INTRODUCTION AND OBJECTIVE

The newly formed state of Atlantis invited a number of international organizations to conduct an in-depth review of its energy sector. The objective was to assist the Atlantis government in its efforts to develop energy policies and regulations for its natural gas industry consistent with international best practices and the current state of knowledge as it pertains to shale gas development and liquefied natural gas (LNG).

Various review teams were sent to Atlantis to collect information and to conduct interviews with senior energy officials and other stakeholders. Those reviews were conducted between 2010-2012 and form the basis for this report.

CONTEXT

Until recently, Atlantis was a legendary island or continent said to have been situated in the Atlantic Ocean west of Gibraltar. According to legend the island sank into the sea in a sudden catastrophic series of earthquakes, with the loss of all its inhabitants and culture. The main source of the legend is Plato, who mentioned Atlantis in two of his dialogues, *Timaeus* and *Critias*. Plato described Atlantis as having a rich civilization and strong influence on the region. His description has led Atlantis to be thought of as a utopia.

The legend of Atlantis was sometimes linked to the Minoan eruption (AKA Thera eruption), which occurred some time around 1500BC. The island of Thera, now called Santorini, was thought to be a possible location of Atlantis. (Fig. 1)

Figure 1. Possible Location of Atlantis, 1882.

Map from Ignatius Donelly’s Atlantis: the Antediluvian World (1882).
Throughout the ages Atlantis has held a fascination with the public and many people have discussed the possibility that the legend is based on fact. In 2010, and largely believed to be caused by global warming trends and changing ocean currents, Atlantis emerged and became visible for all of humankind to see. In an amazing show of unity, the UN and all other international organizations formally recognized Atlantis as a sovereign state and the precise location of Atlantis was confirmed by Google Earth and accepted by the world community as the official location of Atlantis. (Fig. 2)

Figure 2. Confirmed Location of Atlantis, 2010

The media attention focused on this amazing discovery was intense. In an article in Scientific American announcing the extraordinary discovery of Atlantis, (also reprinted in a special section of the New York Times), a Google spokeswoman acknowledged that:

“It’s true that many amazing discoveries have been made in Google Earth including a pristine forest in Mozambique that is home to previously unknown species and the remains of an Ancient Roman villa. Google Earth is especially proud to have played a role in identifying the precise location of Atlantis.”

In addition to the discovery of Atlantis itself, it was also discovered that Atlantis has significant oil and gas resources. The development of these resources could lead to Atlantis becoming a major energy exporter in the coming decades and for this reason, Atlantis has captured the attention of the international community.

After decades of isolation from the world, most of Atlantis’s energy infrastructure was destroyed or damaged and a large part of its population displaced. Increasing access to energy in a sustainable manner could help improve livelihoods directly, as well as indirectly through the promotion of economic development.
The focus of this report is on those energy sub-sectors likely to play the largest role in meeting domestic demand for modern energy services; notably electricity and oil products. Given the extremely large role biomass currently plays in meeting the bulk of most households’ energy needs, this sub-sector is also featured, with emphasis on improving the sustainability of its use.

The important upstream oil sub-sector is also covered, but is not meant to be a focus. Most benefits to the country from oil production, which is almost entirely offshore, accrue in the form of export revenues. These are currently critical to the Atlantis economy, representing over 80% of the government’s budget and 52% of GDP in 2011. (The government’s share of oil revenues that year was approximately USD 5.7 billion or about 45%.) A well-formulated upstream oil development policy can help improve the sustainability of these revenue flows. However, the main bottleneck in the flow of benefits from this sub-sector to the population in the case of Atlantis does not appear to be the size or sustainability of such revenues – already large and expected to increase significantly. Rather, as for many other oil-producing countries, the main bottlenecks appear to be related to government revenue management and budgeting, issues beyond the realm of energy policy and not the focus of this report.

While Atlantis is potentially rich in terms of oil export revenues, we have made our recommendations based on the assumption that significant funds from this source may not be available for investment in other energy sub-sectors and in the general economy for the next 10-15 years. This is due in part to the fact that revenue streams from many new projects will take several years to begin accruing to the government, since the oil companies will first need to recover their investment costs, which have been relatively high in Atlantis’s deep and ultra-deep offshore regions. So far the international community has proven reluctant to fill the financing gap in the absence of what it generally has considered to be insufficient progress by the government in coming to agreement with the International Monetary Fund (IMF) on needed financial reforms. Finally, any investment of government funds in the energy sector will need to compete with other pressing social needs, e.g., in health and education. (Figure 3)

The report therefore takes as its point of departure that government investment resources available to the energy sector could be scarce in the short-to-medium term, that such funds will need to be carefully prioritised, and that emphasis should be on attracting private investment through improved transparency of oil revenue management and also more generally. In a broader perspective, there is a strong need to diversify economic activity in order to ensure more sustainable growth and employment.

