

## 6.0 CONCLUSION

Finally as the conclusion, is to be made using the above report structure and the methodology and it is needed to summarize all the findings at the end. As this research is based on the analytical results of the feasibility studies as well as the survey outcome analysis, both qualitative and quantitative techniques are used.

Observing the fuel import data and analyze the figures it is more obvious that the demand for every type of fuel is growing and more and more crude oil as well as refined products to be imported to the country in order to cater this demand without generating and shortages in supplies. Figures of petroleum imports in the annual report highlighting the story that demand is constantly increasing even the oil prices are drastically fluctuating. Therefore a massive amount of foreign exchange is needed to import the required fossil fuels to the country. This value seems to be more than 20% of all imports by having a share of one fifth, which is an enormous amount of money. Even with economic growth and GDP growth in the country, this fuel imports should be higher and the money is going away for fuels extensively is the money which can be used for country's further development.

This money should be generated within the country or should be earned by the export sector of the country. For an example, the income generated by exporting the agricultural crops and products can be used to cover the expenditure of oil imports but this money is not enough to cover. But with the recent price hikes and the high price volatility in petroleum fuels, a decision should be made to at least use an alternative fuel blended with fuels in order to reduce the fuel usage. If the country can invent an alternative to blend up to 10% with gasoline to be used in the vehicles, this can cut down and save 10% of gasoline that need to be imported from oil producing countries.

Being served the bio fuels as a hot topic these days, most of the developed countries are very much worried about the environmental impacts done by fossil fuel burning. Since these bio fuels can be made out of natural organic feed stocks and there are many organics supplies available in the country, it is important to go for at least in small scale to produce bio fuels.



Bio diesel is producing using somewhat advanced technology than bio ethanol hence, as the first step bio ethanol can be selected as an alternative fuel for gasoline. Ethanol can be produced by many natural organic raw materials and many manufacturing processes are available in the industry. If we are to produce bio ethanol in Sri Lanka, several raw materials are available such as sugar cane molasses, cassava, paddy straw, organic waste (not so effective) and newly invented algae. As the country is having the experience of producing ethanol in sugar manufacturing processes, the most suitable raw material can be taken as sugar molasses. Sri Lanka is producing only up to 15% of its annual sugar demand (in year 2011, it was only around 5-6%) therefore sugar cane cannot be directly taken in to the process like in Brazil but the sugar molasses can be taken which is the process byproduct. As with the relevant calculations, it can be considered that the country can go only up to less than 1% of ethanol blending with gasoline. This can be further increased by both increasing the land utilized for sugar cane cultivations and by improving the technologies of sugar cane harvesting.

In the Chapter 4, the requirement of ethanol production to blend with gasoline up to 2% is calculated and the relevant sugar cane quantity that needs to be harvested in order to get that ethanol requirement is also estimated using practical data from reliable sources. Ethanol is mainly produced in sugar manufacturing plants in the country is mainly for drinking purposes and even from that demand, only up to a certain percentage is produced locally. To achieve self sufficiency state for ethanol requirement in the country (for both arrack manufacturing and 2% blending with gasoline), it is required to produce more than 39,800 MT of ethanol and 71,500 ha of land extent. But with the land area available for sugar cane is up to 25,000 ha hence this target is not so viable in the current scenario. Anyway there is a possibility to go near to this value by utilizing the available resources effectively and efficiently.

Cassava roots are another feedstock that can be successfully used to produce bio ethanol. Scientifically ethanol can be made out of either sugars or starches and natural starches are comparatively high in yields as well as less expensive compared to sugars. For an example, the yield rate of cassava per hectare is more than that of sugar cane. Considering the Sri Lankan agricultural field, cassava is not a completely new thing and it can be easily grown in most of the areas of the country. With the analysis done in the 4<sup>th</sup> chapter, it is shown the required land area and the percentage of land area that needs to be used to cater the future demand of cassava as a



food item as well as the demand that need to produce ethanol, which is enough for 2% blending with gasoline.

