



TECHNOLOGY EXPORTS

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EXPORT OF CARBON DIOXIDE PRODUCTION PLANTS

Experiences of SS Foundry Chemical Industries Pvt. Ltd.*

S.S. Aggarwal**

1. Carbon Dioxide – Applications and Characteristics

Carbon Dioxide (CO₂) has got a unique property of existing in all the three states – solid, liquid and gaseous. This property has been utilized for various industrial uses. For example in gaseous form, it is used in the following:

1. Soft drinks
2. Mineral water
3. MIG welding
4. Fire fighting, etc.
5. Providing inert atmosphere
6. Providing anti-bacterial property
7. Green house controlled input of CO₂ for better growth
8. Increasing the shelf life of food products

| CARBON DIOXIDE | | | | |
|-----------------------|-----------------------------|---------------------------------------|----------------------|------------------|
| | WEIGHT Kilograms (KG) | GAS Cu. Mtr. (NM ³) | LIQUID Litres (L) | SOLID Cu. Ft. |
| 1 Kilogram | 1.0 | 0.5058 | 0.9860 | 0.2260 |
| 1 NM ³ Gas | 1.9772 | 1.0 | 1.9480 | 0.04468 |
| 1 L Liquid | 1.0151 | 0.5134 | 1.0 | 0.02293 |

NM³ (Normal cubic meter) gas measured at 1 atmosphere and 0°C.
Solid measured at -109.25°C

In the solid form called dry ice, it is used in the following:

1. Refrigeration of food products, meat products and preserving food packets in the cyclone/earthquake effected areas, etc.

* The article published in this Issue is based on a presentation made by Dr. S.S. Aggarwal in DSIR-IIFT-TEDO Technology Exports Lecture Series, on 17 January 2007.

** Chairman-cum-Managing Director, S.S. Foundry Chemical Industries Pvt. Ltd. (SSFCI).

PHYSICAL CONSTANTS: CARBON DIOXIDE

| | Metric Units |
|--|---|
| International symbol | CO ₂ |
| Molecular weight | 44.01 |
| Density of the gas | |
| At 70° F (21.1° C) and 1 atm | 1.833 kg/m ³ |
| At 32° F (0° C) and 1 atm | 1.977 kg/m ³ |
| Specific gravity of the gas | |
| At 70° F (21.1° C) and 1 atm (air=1) | 1.522 |
| At 32° F (0° C) and 1 atm (air = 1) | 1.524 |
| Specific volume of the gas | |
| At 70° F (21.1° C) and 1 atm | 0.5457 m ³ /kg |
| At 32° F (0° C) and 1 atm | 0.5059 m ³ /kg |
| Sublimation temperature (1 atm) | - 78.5° C |
| Critical Temperature | 31.1° C |
| Critical Pressure | 7382kPa, abs. |
| Critical density | 468 kg/m ³ |
| Triple point | -56.6° C at 7.1802 kPa, abs |
| Latent heat of vapourization | |
| At 32° F (0° C) | 234.5 kJ/kg |
| At 2° F (-16.7° C) | 276.8 kJ/kg |
| At -20° F (-28.9° C) | 301.4 kJ/kg |
| Latent heat of fusion at -69.9° F (-56.6° C) | 199 kJ/kg |
| Ratio of specific heats at 59° F (15° C) | 1.304 |
| Solubility in water, vol/vol at 68° F (20° C) | 0.90 |
| Weight of liquid | 1014 kg/m ³ |
| Latent heat of sublimation at -109.3° F (-78.5° C) | 571.0 kJ/kg |
| Viscosity of saturated liquid at 2° F (-16.7° C) | 0.119 (g/cm) (sec) X 10 ⁻² (centi-noise) |

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2. Tempering, e.g. edge and blades.
3. Movie sets making, etc.

In the liquid form:

1. It is used for shrink fitting
2. It is this form in which it is stored and then converted into either gaseous form or dry ice form.
3. Super cooling
4. Critical Extraction

2. MEA Technology for Production of Carbon Dioxide

Oil or natural gas or any other carbonaceous material is burnt to get 10-14 per cent CO₂, which is absorbed in Mono Ethanol Amine (MEA) solution at low temperature. MEA selectively absorbs only carbon dioxide and when heated, yields pure CO₂ gas. The entire plant balances the movement of MEA economically again and again in the circuit/production cycle. Almost pure but wet CO₂ gas is then passed over a battery where it is compressed and then passed over activated carbon, potassium permanganate, dryer unit, etc. for purifying. The pure CO₂ is then passed through a refrigeration unit which liquifies it. The liquid carbon dioxide is then stored in a storage tank. The material of construction of the storage tank is special stainless steel of 516 grade (SA 70). In brief, the company offers state of the art carbon dioxide production plants which have a very attractive pay back period.



3. Carbon Dioxide as By-product

Carbon dioxide is obtained as a by-product either from a fertilizer unit or from brewery/distillery or from ground well, which is 98 per cent pure. Then the gas is purified to make it food grade. Carbon dioxide is also recovered from flue gases which are obtained as waste product. The percentage of CO₂ is not more than 12-14 per cent in the flue gases. Here, MEA method is used to make food grade CO₂ gas.

One of the big users of CO₂ is soft drink manufacturers as it is an integral part of all soft drinks. They have very strict specifications for gas. The company follows all specified norms in producing the gas.

4. Storage and Transportation of Carbon Dioxide

CO₂ is best stored in liquid form either in cylinders or in storage tanks and the company has specialized in these sizes ranging from 1 to 50 tons, both horizontal and vertical. It also makes CO₂ transportation tankers for storage and transportation under safe conditions. The tankers manufactured have complete inbuilt refrigeration units, heating systems, weighing systems using electronic weighing systems as also the differential level indicators.

