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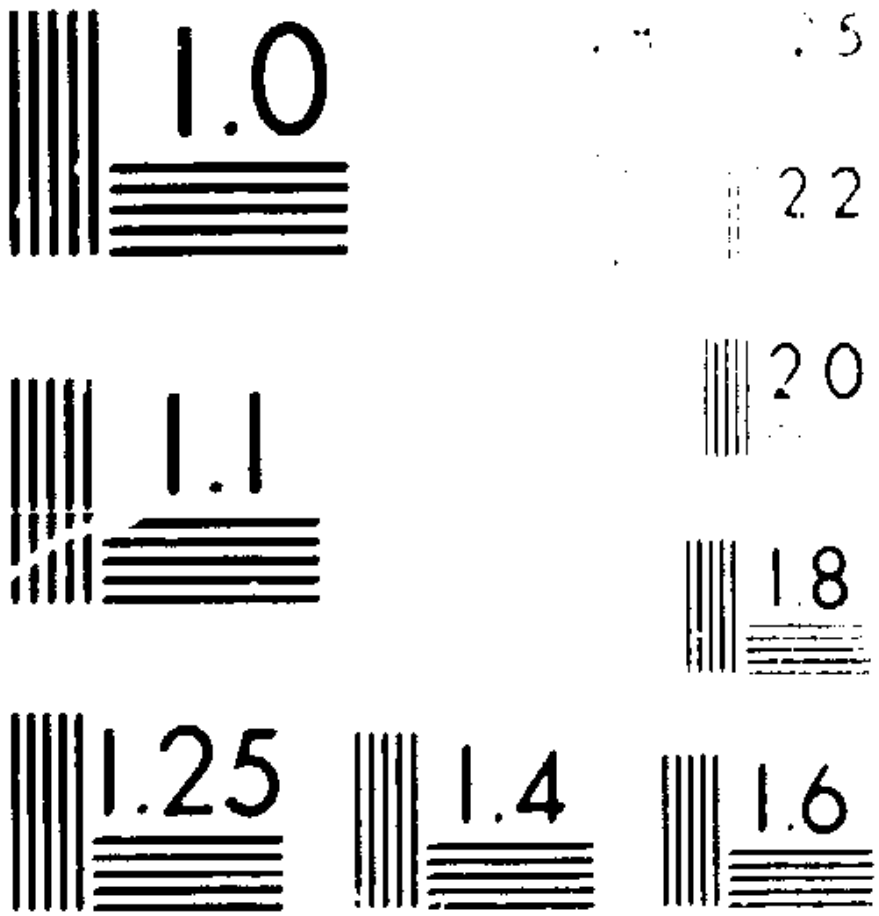
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THE PETROCHEMICAL AND POLYMER INDUSTRIES IN TRINIDAD AND TOBAGO*

by

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During recent years the plastics industry has assumed progressively increasing importance in its impact on everyday life in Trinidad and Tobago. This is evidenced by the growing use in consumer goods, industrial materials, building materials and adhesives of plastics. Domestic consumption has climbed from a per capita value of 2.5 kgs. in 1966 to 7.5 kgs. in 1970 and 14.2 kgs. in 1980. This seemingly impressive growth is dwarfed however when compared to per capita usage for 1980 in developed countries of USA - 56 kgs. Canada - 45 kgs, and Europe - 32 kgs. Domestic consumption however is projected to reach 34 kgs per capita in 1985 or a total annual consumption of 21,000 tonnes.

An analysis of the industry in Trinidad and Tobago reveals that activity is concentrated primarily in the polymer processing area, with negligible activity in the upstream resin producing field. The development of an integrated plastics industry can contribute significantly to the industrialization of the country. Trinidad and Tobago possess certain advantages that promote the viability of such industries and serious consideration should be given to their establishment. The polymer industry is structured as follows - the production of resins, and the subsequent processing of such resins to finished products. In Trinidad and Tobago activity is concentrated on the latter. Figure 1 lists the major resins and quantities currently used.

FIGURE 1 *

Resins	Estimated consumption (tonnes)
Polyvinyl Chloride	6000
Polyethylene	6000
Polystyrene	2200
Polyurethane	1400
Polyesters	600
Acrylics (Methyl Methacrylate Monomer)	300

In 1981, the major user of urea formaldehyde resin, Trinidad and Tobago Bagasse Products Limited ceased manufacturing operations. At peak capacity, this plant could utilize 1500 tonnes of urea formaldehyde.

