Prospects and Policy Options for Thailand's Trade in Bioenergy in the Mekong Region: Implications for Sustainable Development[1]

Sabrina Shaw[2]

Abstract

The emerging dynamics of integration are in the process of being defined in the Mekong region. Trade has become the currency of cooperation. This unprecedented level of cooperation in Asia on agriculture, energy and trade, in combination with the need to address climate change, sets the stage for implementing a regional vision for a sustainable energy future. This article seeks to examine Thailand's policy space to develop bioenergy in the Mekong Region. Whilst Thailand has signaled a new era with its recent renewable energy strategies, it has yet to assess fully the socio-environmental effects of biofuels. This research brings together theory, policy and practice within the framework of sustainable development. Among its main conclusions is that, if current practices prevail, Thailand is likely to use an unsustainable model of trade-led development for biofuels at the regional level. Although increased use of biofuels in

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[2] Ph.D. candidate (Thai Studies), Faculty of Arts, Chulalongkorn University and Associate, International Institute for Sustainable Development.

Thailand may address immediate energy needs, it may also lead to increased food prices and encourage farmers to expand agriculture in environmentally unsustainable areas or to utilise unsustainable production methods in neighbouring Mekong countries. Use of alternative bioenergy sources may promote energy security, revitalise rural economies and reduce greenhouse gas emissions if implemented at the local community level according to the concept of Sufficiency Economy. Meeting food and energy needs in the Mekong region in the 21st century will require a range of approaches that shift the current development paradigm to enhance the sustainability of agricultural productivity. To this end, there are significant synergies between small-scale initiatives and enhanced agro-energy sustainability.

Introduction

We have to develop some means to get at the balance between the environment and development.

Charit Tingsabadh

There are several reasons underlying this research. First, intraregional trade is increasing between Thailand and its Mekong neighbours (Cambodia, China, Lao People's Democratic Republic, Myanmar and Vietnam). This will change the pace of growth in the region, which in turn, will have social and environmental effects. These effects will not be inconsequential given the prospects for resource intensity and scale of trade. In this context, there are rapidly increasing demands for agricultural crops to be used for fuel (e.g., sugarcane and cassava for ethanol; palm oil for biodiesel).[3] The expansion of first generation biofuels produced from agricultural biomass has the potential to displace food and fiber production and

[3] *Development Partners Meeting on GMS Biofuels and Rural Renewable Energy.* Bangkok: Asian Development Bank, 2009.

has caused considerable controversy.[4] Second, greater use of biofuels, particularly in the transport sector, would serve to lessen the region's dependence on imported oil.[5] Thailand's policymakers recognise that the next decade may witness a transition to more cost-effective second generation biofuels, which are at least a decade away from commercialisation (e.g., wood residues and algae).[6] To this end, research and development is concentrating on developing the necessary technologies to utilize the Mekong region's abundant natural resources more efficiently. This includes collaborating with biofuels leaders, such as Brazil, to stimulate south-south cooperation and technology transfer.

Third, the potential to trade in biofuels represents opportunities, as well as challenges for Thailand. In order to capture the opportunities, there needs to be a better understanding of the relationship between Thailand's production, promotion and use of biofuels and sustainable development. Bioenergy synergies need to bring together theory, policy and practice within the framework of sustainable development in order that practice can better inform agro-energy policymaking in the region. In this way, opportunities for Thailand to emerge as a key biofuels producer and consumer may contribute to building a sustainable energy future for the region. Finally, through implementing the concept of *Sufficiency Economy*, Thailand has gained experience in adapting to the impacts of

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[4] Mario Giampietro and Kozo Mayumi, *The Biofuel Delusion: The Fallacy of Large Scale Agro-biofuels Production* (London: Earthscan, 2009); *The State of Food and Agriculture. Biofuels: Prospects, Risks and Opportunities* (Rome: Food and Agriculture Organisation of the United Nations, 2008); *Sustainable Bioenergy: A Framework for Decision Makers*, (New York: United Nations, 2007); Richard Doornbosch and Ronald Steenblik, *Biofuels: Is the Cure Worse than the Disease?* (Paris: Organisation for Economic Cooperation and Development, 2007).

[5] *Exploring Core Environment Program-Private Sector Partnerships for Developing Biodiesel as an Alternative Fuel in the Greater Mekong Subregion* (Bangkok: Asian Development Bank and National Science and Technology Development Agency, 2009); *Road Map for Expanded Energy Cooperation in the Greater Mekong* (Manila: Asian Development Bank, 2009).

[6] Peesamai Jenvanitpanjakul and Teerapatr Srinorakutara, "Thailand's Research and Development in Biofuels," *Proceedings of the World Alternative Energy Sciences Expo* (Bangkok, 2009).

globalisation through community-based agro-energy initiatives. This concept offers a basis from which to build resilience at the local level and enable a transition to low-carbon economies in the highly climate-vulnerable Mekong region.

This article presents an analysis of Thailand's prospects and policy options for trade in bioenergy in the Mekong Region, to provide a better understanding of the public policy choices that are necessary to strike a balance between trade and development in the emerging bioenergy matrix in Thailand and the Mekong region. The findings are based on secondary sources, field work and a survey questionnaire conducted by the author between October 2008 and July 2009. The article puts forward policy recommendations and offers some conclusions flowing from the research.

Thailand's Bioenergy Strategies

Why Biofuels?

Thailand has a long history of research on biofuels initiated by the King's Royal projects in Chitralada Gardens in the 1980s. [7] As the world's largest exporter of tapioca and rice, and second largest sugar exporter, Thailand has significant capacity to produce agricultural feedstocks for biofuels. Emphasising the need to help farmers reap the benefits of new energy crops and related technologies, the shift to bioenergy has been set in Thailand's Alternative Energy Development Plan (2009) and in the common agricultural strategy endorsed by the six Mekong Ministers of Agriculture in 2007. Thailand's energy intensity in relation to gross domestic product (GDP) has been rising since the early 1980s to a relatively high level of 1.4 to 1. This means that for each percent increase in GDP, there is a resulting increase of 1.4% in energy consumption. The majority of energy is consumed in the transport (37%) and industrial (36%) sectors.[8]

Thailand's biofuels sector is more advanced than in other countries in Asia for several reasons. First, Thailand is heavily

[7] *Renewable Energy in Thailand: Ethanol and Biodiesel* (Bangkok: Department of Alternative Energy Development and Efficiency, Ministry of Energy, Thailand, 2004).
[8] *Thailand Economic Monitor* (Bangkok: World Bank, 2009).

dependent on imports of petroleum to stimulate its export-led growth. Over the past decade, Thailand spent approximately 10% of its annual GDP on oil imports. Already in the 1980s, Thailand began investing in research and development to decrease oil dependence by converting its abundant agricultural biomass into biofuels. [9] Notwithstanding these efforts, policies promoting sustainable biofuels are perceived to be lacking, with all respondents of the survey undertaken for this research overwhelmingly indicating that information and coordination needed to be improved.

