東アジアバイオマスリサーチセンター	
題目	地域主導型スマートコミュニティの構築の海外展開に関する研究
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1. Background

This study approached the smart community establishment topic from two perspectives. First, from the bottom-up perspective where renewable energy technology is reused to improve the connectivity of an off-grid community. Second, from the top-down perspective where smart mobility technologies are reviewed for their readiness and distribution globally.

2. Research results in academic year 2022

(1) Demonstration of appropriate off-grid renewable energy system design.

We have established a guideline for designing a renewable energy system that is appropriate to the socio-economic conditions of off-grid communities (Fig. 1). Result for the case study in a palm-oil agricultural village in Indonesia showed that the cost of per kWH of electricity produced using the available renewable energy resource in the village is higher than the price cap introduced by the national electricity company. Therefore, it is important to exclude off-grid systems from such pricing restrictions. Furthermore, the guarantee of Feed-In-Tarrif monetization, and the integration of the energy system to the local economy is key for sustainability of the system.

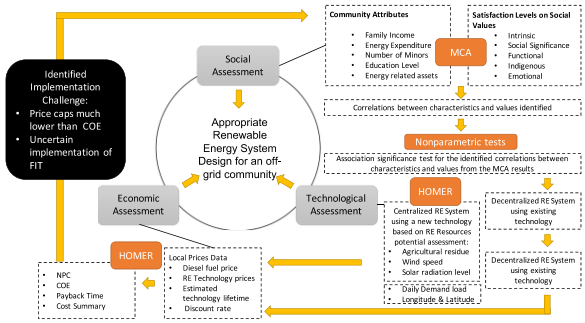

Fig. 1 Appropriate Renewable Energy System Design Process

(2) Case study of reusing solar panel to improve access to information and communication in an off-grid village.

To further demonstrate how energy system should be integrated to the needs of the local economic activities, we performed a Life Cycle Cost (LCC) analysis in the case study village in Kalimantan. The results show that other than under the pessimistic ratio where only 2 customers use the charging service, the proposed business model will reap positive benefit cost ratio (BCR). Furthermore, a net present value (NPV) of 8683.24 USD can be achieved by the optimistic scenario of 20 charging customers per day, and the payback period can be achieved within 4 months under the standard scenario.

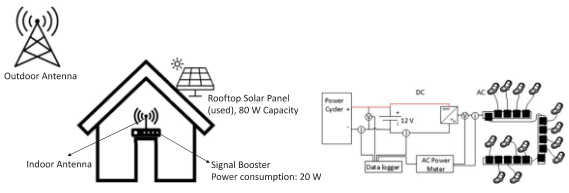

Fig. 2 Diagram of cellphone signal booster and charging station using reused solar panel

(3) Global distribution and readiness status of smart mobility technologies.

We map the distribution of smart mobility development projects in the world using Geographic Information System (GIS) and measure the readiness level using the Japan Technology Readiness Assessment (J-TRA) methodology. We found that the biggest number of projects is located in Europe (Fig.3). We also found that among the analyzed artificial intelligence (AI) uses in smart mobility technologies are the smart parking system and lane tracing assistance technologies have the highest level of readiness (Fig. 4). Further training of AI to be fully compatible with the real operating environments and updates of traffic policies are necessary to allow advancement of the technology readiness of the rest of smart mobility technology types.

Fig. 3 Global distribution on smart mobility technology development projects

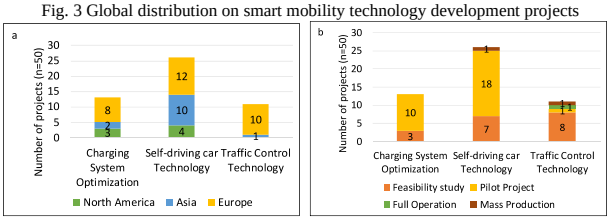

Fig. 4 Global smart mobility projects by (a) type (b) readiness level

3. Next year's research plan

As we have understood from our off-grid study, introducing a new technology must start from identifying the challenges and needs of the potential users. Therefore, in the next academic year (2023), we will look deeper into the users' challenges and needs in the area of autonomous vehicle and other automation technology such as contactless waste collection and separation.

4. Research Publications

1. (Scopus) Pandyaswargo, A. H., Maghfiroh, M. F. N., & Onoda, H. (2023). Global distribution and readiness status of artificial intelligence application on mobility projects. Energy Reports, 9, 720-727.
2. (Scopus) Pandyaswargo, A. H., Wibowo, A. D., & Onoda, H. (2022). Reusing solar panels to improve access to information and communication in an off-grid village: A financial feasibility assessment. Energy Reports, 8, 857-865.
3. (Scopus) Pandyaswargo, A. H., Maghfiroh, M. F. N., & Onoda, H. (2022, September). Readiness Status of Artificial Intelligence Applications on Electric Vehicles: A mini global review and analysis using the J-TRA method. In Proceedings of the 2022 International Conference on Engineering and Information Technology for Sustainable Industry (pp. 1-5).
4. (Scopus) Pandyaswargo, A. H., Wibowo, A. D., & Onoda, H. (2022). Socio-techno-economic assessment to design an appropriate renewable energy system for remote agricultural communities in developing countries. Sustainable Production and Consumption, 31, 492-511.
5. Pandyaswargo, A.H., Addressing Japanese Elderly Mobility Problems With Autonomous Vehicles. The 33rd JASID Annual Conference. 3 Dec 2022. (Online)
6. Pandyaswargo, A.H., Maghfiroh, M. F. N., & Onoda, H., Readiness Status of Artificial Intelligence Applications on Electric Vehicles: A mini global review and analysis using the J-TRA method. The 2022 International Conference on Engineering and Information Technology for Sustainable Industry. Serpong, Indonesia. 21 – 22 September 2022. (Online)
7. Pandyaswargo, A.H., Maghfiroh, M. F. N., Onoda, H., Global distribution and readiness status of artificial intelligence application on mobility projects 2022 9th International Conference on Power and Energy Systems Engineering (CPESE 2022), Doshisha University, Kyoto, Japan, 9–11 September 2022. (Online)
8. Wibowo, A. D., Pandyaswargo, A. H., Designining an appropriate renewable energy system for small-isolated islands communities. The 17th IRSA International Conference. Mataram, Lombok Island, Indonesia, 18 – 19 July 2022.
9. Pandyaswargo A.H., Wibowo, A.D., Onoda, H., Reusing solar panels to improve access to information and communication in an off-grid village: A financial feasibility assessment 2022 The 4th International Conference on Clean Energy and Electrical Systems (CEES 2022), Tokyo, Japan 2 – 4 April, 2022. (Online)