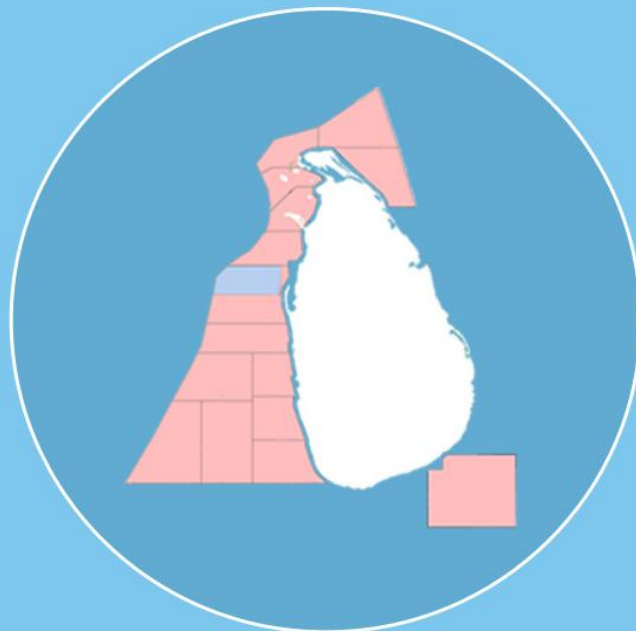


Workshop on
**“Competency Building and Capacity
Enhancement of the
Emerging Off-shore Gas and Oil Industry in
Sri Lanka”**

On 07 - 08 January 2013

at Jetwing Blue, Negombo

**ABSTRACTS
&
List of Invitees**



University Grants
Commission



Petroleum Resources
Development Secretariat (PRDS)

Competency Building and Capacity Enhancement of
the
Emerging Off-shore Gas and Oil Industry in Sri
Lanka

Abstracts and List of Invitees of the Workshop

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07 January 2013

The Exploration and Production Industry: Global Perspectives and Sri Lankan National Prospects and Opportunities

Prof. Stuart Burley

Head of Geosciences, Cairn India Limited, India

The World demand for energy increases almost linearly with population growth. Although non-hydrocarbon and renewable sources of energy are increasing in availability, and the cost of these forms of energy are reducing, hydrocarbons remain an essential part of the global energy supply mix, with oil declining in proportion but gas increasing dramatically in proportion. All predictions indicate that this trend will continue to 2030 and probably beyond, although the impact of global warming and consequential anthropologically accelerated climate change, is a 'wild card' that inevitably will destabilise the widespread unregulated use of hydrocarbons. The 'Stone Age' did not end because the world ran out of stones. Time for new country entries construct from ground zero a traditional E&P industry is limited.

The World has passed 'peak oil' – that is we are producing more oil than we are finding, but this is not true for gas, as unconventional gas resources play an increasingly more important part of the global resource base. This trend will continue. Enormous volumes of gas are being discovered in shales, traditionally seen as source rocks or seals, and unimagined as reservoirs less than 10 years ago. Other sources of unconventional gas resources (such as methane clathrates) will further dramatically change the hydrocarbon industry over the next few decades, and continue to facilitate LNG and GTL technologies.

The oil and gas industry is highly technical and has undergone a series of revolutions, largely driven by selling price. The industry is different from mining and other technical businesses in that the resource – oil and gas - is hidden from the eye by virtue of the fact that it lies beneath the ground, and so the industry employs specialists and advanced techniques to see into the subsurface to find the hidden hydrocarbons. Geochemical scientists tell us that typically less than 3% of the volume of a sedimentary basin encounters hydrocarbon migration and accumulation – its very easy to drill into the remaining 97% !There are therefore inherently huge risks and uncertainty associated with hydrocarbon exploration and production, with the amount of risk decreasing as the hydrocarbons are discovered and preparations are made for development and production. The industry invests expertise, money and time to reduce risk and uncertainty so that the maximum amounts of hydrocarbons found and produced CAPEX and OPEX costs are optimized. E&P companies are international. They operate across international boundaries wherever oil and

gas are found because the sedimentary basins do not follow national boundaries. They use technology to make discoveries in new basins, in deeper waters, in more extreme environments, and in less permeable rocks, economic. Opportunities for niche players will therefore arise wherever national organisations and technology companies can provide expertise and essential services. The E&P industry has a long established track record for 'borrowing' and adapting technologies from other industries to apply in the search for oil and gas.

