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A Quarterly e Newsletter

SPWD Landuse Group

Issue: 01, May2008

BIO FUEL - Special

"The Only Limit To Our Realization Of Tomorrow Will Be Our Doubts About Today."

Franklin D. Roosevelt

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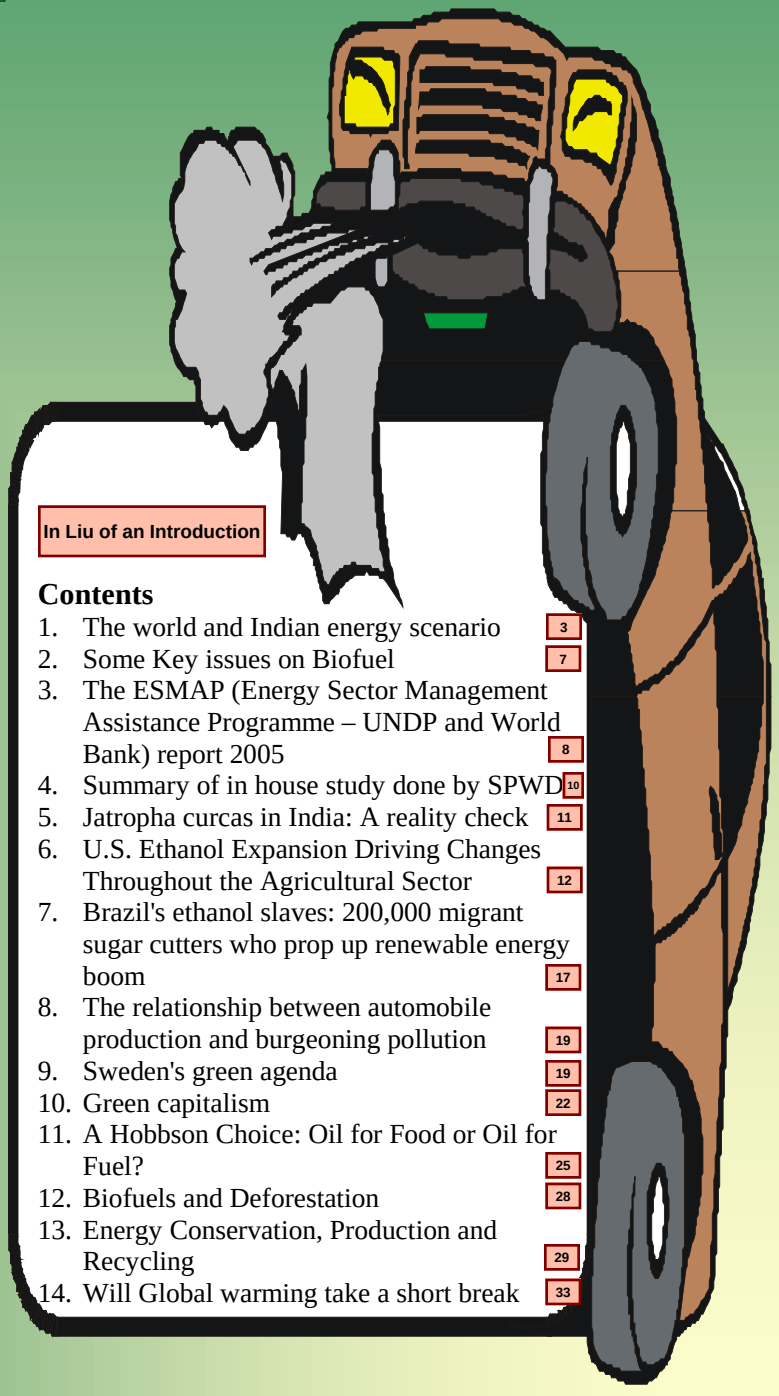

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From the Frying Pan into the Fire

In liu of an introduction

The biofuel issue has come centre stage with the escalating food prices . The Bush administration has come out with statements that the rise in corn prices is only partly to do with the new US policy for enhanced ethanol production from corn and more to do with rising fuel prices and increased demand for meat from countries like India and China. Prime Minister Manmohan Singh on the other hand has expressed deep concern that the rising price of grain will offset the gains achieved from liberalisation.

It is in this connection that SPWD would like to bring out periodic issues on the burning subject of biofuel and related issues . It not the purpose of this magazine to come out with a definitive answer to this controversy . However the magazine will definitely attempt to look at the issue in its various dimensions and interconnections so as to reach at the heart of issue being debated.

The biofuel issue has as its roots the questions related to energy sustainability on one hand and climate change triggered by CO_2 emissions on the other . While the movie Inconvenient Truth by Al Gore shows the alarming rise in CO_2 emissions and its implication for climate change, recent research gives a ten year breathing space to mankind to get its act together on this issue. It seems there are times when the curve is flat !!!!

The study coinciding with the heating controversy on biofuel as a result of the escalating food prices raises more questions than it answers . How do we weave our way through this maze is indeed the of prime importance .

In a recent Consultation on this issue organized by Deccan Development Society and Grain , there was an attempt to distinguish between Corporate driven Biofuel production and Biofuel production for self consumption by communities. The controversy related to Biofuel notwithstanding, should not lead us back into the laps of the petroleum and coal lobby which is as much Corporate driven as biofuel if not more .

Should the question be yes or no to biofuel, or who gains from biofuel in the current context ?? Similar questions can be raised about issues related to energy sustainability and climate change .

The articles below attempt to highlight different facets to throw more light on the above. We hope that this will provide some pointers as to the direction in which the current debate can be resolved . We look forward to your contributions and continuing support in this regard

- Viren Lobo

Snapshots from the visit of GRAIN & KALPVRIKSH to Jhadol, Udaipur

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1. The world and Indian energy scenario

The modern concern for depletion of the natural resources first begins with the club of Rome which predicted doomsday within the next hundred years in terms of the depletion of natural resources (Limits to Growth by Denis Meadows et al 1972) . While there a still seventy years to go, the predictions of the Club of Rome have been belied with the finding of newer resources which expanded the known reserves and better ways to exploit the old resources. Consumption curves have been exponentially rising with all pleas for restraint falling on deaf ears. The issue of energy is no different. On the energy front, the graph below depicts the current consumption of energy per capita as a function of cumulative population.

World energy scenario[1]

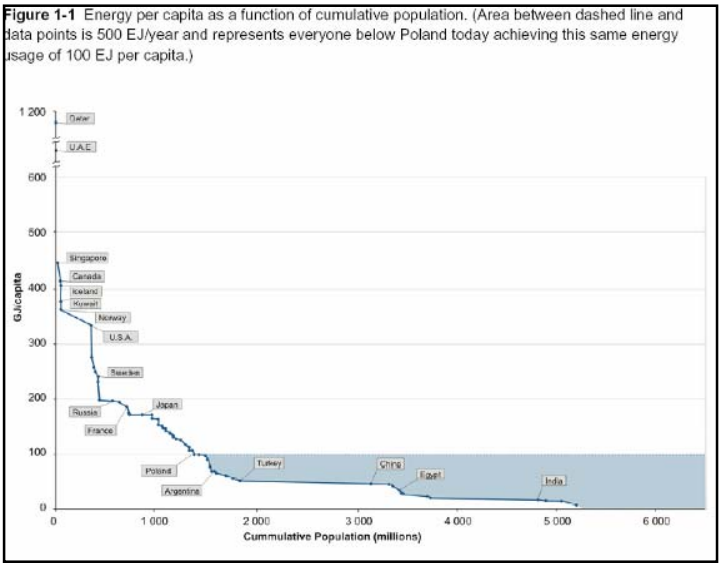


Figure 1-1 Energy per capita as a function of cumulative population. (Area between dashed line and data points is 500 EJ/year and represents everyone below Poland today achieving this same energy usage of 100 EJ per capita.)

The Bruntland report (Our Common Future) rephrased the crisis. Concern for environment and its degradation became the corner stone. In the events leading to Kyoto protocol and beyond, the concerns for climate change and the acrimonious debate on the subject have different dimension which need to be carefully examined. The energy consumption pattern of different countries (see table above) on the one hand and the pollution pattern is one major aspect that one needs to get a handle of. Countries like India defend the need for growth on the grounds of low per capita energy consumption (see table above) and low contribution to pollution . America on the other hand questions the logic given under the Clean Development mechanism outlined under Kyoto protocol as a means of defending its position as the largest energy consumer (per capita * population) and the largest polluter of world resources. This notwithstanding, one of the largest dealers in carbon credits is the Chicago Stock exchange. The issue of carbon credits/ CDM can be exploited for whatever profit there is to be had. Who ultimately pays for this concern on environment?

Despite the modernity of the scenario, is this debate new? In 1798 Malthus in his Essay on the principles of population, highlighted the following.

1. Population is necessarily limited by the means of subsistence.
2. Population invariably increases where the means of subsistence increase unless prevented by some very powerful and obvious checks.
3. These checks and the checks which represent the superior power of the population and keep its effects on a level with the means of subsistence are all resolvable into moral restraint, vice and misery [2].

As is well known, population has increased by leaps and bounds since then, with India beginning its upward trajectory only in the 20th century. While poverty and abject misery have not been relegated to the past, consumption patterns have not only kept pace with population, they have increased dramatically. With the doomsday predictions of the Club of Rome and the very recent Bali conference on climate change being kept on hold for the moment, clearly there is more to the concern for the environment than Malthus. However it is not the purpose of this issue of the magazine on biofuel to go

[1]Deciding the Future : Energy policy scenario 2050 World Energy Council 2007
[2] From - A history of Economic Thought by Isaac Ilyich Rubin

into those issues. This issue tries to look at the various current dimensions of energy and its reflection in the thrust given to biofuel .

The tables below outlines some selected parameters with respect to energy [3].

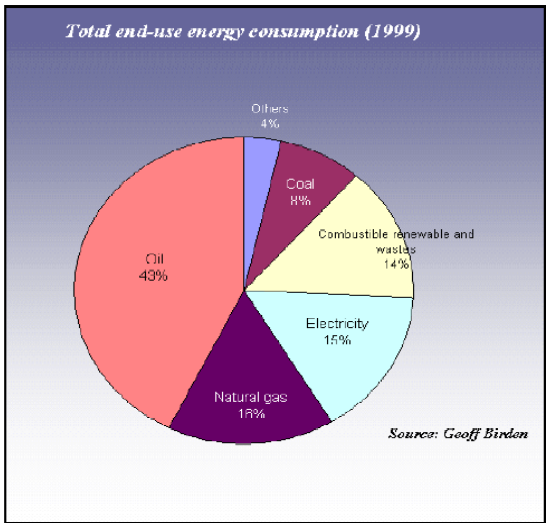
Table B-1 Energy price drivers

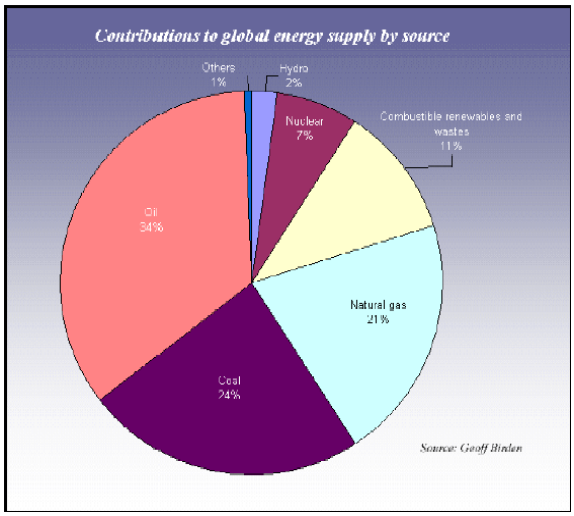
Driver	Oil	Gas	Coal	Uranium
Demand	– Strong growth – Global trend +1-2% per annum	– Growth similar to oil – Globally +1.5-2% per annum	– Growth similar to oil – Globally +1.4-2% per annum	– 2004 demand outstripped supply – Secondary sources
Reserves	– Currently consumed one-third of proven conventional reserves – Peak oil not an issue for some time	– Very large reserves – 65 years of proven reserves estimated – At least as much again – Non-conventional, too	– Huge reserves >200 years – Well distributed	– >50 years – Geographically concentrated though
Costs	– Production costs USD2-25 (conventional), >USD40 (non-conventional) – Rise of oil synthetics?	– Shipping costs are key	– If not locally extracted and used, freight rates key driver	– Driver is the cost of extraction and shipping
Market Power	– Strength of OPEC?	– Three countries with 55% of reserves	– Limited	– Small number of suppliers – Impact limited
Other	– Development of reserve capacity	– Importance of "gas-to-gas" competition – Oil de-link	– Fuel substitution – Environmental regulation	– Much investment in mining needed
Possible Price Outcome	– EIA price, falling to USD47/bbl in 2014 (2004 value) – IEA more aggressive	– Regional markets important – No price as yet	– Reasonably static at around USD50/t	– Nothing reported

Table B-2 Emissions Intensity in terms of energy and GDP for selected countries (data from IEA, 2005, and World Energy Council, 2007).

