



Intense Year Ahead for NGC's Project Teams

Page 2

Mitigating the Impact of
the Proposed Port on
Claxton Bay Fisheries
Page 13

July 2010

The National Gas Company of
Trinidad and Tobago Limited (NGC)
Orinoco Drive
Point Lisas Industrial Estate, Couva
Republic of Trinidad and Tobago
West Indies

● **MANAGING EDITOR**

Christine Punnett

● **CONTRIBUTING WRITERS**

Wade Hamilton, Haydn I. Furlonge,
Daren Ragoonanan, Shazam Edoo,
Dr Reeza Mohammed

● **PHOTOGRAPHS**

NGC Archives, Kevin Reis

● **DESIGN**

Lonsdale Saatchi & Saatchi
Advertising Limited

● **PRINTING**

Zenith Printing Services Limited

● **ALL CORRESPONDENCE TO**

GASCO NEWS
c/o NGC Marketing Communications
P.O.Box 1127, Port of Spain
Trinidad and Tobago

● **PRODUCED BY**

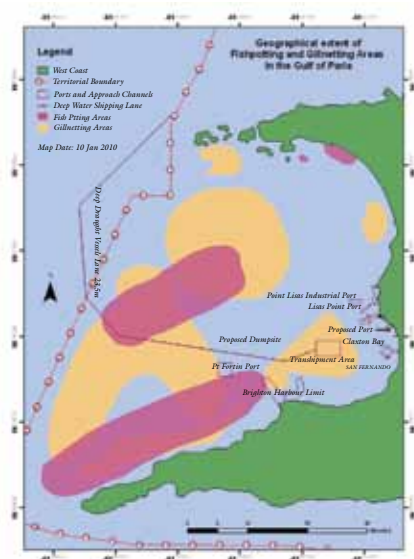
The National Gas Company of
Trinidad and Tobago Limited (NGC)

Front Cover: NGC pipelaying activities.

Material in this publication,
with the exception of
photography, may be
reproduced once credit
is given to GASCO NEWS.



*Wade Hamilton, right, VP Technical Operations, with Gas Exporting
Countries Forum's Secretary-General, Leonid Bokhanovsky.*



14



29



30

TECHNICAL OPERATIONS

An Intense Year Ahead
for NGC's Project Teams 2

BUSINESS DEVELOPMENT

Consideration for New
Energy Policy Direction 6

Business Continuity Management
– Are We Prepared? 9

THE ENVIRONMENT

Strategies for Mitigating the Impact
of the Proposed PLSEIE Port on the
Mullet and Shellfish Fisheries in
Claxton Bay (Conclusion) 13

NGC NEWS

Pipeline Projects
Move Ahead 27

Gas Exporting Secretary-General
Impressed with NGC 27

Liquid Fuels Pipeline Project 28

NEC NEWS

Oropouche Bank 29

Galeota Port 29

Pt Lisas South and East
Industrial Estate Port
Development 29

Towage and Harbour Operations 30

LABIDCO NEWS

Infrastructure Projects at the
Port of Brighton 31

Dock and Storage Yard 31

Raw Materials Storage and
Handling Facility 31

Capital and Maintenance Dredging 31

INDUSTRY NEWS

EOG Adds 2.27BCM from Pelican;
Toucan Next 32

New Energy Minister 32

Genesis to Evaluate Block 5c
Commercialization Options 32

National Gas Talks Coming 32

New Bid Round Soon for
Deep Water Drilling 32

AN INTENSE YEAR AHEAD FOR NGC'S PROJECT TEAMS

The 2009-2011 period is proving to be a significant milestone for NGC in terms of construction projects, since the last major activities with the development of the Cross Island Pipeline (CIP) and Beachfield Upstream Development (BUD) projects in 2003-2007.

NGC's Projects Division currently has a portfolio of five major projects, representing over TT\$4.9 billion under active development, in addition to a number of smaller ongoing projects. The span is island-wide and inclusive of Tobago, starting with the NEO (North-eastern Pipeline) and Tobago offshore pipeline projects in the northeast, the Liquid Fuels Pipeline and Phoenix Park Valve Station projects in Central Trinidad and the Union Industrial Estate pipeline project in the southwest of the country. The projects are all Greenfield developments, with the exception of the Phoenix Park Valve Station Upgrade (PPVS) which is a major Brownfield upgrade. These projects are all now under active construction and will be substantially completed by the end of the 1st quarter 2011.

The task that faced the Technical Services Group was daunting. The Engineering and Construction Division was severely challenged in the development of these projects due to limited manpower resource availability. The commitment to deliver in order to meet contractual obligations required creative thinking as it was no longer business as usual. Projects were combined to optimise the use of resources where there were natural synergies such as the NEO and Tobago projects, given their proximity to each other. Teams had to be staffed with a combination of internal employees and external contract personnel at all



By WADE HAMILTON
VP Technical Operations

levels, from Project Manager all the way through to field inspectors, via direct hire, or external service providers. One way or the other, the job had to get done.

The approach and methodology for management and execution were altered, where greater responsibility was given to the consultant as and when required. In some instances, elements of the projects were broken into smaller design sub-packages that were issued to several local engineering houses. There was also the need to break with tradition where the responsibility for material procurement and QA/QC functions was being assigned to the Engineering Consultants, a task that is normally guarded and performed by NGC in-house personnel.

Despite these and a host of other challenges, not to forget the lack of office space, the outlook for completion of these projects is bright. The teams have delivered and the designs that once stood on paper are now materialising into finished structures. There were casualties, such as the delay in getting the new administrative complex developed. However, this will be given special emphasis this year.

PROJECT UPDATES

THE TOBAGO PIPELINE PROJECT

The Cove Estate

The Cove Eco-Industrial Estate will be the first gas-based estate in Tobago. The Company is currently constructing an inlet gas receiving facility that is designed to handle between 15 and 120 million cubic feet per day (MMscf/d), and a low pressure distribution pipeline on the estate. At present, its only tenant is a T&TEC power generation plant. However, once the Tobago Pipeline is completed, the T&TEC plant will switch from diesel to the cheaper and environmentally-cleaner natural gas.

Several light gas-based industries are expected to take advantage of the versatile fuel which will be available once the pipeline is commissioned. The resulting boost to the Tobago economy, both in terms of direct employment and the multiplier effect upon local support services, will be substantial.

Staging Point for the Eastern Caribbean Pipeline Project

The Tobago pipeline will also provide the staging point for the proposed Eastern Caribbean Pipeline Project, which is expected to supply approximately 30 MMscf/d of natural gas to Barbados and potentially to other islands in the eastern Caribbean.

Major Contracts Awarded

The Tobago Pipeline Project is on target for completion as per planned schedule with a high probability for an early completion in December 2010.

The near shore pipeline spread contract was awarded to Mear's



Construction work for marine pipelaying – NEO/Tobago pipeline projects

International for the Horizontal Directional Drilling (HDD) and the nearshore 1.2 km pipelay was awarded to Allseas. The works commenced in early October 2009 and were successfully completed in January this year without any loss-time accidents, an effort well deserved of commendation. It is expected that that main 54 km subsea pipelay exercise will commence in the 2nd Quarter with the construction of the 12-inch-diameter subsea pipeline that will run from the proposed BHP Billiton Gas Export Platform (GEP) in the Angostura field to Cove Estate in Tobago.

The engineering design has been completed and the focus of the project team is now concentrated on constructing the facility and the subsea pipeline. All of the major contracts for the supply of plant and equipment have been awarded, with the exception a few smaller items that are still pending. Supplies were procured through the services of local vendors and agents wherever possible.

The major local contracts were

awarded to Carillon and API Pipeline Contractors for the civil and mechanical erection works respectively. The Carillon civil works contract at the end of December 2009 was substantially completed. The main mechanical work package was awarded to API Pipeline Construction Company Ltd. It is expected to commence at the end of the 1st quarter this year. If the project continues to maintain its current rate of progress, there is a distinct probability that we could achieve an early completion.

NEO PIPELINE PROJECT

Construction of the North Eastern Offshore Pipeline also continues apace. The project is being conducted simultaneously with the Tobago project. The 36-inch subsea pipeline will leave the BHP platform and run parallel to BHP's oil pipeline and make landfall at the Mayaro Bay regulator station where NGC's 30-inch Cassia pipeline comes ashore. It is expected that this line will be laid between the end of the 2nd quarter and 3rd quarter this year.

When completed, this pipeline will have capacity to deliver 1.0 billion cubic feet per day into the Beachfield onshore terminal facility.

The contract for construction of the 9 km on-land section between landfall at Mayaro Bay and Beachfield was awarded to South M Contractors Ltd. Construction is expected to commence at the end of the 1st quarter this year.

As with the Tobago project, an HDD bore is planned to bring the 36-inch pipeline ashore. The HDD decision was taken in an effort to minimize the impact on the coastal environment and to reduce the potential risk of damage to the existing 30-inch pipeline.

PHOENIX PARK VALVE STATION

The Phoenix Park Valve Station (PPVS) project continues to gather momentum as this is a major Brownfield upgrade to NGC's central hub in addition to the fact that major works are being conducted in an active facility.

To date all of the major contracts for construction have been awarded, with the exception of the contract for the

electrical and instrumentation and safety shutdown systems.

The main mechanical erection work package was recently awarded to Trinweld Contracting Services Ltd and it is expected that this work will commence in early April. If all goes according to plan, it is expected that the project will be completed by the end of the 1st quarter 2011. The new PPVS station will have the capacity to handle up to 3.0 Bcf.

UNION PIPELINE PROJECT

The Union Pipeline project is designed to bring gas to the Union Industrial Estate (UIE) via a 24-inch spur line connected to the Cross Island Pipeline near Pablito Trace. The project entails the construction of a 6 km 24-inch pipeline, an inlet receiving and metering facility, and a high and low pressure distribution pipeline network. The facility was designed by Universal Pegasus who was also given the responsibility for material and equipment procurement. So far, the clearing of the Right-of-Way commenced in early November 2009. The civil works contract for the facility was awarded to local contractors Namalco Construction Company Ltd. The main pipeline

The new facility will replace the need for bulk fuels to be transported by ship from Petrotrin and NP Sea Lots, and eliminate the need for tank wagons to carry jet fuel on the roads



Horizontal Drilling – Liquid Fuels System

construction contract was similarly awarded to API Pipeline Contractor Ltd. These works have commenced. This project is on a tight delivery schedule to facilitate the early startup and commissioning the TGU power plant in June 2010.

LIQUID FUELS SYSTEM

The Liquid Fuels System Project is also progressing. The project entails the construction of an 8-inch-diameter line that will transport premium and super gasoline, A1 jet fuel and diesel from Petrotrin to a terminal storage facility currently under construction at Caroni. A second line will transport aviation fuel from Caroni to the Piarco International Airport.

The project includes the construction of large storage tanks at Petrotrin and Caroni in addition to a new state-of-the-art loading rack at Caroni. NGC is managing this project on behalf of the Government of Trinidad and Tobago.

The new facility will replace the need for bulk fuels to be transported by ship from Petrotrin and National Petroleum Marketing Company (NP) at Sea Lots,

and eliminate the need for tank wagons to carry jet fuel on the roads. When completed and operational there will be a reduction of carbon emissions of approximately 3.5 million tonnes per year.

Pipelaying Works Complete

Two local contractors were awarded the contracts for pipelaying services. The portion of the pipeline between Petrotrin and Pierre Road was constructed by South M Construction Services Ltd, while the segments between Chaguanas and Piarco were laid by Trinweld Contracting Services Ltd.

The line has been constructed with only minor works outstanding, such as the installation of critical isolation valves. It is expected that all work on the pipeline will be completed in June when the line will be hydrostatically pressure tested.

The Caroni Facility

The new facility is located in the western end of the new eTeck Frederick Settlement estate in Caroni. It will feature nine large fuel tanks, two slop tanks, a fire-water tank and a potable

water tank, a control room building and road tanker wagon product loading bay. It is designed for highly automated operations whereby fuels will be pumped from the product tanks to the loading bay that houses a number of loading arms that can simultaneously load 14 road tanker wagons. Jet fuel will be transferred via pipeline to the Piarco International Airport. There will, however, be a single loading arm at the Caroni facility that serves to dispense kerosene/jet fuel to domestic operators of light aircraft and helicopters, as well as being able to act as a backup system in event of a failure of the line to Piarco.

Major Contracts Awarded

The laying of the tank foundation is being performed by S. Jagmohan & Sons Ltd, and is due for completion by the end of March, whereupon the tanks themselves will be constructed by Damus Ltd at Caroni and Piarco. Chicago Bridge Ironworks will construct the tanks needed at the Petrotrin Refinery. Other contracts, such as those for E&I and mechanical installation, were awarded at the end of March.

The design of the facility is completed and the procurement of material and equipment is approximately 80% completed. In a bid to have better management and control over the storage of equipment and material for the major projects, it was agreed that all material will be temporarily stored at a new site under development on Rivulet Road in Point Lisas.

NP, the key stakeholder who will be responsible for operating the facility, has begun recruiting and training personnel. The operation of this facility will be monitored and controlled using state-of-the-art computer-controlled systems. Operators will be required to undergo intense training using sophisticated simulation software to ensure they are prepared for any possible scenario. It is expected that the overall facility will be commissioned by the end of 2010.

Overview

By the end of 2010, these projects will result in the addition of 177 km of new pipeline infrastructure to the NGC network, resulting in a total of 977 km of pipeline.

In all of the projects being undertaken, NGC continues to encourage the use of local contractors, vendors and service providers wherever possible. NGC is proud that we have been able to reach levels in excess of 40% on some of the projects under current development.

OTHER PROJECTS

Despite the size and extent of these major projects, NGC continues to undertake a number of projects with respect to the upgrade and maintenance of its existing pipeline network. One of the major initiatives for 2010 is an assessment of its 16-inch line into Port of Spain which is over 47 years old. Should the study determine that this pipeline needs to be replaced, design and engineering works will begin this year. This activity will also allow for the planning for the development of a new pipeline to supply gas to a proposed new power plant to be constructed in the Sea Lots area.

The anticipated growth in the Light Industrial and Commercial (LIC) sector, and increased interest in Compressed Natural Gas as a vehicular fuel (which NGC has been promoting in accordance with a government mandate), will

also result in heavier demands being placed on NGC. One such new client is the Tamana InTech Park. A natural gas pipeline to the park was recently commissioned. It will not only serve future clients of the park, but provide fuel for cooling the eTeck Flagship building on the site.

The latter part of 2010 will also see NGC issuing tenders for the pipeline into the Industrial Estate at Diego Martin. This line should be completed by the end of the 4th quarter. NGC sees these efforts as facilitating growth in the LIC sector, another way in which it contributes to national development.

