付属書類 V: セミナーでの発表資料

Decentralized Bio-ethanol Production System

<u>Demonstration Test of Fermentation</u> [Sweet-Sorguhm raised in Philippines]

> 2013 December 6 IB Consultant Co., Ltd President BINTARO IZUMI

















<u>Decentralized Bio-ethanol Production</u> <u>System</u> <u>Devrlopment-Purpose of [Decentralized Bio-ethanol</u> <u>Production System]</u>

•This system is installed near the plantation to avoide longtimetransportation. (decrease the fuel-consumption by transportation)

This system is useful for fermentation by Sugarcane, Sweet-sorghum.
(1) Onsite-system is useful for preventing the saccharine depletion by germs, bacteria. (make germs-activity decrese)

(2) Even fallen Sugarcane, Sweetsorghum by strong wind, is reuse for fermentation, because of onsite-system.

Structure of Decentralized Bio-ethanol Production System

- 1. Function of [Staition](30~40% ehanol produced here)
 Simplified Fermentation Plant should be installed near the plantaition of sweet sorghum in rural areas.
 - •Capacity of Station will be in proportion to crop-qantity. •Number of Bio-reactor will be fixed by capacity of station (it 'depends on crop-quantity).

2. Function of [Base]

•Ethanol from Station(concentration:30~40%) will be concentrated on over 99.5% ethanol at Base. •Heat-source shoud be biomass-boiler or solar-heat.



[STATION (consist of several Bioreactor)]

- Twin Bioreactor can produce over 260KL . In order to cut the cost, many parts of this system are in common.
- Bioreactor tank has the function of liquescent -tank, saccharine -tank, remainder-tank and evaporation- tank.
- Temperatue & time in each process is controlled by program control-system.
- Vacuum pump is provided to draw out the ethanol in bioreactor.

(ethanol concentration of bioreactor outlet : 30~40v%)



[BASE for Distillation & Dehydration] Ethanol from Station(concentration: 30~40%) will be con -centrated on over 99.5% ethanol at Base.



Fermentation test by bio-reactor (Sweet-sorgum raised in philippenes





- 2. Decentralized bioethanol production system is available for preventing the saccharine depletion by germs, bacteria.
- 3. Stalk squeese rate (efficiency) should be improved (30‰→70%)
- 4. Suitable yeast should be selected for each materials etc.









Demonstration Test of fertilizer made from fermentation waste

[Simulation test of rice-grow in greenhouse]

Simulation test of rice-grow in greenhouse

- 1. Simulation test conditions
 - Kind of riceplant : Philippens improve kind (indica IR-72)
 - Temperature : day time=30°C, night=25°C
 - growing term : 2013/Sept.end~2014/Feb.end
- 2. Fertilization of fermentation waste (1) Fermentation waste is grouped in 4 classes by nitrogen, and made 4 kind fertilizer.
 - (2) Fertilizer with rich inorganic matter(K,P) is made by N-chemical compound in fermentation waste resolved in ageing
- 3. Observation of rice-grow and soil (ph,deoxidization)

Project Formulation Study on the Development of Decentralized Bioethanol Production Systems at the Rural Areas of the Philippines

Seminar on findings of the Study

December 6, 2013

City Garden Hotel Makati, Metro Manila

Project Formulation Study on the development of Decentralized Bioethanol Production Systems in the Rural Areas of the Philippine





- 1. Summary of the Findings
- 2. Study Frameworks
- 3. Development Policy of Bioethanol and its Progress
- 4. Proposed Bioethanol Production Systems and its Application to the Philippines
- 5. Brief Results of the Study
- 6. Issues identified through the Study
- 7. Impact of the Project to Filipino Economy and the Developer
- 8. Risks and Countermeasures to be considered

Summary of the Findings

- 1. The Philippines has strategic advantage for investors who are interested in the production of Bio-ethanol over other countries, because of its mandatory purchasing systems by oil dealers which is enforced by Bio-fuel Act.
- 2. Despite of long-lasting development and support programs by Govt./Academia, Cultivation of Sweet-sorghum is not widely disseminated throughout the Country. There is considerable areas to be improved in the fields of Seed Production, Crushing and Syrup-making processes, and Fermentation Technologies.
- 3. Decentralized Bio-ethanol Production Systems are more suitable for the production of Bio-ethanol at the rural areas and remote Islands, because of that the systems can avoid long-distance transportation of feedstock to the central plant.
- 4. The Multi-functional Reactor Device being introduced by IB Consultant can also be used as supplementary module for the existing Bio-ethanol Distillery Plants.
- 5. For dissemination of Bio-ethanol Production in the Philippines, a Financial Package shall be provided to the growers of feedstock.