Second, in light of the volatile world price of oil, biofuels offer a means to diversify fuel sources, thereby increasing energy security. The predominant rationale behind the region's quest to develop bioenergy is to enhance energy security through cultivating a substitute for costly petroleum imports. The vast majority of respondents (82%) in the research survey ranked energy security as the main driving force behind bioenergy development in the Mekong, with only one respondent referring to climate change as a driver.

Third, developing the biofuels sector represents an opportunity to add value to the agricultural sector and stimulate rural development. Fourth, biofuels may help to reduce greenhouse gas emissions, thereby contributing to addressing climate change. While studies are ongoing to calculate the net energy balance of various biofuel feedstocks, more efficient use of agro-processing waste materials and water effluents is reforming the sustainability of the agricultural sector (specifically for tapioca and oil palm processing mills).[10]

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[9] Wannarat Channukul, *Alternative Energy: A Critical Strategy for Sustainability of Thailand's Energy Sector* (Bangkok: Chulalongkorn University, 2009); *A Decade of Achievements: 1998-2008* (Thonburi, Thailand: King Mongkut's University of Technology, Joint Graduate School of Energy and Environment, 2009).

[10] *Enabling Agriculture to Contribute to Climate Change Mitigation,* Submission to the Ad Hoc Working Group on Long-term Cooperative Action under the Climate Change Convention (AWG-LCA), February 6, Rome: Food and Agriculture Organisation, 2009, 11 August 2009 <http://www.unfccc.int/resource/docs/2008/smsn/igo/036.pdf>; *Bioenergy for Sustainable Development and Global Competitiveness: The Case of Sugar Cane* (Stockholm: Stockholm Environment Institute, 2008); Surapong Charoenrath, *Fuel Ethanol Market Assessment and Potential of Cassava in Thailand* (Bangkok: Field Crop Research Institute, Department of Agriculture, Thailand, 2008).

Based on this combination of diverse policy objectives, Thailand's Cabinet approved a strategic plan for gasohol in 2003 and one for biodiesel in 2005, as well as created a *National Biofuels Committee* to coordinate efforts. Thailand's longer-term ambitious target, approved in March 2009, is to supply 20% of national energy consumption with renewable energy by 2022, compared with 8% in 2008. Energy experts agree that this is an ambitious objective.

Prospects for Trade in Biofuels

Thailand's current objective is to increase production of biofuels to meet domestic targets in the transport sector. Thailand's strategic plans for gasohol and biodiesel have established blending targets supported by crop production plans. These plans are geared to meeting domestic targets to increase Thailand's renewable energy matrix. In the context of increasing trade and investment integration and mandated renewable energy targets in other countries, there are also emerging opportunities for biofuels trade with countries in the Mekong region, ASEAN and the European Union. There are valid concerns about the environmental and social consequences of increasing the contribution of agricultural feedstocks to fuel as opposed to food.[11] Nevertheless, research indicates that trade in biofuels – under the appropriate conditions – may generate economic, environmental and social benefits.[12]

In addition to integrating ethanol in the domestic fuel mix in the transportation sector, Thailand is taking tentative steps towards increasing exports of surplus *ethanol*. As set out in Table 1, only 21 of the 47 licensed ethanol plants are in operation, with an annual capacity of 3.2 million liters.

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[11] *Sustainable Bioenergy: A Framework for Decision Makers* (New York: United Nations, 2007)

[12] *Biofuels in Asia: An Anaylsis of Sustainability Options* (Bangkok: United States Agency for International Development, 2009); *Small-scale Bioenergy Initiatives* (Rome and Nairobi: Food and Agriculture Organisation and Policy Innovation Systems for Clean Energy Secruity, 2009); *Biofuel Production Technologies: Status, Prospects and Implications for Trade and Development* (New York and Geneva: United Nations Conference on Trade and Development, 2008); *Biofuel Promotion and Development in Lao PDR* (Vientiane: Lao Institute for Renewable Energy, 2008).

Table 1: Thailand's Ethanol Production Capacity, 2009 (Million liters)

Status of plant	Sugarcane molasses		Cassava		Sugarcane and cassava		Total	
	Plants	Capacity	Plants	Capacity	Plants	Capacity	Plants	Capacity
Operating	10	1.445	1	0.13	1	0.15	12	1.725
Under construction	1	0.15	8	2.04	0	0	9	2.19
Licensed	15	2.69	24	8.39	8	1.22	47	12.30

Source: Interview with Natikorn Prakabbon, Department of Energy Development and Efficiency, Ministry of Energy, Bangkok, 1 May 2009.

In 2008, Thailand exported 71 million liters of ethanol to a range of countries, including Australia, Japan, the Netherlands, the Philippines, Singapore and Taiwan. [13] Exports are hampered by the need for case-by-case approval from the Ministry of Commerce. This is due to the fact that the Cane and Sugar Act (1984) does not differentiate sufficiently between alcohol production for beverage use and for fuel.[14] The Thai Ethanol Manufacturers Association argues that the regulatory framework should be revised to distinguish between the two to facilitate exports of surplus ethanol. Moreover, permitting ethanol to be produced directly from sugarcane juice (as opposed to molasses) and allowing market dynamics to drive the degree of substitution between sugar and ethanol production would increase the economic viability of the sector. The majority of respondents (68%) in the research survey considered that the main challenge to the development of the ethanol sector is a combination of a consistent policy framework and policy implementation, as opposed to improving crop yields, harvesting techniques or processing technologies.

