IJCRT.ORG ISSN : 2320-2882
INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)
An International Open Access, Peer-reviewed, Refereed Journal

Recent Trends in Green Technology for Clean Energy Production: A systematic Review on bio-ethanol fuel

Shelke S.N [1]. Nehe S.S. [2] Fulpagre S.V. [3]
[1](Phd Student, Mechanical Engineering, JJTU,Rajasthan,,India)
[2](Phd Student, Mechanical Engineering, JJTU,Rajasthan,,India)
[3](Asst. Prof.,Mechanical Engineering, Samarth College Of Engineering, Belhe ,SPPU,Pune)

Abstract : *Using bio-ethanol blended gasoline fuel for automobiles can significantly reduce petroleum use and exhaust greenhouse gas emission. Bio-ethanol can be produced from different kinds of raw materials. These raw materials are classified into three categories of agricultural raw materials: simple sugars, starch and lignocellulose. Bio-ethanol from sugar cane, produced under the proper conditions, is essentially a clean fuel and has several clear advantages over petroleum-derived gasoline in reducing greenhouse gas emissions and improving air quality in metropolitan areas. Conversion technologies for producing bio-ethanol from cellulosic biomass resources such as forest materials, agricultural residues and urban wastes are under development and have not yet been demonstrated commercially.**The** implementation of the Brazilian sugarcane ethanol program always included a continuous assessment of its sustainability. The possibilities for increasing production in the next years must consider the exciting promises of new technologies (that may lead to 50% more commercial energy/ha, from sugarcane) as well as environmental restrictions. The greenhouse gases emissions associated with the expansion are analyzed in the next sections.*

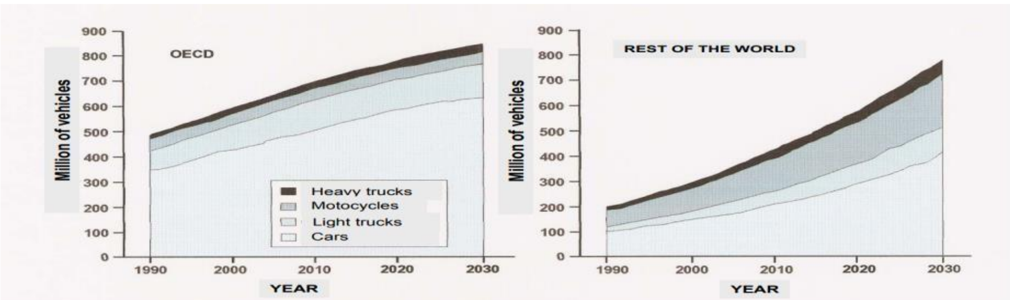
Keywords - *Biomass, Bio-ethanol, Fuel properties, GHG emissions*

I. INTRODUCTION

Motor vehicles account for a significant portion of urban air pollution in much of the developing world. According to Goldenberg [2], motor vehicles account for more than 70% of global carbon monoxide (CO) emissions and 19% of global carbon dioxide (CO_2) emissions. CO_2 emissions from a gallon of gasoline are about 8 kg. For example: CO_2 emissions from a gallon of octane

$$= 3.78L \times 0.699\, kgL^{-1} \times \frac{96}{114} \times \frac{44}{12} = 8.16\, kg \qquad (1)$$

There are 700 million light duty vehicles, automobiles, light trucks, SUVs and minivans, on roadways around the world. These numbers are projected to increase to 1.3 billion by 2030, and to over 2 billion vehicles by 2050, with most of the increase coming in developing [2] **Evolution of automobiles fleet**



In today's world of volatile fuel prices and climate concerns, there is little study on the relationship between vehicle ownership patterns and attitudes toward vehicle cost (including fuel prices and fee bates) and vehicle technologies. This work provides new data on ownership decisions and owner preferences under various scenarios, coupled with calibrated models to micro simulate Austin's personal-fleet evolution. Opinion survey results suggest that most Austenite's (63%, populationcorrected share) support a fee bate policy to favor more fuel efficient vehicles. Top purchase criteria are price, type/class, and fuel economy. Most (56%) respondents also indicated that they would consider purchasing a Plug-in Hybrid Electric Vehicle (PHEV) if it were to cost $6000 more than its conventional, gasoline-powered counterpart. And many respond strongly to signals on the external (health and climate) costs of a vehicle's emissions, more strongly than they respond to information on fuel cost savings.

