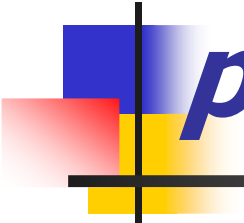


***Which factors are effective  
for farmers' biogas use?  
Economic, resource, or  
policy factors?***



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# Outline

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- Introduction
- Study area and Method
- Result of Probit Model
- Discussion and Conclusion



# Introduction

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- China, the biggest developing country in the world with 1.3 billion people, > 70% lives in rural areas
- most of their energy requirements (for domestic needs) from traditional biomass fuels over the past decades (zheng, 2010).
- has been playing an important role in rural domestic energy resources for a long time (Chen et al, 2009)
- about 46% of the total energy supply in rural areas from 1996 to 2004 (Zheng et al, 2010).
- per capita energy consumption of farmers was very low, mainly used for cooking and water heating
- residues and forest accounted for 51.9% and 45.8% of total residues for energy use respectively (Liao *et al*, 2004).



# Introduction

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- China's biogas increased very rapidly in past 10 years
- more and more problems with rapidly increasing, different geographical and complex social economic conditions
- there are considerable regional differences in farmers' interest for biogas and utilization rates of household biogas.



# Introduction

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According to Yan (2007) & Gao (2000)'s research about new technology using of farmers

- two kinds of factors which affect farmers' decision whether or not to adopt a new technology

**farmer's individual condition:** age, gender, education level, management skills, or communication behavior.....

**condition of the external environment:** technical services, the natural environment, the political environment, rural communal infrastructure, credit conditions, the social organization of rural society or the rural community culture.



# Introduction

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- it is important to understand clearly the needs of the farmers and the gaps between the government's policies and the farmers' demands



# Introduction

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- gain insight into:

which factors may be important for that the impulse by the government is carried further?

Which factors are important to the farmers for the decision of whether to adopt biogas technology?

which policy and technology solutions may cover the gaps in biogas productivity in the north and south regions be bridged, after the large-scale promotion of biogas and substantial investment by the government



# Study area and Method

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- ***Study area***

1299 household surveys of 34 villages in 10 counties of 4 provinces, Guangxi, Hubei, Shandong and Gansu Province in China

focus on household-level biogas digesters

dropped the two centralized biogas project villages

actual sample counts 1227 households in 32 villages of 10 counties in 4 provinces.





**Table 1 Distribution of the survey data**

<b><i>Province</i></b>	<b><i>County</i></b>	<b><i>Survey households</i></b>
<b>Gunagxi</b>	<b>Hepu</b>	<b>153</b>
	<b>Mashan</b>	<b>155</b>
<b>Hubei</b>	<b>Enshi</b>	<b>146</b>
	<b>Jianshi</b>	<b>151</b>
<b>Shandong</b>	<b>Linqu</b>	<b>78</b>
	<b>Linyi</b>	<b>81</b>
	<b>Qingzhou</b>	<b>79</b>
	<b>Decheng</b>	<b>79</b>
<b>Gansu</b>	<b>Yuzhong</b>	<b>153</b>
	<b>Jinchuan</b>	<b>152</b>
<b>Total</b>		<b>1227</b>



