Beijing University of Chemical Technology(BUCT)

Biogas Production in China: current status and future development

Dr.Xiujin Li
Department of Environmental Engineering

Outlines

1. Developing history
2. Current status
3. Future development
4. Summary

Outlines

1 Developing history

2 Current status

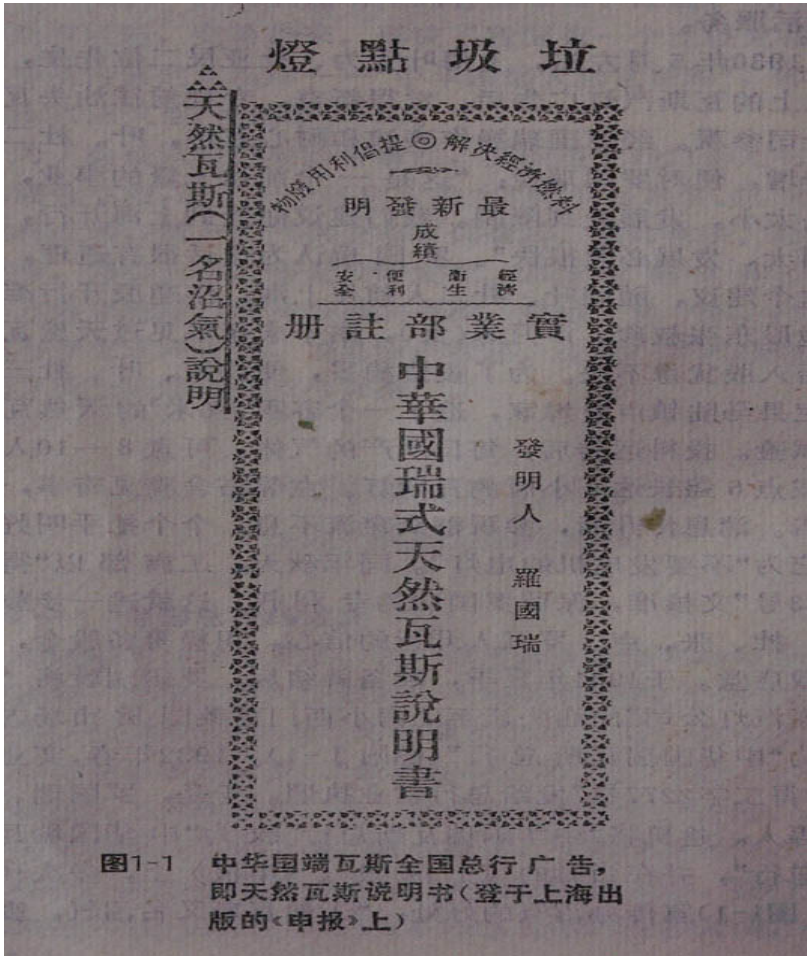
3 Future development

4 Summary

1. Developing History

- As early as 1880’s, some Chines people started to build simple and small digester for biogas in the south of China.
- According to formal history record, the first digester(8m^3) was built by Mr. LUO Guori in 1920’s, biogas was used for family cooking and lighting.
- In 1950’s, Chinese government started to promote biogas in rural area for providing energy for farmers, as they are in lack of energy for living.

Advertisement for LUO' biogas, in《 Shen Newspapers》 in Shanghai,1932.


垃圾點燈

天然瓦斯(一名沼氣)說明

物質用利倡提◎解決經濟恐慌

最新發明

成績

經濟 衛生 便利 安全

實業部註册

中華國瑞式天然瓦斯說明書

發明人 羅國瑞

图1-1 中华国瑞瓦斯全国总行广告，即天然瓦斯说明书（登于上海出版的《申报》上）

The first biogas digester built in1921, now under XINXIN street in Shantou City.

1. Developing History

- In 1970-80's, biogas production was further promoted by continuing support by Chinese government.
- In 2003-2013, the period of rapid development in rural areas, 41.68 million household small digesters (8-12m^3), were built.
- Also, AD technology starts to be used in municipal and industrial sectors.

Outlines

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2. Current status

（1）Agricultural and rural sector (by the end of 2012)

- Household small digesters：

  41.68 million units, providing clean energy for 160 million population in rural area.

