

**TO ESTABLISH AN AGRICULTURAL SYSTEM
WHICH HARMONIZES HUMAN LIFE WITH THE
ENVIRONMENT
THROUGH SMART USE OF RURAL RESOURCES
IN A REGIONAL ENVIRONMENT**

**– JIRCAS’S CLIMATE CHANGE INITIATIVES
FOR THE MEKONG DELTA, VIETNAM**

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Yasukazu Hosen holds a Doctorate degree in Agriculture from the University of Tokyo (Japan). His expertise is in the area of soil science. He worked at the National Institute of Agro-Environmental Sciences, Japan, at the Japan International Research Center for Agricultural Sciences (JIRCAS), Japan, the International Rice Research Institute, the Philippines, and at the Ministry of Agriculture, Forestry and Fisheries of Japan. Currently, he is a Project Leader of JIRCAS.

ABSTRACTS

In the Mekong Delta, Vietnam, the Japan International Research Center for Agricultural Sciences (JIRCAS) and Can Tho University (CTU), collaborating with other institutions, have been carrying out several research activities, three of which directly aim to mitigate greenhouse gas (GHG) emissions from agricultural activities and at the same time, to further farmers' interests. One of the three activities is conducted in rice paddies that are widely stretched over the Mekong Delta and were reported to have yielded 21 Mt of rough rice in 2008 (Can Tho Statistical Office, 2010); this was equivalent to twice the total production of Japan. The activity involved the introduction of a water-saving irrigation technology, which resulted in over 50% reduction in GHG emission and higher grain yields. The second research activity is carried out in the field of stock raising, which is expected to flourish in the region, to mitigate methane (CH₄) emission from beef cattle by developing and utilizing total mixed rations (TMRs). They provide adequate nourishment to meet the needs of cattle. Feeding cattle with TMRs resulted in increased rate of body weight gain and effective reduction of CH₄ emission from beef production per cattle compared with a forage-only diet feeding. The last activity involves the development of a local project in line with the Clean Development Mechanism (CDM), an international effort that helps disseminate mitigation measures against GHG emissions. Under this project, which is entitled "Farm Household Biogas Project Contributing to Rural Development in Can Tho City", biogas digesters (BDs) that generate CH₄ fuel from livestock excrement for household use, e.g., for cooking, were distributed. The emission reduction achieved through this project resulted in the issuance of Certified Emission Reductions (CERs or carbon credits) by the CDM Executive Board under the rules of the Kyoto Protocol (UNFCCC CDM 2015; Izumi et al. 2015).

The results individually obtained from each of these research activities, namely on rice, beef cattle and BDs, can be linked up together to enhance the efficiency of utilization of local materials/nutrients available in the Mekong Delta. For example, the large amount of rice straw, estimated to be 24 Mt y⁻¹ (in dry weight of the total aboveground biomass; Hong Van et al. 2014), which is derived from the huge rice production in the Mekong Delta, needs to be tapped. With an integrated approach, it is possible to realize an environment-friendly, profitable agriculture in the region. Underutilized or inefficiently utilized materials/nutrients in the region could be used efficiently by linking up the three components as follows: 1) rice straw, only 21% of which is estimated to be positively utilized in the region (Hong Van et al. 2014), can be utilized as feed in cattle raising instead of burning them (Arai et al. 2015); 2) cattle excrement can be utilized for CH₄ generation by using BDs (Izumi et al. 2015) instead of discharging them into water systems; and 3) BD effluent, waste fluid from BDs, can be utilized as fertilizer for rice cultivation. Through this linkage approach, rice and beef/milk production may be increased or kept at the present level without the need to increase or reduce the application rate of fertilizer and forage, respectively; and additionally, CH₄ fuel from BDs would be available for household use. On the contrary, increasing rice and beef/milk production following the conventional way, i.e., without integrating the said three components, would require increased fertilizer and forage input from external sources, consequently increasing local environmental loads. The combined use of the above-mentioned research results, is expected to exert a positive impact on GHG emissions reduction efforts not only at the regional level but also globally.