Improved Project Management Systems to Come Soon

NGC as company has evolved over time from the days when the Engineering and Construction Department would handle one or two major projects every three to five years to the point now where they are handling four to five major developments. The doubling of the workload has placed serious challenges on resources and has to some degree impacted on our ability to deliver projects in a cost-effective and timely manner.

The Company recognized that there was a need to upgrade its project management capability and saw the need for the establishment of a Project Management Control Unit. The PMCU is an oversight group that will consist of highly trained professionals who will provide support in areas such as scheduling, design, claims, and contracts administration to the respective project managers and heads. This new structure will also help build the skills of NGC's personnel, to provide for better management of future projects. It is expected that by the end of June the unit will be fully operational and it is intended that the service will be offered to the wider NGC and the NGC Group of Companies.

By the end of 2010, these projects will result in the addition of 177 km of new pipeline infrastructure ...

CONSIDERATION FOR NEW ENERGY POLICY DIRECTION

The natural gas industry is by nature dynamic, reactive and at times unpredictable. Recent convulsions in the financial markets, globalization and changing energy supply-demand drivers are some recent worldwide trends. This article distills a few of the key issues that have implications for Trinidad and Tobago's energy sector and stability of the economy.

Current Energy Landscape

Firstly, the backdrop is one of a staggered climb out of global recession, with global demand for energy being dragged along by the most unlikely economies, such as Brazil, India and China. Over recent months, crude oil prices have been buoyant once again (slightly above the average over the past five years of US\$70/barrel), with ammonia and methanol prices struggling



By HAYDN I. FURLONGE, PhD
Assistant Manager, NGC
LNG & Investment Analysis

to maintain healthy levels (around or just below historical averages of US\$330 and US\$393 per tonne respectively). International natural gas/LNG markets

have been bearish, with prices expected to remain less than favourable (well below the historical average of US\$7 per million British thermal units) to exporters until the end of the decade. An imminent 20% increase in LNG production capacity, and displacement of gas imports due to indigenous production from shale deposits contributes to this poor outlook. Why is all of this important to T&T? Figure 1 demonstrates the strong relationship between the prices of crude oil and natural gas and GDP since the country gained Independence. A high degree of correlation also exists between GDP and total hydrocarbon production.

Energy and Economic Development

This economic construct is largely as a consequence of an industrialization-based model proffered by Sir Arthur

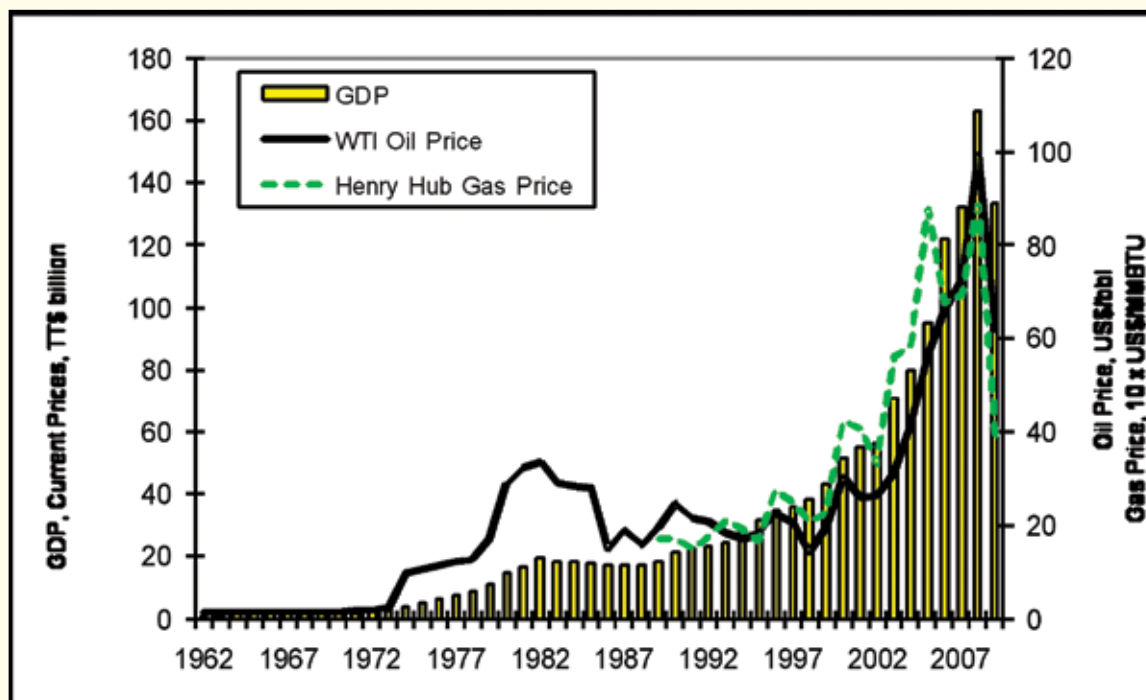


Figure 1. Crude oil and gas prices versus GDP in Trinidad and Tobago

Source: E. Bahaw and H.I. Furlonge, *Proceedings of the Tobago Gas Technology Conference, UTT, 2008*

Lewis in the 1950s, the Mostofi Commission of Enquiry in 1964 and others, which sought to identify (e.g. geographical location, natural resources) and capitalize (via fiscal incentives, provision of cheap land and labour, etc.) on competitive advantages in order to attract industrialists for manufacturing and export. This approach has been adopted and modified by successive Governments since the 1960s, and has given birth to an energy sector that has contributed between 48% and 62% of total Government revenues, between 36% and 48% of GDP, and between 86% and 91% of export receipts over the past five years. Our industry currently comprises a 5:1 ratio of natural gas to oil in terms of energy equivalent production levels. The relative overall contribution to the economy is slightly lower, making it safe to conclude that T&T is now a predominantly gas-based economy. Juxtapose the market scenario for petrochemicals (30% of T&T gas portfolio) and LNG (60%) described earlier, and one realizes that notwithstanding high oil prices, economic outlook is less than what we have been growing accustomed to.

This high level of skewness of the economy and exaggerated volatility in macroeconomic performance have been cause for concern. High inflation in times of above-average hydrocarbon prices, and stifling of non-energy (tradable) sectors due to currency appreciation (typical Dutch Disease effect), pose inherent challenges to resource-rich countries. The following sections examine energy policy matters that have implications for the future state of the T&T economy.

Diversification

Having just passed 100 years of commercial hydrocarbon production, there is much to be proud about in terms of establishing a national identity in the global energy arena. However, by its very nature, oil and gas resources will

be depleted if not beyond the physical limits due to technological capability, then as a result of some impassable economic hurdle (e.g. market price and competition). Yet it may be argued that turning down the burner, so to speak, for the sake of achieving economic sustainability is not prudent. The industry needs to continue growing while diversification pathways are pursued.

One strategy may be to use our strong energy base (not just its revenues) as a foothold for new business opportunities, by developing new energy-related skills and creating more sustainable jobs. Clearly, new strategies are required to help deliver on an effective local content policy. Opportunities include the provision of goods, services, technology and capital/financing by nationals and local companies in the engineering, construction and procurement phase of energy sector projects, and in their ownership, operation and management. The education thrust must be geared towards such economic activities and in creating entrepreneurs, rather than more of the same. A national innovation system and institutional framework for steering and governing R&D is also needed to provide a competitive edge on products and services in the global market place. This must be more than just an academic exercise, and should seek to establish direct linkages with the economy, and to maximize the

resources of all stakeholders, especially the multinational energy companies operating in T&T which may have much to offer in this regard.

Growth and Competitiveness

A sobering aspect of the industry is declining crude oil production, and the much-debated gas (proven) reserves to production ratio which currently stands at around 10 years. Lower than expected results of past bid rounds, protracted negotiations in finalizing recent award of production sharing contracts, maturing fields, and slow pace in cross-border unitization with Venezuela have shaped the current dimmed supply projection. This has affected the timing of any major expansion in downstream activity, given the lag between exploration and reserves commercialization activities. There are implications for GDP growth rates in the coming years, and the multiplier effects (boost in local energy services demand) that would normally ensue from new energy projects. Additionally, the matter of a reserves policy for treating with long-term availability and pricing of gas for electricity generation for residential and commercial sectors may be more relevant today than previously. One must bear in mind that competitiveness of the country's manufacturing sector relies in part on relatively low cost electricity and natural gas.

Another critical consideration is the cost of finding new reserves. Increasing probable, possible and more importantly

One strategy may be to use our strong energy base (not just its revenues) as a foothold for new business opportunities, by developing new energy-related skills and creating more sustainable jobs

proven reserves would require exploration and development work in deeper waters (above 1,500 feet), which is more capital intensive. Fiscal regime revisions and other strategies are necessary to rekindle activity and elongate the backbone of the economy whilst ensuring fair economic rents to the State. One must bear in mind that commercializing such relatively expensive reserves would face competition from the many new and cheaper suppliers such as Qatar and African countries. Furthermore, these suppliers are now competing for a share of the best markets in the Atlantic Basin region which is a serious threat to the country's netback earnings, just as PetroCaribe would have dealt a blow to our markets for petroleum products. Appropriate energy and foreign policy responses are called for.

Adding Value

Value from the energy sector is generated largely in the form of rents (royalties and taxes) from extraction and primary hydrocarbon processing. Further-downstream conversion of ammonia, methanol and ethane/propane presents value-added opportunities. The urea-ammonia-melamine and gas to propylene projects for instance would generate incremental revenues and jobs per unit of gas consumed. It must be emphasized, however, that the real value of such a policy to the broader economy is derived from linkages with the manufacturing sector which would use the secondary products (melamine and polypropylene) for conversion to consumer items. Strategies for pursuing these linkages need to be considered.

State Ownership

With regard to local ownership, indigenous value is derived from dividends (hence reduced expatriation of wealth) and jobs/skills development. Whilst T&T is a major exporter of gas and its derivatives, Government shareholding and depth of involvement

Clean development mechanism (e.g. energy and exergy efficiency and conservation) projects, carbon capture and storage, development of hybrid (fossil fuel/RE) energy systems, and an RE equipment sales and service sub-sector are some of the specific new opportunities to integrate mainstream energy with other business ventures.

in the business is limited compared to that in countries such as Algeria and Malaysia. Indeed, resource nationalism is a growing trend worldwide, whereby Government-owned oil and gas companies are holding greater shares in reserves and in marketing of products. Investments in exploration and production, energy projects in other countries, offshore activities such as LNG shipping and trading, and in exporting energy skills and services are other examples. This goes well beyond the facilitator and rent-collector model adopted locally, notwithstanding certain strategic investments made within country. The question is, how does exploitation of these business opportunities fit into the dual firm model of State enterprises which seek to balance private sector behaviour with delivering on State directives in the interest of the overall public good. Moreover, is there appetite for the risks involved, namely technological, operational, market, price, labour, logistics, financing, and credit risks.

Sustainability

The country's energy agenda cannot be divorced from the global warming issue, since this is largely attributed to the burning of fossil fuels. Being a small island developing State necessitates special attention. Carbon reduction

initiatives, climate change mitigation programme, and renewable energy (RE) implementation are possible strategic initiatives. Clean development mechanism (e.g. energy and exergy efficiency and conservation) projects, carbon capture and storage, development of hybrid (fossil fuel/RE) energy systems, and an RE equipment sales and service sub-sector are some of the specific new opportunities to integrate mainstream energy with other business ventures. Compressed natural gas as a fuel for transportation can have a net positive effect on the environment and yet reduce Government subsidy on liquid fuels (gasoline and diesel). Further, sugar to bioethanol, vegetable oil/algae to biodiesel and biomass to energy could create linkages between energy and agriculture. The foregoing areas not only contribute to environmental sustainability but can have a positive effect on T&T's energy security which may be an important item on the country's energy agenda in the not too distant future – it has been conspicuously silent thus far.

Acknowledgement

The preceding has been adapted from an article by the same author in the *T&T Review* (<http://www.tntreview.com/>), the Lloyd Best Institute of the West Indies, *Express Newspapers*, 31 May 2010.

BUSINESS CONTINUITY MANAGEMENT – ARE WE PREPARED?

Disaster can strike at any time and in most cases with little or no warning. While certain weather systems or events can be predicted, for the most part it is almost impossible to know when a disaster will strike. As a corporate organization or any company for that matter, it is of utmost importance that strategies and systems are set up to protect the business in the event of an emergency to ensure that all the basics are covered before disaster strikes. It is advisable that organizations as well as their stakeholders have a business continuity plan (BCP) in order to minimize the damage and business interruptions that result from man-made or natural disasters so that they will have a process for recovery and continuation of operations.

The Disaster Recovery Institute (DRI) International defines Business Continuity Management (BCM) as a holistic management process that identifies potential impacts that threaten an organization and provides a

By DAREN RAGOONANAN,
Business Analyst – NEC and
SHAZAM EDOO,
EHSS Coordinator – NEC

framework for building resilience with the capability for an effective response that safeguards the interests of its key stakeholders, reputation and value creating activities.

The primary objective of BCM is to allow the company's Executive to continue to manage business operations under adverse conditions, by the introduction of appropriate resilience strategies, recovery objectives, business continuity, operational risk management considerations and crisis management plans.

The required BCP should be one which will be used for accidents, terrorism, information hacking, earthquake, flooding, hurricanes, and other natural calamities or attacks

which are done either intentionally or otherwise. In other words, the BCP is all about how the organization will continue to operate despite the fact that it is facing an emergency. The plan should involve steps which will be used for emergency preparedness, crisis management and disaster recovery. The elements of the plan form a continuous cycle or the BCM Wheel, which takes into consideration the people, processes and places (*Figure 1*).

Business Continuity Management – Professional Practices

The BCM process comprises 10 professional practices (PP), each of which will be briefly highlighted. It should be noted, however, that the PP are not necessarily presented in any particular order, as it may be necessary to undertake and /or implement sections concurrently during the development of the BCM Programme.

Programme Initiation and Management

The primary activity that an organization ought to do is to establish that there is a need for a BCP. However, the prerequisites within this effort should include Management's support and formulation of the functions/processes required to construct the BCM framework. The BCP needs to be aligned with the organization's Mission and become part of the corporate culture. At this stage, a BC Planner/Co-ordinator needs to be selected to spearhead the plan and work with a Steering Committee that may comprise departmental managers and other staff as deemed necessary.

