounts for 77 per cent of labour force participation, and the main agricultural products are peanuts, millet, corn, sorghum, rice, cotton, livestock and fish. Despite the country’s recently improved economic performance, poverty remains high and predominantly rural, affecting 46.7 percent of the population. According to the Effectiveness Review 2016 for agriculture, produced by the African Development Bank (2016b), growth in agriculture is at least twice as effective at reducing poverty than any other sector. Various key organisations focus on the sector of agriculture and it is the top sector on the development agenda in Africa. Agriculture is one of the African Development Bank’s highest priorities. The Bank as well as African leaders have committed to promote private investment and new policies in agricultural sector.</p> <p>The African Development Bank (2016b), believes that one of the most important frontiers for Africa’s development is the transformation of Africa’s agriculture sector, so that it can drive sustainable and inclusive growth, create jobs and improve food security. The initial assumption for the proposed study is that the Senegal’s economy development will also focus on agriculture. Priority sectors are often already defined in national development frameworks in accordance with national priorities. The Emergent Senegal Plan 2014-2018 identified the following 6 prior sectors for which the public funds are were allocated: infrastructure and public services (26,3%), energy (13%), agriculture (11,1%), education and training (10,9%), drinking water and sanitation (10,7%) and health (5,3%). The focus for agriculture development is on groundnut sector, grain corridors, micro-projects, high-value added sectors and livestock (see MOFEP, 2014). The groundnut value chain which is the main source of income of the vast majority of farmers living</p>

	under poverty. There is large room for further evidences to formulate sector development from the groundnut value chain to the horticultural crops which are displaying some positive progress for income diversification of the rural population, nutrition, private sector involvement and poverty alleviation.
Project Objectives	This proposal offers the development of a comprehensive opportunity study to identify the potential for agricultural development in 14 administrative regions in Senegal. With the comprehensive study the existing potential for agricultural development in each region will be determined. Based on the outcome of the study interested investors will be able to take substantiated decisions in which agricultural product/production to invest in each region. Investment opportunities can be prioritised starting with the high potential regions and products. Based on the outcome of such study, the financing organisations are able to lunch tenders for potential investors in the region.

Project 5 Partnering in education

Project Title	Partnering in education
Problem Statement	<p>Education is a major challenge in Senegal: while in sub-Saharan Africa, children on average attend school for 5.2 years, in Senegal that number is just 2.5 years (UNDP 2016). For girls, the number is even lower with an average of just 1.8 years. Children under 15 years of age represent more than 42% of the population, bringing the average age of the population down to approximately 22 years. Young people represent 60% of job seekers.</p> <p>Besides the engineering training on geology and geophysics provided by the Institute of Earth Sciences of the Cheikh Anta Diop University in Dakar, and specified staff training courses organised by companies distributing fuel and lubricant, no training courses are available in the country. Accordingly, COS Petrogaz has approached the Institut de Petrole in Paris to help establish a petroleum institute in Senegal. Furthermore, COS Petrogaz paid a visit to the UK, the base country of Cairn and BP, and requested also for educational assistance for the petroleum sector.</p> <p>For Senegal, on the brink of major capital oil and gas investments, it is primordial to (re)initiate their thinking on engineering training. At present, in Senegal, apart from the engineering training at the Cheikh Anta Diop University of Dakar in the field of geology and Geophysics, as well as training organised by companies, there is no training directly related to the oil and gas supply chain.</p> <p>In line with SDG 4: ‘<i>Ensure inclusive and quality education for all and promote lifelong learning</i>’, and notably the targets below, Senegal’s educational landscape would benefit from strong</p>

	<p>partnerships with a Dutch higher education institution.</p> <ul style="list-style-type: none"> • <i>By 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship</i> • <i>By 2020, substantially expand globally the number of scholarships available to developing countries, in particular least developed countries, small island developing States and African countries, for enrolment in higher education, including vocational training and information and communications technology, technical, engineering and scientific programmes, in developed countries and other developing countries</i> <p>The partnership could focus on a number of benefits including but not limited to:</p> <ul style="list-style-type: none"> • Institutions use partnerships to promote student and staff mobility (scholarships) in a targeted manner, for example through joint programmes. Cooperation with the right partners can help the Senegal's institutions increase their local and international brand value. • Strong partnerships not only focus on linkages with worldwide academic and research institutions but also build on an extensive network with government, NGO, private and business partners, creating pathways for students and enabling them to progress toward jobs or running a business. • Institutional partnerships also offer great potential in terms of the more effective application of research funding and facilities.
Project Objectives	The proposed project is a quick scan and will assess the needs and requirements of post-secondary education in Senegal and viability of a partnership with a Dutch institute.