	CO_2/E (Mtonne/Mtoe)	CO_2/GDP (tonnes/kUSD)		CO_2/E (Mtonne/Mtoe)	CO_2/GDP (tonnes/kUSD)
Argentina	2.12	303.0	Republic of Korea	2.24	521.6
Australia	2.99	597.2	Mexico	2.39	419.0
Bangladesh	1.54	144.9	Russia	2.44	1247.6
Brazil	1.62	238.7	Saudi Arabia	2.41	1118.5
Canada	2.05	577.1	South Africa	3.18	841.6
China	2.90	671.8	Sweden	1.05	216.0
France	1.41	238.2	Syria	2.68	812.3
Germany	2.44	406.8	Tanzania	0.17	139.3
India	1.96	377.9	Thailand	2.26	448.0
Iran	2.73	853.3	United Kingdom	2.36	342.5
Japan	2.37	360.6	United States	2.50	553.8

[3] Deciding the Future : Energy policy scenario 2050 World Energy Council 2007





World population	5,921.39 million
GDP	US$32,445.29 billion (1990 dollar)
Total primary energy supplied	9,774.48 Mtoe
Electricity consumed	13,502.41 TWh
CO_2 emissions	22,955.80 million tonnes

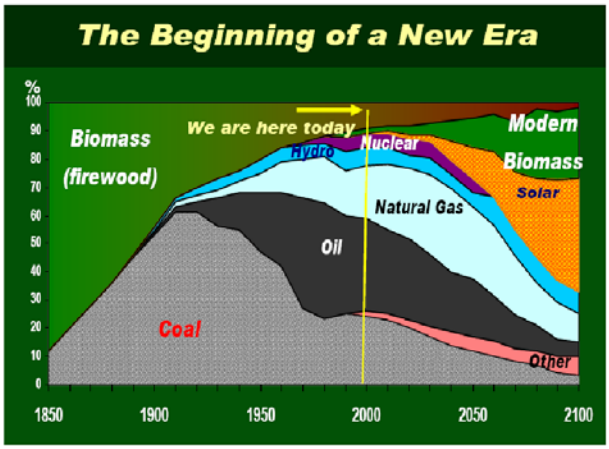
Table 1.3: some global parameters

Such data can be used to develop energy indicators. Selected examples are given in Table 1.4 All figures are for the year 1999 and financial quantities are based on the 1995 US dollar.

Indicator	Units	1999 figure
Total primary energy supplied	toe/capita	1.65
Total primary energy supplied	toe/US$1000 GDP	0.50
Total primary energy consumed per capita	kWh/capita	2229.6
CO_2 emissions per toe of primary energy supplied	tonnes CO_2 /toe	2.63
CO_2 emissions per capita	tonnes CO_2/capita	3.88
CO_2 emissions per US$ of GDP	kgs CO_2 /US$	0.708

(Source: IEA Statistics)

Chart 1. Changes in primary energy shares, 1850 to 2100
Source: Nakicenovic et al (1998) Fig 5.7 Scenario C1



Despite the concern for sustainable fuel, one prediction indicates that it is only after 2050 that solar energy and bio fuel will be a major contributor of energy[4]. The predictions take into account production patterns and the nature of the cost and profitability factors driving change in various scenarios from aggressive government push to a more market based approach. The success story of Brazil vis a vis ethanol reflects more the competitiveness of Brazilian ethanol vis a vis petroleum prices (40 % the price of petrol at present and at 70% efficiency ie effectively 60 % of the price) than any other single factor. http://www.europabio.org/Biofuels%20reports/Worldwatch_biofuels.pdf. An examination of the history of Brazils success in ethanol will show how the rising cost of petroleum exports, forced the government to develop a conducive policy for the ethanol based car industry. On the other hand, the energy scenario for India projected for 2031-32 still depends on coal based energy production which will account for more than 40 % of the requirements i.e. more than double that of the world usage of coal today. Clearly sustainable energy has a long way to go[5] . The table below shows the top five producers

[4] A Biofuels Manifesto: Why biofuels industry creation should be 'Priority Number One' for the World Bank and for developing countries John Mathews* September 2006.
[5] Draft report of India's integrated energy policy , planning commission 2005 .

of Ethanol and Biodiesel. While Brazil and the US top in ethanol production Germany is streets ahead of the rest in ethanol production[6].

Table 1. Top Five Fuel Ethanol Producers in 2005

	Production (million liters)
Brazil	16,500
United States	16,230
China	2,000
European Union	950
India	300

Source: Christoph Berg

Table 2. Top Five Biodiesel Producers in 2005

	Production (million liters)
Germany	1,920
France	511
United States	290
Italy	227
Austria	83

Source: F. O. Licht

Indian Fuel mix scenario in 2031 – 32 at 8 % GDP growth [7]

Table 3.7: *Scenario Summaries for 8% GDP Growth — Fuel Mix in Year 2031-32*

Million Tonnes of Oil Equivalent (MTOE)

Scenario No.	1	2	3	4	5	6	7	8	9	10	11
Scenario Description	Coal Dominant Case	Forced Nuclear	Forced Hydro	Forced Nuclear+Hydro	Forced Nuc+Hyd+ GAS	Forced Nuc+Hyd+GAS+ coal eff	Forced Nuc+Hyd+GAS+ DSM	Forced Nuc+Hyd+GAS+ DSM+ coal eff	Forced Nuc+Hyd+GAS+ DSM+ coal eff+ rail share up	Forced Nuc+Hyd+GAS+DSM +coal eff+rail share up+transport eff	Scenario 10+Forced Renewables
Oil	467	468	463	493	464	486	486	486	487	416	486
Natural Gas	114	114	116	121	224	181	164	164	164	163	168
Coal	1,082	995	1,031	940	807	776	706	658	658	659	573
Hydro	5	5	49	49	49	49	50	50	50	50	50
Nuclear	3	89	3	89	89	89	89	89	89	89	89
Solar			1								4
Wind	1	2	0	0	1	0	0	0	0	0	12
Fuelwood											69
Ethanol											4
Bio-diesel											8
Total	1,672	1,673	1,663	1,692	1,633	1,581	1,494	1,446	1,447	1,378	1,383
Oil	28%	28%	28%	29%	28%	31%	33%	34%	34%	30%	29%
Natural Gas	7%	7%	7%	7%	14%	11%	11%	11%	11%	12%	12%
Coal	65%	60%	62%	56%	49%	49%	47%	45%	45%	48%	42%
Hydro	0%	0%	3%	3%	3%	3%	3%	3%	3%	4%	4%
Nuclear	0%	5%	0%	5%	5%	6%	6%	6%	6%	6%	6%
Solar	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Wind	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%
Fuelwood	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	5%
Ethanol											0%
Bio-diesel											1%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

[6] Biofuels for transportation Global potential and implications for sustainable agriculture and energy in the 21st century prepared by the Worldwatch Institute for the German Federal Ministry of Food, Agriculture and Consumer Protection (BMELV), in cooperation with the Agency for Technical Cooperation (GTZ) and the Agency of Renewable Resourcs (FNR)

[7] Draft report of India's integrated energy policy , planning commission 2005 .

2. Some Key issues on Biofuel[8],

Some the major issues highlighted in this essay written in 2006 are as follows.

1. One reason that biofuels have achieved such a high place on the global agenda is that demand for energy is rising and is certain to continue to rise in the coming decades. Energy use is predicted to jump in many parts of the developing world, where use of marketed energy has been very low until now. Indeed, some 2 billion people still have little or no access to modern energy.
2. According to the U.S. Energy Information Administration's 2006 *International Energy Outlook*, global consumption of marketed energy is projected to rise by 71 percent between 2003 and 2030, from 421 quadrillion British thermal units (Btu) to 722 quadrillion Btu. Three-quarters of the increase will come from developing countries.
3. Food insecure people do not have the income to buy the food that is available. If increased production of biofuels can raise the incomes of small farmers and rural laborers in developing countries, it may in fact improve food security. Still, risks for food security remain, particularly if the biofuel sector is not well managed and if oil price instabilities drive food price instability. Destabilizing oil price fluctuations that translate into food price fluctuations may actually be more worrisome than long-term price effects, as the poor have little capacity to adjust in the short run. Opening up trade opportunities for biofuels can dampen price fluctuations. Thus the effects of biofuel expansion on food security depend heavily on policies related to technology and trade.
4. The table above shows that with technology improvements, the nature of price increase in food grains after the introduction of technology improvements[9]
5. The high demand for energy and the apparent enormous potential of biofuels are no guarantee that small farmers and poor people in developing countries will receive the benefits. Creating an industry that helps the neediest people improve their lives and livelihoods will require careful management at all levels . This management includes taking the necessary steps to develop a global market and trade regime with transparent standards for biofuels.

Percentage Changes in World Prices of Feedstock Crops under Scenarios, Compared with Baseline

Feedstock crop	Aggressive biofuel growth scenario without technology improvements[a]		Cellulosic biofuel scenario	Aggressive biofuel growth scenario with productivity change as well as cellulosic conversion
	2010	2020	2020	2020
Cassava	33	135	89	54
Maize	20	41	29	23
Oilseeds	26	76	45	43
Sugar beets	7	25	14	10
Sugarcane	26	66	49	43
Wheat	11	30	21	16

Source: IFPRI, IMPACT results, 2006.

[a]Assumptions based on stated plans for biofuel production in Brazil, China, Europe, India, and the United States, and on a scenario of aggressive biofuel growth in Africa (for details see M. W. Rosegrant et al., "Bioenergy and the Global Food Balance," brief in *Bioenergy and Agriculture: Promises and Challenges*, 2020 Focus 14 [Washington, D.C.: IFPRI, 2006]).

(The paper while providing a road map for biofuel, advocates for its industrialization. It is however not clear how the concrete issues raised in the paper itself will be addressed. In the absence of conscious efforts by the State in favour of the poor, the major benefits of biofuel will go to corporates. eds).

[8] excerpts from an essay by Joachim von Braun and R K Pachauri

[9] *A Closer Look at the Food-versus-Fuel Debate* Mark W. Rosegrant, Siwa Msangi, Timothy Sulser, and Rowena Valmonte-Santos

3. The ESMAP (Energy Sector Management Assistance Programme – UNDP and World Bank) report 2005

The report provides insights into the biofuel programme in various countries.

Ethanol is widely used in Brazil as a transportation fuel, and the United States, the world's second largest consumer of fuel ethanol, passed legislation in 2005 to expand the use of renewable fuels, such as ethanol and diesel, to a minimum of 4 billion gallons (15 billion liters) by 2006 and 7.5 billion gallons (28 billion liters) by 2012. Brazil and the United States account for 80 percent of world ethanol demand. The European Union (EU) is pursuing large-scale expansion of biofuel use in the transport sector. This policy will also affect the EU accession countries. Australia, China, Colombia, India, and Thailand are all embarking on national biofuel programs to varying degrees.

Brazil is the world's largest producer and exporter of sugar, and is also the largest producer and consumer of fuel ethanol from sugarcane as a transportation fuel. Between 1975 and 2004, the ethanol program in Brazil substituted about 230 billion liters of gasoline (Nastari 2005a). The Center-South region of Brazil is the lowest-cost sugarcane-producing area in the world. This region accounts for 85 percent of Brazil's sugarcane and ethanol production (Macedo 2005). The state of São Paulo is the largest and the lowest-cost ethanol producer in the country. One-half of the sugarcane output in Brazil has been made into ethanol in recent years. In the 2004–2005 season, Brazil produced one-quarter of the total world sugarcane output. About 5.4 million hectares are used for sugarcane production, and Brazil produced close to 12.5 billion liters of anhydrous and hydrous ethanol in 2004. As of December 2004, there were 320 Brazilian plants processing sugarcane (Nastari 2005a).

The bioethanol industry in Brazil is an undisputed world leader. Ethanol from sugarcane in Brazil is arguably the first renewable fuel to be cost-competitive with a petroleum fuel for transport. This achievement builds upon 70 years of history. Blending of 5 percent anhydrous ethanol in gasoline was first authorized in 1931, and mandated in 1938. The percentage of ethanol blended into gasoline was increased to 22 percent in 1993, and adjusted on several occasions subsequently. Since the National Alcohol Program, Proálcool, was launched in 1975, the ethanol industry has addressed and overcome a number of challenges and difficulties. Today, the domestic content of equipment for sugar and ethanol production and combined heat and power generation is nearly 100 percent. Many advances have been made in agroscience to control pest, disease, and weed infestations. Effluents and wastes, previously sources of serious environmental contamination, are now recycled to a considerable extent for ferti-irritation, aiding to minimize environmental damage.

The first oil crisis of 1973–1974, which quadrupled the price of crude oil, prompted Proálcool to be established by Decree 76593 of November 14, 1975. At the time Brazil was importing four-fifths of its oil. The objective of Proálcool was to use ethanol as a fuel substitute for gasoline and to increase ethanol production for industrial use. The guidelines for Proálcool were defined by a number of instruments enacted by the Instituto do Açúcar e do Álcool (IAA, Institute of Sugar and Alcohol), a government agency that was part of the Ministry of Industrial Development and Commerce.

In the 1970s, an estimated 200–250 plantation families controlled two-thirds of cane production and all of the processing. By 1979, 104 ethanol distilleries were in operation. This rapid expansion was a direct result of extremely attractive incentives in the form of credits provided for distillery construction, effectively offering a government subsidy of as much as 75 percent for these projects, to the point where overcapacity became a concern. The principal beneficiaries of the credit programs were the large producers. There was also rapid expansion of cane areas. For example, total areas under cane cultivation in São Paulo increased by 31 percent between 1978 and 1979. Much of this increase occurred as a result of larger plantations buying up surrounding land belonging to small farmers who were primarily food producers. Existing incentives for food production were not competitive with those of Proálcool, and many chose to sell out and move. According to reports, some farmers were forced off their land by legal or economic pressure, or by direct physical intimidation (Saint 1982).