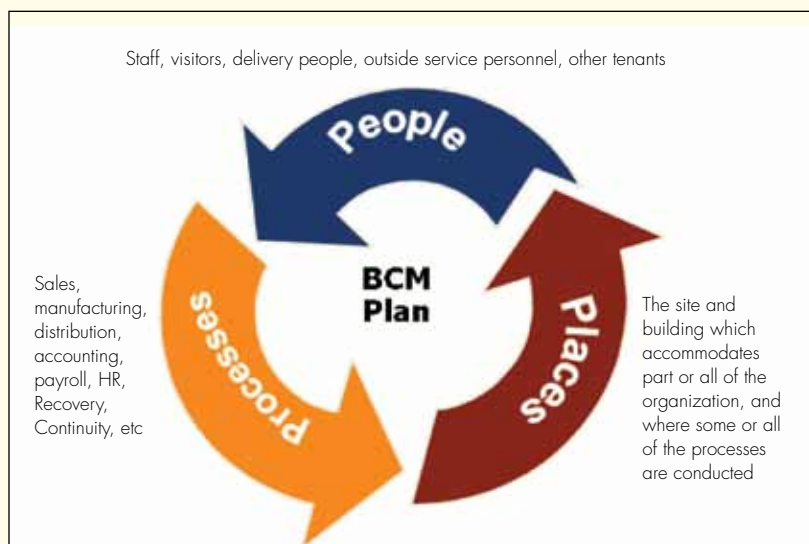


Figure 1: BCM Wheel
Source: DRI International

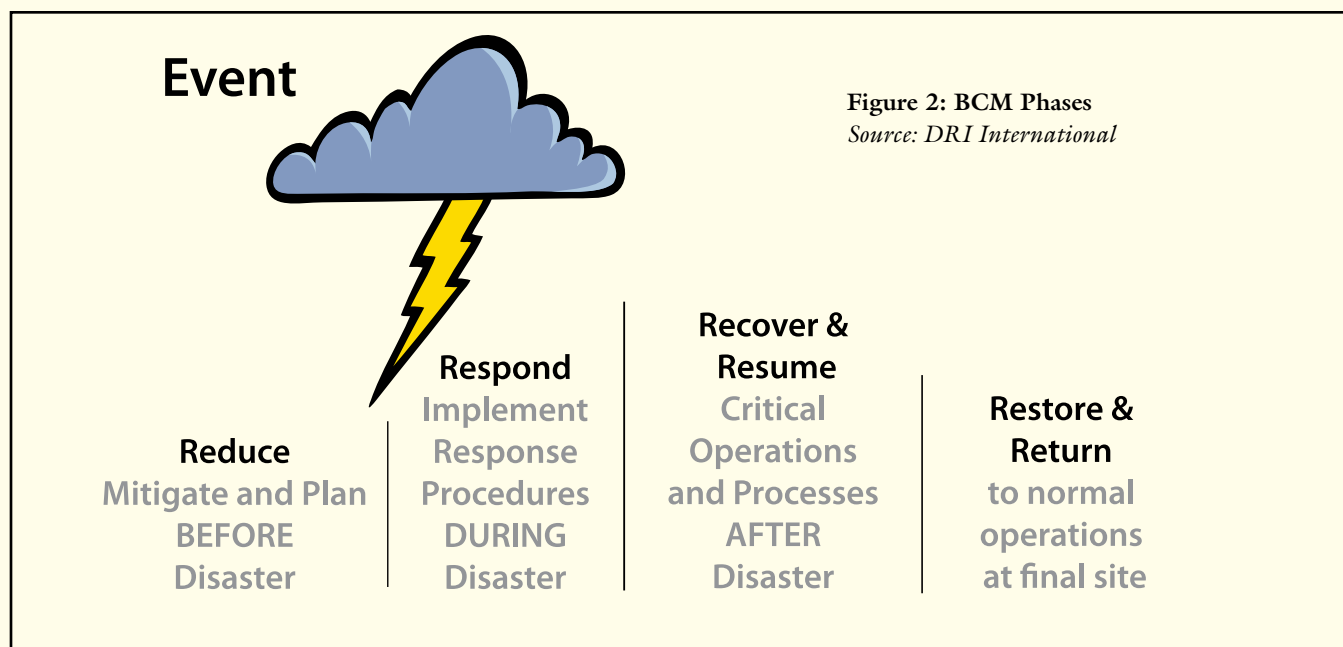


Figure 2: BCM Phases
Source: DRI International

Risk Evaluation and Control

The identification of risks and elements that can adversely affect the organization and its resources, e.g. people, facilities and technologies due to business interruptions. These events can cause great disruption to business activities. As such, it will be important to identify controls, evaluate the controls and devise risk mitigation measures that can decrease the impacts of such risks and exposures to the organization. A cost-benefit analysis is also important to this phase in order to justify the investments in selected controls. NEC is in the process of developing and populating risk registers for its business operations. This activity can not only form part of the BIA process but also meet regulatory (OSH Act) requirements.

Business Impact Analysis (BIA)

The BIA identifies the functions that require the most protection during a crisis. These functions are generally considered to be critical functions to an organization. This is usually done in a report format and presented to Management at the end of the exercise. The BIA also identifies the techniques

The BIA identifies the functions that require the most protection during a crisis. These functions are generally considered to be critical functions to an organization

that can be used to quantify and qualify impacts during a crisis. It also includes the identification of time-critical functions, the recovery priorities and inter-dependencies so that recovery time objectives can be established and approved by Management.

Business Continuity Strategies (BCS)

The risk evaluation and BIA will feed into the recommendation and development of BCS. It is the responsibility of the Steering Committee to review all possible strategies for

treating and dealing with a potential crisis. The basis for these strategies is to accurately determine the recovery time and recovery point objective that support the organization's critical functions. Some of the options that may be revealed can include doing nothing, taking action at the time of the disaster or using a reciprocal arrangement (shadow-type facility). It is noteworthy that as in any other phase of the BCP process, a report must be made to Management for their approval.

Emergency Response and Operations

Emergency planning and response operations provide the organization with the requisite tools to be capable and ready to respond to an emergency. This must be carried out in a coordinated, timely and effective manner. Procedures need to be developed and implemented for initial response so that stabilization of a situation can occur until the arrival of the appropriate authorities that will then have jurisdiction over the event. An emergency response plan is designed to ensure the protection of people and assets. *Figure 2* provides an overview of the Business Continuity phases in such an incident.

Development and Implementation of BCP

The BCP must be designed, developed and implemented in such a manner that it would provide continuity and/or recovery as identified by the organization's requirements. The BCP can address strategic, operational and tactical issues depending on the type of organization. At this juncture, it is also necessary to identify teams and assign tasks for rolling out the BCP. The plan must answer "who, what, where, when and how" does it affect the organization and specific persons, assets and functions.

Awareness and Training Programmes

As in any other major plan, people need to be aware of the major elements, how they can contribute to the success of the plan and how they can be affected by the implementation and lack of implementation. A comprehensive awareness and training programme therefore needs to be established in order to create and maintain corporate awareness and enhance the skills needed to develop and implement the BCP.

Awareness and sensitization will address new employees and staff as a whole, so that they will be familiar with the BC Team. Awareness and training also demonstrate the organization's care and commitment.

Training programmes will also help the BC Team to identify gaps in awareness and training, so that the process is continuously improved.

BCP Exercise, Audit and Maintenance

This phase deals with the establishment of an exercise/training programme, which documents plan/exercise requirements. This will include the planning, scheduling, facilitation, communications, auditing and post-review documentation of the plan. The establishment of a maintenance programme is instrumental in maintaining current and up-to-date plans.

An audit process will provide

During an emergency, it should be noted that the Crisis Management Team (CMT) will be responsible for implementing the crisis communication plan. The CMT approves all communication and chooses an appropriate spokesperson to correspond with the media in the event that a disaster occurs

for validation and compliance with standards. Additionally, it can serve to review solutions as well as verify appropriate levels of maintenance and exercise activity.

The exercise, audit and maintenance phase will also give a determination as to whether the plan is logical and can be effectively implemented by Management and the employees as a whole.

Crisis Communication

As in any other type of plan or programme, communication is essential. As such, a crisis communication plan needs to be developed. This can be done as a joint effort of the BC Co-ordinator and the Corporate Communications Department. The crisis communication plan would identify the actions to be implemented in order to effectively facilitate communication of critical BC information.

During an emergency, it should be noted that the Crisis Management Team (CMT) will be responsible for implementing the crisis communication plan. The CMT approves all communication and chooses an appropriate spokesperson to correspond with the media in the event that a disaster occurs. The Steering Committee becomes the CMT when the organization is in crisis mode.

Co-ordination with External Agencies

During an emergency, there are several external agencies that will provide assistance to the organization, e.g. Fire

Services. Should a crisis or disaster occur, the linkages with such agencies provide the organization with access to resources with a quick response time and as such result in minimal loss of assets, information, or even persons.

BCM Impacts and Initiatives Related to NEC's Operations

NEC's operations span several areas, which include Towage and Harbour Operations, Marine Terminal Operations, Labidco, Union Industrial Estate (UIE) and an Administration building. As such, although the organization would require a BCP to appropriately respond and recover from a crisis, it may be necessary to develop plans to address each of these main functional areas in a particular manner.

For example, the Company's marine assets are at risk should a disastrous event occur at the port. NEC's main source of income would be greatly affected. As such, the BCP for this area and these types of operations needs to be carefully crafted and should address issues pertaining to these specific operations. In this regard, the BCP needs to be developed by a team of persons with cross-functional skill sets. Implementation of the plan is also a critical aspect as it will serve to increase the downtime of any disastrous occurrences by increasing the Company's recovery capabilities.

In this regard, the Savonetta Pier

Coordinating Committee (SPCC) has taken the initiative to prepare its members for business continuity in the event of a natural or manmade disaster. The committee is chaired by NEC and comprises all users of the Savonetta Piers and Plipdeco.

Given the various types of risks that have been emerging in recent years, the NEC-chaired committee thought it necessary to take the industry's preparedness to the next level and focus on recovery of business operations in the shortest possible time frame, rather than merely responding to an emergency.

As such, DRI International was invited to conduct a Business Continuity Programme during the period April 12-16 2010. Participants included staff from NEC, Labidco, Shell Trinidad Limited, Methanex Corporation, PCS Nitrogen Trinidad Ltd and Nu-Iron. Participants were required to sit an exam at the end of the five-day training and successful persons qualified for an internationally recognized certificate.

Based on the knowledge gained through that course, it is expected that SPCC member companies and NEC in particular can now formulate business continuity plans for their respective organizations.

Preparedness is key, as it would give some measure of confidence and demonstrate a duty of care to customers and suppliers. It should also be noted that people would support what they help create. Employees ought to be actively involved in some aspect of the BCP and its importance to the company.

In order for NEC "to be a global leader in the development of sustainable energy industries," BCM is critical in addressing those issues that place the Company at risk, since they are linked to the strategic goals of the organization. A BCP will also illustrate to customers or suppliers that the organization is able to recover operations within a short period of time, unlike the competition,

Preparedness is key, as it would give some measure of confidence and demonstrate a duty of care to customers and suppliers. It should also be noted that people would support what they help create. Employees ought to be actively involved in some aspect of the BCP and its importance to the company.

especially in the areas of port and tug usage. This can translate into a positive effect on the Company's market value and customer confidence.

With regard to insurance, there are some things that business interruption will not cover, such as loss of business opportunities, loss of reputation, the cost of losing current business customers and the erosion of brand value. Insurance will provide some financial protection but will not ensure that the organization survives after a crisis or disaster. However, insurance companies now realize that BCM helps with risk reduction and is becoming increasingly common for a condition of insurance cover to show the existence of a BCP. Therefore, companies can find themselves subject to a lower premium if they have an effective BCP.

Conclusion

Many companies are so busy in "here and now" that they fail to think about the "what ifs" that could be right around the corner. When everything is running smoothly and everything is working in tip top form, it is easy to overlook the need for a BCP. Unfortunately, should an organization wait until a plan is needed, it may be too late to devise a strategy.

A BCP provides an outline of the

steps that the organization will have to take after a disaster strikes. This plan will determine and inform as to how to continue operations as well as recover and restore any data that was compromised. Without such a plan of action, the business is more than likely to suffer.

A BCP is an investment in the continuous operation, future survival and sustainability of an organization. In today's high-risk environment, it is one investment that should be given top priority.

References

- *DRI International*
- *Don't Let a Crisis Put You Out of Business, John Lawlor*
- *Does your Business Have a Business Continuity Plan?, Eric Simpson*
- *Why a Business Continuity Plan is Necessary, Jared Ingram*
- *Business Continuity Management – Bridging the Divide, Tony Stranack and Charlie Cornish*
- *NGC Echo Line Issue 106 – May 10, 2010*
- *www.businesscontinuity.com*
www.talkingbusinesscontinuity.com

STRATEGIES FOR MITIGATING THE IMPACT OF THE PROPOSED PT LISAS SOUTH AND EAST INDUSTRIAL ESTATE PORT ON THE MULLET AND SHELLFISH FISHERIES IN CLAXTON BAY

(CONCLUDED FROM *GASCO* MARCH 2010 ISSUE)

This section expands upon the possible strategies identified in the preceding Sections for improving the efficiency of both the Mullet and the Shellfish fisheries at Claxton Bay. It also describes the mitigation strategies for reducing the long-term impacts of the proposed construction of a Port, Navigation Channel and Turning Basin on the Mullet fisheries and Shellfish fisheries in the Claxton Bay area. It is anticipated that the measures, techniques, tools and training proposed in this section shall mitigate the impacts of the proposed port, as well as promote the socio-economic well-being of the finfish and shellfish fishers operating in the Claxton Bay fisheries area of the Gulf of Paria.

PART 2

Exploitation of Alternative Fisheries within the Gulf of Paria

The environmental and social impact analyses carried out by REAL (2003) et al. (2009) for the construction of the Point Lisas South and East Industrial Port project has identified that the Mullet fishery at Claxton Bay would be at risk as a result of the restrictions which are expected to be placed on the traditional areas used for the gillnetting of the species. Additionally, the review of the artisanal Mullet fishery of Claxton Bay provided in Part 1 has identified that the fishery is seasonal in nature and the largest percentage of annual income is generated during the first four months (January to April inclusive) of the year. One option for mitigating any decrease in earnings generated



By REEZA MOHAMMED, PhD
Environmental Coordinator, NEC

by fishermen is the identification and integration of an alternative fish species for harvest. By engaging in an alternative fishery fishermen can target alternative commercial finfish species during the low Mullet season months, thus supplementing the current activities of the Mullet fishery.