Twenty five-year simulations of Austin's household vehicle fleet suggest that, under all scenarios modeled, Austin's vehicle usage levels (measured in total vehicle miles traveled or VMT) are predicted to increase overall, along with average vehicle ownership levels (both per household and per capita). Under a fee bate, HEVs, PHEVs and Smart Cars are estimated to represent 25% of the fleet's VMT by simulation year 25; this scenario is predicted to raise total regional VMT slightly (just 2.32%, by simulation year 25), relative to the trend scenario, while reducing CO2 emissions only slightly (by 5.62%, relative to trend). Doubling the trend-case gas price to $5/gallon is simulated to reduce the year-25 vehicle use levels by 24% and CO2 emissions by 30% (relative to trend).

Two- and three-vehicle households are simulated to be the highest adopters of HEVs and PHEVs across all scenarios. The combined share of vans, pickup trucks, sport utility vehicles (SUVs), and cross-over utility vehicles (CUVs) is lowest under the fee bate scenario, at 35% (versus 47% in Austin's current household fleet). Fee bate-policy receipts are forecasted to exceed rebates in each simulation year.

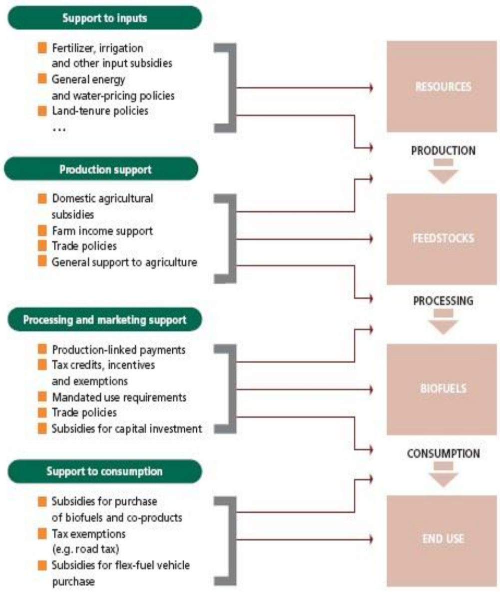
In the longer term, gas price dynamics, tax incentives, fee bates and purchase prices along with new technologies, government-industry partnerships, and more accurate information on range and recharging times (which increase customer confidence in EV technologies) should have added effects on energy dependence and greenhouse gas emissions

Emissions from Transportation

More than 70 per cent of all carbon monoxide (CO) emissions, More than 40 per cent of nitrogen oxides (NOx) emissions, Almost 50 per cent of total hydrocarbons (HCs), Around 80 per cent of all benzene emissions; and At least 50 per cent of atmospheric lead emissions., 14% of all greenhouse gas emissions to the atmosphere and 19% of the CO2 emitted. [3]

II. STRETARGIC DEVELOPMENT PLAN FOR BIO-ETHANOL

The main drivers behind government support for the sector have been concerns over climate change and energy security as well as the desire to support the farm sector through increased demand for agricultural products. Although seemingly effective in supporting domestic farmers, the effectiveness of biofuel policies in reaching the climate-change and energy- security objectives is coming under increasing scrutiny.[5] **Underlying objectives of biofuel policies:**



As noted above, several countries have introduced policies promoting the development of liquid biofuels. High and volatile petroleum prices, increased awareness of fossil fuels' contribution to global climate change and the desire to promote economic revitalization in rural areas are the most commonly expressed reasons underlying these policies (FAO, 2007b).