With the second oil crisis of 1979, the government expanded Proálcool to promote the use of hydrous ethanol as an automotive fuel. The government gave tax incentives for the purchase of cars fueled by hydrous ethanol and subsidized ethanol prices. One fiscal goal set was to ensure that the retail price of hydrous ethanol was at most 65 percent of the retail price of gasoline, making ethanol cheaper than gasoline even after accounting for hydrous ethanol's lower fuel economy. Despite serious fiscal problems that arose in the 1980s, the price difference was not reduced from 35 percent to 25 percent until January 1989 (Szmrecsányi and Moreira 1992). During the first 10 years of Proálcool, ethanol production increased at an annual rate of 35 percent (Szmrecsányi and Moreira 1992). Between 1983 and 1988, cars fueled by hydrous ethanol were more than 90 percent of total auto sales. The highest penetration of ethanol in the fuel market for spark-ignition engines occurred in 1988 when ethanol made up 57 percent of the total fuel consumed (Nastari 2001). By 1990, more than 5 million ethanol-fueled vehicles were in circulation, and represented an estimated 50 percent of the fleet (de Hollanda and Poole 2001). The amount of sugarcane harvested area doubled between 1975 and the mid-1980s (Bolling and Suarez 2001). In fact, enough cane was planted to supply virtually the whole world sugar market had all cane be refined into sugar (Hannah 2000).

Potential for Biofuels for Transport in Developing Countries lower It is informative to estimate how much GHG emission reductions can contribute to the cost of biofuel production. For the first commitment period of the Kyoto Protocol (2008–2012), an estimated upper bound to the price of carbon is US$10 per tonne of carbon dioxide (CO2)-equivalent, and the subsequent period is unlikely to see a price above US$15 per tonne. A well-to-wheel analysis of gasoline and diesel shows that producing and combusting a liter of gasoline or diesel gives off 2,000–3,500 grams (g) of

CO2-equivalent per liter. At US$10 per tonne, a 100 percent reduction in GHG emissions to zero (representing the maximum financial benefit the industry can hope to achieve) would pay US$0.02–0.035 per liter if the energy content is the same, and less if the biofuel has energy content (as with ethanol). A rule-of-thumb estimate used for Clean Development Mechanism (CDM) projects in India is that 1,000 liters of diesel can offset about 1.5 tonnes of CO2-equivalent (Mathur 2005), or US$0.015 per liter at US$10 per tonne, rising to US$0.03 per liter at US$20 per tonne. These are significantly below the tax exemptions granted around the world for biofuels and hence could not be expected to be the main instrument for making a biofuel industry sustainable for the foreseeable future.

(Apart from this serious questions are being raised about the potential for biofuel to reduce GHGs itself, due to the possibility of green house gases leading to deforestation in some cases - eds).

From a climate perspective, biofuels are a relatively expensive way of reducing GHG emissions compared to mitigation measures in other sectors. Even within the transport sector, the promotion of public transportation, non-motorized transport, vehicle energy efficiency improvements, and urban planning and land-use changes are expected to provide much larger and lower-cost GHG reductions than biofuels, and are strategically important in developing countries where transport demand is still growing rapidly. *(Only the cost of Brazil's ethanol is viable in terms of GHGs mitigation cost if one does not look at deforestation issues eds).*

4. Summary of in house study done by SPWD [10]

With the increasing burden on petroleum imports on one hand and the need to reduce CO_2 emissions on the other, the need for biofuels has gained importance. The National Biofuel Mission has estimated that there is a need to aim for 20% substitution with bio-diesel by 2011-12 (as beyond that level it will have adverse effect on the automobile engine). With the consumption of Diesel expected to rise to 66 MMT, 13.38 MMT of bio-diesel will be required. This corresponds to undertaking 11.2 m ha of Jetropha plantation (assuming average production of 4-5t/ha and percentage recovery of 25-40%). The Mission has estimated an availability of 13.4m ha land for the purpose.

While the mission estimates that wastelands to the extent and nature estimated are available, our understanding of working with marginal communities reveals that this is not the case. There are land which are less productive, but there is no land which is waste in the sense that it easily lends itself for cultivation of this magnitude. The secondary literature review and the field visits undertaken by the team reveal that in order to achieve the high yields and reduce cost of production, better land is being sought.

Another aspect is that even if it is common land, intensive land and water management practices are required if one is to get the required yields not only in terms of seed production, but also in terms of percentage oil content Companies do not see communities doing this on their own and hence moves are on to privatize the commons for the development of Jetropha (the more productive lands will be privatized as mentioned above). Refer to the orders for Rajasthan, Chattisgarh. In Tamil Nadu however, DI oils has entered into contract with the farmers to produce Bio-diesel from their private lands. The farmers have been provided with a loan arranged from SBI on the guarantee of DI Mohan Bio Oils. The loan will be repaid from the purchase of oilseeds by DI Mohan Bio Oils.

With respect to the energy scenario, the prime reason for promoting biofuel is the rising oil prices and the need to reduce CO_2 emissions. EU is also in similar situation. However with the limited amount of land available with them, they are looking to source their biofuel from elsewhere. India and China are the main targets, for which DI Oils in particular is entering into agreements with various State governments and Tamil Nadu in particular. With the price differential of $ 200 /ton, the bio-diesel is likely to be exported out of the country. While Tamil Nadu for instance has kept a safeguard of not more than 25% to be exported, how this would get translated into practice remains to be seen. Even if we assume that our foreign exchange requirements for fuel are being offset by the exports, the need to reduce carbon emissions still remains. One straight conclusion is that 33% additional land will be required to meet this demand (land requirement going up to 15 m ha, provided productivity parameters can be adhered to. Considering that this land has to be the more productive land, the implications of these terms of land use management need to be seen).

In terms of the economics of bio-diesel production, in actual practice the oil content varies from 15% to 25% while per ha yield varies from 0.75 T/ha to 2 T/ha. With an oil production of 120 kgs to 500 kgs per ha, the price ranges from Rs3/kg to Rs5/kg seed. It is obvious that wild production such as may be possible on degraded wastelands is not feasible for large-scale production of Jetropha. Heavy investment of Rs30-40 thousand per ha is required to get higher yields. DI Mohan bio Oils and others are researching for ways to improve production per ha as well as oil content of the seeds.

One of the lands, which are being targeted for Jatropha is the pastureland. With the better quality land being targeted, there is bound to be an impact in terms of fodder reduction. The proposed move by the Rajasthan government to privatize the commons was resisted, the amount of land to be allotted was scaled down from 64 lakh has to 1 lakh, with the safeguard that the community approve such allotment.

The railway, which has a big demand for diesel, is experimenting with the use of bio-diesel at various locations, Chennai being one of them. The railways feel that attempting to develop the land available with them for bio-diesel would take them away from their main work of transportation. They have therefore outsourced plantation and collection. In addition due to the high cost of seed, they are

[10] Promotion Biofuels in India : Issues and Prospects Kanishk Negi, Juned Khan and Pran Ranjan . Further developments have taken place since then which have not been included.

resorting to used cooking oil which is procured at Rs 35/litre from hotels. Added to this, the high cost of methanol, which is procured from Maharashtra, make the cost of production of bio-diesel Rs 44/ litre. The railways are undertaking to produce biofuels even at this high cost, to understand the technicalities involved in running the engines etc. Commercial production will have to be done at a lower price. Methanol being explosive also has many restrictions imposed on procurement and transportation. Since estrification depends on methanol, the kind of agencies that can perform this task becomes very limited in number.

Unlike the other uses of Jatropha, for bio-diesel to be worthwhile as an alternative, it has to be produced on a mass scale. Chattisgarh, recognizing this had proposed cluster plantation of 200 ha. AP has proposed plantation at mandal level of 100 ha. Rajasthan envisaged plantations as large as 20,000 ha. These models have however not worked out on the ground. With the boost given to the production of Jatropha in Rajasthan at Rs 8 /kg seed (compared to the natural price of Rs 3 / kg seed offered to the collectors), some agencies went for large-scale procurement of Jatropha. While an artificial price exists in terms of the seed market, this is only temporary. Higher yields cannot be realized without technology improvement, better soil and water management practices etc. This in turn will not translate into higher return without the processing facilities and blending of bio-diesel. The petroleum market is tightly controlled by a few companies, what will be the bargaining point between industry and farmer after they have invested heavily in Jatropha?

To conclude, after taking into account concerns for biodiversity and potential loss of other livelihood opportunities, as a livelihood option, Jatropha depends a great deal on the value added in terms of technological advancement in Jatropha, credit and the processing of oil seed into bio-diesel. Such risks can only be taken by slightly better off farmers. Even then the dependency of the farmer on the processing chain is very high. Jatropha offers potential to diversify livelihood options but in the limited context defined above. Jatropha production in the main will be governed by the major players in the market, be it financial institutions (the role being played by SBI for instance) or Institutions specially created by Industry to deal with bio-diesel as a commodity (DI Mohan Bio Oils, government Institutions like railways, roadways etc).

5. Jatropha curcas in India: A reality check[11]

Reasons stated for its adoption

- Abundant wasteland available
- Jatropha can grow any where;
- Means of wasteland regeneration
- Production and yield requires minimum inputs
- Employment generation
- Energy security

Biodiversity & Jatropha

Implementation in practice

- Wastelands are being used (the term itself is misleading), no contiguous patch of land available.
- Low productivity and heavy inputs requirements make better off lands preferred choice
- Regular inputs required for good production
- Privatisation means potential loss of livelihoods
- Risk of failure has been put on the farmers

Will it flourish here on grazing land?

[11] From the presentation made by Kanish Negi at the biofuel summit Jan 29th 2007 (based on the inhouse study on biofuels by Kanishk Negi et al) .

- European market poses threat to objective of self sufficiency

So why all this hype?

Grain in its magazine seedling July 2007 provides a detailed expose of corporate interest in biofuels in various sectors. It will suffice to provide just one table .

Table 1. Some transnational corporations investing in agrofuels

Agribusiness	ADM, Cargill, China National Cereals, Oils and Foodstuffs Import & Export Corporation, Noble Group, DuPont, Syngenta, ConAgra, Bunge, Itochu, Marubeni, Louis Dreyfus
sugar	British Sugar, Tate & Lyle, Tereos, Sucden, Cosan, AlcoGroup, EDF & Man, Bajaj Hindusthan, Royal Nedalco
palm oil	IOI, Peter Cremer, Wilmar
forestry	Weyerhauser, Tembec
Oil	British Petroleum, Eni, Shell, Mitsui, Mitsubishi, Repsol, Chevron, Titan, Lukoil, Petrobrás, Total, PetroChina, Bharat Petroleum, PT Medco, Gulf Oil
Finance	Rabobank, Barclays, Société Générale, Morgan Stanley, Kleiner Perkins Caufield & Byers, Goldman Sachs, Carlyle Group, Kohsla Ventures, George Soros

Corporate interest in biofuels does not escape Indian companies too. Reliance and Adanis among others have been expressing interest in this area in various forms. Provision of expertise to develop land in Nigeria in exchange for uranium supplies is well known.

6. U.S. Ethanol Expansion Driving Changes Throughout the Agricultural Sector[12]

The recent controversy being raked up by the US administration targeting Indians and Chinese as the major cause for rising food prices has to be taken with a pinch of salt. The article below shows who is really benefiting from the recent US policy to divery the production of corn towards the production of ethanol. While the growth in corn-based ethanol can contribute to the Nation's fuel supply, that contribution is relatively small in the gasoline market but can have large effects in the agricultural sector.

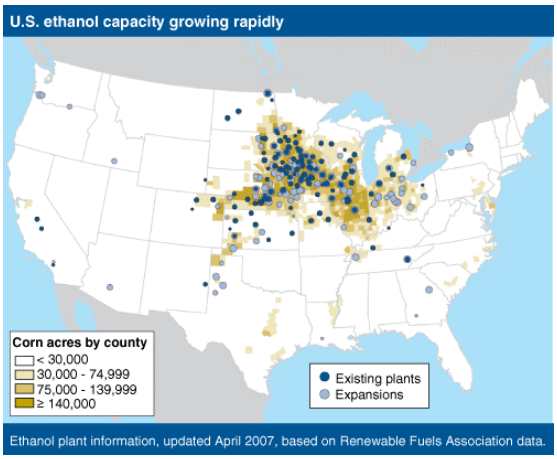
- A large expansion in ethanol production is underway in the United States, spurred by high oil prices and energy policies.
- Although corn is the primary feedstock used to produce ethanol in the United States, market adjustments to the ethanol expansion extend well beyond the corn sector.
- Adjustments in the agricultural sector to increased demand for biofuels will continue as interest in renewable sources of energy grows.

[12] Paul C. Westcott

U.S. ethanol production climbed to almost 5 billion gallons in 2006, up nearly 1 billion gallons from 2005. Despite the speed and magnitude of this increase, the industry is stepping up the pace of expansion, with production expected to top 10 billion gallons by 2009.

The explosive growth of U.S. ethanol production is being felt by nearly every aspect of the field crops sector—domestic demand, exports, prices, and the allocation of acreage among crops—as well as the livestock sector, farm income, government payments, and food prices. Additionally, issues have been raised regarding possible effects on natural resources resulting from the ethanol expansion and changes in farmers' cropping choices. Adjustments in the agricultural sector to this strong demand are underway and will continue as interest builds in renewable sources of energy to lessen dependence on foreign oil.

What's Driving the Boom in Ethanol Production?



Market conditions and policy factors are fueling the rising interest in ethanol. A rapid runup of oil prices over the past several years has combined with provisions of the Energy Policy Act of 2005 and already existing Federal and State biofuel programs to provide economic incentives for an expansion of U.S. ethanol production.

Crude oil prices, which averaged less than $20 a barrel (refiners' acquisition cost for imports) in the 1990s, reached almost $68 in summer 2006, and averaged $59 for the year. This increase in prices reflects rising global demand for crude oil resulting from strong world economic growth, including rapid manufacturing gains in China and India. Further growth in global economic activity will continue to drive up world demand for oil, particularly in highly energy-dependent economies in Asia. Although the increase in demand is likely to be partly offset by future oil discoveries, new technologies for finding and extracting oil, and continued expansion and improvement in renewable energy, oil prices are expected to remain high by historical standards.

