

Up-Cycling Agricultural Residue Into Bio-Products : EU and China Solutions



AD Technology Application in China

—Current Status and future development

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Outlines

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2. AD technology application in China
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1. Waste Generation in China



Biowastes generated from three sectors

◆ Agricultural: : **7250 million tons**

crop stalks (rice straw, wheat straw, corn stover...);
pig, cow, poultry, sheep...)

◆ Industry: : **233 million tons**

mainly from light industry such as food processing,
fermentation, beverage, pharmacy...

◆ Municipal: **190 million tons**

garbage, food waste, sludge...

Total: 7,673 million tons

Crop straws



Animal manures



Industrial organic wastes and water



Municipal solid wastes (MSW)



refuse



activated sludge



food waste

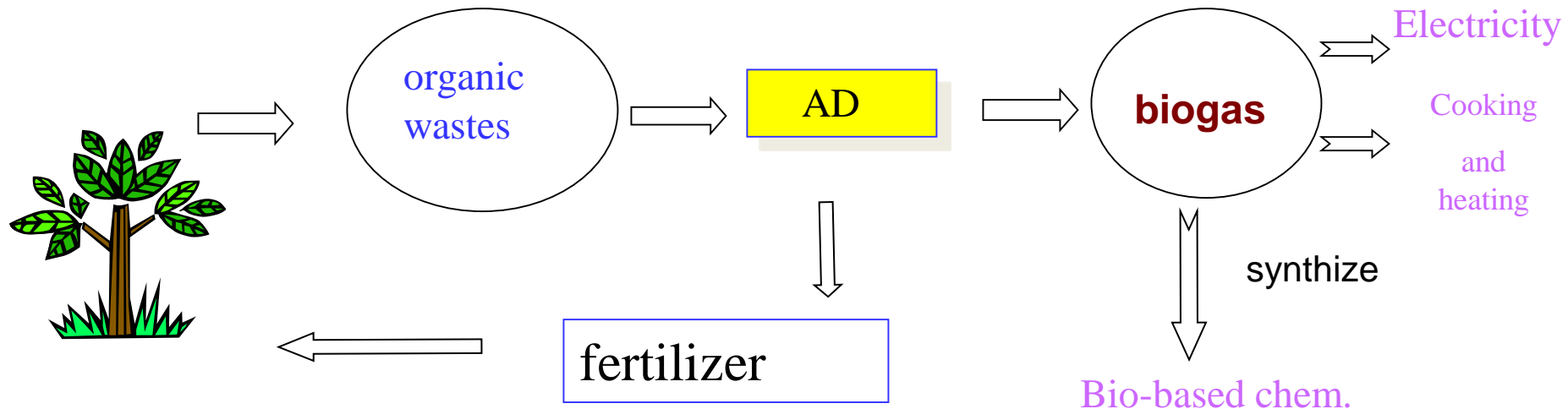


human excrements



There are a number of treatment and reutilization methods, anaerobic digestion (AD) technology is one of the most promising technologies for biowastes, as it can convert wastes into bioenergy, while produce organic fertilizer, and treat wastes

