TECHNOLOGY FACTSHEET

BIOMETHANE FOR TRANSPORT [1]

1. **Sector**: Energy/Transport

2. Introduction

Biogas is produced by a biological process by a group of micro organism by the digestion of easily biodegradable organic materials in an anaerobic (oxygen free) environment. Usually, biogas consists of methane (approximately 60%) and the balance Carbon dioxide. Traces of Hydrogen sulphide gas could be found in biogas produced from some type of organic materials.

In order to use biogas as a transport fuel it is necessary to compress it into cylinders. To cover a reasonable distance between re-fillings of cylinders, the compressed gas should have a pressure of around 200 atmospheres. Such gas cylinders are very similar to cylinders used for storing oxygen for hospital and industrial applications.

Prior to compression of biogas to such high pressures, for technical reasons, it is essential to remove the carbon dioxide from the gas. The removal of carbon dioxide also increases the energy content in the compressed gas cylinder, thus increasing the travel distance achievable between re-filling. There are many technologies practiced to absorb and separate carbon dioxide from a gas stream. One or more of these standard technologies could be deployed for this purpose.

To protect the vehicle engine from damage, and to minimize engine maintenance costs, it is useful to remove hydrogen sulphide gas in biogas prior to compression. Here again one of many technologies available could be deployed to remove hydrogen sulphide from biogas.

3. **Technology Name:** Biomethane for Transport

4. **Technology Characteristics:** (Feasibility of technology and operational necessities*)*

Relevance of Compressed Natural Gas (CNG) as Transport Fuel

Although the use of compressed bio methane as a transport fuel at present is limited to a few countries in the world, the use of compressed natural gas as fuel for transport vehicles is wide spread in the world. Natural gas and bio methane (after the removal of carbon dioxide and hydrogen sulphide from biogas) are chemically and physically almost identical – CH_4 – Methane. The differences are in the way it is produced or extracted.

[1] **This fact sheet has been extracted from TNA Report – Mitigation for Sri Lanka. You can access the complete report from the TNA project website** http://tech-action.org/

Natural gas is a fossil fuel extracted from the ground in gas, oil or coal fields. It is available only in limited number of countries. At the present rates of extraction and discovery of new fields, this resource in the earth is expected to last for another 50 years.

Bio methane on the other hand is produced by biological processes by a host of naturally occurring micro organism utilizing easily biodegradable biomass wastes such as animal dung, decaying leaves, fruits and vegetables etc. As such biomass is produced by the process of photosynthesis utilizing solar energy and atmospheric carbon dioxide and soil moisture, this is a renewable process.

All vehicles, equipment, devices and appliances used in the compression, storage and use of CNG for transport purposes could also be used for compressed bio methane without ant alternations or modifications.

When methane (bio methane or natural gas) is used as the fuel in internal combustion engines instead of liquid fuels such as diesel or petrol, the undesirable emissions are much lower. For this reason, many countries have introduced legislations to use methane as the fuel for urban transport fleets. A noteworthy example is New Delhi. Here all "Public Vehicles" meaning vehicles used by the public, such as busses, taxies, three wheelers etc. are allowed to use ONLY CNG within the city limits. With the recent introduction of this legislation, the air pollution level in the city has improved drastically.

For the year 2007for which published data are available, nearly 50% of the total petroleum imports of 4,287,880 tonnes amounting to 2,134,200tonnes were used for transport applications. Hence the transport sector is heavily dependent on imported fuel. Apart from incurring heavy foreign expenditure, this sector is solely depends on imports. This is a threat to national security. Hence there is a need to find an indigenous resource of producing transport fuel. Hence the development of this technology would address this issue.

5. Country specific applicability

Apart from the heavy expenditure and dependence on foreign imports for transport fuel, the country has the potential to produce significant amount of biomethane from the liquid wastes generated within the country. These liquid wastes need to be treated prior to disposal. Table 1gives the quantities of liquid wastes produced annually.

Availability of Raw Materials in Sri Lanka for Bio Methane Production

Data collected by the University of Moratuwa on the availability of industrial waste water in Sri Lanka is given in Table 1.