Further contributing to the interest in ethanol, the Energy Policy Act of 2005 mandated that renewable fuel use in gasoline (with credits for biodiesel) reach 7.5 billion gallons by calendar year 2012, with gains in later years in line with growth in the volume of gasoline "sold or introduced into commerce." Additionally, the legislation did not provide liability protection for effects of methyl tertiary butyl ether (MTBE), an oxygenating gasoline additive that has been found to contaminate drinking water. As a result, blenders have sharply reduced use of MTBE and switched to ethanol as a fuel additive.

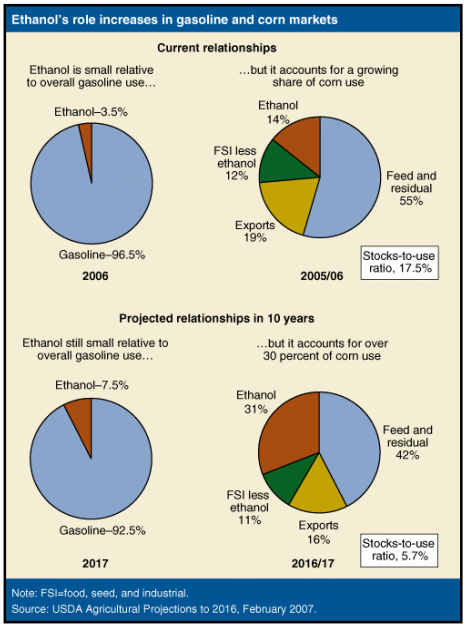
Federal tax laws also provide incentives for biofuels. Under current law, blenders can receive tax credits equal to 51 cents per gallon of ethanol blended with gasoline. This makes ethanol more economical to produce, as part of that credit is, in effect, passed back from blenders to ethanol producers. Additionally, ethanol imports are subject to a tariff of 54 cents per gallon, although imports from designated Central American and Caribbean countries are duty-free up to a maximum of 7 percent of the U.S. ethanol market.

In response to these strong incentives, ethanol production capacity has risen sharply over the past year as new plants have been built or are under construction. With completion of the plants currently under construction, production capacity in the industry will exceed 12 billion gallons within a few years. Ethanol production is expected to be well above the renewable fuel standard mandated in the 2005 Energy Policy Act. Although the ethanol expansion is then expected to slow somewhat, even with the industry operating at less than full capacity, USDA's 2007 long-term projections show ethanol

production growing to more than 12 billion gallons by the middle of the next decade, assuming no changes in policy or technology.

Ethanol Relatively Small in the Gasoline Market but Large in Agriculture

Most of the current expansion in ethanol production uses corn as the feedstock. Although cellulosic-based production of renewable fuels holds some longer-term promise, much research is needed to make it commercially economical and expand beyond the 250-million-gallon minimum specified for 2013 in the Energy Policy Act of 2005.



Ethanol accounts for a small share in the overall gasoline market, but its importance to the corn market is relatively large. In 2006, ethanol (by volume) represented about 3.5 percent of motor vehicle gasoline supplies in the United States. But 14 percent of the U.S. corn crop went to ethanol production, a share projected to grow to more than 30 percent by 2009/10 and to remain at that level in subsequent years. Even so, by the middle of the next decade, ethanol production (by volume) is expected to represent less than 8 percent of annual gasoline use in the United States. Thus, while the growth in corn-based ethanol can contribute to the Nation's fuel supply, that contribution is relatively small in the gasoline market but can have large effects in the agricultural sector.

In Agricultural Markets, Corn To Be Affected Most Directly…

The rapid expansion in ethanol production will have far-reaching effects throughout the agricultural sector. The corn market is being affected directly by the increase in ethanol production. As the ethanol industry absorbs a larger share of the corn crop, higher prices will affect domestic use and exports, providing for more intense demand competition between domestic industries and foreign buyers of feed grains.

Higher prices affect corn's role as an animal feed. Livestock feeding is the largest use of U.S. corn, typically accounting for 50-60 percent of total utilization. According to the USDA 2007 long-term projections, corn for animal feeding is expected to decline to 40-50 percent of total use over the next decade, as a result of higher prices (see box, "What's the Difference Between Projections and Forecasts?").

What's the Difference Between Projections and Forecasts?

The discussion presented in this article is based on USDA's long-term agricultural projections to 2016, released in February 2007. These projections, however, are not forecasts for the future.

Projections are based on a specific set of assumptions, such as a continuation of current farm legislation. These conditioning assumptions are usually designed to provide a neutral backdrop for the projections to allow the analyses to focus on key long-term underlying factors. For example, projections would typically assume longrun trend growth rates for key macroeconomic variables rather than forecasting the timing of business cycles. And normal weather with trend growth for crop yields would be assumed for projections. Thus, USDA's long-term projections represent one plausible scenario for the next 10 years.

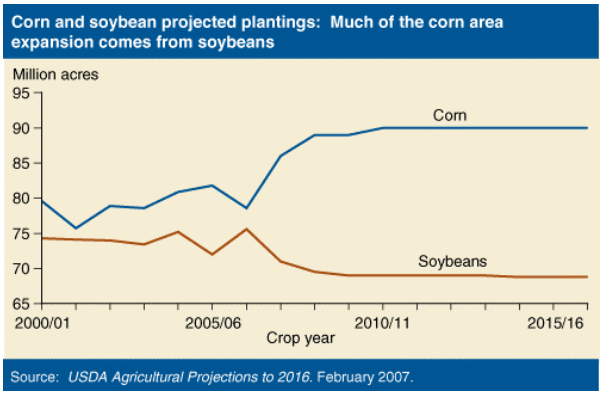
In contrast, forecasts focus on predicting actual outcomes. Forecasts incorporate additional information that departs from the neutral assumptions of the long-term projections and thus can produce different results. For example, forecasters may consider what will happen under pending farm legislation if they believe the legislation will be enacted. A forecast may also predict the timing of business cycles in the general economy.

Increased use of U.S. corn for ethanol production and higher corn prices also will have important implications for global trade and international markets. The United States typically accounts for 60-70 percent of world corn exports; however, higher corn prices are projected to reduce this share to 55-60 percent over much of the next decade—a result of reductions in foreign demand and increases in foreign production.

Higher corn prices also will affect farmers' production decisions, as higher producer returns provide economic incentives to increase corn acreage. Much of this increase is likely to occur as farmers adjust crop rotations between corn and soybeans. Other sources of land for potential increased corn plantings include cropland used as pasture, land in fallow, acreage returning to production from expiring Conservation Reserve Program (CRP) contracts, and shifts from other crops, such as cotton. According to USDA's Acreage report, (June 29, 2007), farmers planted nearly 93 million acres to corn this year, up over 14 million acres, or 18.6 percent, from 2006.

On balance, increased use of corn to produce ethanol is projected to result in higher corn prices, which will trigger reductions in other uses and increases in supplies to bring the corn market into equilibrium. Nonetheless, stronger ethanol demand will result in lower carryover stocks of corn. At the same time, ethanol demand is very inelastic (unresponsive to price changes) in the range of prices expected over the next decade and relative to other major demands for corn, such as feed use and exports. Thus, overall demand in the corn sector is projected to become more inelastic as ethanol production grows. In combination, these factors will make the corn market more vulnerable to shocks, such as production shortfalls due to weather, pests, or other factors. Low stocks provide limited buffers to shocks. As demand for corn becomes more inelastic, a greater change in market prices would be needed in response to a shock to bring the market to equilibrium. Thus, overall price variability and market volatility in the agricultural sector are likely to increase.

…With Other Crops Affected Indirectly



The jump in corn prices will initially favor corn production over other crops. Soybeans compete most directly with corn and on the largest amount of land. Thus, soybean plantings and production will likely take the brunt of the effect of the expansion in corn plantings and will correspondingly decline. In the Corn Belt, where producers frequently rotate crops, with corn planted one year and soybeans the next, some of the acreage shift can occur through changes in rotational practices. For example, the rotation might be changed to planting corn for 2 successive years, with soybeans planted every third year. Based on USDA's *Acreage* report, much of the 2007 increase in U.S. corn acreage will come from reduced soybean plantings, which are down more than 11 million acres (15 percent) from 2006.

Reduced soybean production would mean higher prices for soybeans, which would trigger other adjustments in the soybean complex. As with corn, higher soybean prices are expected to bring a reduction in exports and lower levels of carryover stocks, as well as higher prices for both soybean meal and soybean oil. Any concurrent expansion in the use of soybean oil to produce biodiesel would also contribute to higher soybean and soybean oil prices.

In some areas, plantings for other crops that compete with corn or soybeans for acreage are likewise projected to decline. For example, cotton plantings for 2007 were down more than 4 million acres from the previous year in USDA's *Acreage* report.

Livestock Production Projected To Decline

Higher corn prices reduce the profitability of meat production because of corn's importance to the livestock sector as an animal feed. In response, red meat production is projected to decline in the United States and growth in poultry output is likely to slow. The impact of higher corn prices and feed costs is expected to be partially offset by the greater availability of distillers' grains (from ethanol production) as a substitute source for feed.

Distillers' grains are a co-product of dry-mill ethanol production that can be used for livestock feeding. As produced, distillers' grains are relatively wet, with as much as 65-70 percent moisture content. This co-product can be used in its wet form, or it can be dried and used in a form with lower moisture content to facilitate shipment over greater distances, including for export. Additionally, distillers' solubles from the dry-mill ethanol production process, which include other nutrients from corn, may be added to the distillers' grains. Thus, the general term "distillers' grains" refers to a number of forms of the co-product, including wet distillers' grains, dried distillers' grains, wet distillers' grains with solubles, and dried distillers' grains with solubles. Whether used in a wet or dried form, however, distillers' grains used in livestock feed can replace some direct corn use, as well as soybean meal, in some animal rations.

The effects of higher corn prices will vary across livestock species, due to differences in feed conversion efficiencies and constraints on some animals' ability to use distillers' grains in rations. Distillers' grains primarily benefit ruminant animals like beef cattle and dairy cows. Only limited amounts of distillers' grains can be included in the rations of monogastric animals like hogs and poultry.

According to USDA projections, based on the different uses among the livestock species and a number of other important underlying assumptions, each bushel of corn used to produce ethanol results, on aggregate, in a reduction of about a fifth of a bushel of direct corn feeding, due to the use of distillers' grains in rations. However, the substitution of distillers' grains in feed rations is expected to bring only a small reduction in soybean meal use. Beef cattle are assumed to be the largest users of distillers' grains, and beef cattle rations typically use urea as the protein source rather than soybean meal.

Variability in the quality of distillers' grains from different sources—and from the same source at different times—also is a concern in the livestock sector. This lack of consistency in nutrient content makes it more difficult to determine the best use of distillers' grains in livestock rations. Over time, adjustments in the market for distillers' grains can address this issue. Adjustments in the ethanol production process are likely to improve the consistency of distillers' grains for use in the livestock sector. And, as the market develops further, livestock producers will likely become more familiar with the product and learn how to better manage it in ration formulation.

Farm Income Higher and Retail Food Prices Rise

Overall, ethanol expansion will boost net farm income. Higher commodity prices over the next several years, particularly for corn and soybeans, are projected to bring large increases in total farm cash receipts. But to some extent, these gains are expected to be offset by somewhat higher production expenses for inputs such as seed, fertilizer, and livestock feed.

Higher prices for corn and other crops also mean smaller government payments under current farm commodity programs, particularly price-sensitive marketing loan benefits and counter-cyclical payments. In contrast, with higher crop prices, use of land for production becomes more valuable, so new rental rates for land enrolled in the CRP are likely to rise. As a result, conservation payments and fixed direct payments under the 2002 Farm Act (which do not change with market prices) are projected to account for a larger share of total direct government payments, assuming no changes in policy.

With lower government payments, the agricultural sector will rely on the market for more of its income, and the share of income provided by government payments is projected to fall. Government payments, which averaged over 7 percent of gross cash income in 2000-05, are expected to account for less than 4 percent during most of the next decade—meaning that over 96 percent of gross cash income would come from cash receipts and farm-related income.

While the ethanol boom can be expected to bring higher incomes to farmers and reduce government outlays for farm programs, it will also most likely mean higher food prices for consumers. Retail price increases for red meats, poultry, and eggs are projected to exceed the general inflation rate in 2008-10, as the livestock sector adjusts to higher feed costs. As a result, overall retail food prices would rise faster than the general inflation rate in those years.

7. Brazil's ethanol slaves: 200,000 migrant sugar cutters who prop up renewable energy boom[13]

The ESMAP report 2005 cited above, shows how 200-2500 plantation families control 60 % of Brazils sugarcane production and almost all of its ethanol production capacity. The article below shows how the sugarcane producers are trying to reduce the cost of labour by employing migrant sugar cutters . Who gains from Brazils ethanol boom? The low cost of Brazilaian ethanol as compared to all other biofuels is reflected in the report prepared by World Watch Institute for the German Federal ministry of Food and Agriculture and consumer protection in collaboration with GTZ . a quote from the extended summary Analyses from many countries indicate that biofuels are currently a relatively expensive means of reducing GHG emissions relative to other mitigation measures, with the cost of CO2-equivalent emissions reductions exceeding €135 ($163) per tonne, according to estimates analyzed by Fulton et al. (2004). (See Figure 11.) The one exception is Brazil, where pure ethanol sold for nearly 40 percent less than the gasoline-ethanol blend in late 2005 (even accounting for the lower energy content in ethanol)[14] . Another significant development is the fact that Brazil and the US have ties with respect to ethanol and other biofuel uses in the hemisphere. Considering Brazils cost advantage in ethanol over gasoline, the move is on the one hand aimed at expanding the Brazilian ethanol market in the US (restricted by high tariff barriers) on the one hand and undercutting the Oil producing nation of Venezuela on the other . Will the US with the help of Brazil use green politics to batter Venezuela into submission ?

