Opportunity and challenge of Biogas market in China

Qian Mingyu 钱名字
China University of Petroleum (Beijing)
Deutsches Biomasseforschungszentrum gGmbH (DBFZ)
Universität Rostock
Outline

- Biogas policy and development in China
- Subsidy system
- Sino-German biogas cooperation
Outline

✓ Biogas policy and development in China
✓ Subsidy system
✓ Sino-German biogas cooperation
Introduction of CUPB

CUPB was founded in 1953, and is a ‘211’ national universities under administration of the Ministry of Education. The present focus of CUPB includes its traditional energy related fields alongside with the new outreach to sustainable and renewable energy technology and clean energy technology. There are 1,369 teachers in total including 229 professors and 274 associate professor. We have 7,663 undergraduate students, 5,426 Master students, 1076 PhDs and 832 overseas students from 52 countries.
China is developing rapidly.

2014, GDP of 63.65 trillion CNY, 47900 CNY (7500 USD) per capital
2015, GDP of 71.15 trillion CNY, 54700 CNY (8172 USD) per capital

Source: energy research institute, NDRC
Energy consumption is also very fast

- In 2015, energy production of 3.58 billion tons sce.
- In 2015, energy consumption of 4.3 billion tons sce, including electricity of 5.7 trillion kWh, coal of 3.96 billion tons, apparent oil consumption of 550 million tons, apparent NG consumption of 205 billion m³, increasing of 0.9% over last year.
- Coal occupied 64% of energy consumption, renewable energy occupied 10.1%
Peak Value of CO₂

18% 15% 20%

By around 2030, CO₂ emissions will reach the peak, and the goal will be strived to achieve as soon as possible.

2020年单位GDP二氧化碳排放量较2015年下降18%。

CO₂ emissions of per unit GDP will decrease by 18% in 2020 compared to 2015.

2020年非化石能源占一次能源消费比例达到15%，2030年达到20%。

By 2020, the proportion of non-fossil energy in primary energy consumption will reach 15%, and 20% by 2030.
Energy structure need to be improved

<table>
<thead>
<tr>
<th>Energy structure</th>
<th>2015</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-fossil power installed capacity</td>
<td>35%</td>
<td>39%</td>
</tr>
<tr>
<td>Non-fossil electricity</td>
<td>27%</td>
<td>31%</td>
</tr>
<tr>
<td>Non-fossil energy consumption</td>
<td>12%</td>
<td>15%</td>
</tr>
<tr>
<td>NG consumption</td>
<td>5.9%</td>
<td>10%</td>
</tr>
<tr>
<td>Coal consumption</td>
<td>64%</td>
<td>58%</td>
</tr>
<tr>
<td>Coal for power / coal consumption</td>
<td>49%</td>
<td>55%</td>
</tr>
</tbody>
</table>

4.3 million deaths every year as a result of exposure to indoor smoke from cooking fuels
3 million as a result of exposure to fine particulate matter

In China, coal burning is the main contributor to air pollution, every year about 366,000 deaths as a result of particulate matter from coal burning
China Natural Gas demand 1990 to 2020

2015: total NG consumption 213.6 billion m³, import 81.8 billion m³
2020: demand >300 bn m³ /yr

About 3000 CNG filling stations in China
2015: CNG app. 20 bn m³ /yr

中国常规天然气资源量56万亿m³，估计可采储量为22万亿m³，约占世界的1.7%。
in China, conventional NG reserve of 56 trillion m³, only 22 trillion m³ recoverable, 1.7% of world’s recoverable
## Big potential for biogas/biomethane – bio-natural gas

<table>
<thead>
<tr>
<th>Feedstock</th>
<th>Amount (M ton)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Straw</td>
<td>818 (available 228)</td>
</tr>
<tr>
<td>Agricultural processing waste</td>
<td>400 (available 164)</td>
</tr>
<tr>
<td>Animal manure</td>
<td>5800 (incl. wastewater) 1900 (available 1060)</td>
</tr>
<tr>
<td>Solid waste</td>
<td>120 (mainly for incineration)</td>
</tr>
<tr>
<td>Wastewater</td>
<td>5300</td>
</tr>
<tr>
<td>Restaurant waste</td>
<td>30 – 40</td>
</tr>
<tr>
<td>Sewage sludge</td>
<td>30 – 35 (wet) 11 (dry)</td>
</tr>
</tbody>
</table>