The way in which the E&P industry reduces risk and uncertainty is through the collection of subsurface data and through the application of technology and expertise to get the most and best quality data possible. A national data repository is therefore an essential national asset that should be enforced to make data collection and archive mandatory, with the data being available to the industry and academia via a regulatory body. In examples of best practice, such as in the US, Norway, UK and Australia, it is the national data repository that has created research laboratories open to all bona fide researchers from their national datasets.

The E&P industry in Sri Lanka is at a very nascent stage, with no oil or gas production to date, but Sri Lanka has the potential over the next decade to become an oil and gas producing nation. Now is the time to define policy and strategy and invest in niche parts of the E&P business cycle and use expertise and technology to national advantage. Technology is a global activity – we live in the 'global village' – where there is no shortage of technology, innovation and skills/knowledge transfer in E&P. The key to building competency and capacity for new country players lies in strategic partnership and positioning in this global technology village.

Sri Lanka's Petroleum Legislation and Fiscal Regimes

Saliya Wickramasuriya

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Being one of the last countries in the world to contemplate ownership of commercial hydrocarbon reserves, Sri Lanka is not short of precedent. History books are replete with examples of countries whose economic prosperity was accelerated by the exploitation of their mineral wealth. However their experiences have by no means been uniform; each has faced considerable challenges in the management of its resources; and in the worst cases, successive governments have failed to ensure that the true owners of this wealth – the people – have benefited adequately. One fact that emerges from this study is that there is no particular "best practice" to follow. Each country has its own unique solution.

Many resource-owning countries did not in the initial stages of their development possess adequate volume of the highly specialised knowledge or the substantial funds required to successfully find and produce hydrocarbons. This led to oil and gas exploration becoming a primarily private sector activity worldwide, dominated by international oil companies (IOCs) with the relevant skills, experience and financial strength to take on significant exposure. The main objective of all oil companies, international or national, namely to generate profits with which to reward shareholders or fund national budgets, is tempered by the highly speculative nature of the business, where potential returns may be over a decade after investment. This unusual risk profile requires a special approach to both project evaluation and accounting, as the sensitivities of the parameters that influence attractiveness are different from those for more conventional investments. Coupled with these special and often confusing financial skills, oil and gas companies also typically have a much better understanding of the asset than the resource owner. This asymmetry of information has led to inequity in resource sharing agreements worldwide, and is something that emerging resource owners like Sri Lanka need to address early.

As such, the objectives of a Government newly embarking on the road to mineral wealth must be to first understand the resource fully, and then learn how to manage it effectively. This requires us to develop the geotechnical and economic expertise to understand and manage business risk like a private sector oil company, yet simultaneously balance the spectrum of social, cultural, environmental and political imperatives that are State responsibilities. It will

mean forging and maintaining international relationships that complement national objectives, engaging indigenous businesses and professionals in building the capacity to make future key decisions locally, and ensuring industry stability by positively engaging all segments of society.

The paper identifies the ingredients required to create an attractive investment climate in a highly competitive environment, while at the same time securing maximum national benefit. The underlying message is that oil and gas have the capability to deliver the quantum economic stimulus the country needs, but that in order for it to happen the hydrocarbons must first come out of the ground. This in turn will require clear and firm action from a number of key stakeholders, many of whom are represented at this workshop.

Exploring the Mannar Basin, Sri Lanka - The story so far and future potential

Prof. Stuart Burley

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on behalf of the Cairn Lanka Exploration Team; P. Mohapatra, M.S. Srinivas,
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The Mannar Basin is located off the western coast of Sri Lanka and contains a sedimentary section that exceeds 7km in thickness, the age of which ranges from Jurassic to Recent. The basin developed during the rifting and related continental break-up associated with the fragmentation of Gondwanaland during the late Jurassic and has similarities with the east coast of India basins to the north of Sri Lanka where several hydrocarbon discoveries have been made in the Cretaceous rocks of the Cauvery Basin. This similarity provided the impetus for Cairn's initial interest in the basin even though some 10 unsuccessful wells have been drilled on the Indian side of the basin over the last 2 decades and 4 dry wells were drilled in Sri Lankan waters in late 1970s and early 1980s.