Project Formulation Study on the development of Decentralized Bioethanal Production Systems in the Rural Areas of the Philippines

Objectives and Background of the Study

- 1. Collection and review of the data and information related to the development of Bio-ethanol in the Philippines,
- 2. Fact-finding survey on the cultivation, harvesting, crushing and juice extraction of the Sweet-sorghum and identification of issues
- 3. Marketing and Distribution Surveys on the Bio-ethanol products, Distribution Systems of Yeasts for production of Bio-ethanol, and Survey on the possibility of manufacturing the Bio-ethanol production plant in the Philippines.
- 4. Fermentation Test at Fukushima Plant and Verification Test at Shimane.
- 5. Follow-up Studies and Organizing a Publicity Seminar on the findings of the Study

mutation Study on the development of Decentralized Bioethanol Production Systems in the Rural Areas of the Philippine



Proposed Bioethanol Production Systems

One-stop Services from Supplies of Yeasts, Fermentation Technologies to Production Plants

(1) Simplified Bio-ethanol Production Plant

- Since all the Production Processes from Material Preparation, Liquefaction, Saccharification, Fermentation to Alcoholization shall be processed in one tank, thus production costs may be managed at lower level.
- · Less energy consumption is required in the processes of Production

(2) Special Fermentation Program Select the most suitable yeast depending on the characteristics of Materials and Starches, develop special fermentation programs and integrated into the control panel on the production systems, thus no special training is required to operate the production systems.

ulation Study on the development of Decentralized Bloethanol Productio



Member of the Study Team					
Bintaro Izumi	Team Leader	IB Consultants Co., Ltd.			
Junichiro Motoyama	Deputy Team Leader	World Business Associates Co., Ltd.			
Hidenori Imazu	Water Quality Specialist	International Public-relations System Co., Ltd.			
Hitoshi Tainaka*	Fermentation Specialist	IB Consultants Co., Ltd.			
Nobuo Nakata	Project Coordinator	IB Consultants Co., Ltd.			

Project Formulation Study on the development of Decentralized Bioethanal Production Systems in the Rural Areas of the Philippines 6



Outlines of Study Findings

- 1. Government Policy on Bio-ethanol Development in the Philippines
- 2. History of Sweet Sorghum Research
- 3. Survey on the Cultivation Plan and Production Sites
- 4. Survey on the Manufacturers for the Bioethanol Production Plant/Equipment
- 5. Survey on the Distribution Systems of Fermentation Yeast and Seed of Sweet Sorghum

Brief History on the Bioethanol Production in the Philippines

- 1. First Fuel Ethanol & Power Plant in San Carlos, Negros Occidental (May 30, 2005)
- 2. Launching of the first Fuel Ethanol (E-10) Gasoline Fueling Facility by SEA OIL (August 29, 2005)
- 3. At present, avail of 69 location of E-10 Gasoline Station in Metro Manila (55 by Shell, 14 by Petron and 105 Stations by SEA OIL nationwide)

ear	Target Blending	Gasoline Demand (mli)	Bioethanol Req'd (mli)
013	10%	3,813.18	381.32
014	10%	3,839.31	383.93
020	20%	4,328.87	865.77
025	20%	4,712.28	942.46
030	20%&85%	5,084.05	1,016.81
		a 2	Source: DOE HP

Government Policy on Bio-ethanol Development

Philippine Biofuels Policy Framework

- Measure to help address energy security especially in light of oil supply security concerns and the impact of oil price increases.
- Establish mandatory market and standards to jumpstart private sector investments in production and infrastructure support facilities
- Establish policy framework and support facilities to ensure security of feedstock supply and investments in supply infrastructure

The Biofuels Law or RA 9367

Objectives of the Law

- To reduce the Philippine's dependence on imported oil
- To increase the economic activity in the country and boost employment
- To improve energy efficiency
- To contribute in improving air quality
- > Mandates minimum blend into all diesel and gasoline fuels as follow;
- 1% biodiesel within 3 months from effective date of the Act
- 5% of bioethanol effective from February 2009
- 10% of bioethanol effective from February 2012
- Project Formulation Study on the development of Decentralized Bioethanal Production Systems in the Rural Areas of the Philippines

History of Sweet Sorghum Research

Sweet-sorghum is known as "Sugarcane of the desert" and grow in tougher dry-land and can produce very high yields with irrigation systems. The grain stalk juice and bagasse can be used to produce food, fodder, ethanol and in cogeneration of power.



History of Sweet Sorghum Research

- Introduction of Sweet-sorghum to the Philippines After the discussions with scientists and officials of the Philippines and India, Sweet-sorghum has been introduced to Philippines in October 2004 through PCARRD. Seventeen cultivars were initially provided by ICRISAT and planted for preliminary evaluation trials at MMSU.
- Pilot studies and Multi-location trials
 Following the Pilot studies on 5 cultivars out of 17 cultivars planted were
 conducted in October 2004. In 2005, multi-location trials were conducted
 with the selected varieties in strategic areas to evaluate their performance
 and adaptability under different agro-ecological zones.
- 3. Feasibility study

DA-BAR funded a scoping study on the "Feasibility Study on Sweetsorghum" in March 2006. This was followed by small group meetings and visits to techno-demo sites with investors to prepare business plans as a prelude to establishing Sweet-sorghum Bio-ethanol distilleries.

ource: Sweet Sorghum in the Philippines: Status and Future



History of Sweet Sorghum Research

4. National R&D Initiatives

Various line departments in the Philippines embarked on several biofuel production development programs. A study was conducted to determine the viability of growing Sweet-sorghum as a source of bioethanol. Although the field trials showed positive results, doubts about the commercial viability of growing the crop and processing it into Bio-ethanol needed to be addressed. This called for inter-agency RDE work on Sweet-sorghum.

