

**Human Capital Development in a Period Of Rapid Industry Growth-  
The Case Of Trinidad And Tobago 1992-2008**

**By**

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**Paper presented to the**

**25<sup>th</sup> World Gas Conference**

**Kuala Lumpur, Malaysia**

**4<sup>th</sup> – 8<sup>th</sup> June 2012**



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## **Human Capital Development in a period of rapid industry growth- the case of Trinidad and Tobago 1992-2008**

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### **1 Background**

The twin island Republic of Trinidad and Tobago is the most southerly of the chain of islands in the Caribbean Sea. With a population of 1.3 million persons (Census, 2000), Trinidad had a per capita GDP of around US\$15,000 placing it among the middle income countries in the world. Oil and gas is the dominant economic sector in Trinidad and Tobago, accounting for over 35% of GDP; 55 % of Government revenue and 85% of export earnings.

The hydrocarbon industry in Trinidad and Tobago (T&T) is over 100 years old. The first commercial production of oil in this former British colony was recorded in 1908. Essentially, production and refining of crude oil was the main focus of the industry from its inception straight up to the late 1970's. Major multinationals – including Shell and Texaco, made Trinidad part of the global refining network. The discovery of significant reserves of natural gas in late 1960s triggered a shift in focus to this hydrocarbon in ensuing decades. Blessed with windfall oil revenues from the oil crisis of the 1970's , the Government embarked on a deliberate strategy of resource based industrialization , centred on direct investment in various gas based industries in order to monetize available relatively cheap natural gas . The transition took place gradually with the growth of petrochemical production (such as ammonia and methanol) from the 1980's onwards and the emergence of liquefied natural gas (LNG) in the late 1990's.

The natural gas sector has experienced phenomenal growth over the last twenty years as the country has moved from relative obscurity to become one of the world's leading exporters of ammonia, methanol and liquefied natural gas. Between 1991 and 2010, natural gas utilization increased at a compounded growth rate of 11 per cent per annum from a daily average of 490 MMscfd to 4010 Mmscfd. By the end of period, T&T with just 0.2 per cent of world gas reserves accounted for 1 .4 per cent of production and 8.3 per cent of global gas trade. The industry is poised for further growth in the next five years.

Notwithstanding its long history with the industry, this period of rapid growth presented serious challenges to the development of human resource capability development within the constraints of time and quality.



**Table 1**

**Natural Gas Utilization in Trinidad and Tobago (MMscfd)**

<b>Year</b>	<b>Average Total</b>
2000	1372
2001	1464
2002	1716
2003	2503
2004	2835
2005	2987
2006	3536
2007	3752
2008	3710
2009	3837
2010	4010
*Source: Ministry of Energy and Energy Industries	

**2 Aim**

This paper seeks to explore strategies used in T&T to meet the human capital needs of the natural gas industry. The paper will aim to distinguish between emergent and planned strategies and to examine the different approaches of the Government, state enterprises and foreign multinationals in treating with the problem of attracting and retaining human capital. The paper will distil lessons learnt from the experience which will inform policy initiatives at the level of the firm and industry.

**3 Methodology**

The paper was developed with a combination of desktop research, field interviews and primary and secondary data collection and analysis. Interviews were conducted with current as well as previous human resources professionals at National Gas Company of Trinidad and Tobago Limited (NGC) and other companies. Primary data collection included publications from the National Training Agency (NTA), National Institute of higher Education Research Science and Technology (NIHERST) reports and surveys, the University of the West Indies (UWI) and the University of Trinidad and Tobago (UTT). Technical reports and academic papers published locally and internationally on the challenges of human capital development were also utilized. Data was gathered and analysed on technical skills and professions, disaggregated along the lines of the gas/energy chain. The paper explores the role of the various players in the sector – including foreign multinationals, state enterprises and the Government in the process. The research covered many areas in the field of strategic human resource management including issues such as compensation practices in response to tightening labour market conditions,



industry benchmarking, special allowances, employee self development, graduate internships, and work-life balance .

## 4 Results

### 4.1 Economic and Social Context

Trinidad and Tobago is arguably the strongest member of the Caribbean Community and Common Market (CARICOM). In 2010, Trinidad and Tobago with a population of 1.3 million had an estimated per capita GDP of \$15,511, one of the highest in the region. The country's wealth is derived mainly from its hydrocarbon sector which in 2010, accounted for around 40% of GDP, 85% of exports earnings and 52 % of Government revenue. Ironically the energy sector employs only 3.5 per cent of the labour force, testimony to its capital intensive nature. Historically, the fortunes of the economy are inextricably linked to the health of its energy sector; this is particularly evident during periods of boom and bust in the global oil industry. The economy has experienced three consecutive years of decline since 2009, as a result of the global recession, fall in commodity prices, the collapse of lending financial institutions, a sharp reduction in both Government and private sector investment. (Table 2)

The Government's fiscal operations provide the channel for the transfer of energy wealth into the wider economy. As many other oil producing states the Trinidad and Tobago economy is characterized by a high level of social spending (transfers and subsidies), which accounted for 54 % of the budgeted expenditure for fiscal 2011-12. Outlays on education constitute an important component of that spend

The high level of government spending on transfers and subsidies has resulted in a fairly high standard of living for most citizens. The government uses revenue from the energy sector to provide inter alia free education, free public health care, and expanded social net programmes. Furthermore, refined petroleum products sold locally are heavily subsidized making them by far the cheapest in the region and among the cheapest in the entire world. One litre of super gasoline sells locally for US \$0.43.

In the UN's 2011 Human Development Report, Trinidad and Tobago's Human Development Index (HDI) is estimated at 0.76 placing Trinidad and Tobago 62<sup>nd</sup> overall in the world in terms of living standards. Unemployment now stands at around 7 per cent. According to the UN report, approximately 0.7 % of the population is either severely poor or vulnerable to poverty. In order to assist the poor, the government has several social programs which include the Food Card Programme and the Utilities Assistance Programme which seek to reduce the food and utilities bill for the poor and also the disabled. In a 2000 survey, 75.8% of households owned their home, over 90% used electricity to light their homes and 83.4% had access to pipe-borne water.



Table 2

Key Economic Indicators for Trinidad and Tobago

Indicator	Unit	2006	2007	2008	2009	2010
Real GDP Growth Rate	%	13.4	4.8	2.4	-3.5	0.1 *
GDP per Capita	US \$	14,223	16,678	20,879	15,038	15,511
Inflation	%	8.3	7.9	12	7.2	10.5
Unemployment Rate	%	6.2	5.5	4.6	5.3	5.8**
Value of Exports	US \$Ms	14,217	13,391	18,686	9,175	7704.4 ***
Value of Imports	US \$Ms	6,517	7,670	9,622	6,973	4835.6 ***
Exchange Rate	(TT\$/US\$)	6.2809	6.3008	6.2563	6.2997	6.3480
Gross International Reserves	(US \$M)	7,080	8,633	11,583	11,391	11,032
Government Revenue	(TT \$M)	38,911	40,064	56,848	39,045	43,212
Government Expenditure	(TT \$M)	31,198	37,766	44,715	45,731	43,520
Non Energy Fiscal Balance/GDP	%	-14.6	-15.1	-12.5	-19.1	-16.8
International Credit Rating	S&P	A-	A-	A	A	A

Source: The Central Bank of Trinidad and Tobago

Historically education has constituted an integral part of the development strategies of Government in Trinidad and Tobago. Both primary and secondary school education have been free since the attainment of independence in 1962. Tertiary education, partially free in 1999, has been fully state financed since 2004. Over the period 2008-2012, expenditure on education and training constituted 16 per cent of Government expenditure (Table 3). Budgeted expenditure on education and training represents the single largest categorized allocation over the last five years.