The alternative method of fishing considered within the ambit of this proposal is that of fishpotting for species of demersal groundfish. Landings of groundfish obtained from gillnets, lines (banking, palangue, a-la-vive), beach-seines and fishpots in Trinidad and Tobago are dominated by six main species groups of major commercial importance. These are Whitemouth Croaker (*Micropogonias furnieri*), Salmon (comprising several species of Cynoscion; *Macrodon ancylodon*), Blinch (*Diapterus* spp.), Redfish/ Snapper (primarily *Lutjanus synagris*), Grunts (several species of *Haemulon* and *Orthopristis*; *Genyatremus luteus*) and

It is anticipated that the measures, techniques, tools and training proposed in this section shall mitigate the impacts of the proposed port ...

Catfish (several species of *Bagre* and *Arius*) (Kuruvilla, 2007).

Based on Fisheries Division statistical records from 2005-2008, for fishpotting activities along the west coast of Trinidad, a total of eight different commercial species of fish were landed along the west coast using fishpots. These included; Blinch, Crevalle Jack (Cavalli), Grunt (Torroto), Kingfish, Sea Catfish, Snapper, Brochet and Weakfish (Salmon). Table 1 shows the estimated value of each species based on the 2008 ex-vessel price per kg of each species (Fisheries Division), the 2008 wholesale price per kg of each species (Namdevco) and the export potential of each species (Fisheries Division, 2009). The main commercial species of finfish targeted by fishpots along the west coast is the Lane Snapper. It is estimated that 86.2% of the snapper landings from fishpots on the south coast are dominated by Lane Snapper (Manickchand-Heileman and Phillip, 1993). Details of this species biology are presented later in this section.

Fishpots are a particularly suitable

Table 1: Assessment of Commercially Viable Species of Fish Landed at Claxton Bay in 2008 using 2008 Statistical Data provided by the Fisheries Division and Namdevco.

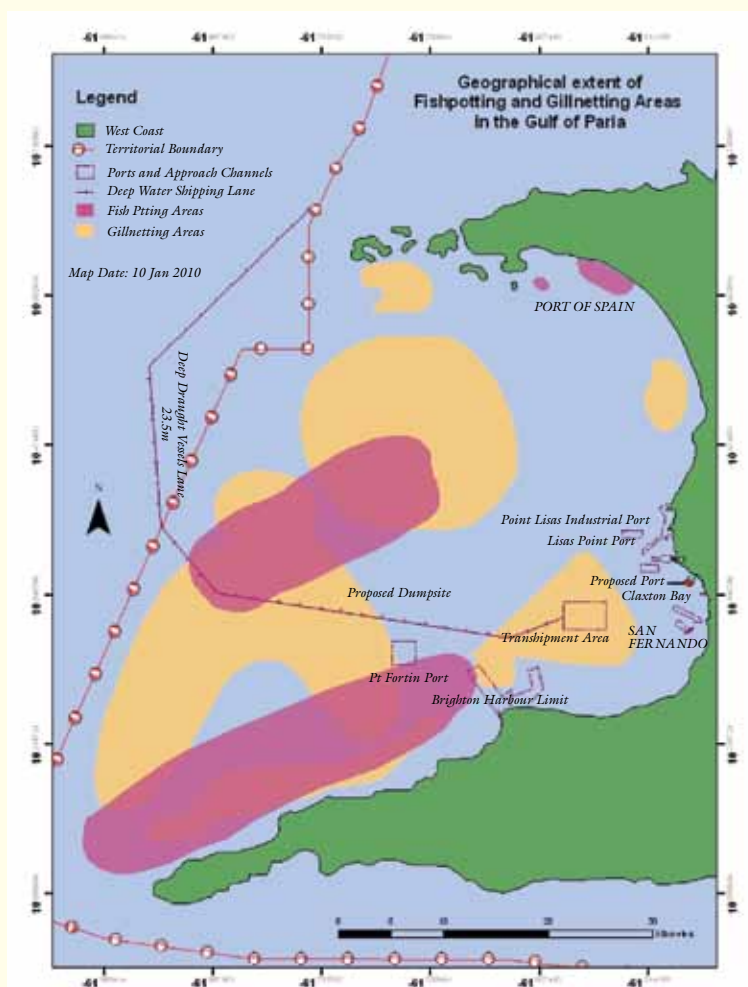
Fish Species Landed at Claxton Bay in 2008 using Fishpots	Average Ex Vessel Price per Kg 2008 TTD (Fisheries Division 2008)	Average Wholesale Price per Kg (POS) 2008 TTD (NAMDEVCO 2008)	Frequency of Catch at landing sites along the West Coast of Trinidad between 2005-2008 (Fisheries Division 2005-2008)	Exported
BLINCH	\$7.09	*	Periodic	—
CREVALLE JACK (CAVALLI)	\$13.50	\$17.77	Seasonal	—
GRUNT (TORROTO)	\$9.15	\$7.94	Seasonal	—
KINGFISH	\$30.70	\$39.21	Seasonal	X
SEA CATFISH	\$5.40	\$6.49	Caught Throughout the Year	—
SNAPPER	\$25.76	\$32.28	Caught Throughout the Year	X
SNOOK/BROCHET	\$16.60	\$16.36	Caught Throughout the Year	—
WEAKFISH (SALMON)	\$18.98	\$21.69	Seasonal	X

type of gear for artisanal use along the western and south-western coast of Trinidad where there are problems with drift nets and set gillnet being damaged by ship traffic. Fishpots are set on the sea floor or just above the sea floor and out of the way of ship traffic, making it an ideal gear type for areas with high sea traffic. The current geographic location where fishpotting is carried out in with the Gulf of Paria is shown in Figure 1. Artisanal fishermen operating in shallow coastal waters generally use rectangular V- or Z-shaped Antillean design pots with wooden or steel frames measuring 2m x 1.5m x 0.6m with 30mm hexagonal wire mesh walls and two 180 x 360 mm openings. (Figures 2 and 3 refer.)

Figure 1: Fishpotting and Gillnetting Areas of the Gulf of Paria.

Reference Data

- 1) *Geographic Extent of Fishing Areas*
Fisheries Division Map 2002
- 2) *Navigational Chart, Gulf of Paria*
Hydrographer of the Navy, 3rd Edition
2005, Updated September 2009
- 3) *Produced Using ArcGis 9.2*
Copyright ESRI 2006



Lane Snapper (*Lutjanus synagris*)

The Snapper fishery is one of the country's most commercially valuable groundfish fisheries. The main species of importance in terms of annual landings and value are *Lutjanus synagris* (Lane Snapper), *L. purpureus* (Southern Red Snapper) and *Rhomboplites aurorubens* (Vermilion Snapper). Other species regularly caught are *L. griseus* (grey snapper), *L. jocu* (Dog Snapper) and *L. vivanus* (Silk Snapper/Vivanot,) (Soomai and Porch, 2006).

Lutjanus synagris is more commonly associated with muddy/soft bottom substrates than the other snapper species, which are associated with hard substrates and are mainly caught on the southeast coasts of Trinidad. *L. synagris* is landed predominantly on the south and south-west coasts of Trinidad, in the Gulf of Paria and the Columbus Channel, where environmental conditions are characteristic of the Brazil-Guianas Continental Shelf (Soomai and Porch, 2006). Given its biology, the sheltered waters and the associated mangroves and seagrass patches just north of Claxton Bay provide an ideal habitat for the Lane Snapper. Adults of the species live in a variety of habitats, but are most commonly observed over reefs and vegetated sandy bottoms in shallow inshore waters. Juveniles of the species also live in protected inshore areas. Once established, adult snappers remain in the same area for their entire lives. Shrimp being just one of its many food resources, the Lane Snappers also frequent seagrass beds (Florida Museum of Natural History web archives, 2010)

Data collected by the Fisheries Division in 2008 indicate that the Lane Snapper is one of the more marketable fish species harvested from the Gulf of Paria (Figure 4 refers). Although it is not one of the primary species sought after at Claxton Bay, it is landed at the site throughout the year (Fisheries Statistical Data 2005-2008). At present,

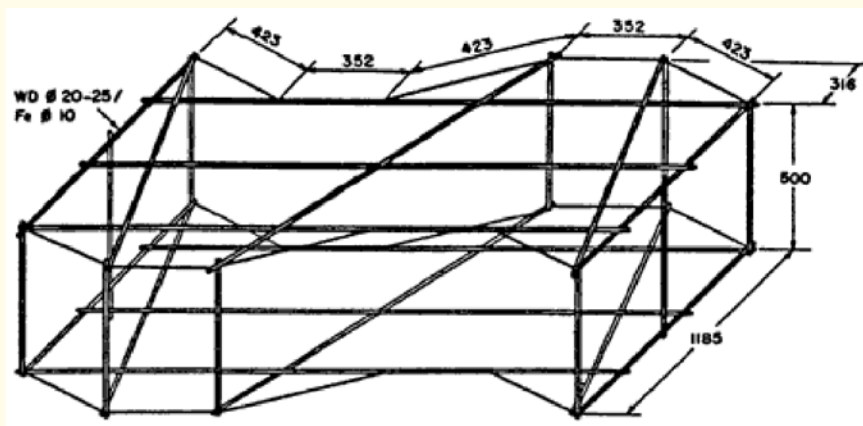
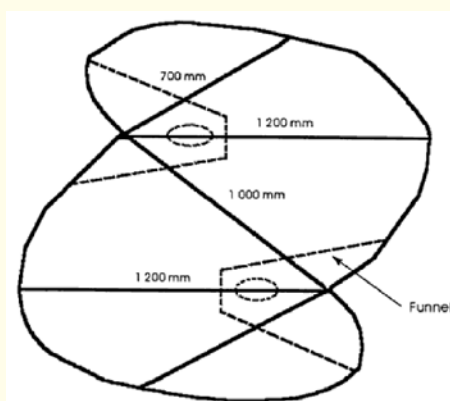


Figure 2: Typical Antillean "Z" pot (Frame and Dimensions)
(Source FAO 2010)



- Trap 700mm deep
- All frames made from 10mm Iron rod
- Trap covered with wiremesh
- Funnel covered with polyethylene stretched mesh or chicken mesh

Figure 3: A typical "S"-shaped trap
(Source FAO 2010)

Snappers are exploited by the artisanal multi-gear (fishpots, lines, gillnets, trawl), the semi-industrial multi-gear (fishpots, lines) and the semi-industrial and industrial trawl fleets in Trinidad and Tobago waters (Ferreira and Martin, 2005). The semi-industrial multi-gear vessels entered the fishery in the 1980s and targeted the snapper resources on the offshore continental shelf on the north and east coasts of Trinidad and off Tobago. They employed arrowhead-shaped pots constructed of steel frames



Figure 4: Lane Snapper
(Source: Florida Museum of Natural history)

and operated at depths of 55m-134m (Mohammed et al. 2005). The landings from this fleet account for almost all the Snapper export earnings from this country (Mohammed et al. 2005).

In Trinidad, the Lane Snapper spawns throughout the year with a peak of activity from February to September and juveniles are known to be present throughout the year (Dass, 1983; Maingot and Manickchand-Heileman, 1987, Manickchand-Dass, 1987). The most recent study conducted on the Lane Snapper fishery of Trinidad and Tobago was reported on by Soomai and Porch in 2006 at the second annual scientific meeting for the Caribbean Regional Fisheries Mechanism (CRFM) held at Port of Spain Trinidad. The

working group for this project used:

- Data collected between 1995 and 2004
- Historical records (1963, 1975)
- Reconstructed data (1908 to current) on annual Catch Per Unit Effort (CPUE) levels for artisanal gillnet, line and trawl fleets operating in Trinidad
- Fish length data obtained from fishpot and banking (handline) in 1996-1997, and
- Biological parameters obtained from a previous assessment for the Lane Snapper in Trinidad (Manickchand-Dass, 1987).

Although the findings of this project were inconclusive, it has been suggested that the overall stock biomass of the Lane Snapper was not affected by the high local fishing mortality due to relatively constant recruitment to the fishery in Trinidad from an external source of the stock in the region. The working group also identified that the management advice provided by Manickchand-Dass in 1987 for the local stock was dated and perhaps questionable given the considerable changes made in fleet composition and fishing operations since the late 1980s. However, they were unable to present specific (new) management advice because there were data gaps that influenced the ability of the assessment to give good results (Soomai and Porch, 2006). It should also be noted that in light of the need to review the quality of the available data for the fishery and from a scientific perspective, it was recommended at the second annual meeting of the CRFM that the members of the Lane Snapper working group should not advise on whether an increase or decrease in fishing effort would be precautionary (CRFM, 2006).

Lane Snapper was sold at an average of TT\$26.90 per kg (ex vessel). This value was based on prices recorded by the Fisheries Division at landing sites

NEC as part of its retooling and training effort shall consider providing bona fide fishers operating out of Claxton Bay with the necessary materials and technology to enable them to build the fish pots locally

along the west coast of Trinidad in 2008 (Fisheries Division Statistics, 2008). The fish wholesaled at an average price of TT\$32.28 per kg at the Port of Spain Fish Market in 2008 (Namdevco Statistics 2008). By comparison, Mullet was sold at an average of 5.05TTD per kg (ex vessel) based on prices collected from all landing sites along the west coast and at an average of TT\$3.06 per kg (ex vessel) at the Claxton Bay Landing site in 2008 (Fisheries Division Statistics, 2008). This fish wholesaled at an average price of TT\$7.19 per kg at the Port of Spain Fish Market in 2008 (Namdevco Statistics, 2008).

Based on these statistics, it would require a larger quantity of Mullet to achieve the same returns obtained from the harvest of Lane Snapper. Snappers are exported from Trinidad to markets in the United States and Canada. Based on statistics collated by the Central Statistical Office of Trinidad and Tobago, an average of TT\$338,486 worth of snappers and groupers were exported annually between 1995 and 2005. During this 10-year period a total of TT\$3,723,351 was earned through the export of this species (CSO, 1995-2005;

Fisheries Division, 2009).

Should this species be accepted as a supplementary fishery to the Mullet fishers at Claxton Bay, NEC as part of its retooling and training effort shall consider providing bona fide fishers operating out of Claxton Bay with the necessary materials and technology to enable them to build the fish pots locally as well as the training required for constructing, maintenance, repair and appropriate use of pots. A proposed implementation strategy for such a retooling and retraining programme is presented in Section 4 of this document.

Training/Retraining for Fishermen and Shellfish Harvesters

The Training/Retraining of fishermen operating out of the Claxton Bay landing site and shellfish harvesters utilizing the Claxton Bay Mangrove system has been proposed as a method for:

1. Mitigating the long-term impacts to the Mullet fishery and shellfish fishery in the Claxton Bay area,
2. Integrating new and improved methods of fishing/processing. Fishermen and harvesters will be afforded training and retraining opportunities in the use and repair of fishing gear, and fish processing techniques, and,
3. Training of those fishers impacted or displaced by the port development in small business management, enabling them to find alternative sources of employment if they so wish.

