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Utilizing Biochar Potential in Nganjuk Regency: Reducing Climate Change Effects and Enhancing Rural-Urban Linkage through Low Carbon Green Growth Program (Lesson Learned from Kameoka City, Japan)

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Abstract

Climate change is a global issue that all governments have to encounter nowadays. In recent years, many governments are aware of the environmental issues necessary to agenda setting in their development objectives. Sustainable Development Goals (SDGs) conducted by the United Nations gives guidelines for the governments to integrate both economic and environmental issues in a sustainable development framework. Meanwhile, the rural development has also become a global agenda in reducing the disparity between urban and rural areas. Many governments have conducted development strategies for ensuring economic prosperity along with ecological sustainability, yet for generating rural-urban equality as well. Low Carbon Green Growth Program is one of the strategies aimed to meet those objectives. The main purpose of the program is to reduce carbon dioxide emission to minimize the effects of greenhouse gasses (GHGs) as the main cause of climate change and global warming. An immediate action useful to implement the program is managing and utilizing biochar in agricultural process. Previous studies have proved that the biochar reduces CO_2 emission and also restores soil fertility. One of the best applicable Low Carbon Green Growth Programs might be the pilot project conducted in Kameoka City of Japan called The Carbon Minus Project. The project's main purpose is to reduce carbon emission by promoting a low-carbon lifestyle, yet economically profitable. Nganjuk Regency generates abundant biomass from agriculture products, livestock, plantation, and forestry. The solid biomass can be converted into biochar through a pyrolysis process. The result of this study is expected to be taken into consideration by the local governments to promote low carbon lifestyle, to combat climate change, and yet to reduce the rural-urban disparity.

Keywords: biochar; climate change; low carbon green growth program; SDGs

1. Introduction

The development process is always facing both economic and environmental issues. Until the end of 20th century, economic issues such as economic growth, poverty eradication, and rural-urban disparity reduction were mostly regarded as development objectives. On the other side, environmental issues such as climate change, greenhouse effect, and soil degradation were often being neglected in the common development objectives. Today, many governments are aware of the environmental issues, making them more important in the formulation of development objectives. The United Nations has declared Sustainable Development Goals (SDGs) as a guideline for every government to deal with both economic objectives and environmental sustainability, creating policymakers' viewpoint change to balance multiple challenges such as economic condition, social, and environmental risk and the uncertainty (Santucci, 2011).

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SDGs aims to take immediate action for combating climate change and its impacts. More specifically, the targets of SDGs focus on the integration of climate change measures into national policies, which is derived into local government policies, the improvement of education and awareness-raising for climate change and its impacts, and the enforcement of institutional capacity on climate change mitigation, adaptation, impact reduction and early warnings. Meanwhile, rural development has become a global agenda to reduce the disparity between urban and rural areas (UN-Habitat, 2016). The rural development aims to increase food production sustainably and enhance food security, which involves education initiatives, utilization of economic incentives, and the development of appropriate and new technologies. The rural development can also ensure stable supplies of nutritionally adequate food, access to those supplies by vulnerable groups, and production for markets; employment and income generation to alleviate poverty; and natural resource management and environmental protection (United Nations, 2016).

Many governments have conducted strategies to ensure the synchronization between economic and sustainable developments such as Green Economy, Low Carbon Green Growth and Carbon Minus Project. All those efforts aim to create a balance in both economic and environmental aspects; to generate equality between rural and urban areas; and also, to achieve sustainable development.

Green Growth is one of the strategies to achieve sustainable development that focuses on greening conventional economic systems and developing a green economy, where economic prosperity can be achieved together with ecological sustainability. The United Nations Economic and Social Commission for Asia and the Pacific (UN-ESCAP), issued the Low Carbon Green Growth roadmap (Santucci, 2011), as follows:

1. shifting from quantity to quality of growth;
2. integrating ecological prices;
3. promoting sustainable infrastructure;
4. turning ‘green’ into a business opportunity; and
5. promoting low carbon economies.