5. About SSFCI

S.S. Foundry Chemical Industries Pvt. Ltd. (SSFCI), which is now recognized as S.S. Gas Lab Asia is a company with experience of about 45 years in manufacture of Plants & Machineries and the export of technology in the field of CO₂ plants. It is an ISO 9001 certified company and is rated No. SE-2B by Dun & Bradstreet which indicates high performance capability and financial strength. It exports 5-6 plants every year to Gulf/Middle East countries and specializes in making plants both for production as well as for by-product sources of CO₂.

Its list of prestigious customers includes L&T, Praj Industries, Parle, UB group, etc. Outside India, the company targets Middle East as gas and oil are available at economical prices, and it supplies by-product plants to those countries where CO₂ is coming from ground well.

SSFCI has a workforce of 30 dedicated workers, and the infrastructure includes a well-equipped workshop, an assembly shop, and also a CAD centre. The making of quality products here is achieved through sustained teamwork, rigorous in-house inspection at different stages of manufacture and assembly of plants.

SSFCI's history is a clear tale of growth and dynamism in the field of exporting technology. The firm initially started in 1930 by collecting CO₂ as by-product from the chemical reaction in the process of making magnesium sulphate, compressing it in cylinders and selling it to British soldiers for soda. It became a well established company, and set up plants producing sodium silicate at Delhi and Rawalpindi (West Pakistan) till 1947, when trade links broke with Pakistan, it was left with only Delhi plant. Today, the company is recognized as a dynamic and growing organization with an annual turnover of Rs 7-8 crore.

SSFCI firmly believes that in the manufacturing sector, the concept of appropriate technology is important as technology emulated from the West might not augur well for India since it is capital intensive. While indigenous technology can be an asset, SSFCI also believes that after-sales service as well as training of the technical staff of the importer so that they get fully acclimatized with the operation and finer nuances of the project/equipments exported remain vital for export success. Added to that is the need for international quality at competitive prices and timely delivery, and these together constitute the basic mantra for success in exports for the company.

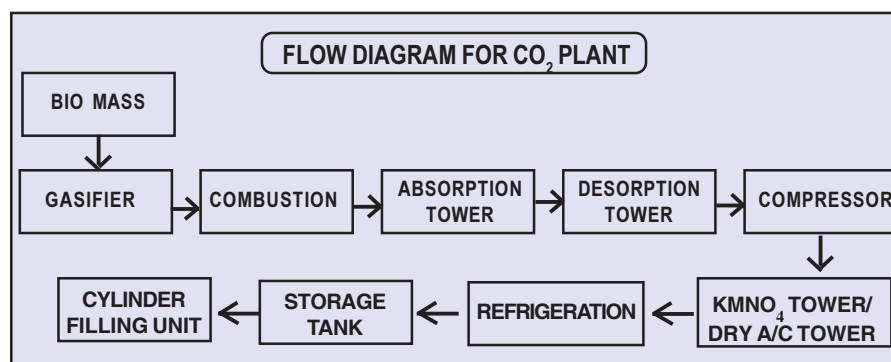
6. Innovations by the Company

6.1 Production of Carbon Dioxide from Biomass

In 1973 there was "Petroleum shock" and prices of petroleum products were unanimously increased by OPEC. The economics of producing carbon dioxide gas by burning diesel or kerosene, etc. was offset with sharp increase in the price of petroleum products. The firm then explored the possibilities and based on in-house expertise and R&D, developed a suitable technology for production of CO₂ gas from biomass. In India, the metropolitan cities produce huge solid wastes which can be effectively used for biomass and biogas. For example, in Delhi alone, 1000 MT of garbage can produce considerable quantity of methane gas, refused dry fuel and 50 tons of bio fertilizer.

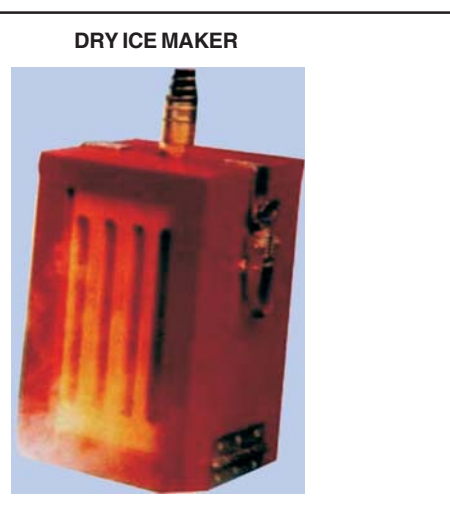
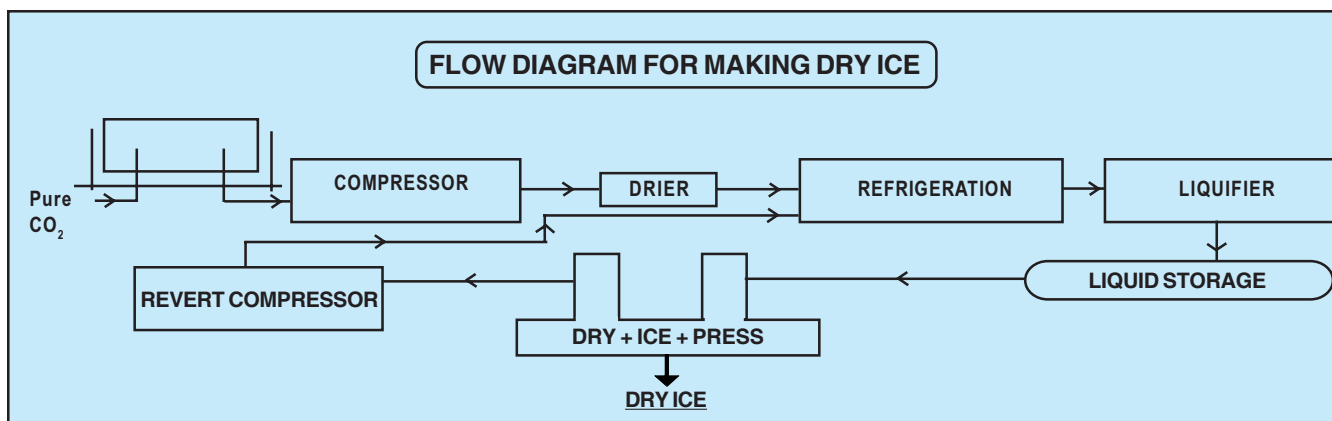
IIT Delhi has worked out a process to produce carbon dioxide and methane from Gobar Gas. The company is in the process of discussion with the institute to develop a process where CO₂ is produced using poultry waste as practiced in many developed countries.