In 2007, the Sri Lankan Government, under the auspices of the Petroleum Resources Development Secretariat (PRDS), launched the new licensing round for the Mannar Basin. Subsequently, the block SL 2007-01-001 was awarded to Cairn in 2008. This marked resumption of hydrocarbon exploration in Sri Lanka after a hiatus of some 25 years and saw Cairn Lanka enter the frontier Mannar Basin as Cairn India Limited's first international venture. Technical work and planning led to the tendering of geophysical surveys in 2009.

In January 2010 the exploration phase started with the first ever 3D seismic acquisition programme in Sri Lanka with 1750km² of high resolution 3D seismic being successfully acquired along with supporting gravity and magnetic acquisition surveys. Processing and subsequent interpretation by Cairn Lanka geologists and geophysicists revealed the presence of multiple hydrocarbon plays that could lead to the discovery of hydrocarbons. The main technical challenges were to develop an understanding of:

- Reservoir presence, type and quality;
- Source rock presence, type, timing of generation and hydrocarbon migration to traps;
- Presence of traps and seal potential;
- Understanding igneous rocks in the basin and their thickness, and potential to have produced heating to 'over-mature' the source rocks.

This work recognized the enormous uncertainties in the basin and required the use of best-in-class technical expertise, advanced techniques, workflows and technologies to reduce these geological risks. The technical work demonstrated that the basin contains a complex sequence of potential source and reservoir rocks. An extensive early Cretaceous source kitchen was mapped over large parts of the basin which geochemical modeling suggested that the source rock in this kitchen is gas prone but that oil prospectivity is possible.

Once the technical work was completed, and proposals were reviewed with PRDS, the first phase of exploration drilling began in Q3 2011, with 3 exploration wells being completed and two gas and condensate discoveries made. The main result of this exploration campaign was the establishment of a working petroleum system in the frontier Mannar Basin. Potential deep water reservoirs are represented by channel-levee complexes, slope fans and basin floor fans in the Cretaceous. Thick sand packages are present in the Late Cretaceous and Tertiary in the recently drilled wells in the basin, with log-based porosities of up to 30%. The presence of multiple play types, including four way structural closures, stratigraphic pinch-outs, rotated fault traps and deep water channel-fan systems are further positive indications for the hydrocarbon prospectivity in this frontier territory.

Cairn Lanka acquired an additional 600km² of 3D seismic in 2012 and will continue technical work leading to further exploration and appraisal wells in 2013 and beyond.

Development of Petroleum Reserves in Sri Lanka with the Experience from the North Sea

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North Sea oil and gas is a great industrial triumph of the twentieth century and the largest, most successful single enterprise in the modern economic history. Massive in concept, in employment and in the generation of vast wealth, the production of hydrocarbons from some of the most unforgiving waters on earth has been a triumph of pure human endeavour to equal any achievements in space. The heroic saga of the North Sea began quietly in the mid-1960s, when a group of geologists and seismologists, sought to prove an academic theory that the seabed harboured secret reservoirs of hydrocarbon.

The first oil production from the Norwegian North Sea started in 1971 from the giant oil and gas field, Ekofisk, operated by Phillips Petroleum. The economy of Norway has shown robust growth since the start of the industrial era and much of this growth has been fuelled by an abundance of natural resources, including petroleum exploration and production, hydroelectric power, and fisheries.

The first oil from Forties operated by BP, UK reached the land at Cruden Bay in 1975. The stagnant economy in Aberdeen and the North East were hauled into the twentieth century and transformed into the energy capital of Europe, by a dynamic mass of 900 new businesses with a work force of 150 thousand people, and at its zenith, 400 to 450 thousand in the UK.

A comparison of Stavanger and Aberdeen affords a valuable analytical opportunity as the circumstances under which the two regions developed into oil capitals are strikingly similar. But the development of local technological and industrial capabilities has followed very different paths in the two regions. In Norway, the national, regional and local authorities made concerted efforts to develop local capabilities in the oil and gas industry. In contrast, the industry in Aberdeen grew despite a lack of consistent support from local industry. These differences in the institutional and policy environment do not, however, appear to have led to significant differences in the international competitiveness of the two local industries.

