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# From the Chairman



The Indian Economy, according to latest figures, attained a robust GDP growth of 9.4 per cent in 2006-07. This is the highest GDP growth seen by the country in the last 18 years. The services sector grew by 11 per cent, industrial sector by 10.9 per cent and agricultural and allied sectors registered 2.7 per cent growth. The growth in the manufacturing and construction sectors was 12.3 per cent and 10.7 per cent respectively.

According to the World Bank's Global Economic Prospects Report, 2007, 'the developing economies are projected to grow by 7 per cent in 2006, more than twice as fast as high income countries, whose growth is around 3.1 per cent'. All developing regions are growing about 5 per cent or more. It has been said that over the next 50 years, the BRIC economies could become a much larger force in the world economy. According to a recent update, India will overtake the G-6 economies

faster than envisaged earlier and India's GDP, in US dollar terms will surpass that of the United States before 2050, to make it the second largest economy.

In 2006-07, the Indian demand for petroleum products recorded an year-on-year growth of 5.9%. This may seem like an aberration to the historic data, but it takes the average growth in consumption of petro-products to 3.4 per cent over the last five years. The current fiscal is projected to witness an increase in demand of petroleum products by 4.4 per cent.

India's imports of crude oil, however, continue to go up. On the other hand, the price of the Indian crude basket around mid-June touched the highest level so far in the current fiscal of \$69.28 per barrel. At the same time the oil marketing companies continue to suffer an under recovery of Rs. 5.04 per litre on petrol and Rs. 3.80 per litre on diesel apart from losing Rs. 14.65 per litre on kerosene & Rs. 162 per cylinder of LPG. While it may be necessary to curb inflation, our not having market determined petro-product prices is aggravating complacency and diminished efforts towards energy conservation and efficiency enhancement besides an

impending slow down in the rate of growth of the Indian hydrocarbon sector.

A PetroFed study of 'macro-economic impact of high oil prices' had last year concluded that in case the Government restricts the pass through of world oil price increase to the domestic economy, it stands a very high risk of jeopardising the fiscal position. It had said further, that the deteriorating fiscal deficit would lead to a contraction of the economy risking the health of the economy for future growth. A weakened petroleum sector and the industrial sector, it said, would lead to dampening of investment sentiment leading to a very negative situation for a growing economy like India. Indian exploration companies are already facing the heat of shortage of drilling rigs. It has been estimated that the number of rigs used in India fell to 81 in May from 86 in January and the number of offshore rigs fell to 27 from 32 in January '07.

As it is, India, as the world's sixth largest energy consumer is in a more vulnerable situation as compared to its peers. For example, crude oil imports account for well over two-thirds of India's requirement, while China imports a third of its crude oil consumption.

Furthermore, China's proven oil reserves stand at 18 billion barrels compared to 5 billion barrels in India. The BP Statistical Review of World Energy 2007 has forecast that India's oil reserves would last over 19.3 years at current production levels. Last year, the same study had said that the country's reserves would last about 20 years. Thus a review of domestic petro-product pricing and subsidies is overdue.

The world's growing concern for the environment has never been in such sharp focus as today. The futures of hundreds of millions of people across the world will be affected by declines in snow covers, sea ices, glaciers, permafrost and lake ice according to a report launched to mark World Environment Day. An estimated 40% of the

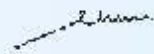
world's population could be affected by loss of snow and glaciers on the mountains of Asia according to the UN Environment Programme report.

A total meltdown of the Greenland ice sheet would trigger an estimated seven metre rise in sea levels. Just a 20 per cent melting of Greenland and 5 per cent melting of Antarctica would result in a four to five metre sea level rise. Based on today's population a one metre sea level rise would, without adaptation measures, expose some 145 million people to flooding, with Asia most affected. Areas of concern include many small islands and populations living in the mega deltas of the Ganges-Brahmaputra, the Mekong and the Nile in Africa. Low lying Bangladesh is singled out as a

country of particular concern, in the UNEP report.

At the same time global atmospheric concentrations of carbon dioxide, methane and nitrous oxide have increased markedly as a result of human activities since 1750 and now far exceed pre-industrial values. The global increases in carbon dioxide concentration are due primarily to fossil fuel use and land-use change. Eleven of the last twelve years rank among the twelve warmest years in the instrumental record of global surface temperature since 1850.

The message is clear -- reduce fossil fuel usage and adopt environment friendly technologies for a better planet.



S. Behuria  
Chairman

### Youngest Billionaires

The average age of the world's 946 billionaires is 62, close to retirement, but a handful get to enjoy the trappings of wealth well before crow's-feet set in.

Thirty-three of this year's billionaires—a mere 3% — are

under the age of 40. Their combined net worth is \$118 billion, giving them an average net worth of \$3.6 billion, on par with their grayer counterparts.

The youngest billionaire in the world is German prince Albert von Thurn und Taxis. The 23-year-old monarch first

appeared briefly on the list at age 8, the year his father died, making him the youngest billionaire ever on our list. He didn't appear again until age 18 when he officially inherited his fortune.

*Courtesy: Forbes*

# DG's Report



After more than one year of the enactment of the Petroleum & Natural Gas Regulatory Board Act 2006, the Board is finally in place. Even as this edition goes for printing, all the members have yet to join. The Chairperson of the Board, Shri L. Mansingh and two members have joined. PetroFed welcomes this development and it is hoped that it will augur well for the growth of the Indian oil & gas industry. PetroFed, on its part, has already submitted industry views on both oil & gas regulations to the Government and the Board for consideration.

Fossil fuels have come in for severe criticism in the recent past as harbingers of global warming. According to the International Centre for Integrated Mountain Development (ICIMD), the Himalayan glaciers could disappear within 50 years because of climate change with far reaching implications for more than a billion people living in the region. In the past

30 years, global warming has pushed up the temperatures of the Himalayas by upto 0.6 degrees Celsius. The Earth's temperature has increased by an average of 0.74 degrees celsius over the past 100 years.

ICIMD has noted that thousands of glaciers in the Himalayas are the source of water for nine major Asian rivers whose basins are home to 1.3 billion people from Pakistan to Myanmar including parts of India and China. Rapidly melting glaciers will have an adverse impact on biodiversity, hydropower, industries and agriculture and make the region dangerous to live in. At the same time global average sea levels rose at an average rate of 1.8 millimetre per year over 1961-2003. The rate was faster over 1993 to 2003 at about 3.1 millimetre per year.

The European Union launched a carbon market to try to make low-carbon sources of energy like gas, wind, biomass and nuclear more competitive against high carbon coal. The problem is that soaring oil prices have dragged up gas prices making coal cheap by comparison. Energy price rises have driven more investment into coal and coal to liquids than into renewables. The EU market has given utilities most of the emissions rights they need for

free and allowed them to pass on these non-existent carbon costs to the power consumer, further diluting the effect of the carbon price on dirty generations. You can have carbon at 50 Euros (US \$ 67.15), but as long as the power price makes it worthwhile to burn the coal and buy the emissions, then that will happen according to traders. The European Union has already declared to cut Greenhouse Gas emissions atleast 20% by 2020.

According to Government figures, in Britain last year 37% of power was still generated by coal compared with 36% by gas and 18% by nuclear. On the other hand gas-fired generation emits 0.40 tonnes of carbon dioxide per megawatt of generation compared to that of coal fired of 0.90 tonnes. Carbon emission rights for 2008 delivery are now trading at around 21 Euros per tonne. Even in India the power sector's preference for coal-based plants may eventually change as stricter norms for carbon emissions emerge. According to a recent report by Tata Strategic Management Group (TSMG), quoted by a leading newspaper, if the cost of carbon emissions is factored in the delivered cost of power from gas-based generation becomes preferable to non-pithead coal, if emission cost

exceeds \$ 15 per tonne of carbon dioxide. PetroFed has undertaken a study in association with TERI which will internalise the environmental impact of various fuel options for power generation and delivery.

As a follow-up on PetroFed Study 'The Green Imperative-Future of Natural Gas in India-2030' a paper was submitted to MoP&NG on Government actions required for gas market development in India. Significant industry issues pertaining to:

(a) benefit of deduction under Section 80-IB(9) of the Income Tax Act for lack of clarity in the definition of mineral oil,

(b) broadbanding of the definition of 'capital goods' to include capitalized cost of pre-production activities in E&P sector to enable avail short

term ECBs and trade credits, have been taken up with the Government.

A presentation was made by a PetroFed-led industry team before the Commissioner, CBEC on resolution of classification of dispute on Central Excise Duty on Naphtha at the behest of CBEC. The matter is under consideration.

PetroFed led an industry delegation to the St. Gallen Symposium, Switzerland where Chairman PetroFed and IndianOil delivered a keynote address. After providing inputs to the National Petroleum Council, USA for their study on Global Oil and Gas Supply, a PetroFed delegation attended the first meeting of the Co-ordinating Sub-committee at Washington DC. PetroFed also actively associated in discussions on data quality, its collection and reporting in the

hydrocarbon sector, in accordance with the MoU between Energy Information Administration (EIA), USA and the Government of India, with Petroleum Planning Analysis Cell (PPAC) as the nodal agency.

While PetroFed continues its efforts for the healthy growth of the Oil and Gas industry in India the country cannot shy away from the fact that cleaner technologies for sustainable development are becoming an increasing necessity. We need to align our long term policies on these lines, while retaining focus on energy security. Corporates also would need to augment attention towards affirmative social responsibility and set benchmarks for Corporate Governance.



A. K. Arora

### Snippets

It is often more cost-effective to invest in end-use energy efficiency improvement than in increasing energy supply to satisfy demand for energy services

*Intergovernmental Panel on Climate Change, Fourth Assessment Report, Working Group III, May 2007.*

Renewable energy and energy efficiency technology industries set a new record of more than \$100bn worth of financing transactions over the course of 2006. Of this, \$70.9bn was new investment,

an increase of 43% on 2005, while \$29.5bn consisted of M&A activity, leveraged buyouts and refinancings of assets.

The biggest growth has been in public markets and venture capital/private equity investment activity, which increased by 141% and 167%, respectively. Asset financings grew at a more sedate 22.9%.

This healthy investment environment bodes well for the continued growth of the sustainable energy sector. The report provides an overview of different types of capital flows

and an analysis of the trends in sustainable energy investment activity in OECD and Developing Countries. report provides an overview of different types of capital flows and an analysis of the trends in sustainable energy investment activity in OECD and Developing Countries.

The information is intended to be a strategic tool for understanding the status of the sustainable energy sector's development and for weighing future public and private commitments to the sector.

*Courtesy - United Nations Environment Programme (UNEP)*

# CEO Speak



*Vimal Kapur  
Managing Director  
Honeywell Automation India Ltd.*

It is indeed a great opportunity & pleasure to share some thoughts in this issue of Petrofed.

Our country is going through a rapid phase of growth with all industrial sectors growing rapidly be it Oil and Gas, Refining, Metals or Power. For organizations today, facing ambitious growth targets, the focus is on maximizing the growth opportunity in this phase. While challenges of growth differ from industry to industry and organization to organization, the one common challenge which all of us face is shortage of skilled/talented manpower. It is indeed ironical that searing growth should throw up shortages in manpower resources. Five years ago, the nation was bemoaning lack of jobs for qualified youth; now the tables have turned and a thriving economy is suddenly searching for skilled labour.

As the market expands there is a serious dearth of

qualified experienced personnel. What has created this big vacuum is the recent surge in demand not just for qualified engineers, but also for finance, marketing, commercial, IT and HR personnel. When my global counter parts in Honeywell hear this, they are surprised at this scenario as we are perceived to be a country of a billion people with the largest resource pool of technical manpower. So why is Manpower shortage a worrying trend? What is the root cause of this and what we can all do to reduce this if not eliminate this altogether? Let us look at factors which is causing this huge shortfall

## Rise of new growth sectors

Previously, the career options for an average professional was restricted to “traditional sectors” like Process industry, construction etc. The rise of new sectors like Telecom, Auto, IT and Retail, all with dizzying growth rates, have become equally attractive options for professionals. Traditional sectors seem to have lost their sheen with the perception being that the new sectors offer lucrative and comfortable jobs

## Global companies making India their base

With fortune 500

companies like IBM, Accenture, EDS, SAP, Dupont, Nokia etc setting up their global centers for R & D., Product development, sourcing and operations each employing more than 10,000 engineers, the demand for skilled professionals has become all the more acute. These companies offer world class work environment and challenging job assignments.

## High growth in India and abroad

A very high growth target for all Indian companies translates into adding manpower at the rate of their growth. As growth rates have doubled if not more, we need double the number of people we required 10 years back.