Behind rusty gates, the heart of Brazil's energy revolution can be found in the stale air of a squalid red-brick tenement building. Inside, dozens of road-weary migrant workers are crammed into minuscule cubicles, filled with rickety bunk-beds and unpacked bags, preparing for their first day at work in the sugar plantations of Sao Paulo.

A farm worker cuts sugar cane in Piracicaba, Brazil. Photograph: Alexandre Meneghini/AP

This is Palmares Paulista, a rural town 230 miles from Sao Paulo and the centre of a South American renewable energy boom that is transforming Brazil into a global reference point on how to cut carbon emissions and oil imports at the same time.

[13] Tom Philips the Guardian Friday March 9, 2007

[14] Biofuels for transportation Global potential and implications for sustainable agriculture and energy in the 21st century prepared by the Worldwatch Institute for the German Federal Ministry of Food, Agriculture and Consumer Protection (BMELV), in cooperation with the Agency for Technical Cooperation (GTZ) and the Agency of Renewable Resourcs (FNR)

Inside the prison-like construction are the cortadores de cana - sugar cane cutters - part of a destitute migrant workforce of about 200,000 men who help prop up Brazil's ethanol industry.

Biofuels are mega-business in Brazil. Such has been the success of the country's ethanol programme - launched during the 1970s military dictatorship - that it is now attracting attention from around the world. Yesterday President George Bush arrived in Sao Paulo to announce an "ethanol alliance" with his Brazilian counterpart, Luiz Inacio "Lula" da Silva. The bilateral agreement has been touted by the Brazilian media as the first step towards the creation of an "ethanol Opec".

Last year sugar and alcohol were Brazil's second biggest agricultural export products, worth an estimated $8bn (£4bn). Producers, meanwhile, expect the country's sugar cane production to jump by 55% in the coming six years, largely because of growing demand from the US and Europe. They hope that closer trade ties with the US in particular will help accelerate the ethanol industry's growth, providing jobs and funding the construction of dozens of new processing plants in the region.

But drive to the outskirts of Palmares Paulista and a much bleaker picture emerges of what President Lula has dubbed Brazil's "energy revolution". On one side, thick green plantations of sugar cane stretch out as far as the eye can see; on the other lopsided red-brick shacks crowd together, home to hundreds of impoverished workers who risk life and limb to provide the local factories with sugar cane.

Economic refugees fleeing the country's arid and impoverished north-east, these men earn as little as 400 reais (£100) a month to provide the raw material that is fuelling this energy revolution.

Palmares Paulista is both a burgeoning agricultural town and a social catastrophe. "They arrive here with nothing," said Valeria Gardiano, who heads the social service department in Palmares, a town of 9,000 whose population swells each year with the influx of between 4,000 and 5,000 migrant workers.

"They have the clothes on their bodies and nothing else. They bring their children with malnutrition, their ill mothers-in-law. We try to reduce the problem. But there is no way we can fix it 100%. It is total exploitation," she said.

Activists go even further. They say the "cortadores" are effectively slaves and complain that Brazil's ethanol industry is, in fact, a shadowy world of middle men and human rights abuses.

"They come here because they are forced from their homes by the lack of work," said Francisco Alves, a professor from nearby Sao Carlos University who has spent more than 20 years studying Sao Paulo's migrant workforce. "They will do anything to get by."

That includes working 12-hour shifts in scorching heat and earning just over 50p per tonne of sugar cane cut, before returning to squalid, overcrowded "guest houses" rented to them at extortionate prices by unscrupulous landlords, often ex-sugar cutters themselves.

Faced with exhausting work in temperatures of over 30C (86F), some will die. According to Sister Ines Facioli, from the Pastoral do Migrante, a Catholic support network based in nearby Guariba, 17 workers died between 2004 and 2006 as a result of overwork or exhaustion.

But the annual exodus from the northeast continues, and as foreign investment in the ethanol industry increases the numbers are expected to grow further.

Among the newest arrivals in Palmares are the Santos family, four brothers aged 19, 22, 24 and 26 who last week stepped off an illegally chartered bus after a 24-hour journey from the arid backlands of Bahia state. "We need the work," said Sidney Alves dos Santos, 24, sitting in the stuffy shack that will be his home until the harvest ends in December. "There's no other way."

In another tatty hovel Pedro Castro, a 26-year-old from Bahia, remembered last year's harvest. "It's like you are inside a bread oven," he said of the thick protective clothes needed in the plantations to protect workers from their sharp machetes. "But there's no work back home. What else are we supposed to do?"

At just after 5pm the square outside Palmares' church fills with the growl of bus engines. A fleet of a dozen battered Mercedes coaches rattle through the town centre, filled with exhausted workers returning from a day in the fields.

"It breaks your heart," said Cristina Vieira, a member of the local Catholic mission that offers support to the workers. "They think it rains money in Sao Paulo but they are chasing an illusion. When you talk to them a lot of them say: 'If I'd have known it would be like this I would never have come.' They have no rights and they can't complain to anyone - in a certain way they don't exist."

In numbers

£4bn - Annual value of Brazil's sugar and alcohol exports
55% - Anticipated increase in sugar cane production over the next six years
£100 - Equivalent value of the average sugar cane cutter's monthly wage

8. The relationship between automobile production and burgeoning pollution[15]

The ESMAP and World Watch reports quoted above recognizes that in terms of costs, biofuels is an expensive way of reducing green house gases. more efficient ways exist, predominant among them is the development of the public transportation system . Paul Sweezy in his essay on cars and cities, has this to say *"But congestion and pollution are essentially superficial phenomena, comparable to the outward symptoms of a disease with deep roots in the organs of the body. If we are ever to deal with the disease itself we must go beyond the symptoms and study its etiology. In the present instance what we need first of all is to understand the ways in which the automobile in the process of becoming a mass-consumption good impinged upon and ultimately transformed the geography and demography of the country."* This essay first appeared in Monthly Review, vol. 24, no. 11 (April 1973). Why has it take ESAMP and other so long to only partly recognize what Paul Sweezy predicted in 1973 ?? . The article in fact starts with a quote "Cities, after all, have a great deal in common with cars. More and more, in fact, they often seem to be turning into cars. There are deep mysteries here, impenetrable to the present shallow state of human understanding. Somehow, we know not how, things communicate." —Russell Baker, New York Times, March 8, 1973

9. Sweden's green agenda[16]

Darryl D' Monte tracks some of the contradictions in Sweden's novel experimentation on smart consumption in the article below .

Ninety-five per cent of all Swedes believe it is important to do something about climate change; two out of every three think it is very important. Sixty Stockholm families have embarked on a novel experiment related to 'smart consumption'

We could be forgiven for thinking we had intruded into a garden party, one balmy summer evening in suburban Stockholm recently. The table, under a tree groaning with apples, was laden with home-baked pies, pastries, fruit, beer and juice. The hosts were more than cordial: Andi and Marianne Loor very

[15] Insights from Paul Sweezy
[16] Darryl D'Monte InfoChange News & Features, September 2006

warmly welcomed us international environmental journalists, apologising for the absence of their two-year-old daughter, Alina, who was playing at a neighbour's. It was with some difficulty that we had to remind ourselves that this was no social visit. We helped ourselves and then got down to business: to interview what is by no means an ordinary Swedish family.

The Loors are one of 60 Stockholm families specially chosen for a novel experiment on "smart consumption," as their mentor and project leader, a well-known economist called Martin Saar who was also present, explained. The 60 families are a cross-section of Stockholmers. The Loors, who emphasised "we are no freaks," live in a suburb called Garden City. This was created in the 1930s, emulating famous but ill-conceived garden cities in the UK (like Wellwyn Garden and Harlow) which were ring towns meant to ease the pressure off the metropolis, whilst simulating a "green" ambience. However, the green was too formal, as was the design of each town itself, which alienated most of the residents who complained that the cities had lost their soul. As city planners all over the world recognise now, such social engineering may be all very well in theory, but it doesn't work in practice. It also meant that residents had to travel some distance to work, even though the areas were supposed to be self-contained.

Saar explains: "It was meant to be an alternative for workers living in narrow and dark residential buildings in the city centre. Garden City is a residential area with 500 rather small houses, comprising two rooms and a kitchen, or slightly larger homes." The Loors were chosen because they opted for the initiative. Out of the 60 families, only one in eight live in a house of their own, as distinct from an apartment. As many as 90% of Stockholm's residents live in flats, and two-thirds of residents are single occupants (which is socially problematic as well as environment-unfriendly because it wastes more energy on all fronts). The families are located in 14 out of the 18 city districts and are thus in every demographic way a representative sample of Stockholmers.

Both Andi and Marianne work with the media in one way or another. They are different from the other families in that they both once worked for Greenpeace and are therefore more environment-conscious. As they observe: "Having a child and looking back to what has happened, or rather what has not happened since we were actively involved with environmental issues, we decided it was time to do more. Our first task was to look back at our consumption and provide information on our normal (household) running costs. Then we collected receipts for all our everyday purchases... The idea during this phase was not to change consumer behaviour, rather to get an idea of what it looked like."

While Sweden figures among the greenest countries in the world, it is significant that Swedes have by no means been able to rid themselves of their passion for the motorcar, which is surely one of the worst offenders in this respect. Even the Loors have two cars, despite Stockholm in particular and Sweden in general being very well endowed with public transport. "We have two cars," Andi reported, somewhat apologetically, "an ordinary Volvo and a hybrid Honda Insight (the engine of which combines petrol with electricity). I travel about 40 km a day, but the Honda gives me 100 km with just 4 litres of petrol." To compensate, Marianne works from home. The Loors are enthusiastic supporters of the proposed congestion tax, a referendum on which will be held in Sweden on September 17, along with national elections. If it is voted through, they -- as suburbanites -- will have to pay around $ 10 each time they leave the city centre. They also car-pool whenever possible.

Surprisingly, apart from transport, the Loors and other families have found that a major item of energy consumption is food. Once you start auditing the total amount of energy spent on food -- on agriculture itself (irrigation, mechanisation, plus on fertiliser and pesticides), transport, packaging and marketing -- it adds up to a hefty amount of calories. Of course, thanks to heavy subsidies in European agriculture many of these costs are hidden. Some experts assert that the amount of calories totally spent on inputs in European and North American farming in this manner actually exceeds the calories in crop output, thanks to the market distortions!

That's why the Loors are trying to free themselves of this trap by buying fresh organic produce from the surrounding farmers. Marianne says: "Organic food, vegetables and fruit are brought to the door once a week. Many families are now shopping less as a result, which cuts down the time and energy spent. We buy less meat and eat less red meat." Throughout the world, alternative economists like the British-born Hazel Henderson are pointing to the environmental costs imposed by profligate lifestyles, where produce is being sourced from increasingly distant locations. Apart from the emissions involved in transporting such food, there is the use of water and other inputs, often in developing countries that grow these crops. Instead, they call for accessing local produce wherever possible. In India, this could mean avoiding buying those red-cheeked apples from New Zealand or China and going in for the lowly guava or ber instead, which may be just as nutritious.

The second phase of the "smart consumption" initiative is to review the emissions that each family makes to the global environment. This includes such sectors as gardens, renovation of housing, travel and transport, and energy consumption. One of the surprising findings is the huge toll on the environment the annual European summer holiday is. A Swedish family of four that goes to Phuket, the Thai beach resort, for example, consumes 9 tonnes of carbon dioxide on air and surface travel. This compares unfavourably with the average carbon dioxide emissions per Swede, which amounts to only 10 tonnes for the full year. What "smart consumption" may well point to, just as it has done for food, is that people should travel closer to their homes and avoid the exotic locales that are so much in demand these days.

This will have interesting repercussions, if adopted widely, for international tourism, which is the fastest growing industry in the world these days. Apart from helping to green the planet, such a move may reduce the social distortions that mass tourism brings in its wake.

All this fits in well with the profile of Sweden as a whole -- as one of the most environmentally conscious countries in the world. A poll conducted by the Swedish Environmental Administration four years ago found that 95% of all Swedes believed it was important to do something about climate change; two out of every three thought it was very important. Importantly, Swedes are "becoming the change they want to see" by acting on their concerns, not just being well informed about them.

Stockholmers believe that traffic is the most serious environmental problem. One-fifth of the cars in the country use either ethanol, a clean biofuel, or are hybrid models (and will evade the Stockholm congestion tax if it comes). Not that it is easy to drop the habit. Surveys show that only 18% of all Swedish adults do not possess a car. There is a gender dimension too: as many as 55% of single women without children, between 25 and 44 years old, are car-less, as against 34% of males in the similar category.

Stockholm has experimented with a congestion tax -- payable on exiting the central business district, not on entering, as one does in London. Many observers feel that it may not receive the green signal in the forthcoming referendum. It was opposed by political conservatives but championed by the social democrats, along with the left and greens. Once it came into effect for a trial period, during the first half of this year, Stockholmers found that the city centre was clear of congestion, enabling everyone to reach their places of work easily and speedily. Still, to question a long-felt "right" of motorists to drive where and when they please is something of a political challenge, which may come unstuck on September 17. In Edinburgh, three-quarters of the residents voted against such a tax, fanned by a sceptical media.

Stockholm is proud to display its 400-strong fleet of pollution-reducing ethanol buses, which has given other cities -- Madrid, Rotterdam and even Nanyang in China -- ideas. These will be funded by the European Union under a project called Bio Ethanol for Sustainable Transport, or BEST -- coincidentally the same as Mumbai's much-vaunted bus service. Tests show that the emissions from these buses are well below Euro 5 and other standards. The bus undertaking showed journalists around its fuel depot, where gleaming red single-decker buses filled up from ethanol tanks, just like petrol

vehicles. With such clean and efficient buses and a well-networked metro service, Stockholmers can count on public transport to get them everywhere in next to no time.

