# A business feasibility study on paprika with carbon footprint (CFP) label

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## 1. INTRODUCTION

Ministry of Agriculture, Forestry and Fisheries (MAFF in Japan) Try to promote an eco-friendly scheme to agricultural sector The carbon-footprint (CFP) for agricultural products Consumers in Japan The added value for CO<sub>2</sub> emission reduction The carbon-footprint on the agricultural products might be brought (Itubo, 2009) such as vegetables would become attractive

We focused on greenhouse using a lot of energy and conducted feasibility study on our system, supplied electricity, thermal energy and CO<sub>2</sub> for growth promotion to paprika cultivation by BT under added-value for CFP.

The standard price of a paprika is higher in comparison to other vegetables.

Amount of distributed the paprika is increasing each year.

\*The standard price of a paprika: 200JPY

As one of vegetables the added value for CO<sub>2</sub> emission reduction might be brought, we focused the paprika cultivation.

Table 1 The condition of specification for our case study

	Gas Engine			SOFC + HP	
	Cultivation scale	BT-plant scale		Cultivation scale	BT-plant scale
GE-Case1	2ha	15t/day	SOFC-Case1	2ha	15t/day
GE-Case2	2ha	30t/day	SOFC-Case2	2ha	30t/day
GE-Case3	2ha	60t/day	SOFC-Case3	2ha	60t/day
GE-Case4	4ha	15t/day	SOFC-Case4	4ha	15t/day
GE-Case5	4ha	30t/day	SOFC-Case5	4ha	30t/day
GE-Case6	4ha	60t/day	SOFC-Case6	4ha	60t/day

### 2. METHODOLOGY

#### 1. Outline of our system

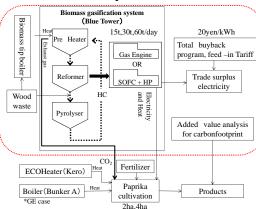
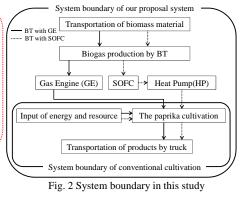


Fig. 1 Proposed system

#### 2. Biomass LCA



 CO<sub>2</sub> emissions for products are based on LCA methodology.

## 3. Willingness to Pay due to Carbon footprint

In this previous study ...

The consumer should have a willing to pay (WTP) for ecofriendly vegetables.

There is potential to reduce CO<sub>2</sub> emission by purchasing the product.





4000

§ 2000

#### Added value

We clarified the sustainable business conditions in the consideration of the additional profit due to WTP besides the public support.

# 3. ENERGY AND CO, EMISSION OF THE CULTIVATION

#### 1. Conventional cultivation system

We estimated the energy consumption and CO<sub>2</sub>

Table 2 Annual production yield and energy consumption

240	t/year
240000	L/year
4300	L/year
58460	kg/year
100	MW/year
23715	kg/year
	240000 4300 58460 100

## 2. CO<sub>2</sub> emission of conventional cultivation

Table 3 Specific CO2 intensity

2.8	kg-CO <sub>2</sub> /L	
2.51	kg-CO <sub>2</sub> /L	(
0.2	kg-CO <sub>2</sub> /kg	
0.468	kg-CO <sub>2</sub> /kW	(
2.5	kg-CO <sub>2</sub> /kg	
	2.51 0.2 0.468	2.51 kg-CO <sub>2</sub> /L 0.2 kg-CO <sub>2</sub> /kg 0.468 kg-CO <sub>2</sub> /kW

582.4g-CO2/paprika (4ha) 573.9g-CO<sub>2</sub>/paprika

## 3. The cultivation installing proposed system

Results from the interview to the farmer CO<sub>2</sub> gaseous concentration **11** 3000ppm \*conventional case: 600 ~700ppm Total yield would be three times

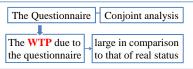
Fig. 3 CO<sub>2</sub> concentration and increasing rate of yield

# ◆ CO<sub>2</sub> reduction rate(each case): 55.1 ~ 89.8%

# 4. ANALYSIS OF COMSUMER'S AWARENESS AND ADDED VALUE FOR

## 1. Conjoint analysis, Questionnaire and Result

- We analyzed a questionnaire using conjoint analysis. The Questionnaire
  - ◆ Residents in Miyagi prefecture in Japan : 1000 families
  - ◆ The responses : 241(24.9%)
- ◆ The investigation period : from Oct. 1 to 15, 2010 (1) the preference survey of paprika, (2) the survey of environment awareness and (3) the predicable survey



#### 2. Estimation of added value



Price: 200yen/paprika

Table 4 Marginal W H	,
Rate of CO <sub>2</sub> reduction [yen/a paprika CO <sub>2</sub> reduction 100%]	82.9
Production area(Otherprefecture) [yen/a paprika]	61.2
Production area (Miyagi) [yen/a paprika]	117.0



200yen/paprika CO<sub>2</sub> benefit : 15.0 ~ 24.4yen/paprika

215.0 ~ 224.4yen/paprika

## 5. CASE STUDY

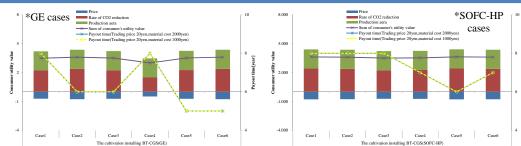


Fig. 5, 6 Relation between payout time, internal rate and consumer's utility

# 6. CONCLUSION

> It is highly possible that our system which is a combined system with the agriculture facility would be practically.

Abatement of

investment cost

- The combined SOFC system which would be fueled by the bio-fuel of hydrogen would be extremely promising one in the near future.
- They have good potential to pay more money for the products by which their utilities would be raised up.
- Due to the beneficial combinations, we would be able to reduce the cost relatively while abating CO<sub>2</sub> emission.