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By Jiamin Jin

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[CO_2-Coal+ Firewood - Electric Gas Generators] three together can save the earth. Let men live a peaceful and happy life.

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I. Introduction

The weather is getting warmer and the extreme climate is frequent, which seriously threatens the survival and safety of human beings. The CCS has become a focus of research and an international strategy to reduce greenhouse gas emissions. The United Nations has met many times for this purpose, particularly in Paris. The International Energy Agency (IEA) has repeatedly issued updated the CCS technology routes to guide countries around the world. Zhang Dong xiao, president of China's Institute of Clean Energy at Peking University, believes that CCS is expected to be the world's largest single technology for reducing carbon emissions. At present, the CCS technology is still in the research stage, and Some scholars believe that the combination of burial and application is only the feasible technical route, but the purification application of carbon dioxide is a global problem, to 30-50% is still to be raised. So say, the CCS technology route is not yet fully mature。

At present, there are 56 projects in operation or planning in the US, EU and China, and three industrial-scale CCS projects were in operation around the world. On August 6.2012, China's first carbon dioxide storage to the underground salt water layer full process demonstration project was completed and put into operation for more than a year, it has accumulated more than 40,000 tons of carbon dioxide, it is considered to be technology breakthrough progress in CCS technical field. The IEA's call for 200 CCS projects to be put into operation by 2020, and by 2050, 3000 projects will have to be put into. Thus, the international community's concerns about climate change are anxious and impatient.

I wrote four articles on the CCS for years [1,2,3,4]. It doesn't seem to get attention. The purpose of this article is to further clarify the author's views, it is hope for attention.

II. Problems in CCS Technical Routes

CCS technology routes from a power plant in the United States. The current situation is that CCS technology routes are fully adopted globally. The International Energy Agency (IEA) has repeatedly stressed that CCS technology routes are an green house gas emission reduction solution.

The CCS has been described in detail in the paper "Progress and Problems in Carbon Dioxide Capture and Sealing Technology " written by Li Xuejing, Qiao Ming[5]. This article is only briefly describe and supplement.

a) *There are still some problems to be studied in CCS technology route*

The CCS technical route consists of three parts: carbon capture, transport, and burial, in which the cost of carbon capture accounts for 2/3 of the total cost. In the view of some scholars, be near economically, it is not advisable to keep all carbon dioxide in storage; Therefore, the burying and applying it together is the only feasible technology route. But the purification of CO_2 is a global problem that has not solved as yet. That is to say, it is not feasible to bury and apply simultaneously。

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b) High cost

According to the Internet report that power plants that use CCS technology have consumed 30-50% more energy than those that do not use CCS technology. Burial a ton of carbon dioxide, which costs $52. Electricity bills per kilowatt-hour rose by $0.01-$0.05.

c) Limited burial site

The storage of carbon dioxide includes geological and marine storage. Some scholars believe that the saltwater layer beneath the Ordos Basin in China can contain tens of billions of tons of carbon dioxide, and the zone is more common in China. However, the author believes still that this can only be said to be limited storage zones. It cannot last forever to stored in the long history of human life.

d) There are safety risks

The safety hazard should be the most important. Whether it's geological or marine, there's always a carbon dioxide leak. After 100 or 1,000 years, if unpredictable geological hazards occur in the burial site, and a large amount of carbon dioxide is released, humans will be wiped out. For the sake of future generations, we have to stop.

The above analysis shows that there are still many problems to be studied in the CCS technical route. Therefore, the international community turned to the CCS technical route, and we had to think deeply.

III. Carbon Capture and Storage Energy-CCSE or Smoke Storage Energy-SSE

The production processes of CCSE or SSE are as follows:

Raw materials (CO_2+ Carbonaceous raw material)→ electric gas generator → cooling tower → dust removal → desulfurization → gas storage tank.

In the preceding article[3], raw materials, production processes, production equipment and safety for CCSE etc. have been described. The SSE is first proposed in this paper. The following points need to be added:

a) Theoretical side

Related Carbon Gasification Reactions:

$$C+CO_2=2CO\ -162297kj/kg.mol(-38790kcal/Kg.mol) \quad (1)$$

$$2CO+O_2=2CO_2\ +570865kj/kg.mol(136440kcal/kg.mol \quad (2)$$

$$C+O_2=CO_2\ +408568kj/kg.mol(97650kcal/kg.mol \quad (3)$$

The (1) formula is famous Boudouard reactive formula. It is endothermic reaction. The heat absorbed by carbon gasification reaction plus the heat released from the full combustion of carbon is equal to the heat released from the combustion of carbon monoxide., that is, (1)+ (3) = (2). This fully conforms to the energy conservation law.