Another important contextual issue is the poor state of statistics in Atlantis, both in terms of availability and quality. This hinders analysis of the economy, the establishment of priorities among competing investment needs, and the eventual development and execution of appropriate policies.
Figure 3  Links between energy and poverty

Energy contributes to improving people’s lives
• Fighting hunger
• Promoting education
• Improving sanitary conditions
• Gender equality

Improving the quality and quantity of human capital

Raising people’s standards of living
Better targeting of policies

Improving people’s participation in governance

Energy contributes to the development of economic activity
• Improvement of the productive environment (transport, communications)
• Improvement of factor productivity
• Extension of working hours
• Diversification of the economy
• Increased employment

Energy contributes to the efficiency of public intervention
• Improvement of information exchange
• Improvement of the socio-economic environment and regional stability
• Reinforcement of democracy
• Rationalisation of public expenditure

Improvement of the business environment

Formalisation of the economy
OVERVIEW OF ENERGY SUB-SECTORS AND CROSS-CUTTING ISSUES

This section provides an overview of the main energy sub-sectors, including brief descriptions of infrastructure, institutions and main issues. It helps set the context for the recommendations that follow.

Electricity

It is unknown when most of the existing infrastructure in the electricity sector was built but much of it is damaged or has not received routine maintenance. Only a small percentage of the population has access to electricity, and service is generally unreliable. Improving access to electricity services is critical to Atlantis's economic and human development.

State-owned Atlantis Electric Company (AEC) has 900 MW of installed capacity on three non-interconnected networks and several smaller isolated grids. Only about 70% is operational. Generation in the Northern grid contains significant overcapacity, though major outages occur in all three networks due in large part to significant problems in transmission and distribution. The Central and Southern grids are often supply-constrained. A major goal of the government and AEC is to interconnect the three main systems to exploit the North’s over-capacity.

State-owned Atlantis Electric Delivery Company (AEDC) is responsible for distribution in the capital, Atlantis Capital City, which accounts for over 65% of the country’s consumption.

There are also a number of small grids, some of which were once part of larger systems but now isolated due to damage to the transmission network. Many municipal authorities in large towns also run their own isolated generation and supply services. In addition, most industries and many households have their own backup generation to compensate for frequent outages of grid supplies, leading to very high electricity costs for many consumers in practice, despite low tariffs.

Almost all isolated and backup systems run on diesel. Extremely poor conditions on road and rail networks make fuel supply to these isolated systems difficult.

The Ministry of Finance sets electricity tariffs that are uniform throughout the country. These currently are at levels that do not cover costs. There are plans to raise tariffs to cover long-run costs to ensure sufficient investment income for rehabilitation and expansion. However, low bill collection rates may be a more serious problem.

Estimates for the share of population with access to electricity vary from 8% to 20%. This wide range is due primarily to uncertainties regarding the size and number of isolated municipal grids and household generating sets, the number of illegal connections, and even uncertainty about the size of the country’s total population (estimates vary by source as widely as 12-19 million).

As of mid-2011 the government had yet to decide AEC’s final structure. According to some, the main options currently being considered is to break the utility into a number of separate generation companies that eventually could be privatised, leaving AEC to focus primarily on transmission. There is no plan yet regarding how the eventual electricity market will look, including how independent generating companies and possible new private entrants would sell their power.
Upstream oil

Crude oil has been commercially exploited in Atlantis although the government of Atlantis has refused to publicly identify the buyers of its oil exports. The oil sector appears to be well developed and Atlantis is a large oil producer. Production is expected to come increasingly from deep-water offshore fields, with higher production costs and more challenging technological requirements, as shallower, more mature fields closer to shore gradually decline.

