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Locally-led renewable energy implementation for energy system transition in Korea:

a case study of Jeju Special Administrative Province

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Abstract:

In recent the Republic of Korea formulated its national energy policy stance of phasing out nuclear and coal power whilst emphasizing the expansion of renewables through the transition to decentralized energy system. The Jeju province in Korea has been promoting self-energy system utilizing local rich natural resource such as wind and proposed an ambitious target to replace 100% of the power supply in Jeju Island with renewable energy through increasing residents' participation in the local energy business and boosting related local industry. Based on policy overviews and interviews with core stakeholders in Jeju province, this study aims to identify the characteristics of the policy and strategies of renewable energy promotion at a local level and further discusses the current challenges and barriers.

The initial projects of renewable energy in Jeju island have revealed several problems and issues in policy implementation and related business operation such as monopoly business by large corporations, outflow of profits, unfair utilization of natural resources, conflict between winner and looser groups in wind business among local residents, damage to the natural environment, and inexperienced administration in the proceedings process. However, as notable characteristics in promoting wind power business in Jeju are that, from the early lessons and experiences, it accepted the concept of publicization of wind resources institutionally and took measures to transfer the benefits generated by the power generation project to the local community and to ensure local industries to participate in the wind power projects.

The policy implications derived in this study can be drawn for public policies and initiatives in the future and applied for other regions in Korea in promoting the local-based energy transition.

Keywords: Carbon Free Island, Jeju special administrative province, Korea, Renewable energy

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1. Introduction

Under the climate regime and SDGs, there is more interest in energy transitions around the world moving forward to renewable energy than ever before. Related policies and measures for introducing and expanding renewable energy over the mid- and long term toward energy system transition are accelerating globally. Whereas many of the policy initiatives and negotiations relating to energy and climate change are being undertaken at the national and international levels, in parallel many leading cities and towns are making their own decisions concerning their energy destiny by engaging in local climate and sustainable energy action –and their movements are beginning to have an impact (IEA, 2009, Hoppe et al., 2015, Mans, 2012, Laihanen et al., 2016).

In similarly, a number of locally-centered renewable energy policy initiatives have launched in recent in the Republic of Korea (hereafter Korea), which is in line with the national energy policy stance of phasing out nuclear and coal power whilst emphasizing the energy system transition to a decentralized energy system and expansion of renewables. Among which, Jeju special administrative province (hereafter Jeju province) has been promoting self-energy system utilizing local rich natural resource such as wind and shown the ambitious renewable energy policy target and implementation through a 'Carbon Free Island 2030 (CFI2030)' project in 2012. CFI2030 aimed to replace 100% of the power supply in Jeju Island with renewable energy through boosting local business and industry operated by local residents, dissemination of electric vehicles, as well as self-promotion as a Smart Grid base.

Their advanced efforts and achievements aimed at a transition to renewable energy policy is expected to act as a model for other regions in Korea, but also an important reference source for Korea's energy conversion policy. Thus, overviewing the related policies and projects in Jeju, and revealing the characteristics and difficulties which it faces are meaningful, and the findings therefrom will be of high significance in making policy suggestions for Korea's renewable energy policy.

In this context, this study aims to identify the characteristics of the policy and strategies of renewable energy promotion at a local level and clarifies the roles of related major stakeholders as well as structure of their cooperation in promoting CFI2030, and further discusses remaining challenges and future directions. It is based on literature reviews and policy overview of public documentation as well as findings from interviews with core stakeholders in Jeju province which were carried out in August, 2017.

It is organised as follows. Section 2 presents an analytical framework, research method and a brief profile of target region, Jeju province. Section 3 provides an overview of the progress and status of renewable energy policies at the national and regional level in Korea. In Section 4, the analysis results based on the analytical framework, together with the overall structure of related stakeholders are discussed covering the characteristics, challenges, and future directions, which is then followed by Section 5 that describes conclusions and policy recommendations.

2. Method and Materials

2.1 Analytical framework

With focusing on the current status of Jeju's renewable energy policy, **Figure 1** depicts the analytical framework of this study. In analyzing the features of the region - led renewable energy introduction policy for Jeju province in Korea, four aspects, (1) motivation, (2) main renewable energy resource, (3) renewable energy introduction and diffusion type, and (4) key stakeholders were focused.

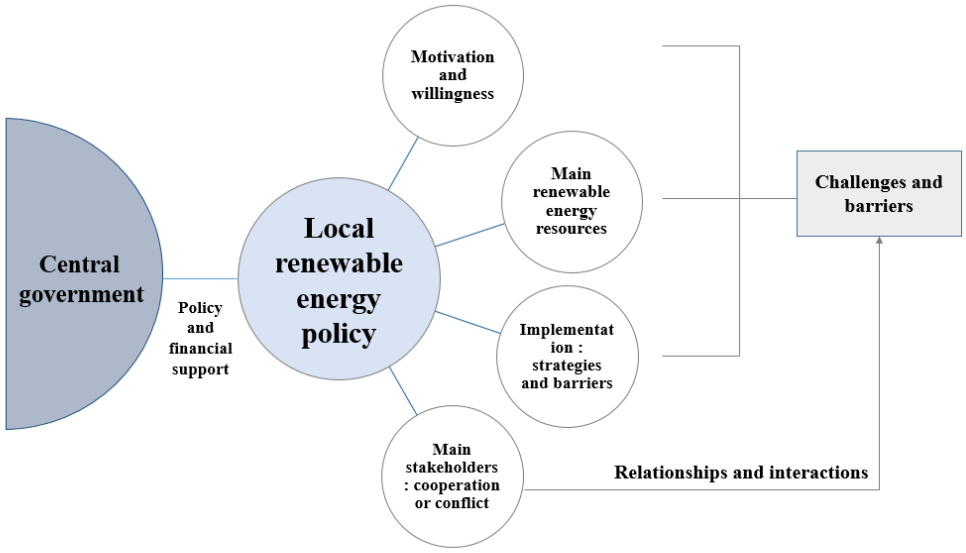


Figure 1 Analytical framework

Source: author depicted.

The motivation of introducing renewable energy in the region is related to its energy policy in past and present, supply-demand characteristics, and related issues facing the region. By overviewing these matters, the characteristics of renewable energy policies in the region were identified. The selection of renewable energy sources to be focused on renewable energy policy considers the abundant nature and the nature of infrastructure of existing industries in the region, which will affect the basis and further future policy direction in the expansion of renewable energy in that region. Therefore, it is important to understand what is considered as a source of attention energy.

The forms of renewable energy projects are likely to be grouped as mainly government-led policy projects, enterprise-led projects, and forms of civil society movements. This study revealed what type of business of renewable energy in Jeju Island. This study also identified key stakeholders related to Jeju's renewable energy policy and analyzed their roles and incentives as well as interactions, cooperation and conflicts among stakeholders.

