LOW-CARBON WATERSHED MANAGEMENT: INTEGRATION OF RENEWABLE ENERGY SUPPLY AND DECENTRALIZED WASTEWATER TREATMENT : A CASE STUDY IN VIETNAM

論 文 の 内 容 の 要 旨

Thesis Summary

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（ベトナムにおける再生可能エネルギーと分散型排水処理の組み合わせによる低炭素型流域管理方法の提案）

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Vietnam is among the most climate change vulnerable and disaster-prone nations and water is the first sector to be affected by climate change. Being one of the developing countries launching climate policies, the country has recently announced to strive for low-carbon economy. Nevertheless, there is mismatch in the development strategy between the power sector and the related climate policies which might lead to the ambiguous in further implementation of climate change mitigation strategies. To achieve sustainable development and green growth, the government goal is to increase renewable energy share to 9.4 % and wastewater treatment to 80 % in year 2030. However there are no specific guidelines to accomplish the multiple targets. The research goal is to propose the integrated mechanism of renewable energy supply (run-off-river hydropower) and decentralized wastewater treatment system. The proposed mechanism is expected to reduce greenhouse gas emission from power generation and alleviate environment pollution from domestic wastewater.

The objective of this study has been three-fold. First, to estimate the potential of small hydropower (in the form of run-off-river hydropower) and its contribution to greenhouse gas emission reductions in the representative river basin of Vietnam. Second, to estimate the potential of greenhouse gas emission reductions by providing adequate domestic wastewater treatment facilities. Third, to demonstrate the co-benefits of the integrated mechanism through scenario analysis, considering social, financial feasibility and carbon crediting scheme.

To achieve the first objective, this study estimated run-off-river hydropower potential in Central Vietnam using a distributed hydrologic model and power duration curve method. The second objective was accomplished by employing the GHG protocol and IPCC Guidelines for National Greenhouse Gas Inventories. For the third objective, questionnaire survey and financial analysis was conducted. The questionnaire covered detail electricity consumption, wastewater treatment facilities of the rural households living in the corresponding river basin. Financial analysis including investment costs, levelised cost of electricity and abatement cost were calculated. The co-benefits demonstration of the integrated mechanism was performed by using the benchmarking analysis. The result suggests that run-off-river hydropower has potential to fulfill the electricity demand for the rural villages in the river basin, especially remote communities without access to grid with the total capacity 277 MW at the capacity factor of 40.2 %. The co-benefits of the integrated mechanism were emphasized on the simultaneous impact when

providing alternative electricity source to ensure the reliability of the grid by reducing grid load, prevent from blackout and brownout. Renewable electricity generation from ROR hydropower scheme will provide power for decentralized wastewater treatment facilities within the watersheds to alleviate water pollution. Full implementation of run-off-river hydropower generation and wastewater treatment system would reduce the total amount from 0.38 million tCO2e per year (on-grid based) to 0.60 million tCO2e per year (off-grid based). The results from scenario based analysis showed that under domestic conditions the project return period is 18.39 years and IRR is 8.5 %. If the project is implemented under the integrated mechanism, the project payback periods are from 7.31 years to 18.17 years and IRRs are from 10.04 % to 26.57 %.