5. Sweet-sorghum Cultivation by Bapamin Farmar's Cooperative (BFC). Funded by NEDA, Barangay-based techno-demo on Sweet-sorghum production for ethanol, food, feed and forage was undertaken in 2007 to assist farmers in growing the crop after rain-fed paddy fields. At Barangay Bungon, Batac, Ilocos Norte, BFC in collaboration with MMSU set aside area for its Sweet-sorghum stalk crushing and processing facilities. Residents were trained to grow Sweet-sorghum and process it for food and feed. In order to ensure sustainability of the project, BFC was linked with a private sector integrator to provide the production inputs and marketing assistance.

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History of Sweet Sorghum Research

6. On-farm Demonstration

The Government of Philippines, through DA-BAR, have financially supported the first commercial production and utilization of Sweet-sorghum in the country. Technical Demonstration Farms were set up in various areas. In Barangay Bungon, Batac, Ilocos Norte, DA-BAR granted a project on processing of Sweet-sorghum juice to vinegar or wine or basi. Heavy duty cane mills were used to extract the juice which was pasteurized in three sets of furnace-cum-vats. Large-scale processing of Sweet-sorghum juice was taken up by BFC. BFC acquired two mobile crushers that can be used over a 30-60 km radius service area and 3-5 km radius service area respectively. 7. Ethanol Production

The first commercial Bio-ethanol distillery for fuel, San Carlos Bio Energy Incorporated, was established in Negros Occidental. Sugarcanes are used as raw materials for this distillery and the plant is operational for six months in a year. Although Sweet-sorghum may be grown to extend the operational period of sugarcane-based distillery, it may take some time to set up distilleries that can use Sweet-sorghum along with other source of feedstock for Bio-ethanol production.

lation Study on the development of Decentralized Bioethanol Production Systems in the Rural Areas of the Philippines

Water Quality Survey at the proposed sites

1. Water Quality used for the bio-ethanol fermentation

+All the sites except for No.2 showed good performance on the bacteria tests. +The PH on the Site No4 was 8.8. The high alkalinity may be dew to its deep well. +The turbidity was good.

+Water quality in the surveyed area was good as overall judgment.

+The membrane fiter blocked bacteria completely and reduced turbldity significantly.



_					Bacillus Result	(ghnu)
Sample Nama	Sampling Point	PH	Turbicity	General Bacteria (OFU/mi)	Presence of Gas formation	Confirmate ry Test
6F-1	Site No 1	7.4	0.0	7	-	0
0F-2	Site No 2	7.1	0.0	132	+	0
8F-3	Site No 3	72	3.0	19	-	0
6F-4	Site No.4	8.8	0.7	.0	-	0
88-5	Site No.5	6.6	3.0	1	-	0
AF-1	Site No.1	7.4	0.0	0	-	0
4F-2	Site No 2	72	0.0	0	1 + I	0
AF-3	Site No.3	7.3	0.0	.0	-	0.
AF-4	Site No.4	8.8	0.1	0		0
AF-5	Site No.5	68	0.0	0	-	0
OF Beta	re Fitration	ra .				

Water Sample Collection and Testing at Site



Survey on the Distribution Systems of Fermentation Yeast and Sweet-sorghum Seeds

- Distribution Systems of Fermentation Yeasts
 It is understood that Dry Yeasts are used for the purpose of
 Fermentation in the processes of Bio-ethanol production in the
 Philippines. In many cases, Bio-ethanol producers are used to
 purchase these Dry Yeasts from local suppliers.
- Distribution Systems of Sweet-sorghum Seeds
 Since the cultivation of Sweet-sorghum is not in a bigger scale at present, there is no distributor of Sweet-sorghum Seeds.
 However, Seeds of Sorghum are distributed by certain distributors of vegetable seeds.

monant of Decembrolited Ricethonal Production Systems in the Rural Areas of the Philip

Survey on the Manufacturers for the Bioethanol Production Plant/Equipment



Issues identified through the Study

- 1. Lower Germination Rate of Sweet-sorghum seed and Lower Yield Rate.
- 2. Lower Extruding Rate of Sweet-sorghum Juice due to Ineffective Crushing Machine.
- 3. Higher Energy Costs on Syrup Production.
- 4. Inconsistent Supply of Sweet-sorghum as feedstock to Bio-ethanol Production.

Impact of the proposed Project to Filipino Economy and the Investor

- 1. Additional Incomes to Rice Growers at Rain-fed Agricultural lands and contribute to lift up the regional economy,
- 2. Create Employment Opportunity by production of Sweet Sorghum and Bio-ethanol Processing,
- 3. Contribute to improve Balance of Trade by reducing Payout of foreign currency for import of fossil oils,
- 4. Contribute to improve air quality by reducing CO2 Gas emission from automobiles.