It has already supplied a CO₂ plant in Vadodara which works on woody biomass, and the plant is working well for the last 4-5 years.



6.2 Carbon Dioxide Pelletizers Machine

The company developed a carbon dioxide Pelletizers machine which makes dry ice in the form of particles. Dry ice in the shape of rice particles is used in blasting or cleaning of surfaces. This is eco friendly in the sense that CO₂ directly evaporates from the solid state to gaseous form, and as it is part of the natural cycle, there is no pollution and damage to the environment. The company has developed the machine in India through their own R&D efforts, with help from a premier institute of the country and is already exporting it. The company is in the process of developing the other part of the operation in which the palletized snow is put under pressure of air and then bombarded through a gun on the surface to be cleaned. It intends to market this in India and outside India.



7. Export of CO₂ Production Plants

The SSFCI has exported plants that produce CO₂ gas by burning carbonaceous fuel. Such plants supplied by the company are working satisfactorily in Middle East, Gulf, South East Asia and African countries.

The plants based upon collection and bottling of CO₂ gas by burning of biomass (wooden chips) have also been working satisfactorily in India.

First time, the company has also exported plants which make use of CO₂ coming out from the soil. The company is now experimenting to separate the CO₂ and methane as obtained from Gobar Gas, dropping of hen and other types of biomass.

8. Conclusions

8.1 The prices that the firm offers are about 30-40 per cent lower than the corresponding prices of some plants and equipments from other European companies like ASCO, UNION, Wittemann, etc. In fact transportation tankers and storage tanks are their regular

exportable items, where insulation is done both by polyurethane foam as well as by vacuum. Each tank is fitted with a measuring device (sophisticated or simple as may be required), safety valves, apart from inlet/outlet valves.

8.2 For many countries the company's technology is suitable as either they still have not reached their stage of industrialization or equal to them. The plant and technology supplied by them always keeps a little extra space so that repairing of the plant is possible instead of throwing away. The company takes Asian concept in consideration.

8.3 Small and medium exporters can benefit if they maintain a close networking with Indian Embassies/Missions abroad and pose their specific requirements to the embassies. The embassies also need to respond positively to their requests.

8.4 Small and medium exporters need to carefully evaluate the technologies available with R&D laboratories and in most cases need to add value to the technologies acquired before using it practically.

KALEIDOSCOPE OF INDIA'S OVERSEAS BUSINESS

ENERGY

Praj Ind Bags Rs 170 cr Orders from US

PRAJ INDUSTRIES has contracted the second phase orders from Cilion for its Imperial County project and from Missouri Valley Energy for its Meckling, South Dakota project.

The company has also bagged the first order from the sugarcane belt of the US. The total value of these three orders is Rs 170 crore.

Shri Shashank Inamdar, Managing Director, said that for Cilion and Missouri, the first phase had involved the supply of technology package while the second phase dealt with equipment supply. He added that the Imperial County project is the third project for Praj from the Cilion Group. Cilion will produce 110 mgpy (400 million litres per annum) ethanol from this facility. These second phase orders have been received during the last quarter of 2006.

Shri Inamdar said that the order from Missouri Valley for a 55 mgpy ethanol plant gave it the entry into corn farmer's cooperative sector in the US mid-west. Missouri Valley Energy is promoted by Glacial Lake Energy, which operates an ethanol plant in the mid-west and is currently engaged in the construction of three greenfield ethanol facilities.

Shri Inamdar also said that it has bagged an order from the sugarcane belt of the US. Louisiana Green Fuels has awarded a contract to Praj for an integrated 23 mgpy ethanol plant using sugarcane based feedstock. This plant will be located at Lacassine in Louisiana, adjacent to an existing cane syrup mill.

In the very first year of entry into the US, Praj has achieved sizable business resulting in capacity addition in the region of 700 mgpy by way of Praj technology and equipment, Shri Inamdar said.

(The Hindu Business Line, 3 January 2007)

L&T Bags Rs 418-cr Abu Dhabi Order

LARSEN & Toubro Ltd. (L&T) has bagged an order valued at Rs 418 crore from the Abu Dhabi Water & Electricity Authority to construct six major electrical substations in the Al Ain sector of Abu Dhabi.

As per the terms of the contract, L&T will supply and install 33/11KV primary substations to the specifications of the international consultant Mott MacDonald. The project

which includes design and construction of civil building and over 120 km of 33 KV cabling is scheduled for completion within 18 months.

The substations will come up at Al Mutaredh, Al Mezyad South, Al Dhaher South, New Al Qua'a, Al Qattara and Civic Centre to reinforce the region's power distribution network and help meet the increased demand for power in the region.