Everyone is beginning to revert to bicycles too, though not as much as in Holland.

Sweden realised over two decades ago that its early experiments with social engineering -- of the Garden Cities variety -- was wrong, created urban sprawl and made commuting mandatory. It is now very much in favour of "densification," though not high-rise development, with what planners call a "poly-nucleated" pattern, meaning mixed-use neighbourhoods. This means that workplaces and homes are much closer to each other, as are shopping areas. All the Swedes we met in the course of a week-long stay in Stockholm complained about the earlier trend towards the 'Americanisation' of cities, where huge shopping malls were located on the periphery, forcing people to drive since it was not feasible to carry huge loads on public transport.

We were taken to a new township called Hammarby Sjostad, around a lake, which has been inspired -- as indeed much of Stockholm has -- by the surrounding water. This is Stockholm's biggest urban development project in years and is projected to be the answer to inner city problems. Here, housing, far from being standardised "little boxes" (*a la* Pete Seeger), is highly variegated and an architect's delight, since each complex is differently designed. This is an ecological city in the making, with a closed loop for much of the energy and all the waste. Its sewage is purified, heat recycled and nutrients recovered, after which it is returned to farmland. The surface water is locally cleaned and thus does not burden the sewage treatment plant. Energy is produced at the local district heating plant that uses renewable fuel. Combustible waste from the town is recycled as heat, and food waste converts to biogas.

The Hammarby Model provides 10,000 apartments for some 25,000 residents with a heavy emphasis on good public transport, recreation and open spaces. Several of the buildings employ solar panels to heat water for bathing and the kitchen, but, unlike in India, these panels are built into the design, they do not protrude to mar the cityscape. As the planners put it: "Restricted building heights, set-back penthouses, multi-level apartments, generous balconies and terraces, large windows, flat roofs and pale plastered facades facing the water exemplify the application of a modernistic architectural agenda." Many contrasting parks, quays and pedestrian paths are being planned around the model city, and the central expanse of water will "form a visual vocal point, the blue eye of the district".

10. Green capitalism[17]

There are other dimensions to this dilemma as well Can a technology fix based on decentralization provide the answers we need. Darryl D'Monte explores based on a recently concluded meeting in Pune to facilitate K R Datye .

Can the collateral damage of a growth-at-all-costs economic model be addressed by a "regenerative" economy as opposed to a "degenerative" one based on fossil fuels and outmoded notions of industrialisation?Veteran social activist K R Datye believes it can

Environmentalists and activists have often been criticised for opposing so-called development projects and not having anything constructive to offer in their place. The late Anil Agarwal, founder of the Centre for Science and Environment in Delhi, underlined this by pointing out that the greens opposed dams, coal-based thermal power stations and nuclear plants. But, he noted, the dilemma remained: How is a developing country like India going to obtain electricity to run a modern economy?

The question becomes all the more significant in the context of the contemporary "LPG" ideological framework -- liberalisation, privatisation and globalisation. How does one combat this juggernaut,

[17] Darryl D'Monte InfoChange News & Features, April 2008

which sees all economic growth as an end in itself, no matter that it excludes huge swathes of the population?

Some answers have been provided by the Pune-based Society for People's Participation in Ecosystem Management. Since 1991, it has been working on participatory irrigation management and has since broadened its activities to include watershed management, gender and livelihoods, water conflicts and river basin studies. Its mentor is K R Datye, who, for 25 years, worked as an irrigation engineer but then turned to exploring various alternative technologies. At the end of March, likeminded activists and academics paid tribute to Datye, who is now 82, by organising a two-day conference on his seminal ideas at the Tata Institute of Social Sciences (TISS) in Mumbai.

The key word in the deliberations was the emphasis on a "regenerative" economy, as opposed to a "degenerative" one based on fossil fuels and outmoded notions of industrialisation. In Datye's view, the 73rd constitutional amendment is a vital step forward. He bases his alternative development paradigm on the gram sabha, the smallest unit of self-governance in the village. If one unit in a village consisted of 100 households, the first task was to demarcate its boundaries, including common lands, and to evaluate its resource base. The objective is to establish what entitlement such a unit has to that most previous resource -- water.

The village as a whole, typically, may consist of 400 households. The area suitable for producing crops and biomass (organic matter) may be 800 hectares, while the village would have a watershed extending over 1,000 hectares. After meeting these vital needs, there would be sufficient land available for irrigated commercial crops, dryland cultivation, pastures, grass, shrubs and trees. The average availability of water would be estimated by adding up the surface water, groundwater as delayed run-off and groundwater storage. Half this water, in a regenerative economic model, would be allocated to a 100-household gram sabha for priority use.

But, as has been pointed out time and again in any discussion on rural society, it is far from being homogeneous. Caste and class intervene at every stage to make any equitable distribution of natural resources that much more complicated. This is why Datye and his acolytes refer to the "resource poor" among villagers who, again typically, may comprise 20-40 households out of the 100 in a gram sabha. These are jobless artisans, nomadic and denotified tribes, destitute women and project-affected people awaiting resettlement. They are also entitled, as a priority, to water for domestic use and their cattle.

Proponents of this approach recognise the need to boost land productivity without resorting to capital- and resource-intensive inputs. They believe that this can be achieved by boosting the production of biomass, celebrated in Datye's book *Banking on Biomass*. This is radically different from the environmentally destructive production of ethanol and biofuels throughout the world, almost all of which either divert land from food crops or are dependent on expensive inputs.

A fifth of the area available for a 100-household unit could be used to grow wood, bamboo and fibre. Around 15% could be devoted to what is known in foresters' jargon as "non-timber forestry". Foodgrain would comprise a fifth, as would sweet sorghum, pulses and fodder 10%, and 4% devoted to organic vegetables. Nitrogen-fixing varieties could be grown on another 10%. The output would be over 1,100 tonnes of biomass a year. Such a gram sabha would be entitled to preferential employment assistance under the National Rural Employment Guarantee Act, which entitles a person to 100 days of paid work in a year.

K J Joy, who with Suhas Paranjpye is a close associate of Datye's, breaks down these figures and arrives at a scenario where a poor family of five would produce 18 tonnes of biomass a year. In addition, it would produce 3 tonnes of surplus biomass "for value-addition -- the basis for a transition to a dispersed industrial system". This surplus consists of fruits, vegetables and other high-value agricultural produce, which is perishable. Instead, other produce like bamboo, fibres, oils or medicinal plants are a valuable alternative. Such an option, it should be noted, is in direct contrast to Special Economic Zones (SEZs), which represent a highly concentrated, egalitarian form of virtual forced industrialisation.

In this situation, there is a distinction between "assured water", which is the minimum required to guarantee livelihoods and should be 80% dependable, and "variable" water, which could include

supplies from outside the area. Joy explains the position succinctly: "We need to use the assured component of water to provide an equitable basic service for all, and utilise the variable component to provide water as an economic service to the enterprising." If the variable water is used to grow perennial tree species, which produce bulk biomass, these serve as a fallback when the seasonal farm crop fails, as is unfortunately only too often. Indeed, with climate change, such fluctuations in weather are going to become more frequent. The biomass produced per family represents both an energy and capital stock.

Following pioneers such as the late Vilasrao Salunkhe's pani panchayats, as well as the phad irrigation system in Maharashtra, Datye believes in delinking water rights from land rights. It is this ideology that has inspired movements in southern Maharashtra for the equitable distribution of water, which began with the well-known Bali Raja dam, constructed by local people with their own labour (Bharat Patankar, a veteran of that struggle, was present at TISS). The idea is that all those who depend on land for their livelihood should get a certain minimum amount of water, which includes farmers, landless labourers, artisans, women, dalits, etc, irrespective of their holdings.

The concept does not mean that all the water is divided equally among all the villagers. The basic requirement is for drinking and domestic use, for livestock, for production (agriculture, processing, etc) to meet consumption as well as to generate income for needs that are mediated by the market (like education, health and recreation). In a typical family, this works out in the region of 6,400 cubic metres of water per year. The basic service is a right; only after meeting this minimum should water be provided as an "economic service" for production for the market. As Joy explains, this is roughly equivalent to treating the first component as a social good and the second as an economic good.

Water has to be priced. The basic service is at an affordable cost, primarily to recover operation and maintenance costs. The second could be priced at full recovery, recovering the capital costs over time. Such an approach would address the opposing viewpoints about pricing water. The World Bank prescribes full cost recovery, whereas the Left believes it is a social good and opposes privatisation. According to Datye, there is a third strand that tries to bridge the two polarised positions.

This would mean that the basic service has necessarily to be subsidised, whether by cross-subsidy within the sector or across different sectors. But the economic service has to be charged at full economic cost and at premium rates to subsidise the basic service. Joy says: "It is difficult to see how free markets can even begin to meet these complex and contradictory demands."

Professor A Vaidyanathan, a former member of the Planning Commission, who was present at TISS and once headed the Irrigation Pricing Committee, advocates a differential or graded tariff system, which can at least partly address the tension between the two components.

Another novel feature of Datye's regenerative economics is that doles and grants, which make people dependent on the state, have to be replaced by concessional credit which is linked to performance. According to researcher Seema Kulkarni, who presented a paper on the role of institutions and finance in the transition to an alternative system, every gram sabha eligible for employment assistance under the National Rural Employment Guarantee Act will have to agree to norms for allocating resources and their use. Thus, if resource-poor and rich asset-owning households agree to share resources, this would qualify the former for employment assistance. The concessional credit would be available for investing and participating in the biomass-based regenerative system. Additional employment assistance could be secured to create food security and produce energy out of biomass, which would ensure minimum needs.

At the conference, Amita Shah from the Gujarat Institute of Development Research in Ahmedabad elaborated the role of finance and credit in the system. There were investments and subsidies by the state, with special emphasis on employment assistance. The creation of a biomass bank was the main source of credit for developing micro-enterprises in a decentralised setting. Alternative energy modes were promoted and costs recovered through affordable and progressive rates of interest. And even the poorest people -- for instance, tribals -- would have access to the biomass bank.

The strong point about this alternative approach is that these aren't merely theoretical ideas -- almost wishful thinking -- that remain on paper. They have been tested on the ground at every stage, over the

years. A typical initiative in this context is by the Jagrut Mahila Samaj in a village near Ballarpur, in Chandrapur district of eastern Maharashtra, which is a severely drought-prone area. In Kalamana village, through regenerating the local economy, a person with 2 hectares was able to earn Rs 41,000 after two years. In addition, by using the United Nations Development Programme's small grants scheme, the village started a vermiculture project that generated vermicompost worth Rs 65,000. From experience, a prerequisite was a good women's group that could handle the funds in such projects.

According to M P Parameswaran, a veteran of the renowned Kerala Sastra Sahitya Parishat and the literacy movement, "green capitalism" or "solar socialism" was the order of the day. The concept of land ownership would be replaced by the "right to work on land to earn a livelihood", and growth would be predicated upon sharing, not the accumulation of surplus. He envisages that once, say by 2050, every family is provided with a *pucca* house, the roofs of all buildings can be designed to collect solar energy. Around 60 square metres of such area would be required to generate photovoltaic electricity -- between 4,800 and 6,000 units a year. He estimated that the average annual household demand would be only around 2,500 units; the rest could be sold to the grid for intensive energy use.

Parameswaran was clear-sighted enough, however, to recognise that "another world was possible", but not probable. As he put it: "It is impossible within a capitalist regime, where profit is the only motive force. It is based on competition and leads invariably to larger and larger scales, increased urbanisation, growing inequalities and imminent eco-catastrophe." The only answer, as he saw it, was for hundreds of small-scale experiments to show the way to a regenerative ecosystem. If nothing else, presumably, sheer desperation will drive the poorest people to learn how to live within their own natural resource base and to build an economy from the base, without relying on the illusory trickle-down.

11. A Hobbson Choice: Oil for Food or Oil for Fuel?[18]

Ashok Sharma, explores another avenue.. In the context of increasing edible oil imports, where will diversion of production to non edible oils for biofuel fit in. While planning commission has recognized the first aspect in not targeting edible oils for biofuel as the US and Germany have done, will a mere decalaration of using non edible oils instead help?

Oil is central to the economy. Be it the oil for food or oil for fuel. In both the cases the country is dependant on imports.

We import about 70% of petroleum products to meet our energy needs. Our import of petroleum products in the first six months of the current fiscal (2007-08) increased to $ 31399.22 million from $ 29003.64 million in the same period last fiscal. Our import of vegetable oils for solely meeting the needs of cooking is on a rising trend. The import of vegetable oils in the period November 2006 to October 2007 has shot up to 4,213,724 tonne as compared to 3,780,112 tonne in the same period in the previous year. We also import about 600,000 tonne non-edible oils annually for manufacture of soap, cosmetics and other items.

The figures show the extent our import dependency for oil. This does not augur well. It is high time to think of achieving at least near self-sufficiency in either one of the sector of the oil economy. For all considerations, oil for food should be given the top priority. In this sector, the country has the potential to achieve self-sufficiency, provided appropriate policy support and incentives are given. The Technology Mission on Oilseeds could bring the country to a level of near self-sufficiency which was aborted by policy of import liberalization in 1990s and we are now heavily paying for this wrong policy.