Project 6 Introduction of small scale LNG as fuel for the transport sector and as energy source for power generation and local industry in Senegal

Project Title	Introduction of small scale LNG as fuel for the transport sector and as energy source for power generation and local industry in Senegal
Problem Statement	<p>In recent years, consortia with Kosmos and Cairn as operators have identified sizable offshore gas fields, large enough to initiate commercial production of natural gas in Senegal, currently anticipated as from 2021 onwards. Most of the gas is likely to be exported to foreign markets and some of it may find its destination on the locally emerging gas market in Senegal.</p> <p>For the export one or more gas liquefaction plants, together with storage and shipping facilities are considered somewhere along the Senegalese coast. This will allow liquefied gas to be efficiently exported to other locations with high demand such as Asia and Europe. Technical and economical feasibility studies are under way allowing a final investment decision for an LNG terminal, potentially as early as</p>

	2018.
Project Objectives	<p>If such decision is positive and the LNG terminal would be constructed, the government of Senegal has a possibility to consider the introduction of LNG as an alternative fuel for the transport sector. This would have several advantages: (i) it replaces costly fuel, which otherwise would have to be imported; (ii) it will reduce CO₂-emissions from traffic by about 15% or so. In addition to benefits for the climate, (iii) LNG will also reduce substantially SO₂, NO_x and Fine Particles concentrations, thus enhancing living conditions in cities and along major transport arteries.</p> <p>A second emerging opportunity with having downstream LNG fuel infrastructure, is that LNG could also be used as fuel for a (smaller) power plant providing power to the local community, or feeding energy to a local small industrial activity, to small cities and towns in more rural Senegal. For that purpose, a small local LNG storage tank could be provided which is supplied with LNG from the LNG terminal on the Senegalese coast by using LNG road trailers. No, or a smaller gas distribution grid would be needed this way.</p> <p>The project as proposed includes the following:</p> <ol style="list-style-type: none"> 1. Identify and review current and future transport needs in the country for (i) road transport separated in modalities for passenger cars, for heavy duty long distance trucking and for local city distribution vehicles and (ii) for river barging and offshore shipping related to local fishery, local ferries and local freighters; 2. Identify local power plants and industrial activities currently operating on coal or fuel oil to be converted to LNG fuel; 3. Based on the findings under 1) and 2), select most important LNG distribution points (fuel service stations) including a relevant LNG distribution infrastructure to get the LNG there; 4. Investigate appropriate designs of key infrastructure facilities including the truck filling station at the LNG terminal, the road trailers to be used for the LNG distribution, the (manned) LNG service station and a standardized LNG storage tank for use near power plants or local industrial activities; 5. Assess the economic-, environmental-, health- and climatological improvements linked with the introduction of LNG versus conventional fuels in the country; <p>Assess the potential risks, including safety and possible mitigating actions, including key contacts to obtain LNG fuelled trucks and cars for the Senegal market</p>

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Annex 1 Thematic Groups Donor Support

no	Group	Lead organisation
1	Coordination of Education Sector Partners in Senegal	USA (USAID)
2	Private Sector	USA (USAID)
2a	SME Sub- group	Italian Cooperation
3	Environment	EU
4	Decentralization	Germany (GIZ) Spain (AECID)
5	Casamance	USA (USAID)
6	Micro-finance	UNEF Italy
7	Public Finance	World Bank
8	Budget Support	AfDB Canada
9	Aid Effectiveness	USA (USAID) France
10	Water	World Bank
10a	Rural Water and Sanitation	USAID
10b	Urban Water and Sanitation	AFD EU
11	Health	WHO
12	Fisheries	JICA (Japan) World Bank
13	Rural Development and Food Security	WFP JAPAN
14	Justice	France- SCAC Embassy
15	Gender	UN-Women
16	Social Protection	UNDP Belgium
17	Micro-operations	French Embassy
18	Statistics	AfDB UNFPA
19	Energy	Germany (KfW, GIZ) World Bank
20	Trade Assistance	Government (Ministry of Trade) France

Positioning of Donor Support

Priority	Theme	Institution
Infrastructure	Energy/water	AfDB, AFD, World Bank, EIBI Luxemburg Cooperation, GIZ, KFW, JICA, IFC, EU USAID, IDB
	Transport	AfDB, BADEA, World Bank, IDB, WADB Millennium Challenge Account, (MCA) EU
Regional Integration		AfDB, EU
Private Sector	Entrepreneurship and Business Environment	AfDB, AFD, World Bank, IFC, USAID, Canada UNIDO
	Finance/micro- finance	UNDF, AfDB
Qualifications and Technologies	Education	AfDB, Canada, Luxemburg World Bank, ILO
Governance	Public Finance	AfDB, Canada, World Bank USAID, Luxemburg, UNDP
Areas of Particular Interest		
Casamance		AfDB, EU, USAID, WorldBank
Gender	-	UN-Women, ADB
Agriculture and Food Security	-	AfDB, IDB, WFP, FAO
Transition to Green Growth		
Natural Resources Management	-	AfDB, GEF
Resilience	-	AfDB, IDB, EU, JICA, WB, FAO, WFP