Each substation consists of 33 KV gas insulated switchgear, 11 KV air insulated switchgear, 15 MVA 33/11 KV transformers, substation control and monitoring system, protection and telecommunications system, DC system and auxiliaries.

(The Hindu Business Line, 4 January 2007)

AUTOMOBILES

Ashok Leyland Sets Up Arm for Plant in UAE

ASHOK Leyland has established a subsidiary company (LLC) in Ras Al Khaimah, UAE for setting up a bus body assembly plant to cater to the Middle East and neighbouring markets.

In October 2006, the company had announced that it would set up a Rs 22.5 crore (\$5 million) bus assembly unit in Ras Al Khaimah that would be gradually upgraded to a vehicle assembly plant for trucks and buses.

The unit, with an initial annual capacity for 1,000 buses of international styling, manufacture and quality, would start operations as a bus body assembly using Ashok Leyland chassis and bus body CKD kits sent from India including Irizar TVS, Shri Seshasayee, MD of Ashok Leyland, said.

(Business Standard, 12 January 2007)

CHEMICALS & PETROCHEMICALS

L&T Wins Contract from Sinopec

LARSEN & Toubro Ltd. (L&T) won two major contracts of an aggregate value of \$86 million from Chinese petrochemical company Sinopec. L&T has been contracted to design, manufacture and supply of three ethylene oxide reactors.

(The Financial Express, 15 December 2006)

Kvaerner Bags \$6 mn Deal from Hood Oil of Yemen

AKER Kvaerner Powergas Pvt. Ltd., the Indian subsidiary of Aker Kvaerner Group of Norway, has won a \$6-million contract from Hood Oil of Yemen for providing project management consultancy (PMC) for a three-million tonne refinery.

Hood Oil, a subsidiary of the Hayel Saeed Anam Group of Yemen, is building the Ras Issa refinery project at a cost of \$600 million. Reliance Industries Ltd and International Finance Corporation also hold stakes in the project. The project consists of construction and operation of a 60,000 barrel per day refinery on the Ras Issa peninsula on the Red Sea coast of Yemen.

The project is adjacent to the Ras Issa export pipeline, which transports about 50 per cent of crude produced in Yemen.

In India, Aker Kvaerner Powergas provides engineering, procurement and construction services for the oil & gas, refining, petrochemicals, metals, minerals, and chemicals sectors.

(The Hindu Business Line, 7 January 2007)

Marico to Acquire HairCode

CLOSE on the heels of acquiring Fiancie, Marico Ltd. has announced a strategic alliance with the Cairo-based Pyramids group for acquiring HairCode, a leading haircare brand in Egypt. The alliance envisages for Marico, direct investment in a company with manufacturing facilities in Egypt, apart from the acquisition of the brand HairCode.

The Pyramids Group will continue to distribute the brand for the medium term and has agreed not to compete in certain segments. The alliance parties expect that they can grow the brand's turnover from its current base to over Egyptian Pounds 50 million in the next financial year.

Marico had recently raised Rs 150 crore through the QIP (qualified institutional placement) route. This was to enable the company to raise debt at a short notice to fund any acquisition opportunity by restoring the balance in its financial gearing.

Marico CFO Shri Milind Sarwate said: "This alliance makes Egypt an important geographical segment of Marico's operations. This helps us in leveraging the resources deployed in the country optimally. Egypt is a profitable market and we have made an entry into the country at the right multiples."

(The Times of India, 21 December 2006)

RECENT POLICY INITIATIVE

Auto Plan Seeks Tax Sops for Fast Growth

TO attract \$35-45 billion over the next 10 years, the Automotive Mission Plan—AMP (2006-16) has sought a tax holiday for investments over Rs 500 crore made by auto companies. The Plan released by the Prime Minister also sought tax deductions of 100 per cent of export profits and deduction of 50 per cent on forex earnings.

The policy paper aims at making India the destination of choice in the world for design and manufacture of auto components with output reaching a level of \$145 billion, accounting for more than 10 per cent of the GDP and providing additional employment to 25 million people by 2016. The current size of the automotive sector is pegged at about \$34 billion.

To achieve the ambitious goal, the industry would have to invest \$35-40 billion over the next 10 years. Bulk of this investment will come from expansion of capacities by existing manufacturers operating in India and remaining from global multinational corporations seeking to make India their manufacturing base. Besides tax holidays, the Plan also calls for a one-stop clearance for FDI proposals in the sector and deduction of 30 per cent of net income for 10 years for new industrial undertakings.

As in the draft AMP, the final paper also promises to promote manufacturing and export of small cars, multi utility vehicles (MUVs), two-wheelers, tractors and auto components. The paper also seeks to incentivise research and development (R&D) for product process and technology. Setting up of virtual special economic zones (SEZs) and auto parks for auto component industry has also been proposed in the AMP. To help the domestic auto industry move fast, the government would continuously invest in road, port, railways, and power. The AMP proposes to creation of specialized port infrastructure for handling vehicle exports. The government will also draw an Auto Fuel Policy road map beyond 2010.

Among other key recommendations in the AMP are rationalization of motor vehicle regulation, integration of information technology (IT) in manufacturing and promotion of automotive infotronics, among others.

(The Financial Express, 30 January 2007)

JOINT VENTURES

Tata Motors, Thonburi Set Up JV in Thailand

TATA MOTORS has entered into a joint venture with Thailand's Thonburi Automotive Assembly Plant Co. to build, assemble and sell pick-up trucks in that country. The joint venture would make vehicles at Thonburi's manufacturing facility. It would go on-stream in a year's time.

The Indian company will hold 70 per cent of the equity and Thonburi 30 per cent. The new venture would help Tata Motors tap Thailand, the second largest market for pick-up trucks in the world after the US, it added.

