Rio+20 Outcome to Implementation: Water-Energy-Food Security Nexus in Indonesian Palm Oil Industry

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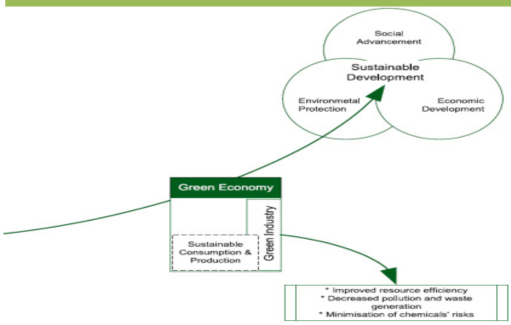
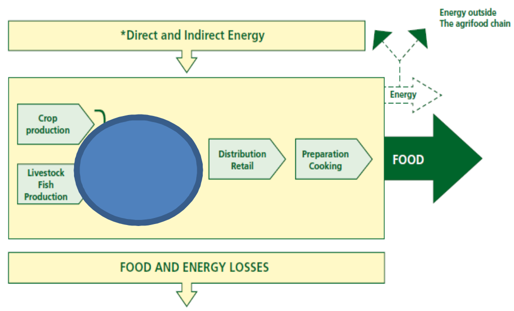
Introduction



Rio+20 Outcome: Green Economy and Sustainable Development (UNIDO)



Problem 1: Energy and Food in Agriculture chain (FAO)

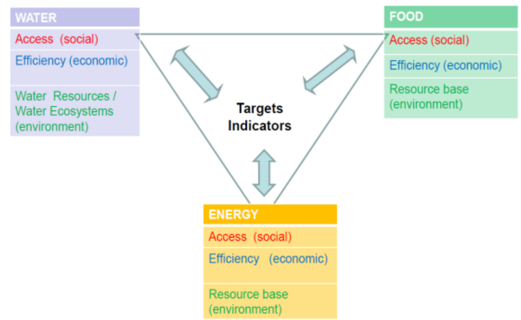
Problem 2: Waste Water Effluent in Palm Oil Industry in Indonesia (photograph: Jupesta)

Background

1. Science (basic research), Technology (applied R&D) and Innovation (STI) play important roles to address global challenges by providing innovative goods and services at low cost that aim to address global challenges that affect the poor.
2. Palm oil is the most important agricultural commodity in Indonesia, and plays a significant role in the country's development, representing a total export of 2.8% of the country's GDP and employs as many as 6 million people using a land area of 8.1 million ha in 2010. From 2005 to 2010, 26% of deforestation in Indonesia is attributed to the expansion of palm oil plantations, which associates palm oil production with biodiversity loss and climate change.
3. Based on the US Environment Protection Agency, that Greenhouse Gas (GHG) emission reduction of palm oil based biofuel is 17% with reference conventional diesel fossil fuel; below the threshold 20%. Implementing methane capture facilities could reduce the GHG emission respectively which leads to sustainability of the palm oil production in general.

Objective

This research project aims to link Rio+20 outcome to implementation by developing an appropriate low carbon technology which also reduce water demand and provide clean energy access such as a methane capture facility at a palm oil industry in Indonesia.



Rio+20 Implementation: Water-Energy –Food Security Nexus.

Literatures

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Methodology

Stakeholder perspectives	Technology design	Technology development	Technology deployment	Technology diffusion
Scientist perspective (system analysis)	+++	+	+	+
Engineer perspective (system design)	+	+++	+	+
Consumer perspective (system modelling)	+	+	+++	+
Policy maker perspective (system governance)	+	+	+	+++

Results

GHG Emissions (KgCO2/ton Crude Palm Oil (CPO))	with methane capture	without methane capture
Plantation	487.8	486.3
Fertilizer	239.7	239.7
Electricity	239.8	238.3
Transport	8.3	8.3
Mill	3,138.4	38.9
Methane	3,099.5	0.0
Diesel Fuel	36.1	36.1
Chemical	2.8	2.8
Total	3,626.3	525.3
Water demand (m3/tonCPO)		
Plantation	0.017	0.017
Mill	6.514	6.188

Fig. 6. The Life Cycle Assessment in a Palm Oil industry.

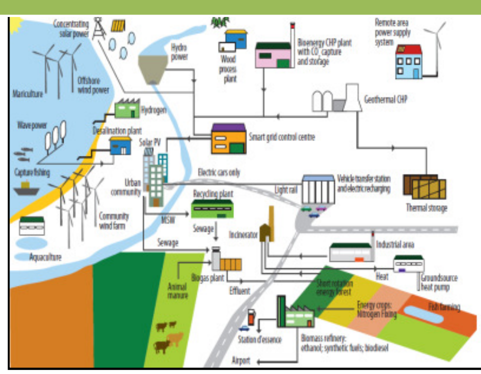

Fig. 7. The Integrated Water-Energy-Food Systems in Agriculture Farming (*adopted from FAO*).

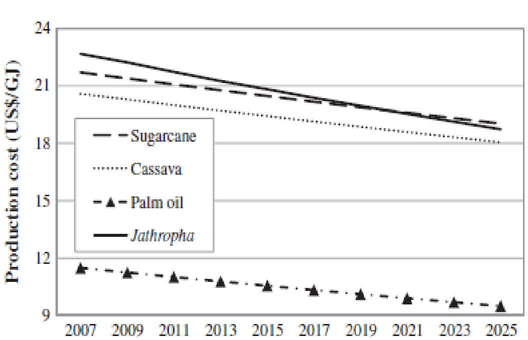

Fig. 8. The Production Cost of Palm Oil with other Biofuel crops. *Source: Jupesta, Applied Energy (2012).*

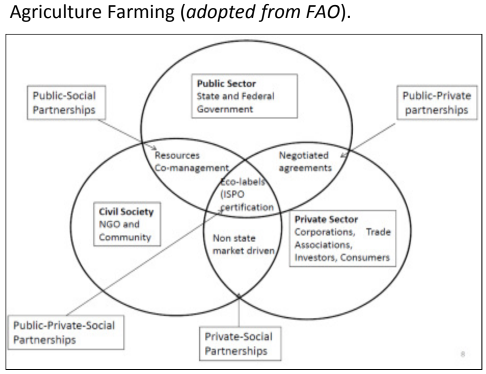

Fig. 9. The stakeholders mapping for certification of Sustainable Palm Oil. *Source: Jupesta. Adopted from Young.*

Conclusions

1. From science perspective (i.e.: life cycle analysis): implementing methane capture could reduce up to 85% of total CO_2 emissions from plantation and mill processes and up to 5% due to less water demand for washing the effluent from the mill processes. The energy from methane could be used as biogas for cooking fuel and electricity.
2. From technology perspective: the sustainable production system requires integration of STI of methane capture facility development starting from integrated approach to ensure high efficiency and reliability of the systems..
3. From market perspective: the production cost may decrease due to economies of scale. The lowest production cost obtained for palm oil production, the decrease cost is 11.5 US$/GJ in 2007 to 9.5 US$/GJ in 2025. The production cost of *Jatropha curcas* which was higher that that of sugarcane in 2007, becomes lower in 2025 as the production costs for biodiesel drops faster than that for bioethanol.
4. From policy perspective: the inclusiveness of relevant stakeholders (public, private and civil society) could be achieved in the case of certification of Indonesia Sustainable Palm oil (ISPO).

Acknowledgment

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