Through the analysis of the above aspects, the features, obstacles and issues to the renewable energy policy in Jeju province were derived and discussed.

2.2 Research method

This paper is based on literature reviews of journal papers, research reports and public documentation, and policy overview of government related documents as well as on-site hearing with core stakeholders including Jeju local government, government affiliated organizations, local research institutes, and etc. in Jeju, as listed **Table 1**.

Table 1 Interviewee institutes

Institutes	Division
Jeju Provincial Government	Future Industry Division
Korea Electric Power Corporation (KEPCO)	Strategic Management Department
Jeju Techno Park	Policy planning team
Korea Federation for Environmental Movements	-
Jeju Research Institute	-
Jeju University	Electric Energy Research Center

2.3 Introduction of the target area: Jeju province

The Jeju Special Self-Governing Province is an administrative district including nine inhabited and 55 uninhabited islands. It is home for 669,328 as of July 2019 (Statistical information on MOIS home page). Jeju Island, the center of Jeju province, is located about 90 km south of the Korean Peninsula as shown **Figure 2** and the largest island of Korea with its size of area, 1,845 km^2 with about 70 km north-south and 35 km east-west (Jeju province homepage).

It is well known for its all-year warm climate, natural beauty and clean environment, which have earned designations of Biosphere Reserve in 2002, World Natural Heritage Site in 2007 and Global Geopark in 2010. As such, Jeju has now become a 'treasure island of environmental assets' of sorts, and one that needs preserving (Jeju province homepage). The main local industries are the primary industry of citrus and fisheries as well as tourism.

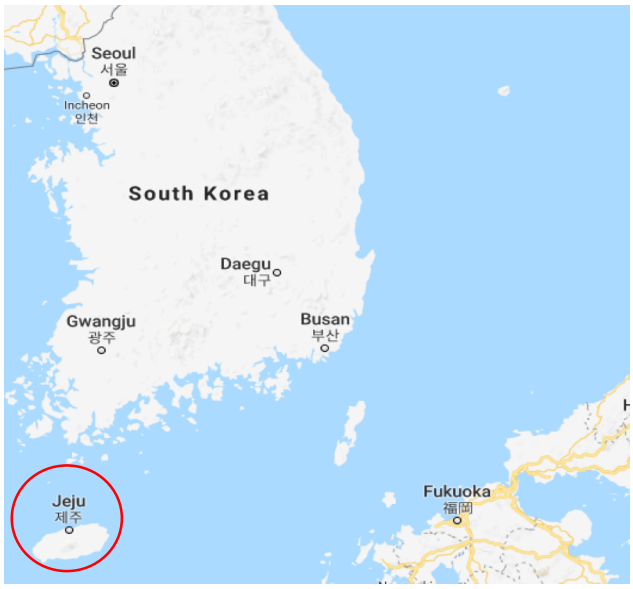


Figure 2 Location of Jeju province on Google map

3. Overview of Renewable Energy Policy in Korea

3.1 Latest national policy of renewable energy and its implementation status in Korea

(1) Renewable Energy 3020 Plan

The Moon Jae-in regime (2017-present) announced a turnaround in its energy policy which contains an innovative sketch of energy sector that seeks to move away from the nuclear and fossil fuel-based policies and transition to renewable energy sources. In details, by 2030 the country plans to increase its use of renewables up to 20 percent to the total power generation — around 12.5 percent increase from today's proportion which is only 7.6 percent (MOTIE and KEA, 2018).

As a practical task, 'Safe and Clean Energy Conversion by Decentralization Policy' was included in 'Tasks of the Top 100 National Agencies of the Five-Year Plan of the National Administration'. (National Planning and Advisory Committee. 2017). The government further plans to implement the measurement, i.e. subsidies to the renewable energy industry and taxes on coal and nuclear power. They are expected to help foster a clean energy industry by strengthening the systematic support for renewable energy industry, and link the energy industry to Korea's new growth engine in connection with the fourth industrial revolution (Policy Briefing, 2017).

(2) Renewable energy introduction status

In 2017, the total renewable energy supply of Korea amounted to 16,448,000 toes, up 16.0% from the previous year. In proportion to total primary energy, it accounted for 5.45%, slightly up from 4.81% in the previous year. The total cumulative capacity for renewable energy generation is 15,703 MW, and a total of 1,825 MW was newly installed in 2017, including 1,333 MW of photovoltaic power and 109 MW of wind power (MOTIE and KEA, 2018). This is only 1.01% of the world's installed capacity of 181 GW in the same year (REN21, 2019). In 2017, the total electricity generated by renewable energy is 43,868 GWh, an increase of 12.1% over the previous year. This corresponds to 7.6% of total electricity generated, a rise of 0.6% from 7.0% in the previous year (MOTIE and KEA, 2018).

In fact, renewable energy in Korea is increasing in proportion to the share of primary energy consumption and electricity production in recent years. However, both amount to less than 5-7.6%, which is insignificant compared to international flows. With regards a renewable energy percentage of total primary energy supply, Korea has showed the lowest figure among OECD countries in 2014 (OECD, 2016). Looking at renewable energy sources, the generation capacity is 51.2% by waste and 16.0% by biomass, which combined account for over 65% of the total amount of renewable energy. Next is solar power at 15.1%, followed by hydro power, at 6.0% (MOTIE and KEA, 2018).

3.2 Decentralized energy initiatives by municipal governments in Korea

In order to increase local resource independence, distributed energy systems are attempting to use renewable energy such as solar, wind, hydro, and geothermal which fit with local conditions instead of fossil and nuclear fuel, which mainly depended on imports.

According to the 8th Basic Plan for Long-term Electricity Supply and Demand in Korea, the proportion of distributed power supply is projected to increase from 12.2% of total power generation to 18.4% (about 120.9 TWh) in 2030. Of these, renewable energy is 76.4 TWh in total, accounting for 63% of total distributed power (MOTIE, 2017). Initiatives and projects in local level come in various forms. For example, as early as 2004, Daegu (a city with approx. population of 2.5 million) declared itself a 'solar city' and pledged to integrate renewable energy into city development (REN21, ISEP and ICLEI, 2009). In the City Declaration for Enucleation and Energy Conversion in 2012, 46 basic local governments participated. In 2013, Wanju-gun (a county with approx. population of 95 thousand) in Jeon-buk province announced its policy of 'transforming local energy' to pursue an energy policy model suitable for rural areas (e2new, 2017). In 2014, Dangjin (a city with approx. population 167 thousand), Nowon-gu (a district with approx. population of 570 thousand) and Gangdong-gu (a district with approx. population of 440 thousand) in Seoul metropolitan city organized a local government council with the aim of converting the national energy plan (e2new, 2017). In 2015, Inje-gun (a county with appox. population of 33 thousand) in Gangwon Province set a goal of 'energy independence in 2045. In November 2015, Seoul Metropolitan Government, Gyeonggi Province, Chungcheongnam-do and Jeju Special Self-Governing Province jointly announced a joint declaration for regional energy conversion (Yonhapnews, 2015). These four municipalities accounted for 49.2% of the nation's population in 2014 and 52% of the regional gross domestic product by 2013. In 2016, Ansan (a city with approx. population of 738 thousand) set a goal of "energy-independent city where citizens participate". Recently, Busan Metropolitan City (population of appox.3.5 million) announced its Clean Energy City policy (June 2017) (NEWSIS, 2017). The population of each municipality above in brackets is the data in 2017 and is shown to indicate the size of each municipality.

