（続紙 １）

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論文題目	Poverty Alleviation by Using Solar Energy: Evaluation of the Solar Energy for Poverty Alleviation Program (SEPAP) in Jinzhai County, China 太陽光エネルギーを活用した貧困削減プログラムの評価 − 中国金寨県の事例を中心に−		

（論文内容の要旨）

Many developing countries have tried to solve issues such as poverty and electricity access with varying degrees of success. Up until 2014, China, the largest developing country, had a massive population living in poverty and lacking a stable electricity supply. In 2014, China launched the so-called "targeted poverty alleviation policies" ("精准扶贫"), which aimed to eliminate extreme poverty by 2020. In this thesis, we explore the Solar Energy for Poverty Alleviation Program (SEPAP), one of China's targeted poverty alleviation policies. Between 2014 and 2020, China constructed and operated 26.49 GW of solar PV systems for poverty alleviation, benefiting 1,472 counties, 138,093 villages, and 4.18 million poor households (National Energy Administration, 2020b).

However, there is still some uncertainty over how to evaluate SEPAP's actual effects. This thesis aims to evaluate SEPAP comprehensively, including its design, implementation, and impacts on poor households. The main research question is whether SEPAP has actually benefited the poor, and if yes, how. To answer the main research question, we have conducted the following three studies that evaluate SEPAP from governance, economics, and sustainability perspectives. The three studies correspond to Chapters 4, 5, and 6 in the dissertation.

Firstly, based on the results from 30 semi-structured interviews with village leaders and local government officials in Jinzhai County, China, we have explored in depth the four types of SEPAP and the stages of SEPAP's development. In addition, we have examined five issues associated with the implementation of SEPAP in Jinzhai County, including poor building quality and poor maintenance. We find that the local government has actively collaborated with both higher levels of government and poor households to solve some of these issues.

Secondly, we have conducted a cost-benefit analysis of SEPAP in the case study of Jinzhai County. Our results demonstrate that SEPAP has provided certain economic benefits to poor households from 2014 on. However, can the poverty alleviation effects be sustained over time as they depend on providing substantial government funding. By conducting a scenario analysis to compare SEPAP with ordinary solar power plants, we find that the poverty alleviation effects stemming from using solar power persist even without government subsidies. Nevertheless, in the midst of the Covid-19 period in 2020 and 2021, there was a rise in the initial cost, which resulted in a decrease in the net present value (NPV). Consequently, it is advisable to consider government subsidies for both the grid benchmark price and initial installation cost in future instances like this.

Thirdly, based on the results of 80 semi-structured interviews with professionals and poor households, we apply the Analytic Hierarchy Process (AHP) and the Fuzzy Comprehensive Evaluation Method (FCEM) to evaluate the sustainability of individual-level SEPAP in Jinzhai County, China. We find that the economic dimension is the most important, with income, employment, training of the poor, and solar panel quality as the most weighted sub-indicators. As a result of SEPAP, the income of poor households increased by around 2,700 yuan in 2021, which was 90% of the government's goals. We have also provided two policy recommendations for maintenance work that will assist the poor in keeping a stable income.

Finally, we discuss future solar energy development in rural areas in China and other developing countries. As for China, we suggest that policymakers should apply the agrivoltaics model and that policy regulations should be enforced with a consistent subsidy scheme in place. A hybrid business model should also be developed to promote future rural development.

As for other developing countries, it is important to recognize that there is no "one-size-fits-all" system, as SEPAP may not be suitable for other countries due to their unique local conditions. However, valuable lessons can be learned and adopted from SEPAP experiences. Firstly, it is necessary to identify all the poor households and understand their true needs. Then, rules and regulations must be established for program implementation. Furthermore, other poverty alleviation programs should be combined with the solar energy program in order to reduce the inherent disadvantages of the solar energy program.

（続紙 2）

（論文審査の結果の要旨）

　Jin君の博士学位論文は発展途上国における太陽光エネルギー導入による貧困削減効果という研究課題に貢献している。具体的に、彼が中国の金寨県において実施したアンケート調査や半構造化インタービューの結果に基づいて、中国の太陽光エネルギーを活用した貧困削減プログラム (以下、SEPAPと呼ぶ)を評価している。本論文の学術的な貢献は次の通りである。

(1) 中国の金寨県において四つのタイプのSEPAP（家計レベルSEPAPを含む）が実施されたが、Jin君が先行研究から明らかではなかったSEPAP実施中に生じた問題を具体的に取り上げ、こういった問題の解決に地方政府が果たした役割を明らかにした。

(2) SEPAPを評価するために、先行研究において費用対効果分析を活用する研究は多いが、Jin君は政府の補助金ありなしの二つのシナリオにおける費用対効果を比較している。その結果、政府の補助金なしの場合、彼はSEPAPの経済的効果は存続不可能だと実証的に示した。

(3) SEPAPの貧困層への影響を論じる際に、SEPAPの経済的効果を主張する先行研究は多いが、Jin君は階層分析法（AHP）とファジー総合評価法 (FCEM)を用いて五つの次元から家計レベルSEPAPの持続可能性評価を実施している。その結果、SEPAPの実施により社会的次元の指標（貧困層の教育やスキルのレベル）や環境次元の指標（化石燃料の利用、二酸化炭素排出量）が改善されないことがわかった。つまり、経済的効果はあるものの、サステナビリティの視点から見れば、SEPAPの評価が低くなるということである。

　また、本論文の主な内容（第4章と第6章）は査読付きの国際学術雑誌に公表されていることはその学術的貢献の高さを証明している。

　本論文は全体として高く評価できるが、いくつかの課題も残っている。例えば、中国においてSEPAPのみならず、ターゲットを絞った他の貧困削減プログラム (targeted poverty alleviation programs)も同時に実施されているため、SEPAPの効果の一部はこういったターゲットを絞った他の貧困削減プログラムによるものだと考えられるが、本論文では検討されていない。また、SEPAPの実施から得られる教訓はどれほど他の発展途上国に有用であるかについて本論文では記述はあるが、より具体的に検討すべきだと思われる。

　しかし、上述した課題は今後の研究課題であり、本論文の質を大きく損なうものではない。よって、本論文は博士（総合学術）の学位論文として価値あるものと認める。また、令和5年6月21日、論文内容とそれに関連した事項について試問した結果、合格と認めた。

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