- Small-scale biogas plants：

  24,000 units, mainly for small animal farmers.

- Medium and large-scale biogas plants:

  3,691 units.

- Biogas plants in animal farmers：

  80,500 units.

2. Current status

（1）Agricultural and rural sector (by the end of 2012)

- Service stations：

  80,000 units.

- Employee：

  290,000.

- Production and service enterprises：

  1,232 units.

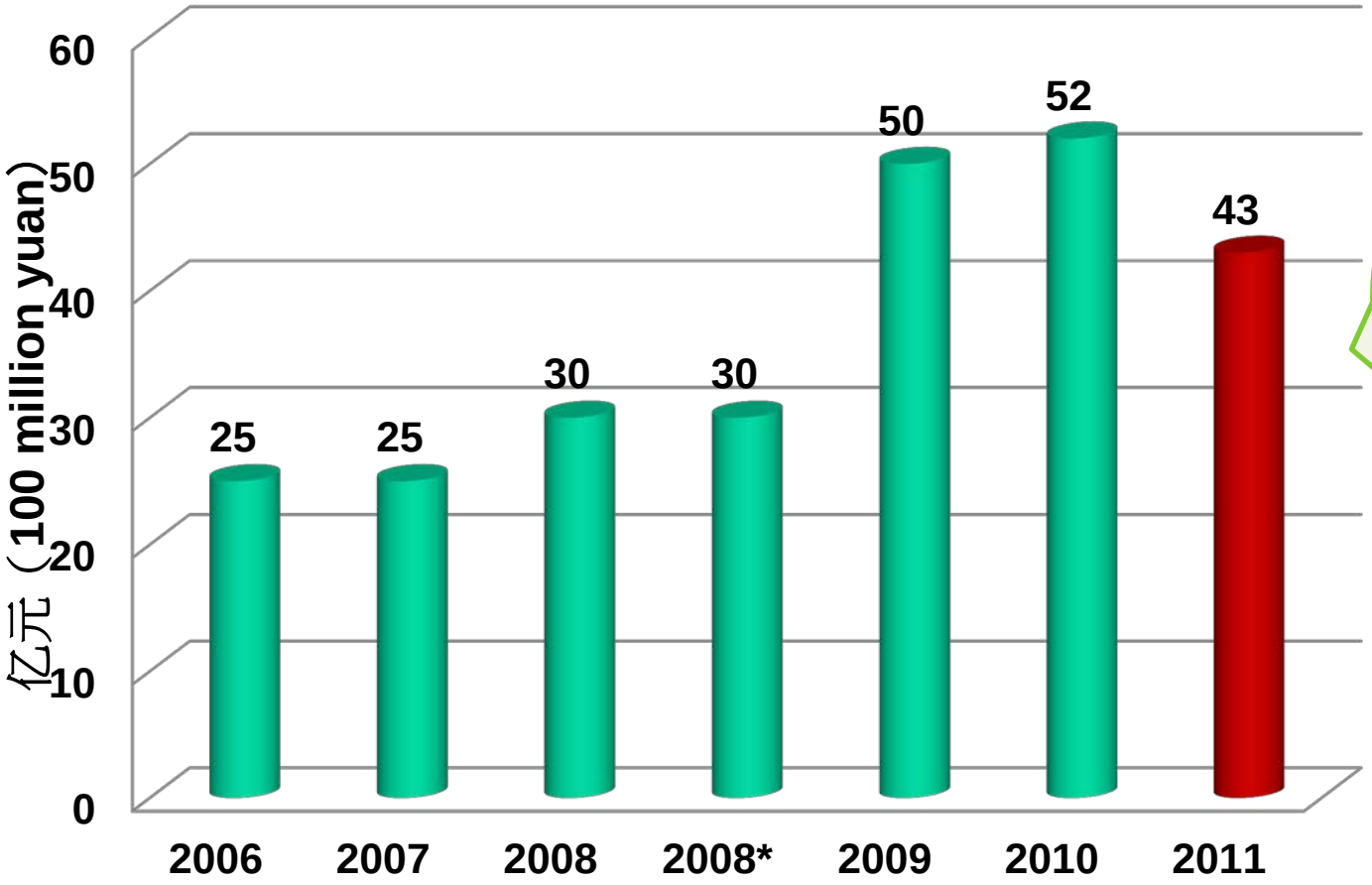
- Annual avenue：

  8.4 billion RMB yuans

- Annual biogas production:

  15 billion cubic meters.