The concept of distributed energy system may differ country to country, but in general involves energy production facilities in the vicinity of energy consumption areas at relatively smaller scales than centralized systems. There have been various bottom-up initiatives (Shirai, 2018), or municipal-centered movements for energy decentralization and decentralized energy systems, from large cities to small and medium-size local governments. Decentralization energy in this study means a shift in paradigm to a regional-led energy system that overcomes the limits of centralized energy as well as leads to changes such as securing energy via renewables, which reduces climate change globally, avoids the potential for large-scale power outages across the nation, and promotes energy independence of localities from the central government.

4. Study results: characteristics and strategies of renewable energy implementation in Jeju Island

4.1 Motivation of renewable energy policy implementation and promotion

The main motivations for renewable energy policy in Jeju Island can be summarized with three aspects, (1) increasing energy demand due to population growth, (2) promotion local green industry and economy and (3) preservation of its clean environment. The details are described as below.

(1) Increasing energy demand in Jeju Island

Jeju Island's total power consumption was approximately 5,014 MWh in 2017 (KEEI, 2019). Over the past ten years, 2008-2017, the average annual power consumption growth rate is around 5% by year. The main reason for the increase in power consumption is population growth. The island's population in 2018 is about 667 thousand and, contrary to many other porcine, has been growing at a faster pace than the national average due to the rising influx of urban second-lifers desiring to live in a clean natural environment, as shown in **Figure 3**, and the increase in tourists.

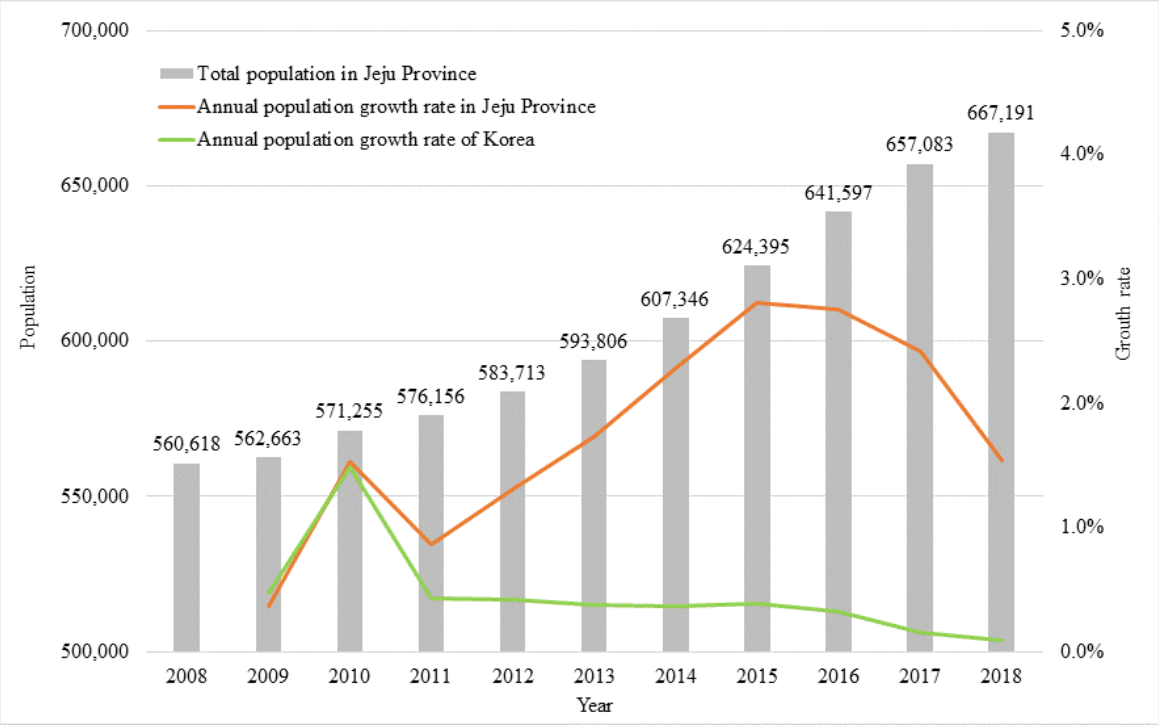


Figure 3 Recent total population trend and annual increase ratio of Jeju Island

(Source: depicted by the author based on MOIS statistic information)

Especially, tourist numbers visiting Jeju Island have soared in recent years due to relaxation of visa regulations for Chinese groups and individuals. In 2017, there were 14.8

million tourists, an increased 171.7% comparing with 2007 (Jeju government, 2018). Jeju government expects the number of annual tourists to reach 20 million by 2025 (Jeju government, 2016). As a result, the share of energy consumption in the commercial sector is the largest: 51%, 42%, and 7% for household and commerce sector, industrial sector, and public sector, respectively in 2015 (Jeju government, 2016). According to the 7th Electricity Supply and Demand Plan, the average annual electricity demand growth rate in Jeju is expected to be 2.5% by 2030, with total anticipated electric power consumption of 6,358 GWh in 2030 (Korean government, 2015). The island's total power generation capacity in 2016 was 1,272 MW, 31% of which was realized through purchase of nuclear power from the mainland. Another 46% came from a thermal power plant (590 MW) in Jeju Island. The remainder (22%) was generated by renewable energy in Jeju (Jeju government, 2016). In this situation, with emphasis on the self-sufficiency of energy and stimulation of the local economy and establishment of the infrastructure within the Jeju island, the Jeju government has prioritized energy policy focusing on renewable energy as a measure to response to population growth and increased energy demand.