In each region, oil and gas is by far the largest industry; and the local industry in each region also accounts for an important share of national employment in the oil sector. This is especially true of the Stavanger region, where nearly 50% of

Norway's total employment in the oil and gas industry is located. In the U.K. more than 20% of the total oil and gas sector employment is found in the Aberdeen region. Local authorities in both locations have, however, worked hard to prepare the infrastructure necessary to attract foreign companies.

Domestic capability building was a clear policy priority for Norway from early on. This was reflected in the establishment of a national oil company, Statoil, and in specifying licensing conditions, which often required technology transfer from foreign companies to domestic organizations. The government systematically evaluated and rewarded foreign oil companies who contributed to domestic capacity building. Concessionary procedures were used as an instrument to force international companies to engage in technology transfer and local content development.

For an industry to be attractive over an extended period of time, it must be able to attract the best human capital into educational programs that provide the prerequisite knowledge upon which industry can build further. Therefore, it is of vital importance that industry keeps close communication with educational policy makers before committing resources to invest in new technologies and competence development.

This paper discusses briefly a few policy orientations of the petroleum industry in Norway and their value and relevance; and draws attention to the experiences, lessons learned and best practices which can be used for the benefit of competency building and capacity enhancement for the emerging oil and gas industry in Sri Lanka.

Challenges of Sri Lankan Petroleum Industry

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Global petroleum demand is around 90/mbd of which about 50 percent is consumed in OECD countries. Sri Lanka's petroleum product consumption is miniscule in comparison to the global demand. The country has long been an import dependent consumer of petroleum products with about 24 percent of country's expenditure on imports being spent on them at present. In 1970s, this industry has had an employment in the region of 600-700 and it employs about 6000-7000 people at present. The government owned Ceylon Petroleum Corporation (CPC) has long been a monopoly provider of petroleum products to the local market before being converted to a duopoly in 2003. Several subsectors of the petroleum industry have been liberalized in 1990s with a view to create a competitive environment. Just like in many other countries, transport sector is the largest consumer of oil in Sri Lanka. CPC was able to meet the total petroleum product demand in the country through its only refinery in 1970s. Petroleum product demand in the country has been rapidly rising in the recent years. As the demand was rising, increasingly the largest proportion of petroleum supplies to the local market has to come from imported refined product sources as the supply capacity of the CPC's refinery remained fixed. Emerging trends in the industry indicate that the regulating the country's petroleum industry is an important area of concern. Ensuring petroleum supply stabilities in a manner to support the ongoing rapid socio-economic transformation of the country have been placed high on the petroleum policy agenda at present. Government pricing policy for the industry has been consistent since 2005 in which frequent price adjustments in tandem with price movements in international markets have been abandoned. Oil for electricity generation has been as an area of major concern to CPC as those supplies have always been heavily subsidized aiming at ensuring uninterrupted round the clock supply of electricity in the country.

Health, Safety and Environment Concerns and Management in the Sri Lankan Offshore Oil & Gas Industry

Prof. Ajith De Alwis¹ and Eng. K.G.V.K. De Silva²

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²*Former Environment Engineer, Abu Dhabi Oil Company Ltd (Japan), Abu Dhabi, UAE*

This paper identifies key health, safety and environment (HSE) issues which may impact the offshore oil & gas industry in Sri Lanka. The different definitions of HSE issues as well as their overlapping nature is considered. Typical areas of concern are then discussed and highlighted. The essential features of an HSE Management System suitable for Sri Lanka is proposed; and the regulatory, infrastructural and human resource requirements for the effective addressing of HSE concerns are presented.