Another important factor fuelling the demand for skilled talent is global job opportunities outside India specifically in the Middle East. While India is growing so is the Middle East and due to this the Oil industry is losing large manpower to various countries across this region. Indian companies also find it difficult to retain talent, with companies in the Middle East offering higher and tax free salaries

High urbanization of India. 15 years back the quality of life

in an industrial township or army cantonment was considered to be better than in cities like Delhi, Pune and Hyderabad. But with India's large young and aspiring population, people these days yearn for a lifestyle that includes malls, multiplexes, infrastructure like roads etc, that are offered only in these dream cities. This throws up a huge challenge in attracting young people to work in remote areas where most industrial plants are located

While we can count on and on, listing all the reasons for the talent shortage, the fact is that none of these macro trends are going to change for the next few years and the problem would only become more acute. So the only option industry has is to realize this and work towards a world where 15% attrition would be a great relief.

The impetus is now on the HR organization to develop new strategies across the spectrum to not only hiring the best and the brightest but also retaining them. Traditional companies that once had their pick of talented new recruits now have to compete in an aggressively entrepreneurial climate and must even fight to keep their own people. Companies are re-thinking their relationships with their employees in order to attract and keep talented people. Clearly, the leadership and management of every organization need to spend far

higher time (upto 30%) on the HR front if we want to overcome this challenge.

The HR division has to re-align itself towards Talent Management and ask itself the following questions:

1. How do we hire better people
2. How do we give them challenging roles
3. How do we develop people with right technical and leadership skills
4. How do we give them compensation and benefits aligned with performance
5. How do we have a well defined reward and recognition system
6. How do we develop succession plan for key roles
7. How do we have systems which bring transparency and consistency
8. How do we keep people constantly motivated and drive them to deliver higher performance

The organizations which are making faster progress towards addressing these questions are clearly ahead of the others.

Finally we have to be open to new ways to working and use the age old framework of Reduce, Redesign and Restructure the work. The framework if effectively

deployed would make us more efficient and reduce the dependence on manpower both in quality and quantity.

- Reduce requires us to eliminate the activities that may have become redundant over a period of time.
- Redesign requires us to automate processes using technology ( IT, telecom), tools ( Six Sigma, Lean, TPS) and training ( like use of simulators to train operators)
- Restructure requires us to consolidate the organization and outsource the tasks which are non core or where the organization finds it hard to retain people

The challenge to attract and retain the best talent has just started. The lack of a well-trained work force could be the biggest deterrent to India's economic growth. The economy will sooner than later pay the price for this neglect as growing demand for skills finds outlets elsewhere in the globalized market place. The first signs are already upon us with a few IT companies locating some activities in the newly emerging economies such as the Philippines, and even in North Africa. But that is a long-term solution; right now the need of the hour is creative, out of the box solutions to help stave off what threatens to become the biggest deterrent to future growth.

# IT Effectiveness for Oil & Gas Industry



*Partha S Banerjee Partner,  
Performance Improvement Practice  
PricewaterhouseCoopers Pvt Ltd*



*Sachin Singhal Consultant,  
Performance Improvement Practice  
PricewaterhouseCoopers Pvt Ltd*

Information Technology (IT) has become critical to the operations and competitiveness of organizations around the world. Significant investments have been made into IT infrastructure and systems which are yielding due results and benefits. These IT systems are mainly implemented for managing, monitoring and improving process and operations.

While achievement of stated objective is of one the common benchmark for

determining the success of IT implementation / project; with the increasing cost pressures, IT Managers across the industries are now striving to further refine the definition of applicable success parameters. Effective management of IT is under the spotlight because IT is now among an organization's top five expenditures, yet research reveals that an average of 10 to 25% of a company's total IT spending is wasted or used unwisely.

This feature aims to initiate an introductory discussion for developing IT Effectiveness framework for the Indian Oil & Gas Industry. A subsequent article, based on primary study of organizations in India, shall bring out the IT effectiveness assessment in the industry and steps taken by the industry leaders to improve the same.

## IT Effectiveness

CIOs, IT managers are now looking at IT Effectiveness frameworks as a tool to manage the IT objectives, roadmap, systems, assets and expenditures. Key areas of focus in IT Effectiveness framework are:

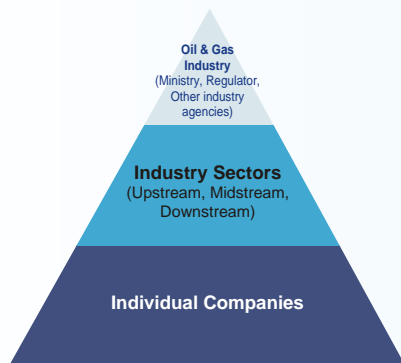
- Defining IT organization to support business requirements

- Alignment of IT to the business needs (at all levels strategic, regulatory compliance, tactical and infrastructural)
- Making IT integral to the larger business enterprise
- Ensuring IT projects are completed on-time, on-budget, and deliver the expected benefits
- Including IT due diligence activities for mergers and acquisitions
- Efficacy in management and sourcing of IT services
- Spending the right amount of money on IT

Effective IT organizations help the company manage its overall risk, rationalize costs throughout the business, and create benefits for the entire organization. In addition, an effective IT organization aligns itself with the business, governs itself effectively, operates efficiently, and measures its performance in business terms.

## IT Effectiveness for O&G Industry

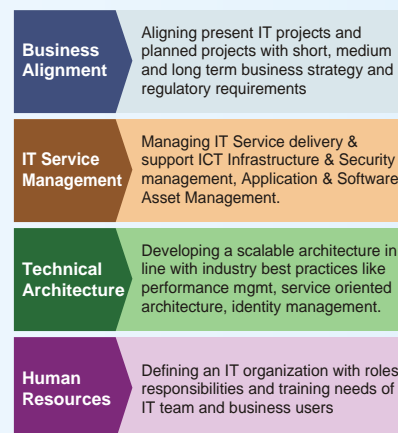
For the Indian Oil & Gas Industry, IT Effectiveness shall be assessed at three levels.



- Effectiveness of IT Systems (regulatory and compliance systems, policy formulation and document management, data management and reporting) at the central bodies and organizations driving the Indian O&G Industry. This shall include government departments, central

bodies like regulatory body, data management commissions like PPAC, national agencies like Petrofed.

- Effectiveness of information and knowledge sharing systems at the Industry Sectors like upstream, midstream and downstream
- IT Effectiveness framework for Oil & Gas companies shall cover all processes and information flow across the value chain of the company. This shall be based on following components.



For O&G companies which have made significant investments in ERP and bolt-on applications, messaging and enterprise wide network systems, servers and helpdesks, ITIL readiness assessment can be a first step in the direction.

## Case Study - Assessment of large US Refinery

From a recent short period assessment. of existing operating environment and IT Management process of a large US refinery, the following key messages were highlighted:

### The IT management processes needed to be rebuilt

- No consistent set of measures, lack of standard definitions, incomplete deployment and variability in usage.
- Little to no use of leading indicators and lack of a clearly defined review process for driving action.
- Reporting activities included redundant, manual efforts which prevented timely delivery and were hindered by a proliferation of disparate systems and databases.

### Poor cost & investment planning processes will hamper future performance management efforts

- Remediation is critical to improve data quality for reliable management information.
- Weaknesses in cost controls over allocation, accruals, and timeliness.
- Overall lack of clarity & control in the investment management process.

### Systems lack functionality and integration to enable effective performance management

- Numerous SAP implementation issues impeding cost management and controls.
- Other non-SAP system and process limitations were found, which cause employees to create private databases to analyze data and create reports. Often these are redundant with the site's systems of record.

## Select List of IT Performance Measures from PWC Publication

Insights from Global Best Practices

### IT Performance measures

IT structure, strategy and support	Systems environment	Cost statistics
IT organizational structure IT users by usage frequency Number of IT user sites Internal end-user support structure Committed response time Call resolution time User rank of IT support and cost User satisfaction measurement methods IT strategic plan IT outsourcing and joint venture rules Top IT priorities	Degree of software customization Legacy system as a percentage of total systems Number of software applications by functional area Number of hardware manufacturers Number of software manufacturers Workstation connectivity Existence of Enterprise Resource Planning (ERP) system Functional areas using ERP systems ERP systems satisfaction level Hardware average age Software average age	Total IT cost as a percentage of revenue Total IT cost per IT user Total cost per IT FTE IT cost by cost category IT cost per system IT funding mechanisms  <b>Control and security</b> IT policies and procedures User compliance to hardware standards Data protection activities Acts of financial loss

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# LP Gas: Modern Energy Anywhere



*James Rockall  
Managing Director  
World LP Gas Association.*

LP Gas has been described by many as a unique fuel. Some have even described it as a gift from nature: providing efficient, clean and modern energy that can be transported like many traditional fuels. This means that it can provide the benefits of modern energy such as natural gas without incurring the associated high infrastructure costs. This makes LP Gas the ideal fuel for the developing world, where economic development and personal income growth far outpace the growth in modern energy infrastructure.

With these qualities, it is perhaps unsurprising that the demand for LP Gas is increasing rapidly in India, and Asia more generally. As an industry we need to make sure that during this growth demand, safety remains paramount and businesses continue to adhere to good practices in both the area of safety and correct and ethical business practices.

A closer look at the advantages of LP Gas reveals why it is becoming so popular. It is available; acceptable and accessible the three critical prescriptions described by the World Energy Council in their landmark 2000 statement on "Energy for Tomorrow's World"

Derived from natural gas and oil production, LP Gas will remain an available fuel for many decades to come. Already with a consumption in the world equivalent to approximately 42% of global hydro-electric power consumption, or 40% of global nuclear power consumption, LP Gas can be considered a major global energy carrier. With a forecast increase in production of natural gas and oil of some 60% by 2030, we can be confident in a similar increase in supply of LP Gas.

LP Gas is most certainly an acceptable fuel. It is clean burning and has recently received a strong endorsement from the World Health Organisation who has highlighted LP Gas as the COST EFFECTIVE solution for reducing pollution from cooking fuel in the developing world. Notably, the World Health Organisation recommends that much of \$13 billion be invested annually in providing LP Gas access.

Because of its portability, LP Gas can deliver rapid access to modern energy. It can be easily transported in cylinders. These can be stored indefinitely and used virtually anywhere from urban centres to remote regions when and where costly, grid-based energy services are unavailable. In the developing world this makes LP Gas a uniquely valuable fuel. Where personal income growth exceeds the rate at which grid-based energy systems can be installed, and where a large proportion of the population live in rural areas, LP Gas presents the most practical

solution to modern energy provision. There is a strong correlation between access to LP Gas and socio-economic development and therefore countries in growth will be able to support that growth, particularly in the rural areas, by encouraging and supporting access to LP Gas.

The fastest-growing use of LP Gas in the world in the last decade has been as an automotive fuel. Auto LPG or autogas can bring rapid improvement to air quality with low infrastructure investment and simple engine conversions. Cleaner air is an imperative in many big cities around the world. For example, in 1995 the World Bank estimated that ill-health caused by vehicle particulate pollution resulted in at least 500,000 premature deaths and 4-5 million new cases of chronic bronchitis. The World Health Organisation states that Exposure to airborne fine particulates results in the premature death of around 288,000 people every year in Europe alone.

A WLPGA study recently estimated that a pragmatic switch to gaseous fuels (both LPG for light and medium duty vehicles and CNG for heavy duty vehicles) could leave to a saving in social and health costs of more than \$1 billion per year per million vehicles in a typical Asian city.

One mis-perception of Auto LPG relates to safety. If the appropriate safety controls are in place and if equipment is manufactured according to accepted standards, autogas can be safer than other traditional fuels.

- Autogas tanks are manufactured to stringent standards they are 20 times more puncture resistant than typical gasoline tanks.
- Fuel delivery systems contain pressure regulators and safety valves ensuring containment in case of rupture.
- A risk assessment by a leading Dutch institute concluded that modern autogas vehicles are safer than gasoline vehicles
- A Belgian research organisation demonstrated that the risk of tank rupture is higher with gasoline than with autogas
- In the US, autogas is a popular fuel for the school bus what better endorsement of the autogas safety record?

As we have seen, LP Gas has many advantages, however, as with any fuel; LP Gas needs to be handled in an appropriate way to reduce the possibility of an accident. Although safety can be measured through tools such as quantitative risk assessment, generally people determine what is safe for them based more on the magnitude of a possible accident rather than a rational consideration of the risk. As an example; what is safer, travelling by plane or by car? It is a fact that flying scares many people because of the dire consequences of an accident, yet those same people wouldn't think twice about driving a car an activity with a far greater risk.