Table 1 – Availability of Industrial Liquid Waste

Industry	COD Loading (ktonne/y)	COD Removal (ktonne/y)	Bio gas Potential (million cu. m. /y)	Energy (TJ/y)	Tonne oil equivalent
Food & Beverages	4.502	3.601	1.801	48.62	1167
Distilleries	0.830	0.706	0.353	9.53	229
Tanning	2.946	2.356	1.178	31.81	763
Desiccated coconut	2.628	2.102	1.051	38.38	91
Rubber Processing	10.600	8.480	4.240	114.48	2184
Total	21.506	17.245	8.623	242.82	4434

Source: University of Moratuwa.

Many of the above industries have taken action to treat these wastes through anaerobic digestion. Others are in the process of doing so, as a statutory requirement. This process of anaerobic treatment generates methane gas. At present most of these gases are utilized for low grade energy production such as process heat. A better option would be to use it for transport application. By the proposed technology intervention these objectives could be achieved.

6. Status of the technology in the country and its future market potential

In order to use biomethane as transport fuel the following steps need to be taken:

- Production of biogas by anaerobic process.
- Clean the gas by the removal of carbon dioxide and hydrogen sulphide by chemical or absorption process.
- Compress methane thus produced into high pressure (200 barg) cylinders.

University of Moratuwa, in collaboration with the Ministry of Science and Technology has developed most of the above steps. In respect of the last step, the University has been able to compress the gas only to about 50 barg. The University is in the process of achieving this step.

It is now necessary to demonstrate a commercial scale operation to invite the private sector to invest in this technology.

Future Market Potential

As a first step, the objective is to use biogas produced by the treatment of a part of industrial waste water. The objective of this phase is to demonstrate a commercial scale operation. For this purpose it is proposed to establish a facility to p[roduce 140 lites of diesoline per day.

In the second phase it is proposed to extend this to all the industrial waste water. This amounts to 4400 tonnes of oil equivalent. This is only 0.02% of the national transport fuel needs.

In the third step, it would be possible to use the short-term biodegradable materials present in the MSW collected in the country by the various local government bodies. According to data compiled by the Ministry of Environment, over 80% of the matter present in MSW is short-term biodegradable materials. The moisture content of MSW collected in Sri Lanka is over 60%. More than 1000 tonnes of MSW is collected daily in the city of Colombo. Of course to use this material it is essential to construct suitable digesters. We need to plan how this could be done.

The potential in this third phase is to generate about 20,000 tonnes of oil equivalent of biomethane. This is about 1% of the national fuel requirements for transport. The biodegradable materials in the Colombo MSW would be just suffient for this purpose.

In the fourth phase it would be possible to use surplus Gliricidia leaves and other biodegradable produced in the country. Perhaps, optimistically, the entire requirements of 2 million tonnes of oil equivalent could be produced in this manner.

7. Barriers: -

8. Benefits: (How the technology could contribute to socio-economic development and environmental protection)

The benefits of the scheme are as follows:

Social Benefits

- Energy security in respect of transport fuel as at present the entire transport sector in Sri Lanka is dependent on imported petroleum fuels.
- Introduction of a new technology to the country.
- Employment to skilled and semi-skilled workforce in the engineering and manual work force.

Economic Benefits

- Production and use of a cost effective indigenous transport fuel.
- Saving of foreign exchange
- Use of digester effluent as organic fertilizer.

Environmental Benefits

- Cleaner local environment as the combustion of methane does not produce any particulates, sulphur dioxide or carbon monoxide.
- Reduction in GHG emissions.

9. Operations: -

10. Costs:

Based on the data provided by the University of Moratuwa the cost of establishing a facility making use of an existing water treatment plant and a "Phil" type compressor to generate the equivalent of 140 liters of diesel per day sufficient to operate a bus is Rs. Rs. 3,000,000. See Figure 1 of a "Phil" compressor.

Figure 1– The Phil Compressor

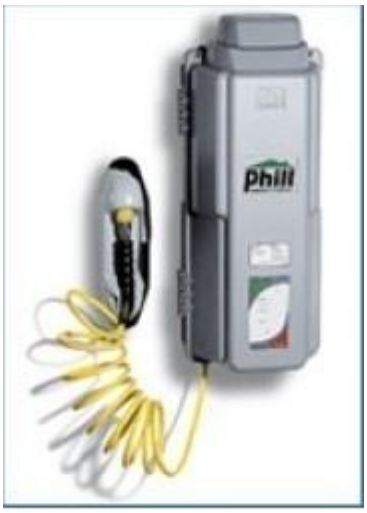

Figure 2: Car GetiingFilled With NG

11. References:

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