Terminal Evaluation Summary Sheet

1. Outline of the Project	
Country: Socialist Republic of Vietnam	**Project Title**: Project for Sustainable Integration of Local Agriculture and Biomass Industries
Thematic Area: Agricultural and Rural development	**Cooperation Scheme**: Technical Cooperation (Science and Technology Research Partnership for Sustainable Development: SATREPS)
Division in Charge: Rural Development Department	**Total Cost**: 3.6 hundred million yen
Project Period (R/D): 8 October 2009 – 7 October 2014 (5 years)	**Counterpart Agencies**: Ho Chi Minh City University of Technology (HCMUT), Department of Science and Technology/People's Committee of Ho Chi Minh City (DOST-HCM), Institute of Tropical Biology (ITB)/ Vietnam Academy of Science and Technology (VAST), Hanoi University of Science and Technology (HUST)
	Supporting Organizations in Japan: Institute of Industrial Science, The University of Tokyo (IIS-UT), Graduate School of Agriculture and Life Science, The University of Tokyo (GSALS-UT), National Institute for rural Engineering, National Agriculture and Food Research Organization (NIRE-NARO)
	Other Related Cooperation:

1-1. Background of the Project

While Vietnam has been industrializing after *doi moi* policy, agriculture is still its major economic sector such that 70% of the populations are engaged in agricultural activities and rice production for export has been increased. At the same time, rice consumption has been increased year by year due to continuous population increase. In addition, soil erosion and water shortage caused by deforestation as well as floods and draught frequently occurred in recent years have led to decrease in yields for crop and large number of farmers who could not ensure subsistence crops. Under these circumstances, formulation of appropriate agricultural production structure such as ensuring food security and promoting rice export is listed in government development policy.

Moreover, electricity demand has been increased in proportion to recent economic growth in Vietnam, which has led to the necessity of ensuring stable supply of power and primary energy. It is forecasted that annual growth rates would be 4.5~5.5% for energy supply and 5.5~7.5% for its demand, and Vietnam would be the net importer of energy. Despite this steady economic growth, regional disparity between urban area and rural one where about 70% of population live has been widened.

In order to cope with these issues which Vietnam has faced, the Government of Vietnam (GoV) requested support of the Government of Japan (GoJ) under the form of scientific technical cooperation with aiming to develop a model of "sustainable integration of local agriculture and biomass industries" enabling i) stable securement of food and energy, ii) prevention of global warming, iii) global environmental protection and improvement, and iv) livelihood improvement and poverty reduction of

rural residents as well as demonstrate this model. In response to this request, detailed planning survey team was dispatched in August 2009 and the record of discussion (R/D) on five-year technical cooperation project "Sustainable Integration of Local Agriculture and Biomass Industries" was signed in October 2009.

1-2. Project Overview

(1) Project Purpose

A model of "Sustainable Integration of Local Agriculture and Biomass Industries" is developed and demonstrated in an area of Southern Vietnam, focusing on biomass conversions for the production of biofuels, such as bioethanol and biogas, and bio-based materials

(2) Outputs

A methodology for designing "Sustainable Integration of Local Agriculture and Biomass Industries" is developed.

Small-scale regional biorefinery processes based on the concept of local production of biofuels and bio-based materials for local consumption are developed and demonstrated.

Key technologies for biorefinery processes, including production technologies of biofuels and bio-based materials, are studied and developed.

(3) Inputs

1) Japanese side

Long-term Expert:	1 Project Coordinator
Short-term Experts:	20 Experts/Researchers (1,972 days in total)
Counterpart Training in Japan:	Business Trips: 22 persons, Training in Japan: 2 persons (incl. 1 person participated 4 times)
Provision of Equipment:	Machinery for Biorefinery Experimental Plant at HCMUT and Demonstration Plant at Thai My Village, office equipment such as copier and computer, and among others
Local Cost:	25,994,805 JPY in total (incl. 379,700 JPY[4] budgeted for JFY 2014)

2) Vietnamese side

Counterpart Personnel:	32 staff in total from HCMUT, DOST-HCM, ITB and HUST
Land, Building, Office, and Facilities:	A project office with telephone line, a building for Biorefinery Experimental Plant with some facilities (desks, air conditioner, photocopier etc), a carbonization system, 3 ovens, and land, building, a set of biogas system for Demonstration Plant in Thai My village
Local Cost:	Approximately 97,143,480 JPY[5] including above mentioned land building and facilities (incl. approx.. 9,086,400 JPY[6] budgeted for 2014)

[4] 3,700 USD was converted into JPY using the average of JICA exchange rate from April to July 2014.