For this reason it is imperative for companies operating in the LP Gas business do their utmost to achieve safety, not only in

production, transportation and distribution but in consumption as well. A good reputation can take a long time to develop. It comes from an absence of incidents and creates trust between customers and suppliers. A publicised accident can rapidly reverse years of good performance and the reputation of our product can be damaged.

With more than 80 years of experience, the LP Gas industry has developed minimum standards of good practice. These are details in two publications of the WLPGA entitled "Guidelines for Good Business Practice in the LP Gas Industry" and "Guidelines for Good Safety Practices in the LP Gas Industry". These publications detail the responsibility of both the industry and the government in ensuring consumer and employee safety. Specifically, the industry should:

- Provide a safe, dependable energy to it's customers
- Provide suitably trained staff
- Operate its plants, transportation and equipment in a safe manner
- Treat employees and customers fairly
- Operate its business ethically
- Cooperate with local and national officials

If adhered to, Good Practices benefit everyone: They help achieve public interest goals, attract customers and minimise regulatory interventions

The government has a vital role in two areas:

### 1. Elimination of Bad Practices. For example:

- Ensuring adequately designed and constructed infrastructure
- Not allowing unauthorised premises to operate
- Enforcing the correct practices regarding cylinder management.
- Eliminating the illegal use of domestic cylinders in autogas installations
- Ensuring correct maintenance is applied

### 2. Provide a competitive business climate. For example:

- Ensuring common rules are equally applied
- Defining the rights and responsibilities of all participants, including the customer
- Providing opportunity for financial return on investments
- Providing redress for those aggrieved by "bad" practices

LP Gas is a fabulous fuel. It does allow provision of modern energy quite literally anywhere and in a growing economy, the demand for LP Gas either as a cooking fuel, a heating fuel or as an automotive fuel, will increase and businesses will endeavour to meet this demand. Government and the LP Gas industry have an important role to play in ensuring a safe development of the market. The interest of the Government is to create an environment where customers and businesses benefit. The interest of the industry is to develop and retain satisfied customers. Only in such a situation can LP Gas markets be developed in a safe and sustainable way.

# Development of Alternative Fuels in India



*Mr. Bakhtiar Talhah,  
Director, PFC Energy*

From a slow start beginning in 2002, CNG, LPG, ethanol-blended petrol and biodiesel are gradually entering the mainstream motor fuels sector in India. Of these, auto CNG and auto LPG are more firmly on the growth path than the other two. The ethanol blended petrol program has gone through several starts and stops and finally began only toward end-2006. Biodiesel, on the other hand, is still in a very early stages of development as an motor fuel, with most manufacturers concentrating on setting up small trial capacities until the government commitment becomes clearer. At the same time, vehicle manufacturers are getting ready, conducting trial runs and developing engines that can run on biodiesel blends.

India's strong economic growth in recent years, coupled with rapid urbanization, has brought a host of problems associated with environmental pollution. The Supreme Court of India ordered the central government to establish emission norms for vehicles. As a result, leaded petrol was phased out in 2000; sulfur content in petrol and diesel is



*Sh. Vasant Lambu,  
Senior Consultant, PFC Energy*

being reduced in phases, from 500 ppm in 2005 to 150 ppm and 350 ppm respectively by 2010. In addition, benzene content in petrol starting with metropolitan areas was reduced. Finally, all Delhi public transport vehicles switched to CNG in 2002, triggering considerable initial demand for this alternative motor fuel.

## **CNG leads the way**

While a Supreme Court decision had forced state transport firms to convert to CNG, private vehicle owners and transport operators are switching to CNG purely on economic grounds. CNG is made available at highly subsidized rates and with duty waivers; in May 2006, Indraprastha Gas (the sole supplier of CNG and piped natural gas to Delhi) claimed that CNG is up to 70%, 40% and 56% more cost-effective than petrol, diesel and auto LPG respectively. Nonetheless, conversion to CNG has been somewhat restrained, mainly due to the lack of retail points, forcing users to queue up for long periods of time. The current storage and distribution facilities of CNG are not as highly developed compared to conventional motor fuels.



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Despite the flurry of activity in this sector, the volumes of natural gas imported have been cited as inadequate, prompting the Supreme Court to issue a court order to supply more CNG to major cities. The situation has improved considerably since, and many more CNG stations have been constructed. Nonetheless, India produces merely half the natural gas it consumes, and the government has acknowledged the need for more natural gas imports.

## **Auto LPG gaining momentum**

The use of LPG as a motor fuel was legalized in India from April 2000, but consumption has been curtailed by growing demand for residential use (over 80% of LPG is consumed by households). Oil companies, which have a near monopoly over LPG retailing, are facing immense government pressure to meet domestic LPG demand. Since 2005, auto LPG sales have been on a firm growth path and this business has been growing at well some 60-80% annually. It is expected to exceed 125 kt by the spring of 2007, with an estimated 94 kt having already been sold during April-December 2006. Although sales figures are still

small in absolute terms, the growing interest in auto LPG has interested oil-marketing firms.

The superb retail infrastructure of oil-marketing companies for the sale of petrol and diesel, and the number of bottling plants across the country, are very useful in building up the auto LPG sales -- an advantage the fuel has over CNG. With the restricted availability of CNG outside the major cities of Mumbai and Delhi, auto rickshaws in many cities have taken the auto LPG route. Before the end of March 2007, it was estimated that there would be nearly 250 retail outlets, compared to around 180 at the same time in 2006.

In all, more than 30 cities are now on the auto LPG map, and the oil marketing companies are adding to this number. Bangalore in particular, seems to be ahead of others in that most of its auto rickshaw fleet, numbering around 125,000, has converted to auto LPG. Four cities Chennai, Delhi, Kolkata and Mumbai currently have over 150 stations that sell auto LPG, accounting for over half of the auto LPG retail network. In addition, auto LPG is available in cities such as Hyderabad, Bangalore, Pune and Ahmedabad.

A major advantage of auto LPG is the already available infrastructure catering to distribute LPG to domestic consumers and commercial establishments. Local sources indicate that

establishing an LPG pump at a retail station costs around Rs 5 m (>US\$ 100,000), while LPG conversion kits cost some Rs 25,000 (>US\$ 500) each (a venture that has caught the attention of carmakers such as Hindustan Motors).

In Kerala, IndianOil plans to install auto LPG stations spanning the state. Meanwhile, private LPG marketers such as Elf Gas are also promoting LPG use in southern cities, and have appointed dealers to set up and operate LPG dispensing units. Elf Gas (a subsidiary of Total) plans to have about 50 such stations in south India in coming years. The completion of LPG cavern facilities at Visakhapatnam (in the second half of 2007, indicatively) through a joint venture between HPCL and Total will also enlarge the market reach of Elf Gas in the southern states. GAIL has tied up with HPCL for auto LPG promotion in Andhra Pradesh and has formed a joint venture company Bhagyanagar Gas Ltd.

Economics and politics will determine if auto LPG takes off as a viable alternative to conventional motor fuels and a formidable competitor to CNG. At the moment, it appears that CNG-fueled vehicles have the edge over LPG-fueled ones in the north, while auto LPG consumption appears to be concentrated in the south.

#### **Ethanol blended-petrol making baby steps**

In contrast to CNG and LPG, ethanol-blended petrol is still in a nascent stage of development, and thus heavily dependent on government policies and incentives.

The government has stipulated that from 1 November 2006, 5% ethanol-blended petrol (E5) is to be made available nationwide, and a 10% blend (E10) could be introduced in 2007 depending on initial results. With domestic petrol consumption amounting to some 8.5 mt in 2005, more than 400 kt of ethanol would be required for 5% blending. Ethanol manufacturers are confident of supplying about 370 kt of the product, but claimed that oil companies have yet to purchase ethanol in significant volumes. An agreement on pricing is vital for the ethanol program; and much will hinge on the response of ethanol suppliers to an invitation by oil companies to submit quotes via a national competitive bidding process.

#### **Biodiesel starts commercial run**

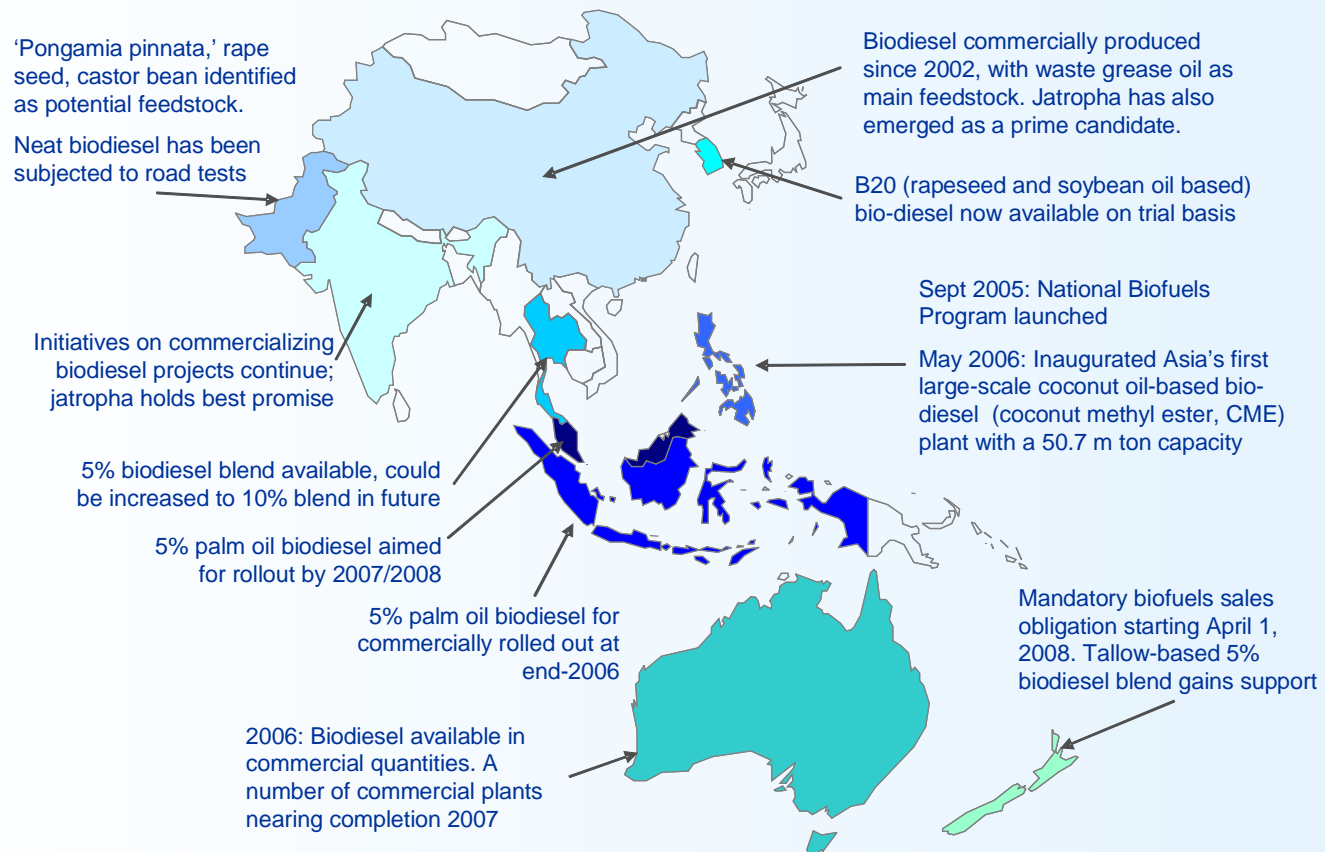
Biodiesel development is regarded as crucial in India, given the dominance of diesel as a motor fuel; the proposed 5% substitution of bio-component in diesel translates into a significant reduction in demand for conventional diesel. Private sector and government initiatives on commercializing biodiesel projects are ongoing, with various state governments and the central government announcing subsidies for the cultivation of biodiesel crops.

1. Conversion kits, which cost about Rs 21,000 (US\$ 457) for auto rickshaws and Rs 42,000 (US\$ 913) for cars, allow motorists to operate on a dual fuel system.
2. Gas dispensing units are dealers who stock LPG cylinders, which are then supplied to domestic households or fitted onto vehicles. On the other hand, BPCL, HPCL and IndianOil have installed auto

- LPG pumps at their retail outlets.
3. Ethanol is a by-product of India's sugar industry, and is traditionally used to manufacture 'extra neutral alcohol' for the potable liquor industry. Ethanol is also used by the chemicals industry as feedstock to manufacture acetic acid and its derivatives. Sugar cane cultivation and processing is

- predominantly operated by district and state level co-operative units, which are controlled by politicians.
4. The excluded states are Assam, Arunachal Pradesh, Jammu & Kashmir, Meghalaya, Manipur, Mizoram, Nagaland, Tripura, the union territory of Lakshadweep, as well as Andaman & Nicobar Islands.