"Introduction of Tata Motors pick-up vehicles and a manufacturing facility in Thailand provide a unique opportunity to the company. We believe the joint venture will make meaningful impact in this most competitive market for pick-up vehicles," Tata Motors Chairman, Ratan Tata said.

As per the agreement, both partners would jointly manage the operation for production and marketing of the product to be sold in Thailand and also exported to other potential markets in the region, the statement said.

"The cooperation with Tata Motors offers Thonburi the opportunity to expand our business portfolio. Tata vehicles have dominated the Indian commercial vehicle market for decades and the company is now aiming for a stronger presence internationally. The new pick-up truck will be the right product for both domestic and export markets," Thonburi Managing Director Robru Viriyaphant, said.

(The Hindustan Times, 19 December 2006)

NTPC to Form Joint Venture in Lanka

NTPC is foraying into Sri Lanka by signing a memorandum of agreement with the Lankan Government and Ceylon Electricity Board to develop a coal based power project. To be built at Trincomalee in Lanka, the 2X250 MW power project would be developed through a joint venture company between National Thermal Power Corporation and Ceylon Electricity Board. Earlier, Ceylon Electricity Board had announced that NTPC and Ceylon Electricity Board would each hold 50 per cent equity in the new joint venture company that would be floated in Sri Lanka.

(The Hindu Business Line, 29 December 2006)

Genus in Pact with Mobix to Make Meters in Brazil

GENUS Overseas Electronics has struck a 50:50 joint venture with Brazil's Mobix for manufacturing meters in the Latin American country. The proposed unit would be set up at Campos near Rio de Janeiro and would commence operations by the end of 2007. According to Shri Kailash Chandra Agarwal, Joint MD, Genus Overseas Electronics, "We expect this unit to contribute about Rs 80 core in revenues for the first year. The total investment would be about \$15 million out of which we would bring in \$3 million each as equity and the rest would be raised through debt." Talking about the strategy behind it he added, for us it is an expansion of our electronic meter business into the Brazil market which holds huge demand potential like India.

Genus, a public listed company, which clocked revenues of around Rs 212 crore last financial year, is aiming at almost doubling it to about Rs 400 crore on a bottomline of about Rs 25 crore.

The company has just set up its second manufacturing unit at Uttarakhand for energy meters. Besides its staple business of meters, it also has projects business and has recently forayed into the consumer power electronics market with its Genus brand of invertors. The consumer side of the business is contributing just about 5 per cent of the overall revenues but is expected to become big by moving forward.

(The Economic Times, 1 December 2006)

Indian Oil Enters Pact with Sinopec

INDIAN Oil Corporation Ltd. (Indian Oil) has inked a memorandum of understanding (MoU) with Sinopec, a major integrated National Oil Company (NOC) of China for hydrocarbon cooperation.

The MoU will facilitate enhanced cooperation in refinery and petrochemicals sector, thereby giving a fillip to Indian Oil, which has entered the petrochemicals business. The MoU was signed by Shri B.M. Bansal, Director (Planning & Business Development), Indian Oil, and Mr. Chen Qi, Director General, Sinopec.

According to an official statement, the other areas of cooperation in the MoU include international trade, exploration and production activities in third countries, collaboration in engineering and technical services, exchange of knowledge/technology in operations, refinery optimization and training.

(The Hindu Business Line, 16 December 2006)

INDIAN INVESTMENT ABROAD

India Prefers to Go Dutch

THE Netherlands has emerged the largest recipient of overseas Indian investment, surpassing traditional favourites—the US and Russia. In the first nine months of FY06, of the total \$1.6 billion overseas investment approvals, around \$244 million has been earmarked for the Netherlands, with the US closely following with \$225 million.

There has been a dramatic improvement in the Netherlands's attractiveness as an investment destination for India Inc. Overseas investments from India, measured in terms of approvals, to the Netherlands between April 2005 and January 2006 was higher than the cumulative FDI from India to that country between April 1996 and March 2005.

A growing number of manufacturing and software companies from India is looking to establish greater presence in the European market. Indian investments to the European Common Market have been the highest among other regions, with manufacturing and non-financial services constituting the bulk of FDI approvals. "Increasing investments into the Netherlands is largely because of the fact that the country is very investment friendly and it offers the best place for Indian companies to establish their presence in Europe. The wide usage of English as a medium of communication gives it an added advantage," says Shri Rajiv Kumar, Chief Executive of ICRIER.

In addition, some Indian companies have also set up their holding companies in the Netherlands to route their investment to Europe and the US. With India Inc. increasing its presence in these regions, more investments are now being routed through these holding companies.

Indian companies are not the only ones attracted to the Dutch market this year. According to the Netherlands Foreign Investment Agency (NFIA), year 2005 witnessed the highest number of new investment projects by foreign companies into that country, with a major chunk from Asia.

While this has been the largest amount of FDI received by the Netherlands from India in any given year, on a cumulative basis, Russia and the US continue to occupy the top spots. The Netherlands remains the tenth overseas investment, if cumulative investment approvals since 1996 are taken into account. Within the other top 10 recipient countries, Vietnam and Oman have been replaced by Sudan and Singapore in the past seven years, as the favoured

destination for Indian investments. While investments in Sudan were mostly for oil exploration, Singapore has attracted mostly IT and tech investments from India. According to the *RBI Annual Report*, more than 1,400 Indian companies are operating in Singapore, of which, around 450 are technology enterprises.