[5] 22,644,400,000 VDN was converted into JPY using the average of JICA exchange rate for each year.

[6] 1,893,000,000VDN was converted into JPY using the average of JICA exchange rate from April to July 2014.

2. Evaluation Team			
Members	Role	Name	Affiliation
	Leader	Kenichiro KOBAYASHI	Director, Rural Development Department, JICA
	Cooperation Planning	Chika ASAKAWA	Deputy Assistant Director, Rural Development Department, JICA
	Evaluation Analysis	Yuki OHASHI	Consultant, Tekizaitekisho LLC
	SATREPS Planning and Evaluation (Observer)	Makie KOKUBUN	Program Officer, Japan Science and Technology Agency (JST)/Professor of Tohoku University
	SATREPS Planning and Evaluation (Observer)	Yoshimi UMEMURA	Assistance Program Officer, JST
Evaluation Period: 23 July 2014 – 7 August 2014			**Type of Evaluation**: Terminal Evaluation

3. Results of Evaluation

3-1. Project Performance

(1) Output 1: A methodology for designing "Sustainable Integration of Local Agriculture and Biomass Industries" is developed.

In the Output 1, it was intended to identify a methodology of design process in the PDCA (Plan-Do-Check-Action) cycle to promote the utilization of biomass. 3 villages with distinct characteristics were chosen as target villages, the necessary basic data including the information about each village and the technologies of biomass utilization was collected and organized, the material and energy flow in the case which biomass industry was incorporated in each village was analyzed and evaluated, and then a model scenario of biomass utilization system (Biomass Town Model) was designed and evaluated for each village. As for Thai My Village, more detailed analysis was conducted using the results of experiments in paddy fields. As a result, a methodology for designing a system for "Sustainable Integration of Local Agriculture and Biomass Industries" was identified, and an example of agriculture with biomass utilization was indicated.

(2) Output 2: Small-scale regional biorefinery processes based on the concept of local production of biofuels and bio-based materials for local consumption are developed and demonstrated.

In the Output 2, it was aimed at installing and operating the Biorefinery Experimental Plant in HCMUT and the Demonstration Plant in a target village. Regarding the Plant in HCMUT, a biorefinery process of the ethanol production from rice straw was established, and as for the Demonstration Plant, a complex process of carbonization and power generation of lignocellulosic biomass and the methane fermentation process of animal manure were developed in Thai My Village. The performance of these processes in both Plants was confirmed as designed. Also, some research activities to minimize the production cost were carried out, and necessary engineering data was collected in the Plants. All planned activities were completed, and the results of the operation and research activities in the Plants were utilized for the design and evaluation of the model of biomass utilization system (Biomass Town Model).

(3) Output 3: Key technologies for biorefinery processes, including production technologies of biofuels and bio-based materials, are studied and developed.

In order to achieve the Output 3, the Project attempted to develop technologies in 1) the pretreatment/ saccharification of lignocellulosic biomass for bioethanol production, 2) the production of biofuels, functional fertilizer, animal feed, and other valuables from local biomass resources, and 3) the separation technologies for biorefinery. Owing to every effort made by researchers, various findings and new technologies were gained through the research activities. On the other hand, some of the research activities did not result in identifying novel technologies during the project period. It is expected to continue further studies in such cases, and also to advance research activities for practical application of the technologies developed by the Project.

3-2. Analysis based on the 5 Evaluation Criteria

(1) Relevance

The Project was relevant to the actual situations and needs of rural areas in Vietnam, where it is required to enhance measures against environmental issues and energy security, while there is abundant biomass accessible as energy source. It was also consistent with the policies of Vietnamese Government, such as the Vietnam National Green Growth Strategy, and the Japanese assistance policy for Vietnam. Also, the approach and contents of the Project were considered highly adequate, and the concept of the Project was appreciated as a suitable direction to promote biomass utilization in rural areas in Vietnam. Particularly, the model scenario of Biomass Town and its core pilot experimental plants for small-scale biomass refinery process have been getting a lot of attention both domestically and internationally. Therefore, it was confirmed that the Project is still highly relevant at the moment of the Terminal Evaluation.

