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Biofuels: Indian Energy Scenario

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Abstract

Energy is a basic requirement for economic development. This growing consumption of energy has also resulted in the country becoming increasingly dependent on fossil fuels such as coal, oil and gas. The country urgently needs to develop a sustainable path of energy development. Biofuels seems to have the potential to contribute significantly to India's energy security. However, a clear choice needs to be made on priorities.

Key words: Fuels, energy, renewable, biofuels

Introduction

In every sector on Indian economy – agriculture, industry, transport, commercial and domestic – the consumption of energy in all forms is steadily rising. Concerns have been raised on the security of energy supply needed to sustain our economic growth in view of rising prices of oil and gas and their shortage in future. Increased consumption of fossil fuels also causes environmental problems both locally and globally[1]. With rapid industrialization, urbanization and population growth, the gap between demand and supply in the Indian energy scenario is bound to continue in the future in the coming decades of 21st Centuary[2]. At present, the estimated gap is about 14 % (peak demand) with the expected growth of 8 % per annum. Although the energy supply through fossil fuels plays a vital role in India, there is a large potential for renewable energy resources, which needs to be harnessed in a planned and strategic manner to close the gap between demand and supply[3].

Increased use of renewable energy sources and energy conservation are the twin planks of a sustainable energy supply. Advantages of renewable energy are manifold: it is perennial, available locally, environment friendly, well-suited for decentralized applications and use in remote areas, does not need elaborate arrangements for transport, and is usually modular in nature, that is small-scale units and systems can be almost as economical as large-scale ones. In terms of the total energy consumption, India probably is the fifth-largest energy consumer in the world[4]. On a per capita basis, however, this consumption is very small as compared to the World Average (particularly in comparison to the US) (figure 1). The per capita electricity consumption in India in 2001 was 561 kWh (kilowatt-hours) as compared to a world average of 2361 kWh. Countries high on the human development index average a consumption of 8520 kWh[5]. Equally important, looked in terms of CO_2 (carbon dioxide) emissions, India's emissions today are about 1.1 tonnes of CO_2 per capita, roughly one-sixth in terms of world average, and very small as compared to Australia or the US[6]. What is also interesting is the fact that in the year 2020, in a business-as-usual scenario, the per-capita energy consumption will increase to only about 2.2 tonnes of CO_2 equivalent. That is still way below what the world averages are, or were, in 1990.

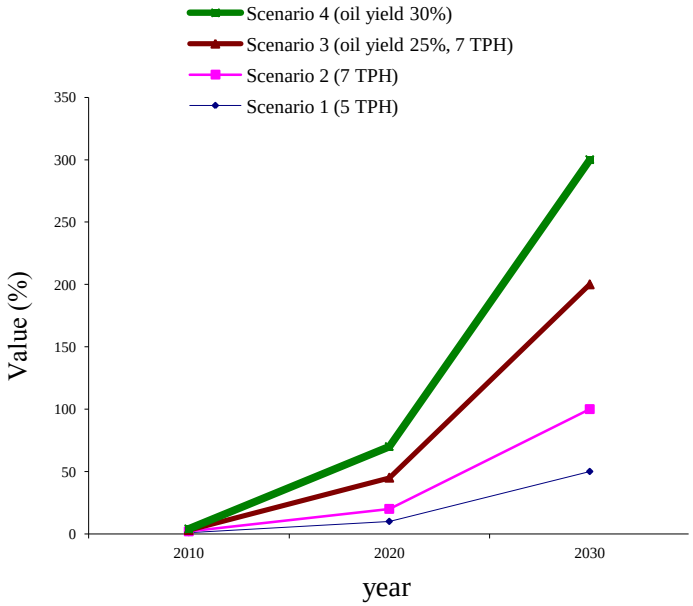

Figure 1: Scenario definitions: suitable wasteland area placed under jatropha

India faces enormous challenges as it aspires to reach rates of economic growth of 8%-10% per annum today and in future. Nearly 57% of India's population has no access to electricity as per the census survey of 2001[7]. Forty-three percent have no access to clean cooking fuels. These people are continuing to

burn biomass with enormous implications, not only for greenhouse gas emissions but also for indoor air pollution and, therefore, the health of women and children. Approximately, half-a-million premature deaths and nearly, 500 million cases of illness are estimated to occur annually as a result of exposure to smoke emissions from biomass use by households in India, making indoor air pollution the third-leading health risk factor[8]. Young children (under five years of age) and women are affected disproportionately.

For those who have access to more modern commercial energy forms, the challenge is to be able to secure access to reliable and good-quality energy, This is borne by the fact that the country even today, is suffering from huge electricity shortages (peak shortage of 12.3% and energy shortage of 7.7%) and has an oil-import dependency of 75%. Estimates from TERI's[8] Integrated Energy Model for India reveal that, by the year 2030, India would be dependent on imported oil to the tune of nearly 95% and would indeed be importing nearly 40% of its coal requirements too! Nearly 40% of the electricity produced in the country is unaccounted for.

On the other hand, demand for petroleum products, in particular diesel, is set to increase rapidly. Transport sector is one of the fastest-growing energy sub-sectors in the economy for two reasons: one, concomitant with growth of the economy would come the increasing demand for both freight and passenger movement; and two, India's base as far as mobility is concerned is very low as compared to the rest of the world. The worrisome aspects of India's growth for transport demands are the fact that[9]: Over 80% of passengers and 60% of freight are moved by road, There is an increasing dependence on personal modes of transport, and Diesel and petrol contribute to 98% of the energy consumed in the transport sector.