Resource: MOA, MOHURD, MEP, CECEP

- 150 billion m³ biogas /yr potential (about 100 billion m³/a BNG), including 104 billion m³ biogas /a from agricultural waste.
- Liaoning, Inner Mongolia, Anhui, Hunan, Heilongjiang and Henan Province occupy 40% of China’s agricultural biogas potential.
- 300 large planting and breeding counties have 27 billion m³ potential, accounts about 18% of China’s biogas potential.
Key plans for biogas / bio-natural gas development in China

✓ 13th FYP on Renewable Energy Development (NEA, Dec. 2016)

✓ 13th FYP on Bioenergy Development (NEA, Dec. 2016)

✓ Guidance for Promoting the Development of Bio-Natural Gas Industry (NEA, Sep. 2016)

✓ 13th FYP on Agricultural Biogas Development in China (MOA, Feb. 2017)

✓ Rural Biogas Transformation and Upgrading Programme (MOA, NDRC, May 2015)
# 13\textsuperscript{th} FYP on Renewable Energy Development

<table>
<thead>
<tr>
<th>Content</th>
<th>Utilization scale</th>
<th>Annual production</th>
<th>SCE (M t/a)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>QTY</td>
<td>Unit</td>
<td>QTY</td>
</tr>
<tr>
<td>Hydropower (not incl. pumped storage)</td>
<td>340 Million kWh</td>
<td>1250 Billion kWh</td>
<td>368.75</td>
</tr>
<tr>
<td>Windpower</td>
<td>210</td>
<td>420</td>
<td>123.90</td>
</tr>
<tr>
<td>PV</td>
<td>105</td>
<td>124.5</td>
<td>36.73</td>
</tr>
<tr>
<td>Solar thermal power</td>
<td>5</td>
<td>20</td>
<td>5.90</td>
</tr>
<tr>
<td>Biomass power</td>
<td>15 7 0.5</td>
<td>90</td>
<td>26.60</td>
</tr>
<tr>
<td>- Biomass incineration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- MSW incineration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Biogas power</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solar water heating</td>
<td>800 Million m\textsuperscript{2}</td>
<td></td>
<td>96</td>
</tr>
<tr>
<td>Geothermal</td>
<td>1600</td>
<td></td>
<td>40</td>
</tr>
<tr>
<td>Biomass heating (Mt)</td>
<td>30 Million tons</td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>Bioethanol</td>
<td>4</td>
<td></td>
<td>3.8</td>
</tr>
<tr>
<td>Biodiesel</td>
<td>2</td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>
13th FYP on Bioenergy Development Guidance for Promoting the Development of Bio-Natural Gas Industry

Bio-Natural Gas (BNG) Demonstration County:
By 2020 (13th FYP): 160 counties, 8 billion m³ of annual production, 30% of NG consumption is BNG;
By 2025: 400 counties, 20 billion m³ of annual production;
By 2030: all the counties with resource condition, 40 billion m³ of annual production.

By 2020, in demo counties, 10 million tons of solid digestate fertilizer, 50 million tons of liquid digestate fertilizer consumption; soil organic matter increases 1.2%;

By 2020, in demo counties, straw comprehensive utilization rate > 90%, husbandry waste comprehensive utilization rate > 95%, COD decreases 8%, ammonia nitrogen decreases 10%
## 13th FYP on Agricultural Biogas Development in China