2. Carbon Minus Project in Kameoka City, Japan

One of the best applicable Low Carbon Green Growth Program might be the pilot project conducted in Kameoka City of Japan called the Carbon Minus Project. The project’s main purpose was to reduce carbon emission by promoting a low-carbon lifestyle, yet economically profitable. The project started in 2008 through a partnership between Ritsumeikan University, Kameoka City Government, and Hozu Farming Cooperative.

The scheme of Carbon Minus Project was applied in both rural and urban areas. In the rural area, the project focused on biochar and agricultural production process. Meanwhile, in an urban area, the project focused on eco-branding products sales and marketing.

The biochar and agricultural production system was quite simple: local biomass from bamboo was charred, applied to the soils and, in the process, carbon was sequestered in the ground. Agro-industries, especially organic manure industries, played an important role in this process as their products were bought by farmers and mixed with biochar to grow the organic crop. The soil then was planted with vegetables which were uniquely branded as eco-branding products called CoolVegeTM, as they helped to mitigate global warming (McGreevy & Shibata, 2010).

Figure 1. Biochar Making Process
(Source: McGreevy & Shibata, 2010 and Site Observation, 2016)

Figure 1 shows how to make biochar easily. Bamboos and woods were appropriate feedstock to make good biochar. The making of biochar applied pyrolysis. The feedstock was put into a kiln with the slope-sided ring and burned with less oxygen mechanism, left to carbonize, and then doused with water. Once the biochar produced, it was transported to a composting facility within the hamlet, mixed with manure and rice husks, left to mature, and then became slightly fermented composts. The composts were then applied to agricultural fields and planted with vegetables. CO_2-capped corporations were responsible for purchasing the emission-offset credits to comply with emission reduction commitments. Those corporations and industries, which were complied with emission reduction commitments, were then eligible to participate in an eco-point system which rewarded consumers for purchasing goods and services from eco-conscious companies and rewarded the industry for enacting green innovation and corporate responsibility. Finally, this scheme increased monetary flows from urban areas and consumers to rural areas through the added value of eco-branding and climate mitigation benefits of carbon sequestration through biochar use (McGreevy & Shibata, 2010). Figure 2 below presents the Carbon Minus Project scheme.

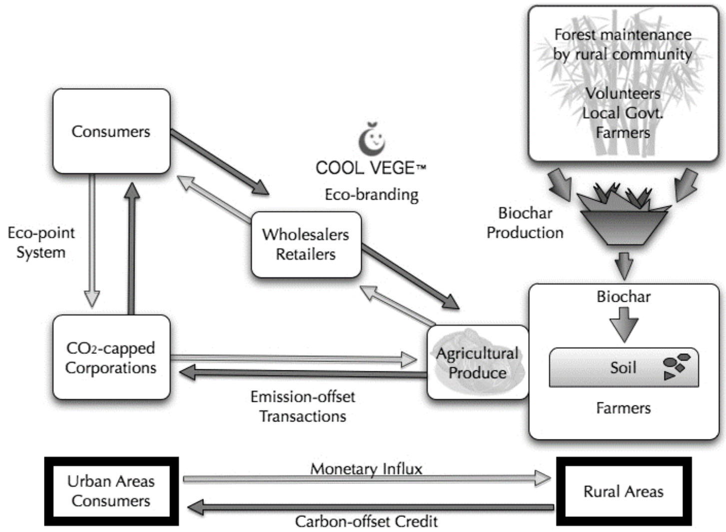

Figure 2. Carbon Minus Project Scheme
(Source: McGreevy & Shibata, 2010)

Carbon Minus Project was not only focused on biochar but also developed the green energy called agri-solar system. Carbon Minus Project has at least four fundamental pillars: agri-solar system, agro-industry, eco-branding (product marketing) and stakeholders' commitment.