## Biodiesel in Asia-Pacific

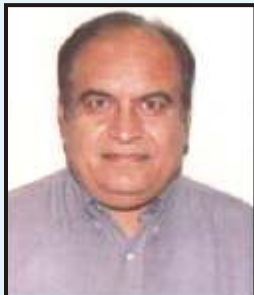


## Ethanol-blended petrol in Asia-Pacific

Country	Status
Australia	Voluntary ethanol blending of up to 10% in petrol
China	5 provinces (Anhui, Heilongjiang, Henan, Jilin and Liaoning) require ethanol blends of 10% in all petrol by end-2005. Gradual rollout to 9 cities in Hubei province, 6 in Hebei province, 7 in Shandong province and 5 in Jiangsu provinces
India	5% ethanol blend in all petrol required by November 2006; 10% blend could be introduced in 2007 depending on initial results
Japan	3% ethanol-blended petrol is legal; 7% ETBE-blended petrol introduced in April 2007
New Zealand	5-10% ethanol blend in petrol proposed, but faces resistance from the domestic automobile industry
Philippines	Planned minimum 5% ethanol blended petrol, rising to 10%. Remains uncertain if legislation will be voluntary or mandatory
Thailand	All petrol retailed in Bangkok must have a 10% ethanol component

Source: PFC Energy

# Marine Lubricants- A Perspective Comprehension



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Marine lubricant is an all encompassing industry parlance which comprises essentially lubricants for marine slow speed, 2-stroke, crosshead engines-the marine cylinder lubricants (MCL) and lubricants for main engine of the vessels-the system oils. However, medium speed 4-stroke trunk piston engine oils (TPEOs) for power generation applications are also often referred to as marine lubricants. The main reason for this misnomer is that often the original equipment manufacturers (OEMs) for both types of engines are the same and so are the approval procedures. Further, as long as the type and make of the engine is same, the same OEM approval is valid for both types of applications.

## **Marine Lubricant Market Potential**

Global marine oil market potential as per the latest estimates is around 2.1 million metric tonnes. Of this, around 55% account for marine cylinder and system oils and rest 45% for trunk piston engine oils. (Fig.1). Continental wise break-up (Fig.2) shows that far east and Asia (38%) followed by Europe and Africa (32%) are way ahead in marine oil consumption compared to North America, Latin America and Middle East. The Euro-Asian domination of marine oil consumption can be attributed to the larger dependence of these continents on their inland waterways for freight movement. In the advanced North America, preferential mode of freight movement, for example, is the much developed road ways and rail roads than their water ways. As far as marine oil suppliers are concerned-five global oil majors-BP-Castrol, Exxon Mobil, Shell, FAAM, Total-

Fina/Elf are having their own marine lubricant technologies - be it for marine cylinder lubricants or for trunk piston engine oil applications. All other oil companies in the world have been re-branding these technologies for their captive use. However, it is heartening to mention that Indian Oil Corporation Limited is the first ever Asia-Pacific Oil Company to have developed a full range of indigenous marine oil technology for both shipboard and power generation segments. Though no authentic industry figures are available, presently, the Indian marine oil market is estimated to be well above 50,000 kl/pa with TPEO vs MCL ratio is very much akin to that of global figure of 45:55.

## **Major Marine Engine Mix --- Global Scenario**

Among the global marine

engines, around 30% belong to 4-stroke medium speed diesel engine segment with rest 70% belonging to low speed, 2-stroke, crosshead engines. In the crosshead engine market (Fig.3), MAN B&W is the leader with around 66% of market share followed by Wartsila Sulzer (26%) and Mitsubishi (8%). In the 4-stroke engine market (Fig.4), there are several players like MAN B&W, Mitsubishi, Fuji, Allen etc. with Wartsila being the undisputed market leader with a staggering 53% of market share. In India also Wartsila leads the lot especially in powergen segment with more than 2000 MW of installed capacity.

#### Attributes Of Marine Lubricants

Trunk piston engine oils are essentially medium speed diesel engine oils which should be endowed with detergency, dispersancy, reserve alkalinity buffer, thermo-oxidative stability, anti-wear and anti-foam characteristics. Though, no universal specifications are in place to govern their performance credentials, API CF is the base line performance, one normally vouch for these oils. However, OEMs accord lubricant approvals only based on structured field trials generally spanning 4000 hours of actual operation. They are formulated in both SAE 30 and 40 viscosity grades and in the base number range of 10-55. Lower base number (BN) oils are normally for those engines, which are operating on distillate fuels

with a sulphur content equal to or less than 1%. Higher BN oils are used for those engines, which are operating on residual/furnace oils with higher sulphur content. Fuel sulphur content and age of the engine form the major selection criteria for BN and viscosity grade of TPEOs. However, of late, for modern engines with very low oil appetite, irrespective of the fuel sulphur content, higher BN oils are being employed to augment faster BN depletion arising out of higher residence time of the oil with minimal oil-top-ups.

As regards to marine cylinder lubricants, detergency, film strength, spreadability, liner wear protection are more important attributes. They are normally formulated to 70-80 BN to offer better corrosive wear protection to cylinder liners by neutralizing the acids being generated during bunker fuel engine operation. Preferred viscosity grade is SAE 50 to offer better film strength characteristics in elasto-hydrodynamic conditions. System oils are like rust and oxidation type (R&O) of oils, which are normally expected to be endowed with adequate detergency and bearing protection (towards corrosion) characteristics. They are also formulated in such a way to possess excellent water separation characteristics. They are circulating oils with 5 BN and SAE 30 viscosity grade. Cylinder and system oil approvals are also based on structured field trials for 4000 hours of operation.

#### Trunk Piston Engine Oils - Recent Trends

Four-stroke trunk piston engines, over the years, have undergone several design changes in terms of engine size, temperatures, peak injection pressures and introduction of anti-polishing or fire/flame rings. These changes coupled with deteriorating residual fuel quality owing to the advancement of refining technology by way of secondary refinery processes, made the lubrication of these engines a veritable challenge. Smaller size and higher temperatures enhanced the thermal stress on the oils. Oils should be robust over longer period of operation for oxidative degradation. Higher injector pressures increased the extent of raw fuel contamination thus causing the blackening problems more acute and prevalent. The high molecular weight polar aromatic asphalt of modern residual fuels, when comes in contact with engine oil, tend to plate out because of polarity difference, thus causing black deposits on the engine parts. Asphalt dispersion has become a bigger issue having direct bearing on engine deposits, centrifuge operation and filter life. So the new generation TPEOs should be in a position to effectively tackle fuel asphalt. Further, low Nox engine modifications and anti-polishing rings have pushed the engine oil appetites to incredibly lower levels. In the event of minimal fresh oil top-ups, base number of the existing oil is fastly depleting thus resulting in increased

sweetening or premature oil drain with respect to BN depletion. Hence, use of higher BN oils, irrespective of fuel sulphur level, has become the new trend.

### Marine Cylinder & System Oils - Recent Trends

Overall economics of marine propulsion operations in the shipping industry are very much dependant on the enhancement of time intervals between engine overhauls. Major engine down time is arising out of replacement of piston rings and to an extent to renew cylinder liners as they wear to the replacement limits. Marine ship engine manufacturers, over the years, have changed their engine designs to make them more fuel-efficient resulting in substantial increase of maximum combustion pressures and brake mean effective pressures. These higher pressures increase the load/stress on the cylinder lubricant films between piston rings and cylinder liners. At top end of the piston, these films further squeeze thus making them degrade faster, vaporize and form more deposits. All these consequences end up in one eventuality- cylinder liner wear or scuffing as a severe extremity. Cylinder liner wear, apart from combustion pressures, also depends on a variety of parameters like operational and liner surface conditions. From cylinder lubricant viewpoint, aspects like film strength, spreadability, viscosity at

surface and additive composition of the oil are of vital significance.

From formulation viewpoint, for years industry had coped up with cylinder oil formulations based on conventional chemistries. However, the new engine design and operational features pressed for more thermally stable formulations. The latest trend is marine cylinder oils fortified with extra anti-wear and Extreme Pressure additives for that extra bit of wear protection. System oils are also being looked for EP performance apart from conventional attributes in order to enhance their multifarious utility.

### IOC's Servo – A New Star On The Firmament Of Global Marine Lubricant Scenario

In the early Nineties, IOC R&D centre took up the project of developing indigenous marine lubricant technology. To understand the basic additive-additive interactions among the pre-dominant additive chemistries of marine lubricants, extensive basic research studies were conducted. Meaningful key additive synergies were worked out of the vast data thus generated. *Incorporating these new, innovative insights of basic additive action mechanism and structure-performance relationships, the first brick of prospective mega marine product series was assembled. Thus, came into existence the-first ever, home grown, Servo Marine XXXX*

*series way back in 1995.*

As a part of our brick-by-brick approach, we have first tested a 10BN formulation in a small 1000KV oil engine and got significant performance data reflecting the superior detergency and oil consumption features of the innovative formulation series. Encouraged by these results, we have undertaken a 4000 hours structured field validation exercise in a Wartsila Vasa 32 DG set (12V32, 3 MW). Based on the validation results, M/S Wartsila Finland approved this entire series comprising of 10-55 BN in their family of engines operating on both distillate and furnace oils up to their Vasa 32 LN make. Subsequently, Rolls Royce (UK) for Allen engines, MAN Holeby, Fuji etc have approved this series for use in their engines. *These efforts of IOC were recognized with the prestigious National Petroleum Management Programme (NPMP)'s highest award in the team category of creativity and innovation in the year 1997.*

As a part of our continuous on-going process of quality up-gradation, a new variant-Servo Marine K-series was subjected to field validation in a Wartsila 12V46 engine (9 MW). Based on the excellent performance, Wartsila, Finland recently accorded Servo Marine K-Series across-the-board approval for entire family of Wartsila and Sulzer trunk piston engine range operating on heavy fuels.

Making our forays into

marine shipboard segment, new additions of 5 BN and 70 BN grades to Servo Marine XXXX series were made to cater to the much intense shipboard applications. Subsequently, field trial clearances were obtained from MAN B&W, Denmark and Wartsila, Switzerland for trying out these new products in their respective marine 2-stroke engines. Field validation of Servo Marine 7050 and 0530 was initiated in a Shipping Corporation of India's vessel-M.T.Suvarna Swarajya fitted with MAN B&W 5S50MC 2-stroke engine. After 4500 hours of trial, Servo Marine 0530 and Servo Marine 7050 has been approved for use in MAN B&W 2-stroke marine engines globally in the year 2005. Quickly acting to

consolidate these superior findings, this newly developed Servo Marine oils were subjected to second field validation in a Wartsila-Sulzer 2-stroke marine engine in a much bigger ship (98,000 MT tanker capacity). 4000 hours evaluation, this time against a leading industry benchmark product as reference, revealed the superior detergency and cylinder liner wear protection characteristics of these oils. These good results led to the approval of Servo Marine Oils by Wartsila, Switzerland for use in the entire family of Sulzer 2-stroke engines. *With these two global approvals, Servo Marine Oils have become eligible to cater to the lubrication requirements of around 90% of global marine 2-stroke engine population.*

To conclude, modern TPEOs are required to be more robust towards a wide variety of fuel oil qualities with respect to engine cleanliness, BN stabilization, wear protection and finally longer useful oil life. In case of marine cylinder lubricants, the need of the hour is to shift towards new chemistry based formulations which offer anti-scuff protection and more thermal stability.

IOC's Servo Marine Oil series is the India's and Asia-Pacific region's first home grown marine lubricant technology, which after due field validation, was accorded with global OEM approval credentials.

For further information : e-mail : ramakumarssv@iocrd.co.in

Fig. 1.:Marine Diesel Market By Type

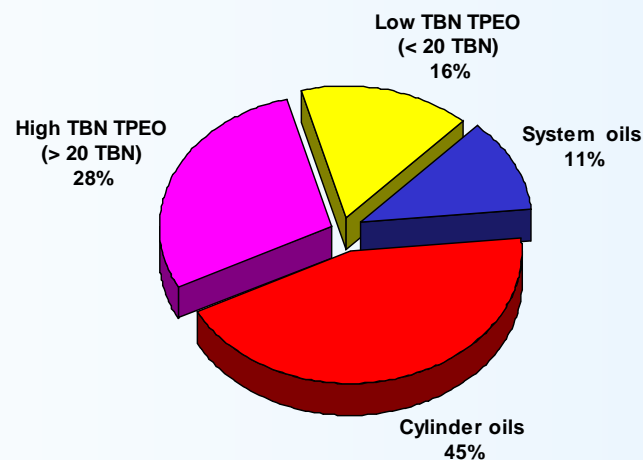


Fig.2: Marine Oil Consumption-Continental break up.