Secure access to energy supplies is a longstanding concern in many countries. Reducing vulnerability to price volatility and supply disruptions has been an objective behind the energy policies of many OECD countries for several decades, and many developing countries are equally concerned about their dependence on imported sources of energy. The recent increases in prices, mainly of oil, have strengthened the incentive to identify and promote alternative sources of energy for transport, heating and power generation. Strong demand from rapidly growing developing countries – especially China and India – is adding to concerns over future energy prices and supplies. Bioenergy is seen as one means of diversifying sources of energy supply and reducing dependency on a small number of exporters. Liquid biofuels represent the main alternative source that can supply the transport sector, which is overwhelmingly dependent on oil, without more radical changes to current transport technologies and policies.

The second important factor driving bioenergy policies is the increasing concern about humaninduced climate change, as the evidence of rising temperatures and their anthropic origin becomes ever more compelling. Few now dispute the need to take action to reduce greenhouse gas emissions, and many countries are incorporating bioenergy as a key element in their efforts to mitigate climate change. Bioenergy has been perceived as offering significant potential for emission reductions, relative to petroleum-based fuels, in electricity, heating and transportation, although actual net impacts on greenhouse gas emissions may vary significantly depending on factors such as land-use change, feedstock type and related agricultural practices, conversion technology and end use. Indeed, recent analyses suggest that large-scale expansion of biofuel production could cause a net increase in emissions. **Policy measures which influencing biofuel development**

Biofuel development in OECD countries has been promoted and supported by governments through a wide array of policy instruments; a growing number of developing countries are also beginning to introduce policies to promote biofuels. Common policy instruments include mandated blending of biofuels with petroleum-based fuels, subsidies to production and distribution, and tax incentives. Tariff barriers for biofuels are also widely used to protect domestic producers. These policies have decisively affected the profitability of biofuel production, which in many cases would otherwise not have been commercially viable. [6]

Policy measures affecting biofuel development Biofuel development is influenced by a wide range of national policies in multiple sectors, including agriculture, energy, transport, environment and trade, as well as broader policies affecting the overall "enabling environment" for business and investment. Policies applied to bioenergy, particularly liquid biofuels, significantly influence the profitability of biofuel production. Identifying the relevant policies and quantifying their impact in specific cases is difficult because of the variety of policy instruments and ways they are applied; however, they have generally translated into (sometimes very significant) subsidies aimed at supporting biofuels and influencing the financial attractiveness of their production, trade and use. Subsidies can affect the sector at different stages. Figure 8, adapted from the Global Subsidies Initiative (Steinbrink, 2007), shows the various points in the biofuel supply chain where direct and indirect policy measures can provide support for the sector. Some of these factors are interrelated, and assigning policies to one category or another may be somewhat artificial in practice. Different policy instruments and types of related support applied at different stages may have very different market impacts. Generally, policies and support directly linked to levels of production and consumption are considered as having the most significant market-distorting effects, while support to research and development is likely to be the least distorting.[7]

III. PROBLEMS WITH THE PRESENT ENERGY SYSTEM

Exhaustion of fossil resources, Security of supply, Environmental impacts

Energy and climate change Climate change is already happening – wreaking devastation on communities and ecosystems around the world. Without urgent action to reduce global greenhouse gas emissions, we face a far worse situation of runaway climate change, with impacts which would dramatically overshadow anything we are seeing today. Exceeding climate tipping points brings a near certainty of even greater hunger, drought, flooding, and temperature and weather extremes, as well as mass extinctions and the forced migration of billions of people, combined with the breakdown of social order and political systems in many places.

Governments have identified an increase of two degrees Celsius in global mean temperature above pre-industrial levels as a key threshold. They have committed to efforts to keep global warming below this threshold in order to avoid the worst impacts of climate change. According to NASA's Goddard Institute for Space Studies, average temperatures have climbed 0.8 degrees Celsius around the world since 1880. However, further warming of 0.6 degrees Celsius is thought to be already locked in without any further increase in the concentration of global greenhouse gas emissions. Furthermore, despite over 20 years of international climate negotiations under the United Nations Framework Convention on Climate Change (UNFCCC), global emissions are showing no sign of abatement. The latest report from the Intergovernmental Panel on Climate Change (IPCC) – the official intergovernmental body tasked with the assessment of climate change and its potential environmental and socio-economic impacts – published in September 2013, asserts that unless we change our current emissions pathway, warming above four degrees

Celsius by 2100 is 'as likely as not'.