JCM	<main actors="" at="" each="" pro<="" th=""><th>cess> CDM</th></main>	cess> CDM
Project Participant / Each Govern Joint Committee	Submission of Proposed Methodology	Project Participant
Joint Committee	Approval of Proposed Methodology	CDM Executive Board
Project Participant	Development of PDD	Project Participant
Third Party Entities	Validation	Designated Operational Entitie (DOEs)
Joint Committee	Registration	CDM Executive Board
Project Participant	Monitoring	Project Participant
Third Party Entities	Verification	DOEs
Joint Committee decides the arr Each Government issues the c	nount Issuance	CDM Executive Board

Japan's Joint Crediting Mechanism (JCM) Systems with Eight Countries



Risks and Countermeasures to be considered

- Fluctuation of Bio-ethanol purchasing price. Compulsory purchase of Bio-ethanol is advantage in the Philippines, However, purchase price calculation mechanism is largely depending upon the prices of sugar and molasses produced in the Philippines. If these prices are changed drastically, the purchase prices of Bioethanol are also sensitively influenced.
- Inconsistent supply of Feedstock.
 Consistent supply of feedstock to the Bio-ethanol production systems is one of the key success factors for a sound operation and Sweetsorghums are sensitive to such natural disaster as typhoon and flood. Cultivation of Sweet-sorghum is rather new to farmers in the Philippines and yield of crop is still remain at lower level
- Higher production cost due to small-scale production. Compare to the production systems in U.S.A. and Brazil, scale of Sugarcane/Sweet-sorghum growers is rather smaller in the Philippines, thus the production cost of Bio-ethanol is costly and operations of such small holders are inconsistent and fragile.

Project Farmulation Study on the development of Decentralized Bloethanol Production Systems in the Rural Areas of the Philippines

Seminar on findings of the Study for The Project Formulation Study on the Development of Decentralized Bioethanol Production Systems at the Rural Areas of the Philippines

Thank you for your Attention

December 6, 2013

City Garden Hotel Makati, Metro Manila







Planting & Harvesting Season

After RAINFED RICE, usually September, October, November...with expected maturity of 100 to 110 days after planting (DAP). The plant ratoons, and maturity is expected 85 days thereafter.



Main Crops

- Grains from the panicles, threshed and sun dried to reach 14% moisture content (MC).
- > Stalks cut, milled to get the juice







EDEAL IN CONTRACT OF THE PROPERTY OF THE PROPE	
LICENSE TO OPERATE FOOD MANUFACTURER	
Parameter for Sections 4 (e) Chapter III of Republic Act No 3720, otherware known an the Goods, Draws and Devices and Committee Act, authority in hereby granted to:	
Nume of Establishment 1 BAPAMIN ENTERPRISES	
Address. Sitis Tunghol, Brgy, Bil-loza, Barae City, Bocos Norte	
OWNER ANTONIO SERIANO ARCANGEL	
to spenner a food and load products monoficituring and processing establishment, specifically as a manufacturer of multi-products having complied with the Rules and Regulations or Defined Requerements.	
This License shall be wild until 28 February 2012 and for the class of fixed products applied for Reserval payment shall be on or before its copiny date and subject to treatdidition after impection.	
Hassever, thends during the period of validity, a violation of any of the provintent of tracks, brogs and Devices and Contents: Act and/or the regulations based therearder be constrained the Lacense with be subject to surportion or revised into.	
WITNESS MY HAND and the Said of this Office, this 28th day of February 2012.	
BY AUTHORITY OF THE SECRETARY OF HEALTH	
SUZETTE IL Adv. MB. FPSICE	
Official Receipt No. <u>0273456</u> Date Issued: <u>06 February 2012</u> Assumpt: <u>Phy 2,820,09</u> (2012)	
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Vision

As pioneer in the propagation and processing of Sweet Sorghum in the country, it is our advocacy to develop its high value products.

Core Values

- Quality and integrity of Sweet Sorghum products
- Transparency to our farmers' cooperators



Mission

- To campaign for mass planting of Sweet Sorghum as an alternative crop to address the food sufficiency in the country and develop its high-value products.
- To promote and educate the farmers of the best agricultural and cultural management practices in the adoption and propagation of Sweet Sorghum crop thereby improving the financial return of the farmers.





Immediate Objectives

 Establish the project through the cooperative that shall promote farm productivity and participative entrepreneurship.



Development Objectives

Alleviate the conditions of the marginalized farmers through their involvement in the production of food & other high-value products, and bioethanol production as well as their membership in the cooperative as vehicle for economic and social transformation.



Immediate Objectives

 Create a synergy with the concerned sectors of the community whose assistance to the cooperative is indispensable (i.e., the farming community, the local government units & agencies, particularly the City of Batac, Department of Agriculture(DA), Department of Science and Technology(DOST) and the Mariano Marcos State University(MMSU).

Immediate Objectives

• Establish linkages with the private companies who shall utilize the outputs of the cooperative in order to hasten market and transaction flow.



Primary and Secondary Beneficiaries

- The farmer-members of the cooperative are the direct beneficiaries.
- The general public is the secondary beneficiary as the cooperative is expected to contribute to the economic gains and its social responsibility to the community at large.











Store Outlets

- From the Northern town of Ilocos Norte, Pagudpud to Metro Manila, we have at present eighty five (85) outlets.
- Sales are on a consignment basis, the payment of sold items is collectable on the next delivery at the time to replenish their stock.