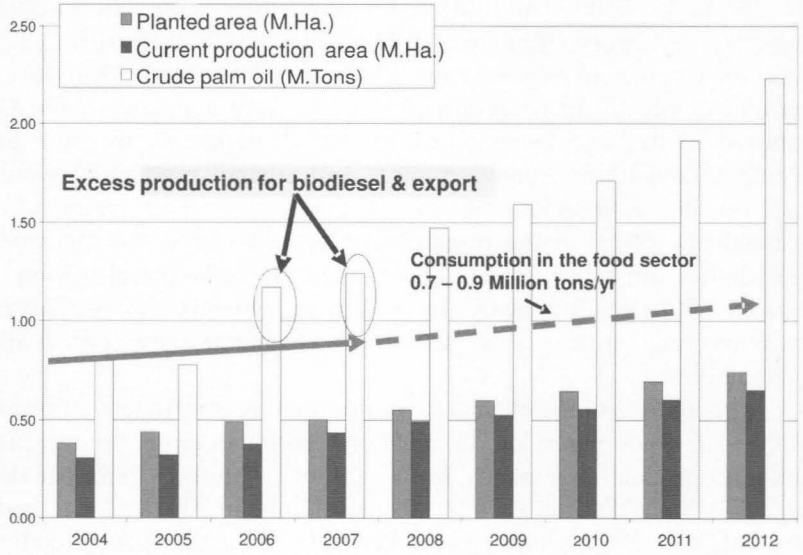
In contrast to the ethanol scenario, there is insufficient domestic supply of *crude palm oil* to meet the national target to increase biodiesel production capacity from 1.39 to 3.3 million liters per day by 2012. Since February 2008, all diesel sold in Thailand has been blended with 2% biodiesel (so called B2). To meet these blending

[13] Natikorn Prakabbon, Department of Alternative Energy Development and Efficiency (DEDE), Ministry of Energy, Personal Interview, 1 May 2009.

[14] The categorization of ethanol as an agricultural product or an industrial good is an issue that also needs to be clarified in the World Trade Organisation.

requirements, the Government plans to increase the area of oil palm plantations by 5 million rais (800,000 hectares) by 2010. There are 9 operational biodiesel plants. Table 2 illustrates Thailand's planned acreage and production of palm oil, indicating domestic consumption in the food sector and the potential for exports. Non-commercial, small-scale biodiesel production and use is also being promoted in nearly 500 pilot communities to enhance local energy sufficiency. As in the case of ethanol, the majority of respondents (72%) in the research survey considered that the main challenge to biodiesel development is a combination of a consistent policy framework and policy implementation, as opposed to the need to improve crop yields, harvesting techniques or processing technologies.

Table 2: Thailand's Oil Palm Acreage and Crude Palm Oil Production, 2004-2012



Source: Jai-In Samai, *Vision and Perspectives of the Biofuel Sector in Thailand* (Bangkok: Presentation at the World Alternative Energy Science Expo, 2009).

There are four key points related to trade in biofuels. First, Thailand's expansion of biofuel capacity initially needs to be supported by a policy and regulatory framework that establishes a secure domestic market. Second, the removal of regulatory barriers to trade would facilitate exports, particularly in the region. Third, the development of high quality performance standards for biofuels to facilitating an integrated bioenergy market in Asia. Thailand recently finalised dual product quality standards for biodiesel (community and commercial) and a standard for ethanol. Discussions are beginning at the Asian regional level on social and environmental indicators related to biofuels. Fourth, Thailand's main trading partners, the European Union, the United States and Japan, are enacting strict sustainability regulations for biofuel imports. This means that any future development of trade in biofuels may depend on certifying the sustainability of the chain of production for energy crops.[15] For example, the 2003 directive adopted by the EU establishes a target of 10% for transport energy by 2020 and requires that the biofuels meet sustainability standards. [16]

Developing Energy Crops in the Mekong

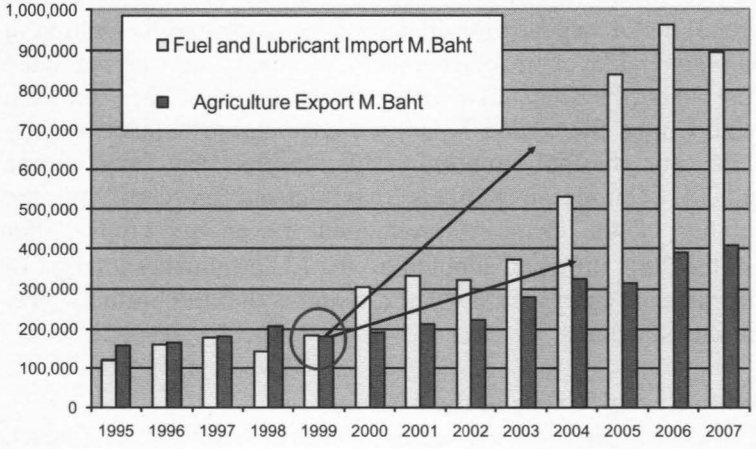
Developing the biofuels sector will have a significant impact, not only for Thailand, but for the predominantly agriculture-based Mekong economies as a whole. Agriculture serves to underpin rural incomes, food supply, and increasingly, feedstock inputs into the rapidly expanding bioenergy sector. While the contribution of the agricultural sector to GDP and exports in Thailand has decreased significantly since the mid-1980s, the contribution of agriculture to employment remains high. Agriculture accounted for 40% of employment in Thailand in 2007 and between 55-75% in other Mekong countries. In 2008, agriculture contributed 10% to Thailand's

[15] Karl Segschneider[0], ed., *Field Survey on Sustainable Palm Oil in Thailand and Compliance with International Standards* (Bangkok: Southeast Asia Consult & Resource Company Limited, 2008); *The Impacts and Opportunities of Oil Palm in Southeast Asia* (Bogor: Center for International Forestry Research, 2009).

[16] Energy and climate change: on the promotion of the use of energy from renewable sources RES-E (repeal. Directives 2001/77/EC and 2003/30/EC), Directive 2008/0016 23 Apr 2009, *Official Journal of the European Union*, 23 Mar 2009.