Scientists have argued that in order to keep global temperature increase below two degrees we need to make global emissions peak and start declining by 2015. However, even a two degree increase is no longer considered safe – at best it is the border between dangerous and extremely dangerous climate change. Even a rise of 1.5 degrees is considered to be dangerous, with predictions of highly destructive impacts for significant parts of the world's population, including water scarcity, hunger and displacement for millions in Africa, as well as threatening the very existence of low-lying, small island states.[8]

IV. MITIGATION OF GHG EMISSIONS USING SUGARCANE BIOETHANOL

The evaluation of the GHG emissions (and mitigation) from the sector in the last years (2002-2008) and the expected changes in the expansion from 2008 to 2020 must consider technology (the continuous evolution and selected more radical changes), both in cane production as in cane processing. Two (alternative) technology paths were selected: The *Electricity Scenario* follows the technology trends today, with commercially available technologies: the use of trash (40% recovery) and surplus bagasse (35%) to produce surplus electricity in conventional high pressure co-generation systems (Sabra, 2008).The *Ethanol Scenario* considers advanced ethanol production with the hydrolysis of lignocellulose cane residues; ethanol would be produced from sucrose but also in an annexed plant with the surpluses of bagasse and of the 40% trash recovered (Sabra, 2008). This condition would lead to a smaller area (29% smaller, for the same ethanol production) than the *Electricity Scenario*; technologies may be commercial in the next ten years.

A] ENERGY FLOWS AND LIFECYCLE GHG EMISSIONS/MITIGATION

The systems boundaries considered for the energy flows and GHG emissions and mitigation include the sugarcane production, cane transportation to the industrial conversion unit, the industrial unit, ethanol transportation to the gas station, and the vehicle engine (performance). Methodologies use data and experimental coefficients as indicated in the tables, and in some cases IPCC (IPCC, 2006) defaults; details are presented in Macedo *et al.* (2008), Sabra (2008) and Macedo (2008). The CO2 (and other GHG) related fluxes are: CO2 absorption (photosynthesis) in sugarcane; its release in trash and bagasse burning, residues, sugar fermentation and ethanol end use. These fluxes are not directly measured (not needed for the net GHG emissions).CO2 emissions from fuel use in agriculture and industry (including input materials); in ethanol transportation;

and in equipment/buildings production and maintenance. Other GHG fluxes (N_2O and methane): trash burning, N_2O soil emissions from N- fertilizer and residues

(including stillage, filter cake, trash) GHG emissions mitigation: ethanol and surplus bagasse (or surplus electricity) substitution for gasoline, fuel oil or conventional electricity.

Table 1. Basic data: sugarcane production

Item	Units	2006 [a]	2020scenarios [b]
Sucrose content	% cane stalks	14.22	15.25 [c]
Fiber content	% cane stalks	12.73	13.73 [d]
Trash (db) [e]	% cane stalks	14	14
Cane productivity	t cane/ha	87.1	95.0
Fertilizer utilization [f]			
P_2O_5	kg/(ha.year)	25	32
K_2O	kg/(ha.year)	37	32
Nitrogen	kg/(ha.year)	60	50
Lime [g]	t/ha	1.9	2.0
Herbicide [h]	kg/ha	2.2	2.2
`Insecticide [h]	kg/ha	0.16	0.16
Filter cake application	t (db)/ha (% area) [i]	5 (70%)	5 (70%)
Stillage application	m³/ha (% area) [j,k]	140 (77%)	140 (77%) [l]
Mechanical harvesting	% area	50	100 [m]
Unburned cane harvesting	% area	31	100 [m]
Diesel consumption	L/ha	230	314

Item	*Units*	*2006* [a]	*2020electricity* [b]	*2020ethanol* [b]
Bagasse use`		*Low pressure cogeneration*	*Advanced cogeneration*	*Biochemical conversion*
Electricity demand	*kWh/t cane*	*14.0*	*30*	*c*
Mechanical drivers	*kWh/t cane*	*16.0*	*0*	*0*
Electricity surplus	*kWh/t cane*	*9.2* [d]	*135* [e]	*44* [f]
Trash recovery	*% total*	*0*	*40*	*40*
Bagasse surplus	*% total*	*9.6*	*0* [g]	*0* [g]
Ethanol yield	*l/t cane*	*86.3*	*92.3* [h]	*129*

Table 2. Basic data: sugarcane processing.

