Biogas; alternative source of energy

1. 0 INTRODUCTION Around the world, pollution of the air and water from municipal, industrial and agricultural operations continues to grow . The concept of the ‘ four R’s’, which stands for Reduce, Reuse, Recycle, and Renewable energy, has generally been accepted as a useful principle for waste handling. The emission of carbon dioxide (CO2) and other greenhouse gases (GHG) has become an important issue, Governments and industries are therefore increasingly on the lookout for technologies and alternatives source of energy that will allow for more efficient and cost-effective waste treatment while minimizing GHG.

Country’s dependence on fossil fuel (gasoline) imports should further encourage the energy market and politicians to invest in a renewable alternative source of energy and create market incentives for biogas. Biogas is the versatile, sustainable energy carrier developing countries are looking for. Energy diversity brings stability. The use of manure and other organic waste should be a priority for biogas production. A large share of energy crops could be converted into biogas, but also used in different technologies, depending on needs in the particular country/region. Such a diverse and wide ranging approach to power will bring greater economic security and stability to our environmental and energy future than our current one-size-fits-all approach” (Logan, 2006). 2. 0 WHAT IS BIOGAS? Various bacteria stains break down organic matter and generate a burnable gas. Biogas is a fuel which is produced from the breakdown of organic matter. The term “ biogas” includes all gas produced by anaerobic digestion of organic matter.

In the absence of oxygen various types of bacteria break down the feedstock to form a secondary energy carrier, a burnable gas which mainly consists of

methane (50% – 75%) and carbon dioxide (25% – 45%). Biogas as a secondary energy carrier can be produced out of many different kinds of organic materials and its options for utilization can be equally versatile. Biogas can be used to generate electricity, heat and biofuels. Also the fermentation residues, called digestate, can be used, for example as a fertilizer.

Historically, a simple gas collector installed over a pile of cattle or pig manure can be seen as the simplest and earliest version of a biogas plant. This principle was already known to the ancient Persians. Today many different feedstocks are used in production of biogas. A general distinction can be made between biomass from agriculture like by-products (manure) or dedicated crops for biogas and various waste streams (see table below). Biogas Feedstocks Agriculture| Waste| Manure| Landfill| Energy Crops, catch crops| Sewage|

Landscape Management| Municipal Solid Waste| Grass| Food Waste| Other by-products| Other waste| 3. 0 BIOGAS AS AN ALTERNATIVE SOURCE OF ENERGY The quest for alternate sources of energy is propelled by numerous factors. One is shortage of conventional fossil fuels. These non-renewable resources like Hydrocarbon, Coal, etc. are constantly shrinking while their demand is ever-increasing. In effect, it pushes the cost of generating power upwards. Apart from scarcity and cost, another problem facing most countries is the ever-growing pile of waste dumps.

What could be more appealing than being able to generate cheaper, cleaner power from waste? One excellent source of energy is Biogas. This is

produced when bacteria decompose organic material such as garbage and sewage, especially in the absence of oxygen. Biogas is a mixture of about 60 percent methane and 40 percent Carbon dioxide. Methane is the main component of natural gas. It is relatively clean burning, colorless, and odorless. This gas can be captured and burned for cooking and heating. This is already being done on a large scale in some countries of the world.

Farms that produce a lot of manure, such as hog and dairy farms, can use biogas generators to produce methane. Biogas offers energy in many areas, including electricity, heat and vehicle fuels (biofuel). 3. 1 BIOGAS FOR ELECTRICITY AND HEAT GENERATION Biogas-powered electricity plants can be built quickly, simply, and for much less money per kilowatt than coal, oil, or nuclear power plants. Unlike these other current energy sources, Biogas is a renewable resource. Biogas is used to generate electricity for both industrial and domestic , in cooking and lighting your farmhouse.

The biogas plant typically comprises a series of tanks, referred to as digesters. Animal dung collected from diary farms along with other organic waste is fed into these digesters. The compartment is heated to a temperature of around 95 to 105 degree Fahrenheit. Bacteria digest the manure anaerobically in the absence of oxygen, releasing biogas (methane, carbon monoxide and traces of other gas). The biogas thus produced is captured and used as fuel to operate a generator. For instance, the anaerobic digester(Biogas Plant) in Chino, California.

It converts manure from ten animal farms located nearby into 2, 10, 000 cubic feet of biogas per day. The biogas supplies fuel for one of two gas-fired

engine generators at the facility, generating 500 kilowatts of electricity. As biogas/biomethane is an energy carrier with high energy it should not be used as source of heat alone but mainly for electricity production in combination with the use of the heat, as transportation fuels, for process heat in industry or as raw material for the chemical industry, or even for fuel cells.

The upgrading to biomethane is especially interesting to further reduce Europe’s dependency on imported fossil fuels for transportation and high temperature process energy which cannot be provided with other biomass fuels. 3. 2 BIOGAS FOR TRANSORTATION FUEL The utilization of biogas as vehicle fuel uses the same engine and vehicle configuration as natural gas. Worldwide there are more than 3 million natural gas vehicles and about 10, 000 biogas driven cars and buses, demonstrating that the vehicle configuration is not a problem for use of biogas as vehicle fuel.