The resources for training are currently available through the Caribbean Fisheries Training and Development Institute (CFTDI) which is part of the Fisheries Division of the MALMR. CFTDI provides training and skills development to individuals, agencies and small and medium sized fish-processing establishments. The cost of each training course delivered by CFTDI varies and is based on type of

training requested by participants and the length of time instructors would require for completion of the course. Queries made to the CFTDI office in Chaguaramas identified that the average cost of a two-day course is TT\$400 per person while a five-day course is generally TT\$800. CFTDI instructors usually run courses for fixed groups at community locations or at its facility located in Chaguaramas. The NEC proposes to work in conjunction with the Claxton Bay Fishing Association through the Community Liaison Office to be located at Claxton Bay to identify the specific training needs of the fishermen and shellfish harvesters and also work with the Association to provide the funding required for covering the cost of the training courses.

A list of the recommended training courses which would be of benefit to the fishermen at Claxton Bay is presented along with their expected duration and estimated cost. Training shall be made available to all bona fide fishers and harvesters at Claxton Bay interested in participating and who meet the requirements of CFTDI.

At present CFTDI requires that persons wishing to participate in training for Fishing Vessel Personnel and Merchant Marine courses be:

- a minimum of 16 years
- medically fit with good eyesight in terms of colour, vision and form
- able to read and write.

Completion of the seaman class

4¹ training is recommended for all participants

For the Seafood Technology courses, applicants must be:

- medically fit and,
- in possession of a valid Food Badge.

Completion of the Finfish Handling & Processing course is a prerequisite for all the seafood technology courses.

Course	Course Outline	Duration	Target Audience
Fishing Gear Technology & Fishing Methods	Use of various types of fishing gear and the appropriate location for use of gear types	2-3 Days	Fish Vessel Managers, Masters and Crew
Engine Maintenance and Repair	Repair and maintenance of outboard engines	5 Days	Fish Vessel Managers, Masters and Crew, General Public
Fibre Glass Reinforced Plastic Technology	Building maintenance and repair of fibre glass boats	2 Days	Boat-builders Fish Vessel Managers
Net Mending	Basics of net design and net repair	2 Days	Fish Vessel Managers, Masters and Crew
Basic Navigation and Sea Survival Techniques	Navigation techniques and survival skills for fishermen and crew	2 Days	Fish Vessel Managers, Masters and Crew

Table 2: Courses Available for Fishers and Fishing Vessel Personnel

Note: the length of the course and resulting cost is subject to change based on the needs of the participants.

The NEC proposes to work in conjunction with the Claxton Bay Fishing Association through the Community Liaison Office to be located at Claxton Bay to identify the specific training needs of the fishermen and shellfish harvesters and also work with the Association to provide the funding required for covering the cost of the training courses.

¹ Course for the merchant marine sector provided by CFTDI

Course	Course Outline	Duration	Target Audience
Onboard Handling of Fish	Sanitation Requirements and Procedures Onboard Vessels, Fish Processing Science, Fish Spoilage, Fish Handling and Determination of Quality, and Fish Handling at sea.	3 Days	Fish Vessel Managers, Masters and Crew
In Plant handling of Fish	Fish Plant Sanitation and Food Hygiene, Fish Processing Science, Deterioration in Fish – causes and measures of control. Handling and storage of Fish	2 Days	Fish Vessel Managers, Crew, Fishermen, Fish Vendors, General Public; Managers, Supervisors and Employees of Fish Processing Establishments, Food and Public Health Personnel
Fish Processing Technology	Finfish Handling and Processing. Salt Curing and Drying of Fish. Smoking of Fish. Shellfish Handling and Processing. Fish and Shell Fish Marinades Technology Comminuted Fishery Products.	6 modules to be completed in 9 weeks	Fishermen and Fish Vendors, General Public, Managers and Supervisors and Employees of Fish Processing Establishments, Food and Public Health personnel.
Quality Assurance and Quality Control in Fish & Fishery Products	Review the principles and processes governing the preparation of chilled frozen and cured fishery products. An examination of the hazards associated with the processing of tropical fish and the process of deterioration in these species. Introduction to the current system of quality assurance in fish and fishery products. Preparation of Standard Sanitary Operating Procedures (SSOP) manuals	15 days	Personnel involved in Quality Assurance and Quality Control in Fish Processing, Establishment: Fishery Products Inspectors from Regulatory Agencies
Fish Processing Technology and Fish Cookery for Teachers of Fish Merchandising.	Transfer of Technology pertaining to chilled frozen and cured fishery products. Provides participants with specific information pertaining to suitability of fish species for preparation of various duties	15 days	Teachers of Home Economics, Catering and Food Preparation Personnel: Other Interested Persons.
Fish Merchandising	A review of various fish and fish species and products used in the trade in Trinidad and Tobago Fish and Fishery Products. Spoilage and measures of Control Handling and Storage Practices for Fish. Managing the seafood counter.	2 days	Fish Vendors; Shop Managers and Employees; Fisheries Personnel

Table 2: Courses Available for Fishers and Fishing Vessel Personnel (continued)

Further details on these courses can be obtained through the Caribbean Fisheries Training Development Institute located at 1st Avenue South, Chaguaramas, Telephone: (868) 634-1635/1865 or email: cftdi@tsstt.net.tt

For those who may not wish to stay in the fishing industry but go into another unrelated field of work, technical and professional skills training can also be provided at a national level through the existing training networks in Trinidad and Tobago which equip persons with the necessary skills to access employment opportunities at the proposed port and in other industrial development projects. Short-term training can be provided through institutions such as like the National Energy Skills Training Centre, The College of Science, Technology and Applied Arts of Trinidad and Tobago (COSTAATT) and programmes such as Multi-Sector Skills Training (MuST) and Helping Youth Prepare for Employment (HYPE).

Upgrade of Existing Building Infrastructure and Amenities Provided at Claxton Bay

At present there are 98 identifiable locations where fish is landed in Trinidad and Tobago. Sixty per cent of these are located on the sheltered west coast. The infrastructure at these sites varies from simple jetties to more elaborate structures. Some of these fish landing sites have facilities for the storage of fishing gear and equipment, repair of boats and engines, making and storage of ice and wholesale/retail marketing. Facilities at some level exist at 25 landing sites in Trinidad of which the Claxton Bay Fishing Depot is one.

As part of their overall impact mitigation strategy, NEC proposes to upgrade the existing facilities at the Claxton Bay fish landing site. It is anticipated that the proposed improvements would facilitate the process of landing of catch at Claxton Bay and increase the earning potential



Claxton Bay Fishing Depot.
(Roadside view from Southern Main Road, Claxton Bay)

of the site through improved fish processing, wholesaling and retailing facilities. The facilities currently provided at the Claxton Bay site were described in Part 1 and they include:

- A shed used for the repair of nets and boats
- A recreational room
- A storage building with locker type facilities
- A slipway
- A building used for fish processing
- An ice trailer
- A retail market with stalls oriented towards the road for fish vending
- Two plastic water storage tanks
- Parking facilities.

The proposed upgrade of the facilities at Claxton Bay is intended to improve the productivity of fishermen as well as enhance the value of their catch. NEC as part of its refurbishment effort shall consider providing the expertise, capital and/or materials necessary for the upgrade of the depot at Claxton Bay. Modifications shall be carried out under the advisement of the Fisheries Division, the current administrators, and it would be based on the current needs

of the fisherfolk using the landing site. The targeted areas for improvement shall include but are not but limited to the landing area, the building used for processing and the retail market.

Upgrade Landing/Boat Repair Facilities

A jetty and dredged approach channel is proposed to accommodate easier access and egress to the Claxton Bay Fishing Depot at all tidal cycles. Once the port is established, fishing vessels will be required to access or egress the Claxton Bay landing site in a westerly or northwest direction to avoid the turning basin. As part of these upgrades it may also become necessary to refurbish the existing boat slipway which is simply a concrete ramp at the northern end of the existing facility. This slipway is currently used for moving boats to and from the repair shed.

The proposed jetty which is subject to the approval of the Maritime Services Division of the Ministry of Works and Transport would be of great benefit to the fishermen at the site who have difficulty landing their catch at low tide because of the shallow muddy nature of the landing area which currently

exists. Landing at low tide is virtually impossible and fishermen have been using a temporary jetty structure at the landing site or an alternative landing location which is 1km south of the fish facility.

Upgrade of Existing Building Facilitates

a) Building used for Processing

The proposed upgrades to this building include:

1. The provision of an industrial ice storage bin and a new industrial ice maker.
2. Remedial building works such as improved plumbing and drainage within and around the facility. Drains must be large enough to carry entrails and scales and other fish material and contain traps which would ensure entrails and other fish parts do not enter the coast/nearshore environment. Maintenance of these traps would be the responsibility of the users of the facility.
3. Provision of dumpsters for the disposal of waste and fish by-products.

It is anticipated that the suggested improvements would increase the quality of fish processed and quality of fish handling carried out at the site. It is also likely that this will encourage/improve the interest of fish exporters and fish processors involved in canning, smoking or packaging of sea food for both local and foreign markets.

b) The Retailing Facility

The proposed upgrades to this facility include:

1. Resurfacing and tiling of elevated concrete stalls used for the sale of fish.
2. Improved plumbing to ensure that each vending stall has a leak-free and reliable supply of potable water.

3. Improved drainage around the retail building. This would involve the construction of large drains around the marketplace designed to carry scales and entrails away from the facility. The drains will also contain traps to ensure entrails and other fish parts do not enter the coastal/nearshore environment. These traps will be periodically cleaned and maintained by users of the facility.
4. Remedial works on the roof and walls of the facility.
5. Placement of an awning on the eastern side of the facility to protect clients and vendors from the elements of sun and rain.

The major benefit to be derived from the upgrade of the retail facility is that the retail market at the site shall attract more customers, as well as achieve higher standards for the safe handling of fish.

The remedial works described above were proposed without the foreknowledge of any current renovation initiatives scheduled by the Fisheries Division or the Claxton Bay Fishing Association. It should therefore be noted that the upgrade of and remedial works to the existing buildings shall be subject to approval by the Fisheries Division of the Ministry of Agriculture, Land and Marine Resources and the specific needs of the building can be renegotiated with stakeholders subsequent to the acceptance of a refurbishment programme.

A proposed strategy for providing the modifications described above are presented in later in this document. It is noteworthy that the intended provision of Immigration, Customs, Protective Services and compliance with ISPS codes for security and safety at the proposed port shall be an additional benefit to fisherfolk operating at Claxton Bay since it was reported by the FAO in 2000 that the fisherfolk at Claxton Bay experienced persistent problems with the Customs and Excise Division in exporting their

fish to Venezuela (Food and Agriculture Organization of the United Nations, 2000). Easy access to a customs facility would improve the regional trading ability of fishermen at Claxton Bay.

Development of Fish Refuges to Support Recruitment of Fishes Back into Traditional Fishing Areas after Construction Disturbance

One of the impacts identified in the EIA report presented to the EMA in February 2008 by NEC for the proposed Point Lisas South and East Industrial Port was that there would be moderate to major impacts on the near shore fisheries during both the construction and operational phases of the port. One of the possible mitigation strategies which may be used to encourage the survival of juveniles of commercial finfish species found in the nearshore areas around Claxton Bay is the building of artificial fish refuges during the post-construction phase of the port project, subject to the approval of the Ministry of Agriculture, Land and Marine Resources and the Maritime Division of the Ministry of Works and Transport. The artificial refuges will serve to maintain the fish propagation potential of the Claxton Bay nearshore environment.

The majority of fish species observed within the study area tend to inhabit sandy coasts, brackish waters and estuaries as juveniles. The importance of the mangroves and seagrass bed for such fish species is usually explained in terms of high food abundance or shelter against predators as a result of high turbidity and structural complexity (Cocheret et al, 2004). In such situations artificial refuges can be used to:

1. Compensate for habitat degradation as a result of turbidity which may result from the initial construction period.
2. Develop a form of marine cultivation for the restocking of juvenile ground finfish species and

in particular, those species which may be harvested using fishpot gear.

The refuges once established would create additional sheltered areas to protect juveniles against predators and decrease natural mortality. The proposed refuges would be established solely for the attraction or aggregation of marine organisms and as a method of increasing biological or fishery yields. If successful, the artificial refuges can be used and further developed by the Fisheries Division as a form of marine cultivation in suitable areas for the restocking of juveniles of selected species.

Artificial refuges have been used for many years in several countries, but with different objectives. The countries that stand out for their experience and success with the use of artificial refuges are Japan, Taiwan and the United States. Until the 1980s, the construction of artificial reefs in the United States was strongly associated with the disposal of waste material that accumulated in many locations. This approach particularly limited the success of the US programme for the development of artificial reefs (Sheehy, 1983).

Japan however has had more success with the use of artificial refuges for the development of commercial fisheries and the methods used have been proven to be more efficient and scientifically supportable. Although artificial reefs have been used traditionally in Japan, a large-scale programme began just 35 years ago. In the early 1970's, as a consequence of the adoption of the 200-mile Exclusive Economic Zone by many countries, as well as the increase in oil prices, the Japanese fishing fleet was forced to reduce the area of its operation (Claro and Garcia-Arteaga, 1999). This process coincided with a period of marine pollution, coastal development and over-exploitation of natural resources. These conditions promoted the allocation of funds for developing

a programme for the construction of artificial reefs, fish aggregating devices, and other methods targeting the increase of fishery. These structures were built mostly with reinforced concrete or metal (Claro and Garcia-Arteaga, 1999). The one-piece modules were typically arranged in clusters and with an arbitrary distribution. As research developed the premise for the design of a refuge in Japan changed to the creation of those elements of the reef that are important for select species. This concept differs from the prior one which had the objective of replicating the complexity and surface of natural reefs. While the small units of the first generation of Japanese structures were plied without any specific arrangement, the second generation included large manufactured units (some of them up to 730-m³) that were placed individually, with specific

pattern of distribution, orientation, and distance. Most of these units were made of reinforced concrete, steel, acrylic, or other materials. They are generally formed from different manufactured pieces allowing the builder to change the design to fit local conditions and to mount them in different ways (Claro and Garcia-Arteaga, 1999). Some examples of such structures are shown above.

