India lacks sufficient domestic energy resources and must import much of its growing energy requirements. India is increasingly dependent on oil imports to meet demand. In addition to pursuing domestic oil and gas exploration and production projects, India is also stepping up its natural gas imports, particularly through imports of liquefied natural gas. The country’s ability to secure a reliable supply of energy resources at affordable prices will be one of the most important factors in shaping its future energy demand.

Coal accounts for more than half of India’s total energy consumption followed by oil, which comprises 31 percent of total energy consumption. Natural gas and hydroelectric power account for 8 and 6 percent of consumption, respectively. Although nuclear power comprises a very small percentage of total energy consumption at this time, it is expected to increase in light of recent international civil nuclear energy cooperation deals. According to the Indian government, 30 percent of India’s total energy needs are met through imports.

India had 5.6 billion barrels of proven oil reserves as of January 2009, the second-largest amount in the Asia-Pacific region after China. India’s crude oil reserves tend to be light and sweet, with specific gravity varying from 38° API in the offshore Mumbai High field to 32° API at other onshore basins.

India produced roughly 880 thousand bbl/d of total oil in 2008, of which approximately 650 thousand bbl/d was crude oil, with the rest of production resulting from other liquids and refinery gain. India has over 3,600 operating oil wells, according to OGJ. Although oil production in India has slightly trended upwards in recent years, it has failed to keep pace with demand and is expected by the EIA to decline slightly in 2009.

India’s oil consumption has continued to be robust in recent years. In 2007, India consumed
approximately 2.8 million bbl/d, making it the fifth largest consumer of oil in the world. Demand grew to nearly 3 million bbl/d in 2008. EIA anticipates consumption growth rates flattening in 2009 largely due to slowing economic growth rates and the recent global financial crisis.

The combination of rising oil consumption and relatively flat production has left India increasingly dependent on imports to meet its petroleum demand. In 2006, India was the seventh largest net importer of oil in the world. With 2007 net imports of 1.8 million bbl/d, India is currently dependent on imports for 68 percent of its oil consumption. The EIA expects India to become the fourth largest net importer of oil in the world by 2025, behind the United States, China, and Japan.

The government of India’s largest crude oil import partner is Saudi Arabia, followed by Iran. Nearly three-fourths of India’s crude oil imports come from the Middle East. The Indian government expects this geographical dependence to rise in light of limited prospects for domestic production.

In light of declining production at the majority of India’s fields, companies are investing in enhanced oil recovery methods. ONGC plans to invest nearly $1.5 billion in such projects, and a multitude of these schemes have been approved for many of the company’s fields.

To help meet growing oil demand and support the country’s energy security, India has promoted various E&P projects in an effort to boost domestic oil production. However, new E&P projects are expected to be difficult due to their deepwater location or terrain type. In order to address these challenges, Indian companies are recruiting foreign firms with greater experience and more sophisticated technology. For example, ONGC recently assigned a participating interest to Rocksourse ASA, a Norwegian company with technological expertise in deepwater drilling, and to Petrobras for the development of an eastern offshore deepwater block. The participation of private foreign firms over the last five years has helped develop previously unexploited
deepwater areas and allow India to tap more of its domestic oil resources.

**Fuel Subsidies**

Beginning in 2002, the Indian government introduced some measures aimed at deregulation in the downstream oil sector. Private refiners may now directly market some of their own petroleum products to their customers. Additionally, the government phased out the Administered Price Mechanism (APM) on oil products in 2002, replacing it with the new Market Determined Price Mechanism (MDPM). However, while the MDPM is notionally benchmarked to international oil prices, the Indian government continues to heavily subsidize domestic prices of oil products such as diesel, LPG, and kerosene for consumers. As such, demand for petroleum products in India has been substantially influenced by the government’s pricing scheme. With diesel prices significantly lower than other fuels, such as gasoline, demand for diesel rose substantially, by as much as 25 percent between 2006 and the first half of 2008, according to industry analysts.

In support of the country’s energy security, Indian officials have declared that the country intends to develop a strategic petroleum reserve (SPR). The decision has been made to set up a strategic reserve of 5 million tons (36.6 million barrels) of crude oil in underground structures in Mangalore, Visakhapatnam, and Padur. The project is expected to come online in 2012. The location of the storage facilities was selected to be along the coast so that the reserves could be easily transported to refineries during a supply disruption. The SPR project is being managed by the Indian Strategic Petroleum Reserves Limited (ISPRL), which is part of Oil Industry Development Board (OIDB), a state-controlled organization. Despite these plans, India does not have any strategic crude oil stocks at this time.