However, the gas quality demands are strict so the raw biogas from a digester or a landfill has to be upgraded. Sweden and Switzerland are the only countries where pure biogas is available as transport fuel. 4. 0 ECONOMICS OF BIOGAS The size of a biogas plant has to be adapted to the individual situation, especially to the availability of input material in close proximity to the facility. Units of agricultural biogas plants normally reach sizes of 100 to 500 kWel (gas production around 28 to 140m3/h). Larger plants are economic f the input material is readily available in close range, for example cattle breeding, fields of dedicated biogas crops or waste water treatment facilities. The economy of scale especially plays an important role for upgrading the raw biogas to natural gas standards. The economic sizes of

biomethane plant ranges between 1 and 2 millions Nm3 biomethane per year. In certain places bigger plants could be more economical. The higher transport cost for the feeding material and the fermentation residues compensate the lower specific investment costs. 5. 0 CURRENT STATUS OF BIOGAS IN EUROPE

Many European countries have established favourable conditions for electricity and heat generation from biogas. Germany, Austria and Denmark produce the largest share of their biogas in agricultural plants using energy crops, agricultural by products and manure, whereas the UK, Italy, France, Greece, Poland, Czech, Finland, Hungary and Spain predominantly use landfill gas. * Germany has a leading role in Europe with almost 4000 biogas plants, most of them on farms for cogeneration of heat and electricity as well in order to reach a better efficiency source of energy. In Austria: Biogas on farms, 294 biogas plants was producing green electricity in Austria in 2008. The average size of 260 kW installed power generation shows the decentralized structure of biogas. * In Chino, California, It converts manure from ten animal farms located nearby into 2, 10, 000 cubic feet of biogas per day. The biogas supplies fuel for one of two gas-fired engine generators at the facility, generating 500 kilowatts of electricity. * Sweden: Biomethane as vehicle fuel; the market for biogas as vehicle fuels has been growing rapidly in recent years in Sweden. 008 there were 17, 000 vehicles driving on upgraded biogas/natural gas. There are currently 38 upgrading plants and in 2008 about 25% of Sweden’s biogas production was used as vehicle fuel and 60 % of the total gas volume sold as vehicle fuel was biogas and only 40 % consisted of natural gas. 6. 0 ADVANTAGES AND BENEFITS OF BIOGAS 1.

Provides a non-polluting and renewable source of energy. 2. It is a cheaper alternative source of energy 3. Efficient way of energy conversion (saves fuel wood). 4. Saves women and children from drudgery of collection and carrying of irewood, exposure to smoke in the kitchen, and time consumed for cooking and cleaning of utensils. 5. Produces enriched organic manure, which can supplement or even replace chemical fertilizers. 6. Leads to improvement in the environment, and sanitation and hygiene. 7. Provides a source for decentralized power generation. 8. Leads to employment generation in the rural areas. 9. Household wastes and bio-wastes can be disposed of usefully and in a healthy manner. 10. The technology is cheaper and much simpler than those of other fuels, and it is ideal for small scale application. 1. Dilute waste materials (2-10% solids) can be used as in feed materials. 12. Anaerobic digestion inactivates pathogens and parasites, and is quite effective in reducing the incidence of water borne diseases. 13. Environmental benefits on a global scale: Biogas plants significantly lower the greenhouse effects on the earth’s atmosphere. The plants lower methane emissions by entrapping the harmful gas and using it as fuel. 7. 0 DISADVANTAGES OF BIOGAS 1. The process is not very attractive economically (as compared to other source of energy) on a large industrial scale. . It is very difficult to enhance the efficiency of biogas systems. 3. Biogas contains some gases as impurities, which are corrosive to the metal parts of internal combustion engines. 4. Not feasible to locate at all the locations. 8. 0 CONCLUSION However, the use of agricultural material such as manure, slurry and other animal and organic waste for biogas production has, in view of the high greenhouse gas emission savings potential,

significant environmental advantages in terms of heat and power generation and its use as biofuel for vehicles.

Biogas installations can, as a result of their decentralized nature and the regional investment structure, contribute significantly to sustainable development in rural areas and offer farmers new income opportunities. (Directive 2009/28/ EC on the Promotion of the Use of Energy from Renewable Sources of the European Parliament and of the Council). 9. 0 GLOSSARY OF TERMS Biogas: is a fuel which is produced from the breakdown of organic matter. Decomposition: The decay or breaking down of materials into smaller components.

Fossil fuels: a non-renewable resource such as gas which is created by the composition of organic material. Kilowatt: a unit of electrical power equal to 1000 watts. Methane: a light, colorless, odorless, highly inflammable gas. Organic material: dead plant and animal tissues that originates from living sources such as plants, insects, and microbes. Renewable resource: resources that can replace themselves. Emission: is referred to as exhaust gas occurring as a result of the combustion of fuel. Green House Effect (GHG): warming of the Earth’s surface as a result of atmospheric pollution by gases. | REFERENCES Cooper, E. L. (1997). Agriscience: Fundamentals & Applications. Delmar Publishers, Albany, New York. Holt, Rinehart, and Winston. (1974). The Winston Canadian Dictionary for Schools. Holt, Rinehart and Winston of Canada, Limited, Toronto. Roa, M. L. (1993). Environmental science activities kit: ready-to-use lessons, labs, and worksheets for grades 7-12. Ill. by Ginny Allen. The Center for Applied Research in Education, West

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