NEC proposes the use of a simple cost effective refuge design such as those used in the United States and the first phase of the Japan fisheries project. The design would be based on artificial refuges used in Cuba known as *pesqueros*. *Pesqueros* have been employed by several generations of fishermen in the Gulf of Batabano and have been used as fishing gear to attract and concentrate fish (Silva Lee,

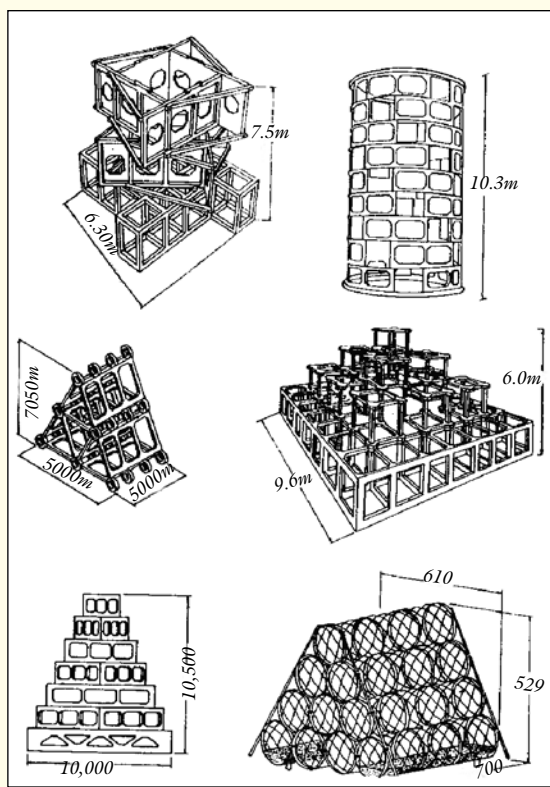


Figure 5: Japanese Artificial Refuge Structures
(Source Claro and Garcia-Arteaga, 1999.)

1975). The best known and frequently employed refuges for concentrating fish in Cuba are those built from Red Mangrove tree roots and branches. Similar pesqueros can be built using any felled mangroves produced during the port construction.

Additionally, other materials which can be considered include car tyres, metallic pipes and bins. Tyres for pesqueros are usually assembled in 18 groups of 18-20 pieces of 1-1.2m in diameter. The tyres used are from trucks and are tied together with galvanized steel chain forming three lines (Claro and Garcia-Arteaga, 1999).

More than 75 years of experience in the Gulf of Batabano demonstrate that the mangrove structures attract the greatest amount of fish in the shortest period of time; however, they degrade rapidly and need replacement every year, whilst structures built from tires last longer (Claro and Garcia-Arteaga 1999). Since the raw material for the Red Mangrove artificial refuges may become available during the construction phase of the port, consideration should be given for its use in reef construction.

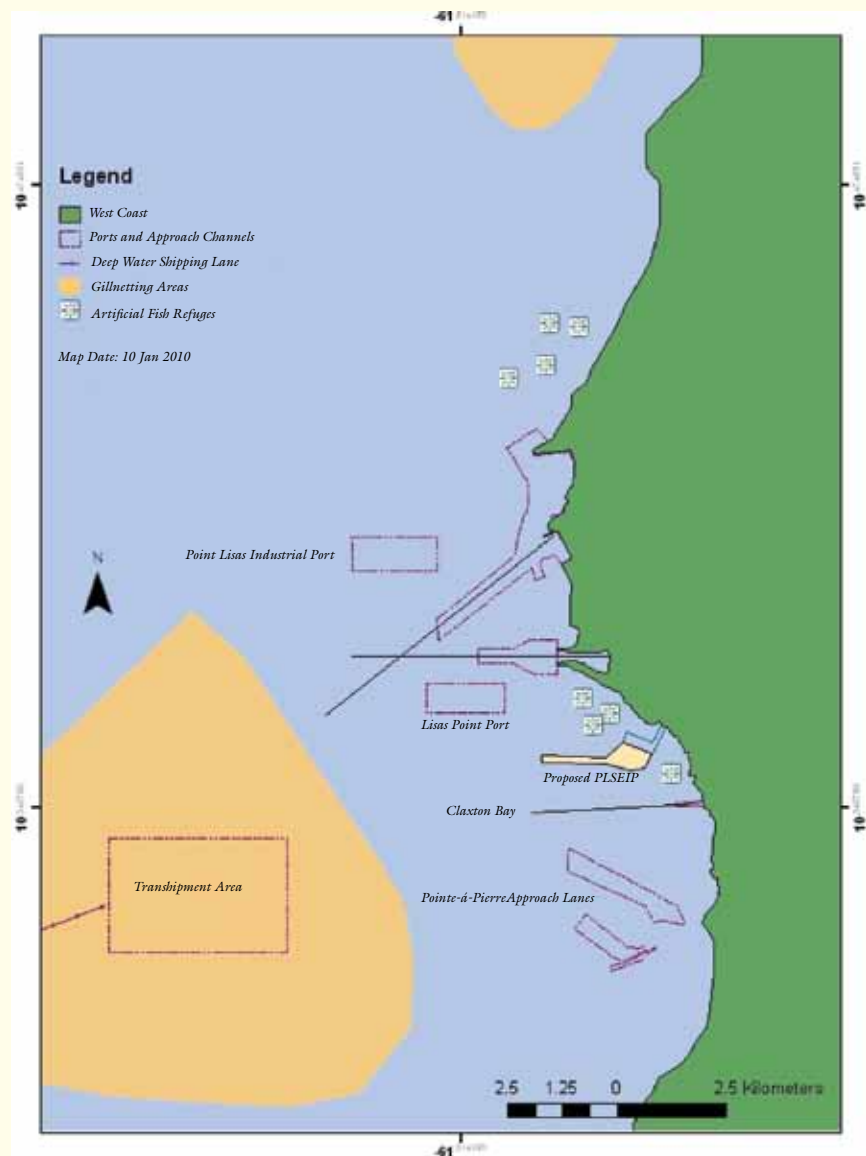


Figure 6: Pesqueros
Source: Silva Lee, 1975)

Figure 7: Possible Locations for Artificial Fish Refuges

Reference Data

- 1) *Geographic Extent of Fishing Areas. Fisheries Division Map 2002*
- 2) *Navigational Chart Gulf of Paria Hydrographer of the Navy 3rd Edition 2005, Updated September 2009*
- 3) *Produced Using ArcGis 9.2 Copyright ESRI 2006*



Provision of Training for Aquaculture or Mariculture Initiatives

Aquaculture is the farming of freshwater and saltwater organisms such as finfish, molluscs, crustaceans and aquatic plants. Aquaculture in Trinidad and Tobago, as in other parts of the world, is considered to be one of the methods used to supplement the declining marine resources in an effort to meet the ever-increasing demand for protein through fish and fish products (FAO, 2010). This should be taken against the background that the coastal marine resources of Trinidad and Tobago are considered to be either heavily exploited or even over-exploited (FAO, 2010). Mariculture seems to be one of the more viable options for improving the harvest potential of the fisherfolk at Claxton Bay.

The stated FAO vision for aquaculture is “to promote the development of an Aquaculture Industry that is sustainable and market driven in support of food and nutrition security, employment generation and rural development, creation of investment opportunities and foreign exchange.” Aquaculture is currently practised at the subsistence and semi-commercial levels in Trinidad and Tobago. There are approximately 53 farmers currently involved in the activity (FAO, 2010). The available information identifies that there are currently three aquaculture farmers of some significance, with the major species farmed being the tilapia. The list of aquatic species currently cultured in Trinidad and Tobago include: *Oreochromos nilotica* and the red hybrid tilapia. Other food fishes which are cultivated include; *Oreochromos mossambica*, *Haplosternum littorale*, *Hypostomus robbini* and *Macrobrachium roenbergii*.

The viability of aquaculture has also been recognized by the Government of Trinidad and Tobago and as such aquaculturists in Trinidad are afforded certain incentives for the construction of ponds. To register as an

Aquaculturist (for ornamental and Food Fish Producers) and benefit from the incentives programme an applicant (18 years and over) is required to:

- Complete and submit an application form obtainable at the Aquaculture Unit of the Fisheries Division, Head Office.
 - Submit two passport-sized photographs
 - Submit copies of documents as requested on application form, e.g. deed, lease, recent tax receipts.
- Aquaculture training is also provided by the Fisheries Division in areas such as:
- Trained
 - Introduction to Food Fish Farming
 - Introduction to Ornamentals
 - Integrated Aquaculture
 - Introduction to Fish Health Inspection

Mariculture is a specialized branch of aquaculture involving the cultivation of marine organisms for food and other products in the open ocean, in an enclosed section of the ocean, or in tanks and ponds filled with seawater or brackish water. In simple terms it can be described as marine fish farming. At present there are no forms of mariculture existing on either island nor are there any government incentives for this venture. However, it has the potential for mitigating the impacts of the proposed industrial port at Claxton Bay as well the increases in industrial development along the entire west coast of Trinidad. The documented experiences of eastern countries have shown that coastal swamps can be profitably diverted to food production and in this process gain other side benefits such as creating employment in the rural areas (Sivalingam, 1981). It has also been shown that production from a unit area of a controlled environment is much more than that from open natural waters. There are examples of various forms of Mariculture from the Bureau of

Fisheries and Aquatic Resources (BFAR) Mariculture Project in the Philippines and their possible application along the west coast of Trinidad.

Whilst aquaculture and mariculture schemes are not considered in this retooling and retraining proposal, NEC proposes to support any person from the Claxton Bay Facility wishing to pursue such initiatives by assisting with the necessary training required to ensure success in the venture.

Framework of Implementing the Proposed Retraining and Retooling Measures and the Upgrade of Existing Facilities at the Claxton Bay Landing Site

It is imperative that the stakeholders be given an opportunity to collectively comment on the proposals made and to indicate their acceptance or rejection of the proposals before a framework for the implementation of the mitigation strategies proposed in this document can be developed. In this regard, stakeholders shall be officially provided with copies of this document and requested to study the proposals before attending a meeting to be hosted by NEC one week after receipt and study of the document by the stakeholders. The intended primary stakeholders would be: (i) Fishers and other users of the Claxton Bay Landing site, (ii) Shellfish harvesters utilizing the Claxton Bay Mangrove System and representatives of the Fisheries Division.

The purpose of the meeting shall be to discuss the proposals and for stakeholders to use the opportunity to make counterproposals for consideration by NEC. During the one-week period the membership of the Claxton Bay Fishing Association will be required to identify a representative who shall be authorized by them to speak on their behalf and represent their collective interests at meetings with the NEC. The

fishers shall also be required to confirm their choice of a representative by having more than 80 per cent of the fishing community at Claxton Bay sign an agreement of approval of the individual identified to represent them. This agreement would then be ratified by the Fisheries Division and NEC.

Upon arrival at a consensus on the way forward, an implementation framework shall be collectively developed.

The structure of this framework may be guided by the following:

1. Establishment of a communication/ liaison route with fishers operating in the project area.
2. Identification of persons who are desirous of receiving training and identifying relevant training institutions to carry out the training.
3. Identification of fishers who wish to be retooled in order to exploit the alternative fishery proposed.
4. Provision of materials required for retooling.
5. Scheduling the refurbishment works for the approved upgrades to the existing buildings at the Landing facility.

Establishment of a Communication Route with Fishermen Operating in the Project Area

During the initial phases of the implementation process NEC through its Community Liaison Office (which will be located in Claxton Bay) shall establish a formal communication route with the elected representative of the Claxton Bay Fishing Association (CBFA) for the purpose of developing and finalising an implementation framework for undertaking the retraining and retooling strategies accepted by the fishers of Claxton Bay. Once a framework has been developed, discussions shall then be held

in order to identify those fishers who require training/retooling.

Identifying Persons Requiring Training at the Claxton Bay Fishing Facility and Identifying Facilities for the Provision of Training

A list of all persons desirous of receiving training, the type of training required and the qualifications of the intended recipients shall be requested from the CBFA representative. It should be noted that the training funded by NEC shall only include those listed within the confines of this document. Once this list is obtained a copy would be provided to the Fisheries Division and to the CFTDI for confirmation. The representative of the CBFA and the NEC Community Liaison Office will then work with the CFTDI to identify appropriate class times, facilities and class sizes for training. Once established, the NEC through its Communication Office would communicate with the CFTDI to finalize the cost of the proposed training.

Identification of Fishers Who Wish to be Retooled in Order to Exploit the Alternative Fishery Proposed

The CBFA representative shall be required to identify fishers desirous of retooling in order to take advantage of the alternative/supplementary fishery proposed and to submit a list of their names to NEC through its Community Liaison Office. NEC shall thereafter take the necessary steps required to give effect to retooling of the fisher.

Provision of Materials Required for Retooling

After the training process is complete those persons wishing to pursue the use of fishpots as a supplementary enterprise to the existing Mullet fishery will be provided with the necessary tools and

materials needed for producing the fish pots. Again a list of the persons would be requested of the CBFA representative and a copy of this list would be provided to the Fisheries Division for verification.

Scheduling the Refurbishment Works for the Approved Upgrades to the Existing Buildings at the Landing Facility

The agreed upon upgrades to the buildings would be carried out in conjunction with proposed construction activities for the PLSEI Port. As such NEC through its Community Liaison Office proposes to hold update meetings with the CBFA representative in order to keep the fisherfolk at the facility abreast of the schedule for the proposed remedial works once they have been finalized.

Proposed Project Schedule

The proposed project schedule for the implementation of the mitigation alternatives is shown in Table 3.

Concluding Notes

NEC proposes to retrain and retool fishermen and improve the fish processing facilities at Claxton Bay incorporating other species of fish into a commercially viable enterprise as a measure to mitigate the long-term impacts of the proposed construction of a Port, Navigation Channel and Turning Basin on the commercial mullet fisheries in the Claxton Bay area.

However, the strategies proposed in this document seek not only to mitigate the impact of the proposed port development activity but improve the economic status of fishfolk at Claxton Bay. Each proposed strategy has its merits which should be carefully considered. NEC hopes that this document leads to open and fruitful dialogue with the fisherfolk (finfish and shellfish) of Claxton Bay and discussions will lead to the eventual improvement and economic well-being of fishers operating out of the Claxton Bay Landing Site.

Table 3: Proposed Project Schedule

Defined Task	Proposed Date for Execution
1) Presentation of proposal to stakeholders	February 24th 2010
2) Consultation with stakeholders on Proposal	March 12th 2010
3) Implementation of a Construction/Training/Retooling Programme at Claxton Bay	The start date to be agreed upon.