<table>
<thead>
<tr>
<th></th>
<th>Unit</th>
<th>Current value 2015</th>
<th>Target value 2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>BNG plants</td>
<td></td>
<td>25</td>
<td>197</td>
</tr>
<tr>
<td>Scale biogas plants</td>
<td></td>
<td>6972</td>
<td>10122</td>
</tr>
<tr>
<td>Small and medium scale biogas plants</td>
<td></td>
<td>103476</td>
<td>128976</td>
</tr>
<tr>
<td>Household digesters</td>
<td>Million</td>
<td>41.93</td>
<td>43.04</td>
</tr>
<tr>
<td>Biogas production</td>
<td>Billion m$^3$</td>
<td>15.8</td>
<td>20.7</td>
</tr>
<tr>
<td>Digestate fertilizer production</td>
<td>Million t</td>
<td>71</td>
<td>97.51</td>
</tr>
<tr>
<td>Agricultural waste treatment capacity</td>
<td>Million t / a</td>
<td>2000</td>
<td>2080.47</td>
</tr>
<tr>
<td>CO$_2$ reduction</td>
<td>Million t / a</td>
<td>28.6</td>
<td>46.22</td>
</tr>
<tr>
<td>COD reduction</td>
<td>Million t / a</td>
<td>12.09</td>
<td>15.81</td>
</tr>
</tbody>
</table>
Biogas development strategic layout

<p>| Region    | BNG | Scale BG | Medium | Small | Manure | Straw | BG   | Region    | BNG | Scale BG | Medium | Small | Manure | Straw | BG   |
|-----------|-----|----------|--------|-------|--------|-------|------|-----------|-----|----------|--------|-------|--------|-------|------|-----------|-----|----------|--------|-------|--------|-------|------|-----------|
| Region I  | 123 | 4815     | 45.51 Mt | 11000 | 5.88 Mt | 3.2 bn m³ |      | Region II | 39  | 4000     | 22.26 Mt | 4450  | 2.19 Mt | 1.4 bn m³ |      | Region III| 10  | 1185     | 4.07 Mt | 50    | 0.56 Mt | 0.3 bn m³ |</p>
<table>
<thead>
<tr>
<th>Region</th>
<th>Key provinces</th>
<th>Number of large farming and breeding counties</th>
<th>Number of demo counties by 2020</th>
<th>Straw theoretical resources (Mt)</th>
<th>Manure theoretical resources (Mt)</th>
<th>BNG development scale (Bm³/ a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>North China</td>
<td>Hebei, Inner Mongolia, etc.</td>
<td>37</td>
<td>22</td>
<td>55.5</td>
<td>92.5</td>
<td>1.1</td>
</tr>
<tr>
<td>Northeast China</td>
<td>Liaoning, Jilin, Heilongjiang</td>
<td>57</td>
<td>36</td>
<td>85.5</td>
<td>142.5</td>
<td>1.8</td>
</tr>
<tr>
<td>East China</td>
<td>Jiangsu, Zhejiang, Anhui, Jiangxi, Shandong, etc.</td>
<td>66</td>
<td>32</td>
<td>99</td>
<td>165</td>
<td>1.6</td>
</tr>
<tr>
<td>Central China</td>
<td>Henan, Hubei, Hunan</td>
<td>69</td>
<td>32</td>
<td>103.5</td>
<td>172.5</td>
<td>1.6</td>
</tr>
<tr>
<td>South China</td>
<td>Guangxi, Chongqing, Sichuan</td>
<td>34</td>
<td>16</td>
<td>51</td>
<td>85</td>
<td>0.8</td>
</tr>
<tr>
<td>Southwest</td>
<td>Shaanxi, Gansu, Xinjiang, etc.</td>
<td>37</td>
<td>22</td>
<td>55.5</td>
<td>92.5</td>
<td>1.1</td>
</tr>
<tr>
<td>In total</td>
<td></td>
<td>300</td>
<td>160</td>
<td>450</td>
<td>750</td>
<td>8</td>
</tr>
</tbody>
</table>
Biogas utilization in China

EnviTec Biogas AG

- Livestock slurry and manures
- Renewable resources
- Organic waste

- Receiving tank
- Pre-mixer
- Digester
- Residue storage tank

- Biogas
- Public gas network
- Treatment for bio-natural gas
- CHP

- Heat
- Electricity
- Public electricity grid

- Residual use
- Agricultural use

- Industry
- Local authority
- Private
Standard suggests:
Large and super-large scale >1.0 m³/m³/d;
Medium scale > 0.5 m³/m³/d