Also there is a method to produce ethanol using paddy straw but this process is still in the R and D stage. If this method is selected then theoretically the country can produce bio ethanol which we will be able to go higher blends more than 25%. But the required technology is very new to the industry compared to other two selected options and needs to do more and more researches on this, in order to enhance the viability of the process. This area will definitely be an excellent topic for future researches under bio ethanol feasibility study as the main raw material (paddy straw) is widely available in the country.

Under the environmental impact analysis, it is obvious that by blending gasoline with ethanol will makes the exhaust more environment-friendly. The harmful emissions such as NO<sub>x</sub>, CO, HC and CO<sub>2</sub> are tending to be reduced with the addition of ethanol in to gasoline. However the fuel economy of the operated system to be reduced slightly as an adverse effect but with the low emission concentrations and with further improved fuel systems, it is a good sign of ethanol blended gasoline.

By analyzing the survey outcome, it is obvious that most of the people in the country know about the bio fuels, environmental impacts, bio ethanol, blended fuels, etc. and most of them believe that bio ethanol can be produced successfully in the country with the available resources. They believe that this fuel is socially accepted among the most of the end users and blended fuel can be a medium term solution for fossil fuels.

Also they expect from the government to be the key role in strategy and policy implementation of this new system by transferring the required technologies from the expert countries. They should first decide on what product needs to be done and if the blended version, then how much of blending taken place. Based on the capability, a certain blending needs to be mandate in certain fleets of vehicles such as government vehicles before implementing directly in to private vehicle in order to earn the trust of the consumers and then implement in to the rest of the vehicles.

Then it is needed to mandate the blending percentages and can get the competitive advantages of bio ethanol over fossil fuel burning.

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## **Annex A: Survey on the Feasibility of an Alternative fuel for motor vehicles in Sri Lanka**

Dear respondent,

You are kindly invited to participate in this survey, which aims to obtain an understanding of the feasibility of an Alternative fuel for motor vehicles in Sri Lanka. By doing this survey, it is expected to get an idea how an alternative fuel will work in the society,

This survey form includes 4 sections mentioned as below;

*Section A: Energy consumption details and the dependency on the current fuel of the respondent*

*Section B: Awareness of the alternative solutions for the current fuel system*

*Section C: Willingness to change by the respondent towards an alternative solution*

*Section D: Demographic and general information of the respondent*

Your responses will be strictly confidential and the findings of the research will be only reported in an aggregate manner without emphasizing any individual responses. This study is entirely for academic purposes your responses to the questions will only be used for the purpose of this study.

Here I would like to request from you to pay several minutes of your valuable time in order to fill this survey form and please be kind enough to e-mail the filled document to the following e-mail addresses: [bimalS@Masholdings.com](mailto:bimalS@Masholdings.com) or [eabsmas@gmail.com](mailto:eabsmas@gmail.com).

Thanks in advance for your kind corporation,

E. A. B. Silva

[Reg No: 09/9034]

MBA MOT 2009/2010



University of Moratuwa

**Survey questions****Section A: Energy consumption**

1. What is your current vehicle's fuel type?

Petrol     Diesel     Other (Please specify: .....

2. How many liters of fuel you are using average per month?

Below 50     50 – 200     More than 200

3. How much you are paying for your fuel per month, a rough percentage per monthly income?

Below 10%     10 – 20 %     More than 20%

4. Do you know the total fuel consumption of the vehicles in the country per year for?

Yes (Please specify: ..... )     No

5. Do you know how much of money is going away per year from the country in order to import crude oil and the refined oil products?

Yes (Please specify: ..... )     No

**Section B: Awareness of the challenge**

6. What is the most critical problem you foresee of your fuel type in near future?

High fuel prices     Scarcity     High environmental impacts

Other (Please specify: .....

