

An Intertemporal Computable General Equilibrium Model of Sustainable Toyohashi City with Green Energy and Smart Technology

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Abstract:

Since the industrialization, the appearance of cities has been enhancing great changes of people's lives by mass production and mass consumption. Because of the human society has been developing through industrialization and urbanization, many environmental problems, such as Green House Gas (GHG) emissions, waste generation have been occurring as well. Thus, city planners and urban policy makers look forward for designing a compact city to attain a sustainable urban system. Because the form of compact city contributes to improve harmful effects of urban sprawl and offers us many benefits, such as less car dependency thus lower emissions, reduce energy consumption, etc. An influential study in "Cities and Automobile Dependence: An International Sourcebook, 1989" by Peter Newman and Jeff Kenworthy show that the denser urban areas in the developed countries have a greater mixture of land use and lower car dependency, thus trends to lower energy consumption and emissions. However, the suburban cities in the developed countries have a common trend of high car dependency, thus increasing energy consumption and emissions. Thus, in order to reduce GHG (especial focus on CO₂) emissions from the suburban areas, this research takes vehicle as subject and is dedicated to introduce an electric vehicle and the low-carbon society. The great advantage of electric vehicle will be to reduce CO₂ emissions, but only when the electric automobiles are powered by natural energy, like solar power. If EVs are powered by the electricity generated from coal, gas, petroleum etc., there will be no significant impact for reducing CO₂ emissions. Thus, solar energy comes first to our mind to reduce CO₂ emissions. Further more, considering the low carbon society, the mass introduction of renewable energy, new power supply and utilization, in Toyohashi city required Smart Grid to make the best use of local renewable energy with a view to maximizing total efficiency. We set Toyohashi City as the study region and apply an intertemporal computable general equilibrium (CGE) model to analyze the economic and environmental impacts after putting electric automobiles into operation.