Table 3



### Budgeted Expenditure for the period 2008-2012 in TT \$Millions

Expenditure/ Year	2008	2009	2010	2011	2012
Education and Training	\$ 7,600.00	\$ 7,121.60	7360	\$ 8,325.00	\$ 8,717.80
Total Budgeted Expenditure	\$ 42,260.90	\$ 49,445.70	\$ 44,366.00	\$ 49,000.00	\$ 54,600.00
% Share of Education and Training	18%	14%	17%	17%	16%

Source: Ministry of Finance

## 4.2 Industry Profile and Growth

Following the discovery of major gas fields in 1968 and 1974, the Government of the day perceived the possibility of developing an alternate sub-sector, to further the diversification and industrial development of the economy. Therefore, when the oil price increases of the 1970's filled the state's coffers with windfall revenues, Government embarked on a natural gas based, export oriented, industrialization strategy. Government established the National Gas Company (NGC) in 1975 and the National Energy Corporation (NEC) in 1978, with 100% state ownership. The Point Lisas Industrial Estate including port facilities was built as an industrial site for new investment. Government also made direct investment in new industries- methanol and steel. NGC/NEC represented the State as investor in gas based industries and it enabled development of the natural gas industry by providing guaranteed market for upstream and secure supply for downstream.

Natural gas consumption of less than 60 million standard cubic feet per day (MMscfd) in 1975 has increased to over 4.1 billion cubic feet per day (bcfd) in 2011 (Figure 1). The industry expansion may be broken up into two phases. In the first period 1975 to 1990 the state played a major role as both facilitator and direct investor. The majority of investments made were either fully owned by the state or were joint ventures with foreign capital. Between 1975 and 1985 state capital spend on the energy sector investments amounted to US\$3.3 billion, 30 per cent of which was in equity (Vision 2020 Energy Subcommittee, 2004). Up until the early 1990's the T&T energy sector comprised of six process plants, the refineries at Point Fortin and Pointe a Pierre and one iron and steel mill and two power generation plants. Jointly these industries consumed around 490 MMscfd.

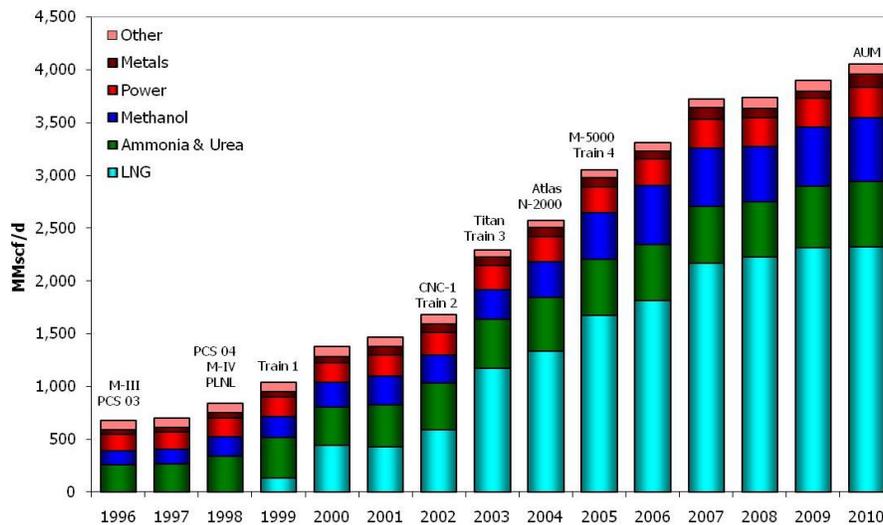
Over the last twenty years the industry experienced very steep growth led by LNG with contribution from other sectors. Between 1991 and 2010 ammonia production increased by 124 per cent from 2465 tonnes per annum to 5533.2 tonnes per annum. Similarly, the productive capacity in the methanol industry increased by 1200 per cent from just 452 tonnes to 5932 tonnes. Iron and steel also witnessed significant growth as two additional steel mills came on line pushing DRI production from 654 thousand tonnes to 1.4 million tonnes in 2010, an increase of 114 per cent. By far, the biggest contribution came from LNG. Between 1999 and 2005 for new LNG plants were established bringing LNG capacity in Trinidad and Tobago to 15 million tonnes per year – the sixth largest in the world. Absent from the gas utilization pie in 1992, LNG accounted for 57% of gas utilization in 2010. (Figure 2)



As at 2010, the energy based plants in T&T included one (1) natural gas liquids processing facility, four (4) LNG trains, ten (10) ammonia plants, seven (7) methanol plants, one (1) urea plant, four (4) DRI Modules, five (5) power generation plants, one (1) petroleum refinery and one (1) cement manufacturing plant. LNG production accounts for 57% of natural gas consumption followed by Ammonia ( 15% ) and Methanol ( 15%).( Figure 2). Total natural gas consumption topped 4 bcfd.

Figure 1

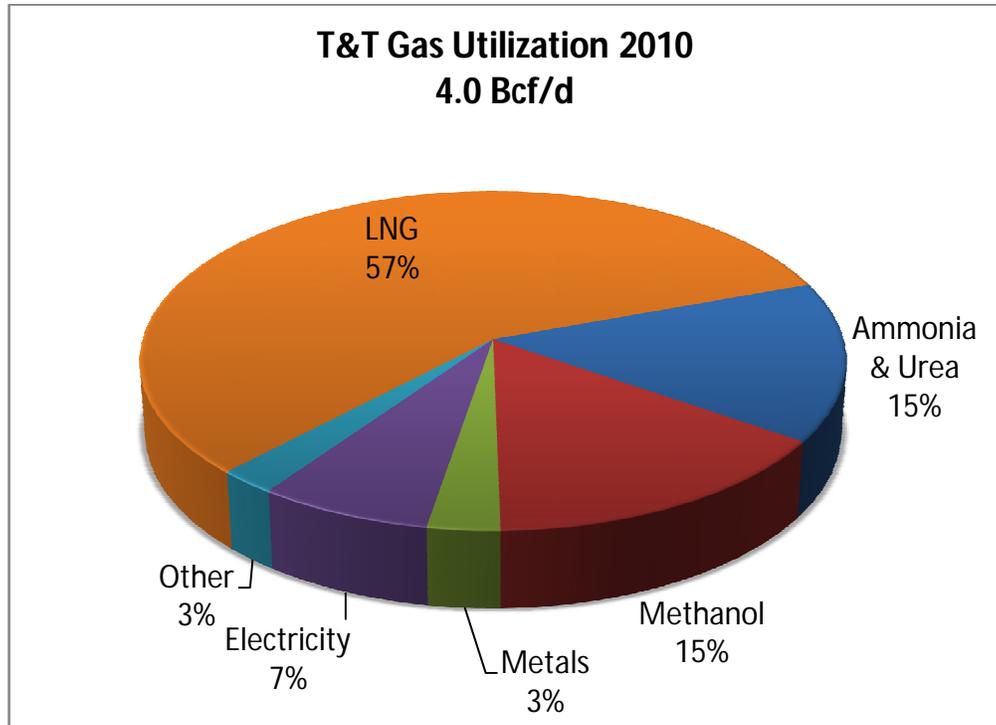
Natural Gas utilization in Trinidad and Tobago



Several major multinational companies have invested substantially in the sector. Listed among the key players in the upstream are British Petroleum, EOG Resources, British Gas, Repsol and BHP Billiton. The downstream sector consists of the Petrochemical, Power and Metal Industry companies. Among the big players are Arcelor Mital, PCS Nitrogen; Farmland, Mississippi Chemicals, Koch; Yara and Methanex. The locally owned joint venture Methanol Holdings Trinidad Limited (MHTL) is also among the largest methanol producers in the world.



Figure 2 Natural Gas Utilization by Sector



\*Source: Ministry of Energy and Energy Industries

Although the industry has a mix of foreign and local ownership, it is operated and maintained almost exclusively by nationals, the vast majority of whom were educated and trained at home. It may be argued that T&T has successfully found the balance between the expertise and investment of the multinationals and the aspiration for greatest localization of the national industry, only possible through the transfer of knowledge to T&T nationals.

### 4.3 Human Capital Demand in Energy Sector

Given the phenomenal expansion of the energy sector a major concern was how the industry would grapple with the evident human resources challenge to accommodate such growth.