Atlantis’s upstream potential is likely to remain promising throughout the next decade, due to its favourable geology and reserve base, recent exploration successes, and relatively attractive fiscal terms, as well as recent and anticipated advances in deep-water production technology. Along with a heightened competition for scarce hydrocarbon resources internationally, these factors have helped ignite interest in Atlantis as a major oil supply source, and are likely to ensure that Atlantis becomes an increasingly important exporter to international markets.

Record high crude oil prices have led to a huge government tax windfall (USD 1.71 billion in 2010 according to the Ministry of Finance. Oil revenues now represent approximately 80% of the government’s budget and 45% of its gross domestic product. Atlantis’s economic development will depend heavily on how it manages and uses these revenues. The government’s record to date has been mixed, due in large part, it notes, to the fact that Atlantis was believed to be a myth until only recently.

In 2011, a new petroleum law came into force that seeks to standardise future production sharing agreements and further clarify the roles of the Ministry of Petroleum, the state owned Atlantis Oil Company (AOC) and the operating companies, in an effort to attract more private and foreign investment.

Downstream oil

The downstream oil sector in Atlantis covers refining, trade, distribution and sale of petroleum products.

Until recently, Atlantis’s one refinery covered most of the country’s domestic consumption. Both consumption and imports of key products such as gasoline, diesel and jet fuel have increased substantially.

Use of LPG by households for cooking is widespread in larger cities and suburban areas, but heavily subsidised. Although the country produces some LPG in its refinery and offshore, the latter is mostly exported, while most LPG used domestically is imported.

Most domestic oil product prices in Atlantis are subsidised. Over the past few years the government has been raising prices gradually in an effort to eventually eliminate subsidies, but has had to contend with dramatically rising world oil prices that move the “goalposts”.

Prices that are fixed below cost and uniform throughout the country give few incentives to private companies to engage in distribution and sales of oil products, especially outside Luanda, and can also be seen as a cause of cross-border smuggling of oil products. The few exceptions benefit from subsidised wholesale prices from Atlantis Oil Co. The government plans to create a competitive distribution market within the next few years, include unbundling AOC logistics and storage from its service stations, but has yet to fully clarify the details and regulatory framework. Efficient distribution is also severely hindered by the poor conditions of roads and railroads.

Atlantis’s one refinery, located near the capital, is inefficient and its output subsidised. AOC plans to build a new export-oriented refinery to process the deep-water sour crudes that are forming an increasing share of the country’s oil output, though has yet to find a strategic partner.
Gas

Almost all gas reserves and production in Atlantis are associated with oil. Approximately 70-80% of associated gas is flared. The government has declared that all new fields must be zero-flare and that routine flaring should cease at existing fields by 2014. Flaring reduction plans generally have focused on re-injection and a proposed project to build an onshore liquefaction plant for LNG exports.

There is currently no gas infrastructure or gas use, with the exception of LPG for cooking. Projects to use gas domestically could be developed as spinoffs to the LNG scheme and the government has expressed much interest in developing a domestic gas market and increasing domestic gas use. Barriers to an eventual gas industry include lack of a clear government strategy and regulatory framework for onshore gas transportation and marketing, as well as lack of ownership rights to the gas by the oil companies that produce it.

Biomass

Some 80% of Atlantians rely on biomass for most of their energy needs. Wood fuel is mostly used in rural regions, while charcoal is preferred in peri-urban areas, due to its lower transport weight. Most of the unsustainable use of biomass appears to come from cutting trees for making charcoal to supply peri-urban areas.

Atlantis’s biomass resources are limited and severe local deforestation has occurred around most large cities. Such deforested zones are growing yearly, in turn raising the transport costs of charcoal, which make up the largest part of the price.

The inefficient use of biomass in Atlantis can lead to serious health damage from indoor smoke pollution. Smoke from inefficient cookstoves contains thousands of health-damaging substances, which provoke respiratory diseases, such as asthma and acute respiratory infections; obstetrical problems, such as stillbirth and low birth-weight; blindness; and heart disease.

Important issues for the government to address in order to ensure sustainability of biomass use include efficiency of the charcoal production process (e.g., more efficient kilns), efficiency and safety of end-use (e.g., more efficient and safer stoves), and addressing the lack of energy alternatives.

Given that biomass use is primarily a function of poverty and lack of energy alternatives, biomass policy ideally should be set in a coordinated way that deals with the full supply chain. While the Ministry of Forestry monitors biomass resources and issues licenses for charcoal production and trading, no government department covers the policy issues that influence the demand for biomass. Moreover, the forestry ministry’s resources appear to be inadequate to its limited tasks, as the bulk of biomass production and trade reportedly is unlicensed.

