Comprehensive evaluation of policy measures to expand use of environmental friendly vehicles in China focusing on reduction of greenhouse gas

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1.Introduction

1.1 Background

A rapid expansion of the human activity in recent years has become to face the new barrier of environmental issues with overwhelming happiness and benefit. Environmental problems are the results of the loss of global balance between the environmental burdens by human activity and processing capacities of the nature. As a high population and high economy growth country, China is facing kinds of serious environmental problems like Green House Gas emission, Acid rain and so on.

In this paper, we pay attention on reduction of Green House Gas emission problem via environmental friendly vehicles introduction in China. To realize this objective effectively, we need pay attention on introducing new energy industry also.

1.2 Objective of the study

This paper discusses the current automotive situation and improvement options in China, and suggests an evolution policy by environmental friendly vehicles introduction to treat with serious GHG emission by normal automotives, to realize sustainable development and environmental friendly solutions, through computer simulation based on Input-Output model.

1.3 Method of the study

In this research, input-output model of China economy, which explicitly includes electricity vehicle manufacturing sectors; energy sectors; transportation sectors; normal industry sectors; petroleum sectors, are constructed and the model is expanded to include household and government sectors so that prices, tax and subsidies are endogenously determined by LINGO simulation.

2. Simulation Modeling

2.1 Goal & Scope

The simulation model is an extensive expanded I/O model which combined interdependent sub-models of

material balance, value balance and energy balance in China. It based on nonlinear programming method to decrease GHG discharged by automotives in China and decrease GHG & air pollutants emission in this region, and find out policy options to maximum economy activities (GDP).

2.2 Framework

Figure 1 is the model framework of this study. This research separated social economy into 3 parts--industry sector; government; household. And make industry into 5 big parts including: petroleum production sector; normal industry; automotive manufacturing sector; energy sector; transport sector.

Because we can get enough information through simulation by this separation: when we introduce EV& HV, we can know gasoline and diesel price change; know EV and HV manufacturing industry change; know energy supply and energy situation change; know transport sector's GHG emission change; and even know GDP change.

Energy from energy sectors to other sectors to be consumed. When EV manufacturing sector be introduced, we must support new energy sector by subsidy, or it will be meaningless (will be proved at next chapter). Materials are consumed as intermediate input in industries & intermediate produce, and be consumed by government and household sector as final consume (demand). In this paper, carbon tax will be introduced as a resource of subsidy. Government levy taxes from industries and spend them as subsidy to new energy sector and EV&HV manufacturing sector or new energy sector, transport sector and household.



Figure 1. Framework of model.

2.3 Carbon tax and Subsidy

To implement police, consider regional environmental tax (Carbon tax) as a target tax and carry out subsidy

policy. The regional environmental tax is based on producer bearing doctrine to levy tax from GHG & air pollutants emission industries and households—it must match their discharge amount. It is possible to use general account as additional budget when target tax income is not enough. Set whole China as policy implementing subject and this research will set the budget limitation in next research step.

For subsidies, this research will consider 2 implement ways: to EV&HV manufacturing industry and new energy sector; or transport sector, household sector and new energy sector. To find out the better way based on simulation result analysis.

2.4 Why consider New Energy Industry?

As Table 1 shows, fast charge for EV will discharge 185g/km CO₂, almost same to gasoline vehicle discharged. So when we introduce EV in China, we must introduce new energy industry as same time, or it will be meaningless to introduce EV even cost much.

Table 1 differences of 3 kind's vehicle			
	Energy	CO ₂ Emission	Cost
	Consumption	(g/km)	(Yen/KWh)
	(KJ/km)		
Gasoline Vehicle	2689	187	9.6
Hybrid Vehicle	1097	76.3	3.91
Electric Vehicle	480	Normal charge:124	Normal charge: 1.61
		Fast charge:185	Fast charge:2.37

3. Expected Result

The objective element in this paper is GDP, it means this research will consider all environment limitations first, and calculate the maximum GDP volume under these environment limitations. So the key point is the carbon tax rate. Because it will affect economy activities and CO_2 discharge volume directly, and keep a trade-off relationship between them.

As an expected result, we will get an exact carbon tax rate by computer simulation under all environment limitations through their model functions to realize our research objective: decrease CO_2 emission by environment friendly vehicles' introduction to realize sustainable development.

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