

The Discuss of the Applicable Pattern of Marsh Gas in Small Town and Village

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Abstract: There are many regions in our country where are short of energy and mainly depend on agriculture. The energy used in daily life in these regions comes from other regions where are plenty of energy. This not only brings pressure on the energy supply in our country, but also consumes energy in the transportation itself, and leads to the energy waste and environmental pollution. To make use of the crop stalk etc. can produce the clean energy- marsh gas, and can produce the high-quality and green fertilizers that can improve crop growth and increase the crop production. This way can result in the incendiary development of the agriculture and energy. This article studies the applicable patterns of heating by use of marsh gas in the small town and village. Furthermore, the article analyses the different patterns of marsh gas production in the view of economic and technical aspects. As a result, the studies find fitter pattern of marsh gas provided in different regions and different conditions,

Keywords: marsh gas, agriculture district, heating, pattern

1. FOREWORD

The energy is an important resource and condition in the development of national economy and people's life, the energy's richness or poor, construction with distribution and the transportation in every local areas would bring direct influence for the exploitation with supply of the energy and the environment. Along with the development of economy in our country, energy consume becomes more and more, our country have already become the second energy consuming country after the United States, energy and environment problem is more serious, to develop and make use of the clean energy and renewable resource becomes an important approach of the incendiary development.

There are many regions in our country where are short of energy and mainly depend on agriculture. The energy used in daily life in these regions comes from other regions where are plenty of energy, such as natural gas transportation from west to east, electricity transportation from west to east, coal supplying etc.. This not only brings pressure on the energy supply in our country, but also consumes energy in the transportation itself, and leads to the energy waste and environmental pollution. How to make use of the reborn energy and to exploit the local potential energy is one of the important approaches to relieving the energy deficiency, and at the same time, being available to environmental protection.

To make use of the crop stalk, dejection of the persons and livestock, the weed etc. can produce the clean energy- marsh gas, and can produce the high-quality and green fertilizers that can improve crop growth and increase the crop production. This way can result in the incendiary development of the agriculture and energy. The article analyses the different patterns of marsh production in the small town and village.

2. ANALYSIS OF ENERGY AND HEATING

2.1 Energy and nature condition

Our country can be classified into five kind types according to the energy store, the level of economy development with energy supply etc.^[1] There are three kinds province that need the energy input, one kind can give energy output and the other is self-sufficient among them. The area of the provinces that give priority to agriculture occupies about 90% in our country, The area of the provinces that mainly depend on agriculture and are short of energy occupies about 70%. We can know the potential of the use of marsh gas in those provinces.

2.2 Heating condition

Now, they mostly use small concentrative heating systems that take coal as fuel in the small towns. Part regions still have no concentrative heating facilities, so residents burn coal to heat by themselves, but the heating effect and sanitation are all bad, and because of the heat efficiency of stove fuel is low, so brings energy waste and environmental pollution. The villages mostly use the crop stalk to heat and cook, but the heat efficiency is about 10%, so this results in huge waste. But the volume of the crop stalk production can't satisfy the peasants' demand, peasants in rich village use coal to complement the shortage, while in the poor village, peasants fell trees to supplement, it destroyed ecosystem, brought the soil erosion.

2.3 The approach of dealing with energy and environment problem

To exploit and use the local and renewable resource in those provinces that are short of energy and are major in agriculture, such as biologic energy, solar energy, wind energy, terrestrial heat energy and marsh gas, is one of important approaches to solve energy lack and protect environment.

For the villages, combine the village home kulak

project to construct energy ecosystem pattern project that takes country marsh gas pool as ligament ,at the same time , according to the effective demand and the local resources, construct solar energy project, economizing bavin and coal project and small power project, in order to make good use of the land, solar energy and biologic energy, and form good cycle of energy and substance of farmer family basic production and life. For the small towns, make use of the advantage that are near the villages to develop the marsh gas heating pattern or combined marsh gas and solar energy heating pattern.