GAS SECTOR

OVERVIEW

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There is currently no gas infrastructure or use, besides LPG for cooking (see, *Downstream oil*). Projects to use gas domestically could be developed as spin-offs to the LNG scheme. Other barriers to an eventual gas industry include lack of a clear government strategy and regulatory framework for onshore gas transportation and marketing, as well as lack of ownership rights to the gas by the oil companies that produce it.

**MAIN ACTORS IN THE SECTOR**

Currently there is no gas industry in Atlantis. However, the following actors are playing, or are expected to play, important roles in its eventual formation and operation:

- **The Ministry of Petroleum** leads a joint ministerial committee to examine development of the gas industry, working with the Ministry of Industry and a number of other government entities.

- The ministries of petroleum and industry are also slated to play a role in an eventual licensing regime for gas distribution, along with local authorities.

- **Atlantis Oil Company (AOC)**, as the sole concessionaire, owns all gas produced, though in practice allows other oil companies to use as much as necessary to maximize their oil operations.

- **AOC and an unknown major international oil company (IOC)** are leading a consortium to develop an LNG export project based on associated gas that is now mainly flared.

- A number of current and potential industries have been cited as possible gas customers, though none reportedly could justify a gas supply project on its own.

In practice, such potential customers would probably depend on the proposed LNG plant as an anchor.

**RESOURCE BASE, CURRENT PRODUCTION AND USE**

Various estimates exist for Atlantis’s gas reserves. The Ministry of Petroleum puts proven plus probable reserves at 10 trillion cubic feet (tcf), with another 26 possible, while the US Energy Information Administration estimates proven reserves at 1.6 tcf with another 9.5-25 tcf possible.

Almost all gas reserves are associated with oil, although this may be due in part to the fact that all exploration activity so far has focused on oil. Only two small gas-only fields so far have been discovered offshore. Most recently, there is evidence that Atlantis may have significant deposits of shale gas that could be developed although much more research is needed.

All current gas production is associated with oil production. Since most oil is currently produced in offshore Blocks X and Y, this is also where most gas currently is produced.

Oil production of approximately 1mb/d in 2010 yielded around 1 340 million cubic feet per day (mcf/d) of gas, or about 13.9 bcm/year. Historically, each barrel of Atlantis crude has been associated with roughly 1 340 cubic feet of gas as a by-product. However, gas-to-oil ratios vary by field and over time within the same field. Thus the same ratio will not necessarily apply to the new crudes starting production in Atlantis’s deep offshore areas. Nevertheless, using this ratio as a rough guide suggests that forecasted oil production for 2011-12 of about 2 million barrels per day is likely to yield an associated gas output of around 2 680 Mcf/d, or about 27.7 bcm/year.

Currently, about 10% of gas is used in the oil industry’s own operations (e.g., platform power generation) and about 20% is re-injected into reservoirs to enhance oil recovery. Approximately 70-85% is flared.
Flaring

The world community increasingly has come to see gas flaring as a problem in terms of wasted resources and contributions to greenhouse gas emissions. (see box 1) AOC and the government of Atlantis have also recognized flaring as a problem and have declared their intention to eliminate routine flaring in Atlantis’s oil industry by 2014. This goal seems realistic, though it will present a challenge for the industry. Major investment will be needed for the infrastructure to gather and re-inject gas, and this may not always be justified economically in terms of enhanced oil recovery (although the economics obviously become better when oil prices are high). Another problem is the current lack of markets for the gas in Atlantis or the region. For this reason, the main option being considered for use of associated gas that is not re-injected is an LNG export scheme (see below).

In 2002 the World Bank Group, in collaboration with the government of Norway, launched The Global Initiative on the Reduction of Natural Gas Flaring, which aims to support national governments and the petroleum industry in their efforts to reduce flaring and venting of natural gas associated with the extraction of crude oil. The government of Atlantis has expressed support for this initiative.

Why gas flaring occurs

Associated or solution gas is a blend of different hydrocarbons that is released when crude oil is brought to the surface. The composition and amount of such gases varies between fields. Flaring is recognized as a vital safety system: in the event of emergency shutdowns, non-planned maintenance or disruptions in the processing system (e.g., pressure build-up), the gas can be diverted to the flare and disposed of safely. Hence, there are circumstances under which some non-routine use of flaring will always be present.