Estimates of skill demand vary. In the downstream environment, between 1992 and 2000, direct incremental employment from new plants in the industry numbered 1240 persons, mainly in the professional, technical and skilled category. No equivalent data are available for the upstream segment. However, the need for new resources can be approximated by the fact that five new production platforms were commissioned for the offshore production fields between 1992 and 1999. To this must be added the secondary indirect employment created from maintenance and other service providers.



A manpower survey of the 16 top firms in the industry in 2002, estimated total employment in the industry to be in excess of 8194 persons (**Error! No se encuentra el origen de la referencia.**). Professionals and technicians accounted for over 80 per cent of those employed, revealing the highly specialised nature of the industry.

**Table 4**

**Employment in Energy process Industries**

<b>Occupation</b>	<b>Quantity</b>	<b>Per cent</b>
Professional	2,192	27%
Technical	4,335	53%
Semi-Skilled & Other	1,667	20%
<b>Total</b>	<b>8,194</b>	<b>100%</b>

The human capital requirements were much greater in the second decade. The increase in production capacity in the downstream energy sector has been noted above. In addition, between 2001 and 2007, 14 offshore platforms were commissioned to bring new gas fields on stream. The manpower study estimated a requirement of 240 professionals and technicians per year to meet the requirements of this segment of the value chain. In anticipation of the planned investments in a portfolio of downstream projects, the manpower study estimated the manpower requirement for process industries – engineers and engineering technicians and skilled to be around 1200 per year. Total additional manpower requirement for the industry over the period 2002 to 2009 was estimated another 8600 persons (Julien, 2002). It must be noted that these estimates were informed by a very optimistic forecast for new gas based investments which included an aluminum complex; an iron and steel complex; and of course LNG. The Aluminum complex alone accounted for more the half the skill demand. Several of these projects, including in particular the Aluminum smelter did not materialize, having fallen victim to either the global recession or the change in Government. However, the projection weighed heavily in Government initiatives pursued from 2004 to 2010.

There is no discernible evidence to suggest that there were any major shortages in the aggregate labour supply, although it can be noted that there were few disruptions occurring from the loss of key veterans who could not have been easily replaced. The strategies employed to accomplish this relatively smooth passage will be addressed in subsequent sections.



Table 5 Energy Sector Additional Manpower Requirements for Energy Sector (2002-09)

Occupation	Total	Quantity/Yr.
Professional Engineers (Chartered & Incorporated)	3,060	~440
Engineering Technicians	5,620	~810
Skilled Craftsmen	3,700	~530
Total	12,380	1780
Source: Julien 2002		

. Future Human Capital Demand

Looking forward, T&T has several planned downstream and gas based projects currently under consideration. Therefore there would be a greater demand for skilled labour in the various disciplines. Table 6 gives an indication of the number of plants expected to come on stream in the near future as well as the estimated employment both at the time of construction as well as permanent employment. (Table 6)

Table 6

Estimates of Employment Impact of Planned Investments

Project	Estimated Employment	
	Peak Construction	Permanent
MHTL AUM II	3,500	450
Methanol to Petrochemicals	3,000-4,000	300-500
Methanol to Olefins	3,000-4,000	300-500
Carisal Calcium Chloride	150	75
Maleic Anhydride	1,000	60
Melamine Derivatives	200-300	100
Source: Energy Chamber of Trinidad and Tobago		



#### 4.4 Human Capital Supply: The Role of the State

Successive Governments in Trinidad and Tobago have expressed full commitment to the view that all citizens, regardless of their gender, class, culture, ethnic origin, etc, have the ability to learn and should be provided with the opportunity to develop that potential to the fullest. This commitment to sustainable human capital development has been a feature of Government policy statements before and during this period of analysis. The Education Policy 1993-2003, notes that the State has a heightened responsibility to ensure that an efficient and equitable system of basic education is established and maintained in Trinidad and Tobago. This is the only true guarantee of the kind of personal and social efficacy needed to sustain and improve our democratic way of life in Trinidad and Tobago (Ministry of Education, 1993 ).

Vision 2020, developed in 2004, recognizes the centrality of the human resource to Trinidad and Tobago's future, acknowledging the limitations of a small population compared with the new rising stars in the world's economy. The Vision 2020, operational plan 2007-2010 puts forward four main goals in creating an innovative people: (1) to become well known for excellence in innovation, (2) to create a seamless self-renewing, high quality education system, (3) to produce a highly-skilled work force to drive innovation and production, and (4) to harness cultural elements to inspire innovation and creativity.

In its 2011-2014 Medium Policy Framework, the current Government stated, "Human capital development is the single most critical success factor for transforming the economy and the society". In the most recent Government planning

Successive Government have used two channels to translate words into action:

- i. Outlays on infrastructure and facilities and,
- ii. Expenditure on human capital development

From the early days of the 1970s oil boom, the Government embarked on a massive expansion programme which saw the construction of several primary and secondary schools and upgrade of technical institutes. This was to ensure the attainment of universal education for all up to the secondary level.

The State has invested heavily in ensuring that the human capital needs for the rapidly growing natural gas industry have been met. <sup>1</sup> Overtime the State created several institutions in the education sector to build the human capability of the industry. The University of the West Indies Engineering Faculty and two technical Institutes provided the base. In Government of Trinidad and Tobago established the Metal Industries Company, (MIC) 1974; National Energy Skills Centre (NESK) (1997), and the Trinidad and Tobago Institute of Technology (TITT) in 2001.

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<sup>1</sup> Ministry of Finance, working document



From the introduction of industry targeted training programs at John Donaldson and San Fernando Technical Institute to the establishment of UTT, there are a considerable amount of institutions offering certification in various disciplines. Although the University of the West Indies was already established with a recognized Engineering Department, the State felt it was necessary to create an institution that would contribute significantly in the long run to address the critical skill shortage envisaged in the natural gas industry in a timely and efficient manner. The establishment of the University of Trinidad and Tobago in 2004 has expanded significantly the opportunities for university education for citizens and has filled a void in the provision of science and technology training at the tertiary level.

In addition to the teaching institutions, the Government established the National Institute of Higher Education Research Science and Technology (NIHERST) with a mandate to popularize science and technology and the National Training Agency (NTA) to focus on the TVET segment of the system. The Accreditation Council of Trinidad and Tobago was also established to provide quality assurance to the training programmes and curriculum in the respective public and private tertiary institutions.

Its attempts at enhancing the quality, and increasing the quantum of skills developed for the natural gas industry, the

Direct funding of tuition for students represented the second pillar in the Government strategy to build human capital. In 2001, the Government introduced what it termed the 'Dollar for Dollar' programme whereby Government paid half the tuition fees for students attending approved Tertiary level institutions. In 2004, Government of Trinidad and Tobago implemented the Government Assistance for Tuition Expenses (GATE) programme. In the GATE programme's initial form, the Government pays the full tuition fees for citizens<sup>2</sup> of Trinidad and Tobago pursuing approved undergraduate programmes at approved Tertiary Level Institutions (TLI). In 2007, the Government introduced free tertiary education not only at UTT and all UWI campuses but also at all accredited private institutions in Trinidad and Tobago. The number of students accessing GATE has grown steadily to over 50 thousands by 2010. (Table 7) The GATE programme was expanded in 2011 to include technical and vocational training. Having recognized the need for a highly skilled workforce, the Government has done its part in the development of human capital and has ensured that it is easily accessible to all.

**Table 7 Government Expenditure on GATE**

	2006	2007	2008	2009	2010	2011
Gate Expenditure	\$ 180	\$ 473	\$ 502	\$ 575	\$ 585	\$ 625
GATE AS% Total Capital Exp.	4%	5%	5%	6%	9%	8%
No of Students	38,669	57,328	53,437	52,822	53,711	45,040
Source: Ministry of Science Technology and Tertiary Education						

<sup>2</sup> Proof of residency in Trinidad and Tobago must be for providing for at least three year prior to accessing GATE funding.



