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POTENTIAL OF PROCESSING AND APPLICATION OF NEW MATERIALS FOR ENERGY AND HEAT GENERATION IN MALAYSIA*

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INTRODUCTION

Malaysia is located near the equator and receives moderately high solar energy. It comprises Peninsular Malaysia in the mainland of Southeast Asia and the states of Sabah and Sarawak in the Borneo island. The total area of Malaysia is about 330,000 km^2 with a population of 17.8 million.

The economy in Malaysia is based on agriculture and manufacturing. It is the leading exporter of natural rubber, palm oil and cocoa. Electrical products are the main export from the manufacturing sector. The contribution of the agricultural sector to the Gross National product, GNP in 1985 is 20.8% and 18.7% in 1990. The share is decreasing due to the rapid growth of the manufacturing sector since 1987. The manufacturing sector's contribution to the GNP increased from 19.7 % in 1985 to 27.0 % in 1990 and is forecasted to be 32.4 % in 1995. Figure 1 shows the contribution of agricultural and manufacturing sectors to the GNP. The manufacturing sector will play an important role in the Malaysian economy in the next decade.

The Malaysian Government has introduced the Industrial Master Plan (IMP) to develop the technology, strategies, policies and planning in science and technology to help the industrialization programme. The advanced material technology has been identified as an important area to be developed. It is important to support the rapid growth of the manufacturing sector. The direction of manufacturing sector is geared toward high value added and high quality products, reduced the production cost, to introduce new technology in the process and services sector and to reduce the environmental impact.

The industrial sector which covers the manufacturing, mining and construction is the largest energy consumer in Malaysia. It account for about 45 % of the final energy used in 19489. The manufacturing subsector which account for 65 % is the largest in the industrial sector. The products in the manufacturing sector include electrical and electronics products, basic metal, non-metallic, fabricated metal, plastic, rubber and textiles.

NEW MATERIALS

New materials, such as Silicon Carbide, Silicon Nitride, Yitrium Barium Copper Oxide can be developed from ceramics, metal, polymers and glass. These new materials can be used as semiconductors, insulators and superconductors in the transport industry, electronics and communication component, energy and engineering industry.

The application and processing of new materials in Malaysia is still at the Research and Development (R&D) stages. An extensive R&D is carried out at various universities and research institution to identify the feasible processing techniques of new materials. Table 1 indicates some R&D projects at various agencies in Malaysia.

Agencies	Research Project	Project Output
1. Agricultural University of Malaysia (UPM)	Preparation of superconductor	To produce high temperature superconductor (YtBaCuo)
2. National University of Malaysia (UKM)	Preparation of superconductor	YtBaCuo
3. University Science of Malaysia (USM)	Preparation of Zirconium powder	To produce sub-micron zirconia powder
4. Standards and Industrial Research Institute of Malaysia (SIRIM)	Preparation of Silicon Carbide and Silicon Nitride	To produce pure and monphase power

Table 1: Some R&D projects at various agencies in Malaysia

Most of the R&D projects on new materials are funded by the government. Collaborative R&D projects with advanced countries are also carried out in the field of oxide ceramics, non-oxide ceramics and glass ceramics.

Different techniques are used in the new materials R&D activities. The "sole-gel" is used to produce alumina powder and silica glass. The pyrolysis atomiser is used to produce thin-film materials for solar energy application. Yitrium Barium Copper Oxide is produced from sintering techniques.

R&D is carried out to produce 1m x 1.5m thin films of zinc oxide (ZnO), indium oxide (IO) and tin oxide (SnO). These films are mainly used for energy conservation window and solar thermall collector. further research is also being carried out to produce photovoltaic cell of SnO/Si. The efficiency of this PV cell 5.5 %. Priority is given to producing thin films of SnO and PV cell of SnO/Si because these sources are available locally.

POTENTIAL OF RENEWABLE ENERGY

Crude petroleum and natural gas are the major energy resources in Malaysia. Figure 2 indicates the share of energy supply by type of fuels in 1978 and 1989. Most of the energy resources are depletable and non-renewable. It is estimated that the oil reserves will be depleted by the year 2000 and the natural gas will last over 100 years.