References

- Agard, J.B.R. and Gobin J. (1993). *Assessment of the coastal marine environment from Pointe-a-Pierre to La Brea (Oropuche Bank). Analysis of Macrobenthic in relation to oil pollution, natural oil seepage and disturbance in Trinidad*, Institute of Marine Affairs (IMA). IMA Technical Report p 26.
- Cervigón, F. (1993). *Los peces marinos de Venezuela*. Volume 2. Fundación Científica, Los Roques, Caracas, Venezuela. p. 497.
- Chan A Shing, C. (2002). *Atlas – Marine Fisheries of Trinidad and Tobago, Part 1, Trinidad Inshore Fisheries*. Fisheries Information Series 10. p. 76. Ministry of Agriculture, Land and Marine Resources, Port of Spain, Trinidad.
- Claro R. and J.P. Gracia-Arteaga, (1999). *Prospective of an artificial Habitat Programme for Fishes of the Cuban Shelf*, Editorial Academia No 452 Florida Sea Grant Programme University of Florida.
- Claro, R. (1994). *Características generales de la ictiofauna*. pp. 55-70. In R. Claro (ed.) *Ecología de los peces marinos de Cuba*. Instituto de Oceanología Academia de Ciencias de Cuba and Centro de Investigaciones de Quintana Roo.
- Cocheret de la Morinière E., I. Nagelkerken, H. van der Meij and G. van der Velde (2004). *What attracts juvenile coral reef fish to mangroves: habitat complexity or shade?* Volume 144, Number 1 Marine Biology.
- Collette, B.B. (1999) *Pomatomidae. Bluefishes*. p. 2650. In K.E. Carpenter and V. Niem (eds.) *FAO species identification guide for fishery purposes*. Vol. 4. Bony fishes part 2 (Mugilidae to Carangidae).
- CRFM (2006). *CRFM Fishery Report – 2006 Volume 1 Report of Second Annual Scientific Meeting – Port of Spain, Trinidad and Tobago*, pp. 13-22. March 2006.
- Dass (1983). *Some aspects of the biology of the Lane Snapper Lutjanus synagris (Linnaeus, 1758) in Trinidad*. Research Report No. IMA/12/83. Institute of Marine Affairs: Chaguaramas, Trinidad and Tobago
- FAO (2000). *Report of a National Workshop on Shrimp And Groundfish Fisheries of the Brazil-Guianas Shelf*. GCP/Int/648/Nor Field Report F-8 (En) Food And Agriculture Organization of the United Nations; FAO/Norway Government Cooperative Programme
- Farbes, B. (1983). *Fisheries related observations of the North-eastern South America*. Draft Report. Fisheries Division Ministry of Agriculture Lands and Food Production, Trinidad, West Indies.
- Fisheries Division (2003). *The Fisheries Division Census of Fishing Vessels of Trinidad*. Fisheries Division, Ministry of Agriculture, Land and Marine Resources.
- Fisheries Division (2005). *Fisheries and Aquaculture Statistics for Trinidad and Tobago*. Fisheries Division, Ministry of Agriculture, Land and Marine Resources.
- Fisheries Division (2006). *Fisheries and Aquaculture Statistics for Trinidad and Tobago*. Fisheries Division, Ministry of Agriculture, Land and Marine Resources.
- Fisheries Division (2007). *Fisheries and Aquaculture Statistics for Trinidad and Tobago*. Fisheries Division, Ministry of Agriculture, Land and Marine Resources.
- Fisheries Division (2008). *Fisheries and Aquaculture Statistics for Trinidad and Tobago*. Fisheries Division, Ministry of Agriculture, Land and Marine Resources.
- Fisheries Division (2009). *Fisheries and Aquaculture Statistics Report for Trinidad and Tobago*. Fisheries Division, Ministry of Agriculture, Land and Marine Resources
- Ferreira, L. and L. Martin (2005). *National Report – Trinidad and Tobago*. In *Report of the First Annual CRFM Scientific Meeting*. CRFM Fishery Report No 11.
- Gade, H.G. (1961). *On some Oceanographic observations in the Southeastern Caribbean Sea and the adjacent Atlantic Ocean, with special reference to the influence of the Orinoco River*. Boletín del Instituto Oceanográfico de Venezuela 1: pp. 287-342.
- Grant, E.M. (1982) *Guide to fishes*. 5th edition. Dep. Harbours Mar., Brisbane, Queensland, Australia, p. 896.
- Gopaul, N.H. and J. Wolf. (1996). *A numerical model of tidal and wind-driven circulation in the Gulf of Paria*. Caribbean Marine Studies. No 5, pp. 23-40.
- Heileman, L.T. and D. Ramsaroop (1990). *Seasonal variations in some oceanic parameters in the Gulf of Paria, Trinidad and Tobago, West Indies*. Caribbean Marine Studies 1: pp. 101-113.
- Kuruvilla S. (2007). *Report on the Marine Resources & Fisheries of the Gulf of Paria for the Environmental Impact Assessments for Exploratory Drilling Activities in Block 1a & 1b Prepared for Coastal Dynamics*. Petro-Canada Block 1b Drilling Programme – Environmental Impact Assessment. Appendix H. Coastal Dynamics Limited, 2007.
- La Croix M. (1971). *The Oyster Fishery of Trinidad and Tobago*. Officer Research Division of Fisheries Ministry of Agriculture.
- Maingot, J. and S. Manickchand-Heileman (1987). *Field per recruit analysis of the lane snapper Lutjanus synagris (Linnaeus, 1758) in Trinidad, West Indies*. Institute of Marine Affairs, Chaguaramas, Trinidad and Tobago.
- Manickchand-Dass, S. (1987). *Reproduction, Age and Growth of the Lane Snapper Lutjanus synagris (Linnaeus), in Trinidad, West Indies*. Bulletin of Marine Science, 40 (1): pp. 22-28.
- Manickchand-Heileman S. and M. Julien-Flus (1990). *Species compositions and seasonality of a coastal demersal fish stock in Trinidad, West Indies*. Caribbean Marine Studies 1: pp. 11-21.
- May, J.L. and J.G.H. Maxwell (1986) *Trawl fish from temperate waters of Australia*. CSIRO Division of Fisheries Research, Tasmania. p. 492.
- Mohammed, E. et al. (2005). *Coastal Fisheries Profile of Latin America and the Caribbean Trinidad and Tobago*. (in press)
- NEC (2008). *Cat Reporting Transcription In Respect Of National Energy Corporation Of Trinidad And Tobago Limited Focus Group Meeting Re EIA for Proposed Development of an Industrial Port at Claxton Bay with the Claxton Bay Fishing Association Held at NEC Head Office Cor. Rivulet Road and Factory Road, Brechin Castle, Couva, on Thursday, September 25, 2008*.
- Nagassar, N. (2001). *Frame Survey*

- of the Gillnet Fishery of Trinidad and Tobago. Presented at the National Consultation on the Monitoring and Advisory Committee on the Fisheries of Trinidad and Tobago. Fisheries Division, Ministry of Agriculture, Land and Marine Resources. pp. 44 – 66.
- Nagassar N. (2000). *Frame Survey on the Gillnet Fishery of Trinidad and Tobago. A Report prepared for the National Consultation of the Monitoring and Advisory Committee on the Fisheries of Trinidad and Tobago.* Fisheries Division, Mins, Agri, Land and Marine Res. Port of Spain Trinidad.
 - Ramjohn D.D. (1999). *Checklist of coastal and marine fishes of Trinidad and Tobago.* Fisheries Information Series 8. Marine Fishery Analysis Unit Fisheries Division, Mins, Agri, Land and Marine Res. Port of Spain Trinidad.
 - *Rapid Environmental Assessments (2003) Ltd (REAL); Worleyparsons Infrastructure and Environment Limited and Senes Consultants Limited, 2009. National Energy Corporation of Trinidad and Tobago Limited Development of an Industrial Port at Claxton Bay North.* CEC 1761/2007 Supplementary Environmental Impact Assessment Study.
 - Schorse M. (2007). *Socio-Cultural Assessment for the Environmental Impact Assessments for Exploratory Drilling Activities in Block 1a and 1b Prepared for Coastal Dynamics.* Petro-Canada Block 1b Drilling Programme – Environmental Impact Assessment. Appendix H. Coastal Dynamics Limited 2007.
 - Solomon F.N. (2002). *The Mullet Fishery in the Gulf of Paria Trinidad.* MPhil Thesis University of the West Indies St. Augustine Campus Trinidad.
 - Soomai S. (2004). *Status of Coastal Zone and Fisheries/Aquatic Resources Management and the Incorporation of Demographic and Socio-Economic Considerations/Indicators: Trinidad and Tobago, August 2004.* CRFM .
 - Soomai S. and C. Porch (2006). *The Lane Snapper (Lutjanus synagris) fishery of Trinidad and Tobago* CRFM Fishery Report (2006) Volume 1. Report of Second Annual Scientific Meeting – Port of Spain, Trinidad and Tobago, 13-22 March 2006. pp. 122-134.
 - Smith, C.L. (1997). *National Audubon Society field guide to tropical marine fishes of the Caribbean, the Gulf of Mexico, Florida, the Bahamas, and Bermuda.* Alfred A. Knopf, Inc., New York. p. 720.
 - Sheehy, D.J. (1983). *New approaches in artificial reef design and applications.* Aquabio p. 13.
 - Silva Lee, A. (1975). *Observaciones sober arrecifes artificiales usados para pescar en Cuba.* Ser Oceanol, Acad. Cien. Cuba 26.1:13.
 - Van Andel, T.J., H. Postma (1954). *Recent sediments in the Gulf of Paria. Reports of the Orinoco Shelf, Vol 1.* North-Holland Publishing Company Amsterdam.
- ### Web References
- BFAR (2009) *Mariculture Bureau of Fisheries and Aquatic Resources Marine Zones and parks.* Accessed January 28, 2010. http://mariculture.bfar.da.gov.ph/mz_business_groupercage.htm
 - Broadbridge C. (2008) *Trinidad and Tobago Newsday Online Resources.* Trinidad's Hidden Garden of Eden, July 5, 2009. Accessed January 25, 2010. <http://www.newspday.co.tt/features/print,0,103268.html>
 - Florida Museum of Natural History Biological Profile. Accessed January 2010 <http://www.flmnh.ufl.edu/fish/Gallery/Describe/LaneSnapper/LaneSnapper.html>
 - Food and Agriculture Organization of the United Nations, Fisheries and Aquaculture Department, Fishery and Aquaculture Country Profiles 2000-2010. Trinidad and Tobago Accessed January 2010. http://www.fao.org/fishery/countrysector/FI-CP_TT/en
 - Food and Agriculture Organization of the United Nations, Fisheries and Aquaculture Department, FAO Corporate Document Repository, *Fishing with Traps and Pots.* Accessed January 2010. <http://www.fao.org/docrep/004/X2590E/x2590e07.htm>
 - Sivalingam S. (1981). *Basic Approach To Mariculture, Problems And Development Strategies (Ken/77/014) Government of Kenya/UNDP/FAO Pilot Project* “Development of Coastal Aquaculture” Food and Agriculture Organization of the United Nations, Fisheries and Aquaculture Department, FAO Corporate Document Repository. Accessed January 28, 2010 <http://www.fao.org/docrep/field/003/AC571E/AC571E00.htm>
 - Sivalingam S. (1981) *Mariculture as a Method of Using Coastal Zones (Ken/77/014) Government of Kenya/UNDP/FAO Pilot Project,* “Development of Coastal Aquaculture” Food and Agriculture Organization of the United Nations, Fisheries and Aquaculture Department, FAO Corporate Document Repository. Accessed January 28, 2010 <http://www.fao.org/docrep/field/003/AC583E/AC583E00.htm>
 - Javeed A. (2008) *Trinidad Guardian Online Resources, Fishing's bleak future South and Central fishermen fear their way of life may soon be gone forever.* Thursday, August 14, 2008. Accessed January 2010. <http://legacy.guardian.co.tt/archives/2008-08-18/bussguardian3.html>
 - Kishore R., Finlay J., Clarke-Marshall M., Ramsundar H, de Souza G. and Haylock H. (2006). *Coastal Resource Management in the Wider Caribbean Resilience, Adaptation, and Community Diversity.* Chapter 7: Political organization and socio-economics of fishing communities in Trinidad and Tobago, Grenada and Belize. Edited by Yvan Breton, David Brown, Brian Davy, Milton Haughton, and Luis Ovares p. 300. Accessed January 2010. http://www.idrc.ca/en/ev-102785-201-1-DO_TOPIC.html#tab10
 - Ministry of Agriculture, Land and Marine Resources (MALMR) 2010. *Government of the Republic of Trinidad and Tobago. MALMAR Services.* Date Accessed January 28, 2010. http://agri.gov.tt/home/index.php?option=com_content&task=view&id=125&Itemid=96
 - Phillip K. C. (2009). *Trinidad and Tobago Express Online Resources.* Pollution killing fish stocks. Monday, April 13, 2009. Accessed January 25th 2010. www.trinidadexpress.com/index.pl/print?id=161464059
 - Sea Foods Enterprises Limited (2010). Date Accessed January 25th 2010 <http://seafoodstt.com/>



Wade Hamilton, right, VP Technical Operations, with Gas Exporting Countries Forum's Secretary-General, Leonid Bokhanovsky.

Pipeline Projects Move Ahead

Horizontal Directional Drilling (HDD) to send natural gas for power generation via pipeline to Tobago was accomplished without any damage to the coral environment.

Other noteworthy accomplishments were that the gas receiving facility at Cove Estate in Tobago was under construction and mechanical/electrical instrumentation work to have the facility operational for receiving gas by year-end was in train. This line is strategically important because it will be the transition line for sending natural gas to Barbados via compression facilities that will be installed when the project led by the Eastern Caribbean Gas Pipeline Company comes on stream.

Gas Exporting Secretary General Impressed with NGC

NGC hosted the Gas Exporting Countries Forum's (GECF) Secretary-General, Leonid Bokhanovsky, to presentations by its senior management team in April. His Excellency Amb Bokhanovsky was greeted at NGC's

Point Lisas Head Office by former NGC/NEC Chairman, Malcolm A. Jones; NGC's President S. Andrew Mc Intosh; NEC's President, Andrew Jupiter; and Special Advisor to the Ministry of Energy and Energy Industries, Frank Look Kin. Mr. Bokhanovsky was given an overview of NGC and a history of Trinidad and Tobago's natural gas industry by NGC's

Horizontal Directional Drilling (HDD) to send natural gas for power generation via pipeline to Tobago was accomplished without any damage to the coral environment.

Vice President, Commercial, Arnold De Four. NEC's presentation was delivered by Mrs. Marleen Lord-Lewis, Vice President of Business Development.

The Secretary General stated that he was very impressed by T&T's achievements in the field of gas and industrial development over such a short space of time. After the presentations, Mr. Bokhanovsky was accompanied by NGC's Vice President, Technical Services, Mr. Wade Hamilton, on an aerial tour of the Point Lisas Industrial Estate and the Atlantic LNG Facility.

The GECF, created in 2001, is an inter-governmental organization of some of the world's leading gas producers. The GECF's share of total exports is 60%, and it possesses 42% of the world's gas reserves. Its members include: Algeria, Bolivia, Egypt, Equatorial Guinea, Iran, Kazakhstan (observer), Libya, Nigeria, Norway (observer), Qatar, Russia, Trinidad and Tobago and Venezuela.