a. Agri-Solar System

The solar panel power plant covered an area of 7 Ha and generated electric power up to 538 Kilowatt-hour (Kwh). The solar panel was placed on cultivated land with specific installment, so it did not interfere agricultural activities (see Figure 3). According to the regulation, the power generated by the individual power plant must be sold to the electric power company; but in this case, it was about 10% to 12% would be shared to the farmers as a subsidy, so the farmers would have to pay electricity cheaper than the other suppliers. If conversion factor of CO_2 emission was 0.891 kg/Kwh, then the power plant could reduce CO_2 emission by almost 0.5-ton equivalent to the amount produced by the fossil fuel power plant in an hour. It means that the CO_2 reduction in a year was equivalent to 7,800 tons. However, the power plant initiated by the Kyoto Government was for research and experimental purposes; and spent approximately USD 1.2 million for the initial investment, which was not a cheap infrastructure. There were so many considerations for developing countries or small cities governments to apply.

On the other side, the agricultural process in the Carbon Minus Project used organic fertilizer mixed with biochar (both made from organic disposal waste), with a ratio between biochar and fertilizer is 1:3. The use of organic materials in the agriculture was the way to promote the products of organic farming and to target specific consumers, which would support the eco-branding marketing process. The impact on the environment was quite significant. The estimated amount of CO_2 reduction in Kameoka City through biochar utilization was approximately one-third of the city's CO_2 emission or equivalent to 152,000 tons. Based on the calculation, the estimated amount of funding available to Kameoka City via offsetting emission credits reached ¥580 million (about USD5.8 million).

Figure 3. Agri-Solar System
(Source: Site Observation, 2016)

Table 1: Estimated Amount of CO_2 Reduction through Agri-Solar System

No.	Type	Assumptions and Calculations	Amount of CO_2 Reduction (t/y)
1	Solar Panel Power Plant*)	▪ Generated power: 538 Kwh ▪ CO_2 conversion factor: 0.891 kg/Kwh ▪ Annual CO_2reduction: = 538Kwh x 0.891kg/Kwh x 24 hours x 365 days	7,800
2	Biochar **)	▪ Farmland area: 2,100 ha ▪ Annual application rate: 25 ton/ha ▪ Biochar to be applied: = 2,100 ha x 25 tons = 52,500 tons/year ▪ Biochar carbon content: 80% ▪ Amount of carbon sequestered = 80% x 52,500 = 48,000 tons ▪ Annual amount of CO_2 emission = 462,000 tons ▪ CO_2 can be offset = 1/3 ▪ Annual CO_2 reduction = 1/3 x 462,000	154,000
		Annual Total CO_2 Reduction through Agri-solar System	**161,800**

Source: *) Based on Indonesian Ministry of Energy and Mineral Resources Standard
**) Based on McGreevy and Shibata (2010)

b. Agro-Industry

The fertilizer industry is an agriculture-based industry which has a complementary role in supporting agriculture activities. The main role of manure industries was to produce biochar-compost as an organic fertilizer for cultivated lands. Manure industries could purchase biochar directly either from farmers or biochar-volunteers as a raw material of biochar-compost (see Figure 4). In the compost center, biochar and the manure mixed with rice husks left them mature and became slightly fermented composts. The manure itself made from organic disposal waste like dairy waste and cattle waste.

