ASIA-PACIFIC NETWORK FOR
GLOBAL CHANGE RESEARCH

POLICY BRIEF LCD-03

APN Global Change Perspectives

Low Carbon Development

October 2015

The Role of Bioenergy in Energy-Food-Ecosystem Nexus in Asia

Lilibeth A. Acosta, Damasa B. Magcale-Macandog, K. S. Kavi Kumar, Xuefeng Cui, Elena A. Eugenio, Paula Beatrice M. Macandog, Arnold R. Salvacion and Jemimah Mae A. Eugenio

SUMMARY

- Conjoint preferences revealed significant trade-offs among energy security, food security and ecosystem capacity in the Philippines, India and China.
- The preferred role of bioenergy for sustainable development reflects the social and economic concerns in the respective Asian countries, e.g. energy security and environmental condition in China, food security in India, and ecosystem degradation in the Philippines.
- Policy should carefully weigh the impacts of bioenergy development on sustainability issues that are closely interlinked in an energy-food-ecosystem nexus.

Box 1. Summary.

The sustainability of bioenergy has raised doubts among experts in both the science and policy communities due to the interdependence, and thus inherent trade-offs, between energy security, food security and ecosystem capacity. The case study on the role of bioenergy in the energy-food-ecosystem nexus (or "interconnection") in countries like the Philippines, India and China are very relevant to policy and society as they are both producers and consumers of biofuel. Energy security is one of the most often cited policy objectives for bioenergy development due to the short-term volatile prices and long-term dwindling supply of fossil fuels, particularly oil, which can destabilise the economy (Acosta-Michlik et al., 2011). Policies that promote bioenergy (e.g. biofuel blending, green economy) have resulted in a dramatic increase in the global production and trade of both raw feedstock (e.g. sugarcane, palm, etc.) and biofuels (i.e. bioethanol and biodiesel) (Acosta et al., 2014). However, bioenergy production has resulted in many unintended adverse impacts on the society. Land expansion for feedstock production in developing Asian countries is mostly driven by private investors, in some cases, resulting in displacement of local farmers and residents. In recent years, bioenergy trade has exerted undesirable impacts not only on specific communities due to social displacement, but also on the entire population of countries due to its threat on food security. Moreover, the widespread system of bioenergy production is causing degradation of the ecosystem, resulting in conversion of forests into monoculture

Recommended Citation:

Acosta, L. A., Magcale-Macandog, D. B., Kumar, K. S. K., Cui, X., Eugenio, E. A., Macandog, P. B. M., . . . Eugenio, J. M. A. (2015). *The role of bioenergy in energy-food-ecosystem nexus in Asia* (APN Global Change Perspectives Policy Brief No. LCD-03). Kobe: Asia-Pacific Network for Global Change Research.

APN Secretariat, 4th Floor, East Building 1-5-2 Wakinohama Kaigan Dori, Chuo-ku, Kobe 651-0073, JAPAN.

Tel: +81-78-230-8017;
Fax: +81-78-230-8018;
Email: info@apn-gcr.org;
Website: www.apn-gcr.org

ASIA-PACIFIC NETWORK FOR
GLOBAL CHANGE RESEARCH

There is a need for both a redirection in government policy and a change in societal behaviour.

The preferences for sustaining energy security, food security and ecosystem capacity are influenced by the socio-economic circumstances and demand of the people.

plantations of soybean, sugarcane, corn, or palm.

A "Nexus" Approach

Trade-offs in bioenergy are increasingly taken into account in "nexus" studies because understanding the form of trade-offs can help avoid the selection of extreme and single-objective management policies. The present case study of the energy-food-ecosystem nexus aims to inform on the need for not only a redirection in government policy but also a change in societal behaviour. The study focuses on analysing societal behaviour, in particular the perceptions and preferences that influence behaviour towards sustainable bioenergy. The analysis is based on choice-based conjoint surveys of respondents representing different parts of society in the Philippines, India and China.

Diverged Views

Across all three countries, the majority of respondents are of the opinion that bioenergy is good for the economy (Table 1). But, opinions on the effects of bioenergy on food security generally diverged. About half of the Philippine respondents from both AGRI and NON-AGRI professions think that bioenergy has negative effects on food security. In India, while half of the AGRI respondents have the opinion that bioenergy affects food security, only about a quarter of the NON-AGRI respondents think the same. The NON-AGRI respondents in this country have high level of education and are living in urban areas. It could be that they are either less informed or less affected, and thus less concerned, by the conflicting issues between bioenergy production and food security. In China, there is a reverse pattern of opinion. About half of the NON-AGRI respondents think that bioenergy affects food security, and only less than a quarter of the AGRI respondents think the same. The AGRI respondents in China are characterised by very low education and mainly living and working in farms. This could explain their lack of awareness on the impacts of bioenergy production on food security.