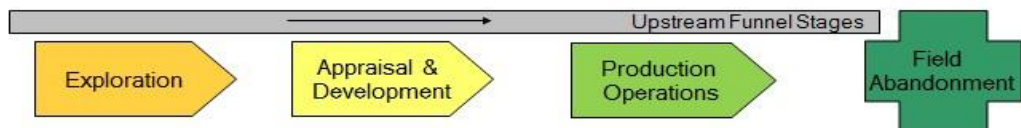
Keywords: HSE, Offshore, Environment, Occupational Health, Safety, Impacts, Risk Based, Management Systems, Regulation, Infrastructure, Human Resource

The Exploration and Production Business Lifecycle: Drivers and Timescales

Prof. Stuart Burley

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The E&P business is well established with a well defined project and workflow funnel, encompassing Exploration, Appraisal, Development, Production and Field Abandonment. The business involves dangerous activities so HSE best practice is paramount throughout the lifecycle. A single major HSE incident can destroy business viability and credibility.



Exploration activities include:

- acquisition of seismic and other geophg to image the subsurface
- understanding the subsurface geology to identify rock types and sequences
- Prediction of where oil and gas might be trapped and calculation of possible oil and gas volumes
- Drilling of wells to search for hydrocarbons

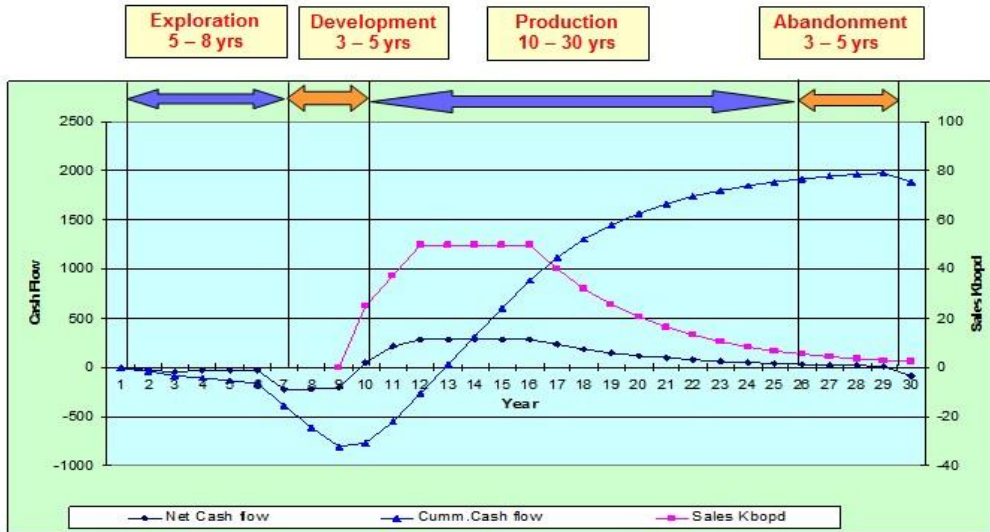
Appraisal & Development activities take place once hydrocarbon discoveries have been made to better constrain the amount of hydrocarbons that are present to assess whether the discovery can be economic. This is the stage Cairn Lanka has reached in the Mannar Basin. Key activities include:

- Collecting additional data, geophysical surveys or from wells to better define field size
- Interpretation of data to characterise the reservoir, understanding continuity and compartments
- Understand how to optimally produce the reservoir with the fewest wells and production facilities
- Make a field development plan
- Production Operations are the activities associated with flowing oil and gas to surface ready for distribution and sales. Key activities are:
 - Recover the oil and gas to surface for processing and transport
 - Optimise flow into the wells and facilities for maximum production

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- Enhanced recovery stimulations, treatments and interventions to maintain flow

Abandonment is simply the safe and environmentally responsible closure of all production activities.



These activities require significant investments and long lifecycles because of the nature the planning, data acquisition and interpretation workflows. Specialist skills and technologies are usually required at each stage, and efforts are continuously made to reduce project time lines. Key drivers are to increase exploration success, reduce time to production, and maximize recovery.

08 January 2013

Local Content Development with Special Reference to Employment and Training

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Local Content (LC) has become very topical globally in the oil and gas sector. The paper explains why it has become an intense issue and urges the need for a country specific LC development policy in order to meet the potential human resource requirement in the oil and gas sector of Sri Lanka.