(2) Promotion of local based green economy in Jeju Island

The renewable energy sector is expected to stimulate the local economy and become an increasingly important part of the green economy in Jeju, providing jobs of both quantity and quality on the island. The main local industries of Jeju Island are the primary industry of citrus and fisheries as well as tourism. The regional economy has been steadily growing since the 1970s, on the back of the rapid development of primary and tertiary industries. However, with the opening of the agricultural market in the 1990s, its agricultural competitiveness has weakened (The Bank of Korea, 2009). Under the agriculture-, forestry-, fishing-oriented industry, although self-employed and daily workers are easily employed and the employment rate is high compared to other regions in Korea, the quality of the employment is weakness since the manufacturing base is weak. The proportion of manufacturing is less than 3% in 2013, well below the figure for mainland Korea, 30% (The Bank of Korea, 2016). Therefore, Jeju government started to invest in the green economy to pursue of becoming a green Island in a bid to fight climate change in the form of carbon-neutral cities and funded research and development for companies in the province, while under the circumstance encouraging participation through a consortium of conglomerates and domestic companies participating in the wind power project from outside. To counter this trend, the Jeju government has made some progress in regional economic revitalization by introducing its first five-year plan of regional innovation development (2004-2008) which focused on four major strategic industries: tourism industry, environmentally-friendly agriculture and life industry, digital content industry, and health and beauty bio industries (The Bank of Korea, 2009).

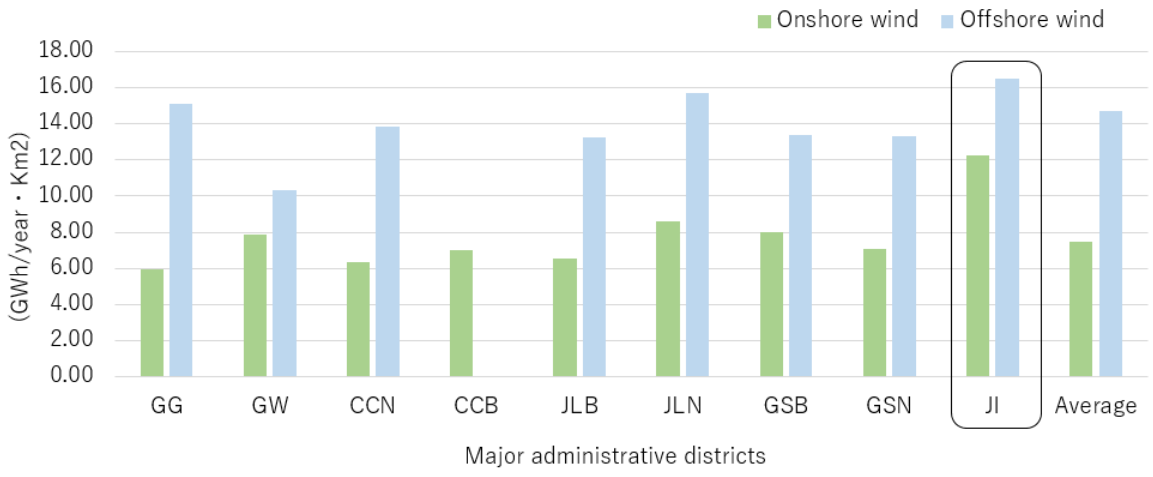
(3) Preservation of the beautiful natural environment

As mentioned early (section 2.3), the clean and beautiful natural environment of Jeju island is a great fame and pride of people in Jeju. With high responsibility, the Jeju government is expanding renewable energy as the best way to preserve the original nature while responding to growing energy needs and revitalizing local industry.

4.2 Main renewable energy resources in Jeju island

The wind power was the major source in Jeju at present. Jeju island goes by the name of 'Samdado', meaning "Island with many of the three, much wind, many stones, and many women". Especially, strong, gusty winds and typhoons were closely related to their culture and affected everyday life and agriculture, language, architecture (well secured thatch roofs to avoid damage from wind), farming style (stepped fields to avoid soil blowing away), shaman culture (serving the spirit of the wind) and natural ecology (branches that lean toward Mt. Halla due to the sea breeze) (Kim, 2008).

These intimate influences of wind on their lives was evolved into the concept of 'Publicization of wind resources' in business using wind, which is described in details in Section 4.3. The island has rich wind resources due to its geographically ideal conditions, as can be seen in **Figure 4**, the annual potential wind power electricity per total area that can be developed by major administrative districts in Korea is greatest in Jeju, both for on- and offshore (MOTIE and KEA, 2016).



GG: GyengGi-Province, GW: GangWon-Province, CCN: ChungChungNam-Province, CCB: ChungChung Buk-Province, JLB: JeonLaBu-Province, JLN: JeonLaNam-Province, GSB: GyengSangBuk-Province, GSN: GyengSangNam-Province, JI: Jeju-Province

Figure 4 Wind energy potential in Korea, by major province

(Depicted by the author based on data from (MOTIE and KEA, 2016))

As of 2017 approximately 270 MW of combined onshore (**Figure 5**) and offshore wind power wind farms had been installed and entered operation in Jeju Island (KEPCO, 2017a).

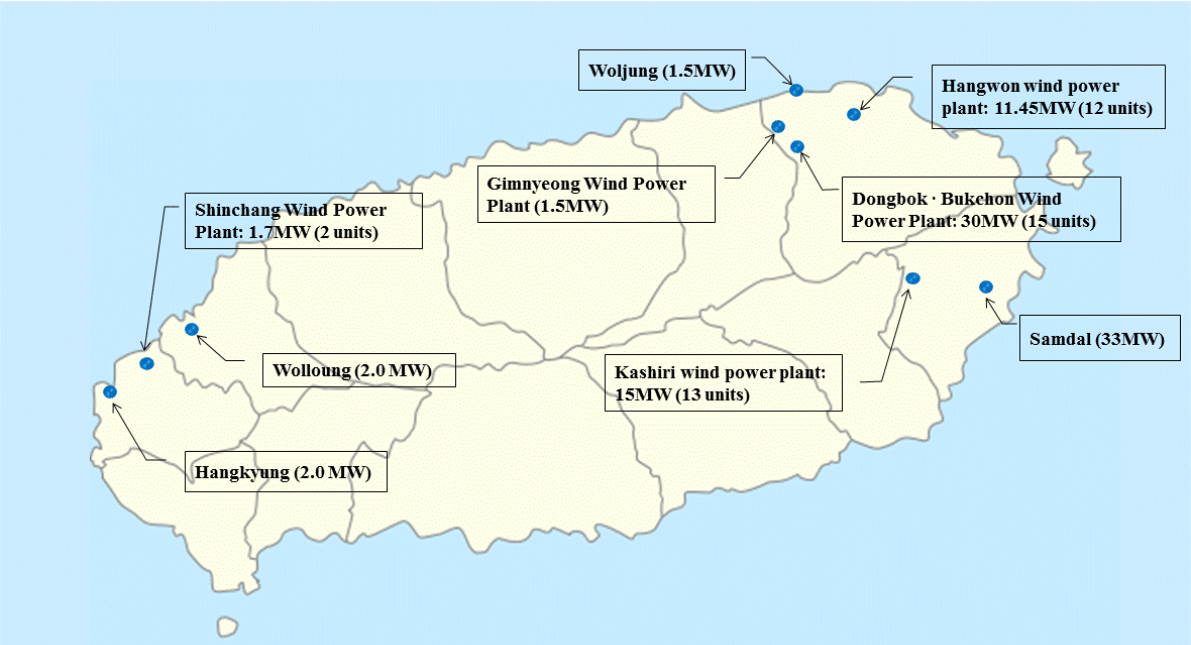


Figure 5 Status of onshore wind power installation in Jeju Island

(Depicted by the author based on information on Jeju Energy Corporation homepage)