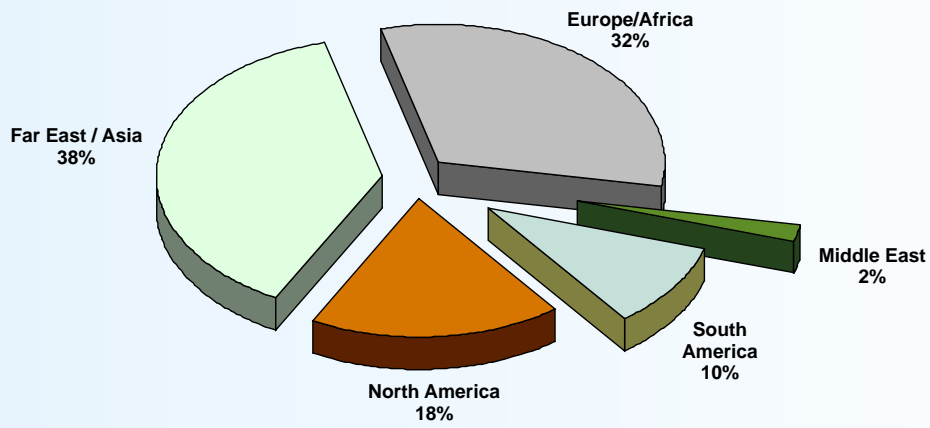


Fig.3: Major 2-Stroke Engine Manufacturers

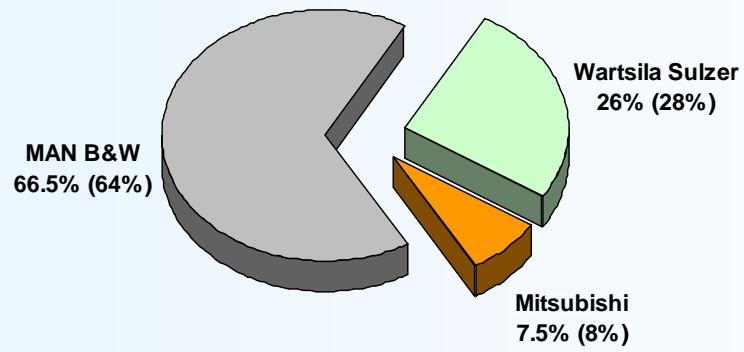
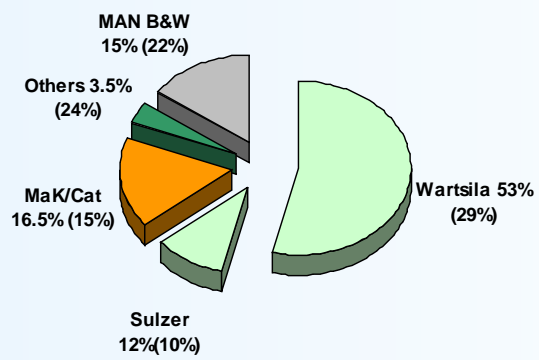


Fig.4: Major 4-Stroke Engine Manufacturers



# Power Generation: India's Snap Shot

India has the fifth largest electricity sector in the world. The electricity sector will need significant new investments to overcome current shortages and to supply an economy growing at nine to ten per cent a year. Indian utility companies have an installed capacity of 128GW, generate 663TWh of electricity, and serve over 150 million consumers. The combined 2007-12 investment plans of utilities amount to 76.4GW of new generation capacity (US\$71 bn), 60,000 km of interstate transmission lines (US\$16bn) and 22GW of additional inter-regional transmission capacity.

Structural reforms in India's electricity industry are gradual but gathering pace. Key milestones include the introduction of IPPs (1991), unbundling of state utilities (initiated in 1996, ongoing, and still pending in some states), independent regulation (1998), open access (2003), and retail competition (phased 2004-09).

The Government of India has taken steps to bring in investment. In thermal, it is bidding out nine projects of 4000MW each, all suitably pre-approved. Those based inland include an offer of captive coal. In hydro, a shelf of pre-feasibility reports has been prepared for projects totalling 50GW. Merchant plants are being encouraged in a recent

initiative, with an offer of captive coal blocks, to set up a total capacity of 10GW. In nuclear energy, the US-India Peaceful Atomic Energy Cooperation Act is expected to result in significant new investment in nuclear power plants, potentially of the order of 48-63GW by 2030. In renewable energy, the primary opportunities are in biomass, wind power and small hydro generation. In fact India has emerged as the fourth largest market in wind power, with an installed capacity of 4.4GW.

The private sector presently accounts for only 11 % of generation capacity contracted by utilities, but most of the merchant and captive capacity. This proportion is set to increase. All utilities are required to procure new generation capacity through an open competitive bidding process and a number of new investors have shown interest in recent bids. There are no limits on private or foreign ownership in the power sector.

In transmission, about 30% of new investment is expected to come from the private sector, either in joint venture form or as independent licensees. A national power exchange is being set up to provide a platform for voluntary trades. Bilateral trading is growing at 14% per annum, and rates have

climbed up to 11-13c/kWh in recent trades. The power exchange is expected to bring in new participants, improve transparency and reduce transaction costs.

In retail supply, liberalisation is scheduled to allow consumers with loads of 1MW and above to be able to choose the source of their electricity in an open competitive market from 2009 onwards. Many states are preparing for this, from drafting the operating rules and setting up settlement systems, to lowering tariffs and improving service quality for these large consumers.

India has about 78 million people who have no electricity. The government has an ambition to achieve universal electrification and meet demand in full by 2012. Rural electrification is being financed on a grant basis, generation and distribution is being deregulated in the notified areas, and supply is to be managed on a local public-private partnership or franchisee approach.

However, primary fuel shortages have slowed development to an extent. Gas-based plants are getting only 64% of their gas requirements. The situation is likely to ease in 2008/09 when new local gas finds are expected to come to market. Power companies already consume 78% of

India's coal production, and will, increasingly, have to import coal.

Regional Electricity Markets and cross-border trading are also gaining more attention. India imports electricity from Bhutan and there are plans for interconnection with Nepal and Sri Lanka. Under the BIMSTEC (the Bay of Bengal Initiative for Multi-Sectoral

Technical and Economic Cooperation) energy ministers have agreed to interconnect and enhance power trade among the seven participating nations. Likewise, under SAARC (South Asian Association for Regional Cooperation), the countries of the south Asia region have agreed to pursue the development of a regional grid.

These initiatives provide

attractive opportunities for the utilities, investors, technology, fuel and equipment suppliers and other service providers. They are key to meeting the growing social and economic aspirations of the one billion plus people in India and, more broadly, the south Asia region.

*Courtesy:*

*PricewaterhouseCoopers Energy, Utilities and Mining Utilities Global Survey 2007*

### Snippets

Rank of Afghanistan and Maldives among eight South Asian countries in terms of 'starting a business' and 'dealing with licences': 1

Rank of India among eight South Asian countries in terms of 'starting a business' and 'dealing with licences': 8

Percentage loss in sales turnover borne by an average manufacturer in India due to power shortages: 8.4

Percentage loss in sales turnover borne by an average manufacturer in China and Brazil due to power shortage: <2

Percentage of manufactures in India who have installed generators: 50

Percentage of manufacturers in China and Brazil, India who have installed generators: 27 & 17

Ratio of number of people worldwide who are over-wight to the number of people who are undernourished: 5:3

Estimated combined wealth of 20 million NRIs spread across the globe, in billion dollars: > 1,000  
Estimated gross domestic product of India currently, in billion dollars: 850

Strength of army in Pakistan, in terms of number of soldiers: 550,000

Strength of army in the USA, in terms of number of

soldiers: 502,000

Estimated number of generals in Pakistan: 1,000

Estimated number of generals in the USA: 900

Estimated number of plastic bags that are used worldwide annually, in million: 100

Estimated number of years a plastic shopping bag takes to decompose: 1,000

Amount the world owed to the USA in 1980, in trillion US dollars: 1

Amount the USA owed to the world in 2006, in trillion US dollars: 3

*Courtesy - Business India*

# Bioenergy in the Global Energy Context

(An introduction to UN-Energy Report on 'Sustainable Bioenergy : A Framework for Decision Makers')

Bioenergy, defined as energy produced from organic matter or biomass, has recently become one of the most dynamic and rapidly changing sectors of the global energy economy. Accelerated growth in the production and use of bioenergy in the past few years is attracting interest from policy makers and investors around the globe.

Modern bioenergy technologies that produce heat, electricity, and transport fuels are advancing rapidly, with much of the recent interest focusing on liquid biofuels, in particular ethanol and biodiesel. The United States and Brazil dominate today's liquid biofuels industry, but many other governments are now actively considering the appropriate role for biofuels in their future energy portfolios.

"The gradual move away from oil has begun. Over the next 15 to 20 years we may see biofuels providing a full 25 percent of the world's energy needs." Alexander M Her, Assistant Director-General for the Sustainable Development Department, FAO

Global production of biofuels alone has doubled in

the last five years and will likely double again in the next four. Among countries that have enacted new, pro-biofuel policies in recent years are Argentina, Australia, Canada, China, Colombia, Ecuador, India, Indonesia, Malawi, Malaysia, Mexico, Mozambique, the Philippines, Senegal, South Africa, Thailand, and Zambia.

"[Bioenergy] is an opportunity to add to the world supply of energy to meet the enormous growing demand and hopefully to mitigate some of the price effects. It's an opportunity to do so in an environmentally friendly way and in a way that is carbon-neutral. It's an opportunity to do so in a way that developing countries like Brazil can provide income and employment for their people." World Bank President Paul Wolfowitz.

Three times in the past three decades, oil-dependent economies have been affected by dramatic oil price increases in the mid 1970s, the early 1980s, and the current period (2004-07). Oil imports now consume a large and unsustainable share of the meagre foreign exchange

earnings of many poor nations, in some cases offsetting any gains from recent foreign debt elimination agreements. In some countries, the foreign exchange drain from recent higher oil prices was five times the gain from recent debt relief. Unstable and unpredictable oil prices have complicated economic planning around the world, and market analysts expect this pattern to persist. Oil production has already peaked in a long list of major oil producing nations, including Indonesia, Mexico, Norway, the United Kingdom, and the Unit-

**THE GRADUAL MOVE AWAY FROM OIL HAS BEGUN. OVER THE NEXT 15 TO 20 YEARS WE MAY SEE BIOFUELS PROVIDING A FULL 25 PERCENT OF THE WORLD'S ENERGY NEEDS."**

ed States. The International Energy Agency projects that oil prices will remain in the \$48-\$62 range through 2030. In addition to the price level, the dramatically increased volatility of oil prices that began in 2004 is further damaging poor economies.

Africa's current oil crisis is "an unfolding catastrophe that could set back efforts to reduce poverty and promote economic

development for years." Abdoulaye Wade, President of Senegal

Recent oil price increases have had devastating effects on many of the world's poor countries, some of which now spend as much as six times as much on fuel as they do on health. Others spend twice the money on fuels as on poverty reduction. At a time when energy analysts predict a period of unpredictable oil markets, with prices dependent on developments in some of the world's least stable regions, fossil fuel dependence has become a major risk for many developing economies. In such national settings, the macroeconomic benefits of channelling fuel revenues into poor, rural economies could be substantial.

With oil production already in decline in many nations, greater biofuel use could help bring the oil market into balance and greatly reduce oil prices. For countries that obtain 50-100 percent of their modern energy from an increasingly unstable world oil market, the arguments for supply diversification are strong. Many of these nations lie in tropical zones where relatively low-cost biofuel crops, such as sugar cane and oil palm, already grow. In this context, 12 African nations joined Senegal in 2006 in forming the Pan-African Non-Petroleum Producers Association, aimed in part at developing a robust biofuels industry in Africa. The idea behind such efforts is to divert

a portion of the money now being sent abroad to pay for oil to local agricultural and manufacturing sectors, where it would strengthen economies and generate employment.

Modern bioenergy can also help meet the needs of the 1.6 billion people worldwide who lack access to electricity in their homes, and the 2.4 billion who rely on straw, dung, and other traditional biomass fuels to meet their energy needs. Locally produced bioenergy can provide energy for local agricultural, industrial, and household uses, in some instances at less than the cost of fossil fuels.