7. Have you ever heard about bio fuels (bio ethanol/ bio diesel)?

Yes                       No

8. Do you know that Bio ethanol can be used as an alternative for Petrol?

Yes                       No

9. Do you know that sugar molasses (a byproduct from sugar production) can be used to produce bio ethanol?

Yes                       No

10. Sugar cane is grown in some areas of the country, purely for sugar production to fulfill the country's demand. But local sugar production is filling only up to 15% of the current demand of the country. Do you think is there a way for our country to produce more ethanol from Sugar industry? Give your suggestions.

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11. If we are to use Bio ethanol in our vehicles, either we can convert the engine completely Ethanol compatible at a cost or we can use the current engine system by going to a blended fuel with ethanol up to 10%. If you have both options what do you select? Give your view points.

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12. Do you know Bio ethanol contributes towards decreasing harmful emissions to the environment?

Yes                       No

***Section C: Willingness to change***

13. If Bio ethanol is produced successfully in the country, do you think people will use them in their vehicles?

Yes                       No

14. If it is produced successfully in the country, are you willing to use it in your vehicle?

Yes                       No

15. Do you think it is economically viable to use Bio ethanol blended fuels in the current system? Please give your view points.

Yes                       No

16. Are you ready to pay an extra premium to contribute towards this change?



Yes

No

17. Do you think it is socially acceptable to use this type of a fuel as the current fuel type performs well in the current vehicle system in the country?

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18. What should be the role of the government in this scenario? Give your view points.

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19. What should be the role of the private sector in this scenario? Give your view points

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**Section D: Demographic and general information**

1. Age group:

- 20-35 years       36- 50 years       Above 51

2. Gender:

- Male       Female

3. Designation (Please specify): .....

4. Working organization/industry:

- Banking and Financial related       Manufacturing       Garment  
 Government       Services sector       Trading       Transport  
 Other (specify in this text box)

5. Highest educational level:

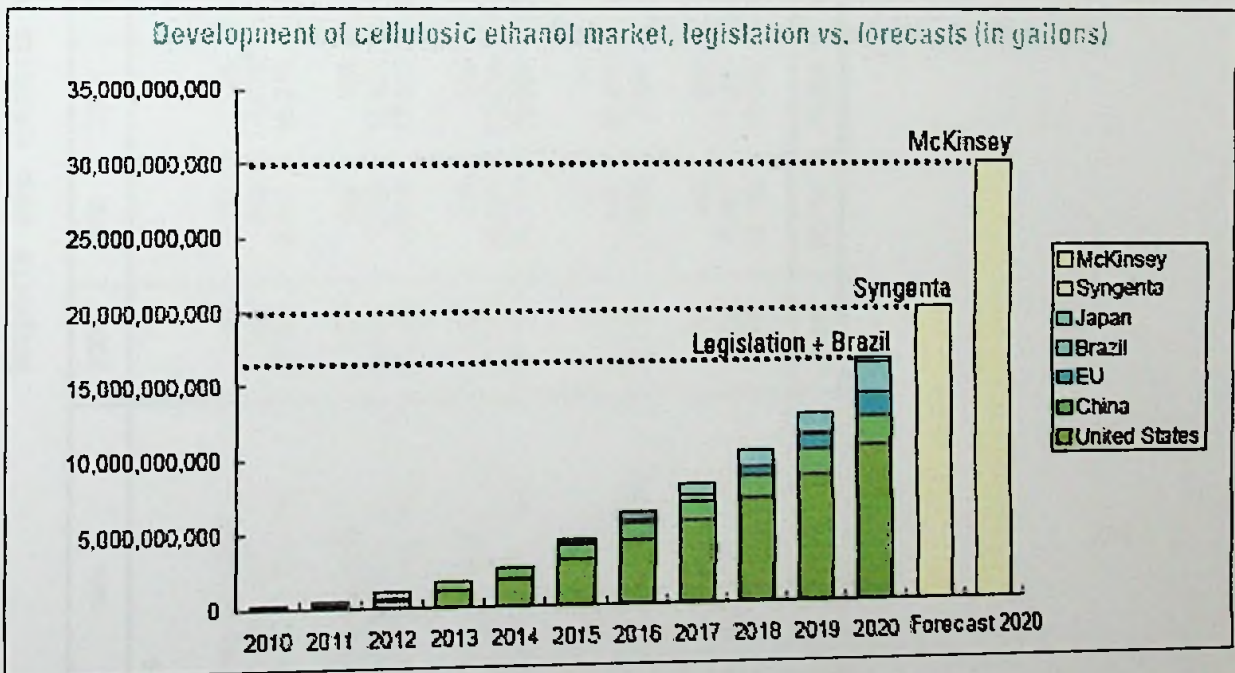
- Doctorate       Post graduate/Masters       Degree  
 Diploma       Primary education