<table>
<thead>
<tr>
<th>Size</th>
<th>Daily biogas production Q (m³/d)</th>
<th>Animal quantity H (pig equivalent)</th>
<th>Single digester volume V1 (m³)</th>
<th>Total digester volume V2 (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Super large</td>
<td>Q≥5000</td>
<td>H≥50000</td>
<td>V1≥2500</td>
<td>V2≥5000</td>
</tr>
<tr>
<td>Large</td>
<td>5000 &gt; Q≥500</td>
<td>50000 &gt; H≥5000</td>
<td>2500 &gt; V1≥500</td>
<td>5000 &gt; V2≥500</td>
</tr>
<tr>
<td>Medium</td>
<td>500 &gt; Q≥150</td>
<td>5000 &gt; H≥1500</td>
<td>500 &gt; V1≥300</td>
<td>1000 &gt; V2≥300</td>
</tr>
<tr>
<td>Small</td>
<td>150 &gt; Q≥5</td>
<td>1500 &gt; H≥50</td>
<td>300 &gt; V1≥20</td>
<td>600 &gt; V2≥20</td>
</tr>
</tbody>
</table>

Classification standard for biogas plant (NY/T 667-2011)
Outline

- Biogas policy and development in China
- Subsidy system
- Sino-German biogas cooperation
Subsidy framework in China – construction subsidy supported by MOA

- Biogas and digestate fertilizer are both important
- Scale of planting (fruit, vegetable, tea) determines scale of biogas
- Scale of biogas determines scale of breeding
- Integration of planting and breeding, to develop circular agriculture

From 2003 to 2015, MOA construction subsidy for biogas plant in total 38.5 billion CNY.

In 2015, Rural Biogas Transformation and Upgrading Programme started, only supports large- and super large- scale biogas plants and biomethen projects. Every year, MOA will support at least 2 billion CNY, till 2020.
Rural Biogas Transformation and Upgrading Programme

- **BNG project:**
  - daily biomethane production > 10000 m³, total fermenter volume > 16000 m³,
  - 2500 CNY investment subsidy per m³ biomethane production capacity,
  - up to 40% of the total investment,
  - up to 40 million CNY of subsidy from central government (MOA)

- **Scale biogas project:** incl. biogas power generation, cooking, heating,…
  - fermenter volume > 500 m³,
  - 1500 RMB investment subsidy per m³ of fermenter volume
  - up to 35% of the total investment,
  - up to 30 million CNY of subsidy from central government

- 2015, 25 BNG projects, 386 scale biogas projects
- 2016, 22 BNG projects, 552 scale biogas projects
- 31 BNG projects are constructed (till Dec. 2016), total investment 1.513 bn CNY, capacity of biomethane production 303000 m³
## Output subsidy for power generation

<table>
<thead>
<tr>
<th>Power benchmark tariff</th>
<th>Power subsidy (obligatory for grid companies &gt;500 kW)</th>
<th>Grid connection subsidy (to grid comp.)</th>
<th>Tax concession</th>
</tr>
</thead>
<tbody>
<tr>
<td>Livestock- &amp; poultry waste</td>
<td>Provincial price of desulfurized coal power in 2005 (app. 0.45 CNY/kWh*)</td>
<td>0.25 CNY/kWh. Since 2010, new projects get 2% decrease than the last year projects. Duration 15 years.</td>
<td>0.01 CNY/kWh (&lt;50 km)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.02 CNY/kWh (50-100 km)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.03 CNY/kWh (&gt;100 km)</td>
</tr>
<tr>
<td>Agro- &amp; forestry-biomass waste</td>
<td>a. 0.75 CNY/kWh (incl. tax)</td>
<td>b. For the approved project or tendering project, the feed-in tariff required approval</td>
<td>No income tax (first three years). 50% income tax (second three years).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>If 70% of feedstock is crop straw, husk and/or corn crop, 10% income is tax free.</td>
</tr>
</tbody>
</table>

**From May, 2015, all the biogas power projects in Hebei Province, will get 0.75 CNY / kWh on-grid price.**
On-grid power price for biogas power generation in China

German EEG (2014)
Special bonus:
- Small plant with manure feedstock: 23.73 ct/kWh
- Waste feedstock: 15.26 ct/kWh