The rapid development of modern bioenergy worldwide clearly presents a broad range of opportunities, but it also entails many trade-offs and risks. Experience with the associated economic, environmental, and social impacts is limited, and the types of impacts will depend largely on local conditions and on policy frameworks implemented to support bioenergy development. Agricultural policy, including the availability of rural infrastructure, credit, and land tenure, will determine the scale and distribution of economic benefits. At the international level, efforts to reduce agricultural subsidies in rich countries and to allow free trade in agricultural commodities are inextricably linked to the development of first-generation liquid biofuels which have become the fastest growing segment of the world agriculture market. Trade

reform efforts will both have powerful effects on and be subject to sizable impacts from biofuels expansion.

The development of new bioenergy industries could provide clean energy services to millions of people who currently lack them, while generating income and creating jobs in poorer areas of the world. But rapid growth in first-generation liquid biofuels production will raise agricultural commodity prices

**MODERN BIOENERGY CAN ALSO HELP MEET THE NEEDS OF THE 1.6 BILLION PEOPLE WORLDWIDE WHO LACK ACCESS TO ELECTRICITY IN THEIR HOMES, AND THE 2.4 BILLION WHO RELY ON STRAW, DUNG, AND OTHER TRADITIONAL BIOMASS FUELS TO MEET THEIR ENERGY NEEDS.**

and could have negative economic and social effects, particularly on the poor who spend a large share of their income on food. In many countries, the current structure of agricultural markets means that the bulk of the profits go to a small portion of the population. Unless ownership is shared more equitably, this divide could become as true for energy commodities as it is for food commodities today. For instance, two companies, Cargill and Archer Daniels Midland, control more than half of the world's grain trade. Thus, the economic, environmental, and social

impacts of bioenergy development must be assessed carefully before deciding if and how rapidly to develop the industry and what technologies, policies, and investment strategies to pursue. Rapid growth in liquid biofuel production will make substantial demands on the world's land and water resources at a time when demand for both food and forest products is also rising rapidly. Liquid biofuel growth has already begun to raise the prices of the world's two leading agricultural feedstocks maize and sugar and soaring palm oil demand may be leading industrialists in Southeast Asia to clear tropical forests for new plantations.

The ability of various bioenergy types to reduce greenhouse gas emissions varies widely, and where forests are cleared to make way for new energy crops, the emissions can be even higher than those from fossil fuels. Unless new policies are

enacted to protect threatened lands, secure socially acceptable land use, and steer bioenergy development in a sustainable direction overall, the environmental and social damage could in some cases outweigh the benefits.

The rapid advance of new crops, farming practices, and conversion technologies now under development may mitigate some of the social, environmental, and economic costs associated with large-scale production of liquid biofuels and increase their potential environmental and economic benefits. The bioenergy field is experiencing an unprecedented wave of research and development, flowing from both the public and private sectors. The timing of commercialization is uncertain, but those countries that have begun to develop bioenergy industries may be the most likely to attract investment and benefit from the resulting technology transfer.

Accelerated interest in bioenergy in the coming years will place great demands on decision-makers to evaluate and guide the development of these new industries. They will need to address chronic structural problems in agriculture, forestry, and the economy so that the economic benefits to the poor outweigh the losses. Brazil, the European Union, and the United States have already demonstrated that government regulations and tax incentives are essential to the development of modern bioenergy. The structure of these and other policies will shape the direction of the new industries in a powerful way.

*Source: UN Energy (Report on 'Sustainable Bioenergy : A Framework for Decision Makers'). Full report at <http://esa.un.org/un-energy/pdf/susdev.Biofuels.FAO.pdf>*

### Snippets

Number of mobile phone subscribers in India as of December 2006, in million : 138

Number of additional mobile connections projected to be sold during 2007, in million : 100

Average duration an Indian

mobile subscriber spends on phone every day, in minutes : 15

Average duration a mobile subscriber in Singapore, Thailand, Malaysia and Australia spends on phone every day, in minutes : 10/7/6/4

Number of neurons in the

human brain, in billion : 100

Number out of 30,000 genes in human body that are expressed only in the brain : 6,000

Amount of blood that flows through the brain every minute, in millilitres : 750

*Courtesy - Business India*

# Global Trends in Sustainable Energy Investment 2007

Investment in sustainable energy is rapidly increasing, with \$70.9 billion of new investment in 2006, which was 43% more than in 2005, and a similar continued growth trajectory so far in 2007. This is in response to a number of global challenges and concerns, including climate change, increasing energy demand and energy security. The investment community recognises the importance of the sector and the opportunities for value creation it presents. Consumers and companies are supporting the roll out of a new energy infrastructure and a

change in individual and corporate behaviour. Most importantly, governments and policy makers are introducing legislation and support mechanisms to accelerate the development of the sector.

This analysis is based on the different types of capital flows and their movement over time, combined with regional and sectoral trends. The implications for all stakeholders of this rapidly evolving capital build-up are examined. The information is intended to provide financiers and policy makers with an overview of the status and

drivers of the sustainable energy market development to help them weigh their commitments to the sector.

## Key findings

Sustainable energy investment was \$70.9 billion in 2006 (Figure 1), an increase of 43% over 2005. The sectors with the highest levels of investment are wind, solar and biofuels, which reflects technology maturity, policy incentives and investor appetite. Levels of investment are similar between the United States and the European Union (27 Member States), with US companies receiving more technology and private investment, and EU-27 capturing the majority of publicly quoted companies. Investment in developing countries is increasing quickly, mostly in China, India and Brazil.

During the first quarter 2007, the overall upward trend continued. A total of \$2.2 billion of venture capital and private equity flowed into the sustainable energy sector, an increase of 58% over the same quarter in 2006. Listed stocks were up, with the NEX index (WilderHill New Energy Global Innovation Index) increasing 25% on the quarter, even though new public markets investment was down 18%.

Figure 1. Global Investment in Sustainable Energy, 2006



Note: Grossed-up values based on disclosed deals. Figures marked \* are based on NEF Desktop database; all other figures are based on industry estimates derived from various sources.

Source: New Energy Finance

Sustainable energy now accounts for a significantly larger share of generation investment than of installed capacity. Its share of generation will increase as technologies mature and as investment into expansion and technology feeds through into installed capacity. Investment in sustainable energy is still very much driven by policy, which today includes a broadening array of tariff and fiscal support regimes in many countries that together create a stable environment globally for continued sector growth. Investor appetite suggests that existing technology is ready for scale-up and that renewable energy can become a larger part of the energy mix without waiting for further technology development. Onshore wind is now an established commodity (while offshore wind continues to be difficult to finance).

Greening of industry and public awareness of climate change and other environmental issues are key drivers of renewable energy and energy efficiency. The market has reached a critical mass, so that if oil prices drop to below \$40, this will likely slow investment in some areas, but it will not stall it altogether.

Venture capital (VC) and private equity (PE) have increased significantly from \$2.7 billion in 2005 to \$7.1 billion in 2006, and look set to continue this growth in 2007. VC activity has moved up the maturity spectrum, with later funding rounds attracting most investment.

There was noticeably higher investment in China during 2006, most of which was PE for solar manufacturing expansion. Biofuels, biomass & waste, solar and wind in roughly equal shares dominate private equity investment for expansion. In early 2007, all stages of venture capital and private equity investment saw increased activity, with later-stage leveraged private equity investments putting in a particularly strong showing.

Research and Development (R&D) increased to \$16.3 billion in 2006, from \$13 billion in 2005. EU-27 lags in new technology investment, which may be due to the comparatively low level of private sector involvement. Business funds 55% of R&D in the EU, as compared with 64% in the US and 75% in Japan. The number of incubators rose globally during 2006, as did the number of incubated renewable energy companies and successful transitions to the next stage of financing.

Public market activity surged in 2006, with \$10.3 billion raised, which is more than double the \$4.3 billion in 2005. Solar IPOs (initial public offerings) boosted 2006 volumes, raising just over \$4 billion. The NEX index rose 31% during the year, which was well ahead of the stock market as a whole. The biofuels sector was the star performer. In early 2007, new listings slowed somewhat, with \$1.8 billion raised in the first quarter, however, listed stocks

continued to perform with a further 33% in the first quarter of 2007.

New asset financing in renewable energy generating plants in 2006 was \$27.9 billion, an increase of 23% over 2005. Early indications in 2007 suggest that this pace is set to continue. Wind is the largest sector (followed by biofuels), however, shortages of key components (e.g. wind turbine gearboxes) have slowed down the rate of installation. New financing structures have emerged as an increasing number of traditional and innovative investors become attracted to RE, especially wind energy. Utilities with RE targets are building wind portfolios through acquisition, which is increasing overall price. The US is the leader, followed by Germany and Spain, and then China. Besides asset finance for generating plants, an additional \$9.3 billion was invested in small-scale installations such as rooftop solar photovoltaics (PV) and solar water heating.

Mergers and Acquisitions (M&A) activity was up 34% in 2006, with deals valued at \$16.9 billion. Most activity was in the wind sector - more than 40% of deals by value. Leading players in the renewable energy sector are taking strategic stakes. Increasingly, manufacturing companies are looking to vertical integration to secure supplies of key components. There is a trend towards companies in developing countries acquiring assets in

OECD countries, suggesting a buy rather than build approach. Widespread availability of cheap capital is enabling this strategy.

Currently, \$18 billion is under management in approximately 180 investment funds that are focused on sustainable energy. Both publicly quoted and private funds have seen high growth since 2005 (43% and 59%, respectively). Private funds are split across specialist and, more recently, generalist fund managers who have recognised the value - and profile - of sustainable energy investment. The challenge all funds face is the availability of high quality investments.

Carbon funds now total \$11.8 billion, with the private sector providing most of the new money coming into the market. Growth of investment in the project development sell-side of the market shows that money is flowing into the development and commercialisation of Clean Development Mechanism (CDM) and Joint Implementation (JI) projects. The net shortfall in project development activity is currently estimated at around \$11 billion. Of the CDM projects currently in the pipeline (total 1,825), more than half (64%) relate to renewable energy (wind, geothermal, tidal, hydro, biomass or solar) and energy efficiency. These, however, represent only a fifth of the total Kyoto first commitment period credits.

Energy efficiency is a significant, but largely invisible market, which is now attracting an increasing share of the limelight as investors realise its role in addressing growing global energy demand. Investment in technologies was the most visible segment of the EE market: in 2006, \$1.1 billion was invested in EE, compared with \$710 million in 2005, which was due to strong support from multinationals and governments.

Capital has shifted to developing countries, which saw higher private investment in 2006. This reflects stronger Foreign Direct Investment (FDI), as well as private capital mobilising within emerging markets. China, India and Brazil are all now major producers of and markets for sustainable energy, with China leading in solar, India in wind and Brazil in biofuels. However, barriers to FDI remain, such as restrictions on foreign ownership in China, causing a prevalence of foreign-local joint ventures. Developing countries face the challenge of fast-growing energy demand combined with less mature capital markets (although this is improving) - which skews investment towards conventional, mostly fossil-fuel generation. Innovative work continues on designing financial instruments to encourage investment and manage risk in developing countries

In conclusion, sustainable energy markets are becoming

more liquid and more global. The various forms of capital now being deployed across the value chain signal the sector's shift into the mainstream. Given the maturing sector fundamentals, the recent capital build-up does not appear to be a sign of short-term volatility, but part of a longer-term trend. With individual sectors there is considerable volatility, however, risk and uncertainty can be diversified across technologies and geographies. These trends have continued through the first half of 2007, with new investment globally in sustainable energy expected to total \$85 billion for the year.

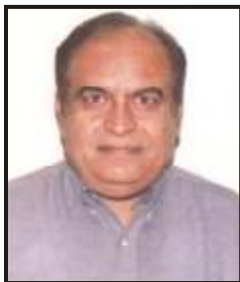
What these figures represent is not a fine-tuning of the current global energy system, but rather full-scale economic development. Investment growth is underpinned by clean energy policy initiatives. Despite the considerable discussion about the need for energy technologies of tomorrow, the investment community already believes that the technologies available today are ready to decarbonise the energy mix.