## 4.5 Human Capital Supply: Institutional Growth

### 4.5.1 The University of the West Indies

In order to trace the evolution of human capital development in T&T as it relates to the energy sector, we must go back to the early 1970's when Government decided to utilize its natural gas resources in a deliberate strategy of industrial development. During this period, the Government of the day as well as the companies within the sector became more integrated and collaborative in their attempt at national talent development. The foreign companies recognized that the development of a highly skilled national staff was a great business opportunity and the recognition by the Ministry of Energy that that a competent, world-class national staff in the energy field was not going to happen without clear and firm guidance from the Government.

As early as 1976 UWI introduced a one-year diploma course in Petroleum Engineering. Its aim was to supplement the conventional programmes of Chemical, Civil, Mechanical and Electrical Engineering which had first been introduced in the Caribbean at the St Augustine campus of UWI in 1962. This Diploma in Petroleum Engineering was intended for first-degree engineering/science graduates as a conversion programme to this discipline.<sup>3</sup> This programme however was quickly converted into a Bachelor of Science Degree (B.Sc.) in the field of Petroleum Engineering and it was later supported through additional M.Sc. teaching programmes in Petroleum Management at the postgraduate level. In 2001, the Bachelor of Science degree in Petroleum Geosciences, now highly regarded in the local industry, was launched with generous contribution a leading firm in the industry.

The University of the West Indies has continued in its path in developing engineers as the growth of national engineering graduates has increased over time. The table gives a clear indication that the number of engineers has grown over time especially after 2004 when the Government introduced the GATE programme which allowed students to access tertiary education free of charge. After the introduction of this programme, the total number of engineers has gradually increased over the period examined. Appendix 4 gives a breakdown of the number of UWI Engineering graduates from 1991. Table 8 shows the sharp rise in engineering graduates after 2004, a trend that is strongly correlated with the introduction of GATE. Although the total number of engineers has increased over time, there has been a significant reduction in the number of Petroleum Geoscience graduates which is highly demanded within the industry. However, there is no discernible evidence to prove that the industry has been affected by the reduction in Petroleum Geosciences graduates.

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<sup>3</sup> The University of the West Indies: [www.sta.uwi.edu](http://www.sta.uwi.edu)



**Table 8 UWI Faculty of Engineering Graduates**

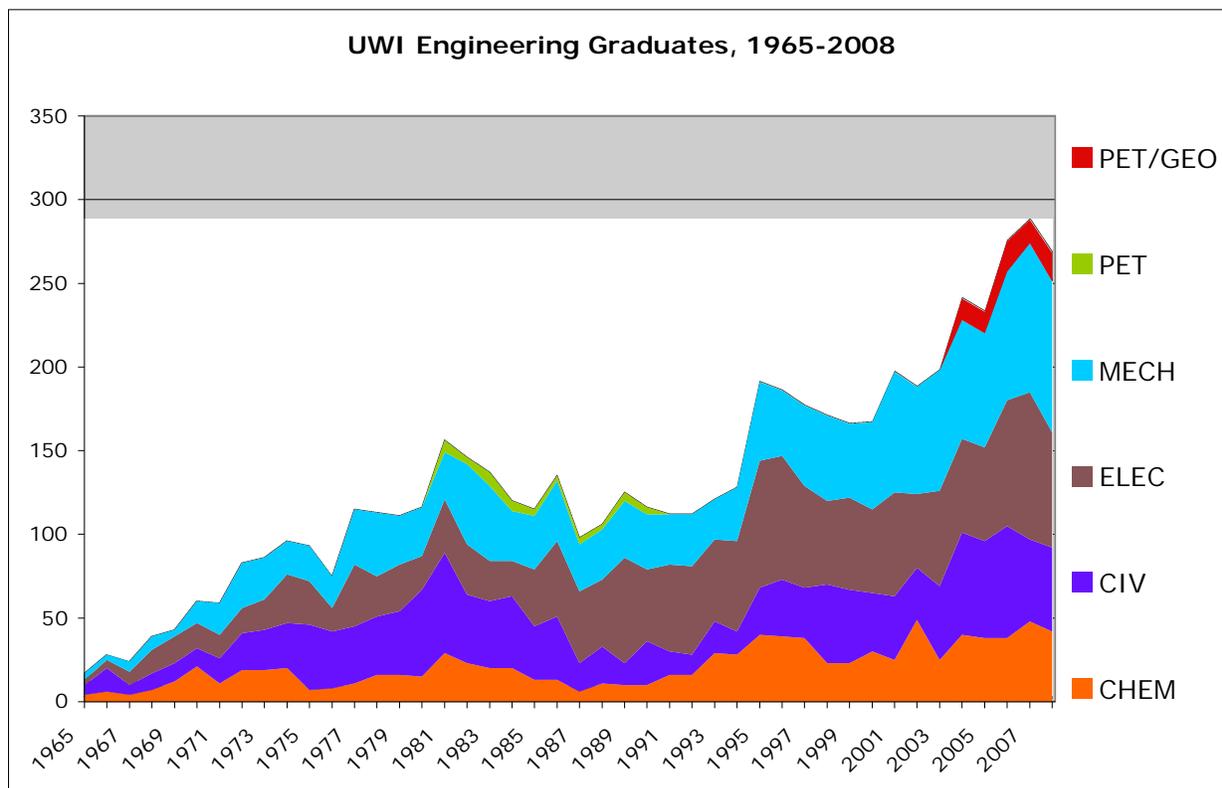
<b>Academic Year</b>	<b>No. of Graduates</b>
1991/92	151
1992/93	146
1993/94	201
1994/95	218
1995/96	215
1996/97	201
1997/98	193
1998/99	194
1999/00	224
2000/01	218
2001/02	223
2002/03	245
2003/24	260
2004/05	291
2005/06	337
2006/07	392
2007/08	374
2008/09	349
2009/10	362

Source: UWI Office of Planning and Development

Apart from the petroleum engineering/ geosciences stream, other engineering disciplines are absorbed by the industry. The experience of BG Trinidad and Tobago, illustrates the extent to which UWI has contributed to meeting the needs of the industry. Of the 51 engineers currently part of BG's staff, Mechanical Engineers make up 35%, Chemical 35% and Electrical Engineers 25%. Electrical Engineers are now a core part of BG's workforce holding key positions in the Operations and Projects functions. UWI graduates accounted for 41% of BG's staff, and of the total UWI graduates employed by BG, 77% were Engineers. (BG Trinidad and Tobago , 2011)



Figure 3 Engineering Graduates by Discipline 1965-2008



\* Source: The University of the West Indies (Engineering Department)

#### 4.5.2 Metal industries Company Limited

The Metal Industries Company Limited (MIC) was established in 1974, with the specific objective to develop local capability in the making of tools, dyes, precision machining and manufacturing engineering. The company at that time was a joint venture of the Government of Trinidad and Tobago (GOTT), and the United Nations Development Programme/United Nations Development Organization (UNDP/UNIDO). It has since evolved into a partnership of the Government of Trinidad and Tobago (GOTT) and a number of private local industries who have continued to pledge their support to the institution through the use of apprenticeship programmes for graduates. MIC offers a wide range of programmes leading to certification at the level of Journeymen and Master Craftsman.

The John Donaldson Technical Institute, San Fernando Technical Institute, the Metal Industries Company Ltd (MIC) as well as the National Energy Sills Centre have all played a role in the supply of skilled labour for the downstream sector. Appendix 6 gives a brief profile of the technical vocational institutions in T&T. These technical institutes respond to the demand for Level 3 skills and it has ensured that there is a constant supply of labour. From the period 2002-2006, there were over 305 graduates in the various disciplines.



### 4.5.3 NESC and TTIT

The National Energy Skills Centre (NESC) was established in 1997, with its primary objective being the building of the human resource capital of Trinidad and Tobago energy sector. It was envisaged then, as the solution to the need for a premier training provider to lead national training initiatives in energy sector specific skills. This vision was based on the projected demands for certified craftsmen, arising out of the growth in the energy sector and consequently, the construction and related industries. This organisation was a partnership between the primary producers in the energy industry (oil and gas) and the Government of the day.