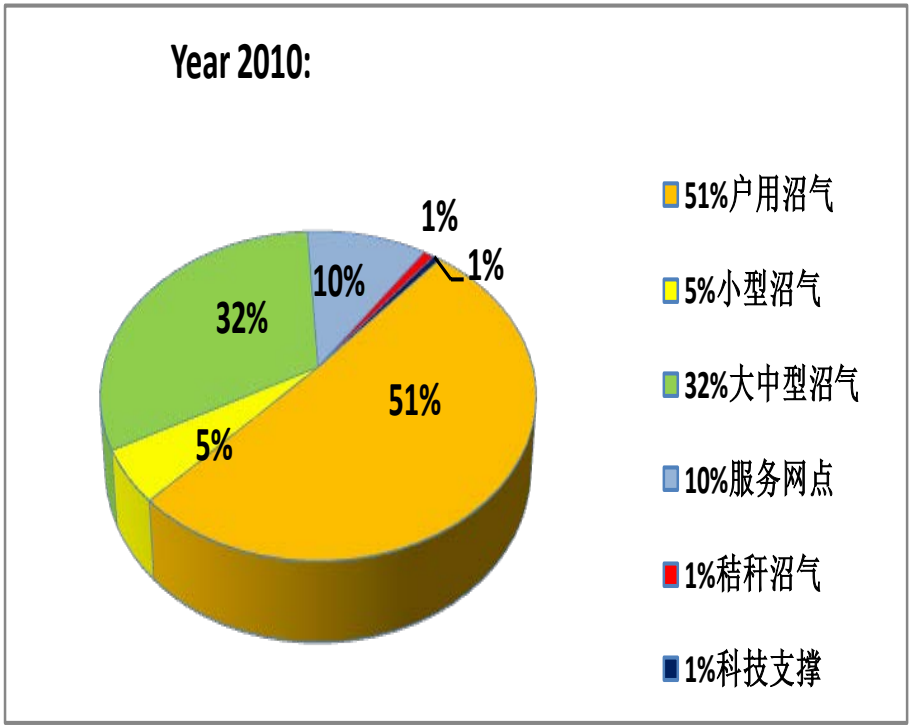
Investment for biogas plant construction from Central Government

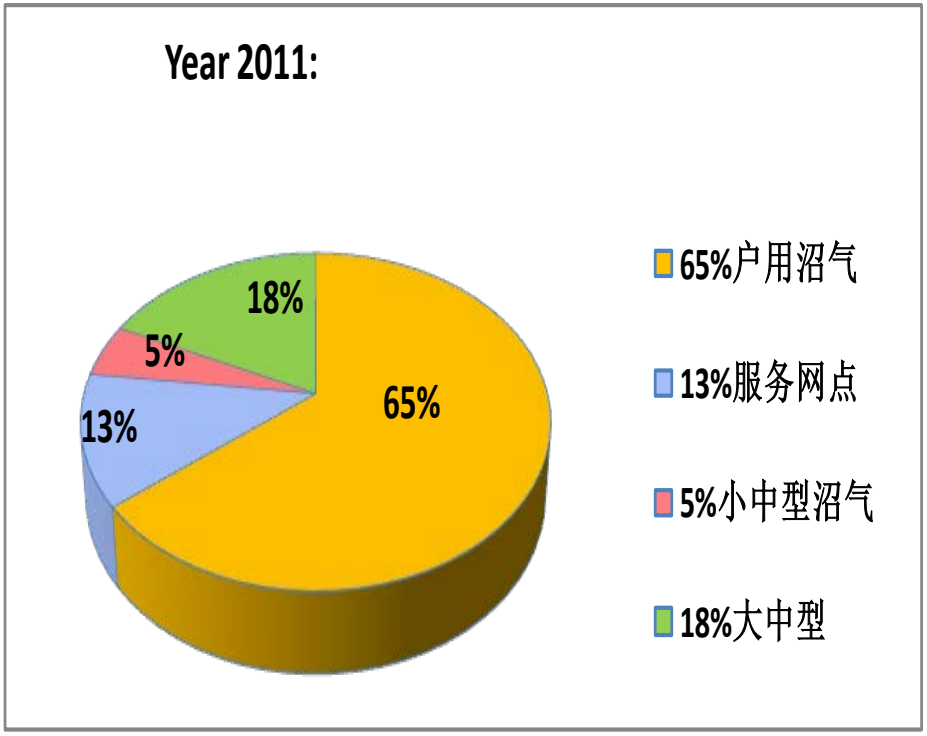


Total:
29.5 billion RMB
(equivalent: 4.75 billion US dollars)