Figure 1 compares the relative importance of energy security, food security and ecosystem capacity based on the respondents' preference levels. There is an obvious disparity in the relative importance of these sustainability variables across the three countries and between the two professional segments. In the Philippines, food security and ecosystem capacity are the most important factors for both AGRI and NON-AGRI respondents as far as promoting sustainable bioenergy is concerned. Awareness on the impact of environmental degradation on vulnerability

Knowledge and Familiarity	Philippines		India		China	
	AGRI	NON-AGRI	AGRI	NON-AGRI	AGRI	NON-AGRI
Familiar with the term bioenergy	74.0	87.0	100.0	100.0	36.5	63.8
Work is related to bioenergy	28.4	6.1	95.6	94.3	7.7	11.2
Bioenergy affects food security	62.4	42.0	50.0	21.4	15.4	50.9
Bioenergy is good for the economy	94.7	95.0	98.9	100.0	98.1	92.2

Note: The table refers to responses from about 600 survey respondents. AGRI refers to agriculture-related and NON-AGRI to non-agriculture professions. The values are percentages of the total respondents in each work category. For the opinion on bioenergy, respondents were asked to answer "yes" or "no". The values presented in the table are only the percentage of respondents who answered "yes".

Table 1. Knowledge and familiarity on bioenergy, by country and profession.

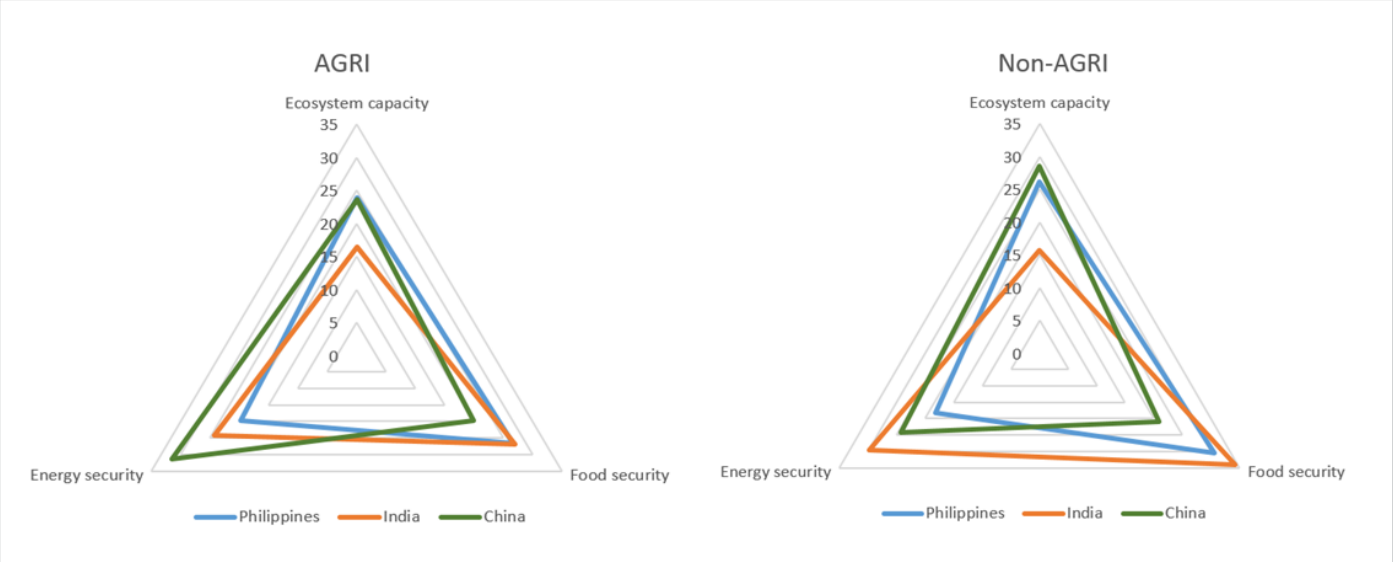

Figure 1. Level of importance of energy security, food security and ecosystem capacity, by country.

to floods and landslides is increasing in the Philippines, which could explain the high preference for ecosystem capacity (Acosta et al., 2014). Although the Philippines has one of the highest energy prices in Asia, it has very good sources of other forms of renewable energy like hydropower and geothermal energy. This may explain why energy security using bioenergy is not a high priority goal in this country. In India, NON-AGRI respondents are more concerned about food security as shown by the highest level of preferences not only in comparison to AGRI respondents in India, but also to respondents in the other two countries. Next to food security, energy security is an important concern for respondents, in particular those with a NON-AGRI profession who live mainly in urban and suburban areas. The preferences for ecosystem capacity is lowest in India. In China, the AGRI respondents consider energy security and NON-AGRI respondents consider ecosystem capacity as the most important sustainability factors for bioenergy development, respectively. The latter may be explained by the concern for environmental problems like air pollution in Chinese cities. These results suggest that preferences for sustaining energy security, food security and ecosystem capacity are influenced by the socio-economic circumstances and needs of the people.