Thermoplastic resins account for approximately 14,000 tonnes, with the remaining 3,000 tonnes being thermosetting resins. There are about fifty (50) small scale enterprises which manufacture a range of products. All resins used are currently imported. Figure 2 lists typical products manufactured by the local processors.

FIGURE 2

Resins	Products Manufactured
Polyvinyl Chloride	Roll flooring, upholstery, laminates shoe components
Polyvinyl Chloride depending on compounding	Pipe and pipe fittings, electrical conduit, bottles
Polyethylene	Packaging film, film for building constructions
Polystyrene	Refrigerator parts, applience housings, food containers, framed insulation
Polyurethane	Furniture, cushions, carpet underlay, mattresses, automotive seating
Polyester reinforced	Boats, water tanks, bathroom sinks, shower enclosures
Acrylics	Signs, Lighting fixtures.

One mechanism in an overall strategy to develop an integrated polymer industry in Trinidad and Tobago should be the expansion of the processing industry as this is a major market for the other sector of resin production. The proliferation of small enterprises is not always a disadvantage as apart from reduced initial capital outlay, the size of the plant does not greatly affect the cost of production, and in many industries small enterprises can be very competitive against large manufacturers. The consumption of resin is wholly dependent on the growth of the processing industry and therefore emphasis should be directed to increase the number of processors, while at the same time increase production of individual processors. To this end several factors that plague the local industry need urgent attention.

These are:-

(a) Shortage of Skills

There is a dearth of trained persons in the country in the area of polymer technology. In addition, no facilities or courses exist in the country for training personnel in this area. Scant information on the industry has so far been compiled.

(b) Cost of Manufacture of Dies, Moulds and Tools

The Metal Industries Company set up by the Government of Trinidad and Tobago provides such a service. However, moulds and dies made locally are more expensive than imported ones. This problem will have to be resolved if competitive products are to be manufactured.

(c) Quality of Raw Materials

As mentioned before, 100% of the raw materials are imported. In the absence of any organization overseeing the interests of the manufacturers or a centre capable of testing and certifying incoming materials, acceptance of substandard materials can become a common occurrence.

(d) Plant and Machinery Maintenance Services

There is no recognized workshop or facilities for the maintenance, servicing and repair of machinery used in the industry. Skilled technicians are critically needed.

It is felt that an efficient local processing sector supported by the necessary expertise can produce quality goods at competitive prices and hence pave the way for significant export market for finished products. Thus a Research and Development Programme must be planned and implemented.

The other major sector of the plastics industry is the production of polymers. Resin production has two stages, the first being production of the monomer; example the production of ethylene in the manufacture of polyethylene and the second is the polymerization of the monomer to make polymerized resin material. The different steps involved are all part of the so-called apparatus industry, which require high investments, intensive automation and sufficient plant size. Several favourable factors indicate that economically viable plants could be established in Trinidad and Tobago and in depth feasibility studies are recommended.

As it is not expected that the requirements of the local processing industry can absorb large proportions of the output of such plants, selling on the world market must be considered. Here a rapidly increasing market for plastic products and hence resin is noted. Per capita consumption is expected to increase from 23 kgs in 1980 to 58 kgs. in 1985 to as much as 75 kgs. in 1990. Indeed, by the year 2000, it is expected that the consumption by weight of plastic will surpass that of steel. These increases indicate the magnitude of demand expected.

CONCLUSIONS

1. The polymer industry has considerable potential for making a significant contribution to the development of Trinidad and Tobago and the Caribbean region.

2. Maximisation of benefits could be obtained through an integrated plastics industry. Initially, plants producing resins in high demand are to be considered. (Examples of such resins are polyvinyl chloride, polyethylene and polystyrene). The strategy involved will be the selection of the most efficient plants and technology so that products will be competitive on the world markets.

In parallel with this activity, the expansion and deepening of the local processing industry is intended, both to satisfy increasing local demand for products and to create larger markets for resins.

There is the need for the:

3. Development of standards and implementation of quality control methods to satisfy the particular needs of tropical environments and the implementation of quality control improvements so that external markets may be served.