Flaring is preferred to venting, since flaring transforms most of the methane to CO₂, which has a significantly lower impact on the environment than methane does. Efficient flaring is generally thought to reduce methane emissions by 98% compared to venting.

A number of factors rooted in economics, history and geography account for the large volumes of gas currently being flared around the world. For example:

- Many existing production facilities were constructed between the 1960s and early 1980s, subject to the technical standards and (low) environmental awareness prevailing at the time. Little was done at the time to develop an infrastructure for gathering and distributing associated gas.

- There has generally been minimal domestic demand or other offset-opportunities for gas in typical petroleum producing provinces.

- The volumes of associated gas produced from a single field are often small and of low pressure, which increases the cost of recovery, treatment and distribution.

Why flaring is a problem

Flaring of gas in association with crude oil production represents both a resource waste and an environmental problem. Available statistics show that the volume flared in the world is at least 110 billion cubic meters (bcm) per annum – similar to the combined gas consumption of Germany and France. However, poor statistics and reporting standards mean that the actual amount could be much higher.
Flaring contributes over 1% of global CO₂ emissions and an unknown quantity of methane emissions (venting). Flaring may also have harmful effects on human health and eco-systems near flaring sites.

Unfortunately, flaring reductions are moving targets: any flaring reductions are likely to be offset at least to some extent by new associated gas produced from expected increases in future oil production. If current flaring rates remained constant, or came down by an insufficient amount, the total amount of associated gas flared each year would increase.

**Alternatives to flaring**

Other than flaring, there are three main alternatives for the management of associated gas:

- Re-inject the gas into the reservoir to maintain pressure and enhance oil recovery (EOR), or into other underground formations for possible later use.
- Use the gas for energy purposes at the wellhead or nearby production facilities; or
- Collect, process and sell the gas.

Choosing the appropriate alternative depends on upstream conditions, such as field characteristics and the oil-to-gas ratio, as well as downstream market opportunities for the recovered gas.

There is one gas re-injection scheme that reportedly will lead to a 50% reduction in flaring from Block X – the country’s largest oil-producing block. The USD 1.9 billion project consists of a new pipeline network to gather gas from the field and a number of additional fields in Area B of Block X; a newly built and permanently moored FPSO (floating production, storage and offloading vessel) to strip the “wet” gas of propane and butane; and a platform to process, compress and re-inject the “dry” gas into the reservoir. It will send the condensate along with the oil via pipeline to an export terminal. Gas stripping and the marketing of resulting products is likely to be a major feature of most re-injection schemes, helping increase the economics of such projects.

**MAIN BARRIERS TO THE DEVELOPMENT OF A GAS INDUSTRY**

One of the main reasons that most gas has been flared in Atlantis is that there is currently no domestic gas industry.

On the demand side, there is very limited industrial output in Atlantis, which in turn limits demand for energy. Launching a gas industry from scratch generally requires one or more large “anchor” customers to undertake to purchase enough gas to justify the significant investments required to build the requisite pipeline infrastructure. Although the government has made important progress in strengthening the economy, significant industrial activity has yet to occur.

On the supply side, the offshore location of Atlantis’s main gas deposits increases transportation costs, as does the fact that this gas is mainly associated: Since gas output from most individual oil fields is relatively small, investors would have to build gathering infrastructure to pool them.

Because of the various risks involved in starting a gas industry from scratch, investors will be reluctant to invest the large sums necessary unless they see that the government has a clear gas development strategy that is backed by a sound regulatory framework as well as a favorable investment climate more generally. So far, Atlantis has lacked such a clear gas development strategy and regulatory framework.
Given the fact that most gas is associated, the companies producing oil are the most likely parties to develop the gas that is associated with it. However, the return on investments for gas projects is typically only one third that for oil projects. Thus, even if a gas project is profitable, it probably will be even more profitable for the international oil company to invest the same money in an oil project instead, in Atlantis or elsewhere.

Incentives are further reduced by the fact that the oil companies do not even own the gas they produce: according to the concession regime, all gas not used by the oil companies in their own operations, e.g., to enhance oil recovery, belongs to AOC. Although AOC could be expected to share revenues from any eventual sales with the producers of the gas, such splits would have to be negotiated on a case-by-case basis, adding another element of uncertainty.