From North to South:  
Gansu,  
Shandong,  
Hubei,  
Guangxi

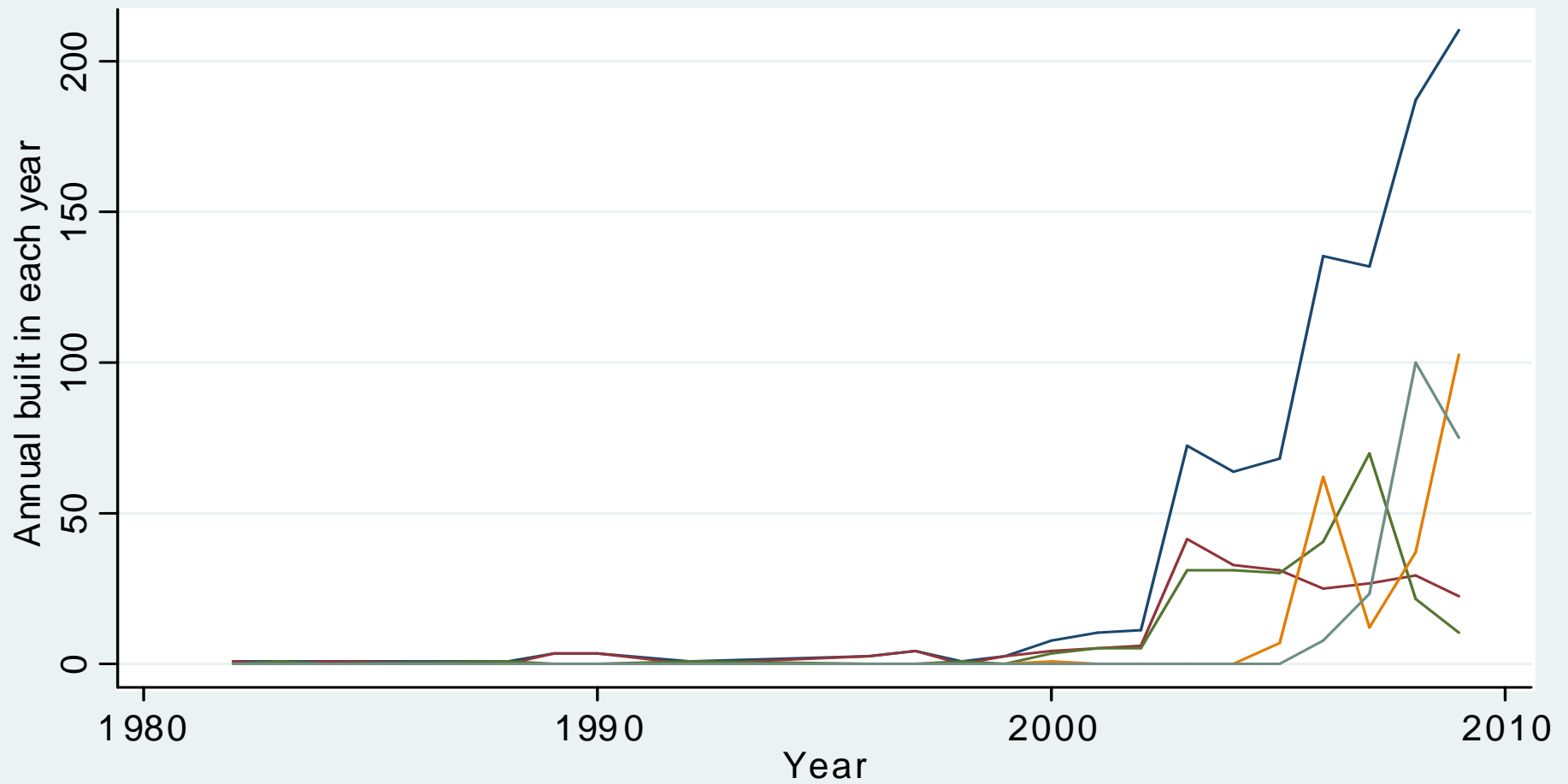
## Table 2 Household background

	<i>HH Average</i>					<i>Head of HH Average</i>		
	<b>Num. of member</b>	<b>Num. of stay at home *</b>	<b>Years of schooling</b>	<b>Age</b>	<b>Income per person in 2009 (yuan)</b>	<b>% of male</b>	<b>Year of schooling</b>	<b>Age</b>
Guangxi	<b>5.3</b>	<b>3.2</b>	<b>7.6</b>	<b>32.8</b>	<b>4,522</b>	<b>92.5</b>	<b>7.8</b>	<b>47.5</b>
Hubei	<b>4.2</b>	<b>2.7</b>	<b>6.9</b>	<b>36.6</b>	<b>4,264</b>	<b>88.9</b>	<b>7.4</b>	<b>46.7</b>
Shandong	<b>3.5</b>	<b>2.6</b>	<b>7.6</b>	<b>36.6</b>	<b>5,891</b>	<b>87.1</b>	<b>7.7</b>	<b>48.2</b>
Gansu	<b>4.6</b>	<b>3.4</b>	<b>6.1</b>	<b>35.4</b>	<b>2,984</b>	<b>94.4</b>	<b>6.4</b>	<b>48.4</b>
Total	<b>4.3</b>	<b>3.0</b>	<b>7.0</b>	<b>35.1</b>	<b>4,383</b>	<b>90</b>	<b>7.3</b>	<b>47.3</b>



**Table 3 % of HH with or without biogas**

<b><i>Province</i></b>	<b><i>% HH built</i></b>	<b><i>% HH not built</i></b>
<b>Guangxi</b>	<b>77.9</b>	<b>21.1</b>
<b>Hubei</b>	<b>85.4</b>	<b>14.6</b>
<b>Shandong</b>	<b>80.4</b>	<b>19.6</b>
<b>Gansu</b>	<b>68.5</b>	<b>31.5</b>
<b>Total</b>	<b>78.1</b>	<b>21.9</b>



**Fig 2 Annual built biogas in each year from 1982 to 2009 of the sample**

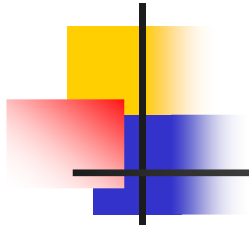


# Result

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- binary Probit Model
- There are 8 significant indicators
  - 4 of the cognitive limitation
  - 4 of the task environment
- results show as below