RECOMMENDATIONS

1. A polymer and plastics technology centre should be established in Trinidad and Tobago to serve both the national and regional needs. Among th several functions of the centre would be:

   - Technical Information Retrieval and Dissemination
   - Research and Development
   - Technological Services
     - Testing
     - Consultancy
     - Trouble Shooting
     - Maintenance
     - Training.

2. A detailed survey of the needs of the region should be carried out with a view to identifying suitable polymer resins for local production and the specific areas for downstream production facilities.

3. 'Sensitising' type conferences are required so that key personnel from both the private and public sectors may be in a better position to carry out their decision-making processes.

4. A Research and Development programme must be formulated and commenced as soon as possible to incorporate the following:

   - Resins manufacture
   - Packing development and design for the tropical environment
   - Biodeterioration of plastics and their impact on the environment
   - Process and plant adaptation and development (when possible) to meet the problems of economies of scale
   - Detailed techno-economic studies for specific products.

APPENDIX I

Trinidad and Tobago Basic Statistical Data

1. LOCATION

Trinidad 10 1/2° N Latitude 61 1/2° W Longitude

Tobago 11° N Latitude 60° W Longtitude

2. AREA

Trinidad - 4828 Sq. Kilometres

Tobago - 300 Sq. Kilometres

3. POPULATION

1980 - 1059825

4. GNP Income per capita - $10,238 TT (1 US Dollar = 2.4 TT$)

5. Second largest island in the English speaking Caribbean.

APPENDIX II

PETROLEUM

The first discovery of petroleum was made in Trinidad and Tobago in 1866. Commercial production began in 1908. The total estimated reserves is 0.7×10^9 barrels. Figure 1 lists petroleum production up to 1980 and estimated production by 1990.

FIGURE I

YEAR	PRODUCTION ($\times 10^6$ Barrels)
1960	43.4
1965	48.9
1970	51.0
1975	78.6
1980	80.0
1990	55.0

The country possesses petroleum refinery capacity in excess of 450,000 barrels per day. The main products are fuel oils, gasolenes and aviation fuels. Table I lists Annual Crude Oil peoduction for the period 1960 to 1980.

Petroleum is expected to be the main raw material for polymer resin products.

TABLE I

CRUDE OIL PRODUCTION

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	
Annual Crude Oil Production											
Million barrels	43.4	45.8	48.9	48.7	48.7	48.9	55.6	65.0	66.9	57.4	
Million cubic metres	6.7	7.3	7.8	7.7	7.9	7.8	8.8	10.3	10.6	9.1	
Daily Avg. Crude Oil											
Thousand barrel/day	115.7	125.4	133.9	133.4	135.9	133.9	152.3	178.1	182.8	157.3	
Thousand cubic metres/day	13.4	19.9	21.3	21.2	21.6	21.2	24.2	28.3	29.1	25.0	

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Annual Crude Oil Production											
Million barrels	51.0	47.1	51.2	60.7	68.1	78.6	77.7	83.6	83.8	78.2	80.0
Million cubic metres	8.1	7.5	8.1	9.6	10.8	12.5	12.3	13.3	13.3	12.4	12.7
Daily Avg. Crude Oil											
Thousand barrel/day	139.8	129.2	139.9	166.2	186.7	215.4	212.2	229.1	229.5	214.4	219.0
Thousand cubic metres/day	22.2	20.5	22.2	26.4	29.7	34.2	33.7	36.4	36.5	34.1	34.8

APPENDIX III

NATURAL GAS*

The production of gas in significant commercial quantities only began in 1959. Table II shows Natural Gas production over the period 1960 - 1980. The total gas reserve for Trinidad and Tobago based on known fields (as at January 1, 1980) was 397 giga cubic metres* (14.01 trillion cubic feet. Table III gives the forecast of National gas production over the period 1980 - 1990. Table IV lists typical chemical compositions of natural gas as related to historical, present, and future production.

Examination of these gas analyses reveals that natural gas produced or potentially available is 'sweet' and relatively free of corrosive sulphur compounds and that the major reserve potential for future development is typified by a very high methane content.

The very low concentration of corrosive sulphur compounds and the overall hydrocarbon composition of the gas render it very suitable as a fuel for domestic industries, for export, and as a chemical feed stock for the manufacture of synthesis gas, which is an intermediate in the manufacture of ammous and methanol, and in iron ore reduction. High methane content of the gas favours its conversion to acetylene.