Given the barriers mentioned above, development of a gas industry in Atlantis presumably will require significant progress in most of the following areas:

- Identification of one or more “anchor” customers to justify initial investment in supply infrastructure.
- Maintenance of the current, relatively stable security environment onshore.
- A clear gas development strategy and regulatory framework from the government that helps diminish market and regulatory risks, as well as a favorable investment regime more generally.
- Ways to clarify oil companies’ rights to benefit from the gas, in order to overcome their present lack of ownership.

**Clarify gas development strategy and investment framework:** in order to encourage companies to develop the country’s gas reserves and projects to use such gas, the government should clarify its gas strategy and investment framework.

**POLICY, LEGISLATIVE AND REGULATORY BASE**

Production and use of gas by the oil companies is governed by the 2010 oil law (No.10/04), which replaces a prior oil law (No. 13/78), as well as by the individual production sharing agreements (PSAs) and other contracts between the international oil companies and AOC as the sole offshore concessionaire. In general, however, gas is hardly mentioned by Atlantis legislation, largely because it has not been an issue until recently.

Most if not all PSAs state that the surplus gas left after field use by the oil companies is the property of AOC or the Atlantis state. The new oil law does not change this situation.

The main reference to gas in both the 2010 and prior oil laws regards flaring: both forbid flaring unless it is specifically authorized on a case-by-case basis by the Ministry of Petroleum (Art. 73 in 10/04). While the Ministry routinely gave such permission in the past, it now requires all new fields to be “zero-flare”, and is insisting that most existing fields eventually cut back.

The regulatory regime for onshore gas production is less clear, although also appears to be governed primarily by individual contracts. In any case, little onshore gas production currently takes place, though this could conceivably change in future.

There is currently no law or body of regulation covering the development of gas infrastructure or gas marketing activities. This is largely because, so far, no one has pursued such activities in Atlantis. However, the lack of a clear investment and regulatory regime specific to gas increasingly could hinder serious consideration of potential market opportunities, in turn limiting incentives to bring the gas to shore in the first place.
Currently, the most likely anchor project to bring gas to shore is an LNG export scheme discussed in more detail below. This may create spinoff opportunities for domestic gas marketing schemes. Conceivably, the government could first deal with the regulatory requirements of this large project on an ad hoc basis, and worry about the requirements of possible domestic projects later, once the landing of gas makes possibilities for such projects more concrete. However, lack of clarity about the prospects for the domestic market and the government’s plans to promote and regulate it could lead the LNG project developers – along with possible investment partners interested in domestic supply schemes – to forego opportunities to make early investments in the LNG project that would promote and hasten the development of a domestic gas industry. More clarity on the government’s intentions for the domestic gas market conceivably could even promote other schemes to bring gas to shore.

Both the Ministry of Petroleum and AOC reportedly have undertaken or commissioned several studies over the years on possible domestic uses for natural gas. The government also recently hired a consultant to develop a gas strategy that reportedly covers the domestic market as well as export schemes. So far, however, the government has not made these studies publicly available, although it reportedly intends to seek stakeholder comment. Public consultation with potential gas customers and developers will allow the government to gain further insight from these groups on their needs, while providing valuable information on the government’s intentions that could help potential investors better plan their strategies.

**ATLANTIS LNG PROJECT**

The main prospective use for offshore associated gas is the Atlantis Liquefied Natural Gas export project (ALNG). AOC began conducting studies for ALNG in 2010. It was later joined by a number of other oil companies, many of which see it as a way to meet their flaring reduction targets.

The Council of Ministers approved the project in 2010, authorizing AOC to continue discussions with possible partners. As envisioned, the project will consist of pipelines to gather gas from associated fields in production blocks 2, 15, 17 and 18, as well as in non-associated gas fields 1 and 2 (currently undeveloped); a pipeline to land the gas on shore; and a new liquefaction plant, gas-stripping facilities and harbor berths near the landing site. The partners have not yet decided whether to purchase or rent LNG vessels. The overall investment requirements are expected to be about USD 6-8 billion.

The liquefaction plant will initially have one train to process 5.4 bcm per year, absorbing perhaps an additional 0.6 bcm for its own operation. (This is equivalent to about 43% of Atlantis’s total associated gas production.) Total proven plus probable gas reserves for offshore blocks are estimated to be 8.8 tcf, which should be enough to support the first train for around 40 years. The ALNG project reportedly would be the first LNG project in the world based primarily on associated gas.