The linking up of the technologies that we have already developed in the Mekong Delta serve as our next challenge in our pursuit to establish an agricultural system which harmonizes human life with the environment in the region.


KEYWORDS

rice, livestock, biogas digester, greenhouse gas emission, Mekong Delta


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- UNFCCC CDM 2015: Project: 6132 Farm Household Biogas Project Contributing to Rural Development in Can Tho City. <http://cdm.unfccc.int/Projects/DB/JACO1335502236.58/iProcess/JQA1409644550.76/view>

To Establish an Agricultural System which Harmonizes **Human Life** with the **Environment** through Smart Use of **Rural Resources** in a Regional Environment



JIRCAS's Climate Change Initiatives for the **Mekong Delta, Vietnam**



Yasukazu HOSEN
Project Leader, Climate Change Project
JIRCAS

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JIRCAS's Worldwide Collaborative Research 


FY 2014
Research activities with 71 research institutes (26 countries)
MOU with foreign research institutes / organizations : 108



475 of overseas travels by 132 JIRCAS staffs


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JIRCAS's Research Programs and Projects (at present)



- Environment and Natural Resource Management**
 - Development of agricultural technologies in developing countries to respond to climate change (Climate Change Project)
 - Development of resilient agro-pastoral systems against the risks of extreme weather events in arid grasslands in Northeast Asia
 - Development of technologies for sustainable agricultural production in the African savanna
 - Development of environment-friendly agricultural production technologies in islands
 - Utilization of Biological Nitrification Inhibition (BNI) function for the development of breeding materials and application to cropping systems
- Stable Food Production**
 - Development of rice production technologies in Africa
 - Development of genetic engineering technologies of crops with environmental stress tolerance
 - Development of breeding technologies toward improved production and stable supply of upland crops
 - Evaluation and utilization of diverse genetic materials in tropical field crops
 - Rice innovation for environmentally sustainable production systems
 - Development of integrated pest management techniques for stabilization of agricultural and livestock production in developing areas
- Rural Livelihood**
 - Establishment of a sustainable and independent farm household economy in the rural areas of Indochina
 - Design and evaluation of a recycling-based agricultural production system in upland farming areas of Northern China
 - Advanced application of local food resources in Asia
 - Development of biofuel and biomaterial production technologies using biomass resources in Southeast Asia
 - Development of forest management and conservation techniques through sustainable use in Southeast Asia
 - Development of aquaculture technologies for sustainable and equitable production of aquatic products in tropical coastal areas
- Information Analysis**
 - Collection and analysis of international food supply and demand, as well as production systems
 - Dissemination of research trends and local information

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JIRCAS's Climate Change Project 

Impact Evaluation

- Effect of meteorological disasters on rice production (Bangladesh)
- A world food model for the yields of rice, wheat, maize and soybeans (World)

Adaptation


- Drought tolerance/avoidance in rain-fed rice production systems through
 - Breeding (Philippines, Japan, Indonesia, Myanmar, India)
 - A decision support system based on seasonal weather forecast (Japan, Philippines, Indonesia, Laos)
- Effective use of reservoir networks (Sri Lanka)
- Salinization measures (Uzbekistan)

Mitigation

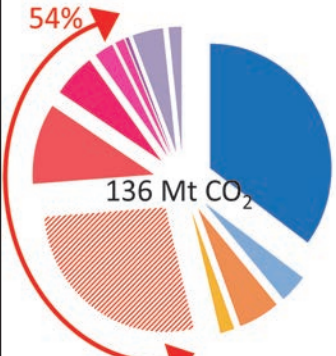
- GHGs from
 - Beef cattle (Thailand, Vietnam)
 - Rice paddies (Vietnam)
- C sequestration through
 - Afforestation/reforestation/agroforestry (Paraguay, Ethiopia, Burkina Faso)
 - Soil C enrichment (Thailand, Vietnam, Indonesia)
- Efficient use of unused resources
 - Fuel production with biogas digesters (livestock waste) (Vietnam)