2012
4.3 billion RMB

2013
4.0 billion RMB





Investment distribution

Typical household small digester for rural family

Biogas lighter

Biogas plants in dairy farmer

Biogas plants in swine farmer

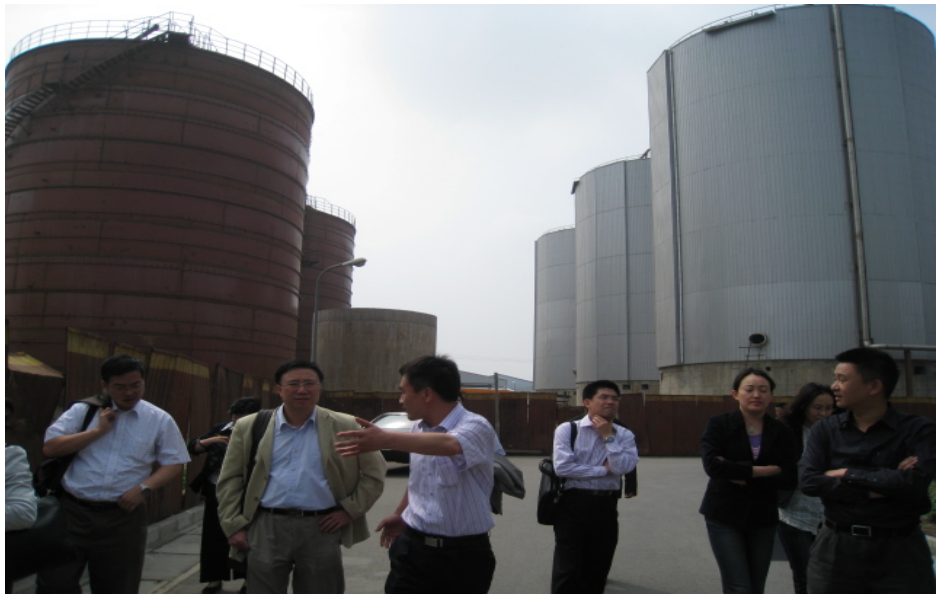
2. Current status

（2）Biogas production in Municipal sector

- Anaerobic Digestion(AD) technology is being used in municipal sector, mainly for treating municipal solid wastes, starting late of last century, so far, around 100 waste treatment plants using AD have been constructed across China

- for sludge: about 51 units
  for refuse：about 10 units
  for food wastes：about 40 units
  ……..

MSW treatment plants using AD tech.
（Beijing）



Food waste treatment plants using AD tech.
（Changsha City）

2. Current status

(3) Biogas production in Industrial sector

- Anaerobic Digestion(AD) technology has been widely used in industrial sector, mainly for treating residues and waste water.
- It was estimated that about 60-80 plants have been constructed, playing very important role in reducing COD discharge.
- The largest one was built in Nanyang City, Henan Province, using waste water from ethanol plant, with daily biogas production of 500,000 cubic meters, able to provide energy for the whole residents in Nanyang City.

Waste water treatment plants using AD tech.