GDP and 15% to exports. It contributed from 20% to 45% of the GDP of other Mekong economies and was responsible for a significant contribution to domestic food supply. [17] In this respect, increased cultivation of energy crops may result in socio-economic and environmental consequences.[18]

Table 3: Fuel Imports versus Agricultural Exports, 1995-2007



Source: Samai

As illustrated in Table 3, since the turn of the century, Thailand's annual expenditure on fuel imports has been rising exponentially relative to agricultural exports. Whilst there are opportunities to add value to agricultural production through

[17] *Thailand Economic Monitor.*

[18] *Sustainable Agriculture and Food Security in the Asia and Pacific* (Bangkok: United Nations Economic and Social Commission for Asia and the Pacific, 2009); *Thailand Biofuels: Biofuel's Impact on Food Crops* (Bangkok: US Department of Agriculture Foreign Agricultural Service, 2009).

developing energy crops, several challenges are identified in the literature.[19]

With countries in the Mekong region considering renewable energy targets, investment in biofuels is increasing at a rapid pace in response to these regulatory requirements (Table 4).

Table 4: National Biofuels Policies in the Mekong Region

Country	Agro-energy crops		Targets in transportation (% share of total fuel consumption)		Fiscal incentives and subsidies	Import/Export Tariff rates
	Biodiesel	Ethanol	Biodiesel	Ethanol		
Cambodia	Oil palm Jatropha	Cassava Sugarcane	*Proposed 5% by 2011*		Tax exemptions; investment incentives; Biodiesel Development Fund	Benefits from General System of Preferences (GSP) & EU Everything But Arms Initiative
China	Jatropha	Corn Wheat Sorghum Cassava Sugarcane	10% by 2020 (Renewable Energy Law)		Tax exemptions; blending credits; low interest loans; R&D funding; ethanol production linked subsidies (US$220 million- 2007)	Biodiesel applied tariff 9% Denatured ethanol: ad valorem 80% Undenatured ethanol: 100%
Lao PDR	Oil palm Jatropha	Sugarcane Cassava	*Proposed 5% by 2020*		Investment promotion	Benefits from GSP & EU Everything But Arms Initiative
Myanmar	Jatropha	Sugarcane Sorghum	*Proposed 5% by 2015*		Demonstration projects	NA
Thailand	Oil palm Jatropha Cooking oil	Sugarcane Cassava	B2 mandated since Feb 2008; B5 promoted	Gasohol (E20) available nationwide	Price guarantees; blending credits; tax exemptions and incentives for gasohol vehicles; R&D funding; investment promotion	Tariff rate quota regime for imports of Crude Palm Oil Biodiesel: ad valorem 5% Denatured ethanol: 2.5 Baht/L Undenatured ethanol: 80 Baht/L
Vietnam	Fish oil Jatropha Cooking oil	Sugarcane Cassava	1% by 2015 5% by 2025		R&D funding; investment promotion	Benefits from GSP & EU Everything But Arms Initiative

Source: ADB, 2009; DEDE, 2009; SNV and WWF, 2009; USAID, 2009; GSI, 2008.

[19] David Pimental, "Food Versus Biofuels: Environmental and Economic Costs," *Human Ecology,* 37 (1) (2009): 1-12; *Renewables 2008: Global Status Report* (Washington, D.C.: Worldwatch Institute, 2009); *World Development Report 2009: Agriculture for Development* (Washington, D.C.: World Bank, 2008); Bundit Fungtammasan, "Recent Policies and Challenges in Sustainable Energy Development in Thailand," *Renewable Energy for Sustainable Development*, Eds. V.K. Vijay and H.P. Garg (New Delhi: Narosa, 2009): 12-25.

Cambodia, Lao PDR, Thailand and Vietnam are promoting energy crops in the framework of the Ayeyawady-Chao Phraya Mekong Economic Cooperation Strategy (ACMECS). Thailand has been actively engaged in the ASEAN Free Trade Area (AFTA) to provide assistance for energy crop contract farming along border areas with Lao PDR, Cambodia and Myanmar and to allow tariff free imports of certain agricultural products. [20] Some experts contend that the current contract farming model for agro-energy is leading to a paradigm shift in agricultural development in the Mekong region. [21] For Thailand, contract farming in neighboring countries (Cambodia, Lao PDR and Myanmar) offers a means to expand agricultural production,[22] and is expected to contribute 1 million rais (160,000 hectares) to oil palm acreage by 2011.

Exploring the Policy Options: Energy, Food Security and Climate Adaptation

Strategies to increase the contribution of biofuels to Thailand's energy mix have to take into account several related issues, notably the consequences for food security and the environment. First, Thailand's creation of a *Food and Energy Management Committee* in 2008 has initiated a coordinated national debate on how to balance food and fuel requirements from agriculture. To ensure that a rising demand for energy crops does not negatively impact production for food, the agricultural sector is being zoned and restructured. Second, given Thailand's position among the world's leading producers and exporters of rice, sugar and tapioca, the issue of food security takes on an international dimension. The fear is that a switch from food to fuel

[20] David Fullbrook, *Contract Farming in Lao PDR: Cases and Questions* (Vientiane: Laos Extension for Agriculture Project, 2007).

[21] Lorenzo Cotula, Nat Dyer, and Sonja Vermeulen, *Fuelling Exclusion? The Biofuels Boom and Poor People's Access to Land* (Food and Agriculture Organisation and the International Institute for Environment and Development, 2008).

[22] *Developing Sustainable Pro-Poor Biofuels in the Mekong Region* (Vientiane: WWF and SNV, 2009).

cultivation, if not properly managed, could adversely impact global food supplies.[23]

Third, and consequently, one of the reasons why Thailand has recognised the need to address climate change, is its potential impact on agricultural productivity. Agricultural systems are dependent on imported fossil fuels and are vulnerable to climate change. The need to adapt to climate change has prompted Thailand to promote local energy sufficiency through the use of bioenergy. Fourth, the Clean Development Mechanism (CDM) of the Kyoto Protocol is stimulating renewable energy projects. As of October 2009, Thailand has approved 88 CDM projects, including 52 for biogas operations (mainly from tapioca and oil palm processing waste water) and 18 for biomass operations (mainly rice husks).[24] Nevertheless, very few respondents (1%) in the survey for this research indicated that climate change mitigation was a driving force for bioenergy development in the Mekong.

Opportunities and Challenges for Thailand's Biofuels Sector

The potential benefits of increasing the production and use of biofuels in Thailand are fourfold: (1) to reduce oil imports; (2) to diversify energy sources and increase energy security; (3) to add value to agricultural products and revitalise rural development; and (4) to reduce greenhouse gas emissions. However, finding the appropriate balance between energy security, energy efficiency and sustainable resource management to develop the biofuels sector in a sustainable manner presents several challenges (Table 5). It will require technological and productivity innovation alongside sustainable resource management. Moreover, building a viable biofuels sector requires sustained political will to ensure effective implementation and enforcement of policy mandates.