FDI APPROVALS OF INDIA'S TOP INVESTMENT DESTINATION 2005-06

| | (US\$ million) | |
|-------------|------------------|-----------|
| | (Till Jan. 2006) | (2004-05) |
| Netherlands | 244.04 | 30.65 |
| US | 225.42 | 251.73 |
| Singapore | 170.22 | 239.02 |
| UK | 137.32 | 71.85 |
| UAE | 118.26 | 41.85 |

On the whole, there has been a 70 per cent increase in actual FDI outflow from India in April 2005-January 2006 over the corresponding period last year. The share of manufacturing is above 50 per cent and the share of non-financial services is 30 per cent.

(*The Economic Times*, 2 November 2006)

Outward FDI Soars, Cos Shop Abroad

STATE Bank of India (SBI) has emerged as the number one Indian investor abroad in 2005-06, investing over \$1bn. In fact, all outward foreign direct investment (FDI) in the banking sector during the year was made by SBI. The public sector bank made investments totalling \$1,179 million in Mauritius, Indonesia and Kenya last year.

Dr. Reddy's Laboratories emerged as the second biggest Indian investor abroad with an investment of about \$770 million in 2005-06, according to a recent report by Crisil. During the period, Dr Reddy's completed the acquisition of Germany's Betapharm, in one of the largest pharma deals by an Indian company.

Among the other top investors of 2005-06 are Suzlon Energy, Tata Steel, Ranbaxy Laboratories, Videocon International, VSNL, Matrix Laboratories, TCS and Wipro. However, if all Tata investments are clubbed together, the group will stand third with an investment of \$755 million.

Indian companies invested over \$1.054 billion in the US, it being the top favourite. As per the Indian investment preferences in 2005-06, the UK came second, attracting \$800 million, says the report. Other countries where Indian

companies were bullish on during the year are Belgium with \$790 million, Germany with \$657 million, and Thailand with \$486 million.

Sector-wise, pharmaceuticals has been the leader, with \$1.58 billion of outward investment in 2005-06 going to the industry. The major investors abroad in this sector are Dr Reddy's Laboratories, Ranbaxy Laboratories, Matrix Laboratories, Jubilant Organosys and Nicholas Piramal India.

Banking follows next with an investment of \$1.18 billion and third comes IT with an investment of \$786 million. In the metals sector, India invested about \$777 million overseas largely driven by Tata Steel's foray into Thailand. The energy sector invested \$630 million abroad.

One of the major investments by an Indian company abroad so far has been that of Aban Loyd Chiles Offshore, which invested \$445 million in Norway.

(The Economic Times, 21 October 2006)

Three-fold Increase Seen in FDI Out of the Country

THE rising appetite of Indian companies for global markets will result in a three-fold increase in foreign direct investment (FDI) out of the country in 2007, predicts a new study by Washington-based Institute of International Finance (IIF).

This trend will mean that such investments from India could hit a record \$3 billion (Rs 13,247 cr.), the study says, while noting that FDI into India will also rise, albeit at a slower pace, to \$8 billion from \$6.5 billion in 2006.

(The Hindustan Times, 23 January 2007)

INVESTMENT OF PROMINENT INDIAN COMPANIES IN EUROPE

(Value: US\$ million, upto Sept. 2006)

| | |
|------------------------------------|--------|
| Dr. Reddy's Laboratories Ltd. | 133.70 |
| Tata Consultancy Services Ltd. | 105.26 |
| Ranbaxy Laboratories Ltd. | 77.80 |
| Wipro Ltd. | 72.95 |
| Raymond UCO Denim Pvt. Ltd. | 68.25 |
| CCL Products (India) Ltd. | 62.47 |
| Matrix Laboratories Ltd. | 59.48 |
| Nicholas Piramal India Ltd. | 58.82 |
| Wockhardt Ltd. | 34.82 |
| Glenmark Pharmaceuticals Pvt. Ltd. | 30.08 |

(The Hindu Business Line, 11 February 2007)

INDIA'S EMERGING STATUS IN GLOBAL TRADE AND R&D

Home-Grown Chip Design

SEVERAL home-grown Indian start-up design companies are making a mark by evolving products for the world market. Most of them have been started by entrepreneurs with prior experience in MNCs like Texas Instruments, Intel and Freescale.

For instance, SiRF Technology, founded by two Indians in 1995 in the US, is now a system solution provider delivering turnkey reference designs and system software along with its semiconductor products. The company set up its Indian subsidiary – SiRF Technology India – in 2004 with the aim of starting a 'Centre of Excellence'.

"We take advantage of the IP creation potential of India and complement it with the cost arbitrage", said SiRF Technology India Managing Director, Shri Ashutosh Pande.

Another firm, Cosmic Circuits, operating out of Bangalore, was started by five engineers from Texas Instruments in June 2005. "In 18 months, we have been able to get 15 customers worldwide and are licensing intellectual property (IP) in power management, data converters and complete analog front end", said its founder President and CEO, Shri Ganapathy Subramaniam.

Another start-up firm Sankalp Semiconductor, offering analog and mixed-signal design and layout services, has adopted a unique model. It plans to grow in Tier 2 cities by creating centres for customers catering to their IP confidentiality needs, according to Sankalp Semiconductors Founder Shri Vivek Pawar.

India Semiconductor Association President Ms. Poornima Shenoy said: "The increase in software content in embedded devices (device software) has led to the augmentation of Very Large System Integration (VLSI) design in India. Along with IP development, it has enabled delivery of complete turnkey solutions to clients."

(Business Standard, 15 January 2007)

Brave New World: R&D Services Export Heralds New Phase in IT Sector

IT has been widely acknowledged that the Indian software industry is largely concentrated on relatively low skill services. There have been a number of studies that have seen India as exclusively a provider of low-wage, low-skill software services. But this could be beginning to change.