The NESC had its genesis in a Trust Deed between the Government of Trinidad and Tobago and the Atlantic LNG Company Limited and was created to address the immediate and pressing demand for skilled personnel to work on the Atlantic LNG, Train 1 project. Its initial focus was addressing the deficiencies that existed in the quality and quantity of craftsmen required for plant construction and maintenance. The NESC subsequently sought to relieve the anticipated shortage of skilled personnel required to operate and maintain the plants that were being constructed in this industry. Based on the results of the 2001 manpower study (Julien, 2002), the need for an expansion of the offerings at NESC was identified. Thus NESC gave birth to the Trinidad and Tobago Institute of Technology in 2001. The focus of the TTIT is on skill development at the middle and upper levels of the industry, including engineering technicians, operators, engineering technologists, engineers, supervisors and middle managers. These were areas in which significant gaps were observed (Table 9).

The TTIT operated along the lines of a corporate university, utilizing industry-experienced faculty, emphasizing hands-on learning based on industry-relevant curricula and implementing a flexible programme schedule. The Institute offered a one-year Certificate course in Process Operations, a two-year Diploma in Technology in the industrial engineering disciplines, and a four-year Bachelor of Applied Technology. TTIT subsequently morphed into the University of Trinidad and Tobago which was established in 2004 to meet the needs of Trinidad and Tobago for a highly trained and qualified technological manpower base.

### 4.5.4 The University of Trinidad and Tobago (UTT)

With its genesis in the Trinidad and Tobago Institute of Technology (TTIT), UTT initially focused on programmes in engineering and technology. Today's programmes, however, go far beyond engineering and technology to a fuller spectrum of educational opportunities where experiential learning programmes are incorporated into the traditional learning environment. UTT was intended to expand the opportunities for the nation's youth for university-level education and learning in applied sciences, engineering and technology. UTT was designed in an attempt by the State to form stronger and a more involved relationship with its sponsors within the energy corporations. The idea behind the institution goes beyond their financial contributions, it included an active participation in helping the university develop the necessary action plans to achieve this vision and most particularly in the execution of those plans. It is hoped that such



partnership with the energy companies will foster growth and development among the graduates so they can eventually be absorbed into the energy companies.

Table 9

Energy Sector Qualifications Profile for Management Personnel

Designation /Qualification	Current Profile	Desired Profile
Engineers	20%	25%
Technologists	-	40%
Technicians	25%	35%
Craft Diploma	55%	-
Source: GOTT Vision 2020 Energy. Draft Report of the Vision 2020 Energy Subcommittee (2003)		

The University of Trinidad and Tobago has focused on programmes in engineering and technology, research and innovation. See Appendix 5 for a complete listing of the programmes offered by UTT and other technical institutions. An interesting aspect of its programming is the collaboration with between UTT and UWI to develop a UTT-UWI B.Tech programme. The main objective of the Applied Engineering Degrees is to provide a cadre of suitably qualified Engineering Technologists to strengthen the technical, supervisory and middle management levels of local industry. UTT also plans to expand its course offerings to include graduate programmes in the fields of refining, gas processing and marketing, petroleum management, natural gas technology and electrical management.<sup>4</sup> Degree programmes would be extended to manufacturing engineering, computer technology, earth sciences and maritime technologies.

UTT has greatly expanded the opportunities for university education and has filled a void in the provision of science and technology training at the tertiary level. In 2006, UTT expanded its capacity by incorporating into its academic programmes: the John Donaldson Technical Institute, the San Fernando Technical Institute and the national Institute of Higher Education, Research, Science and Technology (NIHERST). (Ministry of Finance, Annual Budget Presentation 2006)

UTT's student enrolment has increased by 400% from 2005 -2011. The current student enrolment is around 6500 students.

<sup>4</sup> UTT website: [http](http://www.utt.gov.tt)



Table 10 Network of Training Institutions

Qualification	Level	Institution
Skilled Worker	Level 1&2	Servol, Youth Training and Entrepreneurship Partnership programme (YTEPP)
Journeyman and Master Craftsman	Levels 2 & 3)	Metal Industries Company (MIC) National Energy Skills Centre (NESC)
National Engineering Technician Diploma	Level 3	MIC; NESC. University of Trinidad and Tobago (UTT)
City and Guilds	Levels 1 to 5	External private schools.
Bachelor of Applied Science (Engineering)	Level 4	UTT. MIC
Bachelor of Science (Engineering)	Level 4	UTT and University of the West Indies St. Augustine Trinidad . (UWI)
MSc, MPhil and PhD	Level 5	UTT, UWI,



#### 4.5.5 Kenson School of Production Technology Ltd

Kenson School of Production Technology is a local privately owned institution established in 1995. The school was set up to provide industry relevant training primarily geared towards competency development of employee in the oil and gas sector. The Programmes include: Operations, Safety, Mechanical, Electrical/Electronics and Crane Operations and Maintenance. In the ensuing years, the school sought affiliations and approvals from recognized international and local institutions to support new programme development to match industry needs and to build a platform for sustained growth and development. Simultaneously it has expanded its facilities and increased its intake. This school pioneered the Offshore Production Operator training for the first time entrants to the offshore production environment. It is now an approved City and Guilds Centre and offers programmes ranging from certificate to advanced diplomas.

Kenson has also established a branch in Uganda, becoming the first Trinidad and Tobago institution to export services to the newly emerging hydrocarbon countries of Africa.

#### 4.6 Human Retention Strategies in the Natural Gas industry

The rapid growth of the industry over the last two decades has brought with it intense competition for experienced skilled resources both upstream and downstream. In addition, both foreign and local companies in Trinidad and Tobago find themselves in competition with global operators particularly in the industry “hotspots”. Companies from the Middle East and Canada often target the Trinidad market for experienced resources.

The competition for skilled and experienced resources in the Trinidad context heated up during from around 1995 to 2006, when there was new capacity opening up practically every year. An influx of downstream competitors and upstream operators, whose first approach to staffing was to poach on available resources put a strain on established plants on the Point Lisas Industrial Estate and Petrotrin- the state owned oil company. The impact on companies within the Point Lisas Industrial Estate has been the loss of employees both at the junior and at the senior levels both in the plant-based and administration departments. The area of highest vulnerability has been within the Operations and Engineering and Maintenance departments.

The degree of competition was reflected in the way applicants treated with job offers. One company reports that candidates who were offered positions in the Graduates in Training programme, typically wait on responses from other multinational companies before accepting the offer. The prevailing labour strategy in the market is to sell to the highest bidder.

As a result of this, companies have taken a proactive role in developing strategies for human capital retention. These strategies fall into four broad areas:



- **Competitive Base Salary;** Companies attempt to keep on par with each other with respect to basic pay. Typically however the multinational companies are the market leaders in this regard. Most companies have sought to balance the imperative of attracting and retain the best employees with the need to maintain productivity. As a result incentive pay has become a feature of the compensation package. Some companies have introduced incentives based on corporate performance as well as individual performance. Another feature of the basic pay package is the extra allowance sometimes called a retention allowance paid to mission critical staff. In one case that allowance is left to accumulate for a period of five year. If the employee leaves before that time he is not entitled to the allowance.
- **Enhanced Fringe benefits;** Companies have been enhancing fringe benefits in order to retain employees. Popular benefits include housing allowance; perquisite or lease vehicles; vacation grants; group life and health insurance ; employee savings plan
- **Work Life Balance;** Several companies have introduced greater flexibility in their working hours to cater for an improvement in the work life balance of employees. A popular strategy among the energy sector companies is 9/80 work schedule. Under this arrangement employees work 80 hours over a 9 day period and get the 10<sup>th</sup> day off. This means in reality that every other Friday is a day off to take care of family and or personal matters.
- **Career Development;** Greater emphasis is also being paid to career development among the companies in the sector. This typically takes the form of education incentive payment for successful completion of a relevant course of study. Others have introduced graduate trainee programmes in various forms, the intent being to catch the talented early and retain them within the Company. The multinational companies also make use of external postings as an incentive to attract and retain staff.