4.3 Progress and lessons for the introduction of renewable energy in Jeju Island

(1) Wind power projects at the early stage

Jeju government has implemented wind power-related projects and initiatives since the 1970s. In 1975, Jeju Island implemented the first wind power project in Korea, a 3-kW wind turbine installation project. In 1998, the first commercial wind power enterprise (10 MW) commenced, in Hangwon, Jeju Island, and was supported by the central government as part of local renewable energy support (Jeju government, 2016). These wind power projects at the early stage revealed barriers and conflicts in promoting the related business in Jeju area. The issues mainly involved promoting business by large corporations, outflow of profits, unfair utilization of natural resources, conflict between winner and looser groups in wind business among local residents, damage to the natural environment, and inexperienced administration in the proceedings process.

In the early projects and business, the extent of conflicts over the construction of wind farms increased along with the size of the projects. The nature of the initial construction of the Jeju Island wind farm was no different from that of the developmental paradigm that prioritized economic growth and supply, *i.e.*, large scale, centralized, and at the forefront of

industrialization and urbanization of Korea. However, construction had a divisive effect on the residents, with some gaining and some suffering from the damage, according to their interests. Opposing groups formed a joint organization, called 'Jeju Island Anti-wind Association', which was totally opposed to the project. In particular, the Nanshan wind farm, which is promoted by Nansan-ri, has been in constant conflict with the local residents, which finally brought the project to a halt through a court order (October 10, 2007) invalidating the project's initial approval.

At the heart of the problem as to why the Jeju Provincial Administration failed to actively respond to the conflict was the lack of appropriate laws and regulations, as at that time, although wind power generation differed from existing thermal or nuclear power generation business, no statutes reflecting its characteristics existed. The operators were interested in maximizing profits and were preoccupied by the new business field of wind power generation. They focused on securing agreements with residents or landowners as to the location of the site, whilst also not taking into consideration the need to improve public awareness of the project.

(2) Carbon Free Island by 2030 in Jeju Island and Publicization of wind resources

The need for establishing a fundamental point of view for wind resources has emerged through the lessons of early business. As the alias of 'Samdado', there is such cultural history with strong wind, in which Jeju is intertwined with its ecology that has to be fully understood in the context of carrying out any business related to the wind and designing to make profit from the business (Kim, 2008). In order to resolve the above-mentioned socio-cultural conflicts as regards the use of wind resources, the civic groups in Jeju area suggested to publicize the wind resource. In response, Jeju government commissioned Jeju University to conduct a study on the approval of the Jeju-style wind power project and announced plans to establish publicazation of the wind resource in 2007. Accordingly, Article 221-2 of the 'Establishment of Jeju Special Self-Governing Province and the Development of Free International City' was revised on July 3, 2007, and obligates the approval standards and procedures for wind power projects to reflect the local characteristics of Jeju Island. Through this improvement of the legal system, the concept of wind public resources was applied to the wind power project, which was regarded as a positive step forward for existing regulations, which previously were not obligated to reflect the characteristics of wind power generation or the regional characteristics of Jeju Island (Ha, 2008).

In 2008, Jeju government announced the aim of its energy policy as increasing use of renewables (wind, solar, geothermal, biodiesel, bioethanol, biogas, etc.) to 20% in 2020 and to 50% in 2050. The plan was later revised and incorporated into 'Carbon Free island Jeju by 2030 (CFI2030)'. The vision for 'Carbon Free island Jeju by 2030 (CFI2030)' was announced in 2012 for 100% renewable energy and electric cars within the island by 2030. The meaning of 'Carbon Free' in 'Carbon-free Island' is close to 'Carbon neutral', meaning to build facilities

and produce electricity that can generate as much electricity by renewable energy as expected to be demanded in 2030 by maintaining existing thermal power plants at minimized operational level. CFI2030 was planned to be executed in three steps. The first step was a demonstration pilot project in Gapa Island, which which was an autonomous locally-led project aimed at 100% energy independence of an island, the first such instance in Korea and turned it into a laboratory for this ambitious initiative (refer to BOX 1). This project closed down in 2016. Details are given in Box 1. The second step targets a 50% share of renewable energy by 2020. The third step is for Jeju Island to achieve 100% renewable energy and become a world-class carbon free and green growth city by 2030 (Jeju government, 2016).

[BOX 1] Pilot project of Carbon Free Island Jeju: Gapa Island carbon free island

Gapa Island is an island area located south of Jeju, the power system of which is not connected with Jeju island. In accordance with the Electricity Supply Business Promotion Act for Rural Communities, this island received power from three 150 kw diesel generators using fossil fuel energy for about 200 households, education and industry (desalination facilities). Average power used per day was 119 kW (40-224 kW). On November 1, 2011 Jeju government announced the start of 'Gapado carbon zero island construction project', which was aimed at an energy self-sufficient island making use of wind power generators, photovoltaic generators and energy saving storage (ESS). Through this project, eco-friendly micro grids such as wind power generation, solar power generation, and energy storage system (ESS) were established. Total investment was 14.3 billion KRW (Korean Won). In 2012, a total of 28 million KRW out of the 37 million KRW provided by the wind power project joint venture business was distributed to 90 households of Gapa Island residents (300,000 won each) and the electricity usage fee after the introduction of renewable energy was decreased to 10%. As of 2017, the electricity used by 178 residents in Gapa is covered by two 250 kW wind turbines, a 3 kW solar panel installed at each house, and an ESS of 3.86 MWh, meaning that the average rate of energy independence of Gapa is about 54%, and many of the households still depend on diesel power generation (KEPCO, 2017b).

The CFI2030 project focused on promotion of three areas, power generation (achieving a renewable energy-based power system), transportation (electric vehicles as transportation means), and consumption (globalized smart grid in Jeju Island). Details of each area are given below.