<section-header>





Laoag city, llocos Norte













Companies with big volume that has successfully tried the grains and syrup are just waiting for the cooperative to tell them the level of production that we can deliver to them on a regular basis are;

 Venvi Agro-Industrial Ventures, Inc. Suite 806 Globe Telecom Plaza Pioneer St., Mandaluyong City, Metro Manila Farm site: Sitio 3 Brgy. San Agustin, San Nicolas, Ilocos Norte



2. San Miguel Foods, Inc. San Miguel Properties Centre San Francis St., Mandaluyong City, Metro Manila Farm site: La Union, FEEDPLANT San Juan, La Union

- Destileria Limtuaco & Co., Inc. 1830 Edsa, Quezon City Metro Manila
- 4. Novatech Agri Food Industries Rm 210 Anita Bldg., Quezon Ave., Quezon City, Metro Manila



付属書類 Ⅵ:現地セミナー参加者リスト



Proposed Seminar Program on the Findings of the Project Formulation Study on the development of Decentralized Bio-ethanol Production Systems in the Rural Areas of the Philippines City Garden Hotel, Makati, Metro Manila December 6, 2013, 9:30am-12:40pm



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[Name	Agency	Designation
1	Engr. Tonito Arcangel	BAPAMIN	
2	Ms. Catherine Arancon	Barrionomics	President
3	Dr. Victorino T. Taylan	Central Luzon State University	Director, Non-Conventional Energy Center
4	Mr. Joseph Emnas	Department of Energy	Office of the Sec
5	Sec. Carlos Jericho L. Petilla	Department of Energy	
6	Mr. Pablito dela Rosa	Stainless tank maker	
7	Dr. Shirley C. Agrupis	Mariano Marcos State University	Director, External Affairs & Partnership and Professor I
8	Dr, Heraldo L. Layaoen	Mariano Marcos State University	Vice President for Administration, Planning and External Linkages
9	Mr. Loreto C. Carasi	Phil. Council for Industry & Energy Research & Dev't.	Senior Science Research Specialist
10	Engr. Mel Dimapilis	Phil. Council for Industry & Energy Research & Dev't.	Technical Staff
11	Ms. Eden Gagelonia	Philippine Rice Research Institute	DED for Research
12	Dr. Manuel Regalado	Philippine Rice Research Institute	Head, Engineering
13	Ms. Edna Tatel	Philippine Sugar Millers Association	
14	Dr. Emmanuel V. Sicat	PhilSCAT	Director
15	Mr. Clovis T. Tupas	PNOC Alternative Fuels Corporation	General Manager
16	Mr. Reynaldo Go	Regwill Industries	President
17	Hon. Maria Imelda Josefa R. Marcos	Ilocos Norte	Govemor
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25	Senen Soberano	Lopez Sugar Corporation	
26	Joseph Enmas	DOE	
27	Ranof Saurigur	DOE	
28	Fiorello Abenes	DA-BAR	
29	Arla Agrupis	MMSU	
30	Oscar Cortes	PSMA	
31	Doris Arcangel	BAPAMIN	
32	Jann Nuland	PNA	
33	Rolano Wablo	PNA	
34	Joei Nazan	PNA	
35	Rainer Pantua	PNA	
36	Allabir Diega	Burcis	
37	Diana Benato	PEF	
38	Usurnod Gonzares	PEF	
39	Toress Ru	PEF	
40	Felpie Caud	Maseen Power	
41	Jun Vonuha	Maseen Power	

"Project Formulation Survey" under the Governmental Commission on the Projects for ODA Overseas Economic Cooperation in FY2013

Summary Report

Republic of the Philippines

Project Formulation Survey on the Development of Decentralized Bio-ethanol Production Systems at the Rural Areas of the Philippines

March, 2014

The Joint Venture of IB Consultant Co., Ltd. World Business Associates Co., Ltd. International Public-Relations System Co., Ltd.

The content of this report is a summary of the project formulation survey, which was commissioned by the Ministry of Foreign Affairs of Japan in the FY 2013 and is carried out by the consortium The Joint Venture of IB Consultant Co., Ltd. World Business Associates Co., Ltd. International Public-Relations System Co., Ltd. It does not represent the official view of the Ministry of Foreign Affairs.

Executive Summary

I. Present Status, Issues Identified and Contribution to Solve the Issues

I.1 Policies, Legal Systems and Authorities related to the Development of Bio-ethanol in the Republic of Philippines

The Republic Law No. 9367 which is known as the Biofuels Law, enforces the blending of Bio-ethanol to Automobile Fuels, was enacted in the month of February 2007 in the Republic of Philippines being the first case in a South-east Asian country. Objectives of the Law are: a) To develop and utilize indigenous renewable and sustainably-sourced clean energy sources to reduce dependence on imported oil, b) To mitigate toxic and greenhouse gas emissions, c) To increase rural employment and income, and d) To ensure the availability of alternative and renewable clean energy without any detriment to the natural ecosystem biodiversity and food reserves of the Country.

The Biofuels Law mandates blending of 5% of Bio-ethanol to gasoline after 2 years from the effective date of the Law and 10% of blending after 4 years of the effective date. In addition, there are several incentives adapted such as zero (0) % specific tax being applied for the blended bio-fuels and exemption of value added tax. The Government financial institutions shall accord higher priority to extend financing to Filipino citizens or entities, at least sixty (60) % of the capital stock of which belongs to citizens of the Philippines.