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CDM

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Agricultural GHG in Vietnam 

World's No.5 rice producing and No.2 rice exporting country (2015, FAO)




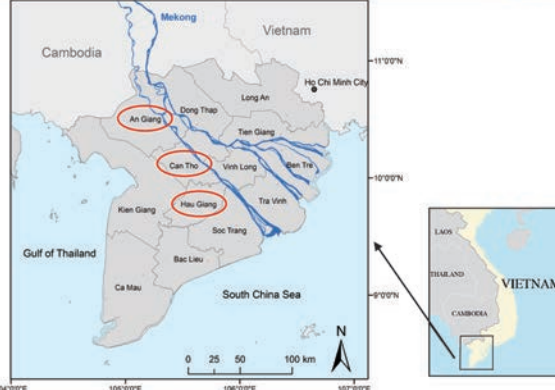
136 Mt CO₂

- Fuel Combustion 35.1%
- Fugitive Emission from Fuels 3.7%
- Mineral Products 5.5%
- Metal Production 1.9%
- Chemical Industry 0.01%
- Rice Cultivation 27.6%**
- Agricultural Soils 10.5%
- Enteric Fermentation 5.7%** (Ruminants in the livestock industry)
- Manure Management 2.5%
- Field Burning of Agricultural Residues 1.2%
- Prescribed Burning of Savannas 0.4%
- Solid Waste Disposal on Land 4.1%
- Wastewater Handling 1.7%

UNFCC Report 2004

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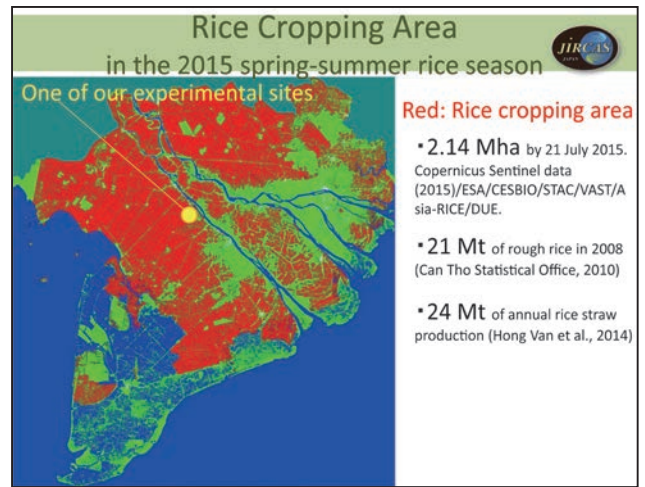
The Mekong Delta, Vietnam 