（Nanning City）

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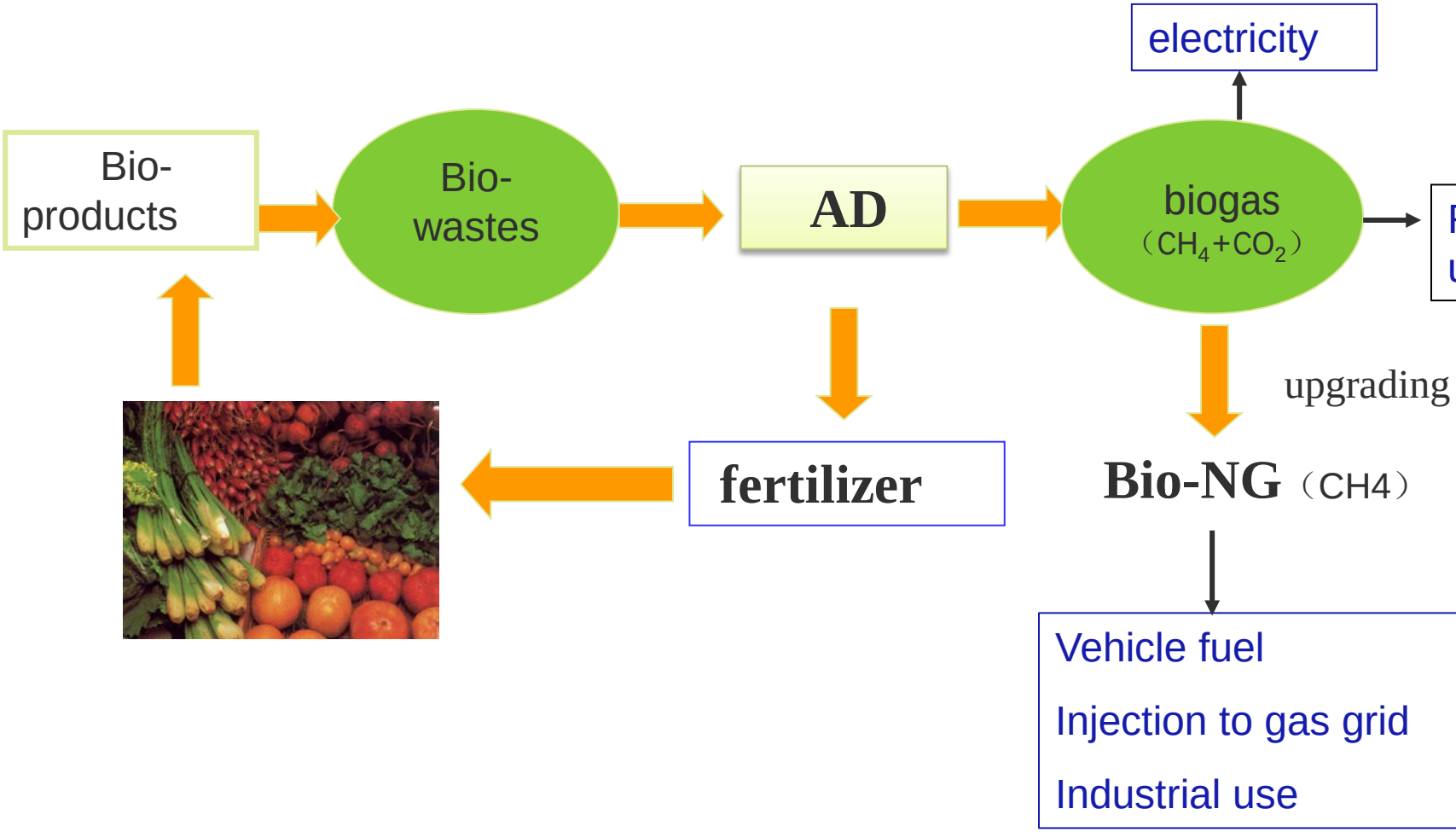
3. Future development

A System(Model):