(2) Effectiveness

The Project presented a methodology for designing “Sustainable Integration of Local Agriculture and Biomass Industries” and small-scale regional biorefinery processes based on the concept of local production of biofuels and bio-based materials for local consumption, and developed some key technologies for biorefinery processes through the research activities. The designed model scenarios of biomass utilization demonstrate some pictures of Biomass Town, which represent the concept of “Sustainable Integration of Local Agriculture and Biomass Industries”. This model indicated its effectiveness, as it showed a potential to offer sufficient amount of energy comparing with the demand by utilizing untapped biomass in rural areas, and to reduce negative effects on the environment. As to the economic efficiency, a model scenario designed for a rice production area of Mekong Delta can be a model of bioethanol production based on the Biomass Town concept in terms of cost-effectiveness as well, an in the case of Thai My Village located close to urban area the model scenario with carbonization/ power generation process of biomass is considered likely to recover its investment costs under the independent administration. On the other hand, in the model scenario of bioethanol production process, the results of estimation showed that the investment recovery is rather difficult at this point. In this regard, further research for technical development to reduce costs and to apply new technologies into practice will be a challenge for the future.

(3) Efficiency

Although the delivery of some inputs was delayed at an earlier stage of the Project due to a matter of procedure, it was carried out as planned afterward and the activities were realized efficiently using the inputs provided by both Japanese and Vietnamese sides. Consequently, the above mentioned results were achieved. A part of the research works, however, did not come up with the development of novel technologies, as it was a challenging task and requires continuing experimental efforts. Therefore, since the moment of the Midterm review it was anticipated that some research activities may not accomplish their expected results during the project period, in spite of the effort made by researchers. Both Japanese and Vietnamese sides admit that the Project reached a good level of achievement through the continuous efforts during the project period, in accordance with its research plan.

(4) Impact

The realization of Biomass Town and the practical operation of the system for sustainable integration of local agriculture and biomass industries are an expectation for the future, although an official overall goal or super goal is not set for this Project. Considering such overview, it is highly regarded that the Project installed 2 pilot-scale plants, which are the first experimental plants for biomass research in Vietnam. Also the model and the design methodology developed by the Project, as well as the novel technologies for small-scale regional biorefinery processes, such as the acceleration of saccharification by adding surface-activating agent and the gas-phase bioethanol adsorption/ concentration, are considered as significant impacts of the Project. On the other hand, in order to promote the small-scale regional utilization of biomass, there are various aspects to be considered to show a path for the practical application, such as the concrete political supports for the small-scale biomass utilization, business models for practical use, necessary investments from either governmental or private sources, preparation of a basis for agricultural production and operational machinery with the concept of biomass utilization, combination with other renewable energy (small-scale hydraulic power, solar power, etc.) and technologies for water and environmental conservation, raising awareness and promoting understanding in other areas and people, and so on. In addition, some positive effects of the Project, such as the contribution to the promotion of understandings about biomass utilization, the contribution in the academic point of view, the promotion of collaboration with related institutions and private firms, among others.

(5) Sustainability

While the political support for the biomass utilization will remain positive, considering that the Vietnamese Government has moved forward with full-scale implementation of the utilization of biomass energy, a further political support for small-scale regional biomass utilization can be also expected under the Green Growth Strategy, which can more directly promote the Biomass Town Model and related technologies developed by the Project. In the organizational and financial aspects, HCMUT has established the Laboratory of Bioenergy and Biomass, and 1,500,000 US dollars budget for the equipment of this new laboratory has been secured. Also, it has presented a proposal to VNU for establishing the Research Institute for Sustainable Energy (RISE) which will develop research activities in renewable energy, and it is expected to be approved by the end of this year. In addition, other proposals have been presented for different sources of research grant, and there is an available research grant of DOST for the related research topics. Therefore, the continuation of the related research

activities can be expected. As to the technical aspect, Vietnamese researchers have gained skills and experiences necessary for the continuation of related research activities, through the project activities during the project period, and the machinery and equipment have been maintained adequately so far, and will be utilized continuously for research activities.

3-3. Factors that have promoted or hindered the implementation of project

(1) Promoting factors

- The collaboration between IIS-UT and HCMUT started in 2004, and their good relationship established before the beginning of the Project promoted the smooth implementation of the project activities.
- Various types of meetings were held periodically to manage and monitor project activities smoothly.
- The Project invited Vietnamese researchers, especially students and young researchers, to Japan for them to gain skills and present the results of their research, which was considered effective in terms of technical transfer. Also, there was an opportunity for some Vietnamese stakeholders to visit biomass plants in Japan, and it helped them understand better the concept of the Project.
- Japanese young researchers stayed in the sites in Vietnam for medium to long period, and the leaders and core members visited Vietnam frequently. It promoted smooth implementation and management of the project activities.
- There was almost no change occurred for the core counterpart staff members, and there were fewer changes of young researchers after the Midterm Review, which helped the smooth implementation of the project activities and technical transfer. Also, negative influence of changes of human resources was minimized by transferring the necessary information to successors adequately.

