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Study of a Decentralized Electricity Market on Awaji Island

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Abstract : Over the last decades, new technologies have significantly changed the way information is transmitted and stored. Renewable energy sources have become prevalent and affordable. Cooperation of the Information and Communication Technology industry and Renewable Energy industry makes it possible to create a next generation, decentralized power grid. In this context, the study seeks to identify the wider benefits to the local Japanese economy as a result of the development of a decentralised electricity market. Our general approach aims to integrate an economic analysis (monetary appraisal of costs and benefits to society) with externalities that are not quantifiable in monetary terms (e.g. social impact, environmental impact). The study also highlights opportunities and sets out recommendations for the citizens of the island and the local government. The simulation is the scientific basis for economic impact analysis. Various types of sources of energy have been taken into account: residential wind farm, residential wind turbine, solar farm, residential solar panels and private solar farms. Analysis of local geographic and economic conditions allowed creating a customized business model. Very often farmers on Awaji Island are using crop cycle. During each cycle, one part of the field is resting and replenishing nutrients. In the next year another part of the field is resting. Portable solar panels could be freely set up in this part of the field. At the end of the crop cycle, portable solar panels would be moved to the next resting part. Because of spacious area, for a single household 500 square meters of portable solar panels has been proposed and simulated. The devised simulation shows that the Rate of Return on Investment for solar panels, which are on the island, could reach up to 37.21%. Supposing that about 20% of households install solar panels they could produce 49.11% of the electric energy consumed by households on the island. The analysis shows that rest of the energy supply can be produced by currently existing one huge solar farm and two wind farms to meet 97.59% of demand on electricity for households on the island. Although there are more than 7,000 agricultural fields on the island, young people tend to avoid agricultural work and prefer to move from the island to big cities, live there in little mansions and work until late night. The business model proposed in this study could increase farmer’s monthly income by ¥200,000 - ¥300,000 (1,600 euro – 2,400 euro). Young people could work less and have a higher standard of living than in a city. Creation of a decentralized electricity market can unlock significant benefits in other industries (e.g. electric vehicles), providing a welcome boost to economic growth, jobs and quality of life.

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