Annex 2 Business opportunities

Onshore opportunities are likely to include the following activities:

- ✓ Access/ roads
- ✓ Worker housing, food-& recreational facilities
- ✓ Consumables storage
- ✓ Water sources
- ✓ Land sites
- ✓ Roads equipment warehousing and storage yards
- ✓ Piping
- ✓ Pipe storage
- ✓ Port facilities for receiving overseas equipment and materials
- ✓ Sanitation and waste disposal systems
- ✓ Medical facilities
- ✓ LNG storage tanks
- ✓ Port facilities for local LNG ships and barges
- ✓ Power supply/ plants and transmission
- ✓ SCADA systems for monitoring right-of-way and operations
- ✓ Airport access
- ✓ Helicopter landing facilities
- ✓ Cleared land right-of-way

As well as offshore services such as:

- ✓ Supplying offshore installations and vessels
- ✓ Personnel transport
- ✓ Towing, anchoring, and positioning of offshore installations
- ✓ Support to the development of offshore oil and gas fields
- ✓ Assistance operations, standby, and

support of offshore oil and gas terminals, including FPSO's

- ✓ Assistance, salvage, and pollution remediation
- ✓ (Heavy) lifting, skidding & jacking
- ✓ Engineering, supervision and management of subsea operations
- ✓ Inspection, maintenance, and repair of offshore structures

Furthermore, non-core/cross sector service opportunities could be as follows:

- ✓ Supply of raw materials (cement, gravels)
- ✓ Transportation of personnel
- ✓ Excavation equipment and services
- ✓ Vehicle fleet management/ maintenance
- ✓ Electronic equipment and maintenance
- ✓ Financial services
- ✓ It and communication services
- ✓ Legal/regulatory services
- ✓ Camp management services (health, catering)
- ✓ Training (vocational, induction, hse)
- ✓ General and hazardous waste management
- ✓ Electrical equipment services
- ✓ Security
- ✓ Other goods and services (air conditioning)
- ✓ Manpower and recruitment
- ✓ Energy (fuels /electrical power)
- ✓ Lubricants / chemicals
- ✓ Personal protection materials and uniforms / cleaning services

Annex 3 Contact list

No	Organisation	Contact
1	The Ministry of Energy and Renewable Energy Development	allée papa gueye fallk Dakar, Senegal medersenegal@gmail.com http://www.energie.gouv.sn
2	Ministry of Environment and Sustainable Development	Building Administratif 2e etage BP 4055 http://www.environment.gouv.sn mepn@environnement.gouv.sn
3	Cairn	Immeuble Epi, Blvd Du Sud X Rue Des Ecrivains 3eme Etage, Point E Dakar, Senegal Bp. 25087 Dakar Fann Telephone number: (+221) 33 869 6101
4	CNOOC	No.25,Chaoyangmenbei Dajie, Dongcheng district, Beijing 100010, P. R. China Tel: 86 10 8452 1010 E-mail: cnooc@cnooc.com.cn
5	COS-Petrogaz	Liberté 3 Jet d'eau Immeuble (Agence Orange) H app. n°7 Dakar, Senegal
6	FAR Ltd, Melbourne office	Level 17 530 Collins street Melbourne vic 3000 Australia phone: +61 3 9618 2550 Impact Africa ltd (sa) First floor, block a 7 West Quay Road V&A Waterfront Cape Town, 8001 South Africa info@impactoilandgas.co.za Telephone: +27 21 834 9701
7	Kosmos Senegal	Dakar Tel: +221 33 839 54 00
8	Kosmos Energy Ltd.	C/o kosmos energy llc 8176 Park Lane, Suite 500 Dallas, texas 75231 Tel: +1 214 445 9600
9	BP plc.	1 St James's Square, SW1Y 4PD London + 44 (0) 207496 4000

		Email: ir@bp.com bpsenegal@bp.com
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11	Oryx Petroleum	+221 338327960 Building Fahd Boulevard El-Hadj Djily Mbaye Dakar, Senegal
12	Oxfam Senegal	Rue MZ 210 Fenêtre Mermoz Dakar, Senegal www.oxfam.org/senegal
13	Senelec	28, rue Vincens Dakar Sénégal BP: 93 webmaster@senelec.sn (+221) 839.30.30
14	T5 Oil & Gas	45 Pont Street SW1X 0BD, London United Kingdom Phone: +44 203 709 6610
15	Timis Corporation	Timis Senegal Petrotim Limited Contact details unknown
16	Total Senegal	Bp. 355 - Dakar (+221) 33 839 54 54 total@total.sn www.total.sn www.total.sn
17	Trace Atlantic Oil Ltd	Immeuble Sicap Point E Bâtiment A - Apt Nr 8 Avenue Cheikh Anta Diop Bp 23569 Dakar Senegal
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