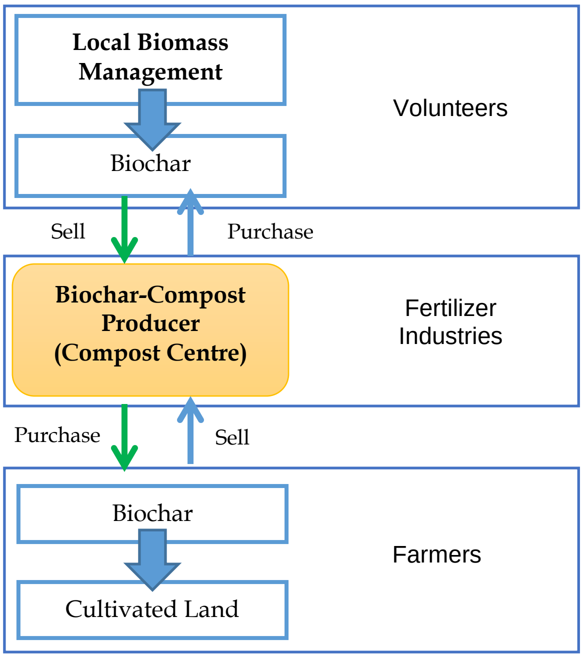

Figure 4. Biochar-Compost Trading System
(Source: McGreevy & Shibata, 2010)

Figure 5. Fertilizer Industry in Kameoka City
(Source: Site Observation, 2016)

c. Eco-Branding

Branding is an important aspect of the marketing process. Branding is the way to promote to the consumers all about the product. In the Carbon Minus Project, they issued a unique brand for the eco-friendly, organic and healthy vegetables they produced. It called CoolVegeTM. It means that the vegetables they produced have responsibility and commitment to reducing CO_2 emission to mitigate global warming and climate change.

Now, the CoolVegeTM is sold in the certain supermarkets and food retailers who are also committed to mitigate the climate change (see Figure 6). CoolVegeTM products are claimed to be economically profitable as they are sold at a slightly elevated price (about 3% to 5%). The market value of CoolVegeTM brand is calculated approximately USD 200,000 per year.

Figure 6. CoolVegeTM products at supermarket in Kameoka City
(Source: Site Observation, 2016)

d. Stakeholders Commitment

The Carbon Minus Project success story cannot be separated from commitment building among the participating stakeholders. Each stakeholder plays a specific role to support the project.

As mentioned before, the project started in 2008 through a partnership between Ritsumeikan University, Kameoka City Government, and Hozu Farming Cooperative. Ritsumeikan University as a part of academia gave an understanding and awareness of climate change issues and initiated the Carbon Minus Project as a solution to reduce GHG emission and engaged the farmers to take part in the project. Kameoka City Government's role related to policy-based activities, particularly in facilitating the initial investment, promotion, subsidy, and others.

Recently, the project has developed covering broader aspects and involved more participating stakeholders such as academia (Ryokoku University and Kyoto Gakuen University), government (Kyoto Prefectural Government), non-profit organization (Japan Biochar Association) and corporation (Daiwa House, Suntory, Toyopet, Kyoto Bank and some supermarkets). These organizing groups gravitated toward the idea of revitalizing agriculture and mitigating climate change together (McGreevy and Shibata, 2014).

Kyoto Prefectural Government has emerged as the certifying body. This independent institution has the roles for approving the project as a carbon credit offsetting activity, including the approved project available to companies looking to offset their emission, and issuing a CoolVegeTM certificate for agricultural products. The certificate contains information about the amount of CO_2 reduction.

Japanese companies were involved in supporting the project through corporate social responsibility (CSR) activities. Kyoto Bank has lent money to the project in exchange for the CoolVegeTM labeling and billboards near the biochar carbon capture and storage (CCS) farmland. The supermarkets took their part as an eco-brand seller and advertised it to consumers. They appealed directly to consumers and communicated their support on environmental protection through carbon sequestration in agricultural land and regional agricultural development. At the lower level of education, it was important to encourage understanding to elementary and junior high school students to participate in planting and harvesting of the CoolVegeTM. The eco-brand promotion also expanded into broader aspects such as CoolVegeTM manga and anime contest to get young people interested in agriculture and farming lifestyle, and to promote ecologically friendly food choices (McGreevy & Shibata, 2014).

Companies could also publicize their commitment to support the project by labeling their company's logos on the CoolVegeTM seals. Labelling their company's logo on the CoolVegeTM seals would become another important element of the project success: a sense of trust among the stakeholders.

