Doctoral Thesis (Abridged)

博士論文 (要約)

TRANSITION TO RENEWABLE ENERGY SYSTEMS IN UZBEKISTAN: SOCIO-ECONOMIC FEASIBILITY IN REMOTE AREAS

（ウズベキスタンにおける再生可能なエネルギー資源への転換：
遠隔地域における経済的及び社会的な観点からの実行可能性に関する一考察）

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A Dissertation

by

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in Partial Fulfillment

of the Requirements for the Degree

Doctor of Philosophy (Sustainability Science)

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Graduate Program in Sustainability Science – Global Leadership Initiative

Graduate School of Frontier Sciences

THE UNIVERSITY OF TOKYO

September 2018

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ABSTRACT

Uzbekistan is currently self-sufficient in terms of energy supply. However, a steady rise in domestic consumption and inadequate energy supply infrastructure frequently result in the country suffering electricity supply shortages. In particular, rural parts of the country, where 50.3% of the population reside, suffer the most from unstable energy supply, and there is an acute need for the replacement, modernization and development of the transmission grids. In this regard the deployment of renewable energy sources (RES) has gained attention among various stakeholders at different levels (government officials, academia, international organizations and business community), as a way to potentially address these problems. The government of Uzbekistan on various occasions manifested its intention to improve the situation, and is committed to increase energy efficiency in all sectors of the economy through the development of renewable energy sources. In particular, wind, solar and hydro energy have been given attention, as these sources are believed to have a significant potential. In line with government's policy towards sustainable economic development and to ensure a favorable environment for further RES development in the country, a number of preliminary reforms of the institutional framework and the establishment of a comprehensive legislative framework have already been put in place.

However, despite their potential and benefits, the use of RES in the country is currently insignificant. In such a situation, the feasibility study of renewable energy systems for remote arears in Uzbekistan that are the most vulnerable and prone to electricity supply issues areas is vital to ensure inclusive economic development. Moreover,

the analysis of the socio-economic impact of deploying such technologies plays an important role for the study of sustainable development pathways for countries with similar economies. This study uses the case of Uzbekistan as an example to demonstrate the challenges and issues faced by countries which are undergoing a transition from government-led economic models to the post Socialist model of economic governance. It also attempts to provide an outline of major problems which go beyond the issues faced by Central Asian (CA) countries, and which are often felt by many other post-Socialist countries (tightly related to political, economic and social systems). Finally, it offers certain clues about the particularities of transitioning from traditional energy resources to renewable energy consumption in developing countries, touching on certain important elements related to government policy.

In this regard, the thesis sets out to develop a holistic approach to the RES integration process in Uzbekistan, which aims to look at the issue from the standpoint of public policy, developmental studies, environmental impact, economic viability, and socio-economic impact perspectives. To do so, the research sets four closely related objectives with relevant methodological solutions. Firstly, the study contains an extended analysis of the energy sector development in Uzbekistan after gaining independence in 1991 and defines the reasons behind government initiatives towards the deployment of renewable energy sources. Secondly, the preliminary findings of this legislative analysis –including also secondary data and media sources-, were verified with the results of local discourse analysis by conducting extended expert interviews during August-September, 2016 and February-March, 2017 in the country. The results show that there is a lag between the intentions announced by policy-makers and the actual actions that accompany those intentions. Then, based on the data derived from expert interviews,

a new classification of barriers for RES deployment that is applicable to the case of Uzbekistan was developed.

Thirdly, the study investigates the feasibility of hybrid wind-solar energy systems as an alternative to diesel-run systems in remote regions of Uzbekistan. In order to do so, real meteorological data for six selected regions in Uzbekistan were fed into the HOMER software. The main focus was to determine what would be the most desirable strategy to ensure the sustainable energy supply of remote villages in the country. The simulation results prove that hybrid wind-solar energy systems present an economically viable and environmentally less harmful alternative to diesel-run energy systems. Besides, RES deployment can help to address issues related to daily and seasonal peak loads and significantly decrease costs associated with infrastructure upgrade/extension and maintenance to the most remote and hard-to-reach areas.

Fourthly, this study attempts to assess the socio-economic impact of RES deployment in the country by providing a preliminary expectation of new job creation from RES development considered in national RES development Program for 2017-2021. To measure the socio-economic impact of RES projects of the scale of small community that located in remote and hard to reach regions, the author utilizes sample models for RES energy systems for such consumers. Furthermore, using such data and indicative employment factors for solar PV and wind power (based on data obtained from local RES installation companies) a preliminary assessment regarding the potential for income growth from RES deployment is provided, and the potential social benefits are discussed.

In conclusion, the results of the present study highlight how the deployment of RES represents a great opportunity for gaining access and improving the reliability of elec-

tricity supply and thus improving the living standards of population, especially in remote areas of Uzbekistan. It provides evidence of the economic viability and environmental benefits of hybrid wind-solar stand-alone energy systems for six regions in Uzbekistan through the simulations utilizing real meteorological data and using real economic indicators. Also, it shows how the deployment of RES can also stimulate the development of a new industry, providing new job opportunities for local people that can increase GDP per capita and income. Finally, increasing the share of RES in the energy balance can help to preserve fossil fuel reserves for future generations and contribute to decrease vulnerability to various types of risks associated with them (availability, prices and etc.). However, there are uncertainties in the national strategy and a lack of a system of incentives and overall market dynamics for further RES development in the country, and the thesis will finish by making some recommendations on how these can be improved.

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LIST OF ABBREVIATIONS

ADB – Asian Development Bank

AMP – Accelerated Modernization Policies

BAU – Business as Usual

CA – Central Asia

CAPS – Central Asian Power System

CAREC – Central Asia Regional Economic Cooperation

CBU – Central Bank of Uzbekistan

CCGT – Combined Cycle Gas Turbines

CER – Center for Economic Research

CO_2 – Carbon Dioxide

CSP – Concentrated Solar Power

EBRD – European Bank of Reconstruction and Development

FiTs – Feed-in-Tariffs

FSU – Former Soviet Union

GDP – Gross Domestic Product

GHG – Green House Gas

HOMER – Hybrid Optimization for Multiple Energy Sources

IEA – International Energy Agency

INDC – Intended Nationally Determined Contribution

IRENA – International Renewable Energy Agency

ISEI – International Solar Energy Institute

LCOE – Levelized Cost of Energy

LEAP – Long-range Energy Alternatives Planning system

NASA –National Aero Space Agency

NGO – Non-Governmental Organization

NPC – Net Present Cost

PV – Photovoltaic

R&D – Research and Development

RES – Renewable Energy Sources

RET – Renewable Energy Technologies

REN21 – Renewable Energy Policy Network for the 21st Century

RHU – Rural Health Centers

SEZ – Special Economic Zone

TPP – Thermal Power Plant

UNDP – United Nations Development Program

UNFCCC – United Nations Framework Convention on Climate Change

WB – World Bank

WECS – Wind Energy Conversion System

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