**Inspite of severe shortages and enhanced future requirements, GOI is still to Comprehend and support Ethanol Blending. It has different outlook to Biodiesel and all support mechanisms and policy decessions are for Diesel which is being heavily subsidised. Plant Biotechnology in Sugar is yet to take shape and we lag to move towards developing Biomass and second generation Cellulosic distillation technologies. Ethanol is still being viewed as Fuel and Oil Companies which discuss calorific value not taking in to account itas Oxygenate with advantages in reducing CHG emissions.**

**Sugarcane in India:**

Indian Sugar Industry has made a turnaround in last 5 years from being a seasonal and Cyclic Industry to a Biorefinery model. Here Sugar, Distillation, Cogen and Biofertilizer are produced optimizing their resources.

With CDM taking shape since 2004 some of these also have utilized opportunity of Cogen by enhancing Boilers and generating additional Power to be sold to Grid and also benefit CER / VER realization. Few of them have also realized CDM for Distillation (Methanation). If UNFCCC provides benefit of CDM realization to Ethanol manufacturers then there is additional benefit that accrues to existing.

Indian sugar industry operates in Zone area allocated to them; they are well networked with farming community of that zone sharing on all areas of inputs from seeding, Crop management, harvesting, and logistics and even in Loan disbursal from banks.

So for two crop years once planted farmer is relieved of sale and pricing of produce and is attracted to this crop as long as it does not pinch his wallet. Harvesting Cost of Sugarcane is of growing concern and its timeliness, as Sucrose content deteriorates if not done at appropriate time. There has been marked improvement in farm equipment too in this segment.Using water shoots and Tops as Fodder has been prevalent for centuries.

Indian sugar industry’s success is also due to contribution from Sugar Breeding Institute (Coimbatore),
Vasant Dada institute, Regional Bodies in Sugarcane research and others. SBI is one of the two World repositories (the other being at Miami, Florida state, USA) of sugarcane germplasm.

India is the world’s largest consumer of cheap liquor and is a major revenue source of state Gov’t, with potable alcohol growing above 10% each year and its impact on social fabric catastrophic and not taken seriously; Energy & Chemical value addition has lot of relevance that need to have support of all. There is another menace of Illicit Liquor from Jaggery and if this curtailed will make more available cane for crushing. India occupies 40% of Global sugar mkt. Of the total cane produced 12% to go in to seed production, 5% to chewing and juice, 25-30% to Khandasari (jaggery). Only 60% would be used for actual sugar production. Percapita consumption of sugar in India: 20kg and 5Kg Jaggery.

Plant/Ratoon ratio is usually 45/55 to 55/45, but almost after 3 decades it’s shifting to 30/70 and to overcome this additional 14-15 milling plantation is required for Sugar alone. Moving towards Transgenetic sugar for alcohol manufacture also would enhance yields. Most of Mills have gone for Semi automation of Milling and Honeywell, Rockwell, OA, ABB, Siemens and several entered this Domain. As future is unfolding to smart grid and Plug-in technologies this Industry would see more of development.

With CNG being produced of spent wash and this also being worthy template for CDM, we would see rural landscape buzzing with Flex fuel vehicles and vibrant innovations.

Biofertilizer of spent wash is a must for all distillations and is still better to Incineration as to totally burn residues we need high energy and Biofertilizer would enhance soil fertility.

Today most Molasses trading Companies like UMC, SVG, Peter Cremer, and Toepfer have no sellers at all and Domestically Present Indian Molasses Prices are above 7000 INR, so factories without distillation too are generating Good Revenues.

Bagasse is also being completely utilized for self Cogeneration and as future is moving to whole cane crushing with Sugars induced in cane leaves no Trash would go waste or burnt in field. Bioplastics is another area which is catching the attention of Industry and Bagasse is the raw material with Sugar as binder and this also Generated CDM. Some have been using Bagasse for paper and particle board manufacturing.

With Agronomy being the prime focus to bring better yields, Crop Sciences have also taken Centre stage and companies like Syngenta, Monsanto, and DuPont and several others conducting lot of research. Indian Companies like NFL, Nuziveedu Seeds, Ralli’s have also seen Success.

Other area of focus in Indian Biofuel Industry is Enzyme manufacturers like Novozyme, Genencor, Abmauri, Tate, Richcore lifesciences, Enzyme India etc.

Traditional Practices like Black Gold agriculture which enhances carbon content and Soil health have again come back to centre stage. VAM fungus has also seen Success in Sugarcane cultivation. Optimizing Fertilizer, water, Insecticides, Pesticides, Herbicides and mapping Crop has also taken precedence. For Seed Treatment of Cane Renewable resources like Solar Power for steam and Temperature are being utilized. Future Cultivation should enable more ratoon years to bring down cost as well stop soil erosion.

Manpower in Harvesting being Critical Semi and full harvesting is being studied and also to optimize cost. Mahindra Tractors is working on Solutions around Tractor suiting Asian needs.