As is obvious from table 1, India will be faced with huge and growing energy shortages in the years to come as per our current development path. If such shortages are not to hamper our economic and social growth aspirations, the energy sector would need to be steered along a more efficient path of development.

Recent Initiatives to Meet the Energy Challenge

India has taken a number of initiatives to try and address the energy challenge that it faces. Reforms programme in the electricity sector was initiated in 1991, largely through the recognition that there was a need for very large infusion of capital into the sector if shortages were to be prevented from expansion exponentially. After nearly ten years of experimenting with various reform models aimed at wooing the private sector, the realization dawned that unless distribution systems are strengthened and result in improved cash flows, little private sector interest can be created. The Electricity Act, 2003, was designed to address itself to promoting competition, efficiency and access in the electricity sector and harnessing private capacities where possible.

Additionally, the EA 2003 also recognized the need to exploit various forms of energy and provided a much-needed emphasis to exploitation and use of renewable energy forms. It calls upon the 'central government to prepare National Electricity Policy and Tariff Policy based on optimal utilization of resources such as and renewable sources of energy' and enjoins state electricity regulatory commissions to 'promote cogeneration and generation of electricity from renewable sources of energy by providing suitable measures for connectivity with the grid and sale of electricity to any person, and also specify, for purchase of electricity from such sources, a percentage of the total consumption of electricity in the area of a distribution licensee'.

Even in the case of the petroleum sector, a draft petroleum regulatory bill has been under consideration of the government for a number of years. Recognizing the challenge of pricing petroleum products rationally to provide a balance between generating adequate internal resources for the companies and providing access to consumers, the reforms road map resulted in dismantling of the administered pricing mechanism for most petroleum products, with the exception of sensitive ones of petrol, diesel, kerosene and LPG (Liquefied Petroleum Gas). If a recent proposal of the petroleum ministry, there would be a phased increase in the prices of LPG and Kerosene o more closely reflect the cost of supply. As per this proposal, if crude oil prices remain at the current level of less than 60 dollars, approximately, 35% of the subsidy would be eliminated by October 2006. Thereafter, it could take nearly a year more for the price to reflect the current costs of LPG supply. In case of Kerosene, families above the poverty line would be paying almost the full cost of kerosene by April 2007. However, those below the poverty line would still enjoy a subsidy benefit of over 40%.

Apart from trying to meet the cooking energy needs of rural consumers, the government also has an ambitious programme of providing electricity to all villages by 2009 and to all households by 2012[10]. Adequate provisions are being made by the government to meet the capital cost of providing the requisite infrastructure for this purpose. However, the challenge of energy supply through these wires still looms large. Subsidized kerosene, which was meant to be a substitute for firewood towards meeting the cooking energy requirements of the poor, is primarily being used to meet the lighting needs as electricity is not available. Nearly 56% people in the rural areas depend upon kerosene as a primary fuel for meeting the lighting requirements.

Table-1
Energy demand and supply projection for India

Fuel		Coal (MT)	Gas (BCM)	Oil (MT)	Total (MTO_{eq})
Demand	2002/03	340.1[a]	43.8	97.7[d]	-
	2006/07	460.5[b]	84.3[e]	134.5[b]	-
	2024/25	669.0[c]	142.7[g]	256.7[c]	-
Supply	2002/03	341.3[a]	31.4[d]	33.0[d]	-
	2006/07	405.0[b]	37.9[bf]	34.0[b]	-
	2024/25	600.0[c]	29.5[cf]	80.0[c]	-
Gap	2002/03	1.2	-12.4	-64.7	-74.8
	2006/07	-55.5	-46.4	-100.5	-164.7
	2024/25	-219.0	-113.2	-176.7	-304.1

MT– illion tonnes, BCM – billion cubic metre, MTO_{eq}–million tonnes of oil equivalent: [a]MoC (2004); [b]Planning Commission (2002); [c]TERI (2004); [d]TERI (2003), [e] Planning Commission (1999[a]), f Including the KG basin discoveries; [g] Planning Commission (1999[b])

The Role of Biofuels

Recognizing access to energy by the poor as a major barrier to the rapid growth prospects of India as well as its vulnerability to volatile international oil prices, the Government of India has, in recent times, provided major emphasis to biofuels, in particular, jatorpha-derived bio-diesel. Public sector oil companies have offered an assured by-back process for bio-diesel at 25 rupees per litre[11]. A detailed project report recently prepared under the ministry of Rural Development identified various end-uses for non-edible SVOs (Strait vegetable oils) produced from plants, such as jatropha, including their direct use for transport applications and power generation on a decentralized basis apart from conversion of the SVOs to bio-diesel for purpose of blending with petro-diesel.

Large tracts of wasteland can be placed under such plantations for production of bio-diesel. Under alternate assumptions of productivity of such plantations and efficiency much as 40 % of India's diesel requirements by the year 2030. Figure 1 gives assumptions behind each of the scenarios.

As such, prima facia, bio-diesel seems to have the potential to contribute significantly to India's energy security. However, a clear choice needs to be made on priorities of use of the SVO produced from plants such as jatropha. The use of SVO for decentralized applications, with R and D, could go a long way in securing access to energy in the remote rural areas, either in the form of a fuel providing motive power or for conversion into electricity to feed into local mini-grids. Alternatively, the SVO could be converted into bio-diesel for purpose of blending into petro-diesel, thereby saving foreign exchange.

Conclusion

Irrespective of the end-use application, there is an urgent need for the government to support a target R and D programme that would address itself to the following issues: Oil extraction, Enhancing plant productivity and resilience, Optimizing plantation models, Raw oil use, Institutional models to maximize local socio-economic benefits, Environmental and social impact assessments

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