In a paper published in *Environment and Planning*, Shri Balaji Parthasarathy and Mr. Yuko Aoyama argue that the recent rise of R&D services exports suggests that the Indian software industry has reached a new phase of development. Nasscom has estimated that in 200-01 R&D services exports was \$1.21 billion, or 15.8 per cent of India's software exports. Its share has grown since then and is expected to rise to \$9.2 billion by 2010. The papers seeks identify the processes that allowed the Indian software industry to upgrade from being a provider of low-cost, low-skill services to a provider of high-skill R&D services, focusing primarily on the experience of Bangalore. Shri Parthasarathy and Shri Aoyama argue that a new phase of technological upgrading is being facilitated in Bangalore by active local entrepreneurship and supported by the gradual strengthening of institutions, both formal and informal.

As Indian firms sought to diversify their client base and business opportunities after the dotcom bust, they stepped up local collaboration and networking. This resulted in the emergence of a technical community consisting of local employees of MNCs, entrepreneurs and large Indian firms as well as NRIs returning home. The widening and deepening of the local technical labour market has not only raised the possibility of bringing together various combinations of skills for MNCs and software firms seeking to upgrade but has also made entrepreneurship more feasible. The potential has thus been tapped both by major service providers who entered the industry in the 1980s as well as entrepreneurial start-ups that focus on niche markets. For the established firms attempting transition to R&D services the shift is not necessarily motivated by financial gain in the short run but is an attempt to gain technological legitimacy in the long run.

The value of reputation alone may often be sufficient as a justification for an Indian software services firm to claim to be an R&D service firm today. At the same time there is room for small firms providing R&D services to large firms who find themselves behind in certain technological areas where they have failed to anticipate growth. Often large companies take a call on what direction the industry is moving and focus their own R&D in that direction. But when that reality moves in a different direction they tap the R&D services of the smaller niche players. The type of R&D services becoming increasingly popular in India involves the sale and transfer of intellectual property blocks in return for a onetime payment plus volume-based royalty to the provider. The focus on R&D as a service that can be developed independently and sold, introduces a further division of labour.

And with everything else in this globalized industry, this too has gone international. Alliances between Taiwanese factories and Indian Intellectual Property block firms suggest

the emergence of a new international division of labour involving the Indian software industry. Shri Parthasarathy and Mr. Aoyama recognize, though, that what is beginning to happen in Bangalore need not automatically happen elsewhere in India. In Bangalore the simultaneous maturing of local expertise, the return of NRIs, the limits of MNCs, and the current technological capabilities of the software industry have all contributed to the signs of transformation in Bangalore's software industry. These conditions may not exist elsewhere. The continuation of the trend within Bangalore too cannot be taken for granted. It is not clear to what extent the growth in the R&D services segment of the software industry is based on a cost advantage. And if it is a substantial factor, will the advantage remain with rising wage costs as well as the increasingly expensive infrastructure in the city? Recent evidence from Bangalore suggests that the Indian software industry is able, and willing, to step out of the low-cost, low-skill comfort zone it has grown up in. Whether it has the resilience to maintain high growth rates at the technologically more advanced end of the global software market remains to be seen.

(*The Economic Times*, 15 January 2007)

FEEDBACK

Dear Readers,

Indian Institute of Foreign Trade (IIFT) in collaboration with Department of Scientific & Industrial Research (DSIR) brings out bi-monthly Newsletter, *Technology Exports*.

The Newsletter aims to familiarise trade & industry with the latest happenings and to bring out the policy analysis in the field of technology exports.

We have received encouraging responses from Indian missions abroad, embassies in India and trade & industry. Words of praise, especially coming from various Indian missions have been extremely fulfilling and inspiring for us.

While positive responses are highly encouraging, we believe continued "Readers' Feedback" will be the key factor not only for improving the contents but also for maintaining sustained interest.

Therefore, we at *Technology Exports* welcome Readers' valuable suggestions, inputs and constructive ideas. We would appreciate receiving specific information such as lead articles, exportable technological developments, achievements in technology related exports, etc., for publication in the Newsletter. Such information may be addressed to: Editor, *Technology Exports*, Indian Institute of Foreign Trade, B-21 Qutab Institutional Area, New Delhi-110 016.

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REVIEW ARTICLE

High Tech Indicators: Technology-Based Competitiveness of 33 Nations – 2005 Final Report by Alan L. Porter, J. David Roessner, Nils Newman, Xiao-Yin Jin and David M. Johnson from TPAC website, Georgia Institute of Technology.

The HTI 2005 report by the Technology Policy and Assessment Center (TPAC), Georgia Institute of Technology, most recent in a series that started in 1993, compares the technological competitiveness of the following 33 nations:

- *North America* – United States, Canada, Mexico
- *Latin America* – Argentina, Brazil, Venezuela
- *Europe* – Czech Republic, France, Germany, Hungary, Ireland, Italy, Netherlands, Poland, Spain, Sweden, Switzerland, UK
- *Asia* – China, India, Indonesia, Japan, Malaysia, Philippines, Singapore, South Korea, Taiwan, Thailand
- *Others* – Australia, Israel, New Zealand, Russia, South Africa

Their competitiveness is measured based on a number of “High Tech Indicators” (HTI) comprising both statistical data (S) and data from a survey of experts (E). The HTI model identifies four “Input” indicators and one “Output” indicator listed below:

- National Orientation (NO), reflecting a nation’s directed action towards technological competitiveness.
- Socio-economic Infrastructure (SE), meaning the social and economic institutions that support and maintain resources of a modern, technology based industrial nation.
- Technological Infrastructure (TI) is institutions and resources contributing towards capacity building to develop, produce, and market new technology.
- Productive Capacity (PC) is the physical and human resource efficiently devoted to manufacturing products.
- Technological Standing (TS) is the “output” factor, indicating recent overall success in exporting high technology products.