When we compares the heat released from the combustion of carbon monoxide with the heat absorbed by the carbon gasification reaction, i.e. (2) / (1) =3.517 or 570865/162297=3.517. Theoretical calculations show that the carbon gasification reaction has absorbed a lot of heat, but it has stored 3.52 times the amount of heat absorbed. This 3.52 makes it clear that it is very cost-effective to convert electricity into chemical energy to use electricity and carbon gasification reaction.

3.52 is the result of theoretical calculations, taking into account heat loss such as furnace wall, but also not less than 3.4.

Please, people, remember firmly the 3.52 in the heart. 3.52 is important and reliable data. because the carbon gasification reaction is a very important industrial reaction. It`s thermodynamics, kinetics, reaction mechanism, catalytic reaction and catalysis mechanism have studied in detail. In the industrial production, the use of this reaction to produce products already has a long history. Example; the blast furnace iron making, it can be said to rely entirely on this reaction, because the possibility of direct contact of solid carbon with oxide iron are almost zero, hundreds of millions of tons of iron rely entirely on this gasification reaction . The production of spongy iron in the flint kiln is also entirely dependent on this gasification reaction. etc.

Remember 3.52, we will inevitable find that there are many unreasonable initiatives in the current industrial production.

Example: A pumped-storage power station. The energy consumption to raise the water of the lower reservoir to the upper must be greater than the electrical energy produced by hydraulic. It is a negative increase, and can not compare to a 3.52 increase.

As compared with CCSE, it is inevitable thinking that it is much more reasonable to build an electric gas generator than to build a pumping station.

The rubbish incinerator, which has been popularized in global, uses kerosene or natunal gas to burn rubbish。 This action, which consumes both energy and resources, and pollutes the environment, it is very unreasonable. If the rubbishs are putted into the electric gas generator, It stores both energy and gets clean gas after over high temperatures.

Besides, electric energy is first used for lighting, electric motor, heating and so on. Author thinks it is also unreasonable. If the electricity is first used in an electric gas generator, electricity is converted into chemical energy, it stores 3.4 times the energy absorbed by gas. At present, the electricity produced in global is 26 billion degrees, If we multiply by 3.4, it's 88.4 billion. The situation of electricity shortage can be solved quickly, and the electric gas generator not only consumes a lot

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of garbage and carbon dioxide, but it also protecting environment, and protecting resources.

Therefore, the author thinks that the application of electric should be: Electric→Electric gas generator→Application and Storage. Controlling the proportion of application and storage can control the carbon dioxide content in the air and control the climate.

b) Raw Material

In addition to coal, firewood; carbon-containing raw materials, such as peat, used rubber, dried algae, domestic waste, medical waste, waste plastics etc. can be used as raw materials to produce gas.

Author thinks that a lot of energy is stored in firewood, We should make full use of the firewood for carbon gasification.

c) The purity of CO_2 and centrifugal gravity concentration

On the gas production, it`s demand is not strict on the purity of CO_2. Even if the smoke is directly introduced into the gas furnace. The calorific value of gas produced is also higher than the city gas. Because the carbon dioxide content in the city gas is always around 5%, and the gas produced by the electric gas generator, the carbon dioxide content can be zero. A large amount of nitrogen only plays a dilution role, no with effect on conversion energy consumption or little effect. The advantage of SSE is that it can reduce emissions quickly and saved a costly carbon capture process.

However, if the smoke were to be recycled to use, the nitrogen content in the smoke will inevitably rise gradually, the calorific value of the gas will become lower and the production will be unstable. Proper enrichment is therefore necessary. 。

Table 1: The specific gravity of several gases (g/cm3).

N2	CO2	NO2	SO2
0.00125	0.00198	0.00198	0.00293

The idea of centrifugal gravity concentration is that the specific gravity of CO_2 is 1.58 times that of N_2, and the specific gravity varies a lot. The current technology can separate U^{235} and U^{238}, and it expects that the separation of N_2 and CO_2 can increase the concentration of CO_2. How much can be improved, it is to be determined experimentally. Fortunately the demand for the purity of CO_2 for gas production is not strict, only for stability.