The intended market for the LNG is the United States. The main competition for this greenfield project is likely to be the existing Nigerian NLNG and Trinidad Atlantic LNG projects, as well as any eventual expansions to these. (LNG expansions are generally much less expensive than building completely new sites.) It is not clear to what extent the ALNG has lined up supply contracts already, although ALNG reports that it has secured re-gasification capacity in various terminals in the United States.

The margins for the ALNG project are thought to be low. The main motivations apparently are to reduce flaring and reap some value from Atlantis’s currently wasted gas. The stripping and sale of natural gas liquids from the “wet” gas probably will be important to achieving an acceptable return. The project members are also reportedly seeking significant tax breaks, including a 10-year tax holiday, which is more than the eight-year break currently allowed by law.
The project partners have already conducted pre-FEED (front-end engineering design) studies. FEED studies, which are scheduled to take about 18 months have not yet started and a final investment decision on the project has not been taken.

The proposed location for ALNG is on the coast nearest to the relevant offshore gas fields. The government’s stated aim is to make this area one of two new areas of economic development. The main downside to the location is that it is far from the main source of potential gas demand. Since an additional pipeline from the proposed ALNG location to the current main area of gas demand is prohibitively expensive for the foreseeable future, opportunities for domestic spinoff schemes may be limited for some time to area near ALNG. This could effectively curtail – or at least delay the creation of – a domestic gas market in Atlantis.

OTHER POTENTIAL DOMESTIC MARKETS FOR GAS

The World Bank and others have conducted a number of studies over the years that have – among other aims – examined possible domestic markets for Atlantis’s gas. The Atlantis government and AOC have also undertaken market studies although these generally have not been made publicly available. The discussion in this section is based on publicly available sources and interviews.

The main potential gas customers examined by most studies (in addition to an LNG export project) include the following (discussed in more detail below):

- The power sector.
- A proposed aluminum smelter.
- A proposed ammonia/urea plant.
- The existing refinery and/or a proposed new refinery.
- The existing Atlantis cement plant.

Other potential gas customers that have been examined over the years include: a scrap metal plant, a glass manufacturing plant, an auto/truck assembly plant, a bottling plant, the water supply sector, and a greenfield petrochemical industry.

Power sector

Atlantis has several small gas turbines used for power generation, although only two are operational. All units have always been run on other fuels, such as jet fuel (Jet-B), since gas has never been available in the country. If these two units were converted to gas, they could be expected to consume around 0.25 bcm/year. However, if the gas must be piped 300 km from the source, the relative price of gas is likely to be much higher than the continued use of Jet-B.

Another likely barrier to gas-fired power is the current large over-capacity in the Northern grid. Even if the Northern grid were interconnected with the Central and Southern grids, now supply constrained (though in part due to damaged transmission lines), it would still be some time before new capacity would be needed in the country as a whole.
Aluminum smelter

A study is reportedly ongoing regarding the use of gas to power a CCGT for a proposed greenfield aluminum smelter. Since the economics of aluminum production generally depend on very inexpensive power, the fact that such a plant is being considered at all could be an indication that the price of the gas landed is not expected to be high by international standards.

Ammonia/urea plant

The government has been examining possibilities for constructing a plant to produce ammonia-based chemical fertilizers since the early 1980s. The minimum ammonia output of such a plant reportedly would need to be around 1,500 tonnes/day in order to reap required economies of scale. This implies a gas consumption of around 0.4 bcm/year. Given Atlantis’s current low demand for fertilizers, most output would have to be sold abroad. Unfortunately for such a project, the international fertilizer market is highly competitive and subject to wide price variations. Such a plant would thus require a very low gas price to be economic.

Refinery

The existing refinery potentially could use an estimated 0.04 bcm of gas per year. However, gas would have to compete in price against the surplus fuel oil that the refinery currently consumes. Powering the proposed new refinery with gas appears to be even less of an option, since it is far from existing gas production and would incur large transportation costs under any supply scenario.

Cement plant

The existing Atlantis cement plant, recently expanded, could consume perhaps as much as 0.2 bcm per year. Since there is no technical advantage to using gas in cement manufacturing, gas would need to compete with other fuels on price. And like the refinery, the cement plant currently uses relatively cheap surplus fuel oil.

(Atlantis_Global Gas Case Study_2012 Dec18_FINAL.doc)