*Source : United Nations Environment Programme and New Energy Finance Ltd 2007(Report on Global trends in Sustainable Energy Investment 2007). Full report available at*

*[http://www.unep.org/pdf/SEFI\\_report-GlobalTrendsInSustainableEnergyInvestment07.pdf](http://www.unep.org/pdf/SEFI_report-GlobalTrendsInSustainableEnergyInvestment07.pdf)*



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# Fuel Efficient Bukhari for Energy Conservation

## Abstract

*An energy efficient kerosene based Bukhari “a space/ room heating device” has now been developed, patented and is also commercialised. It has given excellent performance in the field trials conducted with the help of defence and paramilitary forces of the country at many high altitude places such as Leh, Kargil, Siachen, Joshi Math, Auli and Chusul where sub-zero temperatures and high wind velocity conditions prevail. The salient features, laboratory performance, field performance and post developmental activities of the Nutan Himveer Bukhari are described in this paper.*

## Introduction

Due to the fast depletion of fossil fuels, efforts are being made worldwide to reduce the consumption of hydrocarbons not only for conserving the fossil fuels but also to reduce the emissions for the protection of environment. Under the Petroleum conservation drive, lot of work is being pursued by Research & Development Centre of Indian Oil Corporation Ltd. Development of various energy efficient heating and lighting appliances such as kerosene wick stove, Hurricane Lantern, Kerosene Wick lamp, LPG

domestic stove, LPG commercial burner all in the brand name of “Nutan” were developed and successfully commercialised. As an ongoing activity, an energy efficient Bukhari has been taken up.. The term “Bukhari” derives its name from 'Bukhar', the Urdu word for high temperature and the equipment Bukhari is widely used by the Defence and Para-Military personnel for the purpose of room heating in cold climatic conditions. These are also used by inhabitants of the Himalayan foothills where the ambient temperature plunges below the freezing point during the winter months. The Bukhari developed by IOCL R&D Centre is given a brand name of “Nutan Himveer Bukhari”. The Bukhari can be classified in two categories:

## Bukhari Without Flue Gas Exhaust

This type of Bukhari has heating capacities of 1-5 KW with different sizes of fuel tanks and burners. Its fuel tank is provided with burners, which burn kerosene with the help of either combustible or incombustible wicks. The heat produced radiates in the room through a reflector or burner enclosure provided in the Bukhari. Due to their limited tank capacities and absence of flue gas exhaust system, these

Bukharis cannot be used round the clock and in closed room.

Japanese Omni-230 Bukhari falls in this category. It is efficient and does not generate smoke & soot. But at the same time it does not generate sufficient heat because of its low capacity. Also, as it does not have provision of exhaust pipe, flue gases generated by Bukhari, remains in the room. Therefore, It is useful for small room and for short duration use.

#### **Bukhari with Flue Gas Exhaust**

This category of Bukhari has a high burning rate of kerosene and is provided with draught facility for flue gas escape. In this type of Bukhari, combustion of fuel takes place by means of a hot plate in the combustion chamber which cracks the fuel and burns it to produce heat. The fuel, supplied from outside storage, is made to fall on the hot plate through regulatory system. The heat produced is used for heating the combustion chamber which in turn radiates the heat in the room.

Roaring, silencer and Heat king type Bukharis being used by ITBP were evaluated for their performance at in the laboratory. These Bukharis consume high volume of kerosene and generate lot of smoke & soot and burn with yellow flame. These Bukharis are inefficient, unsafe and require almost daily cleaning for soot. Smoke generation and soot formation take place because of partial combustion

of kerosene fuel.

Nutan Himveer Bukhari falls under this category. However, it utilizes incombustible type wick instead of hot plate for combustion of kerosene fuel.

#### **Development Modalities**

The problems faced with the Bukhari existing in the market were referred to IOCL R&D Centre by one of the Para-Military forces. To meet their demand, IOCL R&D decided to take up the project and to develop a Bukhari with flue gas exhaust, using in house design to overcome the reported problems. Initially some literature search was carried out and few standards of the other countries were studied. Based on this literature study, set up of the performance evaluation facility was conceived. Development of laboratory test facility simulating the high altitude and cold climatic conditions was a costly proposition. Therefore, it was decided to have a laboratory facility in a room of 10' x10'x10' size which has air tight doors and windows and is having provision of opening in the roof for the exhaust pipe. On the roof of the room, a high velocity blower having wind velocity up to 80 miles/hr was installed for studying the effect of wind velocity on the back pressure of Bukhari. Provision was made to measure the room temperature, Bukhari surface temperature and flue gas temperature. Several prototypes of Nutan Himveer were then taken up and their performance was compared with the earlier data generated. The design of the prototype was

then optimized and a final working model was developed. After completing the laboratory studies, field trials were conducted at high altitude areas with cold climatic conditions.

#### **Salient Features Of Nutan Himveer Bukhari**

- Fuel efficient
- Eco-friendly
- Adequate heating capacity
- Ease of maintenance
- Least fire and health hazards
- User comfort

The Nutan Himveer Bukhari has a number of novel features such as specially designed burner base and triple walled perforated sleeves which ensure optimum air-fuel mixture for efficient combustion of fuel. Proper supply of kerosene to all parts of the incombustible wick is ensured through the supply pipe provided at the bottom of the burner base and leveling screws.

#### **Specifications Of Nutan Himveer**

Fuel :Kerosene  
Wick :Incombustible  
Dimensions:35 cm X 110 cm  
Kerosene consumption rate:  
700 gms/hr.  
Efficiency:27 gms/hrs/1°C rise  
Capacity: 10 KW (max)

#### **Performance**

The performance parameters of Nutan Himveer Bukhari are given below:

Specifications Of Nutan Himveer		
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### Performance

The performance parameters of Nutan Himveer Bukhari are given below:

Performance parameters (Typical)	Nutan-Himveer
<ul style="list-style-type: none"> <li>● Rise in temperature in 6hrs. (°C) in a room of 3mX3mX3m</li> <li>● Kerosene consumption rate (KCR) gms/hr.</li> <li>● Kerosene consumed for 1°C temp. rise (gm/hr/°C)</li> <li>● Kerosene savings (%)</li> <li>● Flue gas temperature (°C) (waste heat)</li> </ul>	<p>25</p> <p>666</p> <p>26.24</p> <p>25</p> <p>150</p>
<ul style="list-style-type: none"> <li>● Observation</li> </ul>	<ul style="list-style-type: none"> <li>● No smoke</li> <li>● No soot</li> <li>● Blue Flame</li> <li>● Noiseless</li> </ul>

### Field Trials Of Nutan Himveer Bukhari

#### Field Trials Of Nutan Himveer Bukhari

Above Bukhari was tested by DMSRDE (Defence laboratory), Kanpur, India in their laboratory in comparison with other popular Bukharis. Many field trials were conducted at high altitude and cold climatic areas in association with Northern Command of Defence Army and Para Military Forces such as Leh (11000' altitude), Kargil (13600' altitude), Siachen (9000' altitude), Joshi Math (7500' altitude), Auli (8500' altitude). The following findings were recorded during the field trials:

1. Nutan Himveer Bukhari developed by IOCL R&D Centre, is fuel efficient, eco-friendly, capable of generating high heat output under high wind velocity conditions.
2. Its performance has been found superior to other commercially available Bukharis (indigenous and imported).
3. Its performance has been established in the field trial under most severe weather conditions in winter season up to the highest altitude of 13600 ft.

#### Post Development Actions

A Patent application was filed and the technology has been transferred to NRDC who in turn have issued license to one manufacturer. The

commercial production has already been started. NUTAN HIMVEER was granted PCRA exemplary award for energy conservation.



Figure: Nutan Himveer Bukhari

# State and Trends of the Carbon Market 2007

IN A YEAR that the need for future action to reduce the risks of climate change has figured prominently on the international agenda, a variety of approaches are being implemented to reduce carbon emissions. These range from efforts by individuals and firms to reduce their climate

footprints to initiatives at city, state, regional and global levels. Among these are the commitments of governments to reduce emissions through the 1992 UN Framework Convention on Climate Change and its 1997 Kyoto Protocol, and Europe's carbon constraint for electricity

generators and industry under the European Union Emissions Trading Scheme (EU ETS). The carbon markets are a prominent part of the response to climate change and have an opportunity to demonstrate that they can be a credible and central tool for future climate mitigation.

Table 1: Carbon Market at a Glance, Volumes & Values in 2005-06

	2005		2006	
	Volume (MtCO <sub>2</sub> e)	Value (MUS\$)	Volume (MtCO <sub>2</sub> e)	Value (MUS\$)
Allowances				
EUETS	321	7,908	1,101	24,357
New South Wales	6	59	20	225
Chicago Climate Exchange	1	3	10	38
UK-ETS	0	1	na	na
<b>Sub total</b>	<b>328</b>	<b>7,971</b>	<b>1,131</b>	<b>24,620</b>
Project-based transactions				
Primary CDM	341	2,417	450	4,813
Secondary CDM	10	221	25	444
II	11	68	16	141
Other compliance	20	187	17	79
<b>Sub total</b>	<b>382</b>	<b>2,894</b>	<b>508</b>	<b>5,477</b>
<b>TOTAL</b>	<b>710</b>	<b>10,864</b>	<b>1,639</b>	<b>30,098</b>

The carbon market grew in value to an estimated US\$30 billion in 2006 (€23 billion),

three times greater than the previous year (see Table 1). The market was dominated by the

sale and re-sale of European Union Allowances (EUAs) at a value of nearly \$25 billion

under the EU ETS (€19 billion). Project-based activities primarily through the Clean Development Mechanism (CDM) and Joint Implementation (JI) grew sharply to a value of about US\$5 billion in 2006 (€3.8 billion). The voluntary market for reductions by corporations and individuals also grew strongly to an estimated US\$100 million in 2006 (€80 million). Both, the Chicago Climate Exchange (CCX) and the New South Wales Market (NSW) saw record volumes and values traded in 2006.

EU ETS Phase I demonstrated that a carbon price signal in Europe succeeded in stimulating emissions abatement both within Europe and especially in developing countries. Following the release of verified 2005 emissions data, it became clear, however, that the 2005-07 emissions cap had not been set at an appropriate level relative to what actual emissions were in that period. As a result, market expectations and the Phase I price signal were based on incorrect assumptions of the carbon constraint, leading to high volatility in the EUA market. The EU Commission stated that Phase I was a "learning phase" and assured the market that it would assess second period plans "in a manner that ensures a correct and consistent application of the criteria in the Directive and sufficient scarcity of allowances in the EU ETS."

Market interest in the second half of 2006 shifted out of Phase I, and began to focus on Phase II based on expectations that those caps would be much more stringent.

In contrast to a highly volatile 2006 EUA market, project-based assets showed greater price stability, while transacted volumes also grew steadily. Developing countries supplied nearly 450 MtCO<sub>2</sub>e of primary CDM credits in 2006 for a total market value of US\$5 billion (€3.8 billion). Average prices for Certified Emission Reductions (CERs) from developing countries were up marginally in 2006 at US\$10.90 or €8.40 (with the vast majority of transactions in the range of US\$8-14 or €6-11). China continued to have a dominant market-share of the CDM with 61% and set a relatively stable price floor for global supply of CERs.

In 2006, Joint Implementation (JI) projects from economies in transition saw increasing interest from buyers, with 16.3 MtCO<sub>2</sub>e transacted (up 45% over 2005 levels) - with Russia, Ukraine and Bulgaria providing more than 60% of transacted volumes so far - at an average price of US\$8.70 (€6.70). Preliminary data for the first quarter of 2007 indicate at least the same volumes had already transacted in the first three months alone.

Buyers found it easier to close transactions than six months earlier, while sellers

managed carbon price risk by favoring fixed price forward contracts. CER assets traded considerably higher in secondary markets (in a range of US\$14.30-19.50 or €11-15) than in primary transactions, although accurate volume data were difficult to confirm for secondary transactions.

Since 2002, a cumulative 920 MtCO<sub>2</sub>e (equivalent to 20% of EU-15 emissions in 2004) have been transacted through primary CDM transactions for a value of about US\$8 billion (€6 billion). Hydrofluorocarbon (HFC-23) reduction and nitrous oxide (N<sub>2</sub>O) destruction projects accounted for approximately half of the market volumes, while renewable energy and energy efficiency transactions together accounted for nearly 21% of the CDM market over the same period.

European buyers dominated the primary CDM & JI market with 86% market share (versus 50% in 2005) with Japanese purchases sharply down at only 7% of the primary market in 2006. The U.K., where the City of London is home to a number of global financial institutions, led the market for a second consecutive year with nearly 50% of project-based volumes, followed by Italy with 10%. Private sector buyers, especially banks and carbon funds, continued to buy large volumes of CDM assets, while public sector buyers continued to dominate JI purchases. A

large number of international financial institutions and funds engaged in secondary transactions of carbon portfolios with other banks (primarily in Europe) or companies facing compliance obligations (in both Europe and Japan).

European buyers reported that they increasingly asked for and obtained zero-premium call options to purchase emission reductions beyond 2012. For the most part, the strike price in these contracts was the same as the contract for pre-2012 assets. Others reported a right of first refusal for post-2012 vintages at a future time for an unspecified "market price".