If the cost with compression separation method is not too high, of course it is best. , the gas produced with high concentrations of CO_2 has a high calorific value.

d) Airflow direction on the CO_2

In the previous paper[3], it shows that the direction of CO_2 flow and solid material flow are the same direction, from low temperature to high-temperature, the advantage of this flow direction is that the content of CO_2 in the gas can reach zero, the second is the harmful volatile matter produced in the raw material after high temperature refining, its are completely decomposed, and the result is clean gas. The shortcoming is that the outlet gas temperature is higher, it must be cooled by cooler to improve the thermal efficiency. Of course, the direction of the CO_2 flow can also flow in the opposite direction to the raw material, it is like blast furnace smelting, from high to low temperature. The advantage is higher thermal efficiency. However, the deficiency is that the harmful components in the gas must be treated separately outside the furnace, and the carbon dioxide in the gas cannot be completely converted to CO because of the reaction equilibrium. Carbon monoxide produced in the high temperature zone, to the low temperature zone, under the action of the catalyst, the reverse reaction occurs, and CO is decomposed into CO_2 and carbon.

e) Desulfurization

A "Desulfurization" process is marked in the production process, but the author considers that this process needs to be verified by experiments. The reason is that at high temperature, the carbon is a very strong reducing agent, and the oxidizing gases, such as CO_2, SO_2, NO_2 and H_2O in the smoke, will be reduced or decomposed into sulfur, nitrogen and hydrogen by carbon, and after cooling, they cannot be reoxidized in the presence of a large amount of carbon monoxide. But if the gas produced contains a lot of carbon dioxide, there is also the possibility of re-oxidation. Therefore, at the beginning, the desulfurization process is properly retained.

The smoke is directly introduced into the furnace, the desulfurization and denitrationunit process of the power plant, can be revoked.

f) Equiptment to be researched in CCSE or SSE

i. *Electric gas generator*

The Electric gas generator is the only main equipment of CCSE or SSE, it is also a innovative equipment. In fact, it is a heating furnace, which is characterized by large power. A ton of CO_2 can produce 1000 m^3 CO. Each producing 1 m^3 CO requires about 1 degree of electricity, that is, 1 ton of CO_2 conversion to CO requires 1000 degrees of electricity.

Furnace types can be varied, blast furnace type, rotary furnace type, boiling type, horizontal, vertical。

The authors prefer the rotary furnace type, The final choice needs to be decided by the furnace expert.

ii. *Centrifugal gravity concentrate equipment*

The author thinks that there can be two methods for centrifugal gravity separation, one is by centrifuge principle, the other is by using the ancient windmill principle to separate. Which one of the two is

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better, it should be determined according to the experiment.

IV. Supply of Power

Currently, the world's total carbon dioxide emissions are 35.2 billion tons. The largest is China, 10.9 billion tons, followed by the United States and 5.1 billion tons, with China and the United States making up half of the world's total emissions. The world's electricity generation is 26 trillion degrees, with China accounting for 25.49% and the United States 15.66%. We already know that a ton of carbon dioxide to carbon monoxide requires about 1000 degrees of electricity, and 352 billion tons of CO_2 to CO. far exceed the global total power generation. But there is no need to worry, because the amount of CO_2 absorbed by plants is very much, and How much to capture remains to be determined by experts.

V. Conclusion

Two technical routes, CCS and CCSE or SSE, have compared. The CCS stores "CO_2" that are thought to be waste. But in CCSE or SSE technology routes, the CO_2 becomes into raw materials, into commodities. The CCS technical routes are both difficult and costly. The CCSE or SSE technology routes store energy and store 3.52 times more energy than it absorbs. Therefore, CCSE or SSE is feasible. The CCS is a exhaust the manpower and drain the treasury.

We have to vigorously develop electric gas generator for achieve rural coal gasification. We have to consider reorganizing the direct combustion turn to indirect combustion for improving heat efficiency. we have to make full use of natural resources for achieve natural balance,

The combination of CO_2-firewood and garbage-electricity, can save the earth.

The author believes that the ancient, primitive and most convenient direct combustion mode is very unreasonable. If it is changed to hydropower-gasification-application mode, or fire power-gasification at the same time, it is not only to double the energy, but it is also to protect the environment, to protect resources, human beings do not have to worry about coal and other resources exhausted, live a peaceful and happy life.

We can say that only carbon dioxide can save the earth. The use of CO_2 to convert the vast amount of energy stored in plants and animals into chemical energy for human use will enable mankind to live a permanent and peaceful and happy life.

Références

1. Jia-min Jin. Power generation technology using CO_2 capture energy storage, *Power & energy* 2016 Vol.37. No.4.
2. Jia-min Jin. Make use of capture CO_2 for energy storage and carbon reduction emission, *GUANGZHOU CHEMICAL INDUSTRY, 2017, Vol. 45, No.6.*
3. Jiamin Jin, Making use of the capture CO_2 for the energy storage and carbon reduction emission, *Journal of low carbon economy*. 2017 Vol. 6 No.3.
4. Jiamin Jin, Making use of the carbon capture, coal and firewood to produce gas, *Journal of low carbon economy*. 2019 Vol. 8 No.4.
5. Li Xuejing Qiao Ming, Analysis on the Technology Progress and Existing Problems of Carbon Dioxide Capture and Storage, *Chinese and Foreign Energy* 2008 Vol.13, No.5.

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