	Ethanol use a	Avoided emission b	Net emission c
2006	E100	-2.0	-1.7
	E25	-2.1	-1.8
2020 electricity	E100	-2.0	-2.4
	FFV	-1.8	-2.2
	E25	-2.1	-2.5
2020 ethanol	E100	-2.0	-1.9
	FFV	-1.8	-1.7
	E25	-2.1	-2.0

Table 3. Energy balance in anhydrous ethanol production (MJ/t cane).

	2006	2020 electricity	2020 ethanol
Energy input	235	262	268
Agriculture	211	238	238
Cane production	109	142	143
Fertilizers	65	51	50
Transportation	37	45	45
Industry	24	24	31
Inputs	19	20	25
Equip./buildings	5	4	6
Energy output	2,198	3,171	3,248
Ethanol a	1,926	2,060	2,880
Electricity surplus b	96	1,111	368
Bagasse surplus a	176	0.0	0.0
Energy ratio	9.4	12.1	12.1

Table 4: Total emission in ethanol life cycle (kg CO2 eq/m3

	2006	2020 electricity	2020 ethanol
Cane production	416.8	326.3	232.4
Farming	107.0	117.2	90.6
Fertilizers	47.3	42.7	23.4
Cane transportation	32.4	37.0	26.4
Trash burning	83.7	0.0	0.0
Soil emissions	146.3	129.4	92.0
Ethanol production	24.9	23.7	21.6
Chemicals	21.2	20.2	18.5
Industrial facilities	3.7	3.5	3.2
Ethanol distribution	51.4	43.3	43.3
Credits			
Electricity surplus [b]	-74.2	-802.7	-190.0
Bagasse surplus [c]	-150.0	0.0	0.0
Total	268.8	-409.3	107.3

Table 5. Avoided emissions due to ethanol use (t CO2 eq/m3 hydrous or anhydrous; substitution criterion for the co-products).

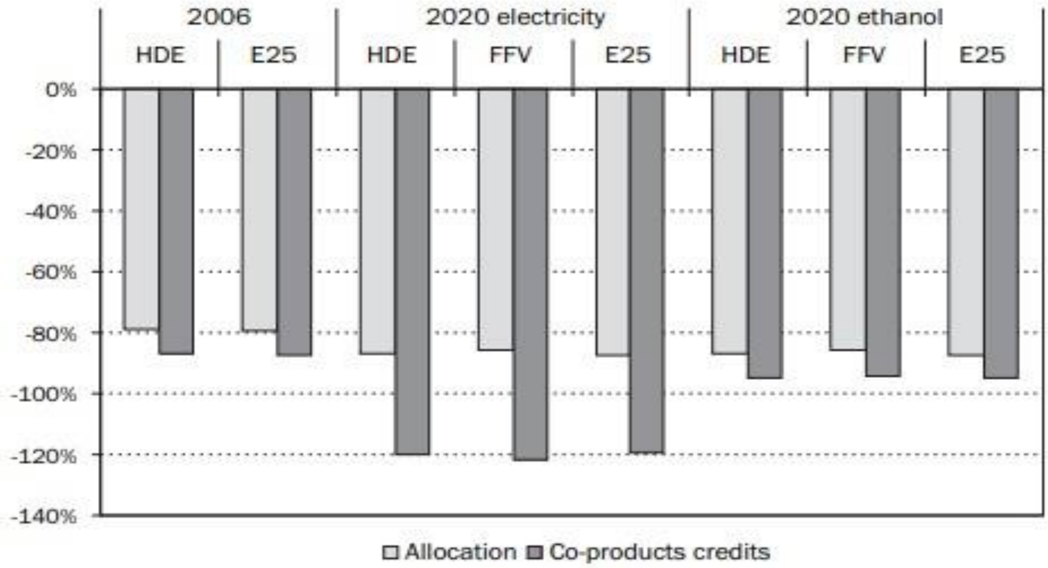


Figure 2. GHG mitigation with respect to gasoline: allocation or co-products credits