3. THE MARSH GAS PATTERN ANALYSIS

At present, according to the difference from living conditions and natural conditions of all areas in our country, I enumerate the following several kinds of ecological agriculture of marsh gas pattern:

3.1 Half arid district energy ecological agriculture pattern^[4]

According to semi-arid region water resource deficient, energy insufficient in supply, fodder shortage, etc. actual conditions, based on land resource of peasant household, regarding solar energy as motive force, new-type and high-efficient marsh gas pond as the tie , it forms the benign cycle system of driving livestock development by agriculture, driving marsh gas development by livestock and driving agriculture(the forist) development by marsh gas.

3.2 Northern energy type ecological agriculture patterns

It is named ecological agriculture pattern of "four in one" . It aims that the agricultural production is difficult in the North winter, the marsh gas pool is difficult to survive in the winter, the agricultural wastes fails to be fully utilized , peasants are free in winter and other questions, enclose the birdhouse, the lavatory and marsh gas pond are all built in the sunlight greenhouse (the large canopy of plastics) , in order to make four kinds of functions combine together, make cultivation technique, high-efficient raise technology, detest oxygen fermented technology and high-efficient utilization of solar energy technology be combined in sunlight greenhouse. The economic benefit of this kind pattern is better.

3.3 Energy type ecological agriculture form of the well-to-do level

It means in the areas where the life level of peasants have reached the well-to-do level, utilizes its abundant solar energy resource fully , on the basis of building the marsh gas pond , changing the lavatory and the kitchen, builds solar energy heating house, and fixes facilities of solar water heater, gasification stove, etc..

3.4 Southern marsh gas pattern

At present, the pattern of the marsh gas in the southern area mainly is pigs-marsh gas- fruit, pig-marsh gas- vegetable, pig- marsh gas- rice, etc.. These patterns all regard peasant household as the elementary cell, utilize its places, such as mountain

region, surface of water, court yard, etc. to build birdhouse, the marsh gas pond, garden of fruit (vegetable), and combine the marsh gas pond ,the birdhouse with the lavatory at the same time .

There are a lot of marsh gas patterns, every region should choose the suitable pattern according to its trait, promotes the local economy to develop fast, makes the using energy structure in the villages become more and more rational and reduces the environmental pollution.

4. THE COMPARISON OF HEATING PROJECT

Now take Haiyang city in Shandong province for example to compare the present condition of using energy with using marsh gas to cook and heat in the villages, and the economic condition of the present condition of heating ,adopting marsh gas to heat with combined marsh gas with solar energy to heat in the small towns.

4.1 Project comparison in the villages

Now, the crop stalk production of each peasant household in Haiyan city is 1 t , wants to satisfy its cooking and heating demand, one household needs about 0.5 t coal(probably 200 yuan) and two pots natural gas(probably 100 dollars)(in wood's area use 1 t trees, suppose a tree is 0.15 t, one household will chop down 70 trees every year), its electricity expenses is about 300 yuan in average every year.

Using marsh gas needs to set up a marsh gas pond of about 8 m³ first, its expenses is about 1500 yuan. Suppose one household keeps 1 head pig, its defection is about 2 kg everyday, the defection of four persons in one house is about 2 kg everyday ,so the all defection is 4 kg everyday, then put all the defection with 2 kg water and 1 kg crop stalk into the pond, its output of marsh gas is about 1.5 m³, it can meet one family of 4 persons to cook and light a lamp, at the same time dealt with its rubbish every day, the marsh liquid can be used for breeding fish , raising pigs , raising chickens, etc., marsh dreg can be made for the good fertilizer to raise the output of the crop.

In this way, it can resolve fuel and electricity problem, save the expenses of about 600 yuan (fuel fee -300 yuan, electricity charges-300 yuan)(or per family can let 70 trees survive in wood areas every year), develop the small scaled breed aquatics, produce good fertilizer for the soil and grow the green products. According to practice, it can get about more 3000 yuan than before every year by using marsh liquid to breed fish , raise pigs , raise chickens etc. and using marsh dreg as fertilizer.