The national energy policy 5 was introduced by the government to reduce the dependence on oil, to develop the alternative energy resources, to encourage efficient use of energy and to reduce the environmental pollution.

Solar energy has been identified as an alternative energy source to be developed in Malaysia for next coming decades. It can be used to generate electricity and heat for heating and drying application. The annual average daily global solar radiation is about 4.5 kwh/m^2. Figure 3 shows the global solar radiation in 1989.

The photovoltaics application for lighting, water pumping and electricity generation is still at demonstration project stage. It is a good potential for the rural electrification programme. The solar thermal system is mainly used for hot water supply in the domestic sector which is popular only for the upper class and middle class society. The price of a complete unit including the installation cost ranges from US$800 to 1,800, compared to the electric heater which only cost US$200.

The major constraint of solar energy application in Malaysia is mainly high capital investment cost and lack of awareness of free environmental problems. The PV modules and the solar thermal collector are imported from Australia, Japan and the United States. The solar collector for the host water system is fabricated locally. The promote the utilization of solar energy an extensive R&D is required to produce new materials and high efficiency which can reduce the installation cost.The government must play an important role to educate people with regard to clean and safe energy resources.

POLICY

Malaysia has introduced national energy policy to diversify the energy resources and to maintain the clean and safe environment. Solar energy has been identified as a potential of renewable energy to be harnessed. A substantial amount of R&D fund is allocated to identify the new materials for electricity/heat generation from solar energy. This allocation is funded through the Intensification of Research priority Area, (IRPA). The R&D activities on new materials will help the government to implement the energy conservation programme and to maintain the clean environment which is stated in the national energy policy. The objectives of national energy policy are:

• To provide the nation with adequate and secure energy supplied by developing and utilizing the alternative resources of energy and reducing our dependence on oil;

• To promote and encourage the efficient use of energy;

• To ensure that factors pertaining to environment are not neglected in the achievement of the above objectives.

CONCLUSIONS AND RECOMMENDATIONS

New materials application will help the industrialization programme in Malaysia. Raw material such as kaolin, tin and silica are available locally. The appropriate technology is required to be transferred from the developed countries to Malaysia to produce new commercial material application for energy application and environmental control.

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FIG.1: THE CONTRIBUTION OF GNP FROM THE MANUFACTURING AND AGRICULTURAL SECTOR