Major authorities engaged in the development of Bio-ethanol are the Department of Energy (DOE) and one of its subsidiary organizations; Philippine National Oil Company – Alternative Fuels Corporation (PNOC-AFC) and the Department of Agriculture (DA) and one of its subsidiary organizations; Philippine Agriculture Development Commercial Corporation (PADCC). National Biofuels Board (NBB) being a cross-departmental organization, has been established in order to achieve the objectives of the Bi-fuels Law and NBB is deciding the selling price of Bio-ethanol produced in the Philippines to the oil distributors in the country.

According to the forecast by the DOE, demands for the Bio-ethanol in the Philippines shall drastically increase along with steady growth in registration number of automobile and accelerating blending ratio of Bio-ethanol to the Gasoline.

Years	Target blending	Projected Gasoline	Demands for Bio-ethanol in
	Ratio	Consumption in million	million liter
		liter)	
2013	10%	3,813.18	381.32
2014	10%	3,839.31	383.93
2020	20%	4,328.87	865.77
2025	20%	4,712.28	942.46
2030	20% - 85%	5,084.05	1,016.81

Demand Forecast by DOE on the consumption of Gasoline and Bio-ethanol

1.2 Present Circumstances, Issues Identified and Prospectus in the Future

In contrast, production capacity of Bio-ethanol in Philippines as of 2013 is far below the demands as shown in the following table, 75 - 80 % of which are filled by the import from abroad such as Brazil and others. Share of Bio-ethanol produced domestically may further be down, if the production capacity of Philippines could not be developed as scheduled, within the context of steady growth of Gasoline consumption.

Name of Producer	Location	Feedstock	Production
			Capacity (ML)
San Carlos Bio-energy, Inc.	San Carlos City, Negros Occ.	Sugar Cane	40
Leyte Agri. Corp.	Ormoc City, Leyte	Molasses	9
Roxol Bioenergy	La Cariota, Negros Occ.	Molasses	30
Corporation			
Green future Innovations,	San Mariano, Isabela	Sugar Cane	54
Inc.			

Name of Bio-ethanol Producers and its production capacity

Itohchu Corporation and JGC Corporation in joint venture with Filipino partner (GFII) have commenced one of the biggest Bio-ethanol and Power Supply Projects in the Philippines. GFII started its operations in April 2012, thus 2013 is the second year of its operations. They are employing approximately 300 number of trucks with 13 tons of loading capacity, in order to deliver 684,000 tons of Sugar Cane to the Bio-ethanol Production Plant annually. According to the interview survey to the Joint Venture, supply of Sugar Cane is not performed as scheduled, thus the Project is suffering with an operating ratio slump with regards to the Plant. It is said that Sweet Sorghum was not chosen as the feedstock for their operation, due to inconsistent harvesting ratio recorded during the trial cultivation undertaken by State University of Isabela, although the cultivation period of Sweet Sorghum is shorter than that of Sugar Cane. The feedstock of San Carlos Energy, Inc. which has commended its Bio-ethanol Production prior to GFII also sources by Sugar Cane, thus there is no commercially operated Bio-ethanol Production Project in the Philippines which is sourced by Sweet Sorghum as the feedstock. In case of San Carlos Bio-energy, they have experimentally processed Sweet Sorghum which was grown by the farmers adjacent to its production plant to Bio-ethanol in 2011, but this operation was seemingly not succeeded in the following years for some reason.

Under the Project Formulation Survey, the Survey Team has conducted intensive interview surveys to various agencies who have been involved in the research and development activities on Sweet Sorghum such as Universities, Farmers Associations, Sugar Mills, Private Entities to understand the status quo of Bio-fuels development and identify its issues, in addition to Governmental bodies for understanding Governmental Policies, Legal Systems and Jurisdictions of those bodies. As the results thereof, the Survey Team has identified several issues on the cultivation of Sweet Sorghum. These include lower germination ratio, in-effective works on crushing and syrup-making, inconsistent delivery of feedstock to the Bio-ethanol Plant, quick deterioration of saccharase after harvest, and others.

II. Possible Applicability of the Proposed Bio-ethanol Production Systems

The simplified Bio-ethanol Production Systems which is developed by IB Consultant can process all the stages of Liquidation of Feedstock, Saccharification, Fermentation and Filtration of fermented feedstock by one piece of reactor which is assisted by certain automated program designed for the production of 40% Bio-ethanol from starches and saccharine materials. With these unique systems, higher quality of products, and labor-saving and low-cost production were achieved. This production plant shall be installed at the Station adjacent to the area of feedstock production. The number of production plant may be determined considering the variety of feedstock and its production volume at the hinterland of the Station. The Bio-ethanol which is produced at the Station shall be regularly transferred by tank lorry to the Base where processes of dehydration shall be performed. The ideal configuration of these two plants is one (1) Base with five (5) Stations. By establishing a network of Base and Station, transportation of huge amount of feedstock to the centralized production plant is no longer required. Energy source for the distillation and dehydration plants

may be obtained from the boiler that is fueled by various biomass available nearby and waste-heat from the plant and incinerators. Since, IB Consultant is currently developing new model of dehydration plant, the plant is applying new separation membrane technologies, and the production cost of the dehydration plant may further be lowered.

With these evidences and prospects, it is firmly believed that the proposed decentralized Bio-ethanol Production Systems may contribute to the expansion of Bio-ethanol Production capacity and improvement of farmers incomes involved in the cultivation the feedstock in the Philippines.