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[23] Jun Yang, Jikun Huang, Huanguang Qiu, Scott Rozelle and Mercy Sombilla, "Biofuels and the Greater Mekong Subregion: Assessing the impacts on prices, production and trade," *Applied Energy* 86 (2009): 537-546.

[24] *TGO Carbon Monthly,* July, August 2009, Thailand Greenhouse Gas Management Organisation, 1 October 2009 <www.tgo.or.th[0]>.

Table 5: Prospects for Trade in Biofuels in the Mekong

Opportunities	Challenges
To add value to agricultural production; efficiently manage waste agricultural residues	Need for well-defined bioenergy policies and targets at the national and regional level
To shift dependence from petroleum to enhance energy security in the emerging Mekong economies	Need to address food security concerns by balancing competing claims for land between food, fuel and fibre
To gain from the Mekong's diversity of energy crops for ethanol and biodiesel	Need for economic incentives to deliver sufficient feedstocks; need to enhance awareness and information on the biofuels market
To develop small-scale community bioenergy production and to build resilience to external shocks; create local energy sufficiency; stimulate rural development and reduce input costs from petroleum and fertilizers	Need to balance large-scale commercialised agro-industrial development of biofuels for the transport sector and for export
To benefit from low costs of production (land, labour, water)	Need to address land use changes and labour migration within the region resulting from biofuels development; need to ensure transparent, equitable investment and safeguard land rights
To develop high potential demand as transportation infrastructure expands in a dynamic region	Need to enforce strategic impact assessments to address social and environmental consequences of biofuels plans and projects
To operationalise the Clean Development Mechanism, gain carbon credits and stimulate investment and technological innovation in second generation biofuels	Need to guide private sector investment through enforcing socio-environmental regulations (air, water, land and labour laws)
To develop the potential to export surplus biofuel production	Need to facilitate exports and secure market access (to meet sustainability criteria and address other non tariff barriers to biofuels trade)

In large part due to the fact that demand for biofuels is driven by regulatory mandates, with production costs subsidised by governments, there are valid concerns about economic efficiency and socio-environmental sustainability. Reports on the biofuels sector in China and Malaysia highlight the risks inherent in subsidising fuel: subsidies increase consumption and discourage more efficient resource use. [25] Moreover, the impacts of converting 'marginal lands' to feedstock production are highly dependent on local circumstances. Indeed, many aspects of sustainability are context specific.

As Thailand increases production, use and export prospects for biofuels, there are likely to be corresponding environmental consequences–for the better and for the worse. Analysis of the potential environmental impacts reveals a mixed and variable outcome depending on the crop. For sugarcane (ethanol) and oil palm (biodiesel) expansion, land use changes and increased water and fertilizer use are identified as variables that may contribute to environmental degradation and social displacement. As a direct result, less water intensive crops, such as cassava (ethanol) and Jatropha (biodiesel) have been put forward by their advocates as potentially more sustainable energy feedstocks. Nevertheless, the degree and extent of the environmental effects will depend on the regulatory and management framework in place for land and water use, as well as wastewater treatment.

Water and its management and scarcity are essential elements of the future of biofuels in Thailand and the Mekong region. Water is a key factor affecting agricultural yield and output. In the case of sugarcane, for example, most production in Thailand is located in rain-fed areas, with only 10% in irrigated zones. Increasing the efficiency of water use to avoid shortages needs to be supported by proper pricing of water to reflect its scarcity. The importance of agriculture is recognised in Thailand's economic stimulus package in 2009, which will support infrastructure development, for example, to improve irrigation systems.

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[25] Gregore Pio Lopez and Tara Laan, *Biofuels at What Cost? Government Support for Biodiesel in Malaysia and China* (Geneva: International Institute for Sustainable Development, 2008).

The current emphasis in Thailand has been to further life cycle analysis and sustainability assessments of biofuel systems.[26] To date, evidence in Thailand indicates that there are significant opportunities to adapt new technologies to increase energy efficiency in biofuel conversion and to utilise agricultural waste residues.

To illustrate the variations in the results of sustainability assessments, depending on the perspective, consider the following. Recognising that its ambitious 5.75% target for biofuels in the transport sector by 2010 will require considerable imports, the EU Sustainability Directive stipulates that this target must be met with biofuels that fulfill sustainability criteria. To meet the EU criterion to achieve greenhouse gas emissions savings of 35%, a recent study examined the greenhouse emissions savings of indigenous Irish rape seed and imported Thai palm oil.[27] Given that palm oil generates more biodiesel per hectare than rape seed and has less demand for fertilizer and fuel inputs, greenhouse gas reductions of 29% and 55% were calculated for Irish rape seed and Thai palm oil systems, respectively. In other words, it appears to be more climate friendly for Ireland to meet the EU biofuel targets by importing palm oil from Thailand.

Transforming Rural Development: Small Is Beautiful

Globalisation and market liberalization are changing global agricultural production, with the risk of excluding small landholder farmers in developing countries from adding value to their production. Large-scale biofuel systems are facing several challenges that do not

[26] Thu Nguyen, Shabbir Gheewala, and Savitri Garivait, "Full Chain Energy Analysis of Fuel Ethanol from Cane Molasses in Thailand," *Applied Energy* 85 (2008):722-734; Thu Nguyen and Shabbir Gheewala, "Fossil Energy, Environmental and Cost Performance of Ethanol in Thailand," *Journal of Cleaner Production* 16 (2008): 1814-1821; *Life Cycle Assessment of Ethanol from Cassava and Sugar Cane* (Bangkok: Department of Alternative Energy Development and Efficiency, Ministry of Energy, Thailand, 2007).