Suppose all of the villages in haiyang city burn coal all the year, one household needs at least 1 t coal every year, then because of this will let 2.65t/a of contamination such as SO₂, CO_x, NO_x and dust etc., 0.27t/a of ash dregs. But marsh gas is a kind of sanitary energy and basically don't produce any pollution, the contribution to reducing air pollution by using marsh gas in the villages speaks for itself.

4.2 heating project comparison in the towns

This article adopts year cost means. The formula is:

$$AC = \left[\sum_{t=0}^n CO_t (P/F, i_c, t) \right] (A/P, i_c, t)$$

In formula: AC—year cost

CO_t —the net cash flux in t year

n—years

$(P/F, i_c, t)$, $(P/F, i_c, t)$ —compound interest

coefficient

The project A is the district heating system using coal as fuel, the project B is the heating system using marsh gas as fuel, the project C is the heating system combining marsh gas with solar energy. To compare heating equipments investment, indoors system investment, administrant expense, running expense, the longevity equipments, the fuel price and policy, constructive expense and so on. According to the local circs, the price of coal is 300 yaun/t, the price of marsh gas is 1 yuan/m³. The heating day is 120 days, the heating index is 40 W/ m², the building area of per family is 100 m², then the winter heat load of per family is 6000 W. The low heating value of coal is 16728 kJ/ Kg, the low heating value of marsh gas is 23 MJ/ m³. I neglect the administrative expense and maintain expense for the heating system with boiler per family, for the heating system of combined solar energy with marsh gas. If the warmty of solar energy water heater is 400 W/ door, it can undertake 7% of the winter heat load. For the sake of simpleness, I take the longevity all the equipments as 10 years. The heating fuel fee of unit area every year is:

$$R = \frac{\bar{q}T}{Q_w \eta_1} P_s$$

In formula: $\bar{q}$ —heating index, W/m²;

T—time of the system runs, s;

Q_w — low heating value of fuel, (J/m³) 或 (J/kg);

η_1 —heat efficiency;

P_s —the price of fuel, (yuan/m³) 或 (yaun/kg).

the comparison of The investment and expense
of all projects: (unit: yaun/m²)

	A	B	C
heating equipments investment	10.0	40.0	55.0
indoors system investment	28.0	28.0	28.0
summation of investment	38.0	68.0	83.0
expense of fuel every year	37.2	15.4	13.6
heat efficiency	20%	85%	85%
expense of electricity every year	0.0	2.2	2.0

$$AC_A = 38.0^* \quad (A / P, 4\%, 10) \\ + 37.2 = 38.0^* 0.1233 + 37.2 = 41.9 \text{ yaun/ m}^2$$

$$AC_B = 68^* \quad (A / P, 4\%, 10) \\ + 17.6 = 9.9^* 0.1233 + 17.6 = 18.8 \text{ yaun/ m}^2$$

$$AC_C = 83^* \quad (A / P, 4\%, 10) \\ + 15.6 = 83^* 0.1233 + 15.6 = 25.9 \text{ yaun/ m}^2$$

$NPA_B < NPA_C < NPA_A$, so the project B is the best.

5. CONCLUSION

5.1 Marsh gas is inexhaustible ,high quality ,cheap healthful and reproducible energy source ,which has remarkable energy ,economy ,zoology and society benefit .It can make full use of the crop straw and the dejection of the livings , solve the surplus of the straw and the serious pollution of the environment caused by straw burning , change the garbage to treasure, satisfy the high level energy source demand from persons and improve the living quality of the farmer.

5.2 Every region should choose the appropriate marsh gas pattern in the view of its trait. The potential of the development of the marsh gas is great.

5.3 Our country mainly depends on agriculture, The utilization of the mash gas in the village connects the reasonable utilization of the energy source, which is the main approach of improving the living quality of the farmer. Every region should accelerate the speed of the development to make the farmers have healthy, comfort and rich life.

5.4 In the small town, the economic benefit of using the marsh gas to heat is quite great.

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