Dependent variable: built biogas digester or not? 0=no, 1=yes



<i>Variable</i>	<i>Parameter</i>	<i>Std. Err.</i>	<i>z</i>	<i>P&gt;z</i>	<i>Marginal effects</i>
sex	.0438364	.180133	0.24	0.808	.01136
<b>age***</b>	<b>.1034499</b>	<b>.0330394</b>	<b>3.13</b>	<b>0.002***</b>	<b>.0263682</b>
<b>age2***</b>	<b>-.0011396</b>	<b>.0003391</b>	<b>-3.36</b>	<b>0.001***</b>	<b>-.0002905</b>
edu	.0201381	.0167832	1.20	0.230	.005133
person	-.0301376	.0457184	-0.66	0.510	-.0076817
<b>Stay***</b>	<b>.1283802</b>	<b>.0418691</b>	<b>3.07</b>	<b>0.002***</b>	<b>.0327226</b>
shouyi1	-.0219697	.1142535	-0.19	0.848	-.005586
hostparty	-.0621894	.2809537	-0.22	0.825	-.0162844
landa	.0025891	.00995	0.26	0.795	.0006599
offincper	.0338614	.0275277	1.23	0.219	.0086309
newtech	-.0026033	.0155101	-0.17	0.867	-.0006636
trust	-.0016457	.1490993	-0.01	0.991	-.0004192
<b>Loginc**</b>	<b>-.0301999</b>	<b>.0135041</b>	<b>-2.24</b>	<b>0.025**</b>	<b>-.0076976</b>
<b>loginc2**</b>	<b>.0061681</b>	<b>.0026439</b>	<b>2.33</b>	<b>0.020**</b>	<b>.0015722</b>
aerfa	.1285447	.08794	1.46	0.144	.0327646
<b>disountrate**</b>	<b>-.6667984</b>	<b>.2808083</b>	<b>-2.37</b>	<b>0.018**</b>	<b>-.1699593</b>
<b>considerecon**</b>	<b>.360928</b>	<b>.1457262</b>	<b>2.48</b>	<b>0.013**</b>	<b>.0888018</b>
<b>xuanchuan***</b>	<b>.7513935</b>	<b>.1296995</b>	<b>5.79</b>	<b>0.000***</b>	<b>.2289863</b>
<b>knowaim***</b>	<b>.3710644</b>	<b>.1328269</b>	<b>2.79</b>	<b>0.005***</b>	<b>.0985022</b>
<b>prov1***</b>	<b>.9546395</b>	<b>.2011216</b>	<b>4.75</b>	<b>0.000***</b>	<b>.1860489</b>
<b>prov2***</b>	<b>1.018265</b>	<b>.2005484</b>	<b>5.08</b>	<b>0.000***</b>	<b>.1967728</b>
prov3	.2458176	.1519992	1.62	0.106	.0589431
<b>_cons***</b>	<b>-3.410766</b>	<b>.8869793</b>	<b>-3.85</b>	<b>0.000***</b>	





# cognitive limitation

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- the variable of the household head's age has an inverse-U shape. The marginal effect of age is changing with age, middle aged household heads are more likely to build a biogas digester than households with either young or old heads.
- The number of household members staying at home rather than the total number of household members has a significant effect on whether or not a household builds a digester (at 1% level). Each additional member staying at home will increase the probability of building a biogas digester by 3.2%.



## cognitive limitation

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- The total income of the family has an inverse-U shape too. That means middle income households are most likely to build a biogas digester compared to households with either high or low incomes.
- The discount rate has a significant negative effect (at 5% level) on the decision of whether to build a biogas digester. Farmers with high discount rates are less likely to build a biogas digester.



# Task Environment

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- For the farmers, before they decided whether to build the biogas digester, the expected benefit is very important;
- The results show that governmental subsidy policies can considerably affect the choice of farmers. Economic considerations can in general stimulate the building of biogas digesters for about 9%.



# Task Environment

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- an extension seems to be important which points at the multiple benefits of biogas and can help farmers to understand them clearly. Since, not only individual farmers benefit, but also the village and rural environment.
- The result shows that if a household refers to the government as the information source and initiator, they are more likely to build a digester; and as the same time, if a household knew the objectives why the government promote the biogas, they are furthermore more likely to build a digester too.
- farm households in Guangxi and Hubei are more likely to build biogas digesters.



# Discussion and Conclusion

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- Farmers' decision of whether to build a biogas digester follows a bounded rationality rationale.
- Extensive, in-depth information and related knowledge training, will in future be very good in order to support farmers taking initiative for constructing biogas digesters (without governmental support).



# Discussion and Conclusion

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- there are differences across provinces in regard to the desire of farm households to construct biogas digesters.



## Discussion and Conclusion

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- rich families don't want to pay more labors to treat the biogas, and poor families prefer to pay more attention to find a good way to get more money in the short run
- the government shall incorporate these kinds of differences in subsidy policies through increasing subsidies for households in poverty stricken areas and therewith encourage them to build biogas digesters.



**Thanks!**

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**22nd May 2011**