[27] Thanasit Thamsiriroj and Jerry Murphy, "Is it better to import palm oil from Thailand to produce biodiesel in Ireland than to produce biodiesel from indigenous Irish rape seed?" *Applied Energy* 86 (2009):595-604.

paint a picture of sustainability, particularly in developed countries.[28] Moreover, large-scale, energy-intensive monocrop plantations are deemed to be one of the main causes of deforestation, soil erosion and the increased use of chemical fertilizers and pesticides, with impacts on water quality and quantity.[29]

Conversely, more efficient use of biomass at the rural level is an attractive alternative to enable a shift to a more sustainable energy matrix. The International Assessment of Agricultural Knowledge, Science and Technology for Development–a multi-stakeholder report commissioned by the World Bank and the Food and Agriculture Organization of the United Nations (FAO) critiques conventional industrial agriculture and calls for a fundamental change in farming practices so as to better address increasing food prices, food insecurity and environmental crises. The report reflects a growing consensus among scientists and many governments that the old paradigm of industrial energy and chemical-intensive agriculture is an outdated concept. The report also points to the role of small-scale farmers and agro-ecological methods in providing a way forward for sustainability in the face of water shortages, soil erosion and climatic change. The conclusion of this seminal report is that past emphasis on increasing production and yields–the Green Revolution–brought some benefits. However, the experts agree that these gains occurred at the expense of environment and social equity. The report concludes that more emphasis is required on addressing the local needs of developing country farmers, including providing them with markets for their products, and infrastructure and financing to add value to the agricultural chain of production.[30]

Small-scale community biodiesel production and use has the potential to empower small landowners with energy sufficiency,

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[28] Giampietro; Li Minqi, "The Age of Transition: The US, China, Peak Oil and the Demise of Neoliberalism," *Monthly Review* (2008), 28 August 2009 <http://www.monthlyreview.org/080401li.php>.

[29] David Pimentel, "Soil Erosion: A Food and Environmental Threat," *Environment, Development and Sustainability* 8 (2006): 119-137.

[30] *Agriculture at a Crossroads: Summary for Decision Makers of the Global Report,* United Nations International Assessment of Agricultural Knowledge, Science and Technology for Development (Washington, D.C.: Island Press, 2009).

thereby lowering their energy input costs and increasing their income.[31] Such an agricultural transformation in rural Thailand has its roots in the Sufficiency Economy concept. In other words, farmers are key front-line environmental stewards with the local knowledge and resilience to guide sustainable resource management. Thailand's community biodiesel programmes have the potential to put into practice local energy sufficiency, whilst simultaneously adding value to agricultural activities and decreasing input expenditures on petroleum and chemical fertilizers and pesticides. Whether a small-scale, local-livelihoods model is further entrenched in Thailand and developed in other countries in the Mekong where Thailand's investment in bioenergy is flourishing remains to be determined.

Agricultural Trade Liberalisation

Agricultural trade liberalisation is a critical component of the Doha round of multilateral trade negotiations in the World Trade Organisation (WTO). First, commodity-exporting developing countries, in particular, would benefit from greater *market access* for agricultural products (energy crops) and biofuels. This would serve to increase revenues for research and development of sustainable production practices and technologies. Second, as a major agricultural exporter, Thailand would gain from agricultural trade liberalisation to remove export subsidies in key developed countries, such as Japan, the EU and the US. As noted in an early Brazilian proposal to the WTO,[32]

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[31] Miguel Altieiri, "Agroecology, Small Farms, and Food Sovereignty," *Monthly Review* July-August (2009); *The Impacts and Opportunities of Oil Palm in Southeast Asia*; Maria Estrella Penunia, "Upscale Sustainable, Integrated, Diversified, Organic Agriculture by Smallholders Farmers To Adapt and Mitigate Effects of Climate Change by the Asian Farmers' Association for Sustainable Rural Development," Paper presented at the 32nd session of IFAD's Governing Council, 2009, 26 August 2009 <http://asianfarmers.org/?p=592>; *Bioenergy for Sustainable Development and Global Competitiveness*.

[32] "The Energy Sector: The Case of Alcohol Fuel (Ethanol)," *Submission to the World Trade Organisation Committee on Trade and Environment* (Geneva, 1998). In 2005 and 2007, Brazil submitted proposals to the WTO for biofuels to be included in the environmental negotiations, See: "Environmental Goods for Development," *Submission by Brazil to the WTO (TN/TE/W/59)* (Geneva: World Trade Organisation, 8 July 2005).

agricultural export subsidies in developed countries distort market access for biofuel exports from developing countries. Notwithstanding price support schemes, for example, for sugar, rice, cassava and palm oil, Thailand's agricultural sector is considered to be competitive on the world market.

Third, trade trends will be affected by the definition of biofuels as industrial, agricultural or environmental goods. The harmonised system of tariff classification used in the WTO classifies ethanol as an agricultural product with no distinction between its use for fuel or other purposes, whereas biodiesel is classified as an industrial product.[33]

Sustainability Criteria for Land and Water Hungry Energy Crops

One way to address the social and environmental impacts of biofuels is to establish and enforce *sustainability criteria*. This is the path forward for biofuels charted by many governments, international organisations and non-governmental efforts to address rising concerns. Most criteria to assess sectoral sustainability take into account the socio-environmental effects of *direct* biofuel production with respect to the land and production processes employed. However, as emphasised by the Dutch Cramer Commission [34] and World Wide Fund for Nature (WWF) reports, [35] the most serious sustainability issues are those related to the *indirect* impacts of large-scale biofuel production, mainly displacement of other agricultural activities and subsistence farming, as well as changes in land use from forests or grass to crops. [36] Criteria developed by the Roundtable for Sustainable

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[33] Doaa Abdel Motaal, "The Biofuels Landscape: Is There a Role for the WTO?" *Journal of World Trade* 42 (2008): 61-86.

[34] *Testing Framework for Sustainable Biomass* (The Netherlands: Cramer Commission, 2007).

[35] Bart Dehue, Sebastian Meyer and Carlo Hamelick, *WWF – Towards a Harmonised Sustainable Biomass Certification Scheme* (Utrecht: The Netherlands, 2007).

[36] Tim Searchinger, "Government Policies and Drivers of World Biofuels, Sustainability Criteria, Certification Proposals and their Limitations: 37-52," *Biofuels: Environmental Consequences and Interactions with Changing Land Use*, Eds. R. Howard and S. Bringezu (Ithaca: Cornell University, 2009).

