



Green building blueprint: Using renewable energy, protecting the environment and resolving externality

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ABSTRACT

The using of renewable energy in building is very important for energy conservation and environmental protection. Because the development of renewable energy building(REB) is affected by increased costs, government policies, consumers' acceptance. In this paper, authors analyze the external characteristics of renewable energy building by using external economic principles. By analyzing it knows that the government policies play very important role in resolving the external characteristics of renewable energy building and the compensation mechanism economic principles should be used to solve the barrier problems of renewable energy building promotion which has important theoretical significance.

Keywords: Renewable Energy; Green Building; Externality; Energy-saving

INTRODUCTION

In recent years, the relevant ministries and commissions of the central government establish and implement some policies about renewable energy application in the building to encourage and support the promotion of the REB with the natural characteristics of the region appropriate so as to increase the usage of renewable energy in breadth and depth in buildings. Renewable energy used in buildings, the building energy sustainable development is possible [1-6]. The proportion of energy consumption of buildings in society energy end-use will become increasingly higher and higher due to the urbanization and urbanization process. The level of building energy consumption in China is now close to the developed countries [7]. From the property, REB can be considered as renewable energy and building integrated application. However, due to its inherent characteristics, it produces a positive external economies throughout the life-cycle of building. From the point of view of economy, the government needs to take certain economic measures to resolve the market failure of the renewable energy in the building because of the existence of external economies.

Academician He Zuo-xiu pointed out that the government should solve the problem of policy investment and should carry out the national strategy of energy saving and emission reducing and the government may solve the external problem through implementing corresponding policies in promoting the renewable energy building [8].

2. External characteristics and impact analysis of REB

Externality is an important study of neo-classical economics and new institutional economics. Externalities can be divided into three types, positive externality, negative externality and bidirectional externality, in accordance with the impact of externality. Externality problems can lead to differ between private benefits and social benefits(private costs and social costs). The deviation of the difference in costs and benefits can lead to market failure.

REB exhibits a positive externality for using renewable energy which produces the practical effect of energy saving and emission reduction. In recent years, the REB develops slowly because the market mechanisms can not play an effective role. That is, there is a market failure. The government should take appropriate policy measures to resolve this problem. Generally, the costs of REB are more than the general building. In accordance with the fundamental principle of externalities, external problems should be transformed into internal problems. That is, through institutional arrangements, the social benefits turn into private benefits. In accordance with the principle of externalities, the government should take certain economic means to eliminate or reduce the external costs to enhance the enthusiasm and initiative of investors and consumers. Only in this way, REB can achieve healthy development. In accordance with the laws of the market, REB market would fail if the government does not give positive encouragement to externalities.

In the using of renewable energy, China's urban area of solar thermal applications will reach to 2.46 billion square meters, the geothermal resource to 3 billion square meters area and BIPV to 1079 MW. According to China's current total of nearly 500 million square meters buildings, REB accounts for only a small part, the proportion of REB, comparing to new buildings every year, is very low. Several national ministries have implied many measures, in order to solve the promoting problem of REB. To some extent, these policies promoted the development of REB, but did not reach the ultimate goal of policy implementation.

The REB is compared with the general building in figure 1. In figure 1, the distance of every point on the horizontal axis to the point A represents the amount of general building and the distance of every point on the horizontal axis to the point B represents the amount of REB. AB represents the total number of buildings. Curves MR_1 and MSR_1 represent the private marginal benefits and social marginal benefits of REB. Curves MR_2 and MSR_2 represent the private marginal benefits and social marginal benefits of the general building. The REB and general building would keep balance in the market mechanism, if we do not consider the external characteristics. That is, the crossing point E. In this crossing point, the equilibrium amount of REB is Q_2B and the equilibrium amount of general building is Q_2A . Considering the externalities, the equilibrium of social optimal about REB and general building is the crossing point F. In this crossing point, the equilibrium amount of REB is Q_1B and the equilibrium amount of general building is Q_1A . In the equilibrium point Q_1 , the marginal private benefit of REB is P_1 and the marginal private benefit of general building is P_2 . At the same time, the difference Q_1Q_2 is produced between the REB of market spontaneous configuration and social optimum configuration. In the socially optimal configuration, the amount of general building should be controlled at point Q_1 . However, in this case will lead to the private marginal benefits price difference between the general building and REB. The point Q_1 would move to Q_2 if the external benefits can not be transformed into internal benefit. Then, the number Q_1Q_2 of REB will turn into general building. That is the key reason in developing REB from the point view of economy.

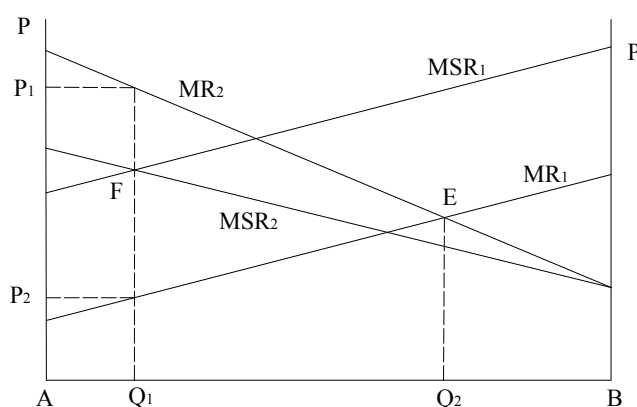


Figure 1. REB external characteristics analysis

3. Analysis in policies to resolve the externalities of REB

In accordance with the basic methods and principles to resolve externalities, External characteristics of REB can be resolved through the following ways. In figure 2, we assume that the supply curve S is determined by private