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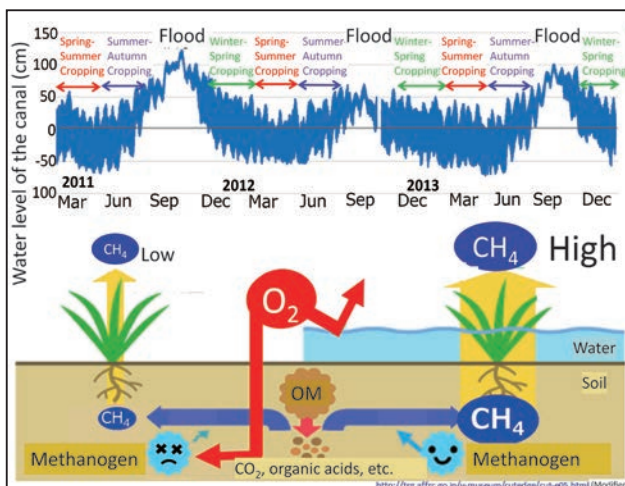
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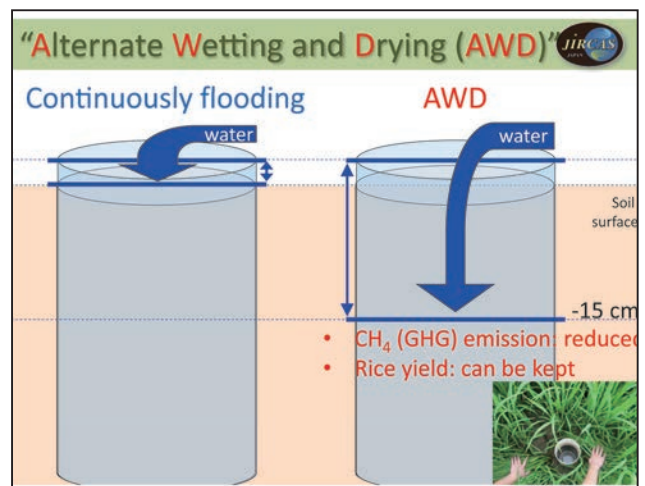
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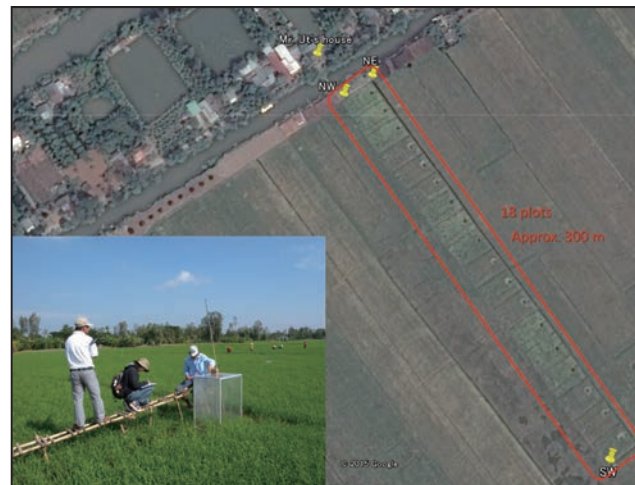


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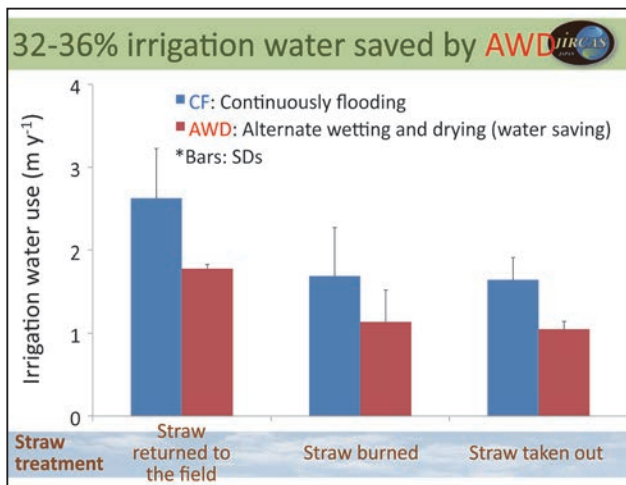
But Why Water-saving in the Mekong Delta Rich in Water?

- To **reduce CH₄** (GHG) emission,
- To **reduce fuel costs for irrigation**,
- and possibly, to **increase the rice yield**.