In Sugar manufacturing saving steam, minimizing usage of Lime, HCL, Sulphur and also moving towards refined Sugar has caught up attention of Industry. Using Fondant for Crystallization is visible in all plants. Sugar the Commodity is moving from being a sweeter to Fortification and Low GI Sugar bringing in value addition and take cognizance of Health & Diet. With Distillation rapidly moving towards Second generation and Stable prices for Alcohol as Fuel and also Potable usage, Sugarcane’s 50% revenue stream would be from Sugar and 50% from Alcohol and Cogen.
**Alcohol requirement:**

- Alcohol based chemical Industries: 1,100 million Its
- Potable Alcohol requirement: 1,000 million Its
- @5% ethanol Blending : 600 million Its
- @10% ethanol Blending : + 600 million Its

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3,300 Million Its
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India produces 1.3 billion Its and requires almost 2 billion Its if it has to cater 10% blending. Petrol Consumed in 2006-07: 9,295,000MT. Only 0.64% of petrol is replaced with Ethanol. Alcohol at 10% level requires another 10-15 million KIts, so a possible acreage growth of 25-30 Million ton based on price rewarded to farmer.

**Area Under Sugarcane:** 3,329,000 hectares

- Production of Sugarcane (Yield) : 65 MT/Hectare
- No of Factories in Operation : 500 & above
- Average capacity of factory : 3500 Tone Per Day
- Molasses Production : 6,500,000 MT
- Molasses Percentage : 4.4%
- Percapita Consumption of Sugar : 20 Kg
- Percapita Consumption of Jaggery : 5Kg

Of the Total Cane Production:

- 12% will go into Seed purpose and 5% goes to Chewing and Juice manufacturing.
- 25-30% will go into Khandasari and Jaggery Production.
- Only 60% is being used for Sugar production. India requires additional 30 million ton of cane production to its regular sugar sweetener cane requirement.

**Other Liquid Fuels of Cane:**

**Bio Butanol**: Biobutanol offers several advantages. It can be transported in existing pipelines, it’s less corrosive, it can be mixed with gasoline or used alone in internal combustion engines, and it packs more energy per gallon than ethanol.

Until the mid-20th century, Biobutanol was produced from fermented sugars such as corn glucose. But low yields, high recovery costs and petroleum’s increased availability after World War II sidelined fermentation-based systems for Biobutanol production.

Biobutanol processes employed Clostridium bacteria to carry out the critical task of fermentation. Such
processes normally involve four preparatory steps (pretreatment, hydrolysis, fermentation and recovery) carried out separately and sequentially.

Now only three steps used. For example, enzymes and the bacteria are allowed to carry out their respective tasks simultaneously. Throughout, a procedure known as “gas stripping” is used to extract the Biobutanol as it is produced.

“fed-batch-feeding,” increased production even further. For example, during a 22-day fed-batch operating period, a culture of C. beijerinckii P260 converted nearly 430 grams of sugar into 192 combined grams of acetone, Biobutanol and ethanol.

Laxmi organic industries of Mumbai has announced Biobutanol plant of 1000MT/Year with Green BioLogics UK.

**Methanol:** (CH3OH) is a simple one-carbon alcohol that is a colorless and tasteless liquid with a faint odor. Other names are Methyl-alcohol and Wood-alcohol. It is produced from natural gas but can also be derived from renewable bio-feedstocks.

Methanol is a basic building bloc and a raw material for many derivatives in the chemical industry. It is used to produce formaldehyde, acetic acid and a variety of other chemical intermediates. These derivatives are ultimately used in the manufacture of countless products that we find in our everyday lives, including: resins, adhesives, paints, inks, foams, silicones, plastic bottles, polyester, solvents and windshield washer fluid. A significant amount of methanol is also used to make MTBE (methyl tertiary butyl ether), an additive used in cleaner burning gasoline. Methanol is also widely considered to be a potential hydrogen carrier for many future fuel cell applications.

Worldwide consumption of methanol is about 35 million tons which ranks it among the top 4 globally used chemicals.

**Liquid Hydrogen:** Comprising nano particles of rhodium and palladium, supported by larger particles of cerium oxide, the catalyst allows the reaction to occur at a temperature of around 500 degrees Celsius.

The hydrogen produced is reported to be pure enough for use in fuel cells and, unlike current production methods which are 90 per cent reliant on natural gas and emit large quantities of carbon dioxide the fuel source is renewable.

“As with traditional methods of hydrogen production, carbon dioxide is still created during the process we have developed. However unlike fossil fuels which are underground we are using ethanol generated from an above-the-ground source - plants or crops. This means that any carbon dioxide created during the process is assimilated back into the environment.

Tata's and ISRO are working on Hydrogen Fuelled vehicles.