Policy Implications

A significant number of respondents perceived bioenergy as beneficial for the economy, although many of them think that it affects food security. Policies promoting bioenergy may have provided a general perception in society about its economic benefits, despite the negative implications on food security and ecosystem capacity. Moreover, the preferred role of bioenergy for sustainable development reflects the general social and economic concerns in the respective countries, e.g. energy security in China, food security in India, and ecosystem degradation in the Philippines. This implies that society expects that bioenergy development could contribute to addressing these socio-economic problems. Thus, policy should carefully weigh the impacts of bioenergy development on sustainability issues that are closely interconnected in an energy-food-ecosystem nexus because society may favour one or two sustainability issues at the cost of another issue.

Policy should carefully weigh the impacts of bioenergy development on sustainability issues that are closely interconnected (energy-food-ecosystem nexus).

RECOMMENDATIONS

- Decision makers at all administrative levels should aim to increase awareness in various parts of society not only about economic opportunities but also about the social and ecological implications of bioenergy production.
- Government programmes that support environmentally sustainable production of bioenergy should ensure the protection of ecosystem services on which sustainable food production depends.

Box 2. Recommendations.

References

Acosta, L. A., Eugenio, E. A., Macandog, P. B. M., Magcale-Macandog, D. B., Lin, E. K., Abucay, E. R., Cura, A. L. & Primavera, M. G. (2014). Loss and damage from typhoon-induced floods and landslides in the Philippines: community perceptions on climate impacts and adaptation options. *International Journal of Global Warming, In Press*, p. 33.

Acosta-Michlik, L., Lucht, W., Bondeau, A. & Beringer, T. (August, 2011). Integrated assessment of sustainability trade-offs and pathways for global bioenergy production: Framing a novel hybrid approach. *Renewable and Sustainable Energy Review, 15 (6)*, 2791–2809.

Bindraban, P. S., Bulte, E. H., & Conijn, S. G. (July, 2009). Can large-scale biofuels production be sustainable by 2020?. *Agricultural Systems*, *101 (3)*, 197–199.

Ciaian, P. & Kancs, D. (2011). Food , energy and environment : Is bioenergy the missing link ?. *Food Policy, 36 (5)*, 571–580.

Ciaian, P. & Kancs, D. (2011). Interdependencies in the energy – bioenergy – food price systems : A cointegration analysis. *Resource and Energy Economics, 33 (1)*, 326–348.

Doornbosch, R., & Steenblik, R. (2007). *Biofuels: is the cure worse than the disease?*. Paris: OECD. Retrieved from http://www.oecd.org/sd-roundtable/39411732.pdf.

Headey, D. & Fan, S. (2008). Anatomy of a crisis : the causes and consequences of surging food prices. *Agricultural Economics, 39 (S1)*, 375–391.

Kuchler, M. & Linnér, B. (2012). Challenging the food vs. fuel dilemma: Genealogical analysis of the biofuel discourse pursued by international organizations. *Food Policy, 37 (5)*, 581–588.

UNCTAD. (2014). *The global biofuels market: Energy security, trade and development (UNCTAD Policy Brief No. 30)*. Retrieved from http://unctad.org/en/PublicationsLibrary/presspb2014d3_en.pdf.

About this publication: This policy brief is developed for APN project "Integrated Sustainability Assessment of Bioenergy Potentials in Asia: An Application of A Hybrid Approach on Trade-offs and Pathways (PIC-STRAP)" (LCI2012-04NMY(R)-Macandog; LCI2013-04CMY(R)-Macandog) under APN's Low Carbon Initiatives Framework. It is also a summary of an article submitted to the Special Issue "Sustainable Agriculture" of the journal Agriculture. For full details of this project, including technical reports and other outputs, please visit the project metadata page at http://www.apn-gcr.org/resources/items/show/1918.

Authors: Prof. Dr. Lilibeth Acosta-Michlik, Potsdam Institute for Climate Impact Research (PIK), German Development Institute/Deutsches Institut für Entwicklungspolitik (DIE), Germany; Prof. Damasa B.M. Macandog, University of Philippines, Philippines; Prof. Dr. K. S. Kavi Kumar, Madras School of Economics, India; Dr. Xuefeng Cui, College of Global Change and Earth System Science, Beijing Normal University, China ; Elena A. Eugenio, Paula Beatrice M. Macandog, Arnold R. Salvacion, Jemimah Mae A. Eugenio, University of Philippines, Philippines.

Managing Editor: Linda Anne Stevenson;
Content Coordinator: Taniya Koswatta;
Editors: Linda Anne Stevenson, Taniya Koswatta, Xiaojun Deng;
Design: Xiaojun Deng, Huong Long Dinh.