The fiscal regime (state take) associated with petroleum resources sharing systems is of direct benefit to the host country. Royalty, profit share, NOC share, bonuses and taxes have an impact on the host country's economy. However, in many countries, owing to mismanagement, corruption and other problems, the benefits of this major industry have not been shared out fairly amongst the whole community. Therefore the LC, commonly referred to as indirect benefits or added value, has become an important aspect of the oil and gas sector. LC is subjective and is defined variously, depending on the country's level of socio-economic development. As per the Nigerian LC act, LC refers to the quantum of composite value added to or created in the local economy by a systematic development of capacity and capabilities through the deliberate utilization of local human, material resources and services in the oil and gas industry of the host county. There are other definitions such as "added value brought to the host country through procurement of goods and services and development of the local workforce" and strategic community investment". To achieve these benefits, countries have developed their own LC strategies and made the LC a contractual obligation by incorporating in their resource sharing agreements all or part of the LC provisions such as improvement of livelihood of needy communities, transfer of technology, preference for the procurement of local goods and services, maximum use of local workforce, research & development, and local knowledge enhancement through education and training opportunities. Also, the LC is a frequent flashpoint between Contractors and governments as the government wants to maximize opportunities and benefits to its citizens, while the Contractor wants the best workers, supplies and, above all,

quality and safety. Therefore planners of a local content strategy need to play a balanced role in providing a winning proposition for both government and the Contractor.

The LC development strategy starts with collaborative activities with individual institutions and foreign contractors and develops progressively in stages from a basic LC model to centres of excellence. Many countries are in the process of enacting laws to make LC mandatory. Nigeria signed its LC act into law in April 2010 and emphasizes a Nigerian Content Plan that incorporates an employment and a training plan. Also countries like Norway, Brazil, Canada which have reached higher level of Petroleum activities execute their LC requirements through centers of excellence delivering project-based total industry solutions. Overall, the development of LC strategies with special reference to employment and training has become an integral part of almost all countries engaged in petroleum activities.

Sri Lanka is a frontier basin which implements basic LC provisions with its Contractor Cairn Lanka in a collaborative and a friendly manner. Section 22 of the PRA (Block SL 2007-01-001) with Cairn Lanka emphasizes the establishment of an annual training program for Sri Lankan nationals and employment of Sri Lankan nationals with appropriate qualifications and experience to the fullest possible. Further, the recent hydrocarbon discoveries, future developments in the E&P activities and the upcoming international licensing round necessitate the country's preparedness for a basic LC model with special reference to employment and training of Sri Lankan nationals. This could only be achieved through an effective participation of the key stakeholders such as government, local industry, R&D sector, education sector, financial sector, oil & gas investors, and service companies.

Academic, Scientific and Managerial Personnel Needed to Support the Emerging Gas and Oil Industry in Sri Lanka

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Sri Lanka has an Exclusive Economic Zone (EEZ) of 517,000 km² extending to 200 nautical miles (370 km) from the coastal line, which is eight times the size of the landmass. Thus only about 12% of the country is above water and the remaining 88% is under water. Sri Lanka has the rights to resources in the water column, seabed and subsurface in the EEZ and, under the UN Law of the Sea, is also entitled to claim for an extended area of seabed where the thickness of the sediment layer exceeds one km. This claim has been made and if accepted, Sri Lanka would gain an additional seabed area. Therefore the EEZ is likely to expand further with the delimitation of the outer edge of the continental margin of the country, allowing Sri Lanka to own an EEZ which is 23 times (approximately 1,400,000 km²) its land mass. Apart from living resources, the Zone has a variety of exploitable minerals and hydrocarbons (oil and natural gas); and deposits containing titanium, zirconium, thorium, cobalt, nickel, copper, iron and manganese have already been discovered. Thus, Sri Lanka possesses a huge outstandingly rich and diverse biological, chemical, mineral and physical resource base, which remains almost untouched. These resources hold great promise, and the future prosperity and wellbeing of the nation depends on how well these resources are managed and exploited.