(2) Hindering factors

- Due to the conventional forms of contract for Vietnamese young researchers, it was difficult to avoid the changes of human resources for the Project. In the first half of the project period, the change of 3 members for plant operation affected the implementation of activities.
- Due to the timing of the commencement of the Project and the schedule of budget application in Vietnam, the budget for the Project was not secured for 2010, and it caused delay in the delivery of inputs. It required an additional measure for Japanese side, and Vietnamese side had to manage to raise the necessary funds by an unusual and complicated procedure.
- As for the acquisition of land for the Demonstration Plant in Thai My Village, it was a time consuming process since the land management law in Vietnam is quite complicated, and it was also the first experience for Vietnamese C/P personnel to acquire land outside their campus.
- In the research activities of Biological Research Group, there was insufficiency in the necessary equipment at the earlier stage of the Project, which required time and trouble by sending samples to Japan for experiments and such. It was improved after the necessary equipment was delivered in 2011.

3-4. Recommendations

(1) Development of further research based on the outputs of the Project

Through this Project, a model of "Sustainable Integration of Local Agriculture and Biomass Industries" that focuses on converting biomass into biofuels has been developed and demonstrated in Southern Vietnam. However, the Project has also clarified some issues in the biofuel production process and technologies required for its practical use, which are necessary to be tackled after the completion of the Project. HCMUT is trying to launch a new institute, so called "RISE", to tackle these issues, and the budget for necessary activities in RISE has been secured partly. The evaluation team appreciates the effort of HCMUT to enhance the sustainability of the project from the academic point of view. For other concerned institutes, such as ITB, it is strongly recommended to continue collaborative relationship with HCMUT to be able to develop their related research. In addition, the evaluation team believes that the Japanese research institutes will continue to support future projects planned by Vietnamese research institutes.

(2) Collaboration among research institutes, government agencies, and private companies toward practical applications

For the practical use of the output of the Project, it is also necessary that farmers apply the technologies developed by the Project in their daily lives, and that private companies adopt the developed technologies in their businesses. Because this is not easy in practice, the central and local governments should adopt new policies such as subsiding initial costs to encourage farmers and business people to apply these technologies. In addition, disseminating the technical information about the Project might be effective to promote the participation of private sector. The evaluation team recommends that collaboration among research institutes, government agencies, and private companies is essential for future projects in the field of biomass in Vietnam.

(3) Strengthening of relationship with other Asian countries

In ASEAN countries, research and development related to the production and the use of biofuels, which are produced from various kinds of biomass such as sugar cane, cassava, Jatropha, oil palm, etc. have been promoted and the demand for biofuels has also been increased in recent years. Therefore, exchange of views, sharing of information and cooperation with the other neighboring Asian countries as well as Vietnam and Japan should be strengthened in order to develop more efficient, effective and practical system in the future. The installed pilot-scale facilities can be widely utilized for biomass-related projects in Vietnam as well as in other ASEAN countries.

3-5. Lessons Learned

(1) Importance of human relationships between the research institutions of both sides as a factor of the project's success

The active participation and hard work of Vietnamese researchers in the Project deserve special mention in this Terminal Evaluation Report. In addition, the financial contribution by Vietnamese side was appropriate in terms of the amount and timing of disbursement, except for the first fiscal year. This owes to the trusting relationship among the research institutes both in Vietnam and Japan built before the project formulation period. This shows the importance of assessing the existing relationship with C/P research institutes during the project formulation period for future SATREPS projects.

(2) Effective information sharing through internet communication tools

In this Project, the researchers communicated closely through email and internet telephone for sharing the progress and discussing issues in real time. Furthermore, the project installed web cameras in the pilot plants and experimental fields. It helped Japanese research institutes to monitor closely the situations of the Project during their absence also, and to give adequate advices in a timely manner. These means of communication contributed to the smooth implementation of the collaborative research.

(3) Adequate budget preparation according to the fiscal year of the partner country

When this Project launched in 2009, the Vietnamese budget application for FY 2010 had been already closed. Thus, Vietnamese side was unable to secure the necessary budget at the beginning of the project period, and this caused a delay in the delivery of inputs. In order to cope with this situation, Vietnamese and Japanese sides had to secure the budget in an irregular manner, and the arrangements and procedures were quite a burden for both sides. In order to launch projects smoothly, it is necessary to consider budget application schedule of the partner country during projects planning period.