III. Verification on Adaptability of the Proposed Bio-ethanol Production Systems

The Survey Team has conducted verification test at Bio-ethanol Test and Research Plant in Fukushima, Japan, utilizing testing materials of Syrup, Cane Juice and Grain Powder of Sweet Sorghum being procured from the Philippines. The quality of fermented products was verified through analytical test that it is satisfactory qualify the requirements defined by the standards of Philippines Government for Automobile Fuels. In addition, it was analyzed, based upon the cost of simplified Bio-ethanol Production Plant produced by IB Consultant, that the production costs of Bio-ethanol will be 41.8 Philippine Peso per one liter in case of Type I (Annual Production Capacity: 130 KL), and 32.3 Philippine Peso per one liter in case of Type II (Annual Production Capacity: 260 KL), which are lower than that of selling price of Bio-ethanol domestically produced which was announced recently by the National Biofuels Board (NBB) of Philippines.

IV. Expected Development Impact and Effect on the Business

Development for the Proponent through the Proposed ODA Project

IV.1 Impacts to the Shimane and its Surrounding Economies by Overseas Business Development of the Proponent

Since this Production Systems are simplified and cheaply priced, large-scale manufacturers are difficult to enter into the market, and in fact most of the key components are produced by Small and Medium Enterprises (SMEs) in Shimane Prefecture. Thus it will contribute to activate regional economy and to increase the number of employment of Shimane Prefecture and its surrounding area, if number of the production will increase by the business development of the Proponent to the Philippines. Also, the Fermentation Yeasts being used for the Bio-ethanol Production are selected in close collaboration with Shimane University and a special trading house. If these Yeasts are used in the Bio-ethanol in the Philippines, it will also contribute to the activation of Shimane Regions.

IV.2 Impacts to the Filipino Economy by the Proposed Bio-ethanol Production a) Promotion of Sweet Sorghum Cultivation at the Rain-fed Areas

The DA has launched National Sweet Sorghum Program in 2007 by appointing Dr. Heraldo L. Layaoen and intensively promoted the cultivation of Sweet Sorghum for the production of Bio-ethanol. In the Philippines, there are considerable hectare of rain-fed agricultural areas where are affected by drought. Since the proposed Project seeks for the supply of various feedstock such as Sweet Sorghum for the production of Bio-ethanol, it will greatly contribute to the expansion of cultivation of Sweet Sorghum in particular at the Rain-fed agricultural areas.

b) Promotion of Bio-ethanol Production at the Sugar Mills

In order to overcome negative impacts of ASEAN Economic Integration which is scheduled due in 2015, many sugar mills in Negros Island which is known as the Sugar Kingdom are looking for diversification from monoculture of Sugar to other products, one of which is Bio-ethanol. Some sugar mill owners have expressed their interest in procuring the proposed Simplified Bio-ethanol Reactor which can produce 40 % of Bio-ethanol for their sugar mill where they have already installed a Dehydration Plant which can produce dehydrated Bio-ethanol for automobile fuels. Thus the proposed simplified Bio-ethanol Reactor may respond to these requirements.

IV.3 Necessity of Viability Verification on the Proposed Project through ODA Project

It was clearly understand through the Project Formulation Survey that a drastic improvement of Bio-ethanol production in the Philippines may not be achieved only by distributing the Bio-ethanol Production Systems but more comprehensive approaches are required. These program shall cover from the training on plantation, cultivation, fertilization, and harvesting of Sweet Sorghum, fermentation and dehydration of Bio-ethanol and it is difficult to undertake all of these activities by a private entity. Considering the magnitude of the gigantic scope of activities to be performed, the proponent is looking for a formulation of joint venture with PNOC-AFC and PADCC for Dissemination and Verification Test Project of the proposed Decentralized Bio-ethanol Production Systems in to the entire region of the Philippines. In the future, formulation of a joint venture with these national corporations will be key managerial strategy and adaptation of one-stop services covering the supply of cultivation support services for Sweet Sorghum and supply of fermentation yeasts will be key marketing strategy for the proponent.

V. Proposals for the Proposed Dissemination and Verification Test Project

V.1 Outlines of the Proposed Dissemination and Verification Test Project

After completion of the project formulation study, it is considered that this project will proceed to the stage of dissemination by applying for the Dissemination and Verification Test Project which will be funded by the Japan International Cooperation Agency (JICA). The Supreme Objective and Project Objectives may be defined as stated below.

[Supreme Objective]

To verify and confirm the commercial viability of the proposed Decentralized Bio-ethanol Production Systems in the Philippines and make the applicant prepared for implementing a venture.