[BOX 2] CFI2030 project

Smart grid test-bed

Korea's government created a smart grid demonstration complex in Jeju Island in 2008 and experimented with establishing a supply network that connects existing power plants with renewable energy such as wind power and solar power. In 2009 at the Italian G8 Summit, Korea stated it would shoulder the responsibility of fostering smart grid technologies. Not long after, Jeju Island was designated as a Smart Grid Test-Bed. With an investment of 240 billion KRW (208 million USD), facilities were built in Guwja-eup, Jeju City, with the purpose of testing, developing, and producing Smart Grid technologies (KEPCO, 2017a). Building on this experience, under CFI2030 supporting smart grid technology, developing business models and commercializing the technology, Jeju government planned to build the world's largest smart grid community.

Wind and solar power for the island

Table 2 indicates the renewable energy mix plan for Jeju Island by 2030. Jeju plans to extend the total power generation capability of renewable energy up to 4,311 MW by 2030, including offshore wind power generation (1,900 MW), onshore wind power (450 MW) and solar power generation (1,411 MW). Utility companies are obligated to install ESS (Energy Storage System Energy Storage), which can store 10% of the generation capacity (Jeju Energy Corporation, 2016).

Table 2 Expansion of new and renewable energy supply: Generation Plan (2030)

Category		Facility Size (MW)		Generation (GWh)		Remarks
Total		4,311		12,982		100%
Wind power	Terrestrial	2,350	450	6,605	946	51%
	Marine		1,900		5,659	
Photovoltaics		1,411		1,854		14%
Fuel cell		520		4,523	4,327	35%
Geothermal		10			79	
Marine energy		10			35	
Bio energy		10			82	

Source: recited from Kim, 2016a

Zero emission mobility: promoting electric vehicles

In 2011, Jeju was selected as the leading model cities designated by Korea for electric vehicle distribution (MOE, 2011). As of May 2017, the number of registered electric vehicles in Jeju Island was 7,040, or 2% of the cars registered. According to the CFI2030 driving roadmap, 40% of the cars in the city, including city buses, will be converted to electric by 2020 and the number of cars will be increased to 209,000 in 2025. By 2030, all 377,000 cars on the island will have been replaced with electric cars. At the same time, about 15,000 rapid-charging stations will have been installed by 2030 from the current mere 79 stations. Subsidies for EVs will be available for residents as well as an EV battery lease program (Jeju government, 2016).

Jeju government has announced sub-plans of CFI2030 in succession, i.e., 'Global eco platform Jeju (land wind power increased from 350 to 459 MW)', 'Green Big Bang project', 'Public-led wind power investment promotion plan', 'Basic plan of solar power supply business leading to income of the province'. These individual plans have been set up consistent with the CFI2030 plan and will be reflected upon achieving CFI2030 (Kim, 2016b). The project is expected to cost 6 trillion KRW (5.4 billion USD) in total (The Korea Herald, 2015), provide a ripple effect of generating 13.5 trillion KRW (11.6 billion USD) for the province, and directly bring in 5.8 trillion KRW (5 billion USD) annually (The Jeju Weekly, 2012). Achievement of the CFI2030 project is expected to bring about a 50.6% (about 2.98 million tons) reduction in GHG emissions from an estimated 5.68 million tons (projected based on BAU 61% compared to 2013; or a 3.53 million ton increase since 2013) (Jeju government, 2016). The Bank of Korea (2016) estimated that the added value of CFI roadmap will be about 853.8 billion won by 2030. The government also anticipated that Jeju residents will obtain proliferation through CFI2030.

In accordance with the publicization policy of wind resources described above, the Jeju government established the Energy Corporation, a locally-owned company that is directly operated by local government to increase fairness and work efficiency, which supervises the wind power business and enables the participation of private businesses and local residents. For the high-tech big budget offshore wind power projects, private companies other than Jeju Island, mainly major domestic large companies, are able to participate through forming consortiums with local companies in Jeju as a form of Special Corporation. They are required to feedback a portion of the profits of the net profit generated by the business to the ‘wind resource sharing fund’ specified in the Ordinance (Wind Resource Sharing Fund Ordinance) enacted by Jeju local government in 2016. This fund is to be used for contributing to local energy self-reliance (encouraging the development, use and promotion of renewable energy) and energy welfare

projects (support for vulnerable groups) in Jeju. In 2016, a total of 5.6 billion KRW was collected from four power generation companies. Onshore wind power projects are being promoted in the form of private participatory wind power projects, in which local residents as a community unit and private wind power providers conduct co-ventures. The community provides the land, called 'designated wind power district', to the private power providers and receives a certain amount of profit per wind turbine installed. This amount is usually higher than the published land price. The related community is also permitted to generate revenue by installing a small wind turbine of 3 kW or less on the same site. There are currently three wind power districts in Jeju Island. As revealed in an interview, due to the positive effect on the financial independence of the village, it is competitive in attracting wind power business districts in Jeju, which can be understood by the mantra it has adopted: "Yes In My Front Yard". Although wind power is a business that requires large-scale capital and superior technological knowhow, and participation of large corporations is inevitable, the Jeju government has set up a system for citizen participation. However, it is necessary to improve the system design and operation mode in order to prompt initiative from the residents. Specifically, it has been pointed out that the current public-led initiative to promote wind power investment is biased to benefit large-scale operators. In other words, on the face of it, it may appear as a business run by a village, but in actuality is a big win for private enterprise, which receives most of the profit. On the other hand, low awareness and participation of the citizens are also pointed out as important obstacles. A fully green and environment-friendly energy conversion in Jeju will only occur if citizens are more active in policy processes and can separate themselves from thinking based on government initiatives.

4.4 Stakeholders' role and cooperation structure

The local process, which is led by local governments, requires the involvement of many stakeholders: business and industry, citizens, and non-profit organisations (Staden, M., 2017). The CFI2030 of Jeju Island has been promoted in close cooperation with the central government, related organizations, research institutes, committees and civic groups. The relevant groups and their respective roles are shown in **Table 3**.