3. Appropriate Model for Nganjuk Regency

Nganjuk Regency is adjacent to Kediri on the south, Madiun on the west, Bojonegoro on the north and Jombang on the east. It is located on the primary arterial road system, connecting Surabaya City to Madiun City in East Java Province, and Surakarta City in Central Java Province. Nganjuk Regency also connects Kediri City in the southern part. Due to its strategic location, Nganjuk Regency has potential to develop. In the last five years, manufacturing and industrial activities grew in some districts and potentially caused environmental problems. On the other side, Nganjuk Regency has been promoted by the Indonesian Government to be one of the food-supporting zones nationally. It means the local government has a responsibility to ensure that the agricultural productions are sufficient to support its role.

Farming households have been facing several problems such as farmland conversion, livelihood conversion, soil degradation, migration, and others economic reasons. These problems potentially create a wider gap between urban and rural areas.

Nganjuk Regency consisted of 1,224.33 km2 area and population of 1,041,716 inhabitants by the end of 2015. The land use dominated by forestry (38.39%) which is mostly located in the northern and southern areas, agriculture (35.20%), and residential (12.53%).

Considering the annual fiscal capacity of Nganjuk Regency was very limited worth of about USD 188 million, and the half portion was allocated for civil servant salary already, hampering the local government to initiate high-cost program such as green energy similar to Kameoka City's Solar Panel Power Plant. On the other side, the abundant production of biomass feedstock in Nganjuk Regency has made biochar-compost utilization is likely more feasible to be applied. It was also empirically proven that the project is economically profitable, yet also provides benefit for the environment.

Table 2 shows the production of major biomass feedstock, particularly for some crops, livestock, and woods.

Table 2: Production of Major Biomass Feedstock in Nganjuk Regency

District	Production (t/y)							Livestock Population			
	Agriculture					Plantation & Forestry					
	Rice	**Maize**	**Cassava**	**Peanut**	**Soybean**	**Coconut**	**Wood**	**Cattle**	**Buffalo**	**Sheep/ Goat**	**Poultry**
Sawahan	28,927.49	12,626	16,386.85	295.40	-	342.83	1,467.00	5,003	7	19,042	-
Ngetos	17,573.91	12,709	4,458.12	84.82	-	140.04	1,071.73	5,782	-	11,847	108,600
Berbek	33,597.17	13,707	5,282.18	-	-	-	637.36	6,501	99	10,279	178,000
Loceret	36,122.98	18,509	6,484.46	916.72	1,107.47	-	596.54	9,849	-	5,748	532,000
P a c e	36,609.45	21,632	6,198.14	189.00	757.88	23.01	411.46	9,529	-	12,254	90,550
Tanjunganom	69,731.80	20,684	49.02	296.75	305.39	-	20.57	16,418	-	16,461	68,000
Prambon	41,553.65	11,410	-	681.78	938.56	-	13.82	11,912	-	8,858	34,200
Ngronggot	25,435.48	14,071	194.40	206.19	6.39	-	27.65	11,885	6	12,260	1,169,500
Kertosono	9,627.96	5,767	14.00	-	-	-	27.51	3,240	-	6,949	182,000
Patianrowo	29,544.68	6,593	-	-	-	-	27.32	4,766	-	6,295	133,500
Baron	40,578.56	13,836	81.26	3.97	499.58	37.40	28.64	7,365	-	4,773	254,850
Gondang	40,621.51	11,975	239.08	-	4,144.62	-	33.27	7,192	260	16,980	169,000
Sukomoro	32,400.27	13,076	-	-	1,125.21	-	13.50	2,934	-	8,102	24,450
Nganjuk	16,312.60	4,003	-	79.93	1,500.44	-	13.82	3,832	13	8,886	1,500
Bagor	33,704.04	4,384	986.56	-	3,137.11	-	58.02	6,145	-	7,672	240,400
Wilangan	22,040.28	4,554	9,849.02	-	1,999.09	5.75	86.45	2,858	90	4,496	-
Rejoso	51,454.68	8,729	-	-	5,334.43	-	69.12	11,361	33	12,320	112,000
Ngluyu	11,288.15	9,555	122.30	-	281.84	10.36	78.71	3,903	183	4,143	-
Lengkong	17,565.66	3,078	503.20	108.60	-	-	45.32	4,104	43	3,342	51,500
Jatikalen	17,366.76	3,044	-	48.60	-	-	89.96	3,952	-	4,156	261,000
Total	**612,057.07**	**213,943.67**	**50,848.57**	**2,911.76**	**21,138.00**	**559.40**	**4,817.79**	**138,531**	**734**	**184,863**	**3,611,050**