Companies have reported varying degrees of success in these measures.

There is the view that the situation requires a holistic scientific and long-term approach to employee retention. The continuous competitive increase in compensation is seen as self defeating and is not the answer. Such an approach serves only to inflate the cost of production and artificially inflate the value placed on the services provided by employees once the demand for same drops off. It is therefore recommended that companies attempt in the immediate term to retain critical resources which are under threat of being recruited away by determining reasonable accommodation in compensation. This can be achieved by placing a premium on resources which are difficult to acquire or there is the need to retain.

In the medium to long-term, companies can address the non-compensation related issues by developing programmes based on employee and company expectations. These may include the development of a corporate culture, a more accepted employee recognition programme, a well-structured internal communications programme, a mentorship programme, career planning initiative, employee involvement and team building programmes and a corporate identity strategy to build the organization's image nationally and internationally.



#### 4.7 The Case of the National Gas Company of Trinidad and Tobago Ltd

The National Gas Company of Trinidad and Tobago Limited is one of the largest and most profitable enterprises in the Caribbean region. As at December 31<sup>st</sup> 2010, NGC's asset base was valued at of US\$4.4 billion, with investments in five main categories of business activities:

- NGC QUICK FACTS**
- Incorporated : Aug 22, 1975
  - Start-up Capital: TT\$80,000 /US \$12,500
  - Current Asset Base: TT\$28 Bn /US\$4.4Bn
  - Credit Ratings: BBB+ (S&P)  
A3 (Moody's)  
AAA (CariCris)
  - Start up Capacity: 16" Pipeline
  - Current Capacity: 880Km onshore / offshore network, 4.4 Bcfd
  - Current Staffing: 700+

- Natural Gas purchase, sale, compression, transmission and distribution.
- Pipeline construction, operation and maintenance
- Natural Gas Liquids (NGL) and Liquid Natural Gas
- Port , Maritime and Industrial Estate Infrastructure
- Oil and Gas Exploration and Production

Established in 1975, the NGC group has played a pivotal role in the process that, in within thirty years, has seen Trinidad and Tobago move from relative obscurity to be ranked among the world's leading exporters of ammonia, methanol and LNG.

Strategically positioned as a mid-stream operator along the natural gas value chain, NGC has invested in the development of pipelines, port and industrial infrastructure and offers a uniquely competitive gas pricing model which has given rise to a thriving energy sector. Over the last two decades the Company's growth has paralleled that of the overall industry. The natural gas sector has seen an

average of 10% year on year growth since 1998 and now accounts for over 40% of national GDP. NGC traded gas volumes grew by 896 per cent from 192 mmscfd in 1990 to 1720 mmscfd in 2010.

The overarching goals of the NGC's Strategic Plan 2011-15 are to increase shareholder value and ensure sustainability. In order to achieve these goals, NGC has identified five (5) Strategic Initiatives (SI's) viz.

- a. Continued growth in the local market
- b. Investment in new ventures in external markets
- c. Strengthening brand and corporate social responsibility
- d. Changing culture and strengthening competencies
- e. Strengthening asset integrity management.



As a state enterprise whose business is in the country's high income sector, NGC faces several challenges in the market for skilled human resources. Firstly, Government (shareholder) policy aligns NGC salary scales. As such, its salary levels are determined by Central Government who prefers to see the Company as part of the wider public sector. NGC is viewed as a good starting ground for nationals who then are attracted to or poached by the competing multinational firms in the energy sector. As a result of the Government's position that NGC is a part of the public service.

Further, NGC's compensation continues to be less competitive with the rest of its energy competitors. This is due to governmental remuneration regulatory controls implemented at state enterprises including those in the energy sector in an attempt to support its controls for central public services and their employees. As a result NGC is less attractive as a first or employer choice for the best available human resources. Additionally, it is still a locally based Company and therefore offers no opportunity for external posting and cross company career growth is limited which is a significant pull factor for attracting and sustaining the best human resources.

In the period under review, 2001 to 2010, NGC staff complement increased from 492 to 749 strong. In terms of distribution of core skills the composition of total staff over the period showed that the largest increase was in the area of Technical services. Engineers grew by 53% and Technicians by 52 %. Coincidentally, the employee base of other professionals also increased by 53%. At the same time only 50% of those leaving the Company before retirement, said that they were moving on to other jobs. It may be concluded therefore that in spite of the pull of higher salaries in a rapidly expanding industry NGC suffered minimal staff losses due to competitive pressures. In this period, NGC implemented a multipronged strategy in its plan to attract and retain high quality staff. Key initiatives included: Compensation Philosophy; Employee Initiated Training & Development; Graduate Internship and Skills Development Programmes.

#### Compensation Philosophy:

The NGC is non-unionized and has developed a unique system for adjusting employee salaries. The underlying Compensation philosophy is that in order to be competitive and attract high quality resources, NGC will position its cash and non-cash compensation in the upper third quartile (75<sup>th</sup> Percentile). However, the practice to date has been to seek to peg salaries at the P50 market median. In 2005, the Board of Directors and Government endorsed this philosophy and approved a procedure for determining salary adjustments in the Company. The procedure requires NGC to periodically conduct independent market compensation surveys of local benchmark Energy Sector companies to determine the competitiveness of NGC's compensation.

The Company also has an incentive /bonus plan as part of its compensation package. Each year, eligible employees are paid a part of the corporate profits in accordance with the performance. Performance is measured at the Corporate, Division and individual levels. Under this gain share policy top performing employees earn up to 3.5 months salary.



## Non Cash benefits

NGC maintains the standard non cash benefits as part of its compensation package, This includes housing allowance, motor vehicle, group life and health insurance, Other elements of a Retention Strategy included the application of a Professional Retention Allowance paid to employees in specific positions and disciplines and areas of the company's operations that were deemed to be threatened by the poaching by its competitors and scare labour market. This payment bore fruit and stymied the loss of critical skills and organizational knowledge on a voluntary basis.

Apart from the fully funded developmental interventions to build and sustain its core and support competencies amongst all employees, NGC also provides financial assistance to permanent and long-term contract employees desirous of pursuing programmes of study which can support their present positions or future positions in the company under its Employee Initiated Training and Development (EITD) Programme. The programme provides for significant financial support to successful applicants in Certificate, Diploma, Associate Degree, Undergraduate and Post Graduate levels of education.

## Training Initiatives:

NGC continues to execute a series of training initiatives and support special programmes to build national capacity for scarce skills its traineeship and internship programmes with many educational, training and development institutions such as National Energy Skills Centre, Trinidad and Tobago Institute of Technology, The University of Trinidad and Tobago and Metal Industry Centre

NGC supports nationals pursuing programs of study at these Institutions by providing hands-on training for periods of one to two years. Many of the students have been afforded the opportunity of temporary, contract and permanent employment upon successful completion of their periods of training.

NGC has provided training in all aspects of its operations for the past (18) eighteen years in various disciplines including Accounting, Electrical, Telecommunication, A/C and Refrigeration, Offshore Operations, Mechanical Engineering, Instrumentation, and Pipeline Maintenance and Operations,

In addition, NGC launched its two-year, Graduate Trainee Programme 2004 with an intake of four (4) nationals. The interns were exposed to the company's operations during their first year and were assigned to their area of specialization during the second year. Graduates were selected from nationals who pursued studies with majors in Human Resource Management, Business Management or Marketing. The second batch of interns was selected from nationals who pursued studies and majored in Engineering. After a 4 year hiatus the Company is once again ready to open its doors to a number of Graduate Trainees in various discipline including Engineer, Information Technology, Corporate Communications, Human Resource Management, Accounting and Finance and Legal.



In the same period NGC has had its fair share of staff attrition in the disciplines of Computer Aided Design (CAD), Purchasing/Procurement, Project and Construction Services, Legal Services, Surveying and Auditing. These areas have experienced attrition rates from as high as 100% (Legal Services) to as low as 33% (CAD) and to present continue to pose challenges to attract and retain staff. The many reasons include a limited labour market with candidates that will have a short learning curve to be fully functional at NGC (CAD, Legal, Auditing), the compensation (Purchasing/Procurement, Project and Construction) and the professional requirements for professional membership (Surveying).