The potential of our natural gas as a raw material for PETROCHEMICALS is hindered by the low proportion of of ethane and higher hydrocarbons which could be extracted from it for use in the manufacture of olefins.

(1 giga cubic metre = 10^9 cubic metres)

The natural gas potentially available from our north coast offshore areas has virtually no potential for olefin manufacture while a technical evaluation of the prospects for olefin production from east coast, Natural gas has indicated a volume of gas in excess of 28 million m^3/day will have to be processed to provide an economic feedstock for an olefin unit of the order of 200,000 tonnes per year capacity. Table lists the natural gas production and utilization over the period 1965 - 1984.

Therefore the principal techno-economic uses of the country's natural gas resources may be as follows:

(a) as an injection fluid and/or fuel in secondary and enhanced oil recovery projects.

(b) as a clean source of fuel for:

  (i) electricity generation;

  (ii) small domestic energy-intensive industries.

  (iii) large-scale processing industries, e.g. petroleum refining and petrochemicals manufacture;

  (iv) large scale energy-intensive industries, e.g. cement manufacture, steel production and aluminium production.

(c) as a chemical feedstock for:-

  (i) the manufacture of ammonia and its derivatives;

  (ii) the manufacture of chemical grade methanol and its derivatives;

  (iii) the direct reduction of iron ore; and

(d) as a feedstock for energy-export industries, e.g. liquefied natural gas, fuel-grade methanol and synthetic gasolenes.

However, current process developments indicate that new technologies may develop in the near future and ar indigenous Research and Development effort will be necessary if maximum use is to be made of these new opportunities.

TABLE II

NATURAL GAS PRODUCTION

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	
Annual Gas Production											
Billion Cubic feet	97.7	102.3	99.9	99.4	110.7	111.5	118.9	140.3	151.4	137.5	
Million Cubic metres	2.7	2.9	2.8	2.8	3.1	3.2	3.4	4.0	4.3	3.9	
Daily Avg. Gas Prod.											
Million Cubic feet/ day	266.8	280.4	273.8	272.3	302.5	305.5	325.5	384.5	413.8	376.7	
Thousand Cubic metres/ day	7.6	7.9	7.7	7.7	8.6	8.7	9.2	10.9	11.7	10.7	

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Annual Gas Production											
Billion Cubic feet	121.1	109.8	104.3	120.0	128.3	126.4	137.0	149.6	157.9	169.7	193.
Million cubic metres	3.4	3.1	3.0	3.4	3.6	3.6	3.9	4.2	4.5	4.8	5.
Daily Avg. Gas Prod.											
Million Cubic feet/ day	331.7	300.9	285.1	328.7	351.5	346.4	376.9	409.8	432.7	465.0	52[illegible]
Thousand Cubic metres/ day	9.4	8.5	8.1	9.3	10.0	9.8	10.7	11.6	12.3	13.2	1[illegible]

TABLE III

FORECAST OF NATURAL GAS PRODUCTION 1980 - 1990

(excluding production for LNG)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Annual Gas Production											
Billion Cubic Feet	193.5	222.2	227.4	224.1	247.8	293.8	296.7	300.7	301.9	299.3	298.2
Million Cubic Metres	5.5	6.3	6.4	6.3	7.0	8.3	8.4	8.5	8.4	8.5	8.4
Daily Avg. Gas Production											
Million Cubic Feet/day	529.	609.	623.	614.	679.	805.	813.	824.	827.	820.	817.
Thousand Cubic Metres/day	15.0	17.2	17.6	19.2	19.2	22.8	23.0	23.3	23.4	23.2	23.1

TABLE IV

CHEMICAL COMPOSITION OF NATURAL GAS IN TRINIDAD AND TOBAGO
(Volume Percentage)

Chemical Composition	'A' Associated Gas	'B' East Coast Dry Gas	'C' North Coast
Nitrogen	0.29	0.10	0.17
Carbon Dioxide	1.78	3.17	0.10
Hydrogen Sulphide	-	-	-
Methane	89.72	92.77	99.40
Ethane	4.04	2.48	0.20
Propane	2.08	0.84	0.11
Isobutane	0.58	0.21	0.01
Normal Butane	0.62	0.14	0.01
Pentane	0.62	0.19	-
Hexane and Heavier	0.27	0.10	-
Specific Gravity at 15°C	0.6479	0.6161	578
Gross Calorific Value kj/m^3	41239	38220	669

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