waste treatment + clean energy + ecological agriculture



3. Future development

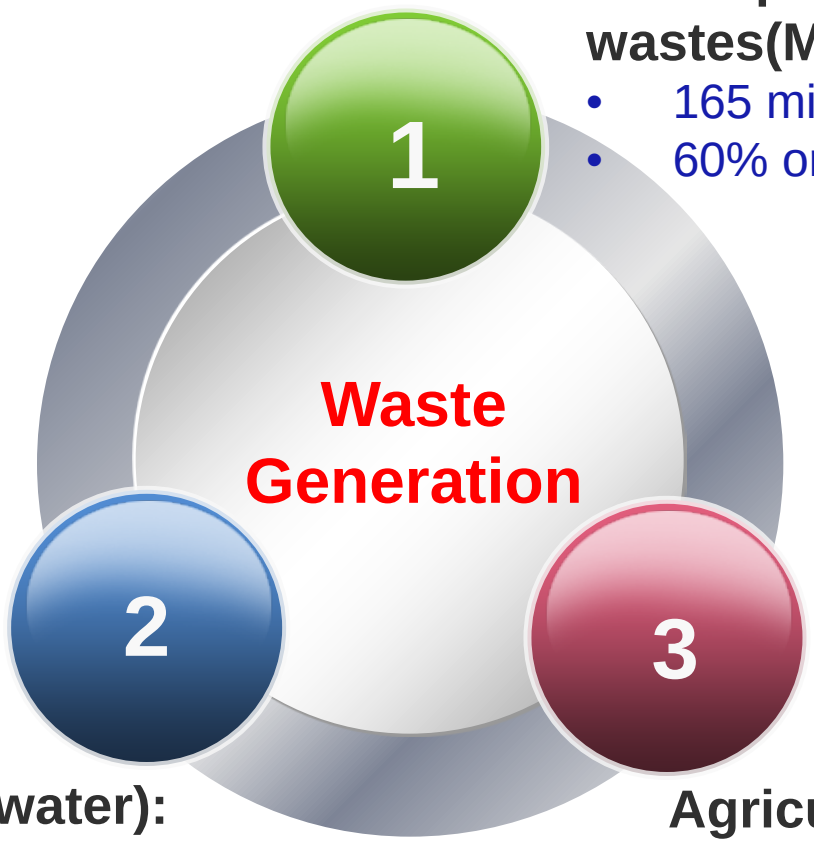
(1) Feedstocks

Mainly animal manures

Co-digestion of multiple wastes

- Crop stalks
- Food wastes
- Sludge
- Fruit and vegetable wastes
- Human being excrement
- Energy crops
- Organic waste waters

3. Future development



Municipal solid wastes(MSW) :

- 165 million tons/a,
- 60% organics

Industrial wastes(water):

- 1,200 million tons/a,
- 25% organics/a

Agricultural wastes:

- 4,000 million tons/a,
- almost 100% organics


禁止通行


垃圾分类 保护环境
禁止通行


厨余垃圾车


其它垃圾
纸张
可回收物
Recyclable
其它垃圾
Other Waste

MSW: kitchen、food、sludge、excrement etc..

Industrial wastes

Agricultural wastes(1)

Agricultural wastes(2)

Agricultural wastes(3)

3. Future development

Biogas potential（billion cubic meters）

MSW：15
Industry：48
Agriculture：288.9

In total：

351.9, if 100% used
176, if 50% used（equivalent to total natural gas consumption）
88, if 25% used

3. Future development

（2） Industrialized production

Household small digesters ⟹ centralized large biogas plants

Agricultural sector ⟹ municipal and industrial sectors

3. Future development

（3） Value-added products:

Biogas to bio-natural gas (BNG)

biogas —upgrading→ **BNG**

- As vehicle fuel, replacing gasoline
- Injection to gas grid
- Industrial use

Gas station

Gas-gasoline hybrid car, by Citroen

3. Future development

（4） ecological use for agriculture

digestate and solid residue
__to produce liquid and solid organic fertilizers

3-dimension fertilizing: CO_2+digestate+solid
20% more yield achieved

3. Future development

（5）continuing R&D on tech. and equipment

Technology R&D is needed for industrialized large-scale biogas plants, including feedstocks property analysis, pretreatment, AD process optimization, biogas upgrading, residue reuse etc..

Equipment needs to be developed to meet technology requirement, including pretreatment, reactor, agitator, upgrading, monitoring equipment etc..

3. Future development

（6） policy support

- Financial support (bonus, tax exempt etc..) is still restricted to agricultural sector.
- Financial support should be extended to municipal and industrial sectors.
- Financial support should be changed from “construction” to end-product “biogas”.

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- China is a world leader in household small digester construction for biogas production for farmers living in rural area, mainly due to long-term and strong support from Chinese central government.

- AD technology starts to get wider use in municipal and industrial sectors, mainly for waste treatment.

- There is great potential in biogas production and market in China. However, there is still a long way to go before biogas industry is successfully developed. We need to consider biogas industry as a SYSTEM, including feedstocks, AD conversion, bio-NG, residue ecological reuse, and policy support etc..

Thank you for Your Attentions