Sri Lanka has fifteen universities, ten degree awarding institutes and seven postgraduate institutes under the purview of the University Grants Commission (UGC). These higher education institutions (HEIs) offer nearly ninety degree programmes of which only two (at the Universities of Ruhuna and Wayamba) concern biological marine resources. The University of Peradeniya offers a degree programme in Geology, which deals with Sedimentology and Marine Geology to some extent while the degree programme in Earth Resources

Engineering at the University of Moratuwa deals marginally with the mining of offshore earth resources. The situation is not very different with postgraduate programmes offered by the HEIs. The National Institute of Fisheries and Nautical Engineering (Ocean University), the Kotelawala Defence University and Colombo International Nautical & Engineering College (CINEC), which are outside the jurisdiction of the UGC, offer a degree or diploma programmes in Marine Engineering. CINEC also offers programmes related to Maritime Transportation Management and Logistics. Thus the number of degree courses presently offered by the HEIs in Sri Lanka in Oceanic Sciences and allied fields is woefully inadequate.

Thus, there is a dire need to develop and offer a suite of graduate and postgraduate degree programmes including postgraduate diplomas related to sustainable management and exploitation of marine resources. The need has heightened particularly since the discovery of appreciable quantities of hydrocarbons in the Mannar basin and the new national policy of transforming Sri Lanka, among other things, into a naval and energy hub.

Attention is mainly paid in the paper to the needs of trained manpower in the upstream, midstream and downstream segments of the petroleum industry with special emphasis on the first. In this connection, graduate and postgraduate degree programmes covering the following disciplines will be particularly important:

- Oceanography
- Petroleum Sciences
- Marine Geology
- Mineralogy
- Sedimentology
- Geophysics
- Geochemistry
- Hydrogeology
- Hydrology
- Mud Logging
- Maritime Health, Safety, Security and Environment (HSSE)
- Off-shore Surveying and Digital Mapping
- Off-shore Engineering
- Engineering Geology
- Petroleum Geology
- Petroleum Engineering
- Process Engineering
- Chemical Engineering
- Drilling Engineering
- Mining Engineering
- Reservoir Engineering
- Pipeline Design Engineering
- Structural Engineering

- Sub-sea Hardware Engineering
- Naval Architecture
- Oil Brokering
- Plant Management
- Personnel Management
- Marketing Management
- Account Management
- Maritime Transportation and Logistics
- Law of the Sea

Lack of necessary trained human and infrastructural resources in the HEIs constitutes a serious constraint to developing and delivering such courses. This deficiency could be circumvented to some extent by sharing and utilizing the human and physical resources available in the HEIs as well as in the public sector (Sri Lanka Port Authority, Geological Survey and Mines Bureau, Ceylon Petroleum Corporation etc.) and the private sector (Colombo Dockyard Pvt. Ltd., Lanka Hydraulics Institute, Master Divers, Laughs etc.) institutions in the country. An appreciable number of Sri Lankan expatriates hold senior positions in the petroleum industry and in universities in leading oil producing countries. Development of a database of such expatriates would be useful in obtaining their services to identify, develop and deliver relevant courses. This could be further augmented by developing link programmes with appropriate, renowned foreign universities and research institutions that could assist in capacity building in relevant disciplines.

Gas and Oil industry can offer lucrative employment opportunities for students in Science, Engineering, Management, the Humanities and Social Sciences. Some of these courses can be quite attractive to foreign students as well, and thus serve as a source of additional income to higher education institutions in Sri Lanka. It is therefore of paramount importance to develop human resources in the said fields for the sustainable management of the marine resources, promoting economic development and social wellbeing of the people of Sri Lanka.

Manpower Needs at Craft Vocational and Technical Levels and Capacity Building in Educational Institutions

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Indications of the presence of petroleum reserves in the Mannar basin from the recent exploratory drillings has generated interests for further explorations and possible oil drilling and production. Exploration of petroleum reserves offshore had been practiced for many decades and technological advancements have been made to make the complex operations possible in increasingly deeper waters. Exploratory drillings will bring new technologies and series of ashore based industries. The identified exploration company has agreed with the government to engage Sri Lankan nationals for the exploration process.

This paper would examine manpower needs for the process of exploration, drilling and production of Gas and Oil. The processes would begin with construction of wells, well platforms, feeder subsea pipes lines, processing platforms, export pipes lines and tanks for evacuation of oil. Depending on the depth of water, different types of platforms are constructed using either concrete or steel.