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Table 3 Relevant stakeholders and their roles in renewable energy policy in Jeju Province

Stakeholders			Roles
Government	Central	Office for Government Policy Coordination Prime Minister's Secretariat; Ministry of Commerce, Industry and Energy	· Establishing policy on strengthening decentralization of local government; · Establishing local government financial independence policy; · Transferring authority on local government energy policy; · Financial supporting
	Local	Future Industry Division of Jeju Provincial Government	· Establishing and implementing a comprehensive plan for renewable energy; · Promoting public management of wind resources and its profits
Energy company		Korea Electric Power Corporation (KEPCO); Korea Power Exchange (KRX); Jeju Energy Corporation; Power generation company	· Supporting system improvement and infrastructure construction; · Initiating public-led new and renewable energy projects; · Promoting social contribution projects
Research institute		Jeju university (Electric Energy Research Center); Jeju techno park; Jeju research institute	·Providing policy suggestions and recommendations through studies on business strategies of renewable energy and technology development
Committees		Wind Power Project Review Committee; Wind Resource Sharing Fund Management Review Committee; Jeju Green Big Bang Promotion Committee	· Addressing efficient utilization of wind resources; · Finding business models for CFI specification; · Providing policy comments to secure publicity and legitimacy of new and renewable energy
Civic groups		Korea Federation for Environmental Movements	· Collecting opinions from citizens; · Making policy suggestions

Source: produced by the author

The main relevant ***central government department*** *is* the State Planning and Coordination Department in the Ministry of Industry and Resources, which acts as the control tower and provides policy and financial support. The Future Industry Division of ***Jeju Provincial Government*** oversees the renewable energy related business, and consisted of around 19 persons in four sub-teams as of August 2017. Its major tasks are establishment and implementation of a comprehensive renewable energy plan, wind power generation plan, solar energy plan, as well as public management of wind resources and benefit sharing. ***Jeju Energy Corporation*** was established in 2012 to systematically manage the renewable energy business and is mainly engaged in offshore wind power business. ***Techno Park*** is concerned with projects supplying electric vehicles and charging stations, and in particular promoting and supporting industries related to renewable energy. These are the major bodies working for local business initiatives related to renewable energy. Several civic groups have also been involved in Jeju area. In particular, ***Korea Federation for Environmental Movements of Jeju*** area has been engaged in investigating environmental impacts due to the installation of wind turbines,

and has made policy recommendations and suggestions reflecting resident opinions thereon. Notably, as well as making a statement concerned with the publicization of wind resources in Jeju in 2008, they suggested to forming policy on public management of wind resources in promoting wind power business. In response, the local government established the value of wind as a resource and declared it a public resource in 2011 via stipulation in an ordinance, the Jeju Special Law. ***Korea Electric Power Corporation Jeju region*** and ***Korea Power Exchange Corporation***, those who are related to energy generation, transmission and distribution companies in Korea, support system improvement, infrastructure construction, public-led renewable energy business, and social contribution project as the CFI support council together with the power generation company, private experts and the central government. Local research institutes, ***Jeju University and Jeju Research Institute,*** carried out studies to develop the business model of renewable energy and are playing a role as the center of technological innovation to support local industries.

The following **Figure 6** depicts the overall structure of cooperation systems of related organizations in promoting renewable energy project in Jeju.

This structure has been tided by several sub groups considering their function, roles, and relationship. ***CFI2030 support council*** including central government, Power Company. Korea power exchange, Korea electric power corporation and private experts. In February 2017, a ***Task Force (TF)*** was formed to support CFI 2030, which included Jeju Provincial Office, Korea Electric Power Corporation, Power Exchange, Jeju University, Jeju University, and Energy Corporation. The ***gray oblong*** is grouped with Jeju energy corporate, techno part, external companies and local companies, which interacts for fostering local industry in the form of consortium with large companies with supporting Jeju Energy Company and Techno Park. As mentioned early, Jeju energy corporate strategically established and engages in offshore wind power business and support local company. Meanwhile, a structure for returning profits to the region and encouraging local residents to participate in the project is established, which is emphasized by the ***red oblong***. The Jeju government enacted the ordinance and enforced this structure, which raise the fund sourced from part of the profits returned by private companies participating. Three Committees, 'Wind Power Project Review Committee', 'Wind Resource Sharing Fund Management Review Committee', and 'Jeju Green Big Bang Promotion Committee' are involved in the operation of this fund by establishing a fund management plan. They also deliberate on ways to utilize wind energy resources efficiently, propose policy models to secure publicity and legitimacy of new and renewable energy, suggest business models under the CFI2030. Local residents directly participate in the project leading the onshore wind power project and indirectly through lending the land to the wind power projects of the outside companies that get revenue. These was embodied in the public-initiated wind power development investment promotion plan announced in September 2015. In the expansion of renewable energy in the Jeju region, there is a slight difference in the viewpoints and strategies among the related organizations and institutions in the following three perspectives, leading by

the government of Jeju under the support of the central government, attracting more large companies, or expanding business by local residents in a small scale. Ultimately, however, the goal of expanding the opportunities for local residents to participate in the project and maximizing the return of the profits of the project, thereby fostering the infrastructure industry and improving the quality of life, was emphasized in common.

4.5 Barriers and issues: Energy self-government and energy democratization

With regards to the climate change policy, local governments have been expected to become more involved in policy-making by undertaking strategic planning; formulating, approving and implementing appropriate policies; evaluating their effectiveness; and disseminating successful actions replicable elsewhere (IEA, 2009).

In Korea, since the introduction of the local autonomy system in 1995, energy policy has been implemented at the local level, but the authority of the local government to enforce energy policy is limited at present. The central government has concentrated on demand management, supply forecasting, and budgeting under the centralized, large-scale, country-based plan. Municipalities are in a position to carry out the duties delegated by the central government that support the national plan by relying on subsidies.

However, local energy projects promoted by municipalities have weak autonomy and financial standing, and have seen little progress as a result of their inefficient business model. This situation was considered as the primary barrier for local government to initiate and expand regional-level distributed renewable energy business. This makes the case of Jeju government highly pertinent, since it is the sole local government to secure authorization and permission to promote and expand its wind power business in the province. Its provincial location offers certain advantages vis-a-vis other business locations, whether in terms of economic, geographic or other factors, which provides a basis for growth (University of Amsterdam and ICLEI, 2012).

Jeju Island saw its isolated location as an opportunity, which underscored its need to promote energy self-government. In addition, the CFI2030 policy has been pursued as an opportunity to construct a distributed energy conversion model through the role of a test bed. Several leading and progressive cities and towns have already taken innovative decisions to enhance the deployment and use of renewable energy resources within their geographic boundaries (IEA, 2009).

In Korea, energy plans, such as the basic plan for power supply and demand that affects the region, necessitates local participation from the ground up. In policy implementation, it is desirable to transfer existing centralized energy policy authority to local governments. Transitioning to a decentralized energy system does not simply imply a switch in energy sources—it also means devolving authority as a comprehensive governance entity, including political, financial and administrative responsibilities.