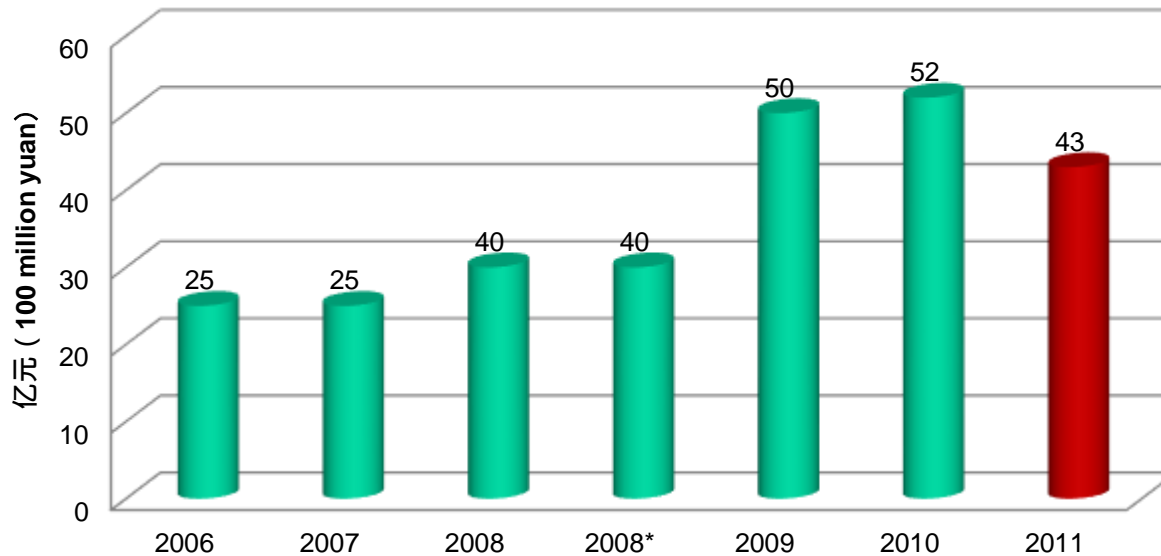
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2. AD technology application in China

2.1 In Agricultural Sector



*2008新增投资(additional investment in 2008)

2012: 40亿
2013: 24亿
2014: 20亿
2015: 20亿
2016: 20亿
2017: 20亿



Over last 12 years, central government provided 36.9 billion RMB (5.27 billion Euro equivalent)

2.1 In Agricultural Sector



- Household small biogas digesters: 43 million units, benefiting 160 million.
- Centralized villages biogas digesters: 24 thousand units
- Biogas plants for livestock farmers: 80.5 thousand units
- (among of which are 3691 units large-size biogas plants)
- Service stations: 80 thousand units
- Labor involved: 290 thousand persons

Biogas production annually: 15 billion m³ biogas/year, with value 8.4 billion RMB

2.2 In Industrial Sector



3590 biogas plants were constructed or under construction, including

- 290 plants, treating 25 million tons of solid residues per year, producing 900 million m³ BNG
- 3300 plants, treating 900 million tons of waste water per year, producing 4.5 billion m³ BNG

Annual bio-methane production: 8.6 billion m³

2.3 In Municipal Sector (including landfill gas)



__A total of 1261 biogas and landfill gas plants were built by 2013

Category	Amount	Capacity (million tons/year)	Output (million m ³ BNG/year)
MSW biogas plant	13	6	80
Kitchen waste biogas plant	100	10	560
Sewage sludge biogas plant	200	6.7	276
landfill	1000	135	2590

The above plants could dispose 152 million tons of solid wastes and produce 3.2 billion m³ BNG every year

2.4 Total biogas (biomethane) production in three sectors



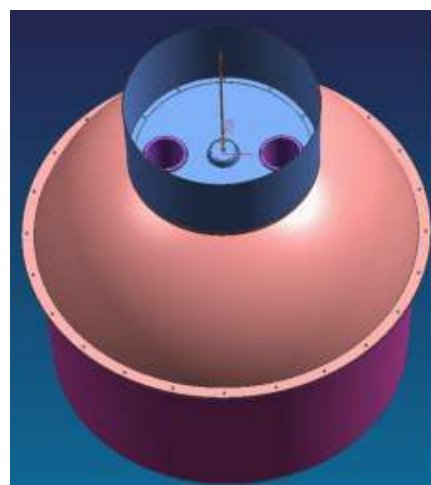
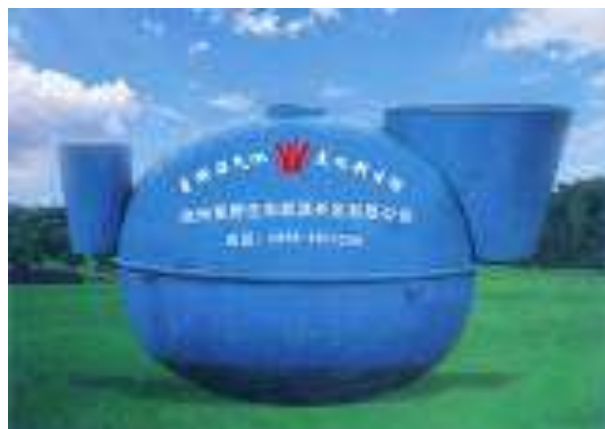
Total bio-natural gas (BNG) production in three sectors annually