#### Outlook

Most market players stated that considerable price risk - and likely volatility - remained in the market for both CERs and EUAs. There is a consensus emerging among market analysts that the expected shortfall in the EU ETS Phase II is likely to be in the range of 0.9 billion to 1.5 billion tCO<sub>2</sub>e. Estimates for not-yet-contracted volumes from JI/CDM and projected EU shortfalls are very similar to each other in these projections (unless additional demand before 2012 and the promise of higher prices stimulates additional JI/CDM supply).

The current projected demand-supply balance excluding Canada (and residual demand from Japan) implies that the price of

CERs/ERUs is likely to help set the market equilibrium price for EUAs in Phase II. EU ETS companies would be the prime beneficiary of this balance provided that: no significant Japanese or Canadian competition appears for these assets; and provided that there are no surprises from higher than expected under-delivery of CERs/ERUs; as well as no consistent anomalies over the five years from weather or from fuel prices; or any major technological inflection points in that time period. The prospect of EU ETS Phase III - and the ability to bank allowances across the second and third periods - gives a longer time planning horizon to market players considering new investments for abatement from both the CDM/JI and marginal abatement within the EU.

The April 26, 2007 climate change announcement by the Government of Canada calls for improvements in carbon intensity leading to an emission target of 20% below 2006 levels by 2020 (assumed to be 150 MtCO<sub>2</sub>e by Canada). The approach incorporates emissions trading and also includes the idea of early action and banking and allows CERs for up to 10% of the projected shortfall. If these assumptions are true, then some demand from Canada could enter the CER market relatively soon.

Developments in California, the eastern United States and Australia hold some promise of market continuity

beyond 2012. There is continued debate, especially in California, regarding whether emissions trading, including offsets from overseas will be allowed. Precise rules to be developed will clarify to what extent these emerging carbon markets will seek to maximize value from high quality offsets no matter where they are sourced from. At least two pending pieces of draft federal legislation before the U.S. Senate include provisions that would welcome overseas credits.

The carbon market and associated emerging markets for clean technology and commodities have attracted a significant response from the capital markets and from experienced investors, including those in the United States. Analysts estimated that US\$ 11.8 billion (€9 billion) had been invested in 58 carbon funds as of March 2007 compared to US\$4.6 billion (€3.7 billion) in 40 funds as of May 2006. 50% of all capital driven to the carbon value chain is managed from the UK. Most of the newly raised money, of private origin, came to the sell-side (project development and carbon asset creation) which currently represents 58% of the capitalization. A key indicator of interest in aligned and closely related fields is the record US\$70.9 billion in clean technology investments in 2006, with major investments (and announcements) from well-known investment banks.

Most public companies in the carbon space are in a fast-growth mode and are yet to show a profit. One public company delayed its public disclosure in the wake of an unfavorable analyst report. Some companies cited the delay in the operations of the International Transaction Log (ITL) as a risk that would make it more difficult to earn and book revenues from CER spot sales this year.

There was increased consolidation in the sector and evidence of growing interest in the U. S. markets. A prominent investment bank bought a sizeable stake in a leading project development and asset management company. Another company acquired a boutique analyst firm in the United States, while a third acquired a smaller company in Washington DC specializing in developing Project Design Documents (PDDs). Several European entities opened offices in the United States citing the need to develop a presence in this potentially large market. Reports of early offset transactions in North America filtered in with prices reported in a very wide price range starting at around US\$1.50, e.g. from pre-compliance buyers for emission reductions from enhanced recovery from oil and gas fields.

The most promising impact of carbon markets has been its impact on innovation as smart capital takes an early, long-

term bet on the quickly growing emerging market for environmentally-oriented investment. A key indicator of interest in aligned and closely related fields is the record US\$70.9 billion in clean technology investments in 2006, with major investments (and announcements) from well-known investment banks.

In the emerging fragmented carbon marketplace, efforts to mitigate carbon are multiplying in both the regulated and the unregulated sectors. For regulated markets, emissions trading can help achieve a given level of emission caps efficiently by setting an appropriate price, but this requires that policymakers set the caps consistent with the desired - and scientifically credible - level of environmental performance. Regulated carbon markets can only achieve environmental goals when policymakers set scientifically-credible emission reduction targets while giving companies maximum flexibility to achieve those goals. They also require clarity on the assumptions for economic growth and baseline carbon intensity improvements, orderly and transparent release of periodic market-relevant emissions data and the imposition of strict penalties for fraud or non-compliance. The key elements for well-functioning carbon markets include: competitive energy markets; common, fungible units of

measure; standardized reporting protocols of emissions data; and transferability of assets across boundaries.

Markets can, to a certain extent, accommodate the appetite that individuals and companies in Europe, Japan, North America, Australia and beyond have for carbon emission reductions that go well beyond what their law makers require of them. This high-potential voluntary segment, however, lacks a generally acceptable standard, which remains a significant reputation risk not only to its own prospects, but also to the rest of the market, including the segments of regulated emissions trading and project offsets.

The enormity of the climate challenge, however, will require a profound transformation, including in those sectors that 'cap-and-trade' markets cannot easily reach. These include making public and private investments in research and development for new technology development and diffusion, economic and fiscal policy changes, programmatic approaches to decouple economic growth from emissions development as well as the removal of distortionary subsidies for high-carbon fuels and technologies.

*Source: Extracts from the world bank report on 'State and Trends of the Carbon Market 2007'. Full report available at [http://carbonfinance.org/docs/carbon\\_Trends\\_2007-\\_FINAL\\_-\\_May\\_2.pdf](http://carbonfinance.org/docs/carbon_Trends_2007-_FINAL_-_May_2.pdf)*

# EVENTS

## Right to Information

The comprehensive contours of the 'Right to Information' were explained and discussed at a Guest Lecture on the subject by Shri K G Verma, Director (Reservation & RTI), DoPT organised by PetroFed on April 12, 2007 at New Delhi.

Chairing the session, Shri R Ramanujam, Joint Secretary, DoPT in his opening

remarks gave an overview of the Right to Information Act, 2005 and developments regarding the same since its enactment. He dwelt on the salient subtleties of the subject.

Shri K G Verma, in his lecture thereafter, covered the various aspects of the Act in detail including the scope of the Act, the procedures and

involved, the obligations of the Public Authority, the provisions for appeals and penalties and the functions and powers of the Central Information Commission.

In a prolonged discussion thereafter the large number of queries of participants, including several former CMDs, were clarified by the Session Chairman and the Speaker.



Session Chairman Sh R Ramanujam, Jt. Secretary, DoPT (centre) delivering opening remarks; (L) Sh A K Arora, DG, PetroFed; (R) Sh K G Verma, Director, DoPT.



Sh K G Verma delivering lecture.

EVENTS

## Challenges for EPC Contractors in Hydrocarbon Sector

In its continuing series of Guest Lectures & Thought Leadership Programmes, PetroFed organised a lecture on 'Challenges for EPC Contractors in Hydrocarbon Sector' by Shri M.R. Shanker, Executive Vice President, Larsen & Toubro Limited on April 18, 2007 at the PetroFed Conference Hall, New Delhi .

Chairing the session Shri N Bhalla, Group General Manager, Oil India Limited and a member of PetroFed Governing Council highlighted

the importance of competent EPC Contractors in the globalised scenario for high growth in the Indian Hydrocarbon Sector.

Shri Shankar in his presentation admirably brought out the challenges and the opportunities for EPC Contractors in the Hydrocarbon Sector in a global scenario. Tighter budgets, schedules, global competition, very large project sizes, overloaded vendors, volatility in commodity prices and single

point responsibility were emerging trends, he said. He elaborated on the modes of execution, the LSTK approach for mega projects, the emerging concept of cost conversion to LSTK and the LSTK contract conditions.

The extended question and answer session brought to fore the need for closer interaction among EPC contractors and project owners for strengthening cooperation for mutual benefit.



Session Chairman Shri N Bhalla, GGM, OIL & PetroFed Governing Council member being welcomed by Sh A K Arora, DG, PetroFed (right).



Shri M R Shanker, Executive Vice-President, L&T (left) being welcomed by Sh N Bhalla.



Shri S L Das, Director(BD&C), PetroFed welcoming participants



A section of the participants.

## Oil Price Risk Management - An Indian Perspective

Since India imports over three fourths of its crude oil requirements and it is vulnerable to price volatility in the international market, PetroFed organised a one day workshop on 'Oil Price Risk Management-An Indian Perspective' for practicing managers on April 27, 2007 at New Delhi . The workshop covered the basics of derivative contracts, the markets where such contracts are traded, tools and techniques to use the derivative contracts in conjunction with physical contracts to mitigate risks and reduce uncertainty in business.



Shri A K Arora, DG, PetroFed (left) welcoming Shri S. V. Narasimhan, Director (Finance) Indian Oil Corporation Ltd

Shri S. V. Narasimhan, Director (Finance), IOCL elaborated in his inaugural address on international trading by recapitulating the changing market in a historical perspective. He dwelt on the key issues to be kept in mind by practicing managers for mitigating risks in a competitive environment.

In the pre-lunch session, Shri Manish Bansal, Vice President, Citigroup graphically, and in an interactive manner, explained not only international commodity and oil prices but

the consequences of their volatility for the domestic market. The practical considerations in oil price risk management were dealt in detail by Shri T Srinivas, Chief Manager (IT), Risk Management, IOCL. He explained minute details of the subject by virtue of his vast hands-on experience.

The exchange traded futures markets in energy were dealt in detail, post-lunch by Shri Arvind Pal Singh, Assistant Vice President, NCDEX. He explained the roles of spot, forward and futures markets and the evolution of commodity derivatives in India

. Shri C. K. Sengupta, Executive Director (IT), BPCL, thereafter explained over-the-counter markets and derivative tools including hedging and risk management framework. The pricing issues and risks in gas markets in India were detailed by Shri Ashish Kashive, Head Fuels Practice, CRISIL Limited.



Chief Guest Shri S. V. Narasimhan, Director (Finance), IndianOil delivering inaugural address. On the left is Shri A K Arora, DG, PetroFed.

EVENTS



Shri Manish Bansal, V.P., Citigroup,  
delivering his lecture.



Shri T. Srinivas, Chief Manager(IT),  
Risk Management,  
IndianOil delivering his lecture.



A section of the participants



Shri Arvind Pal Singh, Asst. V.P., NCDEX  
(left) being presented a memento  
by Shri S.L. Das, Director (BD & C),  
PetroFed after the lecture.



Shri C K Sen Gupta, ED(IT), BPCL delivering lecture.  
On the left is Shri Ritesh Kumar, Asst  
Director(systems), PetroFed



Shri Ashish Kashive, Head Fuels Prattice,  
CRISIL Ltd, delivering lecture.

## Energy Security - Few Possible Options

In its continuing series of Guest Lectures & Thought Leadership Programmes, PetroFed organised a lecture on 'Energy Security Few Possible Options' by Shri B. C. Bora, Former CMD, ONGC, OIL, Consultant and Member, Energy Think Tank on May 25, 2007 at New Delhi.

Chairing the session Prof. T. K. Roy, Consultant and Professor emeritus in Chemical Engineering, highlighted the importance of other options in tackling the issue of energy security. He termed Shri Bora

as a doyen of the oil industry with over 45 years experience.

Shri Bora in his lecture drew attention to not only the growing energy needs but also the need for carbon-free power to curb global warming. He briefly highlighted ten major areas, adding that this was not a comprehensive list. He drew attention to revitalization of marginal and stripper wells, use of reversible surfactant to improve oil recovery, transportation of gas from marginal fields as gas hydrates, geothermal power,

tidal and wind turbines, algae-based fuels and making gasoline from carbon dioxide.

In addition, he stressed on supply side challenges like improving energy efficiency, carbon sequestration developing emerging fossil fuels and expanding non-fossil fuel energy for long term sustainability.

The programme ended with a wrap-up by the session Chairman Prof. T. K. Roy and Director General, PetroFed, Shri A. K. Arora.



DG, PetroFed, Shri A K Arora welcoming Session Chairman Prof T. K. Roy



Shri B. C. Bora being welcomed by Session Chairman Prof T K Roy



(R-L) Shri N Bhalla, GGM, OIL and Member PetroFed Governing council, Shri S S Ramgarhia, Sr VP (Oil & Gas), Essar Group, Shri S Rajagopal, GM, IOCL



(L-R) Shri Suresh Mathur, Director (Oil & Gas), Essar Group & former MD Petronet LNG, Dr IB Gulati, Director, IDS, Shri C Ratnam, Former CMD Oil India & Member, ETT

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