- Thank you -

## Annex B: World's ethanol production in recent years with the forecast up to 2020

Millions of Gallons	2008	2009	2010	2011	2012
Brazil	4,988	5,238	5,489	5,739	5,990
U.S.	6,198	6,858	7,518	8,178	8,839
China	1,075	1,101	1,128	1,154	1,181
India	531	551	571	591	611
France	285	301	317	333	349
Spain	163	184	206	227	249
Germany	319	381	444	506	569
Canada	230	276	322	368	414
Indonesia	76	84	92	100	108
Italy	50	53	55	58	60
ROW	2,302	2,549	2,794	3,040	3,286
World	16,215	17,574	18,934	20,293	21,653

Source: USDA, Company Research





## Annex C: Imports of major commodities to the country

## Imports and Exports of Major Commodities (a)

Item	2000	2001	2002	2003	2004	2005	2006	2007	2008 (b)	2009 (c)
<b>IMPORTS</b>										
<b>Rice</b>										
Quantity (mt '000)	15	52	95	35	222	52	12	88	84	52
Value (Rs. mn)	288	969	1,732	919	6,186	1,554	577	4,261	4,785	2,616
Price - C.I.F. (Rs./ mt)	19,368	18,647	18,215	23,677	27,902	30,035	48,083	48,420	56,868	50,023
<b>Wheat</b>										
Quantity (mt '000)	922	760	993	919	993	864	1,200	952	919	1,026
Value (Rs. mn)	9,625	9,793	12,427	13,255	18,536	14,200	20,679	25,891	40,563	29,769
Price - C.I.F. (Rs./ mt)	10,443	12,865	12,512	14,428	18,668	16,438	17,233	27,196	44,149	29,014
<b>Sugar</b>										
Quantity (mt '000)	562	420	554	509	438	418	525	481	575	467
Value (Rs. mn)	10,777	10,289	12,634	11,199	11,048	13,303	23,286	17,055	22,350	25,119
Price - C.I.F. (Rs./ mt)	19,187	24,511	22,809	21,982	25,227	31,825	44,297	35,474	38,869	53,830
<b>Crude Oil</b>										
Quantity (mn BBLs)	17	14	17	15	16	15	16	14	14	15
Value (Rs. mn)	37,697	31,619	40,404	41,628	61,434	77,795	106,699	113,584	143,159	111,715
Price - C.I.F. (Rs./ BBL)	2,181	2,200	2,408	2,840	3,803	5,195	6,669	8,113	8,369	7,345
<b>Fertiliser</b>										
Quantity (mt '000)	559	460	537	514	510	529	633	589	773	501
Value (Rs. mn)	6,059	6,047	7,259	8,457	10,902	13,552	17,036	21,422	62,420	22,215
Price - C.I.F. (Rs./mt)	10,839	13,150	13,519	16,452	21,387	25,616	26,913	37,549	80,801	44,365
<b>Total Value - Rs. mn.</b>	<b>64,446</b>	<b>59,707</b>	<b>74,456</b>	<b>75,358</b>	<b>108,106</b>	<b>120,404</b>	<b>168,247</b>	<b>182,213</b>	<b>244,277</b>	<b>191,635</b>