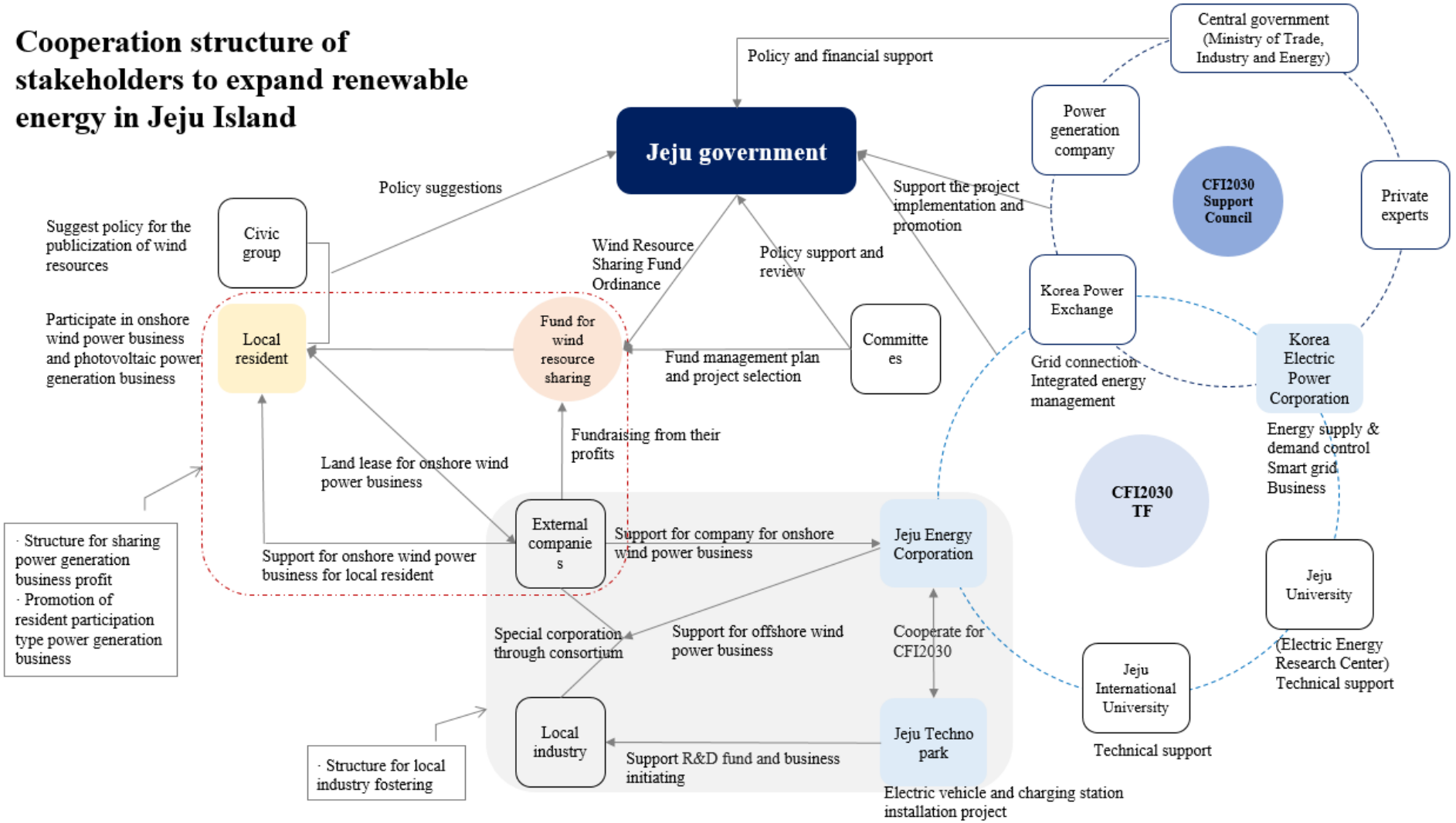

Figure 6 Structure of cooperation system of stakeholders for renewable energy policy

(Source: depicted by the author)

5. Summary and Conclusion

Jeju island is the largest island belonging to the Korean peninsula and is home to 600 thousand people. While 40% of its energy is supplied from inland, Jeju is recently having to face increasing energy demand due to the surge in tourist numbers as well as domestic population inflow. Sustainable energy is a key policy priority, as is maintaining a clean environment. Therefore, the Jeju government has declared the 'CFI2030'and pursue to fulfill total energy requirements by using 100% renewable energy by 2030. This project is expected to contribute to carbon reduction at the national level using renewable energy, while accruing success stories in energy-related new industry through expanding the electric automobile industry, expansion of the demand management infrastructure, as well as for creating eco-friendly ICT (Information and Communication)-literate smart customers, which in sum total act as a very good precedent for local decentralized energy strategy in Korea.

Although many local governments tend to follow early innovators rather than lead, in promoting renewable energy business, Jeju local governments have taken a lead role, under central government support, and carried out several wind power projects, including a demonstration project on a smaller island by overseeing the design, investment and monitoring. Jeju government has endeavored to develop energy policies democratically, such as by raising the number of residents in the wind power industry, establishment of related public institutions, and establishment of a cooperation framework between related organizations. It is noteworthy that the government enacted the special laws and ordinances to publicize wind resource and share its profits with the island by encouraging resident participation in business. Meanwhile, considering the characteristics of large-scale capital and technology-related wind power projects, the government has tried to attract companies with technology and capital, whilst also preventing capital outflows and ensuring local business side can participate. Such systematic efforts on the part of the government will no doubt lead to the discovery of industries that can incorporate local characteristics into their business strategy.

Nevertheless, it seems that there is still room for improvement in terms of how participation occurs. The renewable energy policy of Jeju focused especially on is wind power, and securing large-scale offshore wind technology is likely to be the key to realize the CFI2030 policy, while the use of other renewable energy sources is extremely limited. On the other hand, expansion and support of small-scale projects, such as photovoltaics, might help in terms of circulating profits using local-led businesses.

As regards the CFI 2030 plan, criticism has been raised at the fact that the project only focuses on expanding renewable energy facilities and capacity (Environmental Movement Alliance, 2016). However, the government may need to consider utilizing a mix of energy sources through identifying the potential of other natural energy resources and emphasizing energy saving and efficiency improvement, which the current policy makes no mention of.

More active policy promoting, related information providing, and set a training and education ground citizen is needed. Through this, local residents can be made aware of related policies, made efforts for better energy performance and more be encouraged to participate on the local energy business side.

Valuable lessons can be learnt from the achievements and failures of Jeju Island; particularly in respect of bottom-up processes that are also linked at the national and international level. Local authorities can serve as actual agents of change rather than just as vehicles to implement top-down policies from national governments. They should design their own policy in accordance with their situation and needs of local constituents in the consistent way with local policy priorities by utilizing local renewable energy resources, which will find solutions to deal with climate change. Thus, Korea's government needs to stimulate actions at the local government level in order to fully integrate renewable energy into its decentralization strategies. It needs to provide a supportive, enabling national framework for the energy business to work with through use of local decision-making processes and implementation to bring about immediate, impactful and assured action.

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