

# Study on Market-based Policy Instruments for Biogas Power Generation Promotion

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# 1. Research background

- 1.1 Abundant resource
  - 6000 million m<sup>3</sup> annually can be get from IOW( water and solid) =4284 thousand TCE
  - Beer and alcohol industry
- 1.2 broad market
  - Huge power demand: 6.5% ( IEA , 2000-2010 )
  - Above 200 BPG sets or stations and total installed capacity are 5 MW

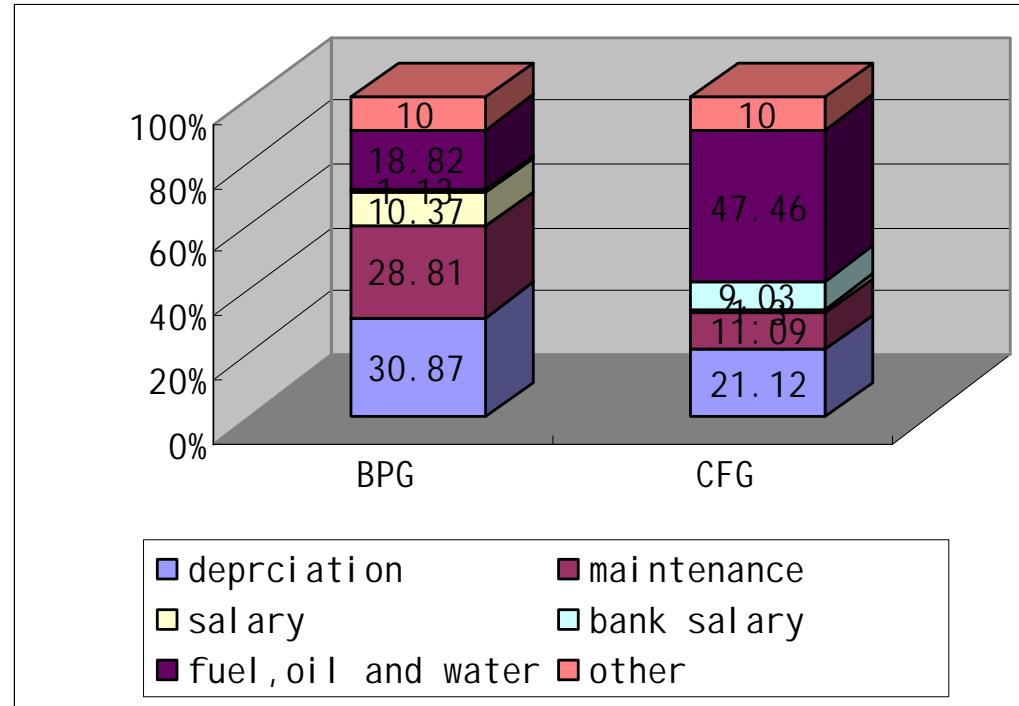
# 1. Research background

- 1.3 main obstacle in China for BPG
  - Equipment: small unit capacity and low efficiency
  - High electricity supplying cost and price
    - Supplying cost: 0.27 RMB; Price: 0.42 RMB
    - Higher than coal-fired electricity
    - 10 ~ 15% ;                                    30 ~ 35%
  - Lacking of concrete market-based policy instruments

# 1. Research background

## High electricity supplying cost

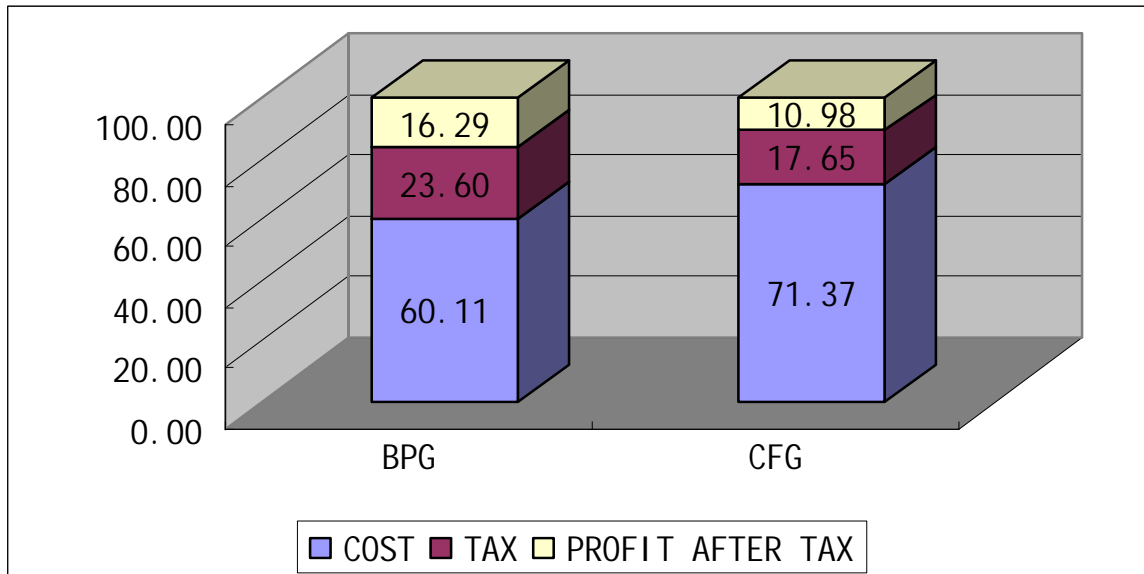
- High Capital Assets  
Depreciation cost
  - 21% for CFG;  
31% for BPG
- High Equipment  
Maintenance cost