The objectives of the GECF are:

- to foster the concept of mutuality of interests by favouring dialogue between producers and consumers and between governments and energy-related industries
- to provide a platform to promote study and exchange of views
- to promote a stable and transparent energy market.

Liquid Fuels Pipeline Project

The Liquid Fuels Pipeline Project is being constructed to transport gasoline, jet fuel and diesel fuel from Petrotrin in



Frederick Settlement Facility – Liquid Fuels Pipeline Project

Pointe-a-Pierre to Caroni, and jet fuel pipeline to Piarco Airport.

Caroni Complex

At Caroni's Frederick Settlement a world-class terminal storage and loading facility is being built for the routing of the different fuels along the line where they will be moved, stored and regulated.

Foundations are being constructed for the Loading Area, the Main Pipe-rack, Pumps, Administration Building and Maintenance Buildings. Once these are finished, the loading arms and other related equipment will be installed.

A high-security fence is being installed around the complex. NGC will award contracts for building works and electrical works. Buildings will include the control building, the maintenance buildings and guard huts.

Road Works

NGC will build an access road near the eastern side of the complex which will be dedicated to vehicles entering and exiting the facility. This will assist motorists using the Caroni Savannah Road from having to encounter heavy vehicles and equipment.

Other Infrastructure

NGC expects to have approval soon from WASA to install potable water pipelines to the Caroni facility.

At Petrotrin

NGC will install four tanks and necessary equipment at the western side of the Pointe-a-Pierre refinery. The foundations for these tanks are being constructed. Construction is expected to begin mid-September.

At Piarco

NGC is building two Jet A-1 tanks at Piarco to increase NP's existing storage capacity. This was completed at the end of July. NGC will also construct a Control Building and a Metering System at Piarco.

Completion Date

The project is scheduled for commissioning in the first quarter, 2011.

At Caroni's Frederick Settlement a world-class terminal storage facility is being built for the routing of the different fuels along the line where they will be moved, stored and regulated.

Oropouche Bank

This project is a viable alternative using reclaimed land for the creation of an offshore industrial space/parkland. The site selected at Otaheite met the criteria for economical reclamation as it is in shallow water – (3-5 m) on seismically stable formation.

The initial phase (400 Ha) can be constructed using dredged materials taken from the navigation channels which will be constructed. The final build-out, as investors seek allotments to locate their industries, will be on an overall site of approximately 1400 Ha.

In the master plan, a road link bridge between the mainland and the site will ensure the free circulation of sea water. The reclamation will be approximately 2.5km offshore and designed to offer protection against the eroding coastline and the perennial flooding of the Mosquito Creek.

Extensive preliminary engineering and planning studies have been undertaken which optimize both the shape and location of the proposed offshore industrial estate.

Galeota Port

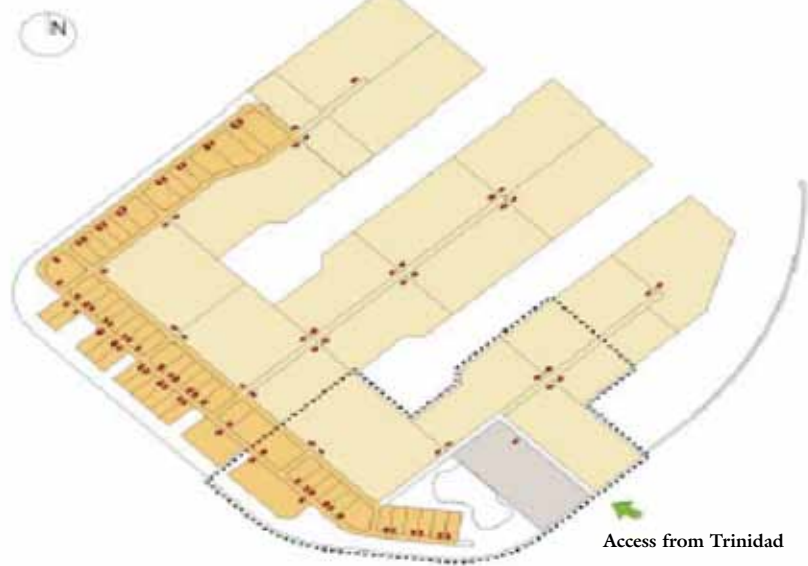
NEC is concluding acquisition for 3.2Ha of land presently leased to bpTT which will be excised and amalgamated with the proposed reclamation (2.79Ha) to create the port backland (5.9Ha). The backland will be utilized for storage, mud mixing, bunkering, etc. All pile materials (2,609 tons) for 567m of dock wall comprising five berths and associated works have been procured, sand blasted and coated.

The other aspect of the works comprising the development of the fish landing facility is eagerly awaited by



The reclamation will be approximately 2.5 km offshore and separate from the shoreline ...

Access to Plots



the Mayaro fishing community. The Environmental Management Authority granted a Certificate of Environmental Clearance (CEC) and approved monitoring plans, following which the Town and Country Planning Division issued planning permission.

Environmental monitoring has been ongoing for the construction phase and

will continue approximately three years into the operational phase. The essential components of the monitoring are shoreline monitoring and management, reef survey, socio-economic parameters, stakeholder engagement and environmental compliance in accordance with the CEC.

Environmental monitoring has been ongoing for the construction phase and will continue approximately three years into the operational phase.

Pt Lisas South and East Industrial Estate Port Development

This project was developed to serve industries proposed for the Pt Lisas South and East Industrial Estate.

The existing port at Pt Lisas cannot accommodate new ship loaders nor the throughput anticipated while right of ways (ROWs) cannot be made available for corridors, roads, rails, pipelines and conveyors, etc.

This port has been modified to reduce the extent of reclamation to minimize the impact on the sea floor. Further, a commitment was given to the Environmental Management Authority (EMA) that only the initial phase comprising 700m of quay wall will be constructed with a backland 116m wide. In addition, the corridor access to the port was shortened in order to reduce the overall cost of the project.

Detailed designs were completed. The designs were reviewed and certified by an independent engineering firm. Field bathymetric and geotechnical surveys were completed. Approximately 9,000 tons of pile materials have been procured and stored in Pt Lisas.

At present the contractor has used the provisions under the contract for prolongation delay to minimize the cost impact. The contractor, Saipem, demobilized and minimized staff at their local office to reduce field and head office overheads.

NEC continues to respond to the clarifications sought by the EMA in order to procure the grant of a Certificate of Environmental Clearance (CEC). Pending the outcome of a decision for the grant of a CEC, construction will commence.

Towage and Harbour Operations

On May 1st 2010 the Towage and Harbour Operations Department evolved into the Towage and Harbour Operations Division. Based on a mandate from the Board of Directors, the National Energy Corporation is now directly responsible for the commercial, technical and crew management of its towage operations. The primary objectives of moving from outsourcing Crew and Technical Management to in-



Illustration map: Point Lisas South and East Industrial Estate

sourcing these areas included:

- To gain better control of operations and in particular our safety management system
- To improve our cost performance
- Long-term stability and sustainability from being self-sufficient.

At a time when NEC's revenue earning stream has been challenged by the global recession, NEC's towage business has been able to weather the storm to meet budgeted targets. This has been achieved by leveraging on our competitive advantage by NEC

commitment to service excellence.

It has just been two months and already NEC has to improve on our cost effectiveness as displayed through the record time completion of the dry-docking of two of our tugs. On average, our dry-docking exercises are completed in excess of 14 days.

Through a careful, comprehensive and diligent planning exercise, coupled with competent technical supervision, the *NEC Pride* and *NEC Spirit* were successfully dry-docked in half the usual time and within budget.

A commitment was given to the Environmental Management Authority (EMA) that only the initial phase comprising 700m of quay wall will be constructed with a backland 116m wide. In addition, the corridor access to the port was shortened in order to reduce the overall cost of the project.

Infrastructure Projects at the Port of Brighton

At the Port of Brighton the following infrastructure projects have been undertaken:

- The Dock and Storage Yard
- Raw Materials Storage and Handling Facility, and
- Capital and Maintenance Dredging.

Dock and Storage Yard

The dock, which is essentially an extension of the Labidco Port, adopted the quay wall method of construction with a total length of 307m. It was designed to accommodate Handymax vessels with an “alongside” approach and a draft depth of 12.8m chart datum. The dock has been outfitted with bollards, fenders and access ladders. Additionally, a crane rail with a 12m gauge and storm tie-downs were also integrated into the dock to accommodate a gantry crane and ship unloader.

For the storage yard, a total of five hectares of sea was reclaimed for this project to create a total of nine hectares of backlands, which is being developed further into the Raw Materials Storage and Handling Facility. This area is now enclosed by the dock to the north and coastal protection to the eastern boundary. The rip-rap method of coastal protection was employed and involved the placement of suitably sized rocks and geotextiles fabric to prevent soil loss via the rock apertures.

A new access corridor 450m long, designed to accommodate the vehicles that are typical to Port Operations, was also constructed to link the Dock and Storage Yard to the Labidco Estate. The Project which cost US\$45.7m was officially taken over by NEC effective December 31, 2009 from the Design and Build Contractor Pihl-Besix.



Completed dock at the Port of Brighton

Raw Materials Storage and Handling Facility

The Materials Storage and Handling Facility originally involved the development of the aforementioned 9-hectare storage yard for Alutrint. It was designed to facilitate the unload of raw materials for the Alutrint Smelter Plant, namely, bulk alumina and petroleum coke at the port with a pneumatic ship unloader and gantry crane; and transportation of these materials by conveyor to the bulk materials storage area adjoining the dock. Export of downstream products was also envisaged.

As a result of the recent change in Government, NEC was mandated to explore possible alternative uses for the Brighton Project. In the interim, NEC has instructed its Engineering, Procurement and Construction Contractor, GLF Corporation specifically, not to advance further the Alumina Silo, Petroleum Coke Stacking Tube and the Conveyor System. All other works that are not specific to the handling of Alumina or Petroleum Coke are proceeding as per original

contract. These include the roads, drains, warehouse, office building, storage areas, etc.

The contracted cost of the project is US\$98m and the project is scheduled to be completed by December 31, 2010. To date the Engineering Designs have been completed, Procurement is 96% complete and Construction is approximately 60% complete.

Capital and Maintenance Dredging

The Capital and Maintenance Dredging aspect was a requirement for the Port to accommodate Handymax vessels and possibly larger. It entails the deepening and widening of the existing channel and turning basin. The design width and diameter of the channel is 150m and 500m respectively, with a depth of 12.8m chart datum.

The contract was awarded to Boskalis Westminster Overseas in the sum of US\$12.9m. In May 2010 NEC was granted CEC approval and dredging is expected to be completed during the fourth quarter of 2010.



Brighton Port – Handling and Storage Area

EOG adds 2.27BCM from Pelican. Toucan Next

EOG Resources has added 80Bcf (2.27BCM) net from its Pelican discovery in Trinidad, according to company senior executive VP of exploration, Loren Leiker. The company drilled a successful development well at Pelican in the first quarter, Leiker said. A six-well drilling programme on the Toucan discovery is due to begin by year-end and will add 279Bcf net, added the executive.

EOG's Trinidad operations span offshore blocks 4(a), U(a), U(b) and SECC, with current output at around 300MMcf/d. The company's reserves in the country at end-2008 totalled 87Bcf.

New Energy Minister

Trinidad and Tobago has a new Energy Minister with the appointment of Mrs. Carolyn Seepersad-Bachan following the May 24th 2010 General Elections. Mrs. Seepersad-Bachan has Bachelor's and Master's degrees in Engineering and is regarded an Energy Expert after her years as Chairman of National Petroleum (NP). This portfolio reinforced her experience and knowledge of the energy sector. The MP for San Fernando West, Mrs. Seepersad-Bachan also worked as a lecturer at the Faculty of Engineering at the University of the West Indies.

Genesis to Evaluate Block 5c Commercialization Options

The UK's BG Group (LSE: BG) has engaged Genesis Oil and Gas Consultants to evaluate natural gas commercialization options in Trinidad,

according to Canadian Superior Energy's COO, Leif Snethun.

BG holds a 75% stake and is operator of block 5c offshore Trinidad; Canadian Superior holds the remaining 25%. BG is progressing with geo-technical work, well design and the purchase of long-lead drilling tangibles. Mr. Snethun added that an appraisal well could be spud on the Bounty discovery between the fourth quarter and Q1, 2011.

The block's undiscovered gas reserves are estimated to exceed 4Tcf (113BCM).

National Oil and Gas Talks Coming

A national consultation on natural gas pricing and utilization is to be held. It will seek to arrest the decline in the country's oil production with the hope of bringing it on par with local gas production. The findings of the consultation when approved will become national policy. The Energy Minister views the development of a natural gas

policy as key to the management of the energy sector. By re-balancing the oil and gas production profile and increasing the volumes extracted from proven reserves, including the securing of new investors to explore in areas already identified by the ministry, it is hoped there can be a re-energizing of the sector.

Mrs. Seepersad-Bachan said in order to replace 1.5Tcf per year for LNG and gas-based industries, seven to nine exploration wells would have to be drilled per year.

New Bid Round Soon for Deep Water Drilling

A new competitive bid round for deep water drilling in Trinidad and Tobago will be launched in the coming months. The launch will take place in the wake of the April 20 oil spill from British Petroleum's (BP) Macondo Project in the Gulf of Mexico.

During the 2010 Society of Petroleum Engineers Conference held in June in Port of Spain, Government noted it would review the fiscal and tax regime for the petroleum industry.

The Energy Minister views the development of a natural gas policy as key to the management of the energy sector. By re-balancing the oil and gas production profile and increasing the volumes extracted from proven reserves, including the securing of new investors to explore in areas already identified by the ministry, it is hoped there can be a re-energizing of the sector.

one moment please

to reflect on the beauty
that surrounds us here
in Trinidad and Tobago

SWEET HISTORY:

The Trinidad and Tobago landscape is punctuated with historical buildings that remind us of our rich colonial history. Images like this of a sugar mill in Lowlands, Tobago serve as a reminder of our long-standing history of sugar production in both islands. Tobago, in particular, was a major producer of sugar for most of the 18th century. This mill still stands tall today as remarkable symbol of our heritage.

Photo by Kevin Reis





*THE NATIONAL GAS COMPANY
OF TRINIDAD AND TOBAGO LIMITED*

Orinoco Drive
Point Lisas Industrial Estate, Couva
Republic of Trinidad and Tobago, W.I.
P. O. Box 1127, Port of Spain
Tel: (868) 636-4662, 4680
Fax: (868) 679-2384
Email: info@ngc.co.tt
Website: www.ngc.co.tt