costs MC , the market demand curve D_1 is determined by the private benefit MR , the REB market demand curve D_2 is determined by social benefits MR . Assuming that the government does not take any measures, the investors' max equilibrium amount Q_1 and price P_1 should be determined by the intersection E_1 of the supply curve D_1 and the supply curve D_1 . Thus, the consumers' surplus is area $\Delta P_1 E_1 L_1$, the producer surplus is area $\Delta P_1 E_1 O$, social benefits is area $\Delta L_1 E_1 O$ that is, the two together of the consumers' surplus and producer surplus. Conversely, if the government takes some measures, equilibrium amount Q_2 and price P_2 are determined by the intersection E_2 of the market demand curve D_2 and the supply curve S . Thus, the number can reach the optimal level of social requirement. The consumer surplus is area $\Delta P_2 E_2 L_2$, the producer surplus is area $\Delta P_2 E_2 O$, social benefits is area $E_2 L_2 O$. Area $P_1 P_2 E_2 E_1$ represents the pay or benefits influenced by government tax and subsidy policies investors.

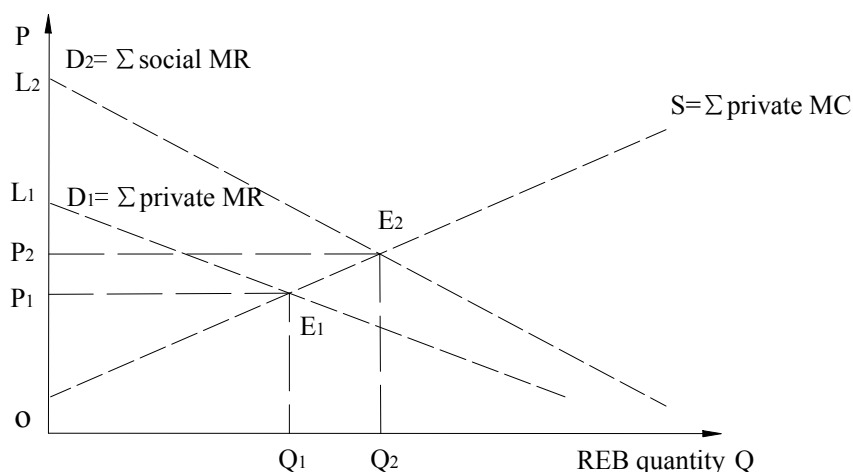


Figure 2. Policies to resolve the REB externalities

In accordance with the externalities theory, the social benefits or social costs can be translated into private benefits or private costs through economic activity. The principles of economy shown in Figure 3.

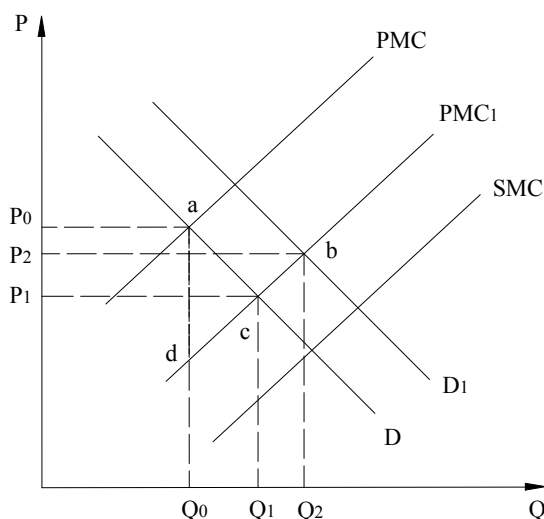


Figure 3. The compensation principle of economic incentive

In figure 3, D is a market demand curve of REB, PMC is a private marginal cost curve, and SMC is a social marginal cost curve. PMC is greater than SMC for the positive externality of REB. Q_0 and P_0 are the amount and the price of REB, when the building market reaches equilibrium. PMC is equivalent to a supply curve of REB. To eliminate positive externalities of REB, we should move PMC to SMC . From figure 3, we

should increase the amount of REB in the initial stages, and take the economic incentive policies to compensate for the incremental cost [9-11]. If the compensation amount is $a - d$, private marginal cost curve moves from PMC to PMC_1 , the amount of REB will increase from Q_0 to Q_1 . This is beneficial to the development of REB. In accordance with principles of economy, the development of REB makes the private marginal cost closer to the social marginal cost, but it does not mean that it totally depends on government compensation measures to support the development of REB. Subsidies for Increasing costs of REB do not increase with PMC moving to SMC . When the REB markets develop to the amature industry chain stage, the compensation amount would gradually reduce until it disappears.

CONCLUSION

In this paper, the author analyses the external characteristics of REB by using the principles of economy and points out the important role of government policies to resolve the external characteristics of REB. In the early stages of promotion, if the government wants to increase the amount of REB, it is necessary to adopt economic incentives for investors to compensate the incremental cost. When the industry develops to a certain stage, the economic compensation would be gradually reduced with the public gradually knowing and accepting the benefit of REB, and with the investors reducing investment cost. At the same time, the role of government should be changed to market supervision.

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