Source: Badan Pusat Statistik Kabupaten Nganjuk (2016)

Biomass waste calculation is using a parameter as shown in the following table.

Table 3: Parameter Used for Estimating Biomass Waste Production

No.	Type	Biomass Feedstock (Disposal Waste)	Biomass Waste Ratio	Unit
A.	Farm field			

Table 3 Continued

No.	Type	Biomass Feedstock (Disposal Waste)	Biomass Waste Ratio	Unit
1	Paddy (loosen)	Straw, husk	1.40	t/t
2	Maize (loosen)	Stem, leaf, husk, cob	1.00	t/t
3	Cassava	Stem, husk	0.40	t/t
4	Peanuts	Stem, nutshell	0.40	t/t
5	Soybeans	Stem, husk	0.40	t/t
B.	Plantation and Forestry			
1	Coconut	Shell, fibre, frond	0.81	t/t
2	Wood	Wood chip, sawdust	0.784	t/t
C.	Livestock			
1	Cattle	Solid waste	1.10	t/y/head
2	Buffalo	Solid waste	1.46	t/y/head
3	Sheep/Goat	Solid waste	0.18	t/y/head
4	Poultry	Solid waste	0.037	t/y/head

Source: Hall et al. (1993) in The Japan Institute of Energy (2008)

The estimation of biomass waste production in Nganjuk Regency is shown as follows:

Table 4: Estimation of Biomass Waste Production in Nganjuk Regency

District	Biomass Waste Production (t/y)											Total (t/y)
	Agriculture					Plantation & Forestry		Livestock				
	Rice	**Maize**	**Cassava**	**Peanut**	**Soy-bean**	**Coco-nut**	**Wood**	**Cattle**	**Buffalo**	**Sheep/ Goat**	**Poultry**	
Sawahan	40,498	12,626	6,555	118	-	278	1,150	5,503	10	3,428	-	**70,167**
Ngetos	24,603	12,709	1,783	34	-	113	840	6,360	-	2,132	4,018	**52,594**
Berbek	47,036	13,707	2,113	-	-	-	500	7,151	145	1,850	6,586	**79,087**
Loceret	50,572	18,509	2,594	367	443	-	468	10,834	-	1,035	19,684	**104,505**
P a c e	51,253	21,632	2,479	76	303	19	323	10,482	-	2,206	3,350	**92,122**
Tanjunganom	97,625	20,684	20	119	122	-	16	18,060	-	2,963	2,516	**142,124**
Prambon	58,175	11,410	-	273	375	-	11	13,103	-	1,594	1,265	**86,207**
Ngronggot	35,610	14,071	78	82	3	-	22	13,074	9	2,207	43,272	**108,426**
Kertosono	13,479	5,767	6	-	-	-	22	3,564	-	1,251	6,734	**30,822**
Patianrowo	41,363	6,593	-	-	-	-	21	5,243	-	1,133	4,940	**59,292**
Baron	56,810	13,836	33	2	200	30	22	8,102	-	859	9,429	**89,323**
Gondang	56,870	11,975	96	-	1,658	-	26	7,911	380	3,056	6,253	**88,225**
Sukomoro	45,360	13,076	-	-	450	-	11	3,227	-	1,458	905	**64,488**
Nganjuk	22,838	4,003	-	32	600	-	11	4,215	19	1,599	56	**33,373**
Bagor	47,186	4,384	395	-	1,255	-	45	6,760	-	1,381	8,895	**70,300**
Wilangan	30,856	4,554	3,940	-	800	5	68	3,144	131	809	-	**44,306**
Rejoso	72,037	8,729	-	-	2,134	-	54	12,497	48	2,218	4,144	**101,860**
Ngluyu	15,803	9,555	49	-	113	8	62	4,293	267	746	-	**30,896**
Lengkong	24,592	3,078	201	43	-	-	36	4,514	63	602	1,906	**35,035**
Jatikalen	24,313	3,044	-	19	-	-	71	4,347	-	748	9,657	**42,200**
Total (t/y)	**856,880**	**213,944**	**20,339**	**1,165**	**8,455**	**453**	**3,777**	**152,384**	**1,072**	**33,275**	**133,609**	**1,425,353**