## 5 Conclusions

Trinidad and Tobago natural gas sector experienced 11.5 per cent per annum industry growth over the period 1992 to 2010. The steady expansion required additional resources estimated at around 5000 persons in direct employment at the professional and technician levels. The industry coped exceptionally well during the period of rapid expansion, partly because of proactive action but also because some of the largest planned projects did materialize. This resulted in a sizable gap between projected and actual demand. Nevertheless, the following features seem to have contributed to the relative success.

1. Close collaboration between the Government and the industry in forecasting and provisioning for meeting the requirements of the industry.
2. Conscious decisions by Government to advance education opportunities by dedicating at least 15 per cent of its capital and current spend to Education.
3. Company support and substantial sponsorship of industry specific training programmes
4. Companies use of graduate internship programmes to capture and nurture young talent
5. The use of various compensation incentives to retain staff in core mission critical positions and ward off competition.

The experience also has had negative impacts. Perhaps the most evident is the widespread poaching of experienced staff among companies. These actions help to push industry wages levels upwards and erode competitiveness and maybe also have had a demonstration impact on wages levels across other non energy sector. A second consequence of poaching is that the state enterprises are perhaps the hardest hit. In situations where compensation is constrained by Government policy on public sector wages, the state owned energy sector companies are left behind the rest of the industry and highly vulnerable to loss of their most valuable staff. This ultimately impacts negatively on business continuity and performance.

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The National Gas Company has demonstrated a strong commitment to human capital development throughout the period of expansion. NGC incorporated national human development imperative within its own Corporate Social Responsibility matrix. In doing so, NGC continues to partner with communities and stakeholders in ensuring maximum value is derived from our natural gas resources now and in the future.

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## 7 Appendices

### Appendix 1: Companies in the Natural Gas Sector of Trinidad and Tobago, 2010

Company	Start-up year	Original ownership	Current Ownership	Rated Capacity	Number of employees
Ammonia					
Hydro Agri Trinidad	1959	WR Grace	Norsk Hydro (1992)	227,000 MT/y	272
Trinidad Nitrogen (Tringen 1)	1977	GOTT, WR Grace	GOTT, Norsk Hydro (1992)	500,000 MT/y	N. A.
Tringen II	1988	GOTT, WR Grace	Norsk Hydro (1992)	454,000 MT/y	N. A.
PCS Nitrogen I	1981	GOTT, Amoco	PCS (1995)	450,000 MT/y	300
PCS Nitrogen II	1984	GOTT, Amoco	PCS (1995)	450,000 MT/y	
PCS Nitrogen 111	1996	PCS	PCS	250,000 MT/y	
PCS Nitrogen IV	1998	PCS	PCS	650,000 MT/y	150
Farmland/Miss Chem	1998	Farmland, Miss Chem	Farmland, Miss Chem	690,000 MT/y	80
Caribbean Nitrogen Company	2002	CL Financial, Ferrostaal AG, Proman, Kellog Brown & Root, EOG Resources, and Duke Energy.	CL Financial, Ferrostaal AG, Proman, Kellog Brown & Root, EOG Resources, and Duke Energy.	656,750 MT/y	150
Caribbean Nitrogen	2004	MAN Ferrostaal,	MAN Ferrostaal, PROMAN and	650,000	



Company	Start-up year	Original ownership	Current Ownership	Rated Capacity	Number of employees
Company Nitrogen 2000 (N2K)		PROMAN and KOCH Industries and local company, EOG Resources Trinidad Ltd.	KOCH Industries and local company ,EOG Resources Trinidad Ltd	MT/y	
MHTL (AUM Ammonia)	2009	MHTL	MHTL	650,000 MT/y	
Granular Urea					
PCS Nitrogen II	1984	GOTT, Amoco	PCS (1995)		150 (includes employment in PCS Nitrogen I II, III, IV)
Methanol					
Trinidad and Tobago Methanol Company I	1984	GOTT, Ferrostaal AG, Helm	Methanol Holdings Trinidad Ltd., CL Financial, Ferrostaal AG, and Helm AG (1996)	460,000 MT/y	80
Caribbean Methanol Company	1993	Clico Energy, Ferrostaal AG, and Helm AG	CL Financial and Ferrostaal AG. (1996)	500,000 MT/y	80



Company	Start-up year	Original ownership	Current Ownership	Rated Capacity	Number of employees
Trinidad and Tobago Methanol Company II	1996	GOTT, Ferrostaal AG, Helm AG.	CL Financial, Ferrostaal AG, Helm AG and Methanol Holdings Trinidad Ltd.	550,000 MT/y	100
Methanol IV Company	1998	Clico Energy, Ferrostaal AG and Helm AG.	CL Financial and Ferrostaal AG.	580,000 MT/y	80
Methanex Trinidad Ltd (Titan)	1999	Beacon Energy, Amoco, MG Methanol	Methanex, bpTT. JP Morgan Chase	860,000 MT/y	100
Methanex (Atlas Plant)	2004	Methanex Corporation Canada, bptt	Methanex Corporation Canada, bptt	1.7 M (MT/y)	
Methanol Holdings Trinidad Ltd (M 5000 Mega Methanol Plant)	2005	MHTL	MHTL	1890,000 Mt/y	
Methyl Tertiary Butyl Ether (MTBE)					
PETROTRIN MTBE	1997	PETROTRIN MTBE	PETROTRIN MTBE	365,000 MT/y	N. A.
Direct reduced iron, steel billets and wire rods					
Caribbean Ispat Ltd.	1980	Iron and Steel Company of Trinidad and Tobago	Ispat International N.V. (1994)	Billets: 700,000 MT/y  Wire rods: 600,000 MT/y	



Company	Start-up year	Original ownership	Current Ownership	Rated Capacity	Number of employees
Ispat DRI	1999	Ispat International	Ispat International N.V.	DRI pellets: 800,000 MT/y	744
Propane, Butane and Natural Gasolene					
Phoenix Park Gas Processors Ltd.	1991	Natural Gas Company of Trinidad and Tobago, Conoco and PanWest	Natural Gas Company of Trinidad and Tobago, Conoco, PanWest and Methanol Holdings Trinidad Ltd. (1996)	700,000 mmcf/d	150
Liquefied Natural Gas					
Atlantic LNG Company of Trinidad and Tobago	1999	Amoco, British Gas International, Cabot LNG, National Gas Company of Trinidad and Tobago.	bpTT, BG International, Tractabel, National Gas Company of Trinidad and Tobago	LNG 3 mil Mcf/d NGL (natural gas liquids) 6,000 bdp	200
Atlantic LNG 2/3 Company of Trinidad and Tobago Unlimited	2002 (train 2) 2003 (Train 3)	bpTT, BG International, Repsol	bpTT, BG International, Repsol	LNG: (for each plant) 3.3 mil Mmcf/d NGL (for each plant) 12.000 bdp	300
Atlantic LNG	2005	bpTT 37.78% BG -28.89%	bpTT 37.78% BG -28.89%	5.2Mn	



Company	Start-up year	Original ownership	Current Ownership	Rated Capacity	Number of employees
(Train 4)		Repsol 22.22 % NGC-11.11%	Repsol 22.22 % NGC-11.11%	tonnes/yr	

Notes:

1. PCS is the Petrochemical Company of Saskatchewan, Canada.
2. Methanol Holdings Trinidad Ltd. is a holding company that was formed to consolidate the shareholding and management of Trinidad and Tobago Methanol Company I & II, Caribbean Methanol Company and Methanol IV Company. The Methanol Holding Trinidad Ltd is a subsidiary of the Trinidadian-owned conglomerate, CL Financial.
3. GOTT is Government of Trinidad and Tobago.
4. PETROTRIN (Petroleum Company of Trinidad and Tobago Limited) is the state-owned oil company of Trinidad and Tobago.