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[18] ASHOK B SHARMA **(***The writer is the Agriculture Editor, The Financial Express, India . This article appeared in the Souvenier-2007 of Indian Vanaspati Producers' Association)*
http://www.mynews.in/fullstory.aspx?storyid=2028

The import of fossil oil for energy is definitely more in dollar terms. But in the case of edible oil imports it is the issue of food security. While energy security is important, food security is vital. While there are a number of options available for ensuring energy security, the options for ensuring food security is very narrow, particularly with the decline in area under cultivation. However, the government has failed to distinguish between food and energy security in the right perspectives.

The government has now embarked on a massive programme for ensuring energy security through largescale cultivation of Jatropha for producing bio-fuels. However, there are some right thinking persons in the government who have a different view.

The government's energy adviser, Surya P Sethi views that food and water security concerns are as critical as energy security.

Criticising the exaggerated claims of the proponents of bio-energy about availability of waste and marginal lands, availability of plant varieties and germplasm that need practically no water for growth, yield levels, costs and most importantly the benign nature of bio-energy, Sethi says that these claims are however not based on rigorous research.

According to him if 60 million hectares of land is used for energy plantation like Jatropha Carcus and other crops), the commercial bio-energy produced would meet only 29% to 35% of country's energy needs even 25 years from today. Data on annual bio-diesel yields from Jatropha ranges from a low of 0.3 tonne to one tonne per hectare.

Based on available data wood plantations provide the best use of such lands for commercially grown bio-energy as it would yield some 9 times the energy compared to bio-diesel from equivalent land mass.

The annual yields of bio-energy from wood plantations are estimated at a low of 5 tonne to a high of 20 tonne per hectare, he says.

According to Sethi, ethanol based on sugarcane or alternate crops could match wood but the crops would require intensive cultivation, water, fertilizer and arable lands.

Suggesting another alternative Sethi says, "To put this in perspective, just 2.25 million hectare land under solar cells with 15% conversion efficiency could yield the same energy as 60 million hectare of wood plantation. Only 7 to 8 million hectare land under solar cells can give India energy independence even 25 years from today."

As an alternative for ensuring energy security, Sethi suggests setting up solar panels on totally arid lands, including desserts, mountain tops and roof tops.

Sethi say that about 31% of India's primary energy needs are met from bio-energy produced on non-commercial basis from agricultural and forest waste, wood chips, animal waste and bio-fuels.

Bio-fuels have been used for centuries by the tribals. Non-commercial energy will constitute at least 10% to 1 2% of India's primary energy mix even in 2031-32 and remain as the third important energy source for next 25 years after coal and fossil oil.

Sethi is of the view that production of bio-energy in a localised and decentralised manner consistent with current patterns is indeed sustainable. He raised questions about the proposed large-scale commercial cultivation of bio-fuel crops, particularly relating to sustainability and viability, impact on eco-systems, socio-economic settings and local lifestyles, livelihood of indigenous people, food and water security. He criticized the US direct subsidy of $ 3.4 billion for corn-based ethanol.

"The consumers have paid $ 3.6 billion extra for energy they received from 4.9 billion gallons of ethanol in 2006. The entire world has suffered the consequences of this $ 7 billion billion subsidy by way of lower availability and consequent higher prices for grains and pulses. Europe and Canada have done the same for subsidy on rapeseed," he says.

"How green is the so-called green energy," questions Sethi and said that there were growing body of evidences to show "green" fuels were not always green. Studies at Berkley and Academy of Sciences have conclusively shown that greenhouse gas (GHG) reductions through use of doped gasoline using

corn-based ethanol (E85) will be less than 0.2% in 2017 when ethanol production is expected to peak in US.

The total lifecycle emission of 5 major pollutants (carbon dioxide, volatile organic compounds, PM10, Sox and Nox) are higher with E85 compared to gasoline. E85 also produces much higher concentration of ground level ozone, which is a serious health hazard.

He says that Indian studies have confirmed that sugarcane-based ethanol has an overall negative energy balance when all energy inputs are considered. Sweet sorghum based ethanol, bio-diesel, cellulosic ethanol, agricultural and animal waste and wood plantations come out progressively greener.

Sethi is also critical about the government's proposed direct input subsidy and market intervention for promotion of bio-fuels in the country.

In a recent paper - Sustainable Policy Framework for Bio-fuels – Sethi said "I with all the humility at my command, must state my fundamental objection to direct input subsidies and interventions by the government in markets through the proposed National Bio-Fuel Board."

The new and renewable energy ministry has suggested setting up of a National Bio-fuel Development Board (NBDB) and formulation of a national bio-fuel policy. The NBDB would determine the minimum support prices (MSPs) for bio-fuel crops like jatropha, karanja seeds and oil-bearing materials. It also suggested that the government render financial support to oil processors for a period of five years. On the other hand, the rural development ministry has demanded a gross budgetary support of Rs 1,340 crore (Rs 13,400 million) for five years to set up a national mission on bio-diesel and the launch of its first demonstration phase of jatropha cultivation in 4,00,000 hectares.

Sethi's remarks comes at a time when a group of ministers (GoM) headed by Union agriculture minister Sharad Pawar is deliberating on the demands made by two rival ministries.

Sethi suggested that bio-energy be pursued as a domestically available energy and chemical feedstock option. This objective must not be diluted by a desire to meet other legitimate objectives like raising rural income and employment, creating another cash crop based on MSPs and promoting renewables. Even any climate dividend should be treated as a bonus. The government should not distort markets by mandating blending, restricting rights to direct marketing of bio-fuels, imposing ad-hoc and differential taxes and duties on inputs and restricting import or movement of bio-fuels. Any taxes that should be imposed should be on outputs rather than inputs. There should be only output-based incentives. R&D outlays should be allowed as a deduction from taxes due and this incentive should be made tradable, he said.

According to Sethi "Green Energy" are not always green. The total lifecycle emission of 5 major pollutants (carbon dioxide, volatile organic compounds, PM10, Sox and Nox) are higher with corn-based ethanol (E85) compared to gasoline. However in India sugarcane-based ethanol has an overall negative energy balance when all energy inputs are considered. Sweet sorghum based ethanol, bio-diesel, cellolosic ethanol, farm and animal waste and wood plantations come out progressively greener, he said.

The UNCTAD's trade and development report-2007 has talked on similar lines. It has said that the increase in global demand for bio-fuels has pushed up the prices of agriculture commodities. But the farmers in the developing countries, including India, have not gained much.

It has said that strong demand for bio-fuels was in response not only to high crude petroleum prices but also to the growing concerns about global climate change. Global prices of sugar, corn and vegetable oils, in particular, shot up as these are used for production of bio-diesel. In 2006 sugar prices increased by 49.4%, maize prices by 24.4% and that of palm oil by 13.3%.

The UNCTAD report has raised concerns over the competing use of land for production of food, animal feedstock and bio-fuels. Corn cultivation in US for bio-fuel production has displaced soybean cultivation. The soybean prices rose sharply in mid-2006. The situation, in turn led to higher prices for animal feedstock and meat. The higher food prices can have dramatic consequences for food-importing developing countries, the report said.

The report also raised concerns that bio-fuel crop cultivation may cause deforestation, water scarcity and biodiversity loss. It, however, suggested that a possible solution may be the extraction of bio-oil from tropical plants like, Jatropha which can be grown on "degraded" lands and therefore not compete with food crops.

Analysing the terms of trade, the report said that in 2006 there was significant gains for oil and mineral exporting countries. Most vulnerable have been the oil-importing countries, which export few primary commodities. East Asia, South Asia and Africa suffered deterioration in the terms of trade.

The global push to develop bio-fuels in a bid to reduce oil dependence could "offer a cure that is worse that the disease," a recent report of the Organization for Economic Cooperation and Development (OECD) said. It further said that existing bio-fuel technologies have limited abilities to meet global energy needs without compromising food supplies and prices and the environment.

"In theory there might be enough land available around the globe to feed an ever-increasing world population and produce sufficient biomass feedstock simultaneously," the report said and added "but it is more likely that land-use constraints will limit the amount of new land that can be brought into production leading to a 'food-versus-fuel' debate." Since land use is driven largely by profit motives, it says, diversions of cropland from food production will lead to food price increases over the next decade, the OECD report said.

Biomass production will likely put increased environmental pressure on tropical regions, whose land is most suitable for such crops, the report said. "When such impacts as soil acidification, fertilizer use, biodiversity loss and toxicity of agricultural pesticides are taken into account, the overall environmental impacts of ethanol and bio-diesel can very easily exceed those of petrol and mineral diesel," it said. Moreover, the report questions whether developed nations have dramatically overestimated the extent to which bio-fuels can displace fossil fuels and warns that many of the more optimistic scenarios are highly unlikely to come to fruition.

"In only a very few countries do bio-fuels have the potential to make a significant dent in dependence on imported oils," the report said.

Finally it is important for the government to ponder whether to ensure oil for food security or go for use farmlands for massive production of bio-fuels.

12. Biofuels and Deforestation[19]

Stephen Leahy questions the validity of biofuels facilitating carbon sequestration. With nearly 40,000 has vanishing every day to feed the growing hunger for timber, pulp and paper and ironically, new biofuels and carbon credits designed to protect the environment. The article further says getting accurate numbers on how much forest is being lost is very difficult.

The FAO's State of the World's Forests 2007 released last week reports that globally, net forest loss is 20,000 hectares per day -- equivalent to an area twice the size of Paris. However, that number includes plantation forests, which masks the actual extent of tropical deforestation, about 40,000 hectares (ha) per day, says Matti Palo, a forest economics expert who is affiliated with the Tropical Agricultural Research and Higher Education Center (CATIE) in Costa Rica.

"The half a million ha per year deforestation of Mexico is covered by the increase of forests in the U.S., for example," Palo told IPS.

[19] Stephen Leahy - Biofuels Boom Spurring Deforestation(This story is part of a series of features on sustainable development by IPS and IFEJ - International Federation of Environmental Journalists.) (END/2007)

13. Energy Conservation, Production and Recycling[20]

"The collective memories of those who inhabit a place provide a powerful map of its constraints and possibilities…It embraces the realization that needs can be met in the potentialities of the landscape and the skills already present in the community"[21]

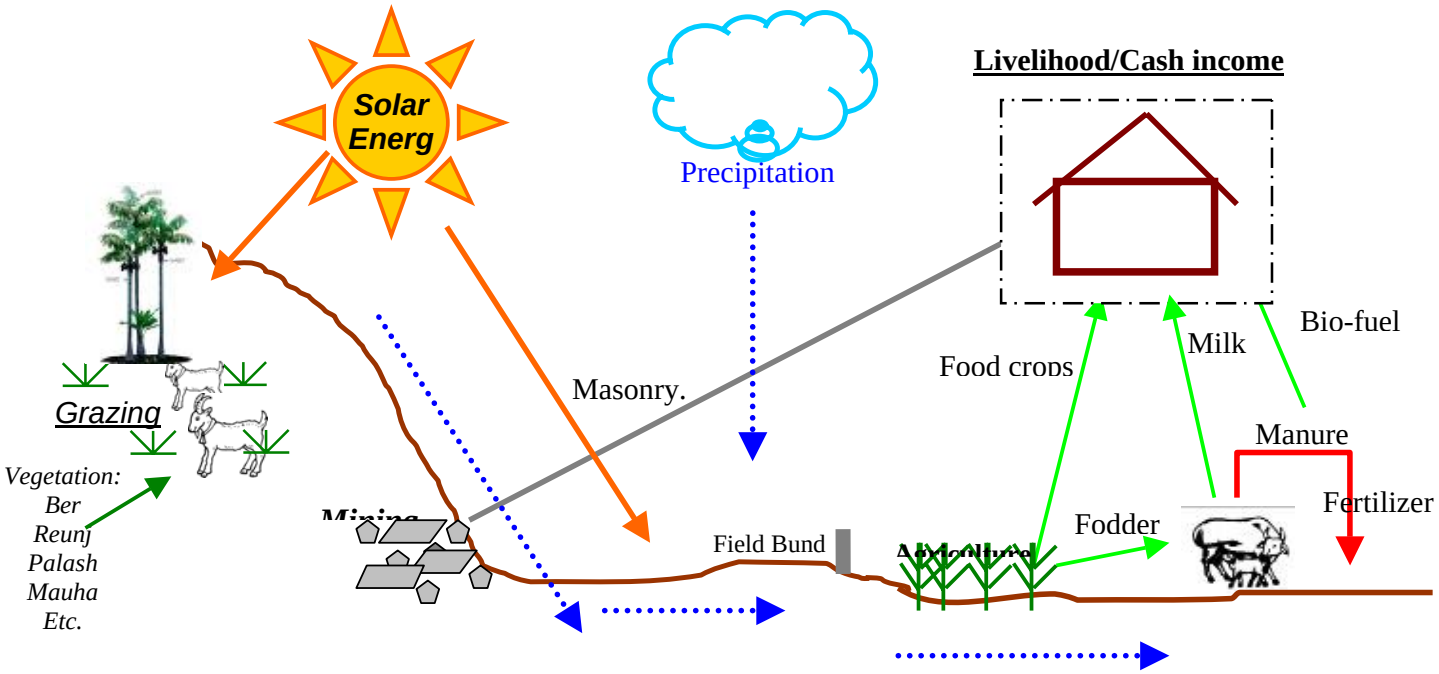
Susannah Burrows an FSD intern with SPWD , Udaipur in the article below has some interesting things to say about people's wisdom and their instinctive choices for energy conservation . Apparently far removed from the exploitation of nature .. However an analysis of the CDM projects for energy recycling will reveal similar concepts in attempts by multinationals at energy conservation as well . Clearly there is something else which governs this distortion between instinctive wisdom and what is observed in practice (local deforestation and environment degradation by the community on the one hand and large scale pollution , deforestation by Multi nationals be it from mining, industry or the latest biofuel craze) .