Source: Authors Analysis (2016)

The proportion of biomass waste is mostly produced by crops (77.23%), followed by livestock (22.47%) and plantation/forestry (0.30%). The total estimated biomass waste in Nganjuk Regency is about 1.4 million tons per annum. The biomass waste in Nganjuk Regency particularly comes from by paddy/rice, maize, cattle, and poultry. Estimated rice waste in a year is over 800,000 tons, while maize waste is about 200,000 tons and cattle solid waste is about 150,000 tons. However, the biomass waste still has underutilized in Nganjuk Regency.

Most of those wastes such as straws, husks, and cobs are dumped, buried or burnt out while the rest are for animal food stock. In a small scale, livestock's solid wastes are converted to compost by burying them. The utilization of biomass wastes as biochar and compost will be profitable, especially for farmers, and generally will give benefit for rural development agenda.

Based on the biomass waste data, approximately the amount of carbon sequestered in Nganjuk Regency is 165,000 tons with CO_2 equivalent is 605,000 tons (see Table 5).

Table 5: Environmental Implications through Biochar Utilization in Nganjuk Regency

No.	Criteria	Assumptions and Calculations	Unit	Result
1	Biochar tonnage	▪ Biochar ratio 20% of biomass waste = 20% x 1,105,013	t/y	220,000
2	Farm land utilized with biochar	▪ Annual application rate: 25 ton/ha ▪ Area:	Ha	8,800

Table 5 Continued

No.	Criteria	Assumptions and Calculations	Unit	Result
		= 220,000 / 25		
3	Amount of Carbon Sequestered	▪ Biochar carbon content: 75% = 75% x 220,000	t/y	165,000
4	Carbon dioxide equivalent		t/y	605,000

Source: Authors Analysis (2016)

Biomass waste utilization in rural area is a cyclical process, and every action is interconnected each other creating further impacts to another, and so on. The designated cyclical process of biomass utilization in rural area is shown in Figure 7.

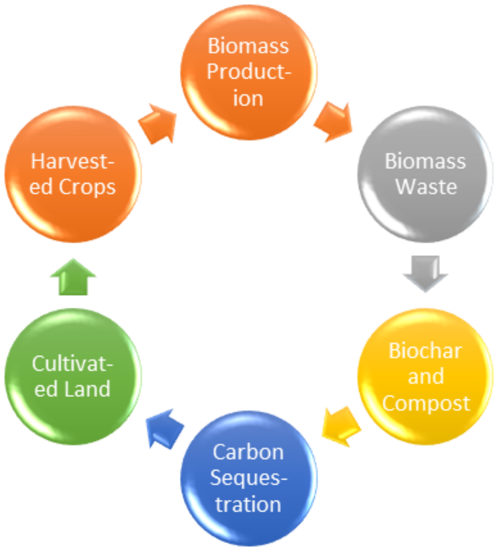

Figure 7. Designated Cyclical Process of Biomass Waste Utilization
(Source: Authors Analysis, 2016)