## Appendix 2

### A Snapshot of Planned Energy-based and Downstream Projects for Trinidad and Tobago

PROJECT	ESTIMATED EMPLOYMENT		PROJECTED START OF CONSTRUCTION	PERIOD OF CONSTRUCTION (YRS)
	PEAK CONSTRUCTION	PERMANENT		
MHTL AUM II	3,500	450	2012	3
Methanol to Petrochemicals	3,000-4,000	300-500	2013	3
Methanol to Olefins	3,000-4,000	300-500	2013	3
Carisal Calcium Chloride	150	75	2012	3
Maleic Anhydride	1,000	60	2013	3
Melamine Derivatives Facilities	200-300	100	Various -2012-2014	1-2

\*Source: Energy Chamber of Trinidad and Tobago



### Appendix 3: Real GDP growth in Selected Sectors

Date	Real GDP Growth - Non-Petroleum Sector - 2000=100	Real GDP Growth - Petroleum Sector - 2000=100	Real GDP Growth - Petrochemicals - 2000=100
1996	7.2173	7.4768	12.1938
1997	11.3387	0.8563	5.959
1998	6.7594	9.0784	11.1613
1999	3.3804	21.5018	26.4621
2000	5.4768	12.4027	3.1825
2001	2.8273	5.5852	6.7461
2002	4.8172	13.4952	12.4592
2003	6.7	31.4	4.5
2004	6.7	8.2	11.3
2005	5	8.3	19.5
2006	6.4	21.8	15.3
2007	7.6	1.7	-2.3
2008	4.9	-0.3	-2.8
2009	-6.7	2.5	8.7
2010	-3.8	2	-0.8

\*Source: Central Bank of Trinidad and Tobago



#### Appendix 4 Natural Gas Production & Utilization 2000-2010 (MMSCF/D)

Year	Production	Utilization
2000	1,498	1,372
2001	1,602	1,464
2002	1,863	1,716
2003	2,612	2,503
2004	2,914	2,835
2005	3,197	2,987
2006	3,882	3,536
2007	4,083	3,752
2008	4,049	3,710
2009	4,220	3,837
2010	4,330	4,010

\*Source: Ministry of Energy and Energy Industries

#### Appendix 5

##### Production of Ammonia, Urea and Methanol (MT)

	Ammonia Production (MT)	Urea Production (MT)	Methanol Production (MT)
<b>Year</b>			
2000	3,253,887	565,130	2,415,704
2001	3,694,334	514,980	2,773,543
2002	4,007,893	674,398	2,825,170
2003	4,348,993	647,196	2,840,395
2004	4,656,459	619,432	3,400,733
2005	5,184,832	748,112	4,577,341
2006	5,114,464	693,408	5,943,452
2007	5,193,988	709,512	5,936,214



2008	4,978,367	636,000	5,698,735
2009	5,493,794	682,860	6,120,247
2010	5,553,242	708,760	5,932,231

\*Source Ministry of Energy and Energy Industries

### Appendix 6

#### Crude Oil Production by year for Trinidad and Tobago (000 Barrels)

Date	Crude Oil Production (000 Barrels)
1993	45,202.50
1994	47,842.80
1995	47,690.00
1996	47,171.10
1997	45,190.00
1998	44,888.00
1999	45,688.90
2000	43,680.50
2001	41,468.80
2002	47,690.40
2003	48,981.10
2004	44,984.70
2005	52,739.60
2006	52,104.80
2007	43,807.00
2008	41,827.80
2009	39,117.00
2010	35,854.90

\*Source: Central Bank of Trinidad and Tobago Data Centre

### Appendix 7

#### LNG production for Trinidad and Tobago (cubic metres)

Date	Liquefied Natural Gas (cu m)
2000	6,483,644



2001	6,215,950
2002	9,108,194
2003	20,139,605
2004	23,088,800
2005	23,255,858
2006	29,880,453
2007	32,093,098
2008	32,956,730
2009	33,895,055
2010	34,319,622

\*Source: Ministry of Energy and Energy Industries

#### Appendix8: UWI Engineering Graduates 2006-2010

MAJOR (Area of Specialization)	YEAR GRADUATED				
	2006	2007	2008	2009	2010
Mechanical Engineering (Bachelor of Applied Technology)	0	16	33	2 0	4
Electrical (Bachelor of Applied Technology)	0	20	17	20	0
Geomatics	0	0	0	26	47
Land Management	0	0	0		6
Petroleum Geoscience	18	14	17	14	8
Surveying and Land Information	41	45	40	16	6
Chemical & Process	39	49	40	64	54
Civil	68	51	48	44	52
Civil with Environmental	5	2	6	10	12
Electrical and Computer	74	87	70	44	71
Industrial	8	17	9	14	11
Mechanical Engineering with Biosystems	7	5	4	2	4
Mechanical Engineering	77	86	90	75	87
<b>TOTAL</b>	<b>337</b>	<b>392</b>	<b>374</b>	<b>349</b>	<b>362</b>
* Source - UWI Office of Planning and Development					

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## Appendix 9

### Total Engineering UWI Graduates 1992-2010

Academic Year	No. of Graduates
1991/92	151
1992/93	146
1993/94	201
1994/95	218
1995/96	215
1996/97	201
1997/98	193
1998/99	194
1999/00	224
2000/01	218
2001/02	223
2002/03	245
2003/24	260
2004/05	291
2005/06	337
2006/07	392
2007/08	374
2008/09	349
2009/10	362

\*Source: UWI Office of Planning and Development



## Appendix 10

### Graduates of Technical Institutions for Trinidad and Tobago

FIELD OF STUDY	YEAR GRADUATED				
	2002	2003	2004	2005	2006
Electrical/Electronic Engineering	23	19	22	22	28
Mechanical Engineering	17	21	5	24	17
Telecommunication Engineering	2	8	4	2	4
Industrial Instrumentation	5	3	1	7	2
Process Plant Operations	7	4	7	7	2
Industrial Maintenance	7	6	10	8	11
<b>TOTAL</b>	<b>61</b>	<b>61</b>	<b>49</b>	<b>70</b>	<b>64</b>

\*Source: NIHERST- Survey of Graduates of Technical Institutions

Technical Institutes include:

- Metal Industries Company Ltd (MIC)
- University of Trinidad and Tobago (UTT)
- John Donaldson Technical Institute
- San Fernando Technical Institute
- Trinidad and Tobago Institute of Technology (TTIT)



**Appendix 11a: Programmes offered by UTT**

Programme	
<b>Certificate</b>	Process Operations
<b>National Engineering Technician Diploma (NETD)</b>	Chemical Engineering
	Computer Engineering
	Computer
	Electrical Engineering
	Electronics Engineering
	Industrial Engineering
	Information and Communications- Computer Engineering
	Information and Communications- Communication Engineering
	Manufacturing Engineering
	Mechanical Engineering
	Petroleum Engineering
	Applied Process and Utilities Engineering – Mechanical
	Applied Process and Utilities Engineering – Chemical
	Telecommunications
<b>Bachelor of Applied Science (B.A.Sc.) /Master of Engineering (M.Eng)</b>	Information and Communication Technology
	Manufacturing and Design Engineering
	Petroleum Engineering
	Process Engineering
	Utilities Engineering- Options-Electrical, SCADA & Mechanical
	Civil Engineering Systems- Environmental Engineering
	Civil Engineering Systems – Structural Engineering
	Civil Engineering Systems – Construction Engineering & Management
	Biomedical Engineering



#### Appendix 11b: Programmes offered by NESC

<b>4 Year Apprenticeship Programme</b>	Automotive Service Technician
	Heavy Equipment Technician
	Industrial Mechanical Maintenance
	Instrumentation
<b>Industry Specific</b>	Pipefitting and Fabrication
	Programmable logic Controls (PLC)

\*Source: NESC

#### Appendix 11C> Programmes offered by MIC

<b>Mastercraft Programme</b>	Mechanical Engineering Technology
	Electrical Engineering Technology
	Mechatronics Engineering Technology
	Construction Technology

\*Source: Metal Industries Company Ltd