Table 6. Soil carbon content for different crops (t C/ha)

Crop	IPCC defaults a		Experimental b		Selected values
	LAC	HAC	HAC	Other	
Degraded pasturelands	33	46	41	16 c	41
Natural pasturelands	46	63	56		56
Cultivated pasturelands	55	76	52	24 c	52
Soybean cropland	31	42	53		53
Maize cropland	31	42	40		40
Cotton cropland	23	31	38		38
Cerrado	47	65	46		46
Campo Limpo	47	65	72		72
Cerradão	47	65	53		53
Burned cane	23	31	35-37	35 d	36
Unburned cane	60	83	44-59		51

Table 7. Above ground carbon stocks (t C/ha) a.

Degraded pasturelands	1.3
Cultivated pasturelands	6.5b
Soybean croplands	1.8c
Maize croplands	3.9
Cotton croplands	2.2d
Cerrado *sensu strictu*	25.5e
Campo Limpo	8.4f
Cerradão	33.5g
Unburned cane	17.8

V. CONCLUSION

The analyses of the GHG emissions (and mitigation) with ethanol from sugarcane in Brazil in the last years (2002-2008) and the expected changes in the expansion from 2008 to 2020 show that:

The large energy ratios (output renewable/input fossil) may still grow from the 9.4 value (2006) to 12.1 (2020) in two Scenarios: the better use of cane biomass to generate surplus electricity (2020 Electricity Scenario: already under implementation) or to produce more ethanol (2020 Ethanol Scenario: depending on technology development). The Ethanol Scenario, if fully implemented, would reduce the area needed by 29%. The corresponding GHG mitigation (with respect to gasoline), for ethanol use in Brazil, would increase from the 79% (2006) to 86% (2020) if only the ethanol is considered (with emissions allocation to co-products), or from 86% (2006) to 95% or 120% (2020: Ethanol or Electricity Scenarios) if all co-products credits and emissions are considered for ethanol (substitution criterion).

REFERENCES Journal Papers:

[1] *Recent trends in global production and utilization of bio-ethanol fuel Mustafa Balat *, Havva Balat Sila Science and Energy Unlimited Company, Mekan Sok, No 24, Trabzon, Turkey Applied Energy 86 (2009) 2273–2282*

[2] *Goldenberg J. Environmental and ecological dimensions of biofuels. In: Proceedings of the conference on the ecological dimensions of biofuels, Washington, DC, March 10; 2008.*

[3] *Evolution of the household vehicle fleet: Anticipating fleet composition, PHEV adoption and GHG emissions in Austin, Texas Author links open overlay panelSashankMustiaKara M.Kockelmanb*

Books:

[4] Sugarcane ethanol: Contributions to climate change mitigation and the environment P Zuurbier, J van de Vooren - 2008 - books.google.com

Chapters in Books:

[5] Source & ©: FAO, the State of Food and Agriculture, Part I: Biofuels: Prospects, Risks and Opportunities (2008), Chapter 3, Section Key messages, p.40

[6] Source & ©: FAO, the State of Food and Agriculture, Part I: Biofuels: Prospects, Risks and Opportunities (2008), Chapter 3, Section Key messages, p.39-40

[7] Source: FAO, The State of Food and Agriculture, Biofuels: Prospects, Risks and Opportunities (2008), Chapter 3, Section policy measures affecting biofuel development, p.28

[8] Chapter 4 Mitigation of GHG emissions using sugarcane bioethanol Isaias C. Macedo and Joaquim E.A. Seabra

Theses:

[9] https://gebe.foei.org/good-energy-bad-energy/problems/problems-with-the-current-energysystem/#:~:text=Energy%20waste&text=In%20terms%20of%20energy%20production,lost%20via%20transmission%20and%20dist ribution