Al Balqa Applied University -BAU

Amjad Abu Sirhan
amjadsirhan@yahoo.com

Animal waste-to-energy in Jordan

Awarded the 2016 Energy Global National Award

Converts animal manure into energy and heat sources

- **Traditional unit manufactured from local produced materials to reduce the farmers' production costs.**

Waste-to-energy in Jordan

- A recycling system that converts animal manure into energy and heat sources has been **awarded the 2016 Energy Global National Award (Austrian Energy Globe Foundation)**for the best environmental project in Jordan.

Waste-to-energy in Jordan

- The project uses **cow manure** to produce biogas through anaerobic digestion
- The digester mixes manure with **wastewater,** which is heated by a thermal system,
- To generate **biogas** and **fertilizer**

Waste-to-energy in Jordan can be applied on all animal farms

- Animal manure, mainly from cows and chickens is the major agricultural biomass energy resources in Jordan is
- The animal waste in farms can be used to develop a new source of energy for livestock breeders

Animal Waste to Energy

- The daily cow feed = 50 kg

  (produce 15 - 20 liter of wet cow manure) = 10 kg air dry manure

- The retention time was approximately 25 – 30 day .(2 holes is needed)

Gas Production

- The daily biogas production (10 cows) was estimated at 7 m3 equivalent to 4 kg of Liquefied Petroleum. worth US$140 per month

Digester size calculation

- The size of the digester is calculated based on the number of cows in the farm and the amount of manure produced by each cow (estimated at 10 kg per day).

- Size of Digester (m3) = No. of cows × 10 (liter/day) * 30 days × 2

  For example a dairy farm has 10 cows, and then the digester size would be:

  Manure holder size = 10 × 10 × 30 × 2 = 6 m3, add 10% = 6.6 m3

- **Biogas holder size** = (100 kg/day × 25 m3 biogas/1000 kg) = 2.5 m3, add 10% = 2.75 m3
- **Digester overall size** = 6.6 + 2.75 = 9.35 m3
- The daily manure feeding = No. of cows ×10 kg waste per cow = 100 kg/day

  The water requirement for mixing = organic waste × 2 = 200 liter/day

  Size of mixing tank = 100 + 200 = 300 liter, we used 0.5 m3 size mixing tank.
- **To simplify, the bio-digester size is equal to (*number of cows) m3***



Step 1-3



Step 4-6



Step 7-9

Construction and Installation of the Thermo-philic Biogas Digester

Method

- The installation of this unit involved **digging a hole** with 3.3 m diameter and 2.5 m high.
- lining the walls and bottom with **PVC sheet** to avoid water penetration into digester.
- Applying **thermal insulation** for the bottom and the wall.

Method

- Building the concrete bricks (10 cm wide, 40 cm long and 20 cm height) in circular shape and installing the inlet and exit pipes.
- Plastering the bricks with 2cm fined concrete.
- the bio-digester was raised above the ground level by 1 m, keeping a space for the gas holder.

Method

- The final steps involved installing *circulation pump and* the digester cover; a metal frame covered by synthetic leather.

The total costs of installing this unit were US$1472. These calculated costs vary according to labor and raw materials in the region of interest

Importance of this project

- In Jordan, waste-to-energy is applied at small-scale for heating/cooking purposes, it can be used at a large-scale for power generation and industrial heating.