[Project Objectives]

- a) Verify the viability of resolutions being proposed for addressing the issues along with the commercial production of Bio-ethanol through the proposed Decentralized Bio-ethanol Production Systems at the designated areas in the Philippines, and
- b) Conduct of transfer of technology for the development of Human Resources along with the implementation of the Dissemination and Verification Test Project

	Major Activities	Expected Achievement		
1	Experimental Cultivation and its Evaluation, and Selection of superior seeds of Sweet Sorghum	Higher yield of Sweet Sorghum by selecting superior seeds which have a higher germination ratio and higher yield of crop will be achieved.		
2	Introduction and improvement of Crushing Machine for Sweet Sorghum	Higher productivity on Bio-ethanol production by introducing Crushing Machine with higher extract ratio will be achieved.		
3	Verification Test at the cultivation field for utilization of liquid fertilizer made of residue and waste water derived from the Bio-ethanol production processes.	Higher productivity on Bio-ethanol production by developing Liquid fertilizer made of residue and waste water derived from the Bio-ethanol production processes will be achieved.		
4	Selection of fermentation yeasts/enzyme which is suitable for the fermentation in environments of higher humidity and temperature through the Verification Test.	Higher productivity on Bio-ethanol Production by selecting the most suitable yeasts/enzyme for fermentation of Bio-ethanol in Philippines will be achieved.		
5	Assisting for preparation of a standard farming plan for small-scale farmers participated in the proposed test, considering the climatic conditions and actual conditions of farming.	Farming Plan for the farmers participating in the cultivation of feedstock for Bio-ethanol will be established.		
6	Investigate and establish an verified MRV Methodology on the CO2 reduction along with the production of Bio-ethanol processes which may be applied for the JCM/BOCM.	Reliable MRV Methodology applicable for the Joint Crediting Mechanism (JCM) under the Bilateral Offset Credit Mechanism (BOCM) systems will be established.		

[Major Activities and the Expected Achievement]

V.2 Tentative Implementation Schedule of the Project

A tentative implementation schedule for the Dissemination and Verification Test Project is illustrated in the following table. According to the proposed schedule, substantial Verification Tests shall be completed by 2015 and data collection on the cultivation of feedstock and business transaction and distribution, and production of Bio-ethanol shall be done in 2016, while products of which shall be sold and the income thereof shall be supplemented to a part of the expenditures of the Dissemination and Verification Test.

Fiscal Year↔	2014	2015+	2016+2
Item+2			
 Adjust Meeting with cooperative Enterprise and Counter⁴ Part. Design of Fundamental System Frame ⁴ Conference with PNOC·AFC, PADCC ⁴ Siting and Designing of Fundamental System Frame.⁴ Design discussion with Ryuki engineering <u>Co.Ltde</u>⁴ Design discussion with International Public Relation⁴ 	D Site deciding, wor Bio reactor size de - Bio reactor Bio Reacto - Advanced	e k:assignmentstg. tiding, Fundamental frame designe r designe dehydration devices designe	ο O
 Manufacturing and installation of Simplified Device of Bio'ethanol production(Called Bio'Reactor)+' Manufacturing the Bio'reactor and Establishment of+' it's maintenance system+' Proceeding to Export, etc.+'	۵ 	لی Maintenance system ب ا ا Blendingب	¢ Sale of mixed fuel↔
Flow*' 6. System Siting Plan ,System Spread Plan , Training Center <u>+'</u> Lecture Plan*'			
 Evaluating LCA , Examination of Reducing Co2⁴ And Green house gas.⁴			ρ
			l

V.3 Estimated Budget of the Project

Estimated amount of budget for the proposed Dissemination and Verification Test Project may be summarized as follows;

 Survey and Report: J. Yen 8,000,000
 Consulting Services: J. Yen 7,000,000
 Manufacturing and Installation of Bio-ethanol Production, Dehydration and Auxiliary Plants: J. Yen 72,000,000
 Verification on Seeds/Yeast/ Liquid Fertilizer/MRV Method: J. Yen 13,000,000
 Total: J. Yen 100,000,000

V.4 Implementation Structure of the Project

The proposed Dissemination and Verification Test Project will be implemented along with the following members and implementation structure.

Project Formulation Survey on the Development of Decentralized Bio-ethanol Production Systems at the Rural Areas of the Philippines

Proponent and Counterpart Organization

- Name of the Proponents : IB Consultant Co., Ltd.
- Location of the Proponent : Shimane Pref., Japan.
- Survey Sites : Metro Manila, Ilocos Norte and Visayas Region, Philippines.
- Counterparts: Mariano Marcos State University, Bapamin Farmers Cooperative. Batac City Govt.

Concerned Development Issues

- Govt. of the Philippines has enacted the Bio-fuels Act in 2007 which requests compulsory mixing of Bioethanol for 10% to Gasoline and compulsory buy-out of the Bioethanol to oil dealers. Although production of sugarcane based Bioethanol has began, its extension is limited.
- National Sweet Sorghum Program was launched in 2007 with an attempt to cultivate Sorghum as the second crop in the dry-season at the rain-fed paddy fields.

Products and Technologies of the Proponent

Decentralized Production Systems consists of simplified bioethanol plant and dehydrization devices which best suite to rural areas and remote islands, have technical advantages over the Centralized systems in the production of Bioethanol from such saccharic materials as sugar-cane that decreases brix quickly after harvest. The systems will be used with Effective Yeasts.

Proposed ODA Projects and Expected Impact

Establish a joint research team together with Counterpart Agencies and Local Govt. for experimental production of Bioethanol and distribution Bioethanol to commercial markets in the Philippines. These experimental facilities shall be used as a training center for Bioethanol Production and Maintenance works in the future. Seek for cooperation from DOE & DA of Philippine Govt.

Future Business Development by the Proponent



Once venture in the Philippines has successfully been implemented, similar business model may be extended to those countries where large number of rain-fed paddy fields are located such as Indonesia, Cambodia, Myanmar and others .

