BIOGAS ENERGY POTENTIAL IN SYRIA: PROSPECTS AND CHALLENGES

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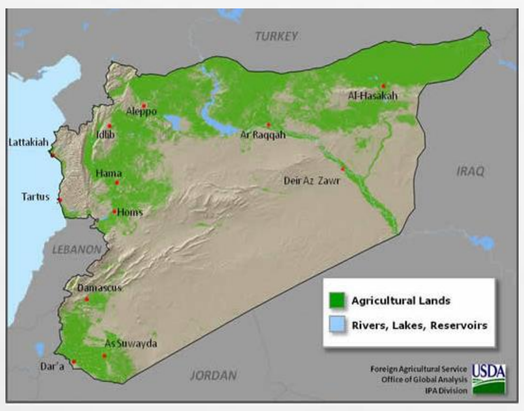
Introduction

Syria is one of the countries where agriculture occupies an important position. It possesses a huge amount of organic and animal waste, which is suitable for the production of bioenergy.



Picture 1: Agricultural lands in Syria

Agriculture accounts for 26% of the total national income. About 1 million workers in the labor market work in agriculture. Figure 1 shows number of animals producing potential waste for biogas production.

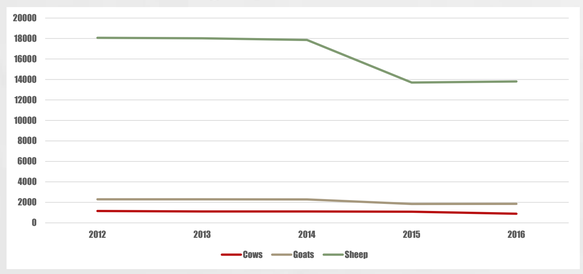


Figure 1: Number of lactiferous animals in the cooperatives in Syria between 2012-2016
(in thousands) (Syrian Central Bureau of Statistics)

The potential resources of biogas production in Syria

- **Agriculture waste**

Biogas can be obtained from agricultural waste in Syria. In 2010, the average production of olive waste was 391,999 tons, while the average production of citrus residues amounted to about 111,799 tons. All these wastes are disposed of by burning without being invested and utilized.

- **Livestock waste**

The total production of animal waste from 2009 is estimated to be about 44 million tons. This quantity could increase theoretically or decrease depending on the type and quantity of feed consumed (Al Afif, 2010).

- **Sewage and Industrial waste**

The estimated quantity of solid waste in 2010 was 34,635 tons daily, which leads to the production of 11.22 mil. m^3 of gas per day (theoretically).

- **Municipal waste**

The amount of organic waste in Syria can produce about 300 mil. m^3 of biogas per year. It can cover 7.5% of energy consumption in the Syrian Arab Republic.

Biogas situation in Syria

The Syrian experience in the application of biogas technology is modest, with 43 governmental biogas small, medium and large scales units until 2010, with a size ranging between 13 and 100 m^3. Table 1 shows some of the implemented biomass in Syria. Since 1990, the Syrian Ministry of Agriculture and the Arab Center for the Studies of Arid Zones and Dry Lands (ACSAD) have established some small experimental units in Syria.

Table 1: Sample of implemented biogas scales in Syria

Biogas plant's name and location	Size (m^3)	Model	Number of units	Sponsor	Executing agency	Year of construction	Used feedstock in the BGP	Biogas production usage
The first Gouta station in Damascus	100	Indian-Chinese	1	Ministry of Agriculture	Expert from India	1990	Cow manure	Electricity and cooking
The second Gouta station in Damascus	14	Indian	1	United Nations Economic and Social Commission for Western Asia (ESCWA)	(ESCWA)	1991	Cow manure, kitchen waste	Cooking
The third Gouta station in Damascus	14	Chinese	1	(ESCWA)	(ESCWA)	1991	Cow manure, deciduous herbs and fruits	Cooking
Faradis biogas station in Hamaa	14	Chinese	2	(ESCWA)	(ESCWA)	1994	Cow manure, kitchen waste	Cooking
Ezraa biogas station in Daraa	14	Chinese	1	Islamic development bank	(ACSAD)	1996	Cow manure	Cooking
Daraa biogas station in Daraa	14	Chinese	1	Private sponser	(ACSAD)	1995	Cow manure, kitchen waste	Cooking
Ibtaa biogas station in Daraa	20	Indian-Chinese	1	Private sponser	(ACSAD)	2001	Cow manure	Cooking
Kareem Station in Salamia	100	Tunnel	1	International Fund for Agricultural Development	(ACSAD)	2000	Sheep manure, cow manure	Electricity and cooking
Khrabo biogas station in Faculty of Agriculture in Damascus	30	Indian-Chinese	1	Damascus University	(ACSAD)	2003	Cow manure	Research studies purposes
Ezraa second biogas station in Daraa	100	Tunnel	1	Private sponser	(ACSAD)	2004	Cow manure	Electricity and cooking
Alwafaa station in Swaida	14	Indian	2	United Nations		2008	Cow manure, kitchen waste	Cooking
Zahed station in Tartus	14	Indian-Chinese	1	Syrian Agricultural Research Authority	(ACSAD)	2008	Cow manure	Cooking

Picture 2: Biogas station implemented by FAO in Mesiaf region
(source: author)

Picture 3: Zahed biogas station in Tartous
(source: author)

Discussion

Table 2: The main difficulties faced by household biogas plants owners in Syria

Economical difficulties	• High construction costs • Lack of financial support to implement this technology
Socially	• Opposition of neighbors • Cultural obstacles leading to refusing the technology
Technically	• Lack of the necessary construction expertise for the establishment of biogas plant • Lack of the equipment to measure the pH level, the temperature and the amount of gas produced
Other difficulties	• Difficulty with supply of animal dung and organic waste to non-livestock breeders

Comparison of the reality of biogas in neighboring countries

- **Biogas in Jordan**

In 2017, agriculture accounts for 4% of the country's GDP. The estimated annual biogas and power potentials are 313.14 million m^3 (Al-Hamamre, 2017). There is one plant for the production of biogas using landfills since 1998 with a capacity of 3.5 MW in the Rusaifa dumpsite area, with total energy production of 78,945 GW between years 2000-2011. The number of biogas projects implemented by the National Center for Research and Development and USAID, between 2008 and 2014 amounted to 6 projects (Shahin, 2014).

- **Biogas in Turkey**

Agriculture is a major sector in Turkey's economy, with 8.53% from GDP contribution in 2017. The industrial application of anaerobic digestion technology emerged in the year 1980. Today, there are approximately 70–80 industrial plants that use this technology. Biogas accounted for (0.6%) of total electricity generation in 2015. Since 2004 Turkey has noticed an increase in the landfill gas to energy plants with 167 (MWe) as an installed capacity from 22 plants in 19 cities. Turkey is one of the livestock and agricultural zone in the world, therefore, has a large biogas potential. Each year 221.5 PJ could be gained from biogas energy and the biomass energy potential is 9.5 GW (Ozcan, 2015).

Conclusion

The biogas production technology in Syria has not been widely deployed yet for economic, social, technical and other reasons and difficulties.

The basic components of the application of biogas production technology in Syria are available through the presence of suitable quantities of organic waste and the moderate climate in the region.

By comparison, Turkey plays a leading role in the use of biogas technology in the Middle East and may be used as an inspiration for Syria.

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