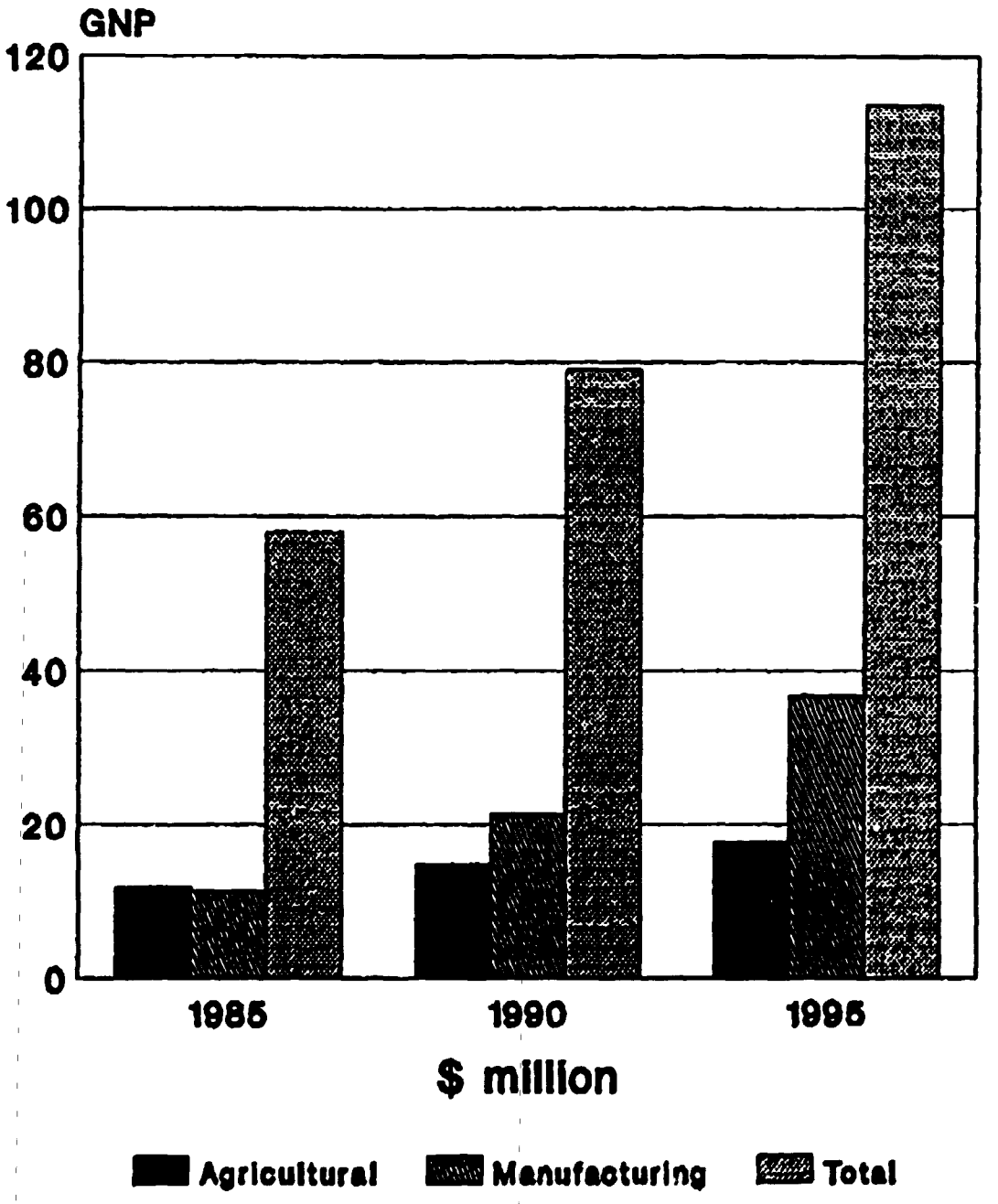
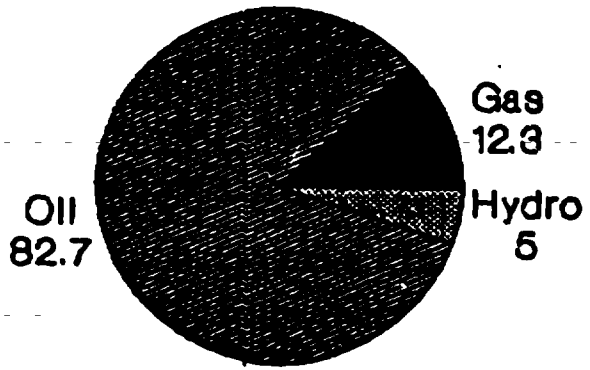


FIG.2 : THE PERCENTAGE OF PRIMARY ENERGY SUPPLY BY FUEL



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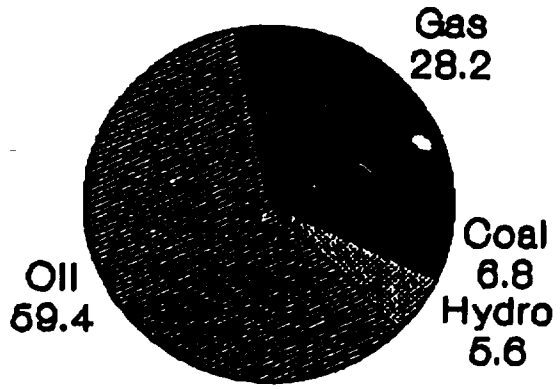

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FIG. 3: MONTHLY MEAN DAILY GLOBAL