Localized Energy Flows

Livelihoods in the rural areas are very much dependant on the land. The people not only live *on* the land, but also *with* the land. Much of their livelihood needs come from the land and their own labour. Local knowledge of the land patterns and native vegetation, and their multiple roles, has allowed for an integrated system of land use. Daily requirements of fodder, water and energy are collected by traveling on foot. Food is grown locally, cooked with locally collected fire wood or sold in the local market. Animal husbandry practices are linked to the production of fodder on agricultural land as well as grazing on the common lands. In fact once the fields are harvested, grazing takes place there as well. Subsequently, the ownership of cattle and goats depend to a great extent on the land ownership pattern. Those that can produce year-round fodder from their agricultural lands have buffaloes that are used for milk production while those with relatively lesser agricultural production have goats that are used for meat. Basic requirements like food and cash determine whether the land is used for self consumption or to generate produce that can be sold in the market. Therefore, the intimate knowledge the villagers have of their land and the biodiversity along with their livelihood considerations translates into their way of life. The diagram of the land use patterns below will reveal how they maximize their livelihoods through a balance of energy and resources that are available to them.

These patterns of land use go hand in hand with how energy is conserved, used and recycled. Agriculture, mining and animal husbandry are tied to such energy flows and balance of livelihoods. Energy sources are more or less diverse. In the villages of Bhekra and Karget, most energy comes from local natural resources which in turn derive the energy from the sun, which is undoubtedly the most abundant and recyclable energy source. The bio-energy from the sun translates into different localized results depending on the quality of the soil, water retention, nutrient availability and slope of the land. Land use patterns reflect the balance of these resources. The sun energy is converted into crops and vegetation which are food sources for the people and animals. Fuel for cooking comes from either animal dung or leaves and small branches collected from the forest. The villagers use their knowledge of the local resources and the different ways of harnessing the sun to meet their essential livelihood needs. However due to limitations of local natural resources, outside sources of energy such as diesel and electricity are available. A close study of the villages of Bhekra and Karget exemplify how natural resources are balanced to recycle and maximize the potential of the earth.

[20] Susannah Burrows Foundation for Sustainable Development intern at SPWD Udaipur .
[21] Sim Van Der Ryn & Stuart Cowan. *Ecological Design.* Washington, D.C.: Island Press, 1996. Pg. 65



The local vegetation is crucial to the sustenance of life in Bhekra and Karget. The arid climate and erratic rainfall leaves vegetation sparse leaving only a limited about available for use. In general, the vegetation includes a small range of slow-growing thorny trees, shrubs and grasses that have adapted to the harsh conditions. The vegetation plays many roles for the local community and biodiversity. For example thorny twigs can be used to form barriers between fields to keep animals away from the crops, leaves are dried and used as fodder, fruits are eaten or used for cooking, seeds are made into oils, and trees are used for housing, firewood, or other constructional and agricultural purposes. While the valley bottoms make excellent agricultural fields due to better soil depth and moisture retention, the hill slopes are home to the goats which feed on Ber (Zyzyphus mauritania) and Reunj (Acacia leucoploe). Jatropha is commonly grown throughout Bhekra and Karget for land barriers and as a fuel source. Mahua trees produce a fruit that is tasty off the branch, and when dried is used as a local liquor and or fuel source. Direct and indirect impacts related to human inhabitation effect local vegetation which is why trees and vegetation are cut sparingly, since the role they play in soil and water conservation is well recognized.

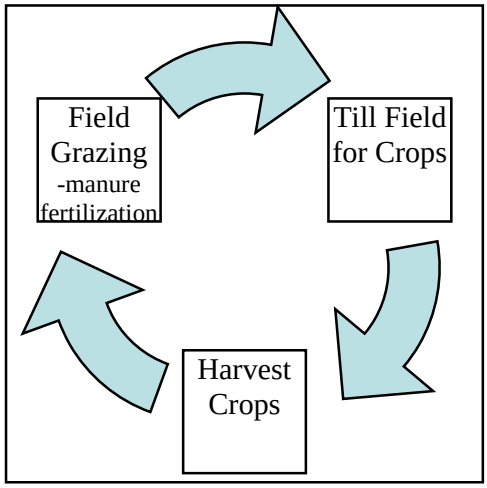
This Jatropha plant is being used to divide land. This landowners has planted approximately 20 Jatrhopha plants surrounding his agricultural fields

Energy Conservation: The *Restorative Material Cycle*

The local vegetation that is available in Bhekra and Karget and how it is used, again depends on land use patterns and these land use patterns reflect intentional energy conservation. In an agricultural field, sunlight is absorbed by the crops to produce fodder and grains. These grains are harvested as fodder for cows, goats, bullocks, etc; whose dung subsequently fertilizes the soil. In turn the soil nurtures the next crop as food stock for the villagers. This process contributes to what can be called a *restorative material cycle* which is a highly effective method of nutrient recycling. This is essentially a process that "first, turns waste into a resource, displacing the need for raw materials; and second, avoids turning

waste into pollution."[22]. One landowner in Bhekra (photo inset) is using this technique to maximize fertility in his fields. He has approximately 85 cows which graze within his fields over a certain period of time. When finished they move to another field. The grazing process allows the cows to eat and produce dung as a natural fertilizer in a controlled way. The manured fields are then later ploughed and will be fertile for crop production. When the crop season is finished he will again allow his animals to graze in the fields and continue the nutrient recycling. Subsequently, waste, by design, equals food.

The Restorative Material Cycle
Waste = Food



Another landowner nearby uses a different method of energy conservation. He is involved in the mining industry and is using his land as a stone quarry mine. By cutting into the stone and literally removing the hill he is also employing a system of restorative material cycles. The mine itself has created a water harvesting system that collects water at the base of the mine. The landowner has noticed this and built a field bund at the edge of his land to capture the ground water stored by the mine. This will subsequently store the mud and water which will be beneficial for a new agricultural field once the mining is complete. Therefore this landowner is benefiting from his land in several ways; he receives an income from the stones cut from the mine, he is creating a new purpose for his land, and harvesting water for crop production. By diversifying his land use based on his knowledge of the resources, he is maximizing his earnings. Many other landowners have used mining as a gateway to creating new agricultural fields and maximizing yields.

Once the mining is complete the new flattened land will be used as an agricultural field.

Multi-tasking and energy conservation: A mahua tree set in the middle of a landscape used for agriculture, field grazing, water harvesting with a field bund, and mining. Miners find shade and relaxation under the mahua tree.

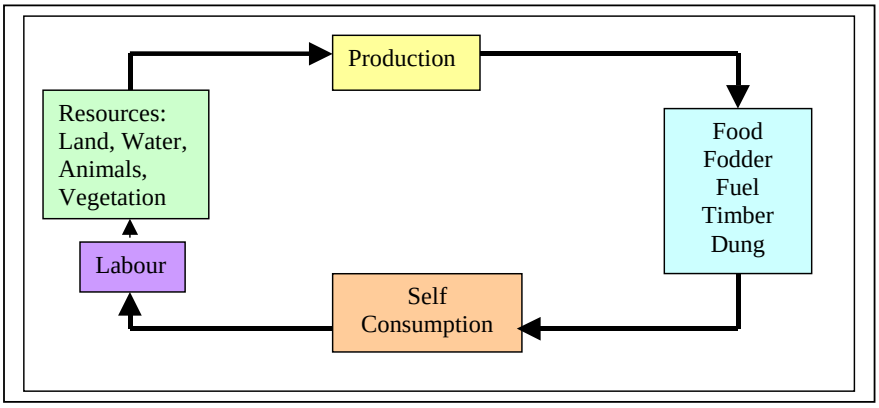
The relationship between mining, agriculture and animal husbandry is noteworthy in terms of energy conservation. Landowners involved in the mining industry earn a living by selling their stone. Cutting into the land makes way for a fresh new agricultural field that can subsequently be uses for animal grazing. Each of these livelihoods seems to work hand in hand. One landowner is allowing trucks to remove dirt from his fields for road construction. He does this free of charge because in the end he had a new farm field to cultivate. Again, this is a balance of available resources and materials and certainly an effective way of multi-tasking.

[22] Van Der Ryn, Pg. 106

Non-Localized Energy

The correspondence between, agricultural fields, stone quarry mines, and animal husbandry patterns translates into a resourceful energy flow that is more or less localized. The landowner directly benefits from his/her efforts and the producer is essentially the consumer. But what happens when there is a transition of local to non-localized production, when production is externally driven and commercialization becomes an issue? This is essentially what is happening with the Bio-fuel craze. Planning Commission has suggested Jatropha cultivation in 400,000 hectare land for four years in the first phase and in 2.5 million hectare in the second phase for meeting the needs of 10% doping of auto-fuel. In Rajasthan Jatropha plantation have been undertaken in Udaipur, Kota, Sikar, Bansara, Chittor and Churu districts. These plantations could certainly impact rural communities such as Bhekra and Karget. Those who criticize the government's bio-fuel policy have said that it would amount to diversion of land from food crops and fodder to fuel and would ultimately endanger food and fodder security of million. But how does this factor into the village level? What happens to the localized methods of production and consumption within a village? The old sources of energy that were recycled from grazing and land use patters would be sacrificed for the mass production of Jatropha bio-fuel.

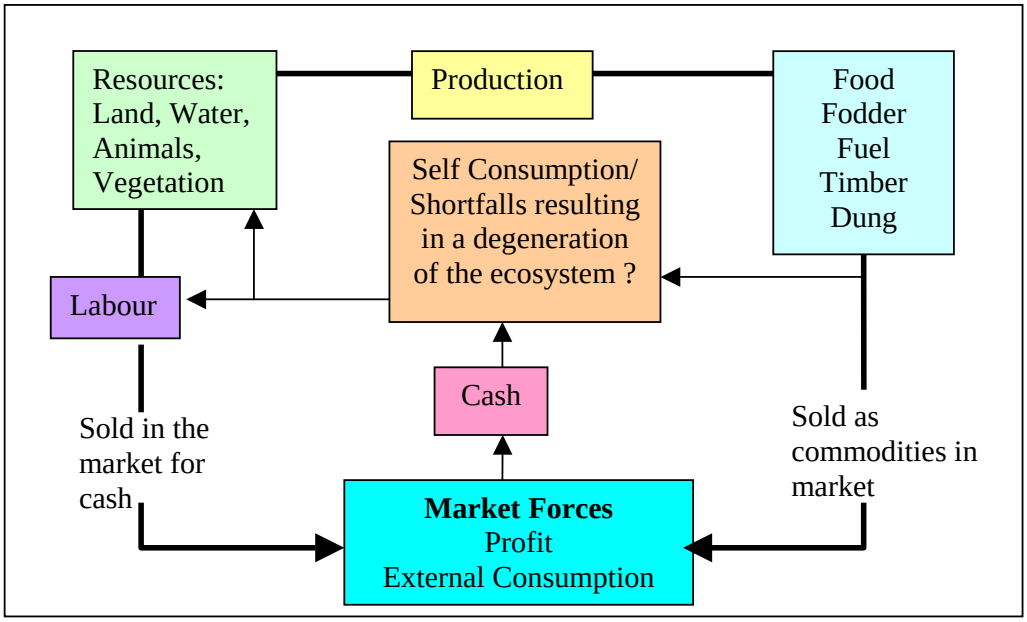
As stated above, in the villages of Bhekra and Karget the impacts that land use patterns are having on the land and biodiversity are confined to the specific area. Some natural vegetation is lost due to mining and agriculture; however, it is localized and controlled. Because the villagers are closely bound to their land, their actions have local, rather than global consequences. In the case of Jatropha and bio-fuel production, cash economy drives the production system and local knowledge of sustainable energy flow systems is compromised. The market system does not necessarily lead to a systematic and sustainable way of handling local and global energy systems as principles of energy recycling do not match with the pricing and profitability regimes afforded by the market. Consequently, larger-scale effects become an issue.



Localized production and consumption vs. Externalized driven production and consumption

If one were to determine the sustainability of such impacts of externally driven production it must be broken down in terms of culture dynamism and sustainability (are the results sustainable for the people?) and land and energy sustainability (what are the specific environmental consequences?). Local participation; manual skills and communication are at the core of culture sustainability. The shared awareness that a community has at a local level must be translated to a wider context when external factors are involved. This shared awareness and intimate knowledge must then be explained in terms of environmental concerns as well. How will local vegetation growth and use be impacted by internal supply and external demand? It is imperative for wider scale, external activities to be evaluated in order to understand the wider implications. The traditional cohesion between community, environmental, and land use patterns must also be maintained to preserve the sustainable flows of energy, materials and natural resources. As demonstrated in the diagrams above, the fewer steps in the energy delivery and return process, the more energy is recycled and less energy is fragmented and thus wasted. Therefore there must be a way to maximize efficiency, allowing external driven production to work hand in hand

with localized consumption so that all needs can be met both within local communities and in wider contexts.



14. Will Global warming take a short break[23]?

And so with a failure to find solutions to the worlds quest for sustainable energy and concrete answers to the issue of global warming, will we now see studies like the one below?

Scientists in Leibniz Institute of Marine Sciences (IFM-GEOMAR) in Kiel and the Max Planck Institute (MPI) for Meteorology in Hamburg , have data to show that policy makers have ten more years to save the world ….With the increasing globalization of production systems reflected by its manifestation in globalised markets (intensive bargaining and bikering between countries and MNCs notwithstanding). Can we expect the market mechanism based on individual ownership and profit motivation to provide us with the answers we need to solve the issues of Global warming and pollution that grip this planet ???

[23] Emmy-Noether[1] fellow and lead author Dr. Noel Keenlyside and Prof. Mojib Latif from IFM-GEOMAR Dr. Johann Jungclaus from the MPI for Meteorology http://www.ifm-geomar.de/index.php?id=4192&l=1