# 1. Research background

## High electricity price

- High tax burden: BPG 24% VS CFG17%
- For 1 KWh, Tax for BPG 0.10 RMB VS for CFG0.06 RMB



# 1. Research background

- Research arrangements
  - To set different policy scenario
  - To analyze the Influence to electricity price
  - To do the cost and benefit analysis
  - To complete policy appraisal and proposal

## 2. Research Method --BPG market competence appraisal model

$$NPV = \sum_{i=0}^N \frac{PQ_i - P_p^i - P_I^i - VAT_i - TOI_i - OC_i}{(1+r)^i} - I \geq 0$$

$$P_{cr} = \left\{ P \left| \sum_{i=0}^N \frac{PQ_i - P_p^i - P_I^i - VAT_i - TOI_i - OC_i}{(1+r)^i} - I = 0 \right. \right\}$$

- $P$  : Price (including tax);
- $Q_i$  : The electricity amount to grid for the I year;
- $P_p^i$  : Capital back to bank for the I year;
- $P_I^i$  ; Interest back to bank for the I year
- $VAT_i$  : VAT for the I year
- $TOI_i$  : Income tax for the I year
- $OC_i$  : Operation cost for the I year
- $I$  : Initial investment
- $r$  : Capital cost



### 3. Policy research -- policy scenario

scenario

I

P1.1

P1.2

P1.3

II

P2.1 half VAT

P2.2

P2.5

P2.6 no income tax

16.5

# 3. Policy research -- policy scenario

III

P3.1

P3.2

P3.3

P3.4

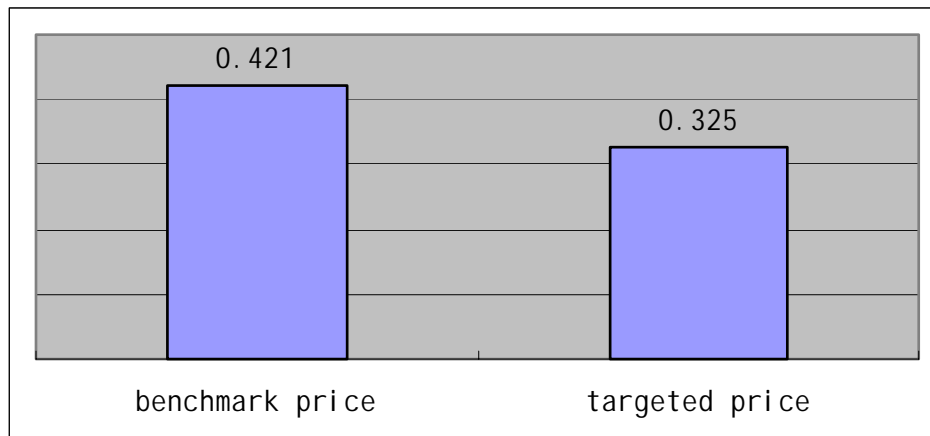
IV

P4.1

### 3. Policy research -- Influence to electricity price

- Cost consist

- Price = cost + tax + profit after tax
- Targeted price ( new CFG ) : 0.325 RMB/kWh
- Benchmark price :
  - Price (including tax) : 0.421 RMB/kWh



# 3. Policy research

## -- Influence to electricity price

- Different influence of different scenario
  - Preferential investment policies
    - A little influence to the price change.
    - i.e., price=0.4 RMB /kWh under the policy of 3 yrs loan provided without interest
  - Preferential tax policies
    - Outstanding influence
    - i.e., influence ratio=5.9% under the policy of no income tax
    - 14.5% under the policy of no VAT
  - Combined policies
    - Outstanding influence
    - influence ratio=5 10%-25%, very close or equal to the targeted price
  - Preferential price policies
    - Most promotional

### 3. Policy research

## --Cost and benefit analysis

#### – Cost

- Cost gap ( $C_m$ ) : the cost gap of the BPG and CFG
- Cost of policy ( $C_p$ ) : additional investment given by government of the preferential policy

#### – Benefit

- Environmental benefit ( $B_e$ ) : reduction of the coal fired; reduction of wastewater pollution
- Tax benefit ( $B_t$ ) : more tax from BPG
- Resource benefit ( $B_r$ ) : less water and coal consumption
- Society benefit ( $B_s$ ) : different to quantify

### 3. Policy research

## --Cost and benefit analysis

- Appraisal index
  - Net present value: NPV
  - Ratio of benefit and cost: RCB

$$NPV) = \sum \{ [B_e(t) + B_t(t) + B_r(t) + B_s(t)] - [C_m(t) + C_p(t)] \} (1+r)^{-t}$$

$$RCB) = \sum [B_e(t) + B_t(t) + B_r(t) + B_s(t)] (1+r)^{-t} / \sum [C_m(t) + C_p(t)] (1+r)^{-t}$$

### 3. Policy research

## -- policy appraisal and proposal

- Policy appraisal
  - RCB or NPV
  - Influence to price
  - Promotion to technology commercialization
  - Obstacle during implementation
- Policy proposal



**Thanks**