India's highest biogas plant commissioned at Leh-Ladakh

Biogas, which is generated from organic digestion under anaerobic conditions by mixed population of microorganisms, is an alternative energy source, that is now being utilized both in rural and industrial areas. Biogas technology offers an attractive route to utilize certain categories of biomass for meeting partial energy needs. Unlike other forms of renewable energy, biogas does not have any geographical limitations and required technology for producing energy and it is neither complex nor monopolistic[1]. Spearheading the effort to tap alternate sources of energy in remote areas, the Defence Institute of High Altitude Research (DIHAR), a constituent laboratory of the Defence Research and Development Organisation (DRDO), has commissioned India's highest biogas plant at Leh-Ladakh at an altitude of 3500 m amsl. It has been set up in collaboration with the Bhabha Atomic Research Centre (BARC), Mumbai for various R&D purposes. It is also the world's second highest biogas plant; the world's highest biogas plant has been established by Nepal at Langtang Valley at 3850 m amsl.

The basic design of the plant is based on a dual process employing partial aerobic digestion followed by anaerobic digestion. It produces biogas and organic manure (soil conditioner) based on the process of biomethanation. The organically rich biodegradable portion of solid waste is mixed with recycled water to form a slurry. The slurry is then aerobically digested in a predigester, where organic matter is converted to organic acids. The predigestion is accentuated by the addition of hot water and intermittent aeration. Predigestion reactions are exothermic and the temperature rises to 40°C. Hot water obtained using solar energy is added to raise this temperature to 50°C. The predigested slurry is further digested under anaerobic conditions for about 15 days. The process of methanogenesis of the acidified slurry takes place in this digester. The plant is fed with cattle dung, horse and poultry manure generated at the DIHAR farm.

The capacity of the biogas plant is 0.5 t/day and will generate about 35–50 m^3 of biogas per day during the processing of biodegradable waste. This can be either fed to a gas engine alternator set of 25 kVA capacity to generate electricity for a period of 4–5 h everyday or can be used for cooking/boiler purposes [1.5–2.1 m^3 of biogas (depending on the methane content of 50–65%) is equivalent to 1 litre of diesel in terms of heat output.] Not only is biogas a fuel for producing green energy, but it also reduces greenhouse gases and may qualify for green credits (http://www.epa.gov/agstar/resources.html). About 25–40 kg/day (on weight basis) high-quality organic manure will be available from the plant which is rich in nitrogen, phosphorus, potassium and iron and devoid of any heavy metals and weed seed. Therefore, the generated organic manure can be utilized in agricultural fields to improve soil fertility as well as productivity.

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Role of Integrated Watershed Management Programme in controlling erosion and reclaming wastelands in India

India has about 55.27 million hectares (m ha) of wasteland. These are not suitable for any purpose and are exposed to the vagaries of nature like weathering, gully erosion, etc. The Department of Land Resources of the Ministry of Rural Development has been implementing three area development programmes since 1995, viz. Integrated Watershed Development Programme, Drought Prone Areas Programme and Desert Development Programme on watershed basis. These programmes have been merged into a single programme called the Integrated Watershed Management Programme (IWMP) since 2006 and above 38.2 m ha of wasteland has been developed into cultivable land.

Watershed or a drainage basin is a unit draining run-off water to a common point. Watershed management is the process of guiding and organizing the use of land and other resources in a watershed to provide goods and services desired without adversely affecting the soil and water resources. So far as water resources in India are concerned, only 35% of rainfall is captured and the rest flows as run-off. Almost 60% of the captured precipitation is lost again in evaporative transpiration due to open storage. The need of the hour is to regenerate the natural resources that have degraded through land mismanagement in the last 50 years or so. India today has about 18% of the world's population and 15% of livestock population to be supported from only 2% of the world's geographical area and 1.5% of forest pasture land and 4% of water resources.

A micro-watershed is the basic unit of development, whose average area is around 500 ha. With the objective of water and soil conservation different structures such as contour bunds, contour trenching, minor pit, gully plugging, lose boulder check dams, and check dams are implemented in the micro-watershed.

Figure 1. ***a***, Storage of rainwater after implementation of IWMP in the field. ***b***, Minor pit for conservation of run-off water in the field for recharge to groundwater.

The IWMP has showed encouraging results in the drought-prone Nawapada–Kalahandi–Bargarh districts of the western Orissa. These districts suffer from long, dry spells in summer and are located in the rain-shadow region. The study area is part of the KBK (Kalahandi–Bolangir–Koraput) districts, which are drought-prone. The area presents conspicuous geomorphic variations comprising moderately high hills, isolated hillocks, undulating plains, intermontane valleys, etc. Out of the average annual rainfall of 1378 mm, a major part goes as run-off and groundwater recharge is less. To enhance groundwater recharge, watershed development is important at the micro-level. The Bhoomijal Samvardhana Puraskar for East Zone in 2007 was awarded to Chilnala Watershed Association, Kurumpuri Gram Panchayat, Nawapada District, Orissa[1]. The association has treated 612.29 ha of land through watershed development work. The implementation of different conservation structures has checked soil erosion, and has results in the improvement of soil moisture, soil quality and vegetation, enhancement of groundwater recharge, etc. Earlier the dug wells were dry in March, but now people in the region are able to harvest crops in the rabi season also. Due to improvement in soil moisture there is increase in plant growth and increase in crop yield. Check in soil erosion leads to land reclamation. As a result, people are involved in pisciculture in their ponds, vegetable cultivation and improved agriculture in their fields. Figure 1 *a* shows storage of water in field. Figure 1 *b* depicts a minor pit for interception of run-off water for recharge to groundwater. IWMP can be implemented throughout peninsular India to reduce run-off and reclaim wastelands. It can also prevent further degradation of lands in semi-arid areas.

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'Congress grass'

The fact that the earliest record of the existence of *Parthenium hysterophorus* L. (Asterceae) in India was revealed way back in 1814 by Roxburgh is not widely known both to several scientists and lay persons. Paul[1] deserves the gratitude of all. I was a victim of its allergic effects when I visited Pune in the early 1960s. I had constant sneezing, cough and fever. A physician prescribed an anti-allergic tablet, and advised me to cover my nose with a handkerchief when I came across the weed to avoid inhaling the minute allergic particles floating in the air. Since then, the Congress government decided to import wheat seeds under the USA PL-480 scheme which contained the seeds of the offending weed, it was derisively called 'Congress grass'.

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