The component measures of each indicator are scaled from 0-100. For certain purposes, the report also average the input indicators.

The HTI 2005 report is markedly significant, the authors indicate, as it presents Statistics-only (S) indicators separately along with the Traditional Statistics-Expert opinion combination (T) for comparison, thereby attempting

a smooth transition towards presenting a purely statistical formulation rather than the traditional Statistics-Expert opinion combination in all future reports.

The report presents a comparative analysis of (T) and (S) value for each indicator. The (T) value of National Orientation (NO) shows Sweden as the leader, and Russia, Indonesia, Argentina and Venezuela as laggards. The (S) indicator shows big differences in position for countries like Canada and Israel. India’s score in both (T) and (S) indicators at 61.6 and 56.8 respectively remain low compared to the leaders.

Socio-economic Infrastructure (SE) indicator exhibits Israel, US, UK, and Sweden as the cluster of leaders in (T) scores, and a double digit decline for Israel, Malaysia and Singapore in (S) scores. India has a poor standing in both the (T) and (S) value. Further, in one of the three components of SE - educational attainment (the other two being foreign direct investment and market attractiveness) it remains a laggard along with South Africa and Indonesia.

The (T) value of Technological Infrastructure (TI) shows the US, China, Japan, and Germany as leaders, while in (S) indicator values China and Germany score comparatively lower. India also shows a massive decline at 2.7 in the relative (S) indicator, compared to its 43.2 (T) value. In Productive Capacity (PC), Japan nudges out the US for the lead, followed by Germany and China. In the (T) value of (PC), China, India, South Korea, Mexico, UK, and Hungary show perceptible increasing trends, while Ireland and the UK suggest negative trends. Technological Standing (TS) shows the two erstwhile leaders US and Japan as having slipped to a certain extent, despite the US being a leader in the individual indicators. This signifies that on this consistently measured time series from 1993 to 2005, other countries have gained more relative to the US. The most stunning gain in (TS) is by China, with a massive leap to the league of US, Japan, and Germany. In fact, China supplants Germany in third position to be one in “Big 3”.

Given the context, the report is an effective tool for Indian analysts and business enthusiasts. In its 1993-2005 Time Series Figures (a collective view of growth over this period) it paints a bright picture for India’s overall future, with increasing average yearly growth of 1.8 per cent, (China’s is 3.2%) compared to other countries at 0.05. China and India also record significant percentage gains at 38.4 and 21.8 per cent respectively. Overall, India shows a decline in (NO), consistent increase in (SE) and (TS), and impressive increase in (PC).

– *Santana Pathak*

TECHNOLOGY/PROJECT OFFERS

LIST OF SELECT EXPORTABLE TECHNOLOGIES/PROJECTS FROM SMEs IN GUJARAT AND RAJASTHAN STATES OF INDIA

| <i>Sector</i> | <i>Technology/Project offered</i> | <i>Name of company</i> | <i>Value of offer*</i> |
|--|---|--|------------------------|
| Chemicals | 1. Mineral Water Production and Bottling Plant | Gujarat Ion Exchange and Chemicals Ltd., Ahmedabad | US\$0.14 mn |
| | 2. Multiple Effect Evaporation Plant | VG Engineers Pvt. Ltd., Vadodara | US\$ 0.20 mn |
| Engineering | 3. Manufacturing of Compact AC Geared Motors | Manu Engineering Works, Ahmedabad | US\$0.156 mn |
| | 4. Manufacturing of High Speed Energy Saving Aluminium Plug Type Spindle | M K Brothers Manufacturer Pvt. Ltd., Ahmedabad | US\$0.22 mn |
| | 5. Plant for Manufacturing Surface Grinding Machines | Pinnacle Engineering Enterprise, Surendranagar | US\$0.22 mn |
| | 6. Rolling Mill Plant for Manufacture of M.S./S.S. Structural | Roll Tech Engineering Pvt Ltd., Ahmedabad | US\$1.73 mn |
| | 7. Manufacturing Plant for Fire Fighting Equipment | Devraj Engineers, Kalol | US\$0.13 mn |
| Food and Agro | 8. Turnkey Project for Modern Rice Mill | Chintan Industries, Ahmedabad | US\$0.44 mn |
| | 9. Turnkey Project for Refined Edible Oil | Patel Engineering Works, Junagadh | US\$3.26 mn |
| | 10. Plant for Chocolate Wafer Biscuit | Bharat Engineering Company, Marwar | US\$0.74 mn |
| | 11. Plant for Sesame/Jatropha/Neem Seed De-hulling | Forsberg Agritech (I) Pvt. Ltd., Vadodara | US\$0.31 mn |
| Pharmaceuticals & Biotechnology | 12. Manufacturing Plant for Enzyme, Haemostatic and Anti Asthmatic Pharmaceutical Formulations | Mercury Laboratories Ltd., Baroda | US\$8.0 mn |
| | 13. Plant for Freeze Drying of various Biological Products including Fruits & Vegetables, Medicinal Herbs, Extracts, etc. | Gujarat Aqua Industries Ltd., Ahmedabad | US\$1.50 mn |
| Plastics | 14. Extrusion Plant for Manufacture of Plastic Monolayer Film/Sheet | Rajoo Engineers Ltd., Rajkot | US\$0.29 mn |
| | 15. Plant for Synthetic Leather | Sonraj Industries, Rajkot | US\$0.42 mn |

* Value is excluding cost of land & building.

- Notes:**
1. The above list is an extract from the "Report on Profiles of Exportable Technologies from SMEs in Gujarat and Rajasthan States in India" prepared by GITCP, Ahmedabad for DSIR, Government of India, New Delhi.
 2. For any enquiries, please contact : spagarwal@iift.ac.in, ashwani@nic.in