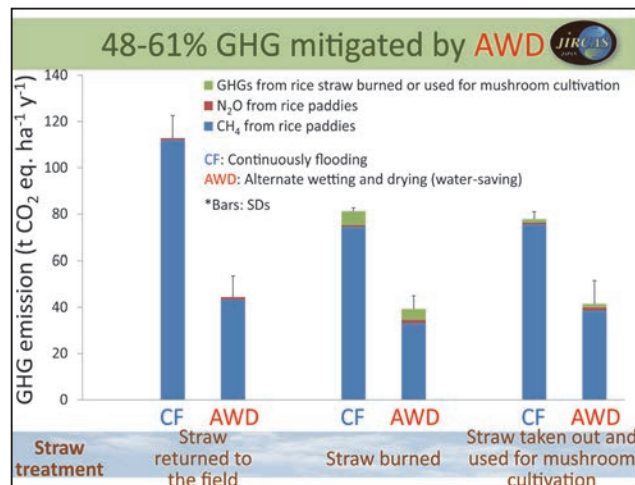
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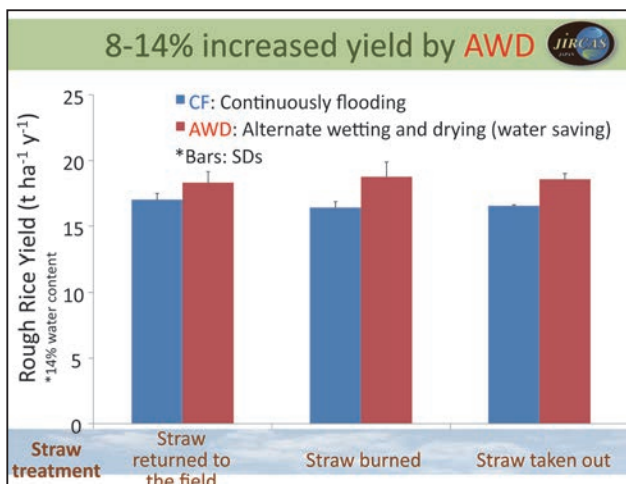
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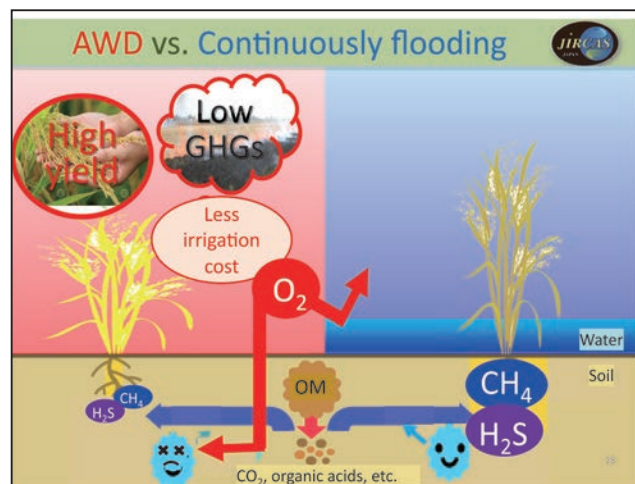
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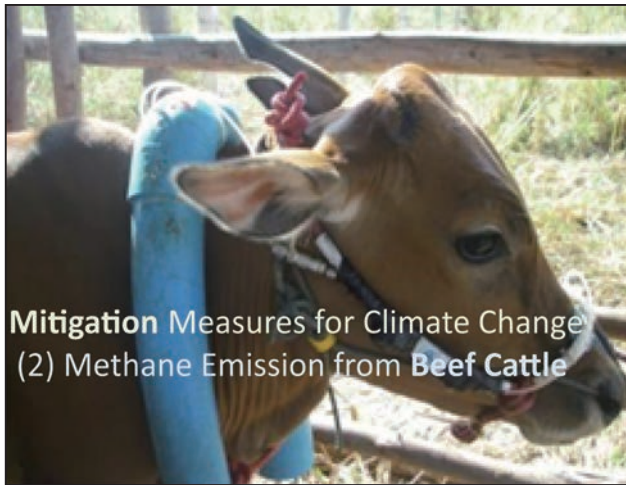
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Methods and Hypothesis

Effective use of easily available local biomass: Rice straw, Rice bran, Cassava pulp, Brewer's grain

Fermented TMR: Well-balanced with higher storage quality

Rapid body weight gain

Low CH₄ emissions per body weight gain

Map: Thailand, Laos, Cambodia, Vietnam, Myanmar, China

Locations: Khon Kaen University, Can Tho University

Image: Front view of head cage

Text: CH₄ emission monitoring with a head cage method

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Pangola Grass vs. FTMR

Animals: 8 Thai native male cattle

Treatment:

- Control: Pangola grass (ad libitum)
- FTMR: Fermented TMR (ad libitum)

Measurement: Intake, body weight, and CH₄ emission

Experimental period: 5 months

Ingredients: Rice straw, Rice bran, Cassava pulp, Brewer's grain, Easily available local biomass

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Pangola Grass vs. FTMR

		Pangola grass	FTMR
DM intake	kg DM/day	1.62	2.56*
DM digestibility	%	54.5	67.4
Average body weight gain	g/day	15	303
ME content	MJ/kg DM	7.1	10.3*
CH ₄ emission	L/day	68.7*	56.0
	L/kg DMI	42.5*	21.9

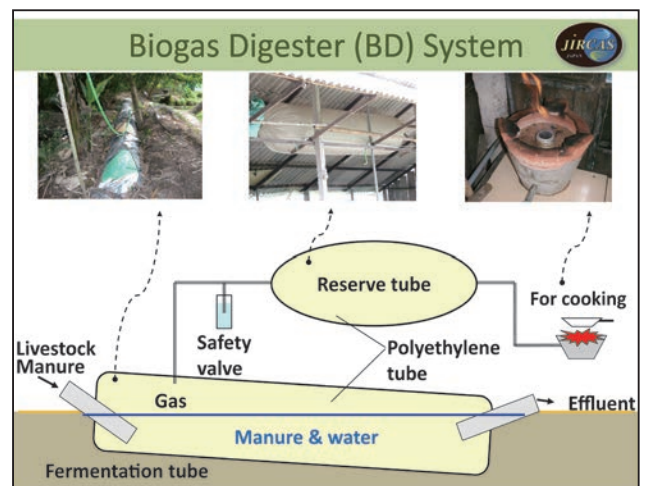
DM: dry matter; DMI: DM intake; ME: metabolizable energy *P<0.05

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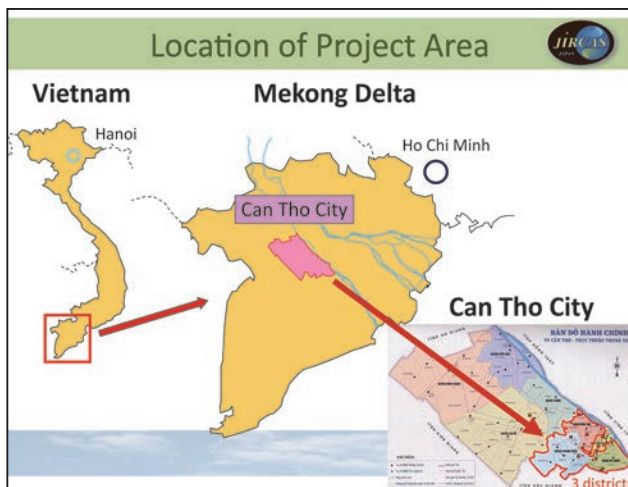


Mitigation Measures for Climate Change (3) A Biogas Digester (BD) CDM Project

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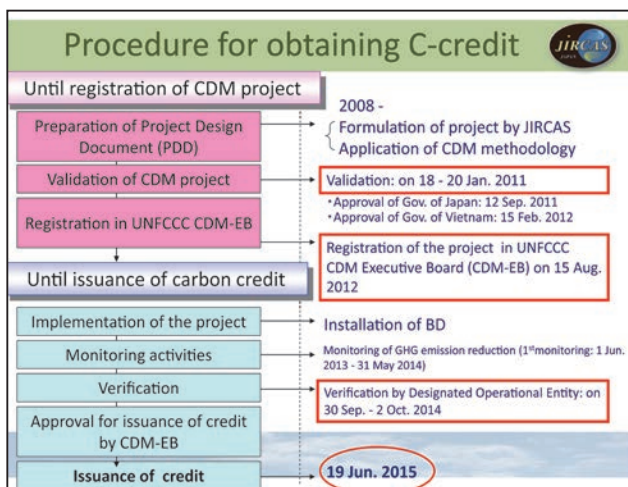
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Outline of the Biogas CDM Project