- From rural sector (agriculture): 7.5 billion m³
 - From urban sector: 3.2 billion m³
 - From industry sector: 5.4 billion m³
- 16.1 billion m³
(BNG)

Accounting for 14.9% of annual natural gas production and 11% of annual natural gas consumption in China

Typical household small biogas digesters in rural areas





Large biogas plant on dairy farms





Large biogas plant on swine farms





Large biogas plant on chicken farm



Biogas plant for **Municipal** solid wastes in Beijing





Biogas plant for food wastes in Changsha





There are **about 160 AD** plants for sludge digestion in China, mainly are medium temperature processes, and mainly are built by foreign loans.



Biogas plant for Bio-ethanol fermentation effluent treatment in Guangxi





3. Future Development



3.1 In Agricultural Sector

- ◆ Since 2015, Chinese government launched a new project called **TRANSFERRING AND UPGRADING (转型升级)**:
 - transferring: from small-scale to large-scale
 - upgrading: from biogas to bio-natural gas(biomethane)
- ◆ Since 2018, Chinese government started another project called **PROMOTION on OVERALL COUNTY SCALE (整县推进)**



For TRANSFERRING AND UPGRADING (转型升级):

- ◆ Provide up to 50 million RMB (about 7 million Euro) fund support for one BNG plant
- ◆ 25, 22, and 18 large-scale BNG plants received the fund successfully in 2015, 2016, 2017, respectively, with total of 65 units
- ◆ The total fund support from government: 2.7 billion RMB



For PROMOTION on OVERALL COUNTY SCALE(整县推进):

- ◆ 84 counties with large amount animal raising have been supported for 2018 (84个养殖大县)
- ◆ 40-60 million RMB will be provide from central government for treating animal manures for each county.
- ◆ More counties will be selected in the next 3 years with similar funding support.



3.2 In Industry Sector

- ◆ For solid wastes:

AD technology has been used, but needs to be promoted more widely, especially for some special waste such as pharmaceutical wastes.

- ◆ For high concentration organic waste water:

AD technology has been widely used, and will continue to play main role.



3.3 In Municipal Sector

- ◆ Refuses separated at source in cities and generated in countryside provides a good opportunity for AD technology application in municipal sector(垃圾源头分类+ 村镇垃圾):
- ◆ AD technology would be a good way for treating separated refuse
- ◆ AD technology:
 - Wet AD: food waste, sludge, resident excrements....
 - Dry AD: ordinary refuse



4. Representative Case



Case: Gansu Province 甘肃高台 (30,000m³/d)





Multiple Feedstocks:

corn stalk + dairy manure + sludge + fermentation residues...



Feeding

Anaerobic digestion

Water scrubbing



◆ Gas use:

(1) gas upgraded to bio-natural gas(BNG)

(2) BNG for resident, industry, and vehicle uses



Bionatural gas stored

Resident use

Factory use

BNG station

◆ Residues use:

- (1) solid part for organic fertilizer
- (2) liquid part for liquid fertilizer production





Liquid separated:
to produce liquid fertilizer

液体有机肥-膜分离浓缩





4. Summary

- ❑ AD technology is very suitable to China situation, has great potential of application , as it is able to reduce waste pollution, produce clean bioenergy, and organic fertilizer.
- ❑ AD technology originally started to be used in agricultural sector, its extension will continue in three directions: transferring from small-scale to large-scale biogas plant, upgrading biogas for BNG, and extension on overall county scale.
- ❑ AD technology will be paid more attention in municipal and industrial sectors.



Thank you!