Basic FIT:
- \( \leq 150 \text{ kW} \): 13.66 Cent/kWh
- \( \leq 500 \text{ kW} \): 11.78 Cent/kWh
- \( \leq 5 \text{ MW} \): 10.55 Cent/kWh
- \( \leq 20 \text{ MW} \): 5.85 Cent/kWh

0.4750 – 0.7042 CNY / kWh (6.25 – 9.27 €cent / kWh)
0.75 CNY = 9.87 €cent / kWh (1 € = 7.6 CNY)
Gas utilization subsidy in coal forbidden area in Hebei province

“Guidance for coal replacement by electricity and gas in coal forbidden area in Baoding and Langfang City”

✓ 70% of household gas utilization instrument is paid by provincial and city-county government.

✓ Each household will get 1 CNY / m³ NG consumption subsidy (for biogas 1.2 CNY / m³), up to 1200 m³ (biogas 2000 m³) per heating season (Nov. to Mar.), for 3 years, paid by provincial, city and county government

✓ Subsidy for grid construction, 4000 CNY per household, 1000 CNY paid by provincial government, 3000 CNY paid by city-county government

✓ Subsidy for gas storage and peak shaving equipment (case by case)
Subsidy for digestate fertilizer

MOA: “Action on organic fertilizer replace mineral fertilizer for fruit, vegetable and tea planting”

- In 2017, build up 100 demo counties
- By 2020, in fruit, vegetable and tea production areas, the utilization of mineral fertilizer decreases 20%, in core production areas, decreases 50%.
- Each county, provide 10 million CNY per year of subsidy for
  - Conduct basic investigation
  - Facilities (incl. treatment, transportation, application, etc.)
  - Services
Subsidy for animal manure treatment

“Opinion on speeding up the utilization of livestock and poultry waste” by the state council on 12th of June

Target:

✓ By 2020, animal manure comprehensive utilization rate reaches 75% in China;
✓ 95% of scale animal farm shall have manure treatment facility;
✓ all the large scale animal farm shall have manure treatment facility;
✓ The above targets shall be reached earlier in key animal breeding counties, agricultural sustainable development demonstration zones, national modern agriculture demonstration zones, and modern agriculture industrial park.

MOA: 1st batch husbandry green development demonstration county
56 counties in 21 provinces, each county gets 20 – 40 million CNY
Outline

- Biogas policy and development in China
- Subsidy system
- Sino-German biogas cooperation
Sino – German Biogas Cooperation

Memorandum of Understanding on Biogas


Implementing agency

Chinese Ministry of Agriculture (MoA)

German Ministry of Food, Agriculture (BMEL)

Sino-German Biogas Working Group

German institutes DBFZ, GFA, K&F…

Rural Energy and Environment Agency (REEA)

Sino-German Biogas Research and Development Center

Sino-German Biogas Demo project – Yutian biogas plant

Functional R&D laboratories and experts communication
Sino – German Demo Biogas Plant

pig farm biogas plant, 6 digesters of each 3200 m³, total investment of 160 million CNY, produce 24500 m³ of biogas per day for 15000 households cooking and biomethane for 200 taxi. Annually produce 50,000 tons of solid fertilizer and 150,000 tons of liquid fertilizer.
Sino – German Joint Biogas Laboratory

Deutsches Biomasseforschungszentrum gGmbH (DBFZ)
China Academy of Agricultural Engineering (CAAE)
MOA Biomass Engineering Center

In total 12,344 m²; 7 floors on ground, 2 floors underground
In total 452 instruments, value to 23.4 million RMB
Sino-German Biomass Utilization Project

- **Project Objective:**
  The motivation for public and private investments in the generation and use of biomass energy (especially from middle-scale and large-scale biogas plants) has increased. The technical standard and operational performance of medium-scale and large-scale biogas plants that produce energy from biomass have improved.

- **Project Volume:** 4.5 million Euro
- **Project Duration:** 2009-2014
- **Delivery Organization:** Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)
- **Chinese Partner:** Foreign Economic Cooperation Center of Ministry of Agriculture
Sino – German Biogas plants

Capital city of the province 省会
ADB Loan biogasplant Provinces 亚行省份
Additional Provinces 另外的省份
Technology import

“Biometec”

'Biomethane generation through fiber membrane technology in China 中国利用纤维素膜技术生产生物甲烷示范项目'

Objectives 目标:
- Application of membrane biogas purification in China 在中国使用沼气膜提纯技术，
- identification of OEM partners 确定制造商，
- test operations 试运行
Construction and operation of 5 large scale biogas plants in Hebei province under consideration of international best practice with a loan of 71.5 million USD from WB.