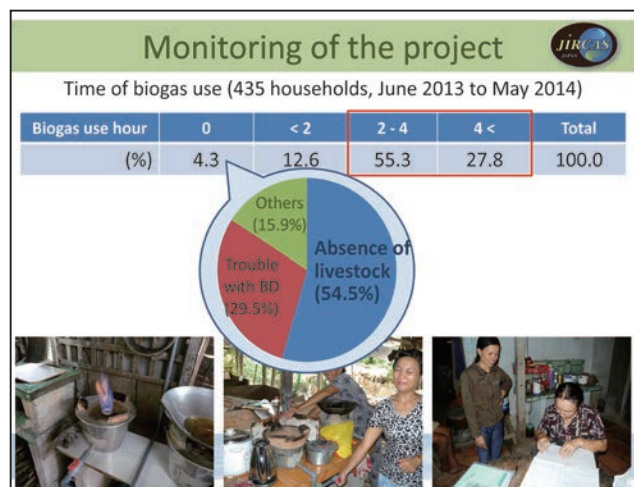
- Title:** Farm Household Biogas Project Contributing to Rural Development in Can Tho City
- Duration:** 7 years. Monitoring period started on 1 June 2013
- Location:** 3 districts in Can Tho City, Viet Nam
- Activity:** Introducing around 1,000 units of biogas digester (BD) system to displace the use of firewood and LP gas with biogas. The estimated total GHG emission reduction is around 1,200 tCO₂/year
- Remarks:** Registered on 15 August 2012 with the UNFCCC CDM-EB. First biogas CDM project to directly benefit low-income households as well as the environment in Vietnam.

CDM: Clean Development Mechanism
UNFCCC CDM-EB: CDM Executive Board of United Nations Framework Convention on Climate Change

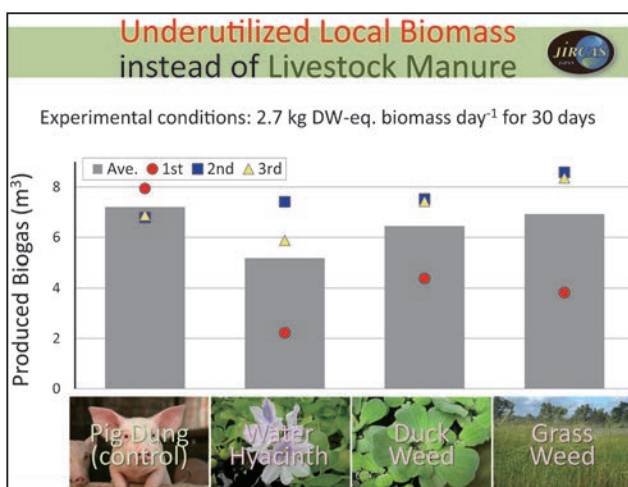
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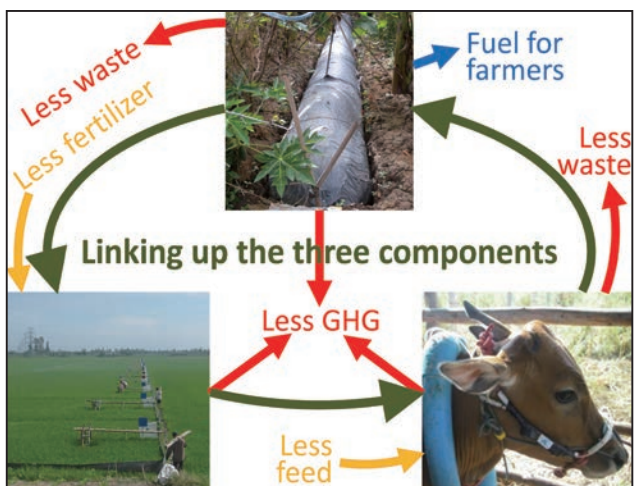
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The Next Challenge

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