英文Abstract

Requirements for the Mobility Revolution toward a Decarbonized Society

Principal Investigator: Hirokazu KATO
Institution: Nagoya University, JAPAN
Tel: 0527892772 / Fax:0527891454
E-mail: kato@genv.nagoya-u.ac.jp
Cooperated by: Waseda University, Okayama University, National Institute for Environmental Studies

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The “mobility revolution” is an upcoming revolution in transportation services and incorporates technological advances in IT(Information Technology), energy, etc. However, there is little academic or objective assessment of how the mobility revolution will affect decarbonisation progress. Therefore, we applied LCA (Life Cycle Assessment) and WtoW (Well to Wheel) methods to comprehensively and quantitatively evaluate the impact of the mobility revolution on CO_2 emissions changes in transportation systems, and developed it into an evaluation methodology that can incorporate changes caused by factors like transportation demand- supply, infrastructure development, and technological advances. Using this, we have clarified the “conditions under which the introduction of new technologies and services to transportation systems can exhibit low-carbon properties” by considering the future socio-economic energy trends through scenario analysis and have made the formulation of an introductory scenario that satisfies these conditions possible.

In this study, we analysed the mechanism involved in the CO_2 emissions changes accompanying the mobility revolution from four perspectives: (1) transportation systems; (2) transportation equipment, energy, and new technologies; (3) transportation management, and (4) population and spatial structures. First, we extracted the major new mobility tools, technologies, and services that will drive the mobility revolution, and created a process tree by identifying the factors that impact CO_2 emissions. To formulate this, we developed the lifecycle CO_2 intensity of each means of transportation and infrastructure, and introduced parameters related to vehicle characteristics analysed in (2) (electrification/regeneration, renewable energy/charging pattern, weight reduction, etc.), transportation characteristics analysed in (3) (new mobility tools, changes in transportation behaviour, IT solutions such as MaaS, car ownership/sharing, etc.), and regional characteristics analysed in (4) (population, spatial distribution, driver’s license holding, etc.). Consequently, we constructed an evaluation technique that allowed us to consider various measures to change each characteristic from the perspective of low-carbonisation.

Using this, we clarified the necessity of implementing various measures, through a back-casting approach, to achieve the 2050 carbon-neutral goal. A socio-economic framework and trends in the spread of renewable energy were selected as scenarios, and the selection and combination of measures related to technology and transportation in each region were considered to assess the probability of achieving the goals. As a result, we identified the conditions for the mobility revolution to achieve decarbonisation. It will contribute to the application of evaluation methods in national and local governments’ low-carbon technology introduction

support projects, and to EBPM(Evidence Based Policy Making) for transportation decarbonization measures in local governments.