On Aug. 3rd, 2015, the joint venture among CUPB, CUCD and DBFZ won the bidding, to be the expert team for support the project management and the implementation of the biogas plants.
5 World Bank Loaned super large scale biogas plants in Hebei

<table>
<thead>
<tr>
<th>Name</th>
<th>Project Content</th>
<th>Feedstock</th>
<th>Investment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Anping 6 digesters with total 28,200 m³; biogas production of 31,500 m³/d for 20,000 households cooking, and CNG</td>
<td>Pig manure and maize silage</td>
<td>199 mn CNY</td>
</tr>
<tr>
<td>2</td>
<td>Yutian 6 digesters with total 19,200 m³; biogas production of 21,000 m³/d, for 15,000 households cooking and CHP</td>
<td>Pig manure</td>
<td>174 mn CNY</td>
</tr>
<tr>
<td>3</td>
<td>Zunhua 6 digesters with total volume (30,000m³); biogas production (30,000m³/d), biogas for 20,000 households cooking and CNG</td>
<td>chicken manure</td>
<td>182 mn CNY</td>
</tr>
<tr>
<td>4</td>
<td>Linzhang 4 digesters with total volume (10,000m³); biogas production (8,575 m³/d), biogas for 7,000 households cooking, CHP and self-use</td>
<td>corn straw silage</td>
<td>73 mn CNY</td>
</tr>
<tr>
<td>5</td>
<td>Chengde 8 digesters with total volume (20,000m³); biogas production (16,237m³/d), biogas or 14,060 households cooking and surrounding firms and schools</td>
<td>corn straw silage</td>
<td>135 mn CNY</td>
</tr>
</tbody>
</table>
1st fully German equipped biogas plant

- Dairy manure: 183,000 tons/a
- Corn straw: 83,000 tons/a
- COD reduction: 20,000 tons/a
- N reduction: 850 tons/a
- NH₃-N reduction: 1033 tons/a
- P reduction: 118 tons/a
- Replace urea: 428 tons/a
- PM2.5 reduction: 300 tons/a
- Replace coal: 9500 tons SCE = PM2.5 reduction 50 tons/a
- CO₂ reduction 20,000 tons/a

(methodology about biogas upgrading is under approval)

Sifang biogas plant in Dingzhou city, Hebei Province, turn-key project by Envitec company. Hebei Province No. 1 Project.

6 digester, each 5200 m³
BNG 20000 m³/d
Investment 200 million CNY
(40 million from MOA)
Economic analysis of Dingzhou Project

Biomethane: 2.5 CNY / m³ 4.87 million m³
Subsidy for heating: 1 CNY / m³ 2.43 million m³
Solid fertilizer: 300 CNY / t 41600 tons
Liquid fertilizer: 20 CNY / t 205400 tons
Cost for straw: 140 CNY / t 82800 tons
Cost for manure: 0 182500 tons

IRR = 8.38%
NPV=27.00 million CNY
Static payback period: 8.95 years
Biogas/BNG will play more and more important role on energy, environment and agriculture

“Non-point source pollution treatment Action in Hebei”

By end of 2018, 75% of scale animal farms shall build up biogas plants, which means 30 million tons / a of manure need to be treated, equals to 300 Dingzhou projects in Hebei Province.

According to NEA’s target: by 2030, 40 billion m³ BNG /a production:

5500 Dingzhou Projects
I was the village secretary of party, I was also a biogas expert.
Vielen Dank für Ihre Aufmerksamkeit!
Thanks for your attention!
谢谢您的关注！

Qian Mingyu
Director of Policy and Technical Consulting & International Cooperation, INE, CUPB Representative, DBFZ China Office

Tel.: 0086 10 8973 1300
Mob.: 0086 13810529780
mingyu.qian@uni-rostock.de
mingyu.qian@outlook.com