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Fast development of biogas use in rural China

Numbers of household digesters at the end of the year (1973-2010)

Data source: Ministry of Agriculture, data in 2010 is an estimated number.
Fast development of biogas use in rural China

- Fast growing after 2000, especially after 2005


- In 2008, financial crisis, stimulate economic growth

- Ministry of Agriculture, rural biogas construction has become one of the most important programmes concerning people’s well-being, and a highlight in the development of a new socialist countryside
Problem of sustainability (service network)

Sustainability problem, mainly comes from three aspects:

- Rural life style change, less materials for fermentation (animal manure, human excreta and other organic waste)
- Off-farming, less people in the village especially young
- Service network. In last 10 years, pay too much attention on building digester, not enough for service network
Problem of sustainability (service network)

Government realized the problem, published *National Plan of Building Rural Biogas Service System* in 2007

- Early 1980s, decrease of biogas digester were mainly due to lack of service network
- Service network: 300-500 households 1 service station, equipments and tools need 31k Yuan, central government subsidy: 19k west, 15k middle, 8k east
- Some general rules
Fast development of biogas use in rural China

Numbers of household digesters at the end of the year (1973-2010)

Data source: Ministry of Agriculture, data in 2010 is an estimated number.
Problem of sustainability (service network)

Problem still remain: can the service station survive without subsidy from government every year?

No
Household survey in 4 province: around 300 for each, 1200 in total
From west to east:
- Gansu
- Guangxi
- Hubei
- Shandong
Results

Service network: 3 modes

- Fully market-based private service: only pay after the service
- Farmers’ organization based: members pay a small amount of fee every year and get service with a reduced price
- Insurance-based: pay a fixed amount as the insurance every year, get service for free

**Multinomial Probit model:** choose one from three
Results

Some calculation:

- Less than 1/3 (28.6%) of digesters had something wrong after building, every age of digesters is 4.6 years, so, the annual failure rate is 16.1%

- If one station provide service for 500 households, income from service is $0.161 \times 500 \times 20 = 1610$ Yuan

- The income only from service is far away to support a service station economically

The service network is not sustainable!
## Results (mode 1 is the base outcome)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mode 2</th>
<th>Mode 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age/10</td>
<td>-0.662</td>
<td>-0.900*</td>
</tr>
<tr>
<td>Age²/100</td>
<td>0.0709</td>
<td>0.0842*</td>
</tr>
<tr>
<td>Years of education</td>
<td>0.0339</td>
<td>-0.0619**</td>
</tr>
<tr>
<td>Village leader / party member</td>
<td>-0.00398</td>
<td>-0.00574</td>
</tr>
<tr>
<td>Family size</td>
<td>-0.263***</td>
<td>-0.148**</td>
</tr>
<tr>
<td>Family member stay at home</td>
<td>0.162*</td>
<td>0.106</td>
</tr>
<tr>
<td>Log ( consumption)</td>
<td>0.204**</td>
<td>0.0561</td>
</tr>
<tr>
<td>Risk aversion</td>
<td>-0.0777***</td>
<td>-0.0703***</td>
</tr>
<tr>
<td>Trust relatives</td>
<td>-0.116*</td>
<td>-0.141***</td>
</tr>
</tbody>
</table>

*** p<0.01, ** p<0.05, * p<0.1; 656 observations
**Results (mode 1 is the base outcome)**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mode 2</th>
<th>Mode 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joined farms’ organization</td>
<td>0.391</td>
<td>0.577**</td>
</tr>
<tr>
<td>Use biogas together with others</td>
<td>0.130</td>
<td>0.171**</td>
</tr>
<tr>
<td>Too much gas in summer</td>
<td>0.00257</td>
<td>0.366**</td>
</tr>
<tr>
<td>Not satisfied with current service</td>
<td>0.258***</td>
<td>0.180**</td>
</tr>
<tr>
<td>Whether to buy a fully service package</td>
<td>0.137</td>
<td>0.743***</td>
</tr>
<tr>
<td>Average biogas failure yearly since built</td>
<td>0.194</td>
<td>0.0980</td>
</tr>
<tr>
<td>Hubei Province</td>
<td>0.137</td>
<td>0.00219</td>
</tr>
<tr>
<td>Shandong Province</td>
<td>1.579***</td>
<td>-0.307</td>
</tr>
<tr>
<td>Gaunsu Province</td>
<td>0.639**</td>
<td>-0.291</td>
</tr>
</tbody>
</table>

*** p<0.01, ** p<0.05, * p<0.1
Conclusions

- Current income from service is not enough to support a service station, heavy subsidy (other financial support) or insurance-based service may be needed.

- In literature, (private) insurance is a local public good. Cooperation or other related factors may have impact on farmers’ decision-making (what type of service?)
Thanks!