Biofuels (2009) include life cycle greenhouse gas emissions, biodiversity, agricultural practices and social impacts.[37]

Certification of sustainability represents, at the same time, a valuable marketing tool and a costly non tariff barrier to trade, especially for developing countries. A recent study on EU-ASEAN trade relations estimates that around 20-25% of EU biofuel consumption by 2020 will be derived from imports. Sustainability criteria agreed by the EU in March 2009 will determine market access for palm oil and ethanol exports to the European Union. [38] In this regard, Brazil, Malaysia and Indonesia are among the key biofuel exporters threatening to bring a complaint to the WTO on the basis of trade discrimination. Moreover, as predominantly voluntary instruments applied to the production process, sustainability certification schemes do not necessarily address macro-level impacts, such as increased food prices and displacement of food for fuel crops.

Nevertheless, the sustainability of the entire chain of production of agro-fuels will affect trade and have development implications, particularly for developing countries. Compliance with Roundtable on Sustainable Biofuel guidelines may provide a sufficient incentive to address negative environmental impacts. As with the evolution of eco-labelling and certification over the past two decades, sustainability criteria are deemed to be a central, yet controversial aspect of trade in biofuels.

Evidence of the sustainability of biofuels in Thailand is mixed. A recent review of Thailand's biodiesel prospects concludes that it is arguable whether palm-based biodiesel is economically and environmentally feasible in the long term. This is due primarily to the potential local effects on food supply and prices, as well as changes in land use and agricultural practices related to fertilizer inputs with high embodied energy costs. [39] Moreover, it is noteworthy that the intention

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[37] *Standards for Sustainable Palm Oil 'Version 0.5'* (Kuala Lumpur: Roundtable on Sustainable Biofuels, August 2009).

[38] *Trade Sustainability Impact Assessment for the Free Trade Area between the European Union and the Association for Southeast Asian Nations – Interim Report* (Rotterdam: The Netherlands: ECOFYS, 2009).

[39] Manjula Siriwardhana, G. Opathella, and M. Jha, "Biodiesel: Initiatives, potential and prospects in Thailand: A review," *Energy Policy* 37 (2009):554-559.

in Thailand is to develop the biofuels sector to contribute to a domestic demand stimulated by blending requirements for ethanol and biodiesel in transportation. While there is insufficient palm oil to meet the domestic demand, exports of ethanol began in 2007. This differs from the scenario in Malaysia and Indonesia's well established palm oil capacity predominantly for export. Malaysia and Indonesia account for nearly 90% of global exports of palm oil, primarily to the EU.

The Way Forward: Policy Options

In order to achieve the benefits of biofuels whilst avoiding the potential harmful consequences, the majority of survey respondents for this research recognised that Thailand needs to: (1) enhance incentives for the development of biofuels to stimulate sustained domestic supply and demand; (2) facilitate collaboration among researchers from different ministries and institutes to permit cumulative and coordinated outcomes; (3) remove trade restrictions to enable biofuels trade; (4) develop a comprehensive regional approach to bioenergy expansion in the Mekong region; and (5) learn from the experiences of other countries in devising a coherent biofuels strategy including to enhance efficiency of agro-industrial processes (e.g cogeneration). On average, respondents to the survey for this research viewed the prospects for biofuel development in Thailand and the Mekong region positively. However, when asked whether the biofuels sector was developing along the right path as of 2009, the majority (57.3%) responded in the negative, indicating the need for the government to maintain a coherent and coordinated policy framework. Governmental (60%) and private sector (60%) respondents were amongst those who considered biofuels policies to be on the right track. International and regional organization respondents, on the contrary, overwhelmingly (88%) considered biofuels to be headed in the wrong direction for various reasons, including lack of a coherent and coordinated strategy and consistent implementation. Views were mixed for NGO and local community respondents, with 63% and 54%, respectively, considering that bioenergy policies were not headed along the right path in 2009.

Thailand's three-decade experience in managing its sugar and cassava industries is worthwhile exploring as it relates to biofuels. In this respect, there are three interlinked considerations raised by the respondents during the research. First, two-thirds of Thailand's sugar production is exported in a raw or refined state, leaving significant potential to *add value* to the chain of production through refining sugar and cassava into fuel. Second, as the Thai biofuels industry grows, the share of surplus production available for fuel will also grow. Therefore, with projections for surplus ethanol production over the next several years and vague deadlines for mandated gasohol, there is a need for *regulatory change* to allow flexibility to export. Third, proactive incorporation of *sustainability standards* to address socio-environmental aspects of biofuels would encourage the transition to a more sustainable energy future in the Mekong region. This could be developed through a national interpretation of the Roundtable on Sustainable Biofuels criteria.

Preliminary results of this research demonstrate the following considerations for policymaking:

- One way to lessen dependence on oil imports and diversify energy options is to develop Thailand's abundant agricultural crops as biofuels (e.g., rice, sugarcane, cassava, oil palm) using well established conversion technologies.
- Based on Brazil's experience with ethanol, securing domestic demand is vital to building an economically viable biofuels sector. Thailand should focus, first and foremost, on implementing domestic targets for the use of biofuels in the transport sector.
- The development of first generation biofuels (ethanol and biodiesel from agricultural crop biomass, such as sugar, cassava and palm oil) can assist in the transition to a more sustainable low-carbon energy scenario, *if* sustainability criteria are developed and implemented. To this end, south-south cooperation can stimulate knowledge building and technology transfer in biofuels.
- Small-scale community biodiesel production and use has the potential to empower small landowners with energy sufficiency, thereby lowering their energy input costs and

increasing their incomes by adding value to agricultural production. This is the model Thailand should use to promote bioenergy investment in Thailand and the Mekong. To date, however, Thai agro-energy investment in the region has tended to outsource environmental degradation to neighbouring countries (Cambodia, Lao PDR, Myanmar).

- Improving infrastructure in the Mekong region may contribute to enhancing agricultural yields and lowering costs of production and transportation (e.g., irrigation and electricity systems and roads). However, policy support is required to integrate small-scale agricultural holders in the bioenergy chain of supply.
- Whether Thailand develops the domestic and export potential for biofuels will depend, to a great extent, on the private sector. Nevertheless, the success of private sector initiatives in capturing these emerging opportunities, in turn, depends on the institutional and regulatory setting. A secure investment framework, at both the national and regional level, is essential, with clarity of regulations and consistency in implementation.
- Governance is a vital element in addressing the socio-environmental sustainability of biofuels. To assist in the development of a coherent policy framework, Thailand needs a central body, such as the National Biofuels Committee, to play a leadership role in coordinating the many ministries and private and public sector actors involved. An institutional architecture at the Mekong regional level also would facilitate integrated bioenergy development.
- The lack of political support for biofuels at the international level is one of the main constraints to be addressed in order to allow for those developing countries, such as Thailand, which have suitable domestic conditions to develop an agro-energy sector. While producing biofuels may not be a long-term strategy for a low-carbon economy, it may represent a step forward for some developing countries to use currently

available technology and resources more efficiently in the agro-energy processing sector (e.g. cogeneration).

