A Collaboration Model for Demand-driven Rural Energy Transition

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Background
1. Background

Local Challenges
- Depopulation
- Outmigration
- Low Birth Rate
- Stagnant Agricultural Production & Rural Development

Global Challenges
- Climate Crisis
- The Upcoming End of Fossil Fuel Subsidy Scheme
- Highly Competitive Market Condition
1. Background

Purpose of the Collaborative Model

✓ Suggest Energy Transition as a Regional Regeneration Strategy
✓ Clarify the Pathways of Rural Decarbonization
✓ Conduct a Pilot Project
Energy Consumption and the Challenges
2.1 Energy Consumption Status

Energy Consumption in Rural Areas

In rural areas, oil and electricity are the most used final energy sources. Oil’s role in rural area is the electricity’s and gas’s role in urban area.

• In rural areas, usage of gas is very low.
• For renewables, the difference is not significant due to low use in both the overall and rural areas.
• It means that there is a need to replace oil-dominated sectors in rural areas with carbon-neutral fuels.
2.2 Experts’ Opinion

Experts Survey says...

Q. **Primary Renewable Energy Sources**

What are the most important renewable energy sources in rural areas to achieve the 2050 net-zero goal?

- **Photovoltaics**: 78%
- **Biomass**: 16%
- **Wind power**: 3%
- **Hydrogen**: 3%
2.2 Experts’ Opinion

Experts Survey says...

Q. **Energy Demand Prospects**

Experts’ Opinion on Rural energy demand will be increased (or decreased) in 2050 compared to today.
2.2 Experts’ Opinion

Q. **Fuel Transition**
Which energy sources should be the first to be replaced to achieve carbon neutrality in rural areas?

- Petroleum: 6%
- Renewable: 19%
- Thermal (District Heating): 72%
- Electricity: 3%

Q. **Efficiency Enhancement**
What are the most efficient measures to reduce rural energy demand?

- Electrification of Agricultural Machinery: 38%
- Supplying High Efficiency Heating Equipment: 34%
- Improving Building Insulation: 25%
- Replacing Fossil Fuel: 3%
Collaborative Model
3.1 Challenge and Response

Needs of the Rural Community?

- Improve Quality of Life
- Reduce of Stench and Emissions
- Create Jobs
- Response to Climate Crisis

By Transforming of their Energy Systems

Engagement Process

Innovative Solutions
3.2 Collaborative Model

Collaborative Model is made of

- Process Model
- Energy System Model
- Business Model
3.2 Collaborative Model

Building Up the Process Model

1. Addressing Local Community Challenges
2. Engaging Stakeholders (Planners, Residents, Decision Makers, Investors)
3. Developing an Energy Transition Strategy to Address Local Challenges
4. Action Planning
5. Identifying Solutions
6. Implementing Strategies
7. Securing Financing
8. Obtaining Feedback
3.2 Collaborative Model

Energy System Model Scheme
### 3.2 Collaborative Model

#### Business Model

**Production**
- Electricity (SolarPV/CHP)
- Heating/Cooling (CHP/Biogas)
- Fuel (Bio Methane/Biogas)

**Type of Business**
- Power Generation
- Vehicle/Gas Charging
- V2G
- Demand Response
- Data Analysis
- VPP
- ...

**Payoff**
- Electricity Price +REC
- Carbon Credit Value
- Fuel Price

*REC : Renewable Energy Certificate*
3.3 Case Study

Current Status

**Location**

Hongseong-gun:
Pop. 97,721 (2024)
Area 443.97km²

Gyeolseong-myeon:
Pop. 2,000
Area 29.15km²

**Population & Area**

**Livestock**

Pig: >620,000

**Energy System**

- **Electricity:** Accessed to National Power Grid
- **Heating:** Not accessed to City Gas Grid
  Primarily uses Propane
- **Fuel:** Gasoline and Diesel
3.3 Case Study
3.3 Case Study

Process Model – Role of Actors “Who should be involved”

- **Planner**
  - RDA
  - E&S
  - Sungwoo Swine Farm

- **Decision Maker**
  - MAFRA
  - Municipality

- **Investor**
  - Sungwoo Swine Farm
  - Tractor Company
  - Gen Co.

- **Local Actors**
  - Municipality
  - Residents
  - Sungwoo Swine Farm

- **Sungwoo Swine Farm**
  - Tractor Company
  - Gen Co.

- **Residents**

- **Local Actors**
3.3 Case Study

Energy System Model + Business Model

**Supply (Production):**
- Biogas/Bio Methane
- Solid Biomass
- Community Solar

**Community Demand:**
- Fuel for Machinery (Tractor)
- Fuel for Heating
- Electricity

**Return on Investment:**
- Fuel Sale Payment
- Carbon Credit Value
- Electricity Sale Payment + REC Payment

**Market Value:**
- Avoiding Stench from Swine Farm
- Reduce Water Pollution from Livestock
- Stench Reduction
- Water Quality Improvement
Conclusion
4. Conclusion

1. Rural Energy Transition Needs to Response to the Community Demand

2. A Collaborative Model Includes Participatory Approaches, Climate Solutions, and Proper Business Models

3. Planners Can Help the Community Find Solutions with their Experiences

4. However, without Engagement of the Community, the Solutions will almost certainly not be Implemented later
THANK YOU!