A typical oil production platform is self-sufficient in energy and water needs, housing electrical generation, water desalination and all equipment necessary to process oil and gas such that it can be either delivered directly ashore by pipeline or to a Floating Storage Unit and/or tanker loading facility. Elements in the oil/gas production process include wellhead, production manifold, production separator, glycol process to dry gas, gas compressors, water injection pumps, oil/gas export metering and main oil line pumps.

Looking at the overall scope of production processes involved, training and competency should be concentrated on the following areas of engineering in graduate, diploma and craft levels.

- Electrical Engineering
- Instrumentation and Control

- Electronics and Telecommunications
- Petroleum Engineering
- Mineral Resources Engineering
- Petroleum and Natural Gas Processing Technology
- Mechanical Engineering
- Manufacturing Technology
- Power Plant technology
- Welding Technology
- Industrial Safety and Environment Technology
- Petroleum Marketing and Business Studies
- Marine Engineering and Naval Architecture

Many of the above fields of engineering and technology are presently conducted in Sri Lankan universities at graduate and diploma level and new courses should be commenced in the area the following areas;

- Petroleum Engineering and Geosciences
- Petroleum and Natural Gas Processing
- Instrumentation and Control
- Petroleum Marketing and Business Studies
- Industrial Safety and Environmental Technology
- Welding Technology and Offshore Technology

Manpower at Crafts level should be highly competent and be able to work in offshore environment and in the ashore based industry. Retraining of skilled craftsmen to work in such environments and to handle modern and specialized tools and machinery will become necessary. Safety of workman is one of the most important factors in oil and gas industry and hence safety training and regular upkeeps become necessary

Capacity Building Needs in Industry

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The Oil & Gas (O&G) Industry is a complex and unique industry that entails many opportunities. The requirements being extremely stringent, it is hard for any country to exploit such opportunities easily. The presentation attempts to identify the areas of the O&G Industry in which Sri Lanka has the potential and strength or able to enhance its capacities to reap benefits from the local content the oil & gas exploration activities in Sri Lanka.

The American Petroleum Industry (API) divides the O&G Industry into five sectors;

1. upstream sector,
2. downstream sector
3. pipeline sector
4. marine sector
5. service and supply sector

Understandably, the upstream sector is outsourced from competent global players and the local content, if any is built over very long time.

However, Sri Lanka has the potential to exploit the other industry sectors, with enhancement of capacity.

The Marine Sector can be considered the most potent industry to exploit some of the emerging opportunities. Colombo Dockyard PLC, with its existing ship repair & shipbuilding facility, is ideally located and capable of handling almost all the repair requirements of crude, product and gas carriers save for some limitations; i.e. the size of the docks; which can accommodate only the vessels below 120,000 DWT (Aframax vessels; below 42 m in beam or 260m in length).

Presence of drill ships, support Vessels, FSO (Floating Storage and Offloading) and FPSO (Floating Production, Storage and Off-Loading) facilities will also generate more repair and building opportunities as well. It may be important to evaluate the existing capacities and compare those with the emergent requirements and fill any gaps found.

The Pipeline Sector is a vital sector, but regrettably Sri Lanka lacks the knowhow and experience in designing, construction, laying, operation and

maintenance of the requisite and sophisticated pipelines. Considering the location, size and other demographic reasons of Sri Lanka, the necessity of large networks of pipelines in Sri Lanka would be somewhat remote and limited. However, gradual and systematic building up of capacity to meet the emergent needs may be of importance. The subsea pipelines, i.e. the pipes that are used for transportation of the natural gasses (and oil) that would be extracted from offshore wells or FSO/FPSO (Floating Production, Storage and Off-Loading) facilities. With limited experience and exposure, the designing and laying of such sophisticated pipelines may have to be outsourced, but Sri Lankan companies could engage in fabrication, Non-Destructive Testing, supply and application of coatings & protection systems and in periodic maintenance of such subsea pipelines. Capacity needs to be built to meet such emergent needs.

Service and Supply Sector is yet another vital and highly value-adding component of the O&G Industry, which in fact starts with the commencement of the exploratory work. Such services may vary from very simple & basic services of organizing air-line tickets to sophisticated engineering and/or sub-sea services and the emergent needs have to be clearly identified and requisite capacities need to be enhanced.

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