- As a major exporter of food, Thailand's bioenergy policies have implications beyond its borders for the global supply of food. This is a complex issue that needs to be studied further.

Conclusion: Global Trends, Local Definitions

The issues surrounding the rapid rise of biofuels remain controversial and mired in policy complexities, as well as unintended socio-environmental consequences. The energy challenge of the 21st century for Asia, in particular, will be to satisfy a rising demand for energy with less carbon.[40] Overcoming barriers to the transition to renewable energy will require a secure regulatory framework in combination with support for private sector investment and technological innovation. From Asia to Africa to Latin America, many developing countries are setting domestic targets to increase supply from renewable energy sources, lessen oil dependence and stimulate rural development. Further evidence is needed to determine whether future energy narratives for the Mekong can be crafted from proactive, domestically-driven attempts to cut consumption of fossil fuels by increasing targets for renewable energy, including bioenergy. There are also potential synergies from linking climate mitigation and adaptation with small-scale bioenergy initiatives. Notwithstanding the backdrop of complex market and policy drivers, there is evidence that small-scale biofuels in the Mekong has the potential to shift agricultural production away from high input, energy intensive agriculture in the direction of more sustainable practices. In order to do so, small-scale holders require an enabling policy architecture. In this respect, the Clean Development Mechanism has added to the economic viability and environmental motivation underlying the emerging biofuel scenario in the Mekong, and is further stimulating

[40] *World Energy Outlook* (Paris: International Energy Agency, 2008); *The Economics of Climate Change in Southeast Asia* (Manila: Asian Development Bank, 2009).

investment and innovation in energy from first generation sources (crop residues and biogas) and second generation cellulosic biofuels.

Over the next decade, the world economy will change radically as markets move to reflect scarcities in food and fuel. The direction Thailand provides to guide these market forces will be critical. As a major contributor to the global supply of food, Thailand faces a complex range of factors in implementing its vision for a low-carbon economy. Thailand has the potential to move beyond past inefficiencies and take up a leadership role in developing renewable energy in the Mekong region. If the current stimulus to produce and use first generation biofuels brings about a transition to more technologically complex second generation systems, there will be less competition between fuel and food production. Given that demand for biofuels is driven largely by regulatory mandates, with production costs subsidised by governments, there are valid issues raised related to their economic efficiency and socio-environmental sustainability.

Concerns related to the commercialisation of biofuels alongside small-scale initiatives warrant more deliberate attention, particularly at the regional level. Evidence suggests that developing energy sufficiency based on biomass at the community level would enable Thailand to initiate a shift to low-carbon economies in the Mekong. To map the dual track development of community and commercial bioenergy systems, this research finds gaps between the mounting evidence of bioenergy practices and policies. In other words, whilst the development of biofuels may be beneficial for Thailand, the implications for sustainable agricultural practices in neighbouring Mekong countries are not necessarily as favourable. Bridging this gap to enable the transition towards a more sustainable energy future for the Mekong region as a whole will require leadership in shaping agro-energy investment that internalizes socio-environmental costs of biofuel production.

Thailand's experience with biofuels will serve, in turn, to assist neighbouring countries in the Mekong region to enhance their sustainable energy development options. Whilst national debate invariably ends on an optimistic note concerning the prospects and policy options for renewable energy in general, it is worthwhile noting that there has yet to be a sufficiently rigorous debate in Thailand on

the merits of biofuels. This may explain why the majority of respondents (57.3%) in the survey undertaken for this research considered that Thailand's biofuels sector is *not* developing along the right path as of 2009. To this end, all the 143 respondents surveyed and many interviewees felt the government could benefit from more *information* and improved *coordination* between ministries in formulating biofuels policies.

The experience of the United States has been subject to criticism for the abundant use of subsidies to the corn ethanol industry. These subsidies have distorted markets and increased production to the detriment of the environment. They have led to the extensive application and over-use of pesticides, contaminating water supplies and depleting the soil of nutrients over time.

This leaves us with a fundamental question underlying the hypothesis of this research related to the *policy space* for countries to determine policies. To what extent is Thailand positioned to reap the potential benefits of developing a viable biofuels sector; or, will Thailand repeat the mistakes of those countries that have put in place burdensome subsidies and allowed for agro-industrial production to crowd out smallholder agricultural production.

This research puts forward the argument that there is policy space to define local narratives in response to global problems. In so doing, it can gain from the experience of bioenergy leaders such as Brazil, India and China to accelerate implementation of alternative energy sources. By the same token, it bears emphasising that these narratives need not repeat mistakes learned in other countries, for example, with respect to subsidising biofuels, nor need they ignore conventional wisdom.

The four general points emphasised in this research in response to the rising opposition to biofuels at the international level relate to the *context* in which biofuel development is undertaken. The first involves the *scale* of biofuels development. The second involves the objectives underlying biofuel development. The third is linked with the actors involved in biofuel production and use concerning the dichotomy between commercial and community biofuels. The fourth and, arguably the most important element, concerns *policy space* and *governance* capacity. Effective governance of the policy space, in

turn, will impact the other elements: simply put, how much, for whom, by whom and how.

These four caveats are fundamentally important when considering the way forward for biofuels in Thailand. The Thai energy narrative is currently being formulated, with trade in biofuels an option under consideration. The driving factors behind the current development of biofuels are open to narrower and broader interpretations depending upon the context in which they are advocated. Captain Dr. Samai Jai-In, an energy expert on Thailand's Energy Standing Committee and a leading advocate of community biodiesel, puts forward a multiplicity of sufficiently rigorous explanations to justify the promotion of biofuels in rural Thailand. While it is necessary to improve the economics and monitor environmental sustainability, the argument of biofuel proponents in Thailand and other developing countries, notably Brazil, is that the basket of benefits outweighs the constraints–at least in the transition period to a low-carbon economy.

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