4. Conclusion

As the government demand for adopting the principles of sustainable development has got more intensified, the Low-Cost Green Growth Program could provide a solution for development. The agriculture-based characteristics of Nganjuk Regency also contribute to the abundant production of biochar and compost feedstock. Therefore, the market share of an eco-friendly organic product similar to CoolVegeTM in Japan has great potential.

Due to the feedstock potential, the Low-Cost Green Growth Program could be applicable to Nganjuk Regency, but in the process, there are some conditions to be considered as follows:

a. Efficiency

The most important aspect in the biochar and compost making is efficiency by reducing production and operational costs. To reach efficiency, the process of biochar making and compost center should agglomerate in the nearby location. Otherwise, the processing cost will increase, and the farmers cannot afford the organic fertilizer price so that the biochar distribution cost will increase as well.

b. Project Scope

The Low-Cost Green Growth Program and its similar projects have never been implemented in Nganjuk Regency. So, it would be necessary to start the program as a pilot project. As a pilot project, the reasonable scope for program implementation is in a district or a subdistrict.

c. Commitment

Each stakeholder involved in the program should commit to combat climate change, and also to improve urban-rural linkage through the implementation of Low-Cost Green Growth Program. Farmers as the subject of this program have an important role to succeed the program, and so have the other parties. The biochar-related program is evolving as well as the problems. Commitment and support are needed to deal with the changing situations. Stakeholders have to intensify coordination to create a sense of trust.

The successful Low-Cost Green Growth Program mostly depends on the feedstock supply, specific formulation and the commitment of involved stakeholders. Nganjuk Regency has abundant biomass feedstock, but it needs to prepare other aspects to ensure the program can work well. For applying the Low-Cost Green Growth Program in Nganjuk Regency, the action strategy should be prepared in some stages as described in Table 6. At the preparation phase, some actions/activities conducted are program socialization, excursion study, conduct related studies and also training on biochar-compost making. At the implementation phase, the focus of actions are to accelerate program's kick-off and to organize among responsible stakeholders. At the enhancement phase, the focus of actions is to improve branding, to expand the program's scope and to enforce stakeholders involved in the program.

Table 6: Recommendation Action Strategy in Nganjuk Regency

No.	Phases / Activities	Year 1	2	3	4	5	Responsible Stakeholders
Phase 1: PREPARATION							
1	Program socialization	■					Government, Academia
2	Excursion Study	■					Government
3	Set up facilities and skills	■	■				Government, Academia, Farmers
Phase 2: IMPLEMENTATION							
1	Coordination among stakeholders (fewer parties to be involved)		■	■	■	■	Government, Academia, Farmers
2	Commitment Agreement set up		■				Government, Academia, Farmers
3	Compose program formulation		■				Government, Academia, Farmers
4	Initiate pilot project's location in a district or subdistrict		■				Government, Academia, Farmers
5	Program kick-off			■			Government, Academia, Farmers
6	On-site assisting			■	■	■	Government, Academia, Farmers
Phase 3: ENHANCEMENT							
1	Program promotion			■	■	■	Government, Academia
2	Eco-branding promotion and marketing				■	■	Government, Farming associations, NPO/NGO
3	Emerge certifying body			■	■	■	Independent institution
4	Promote eco-friendly lifestyle awareness			■	■	■	Government, Academia, NPO/NGO
5	Expand parties' involvement				■	■	Corporation involvement
6	Expand and promote product market share				■	■	Corporations, Farming Associations
7	Offer emission-offset transaction and support labeling				■	■	CO_2-capped corporation, supporting corporations
8	Expand program scope					■	All stakeholders

Source: Authors Analysis (2016)

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